Scenario 3: Bioregion Java

Scenario 3

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Bioregion Java

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Urbanisation Beyond City Limits

Urbanisation is conventionally understood as a city-centric process, in which large numbers of people migrate from low-density rural areas to high-density urban ones. From this perspective, the challenges of providing housing, employment, healthcare and education for migrant populations are assumed to be a city's responsibilities. The labour, skill and entrepreneurship that migrants bring are regarded as fuel for the urban growth machine. And, as city growth is usually correlated with national economic growth, this view of urbanisation tends to be broadly endorsed by municipal, state and non-state actors alike.

This city-centric view of urbanisation is increasingly untenable for a variety of reasons. In the first place, urbanisation wreaks damage in areas far beyond the city's boundaries—countryside, wilderness and atmosphere—with severity that is impossible to ignore. We can see that in the hollowing out of rural communities composed of those too young, too old or too poor to travel and secure urban jobs—the so-called 'left-behind' generations. We can see it in the automation and robotisation of landscapes for 'precision' agriculture and silviculture, in the channelisation of river systems for irrigation and energy generation, and in the disruption of distant ecosystems for mineral resource extraction. We can feel it in global warming.

Cities have always relied on areas beyond its boundaries, of course, for food, water, energy and raw materials (von Thünen 1966). For most of human history—in the 12,000 years between the sharp upturns in populations of the respective Agricultural and Industrial Revolutions (Childe 1950, 3)—cities co-existed with such hinterland areas in a relatively stable demographic and metabolic interdependency (Batty 2017).

However, as cities began to grow in size and number after the Industrial Revolution, first in Europe, then the Americas and latterly Asia and Africa, city-hinterland relationships changed dramatically. As urban studies scholars, sociologists, geographers, ecologists and climate scientists increasingly point out (see Wackernagel and Rees, 1996; Steffen et al. 2004; Gandy 2012; Brenner 2013; Brenner and Schmid 2015; Angelo and Wachsmuth 2015; Rickards et al. 2016; Datry et al. 2017), these cities generated resource demands that transcended their respective hinterlands, regions and biomes, and now threaten planetary boundaries. Resultant settlement patterns, they argue, are unprecedented in scale, scope and extent and, as such, herald wholly new forms of urbanisation.

In this context, a city-centric perspective of urbanisation is not only inadequate, but hinders our capacity to see, analyse and positively engage these new forms of urbanisation.

Urbanising Landscapes

One such new form of urbanisation emerging in Asia can be called the urbanising landscape. Here, we loosely draw on McGee's (1987; 1991, 16–17) characterisation of *desakota* conditions (Cairns 2018; Tacoli 2006). While urbanising landscapes are shaped by general processes, they exhibit regionally-specific features, five of which we note here.

First, urbanising landscapes are animated by a heightened mobility of people circulating between cities, towns and villages on daily, weekly and seasonal rhythms following fluctuations in urban labour markets, as well as diversifying job opportunities in the countryside. Second, wealth generated in the city is not always fully expended in the city, but also remitted back to the countryside thereby thickening linkages across urbanising landscapes (McKay 2005; Rigg, Salamanca and Thompson 2016). Third, the physical and ecological footprint of city is itself expanding rapidly, transforming rural land in the process. This can be observed in the suburbs,

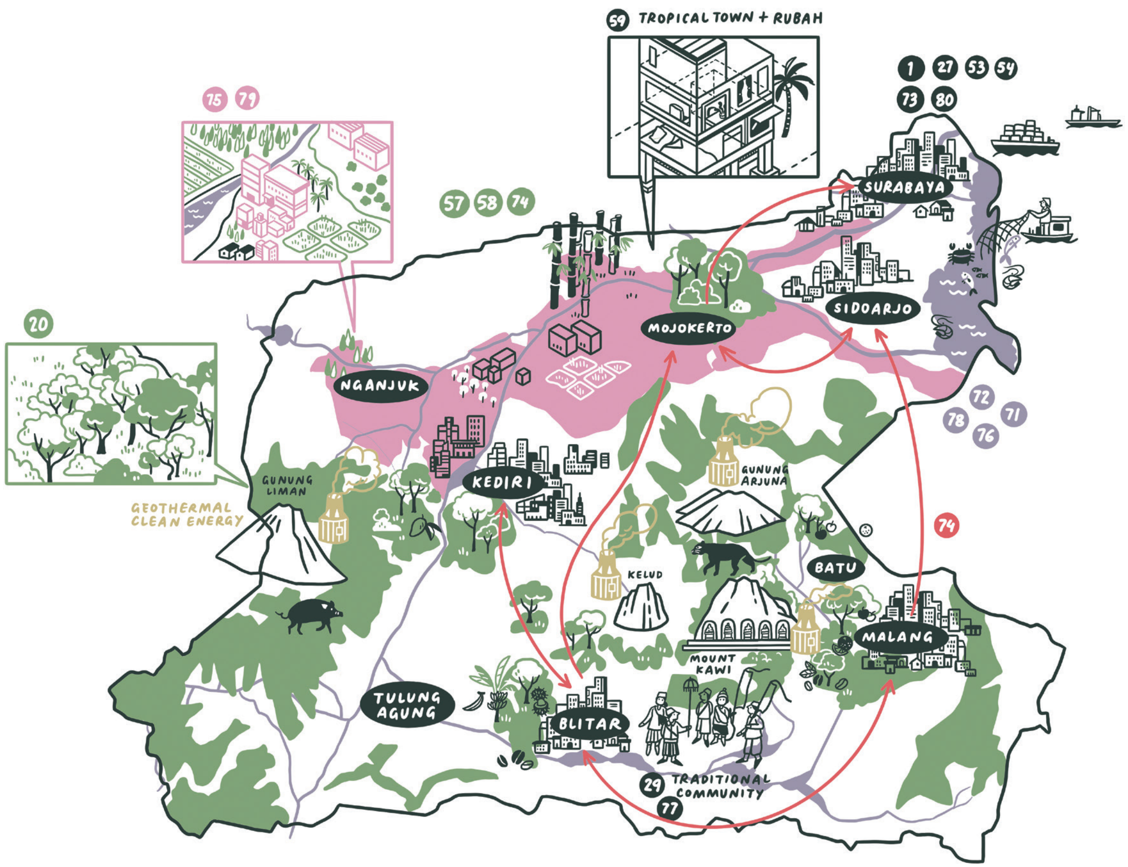

Fig.1 Proposed strategies for Bioregion Brantas

exurbs, industrial estates, and *desakota* zones which sprawl, leapfrog and mushroom around many megacities in Asia. Fourth, urbanising landscapes in Asia typically develop in rural areas that are, by western standards, relatively densely populated. The influx of capital investment, goods, and expertise to these areas have supported local rural communities to urbanise in-situ, that is, to develop economic enterprises—from cottage industries to manufacturing to smart village enterprises and tourist-based initiatives—in their home hamlets, villages and towns. Urbanisation, in this sense, takes place not in the distant city but in the countryside.

Finally, and most importantly for this chapter, urbanising landscapes tend to be multi-jurisdictional and bioregional in scale. Spanning hundreds of kilometres across city, district, regional, provincial and even national boundaries, they interact with—coexisting precariously, pressurising and damaging—large biogeophysical units, such as river basins, watersheds, subterranean aquifers, coastal zones, islands, plateaus, mountains and mountain ranges.

A Case in Java

Special planning and territorial design approaches are needed to support sustainable urbanising landscapes. The remainder of this chapter describes one such approach that emerged from a study focussed on the island of Java.

Java has a thick cultural heritage, a complex colonial and postcolonial history, and rich ecological legacy. At the same time, it shares underlying geological, economic, demographic and climatic conditions with many other parts of Asia, such as the densely settled deltas of the Chao Phraya, the Mekong and the Red River. Java, as with many such regions, is rapidly urbanising, densely populated, agriculturally productive, seismically active and vulnerable to disaster risk. The island's population has expanded sharply since the colonial era—from 9 million (1850), to 77 million (1971) to 150 million people (2020). Demographers predict that the population of Java will reach 240 million by 2050. By that time, 70 per cent of Java's population will live in urban areas, equating to a population of 170 million. Of course, one of the central concerns of this chapter is what 'urban' might mean in this context, where its footprint might reach and with what consequence.

Government and civil society actors are deeply concerned about the critical planning challenges in Java: burgeoning population; dysfunctional infrastructure; pollution and environmental degradation; unsustainable resource management practices; water shortages; and rising socio-economic disparity. How will the growing aspirations of urbanites, the ecological diversity, cultural heritage and agricultural productivity of this island be reconciled? How might the demands of different economic sectors (such as extractive industries, agriculture, manufacturing, trade and services), transboundary phenomena (migration, globalisation, flooding, earthquakes and climate change), and the aspirations of communities (whether concrete local initiatives, regional plans or more abstract national development visions) be reconciled? What, in short, are the most productive planning approaches to the urbanising landscapes of Java?

Historically, government planning authorities have addressed these challenges with a rigid, jurisdiction-based framework consisting of nested city and regency, on provincial and national scales. This approach benefited from the decentralisation reforms adopted in 2000 which gave local agency—in areas such as public works, environment, transport, agriculture, and manufacturing—directly to cities and regencies, bypassing the provinces (FCL-ADB 2018). Later, the government supplemented these reforms with an island-wide planning vision to bring the meso-scale back into focus (Government of Indonesia 2012).

The resulting planning framework is rather ad-hoc and has been proven to be inadequate to current and future challenges in Java (Figure 1) (Verhaeghe and Zondag 2009; Verhaeghe et al. 2008). Planning is still conducted according to rigid jurisdictions, with little integration between sectors such as land use, transport, energy, water, agriculture, manufacturing and mining. It is also clear that as cities such as Jakarta, Bandung, Semarang and Surabaya break their municipal boundaries, new pluri-centric metropolitan settlement patterns are emerging as significant features of Java's urbanising landscapes (FCL-ADB 2018). They are typically defined in functional terms, shaped by the dynamic movement of migrants, commuters, goods and services, as much as the more static distribution of land-uses. As such, patterns of metropolitan settlement are better understood as hybrid spatio-temporal regions (see

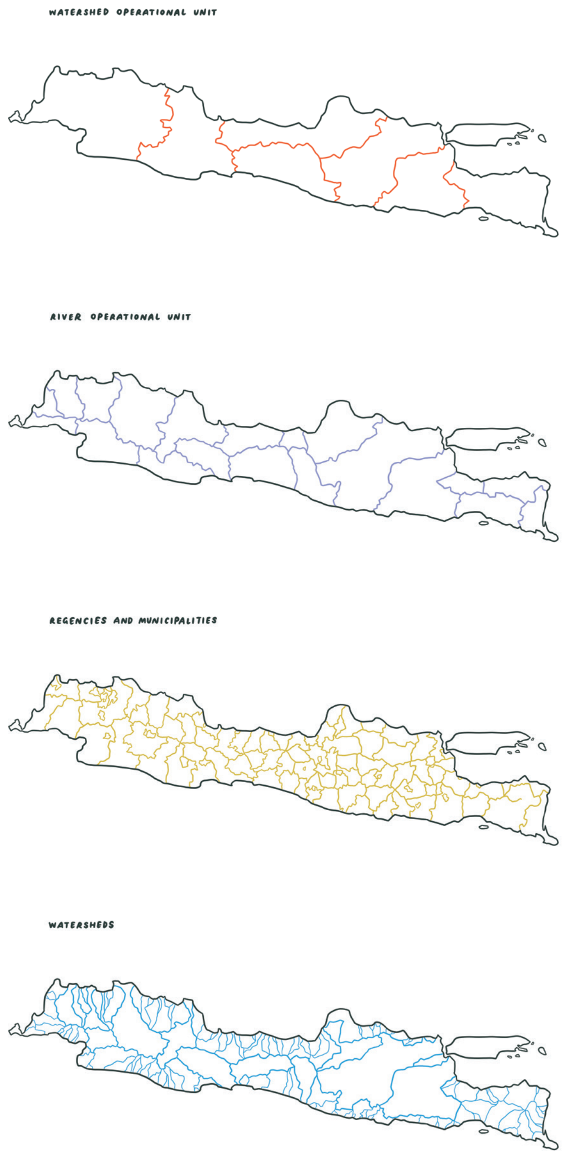

Fig. 2 (a–d) Diagram of various jurisdiction and administrative operational units in Java Island

Uchida and Nelson 2010 on the concept of the 'agglomeration index' AI) rather than as yet another static planning 'scale' straddling city and province.

Bioregioning Java

The Future Cities Laboratory (FCL) sought to contribute to the planning efforts of government and civil society agencies in Java. We did so by conducting a design experiment on the theme of 'bioregioning Java'. The experiment was framed by the formal planning system, and drew upon expertise of civil society organisations and a number of university institutions. It involved background research, data gathering and mapping that culminated in a three-day design charrette in July 2019, at FCL in Singapore (see Evidence).

The charrette helped identify a number of strategic approaches relevant to designing a sustainable urbanising landscape in Java. One of the most prominent was the watershed and the volcano bioregion (see 'Stage Charrettes' and 'Foster Bioregional Governance').

Considering Java through the conceptual lens of the bioregion immediately foregrounds a complex geographical relationship. The volcanic mountain chain that forms the spine of the island, shapes the watersheds of the many rivers that drain from it, while the fertile agricultural land is nourished, and intermittently destroyed, by the lava and water flows of both. As Alex Lehnerer and Philip Ursprung put it, Java's volcanoes are 'giant figures in the landscape ... deeply rooted in the economical, political and cultural life of [the island] creating and transforming the land' (Lehnerer and Ursprung 2017, the FCL Tourism and Cultural Heritage team who studied Java's volcanoes through the eyes of German-Dutch explore Franz Wilhelm Junghuhn). The volcanoes, 45 of which are considered active today, play a vital role in the geological and settlement history of Java. Lava flows and ash deposits from the volcanoes, and concentrated monsoon rains form a complex environmental system that sustains the agricultural base of the island.

The watershed bioregion, as animated by its seismic geology, was identified in the design charrette as a potent catalyst for imagining a sustainable future for Java, and was adopted as the focus of the design experiment—specifically the Brantas River

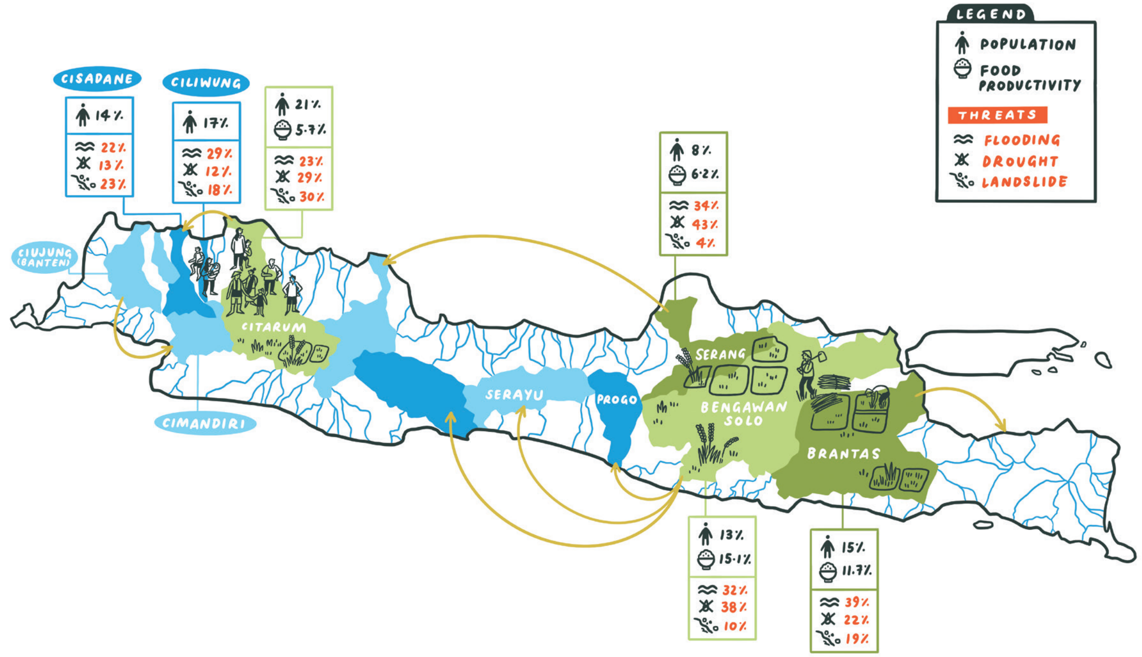

Fig. 3 Diagram of the largest and most populated watershed units in Java Island

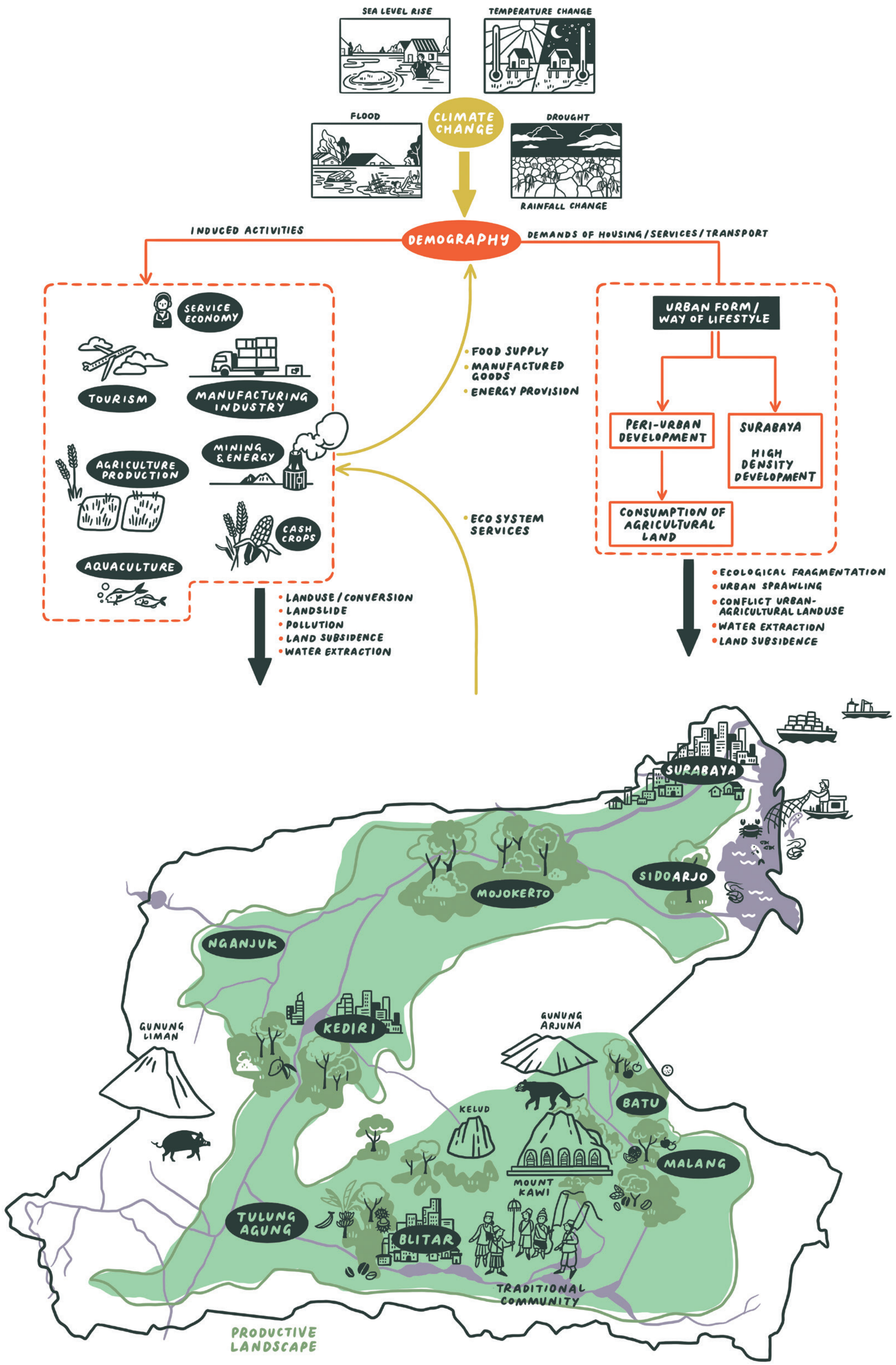

Fig. 4 (a–b) Analysis of Brantas watershed settlement systems (top and bottom)

watershed and the active volcanoes Mounts Arjuna, Kelud, and Kawi in East Java, as we will elaborate below. The watershed bioregion served as a large scale and loosely defined unit that helped organise designs and management strategies for smaller mosaic and patch scales, as well as larger intraregional relationships across political jurisdictions within the island of Java and beyond (see Figure 2). A set of wider aspirations that emerged in the charrette were threaded through this organising unit. These included: new approaches to sustainable settlement planning; an appreciation for the carrying capacities of different bioregions; greater circularity in resource management; conservation of rapidly dwindling natural resources; and an innovative governance system that would appropriately support these aspirations.

Watershed as Bioregion

Java is formally divided into 1,200 river watershed regions of varying sizes. Most are relatively small given the short distances the rivers traverse between the volcanic spine and the coast. Those that follow the valleys that run laterally along the island (such as the Solo River flowing west-east) tend to be fewer in number but larger in size.

The watershed regions in Java are formally managed by seven watershed authorities, and they are responsible for formulating and implementing policies pertinent to the functioning of the watershed, including conservation and rehabilitation (Government of Indonesia 2015; supported by Regulation no. 38 in 2011). Yet, those watershed responsibilities are only loosely coordinated with the spatial planning policy whose municipal and provincial jurisdictions they usually transcend.

The charrette used a range of recent and historical data to identify those watersheds in Java that were most vital to the well-being of their resident populations, whose ecosystems were most delicate and at greatest risk of degradation, and most important for the fortunes of Java as a whole. The Solo River (600km), Brantas River (320km) and Citarum River (270km) were prioritised from a long list of 13 rivers (see Figure 3). Today, the watersheds of these three rivers total 500,000 hectares of human settlement and 1.4 million hectares of agricultural land, and respectively support 16, 15, and 24 million people (Ariefianto, 2016), equating to around 40 per cent of Java's total population (ur-scape calculation based on data from Dirjen Planologi dan Kehutanan, 2015). In addition, the rivers pass through or terminate in three of biggest urban agglomerations in the country: Jakarta and Bandung (Citarum), and Surabaya (Solo and Brantas).

The Solo, Brantas and Citarum watersheds concentrate many of the challenges of managing urbanising landscapes in Java. They are intensely used in various ways, reflecting their mountain-to-coast trajectories: crop irrigation, energy generation, transport, tourism, aquaculture, waste conduit and domestic purposes (drinking, preparing food, washing, bathing and toileting). All the three rivers are heavily polluted, frequently flood and misused in urban and rural planning terms. The misaligned planning jurisdictions, as noted above, are manifestly ineffective.

As we have seen (see 'Foster Bioregional Governance'), the bioregion concept was developed to explicitly improve upon planning outlooks based exclusively on politically- and economically-determined jurisdictions. It sought to do so by integrating the static spatial units of political or economic motivation—city, town and province—horizontally by developing corridors, archipelagos and regions guided by both 'raw geography' and cultural settlement patterns. We seek to develop the bioregion concept, in Java to both complement and improve upon the existing planning framework in Java to serve as a framework for the development of sustainable urbanising landscapes.

Strategies for a Brantas River Bioregion

To illustrate the approach, we examined the Brantas River watershed. The upper reaches of the Brantas are formed by the active volcanoes, Mounts Arjuna, Kelud, and Kawi. It contains 19 regencies and cities in total, and its tributaries pass through the extended metropolitan region that encompasses Surabaya, Malang and Kediri.

The Brantas watershed encapsulates many of the possibilities and challenges of other watersheds in Java. It is extremely fertile, supporting production of staple crops such as rice and sugar cane in the lowlands, with fruit (mangoes, apples, oranges, bananas) and cash crops (tea and coffee) cultivated in highland areas around Batu, Malang, Blitar, and

Kediri. Important shrimp growing and aquaculture regions dot the coast around the town of Sidoarjo (see Figure 4). The region also supports paper and textile production, manufacturing, food processing and brewing. The three active volcanoes that shape the upper reaches of the watershed, Arjuna, Kelud, and Kawi, have recognised potential as sources of geothermal energy.

At the same time, the Brantas watershed faces dual threats of flooding and drought, where 24 per cent of the land within the watershed is categorised as critical. The watershed is increasingly encroached upon by uncontrolled urban development and land-use violations. Challenges in Brantas watershed include water pollution due to agricultural run-off, industrial waste from paper and sugar cane industries, and domestic wastewater; illegal land conversion at the higher altitude areas from forest to dry land agriculture which often leads to soil erosion; sedimentation caused by land conversion and volcanic eruptions; and a shift of employment from agricultural to sand mining.

Adopting a bioregional approach to the development of the Brantas watershed involves a horizontal long-term development plan (see Figure 1). Such a plan would be developed around a range of principles and actions, which we list as follows:

Principle 1
Design Liveable Density

01 Transition to High-Density, Low-Footprint Cities

Principle 3
Partner Nature

20 Support Native Biodiversity and Naturalness

Principle 4
Adopt Open Processes

27 Embrace Innovative Governance
29 Situate Knowledges
37 Stage Charrettes

Principle 6
Stimulate Diverse Economies

53 Build a Relational Marketplace
54 Integrate Urban Food Gardening
57 Establish Bio-Industrial Production
58 Replace Mining With Cultivation
59 Supplement Autoconstruction

Principle 8
Foster Settlement Systems

70 From Hinterlands to Interlands
71 Think Polycentric
72 Foster Bioregional Governance
73 Shift From Waste to Resources
74 Enable Sustainable Material Flows
75 Envision Agropolitan and Minapolitan Futures
76 Build Socially-Cohesive Urban Regions
77 Walk the Talk
78 Adopt Territorial Approach to Extended Urbanisation
79 Design Sustainable Agri-Urbanisms
80 Plotting Urbanism

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Bioregion Java

Java planning charrette

Future Cities Laboratory hosted a planning charrette called Java Archipelago City in the beginning of July 2019 (see Figures 1–3 for images of the planning charrette). The charrette was attended by more than 30 participants (from Indonesia and other countries) and developed as a model of collaborative planning engagement to foster strategic dialogues among the planning stakeholders (i.e., civic society, planning professionals, academia, and policy makers). Central to the concept of this planning exercise are the principles of multi-stakeholdership, transdisciplinarity and data-informed planning (see Figures 4–5 for images of the spatial analysis of Java Island and Figures 6–8 of Brantas Region on ur-scape platform). It also hinges on the importance of bridging state-of-the art research to the real world, opening the possibilities of adopting innovative planning approaches. Most importantly, it adopts scenario thinking to address the need for a long term strategic planning.

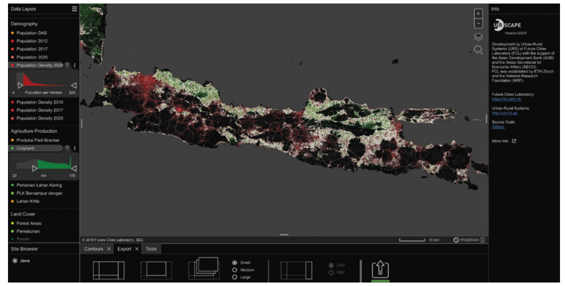
In the charrette, the participants were invited to identify the main challenges of Java and intuitively project its development trajectory 50 years from now under 'business as usual' conditions. Then they ideated on the more desirable alternative future for the island, and subsequently explored development scenarios and pathways to achieve them. Throughout the exercise, participants were encouraged to think out of the box and be experimental.

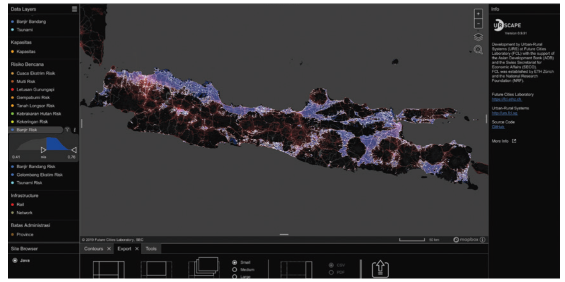
The multidisciplinary nature of the exercise offers a platform for knowledge exchanges among the stakeholders, which sets the scene for an iterative design process. Ideas are constantly discussed, examined and developed collaboratively. It was a demonstration of how various planning heuristics could be combined and integrated. The expected outputs were not polished planning documents, rather, some innovative ideas, that could be used as the basis for further development. The ideas are meant to be further scrutinised, assessed, and built upon,

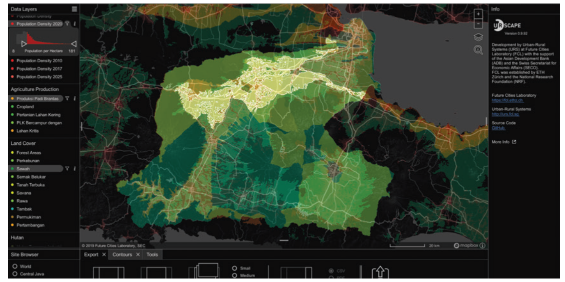
Fig.1-3 Java Planning Charrette FCL2, Credit: C. Teteris

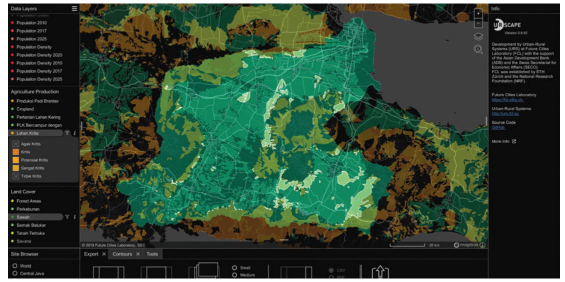
by coalitions of stakeholders (see Figure 9 for Java planning workshop with stakeholders in Future Cities Laboratory). To ensure its impact, the resulting propositions are meant to be integrated in the local planning process, at relevant levels (either, city, district, metropolitan, provincial and national level) and at various stages. It should complement the existing process through a specific feedback mechanism to gauge various stakeholders' needs and priorities.

This charrette model continues to develop in Indonesia, propagated by participants of the Java planning charrette, notably in the Indonesian Association of Planners workshop held in Bali and Semarang in 2020.









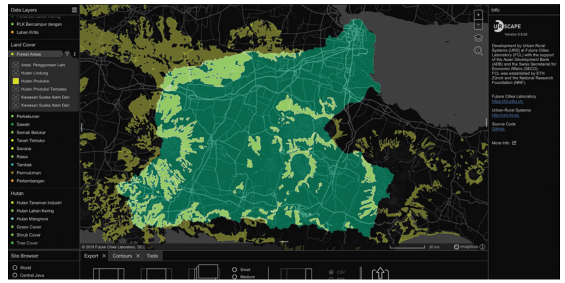


Fig.4 ur-scape cross-analysis for Java Island. The highlighted area in green indicates spatial data intersection of population density and crop coverage.

Fig. 5 ur-scape cross-analysis for Java Island. The highlighted area in blue indicates spatial data intersection of population density and flood prone areas.

Fig. 6 ur-scape cross-analysis. The highlighted area indicates spatial data intersection of population density, rice fields and rice yield per regency in the Brantas Region.

Fig. 7 ur-scape cross-analysis. The highlighted area indicates spatial data intersection of rice fields and agriculture land in critical condition in the Brantas Region.

Fig. 8 ur-scape cross-analysis. The highlighted area indicates the productive forest areas in the Brantas Region.

Fig. 9 Java planning workshop with stakeholders in Future Cities Laboratory.

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