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Human well-being differs by community type: Toward reference points in a human well-being indicator useful for decision support

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ABSTRACT

Human activity has growing impacts on the natural capital humans depend on for existence. While many of these impacts are regional, national, or international in scope, it is increasingly evident that decisions made at the local community level are also important. Yet, understanding the impacts of local decisions, as well as how to correct or mitigate these impacts, can be problematic, as communities differ in resources, priorities, dependencies on natural capital, and even opinions about whether these impacts actually affect quality of life. Every community has unique characteristics, however effective decision support at the community level requires common reference points in measures of human well-being upon which to base decision support. We have developed a community classification system that is intended to find such common ground in community characteristics and tie these common elements to measures of human well-being. This community classification system was developed in the USA with publically available data on resource dependence, socio-economic composition, and existence of natural capital. The resulting classification was applied to coastal communities at the county level and then used to predict human well-being based on an existing human well-being index. Coastal communities were separated into eight characteristics groups based on Bayesian cluster analysis. Classification groups were found to be associated with significant differences in human well-being. More importantly, significant differences in specific elements of well-being were associated with key community characteristics, such as population density and economic dependence on local natural resources. In particular, social cohesion and the leisure time were strong elements of well-being in low density communities with high natural resource dependence but this association weakened as population densities and economically diversity increased. These sorts of commonalities in community type that can be tied to differences in human well-being are important because they provide clear ties to environmental service flows, as well as a meaningful reference point from which to measure the local impacts of decisions as changes in community-specific human well-being.

1. Introduction

Human activity has growing impacts on the natural capital humans depend upon for existence (Condie et al., 2012; Pauly et al., 1998; Peterson et al., 2003). Many of these impacts are regional, national or international in scope such as air pollution (Likens et al., 1996) and climate change (Nelson et al., 2013; Piazza et al., 2010). Yet, there is an increasing understanding that decisions made at the local community level can have significant impacts and need to be understood both as a local issue, as well as a cumulative issue across multiple communities (Israel et al., 1998; Tallis et al., 2008). Natural capital degradation due to human activity is more often being valued and measured in terms of its direct impact on human beneficiaries based on the production and supply of ecosystem goods and services (EGS) (Garcia-Llorente et al., 2011; Grabowski et al., 2012; O'Higgins et al., 2010). All communities have unique characteristics, but also have characteristics in common, such as beneficiaries (i.e., resource user groups), and can be classified into groups to aid in prioritizing conservation and utilization of natural capital. A novel community classification system was developed during this study to inform decision makers about a community's priorities, and the association of these priorities with human well-being as a tool for informing decision makers about sustainable decision outcomes in a community-specific context. This approach can aid

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decision makers in defining meaningful change in human benefit across different communities by establishing reference points and can provide a clear justification for investing in conservation, mitigation, and restoration of natural capital (Adeel and Safriel, 2008; Pascual et al., 2012; Vaissiere et al., 2013).

Describing environmental degradation in terms of human endpoints also fosters discussion on tradeoffs and the concept of ecosystem sustainability. Loss of natural capital has differing values for different user groups; managers must rectify these conflicts in the context of other forms of capital (i.e., built, economic, and social) into a coherent plan that considers the synergistic outcome for all user groups (Butler et al., 2013; Green et al., 2014). Such a plan must also include measurable reference points to evaluate changes in capital as meaningful to beneficiaries. The most useful end point for this approach is the concept of ecosystem sustainability, which rather than focusing on each beneficiary individually, targets the maintenance of net benefits through time (Jorgenson et al., 2014). This is still an 'ecosystem-centric' approach; nonetheless it is dependent on understanding dependencies of human benefits to a broad range of EGS, as well as defining a clear and acceptable measure of overall sustainability (Abunge et al., 2013; Yang et al., 2013). By classifying communities in terms of their economic and social dependence on current delivery of EGS, we arrive at a potentially informative way of delineating communities for the purpose of establishing local reference points from which to measure change, if a community's type can be linked to differences in community sustainability.

Measuring sustainability requires knowing what we wish to sustain. Net delivery of EGS to humans provides a working model for sustainability but currently lacks a coherent framework. Numerous measures of sustainability exist (Krotscheck et al., 2000; Putzhuber and Hasenauer, 2010), but most are single issue indicators, not necessarily tied to multiple human beneficiaries (e.g., Neset and Cordell, 2012; Velasquez et al., 2011). Suites of indicators used to holistically measure human well-being (HWB) show promise as a synergistic measure of the outcome of net EGS production and delivery to humans (Smith et al., 2013b; Summers et al., 2012). Indices of HWB are a measure of benefit to humans, beyond just economic benefits, that is also more responsive to changes in EGS production (Canadian Index of Wellbeing, 2012; Smith et al., 2013b). Indices of HWB include metrics of social cohesion, living standards, personal safety, civic engagement, and connections to nature (Smith et al., 2013b and cites therein). Yet, HWB indicators are not an easily understood concept, and are not a direct measure of service delivery. The challenge in applying HWB measures at the community level is in linking such a broad indicator to community-specific issues and values. Different communities have difference social, economic, and environmental dependencies, defined here are the three pillars of sustainability (NRC, 2011), and we need to demonstrate utility and connect HWB measures to local conditions to establish local index reference points, from which we can measure meaningful change in HWB. Commonalities do exist in the priorities and resources of communities and an examination of composite measures, such as a human well-being index (HWBI) (Smith et al., 2013a,b; USEPA, 2012) across community types, is an effective method to connect human well-being to community decision making.

In this study we took a comparative approach toward well-being references points based on an EGS-based community classification system (CCS). Our objective was to address whether this CCS is informative regarding reference points by asking whether HWBI-type indicator values differ by community type as a potential measure of sustainability. This comparison was undertaken in the contiguous United States based on publically available data. The objective is to identify associations between local social/economic dependence on EGS and differences in human well-being that may suggest informative local reference points for decision making about EGS provisioning. We reduced the geographic variability by focusing on coastal communities, which are particularly relevant, as these communities are known to be highly impacted by human activity (Barbier et al., 2008; Engle, 2011). The expectation is that community types will differ in their well-being and these differences will provide local well-being reference points informative for measuring changes in well-being. The outcome will be an understanding of how community classification based on EGS can be used to inform community decision making focused on sustaining or improving HWB.

2. Methods

2.1. Classifying communities

The community classification system (CCS) used in this analysis was constructed from three sources of data intended to describe a community with respect to three pillars of sustainability (social, economic, and environmental). While the CCS is not intended to describe the sustainability of a community, it is intended to delineate and describe communities with respect to their priorities, dependencies, and available resources. Three data types were combined in the CCS: Social/Demographic composition, local employment dependencies, and ecological region. All CCS data for this comparison were collected from existing national databases available at the county level for the period 2006–2010. Overall, 70 variables were used in the CCS (Table 1; Social/Demographic – 12, employment – 3, Ecological region – 55).

The chosen measure of community Social/Demographic composition was the Tapestry Lifemode dataset (ESRI corp; Table 1) that is a multivariate analyses of census data at the zip code+4 level (e.g., street level; United States Postal Service, www.usps.com). The raw data were transformed into summary groups with a principal components analysis to summarize the variability into a suite of 12 orthogonal variables labeled 'Lifemodes' and were then summarized at the county level as the proportion of citizens in each of the 12 Lifemode categories represented in a given county (Table 1).

The measure of local employment dependencies used was the location quotient (LQ) (Table 1). The employment LQ is a measure of proportion of local employment within North American Industry Classification System (NAICS) sectors compared to the national average. For the purposes of this analysis the employment data were apportioned into three categories based on NAICS supersectors. The first category was labeled 'Local dependence' and was comprised of employment data for Forestry, Fishing, Agriculture, mining, oil and gas extraction, and tourism (NAICS 11, 21, 713, and 721). Locally dependent tourism employment was separated from more general hospitality sectors jobs and included in the Local dependence category, but this was incomplete as we chose to exclude some NAICS sectors that could not be clearly separated (e.g., NAICS 72 'Accommodation and food service' can be subdivided between tourism and non-tourism components, but NAICS 48 'Transportation' cannot). The second LQ category was labeled 'Throughput' and represented all manufacturing (NAICS 31–33) jobs held by residents of the county. Manufacturing is meant here to summarize employment that is only partially locally based (e.g., factory infrastructure) but is also dependent on raw materials obtained outside the community and could be relocated and/or replaced with another equivalent employer. The third LQ category is labeled 'Service' (NAICS 51–56, 61–62, 81) and is comprised of Service sector employment not associated with Tourism or the Public sector. Service sector jobs are considered completely non-dependent on local resources with the exception of human capital. The LQ data are comprised of three dimensionless ratio values (>0;