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The synthesis of environmental and socio-cultural information in the ecological design of urban riverine landscapes

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ABSTRACT

Using the landscape as medium, we explore the relationship between residents and vegetation interaction, and spatial condition, of an urban riverine landscape in the Jakarta subdistricts of Kampung Melayu and Bukit Duri. These offer distinct examples of an urban riverine landscape within a growing megacity. Located on a peninsula of land called 'Kampung Pulo' the neighbourhood studied in Kampung Melayu has several distinctive elements (open spaces along the riverside, communal and private plantings, gentle sloping banks) that define the arrangement of this riverine landscape and influence its condition. In comparison, the neighbourhood studied in the nearby community of Bukit Duri, compressed between the railway siding of KRL-KRD Bukit Duri and the Ciliwung River, has limited river access and riverside open space, houses backing directly onto the river, and less vegetation. The landscape was used as medium to integrate local knowledge for the purpose of ecological design. Using an integrated mixed-methods approach including ethnographic surveys and interviews, and spatial mapping through drawings and image- and range-based modelling. The study discerned that differences in the landscape configuration of the two sites produced differences in resident interaction with domestic and riverine vegetation, and landscape condition. As such, the method is seen to be useful in providing valuable insights for the design of urban riverine landscapes.

1. Introduction

1.1. The problem of river improvement in urban regions

Traditionally environmental problems facing rivers and their urban regions have been understood as biophysical, 'hard' systems, and addressed technically through engineering works in isolation from their social context (Ison, Roling, & Watson, 2007). While such solutions facilitated improved navigability, land reclamation and flood protection, ultimately these led to larger alterations in environmental processes requiring further 'corrections' and works, along with decreased habitat and reduced capacity for floods and riverbank inhabitants (Prominski, Stokman, Stimberg, Voermanek, & Zeller, 2012). Over the last two decades, as a result of these environmental consequences, a major paradigm shift has occurred globally. Catchments and water systems are now acknowledged as socially constructed entities (Ison et al., 2007), and a shift has taken place wherein humans are acknowledged as components of ecosystems (Palmer et al., 2004). This has led to emphasis in the literature on 'effective governance based on principles of equity, efficiency and diverse knowledge integration', which are now seen as similarly important to technological solutions (GWP, 2000). Additionally, understanding and managing landscape change to achieve and protect ecosystem services has been recognised as requiring not only science but ecological design, which aims to synthetically achieve ecological, social and economic goals (Nassauer, Wang, & Dayrell, 2009; Palmer et al., 2004). Riverine improvement research has called for an ecosystem service approach, which understands the benefits to human societies that natural ecosystems provide (Palmer et al., 2004), and encourages society to understand and request these benefits (Vollmer, Prescott, Padawangi, Girot, & Grêt-Regamey, 2015; Wohl et al., 2005). Although efforts in river rehabilitation still favour engineering solutions in developing nations as a means to an end, a paradigm shift in institutional management that accounts for local perspectives is initialising. Local communities often have high-level views on the direction of restoration activities based on knowledge and life experiences (Wagner & Gobster, 2007), with perceptions

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that are 'based on a range of personal, historical, social, cultural and economic factors, as well as on characteristics of the proposed change' (Howard, 2008). As such, understanding belief systems, human attitudes and collective behaviours may be perceived as an integral part of project durability and instigating a process of cultural adaptation (Pahl-Wostl et al., 2008).

1.2. Shifting down scales, from ecosystem services to landscape services

An ecosystem service is understood as the aspects of ecosystems utilised (actively or passively) to produce human wellbeing (Fisher, Turner, & Morling, 2009). Current emphasis within this field utilises environmental and economic sciences in mapping and economic valuation of services and typically considers the regional scale. Researchers, acknowledging landscape as a socio-ecological system (Fig. 1a), in which humans benefit from changes made to the physical landscape, have recommended that a further shift down scales is necessary on the understanding that the local scale where people make concrete decisions about landscape change is increasingly relevant (Gobster, Nassauer, Daniel, & Fry, 2007; Opdam & Grashof, 2011; Termorshuizen & Opdam, 2009). From the standpoint of human experience Termorshuizen and Opdam (2009) recommend the adoption of the term 'landscape services'. As such, the emphasis shifts to landscape as result of human–nature interaction and its spatial explicit pattern. Gobster et al. (2007) also concluded that the 'perceptible realm' – the scale of environmental phenomena whereby landscape patterns are perceived (experienced) by humans – is decisive for landscape change (Fig. 1b). This landscape scale links the everyday experiences of residents with other environmental phenomena that are not directly perceived. The perceptible realm is where humans enact intentional landscape change, described by Nassauer (2012) as a 'design' action.

1.3. General overview of both spatial and qualitative studies – where and why is there a need for further research?

In the last 2 decades growing concern over the reductionism of planning, and urban fragmentation, has called for the integration of the physical landscape with human dimensions through designs that connect communities and environments (Antrop & Van Eetvelde, 2000). However, a review of the literature reveals that research on the processes affecting urban riverine landscapes rarely integrates biophysical changes to landscapes and social conditions, despite research in a range of fields calling for the integration of social factors. Palmer et al. (2004) call for research frameworks that explicitly incorporate humans in ecosystems, arguing that socio-ecological research needs to address the tension between human needs and ecosystem needs. Meanwhile Nassauer (2012) argues that landscape change instigated by professionals should become vernacular, meaning, informed by the actions of local stakeholders and thus more resilient to future transformations. Ecology, she argues, (growing from knowledge that integrates science and practice – design) is necessary to produce landscapes that synthesise apparently distinct societal and environmental functions and anticipate the future (i.e. are resilient). Pahl-Wostl (2006) recommends among others, that the recognition of mutual dependencies and interactions, and the identification of barriers for change and possible solutions to overcome them can be important tools in the design and maintenance of multifunctional riverine landscapes.

1.4. Spatial studies

Systematic and deductive assessments of landscape change have become common over recent decades and typically focus on land cover and/or land use characteristics (Wagner & Gobster, 2007). Based on the scale of the assessment and the time-span under study these assessments generally engage well-established models of landscape change (Baker, 1989), for example, through satellite coverage for use in landscape metrics application (example: Lausch & Herzog, 2002), and aerial and ground-based imagery (example: Du, Ottens, & Sliuzas, 2009), to establish prior conditions. Geographic Information Systems (GIS) are commonly used to measure land cover and land use characteristics in comparative studies. The technology and its measures enable the measurement of spatio-temporal landscape changes, and the visualisation of changes using maps. Van Eetvelde and Antrop (2004) found aerial photos and census data on their own were insufficient to understanding landscape change, and recommended combining these with data from interviews and oral histories for a greater level of insight. Reviewed research acknowledged that information produced using this method of assessment might not be

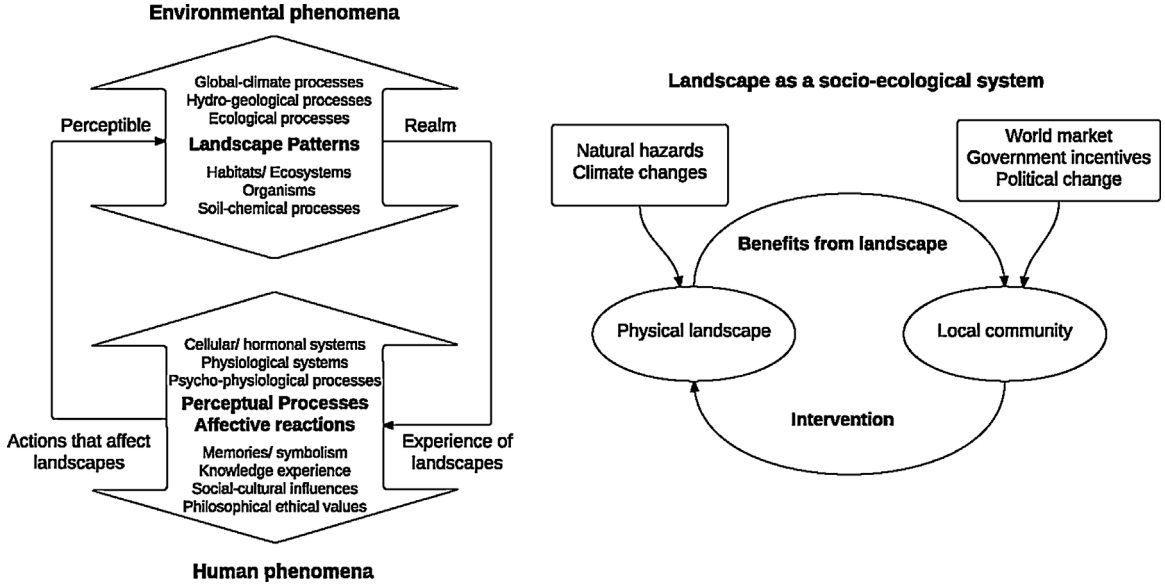

Fig. 1. [Left – a] Landscape patterns are the basis for what people directly perceive about environmental phenomena of all scales, and human experience of landscapes prompts human actions to change landscapes. Redrawn from Gobster et al. (2007). [Right – b] Redrawn from Opdam and Grashof (2011).