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Estimating demand for certification of forest ecosystem services: A choice experiment with Forest Stewardship Council certificate holders

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ABSTRACT

The scope of Forest Stewardship Council (FSC) certification, a market-based mechanism targeting sustainable forest management, could be expanded to certify delivery of a range of forest ecosystem services (FES). To assess the feasibility of such an undertaking, we examined market demand for FES certification based on the benefits and costs applicable to certification of any FES. We conducted a choice experiment with 188 FSC certificate holders to assess the perspectives of potential FES certification adopters. Our results revealed preferences for FES certification system capable of providing a 50% price premium, technical training for forest owners, and greater global market reach. However, potential adopters showed low willingness to pay for FES certification and limited technical capacity to manage FES. Furthermore, only FES traded at the global scale to date is forest carbon. These findings indicate characteristics of FES certification that forest owners would likely require, as well as a number of challenges in developing such as a scheme.

1. Introduction

Launched in the early 1990s, the Forest Stewardship Council (FSC) forest certification scheme was conceived to mitigate illegal logging and loss of forest biodiversity (Cashore et al., 2006; Elliott and Schlaepfer, 2001; Rametsteiner and Simula, 2003). Lately, the FSC has implemented a project[1] to explore the potential of expanding the scope of certified products beyond timber to include forest ecosystem services (FES) (Jaung et al., 2016a, b, c). The project responds not only to increasing interest in comprehensive sustainable forest management (Barry et al., 2012; Kiker and Putz, 1997; Rametsteiner and Simula, 2003) but also to expanding ecosystem services markets, as evidenced by payments for environmental services (PES) schemes (Ezzine-de-Blas et al., 2016; Gong et al., 2014; Wunder et al., 2008). Defined as "the benefits people obtain from ecosystems" (MA, 2005), FES include storage of carbon in forests to mitigate climate change, conservation of forest biodiversity associated forest species values, and improvement of water quality and quantity through protection of watersheds (Balick et al., 1992; MA, 2005; Peters et al., 1989; Sunderland et al., 2013).

Because adoption of certification is voluntary, market demand is a vital enabling condition for development of FES certification as a potential expansion of the FSC scheme to FES. Despite its importance, no empirical study is yet available on this market demand; this study assesses potential market demand for FES certification through a choice experiment (described below) with FSC forest management certificate holders around the world. As potential buyers of an expanded certification scheme, these certificate holders represent the FSC's internal market, potential FES sellers from plantation forests (Bauhus et al., 2010), and forest owners who have perceived actual benefits and costs of forest certification. A complete market analysis of FES certification requires analyzing demands from both service sellers and end-users of services. The latter is beyond the scope of this study but will be addressed in a series of complementary studies currently in preparation.

2. FES certification

2.1. Market demand

Market demand is a vital enabling condition for FES certification, demonstrated by implementation of forest certification. As a voluntary market-based scheme, forest certification differs from conventional policies and regulations, such as command-and-control enforcing compliance (Cashore et al., 2005; van Kooten et al., 2005).

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[1] Forest Certification for Ecosystem Services (ForCES) (2016, October 12). Retrieved from http://forces.fsc.org.

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Consequently, although sometimes propelled by consumer boycotts spearheaded by environmental NGOs, market demand is a major determinant of uptake of forest certification (Barry et al., 2012; van Kooten et al., 2005). Many studies therefore have examined forest owner demand for forest certification (Carlsen et al., 2012; Overdevest and Rickenbach, 2006) as well as end-customer demand for certified wood products (Anderson and Hansen, 2004; Cai and Aguilar, 2013; Jensen et al., 2004; Kozak et al., 2004). These market segments have different motivations. Forest owners certify wood products to access price premiums, to improve their capacity to manage forests, to signal their businesses' soundness to the market, to meet corporate social responsibility goals, and to responsibly manage their own forests (Bowers et al., 2012; Carlsen et al., 2012; Overdevest and Rickenbach, 2006). On the other hand, consumers purchase certified wood products to support biodiversity conservation and reduce illegal deforestation (Aguilar and Vlosky, 2007; Thompson et al., 2010). However, while these motivations have been identified and described in the literature, studies also have found that demand for certified wood products is low, and price premiums are practically non-existent (Durst et al., 2006; Rametsteiner and Simula, 2003; Tikina et al., 2008). Moreover, demand for forest certification has been suppressed by high adoption costs (Carlsen et al., 2012; Durst et al., 2006). These market-based challenges are major obstacles for the uptake of forest certification, particularly in developing countries. Thus, it is assumed that market demand is a requisite enabling condition of voluntary FES certification and that market studies are an essential component of any feasibility analysis for such a scheme.

2.2. Expected challenges

Development of FES certification faces numerous challenges due to the complexity of FES management and delivery (Bennett et al., 2009; Chan et al., 2006; Meijaard et al., 2011, 2014; Ruhl et al., 2007). FES are generated and delivered at different geographical and temporal scales from global (e.g., forest carbon) to regional and local (e.g., watershed protection) (Chan et al., 2006; Meijaard et al., 2011; Womble and Doyle, 2012). Many PES schemes are associated with high transaction costs, in part because PES buyers often do not receive sufficient information about the quality and quantity of FES from PES sellers (Ferraro, 2008; Muradian et al., 2010; Muradian and Rival, 2012). Moreover, many stakeholders of PES and REDD+[2] schemes lack the technical capacity to measure and monitor the provision of FES (Pagiola et al., 2005; Romijn et al., 2012; Wunder et al., 2008). As a result, market demand for certified FES is expected to be low; scientific knowledge on FES standard development is deemed insufficient, and FES standards would need to be simple enough for on-the-ground implementation by forest owners, while scientifically rigorous enough to accurately measure and monitor FES delivery (see Jaung et al., 2016c; Meijaard et al., 2011, 2014). To date, however, no empirical market study has been conducted on the certification scheme. Therefore, this study attempts to address this knowledge gap by estimating market demand for FES certification from forest owners who experienced FSC forest management certification.

3. Material and methods

3.1. Choice experiment

We used a choice experiment to analyze market demand for FES certification developed as a potential expansion of the FSC. A choice experiment is an effective way to elicit survey participants' preferences for non-market goods and services in terms of their expected attributes (Adamowicz et al., 1998; Bateman et al., 2002; Louviere et al., 2000). Following Train (2009), a random utility model of forest owners was defined in Eq. (1):

$$U_{ni} = V_{ni} + \varepsilon_{ni} \; \forall \; j \tag{1}$$

U_{ni} is the random utility of a forest owner n with FES certification scheme i. This utility is decomposed into two parts: V_{ni} and ε_{ni}. V_{ni} represents a forest owner's observable random utility and ε_{ni} represents the unobservable random utility. Assuming a rational decision maker, a forest owner would choose a certification scheme that maximizes her random utility. For example, let's assume there are J number of FES certification schemes. A forest owner would choose the scheme i if this scheme provides the highest random utility among the J number of FES certification schemes. Using maximum likelihood estimation, the probability for her to choose the scheme i over the scheme j is expressed as:

$$\begin{aligned} P_{ni} &= \text{Prob}(V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj} \; \forall \; j \neq i) \\ &= \int_{\varepsilon} I(V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj} \; \forall \; j \neq i) f(\varepsilon_n) d\varepsilon_n \end{aligned} \tag{2}$$

$I(\cdot)$ is a probability function. $f(\cdot)$ is a distribution function of ε_n. If we let $f(\varepsilon_n)$ be logistically distributed, this probability becomes:

$$P_{ni} = \frac{\exp^{Vni}}{\sum_j \exp^{Vnj}} \tag{3}$$

The integral of Eq. (2) can be estimated under various assumptions. This study employed two assumptions resulting in multinomial and mixed logit models. First, ε_n was assumed independently and identically distributed (iid) as an extreme value type 1 distribution. This assumption led to a multinomial logit model. Second, ε_n was assumed to be randomly distributed and follows researcher-defined distributions including normal and triangular distributions. This assumption led to a mixed (or random parameter) logit model.

Marginal willingness to pay (MWTP) was estimated by:

$$MWTP = \frac{(\beta_k - \beta_{k0})}{-\beta_c} \tag{4}$$

where β_k is a coefficient of a certification attribute of interest, β_{kO} is a coefficient of an effect-coding baseline for β_k, and β_c is a coefficient of a certification cost. β_{kO} was subtracted to transform the effects-coded coefficients to dummy-coded coefficients. Therefore, β_k - β_{kO} is considered as a dummy-coded version of β_k.[3] The cost variable was also not randomized in the mixed logit model. In this way, β_c was assumed to be constant instead of random; MWTP estimates avoided singularities arising from dividing taste coefficients by a random cost variable (Train and Weeks, 2005). The confidence intervals of the MWTP were estimated by the Delta method (Bliemer and Rose, 2013; Hole, 2007). For the entire econometrics estimation, R 3.2.3 was used. The computation of choice experiment models was supported by Package mlogit (Croissant, 2013).

Total welfare measures[4] (or compensating variations) were calculated based on scenario-based certification schemes and estimated MWTP for the attributes. Scenarios of certification scheme were generated with all the possible combinations of statistically significant attributes. These scenarios revealed potentially feasible designs for FES certification and allowed estimation of forest owner demand for these designs by summing their MWTP for the included attributes. All the total welfare measures included the MWTP estimate of an alternative-specific constant (*ASC*) since *ASC* represents impacts of certification attributes that were not included in this study. Estimated total welfare

[2] Reducing emissions from deforestation and forest degradation and enhancing forest carbon stocks (Angelsen et al., 2012)

[3] Zweifel et al. (2009) explain the conversion of effects-coding to dummy coding for MWTP estimates.

[4] These total welfare measures were only based on the main effects of each attribute. It is due to the challenge to obtain both main and interaction effects in a robust way. Even the model with only two-attribute interactions became enormous and unstable.