



# A sustainability index with attention to environmental justice for eco-city classification and assessment



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## ABSTRACT

Sustainability programs and their assessments have often been criticized for failing to support social justice. Eco-city development has also raised similar concerns. This research was conducted in order to address such problems. Specifically, this paper develops a new sustainability index that emphasizes environmental justice for the purpose of better classifying and assessing eco-cities. The proposed index measures equity among places as a result of eco-city development. Specifically, this index indicates instances in which a certain location achieves sustainability through means detrimental to another location. Thus, the index, comprised of environmental, economic, and social indicators of sustainability, may also be used to foster justice among diverse locations (urban centers, suburbs, rural areas, and neighboring cities) by highlighting the genuine motives behind eco-city development. One preliminary finding from the application of this classification is that oftentimes, eco-city development is not completed in the environmental, economic, or social interests of the people. Official eco-cities tend to serve government officials' interest in upper mobility. Developer eco-cities tend to be commercial expansions or developments focused on growth, profit, and model demonstration. Both official and developer eco-cities degrade the environment. They are also likely to develop urban centers at the environmental expense of other places. The economic growth of official and developer eco-cities is accompanied by worsening income inequality and social injustice. As a result, these types of eco-cities fail the sustainability performance assessment. Conversely, eco-cities founded by the citizens or by donors tend to focus on social and economic equity. This study was completed using qualitative research methods, including field work in 29 eco-cities throughout China and various countries. This field work was conducted from 2006 to 2014. Data was collected through interviews with 87 government officials, as well as environmental experts, grassroots environmentalists, residents, and real estate developers. The findings reveal that the majority of Chinese eco-cities have been overlooked in global eco-city literature. The research also calls for effective sustainability management in order to avoid the development of eco-cities that negatively impact the environmental and social interests of surrounding areas.

## 1. Introduction

There has been a large number of publications on the development and application of sustainability indexes in recent years, primarily in response to demand for better sustainability assessment and management. For example, the journal of Ecological Indicators has published articles on the development and application of the FEEM sustainability index (Pinar et al., 2014), the transport sustainability index (Reisi et al., 2014), the Sustainable Neighborhoods for Happiness Index (Cloutier et al., 2014), an integrated sustainability index (Chand et al., 2015), a water sustainability index (Juwana et al., 2016), and the general distributive sustainability indexes (Duro, 2016). Meanwhile, many researchers are concerned that current sustainability programs tend to be purely environmentally focused with little attention given to social

justice issues (Agyeman, 2008; McLaren and Agyeman, 2015). Adger (2002) argues that environmental and economic inequalities may be the largest obstacles to sustainability. Social injustice is often the cause of environmental or economic unsustainability (Middleton and O'Keefe, 2001; Liu et al., 2014). Other authors believe that urban environmental sustainability cannot be achieved without social sustainability (Poles and Stren, 2000). Despite these claims, however, environmental justice is not often considered in urban sustainability programs (Warner, 2002). Concern towards this lack of consideration has led to the development of the concept of "just sustainability" to ensure that justice and equity is fully integrated into sustainability programs (Agyeman and Evans, 2004; Agyeman, 2008; Agyeman, 2013; McLaren and Agyeman, 2015).

At the same time, eco-cities have been increasingly promoted as a

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form of urban sustainability in a world that faces the accelerating challenges of environmental degradation, climate change, and rapid urbanization (UN Habitat, 2013; Joss et al., 2013). However, some researchers are concerned that eco-city development is moving away from its original focus on ecosystem protection and becoming a form of green capitalism instead, focused on profit and economic growth (Liu, 2008, 2013; Vallance et al., 2012; Raco and Lin, 2012; Chang and Sheppard, 2013; Cugurullo, 2013; De Jong et al., 2013a; Rapoport, 2014; Säynäjoki et al., 2014). For instance, some eco-cities are built on valuable wetland at the expense of the surrounding natural ecosystem (Datta, 2012). Eco-city initiatives also often disregard the social equity of local communities, and instead aim to produce cosmopolitan centers for the wealthy to live in (Datta, 2012; Chang and Sheppard, 2013; Joss and Molella, 2013; Caprotti et al., 2015; Flynn et al., 2016). In fact, low-income citizens are usually negatively affected by the development of eco-cities (Caprotti, 2014). As a result, environmental conditions improve only in the eco-cities themselves, while the surrounding rural areas undergo environmental detriment (Liu, 2013; Li and Qiu, 2015).

Researchers also argue that sustainability indicators have the potential to be important tools in the governance of urban sustainability (Pupphachai and Zuidema, 2017). Authors have urged for the inclusion of social justice factors in urban sustainability indicators and the measurement of the citizen-centeredness of policies and governance (Marsal-Llacuna, 2016). Attempts have been made to use indicators to assess sustainability and environmental justice (Harner et al., 2002; Lakes et al., 2014; Liu et al., 2014; Ocelli et al., 2016). However, there is still a lack of use of sustainability indicators in urban governance. Furthermore, the urban sustainability indicators that do incorporate measures of environmental justice tend to do so inadequately (Pearsall and Pierce, 2010; Lakes et al., 2014).

Various methods for evaluating Chinese eco-cities or eco-provinces have also been examined (e.g. Wang et al., 2015a,b; Zhou et al., 2015; Dong et al., 2016). These methods involve dozens of environmental, economic, and social indicators, but none address social justice concerns. For example, Dong et al. (2016) reviewed six eco-city evaluation methods, including input–output analysis, life-cycle analysis, ecological footprint, carbon footprint, energy analysis, and cost benefit analysis, all of which lack an assessment of social equity or justice. The China Urban Sustainability Index, which is published by the Urban China Initiative (UCI, 2013, 2016) and assesses 185 Chinese cities (not necessarily eco-cities) in terms of their level of sustainability, does not use any justice indicators. The China Sustainable Cities Report (UNDP, 2015), which evaluates 35 provincial capitals and deputy provincial capitals (not necessarily eco-cities) on their performance in sustainable development by 12 indicators, also includes no environmental justice indicators. Finally, the sustainability index launched by ARCADIS (2016) includes only a single justice indicator: income inequality.

While the promotion of urban sustainability assessment is increasing, there remains a serious lack of sustainability indexes pertaining to environmental justice (Liu et al., 2014). The objective of this paper is to develop a sustainability index with attention to environmental justice for the classification and assessment of eco-cities. This index will balance environmental, economic, and social dimensions of sustainability, while simultaneously promoting a just relationship between different locations. The research focuses on China, which is often regarded as the world leader in eco-city development (Liu and ClimateWire, 2011; De Jong et al., 2013a). The paper begins by defining sustainability, environmental justice, and eco-city, as well as the methods used in this research. This is followed by a short review of eco-city development in China to provide the research background. Finally, since it has been argued that the key function of sustainability indicators is to evaluate performance (Hiremath et al., 2013), the paper concludes by applying a sustainability index oriented towards environmental justice to the classification and assessment of eco-cities.

## 2. Definitions of sustainability, environmental justice, and eco-city

The concepts of sustainability, environmental justice, and eco-city development provide the theoretical foundation for this research. Among the many definitions of sustainability, this paper uses sustainability to mean “meeting the needs of the present without sacrificing the ability of future generations to meet their own needs” (WCED, 1987). This paper also adopts the “three pillars” of sustainability: the simultaneous pursuit of economic prosperity, environmental quality, and social equity (United Nations, 2005; Authors, 2009). In addition, it recognizes justice as a core value of sustainability, one that cares about environmental, economic, and social equity not only within one generation but between multiple generations. Without justice, there would be no sustainability. In theory, justice is a component of sustainability. In that case, some may argue that the development of a “just sustainability” concept is redundant. In practice, however, environmental justice is often overlooked in sustainability programs and sustainability indexes. A sustainability index with attention to environmental justice has the potential to ensure the inclusion of the missing justice component.

The EPA (2017) defines environmental justice as “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.” It implies that everyone enjoys “the same degree of protection from environmental and health hazards, and equal access to the decision-making process to have a healthy environment in which to live, learn, and work” (EPA, 2017). Though many other definitions also exist, common themes of environmental justice include distributional, procedural, and process justice. Distributional justice, or the fairness in the spatial distribution of environmental benefits and burdens, is particularly important to this research. Eco-city development in one place at the expense of others is considered distributional injustice.

The concept of the eco-city has been in a constant state of evolution since its conception by eco-city pioneer Richard Register (1987). Ecocity Builders (2015, p. 1), a nonprofit organization dedicated to reshaping cities for the long-term health of human and natural systems, defines eco-city development as “a whole systems approach integrating administration, ecologically efficient industry, people’s needs and aspirations, harmonious culture, and landscapes where nature, agriculture and the built environment are functionally integrated.” However, various other definitions of eco-city exist, and there is no universal agreement on a single definition (Datta, 2012; Joss et al., 2013). This paper recognizes that the concept of ‘eco-city’ remains somewhat elusive and controversial. Furthermore, many challenges and contradictions exist within the urban sustainability fix in the guise of eco-city building in China (Pow and Neo, 2013). In this paper, the term “eco-cities” refers to urban areas that have intentionally implemented a program that aims to improve the city’s ecological environment while also planning for social and economic enhancements. These urban areas may be considered on different scales, ranging from a portion of a city to the whole city. In China, the eco-cities are those accredited by the central, provincial, and city governments. In the United States, Canada, and Panama, these are self-declared and recognized by the media as eco-cities.

## 3. Methods

This study adopted qualitative methods, starting with a literature review of global and Chinese eco-city development, sustainability, and associated indexes. Additional field research was conducted in 29 eco-cities across several countries from 2006 to 2014. These eco cities included twenty-one in China (Fig. 1), six in the United States (Kansas City, Columbia, and St Louis in Missouri; Chicago, Illinois; Denver, Colorado; and San Francisco, California), one in Canada (Vancouver,

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