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Analysis

Incentivising Participation and Spatial Coordination in Payment for Ecosystem Service Schemes: Forest Disease Control Programs in Finland

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ABSTRACT

This paper considers the problem of designing PES-type contracts to encourage participation and spatial co-ordination amongst private forest owners in Finland. The aim of the policy is to increase efforts to mitigate risks from invasive forest pests and diseases. Such control actions yield spill-over benefits to other landowners and to wider society, meaning that the level of privately-optimal disease control is likely to be less than the socially-optimal level. The policy designer may wish to encourage spatial coordination in the uptake of such PES-type contracts, as spatial coordination delivers an increase in the effectiveness of control measures on disease risks. We conducted a choice experiment with private forest owners in Finland in October 2016. The study elicited the preferences of woodland owners with respect to the design of forest disease control contracts, and gauged their willingness to cooperate with neighbouring forest owners within the framework of such programs.

1. Introduction

Invasive diseases are becoming more common world-wide due to expansions in global trade, increasing specialisation of production, and climate change (Florec et al., 2013: Freer-Smith and Webber, 2015). For forests, invasive pests and diseases such as emerald ash borer, oak processionary moth, sudden oak death (*Phytophthora ramorum*) and red band needle blight (*Dothistroma septosporum*) are capable of greatly reducing the flow of benefits from ecosystem services such as timber production, recreation amenities and carbon sequestration (Boyd et al., 2013). In many cases, costly control actions are available which either reduce the risks of a disease arriving, or reduce its rate of spread or survival once arrived. These control actions include thinning, clear-felling, public access restrictions (some diseases are spread by recreational users), and the spraying of biocides.

Where such pests and diseases (diseases, from now on) affect privately-owned land, it is likely that the extent of control actions which private landowners find it profitable to undertake are less than those which would be socially optimal. This is because such control actions, which incur costs to the private landowner, generate public good benefits such as maintaining recreation and aesthetic values enjoyed by forest visitors, and reducing risks of disease to other forest owners, in addition to the private benefits to the forest owner (Epanchin-Neill, 2017). Since the social benefits of disease control in forests can outweigh the private benefits to the landowner, there is an argument for implementing a Payment for Ecosystem Service-type scheme to incentivise landowners to engage in more disease control, and using general tax revenues to fund payments under such a scheme (Hanley et al., 2012).

As with any Payments for Ecosystem Service (PES) scheme, an important question is how to design contracts offered to landowners (Engel, 2016). The policy designer is likely to be concerned with a range of criteria including how many landowners are incentivised to participate in the scheme (given that participation is voluntary) and the ecological benefits from participation. Participation in turn has been shown to be related to contract design details such as the length of contracts offered, the level of monitoring required, and what management changes a landowner is required to make (Kuhfuss et al., 2016a, 2016b; Broch and Vedel, 2011).

This paper employs the Choice Modelling approach to investigate the willingness of forest owners in Finland to participate in a PES-type programme to promote actions to reduce the expected economic costs of invasive pests and diseases. In particular, we are interested in how spatial coordination amongst those choosing to participate can be enhanced, since such spatial coordination in forest management activities is thought to result in more effective landscape-level risk reductions in

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this specific instance of forest pest and disease control involving neighbour-to-neighbour spillovers (Fenichel et al., 2014; Ma et al., 2018). Moreover, economists have become increasingly interested in the general question of how to motivate spatial coordination in the provision of environmental benefits from land management (Banerjee et al., 2017).

2. Previous Work

2.1. Choice Modelling and PES Design

Choice Modelling has been widely used to estimate the relative importance of contract design factors influencing the potential up-take of PES-type schemes, both by farmers and foresters (Christensen et al., 2011). Choice modelling is commonly implemented in a stated preference format[1], asking land managers how they would respond to different PES contracts differentiated in terms of their contract attributes. Villanueva et al. (2017), for example, list 54 existing studies which use a stated preference approach to estimate how much landowners demand to participate in PES-type schemes; and how stated participation varies with other contract design features. Our paper contributes to this literature by studying potential participation in a programme designed to reduce risks from invasive pests and diseases; and by considering the ways in which an agglomeration bonus influences predicted participation. The advantages of a stated preference choice modelling approach in this context are that (i) a wide variety of scheme designs can be studied (ii) new schemes which have not yet been implemented can be evaluated in terms of their potential effectiveness; and (iii) farmer or forest manager heterogeneity in response can be modelled. The disadvantages of choice modelling include any systematic differences between stated (hypothetical) decisions by land managers and their actual decisions should such a scheme be offered (Johnston et al., 2017), although the determinants or the size of any such hypothetical bias has yet to be determined in a PES uptake context.

Choice modelling in a stated preference context has also been implemented to understand public preferences for invasive species control. For example, Sheremet et al. (2017) quantify the public benefits of forest disease control using choice modelling. They find that the UK general public are, on the whole, willing to pay for government funding of actions to reduce the spread of invasive pests and diseases in UK forests, but that this willingness to pay depends strongly on which ecosystem benefits from forests are most affected, who owns affected forests, and which specific control measures are implemented.

2.2. Spatial Coordination in PES

The efficiency of measures aimed at controlling the spread of forest pest and pathogens depend partly on whether the disease-controlling efforts of different forest owners and managers are coordinated in time and at specified locations (Epanchin-Niell and Wilen, 2012). For example, failing to take effective control actions at a neighbouring forest may mean a plot becoming re-infected after being treated. This reflects a more general finding on the desirability of spatial coordination in responses to invasive species, in order to improve the effectiveness of control measures (Sims et al., 2016). These spatial aspects of the control problem motivate the inclusion of an agglomeration bonus in the choice experiment employed in our study.

The importance of coordinating the efforts of participants in environment protection programs has been extensively discussed in the literature on payment for ecosystem services (PES) schemes. Merckx et al. (2009), Dallimer et al. (2010) and Wätzold et al. (2010) show that spatially coordinated uptake of PES contracts results in greater biodiversity conservation benefits on farmland, and Windle et al. (2009) find that it improves prospects for restoration of native vegetation in Australia.

Mattsson and Vacik (2017), in their survey of managers of several European protected areas, find that although invasive species is the second most important threat to maintaining biodiversity and ecosystem services over the next decade (preceded by only climate change), managers are not inclined to view stakeholder coordination of conservation efforts as a very effective instrument against this threat. Cooperation with adjacent protected areas is perceived as more effective against human-related threats, such as forest conversion or illegal hunting and collecting. Such cooperation will have more chances if coordinated at the regional level, by municipalities or local communities. Stallman (2011) presents a framework for prioritising ecosystem services provided by agriculture in terms of the potential for their collective provision, and classifies pest control (for both endemic and invasive pests, presumably) as highly-suited to collective provision. In a follow-up study, Stallman and James (2015) identify factors which would most encourage farmers in Missouri, USA to cooperate locally over pest control. This paper is part of a wider literature addressing land managers' willingness to cooperate with each other to produce environmental goods, including Sutherland et al. (2012) and Austin et al. (2014).

However, Banerjee et al. (2014) found that encouraging spatial coordination using PES-type incentives can be challenging, partly due to the coordination game created by offering potential scheme participants an agglomeration bonus[2] (Parkhurst et al., 2002; Parkhurst and Shogren, 2007). The agglomeration bonus is a 2-part payment scheme whereby a participation payment is offered to any landowner joining the scheme with an additional bonus paid if one or more of that landowner's neighbours also participate. Experimental studies have shown that, while the agglomeration bonus can achieve target levels and patterns of spatial participation (Parkhurst and Shogren, 2007), the performance of such a scheme depends on factors such as the number of landowners in a neighbourhood, information flows between neighbours, and transactions costs (Banerjee et al., 2014, 2017). In the choice experiment described below we included an agglomeration bonus in the contract design to examine its effect on predicted participation levels. This builds on work by Villanueva et al. (2015), who included an attribute distinguishing individual versus collective participation in a PES-scheme for olive growers in Spain.

3. Methods

3.1. Description of the Case Study

Finland is the most forested country in Europe, with 86% of its land area covered by forests. Forest ownership is very fragmented. There are over 600,000 non-industrial private forest owners (14% of the population), who own majority of the forests (around 60%). The average size of a private forest holding is about 30 ha (Finnish Forest Association, 2018). Thus, the behaviour of private forest owners is likely to be pivotal in forest disease management. Private forests are often managed for timber production, but forest owners typically have multiple objectives. Private forest owners also value non-monetary aspects, such as nature, landscape and recreation (Hänninen et al., 2011; Karppinen, 2000; Takala et al., 2017). This relates to the fact that Finnish forests (including private) have open access. The “everyman's right” enables the active usage of private forests for outdoor recreation. For example,

[1] Note that it is possible to apply choice modelling to revealed preference data. In the current context, this would imply the need to describe variation in uptake of actual PES schemes for invasive pests and disease control as a function of scheme characteristics.

[2] An alternative incentive design to encourage spatial coordination in PES-type schemes is a conservation auction where extra points are awarded to bids made with neighbours (Krawczyk et al., 2016).