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Geospatial Evaluation for Urban Agriculture Land Inventory:
Roanoke, Virginia USA

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ABSTRACT

Urban agriculture is recently being recognized as a distinctive urban land use contributing to greenspaces and food security. The land inventory forms the critical first step in identifying sites for urban agriculture. The authors' analysis greatly expands on prior land inventory strategies, first analyzing land cover to identify all open areas available for siting urban agriculture. Then in GIS, the authors completed a land use suitability analysis, and finally a demographic analysis to assess potential sites for contribution to food security of lower income populations. Results show that Roanoke includes 2,312 hectares suitable for schoolyard gardens, urban farms, community gardens, orchards, and home gardens, of which 189.4 hectares are found in neighborhoods with extremely high rates of poverty. The authors' inventory strategy can be implemented elsewhere without special data or software. A detailed inventory offers opportunities for long-range planning, and broadening participation of stakeholders.

KEYWORDS

Food Insecurity, Geospatial Analysis, Land Inventory, Roanoke Virginia USA, Urban Agriculture

INTRODUCTION

Recently, research on urban agriculture has expanded exponentially because of widespread food insecurity and expanding urban areas across the world. Although urban expansion is attributed to increasing populations, rates of conversion to urban land uses exceed rates of urban population increases (Lincoln Land Institute, 2015). Expanding urbanization causes loss of vegetated lands, expansion of impervious surface cover, increasing demands on existing infrastructures, warmer air temperatures as compared to adjacent rural areas (the urban heat island effect), and increasing demands on municipal services such as waste management and provision of potable water (Pickett et al., 2001). Urban areas also must reach well beyond their political boundaries to import food, energy, and clean water to meet basic needs of their populations and, as such, adverse effects of urbanization reach into regions outside the urban setting (Aitkenhead-Peterson, Steele, & Volder, 2010; Deelstra & Girardet, 2000; Pickett et al., 2001; McGranahan & Satterthwaite, 2003).

Urban agriculture, through its varied manifestations, can offer a multi-dimensional solution to these adverse effects. It improves access to healthy and nutritious fresh food, revitalizes inner cities, promotes social interactions, improves urban hydrology, and mitigates adverse climatic effects. The first step in establishing new urban agriculture sites requires identifying open, available, and suitable

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locations - a *land inventory* (Dongus & Drescher, 2006; Dubbeling & Merzthal, 2006; Dubbeling, van Veenhuizen, & de Zeeuw, 2010).

Although urban agriculture studies include land inventories to identify potential urban agriculture sites, most inventories are limited in scope, often emphasizing identification of vacant lands. In addition, most researchers conduct them to assist local municipalities wishing to incorporate urban agriculture into their planning and/or sustainability initiatives, so tailor their methods to that specific locality. Although some incorporate other stakeholders (i.e. local non-profits or local urban farmers) into their inventory process by asking them what characteristics require inclusion, these results, again, often focus upon specific local characteristics. Although a local perspective is valuable in recognizing unique dimensions of natural, social, and built landscapes, use of geospatial analysis allows us to develop a more generally applicable methodology. Such a framework can be relevant for any urban area, and can include a wider suite of data that nonetheless permits incorporation of those specific parameters necessary when examining an individual locale.

We expand on prior land inventory analyses by incorporating, first - land cover, second - land use, third – urban agriculture form, and finally – demographics, into our evaluation. In our literature review, we introduce and define urban agriculture in its several forms. Next, we identify existing land inventories and parameters researchers included in their geospatial analysis. We then describe our study site and highlight why it forms an appropriate locale for developing our inventory strategy. We step the reader through our analysis, and report results. These results identify locations within the city for siting different forms of urban agriculture (and, at different scales). Our results also include an evaluation of the extent these potential sites are proximally located to assist lower income residents with food security. Our conclusions discuss the significance of our procedures, and their relevance for other urban areas.

URBAN AGRICULTURE

Urban agriculture is the production of agricultural products (for food, fuel, and other uses) and rearing of livestock in urban and peri-urban areas (Mougeot, 2000). It is not a new phenomenon; people began producing agricultural products within urban areas when first establishing them thousands of years ago (van Leeuwen, Nijkamp, & de Noronha Vaz, 2010). In the United States, its history exceeds 100 years (Lawson, 2005), intensifying during periods of national crisis, such as both World Wars and the Great Depression (Deelstra & Girardet, 2000; Iaquinta & Drescher, 2010).

Urban agriculture is now increasing in a context driven by parallel trends of expanding urbanization and increasing food insecurity. Worldwide, one in nine people suffers from chronic malnutrition due to food insecurity (FAO, 2014). In the United States, more than one in ten households suffers from food insecurity (Brown et al., 2002; Coleman-Jensen, Nord, Andrews & Carlson, 2011), and this rate increases to almost one in five (19.5%) in households with children (USDA, 2015). Since, the majority of people now live in urban versus rural areas (in 2009, the percentage of people living in urban areas exceeded 50%, and estimates place this percentage at 66% by 2050 (United Nations, 2014)), many of the food insecure live in urban areas.

Although income factors, significantly, into food choices (Hofferth & Curtin, 2005; Rose, 1999), disparity exists over access to healthy and nutritious foods. This disparity manifests itself spatially as access appears related to differing socio-economic status and types of neighborhoods, i.e. segregated by race or ethnicity (Moore & Diez Roux, 2006; Morland, Diez Roux, & Wing, 2006; Seaman, Jones, & Ellaway, 2010). A lack of supermarkets and commercial food establishments offering healthy choices complicates accessibility to healthy and nutritious foods (Bader, Purciel, Yousefzadeh, & Neckerman, 2010; Eisenhauer, 2001; Galvez et al., 2008; Moore & Diez Roux, 2006; Morland et al., 2006; Rose & Richards, 2004). Urban agriculture is well-documented as contributing to alleviation of food insecurity in lower income urban populations (Eisenhauer, 2001; Mougeot, 2000; RUAF, 2010; Smit, Nasr, & Ratta, 2001).