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A Comparative Framework for Assessing Sustainability Initiatives at the Regional Scale

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Summary. — "Sustainability" has been a prominent goal in environmental and spatial planning over the past three decades. A diverse array of initiatives have been proposed and implemented with the aim of facilitating human economic and social development, while mitigating or even reversing associated environmental damage. These initiatives vary in their definitions of sustainability, their targets for planning and management, their bureaucratic structures, and other characteristics. As such, a universally applicable "how-to" manual for realizing the goals of regional sustainable development remains elusive.

The objective of this paper is to provide scholars and practitioners with a simple analytical framework for assessing objectives, strengths, and weaknesses of sustainability initiatives at the regional scale. Drawing upon a review of theoretical and applied research on regional sustainable development, we categorize initiatives into typologies, including (1) Natural resource and ecology-based; (2) Urbanism; (3) Issue-based; and, (4) Governance, participation and science-based. We analyze each according to their focus, scope, fields of action and activities, and successes and challenges.

Through this analysis, we define axes that highlight the prominent differences in characteristics between diverse approaches to sustainability. These are: (1) "top-down—bottom-up", based on who initiates and maintains the sustainability initiative; (2) "ecological—socio economic", defining the relative emphasis on ecological and/or social systems; (3) "holistic—subject-specific", defining the initiatives' breadth of the planning and management focus; and (4) "regional-local", defining the spatial scale of the initiative. These axes are useful for highlighting considerations that may have been neglected within an initiative, possibly preventing successful outcomes. We suggest that successful sustainability initiatives are introspective and work progressively toward balance between the extremes of these axes. This conclusion is buttressed by the evolutionary development of three global-scale sustainability efforts initiated by UNESCO's Man and The Biosphere program, the International Long-Term Ecological Research Network, and the Urbanist movement.
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1. INTRODUCTION

For the past half century, one of the prominent trends in global environmental policy and planning has been the quest for sustainability at the local, regional, and global scales. This quest was born out of the realization that the combined impact of an exponentially growing human population and increasing material consumption was leading to rapid deterioration of the global environment and loss of biodiversity (Ehrlich & Holdren, 1971; Goodland & Daly, 1996; Vitousek, 1994; Wackernagel *et al.*, 2002). Loss of open spaces, habitat fragmentation and destruction, and sprawling human settlement and associated infrastructures are some of the spatial development phenomena that have been creating increasingly serious environmental challenges to the long-term wellbeing of human society (Cardinale *et al.*, 2012; Chapin *et al.*, 2000; Reid *et al.*, 2005). Growing recognition of these challenges culminated in global proclamations in the 1980s and 1990s, such as the Brundtland Report and Agenda 21, which popularized the concept of "sustainable development" and led to the implementation of sustainability initiatives at local, regional, and global spatial scales (Conca & Dabelko, 1998).

The Bruntland Report defined the term sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" ("Our Common Future," World Commission on Environment & Development, 1987). Inherent in this definition is the assumption that the earth's capacity to provide natural resources and to absorb waste is limited (Meadows, Meadows, Randers, & Behrens, 1972). The combined pressures of increased human population growth and

material consumption are considered a challenge to sustainability in that they lower the resilience of the planet and its ability to provide resources and absorb waste, thus threatening the wellbeing of future generations. From these assumptions rose the first conceptualizations and applications of sustainable development, which were almost exclusively focused on environmental issues such as sustainable resource use. One of the enduring criticisms of applications of the sustainable development framework, in fact, has been their perceived neglect of the social component of sustainability (e.g., poverty, equity and health; Eizenberg & Jabareen, 2017; Hák, Janoušková, & Moldan, 2016), despite the Brundtland Report's emphasis on poverty alleviation.

While sustainable development has been criticized from multiple perspectives (see below), the term and the idea it represents have not only endured, but they have promulgated into every discipline and profession dealing with environment, resources and land use. The definition has been refined and various frameworks for implementing sustainability have been proposed, most focusing on three aspects (or pillars) of human development: social, economic and environmental (e.g., Donald, 2008; Eizenberg & Jabareen, 2017; Hák *et al.*, 2016;

Kearney, Berkes, Charles, Pinkerton, & Wiber, 2007; Reyer et al., 2012; Schädler, Morio, Bartke, Rohr-Zänker, & Finkel, 2011; Weaver, 2005; Wheeler, 2009; Wiber, Berkes, Charles, & Kearney, 2004). These pillars have also been canonized in government policy documents such as Agenda 21 and others (Council of the European Union, 2006; Organization for Economic Cooperation, 2006; United Nations, 1992). The underlying assumption is that only when all three realms of human wellbeing are addressed can true sustainability be achieved.

The "three pillars" definition has been challenged by some, and new sustainability paradigms are gaining increasing attention. Miller (2014) suggests that the "three pillars" categorization locks users into a limited discourse of compromise between the three components. He and others subscribe to the concept of "sustainable livelihoods" (Chambers & Conway, 1991). Chambers and Conway (1991) suggested that sustainability (which they claimed was considered synonymous with "good" in development circles) is but one of three concepts, along with capabilities and equity, that should be rolled into this more integrative principle. Miller (2014) suggests replacing the paradigmatic "three pillars" definition with a pursuit of quality of life and sustainable livelihoods (also suggested in various forms by others, e.g., Biggs et al., 2015; Birkmann, 2006; Horlings & Padt, 2013; Stoll-Kleemann & O'Riordan, 2002). Birkmann (2006) explains that the sustainable livelihood approach "views people and communities on the basis of their daily needs, instead of implementing ready-made, general interventions and solutions." His approach links the concept of sustainable livelihoods with a framework for assessing and lowering societal vulnerability to hazard and risk, adding an important critique that sustainable development—if it is to lead to reducing vulnerability to risk—cannot be a mere "balancing exercise," but rather must address "deeply rooted social, economic and environmental conflicts" (Birkmann, 2006). In order to overcome the false separation of economic, social, and environmental factors, Birkmann recommends the "egg of sustainability," which places the human economy inside the human social system, which is itself embedded within the natural eco-system.

In his critique of the "sustainable development" paradigm, Wall (1997) suggests that the term has, in many cases, become a political slogan or, alternatively, an imprecise catch phrase (although, it also may also act as a catalyst for community discussion). Chambers and Conway (1991), reflecting on multiple definitions of sustainable development, consider it to be unproductively pessimistic in its outlook and over-reliance on "negative syntax" and "defensive objectives".

Critique notwithstanding, the sustainability concept and its three-pillar definition persevere in a plethora of local, regional, and global initiatives. Scholars and practitioners have joined the global effort to address societal challenges, as articulated in the Brundtland Report and others, by proposing frameworks and developing initiatives for spatial development that have sought to achieve sustainability, such that human development could continue, while the environmental damage intrinsic to development could be mitigated and even reversed (Jabareen, 2006; Yigitcanlar & Teriman, 2015). While these efforts can be united under the conceptual umbrella of "sustainability", the array of initiatives differ from one another in approach, objectives, and execution. A sampling of the definitions, as reflected in the current research on regional sustainability initiatives over the past decade, is provided in Appendix 1.

The sheer diversity of sustainability approaches and initiatives has been a mixed blessing: On the one hand, initiatives tailored-made for different socio-ecological contexts have much promise for successful outcomes. On the other hand, the proliferation of models and experiences has been accompanied by a not insignificant amount of unsuccessful projects. For example, in the planning realm, one study found that comprehensive plans that incorporated sustainable development principles were no more sustainable than plans that did not incorporate such principles (Berke & Conroy, 2000). Such results can catalyze skepticism and cynicism toward sustainability efforts.

In this paper, we explore the diverse ways in which communities, planners, policy makers and scholars understand "sustainability" and how they define sustainability at the regional scale. For both theoretical and practical reasons, we chose the regional scale for analysis, which is a broad spatial scale that includes urban areas embedded within a matrix of open (agricultural and natural) spaces. The region includes both natural and social systems, which necessitates a holistic and integrative approach to research and development (Fürst, Helming, Lorz, Müller, & Verburg, 2013; also see Naveh (2000) for an ecological perspective or Pike (2007) for a regional studies perspective). Given that most definitions of sustainability demand an integrative perspective, the region is an ideal scale to explore how sustainability is conceptualized and implemented. [1]

Our objective is to both analyze how scholars and practitioners understand sustainability and extract operative lessons from the cumulative practical experiences of on-the-ground sustainability initiatives as analyzed in the academic literature, particularly those lessons that would be relevant at the early stages of project formulation. It is not, as others have done before us, to re-theorize sustainability or to develop new conceptual frameworks (for different disciplinary approaches to sustainability theory see, for example, Birkmann, 2006; Jabareen, 2008; Mostafavi & Doherty, 2010; Naveh, 2000; Singh et al., 2010), nor is it to assess sustainability indicators, which is an increasingly prominent theme in the recent sustainability literature. The normative goal of this analysis is to encourage successful sustainability initiatives by identifying and characterizing the multiple practical issues that should be considered when initiating a project or evaluating an existing one.

2. EXTRACTING PROMINENT THEMES FROM THE SUSTAINABILITY LITERATURE

In order to extract themes from the sustainability literature, we began with a three-step literature review. First, we conducted a literature search using both Science Citation Index and Google Scholar for the terms "sustainable regional development" and "sustainable spatial planning." We limited our search to work published since 2005, as we wanted to focus on the most recent manifestations and interpretations of sustainability concepts, but we later included earlier studies when relevant. We reviewed this literature (approximately 90 journal articles) and extracted from it articles focusing on the implementation of particular initiatives and projects at the regional scale. From these, we identified prominent, recurring themes for applications (i.e., themes that described initiatives defined in the context of sustainability). We then supplemented the initial search with targeted searches for articles relating to the themes we extracted in the first step. These included ecotourism, sustainable agricultural landscapes, sustainable urbanism, landscape urbanism and others. Finally, we adopted and modified a classification system proposed by

Jabareen (2006, 2013), who analyzed "sustainability" at the urban scale, based on four typologies of regional sustainability initiatives that reflected the initiatives' management focus, philosophical approach, disciplinary framework or other characteristics.

The typologies of sustainable regional development initiatives we identified were (1) natural resource and ecology-based initiatives, (2) urbanism initiatives, (3) issue-based initiatives, and (4) governance, participation and science-based initiatives. For each typology, we examined models that exemplify how the typologies were implemented on the ground. Models have specific managerial, planning or policy guidelines. For each typology and their associated models, we analyzed the following characteristics:

• *Scope:* At what spatial scale does the approach apply? National, regional and/or local? Who is involved (e.g., government agencies, local residents, business interests)?
• *Fields of action and activities:* Is the approach holistic or does it focus on a particular topic, resource or environmental characteristic? What specific actions characterize the approach?
• *Successes and challenges:* What has been the experience of implementation of the approach and what have been the challenges in meeting stated goals?

Next, using the results of the analysis, we developed a set of thematic axes by which to understand each typology and its associated models and to use as an assessment tool for existing and proposed regional sustainability initiatives. We emphasize that no single sustainability initiative falls neatly within a single typology. To the contrary, we found common themes running through most of the initiatives.

3. TYPOLOGIES OF REGIONAL SUSTAINABILITY INITIATIVES

(a) *Typology one: Natural resource and ecology based initiatives*

The primary foci of typology one initiatives are the conservation and sustainable use of natural resources and/or maintenance of ecological integrity and biological diversity of a region. Some are holistic in their approach to the natural environment, adopting region-wide sustainable land use planning that considers natural resources, biodiversity, and ecosystem services (Fürst *et al.*, 2013), while others focus on sustainable use of a particular, focal resource (e.g., soil or water) or species (e.g., salmon). A recurring objective for this type of initiative is landscape/habitat connectivity to assure viable habitats for a particular species or set of species (Fitzsimons, Pulsford, & Wescott, 2013; Fitzsimons & Wescott, 2008).

Australia's unique definition of sustainable development as "ecological sustainable development," or ESD (Kelly, Jackson, & Williams, 2012; Williams & Williams, 2015), provides an excellent example of natural resource and ecology-based sustainability planning. ESD emphasizes ecological priorities within national statutory planning guidelines, which (until recently) were implemented at the regional and local scales (Kelly *et al.*, 2012; Williams & Williams, 2015). This emphasis led to the integration of particular principles within sustainability planning, including inter- and intra-generational equity, precautionary principle, biodiversity conservation, and internalization of environmental externalities (Harding, 2006).

Perhaps in response to the growing evidence that ecological conservation programs cannot succeed in the absence of human wellbeing (Adams & Hutton, 2007; Clark, 2011; Dietz, Ostrom, & Stern, 2003), local community/stakeholder

integration plays an increasingly prominent role in natural resource and ecology-based initiatives, as exemplified by frameworks such as "multi-tenure reserve networks" (Fitzsimons & Wescott, 2008) and "community-based natural systems management" (Blaikie, 2006). Multi-tenure reserve networks are areas of land owned and/or managed by diverse stakeholders that, for the purpose of maintaining ecological integrity and the desire to connect habitats, are integrated into a coordinated management regime (Fitzsimons & Wescott, 2008; Fitzsimons *et al.*, 2013).

Community-based management, a popular form of participatory governance for natural resource management (Kearney *et al.*, 2007), is designed to address both ecological and socioeconomic goals by balancing exploitation of natural resources with their long-term conservation. While it generally focuses on a particular natural resource, it internalizes the axiom that sustainable resource use should be managed by the communities that are dependent on those resources and is based on the assumption that communities connected to natural resources are most likely to foster sustainable use. As such, it advocates devolution of decision-making power and authority to communities and community-based organizations (Kellert, Mehta, Ebbin, & Lichtenfeld, 2000; Wiber *et al.*, 2004). Models for community-based management include social and community forestry, community wildlife management, buffer zone management, and others (Kellert *et al.*, 2000). Indicators of success include revenues from resources, effective long-term resource management and restoration of degraded ecosystems, and of course, maintaining the habitat, species or resource in question. Alternatively, success can be measured in terms of process (e.g., creation of multi-level community dialogs or engaged communities), as governance, leadership, and social and economic networks are all cited as elements of successful implementation.

Biosphere Reserves, particularly in their earliest manifestations, also exemplify typology one initiatives. Coetzer and colleagues (2014) include among the multiple challenges to success of Biosphere Reserves, "confusion over objectives, vague assumptions, naïve expectations and a failure to acknowledge trade-offs between conservation and development priorities" (Coetzer, Witkowski, & Erasmus, 2014). Other challenges in implementing ecology-based approaches are directly related to the size of the area and the diversity of stakeholders within. Overcoming the challenges demands a high degree of coordination between stakeholders and governance structures (Fitzsimons *et al.*, 2013). Initiators often cite lack of trust between local communities, scientists and policy makers. Pre-existing conflicts between stakeholders that are left unresolved may demand attention and arbitration. Other challenges include failure to stimulate interest within local communities, failure to adopt a truly participatory approach, lack of harmonization and coordination in actions of various partners and lack of enforcement of policies (Kellert *et al.*, 2000; Stoll-Kleemann & O'Riordan, 2002). Lack of funding is also a common impediment to successful implementation and maintenance of the initiative (Fitzsimons *et al.*, 2013; Kearney *et al.*, 2007; Stoll-Kleemann & Welp, 2008).

While the devolution of decision-making authority is encouraged, it is also recommended that devolution be implemented with caution, as local communities may not have the social networks and governance structures needed to make, implement and enforce decisions (Wiber *et al.*, 2004). This emphasizes the need and responsibility of government authorities to develop and foster the capacity of local communities to take an active role in decision making (Stoll-Kleemann & Welp, 2008).

Some stakeholders may perceive ecologically focused sustainability initiatives as barriers to economic growth (Coetzer *et al.*, 2014). Recently, the status of the Australia's ecological definition of sustainable development has been eroded by what Williams and Williams (2015) consider to be a neo-liberal effort to catalyze economic growth by abandoning integrated sustainability planning. They consider part of the reason for recent sustainable development policy "reform" to be due to "a misconception of ESD as a policy that unduly prioritizes environmental factors" (Williams & Williams, 2015).

(b) *Typology two: Urbanism*

While urban development has been touted as both inevitable and the prototype for sustainable settlement patterns in an increasingly populated world, it is also viewed as particularly challenging for sustainability (Wheeler, 2009). Many sustainability frameworks for urban regions have been developed to address environmental and socio-economic challenges posed by urban development (Jabareen, 2006; Yigitcanlar & Teriman, 2015). In contrast to the previous typology, urbanism typologies focus on the environmental and social aspects of urban development, with ecology, until recently, taking a relatively minor role.

The typology is divided into three sub-categories, including new urbanism, landscape urbanism, and eco-urbanism. Each, in successive order, evolved as a critique of the previous subcategory. New urbanists advocate design-based strategies based on "traditional" urban forms, with goals of addressing the negative socio-economic and environmental impacts of suburban sprawl and inner-city decline (Bohl, 2000). Objectives, according to the Charter of the New Urbanism, include "restoration of urban centers and town within coherent metropolitan regions, the reconfiguration of sprawling suburbs into communities of real neighborhoods and diverse districts, conservation of natural environments and the preservation of our built legacy" (Congress for the New Urbanism., 2001). Within the new urbanism sub-category, there are several models that include neo-traditional town planning, the pedestrian pocket, transit-oriented development, quartiers approach, and smart growth (Knaap & Talen, 2005), although Knaap and Talen are careful to emphasize that the latter differs significantly from new urbanism in its roots (environmentalists and policy planners as opposed to architects and physical planners) and in its preferences for initiating change via policy prescriptions.

The second sub-category is landscape urbanism, which, as noted, developed in response to criticisms of new urbanism. Its main focus is organizing cities through the design of their landscape, rather than organizing them through their buildings. Gray (2006) offers a succinct definition, "the strategic approach to the formation of an urban scheme through the transformation of the processes related to landscape" that by definition take into account the ecological structure and integrity of the landscape. The concept offers a framework in which to consider complex urban conditions and the reciprocal implications of the city in the landscape (Mostafavi & Najle, 2003) and a sense that landscape can be used as a model for urban initiatives and a lens through which to examine cities (Gray, 2011). Models for (or perhaps modes of expression of) landscape urbanism include the Machinic Landscape (Mostafavi & Najle, 2003), field operations (Corner, 1999), civic infrastructure, and green urban design (Gray, 2006).

The third subcategory is ecological urbanism, which was born out of criticism of landscape urbanism (which, according

to critics, still focused too much on the built environment), and a desire for a more scientifically-guided (i.e., ecological) landscape design (Steiner, 2011). Curiously, just as the discipline of ecology was becoming more human-centered (Naveh, 2000; Singh, Haberl, Chertow, Mirtl, & Schmid, 2013), urbanism—as witnessed by the development of ecological urbanism—was becoming more aware of the importance of ecology. Ecological urbanism calls for city planning that is both multi-scalar and multi-disciplinary and proscribes that designers exploit ecological knowledge to produce environmentally sustainable urbanism (Mostafavi & Doherty, 2010; Steiner, 2011). Influenced by new ecological paradigms of dynamic and unpredictable nature and ecosystems theory (Pulliam & Johnson, 2002), ecological urbanists suggest that the modern challenge of landscape planning is "leading the sciences, humanities, and design culture toward a more rigorous, robust and relevant engagement across the domains of ecology and design" (Reed & Lister, 2014).

Success of initiatives within this typology seems to be measured primarily through individual urban design projects and case studies that reflect the values of the typology (e.g., Steiner, 2011). New urbanism-influenced initiatives have resulted in denser neighborhoods with improved internal connectivity and increased walkability. Landscape urbanism also notes success due to its influence on raising environmental awareness and changing planning paradigms, with increased consideration of landscape integration. However, these approaches also face diverse challenges and criticism (Ellis, 2002). New urbanism is often perceived as riskier than typical urban planning, due to its multiple-use goals and its strategies are sometimes viewed as exclusionary (e.g., a product of more powerful citizens distancing environmental and aesthetic nuisances from their own neighborhoods; Ellis, 2002). In addition, urbanist initiatives are criticized as being based on loosely defined concepts and relying on ostentatious projects to promote the concept. Another recurring criticism is that the approach attempts to promote an anachronistic development model that runs counter to desired urban spatial patterns as expressed by people who live in these environments (Waldheim, 2010).

(c) *Typology three: Issue-based initiatives*

The general assumption of issue-based approaches is that by realizing sustainability in a given economic or social sphere, the impact on sustainability objectives will be felt in all spheres. Donald (2008) emphasizes the potential, for example, of sustainability changes within food systems to have much wider ramifications of social, economic and ecological sustainability. Likewise, climate change adaptation is promoted as a focal topic for "cross-sectoral, adaptive management practices that jointly target a sustainable regional development" (Reyer *et al.*, 2012). Bartke *et al.* (2016) frame their research focus on brownfield development in terms of meetings sustainability objectives and assess tools for region-wide brownfield remediation using sustainability criteria (particularly stakeholder participation in the remediation process). Other initiatives may focus on an economic or cultural mainstay of the region, for example salmon in the case of the Salmon River Watershed Roundtable in British Columbia (Day & Cantwell, 1998). Tree-based ecosystem approaches emphasize the role of trees, when "managed to support the delivery of multiple objectives and ecosystem services," in addressing a range of sustainability goals, such as food security and climate change resilience (Willemen *et al.*, 2013). Agriculture and tourism are two additional foci for issue-based sustainability initiatives at the

regional scale (Loibl & Walz, 2010). Both are considered to be ineluctably tied to environmental quality.

Climate change adaptation, according to Reyer *et al.* (2012), can and should be tightly aligned with regional sustainability strategies. These authors assessed specific adaption policy measures in Brandenburg, Germany, with regard to their ecological, economic and social (i.e., sustainability) implications. They conclude that since climate adaption policy requires a multi-sector, multi-scalar approach that considers the three paradigmatic pillars of sustainability, it exemplifies how other complex sustainability challenges should be addressed. More generally, others have argued for a tight coupling of climate change adaptation and mitigation policies with those of sustainable development (Swart, Robinson, & Cohen, 2003). Eizenberg and Jabareen (2017) use risks associated to climate change as organizing framework for sustainable urban planning, and particularly for strengthening social considerations (defined as safety, equity and socially and environmentally informed economic organization) within such planning.

Ecotourism is tourism that focuses on a component of nature and which should satisfy ecological, economic and sociocultural sustainability (Wall, 1997; Weaver & Lawton, 2007) and encourage active learning that provides transformative experiences (Weaver, 2005; Weaver & Lawton, 2007). The European Commission has designated three strategies for sustainable tourism, including reporting of impact of tourism, exploitation of tourism for environmental awareness campaigns and promotion of good (e.g., sustainable) practices (Diamantis, 2000). According to Diamantis, sustainable tourism and ecotourism initiatives have become prominent on Mediterranean islands, although the actual implementation of policies varies vastly from island to island depending on local considerations and constraints. Community empowerment has become a prominent feature in ecotourism initiatives (Weaver, 2005).

According to Weaver and Lawton (2007), ecotourism research is unclear as to whether ecotourism in general was meeting ecological and economic goals. In the case of species conservation, for instance, they point out that goals of ecotourism can vary between scientists and site managers, and as such, definitions of success also differ. Wall (1997) is significantly more critical, drawing a sharp distinction between sustainable tourism (implying a holistic improvement in both human and environmental conditions) and ecotourism (an instigator of change at the tourism destination often unwanted by local stakeholders). He suggests that a more productive approach would be to consider tourism within the broader rubric of sustainable development, rather than focusing on the specific issue of sustainable tourism.

Like in the previous typologies, the indicator of success can be either the status of the focus of the initiative (e.g., declining carbon emissions with little detrimental impact to other livelihood indicators), or the community processes catalyzed by the initiative, or both. Willemen *et al.* (2013), assessing projects practicing tree-based ecosystem approaches, measured success according to income, production/yield, food security, biomass production, carbon sequestrations, soil erosion, water availability, pest control, and others indicators. Donald (2008), who advocates placing food systems at the center of regional sustainability issues, suggests that success is measured, among other indicators, by collaboration with communities.

(d) *Typology four: Governance, participation, and science-based approaches*

Rather than focusing on the specific target, some initiatives focus on process, in part using the process to generate sustainable stakeholder-driven policy. The common feature of typology four is the underlying assumption that political and planning processes, and stakeholder integration in these processes, are among the most crucial ingredients for producing successful outcome (Fitzsimons *et al.*, 2013; Kearney *et al.*, 2007; Loibl & Walz, 2010; Smulders-Dane, Smits, Fielding, Chang, & Kuipers, 2016). Agenda 21, for example, states forthright that public participation in decision making is a prerequisite for realizing sustainable development (UNCD, 1992). Various forms of community engagement have become cornerstones of sustainable planning and management in diverse fields of planning, landscape design, natural resource management, and environmental policy, and some research describes new and innovative forms of community-based leadership that are developing to meet sustainability challenges at the regional scale (Horlings & Padt, 2013; Smulders-Dane *et al.*, 2016; Wiber *et al.*, 2004). Participatory processes and governance are considered so central to sustainability that much of the literature treats them as indicators of successful sustainability outcome (e.g., Weaver & Lawton, 2007 in the context of ecotourism).

The literature on governance and participation in sustainability initiatives is diverse, but some examples can serve to illustrate the diversity. Loibl and Walz (2010) recount a science-informed stakeholder deliberation process in the Austrian Alps, where stakeholders were prompted to discussion with lectures about climate change and local socio-economic trends. Stakeholders provided their reactions, perceptions and knowledge of development dynamics in their region, and this information was used to generate scenarios and visual data to help the same stakeholders suggest sustainable development priorities and policies for the region's future. Similarly, Kearney *et al.* (2007) emphasize the need to build cross-scale horizontal and vertical interactions between various agencies and stakeholders to catalyze cooperation and avoid fragmentation of decision making. National parks in Switzerland combine bottom-up and top-down approaches to policy making, where local actors formulate policy that is then sent up the government hierarchy for approval. If approved, the federal government then supports the policy initiative financially and logistically (Hirschi, 2010).

Leadership is often noted as an ingredient for success of initiatives. Horlings and Padt (2013) explore regional development initiatives in rural Netherlands and conclude that leadership is crucial in the transition from the "old 'economic' path" to more sustainable regional development. Others concur, noting that leadership is crucial for successful implementation and coordination of multi-tenure reserves (Fitzsimons *et al.*, 2013; Stoll-Kleemann & O'Riordan, 2002), ecotourism projects (Weaver & Lawton, 2007) or communicating sustainability to diverse stakeholders and developing a collective vision with them (Smulders-Dane *et al.*, 2016). However, Fitzsimons *et al.* (2013) warn that too much dependence on specific individuals may not be sustainable over the long-term.

Case studies from the literature are generally portrayed by their authors as successful examples of governance and participation, but there are also examples of insufficient community participation (Kearney *et al.*, 2007; Kellert *et al.*, 2000). The primary challenge is to create a process that truly integrates community input, raising the community from an advisory capacity to one with a bona fide role in decision making (Kearney *et al.*, 2007). Kearney *et al.* (2007) note three crucial shifts in thinking that must take place to create ideal community-based management, including (1) integrating the broad range of diverse stakeholders; (2) holding regulators

and governments accountable and transparent to their public, and (3) allowing communities to take the lead in governance. Further, these empowering shifts must be officially recognized and codified (legally and politically). Kellert and colleagues (2000) report that according to their social and environmental indicators, community-based management in developing countries failed to result in equitable distribution of power and benefits, a reduction in conflict, or increased appreciation of local knowledge, biodiversity protection, or sustainable resource use. The role of stakeholder engagement and participatory planning in regional sustainability is particularly challenging in megaregions, where larger spatial scales include a broader diversity of stakeholders and distance governance structures and policy-making from local communities (Wheeler, 2009).

Also included in this typology is the science-based approach, which posits that research for sustainability can be particularly effective at the local and regional scales and should be, in part, stakeholder driven. An exemplary science-based sustainability initiative is the Long-term Socio-Ecological Research (LTSER) platform. LTSER platforms were conceived and implemented by the International Long-Term Ecological Research (ILTER) network over the past decade (Singh et al., 2013). The LTSER platform is a spatially defined foundation for place-based, sustainability research, whose agenda is determined through collaboration between scientists and local stakeholders (Haberl et al., 2006). The scope of LTSER is regional, although the size of LTSER platforms varies from several square kilometers to more than 100,000 sq. km. (Mirtl, Orenstein, Wildenberg, Peterseil, & Frenzel, 2013). Its focus is on policy-relevant research, defining the scientific agenda in a way that suits the goals of regional sustainability. Collaborative meetings between policy makers, local residents and other stakeholders afford the opportunity to exchange scientific and local knowledge and to facilitate community-level planning. Partners include scientists, local/regional decision makers, land owners, local residents, and other stakeholders. The LTSER network cites among its interim successes (1) a reorientation of scientific research agendas to be better aligned with regional socio-ecological challenges, (2) creation of collaboration between researchers, policy and management agencies and the general public, and (3) establishing an infrastructure for the collection of long-term socio-ecological data (Singh et al., 2013). Coetzer and colleagues (2014) describe biospheres reserves as sites for scientific research and interactive learning, as well.

4. WHERE DO WE STAND? SITUATING SUSTAINABILITY INITIATIVES ALONG THEMATIC AXES

As reviewed above, there is broad diversity of sustainability approaches, foci, management structures, and implementation tools. We derive from this analysis four axes with which to analyze potential, nascent or established sustainability initiatives (Figure 1). These axes highlight four characteristics of initiatives that both define the focus of the given initiative, but also help emphasize where initiatives are possibly neglecting important considerations. It is important to take into account that these axes are actually different sides to the same sustainability "coin," whereas almost all initiatives consider them all, and consider both sides of the individual axes, to some degree. Several underlying characteristics of individual initiatives seem to lead to emphasis of some characteristics at the expense of others, for instance disciplinary expertise, point of entry into the project, priorities of the initiators,

etc. Taking this into account, we suggest that applying the thematic axes helps clarify the potential strengths and weaknesses of an initiative based on aggregate international experiences (see also Appendix 2). The axes are to be thought of as a continuum, and since initiatives are dynamic, the location of an initiative on the axes is not static.

Axis one: top-down versus *bottom-up initiative.* This axis defines who among the stakeholders initiated the effort, top-down actors (e.g., national government or international organizations) or bottom-up (e.g., local residents). In top-down initiatives, a specific tier within the governance structure or other relatively influential groups (like academics, NGOs, or land owners), initiate, set goals and implement the project. While these initiatives may have well-defined goals, they often neglect the aspect of community participation, even when explicitly part of the initiative. Biosphere reserves, for example, when initiated by government agencies rather than by the communities themselves, can be hindered by neglect of community participation. But top-down initiatives benefit from financial support, capacity-building and facilitation, provision of information and expertise, guidance and connection to broader-scale (e.g., national and continental) policies. Bottom-up initiatives, catalyzed by community members themselves, can suffer from lack of focus, organization, and stability. They may depend on the stamina, charisma and commitment of community members to implement projects (Horlings & Padt, 2013). However, planning theory and practical experience suggest that bottom-up initiatives and germane stakeholder integration can increase project durability in terms of community empowerment and support (Chambers, 1994; Fraser, Dougill, Mabee, Reed, & McAlpine, 2006; Reed, 2008).

Axis two: Ecological versus socio-economic focus. This axis defines whether the initiative focuses on ecological priorities or if it emphasizes social or economic concerns. While all sustainability definitions integrate and pre-suppose a balance between ecological and socio-economic considerations, in practice projects often reflect the priorities of their initiators. Biosphere reserves, for example, often reflected an inherent bias toward biodiversity conservation at the expense of socio-economic wellbeing, especially regarding first generation reserves. In contrast, while urban-based, type two, sustainability initiatives often place emphasis on open spaces, clean air and water, and clean transportation systems, they do not always reflect an understanding of habitat conservation, ecological integrity and biodiversity. But overall, there seems to be a general convergence both in theory and practice of consideration of both social and ecological concerns.

Axis three: subject-specific versus holistic systems approach. This axis defines whether the initiative focuses on a single topic or target or whether it takes a holistic approach. Both approaches on this axis have unique advantages for sustainability planning. The subject-specific approach (e.g., the Salmon River Watershed Roundtable; Day & Cantwell, 1998) capitalizes on a culturally and/or economically meaningful component of the natural environment. Yet, even from the individual species or resource perspective, sustainable management demands a more holistic approach to regional planning to assure long-term viability of the resource. Holistic approaches, such as multi-tenure connectivity initiatives, take the broad (ecological) view of a region and work to secure habitat protection for all biodiversity within.

Case studies show that both approaches can be effective, though they both face challenges. Some approaches may be too narrow to allow for a broader look at the ecological or societal impacts of a project (for instance, with ecotourism).
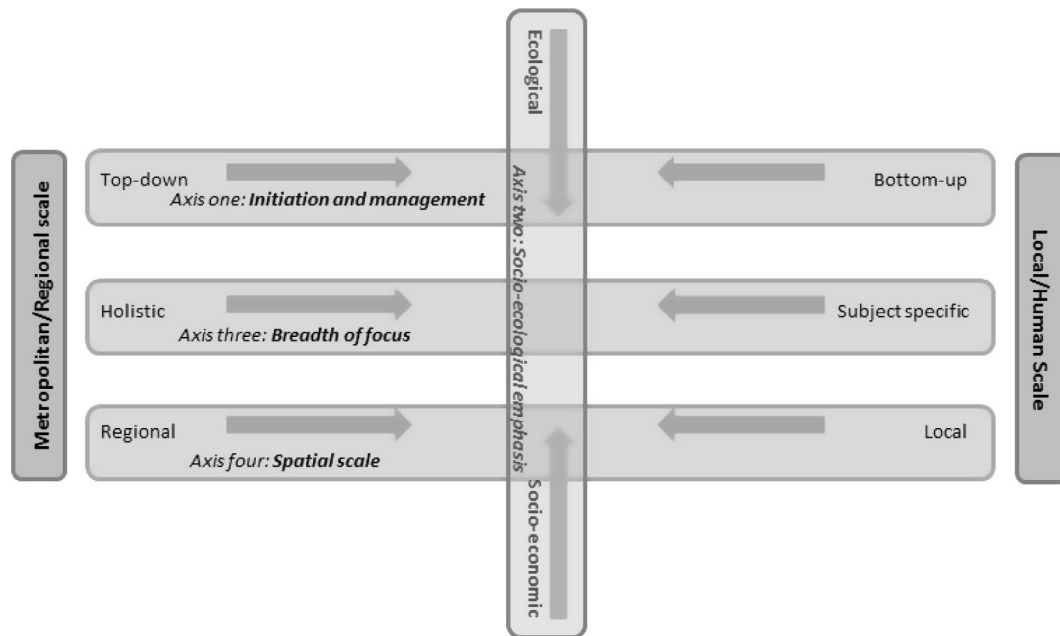
Figure 1. *Thematic axes for analyzing sustainability initiatives.*

On the other hand, holistic approaches, while inherently more appropriate for sustainability and with prolific support from lofty theory, can be too broad or vague to be effective. Further, holistic approaches are more radical in their approach and may be perceived as demanding too much from various stakeholders, thus engendering opposition.

Axis four: spatial scale of approach (regional or local scale of resolution). Deciding on a spatial scale for the initiative is a logical first step in a sustainability initiative. Scale will vary according to natural and political boundaries, social networks, specific sustainability approach (e.g., ecological or socio-economic; subject-specific or holistic), and administrative-political-economic considerations. The success of a project is contingent on proper definition of initiative boundaries (physical and social). The improper definition of boundaries will have a negative impact on a range of issues from ecological integrity to stakeholder engagement. All regions, regardless of size, are also subject to external factors beyond the boundaries of the initiative, and so exogenous change must also be considered within the sustainability initiative.

5. MEETING IN THE MIDDLE: HISTORICAL CONVERGENCE OF EMPHASES IN SUSTAINABILITY INITIATIVES

This overview of spatial sustainability definitions and initiatives is a hopeful testament to the multiple and diverse ways which local communities, the scientific community, and planners and policy makers are addressing contemporary sustainability challenges. By reviewing multiple projects drawn from disparate disciplines and bounded primarily by their common aspiration for regional sustainability, we have identified broad trends and recurring lessons learned at this scale at diverse locations. We suggest that these trends and lessons can provide helpful guidelines for practitioners managing existing initiatives or planning new ones.

Using the proposed thematic axes, sustainability initiatives can be assessed by what they are missing, or where they are weak. For instance, an initiative can be queried regarding its balance of emphasis on social versus ecological systems. Likewise, initiatives should include a collaborative relationship between grass-roots stakeholders and policy makers and land managers, recognizing the relative strengths that both top-down and bottom-up initiatives offer for assuring credibility and durability of the initiative (e.g., Hirschi, 2010). These factors will be defined, in part, by the spatial scale encompassed within the initiative, but practitioners are advised to consider the broader socio-ecological system in which their initiative is embedded. While these points may seem intuitive for theorists, numerous initiatives rise and fall based on their lack of attentiveness to these multi-faceted considerations.

The lessons learned here through the analysis of multiple individual initiatives from the past decade are reflected in three sustainability frameworks that have accumulated significant on-the-ground experience over the past decades: UNESCO Biosphere Reserves, a research paradigm shift within the International Long-Term Ecological Research (ILTER) network, and the paradigmatic shifts from New Urbanism toward Eco-Urbanism within the fields of urban design and urban planning. The historical starting point of each of these efforts (as practiced, if not in theory) can be located at the edges of our sustainability axes, and the evolutionary development of each is marked by a migration toward the center of the axes (i.e., a revising of emphases that are more integrative of the various poles of the axes).

Biosphere reserves began as an initiative of the United Nations Education, Scientific and Cultural Organization's (UNESCO) Man and the Biosphere (MAB) program, which encourages and grants recognition to a network of national reserves across the globe. The original objectives of Biosphere Reserves were to sustain diverse ecosystems and their genetic and biological resources, while conducting ecological monitoring and providing local residents with sustainable economic opportunities. The first generation of Biosphere Reserves were established 35 years ago and they began with a heavy emphasis on biodiversity preservation, often indistinguishable from more classic nature reserves, intended as "ecological baselines

against which the consequences of human driven modification and management interventions could be monitored" (Di Castro, 1976 from Coetzer *et al.*, 2014). Over time and based on experience and criticisms, protocols for establishing and maintaining biospheres became increasingly human-centered, placing a larger emphasis on the socio-economic wellbeing and concerns of biosphere reserve residents (Coetzer *et al.*, 2014; Ishwaran, Persic, & Tri, 2008; Price, Park, & Bouamrane, 2010; Stoll-Kleemann & Welp, 2008). Likewise, management was encouraged to shift to a more inclusive, bottom-up approach.

A second example: The International Long-Term Ecological Research (ILTER) network is a global network of research sites whose scientists are dedicated to the long-term monitoring of ecosystem variables. This network had an exclusively ecological focus whose socio-economic relevance, until recently, was limited to providing policy-relevant data to decision-makers (Hobbie, Carpenter, Grimm, Gosz, & Seastedt, 2003). But over the past decade, a major shift in thinking has taken place within this network, catalyzed by the increasing concern of ILTER scientists about the ecological integrity of the systems they studied. They became increasingly interested in both studying the holistic socio-ecological system and in adopting a transdisciplinary approach to research, which would be problem-driven and informed by both expert and stakeholder (i.e., local) knowledge (Haberl *et al.*, 2006; Singh *et al.*, 2010). Like the conceptual transition within the MAB community, the ILTER community, in the name of sustainability, has been attempting to move from one end of the ecology/socio-economic axes toward the middle, and likewise moving toward a transdisciplinary program that is increasingly bottom-up (stakeholder informed), focused on holistic, socio-ecological systems (Collins *et al.*, 2011; Singh *et al.*, 2013). Accompanying these shifts is an increasingly regional approach that complements LTER's traditional site-based approach.

The third example, the paradigmatic shifts among architects and urban planners from New Urbanism to Ecological Urbanism, like the previous examples, signifies a movement along several axes, but the starting point was very different. Due to their disciplinary and professional framework, New Urbanists began considering sustainability from the vantage point of the built environment. But the sustainability approach took an increasingly broad spatial scale, integrating unbuilt ecosystems both within and beyond the built environment. Likewise, ecological considerations are increasingly considered alongside socio-economic considerations. As reflected in the planning practice in general, an increasing emphasis on stakeholder participation is replacing a more traditional top-town orientation in city and regional planning.

In all three of these examples, through trial and error and active learning from successes and failures, theoreticians and practitioners are reassessing their efforts and finding greater balance of multiple interests and responsibilities. The axes framework introduced here fairly accurately reflects decades of learning within the MAB, ILTER, and the Urbanist communities.

6. CONCLUSIONS: A NEW GENERATION OF SUSTAINABILITY INITIATIVES

While specific characteristics of sustainability initiatives must be tailored for local conditions and priorities, we note a nearly universal convergence regarding key components of a successful sustainability initiative, including the importance of participatory governance and full collaboration and trust between agencies and stakeholders, a focus on local communities and their "quality of life", and strengthening the linkage between ecological and socio-economic wellbeing (Kearney *et al.*, 2007; Weaver, 2005). The target communities must be interested and willing to participate and initiative goals must be determined through a sensitive, though crucial, alignment of interests among stakeholders, who must formulate a common, dynamic vision for regional sustainability (Fitzsimons *et al.*, 2013; Kearney *et al.*, 2007; Smulders-Dane *et al.*, 2016).

We do not address whether a change in how sustainability is conceptualized is needed, and if so, what a new conceptualization would look like. As Jabareen (2008) notes, theoretical frameworks of sustainable development are diverse and tolerant of "diverse interpretations and practices." We suggest that, through countless experiments and initiatives, there are certain convergences of priorities and emphases that must be present and considered in any initiative in order to raise chances of success. Those emphases seem to support quite clearly the need to revise our compartmentalized thinking about sustainability in the search for a more integrative, holistic approach, such as that embodied in emerging sustainability frameworks such as transdisciplinary socio-ecology (Haberl *et al.*, 2006), ecological urbanism (Mostafavi & Doherty, 2010) or in the "sustainable livelihoods" framework (Biggs *et al.*, 2015; Miller, 2014).

NOTES

1. Our choice of scale was also influenced by our practical concern: one of our objectives was to develop a conceptual framework for an NGO exploring options for a regional sustainability in a region where important habitats for biodiversity overlap with areas facing rapid urban and agricultural development (see Appendix 2).

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APPENDIX 1.

APPENDIX 2: APPLICATION OF THE CONCEPTUAL MODEL

Our research objective was triggered by a request from local non-governmental land-holding organization (NGO), Ramat Hanadiv Nature Park, to produce an overview of regional sustainability initiatives in preparation for an initiative of their own. One of the objectives of the nature park is protection of biodiversity. The staff intended to initiate a comprehensive regional sustainability initiative in collaboration with local stakeholders. Their interest was prompted by an ecological study of their site, which yielded conclusions that long-term survival of multiple species on the site could not be assured through management of the site alone (van der Sluis & van Eupen, 2013). Rather, species survival was dependent on connectivity between the site and other habitats in the region and therefore, dependent on regional development (hence the focus on the regional scale in this research). The NGO staff wanted to answer the following questions: (1) What models exist for regional sustainability initiatives? (2) What is the most suitable model for their NGO to adopt for the region, and (3) What would be the most productive role their NGO can play

Table 1. *A sample of the diverse definitions of sustainability and sustainable development applied at the regional scale (note that typologies are not mutually exclusive, and most examples could fall into more than one category)*

Typology	Source	Research focus (typology)	Definition of sustainable development
Issue-based	Wiber et al. (2004)	Community-based fishery management	Referred to in **ecological and economic** terms; "**sustainable livelihoods**"
	Weaver (2005)	Ecotourism	Contentious term, "impossibility of knowing… that a particular course of action is indeed 'sustainable'… This owes to the **subjectivity and malleability** of this [concept], wherein there is no consensus as to what exactly should be sustained." Suggests a continuum of criteria for sustainability from "status quo" to "enhancement" of the local environment.
	Donald (2008)	Food systems	"reducing a region's **ecological footprint**, addressing issues of **hunger**, and providing **more local jobs**; thus ultimately moving toward a more sustainable region in keeping with the **three classic pillars** of sustainability"
	Schädler et al. (2011)	Brownfield development	"**reduction of land consumption and urban sprawl**"
	Horlings and Padt (2013)	Rural Areas (issue-based)	"a **normative concept** referring to the responsibility to make short-term decisions from a long-term perspective… taking the effects on **future generations and a range of geographical scales** into account," and "applies no longer only to **pollution control, the availability of natural resources and protecting species and their ecosystems**, but also to **human and social development, including human rights, good governance and solidarity**." "**Qualities of life**".
Natural resource and ecology based	Harding (2006)	Ecologically sustainable development	Noted a "general agreement that [the interpretation of sustainability] involves simultaneous satisfaction of **economic, environmental and social factors**
	Bartke et al. (2016)	Natural resource management	Notes, as a critique, that sustainable natural resource management has been traditionally defined by rational and scientific criteria, assumed to be "scientific, reliable, authoritative, and reproducible – the very antithesis of local knowledge"
	Fitzsimons and Wescott (2008)	Multi-tenure reserve networks	Noted primarily in terms of **natural resource use** and **ecological** sustainability
	Smulders-Dane et al. (2016)	Stakeholder collaborative land use planning	Derived sustainability definition from 'the Nature Step' focusing on **preventing environmental degradation**, while assuring that "people are not subject to conditions that systematically undermine their capacity to meet their needs"
Governance, participations and science-based	Kearney et al. (2007)	Participatory governance	Reference to the **three components**, but which cannot exist without **community wellbeing**; "Emphasis should thus lie in maintaining or enhancing the **economic and sociocultural well-being, overall cohesiveness, and long-term health of the relevant human systems**…"
	Hirschi (2010)	Network governance	" integrating rural **economic development** objectives and **environmental and landscape protection** goals"
	Loibl and Walz (2010)	Participatory processes in planning	"…strategies should promote **economic and social progress** while **preserving the environment** that should not be seen just as a resource and service provider but rather as a treasure of biodiversity and beauty"
	Reyer et al. (2012)	Regional adaptation strategies in the face of global climate change	"… **ecological and (dependent) social systems** shift to new operating points without dramatically and abruptly changing functionality and characteristics"
Urbanism	Congress for the New Urbanism*	Urbanism	Referred to in **ecological and economic** terms; "**sustainable livelihoods**"
	Reed and Lister (2014)	Landscape architecture	Contentious term, "impossibility of knowing… that a particular course of action is indeed 'sustainable'… This owes to the **subjectivity and malleability** of this [concept], wherein there is no consensus as to what exactly should be sustained." Suggests a continuum of criteria for sustainability from "status quo" to "enhancement" of the local environment
General/theory	Birkmann (2006)	Sustainability within the framework of vulnerability	"reducing a region's **ecological footprint**, addressing issues of **hunger**, and providing **more local jobs**; thus ultimately moving toward a more sustainable region in keeping with the **three classic pillars** of sustainability"
	Jabareen (2008)	Conceptual framing	"**reduction of land consumption and urban sprawl**"
	Wheeler (2009)	Sustainability challenges posed by megaregions	"a **normative concept** referring to the responsibility to make short-term decisions from a long-term perspective… taking the effects on **future generations and a range of geographical scales** into account," and "applies no longer only to **pollution control, the availability of natural resources and protecting species and their ecosystems**, but also to **human and social development, including human rights, good governance and solidarity**." "**Qualities of life**"
	Miller (2014)	Reframing the term "sustainable development" (general/theory)	Noted a "general agreement that [the interpretation of sustainability] involves simultaneous satisfaction of **economic, environmental and social factors**

* https://www.cnu.org/sites/default/files/Canons_0.pdf.

vis-à-vis setting the agenda and facilitating the process of a sustainability initiative? Their initiative can be defined as an authentically bottom-up initiative (albeit by a well-funded NGO) operating within a planning system that has historically been strongly centralized, with rather ineffective mechanisms for stakeholder participation (Alfasi, 2003; Kemp, Lebuhn, & Rattner, 2015).

Since the presentation of our research results and thematic axes, The Ramat Hanadiv NGO has initiated a process of stakeholder meetings in which residents of the surrounding region are collectively determining a long-term vision for their area and determining the most important development challenges with regard to social, economic, and environmental wellbeing. The process has been endorsed by local government and is accompanied by a team of scientists who provide real-time insights into the challenges identified by the stakeholders. While not without its challenges, the initiators are shepherding a process that: Carefully balances bottom-up initiative with top-down guidance and support (axis one); Considers the intersection between ecological and socio-economic priorities (axis two); Maintains a holistic orientation while allowing stakeholders to identify high-priority sustainability issues for attention (e.g., agriculture and transportation; axis three), and; Defines project boundaries according to both ecological and socio-economic considerations (as opposed to their previous approach which emphasized management exclusively within the park boundaries) and including the whole urban–rural mosaic of land cover (axis four).

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