Identifying and assessing the residency effect in Pocatello, Idaho, using combined census and parcel data

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ABSTRACT

Human residency is the spatial effect source on ecosystem and thus it should be studied and assessed. Supporting residency effect research, this study developed and applied procedures and a model to combine census and parcel data for the assessment. The case study is in Pocatello, Idaho, where revealing land service associated with flood control and locating/evaluating resident effect are needed. Methods include (1) data mining, (2) land service valuation, (3) data screening, (4) integration of census and parcel data, (5) data screening, and (5) analysis and modeling with R programing language and ArcMap. Results are, for land service assessment, land value per area unit in residence areas (LAND) along the concrete channel (for flood control) was less than that along the Portneuf River. Spatial responses under LAND to a source effect (either the concrete channel or the river) are the same. The applied methods helped locate and assess a variety of residency effects spatio-temporally. Results informed the human preferences under LAND and the effect distribution to support decision-making. Technically, using the parcels as a baseline provided comprehensive results with a fine resolution for the effect study, particularly as combined with the census data. This study suggests using a data screening and validation procedure besides the mining approach to minimize outcome uncertainty.

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1. Introduction

Residency is the core activity of human and thus the foremost source of human effect on ecosystem. When residing, human affects his surrounding environment and this forms a spatio-temporal residency effect. Assessing the effect is necessary to support decision-making on ecosystem and land use management, which locating and valuing the effect spatio-temporally are core tasks. However, the assessment is difficult due to data constraints and thus needs a comprehensive solution.

In US, parcel data is the public data containing residency information that are collected and managed by local governments, e.g. counties. The parcel data are the available spatial individual plots indicating where residents live and act (Manson et al., 2009), which contain spatio-temporal residency information for tax collection (Jarosz, 2008; Swanson & Tayman, 2012). Fundamentally, the parcels are representative for individual home ranges with the

attributes of geographic identity, land use type, land-associated business type, land/house value, and history. Thus, they reflect the realistic residency boundaries with a fine resolution. Because of their fine resolution, the parcel data have been used to address issues spatial-explicitly in details, e.g. on land fragmentation (Shrestha, York, Boone, & Zhang, 2012), socio-ecological metabolism (Hall, 2011), land-cover fragmentation and configuration (Robinson, 2012), carbon storage potential (Visscher, Nassauer, Brown, Currie, & Parker, 2014), and segmenting private landowner motivations, properties, and management (Nielsen-Pincus, Ribe, & Johnson, 2015). Nevertheless, due to lacks of human information, the application of parcel data for assessing the effects of human residency has been limited.

In a different approach, census data are provided as the public data about human population supplied by the US Census Bureau with resolution levels of state, county, county subdivision, place, census tract, block group, and block (Seidelmann & Merry, 2007). The primary use of census data is for issues of population. As combined with ecological data, census data can be used for investigating the interactions between human and ecosystem. For example, census data may be linked to ecological records to assess
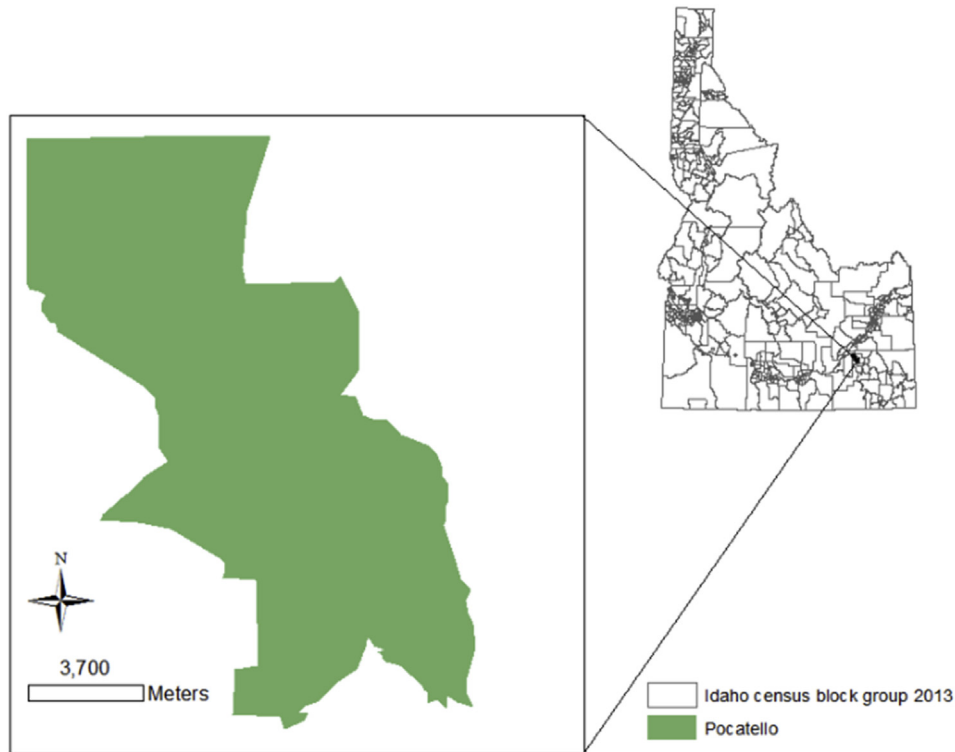
Fig. 1. Pocatello research site within Idaho adapted from United States Census Bureau-Tiger/Line (2015c).
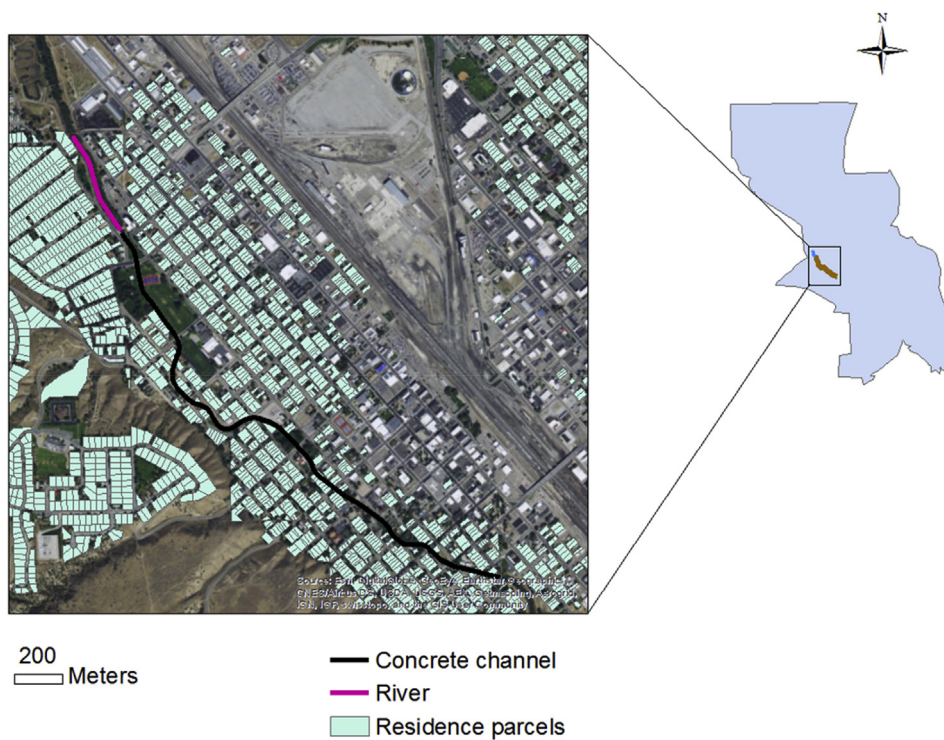

Fig. 2. Research areas for residency land valuation with the parcels, the Portneuf river part, and the concrete channel.

human effects on ecosystems using agent modeling (Rounsevell, Robinson, & Murray-Rust, 2012; Smajgl, Brown, Valbuena, & Hui-gen, 2011), human impacts on land resource (Erb, 2012), and urban vulnerability to extreme heat (Wilhelmi & Hayden, 2010). The

applicability of census data for human impact assessment depends on their information resolution levels. For instance, the census tract data can be used for neighboring socio-economic analysis (Pickett, Ahern, Selvin, & Abrams, 2002; Schuurman, Hameed, Fiedler, Bell,