



Not so biocentric – Environmental benefits and harm associated with the acceptance of forest management objectives by future environmental professionals



Brent D. Matthies^{a,*}, Annukka Vainio^b, Dalia D'Amato^c

^aDasos Capital, Itämerentori 2, FI 00180 Helsinki, Finland

^bNatural Resources Institute Finland (Luke), Bioeconomy and Environment, Latokartanonkaari 9, FI 00790 Helsinki, Finland

^cHelsinki Institute of Sustainability Science, Faculty of Agriculture and Forestry (Dept. of Forest Sciences), University of Helsinki, Latokartanonkaari 7, P.O. Box 27, FI 00014 Helsinki, Finland

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ABSTRACT

It is not yet completely clear how individuals weigh positive and negative consequences of specific environmental actions to the self, others and nature, and how these evaluations are associated with the acceptance of such environmental actions. We explored how the acceptance of ecosystem service-related forest management objectives were associated with perceived positive and negative consequences, perceived knowledge of these objectives, and gender among future professionals in the bioeconomy context. We analysed a survey collected among Finnish university students majoring in agriculture and forestry, and biological and environmental sciences (N = 159). We found that environmental concerns followed a two-factor structure: concerns for humans and concerns for the environment. Perceived harm to nature and humans reduced the acceptance of timber and bioenergy objectives, but only the effect of perceived harm to humans remained when they were considered together with perceived benefits. Perceived knowledge of the objectives had little effect on acceptance of the objectives. Females endorsed the biodiversity and climate objectives more than males, whereas males endorsed timber objectives more than females. These results show that in the context of ecosystem service management, positive consequences are more important than negative when evaluating bioeconomy objectives, and that consequences to humans are more important than consequences to the environment.

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1. Introduction

The bioeconomy is currently being promoted as an important sustainability avenue in the Nordic countries and globally (European Commission, 2012; USA, 2012; Hetemäki et al., 2017). The main idea is to replace non-renewable materials with bio-based solutions, including bio-fuels and bio-energy, bio-material and bio-chemicals (Hetemäki, 2014; Ollikainen, 2014; De Besi and McCormick, 2015). Forest ecosystems and the forest sector play a fundamental role in this context as an important provisioning source.

A renewal of forest management objectives under the Finnish Bioeconomy Strategy (Biotalous in Finnish) could affect the availability and trade-offs of ecosystem services to different societal actors. This discussion thus requires an assessment of the level at

which sustainable bio-based value chains suit the motivations behind pro-environmental or 'green' value creation by value chain actors (e.g., Birch and Tyfield, 2013; Jing and Jiang, 2013). In the value-basis theory, attitudes can act to guide behaviour that is linked to the mitigation of negative environmental impacts (i.e., environmental externalities) based on the relative importance placed on that impact (Stern and Dietz, 1994). On that basis, actions by value chain actors to mitigate negative environmental impacts at different points in the value chain could be motivated by their concern for the potential impacts.

Value-basis theory can be considered a form of non-monetary approach to ecosystem services valuation to inform and enable sustainable ecosystem management. Despite the growing interest in non-monetary techniques in ecosystem service research, so far there have been very few direct applications of the approach to specific ecosystem service-oriented management objectives (for exceptions see e.g., Lamarque et al., 2011). Non-monetary valuation is important for addressing some of the limitations of

* Corresponding author.

E-mail addresses: brent.matthies@dasos.fi (B.D. Matthies), annukka.vainio@luke.fi (A. Vainio), dalia.damato@helsinki.fi (D. D'Amato).

monetary valuation; especially of non-market valuation approaches (e.g., willingness-to-pay) that tend to not account for differences in value orientations between independent outcomes (i.e., two differing ecosystem service offerings – which are the basis of exchange whereby firms and individuals co-create value with natural ecosystems (Matthies et al., 2016a)), an outcome can lead to trade-offs or conflicts within the cognitive space.

In environmental psychology, pro-environmental behaviour has been defined as behaviour that aims at minimizing the negative impacts on the environment (Kollmuss and Agyeman, 2002). Since pro-environmental behaviour of individuals is driven by a complex set of underlying factors that are uniquely and phenomenologically determined, clarifying an entire set of factors behind pro-environmental behaviour by individual actors is challenging and potentially infeasible (Kollmuss and Agyeman, 2002). Still, the pro-environmental concerns of economic actors have previously been shown to be important predictors of pro-environmental behaviour (e.g., Schwartz, 1973; Schwartz and Howard, 1981; Stern et al., 1993, 1995; Schultz, 2001; Snelgar, 2006). Additionally, Fietkau and Kessel (1981) have demonstrated that knowledge and attitudes are also important for understanding pro-environmental behavior. To better understand the role of concerns in determining behavior, Schultz (2001) has presented a survey method for eliciting the attitudes of environmental concerns of individuals. He suggested that egoism (i.e., personal well-being), altruism (i.e., social well-being), and biospherism (i.e., environmental health) form a tripartite characterizing of the pro-environmental concerns of individuals following Stern et al. (1993). Other authors, such as Snelgar (2006), have demonstrated that this method is both robust and provides replicable results.

To better account for the trade-offs associated with the utilization of ecosystem service offerings by different value chain/network actors, we have proposed using the survey method that was developed by Schultz to elicit general environmental concerns related to self, other humans and nature, to elicit the pro-environmental concerns of actors for different forestry-related ecosystem service categories. The aim of this approach is to determine if there are differences in the environmental concerns among individuals towards different ecosystem service offerings in the context of the bioeconomy. This will be important, as previous research has indicated that there are important underlying factors related to concerns about bioenergy and timber production within the broader range of ecosystem services (e.g., in relation to the regulation of genetic diversity and climate change) (Karppinen, 1998; Halder et al., 2010, 2011).

Moreover, much of the pro-environmental concern literature only considers environmental impacts at the general level focusing on negative impacts. Nevertheless, risk perception literature suggests that people evaluate both negative and positive consequences, which both influence the acceptance of a risk and that positive consequences can be even more important than negative ones (Siegrist, 1999, 2000; Siegrist et al., 2007; Visschers et al., 2011). Impacts act to constrain ecosystem service provisioning to the economy and society, and are phenomenologically determined by individuals along the value chain or in the network of chains. This includes both positive and negative environmental impacts, which influence the total potential value available along a value chain or throughout a network of chains (Jing and Jiang, 2013; Matthies et al., 2016a).

The aim of this study is thus to apply value-basis theory methods to elicit pro-environmental concern and acceptance of specific management objectives under a bioeconomy in Finnish forests. The four selected forest management objectives include: biomass for bioenergy production, timber for long-term storage of carbon, genetic and structural diversity to support ecosystem diversity, and conservation of forest to support carbon sequestration and

storage. Forest management objectives were used in the survey, as these are terms that all students surveyed are familiar with whereas the concept of ecosystem services was considered unfamiliar to a minority of students. We have adapted the Schultz (2001) method to evaluate the pro-environmental concern and applied it separately to each of these four ecosystem service-related categories in the context of boreal forest management objectives in Finland. These four categories coincide with the categorizing according to the CICES (2013) classification framework. A survey was developed for eliciting how individuals' concern for each ecosystem service objective, including both positive and negative concerns, is structured (See [Supplementary Materials](#)). The survey was administered to students of natural resource management at the University of Helsinki in Helsinki, Finland between January and May 2016. The surveyed students represented future professionals who will make decisions about forest ecosystem services as part of their career work in the future, and therefore it was considered important to understand better how they perceive environmental concerns associated with forest management issues.

2. Pro-environmental concerns for ecosystem services in the bioeconomy

The ecosystem service concept emphasizes the benefits derived from natural and semi-natural ecosystems. It is an anthropocentric approach for determining the service value flows (i.e., quantity/quality over time) from ecological processes for the benefit of human beings (de Groot et al., 2002; MEA, 2005; Turner and Daily, 2008; Fisher et al., 2009; Matthies, 2016).

Lusch and Vargo (2014), Matthies et al. (2016a) and Vargo and Lusch (2016) all have proposed that the ecosystem service approach is actually a part of the service-dominant logic of value co-creation. Based on that logic, the interaction (e.g., management) with natural ecosystems by human actors results in decisions that impact ecosystem service provisioning over the entire chain or network of actors and value interactions. Actions that increase or decrease ecosystem service provisioning have co-current impacts on or trade-offs with the provisioning of other ecosystem service offerings. These impacts, which Matthies et al. (2016a) have termed *value-in-impact*, are part of the total potential value available to subsequent actors or beneficiaries in the chain or network. According to the same theory, an individual's environmental concerns can have an important role in determining the value creation opportunities that result from utilizing a given set of ecosystem service offerings relative to alternative sets of offerings.

In the context of environmental psychology, Schwartz's (1973, 1977) norm-activation theory states that pro-environmental behaviour is carried out in response to the personal moral norms related to those actions when the individual believes that certain actions lead to negative impacts on the environment, and thus on individuals or society. It follows that the individual also believes that their actions will help to avert the negative impacts on the environment. Following the norm-activation theory, the value-belief-norm (VBN) theory was further refined by Stern et al. (1999), also drawing from the New Ecological Paradigm (Dunlap and Van Liere, 1978, 1984). According to the VBN theory, held values shape individuals' worldviews and beliefs about environmental problems. When the individual believes that adverse consequences are threatening the valued object(s), personal norms take place in triggering response behaviours. The VBN theory suggests that there are three types of environmental concerns: egoism, social-altruism, and biospherism (Stern et al., 1995; Rhead et al., 2015). This three-factor model was postulated to be sufficient to fully capture individuals' concerns related to environmental issues,

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