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Abstract

Along with the negative environmental impacts that result from the loss of green space in an increasingly developed landscape, this loss may also be detrimental to human health. The relationship between green space and health is dependent on not only the presence but also access to green space. This cross-sectional ecological study uses a Geographical Information System (GIS) to examine the relationships between the presence and accessibility of green space and county-level mortality in the state of Florida. After controlling for some of the leading influences of mortality—including the levels of obesity, smoking, old age, and education—we found that the amount of green space within defined distances of census tracts in each county was associated with both all cause and cardiovascular mortality. Neither the gross amount of green space in a county nor the average distance to green space from census tracts in a county were significantly associated with our mortality measures.

Keywords: parks; open space; green space; public health; accessibility; GIS

1. Introduction

Green, pastoral settings and the bucolic life have long been associated with clean living and heightened health. The healthful respite provided by natural settings and green space has led many city dwellers to seek temporary or permanent residence in the countryside or suburban fringe (Fishman 1987). There have also been attempts to promote public health by bringing green into the city. For example, throughout the latter half of the 19th and into the 20th century, the City Beautiful movement sought to heighten the connection between people and green spaces, yielding magnificent urban parks like Central Park in New York City.

Beyond the logic of our *biophilic* or evolutionary connection to green spaces (Wilson 1984) there is an increasing amount of empirical work being undertaken to demonstrate the linkages between green space and conditions and behaviours that affect our physical, mental, and spiritual health and well-being. Despite work that points to the nexus between parks systems and public health outcomes (Bedimo-Rung *et al*. 2005), still lacking are epidemiological studies that link green space to morbidity and mortality. While public health professionals and planners agree that green spaces are important to the overall quality of life in a community, evidence that links green spaces to specific health outcomes has to date been limited.

Bringing a sense of epidemiological rigor to this area of research, Mitchell and Popham (2008) analyzed the relationship between green space and mortality, specifically the role of green space in moderating health inequalities. Although their findings support the conclusion that green space has a significant effect on reducing mortality, their analysis did not employ a Geographic Information System (GIS) to model the potential spatial dimensions of their data. Our work extends the themes explored in Mitchell and Popham (2008) by not only considering the effects of green space on mortality in a new context, but by also employing GIS to allow for more refined understanding of the accessibility of these spaces. The research question guiding our work was: Is the increased accessibility of green space associated with lower mortality? To answer this research question we analyzed the relationship between the accessibility of green space and mortality in the following ways:

1) We analyzed the relationship between the gross amount of green space in a county and county-level all cause and cardiovascular mortality.

2) We analyzed the relationship between the average distance to green space from all census tracts within a county and county-level all cause and cardiovascular mortality.

3) We analyzed the relationship between the average amount of green space within four defined distances from all census tracts within a county and county-level all cause and cardiovascular mortality.

The results revealed that green space accessibility as measured by the amount of green space within defined distances of all census tracts in a county had a significant association with both all cause mortality and cardiovascular mortality. However, both of the other measures of green space accessibility, the amount (gross acreage) of green space in a county and distance of green spaces from census tracts, were not associated with either measure of mortality. To the extent that a cross-sectional study allows, these findings suggest that green space accessibility supports positive health outcomes. Further, these results suggest that if heightened public health is a social goal, then policies and programs should recognize the influence of green space location and accessibility but with the understanding that the way that accessibility is measured is important.

This paper begins with a review of the literature on health and green space with particular emphasis on the health benefits accrued through the use of green space. We then proceed with a description of the methods employed in the GIS and regression analysis and conclude with an optimistic assessment of the use of GIS in evaluating the relationship between green space and health.

2. Health and green space

Although parks and open space contribute to the *landscape structure* (Forman 1995) necessary to support the most basic of human needs for water, air (Whitford *et al.* 2001), and food, the literature examining green space and health largely takes these basic human needs for granted. This is unfortunate because it is only after the natural environment bestows these basic elements of life that other more nuanced built environment influences can and should be considered (Coutts 2009). In addition to our place within ecosystems, our dependence upon these systems, and the essential services they deliver (World Health Organization [WHO] 2005), there are a number of ways that health is influenced by our access to and experience with nature. Evidence that demonstrates the positive relationship between self-reported health status and the amount of green space in one's environment (de Vries *et al.* 2003; Maas *et al.* 2006; Mitchell and Popham 2008; Verheij *et al.* 2008) lends support to belief that there are significant health benefits of everyday exposure and access to natural environments. A recent literature review (Tzoulas *et al.* 2007) and a report published by the Trust for Public Land (Gies 2006) elucidate the many ways that exposure and access to green space and natural settings can support health.

The predominant pathways by which health and green space have been linked to public health outcomes rests in the ability of green space to act as a setting for the health promoting behaviours of physical activity and social interaction (Kuo *et al.* 1998; Lindsey and Nguyen 2004) and the mental health and mentally restorative and stress reducing benefits of these spaces (Hartig *et al.* 1991; Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning, Nature and the Environment 2004; Kaplan and Kaplan 1989; Maller *et al.* 2006; Ulrich and Simons 1991). Better yet, there appear to be synergistic benefits as activity performed in natural settings may produce greater mental health benefits as compared to activity performed in common urban outdoor spaces (Hartig *et al.* 2003; Pretty *et al.* 2005).

The notion of accessibility having an influence on public health is supported by an ecological model of health (Green and Kreuter 1999; Sallis and Owen 2002). An ecological model recognizes the multiple levels of influence, including one's physical environment, on one's willingness and ability to perform health behaviours. For example, with the healthful behaviour of physical activity, there is a need for a land use environment and transportation network that supports this activity. These 'environmental supports' must be in place to support the desired behaviour. A more nuanced consideration of environmental supports would not only consider their presence or availability, such as measured by the acreage of parks or number of trails in a community, but also the quality of the these supports reflected by their accessibility.

Despite the public health goals associated with green spaces, there exists a tension in the provision of these spaces by communities. Conserving sensitive lands by forbidding access to users may be critical in some circumstances to protect fragile ecosystems. Many green spaces exist not for human use but for the protection of sensitive lands and the conservation of habitats for threatened species. Conversely, public parks, in their many forms, are an important form of green space that are oriented to meeting the needs of users in an area, providing space for both active and passive recreation. While this tension does indeed exist, it is now understood that green spaces can satisfy and balance a wide range of environmental and social goals. In their conceptual model of what influences park use, Bedimo-Rung *et al.* (2005) note that park characteristics are an antecedent to park use and these characteristics lead to both social and environmental benefits.

While green space provision is important for serving many goals, the accessibility of these spaces has tended to be overlooked in the health behaviour literature. Often the presence of green spaces is emphasized with little understanding of the accessibility of these spaces. In Florida, for example, many local governments use acres of parks and recreation space as a measure of the quality of their systems (Chapin 2007), yet this measure provides little clarity into the ability of users to access them.

Factoring in and measuring the importance of accessibility has gained the most attention in studies examining the environmental supports for the health behaviour of physical activity. Understanding the factors that influence physical activity is important to discern because this behaviour has far-reaching and varied health benefits that have subsequent effects on quality of life and longevity. These benefits include, among others, weight control, strengthening bones, improving mental health, and reducing the risk of cardiovascular disease, type two diabetes, and some cancers (Centers for Disease Control and Prevention [CDC] 2008a).

While the presence of green space creates the availability of a forum for physical activity, it is the convenience created through access that is important to create what Sallis *et al.* (1998) refer to as a 'supportive environment' for activity. Revealing this distinction, persons who reported the presence a place to walk were significantly more likely to meet recommended levels of regular physical activity than those who reported no place to walk, but there was a direct relation between self-reported convenience of a place to walk and the proportion of respondents who met current activity recommendations (Powell *et al.* 2003). Giles-Corti *et al.* (2005) confirmed that access was the most important consideration in determining use of public open space. This convenience created by proximity was found to be especially pertinent to increasing the longevity of senior citizens (Takano *et al.* 2002).

Although parks are likely the type of accessible public green space that most would be exposed to, the linear landscape feature of greenways are gaining prominence as an important ecological and recreational space (Fabos and Ahern 1995; Little 1990). Individual-level survey findings have revealed that "local" greenways have the potential to serve the greatest number of people (Gobster 1995). This supports the notion that distance from home to a facility is indeed important. The importance of proximity is reinforced by local greenway users reporting "closeness to home" as a positive trail attribute almost twice as often as respondents on greenways at the regional and state scale where residential and population densities were comparatively lower (Gobster 1995). The degree of proximity reduces daily barriers (Humpel *et al.* 2004) such as the distance and time it takes to reach a facility. This is pertinent when considering the greenway as a recreational facility but also important when considering the greenway as a route used for utilitarian travel. The location of trails and the features around them have an influence on how they are used (Bialeschki and Henderson 1988; Coutts 2008, 2009; Dinsmore 1993; Furuseth and Altman 1991). For recreational activity, the greenway is the destination, and the most important measure of a greenway's recreational service is its proximity to home and the spatial access and convenience proximity creates (Giles-Corti and Donovan 2002).

In addition, a cross-sectional sample of US adults revealed that in both higher and lower income levels and across settings (urban, suburban, rural), persons reporting the presence of walking/jogging trails had a higher likelihood of meeting recommended levels of physical activity (Parks *et al.* 2003). In another study, 33% percent of persons that reported having trails use the trails, and, among those using the trails, 42% reported being regularly active (Reed *et al.* 2004). Specific to greenways, a long-term study of multiple greenway systems in Indiana found that at least 70% of users credit the trail with increasing their level of physical activity, and the majority of users fell within the range or exceeded 120-180 minutes per week, long enough to achieve their recommended dose of 150 minutes for moderate level activity (e.g. walking) (Lindsey *et al.* 2001; CDC 2008b).

Clearly green spaces are important for public health outcomes because they support the elements on which human life depends, including air quality and water needs. Green spaces in the form of parks and greenways are also important because they support the behaviours (e.g. physical activity) that lead to health outcomes. Although there is increasing evidence of these associations, to date there has been little attention given to the role of the distribution and accessibility of green spaces on health outcomes. Given that these are spatial issues, GIS is a useful tool for helping to model the role of distribution and accessibility on health. The following methods section details how GIS was used in this study of green space accessibility and mortality.

3. Methods

For this study we employed a GIS to measure the amount and accessibility of green space in each of Florida's 67 counties and then modelled the relationship of these variables to all cause mortality and lifestyle-specific (cardiovascular) mortality at the county level.

Data on all cause mortality (ICD-10 codes A00-Y89) and mortality from major cardiovascular diseases (ICD-10 codes I00-I78) in 2007 were obtained from the Florida Department of Health's Community Health Assessment Resource Tool Set (CHARTS, www.floridacharts.com) database. A total of 167,708 deaths from all causes and 54,542 from cardiovascular disease occurred in Florida in 2007. The occurrence of all cause deaths ranged from 51 in Liberty County to 17,949 in Dade County. The occurrence of cardiovascular deaths ranged from 13 in Liberty County to 6,492 in Dade County.

Data on green space was contained in a 2009 public land file obtained from the Florida Geographic Data Library (Figure 1). These data included all state and national forests and parks, wildlife conservation areas and preserves, and city and county parks. This database is the best approximation of a statewide inventory of accessible green space in Florida. A close review of these data did lead us to exclude categories of land that were either inaccessible to the public or had no strong theoretical basis for influencing health and mortality. Among the categories of excluded lands were golf courses, conserved lands managed by private or nonprofit organizations, land owned by the Disney Corporation, other commercial interests in central Florida, and the nearly 10 million acres of agricultural land (US Department of Agriculture [USDA] 2007). Although there are benefits to green space that is not accessible, such as those mental health benefits accrued by viewing it and the ecosystem services that preserved and possibly non-accessible conserved lands support, there are more direct public health benefits gained through access to these spaces. The data used in this analysis accounted for many, but not all, public beaches identified as state parks and preserves along the state's extensive coastline.

These data were imported into TransCAD GIS v. 4.3 to compute measures of green space accessibility and availability on a county-level basis. Of the 1,842 polygons in the original 2009 public land file, 1,807 were successfully brought into TransCAD and topology was created. The remaining 35 polygons were not brought over in the conversion due to polygon digitizing errors in the original file, duplicates, and lack of consistent topology.

The boundary files of Florida's 67 counties as well as the 3,153 census tracts comprising the entire state were obtained from the US Census Bureau. Census tracts were chosen as a the subunit for accessibility calculations because they represent a reasonable level of spatial detail in terms of intracounty green space access, yet are aggregate enough that the GIS calculations can be accomplished within a reasonable amount of computational time and effort.

There are many ways to capture accessibility, all of which have their strengths and limitations (see Talen & Anselin, 1998; Lei & Church, 2010). We employed a series of metrics. First, we calculated the amount of green space within each county. This was achieved using a GIS overlay procedure to estimate the total area of green space within each county's boundary. This is essentially a simple, but as mentioned previously not very telling, measure of the level of access each county has to green space. This indicates the extent or quantity of green space within the county but lacks detail on the accessibility of the various spaces as determined by their distribution. The distribution concerned with in this study is in relation to the people's location of residence.

To begin to remedy this, we computed a second set of county-level measures that considered access to nearby green space. Using the census tract as the observational unit, and taking the census tract centroid as representative of that unit, we used the GIS to estimate the distance each tract centroid was to its nearest green space polygon. In this case, distance was measured as straight-line or Euclidean distance. This proximity value was computed for each census tract in a given county. Then these values were averaged on a per-county basis to construct a county-level metric. Averaging may be done on an unweighted basis where each census tract's proximity counts equally into a given county's estimate, or each tract's contribution to the average can be weighted by other factors of interest, such as the population size of the tract. We used a weighted county-level proximity metric using population size to capture urban/rural differences in exposure to green space. Green space that was closer to where more people lived was given more weight.

A third set of metrics captured the average accessibility census tracts within a county have to green space. Here, we employed a traditional measure of accessibility based on the concept of cumulative opportunities (Handy and Niemeier 1997, Kwan 1998, Lei and Church 2010). Accessibility measures derived from the cumulative opportunities framework produced a count or assessment of opportunities around a given origin within some fixed distance or time, S. In this case, we estimated the cumulative green space opportunities within variable distances S of each census tract. For each tract we computed the amount of green space within a .40, .80, 1.6, and 4.8 kilometre (¼, ½, 1, and 3 miles respectively) distance. Using notation adapted from O'Kelly and Horner (2003), this can be summarized per the standard accessibility type equation where the accessibility A of i census tract at a distance S to green space G at location j is calculated as:

$$A_i^s = \sum_j G_j \qquad \forall j \in d_{ij} \leq S \qquad (1)$$

In equation (1), d_{ij} represents the distances between tracts and green space locations. Because green space opportunities at locations (G_j) are represented by large polygons and not simpler features such as points, implementing equation (1) requires additional work within the GIS. When implementing this equation, the total green space within a distance S outside of each tract's boundary are summed. Green space features falling within a given tract are also counted. Together, those green space areas inside a boundary and those within a distance S of the boundary constitute a given tracts accessibility. The 'within' estimation is performed using polygon overlay techniques in the GIS. This measure represented in equation (1) is then averaged among all census tracts in a given county to produce a county-level estimate. Like the access proximity measure previously described, average tract accessibility is also be weighted by the population of each tract. In this way, tracts with larger populations have greater influence on the county's average accessibility.

While the amount and accessibility of green space were the primary variables in our analyses, we also controlled for other variables associated with mortality. Using 2007 Behavioral Risk Factor Surveillance System data compiled by Florida CHARTS and U.S. Census data we controlled for the proportion of the population in each county that are overweight or obese, the proportion that smoke, the proportion of people that report being moderately physically active, the percentage of the population 65 and older, and the percentage of the population with a Bachelor's degree or higher. All of these factors are understood to be a significant factor influencing mortality rates. We also controlled for the proportion of the population that was white, as mortality rates vary by race and populations with a higher percentage of non-whites experience higher mortality rates. These control variables are summarized in Table 1.

[Table 1 about here]

Once these data had been obtained and organized, we employed negative binomial regression to test the effect of the amount and the accessibility of green space on all cause mortality and mortality from cardiovascular disease in all Florida counties (n=67) in 2007. A negative binomial regression model was used to accommodate the count nature of the dependent variable, the number of people that died in 2007. Poisson models were considered but rejected due to over-dispersion. The occurrence of spatial autocorrelation was tested and found to be negligible for both all cause (Moran's I Index = 0.12) and cardiovascular (Moran's I Index = 0.13) mortality.

4. Results

Modelling the relationship between our suite of independent variables and our dependent variables, all cause mortality and cardiovascular mortality, produced the following results. We found that the amount (area) of green space in a county and the mean distance to the nearest green space were unrelated to all cause and cardiovascular mortality. However, the amount of green space within defined distances of census tracts was determined to have a significant relationship with both all cause and cardiovascular mortality.

Table 2 presents the summary statistics from the three different methods of calculating accessibility. Note that the mean amount of greenspace at the 4.8 km distance is less than at the smaller defined distances because of the weighting procedure. The area within the larger 4.8 km defined buffer may be larger, but the fewer people living nearer to the green space in a buffer detracts from its significance.

[Table 2 about here]

Table 3 presents the results from a regression analysis of the gross amount of green space in each county on the two forms of mortality. The analysis reveals that the total amount of green space in a county is not significantly related to our two dependent mortality variables. Although not statistically significant, the sign of the green space coefficient behaved in an expected fashion with mortality increasing as the amount of green space in a county decreased. As expected, several of the control variables are significantly associated with the dependent variable, with mortality increasing in those counties with greater elderly populations and decreasing as the percentage of physically active persons increases. Strangely, the overweight/obese variable and the smoking variable do not behave as expected, with increases in these variables yielding lower mortality rates. We discuss this finding later.

[Table 3 about here]

Table 4 displays the results of the regression analysis using the mean distance to the nearest green space aggregated from census tracts (weighted by population) in Florida counties. The insignificant results for the green space variable indicates that the distance to a green space is not a significant correlate to mortality. Similar to the results from the models in Table 3, the sign of the distance to green space coefficient behaved in an expected fashion with mortality increasing as distance to green space increased. Other independent variables generally behaved as expected.

[Table 4 about here]

Table 5 displays the results of the regression analysis testing the relationship between the extent of green space within four defined distances of census tracts (weighted by population) and all cause and cardiovascular mortality. Unlike the other regression models, the results from these analyses find that green space accessibility is significantly associated with mortality at the $p<0.05$ level. Table 5 illustrates that counties with larger amounts of green space that is accessible to more people experienced lower mortality rates in 2007. Unlike the insignificance in the relationship between the amount of green space at the county level and mortality, this measure capturing how green space is distributed in relation to the population is significant. The relationship between green space and mortality is reliant upon the proximity of green spaces to where people live. As with the other regression analyses, the two variables capturing the proportion that performed moderate levels of physical activity and were over age 65 behaved in an expected fashion: higher mortality was associated with less people performing physical activity and more persons in a higher age cohort.

[Table 5 about here]

Unexpectedly, in the models in Table 5, the relationship between green space and mortality were not solely significant at more proximal and easily accessible distances. The fact that green space maintained its significance at greater distances from census tracts speaks to the potential for larger area influences on mortality. Green space within close proximity to more populous tracts is more accessible to these population concentrations and therefore potentially supportive of the behaviours that could result in positive health outcomes (e.g. physical activity). On the other hand, the amount of green space 4.8km (3 miles) from one's home could not be considered an easy walking or biking distance from home for most people, especially in highly urbanized environments. This result could suggest that regional green spaces can be driven to and then used by persons from wider areas, or it could also reflect the important health-supporting ecological services that green spaces sustain and that serve much larger communities than those immediately surrounding homes and neighbourhoods.

One surprising finding from our analyses was the negative direction of the overweight/obese and smoker coefficients. It was expected that mortality would be positively correlated with increased proportions of county residents that were either overweight/obese or smokers. Because this finding raised a question as to the validity of the models, we pursued a number of diagnostic procedures to confirm their validity. First, the distribution of the residuals were tested and found to be in a manner consistent with a negative binomial distribution. Second, interaction terms were introduced. These included interactions between the control variables of smoking and physical activity and overweight/obesity and physical activity. These interaction coefficients maintained the same negative sign. Third, we tested the relationship between the number of persons who died of malignant neoplasms of the trachea, broncus and lung (ICD-10 codes C33-C34) and the proportion of smokers and the resulting sign of the smoking coefficient was the same. Finally, we also produced a scatterplot of the data which revealed no true outliers. Further investigation of the four most populous counties in Florida (Pinellas, Palm Beach, Broward, and Dade), which had the highest proportion of deaths in the state, found lower proportions of adults who were either smokers and overweight/obese. These results allowed us to conclude that smoking and overweight/obesity were indeed negatively correlated with mortality, although the reasons for this counterintuitive relationship remain something of a mystery.

5. Conclusions

Based upon the results of this study, we conclude that the accessibility of green space is indeed associated with mortality, although our finding is dependent upon on how accessibility is measured. More specifically, our results indicate that the gross amount of green space in a county, without regard as to how it is distributed, is not a significant factor in influencing county-level mortality. Similarly, capturing accessibility by measuring simple distances to green spaces was also not significant. Instead, our results point to the importance of accessibility to green space as measured by the amount of green space both very close to and several kilometres from where people reside. If these findings are affirmed in future studies, they suggest that public policies and programs should emphasize the creation of green spaces closer to areas of higher population densities. Although not directly measured here, the greater accessibility and density associated with reduced mortality is presumably operating, at least in part, through its influence on lifestyle choices. More generally for researchers and public health professionals, this study illustrates the value of using GIS to investigate the dimension of green space accessibility, which has been lacking in previous epidemiologic analyses (e.g. Mitchell and Popham 2008).

In closing it is important to note that these results do not allow us to address the specific attributes of green spaces that are better at reducing mortality. Future research should examine how differing landscape structures, patterns, and types of green spaces influence health outcomes. For example, connected green infrastructure systems open to public use—where local parks are connected by greenways and these local systems connected to regional systems—could hold greater health benefits due to the accessibility they create and ability to support ecosystem functioning. We would also note that our measures made use of straight-line (Euclidean) distance in quantifying people's accessibility to green space. Future research should consider employing alternative representations of the distance or spatial separation between people and nearby green space, perhaps by utilizing actual transportation networks. For example, measures such as the distance between a tract centroid and its nearest green space could be estimated based on road network distance. Such analysis would also offer insights into how various representations of space manifest themselves in accessibility and mortality studies.

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Table 1. Summary of control variables

Variable	Year	Source	Description
Overweight/obese	2007	Florida Charts	Combined proportion of adults in county that are either overweight (BMI=25-29.9) or obese (BMI>30)
Smoker	2007	Florida Charts	Proportion of adults in a county that currently smoke cigarettes
Mod. physical activity	2007	Florida Charts	Proportion of adults in county that meet moderate physical activity recommendations of 30 minutes/5 days a week (150 minutes/week)
Over 65	2007	Florida Charts	Proportion of adults in county over age 65
White	2007	Florida Charts	Proportion of adults in county that identify themselves as white
Education	2000	U.S. Census	Proportion of persons in county with a Bachelor's degree or higher

Table 2. Summary statistics of accessibility measures

Green Space Accessibility Measure	Mean	σ
Amount greenspace in county (km^2)	385.77	546.73
Average distance to nearest green space (km)	6.94	3.76
Amount green space (km^2) within four defined distances		
0.4 km	30.57	44.51
0.8 km	33.11	46.59
1.6 km	37.65	50.98
4.8 km	22.77	28.31

Table 3. Regression results from analysis of mortality and the gross amount of green space within a county (n=67)

Model	β	SE	p
All cause mortality			
Greenspace	-0.00	0.00	0.22
Overweight/obese	-0.12	0.03	0.00
Smoker	-0.09	0.03	0.00
Mod. physical activity	-0.09	0.03	0.01
Over 65	0.06	0.03	0.04
White	-0.02	0.02	0.32
Education	0.03	0.02	0.13
Cardiovascular mortality			
Greenspace	-0.00	0.00	0.25
Overweight/obese	-0.12	0.03	0.00
Smoker	-0.10	0.03	0.00
Mod. physical activity	-0.10	0.03	0.00
Over 65	0.06	0.03	0.02
White	-0.02	0.02	0.29
Education	0.03	0.02	0.16

Table 4. Regression results of distance to nearest green space from each census tract weighted by population and aggregated to the county level (n=67)

Model	β	SE	p
All cause mortality			
Dist_Greenspace	0.04	0.04	0.25
Overweight/obese	0.11	0.03	0.00
Smoker	0.08	0.03	0.01
Mod. physical activity	0.10	0.03	0.00
Over 65	0.07	0.03	0.02
White	0.03	0.02	0.19
Education	0.04	0.02	0.08
Cardiovascular mortality			
Dist_Greenspace	0.04	0.04	0.25
Overweight/obese	0.12	0.03	0.00
Smoker	-0.08	0.03	0.01
Mod. physical activity	-0.10	0.00	0.00
Over 65	0.08	0.03	0.01
White	-0.03	0.02	0.17
Education	0.04	0.02	0.10

Table 5. Regression results of amount of green space within defined distances of census tracts weighted by population and aggregated to the county level (n=67)

Model	β	SE	p	β	SE	p	β	SE	p	β	SE	p
		.4 km			.8 km			1.6. km			4.8 km	
All cause mortality												
Amt_Greenspace	-0.01	0.00	0.03	-0.01	0.00	0.02	-0.01	0.00	0.03	-0.00	0.00	0.02
Overweight/obese	-0.11	0.03	0.00	-0.11	0.03	0.00	-0.11	0.03	0.00	-0.11	0.03	0.00
Smoker	-0.09	0.03	0.01	-0.08	0.03	0.01	-0.08	0.03	0.01	-0.08	0.03	0.01
Mod. physical activity	-0.08	0.03	0.02	-0.08	0.03	0.02	-0.08	0.03	0.02	-0.08	0.03	0.02
Over 65	0.06	0.03	0.02	0.06	0.03	0.02	0.06	0.03	0.02	0.06	0.03	0.02
White	-0.03	0.02	0.18	-0.03	0.02	0.19	-0.03	0.02	0.20	-0.03	0.02	0.19
Education	0.01	0.02	0.45	0.01	0.02	0.47	0.01	0.02	0.46	0.01	0.02	0.42
Cardiovascular mortality												
Amt_Greenspace	-0.01	0.00	0.04	-0.01	0.00	0.03	-0.01	0.00	0.04	-0.00	0.00	0.02
Overweight/obese	-0.11	0.03	0.00	-0.11	0.03	0.00	-0.11	0.03	0.00	-0.11	0.03	0.00
Smoker	-0.09	0.03	0.00	-0.09	0.03	0.00	-0.09	0.03	0.00	-0.09	0.03	0.00
Mod. physical activity	-0.09	0.03	0.01	-0.09	0.03	0.01	-0.09	0.03	0.01	-0.09	0.03	0.01
Over 65	0.07	0.03	0.01	0.07	0.03	0.01	0.07	0.03	0.01	0.07	0.03	0.01
White	-0.03	0.02	0.17	-0.03	0.02	0.18	-0.03	0.02	0.18	-0.03	0.02	0.18
Education	0.01	0.02	0.49	0.01	0.02	0.51	0.01	0.02	0.50	0.01	0.02	0.47

Figure 1. Green space in Florida