



Amenity or hazard? The effects of landslide hazard on property value in Woomyeon Nature Park area, Korea



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HIGHLIGHTS

- In Korea, a mountain-type urban nature park increases nearby housing values as a place for leisure and recreation.
- Landslide hazard started to have a negative effect on housing values after the massive landslide event in Woomyeon Nature Park.
- A trade-off between the amenity and hazard effects of urban open spaces exists.
- Disaster prevention efforts in urban open spaces should be combined with landscape and urban planning.

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ABSTRACT

A nature park in an urban area, which generally includes environmentally valuable natural landscape such as forests, mountains, rivers, and beaches, provides valuable benefits for the public such as recreational opportunities and an aesthetic landscape. However, residents near nature parks could be more vulnerable to natural disasters like floods, tsunamis, and landslides. In order to understand the trade-off between the amenity and hazard effects of nature parks, this study explores the case of the Woomyeon Nature Park (WNP) in Seoul, Korea, which experienced a catastrophic landslide disaster in 2011. The hazard and amenity effects of the WNP before and after a landslide event are analyzed using a difference-in-difference approach with a random coefficient model. The results show that the amenity effect of the WNP has continued after the landslide disaster in apartment complexes near the WNP, but its housing market premiums have fallen by up to 11.3% since the event due to the risk of landslide. The existence of the WNP hazard effect underlines the importance of disaster prevention efforts in urban open space design and management.

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1. Introduction

An urban nature park, which generally includes environmentally valuable natural landscape such as forests, mountains, rivers, and beaches, provides valuable benefits for the public in urban areas such as recreational opportunities and an aesthetic landscape. However, residents near nature parks could be more vulnerable to natural disasters like floods, tsunamis, and landslides (Bin, Crawford, Kruse, & Landry, 2008; Highfield, Peacock, & Van Zandt, 2014; Smith, 2013). Understanding the trade-off between the

amenity and hazard effects of nature parks is key to successful landscape and urban planning, for both open spaces and disaster management, but little is known about the effect of nature parks on property values, particularly in the context of a mountain nature park.

In order to address this knowledge gap, this study explores the effects of mountains as both amenity and hazard factors on property values before and after a landslide event in the case of the Woomyeon Nature Park (WNP) in Seoul, Korea. Many of the nature parks in urban areas in South Korea consist of mountains and forests, and they are where local residents go for leisure and recreation activities such as climbing, hiking, and walking. Furthermore, as nature parks furnish fresh air and a fine view, households are likely to want to live close to a nature park to enjoy the amenities, paying a premium on housing costs. However, mountains themselves represent a landslide hazard when their slopes are poorly

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managed and the ground has weakened due to heavy rain (Hewitt, 2014). Thus, the risk of landslide could be negatively capitalized into property values.

Since a catastrophic landslide in the WNP area in July 2011, people began to consider seriously the hazard represented by mountains in Korea. This provides a perfect case to examine the trade-off between the amenity and hazard effects of mountains. By analyzing the housing market near the WNP in Seoul from 2008 to 2014 using a hedonic price model, this study addresses three research questions: (1) What are the amenity and hazard effects of mountains on the value of nearby homes? (2) Is the negative hazard effect strengthened after a catastrophic landslide event? and (3) Does the negative effect of the hazard continue in the long term after the landslide damage has been repaired?

Regarding the amenity effect, urban nature parks provide a variety of benefits to nearby residents. These open spaces are the location for recreation activities and they provide clean air, aesthetic enjoyment, and beautiful scenery, as well as being cultural and historical places (Baranzini & Schaerer, 2011; Brander & Koetse, 2011; Damigos & Anyfantis, 2011; Van Leeuwen, Nijkamp, & de Noronha Vaz, 2010). These social and environmental benefits can have a positive effect on the value of nearby housing and many scholars have presented empirical evidence to that effect using hedonic price models (Tyrvaainen, 1997; Tyrvaainen & Miettinen, 2000).

Early studies focused on the role of proximity to urban open spaces, but recently, the research focus has expanded to explore various functions of urban open spaces and their price effect. For example, Baranzini and Schaerer (2011) analyzed rental markets in Geneva, Switzerland, and found that views of water-covered open spaces increased rents by up to 57%. Damigos and Anyfantis (2011) showed that a pleasant view of the sea or urban parks increased housing values by up to 50% in Athens, Greece.

Hamilton and Morgan (2010) analyzed the differentiated effect of beach views by view-angle based on the case of Pensacola Beach, Florida. They found that one degree in viewshed represented a value of \$1627. Wen, Bu, and Qin (2014) also showed that the effect of the West Lake in Hangzhou, China varied depending on the direction from the lake. Jim and Chen (2010) differentiated the value of availability and view of open spaces using the case of Hong Kong. They showed that the presence of neighborhood parks resulted in a housing premium of 14.93% and a view of the park produced a premium of 1.95%. Saphores and Li (2012) showed green land cover in the Los Angeles region had a positive effect using a geographically weighted regression and spatial lag regression method.

However, urban open spaces or parks can also have a negative effect. The value of views of urban open spaces can vary depending on the type. As noted earlier, a view of water-covered open space increased the housing value, but a view of urban parks reduced the housing values by up to 17.7% in Geneva (Baranzini & Schaerer, 2011). Jim and Chen (2010) argued that a view of an urban neighborhood park and harbor positively affected housing values, but a mountain view reduced housing value. Panduro and Veie (2013) divided green spaces into eight types: park, lake, nature, churchyard, sports field, common area, agricultural field, and green buffer. They showed that the role and effect varied depending on the type of green space. Sander and Zhao (2015) analyzed housing markets in Ramsey and Dakota Counties in Minnesota and showed the value of forest views could be both positive and negative.

The negative effect of urban open spaces could also be a result of hazards of nature, because residents near nature parks could be more vulnerable to natural disasters like floods, hurricanes, earthquakes, and landslides, which can occur in urban nature areas (Bin et al., 2008; Highfield et al., 2014; Smith, 2013). Proximity to risk sources like flood, hurricane, and earthquakes has a significant negative effect. Residential properties located within a flood zone had

a lower market value than equivalent properties outside the floodplain (Bin & Kruse, 2006; Bin & Polasky, 2004; Bin et al., 2008). Harrison, Smersh, and Schwartz (2001) showed that housing value on 100-year floodplains was lower than homes located outside flood zones in coastal counties of Florida. Eves (2002) established that property vulnerable to floods has a lower value than similar property that is not liable to flooding in the Sydney basin area. Bin and Kruse (2006) also found that on average property values are 5–10% lower if located within a floodplain in coastal counties of North Carolina.

Regarding earthquake risk factors, Beron, Murdoch, Thayer, and Vijverberg (1997) examined the variation in residential house prices before and after the October 17, 1989, Loma Prieta earthquake. They found that the hedonic price initially fell after the earthquake because information about earthquake risks was overestimated by residents in the San Francisco Bay area. Ewing, Kruse, and Wang (2007) examined the effects of wind-related disasters like hurricanes and tornadoes on housing prices in six metropolitan statistical areas (MSA). They found that hurricanes and tornadoes caused a decline in housing values of around 2.5% after the events (Ewing et al., 2007).

While most previous studies regarding disasters in the hedonic house price literature showed that proximity to a risk source has a negative effect on housing value, some studies showed that proximity to a river or coast was perceived as an environmental amenity (Zhang, Hwang, & Lindell, 2010). Prices of residential properties within flood zones were higher than the prices of similar houses located elsewhere (Montz, 1993; Shilling, Benjamin, & Sirmans, 1985). Smith and Palmquist (1994) found that residential properties located in ocean-front areas of North Carolina had significantly higher rental prices than other properties. Zhang et al. (2010) examined the effects of proximity to three hazard sources (flood, hurricane, and toxic chemicals) on housing values in Harris County, Texas. They found that the effects varied by residents' perception of the hazard risk. Proximity to river and coast could be perceived as either a potential risk that decreased property values or an environmental amenity that increased the values.

Many researchers have shown the amenity effect of urban open spaces and recent studies have presented the risk factors associated with them. However, little is known about the effect of nature parks on property values, particularly in the context of a mountain nature park. Thus, this study aims to explore the hazard and amenity effects of urban nature parks on nearby property values based on the case of the WNP. To account for the amenity and hazard effects of the WNP before and after the landslide event, this study applies a difference-in-difference (DID) approach. The hedonic price model is estimated using a random coefficient model to address the heterogeneity of housing complexes, which allows researchers to control for unobserved latent variables. We show that proximity to the WNP continuously positively capitalized into housing values before and after the landslide event, but the risk of landslide decreased adjacent housing values by up to 11.3% after the catastrophe.

2. Methods

2.1. A mountain as a nature park in Korea

Around seventy percent of the Korean peninsula consists of mountains. Sixteen mountains are designated as national parks in South Korea. The city of Seoul is surrounded by thirty-seven mountains, including Mount Bukhan (designated as a national park), Dobong Mountain, and Surak Mountain, all over 600 m high. These mountains offer residents hiking trails and walking paths. Of the 37 mountains, 17 (including Woomyeon Mountain) are designated

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