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Willingness to offset? Residents' perspectives on compensating impacts from urban development through woodland restoration

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ABSTRACT

It is increasingly advocated that no net loss policies, aimed to avoid, minimize and lastly offset environmental impacts from development, should not only focus on impacts on biodiversity, but also on the consequences for ecosystem services. The Biodiversity Strategy of the European Union explicitly specifies the 'no-net-loss of biodiversity and ecosystem services by 2020′ as a target. The extent to which ecosystem services could be compensated, however, largely depends on the needs and wants of the people that are affected by the development. Empirical studies investigating the public perception of offset policies are limited. In this study we examine the extent to which local residents perceive woodland restoration as adequate compensation for impacts from urban development on the rural countryside. We use a choice experiment to study whether local residents in East Lothian, Scotland – where the high demand for housing is posing a large challenge for local authorities – are willing to accept additional housing in return for the addition of woodlands to the landscape. Using a latent class model we identify four classes of residents, each with different preferences for woodland restoration and additional housing. A majority of the respondents (75%) expressed that residential development will have a negative impact on the countryside, predominantly on biodiversity, agriculture and the traditional character of the landscape. Respondents, however, differed widely in their willingness to offset these impacts: residents who felt most affected by housing were least willing to offset additional residential development. If no net loss policies are to tackle both biodiversity and ecosystem services, we need to look beyond the ecological impacts from development by taking a closer look at the impacts of environmental change on human well-being. Only after a better understanding of how different beneficiaries are affected by the environmental impacts from development can we begin to discuss how those affected may be compensated.

1. Introduction

Urbanization is a key driver of land use change (Liu et al., 2014; Seto et al., 2011; Song et al., 2015). In Europe, the conversion of non-built-up areas has come predominantly at the expense of high-quality farmland (Feranec et al., 2010; Kasanko et al., 2006; Tucker et al., 2013), particularly as cities increasingly expand in a dispersed rather than compact manner (Salvati and Carlucci, 2015). The dispersion of urban settlements has led to significant environmental impacts as a consequence of land take and an increased demand for transport and energy (Bart, 2010). These developments affect the functioning of ecological habitats and the species that rely on these habitats (Braaker et al., 2014; Pauleit et al., 2005).

The growing concern about negative environmental impacts from urbanization has led to a large set of policy instruments to manage urban growth and minimize its impact on open space (Bengston et al., 2004; Westerink et al., 2013). These instruments include steps to avoid, reduce and offset impacts on the environment, the so-called 'mitigation hierarchy' (BBOP, 2012). Particularly the last step, biodiversity offsets which aim to ensure that residual environmental impacts from development are counterbalanced by environmental gains (resulting in 'no-net-loss'), is receiving much attention (e.g. Maron et al., 2015; McKenney and Kiesecker, 2010; Moilanen et al., 2009).

As no-net-loss policies and biodiversity offset programs are increasingly implemented, they are also increasingly criticized (Bull et al., 2013; Maron et al., 2016). From a functional, ecological perspective critiques relate to the poor definitions and measurability of the values to be offset, the uncertainty in restoration outcomes, and the time lags before achieving the goals of the offsetting (Maron et al., 2012). From an ethical perspective concerns

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are expressed about the framing of biodiversity conservation as a technical and economic problem, downplaying the moral and ethical arguments for protecting biodiversity (Ives and Bekessy, 2015). Increasingly, however, scholars warn for the narrow focus of offset programs on protected habitats and species while neglecting the impact of development on the environmental functions that underpin human well-being (Brownlie et al., 2013; Schulp et al., 2016; Tallis et al., 2015), commonly referred to as ecosystem services (ES) (MA, 2005).

Urban sprawl may negatively affect people currently living in rural landscapes, as these 'multi-functional' landcapes are increasingly valued in terms of multiple goods and services (Munton, 2009; Zasada, 2011), including, for example, cultural heritage, recreation, and tourism. As such, no-net-loss policies should also be aimed to protect people from environmental degradation associated with development in currently unprotected habitats (Villarroya et al., 2014; Persson et al., 2015). The European Biodiversity Strategy (European Commission, 2011) addresses this issue by focusing on biodiversity *and* ES: Action 7 explicitly aims at ensuring no-net-loss of ecosystems and their services by 2020, e.g. through compensation or offsetting schemes (Schulp et al., 2016; Tucker et al., 2013). Despite this focus on ES, however, much is still unknown about how no-net-loss policies can cater for the impacts of environmental degradation on human well-being. No-net-loss policies are predominantly aimed at restoring the ecological functions of an ecosystem and rarely take the people that are supposed to benefit from these functions into account (Tallis et al., 2015).

If we indeed are to broaden the scope of no-net-loss policies to ES, we must gain more insight into the extent to which the people that are affected by development can or are actually willing to be compensated for the loss of ES. In this study we contribute to this research gap by investigating the potential of a no-net-loss mechanism, which we will refer to as environmental compensation, to offset the impact of urban sprawl on ES as perceived by local residents. Using a choice experiment, we examine how local residents evaluate the use of environmental compensation, in the form of added landscape elements, in a rural residential development context. The specific aims are (i) to measure the extent to which residents' are willing to accept the offsetting of additional housing through restoration of landscape elements, (ii) to assess what type of environmental compensation is preferred, and (iii) to explain residents' preferences for different types of compensation by looking at attitudes towards residential development, values for ES provided by the rural countryside and socio-demographic variables.

In the following section we introduce our study area and explain the specific context in which this study took place. In the third section, we explain the methods we used to assess residents' willingness to offset potential impacts from residential development. In the fourth section we present results on residents' perceptions of the rural countryside, their attitude against additional housing and the extent to which they are willing to accept environmental compensation in return for higher levels of additional housing. We discuss the implications of our findings in the final sections of the paper.

2. Study area

Our study region, East Lothian, is one of the 32 council areas in Scotland (Fig. 1) and covers an area of 679 km^2 east from Edinburgh. From north to south, the East Lothian landscape is characterized by dune-back sandy beaches along the coastal margins, a rich farmed coastal plain with historic towns and villages, including lowland river valleys, and edged by the Lammermuir Hills. The lowlands in East Lothian are one of the largest areas of high-quality farmland in Scotland. Since the 1940s, agricultural intensification has led to wide-spread loss of (semi-)natural habitats in East Lothian (Ghaffar and Robinson, 1997). In 2000 the native woodland cover of East Lothian comprised only 0.9% of the total land area. In addition, lack of management has resulted in farm woodlands, especially hedgerows, becoming fragmented.

Large population increases are expected for East Lothian: The population was estimated at 101,360 people in 2013 and is expected to grow by 10.3% to 111,800 in 2022 (East Lothian Council). This increase poses a large challenge for the Scottish government to meet the related housing demand. The pressure for residential development in peri-urban and rural areas has been the basis for much conflict and 'has transformed the rural environment on the periphery of many of Britain's cities into a battle ground' (Pacione, 2013, p. 61).

The demand for new housing is estimated at around 5000 dwellings per year for the entire area of Edinburgh and the Lothians. Brownfield land is prioritized in the allocation of new housing areas, but these are not adequate to meet the housing demand, making the loss of greenfield sites unavoidable. Additional housing, however, is prohibited on greenfield sites within the green belt surrounding the city of Edinburgh, forcing housing development to be allocated to areas in the rural countryside. Nevertheless the councils from Edinburgh and the Lothians strive towards a development that is 'in accordance with the principle of sustainable development, whilst maintaining and enhancing the environmental heritage that underpins the area's quality of life' (Edinburgh and the Lothians Structure Plan 2015). To do so, one of the explicit goals is to protect and enhance the important landscape settings of settlements and areas of green space. This study took place in this particular context.

3. Methods

To analyze how respondents evaluate the use of woodland restoration to compensate for additional housing in East Lothian, we used a Discrete Choice Experiment (DCE). Choice experiments are able to account for the multidimensional nature of landscapes and are specifically suited to evaluate marginal landscape changes and trade-offs between landscape attributes (de Ayala et al., 2015; Domínguez-Torreiro and Soliño, 2011). Since increasingly development strategies that emphasize the multifunctional character of rural landscapes are put forward, choice experiments are frequently used to investigate public preferences for benefits provided by rural landscapes (e.g., de Ayala et al., 2015; Grammatikopoulou et al., 2012; Newell and Swallow, 2013; Vecchiato and Tempesta, 2013). In our study, we tried to better comprehend respondents' preferences for rural landscape options by complementing the choice experiment with an assessment of the importance people assign to ES that can be provided by the rural countryside. We considered respondents' values for ES, the ES respondents attributed to different types of woodlands, and the attitude respondents had towards additional housing in East Lothian.

3.1. Data collection and questionnaire design

We conducted a survey using face to face interviews with local residents in October 2014, after having done a pilot study in July 2014. Based on communication with the local spatial planning department, we selected all towns for which residential development plans were made in East Lothian to conduct the interviews: Haddington, Tranent, Musselburgh, Prestonpans, Dunbar and North Berwick. Residents were approached in public spaces in each of these towns. In total 258 respondents were interviewed.

The questionnaire consisted of five parts. In the first part we asked respondents about their current use of and familiarity with