Regional sustainability assessment framework for integrated coastal zone management: Satoumi, ecosystem services approach, and inclusive wealth

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\textbf{ABSTRACT}

This study proposes a novel regional sustainability assessment framework for integrated coastal zone management (ICZM). Various ICZM indicators have been developed, but their management insights are not always clear. Our framework integrates three separately developed approaches with an explicit reflection of stakeholders’ values: Satoumi (a Japanese concept of socio-ecological production landscapes, SEPLs), ecosystem services approach (ESA), and inclusive wealth (IW). We suggest that the integration of Satoumi, a uniquely Japanese concept, with the ESA and IW complements each other and increases the effectiveness of all three approaches when applied to ICZM and decision making. Satoumi describes the desired state of a coastal zone. The ESA translates Satoumi into IW and helps explain which changes to ecosystems contribute to the asset quality (i.e., shadow prices). As a sustainability indicator, IW differs from other ecological indicators because it comprises human, natural, and manufactured capital assets and incorporates shadow prices to weigh the contribution of each asset to the present value of social welfare. Shadow prices may capture the quality of capital assets in terms of how much people value them, and can therefore be a direct management target for realizing a desired coastal zone. We propose adding two sustainability criteria, desired state and strong sustainability, to the original IW to make it operational. The framework was tested in Japan’s Seto Inland Sea, and the results were analyzed in depth. Based on the outcomes, we discuss the insights for ICZM and future research. While Satoumi is a Japanese concept, the framework could be applied to other countries where similar SEPLs exist.

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1. Introduction

The goal of this study is to advance methodology for development of a regional sustainability assessment framework for integrated coastal zone management (ICZM or IC). ICZM has been globally adopted. The European Commission adopted a new initiative on IC in March 12, 2013 (European Commission, n.d.). The Japanese Basic Act on Ocean Policy (Act No. 33; April 27, 2007) stipulates that a state shall adopt ICZM. The aim of ICZM is to coordinate the application of different policies and activities affecting coastal zones, which covers coastal sea and land areas, in order to develop the coastal zones in a sustainable manner; it respects the limits of natural resources and ecosystems and involves transdisciplinary knowledge and all stakeholders across the different sectors (European Commission, n.d.; Japanese Basic Act on Ocean Policy: Act No. 33, April 27, 2007; Maccarrone et al., 2014).

These ambitious aims provide much scope for improving ICZM. The European Commission, for example, conducted a formal evaluation of ICZM efforts across Europe and suggested the need to make ICZM more operational (Ballinger et al., 2010). Syme et al. (2012) point out that there is a gap between science and coastal management, and it is unclear how to integrate research outcomes into coastal management schemes. We need to develop methodologies for addressing a variety of difficulties including a lack of engagement between scientists, practitioners, and policy makers, a lack of data, uncertainty, contrasting terminologies, and the need to integrate results from a broad spectrum of methodologies and disciplines (Reis et al., 2014).

This study presents a novel sustainability assessment framework that uses indicators to bridge this gap. Indicators for ICZM have been in increasing demand and most of the existing best practices for ICZM outline their use (Maccarrone et al., 2014). Various
social and ecological indicators have been developed (Duraiappah et al., 2012; Hattam et al., 2015; Turner et al., 2014); however, shortcomings remain. For example, Maccarrone et al. (2014) raise four principal shortcomings of ICZM indicators: lack of reflection of socio-ecological interactions, lack of feedback from the responses to previously adopted management actions, lack of consistency with the ICZM objectives, and lack of the availability and homogeneity of the indicator set. Current indicators often lack practical ICZM insights but provide a description of a state or the past; their contributions to sustainability are often not explicitly explained but implicit. Our proposed framework attempts to overcome some of these shortcomings.

Our framework is systematic, not ad hoc, and transdisciplinary; it integrates three separately developed approaches that explicitly reflect stakeholders’ values: Satoumi (the Japanese concept of socio-ecological production landscapes (SEPLs)), the ecosystem services approach (ESA), and inclusive wealth (IW). Each approach makes a different contribution to sustainability assessment, and their integration is complementary and makes the assessment framework credible and operational. Ad hoc approaches (Harris and Pearson, 2004) or a lack of theoretical foundation (Kulig et al., 2010) has hindered the development of a sustainable assessment framework. Without a theoretical or systematic framework, it is difficult to validate and further develop the framework. IW is grounded in neoclassical growth theory but can be extended beyond the neoclassical framework. IW is realistic as it allows for an imperfect economy in which government maximizes intergenerational social welfare (Arrow et al., 2009). It integrates environmental, economic, and social aspects through capital assets, which contrasts with most attempts to measure sustainability (Singh et al., 2012). The integration is transdisciplinary in that it is intended to construct an issue-oriented, interdisciplinary, and participatory assessment framework.1 The transdisciplinary design of the framework makes it operational, in that it provides practical inputs to ICZM to attain or sustain a desired coastal zone. The actual practice of this type of research “has long lagged behind theory” (Fischer et al., 2015, p.146).

The framework was tested in Japan’s Seto Inland Sea (SIS) and analyzed in detail. We discuss the outcomes’ insights for ICZM of the SIS and future research needed to further develop the framework. This case study makes an important contribution to the scientific literature, which comprises predominantly European and North American cases and comparatively few Japanese examples (see Lique et al. (2013) for a review). The case study aims to provide sufficient guidance for readers to apply the framework to their areas of interest.

2. Regional sustainability assessment framework

Our framework comprises three approaches with seven steps (Fig. 1). It extends IW to compute a sustainable development path index by adding sustainability conditions, and adopts Satoumi and the ESA to make IW credible and operational as a regional sustainability assessment tool. Satoumi, ESA, and IW play different but partially overlapping or related roles. Their integration is complementary and increases the effectiveness of all three approaches when applied to coastal zone management and decision making.

IW is calculated as the sum of the net present value of social welfare which is provided by the product of capital assets (i.e., productive base) and the assets’ shadow prices (i.e., social welfare weights; Pearson et al., 2013) instead of uniform weights that are commonly used in ecology (Banzhaf and Boyd, 2012). The original

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1 See Common and Stagl (2005) for the connotations of transdisciplinarity.
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