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Ph.D. Thesis

**Integrating plural values in ecosystem services  
valuation:  
An ecological economics approach**

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## **Main abbreviations and acronyms**

CARDER Corporación Autónoma Regional de Risaralda

CBA Cost Benefit Analysis

COOMDEMA Cooperativa Multiactiva Defensora del Medio Ambiente

ES Ecosystem services

INDERENA Instituto Nacional de los Recursos Naturales Renovables y del Ambiente

IPBES Intergovernmental Platform of Biodiversity and Ecosystem Services

MEA Millenium Ecosystem Assessment

TEEB The Economics of Ecosystems and Biodiversity

UAESPNN Unidad Administrativa Especial del Sistema de Parques Nacionales Naturales.

USD United States dollar

WTP Willingness to pay

WTT Willingness to give up time

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## Summary

To promote ecosystems conservation, ecosystem services (ES) scholars have encouraged the recognition of importance of ES through their valuation. Although the call of integrating plural values has been a mainstay in much of the ES conceptual literature, in practice monetary valuations have remained the dominant valuation tool. Monetary valuations have been criticized because they may obscure the values people attribute to ES and nature on the basis of ethical, emotional, cultural or social concerns. The main goal of this PhD dissertation is to contribute to the ES valuation practice by assessing how plural values can be recognized and integrated in valuations. By addressing the main goal, this dissertation aims to answer three research questions: How ES valuations can recognize and incorporate multiple human-nature relationships, value notions, and valuation methods? How the socio-cultural context influences the attribution of plural values to ES and nature? How do different valuation methods frame valuation outcomes? I answer these questions under the lens of three pillars of Ecological Economics: value pluralism, value incommensurability and value articulating institutions. First, I define a taxonomy of values and valuation methods that can be integrated in ES valuations. I argue that this taxonomy can help researchers to representing people's multiple and context specific ways of valuing nature. Following this analytical perspective, I then empirically explore the second and third research questions by applying a non-monetary valuation approach based on three methods: i) narratives of the importance of ES and nature, ii) prioritization of environmental motivations and iii) willingness to give up time for ES conservation (WTT). I performed qualitative and quantitative data analyses of 589 questionnaires that were collected in the mid-upper stream of the Otún watershed, Colombian Andes.

The empirical research resulted in four main findings. First, respondents attribute multiple values to the ecosystems including intrinsic, instrumental and relational values, supporting the necessity of integrating value pluralism in ES valuations. Second, I found that rural people, compared with urban, prioritized altruistic and biospheric environmental motivations, were more likely to express intrinsic and relational values, and expressed a higher WTT for ES conservation. I argue that the differentiated valuation of nature by rural people emerges from their material dependence on ES and their strong cultural relations with ecosystems. Third, I found that socio-cultural factors (e.g. place of residence, age, education) and environmental motivations underpin the attribution of values by people. This finding supports the perspective that values are place-based and context specific. Fourth, I found that the different valuation methods frame valuation outcomes in different ways. I claim that non-monetary valuation approaches are suitable to capture the values of rural and indigenous people, usually excluded in monetary valuations, because are not inherent related to income distribution. However, I found that WTT can also restrict other social groups of expressing values such as women, elderly and people with high time restrictions.

In sum, this dissertation contributes to current gaps of ES science-policy interface by i) integrating value pluralism and incommensurability in ES valuation practice, ii) understanding the multiple values people place on ES and nature and iii) further development of non-monetary valuation methods. Through the discussion of the ontological, epistemological and ethical assumptions, ES valuations cannot be further framed as technical tools but as political projects on sustainability. I argue that framing ES and nature valuations from Ecological Economics can contribute to depict a more sustainable and just future.

## Resumen

Para promover la conservación de los ecosistemas, el campo de los servicios ecosistémicos ha promovido el reconocimiento de la importancia de los servicios ecosistémicos a través de su valoración. Gran parte de la literatura conceptual sobre la valoración de servicios ecosistémicos ha llamado a integrar múltiples valores. Sin embargo, en la práctica, la valoración monetaria han sido la herramienta de valoración dominante. Las valoraciones monetarias han sido criticadas porque pueden ocultar los valores éticos, emocionales, culturales o sociales que las personas atribuyen a los servicios ecosistémicos y a la naturaleza. El objetivo principal de esta tesis es contribuir a campo de la valoración de servicios ecosistémicos evaluando cómo valores plurales pueden ser reconocidos e integrados en las valoraciones de los servicios ecosistémicos y de la naturaleza. Esta tesis responde a tres preguntas de investigación: 1) ¿Cómo las valoraciones de servicios ecosistémicos pueden reconocer e incorporar múltiples relaciones ser humano-naturaleza, nociones de valor y métodos de valoración? 2) ¿Cómo influye el contexto sociocultural en la atribución de valores plurales a los servicios ecosistémicos y a la naturaleza? 3) ¿De qué manera la elección de los métodos de valoración influencia los resultados de la valoración? En esta tesis respondo a estas preguntas bajo el lente de tres pilares fundamentales de la Economía Ecológica: pluralismo de valor, inconmensurabilidad de valor e instituciones articuladoras de valor. En primer lugar, defino una taxonomía de valores y métodos de valoración que pueden integrarse en las valoraciones de servicios ecosistémicos. En esta tesis argumento que esta taxonomía puede ayudar a que las valoraciones de servicios ecosistémicos, representen las múltiples formas, y además contexto-específicas- de valorar la naturaleza. Seguidamente, exploro empíricamente las preguntas 2 y 3 a través de un enfoque de valoración no-monetaria basado en tres métodos: i) narrativas sobre importancia de los servicios ecosistémicos y de la Naturaleza, iii) priorización de motivaciones ambientales y ii) disponibilidad a donar tiempo para la conservación de servicios ecosistémicos (DDT). Recolecté datos de 589 encuestas aplicadas en la cuenca media-alta del río Otún, en los Andes colombianos y se realicé análisis cualitativos y cuantitativos.

La investigación empírica tuvo cuatro resultados principales. Primero, los encuestados atribuyeron múltiples valores a los ecosistemas, incluidos valores intrínsecos, instrumentales y relacionales. Este resultado soporta el llamado integrar el pluralismo de valor en las valoraciones de servicios ecosistémicos. En especial, argumento que los valores relacionales deben diferenciarse de los valores instrumentales y ser expresados en lenguajes no-monetarios. Segundo, encontré que en comparación con los encuestados urbanos, aquellos que vivían en áreas rurales priorizaban las motivaciones ambientales altruistas y bio-céntricas, eran más propensos a expresar valores intrínsecos y relacionales, y expresaron una mayor DDT para la conservación de servicios ecosistémicos. En esta tesis argumento que este resultado emerge de la dependencia material de la población rural a los servicios ecosistémicos y de relaciones culturales que tejen con los ecosistemas. Tercero, encontré que los factores socioculturales (p.ej. lugar de residencia, edad, educación) y las motivaciones ambientales influyen la atribución de valores. Este resultado sustenta la perspectiva que los valores son contexto-específicos. Cuarto, encontré que la selección de métodos de valoración influencia los resultados de valoración en varias formas. Argumento que los enfoques de valuación no-monetarios, debido a que no están inherente relacionados con la distribución del ingreso son adecuados para captar los valores de las poblaciones rurales e indígenas, generalmente excluidos de las valoraciones monetarias. Sin embargo, también encontré que los estudios de DDT también pueden restringir la atribución de valor de grupos sociales como las mujeres, los ancianos y las personas con altas restricciones de tiempo.

En síntesis, esta tesis contribuye a vacíos de la interfaz ciencia-política de: i) integrar el pluralismo y la inconmensurabilidad de valor en la práctica de la valoración de los servicios ecosistémicos, ii) comprender los múltiples valores que las personas atribuyen a los SE y a la naturaleza, y iii) avanzar en el desarrollo de métodos de valoración no monetarios. A través de la discusión de los supuestos ontológicos, epistemológicos y éticos de las valoraciones de los servicios ecosistémicos y de la naturaleza, estas no pueden seguir siendo enmarcadas como herramientas técnicas sino más bien como proyectos políticos sobre sostenibilidad. Creo que la integración de una perspectiva de economía ecológica en la valoración de servicios ecosistémicos y de la naturaleza, puede contribuir a representar un futuro más sustentable y justo.

## CHAPTER 1 : Introduction

*“We will make more progress in the long run by appealing to people’s hearts rather than to their wallets. If we oversell the message that ecosystems are important because they provide services, we will have effectively sold out on nature” (McCauley 2006: 28)*

*“I do not agree that more progress will be made by appealing to people's hearts rather than their wallets. Ecosystems are critical to our survival and well-being for many reasons — hearts, minds and wallets included” (Costanza 2006:740)*

Humans depends on vital contributions provided by ecosystems such as freshwater, food, diseases regulation, spiritual fulfillment and aesthetic enjoyment (MA 2005). However, in the last 60 years, humans have degraded global ecosystems more rapidly and extensively than in any other period over the last 10,000 years (MA 2005, Steffen et al. 2015). Humans have changed the structure and functioning of the world's ecosystems through the massive extinction of species, degrading land and freshwater systems, emitting greenhouse gases and discharging massive amounts of agricultural chemicals into the environment (Rockström et al. 2009, Butchard et al. 2010, Ewing et al. 2010, Steffen et al. 2015). Human impact on the environment has brought the risk of a global environmental disruption that may endanger the sustainability of the economic system, and more important, life on Earth (Rockström et al. 2009, Steffen et al. 2015).

The degradation of Ecosystems has been the cost of supplying the demands of a growing population but also the ones of the global economic system (Lambin et al. 2001, MA 2005, Krausmann et al. 2009, Guo et al., 2010). Economic growth has been one of the main targets of policy-making in almost every country worldwide. However, economic growth has entailed large environmental and social costs that are not accounted by markets and prices. Further, attempts to monetize environmental costs and benefits are always incomplete in order to make decisions on the environment, because they cannot measure ecological boundaries or ethical concerns (Martinez-Alier et al. 1998). As Rockström (2015) stated, "The number one economic threat to humanity is our inability to value nature". In other words, the global environmental crisis is also a crisis of values. Valuing nature is not only about revealing The monetary value of ecosystems. It implies leaving the realm of economics and entering the realm of ecology, ethics and justice (Rockström 2015).

Although valuations are not a sufficient solution to global environmental crisis, ecosystems valuations aimed at revealing values beyond monetary ones, can provide crucial information for policy and decision making (MA 2005, de Groot et al. 2010, Dendoncker et al. 2013, Gómez-Baggethun and Martín-López 2015, Jacobs et al. 2016, Pascual et al. 2017). First, valuations can reveal the biophysical values necessary to safeguard ecological boundaries and the Life support system (Steffen et al. 2015). Second, valuations can also reveal the sacred, cultural, social and material values of ecosystems attributed by rural and indigenous people, to stress their livelihoods and cultural dependence on ecosystems (Angelowsky and

Martinez-Alier 2008, Muraca 2016). These values are not usually integrated in decision-making, even though that rural and indigenous people have disproportionately borne the costs of ecosystems degradation (Martinez-Alier et al. 2002, MA 2005, Centemeri 2015). Finally, valuations can also recognize that humans may value nature from a different moral position than a commodity-consumer relation and that some human-nature relationships (e.g. aesthetic enjoyment, spiritual fulfillment) may constitute the notion of a ‘good human life’ (Muraca 2011, 2016, Kaltenborn et al. 2017).

## **1.1. Conceptual framework**

### **1.1.1. Ecosystem service research and ecosystem services valuation**

In the last decades, scholars have developed analytical frameworks to understand the link between ecosystems and human well-being relying on the concept of ecosystem services (ES) (Costanza and Daly 1992, Daily 1997, de Groot et al. 2002, MA 2005, TEEB 2011). Defined as the contributions ecosystems provide to humans (Pascual et al. 2017), ES are usually classified in the categories of provisioning, regulating, supporting and cultural services. The provisioning services category include benefits such as food, wood or medicine; regulating services refer to indirect benefits such as climate regulation, soil erosion control and pollination, deriving from the regulation of ecosystem processes; and cultural services are related with our spiritual or cultural needs such as inspiration, aesthetic enjoyment or recreation (MA 2005).

The ‘ES framework’ has been used in a diverse range of science-policy contexts with aims that ranges from the advocacy of biodiversity protection to environmental management (MA 2005, Turner and Daly 2008). Nowadays diverse stakeholders, including scientists, policy-makers, NGOs and practitioners in the environmental science and policy arenas are increasingly using the ES framework (Nicholson et al. 2009, Seppelt et al. 2011, Barnaud and Antona 2014). In this dissertation, I purposely engage with the concept of ES as one of the most influential frameworks in current environmental science and policy processes, to address the issue of integrating plural values in environmental valuation. Different concepts such as nature, ecosystems, biodiversity, natural resources, landscapes or ‘mother earth’ are increasingly conflated under the ES framework. This conflation has been prompted,

particularly, since the implementation of the Intergovernmental Platform of Biodiversity and Ecosystem Services (IPBES); a science-policy interface initiative which intends to operationalize the ES framework in decision-making across spatial scales (Díaz et al. 2015). Although I apply the ES framework, I also acknowledge the implications of simplifying multiple concepts and the need to rely on a broader set of metaphors to promote the integration of plural values in ES –and more generally- environmental valuation (Raymond et al. 2013). For instance, the metaphors of ‘Mother Earth’ and ‘gifts’ instead of ‘ES’ will be more suitable to understand the plurality of values that some indigenous groups attribute to nature (Díaz et al. 2015).

The study of ES values, i.e. the multiple ways in which ES are important to people, is crucial towards the sustainable management of ecosystems, because values represent social agreements about what is right, good, to be cherished (Ives and Kendal 2014, Oyserman 2015, Jacobs et al. 2016, Jones et al. 2016, Kenter 2016a). ES valuation has been defined as the act of assessing, appraising or measuring the importance of ES (Dendoncker et al 2013, Gómez-Baggethun et al. 2014) and has been recognized as a requirement to inform decision-making on ecosystems (MA 2005, Daily et al. 2009, de Groot et al. 2010, Pascual et al. 2010, Pascual et al. 2017).

However, ES valuations have traditionally focused on revealing the monetary values of ES, whilst other disciplinary approaches to the notion of ‘value’ have been less explored (Vihervaara et al. 2010, Seppelt et al. 2011, Christie et al. 2012, Abson et al. 2014, Gómez-Baggethun et al. 2010, 2014, Nieto-Romero et al. 2014). Monetary valuations have been conducted with the aim of revealing that ES conservation represents monetary benefits, whereas their degradation entails monetary costs. Scholars favoring monetary valuation argue that in decision-making contexts, in the absence of monetary values ecosystems will represent a ‘zero value’ (Costanza et al. 1997, 2014). From this perspective, it is assumed that accurate pollution taxes could not be designed if monetary costs of pollution are not revealed; or investments in protected areas will not be prioritized since their benefits are usually not priced in markets (TEEB 2011).

Scholars have largely stressed the drawbacks and potentially negative consequences of an ES monetary valuation framework because manifold reasons (McCauley et al. 2006, Gómez-

Baggethun and Ruiz Pérez 2011, Luck et al. 2012, Jax et al. 2013, Martín-López et al. 2014, Jacobs et al. 2016). First, people may value ecosystems on the basis of ethical, emotional, cultural or social concerns and these values may be obscured with a monetary framing (Kenter et al. 2011, Chan et al. 2012a, Baveye et al. 2013, Boeraeve et al. 2015). Second, the growing recognition of these multiple ‘valuation languages’ (Martinez-Alier et al. 1998, Martinez-Alier 2002) contradicts the assumption of neoclassical economics, which is based on the idea that people prioritize individual welfare above other values (Becker 1976). Third, monetary valuations can hide value conflicts and distributional issues because decisions’ outcomes (e.g. ecological, social or health impacts) are compared and aggregated with the homogenizing measurement rod of money (Wegner and Pascual 2011). Finally, scholars have also stressed that monetary valuations can pave the way towards the expansion of market trade to ES that previously were not part of commercial relations but rather part of ethical or social ones (Gómez-Baggethun and Ruíz-Pérez 2011).

To counteract the hegemony of monetary valuation in ES research, scholars have called for integrating multiple disciplines such as Economy, Ecology or Social Sciences in the valuation exercise. Ecological and sociocultural values have also been recognized in conceptual and empirical contributions in the ES field (de Groot et al. 2002, Farber et al. 2002, Gómez-Baggethun et al. 2010, TEEB 2011, Dendoncker et al. 2013, Jax et al. 2013). In the ES literature, ecological values usually refer to ecological functions, process and components that determine ecosystem’s integrity and their capacity of providing ES (de Groot et al. 2002, Gómez-Baggethun and Martín-López et al. 2015). Parameters such as ecosystems’ complexity, diversity, rarity and stability have been used as proxies of ecological value (de Groot et al. 2010). In decision-making contexts, ecological values have been integrated, for instance, through the precautionary principle and safe minimum standards (Gómez-Baggethun and Ruíz-Pérez 2011).

Socio-cultural values embrace concerns towards ecosystems that usually do not fit in a commodity metaphor often used by monetary valuations (Chan et al. 2012, Daniel et al. 2012, Kelemen et al. 2014). Socio-cultural values cover the material, moral, spiritual, aesthetic, affective, symbolic or medicinal importance of ecosystems for people. Although these values have been included in prominent conceptual frameworks for ES assessments (de Groot et al. 2002, MA 2003, TEEB 2011), they have received less empirical attention



than ecological and monetary values (Gómez-Baggethun et al. 2014). Socio-cultural valuations have been developed under the term ‘non-monetary valuation’ aimed at distinguishing them from traditional monetary valuation (Christie et al. 2012, Gómez-Baggethun and Barton 2013, Castro et al. 2014, Gómez-Baggethun et al. 2014, Kelemen et al. 2014). Non-monetary valuations rely on diverse methods such as surveys eliciting the preference for ES or focus groups aimed at understanding the importance of nature (Kelemen et al. 2014).

In this dissertation, I engage with the discussion under the categories of monetary and socio-cultural values. Although, I will not address ecological or biophysical valuation approaches I endorse the position that they are fundamental for identifying and safeguarding ecological boundaries and for protecting the life support system (Costanza and Folke 1997, Martínez-Alier and Muradian 2015).

### **1.1.1. Ecological Economics Perspectives on Environmental valuation**

The debate on environmental valuation is not a new one. It has been long addressed by diverse fields such as Ecological Economics, Environmental Economics, Environmental Ethics, Conservation Biology and Environmental Management. Particularly, the field of Ecological Economics has devoted a relevant space to the discussion on environmental valuation (Kapp 1972, O'Neill 1997, Gustafsson and Frolova 1998, Martínez-Alier et al. 1998, Spash 2006, O'Neill et al. 2008). In this context, Ecological Economics has integrated the notion of ‘value articulating institutions’ in environmental valuations. Value articulating institutions are socially constructed concepts and rules that are aimed at the elicitation of values but that also shape them in the valuation process itself (Jacobs 1997, Vatn 2005, 2009). The notion of value-articulating institutions brings to the front the ontological, epistemological and normative positions of environmental valuations. Ontological positions are related to the understanding of the nature of values; e.g. what is defined by value? Are there plural values or only one ultimate value? How values are constructed and held? Epistemological positions are related to knowledge about values; e.g. are values commensurable? Which are the suitable methods for eliciting values? Normative positions are related to the ethical assumptions of environmental valuations.; e.g. do humans relate with nature in a merely commodity-consumer relation? Is there any moral obligation to

nature? Valuation processes are not neutral (Kallis et al. 2013, Gómez-Baggethun and Ruiz-Perez 2011, Gómez-Baggethun et al. 2014). By answering these kinds of questions, environmental valuations define who can participate, in which kind of role, which is the relevant data and how it should be handled, and what conclusions may be reached (Vatn 2005, Farrell 2007).

Ecological economists have endorsed plural value articulating institutions (Gómez-Baggethun et al. 2014, Lo 2014) through their commitment to i) the ontological principle of value pluralism and ii) the epistemological principle of value incommensurability (Martinez-Alier et al. 2008, Martinez-Alier and Muradian 2015, O'Neill et al. 2017). Value pluralism is based on the recognition of different and often conflicting value domains, that are neither reducible to each other, nor to some ultimate value (Chang 2001, O'Neill et al. 2008). For instance, ecological economists agree with the perspective that physical health, knowledge and aesthetic enjoyment represent different values that cannot be reduced to an ultimate value such as economic wealth or energy. Contrarily, value monism considers that there is only one value that is valued for its own sake, and that all values can be reduced to this single ultimate value (Chang 2001, O'Neill et al. 2008). Utilitarianism, or the ethical position that the right action is the one maximizing the welfare of affected agents, endorse value monism because welfare is considered as the ultimate value (O'Neill 2017). The principle of value incommensurability implies the recognition of plural values of nature and also that these values cannot be measured with a single value- indicator, such as money or energy (Neurath 1973, Martínez-Alier et al. 1998). Thus, given the plurality of value dimensions, policy-making requires distinct value measures as information inputs in order to make sound decisions (O'Neill 2017).

Conversely to the Ecological Economics position on values, neoclassical economics considers individual welfare (i.e. satisfaction of preferences) as the ultimate value and money is considered as the measurement rod of welfare changes (Bockstael and Freeman 2005). Under this approach, willingness to pay (WTP) is considered the direct measure of the strength of the preferences for environmental goods (Carson and Hanemann 2005) and contingent valuations have been widely applied to measure WTP for changes in the quality and quantity of ES (Mitchell and Carson 1989, Pearce and Turner 1990, Bateman et al. 2002). Further, judgments about social goodness are elucidated through Cost Benefit

Analysis (CBA). This approach adds individual preferences –WTP- associated to a course of action in order to identify which alternative led to the greatest ‘welfare’ (Boardman et al. 2001).

The position of Ecological Economics regarding plural values and value incommensurability has several ethical/normative implications. First, by recognizing plural values, including moral obligations to Nature, Ecological Economics rejects both the anthropocentric view of nature, and the utilitarian frame of maximizing utility (i.e. economic welfare) as the guiding principle for social choice (Spash 2012). Second, since Ecological Economists adhere to value incommensurability they consider that the monetary language is not suitable to express other values such as the integrity of the biophysical system, the rights of other entities to exist, alternative notions of what a good life means or equity concerns (Gómez-Baggethun and Ruíz-Pérez 2011, Wegner and Pascual 2011, Jax et al. 2013, Kallis et al. 2013, Temper and Martinez-Alier 2013, Boeraeve et al. 2015). Third, by adhering to value pluralism and incommensurability, Ecological Economics state the normative position that values cannot be compensated (i.e. a sacrifice on ecosystems integrity cannot be compensated with an increase on economic wealth). Therefore, ecological economists reject the use of money as the only indicator guiding decision-making and rather use multiple value measures in order to give voice to the plural values at stake (Martinez-Alier et al. 2008, Rodriguez-Labajos and Martínez-Alier 2013, Gómez-Baggethun and Martín-López 2015).

Over recent years, a group of scholars are endorsing value pluralism and incommensurability in the ES research (Jacobs et al. 2016). Further, IPBES has emphasized the need to develop plural valuation (IPBES 2015, Pascual et al. 2017). These scholars adopt conceptual and methodological frameworks towards the inclusion of the multiple values of ES (Chan et al. 2012a, 2016, Jax et al. 2013, Kenter et al. 2015, Jacobs et al. 2016, Pascual et al. 2017). They call to integrate multiple disciplines as well as qualitative and quantitative methods in ES valuation (Busch et al. 2012, Van Riper and Kyle 2014, Kenter et al. 2016b, Jacobs et al. in press).

### **1.1.2. Recognizing multiple human motivations beyond self-oriented: Insights from psychology**

A discipline that has been recently integrated in ES valuations is Psychology (Hicks et al. 2015, Raymond and Kenter 2016, Kenter 2016a). The field of psychology strives to understand how humans behave toward nature and why humans care about nature (Clayton et al. 2015). Psychology accounts for a complex notion of the human being by recognizing the influence of motivations, attitudes, beliefs and emotions in decision making (Saunders 2003). Psychology is also aware of the influence of social and ethical norms in forming perceptions and framing behavior (Saunders 2003). Particularly, social psychology research has addressed motivations or the principles that guide human realization and thus orient human judgments and actions (Schwartz 1994, 2005). Motivations influence what people perceive and how they interpret and process information (Manfredo et al. 2016). Motivations are not only individual cognitions, they are also framed by multiple social levels through collective behaviors, traditions, and social institutions (Manfredo et al. 2016). For instance, it has been evidenced that nations with a more competitive forms of capitalism, focused their motivations towards the mastery of nature as opposed to living in harmony with nature (Schwartz 2007).

In relation to the environment, motivations have been often classified in three main categories: egoistic, altruistic and biospheric. Egoistic value orientations give priority to maximization of individual outcomes (e.g. welfare, power); altruistic orientations embrace concern towards other humans (e.g. equity, helping others); and biospheric value orientations give emphasis to non-human species and the biosphere (e.g. unity with nature, living in harmony with nature) (de Groot and Steg 2008, 2010). Evidence suggests that altruistic and biospheric oriented individuals are more likely to support pro-environmental beliefs, norms, intentions and behavior than egoistic ones (Axelrod 1994, Stern 2000, de Groot and Steg 2008).

Within neoclassical economics, motivations don not have an important role in decision-making because it is supposed that individuals have clear preferences about different outcomes and that individual utility is the ultimate motivation (Becker 1976). However, it is more common that people face conflict of preferences when making decisions (Dietz et al

2005). For instance, people may face conflict among competing motivations such as egoistic and altruistic values. In such cases, people may invoke their motivations to decide to which preference they will give more weight (Schwartz 1992, 2005). The preference of a person for option A vs. option B does not result from comparing the net utility gains associated with the two options, but rather the result of hard choice among conflictive and incommensurable motivations. This complexity raises the debate of the applicability of the neoclassical economics approach on environmental decision making, where people consider moral and normative principles to guide their decisions (Spash 2006, Martín-López et al. 2007).

## **1.2. Main research goal, objectives and research questions**

The main goal of this dissertation is to contribute to the ES valuation practice by assessing how plural values can be recognized and integrated in nature and ES valuation practices. To attain this main goal, this dissertation has three specific objectives:

- To define a taxonomy of values and valuation methods to widen the evaluative space for ecosystem service assessments.
- To analyze the place-based and plural values people attribute to ES and nature.
- To advance the development of non-monetary valuation methods which enable the integration of value pluralism and incommensurability into ES valuation.

Each of these objectives is addressed in independent papers that all together comprise this PhD dissertation (see Section 1.5. Structure of the dissertation).

By addressing the main goal, this dissertation aims to answer three research questions:

1. How can ES valuations recognize and incorporate multiple human-nature relationships, value notions, and valuation methods?
2. How does the socio-cultural context influence the attribution of plural values to ES and nature?
3. How do different valuation methods frame valuation outcomes?

In sum, this dissertation aims to contribute to the science-policy interface gaps of i) reflecting about the ontological, epistemological and ethical assumptions of ES valuations, ii) integrating value pluralism and incommensurability in ES valuation practice; iii) understanding the place-based and plural values people attribute to ES and nature; and iv) further development of non-monetary valuation methods.

### **1.3. Structure of the dissertation**

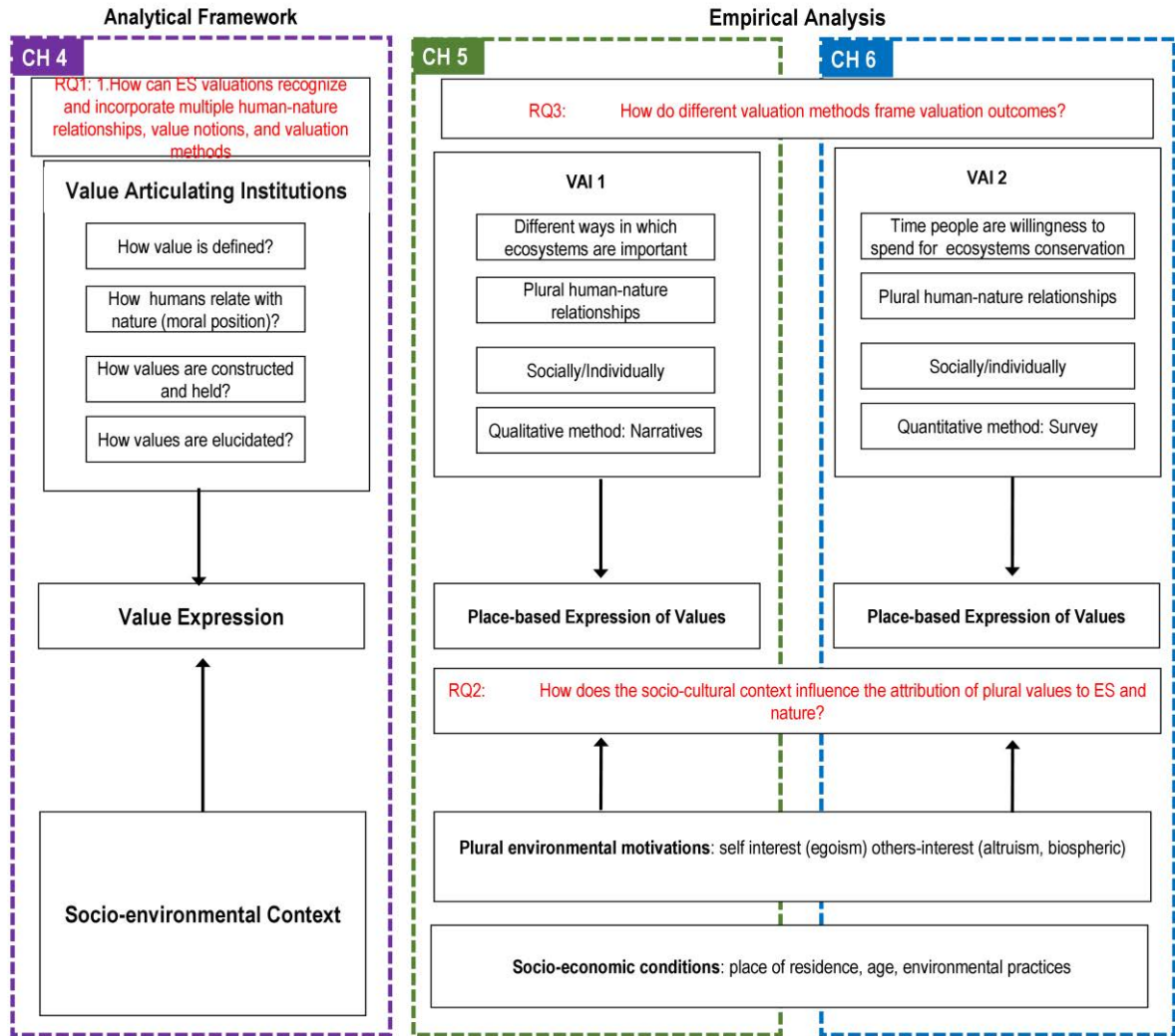
This dissertation consists of a compilation of three original research papers (Chapters 4, 5 and 6), preceded by this general introduction (Chapter 1), the study area description (Chapter 2), and the methodological approach (Chapter 3). In the final Chapter (7) the synthesis of the research and main conclusions are presented. At the time of submission, one research article was in press (Chapter 4), one was resubmitted after major revision (Chapter 5) and one was submitted (Chapter 6). The reader may find some degree of overlap across the dissertation's chapters because the research papers are individual publications that may share similar sections such as the description of the study area. Each chapter is presented in its original research paper format to ensure its internal coherence. A brief description of the research papers and how they contributed to the main goal of this dissertation is described below and **Figure 1.1** represents the outline of this dissertation.

Chapter 4 presents a taxonomy of values and valuation methods aimed at widening the evaluative space for ecosystem services assessments. In this chapter, I address the research question of *How ES valuations can recognize and incorporate multiple human-nature relationships, value notions, and valuation methods?* I present my pre-analytic positions regarding values and valuation of ES; I review different value definitions that are relevant for ES valuation; and I develop a taxonomy of values based on different conceptions of human-nature relationships as well as a taxonomy of methods for ES valuation. I argue that this taxonomy can aid ES scientists and practitioners with the aim of representing people's multiple and context specific ways of valuing nature. This chapter corresponds to the article '*Widening the evaluative space for ecosystem services: A taxonomy of plural values and valuation methods*' which is in press in the journal of Environmental Values since November 2016.

Chapter 5 and 6 develop an empirical analysis aimed at answering the research questions *How the socio-cultural context influences the attribution of plural values to ES and nature?* and *How do different valuation methods frame valuation outcomes?* Both chapters address the second and third specific objectives of this dissertation. Specifically, Chapter 5 explores the multiple values that people attribute to the ecosystems and ES of the mid-upper stream of the Otún River watershed through a qualitative narrative valuation method. I also explore the environmental motivations underpinning these values by applying quantitative data analysis. I argue that environmental management should integrate plural values in order to tackle social conflicts and attempt to capture the diverse needs and interests of different social actors. This chapter corresponds to the article '*Exploring intrinsic, instrumental and relational values for sustainable management of social-ecological systems*', which is in 2<sup>nd</sup> round of revisions in the journal Ecology and Society [Submitted in June 2016].

Chapter 6 applies a non-monetary ES valuation by assessing the time people are willing to spend on ES protection. Here I addresses the influence of the balance between the motivations of self-oriented (i.e. egoistic) and others-oriented (i.e. altruistic and biospheric) have on the time people are willing to spend for ES conservation. I argue that environmental management policies should reflect the multiple and inseparable motivations that influence environmental judgments and behaviors. This chapter corresponds to the article '*Beyond money and self-oriented motivations: a willingness to give up time approach for ecosystem services valuation*', which is in its 1<sup>st</sup> round of revisions in the journal Ecological Economics [Submitted in June 2017].

**Figure 1.1 Overview of the dissertation**



(CH: chapter; RQ: research question; VAI: value-articulating institution). Starting from the left, Chapter IV depict the place-based nature of the expressions of values in the sense that they are influenced by the socio-environmental context in which valuation takes place. Chapter IV also shows how valuation processes are value-articulating institutions because they frame how value is defined, how humans relate with nature, how values are constructed and held and how values are elucidated. RQ2 and RQ3 are addressed in Chapter V and VI. Both chapters develop two different VAI. Chapter V use a qualitative narrative valuation method for elucidating environmental values and Chapter VI develops a quantitative approach, through the time people are willing to spend on ES protection. In each chapter the influence of socio-economic conditions and environmental motivations will be addressed in order to highlight the influence of socio-environmental context in the expression of values (RQ2). The comparative analysis of the value-articulating institution applied in each chapter will allow to also explore how valuation methods frame valuation outcomes (RQ3).



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## **CHAPTER 2 : The mid-upper stream of the Otún River Watershed**

The origins of the word *Otún* is attributed to the Katios indigenous language, in which *O* means path and *TUN* means pond or lagoon. In this sense, *Otún* signifies path to the lagoon-*camino a la laguna* (Angel 2014).

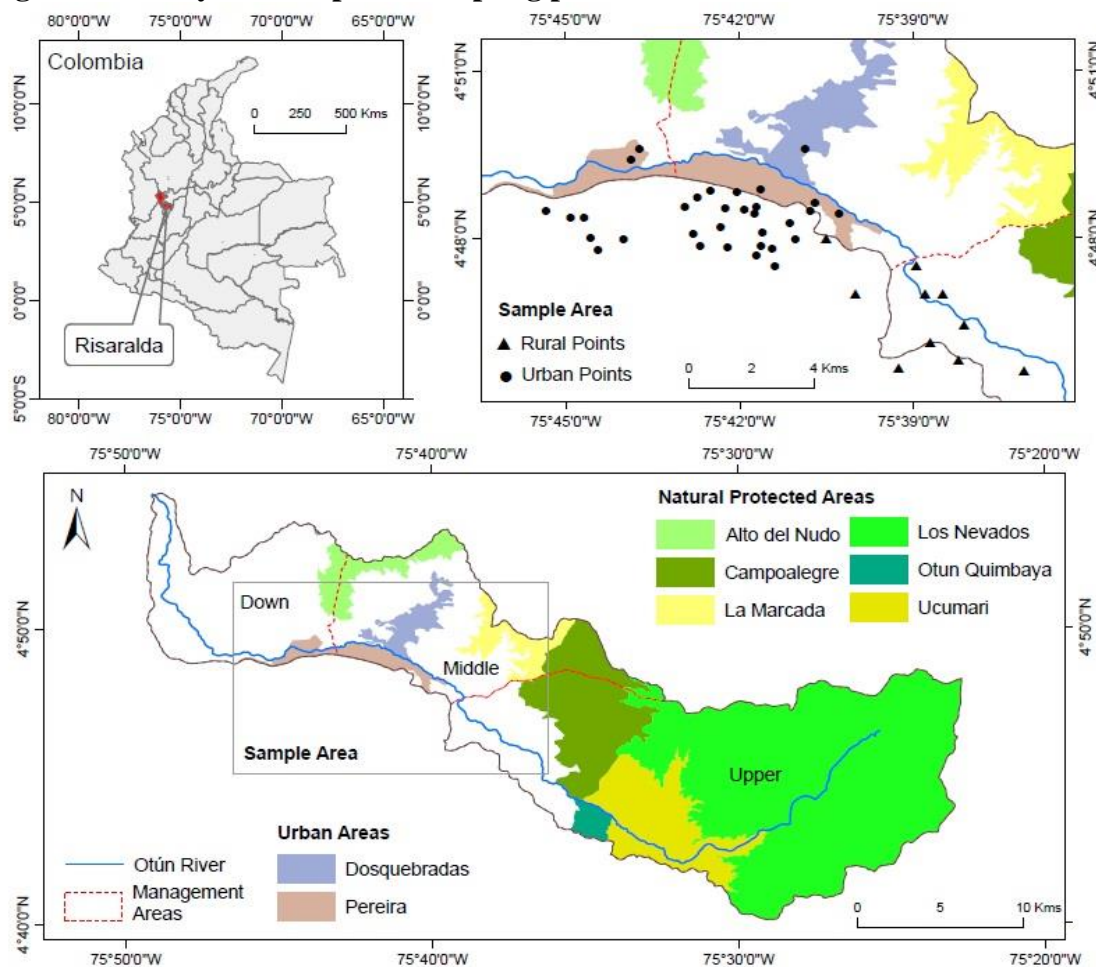
Colombia is a bio-culturally diverse country. Cultural diversity has been highlighted in terms of the presence of indigenous and afro-Colombian groups, which have non-western human-nature relationships and worldviews (Escobar 2010, Ulloa 2012). However, in Colombian rural areas there are also *campesinos* (peasants) groups, many of them distributed throughout the territory in patterns designed by the historical violence experienced in Colombia. As indigenous and afro-Colombian groups, *campesinos* have also differentiated human-nature relationships and worldviews (Silva-Prada 2016). For instance, in April 2017 the peasant community of Cajamarca stated their worldviews when they voted in a referendum against the economic "development" that gold mining will supposedly bring, and rather voted in favor of water protection, food production and the preservation of the *campesino* way of life. This example reveals how *campesinos* may deploy other valuation languages that are in conflict with the monetary valuation language used by economic development projects (Martinez-Alier et al. 1998).

I selected the mid-upper stream of the Otún River watershed as a study area because it represents the socio-environmental complexity of Colombian territory. In the mid-upper stream there are rural (including *campesinos*) and urban people who have actively engaged in the defense of the environment and the *campesino* way of life (Patiño 2006, Barragán and Valdes 2011, Monsalve 2012). Both rural and urban population highly depend on the ecosystem services provided by the ecosystems of the mid-upper stream of the Otún River watershed. The Otún River watershed provides freshwater and environmental-based tourism for urban people, whilst rural people depends on food provision and cultural relations such as identity and local ecological knowledge. This social complexity intertwines with the ecological complexity of the tropical Andes, a worldwide biodiversity hotspot. For these reasons, the mid-upper stream of the Otún River watershed is an appropriate place to investigate the multiple values people attribute to ecosystems.

The Otún River Watershed is located in the mid-west Colombia. This watershed is located in the western slope of the central Andes in the state of Risaralda, Colombia, and has an extension of 480,6 Km<sup>2</sup> (Figure 2.1). The highest altitudes in the watershed are at 5200 m.a.s.l. at Nevados Santa Isabel and Quindio. The Otún river rises at the Ramsar Otún Lake Wetland Complex and runs for 67 Km. until it flows into the Cauca River at 875 m.a.s.l. (CARDER 2008). The climate in the watershed is determined by the two rainy periods, with

peaks in April and October, and the topography and altitude, which also influence precipitation trends. The down-stream areas present an average temperature between 28-32 ° C while in the highest areas the average temperature is around 0 and -2° C (CARDER 2017). For management purposes, the Otún River watershed is divided into three main areas: upper-, mid- and down-stream areas. This dissertation is focused on the mid-upper stream Otún watershed, which is located between 1400 and 5200 m.a.s.l. (**Figure 2.1**).

**Figure 2.1 Study area map and sampling points**



(Triangles for rural population and circles for urban population).

## 2.1. Conservation importance of the mid-upper stream of the Otún river watershed

The mid-upper stream of the Otún river watershed is considered a strategic conservation area due to the presence of ecosystems of high ecological value such as paramos, Andean, High



Andean and sub-Andean forests (CARDER 2008). In the mid-upper stream local ecosystems are the habitat of 300 species of birds, 150 butterflies, 58 mammals and 18 frogs, among others (UAESPNN 2006). Since the 1940s, the management of the Otún river watershed has been mainly oriented towards ecosystem conservation and water provision for urban areas (Benitez and Faustino 2007, Barragán and Valdés 2011, Rincón-Ruíz et al. 2014). Because these conservation efforts, the Otún river watershed is considered one of the best conserved watersheds in Colombia (CARDER 2016). Nowadays, 86% of the total area of the mid- and upper-stream belongs to six protected areas at different management scales: Los Nevados and Otún- Quimbaya protected areas at the national level, the Ucumarí Regional Natural Park at regional level and the Soil Conservation Districts of Alto del Nudo, La Marcada and Campoalegre at municipal level (**Figure 2.1, Table 2.1**)

**Table 2.1 Management Objectives of protected areas in the mid-upper stream of the Otún River watershed.**

Park (Year of creation)	Management institution	Management Objectives
National Natural Los Nevados (1973)	Natural Parks of Colombia	<ul style="list-style-type: none"> <li>• Maintain biomes of Paramos and high Andean forests</li> <li>• Preserve units of glacial and volcanic origin as scenic landscapes</li> <li>• Protect the high river basins of the rivers of Chinchina, Otún, Campoalegre, Quindio, Gualilil.</li> </ul>
Otún Quimbaya Flora and Fauna Sanctuary (1996)	Natural Parks of Colombia	<ul style="list-style-type: none"> <li>• Ensure the preservation of the sub-Andean jungle on the western slope of the central Andes.</li> <li>• Ensure micro-watershed conservation</li> </ul>
Regional Park Ucumarí (1984)	CARDER	<ul style="list-style-type: none"> <li>• Contribute to water resource conservation through ecosystems preservation</li> <li>• Promote ecotourism activities aimed at recreation and environmental education</li> <li>• Articulate conservation processes among protected areas to strengthen the existing biological corridor</li> <li>• Keep a sample of Andean forest</li> </ul>
Soil Conservation Districts of Campoalegre (2011)	CARDER	<ul style="list-style-type: none"> <li>• To ensure the hydrological cycle regulation</li> <li>• Ensure the conservation of valued species</li> <li>• Protect the Andean forest and paramo ecosystems</li> <li>• Promote ecosystems restoration to ensure regional connectivity</li> </ul>
Soil Conservation Districts of La Marcada (2013)	CARDER	<ul style="list-style-type: none"> <li>• Conserve historical and cultural heritage</li> <li>• Conserve tourist attractions and develop ecotourism</li> <li>• Conserve fragments of Andean forest and its associated biodiversity</li> </ul>

Soil Conservation Districts of Alto del Nudo (2013)	CARDER	<ul style="list-style-type: none"> <li>• Conserve water resources</li> <li>• Conserve secondary forest</li> <li>• Conserve landscape and cultural heritage</li> </ul>
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Source: Adapted from CARDER (2016)

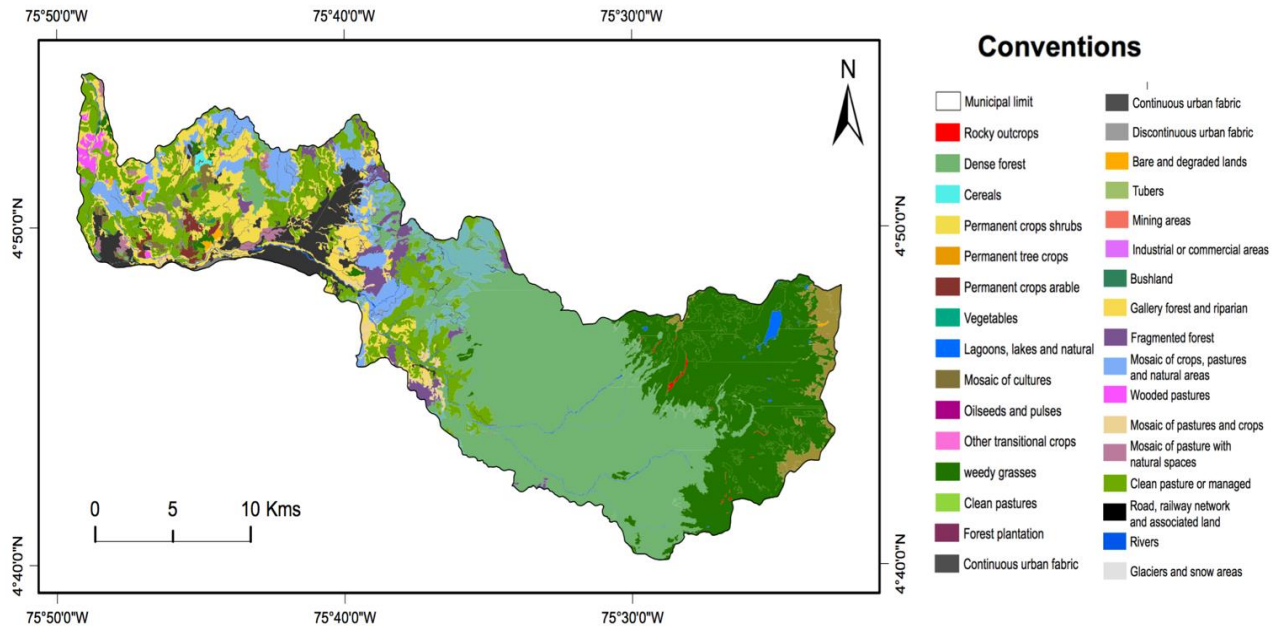
The Otún river watershed hosts 423.130 inhabitants, mainly distributed in the municipalities of Pereira (55.3%) and Dosquebradas (43.7%), and marginally also in the municipalities of Santa Rosa de Cabal (0.9%) and Marsella (0.1%) (CARDER 2017). In the state of Risaralda, the Otún river watershed is the most important watershed, since it provides freshwater to 450,000 inhabitants –including those outside the watershed boundaries (CARDER 2016).

## 2.2. Human dimensions of the mid-upper stream of the Otún river watershed

The water catchment located in the Otún River is managed for twofold reasons: water supply and energy production. The water quality in the rural area of the mid-upper-stream is qualified as good or acceptable. In urban areas is assessed as regular quality due to urban area disposal of wastewater without treatment (CARDER 2016). The Otún river watershed is also prompt to diverse environmental risks (CARDER 2016): (1) landslides in areas with high slopes (<50%), (2) seismic risks because the watershed is located at a high seismic zone, (3) volcanic risk due to the proximity of three volcanos (i.e. Nevado de Santa Isabel, Paramillo de Santa Rosa and Quindío), and (4) floods and avalanches provoked by the long and high intensity rains (CARDER 2016).

In 2011, land uses in Otún River watershed comprised forest (45.3% of total surface), grasses (34.3%); heterogeneous agricultural areas (7,0%); permanent crops (4,7); transitory crops (0,1%); and urban areas (4,9%) (**Figure 2.2**). Between 1997 and 2006, significant land use changes have occurred in the mid-stream area from coffee crops to grasses for cattle production (CARDER 2016). In the upper-stream area, there are no relevant land use changes because of the presence of protected areas (CARDER 2017).

**Figure 2.2 Land uses in the Otún River Watershed in 2011**



Source: Author with data of CARDER 2011

The actual main economic activities include extensive cattle ranching and potatoes crops in the upper part of the watershed and livestock production (poultry and porcine), agriculture, forestry and tourism in the mid-stream area. Main agriculture crops include coffee, large onion, sugar cane, citrus and green banana (*Musa balbisiana*). In a lesser extent there are also crops of cassava, blackberry, bean, maize, tomato, lulo (*Solanum quitoense*), granadilla (*Passiflora ligularis*) guanábana (*Annona muricata*), guava and avocado (CARDER 2016, 2017).

### 2.3. Ecosystem services of the mid-upper stream of the Otún river watershed

Several research projects have identified the ES provided by the ecosystems in the Otún river watershed (**Table 2.2**). The most important ES found by these research projects are the cultural services of ecotourism, recreation and sports, as well as scenic beauty; and the regulating services of maintenance or improvement of drinking water quality and climate regulation (Benitez 2007, Corrales 2007, CARDER-UTP 2008, Ciebreg 2011, Drews et al. 2012).

**Table 2.2 Ecosystem Services (ES) identified in the mid-upper stream of the Otún river watershed.**

**Shades of green represent the number of studies in which the ES has been prioritized.**

<b>Identified Ecosystem Services</b>	<b>Prioritized*</b>
<b>Provision</b>	
Water (human consumption and productive activities)	b, e
Food production (fish, fish, game animals, fruits)	a
Production of wood and non-timber goods (wood, firewood and coal)	a
Ornamental plants	
Seed Bank	
Medicinal plants	
Genetic Bank / Bioprospecting	
<b>Regulating and Supporting</b>	
Biomass production	
Control and disposal of waste, damping and filtering of pollutants	
Maintenance or improvement of drinking water quality	a, c, d,
Erosion control	c, d
Water regulation	c, e
Prevention and mitigation of flooding, torrentiality, landslides, avalanches	c, d
Maintenance of good air quality	a, d
Natural Barrier	
Biodiversity Shelter (species habitat, plant structure regeneration, biological corridor)	e
Seed Pollination and Dispersion	
Biological pest control; disease prevention)	d
Soils (soil formation and fertility, nutrient fixation and cycle)	d
Micro-climate regulation (Maintenance of favorable weather, shade)	b, d, e
Climate regulation (capture of Co2)	b, d, e
<b>Cultural</b>	
Ecotourism	a, b, c, d, e
Recreation, sport	a, b, c, d
Scenic beauty	a, b, c, d
Landscape	
Environmental education and research	c, e
Inspiration for the arts and other spiritual and cultural values	
Raw materials for handicrafts and religious practices	
Traditional Knowledge	
Tranquility / Peace	
Employment generation	

\*Studies developing prioritization of ES a: Benitez 2007, b: Corrales 2007, c: CARDER-UTP 2008, d: Ciebreg 2011, e: Drews et al. 2012)

Among the current socio-environmental problems affecting ES identified by local actors are (CARDER 2016): i) water pollution due to the use of agro-chemicals, wastewater disposals of houses, poultry and pork production, and solid waste deposits by tourists; ii) deforestation due to crops and cattle production and housing development; iii) lack of infrastructure for public space and transportation; iv) unsustainable tourism activities; v) wetland degradation due to agricultural activities; vi) loss of local ecological knowledge and sense of place; and vii) generation of odors by wetlands, wildlife hunting and wildlife entering people's houses.

The most relevant management institutions of ES in the mid-upper stream are: the local public company (Aguas y Aguas de Pereira), the Regional Environmental Authority (Corporación Autónoma Regional de Risaralda, CARDER) and the National Natural Parks Institution (Unidad Administrativa Especial del Sistema de Parques Nacionales Naturales, UAESPNN). In addition, the mid-upper stream of the Otún River watershed counts with a relevant level of community-based organizations (CARDER 2016). The community-based environmental organizations are mainly oriented towards ecotourism services provision, environmental education and sustainable agricultural production.

#### **2.4. Environmental history of the mid-upper stream Otún watershed.**

Complex interactions between social and ecological systems have shaped the current landscape of the mid-upper stream watershed, which allow it to be known as one of the best conserved watersheds in Colombia (UAESPNN 2013, CARDER 2016). The tropical forest landscape was originally shaped by natural phenomena such as glacial melting and volcanism (López and Cano 2004). Further, 9000 years ago human horticultural groups inhabited the area and shaped the landscape through fires and cultural selection as well as transportation of plants (e.g. tubers, rhizomes, pumpkins and squashes) (López and Cano 2004). In later periods (ca. 1,200) and until the Spanish conquest, the Quimbayas indigenous groups occupied the territory and left evidences of artificial terraces for agriculture and also ceramics and goldsmork with complex decorations and shapes (López and Cano 2004).

In the late nineteenth century and early twentieth century the landscape of the mid-upper stream watershed was shaped by the development of *campesinos* settlements (Barragán and Valdés 2011). During this period, the mid upper-stream was managed towards the

exploitation of natural resources (Barrágan and Valdes 2011). Main productive activities were hardwood and charcoal production, hunting, fishing, double-purpose cattle rising, and agriculture. Natural resources of the mid-upper stream were used to develop the city of Pereira (Barrágan and Valdes 2011, Angel 2014). Even blocks of ice were extracted from the paramo areas and transported by mules to be sold in the urban centers as a luxury good (Angel 2014). The deforestation and over-exploitation of ecosystems occurring in the late nineteenth and early twentieth century generated environmental problems such as soil fertility loss, sedimentation, river overflows, landslide events and the diminishing of the river minimum flow (Barragán and Valdés 2011).

In response to the ecological degradation, during the 50's and 60's, national and local management institutions devoted the mid-upper stream as an area aimed at reforestation and industrial tree plantations (Barragán and Valdés 2011). In the 60's, the Public Utilities Enterprise of Pereira (Empresa de Servicios Públicos de Pereira) developed some programs towards the restriction of productive activities, land purchases and eviction of peasants, even though these activities were supported by the national army (Barragán and Valdés 2011). Although the strong restrictions to peasants' agricultural activities, the Ministry of Agriculture and the Public Utilities Enterprise developed forest plantations projects that favored industrial logging, while hiring local peasants as gamekeepers (Barragán and Valdés 2011). During this time, 10.000 Ha. of land were purchased, a process that resulted in the forced migration of local people (Barragán and Valdés 2011). The town of La Suiza illustrates this situation: before the 50's the town used to host 300 households (Angel 2014), nowadays only 25 households remain (Barragán and Valdés 2011).

In the 70s and 80s, a different approach of the mid-upper stream management took place through the promotion of Community Eco-development (Barragán and Valdés 2011). This approach was promoted by the director of INDERENA -Julio Carrizosa, one of the founders of the environmental movement in Colombia- and by local environmental associations such as *Grupos Ecológicos de Risaralda* y *Fundacion Autónoma Ecológica* (Barragán and Valdés 2011). These institutions developed environmental educational projects through Community

Eco-development Schools<sup>1</sup>. The integration of conservation and social objectives was reflected in the creation in 1984 of the Ucumarí Regional park, which included local people's interests as management objectives (e.g. education, research, sports and recreation and cultural heritage conservation). In this same decade the Regional Environmental Authority was created (CARDER) aimed at land use control, reallocation of housing in risk areas and protection of the Otún River banks. In 1987, CARDER declared the buffer zone of the mid-upper stream as an area aimed for the conservation of water quality for human consumption (Law *Acuerdo 036*). This new law strengthened the socio-economic vulnerability of nearly 4000 inhabitants of the mid-upper stream by restricting productive activities and housing developments (Barragán and Valdés 2011: Chapter V).

In January 25 of 1999 the devastating Coffee Region Earthquake generated a strong socio-economic crisis (Barragán and Valdés 2011). That same year, in a participatory audience, rural people demanded the management institutions to generate sources of employment due to the existent productive restrictions (Barragán and Valdés 2011, Monsalve 2012). As of 2000, ecotourism has been promoted by management institutions in order to resolve the conflict. Community-based environmental associations such as COODEMA, Soledad de Montaña and Yarumo Blanco have pro-actively engaged in supplying ecotourism services (Monsalve 2012). However, during 2004-2007 the National Parks institution granted the permit to run ecotourism at the Natural Park of Otún-Quimbaya to a private company rather than to community-based associations (Barragán and Valdés 2011, Monsalve 2012). Local people protested this decision by cupping the Otún Quimbaya Park, but the decision was not reversed (Monsalve 2012). Three years later the private company decided to cancel the permit because the number of entrances drastically decreased and made its investments unsustainable (UAESPNN 2013). From 2009 and until 2019, the community association Yarumo Blanco has the permit to run ecotourism services in the Otún Quimbaya Park.

In the last 15 years, the mid-upper stream has been characterized by a strong grass-root ecological movement involving adults, youths and children who have organized diverse environmental projects. There are children and youth ecological groups (e.g. Cuenkeros

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<sup>1</sup> These schools were subsequently closed because they were considered training centers of leftist guerrillas (Barragán and Valdés 2011)

Herederos del Otún and Los Montañeros), agro-ecological projects (e.g. Agroecological school Santa Maria de la Loma, Civil Society Natural Reserve Los Genaros), an ecovillage (Agrovilla El Prado); peasants culture festivals (Festival del Gallo) and agro-ecological markets, barter programs of recycling waste for food, environmental radio programs and even an environmental football school (Angel 2014). Currently, an updated environmental management plan of Otún watershed is being formulated (CARDER 2016, 2017). In this process, rural community associations still emphasized their historical concerns regarding the restriction of productive activities due to expansion of conservation areas and the lack of income sources.

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## **CHAPTER 3 : Methodological approach**

### 3.1. Data collection and data analyses

As highlighted above, plural ES valuation requires a plural methodological approach that combine different methods (Gomez-Baggethun et al. 2014, Jacobs et al. in press). Here, I used a mixed-methodological approach that allows answering the research questions (see Section 1.2). First, a literature review was applied in Chapter IV to accomplish the first objective of this dissertation, i.e. 1. *To define a taxonomy of values and valuation methods to widen the evaluative space for ecosystem service assessments*. Then, in order to address objective 2. *To analyze the place-based and plural values people attribute to ES and nature* and objective 3. *To advance the development of non-monetary valuation methods that enable the integration of value pluralism and incommensurability into ES valuation*, I developed a non-monetary valuation approach of ES through the combination of three methods: narratives about the importance of ecosystems and ES, prioritization of environmental motivations and willingness to give up time (WTT) for ES protection.

For the purpose of combining narratives, environmental motivations and WTT, I designed a questionnaire in which the three methods were integrated. The questionnaire was designed in Spanish and it was tested in two focus groups with local people and also through a pilot sample of 20 questionnaires. In 2014, between May and June, 600 questionnaires were applied in rural and urban areas of the Otún River watershed (224 in rural areas and 365 in urban ones, see **Figure 2.1**). The questionnaires were applied by myself and by four bachelor students of the program of Environmental Administration at Universidad Tecnológica de Pereira-UTP. I trained the four research assistants and also supervised the application of the questionnaires. Appendix 1: presents the questionnaire applied in this dissertation.

In order to analyze narratives, environmental motivations and WTT, I applied qualitative and quantitative data analysis: content analysis of the narratives and statical analysis of quantitative data (i.e. descriptive statistics, non-parametric tests and multivariate regressions). **Table 3.1** shows the methods applied in this dissertation, the rationale of its application, the disciplines they integrate and how the data was analyzed. Specific information regarding methods and data analysis can be found on the referred results chapters.

**Table 3.1 Methods applied in the dissertation.**

Methods	Rationale	Disciplines	Data Analysis	Results chapter
Literature review	To integrate different disciplinary, normative and methodological approaches in ES valuations  To clarify the ontological, epistemological and normative assumptions of different valuation methods	Ecological Economics, Social Psychology, Environmental ethics, Environmental economics	Not relevant	Chapter 4
Qualitative valuation methods: narratives	To allow respondents express plural values, without using a particular disciplinary notion of value.  To understand the similarities and differences between social groups in the expression of plural values.	Ecological Economics, Environmental ethics	Content analysis of narratives Descriptive statistics Non parametric statistical tests Binary response multivariate regression	Chapter 5
Quantitative valuation methods: measurement of environmental motivations	To assess the plurality of motivations within social groups  To understand the influence of plural motivations on the expression of values  To understand the similarities and differences between social groups in the prioritization of motivations	Social and Environmental Psychology	Descriptive statistics Factor Analysis Non parametric statistical tests	Chapter 5  Chapter 6
Quantitative valuation methods: willingness to give up time for ecosystem services conservation	To analyze ontological and epistemological assumptions of the method of willingness to give up time  To understand which social groups favor or not the expression ES values through a time measure	Ecological Economics	Multivariate regressions addressing selection bias	Chapter 6

### 3.2. Reflection of the research process: Gatekeepers, positionality and ethics

Two institutions acted in my research as gatekeepers (Katz and Tushman 1980) and were key in enabling and facilitating the fieldwork: CARDER and Universidad Tecnológica de Pereira (UTP). On one hand, CARDER put me in contact with the local leaders. I held a meeting with them in May of 2014 in which I explained the objectives of the research. CARDER also provided me the GIS information that was used for the fieldwork planning,

sample calculations and mapping. On the other hand, a Professor of Environmental Economics at UTP, Jhon Jairo Arias, introduced me to the four research assistants who helped me with the logistics and supported me in conducting the survey.

Regarding my position in this research, I can nowadays identify my role as an *insider-outsider*. I am from Cali, Colombia which is located at 200 km from the southwest of Pereira. However, during 2010-2012 I used to work in the mid-upper stream of the Otún River watershed as a researcher of CARDER and UTP and I also developed environmental education activities with children and *campesinos* (peasants) in the Civil Society Reserve Santa María de la Loma. I believe that my previous experience in the research site supported the perspective of local people that I was not merely an outsider.

During fieldwork I purposely emphasized that the research was part of a PhD program of the Autonomous University of Barcelona. I did not want respondents to think that the research had any relation with local institutions so that they could respond the survey questions without any expectations on local institutions or concerns. During fieldwork I did not feel that being a woman affected the research in any way; however, in some occasions I noticed the interest of men in being surveyed by women. This did not bias the sampled population as 41.3% of respondents were men and 57.3% were women.

Finally, regarding the ethics of this research, we inform respondents about this research and we ask for their consent to be interviewed. At the beginning of the survey, the interviewer read to the respondents the section of informed consent. In this section, the respondent was informed that her/his participation was voluntary, that the survey was anonymous and data would be used only for academic purposes. Then, the respondent was asked if she/he wanted to participate in the survey. The survey lasted approximately 25 minutes. Some respondents decided to drop-off the survey before finishing it because they were spending more time than expected or desired. However, in general respondents were enthusiastic to share their opinions and answering the survey.

In the meeting with the leaders of the rural areas some of them expressed that they did not want to participate in research activities because researchers never introduced the research project or disseminated the results among the locals. However, they agreed to participate in

my research because they appreciated the fact that I had presented the research project and consulted them for their approval. I also presented them all the studies of the mid-upper stream of the Otún River watershed that I had collected since I started my work in this area. I also disseminated my results among professors and students at the Universidad Tecnológica de Pereira and among members of CARDER in March and July 2016. Further, in August 2017, I disseminated the results of this dissertation among the community leaders.

Overall, the research did not pose any risk to the respondents or research assistants. Prior to the fieldwork, and with the help of the research assistants, we discarded areas where there could be risk due to robbery or violence. An ethical concern I encountered during the research was how to compensate research assistants because I did not have financial resources for the fieldwork. This was explained before while being engaged in the fieldwork, yet the four assistants agreed to help me without any payment. However, I covered their daily costs of food and transportation. I also gave them a certificate of their research assistance and training. Finally, in Colombia, respondents do not usually ask for monetary compensation for participating in surveys. At the end of the survey, respondents were asked if they were interested to have feedback on the results of the research and the majority provided their email for that purpose. A brochure of the research results and certificate of participation could be provided by email as way of reciprocating respondents for their time invested in the research.

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## **CHAPTER 4 : Widening the evaluative space for ecosystem services: A taxonomy of plural values and valuation methods**

### **ABSTRACT**

Researchers working in the field of ecosystem services have long acknowledged the importance of recognising multiple values in ecosystems and biodiversity. Yet the operationalisation of value pluralism in ecosystem service assessments remains largely elusive. The aim of this research is to present a taxonomy of values and valuation methods to widen the evaluative space for ecosystem services. First, we present our pre-analytic positions in regards to values and valuation of ecosystem services. Second, we review different value definitions that we deem relevant for the discussion of ecosystem services valuation. Third, we propose a taxonomy of ecosystem service values based on different conceptions of human-nature relationships. Finally, we present a taxonomy of different methods that can be used to recognise plural values in ecosystem services. This taxonomy for a plural valuation of ecosystem services can help ES scientists and practitioners with the aim of representing people's multiple and context specific ways of valuing nature. The taxonomy can also serve to pay broader attention to ES values that are overlooked or misrepresented in assessments that restrict their focus to monetary valuations.

**Key words:** Ecosystem Services, Incommensurability, Monetary and Non-Monetary Valuation, Value Pluralism

#### 4.1. Introduction

The concept ecosystem services (ES) is used to refer to the benefits people obtain from ecosystems, such as; fresh water, food, climate regulation, recreation or aesthetic experiences (de Groot et al. 2002, MA 2005, TEEB, 2011). The ES framework is concerned with the development of science-policy tools that are founded on the ES concept (see MA 2005, Turner and Daly 2008). Nowadays, the ES framework is increasingly used by diverse stakeholders, including scientists, policy-makers, NGO's and practitioners, for purposes that range from decision-making support to advocacy for biodiversity protection (Barnaud and Antona 2014). The ES framework focuses on the importance of biodiversity and ecosystems for human well-being (MA 2005), and hence from the outset has had a clear emphasis on nature's instrumental values (Reyers et al. 2012). Since instrumental values refer to the value an entity holds as a means to achieve specific ends, it implicitly assumes that the entities bearing such values may be replaced and compensated for, as long as their substitutes can perform the same functions (Muraca 2011, Zimmerman 2015). The emphasis on instrumental values suggests that two ES that provide the same impact on economic welfare, or human well-being, can be interchanged. This emphasis partially explains why the ES framework is often associated with the practice of monetary valuation and commodification (Gómez-Baggethun and Ruiz-Pérez 2011, Abson et al. 2014, Nieto-Romero et al. 2014). Yet, using the ES framework does not necessarily entail the use of monetary valuations (Ruckelshaus et al. 2015) nor markets as the preferred governance mechanism (Schröter and Oudenhoven 2016).

The influence of the ES framework on environmental and conservation policy has grown over recent years (Kull et al. 2015). This situation begs the question as to how non-instrumental value can be integrated into the ES framework (Jax et al. 2013). In fact, initial ES definitions tended to stress that ecosystems and biodiversity sustain and fulfil the requirements for achieving human wellbeing, often in an attempt to confer nature a higher moral place beyond instrumental values (Deliège and Neuteleers 2015). Furthermore, many influential contributions within the ES framework have advocated the need to integrate plural values of ecosystems and biodiversity. For example, the Millennium Ecosystems Assessment (MA 2005) distinguished utilitarian monetary values of ES from other non-utilitarian values (i.e., ecological, socio-cultural and intrinsic values). Similarly, the initiative



The Economics of Ecosystem Services and Biodiversity (TEEB) recognises that ES valuation involves dealing with conflicting valuation languages that can involve incommensurability (Pascual et al. 2010, p.193). Finally, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) also recognises multiple value systems, including intrinsic, instrumental and relational values (Díaz et al. 2015, p.11).

Some scholars have endorsed the perspective of recognising multiple values in ES beyond instrumental ones (Costanza and Folke 1997, de Groot et al. 2002, Farber et al. 2002, Polishchuk and Rauschmayer 2012, Reyers et al. 2012). ES valuations within this perspective have integrated different disciplinary approaches as well as introduced diverse positions on how 'value' should be defined and expressed. Hence, ES valuations have spanned across different value domains (e.g., ecological, cultural and monetary) and levels of societal organisation (e.g., individual and shared values) (Chan et al. 2012, Martín-López et al. 2014, Kenter et al. 2015). Many influential contributions on ES valuation have grounds in ecological economics (e.g., Costanza and Folke 1997, de Groot et al. 2002, MA 2005, TEEB 2011), a field where value pluralism and incommensurability are considered foundational principles for environmental valuation (Martínez-Alier et al. 1998, Martínez-Alier and Muradian 2015, Gómez-Baggethun and Martín-López 2015). Value pluralism is based on the recognition of different and often conflicting value domains, that are neither reducible to each other, nor to some ultimate value (O'Neill et al. 2008, Chang, 2001, Mason 2015). Furthermore, the principle of value incommensurability implies the recognition of plural values of nature and also that these values cannot be measured with a single value-indicator, such as money or energy (Neurath 1973, Martínez-Alier et al. 1998).

Even if the recognition of plural values has been a mainstay in much conceptual literature on ES valuation, the operationalisation of value pluralism and value incommensurability in ES assessments has remained largely elusive. Monetisation still is the dominant valuation language (Christie et al. 2012, Abson et al. 2014, Nieto-Romero et al. 2014) and is often conceived as a pragmatic language to communicate with political and business institutions (Spash 2013). However, scholars have called attention to the minimal use of monetary valuation of ES in decision-making (Kushner et al. 2012, Laurans et al. 2013), and have also noted that stakeholders, including policy makers, demand other valuation languages beyond the monetary (Ruckelshaus et al. 2015). Ecological economists, and their antecedents, have

criticised the use of monetary valuations as an expression of nature's multiple values and noted that monetary valuations are often conducted without a critical perspective on its consequences (see Kapp 1972, O'Neill 1997, Martínez-Alier et al. 1998, Gustafsson and Frolova, 1998, Farrell 2007, O'Neill et al. 2008, Spash 2006, 2013). Joining this position, scholars working on ES have also stressed the drawbacks and potentially negative consequences of an ES framework biased towards a monetary framing. For instance, monetary values of ES cannot account for limited degrees of substitutability, non-linearities and critical thresholds of ES and hence can guide decision-making towards the acceptance of ecological losses that cannot be substituted or compensated (Boeraeve et al. 2015). Commensurability assumptions have raised ethical concerns regarding the way monetary valuation masks non-instrumental ES values such as ecological and cultural values (Luck et al. 2012, Jax et al. 2013). Monetary valuation has been associated with a push towards ES commodification, i.e. the expansion of market trade to previously non-marketed ES (Gómez-Baggethun and Ruíz-Pérez 2011). ES commodification has been criticised on the grounds that it can promote unequal access to resources (Pascual et al. 2014), erode intrinsic motivations for conservation (Rode et al. 2015) and some entities should not be for sale.

This paper presents a taxonomy of plural values and valuation methods that can serve to open up the evaluative space for recognising the plural values of ES. This aims to advance the dialogue regarding how to speak coherently about the ontological and epistemological complexities of ES values. First, we present our preanalytic positions regarding ES values and ES valuation. Second, we review different disciplinary approaches to the conceptualisation of 'value' that enter into the discussion of ES valuation. Third, based on multiple metaphors for human-nature relationships, we provide a taxonomy of 'value domains', and 'articulated values', relevant for ES valuations. Finally, we present a taxonomy of different methods for construing and constructing ES values (i.e., value articulating methods).

## 4.2. Premises regarding values and valuation of ES

In this section, we state our premises regarding: 1) the object of valuation, 2) the objective and subjective nature of ES values and 3) the framing of ES values by social and political contexts. Before starting let us define our terminology. ‘ES values’ are taken to mean the multiple and incommensurable ways in which ES are important for people. ‘Ecosystem services valuation’ is defined as the process of analysing, assessing or understanding ES values and how these values are comparable in relation to coexistences, synergies or trade-offs (Gómez-Baggethun and Martín-López 2015). ‘Value domains’ refer to the different ways in which ES are important for people affecting how they engage with nature (Centemeri 2015). ‘Articulated values’ signifies the concrete expressions of value domains, stemming from valuation processes (Farrell 2007).

The recognition of plural values in the ES framework involves the integration of plural and complex objects of valuation (Klain et al. 2014). People can refer to the importance of an ES (e.g., global climate regulation), but may also refer to the importance of nature as a broad concept, a particular ecosystem (e.g., a forest) or components of biodiversity (e.g., endemic species). While nature, ecosystems, biodiversity and ES are different concepts, both in science and policy these categories are increasingly conflated under the broader umbrella of the ES framework (Díaz et al. 2015).

Muraca (2011) and Chan et al. (2016) argue that the values attributed by humans originates in the *relational* domain of subjects and objects of valuations. From this analytic perspective, ES values do not originate in human’s attributions (i.e., subjectivist approach) nor are they inherently located in nature (i.e., objectivist approach). It is through valuation processes that humans, via reflection, recognise the importance of nature and ES (Muraca 2011), making it explicit through the articulation of ES values. In ES valuations, the valuing agents or value providers may include individuals, social groups or communities (Kenter et al. 2015). On this basis, ES values and valuations can be regarded as socially constructed. The choice of a value articulating method influences policy conclusions because it frames which data is relevant, how it should be produced (Farrell, 2007), and who can participate and in which role (Vatn 2005). This position frames values and valuations as contingent in regards to the social and political context in which they are immersed. It further recognises ES values and

valuations as being shaped by power relations among valuing agents (Martínez-Alier 2002, Farrell 2007, Douai 2009). These agents frame:

- i) how value is defined;
- ii) what type of ES values are included in ES valuations; and
- iii) which value articulating methods are used.

In the following sections we will provide a taxonomy of value definitions, value types and valuation methods as a pluralistic answer to address these three concerns.

### 4.3. Value definitions for ES valuation

In its broader meaning, the word value is usually related to the notion of importance (Dietz et al. 2005). Although in the ES framework value is often equated to monetary value (Christie et al. 2012, Abson et al. 2014). We identified six definitions of value that need to be considered within the discussion of plural values of ES, and these are specified in **Table 4.1**. These definitions have been the subject of major (inter)disciplinary debates and our aim here is to only briefly present them.

**Table 4.1 Value definitions to be considered in ecosystem services valuation**

	Value definitions	Discipline	References	Examples
1)	Intrinsic value Biodiversity and ecosystems are considered ends in themselves.	Philosophy, deontological ethics	Callicott, (1987); Rolston, (1989)	An endangered species conservation because it has the right to exist.
2)	Principles Stable references that guide human realization and thus orient human judgements and actions.	Social psychology, political ecology, environmental law	Schwartz, (2005), Kallis et al., (2013),	Altruism towards future generations
3)	Monetary value Utility measurements through prices.	Neoclassical economics	Peace and Turner, (1990)	Willingness to pay for a particular ES
4)	Shared values Values people hold for biodiversity, ecosystems and ES as citizens.	Sociology, political science	Sagoff, (1986); Kenter et al., (2015)	Aesthetic value of a landscape
5)	Ecological value Degree to which an entity or process contributes to ecological attributes	Ecology, among others	Farber et al., (2002); de Groot et al., (2010)	An Ecosystem's ecological resilience
6)	Ways of concern Distinctive ways in which it makes sense to care about nature and the provided ES.	Philosophy	O'Neill et al., (2008)	A forest's sacredness value

Value definition 1 derives from philosophers and ethicists who have developed theories supporting the concept of intrinsic value. We take intrinsic values as defined by Callicot (1987) to embrace the notion that biodiversity and ecosystems have value in themselves independently of their usefulness for humans. This argument has been a normative postulate of conservation science for decades (Soulé 1985). However, some authors have questioned its relevance for ES conservation on the basis that intrinsic value represents an abstract and non-operational concept (Justus et al. 2009).

Value definition 2 comes from scholars in fields of social psychology (e.g., Rokeach 1973, Schwartz 2005), political ecology (e.g., Kallis et al. 2013) and environmental law (e.g., Bell et al. 2013). They refer to value as guiding human realisation and orienting judgements and actions (Schwartz 2005). From this perspective, ES values are principles and convictions that guide the ways in which humans relate to each other and nature on ethical and political grounds (Chan et al. 2012, 2016, Gómez-Baggethun et al. 2016). For example, the principle of intergenerational altruism encompasses the concern for sustaining a healthy environment for future generations to inherit.

Value definition 3 comes from neoclassical economics which employs the concept of 'monetary value'. This rests upon the idea of price as the measure of exchange value and the assumption that exchange value measures utility (e.g., Peace and Turner 1990). This utilitarian and chrematistic perspective explains choice through the rational actor model, which portrays humans as calculative and self-interested beings. Monetary values are assumed to be morally neutral from the individual's viewpoint and as providing a suitable objectification of human valuation. Ecological economists have discussed the limitations of the neoclassical economics approach both as an explanation of human behaviour and for understanding of human-nature relationships (see Kapp 1972, O'Neill 1997, Gustafsson and Frolova 1998, Vatn 2000, O'Neill et al. 2008, Spash 2008, 2013).

Value definition 4 contrasts with the neoclassical economists' individualistic rationality and instead uses the notion of shared values. This has been used to refer to the ES values people hold as citizens (Sagoff 1986). This concept relies on a social constructionist perspective (Durkheim 1981), which argues that individuals act based on institutions, or patterns of thinking, roles and social norms (Vatn 2005). Shared values are generally derived through

deliberation (Kenter et al. 2015). They may also be expressed in monetary terms (Spash 2007); for example, exploring ‘societal willingness to pay’ for the protection of a particular ES (Kenter et al. 2015).

Definition 5 comes from ecology. The term ‘ecological value’ has been used to refer to the degree to which an entity or process contributes to ecological features (de Groot et al. 2010). For instance, ecological resilience relates to an ecosystems’ capacity to maintain its integrity in the face of disturbances (Holling 1973, Folke, 2006). In ecological economics, a critical level of ecological integrity is considered a precondition for any socio-economic system to be sustainable in the long term (Costanza 1991, Martínez-Alier and Muradian 2015).

Finally, definition 6 refers to how some philosophers have defined values as ‘ways of concern’ or the different ways in which people care about something (O’Neill et al. 2008). In an environmental valuation context, people’s ways of concern about nature emerge from the various ways people engage with nature (Centemeri 2015). For instance, a community can consider a forest important because it provides inputs for their productive activities (e.g., wood and fibres) but also because it is a sacred place.

By framing the notion of ES values as the different ways in which nature, ecosystems and biodiversity are important for people, the ES framework can conceptually integrate concerns related to diverse definitions of value including: intrinsic value, principles, monetary values, ecological values and shared values. Some of these definitions are not mutually exclusive. For example, the principle of altruism as a motivation for nature conservation may be endorsed from a citizen perspective (i.e., shared value); moral concerns towards ecosystems (i.e., intrinsic values) can be framed from a citizen perspective (i.e. shared value) and as a guiding principle for environmental decision-making.

#### **4.4. Linking metaphors of human-nature relationships to ES values**

The ES concept alone cannot account for the multiple ways in which people engage with nature (Raymond et al. 2013, Klain et al. 2014). Stakeholders have reshaped or rejected the ES concept when it does not represent the ways in which they relate with nature. For instance, non-western participants in the IPBES have played a key role in the integration of

alternative metaphors representing their cosmological visions, e.g., ‘nature gifts’ instead of the ES concept (Borie and Hulme 2015, Díaz et al. 2015). Stakeholders have used the ES concept in very different ways to shape local policy agendas beyond ES commodification (Barnaud and Antona 2014, Kull et al. 2015). By allowing multiple metaphors on human-nature relationships, scholars concerned with the valuation of ES can advance the recognition of plural values and thus propose alternative policy pathways. In this section we present three metaphors on human-nature relationships: ‘gaining from nature’, ‘living for nature’, and ‘living in nature’ (O’Neill et al. 2008). These are summarised in **Table 4.2**.

**Table 4.2 Classification of ecosystem services values across different metaphors of human-nature relationships.**

Metaphors of human-nature relationship	Value Domain	Articulated values	Definition	Examples of valued ecosystem services†
Gaining from nature	<i>Instrumental</i> Ecosystems and biodiversity seen as merely a means to achieve utility	Monetary value	Biodiversity and ecosystems contributions to utility, which are measured through prices	Erosion protection Fibres, fuel and other raw materials Genetic material Biochemical species and or resources Ornamental resources
Living for nature	<i>Intrinsic</i> Biodiversity and ecosystems have value in themselves	Moral duties towards nature	Moral duties towards biodiversity and ecosystems	Nursery habitat Genepool protection
Living in nature	<i>Fundamental</i> Conditions to i) protect the life supporting system, ii) allow people to define themselves, and iii) provide sense to their existence.	Ecological resilience	The capacity of ecosystems of maintaining their integrity in face of disturbance	Climate regulation Water regulation Soil formation and regeneration Biological regulation
		Livelihood, subsistence	Critical ES to achieve livelihood goals	Food Water
		Mental and physical health	Physical benefits perceived from ecosystems’ regulation of water, air and diseases; and mental benefits due to nature exposure	Air quality regulation Natural hazard mitigation Waste treatment Opportunities for recreation and ecotourism
		Identity	Biodiversity and ecosystems are considered references to determine people’s sense of personal and social identity	Cultural heritage and identity
		Cultural heritage	Landscape’s tangible and intangible features which are	Cultural heritage and identity

	historically significant (e.g., buildings monuments, traditions, stories, traditional ecological knowledge, other knowledge systems).	
Sacredness	Spiritual, religious or sacred attachment to biodiversity and ecosystems	Spiritual and religious inspiration
Symbolic value	Meanings associated to ecosystems. These meaning are conceived to be inseparable of the represented ecosystems but are also valuable in them selves	Cultural heritage and identity
Social cohesion	Human uses of biodiversity and ecosystems as a context for social cohesion enhancement	Opportunities for enhancing social relations
Sense of place	Emotional attachment to a place (feelings of belonging, commitment, identity or community)	Cultural heritage and identity
Meaningful occupation	Occupations related to biodiversity and ecosystems that allow people to fulfil a 'good human life'	Cultural heritage and identity
Aesthetic value	Appreciation of the beauty of nature, grounded on sensations and emotions.	Opportunities for aesthetic appreciation
Recreational, leisure	Appreciation of tourism, recreational and leisure activities in natural areas	Opportunities for recreation and ecotourism
Cognitive development,	Appreciation of ecosystems' features within special educational and scientific interest	Opportunities for education and science
Inspiration	Appreciation of the inspirational values of ecosystems' features	Opportunities for inspiration for culture, art, design
Environmental justice	Biodiversity, ecosystems or ES are matters of concern	All ecosystem services

*Eudaimonistic*  
Entities and processes which represent conditions for leading a 'good human life'



	within a human rights or a justice context
Altruism	Concern for biodiversity, ecosystems or ES in favour of a present larger community (intra-generational) or future generations (inter-generational)

† Ecosystem services are largely based on the classification of de Groot et al., (2010).

The metaphors of human-nature relationships ‘gaining from nature’ and ‘living for nature’ were chosen in order to represent two opposing value domains on which the discussion of ES valuation has revolved: instrumental and intrinsic values (Justus et al. 2009, Reyers et al. 2012, Chan et al. 2016). The metaphor ‘gaining from nature’ relates to the view that human welfare and economic productivity depend upon the benefits humans obtain from ecosystems. This metaphor encompasses the importance of nature and ES as being merely a means towards the maximisation of economic utility (i.e. instrumental value domain) and its articulated monetary values. Provisioning services (e.g. food, water and fibres) are examples of ES that have been valued primarily for their instrumental value. However, even within the ES provisioning category, the appraisal of ES importance for people is often strongly influenced by the way they are intertwined with cultural and ecological values (Chan et al. 2012, Reyes-García et al. 2015). The metaphor ‘living for nature’ relates to the view that humans share the environment with other non-human species which deserve *concern* for their own sake and which have a right to exist. Hence, this metaphor encompasses the intrinsic value domain and its articulation as human’s moral duties towards biodiversity and ecosystems. Biodiversity and the so-called ES of ‘nursery habitats’ and ‘gene pool protection’, may be valued grounded on moral concerns and thus can be accommodated within the intrinsic value domain.

The third metaphor, ‘we live in nature’, was taken into account to integrate an intermediary position for those ES value domains and articulated values that cannot be classified as instrumental or intrinsic (Muraca 2011). This third metaphor stresses a mode of engagement in which people are relating to a dwelled-in nature (see Centemeri 2015). In other words, nature is the space where connections among the biophysical, social and cultural worlds take place in a relational way, i.e., through relations (Muraca 2011, 2016, Chan et al. 2016). For example, the importance people attribute to a forest as a place where social relations can be

enhanced where the forest cannot be substituted by another place where social relations can be enhanced (e.g., a football stadium). What is of concern is the context-specific relation of people with that forest for purposes of social enhancement. The number of relational values that may emerge from human-nature relationships can be numerous. Hence, the metaphor ‘we live in nature’ will encompass more value domains and articulated values than the other two metaphors.

The metaphor ‘living with nature’ can encompass two value domains: fundamental and eudaimonistic values (Muraca 2011).<sup>2</sup> The fundamental value domain refers to all systems of relations and processes that are conditions to protect the life supporting system (Muraca 2011), or those that contribute to ecological resilience. The fundamental value domain also refers to all systems of relations and processes that are conditions that allow people to define themselves and provide sense to their existence (Muraca 2011). Or in other words, those conditions necessary for enhancing social resilience.<sup>3</sup> Articulations of the fundamental value domain may include ecological resilience, livelihoods and subsistence, mental and physical health, identity, cultural heritage, sacredness values, symbolic values, social cohesion and sense of place. The eudaimonistic value domain relates to those entities and processes that are conditions for a ‘good human life’, they are not driven by merely egoistic preferences, instead they extend to notions of what one considers meaningful actions in the context of a virtuous life e.g., meaningful occupation, aesthetic values, cognitive development, recreation and leisure, inspiration, altruism and environmental justice.

Although fundamental and eudaimonistic values can be related to human goals, they differ from instrumental values in that they are related to higher ends such as the preservation of life on Earth, the spiritual embedment with nature, or the fulfilment of a ‘good human life’. Intrinsic, eudaimonistic, and fundamental values of ES emerge from non-instrumental relations with nature and these value domains often express a sense of collective meaning

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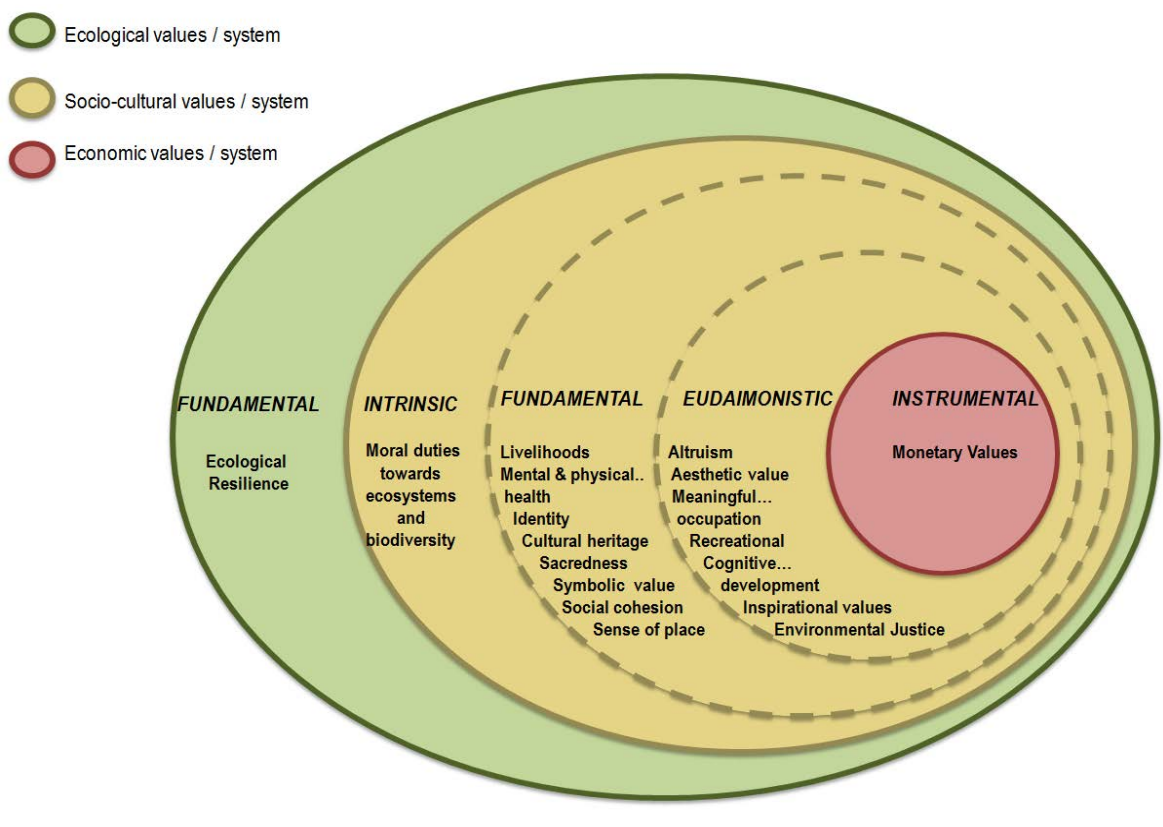
<sup>2</sup> Eudaimonia is a central concept in ancient Greek moral philosophy and in any modern virtue ethics. This concept has been interpreted as ‘flourishing’ or as a non-hedonist concept of ‘happiness’, and also as ‘well-being’ (Hursthouse 2013).

<sup>3</sup> Social resilience has been defined as the “ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change” (Adger 2000: 347)

(i.e., shared values). Thus, ES monetary values cannot represent intrinsic, eudaimonistic and fundamental values of ES.

The classification presented in **Table 4.2** aims to provide a heuristic tool for ES valuations that are conceptually open to integrate plural ES values. However, it does not intend to draw clear boundaries between ES value domains and their articulated values or to dictate a universal way of classifying them, and the classification of the articulated values of the fundamental and eudaimonistic value domains is speculative. The classification in Table 2 also intends to highlight the fact that multiple value domains can co-exist in the object of valuation and they are also often intertwined. For example, a peasant community can state water is important because it is fundamental for sustaining their life (fundamental value domain), they may also recognise that water has a value in itself (intrinsic value domain) and lastly, because it is an input for crop production (instrumental value domain).

**Figure 4.1 Correspondence of intrinsic, fundamental, eudaimonistic and instrumental value domains with the frequently used framework of ecosystem services values classification (ecological, socio-cultural and economic values)**



**Figure 4.1** shows how the proposed classification of value domains (i.e. instrumental, intrinsic, fundamental and eudaimonistic) can be broadly related with the commonly used classification of ES values in ecological, socio-cultural and economic values (TEEB 2011, Gómez-Baggethun and Martín-López 2015). It also shows how the proposed value taxonomy of ES values can be aligned with the sustainability perspective of nested ecological, socio-cultural and economic systems in ecological economics. This perspective implies that human flourishing and development should remain within ecological boundaries in order to not degrade the ecological life support system (Costanza 1991, Martínez-Alier and Muradian 2015). Finally, Figure 1 shows that monetary values do not represent ‘the value’ of nature. The embeddedness of the economic system in the socio-cultural system further conveys the notion of monetary values as a category that cannot be conceived as independent from the socio-cultural context (Vatn and Bromley 1994, Douai 2009).<sup>4</sup> ES valuations can rely on deliberative valuation methods aimed towards the identification and classification of ES values.

#### **4.5. Value articulation: Diversifying methods for ES valuation**

Various value articulating methods (Vat 2005, Farrell 2007) have been applied for ES valuation from the perspective of the beneficiaries’ subjective appreciation. **Table 4.3** provides an overview of ES valuation methods and classifies them along three different axes: i) monetary and non-monetary valuation methods, ii) qualitative, quantitative and mixed valuation methods, and iii) consultation approach (i.e., group-based, individual-based or non-consultative).

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<sup>4</sup> The monetary bias of the ES framework can be framed as an example of the embeddedness of the economic system in the socio-cultural system. This bias resulted from the dominance of two political trends under which the ES discourse expanded in the late 1990’s: the neoliberal ideology, supporting markets as the most efficient regulatory tool and ii) ecological modernization, which conceives technology as the solution for environmental crisis (Gómez-Baggethun et al. 2010, Barnaud and Antona 2014, Kull et al. 2015).

**Table 4.3 Methods for plural ecosystem services (ES) valuation**

Method	Brief description	Consultation approach		
		Group-	Individual-based	Non-consultative
<b>1. Monetary Valuation Methods</b>				
<b>A. Quantitative</b>				
<i>Market price-based approaches</i>	Uses prices of ES traded in markets (e.g., water, timber) as a proxy for its monetary value.			✓
<i>Market cost-based approaches</i> – Replacement costs – Damage cost avoided – Production function	Estimate the costs that are averted due to the ES functioning: costs of replacing an ES (e.g., waste treatment) or mitigating environmental damage (e.g., natural hazard mitigation by forests). The production function estimates how much an ES contributes to the delivery of a marketed good.			✓
<i>Revealed preference methods</i> – Travel cost	Travel cost method analyses individual choices in markets related to ES. Travel cost methods use the costs of travel to a natural area as a measure of the value of recreation.		✓	
– Hedonic pricing	Hedonic pricing method reveals the monetary value of ES (e.g. green areas) mainly through house prices.			✓
<i>Stated preference methods:</i> – Contingent valuation – Choice modelling	Constructs hypothetical markets and asks willingness to pay (WTP) to obtain a specified ES or willingness to accept (WTA) giving it up. Choice modelling infers WTP through trade-offs incurred when choosing between alternatives with different levels of ES and costs.		✓	
<i>Benefit transfer method</i>	Estimate the monetary value of an ES by transferring a measure estimated in a similar context.			✓
<b>B. Mixed (quantitative and qualitative)</b>				
<i>Economic field experiments</i>	Experiments developed in naturally-occurring settings aimed at analysing behaviour and decision making (e.g., choices influenced by reciprocity, norms, altruism and uncertainty).	✓	✓	
<i>Deliberative economic valuation</i>	Combines stated preference valuation methods with elements of deliberative processes.	✓	✓	
<b>2. Non-monetary Valuation Methods</b>				
<b>A. Quantitative</b>				
<i>Surveys of preference assessments</i>	Surveys aimed to rank or rate ES preferences. Used to analyse perceptions, knowledge and values of ES demand or use.		✓	
<i>Photo-elicitation surveys</i>	Visual elements (e.g. photographs, pictures) are included in surveys to assess individuals' perception of ES supply and preferences towards landscape views.		✓	
<i>Time use surveys</i>	Captures individual's willingness to give up time (WTT) for activities that promote ES maintenance.		✓	
<i>Psychometric Surveys</i>	Elicits data of individual attitudes, views, reported behaviour, motivations and values towards ES.		✓	
<b>B. Mixed (quantitative and qualitative)</b>				
<i>Delphi Method</i>	Uses expert opinion to reach an agreed conclusion. It may involve quantitative and qualitative assessments.	✓		
<i>Q Methodology</i>	Analyses subjectivity (i.e. attitudes, shared perceptions, and worldviews) through individual ranking of statements. Common worldviews are elucidated through factor analysis.		✓	

Method	Brief description	Consultation approach		
		Group-	Individual-based	Non-consultative
<b>C. Qualitative</b>				
<i>Semi-structured and in-depth interviews</i>	In-depth interviews capture how people value or understand something. In a semi-structured interview, the researcher orients the conversation to specific topics.		✓	
<i>Participatory observation</i>	The researcher gets involved with people in their natural environment. Aimed at analysing people's cultural behaviours and interactions.			✓
<i>Participant diaries</i>	Participants are asked to make regular records or narrative descriptions of personal experiences. Aimed at exploring thoughts, feelings and understandings of a topic of interest to the research.		✓	
<i>Photo-voice</i>	Stakeholders take their own photographs of different features of ecosystems and landscape (e.g. ES). Useful to integrate the perceptions of marginalized social groups.	✓	✓	
<i>Focus groups</i>	An externally guided group discussion about a topic. Aimed at discovering different positions and to explore how participants interact when discussing.	✓		
<b>Deliberative methods</b>				
<i>Citizen juries</i>	Groups of representative citizens -randomly chosen- act as jurors to consider issues of public importance.	✓		
<i>Deliberative focus group</i>	Similar to focus groups but may take more than one reunion and has an emphasis on consensus and collective decision.	✓		
<i>Participant action research</i>	People work collaboratively with researchers in knowledge co-production. Aimed at finding solutions to problems of common interest.	✓		
<i>Participatory Rural Appraisal; Rapid Rural Appraisal</i>	Promote local knowledge and enable local people to make their own appraisals, analysis and plans.	✓		
<i>Participatory scenario planning</i>	A tool for analysing future prospects of change in ES and its trade-offs. Involves the participatory identification of storylines, drivers of change, uncertainties and scenario outcomes.	✓		
<i>Mediated Modelling</i>	Combines dynamic system modelling with stakeholder participation aimed at creating a shared model of alternative outcomes.	✓		
<i>Deliberative mapping</i>	Stakeholders create a map via consensus, indicating valuable ES and landscape futures.	✓		

Sources: Christie et al. (2012), Castro et al. (2014), Kelemen et al. (2014), Gómez-Baggethun et al. (2016).

The most widely applied methods are those of monetary valuation (Christie et al. 2012) including: market price-based approaches, market cost-based approaches, revealed preference methods, stated preference methods, benefit transfer, economic field experiments and deliberative monetary valuation. Non-monetary valuation of ES (sometimes referred to as socio-cultural valuation) covers a collection of methods that aims to reveal the importance of ES by using other metrics than money (Kelemen et al. 2014, Castro et al. 2014). Non-monetary valuation methods elicit information about the emotional, symbolic, cognitive or

ethical importance of ES. These methods include quantitative (e.g., surveys of preference assessments); qualitative (e.g., semi-structured and in-depth interviews), mixed methods (e.g., Q methodology) and deliberative methods (e.g., citizen juries). Valuation methods determine how values are articulated into concrete qualitative or quantitative expressions, including premises about what is possible to do in regards to decision-making (Vatn 2005, Farrell 2007). For example, individual monetary valuation methods often stress market-based instruments as solutions for environmental problems (Gómez-Baggethun and Muradian 2015). When choosing a particular valuation method, ES practitioners should take into account how that method actually answers the questions: what is value and how are values generated and held?

First, by discriminating between monetary and non-monetary methods, we highlight how the valuation methods broadly respond to the question: What is value? The bulk of the literature on monetary valuation often rests on a neoclassical economics and strongly emphasises instrumental values. As stated earlier, intrinsic, fundamental and eudaimonistic value domains represent non-instrumental relations with nature and a sense of collective meaning (i.e. shared values); therefore, they might be better addressed by non-monetary valuation methods.

Second, by discriminating between whether a method is based on individual or group consultation, we broadly delineate a response to the question: How are values generated and held? Valuation methods based on individual consultation rely on methodological individualism (Weber 1968), which analyses collective forms as the result of the sum of individual actions (e.g. aggregation of individual willingness to pay). On the other hand, group based consultation through deliberative methods generally considers shared values to be fundamentally different from the sum of its parts. Deliberative methods may allow participants to reflect on the values at stake and to share their knowledge, views and perceptions with other participants (Zografos and Howarth 2010, Kenter et al. 2015).

Valuation methods can be combined to depict a more complex picture of why and how people value ES. For instance, the sacredness value of an ecosystem (a fundamental value) may be elicited through in-depth interviews, where people can express ‘why’ they conceive the ecosystem to be sacred. For example, some Berber shepherds of the High Atlas in Morocco have attributed sacred values to the communal pastoral areas because the existence

of a patron saint that is also connected with the internal regulations of when, how and by whom the communal pastures are used (Dominguez et al. 2010). Surveys, on the other hand, may be used to address ‘how’ sacred values relate to socio-demographic conditions. In the example of the High Atlas, beliefs underpinning sacred values may be weaker among younger generations due to the on-going acculturation and abandonment of local belief systems (Dominguez et al., 2010).

#### **4.6. Conclusions**

Understanding the importance of nature, ecosystems or ES for people involves dealing with multiple and, often, conflicting valuation languages. Plural values, representing different ways of engagement with nature, may be integrated not only in environmental valuation but also in the more specific field of ES assessments. Beyond attributing instrumental and intrinsic values, people can value ecosystems and biodiversity because they are fundamental in human-nature relationships and because they fulfil a ‘good human life’. The ES framework can enhance the integration of value pluralism in ES valuations by integrating *relational values* such as fundamental and eudaimonistic values.

The taxonomy of plural values presented here classifies ES value types across different conceptualisations of human-nature relationships, thereby providing an open conceptual framework that is able to accommodate a diverse set of ontological and epistemological perspectives. This taxonomy may orient ES practitioners to identify the broad types of values that may emerge on the ground. In a context where monetary valuations remain the dominant valuation language in ES assessments, our taxonomy of plural values and valuation methods may also aid in clarifying which values of ecosystems and biodiversity are overlooked or misrepresented when expressed merely by monetary values.

Articulating value pluralism in the ES framework implies stressing the ES concept in a heuristic understanding that enables integrating different visions on humans’ engagement with nature. This process implies a departure from ES as the only object of valuation and the use of other scales of nature and metaphors of human-nature relationships. This has been the case for the IPBES conceptual framework, which has integrated Western and non-Western



visions on human-nature relationships. In this context, our taxonomy on plural ES values and valuation methods can support the advancement towards understanding and recognising the multiple ways in which humans relate to and care about nature.

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## **CHAPTER 5 : Exploring intrinsic, instrumental and relational values for sustainable management of social-ecological systems**

### **Abstract**

The values (i.e. importance) people place to ecosystems has been identified as a crucial dimension towards the sustainable management of social-ecological systems. Recently, the call for integrating plural values of ecosystems beyond intrinsic and instrumental ones, has prompted the notion of ‘relational values’. With the aim to contribute to environmental management, we assess the environmental motivations (i.e. egoistic, biospheric, altruistic) and values that people attribute to the ecosystems of the mid-upper stream of the Otún River watershed (central Andes, Colombia). We analyzed 589 questionnaires that were collected in urban and rural areas of the Otún River watershed, by using the non-parametric Mann-Witney U test and logistic regressions. We found salient biospheric motivations and the attribution of plural values (i.e. intrinsic, relational and instrumental) to the ecosystems of the mid-upper stream of the Otún River watershed. Particularly, relational values were the most frequent mentioned value domain. Further, our results showed that environmental motivations and socioeconomic factors are associated to the expression of different value domains. We found negative associations between egoistic motivations and intrinsic values, and between rural respondents and instrumental values. Positive associations were found between altruistic motivations and relational values and between rural respondents and both intrinsic and relational values. In light of our results, we argue that intrinsic, instrumental and relational values coexist in people’s narratives about the importance of ecosystems. Plural valuation approaches could be enhanced by differentiating relational from instrumental values, and by expressing them in non-monetary terms. We argue that multiple values of ecosystems expressed by rural and urban societies should be included in environmental management in order to tackle social conflicts and consider the diverse needs and interests of different social actors.

**Keywords:** environmental values; environmental motivations; ecosystem services valuation; value pluralism; environmental management; watersheds

## 5.1. Introduction

Ecosystems provide vital ecosystem services to humans such as freshwater, energy and food, climate regulation, hydrological regulation, recreation and aesthetic experiences (MA 2005). At the same time, human's decisions and behaviors over ecosystems influence their capacity of supplying ecosystem services (Daily et al. 2009). Human decisions and behaviors over ecosystems are also determined by the multiples ways in which nature, ecosystems or ecosystems services are important for individuals or social groups (Ives and Kendal 2014, Jones et al. 2016, Pascual et al. 2017, Arias-Arévalo et al. in press).

The importance people place to ecosystems and ecosystem services has been identified as a crucial dimension towards the sustainable management of social-ecological systems (Ostrom 2009). However, the study of values -and other human cognitions- have been weakly addressed by the research on socio-ecological system research (Jones et al. 2016) and environmental management (Floress et al. 2015, Castro et al. 2016). Particularly, in the scientific field of ecosystem services, monetary valuation methods have received more attention than other valuation methods (Abson et al. 2014, Gómez-Baggethun and Martín-López 2015). Focusing on only monetary valuation may emphasizes instrumental values, while it may also hide intrinsic and relational values (Arias-Arévalo et al. in press).

A call towards exploring plural values beyond instrumental values is gaining momentum in the research of socio-ecological systems and ecosystems services (Chan et al. 2016, Kenter 2016a, Jacobs et al. 2016, Jones et al. 2016, Pascual et al. 2017, Arias-Arévalo et al. in press). Instrumental values represent the value of ecosystems as merely means-to-ends and are often measured in monetary terms. By contrast, intrinsic values refer to the value of ecosystems as end in them-selves and often represented as moral duties (Arias-Arévalo et al. in press). The instrumental-intrinsic dichotomy has guided decisions about environmental management by either fostering market-based conservation approaches (e.g. Payments for Ecosystem Services) or prompting the conservation of protected areas without any human intervention (Spash 2013, Anguelovski and Martínez Alier 2014, Martín-López and Montes 2015).

In recent years, ecosystem services valuation scholars have adhered to value pluralism: the

recognition of different and often conflicting value domains, that are neither reducible to each other, nor to some ultimate value (Gómez-Baggethun and Martín-López 2015, Jacobs et al. 2016, Kenter 2016a, Pascual et al. 2017, Arias-Arévalo et al. in press). Ecosystems valuation has been widened through the integration of ‘relational values’, which are those concerns associated with relationships and responsibilities between people or between nature and people (Chan et al. 2016). Examples of relational values include the ecological conditions ensuring the preservation of life on earth, the social conditions for maintaining harmonic human-nature relationships (e.g. sacred and cultural values), or the experiences and entities necessary for cultivating the notion of a ‘good life’ (e.g. aesthetic appreciation or cognitive development in nature-based contexts) (Chan et al. 2016, Tadaki et al. 2017, Muraca 2016, Arias-Arévalo et al. in press). See Box 1 for definitions of values.

**Box 1. Definitions of relevant concepts**

**Altruistic motivations:** Principles embracing concerns towards other humans (e.g. social justice).

**Anthropocentrism:** Human centered system of values; the importance of entities for serving human beings and their purposes

**Articulated values:** Concrete expressions of value domains stemming from valuation processes

**Biospheric motivations:** Principles embracing concerns to non-human species and the biosphere (e.g. unity with nature).

**Eco-centrism:** System of values oriented to both living and no-living systems.

**Ecosystems plural valuations:** The process of analyzing, assessing or understanding the multiple ways in which ecosystems and ecosystem services are important for people, and how this multiples ways of importance are related (e.g. coexistences, synergies, trade-offs).

**Egoistic motivations:** Principles embracing the maximization of individual gain (e.g. social power).

**Instrumental value:** The value of an entity as merely means- to-end.

**Interests:** Stakes at play in decisions contexts, which are influenced by motivations, values and beliefs.

**Intrinsic value:** The value of nature, ecosystems, or life as ends-in-them-selves, irrespectively of their utility to humans.

**Motivations:** Stable principles that guide human judgments and action.

**Relational values:** The importance attributed to meaningful relations and responsibilities between humans; and between humans and nature.

**Value domain:** A broad notion of the importance people attributes to ecosystems, emerging from the diverse ways in which people engage with nature.

**Value pluralism:** Axiological position that recognizes different and often conflicting value domains, that are neither reducible to each other, nor to some ultimate value.

**Values:** Multiple ways in which nature, ecosystems or ecosystems services are important for individuals or social groups.

Under this value pluralism approach, scholars have called to integrate multiple disciplines as well as qualitative and quantitative methods in ecosystem services valuation (Jacobs et al. in press, Kenter 2016a, Tadaki et al. 2017). For instance, recent research has proven the benefits to integrate environmental psychology and valuation. In doing so, motivations-also known as orientations (Groot and Steg 2008, 2010, Steg et al. 2011)- are considered as key factors determining environmental values (Raymond and Kenter 2016, Kenter 2016b).



Scholars have quantitatively addressed three major motivations that influence environmental attitudes and behavior: egoistic, altruistic and biospheric (de Groot and Steg 2008, 2010, Steg et al. 2011). Whilst egoistic motivations give priority to the maximization of individual gain, altruistic motivations embrace concerns towards other humans, and biospheric motivations extend these concerns to non-human species and the biosphere. See Box 1 for environmental motivations.

Understanding plural values of ecosystems has been identified as critical research priority towards their sustainable management. Plural valuations may aid in: i) understanding the coupled nature of social-ecological systems offering new intervention points (Jones et al. 2016); ii) framing values as indirect or direct drivers of change (Jones et al. 2016); iii) aligning management interventions with people values (Ives and Kendal 2014, Jones et al. 2016); and iv) identifying consensual and conflicting values associated to management approaches (Ives and Kendal 2014, Jones et al. 2016, Jacobs et al. 2016).

The main objective of this research is to assess the environmental motivations and values people attribute to the ecosystems of the mid-upper stream of the Otún River watershed (central Andes, Colombia) with the aim to inform environmental management. Specifically, we aim to: (1) examine people prioritization of environmental motivations -egoistic, biospheric and altruistic; (2) assess the intrinsic, relational and instrumental values by which rural and urban people attribute importance to the ecosystems of the watershed; and (3) analyze how motivations and socioeconomic factors (e.g. residence area, education) influence the expression of values. **Figure 5.1** presents the roadmap of this research by indicating how specific objectives relate with different disciplines and how they are addressed by using multiple analytical methods.

**Figure 5.1 Roadmap of the research**

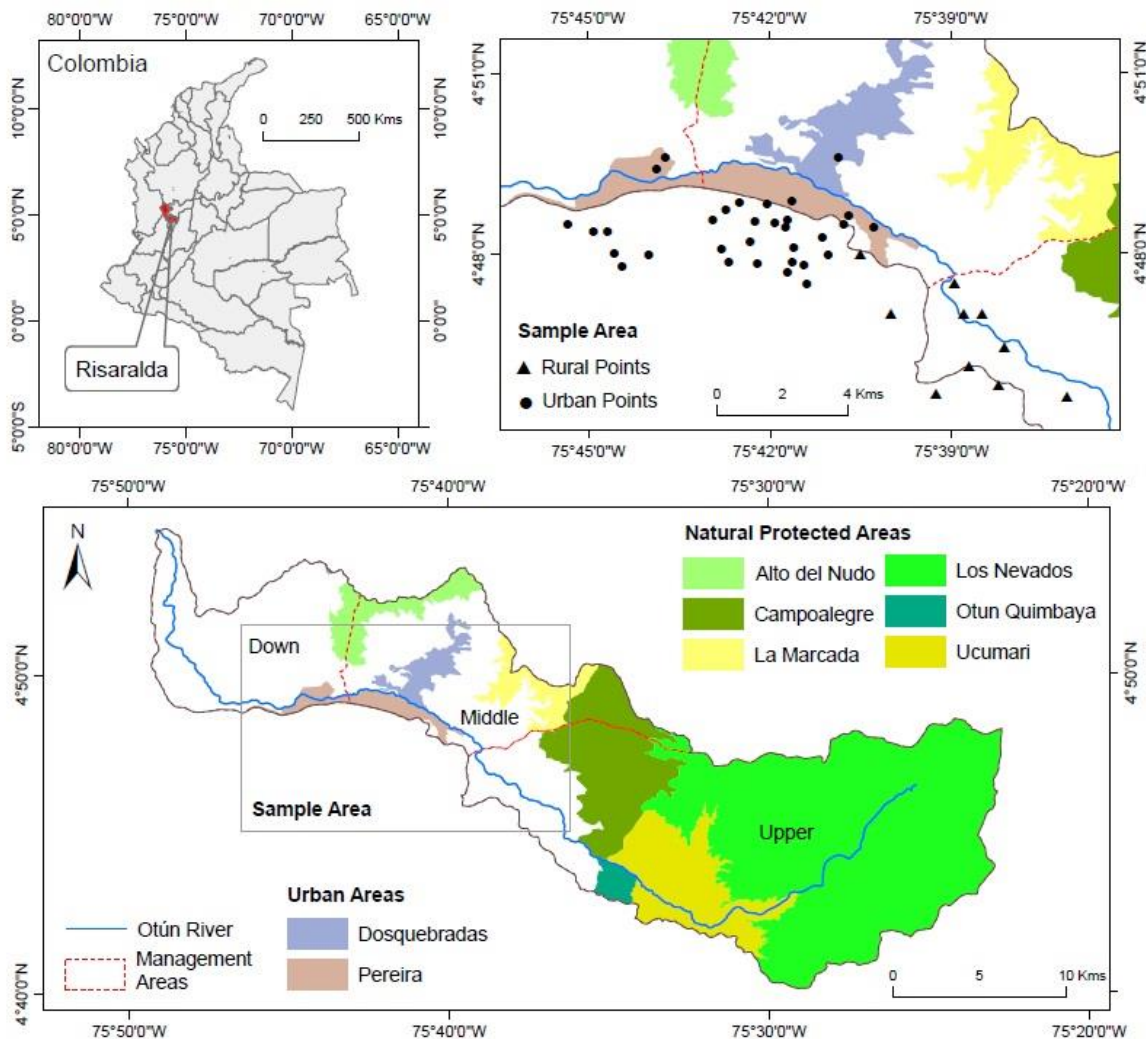
Specific objectives	Integration of disciplines	Methods and Data Analysis	Results
1. Examine urban and rural prioritization of environmental motivations -egoistic, biospheric and altruistic.	A. Social and environmental psychology (de Groot & Steg, 2008, 2010)	<ul style="list-style-type: none"> <li>Quantitative measurement of environmental motivations through surveys.</li> <li>Reliability of environmental motivations through Factor analysis</li> <li>Differences between urban and rural respondents through Mann-Whitney test</li> </ul>	<ul style="list-style-type: none"> <li>Are the motivations constructs internally consistent?</li> <li>Which environmental motivations prioritize rural and urban respondents?</li> </ul>
2. Assess the intrinsic, relational and instrumental values by which rural and urban people attribute importance to the ecosystems of the mid-upper stream Otún watershed	B. Environmental ethics, Ecological Economics perspectives on ecosystem services valuation (Jax et al. 2016; Arias-Arévalo in press, Chan et al. 2016)	<ul style="list-style-type: none"> <li>Qualitative Narrative approach: open-ended question about the importance of ecosystems.</li> <li>Content analysis to classify 20 articulated values and 3 value domains (i.e. intrinsic, instrumental, and relational).</li> <li>Differences between urban and rural respondents through Mann-Whitney test</li> </ul>	<ul style="list-style-type: none"> <li>What values domains and articulated values, rural and urban respondents mentioned?</li> <li>Are there any differences in the mentioning of value domains between urban and rural respondents?</li> </ul>
3. Analyze how motivations and socioeconomic factors (e.g. residence area, education) influence the expression of environmental values.	Integration of A and B	<ul style="list-style-type: none"> <li>Quantitative multivariate logistic regressions to evidence the relationships between both socio-economic factors and environmental motivations and the expression of value domains.</li> </ul>	<ul style="list-style-type: none"> <li>Which socio-economic factors and environmental motivations are associated with the expression of environmental values?</li> </ul>

## 5.2. Study area

The Otún River watershed is located in the western slope of the central Andes in the state of Risaralda, Colombia, with an extension of 480.6 Km<sup>2</sup> (**Figure 5.2**). The Otún River rises at 5200 m.a.s.l. at the Ramsar Otún Lake Wetland Complex and flows into the Cauca River at 875 m.a.s.l. (CARDER 2008). The Otún River watershed hosts 423130 inhabitants, mainly distributed in the municipalities of Pereira (55.3%) and Dosquebradas (43.7%), and marginally also in the municipalities of Santa Rosa de Cabal (0.9%) and Marsella (0.1%) (CARDER 2017). The Otún River watershed has been considered as strategic conservation area due to the presence of ecosystems of high ecological value such as paramos, high andean and subandean forests (CARDER 2008). The Otún River supplies water to nearly 450000 habitants, including urban inhabitants of Pereira and Dosquebradas who are not allocated within the watershed boundaries (CARDER 2016). For management purposes, the Otún River watershed is divided into three main areas: upper-, mid- and down-stream areas (**Figure 5.2**). Our research focuses on the mid-upper-stream, which range from 1400 to 4800 m.a.s.l. Nowadays, 86% of the total area of the mid-upper-stream belongs to protected areas (e.g. Los Nevados National Natural Park, Santuario de Flora y Fauna Otún Quimbaya). Due to the conservation efforts developed in the last 60 years, the Otún River watershed is

considered one of the best conserved watersheds of Colombia (CARDER 2016).

**Figure 5.2 Study area map and sampling points**



Triangles for rural population and circles for urban population.

Urban and rural people are different related with the ecosystems of the mid-upper stream of the Otún River watershed. Rural people use rivers and water sources to supply freshwater for human consumption and productive activities. Some rural people develop agricultural activities aimed at commercialization and subsistence and others provide ecotourism services to urban people (Rincón-Ruíz et al. 2014, CARDER 2016). Rural people conceive the territory as the space for the social and cultural reproduction of the peasant culture (Ángel 2014). Rural people relations with ecosystems are crucial for securing the provision of ecosystem services for urban people: freshwater, food production, recreation, tourism, education and research (Rincón-Ruíz et al. 2014, CARDER 2016). Mobilization and culture exchange between rural and urban inhabitants are prominent because urban centers and rural

towns are geographically close (**Figure 5.2**). For a summary of rural actors in the mid-upper stream of the Otún River watershed see **Table 5.1**.

**Table 5.1 Main rural actors of the mid-upper stream of the Otún River watershed, Colombia.**

Actors	Description
Communal action boards (Juntas de Acción Comunal)	Civic society corporations aimed at neighborhood problems resolution.
Rural community aqueducts	Non-profit community-based organizations aimed at rural water supply
Community-based environmental associations	Community-based organizations aimed at ecotourism services provision, environmental education, ecosystems conservation and sustainable agriculture projects, promotion of traditional local knowledge, social cohesion and leadership (e.g. Cooperativa Multiactiva Defensora del Medio Ambiente-COOMDEMA; Soledad de Montaña; Yarumo Blanco; Civil Society Natural Reserves Danteros and Santa María de la Loma)
Ecotourism services	Rural people providing transportation, lodging, recreation and food services
Representatives of productive sectors	Representatives of productive sectors such as porcine, poultry, cattle, onion and coffee

Since the 1940s, the management of the mid-upper stream of the Otún River watershed has mainly focus on biodiversity conservation and water provision for urban areas (Barragán and Valdés 2011). Nowadays, the most relevant management institutions are: the local public company (Aguas y Aguas de Pereira), the Regional Environmental Authority (Corporación Autónoma Regional de Risaralda, CARDER) and the National Natural Parks Institution (Unidad Administrativa Especial del Sistema de Parques Nacionales Naturales - UAESPNN). These institutions have developed conservation actions such as land purchases for ecosystems restoration, creation of protected areas and the declaration of the buffer zone (areas above the water catchment) as an area for the conservation of water for human consumption (Law 36 of 1987, CARDER).

The development of conservation programs has created conflicts and tensions between rural actors and management institutions because such programs have affected rural people livelihoods (Barragán and Valdés 2011, Monsalve 2012, Rincón-Ruíz et al. 2014). Land purchases and the expansion of protected areas have caused rural migration. In the buffer zone, restrictions of agricultural activities have caused the shot down of poultry and porcine

farms which were an important source of employment in the area; transitional crops restrictions affected the cultivation of vegetables and medicinal plants aimed at subsistence and commercialization; and the prohibition of new housing developments increased both the density of the number of people per household and lease prices (Barragán and Valdés 2011).

Due to agricultural restrictions in the buffer zone, since 1999, ecotourism has been promoted by management institutions as an income source for some community-based environmental associations (Barragán and Valdés 2011). In 2013, an ecotourism management plan was formulated with the goal of promoting sustainable ecotourism and generating revenues to an extended population beyond the members of the community-based associations (UAESPNN 2013). Currently, a new environmental management plan of the Otún River watershed is being formulated (CARDER 2016). In this process, rural community associations still emphasized concerns regarding the restriction of productive activities due to the expansion of conservation areas; unsustainable tourism and the lack of income sources. In this new management plan, payment for ecosystem services has been considered as one of the programs that can address these rural concerns (CARDER 2016). The development of these plans could become an opportunity towards the integration of rural interests in the management of the mid-upper stream of the Otún River watershed.

### **5.3. Methodology**

#### **5.3.1. Data collection**

Direct face-to-face questionnaires were conducted in June and July 2014. A draft of the questionnaire was pre-tested in May 2014 and thereafter revised. A simple random sampling was applied to represent rural and urban households. Then a purposive sampling was conducted in order to select sampling points that covered different urban (33 sample points) and rural (10 sample points) settlements (**Figure 5.2**). Urban sample points cover neighborhoods of the urban centers of Pereira and Dosquebradas (which together concentrates 668.5 thousand inhabitants). Rural sample points comprised districts outside these urban centers. Some sample points were outside the watershed boundaries, but they were selected because they are located in areas where people also demand ecosystem services provided by the mid-upper stream of the Otún watershed, including water provision,

recreation and leisure. Six hundred individual questionnaires were conducted, of which 11 were disregarded for not being complete, leaving a final sample size of 589 questionnaires.

The questionnaire consisted of four sections. The first section aimed to identify whether the respondent was suitable to fill the survey (i.e. older than 16 years old and inhabitant of the watershed or influencing areas). The second section addressed environmental motivations. In this section, respondents were asked to rate the importance of different motivations as guiding principles for action on a nine-point scale: -1 'contrary to my life motivations'; 0 'not at all important' to 7 'of supreme importance'. We followed the classification of environmental motivations of de Groot and Steg (2008). Egoistic motivation embraced the prioritization of power, influence, ambitious, authority and wealth. The altruistic motivation prioritized aspects like a world at peace, being helpful, social justice and equality. Finally, the biospheric motivation embraced the prioritization of preventing pollution, respecting the earth, unity with nature and protecting the environment (see Appendix 1 for the description of motivations' components). In the third section, an open-ended question was included to identify the values that respondents attributed to the mid-upper stream of the Otún River watershed: 'Why do you think it is important to conserve the ecosystems and landscapes of the mid-upper stream of the Otún River watershed?' This open-ended question was applied because narrative approaches have been highlighted as suitable for capturing plural values (Klain et al. 2014, Tadaki et al. 2017, Jacobs et al. in press). The final section included questions of the respondents' socio-economic characteristics such as household income, education level or labor status.

### **5.3.2. Data analysis**

First, a factor analysis was applied in order to assess the level of internal consistency among environmental motivations. Factor analysis contributed to cluster motivation components (e.g. social justice, equality, a world at peace) into the theoretical groups of motivations (e.g. altruistic). Cronbach's alpha was used to measure the reliability (i.e. internal consistency) of each motivation cluster. Cronbach's alpha 'describes the extent to which all the items in a test measure the same concept or construct' (Tavakol and Dennick 2011:53). Cronbach's alphas range from 0 and 1. Means and standard deviations of each motivation were estimated to identify the prioritization of environmental motivations in the total, urban and rural

respondents. Differences between rural and urban prioritization of motivations were explored by using the Mann-Whitney U test.

To assess the values attributed by local people to the ecosystems of the mid-upper stream areas of the Otún River watershed, respondents' answers were coded through a content analysis. We coded the answers into 3 value domains (i.e. instrumental, intrinsic, and relational) and 20 articulated values, following Arias-Arévalo et al. (in press). Respondents' references to economic development and monetary benefits were coded as instrumental values. References to the importance of the ecosystems for securing life on earth was coded as intrinsic value, as well those mentions to moral duties towards non-human entities. Relational values included references to ecological conditions ensuring ecosystems resilience; social conditions for maintaining harmonic human-nature relationships (e.g. identity, cultural heritage, symbolic and sacred values); or experiences and entities necessary for cultivating the notion of a 'good life' (e.g. aesthetic and cognitive development values). Differences regarding the frequency of mention of environmental values between rural and urban respondents were explored through the Mann-Whitney U test.

Finally, three logistic regressions were performed to analyze the effect of environmental motivations and socioeconomic factors on the probability of expressing each value domain. Logistic regressions are used to test hypothesis if a categorical outcome variable (e.g.  $Y=1$  if the respondent mentioned a value domain;  $Y=0$  if the contrary) is explained by other exposure variables (e.g. residence area) (Peng et al. 2002). Odds ratio (OR) were calculated to measure the effect of exposures on the probability of expressing a value domain. When  $OR=1$ , the exposure does not affect odds of outcome;  $OR>1$  indicates that the exposure is associated with higher odds of outcome; and  $OR<1$  indicates that the exposure is associated with lower odds of outcome (Szumilas 2010). The exposure variables included environmental motivations, education level, marital status, labor status, residence area and activities performed in the mid-upper stream of the Otún River watershed. Continuous variables (i.e. environmental motivations and education level) were re-escalated to a 0-1 range before conducting logistic regressions. Final models were selected according to the Akaike's information criterion (AIC: Akaike 1974).

## 5.4. Results

### 5.4.1. Sample characteristics

Of the 589 completed surveys, 224 (38.0%) were conducted in rural areas and 365 (62.0%) in urban areas. The mean age of the sample respondents was 39 years old (standard deviation, SD=16.2). The average of the personal monthly income was of \$185.9 USD<sup>5</sup> (SD=332.7). The average monthly personal income for the rural respondents was \$140.7 (SD=177.7), whilst for the urban ones was \$217.6 (SD=220.8). The average of the number of activities performed in the mid-upper stream of the Otún river watershed for all respondents was 3.5 (SD=3.3); and 4.5 (SD=3.4) for rural and 2.8 (SD=3.0) for urban ones. A synthesis of the socio-economic characteristics of respondents is presented in **Table 5.2**.

**Table 5.2 Sample characteristics of respondents (n=589)**

Variables	Definition	Rural Respondents		Urban Respondents		Total Respondents	
		n	%	n	%	n	%
Education level	None	6	2.7	2	0.5	8	1.4
	Primary	75	33.5	40	11.0	115	19.5
	High school	98	43.8	136	37.3	294	39.7
	Technical school	24	10.7	70	19.2	94	16.0
	University grade	19	8.5	104	28.5	123	20.9
	University post grade	2	0.9	13	3.6	15	2.5
Women	Women=1, Men=0	132	58.9	214	58.6	346	58.7
Single	Single=1, Otherwise=0	80	35.7	177	48.5	257	43.6
Retired	Retired=1, Otherwise=0	8	3.6	16	4.4	24	4.1
Student	Student=1, Otherwise=0	23	10.3	56	15.3	79	13.4
Residence area	Rural area=1, urban=0	224	–	–	–	224	38.0

<sup>5</sup> Calculated based on the exchange rate of April 2016: \$3003 COP= \$1USD



Activities performed in the mid-upper stream of the Otún River watershed	Aesthetic appreciation , yes=1, no=0	136	60.7	162	44.4	298	50.6
	Hiking=1, Otherwise=0	120	53.6	138	37.8	258	43.8
	Wildlife watching =1, Otherwise=0	115	51.3	110	30.1	225	38.2
	Swimming in the River =1, Otherwise=0	85	37.9	105	28.8	190	32.3
	Visiting waterfalls =1, Otherwise=0	94	42.0	72	19.7	166	28.2

#### 5.4.2. Environmental motivations

Overall, respondents prioritized biospheric ( $X=6.5$ ;  $SD=0.8$ ) and altruistic ( $X=6.3$ ;  $SD=0.9$ ) motivations over egoistic ones ( $X=4.2$ ;  $SD=1.4$ ). Rural and urban respondents also presented this prioritization (**Table 5.3**). The Mann-Whitney U tests showed statistical differences of biospheric and altruistic motivations between rural and urban respondents. The Cronbach's alpha revealed that biospheric and altruistic environmental motivations are internally consistent ( $\alpha =: 0.81$  and  $\alpha =: 0.73$ ; respectively). The egoistic motivation showed lower internal consistency ( $\alpha = 0.64$ ) than biospheric and altruistic ones.

**Table 5.3 Prioritization of environmental motivations in total, rural and urban respondents.**

(SD: standard deviation; asterisks show statistical significant differences between urban and rural according to U Mann-Whitney tests: \*\*\*  $p \leq 0.01$ , \*\*  $p \leq 0.05$ , \*  $p \leq 0.1$ )

Environmental motivations	Total Sample		Rural		Urban		U Mann-Whitney
	Mean	SD	Mean	SD	Mean	SD	
<i>Biospheric</i>	6.471	0.830	6.694	0.705	6.333	0.871	28564 ***
<i>Altruistic</i>	6.315	0.877	6.569	0.669	6.159	0.951	29898 ***
<i>Egoistic</i>	4.255	1.389	4.376	1.301	4.181	1.436	37738

#### Environmental values

Respondents referred to a plurality of environmental values when they reflected upon the importance of the mid-upper stream of the Otún River watershed (**Table 5.4**). Values in the domain of relational values were the most frequently mentioned by all respondents (93.0%), followed by intrinsic values (40.7%) (Appendix 2). Instrumental values were only mentioned by 2.2% of respondents. The most widely mentioned articulated values in the

total sample was the relational values of ‘subsistence and livelihoods’ (73.9%) and altruism (37.0%). The third most mentioned articulated value was ‘moral duties towards biodiversity and ecosystems’ (34.0%) in the intrinsic values domain (**Table 5.4**).

**Table 5.4 Frequency and examples of respondents’ articulated values when mentioning the importance of ecosystems in the mid-upper stream of the Otún River watershed**

Value domain	Articulated values	n	%	Examples†‡
Instrumental	monetary benefits, economic development	13	2.2	“If the Otún River watershed is not conserved, the water will run out and humans depend on it. Onion crops is what people do as way of living, and if water runs out, this will be harmful for people”(546R)
	Life	64	10.9	“The Otún River watershed should be conserved to maintain the life of people, plants and animals” (#50U)
Intrinsic	Moral duties to other organisms and ecosystems	200	34.0	“If we conserve the Otún River watershed, the trees, the river and wildlife will be preserved. They also have the right to have a clean home.” (#130U)
	Ecological resilience	116	19.7	“The Otún River watershed ecological equilibrium has a big chance of being altered; therefore its conservation is vital for both the city and the surrounding rural communities”( #313U)
	Subsistence, livelihoods	449	76.2	“If we do not conserve the Otún River watershed we will not have water.... What is the worth of money if there is no water or food?” (#465R)
	Mental and physical health	134	22.8	“Having good quality water ensures a good health and a good quality of life” (#166U)
Relational	Identity	14	2.4	“Our way of life comes from the Otún River watershed. The Otún River watershed is the identity of all the people from Pereira”. (#308U)
	Sense of place	18	3.1	“If we don’t take care of the Otún River watershed, we will lose all. If there is a day I have to return to the city that will be very hard for me. We have here our jobs. If we don’t take care of the Otún River watershed, who will take care of it? People from the city will not come to take care of it” (#463R)
	Cultural heritage	27	4.6	“The watershed with its natural beauty is the lung of the city, it’s beautiful landscapes and its crystal water are a national heritage”( #13U).
	Sacredness, religious value	14	2.4	“Our lives depend on the river, God gave it to us and it is our duty to take care of it” (#259U)
	Symbolic value	18	3.1	“The Otún River watershed is the soul and life of Pereira, this is a territory of peace which exists in very few places”( #415R).
	Social cohesion	3	0.5	“Here comes everybody, they have no fear of being robbed, if they are lost, local people orient them. People are friendly and helpful” (#471R)

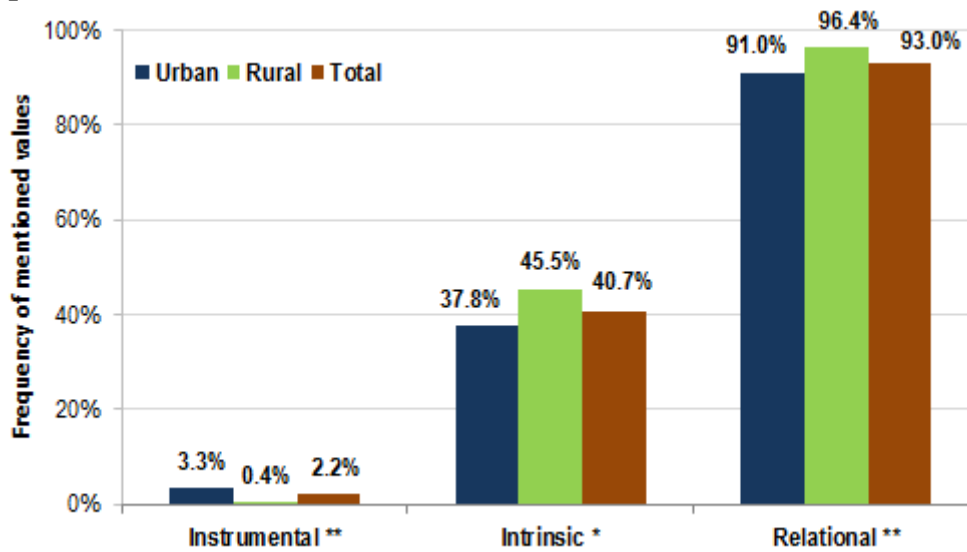
General wellbeing	53	9.0	<i>“The Otún River watershed should be conserved because it is the basis of social wellbeing” (#97U)</i>
Meaningful occupation	8	1.4	<i>“We must avoid pollution and that the river dry out, and thus avoid peasants unemployment” (#506R)</i>
Altruism	218	37.0	<i>“If we don’t take care of the Otún River watershed, who will take care of it? Nature is not ours, it is lent; Nature is owned by our children. Downstream people drink water and here the river is born, we must take care of the water in benefit of the downstream people” (#265 U)</i>
Environmental justice	6	1.0	<i>“The Otún River watershed has been degraded because [people who have recently arrived to the mid- and upper-stream watershed] abuse the watershed. The owner of the camping zone abuses the river. The river has no owner and she charges fees for access. Local children used to go there to swim and now she denies them the entrance.” (#475R)</i>
Aesthetic	54	9.2	<i>“The Otún River watershed provides us with the opportunity to enjoy its landscape and also have a near place to get in touch with nature” (#172U)</i>
Recreation, leisure	24	4.1	<i>Because is a place of nature in which we can recreate, rest and have fun for a while(#253U)</i>
Nature-based tourism	20	3.4	<i>“The Otún River watershed is a tourism site for outsiders. It is the ‘Country Club’ for the people from Pereira” (#422 R)</i>
Education and cognitive development	15	2.5	<i>“I arrived to the watershed as a blind man, the peasants taught me and I could open my eyes...It is important to protect the Otún River watershed in order to teach our children that we have beautiful sites, to teach them that the city is not everything we have” (#466R)</i>

†Parentheses indicate the questionnaire number and the respondent’s residence area: R for rural and U for urban

‡We select those answer extracts that specially highlighted a value expression; however, the reader may infer in the same extract multiple articulated values.

Statistically significant differences of the value domains mentioned by rural and urban respondents were found (**Figure 5.3**). Respondents from rural areas referred to the domains of relational and intrinsic values more frequently than urban respondents (Relational: U= 38644,  $P$ -value= 0.011; Intrinsic: U=37721,  $P$ -value = 0.064; **Figure 5.3**). Although the mention to the domain of instrumental values was scarce in both sample groups, urban respondents referred more frequently to instrumental values than rural ones (U= 39718,  $P$ -value = 0.023; **Figure 5.3**). Appendix 2 presents the percentage of urban and rural respondents mentioning each articulated value.

**Figure 5.3** Frequency (%) of the mention of value domains by the urban and rural respondents.



Asterisks show statistically significant differences between urban and rural according to U Mann-Whitney tests: \*\*\*  $p \leq 0.01$ , \*\*  $p \leq 0.05$ , \*  $p \leq 0.1$ .

### 5.4.3. Influence of motivations, worldviews and socio-economic characteristics on environmental values

The analysis of OR in the logistic regressions showed that those respondents who gave a higher score to the egoistic motivation were less likely to express intrinsic values, whilst those who gave a higher score on altruistic motivations were more likely to express relational values (Table 5.5). With regard to socio-economic factors, respondents living in the rural area were more likely to express intrinsic and relational values. By contrast, rural respondents were less likely to express instrumental values. Higher educational level was associated with higher likelihood to express intrinsic and relational values. Further, higher number of activities conducted by respondents in the mid-upper stream of the Otún River watershed was related with a higher likelihood of expressing relational values.

**Table 5.5 Results of logistic regressions that show the effect of motivations and socio-economic factors on environmental values.**

	Instrumental			Intrinsic			Relational		
	Odds ratio	SD	P-value	Odds ratio	SD	P-value	Odds ratio	SD	P-value
Interception	0.021	0.008	0.000	0.353	0.164	0.025	0.859	0.703	0.852
<b>Motivations</b>									
Egoistic				0.339	0.168	0.029			
Altruistic							4.906	3.673	0.034
<b>Socio-economic factors</b>									
Education level				4.064	2.068	0.006	8.592	8.226	0.025
Single				1.502	0.276	0.027	0.477	0.167	0.035
Student	5.302	3.048	0.004						
Retired				0.360	0.203	0.069			
Living in rural area	0.148	0.155	0.069	1.736	0.342	0.005	2.308	1.029	0.061
Number of activities							6.227	5.819	0.050
Aesthetic				1.461	0.260	0.033			
n	589			589			589		
Observed Y=1	13			240			548		
Observed Y=0	576			349			41		
<b>Regression Tests</b>									
Log -Likelihood	110.915			755.203			273.396		
Wald Chi-square	12.203	0.002		36.671	0.000		21.656	0.001	
Hosmer & Lemeshow	1.83	0.1762		425.45	0.221		406.36	0.4299	
Akaike information criterion-AIC	116.915			769.203			285.396		
Percentage of correct estimated predictions (%)	97.79			64.35			93.04		

## 5.5. Discussion

### 5.5.1. Methodological strengths and challenges

In this study we provide an example of the integration of quantitative (i.e. environmental motivations measurement) and qualitative methods (i.e. narrative method) can contribute to comprehensively value ecosystems. One of the strengths of our methodological approach was the possibility of covering a large sample of respondents with different socio-economic characteristics. This approach allows the application of a quantitative approach to address associations between values and both motivations and socio-economic factors (**Table 5.5**). Further, this study demonstrates that narratives is a simply approach towards capturing the

diversity of environmental values (Tadaki et al. 2017, Jacobs et al. in press). However, challenges remain in the exercise of classifying environmental values because the difficulty of squarely fit respondent's quotes with particular articulated values and domains. For instance, when a respondent stated "*Our way of life comes from the Otún River watershed*" (#308U), we decided to classify this statement in the articulated value of identity; however, this statement could be also related to the articulated value of 'sense of place'. Moreover, coding narratives in value domains implies the translation of meaning from a conversational setting to an academic one, that may not represent the meanings originally stated by the respondent (Tadaki et al. 2017).

### **5.5.2. From the dichotomy of intrinsic-instrumental values to the empirical recognition of plural values**

Our results show that both urban and rural respondents attributed diverse values to the ecosystems of the mid-upper stream of the Otún River watershed, including intrinsic, relational and instrumental (**Figure 5.3, Table 5.4**). A respondent mentioned that the ecosystems of the mid-upper stream of the Otún River watershed are important because "Water is indispensable for life on the planet: for humans, animals and plants...Having good quality water ensures a good health and good quality of life. Additionally, many families depend economically on the watershed" (#166U). In her narrative, the respondent mentioned intrinsic values (i.e. earth life dependency on water; concerns towards plants and animals); relational values (i.e. health and quality of life) and instrumental values (i.e. economic dependency on the watershed). This holistic worldview contrasts with the dichotomy between intrinsic and instrumental values as the main argument for ecosystems conservation. People can endorse multiple values to the same ecosystems, indicating that the integration of value pluralism is necessary in environmental valuation.

It is important to note that 'relational values' was the domain most mentioned among urban and rural respondents (<90%) (**Figure 5.3**). Among relational values, the most mentioned articulated values were the subsistence value of water, mental and physical health, and the altruistic value embracing concerns to other human's groups and future generations (Appendix 2). The concept of relational value has been recently emphasized in the academic discussion of ecosystem services assessments and valuations (Díaz et al. 2015, Chan et al.

2016, Tadaki et al. 2017, Pascual et al. 2017, Arias-Arevalo et al. in press)<sup>6</sup>. Under the intrinsic-instrumental dichotomy, relational values have been conflated with instrumental values because of their anthropocentric nature (see Sagoff 2009, Justus 2009). Such conflation implies that the aesthetic appreciation of the paramo ecosystem in the Otún River watershed (a relational value) can be substituted by the aesthetic appreciation of a painting of the same paramo. However, what it is of value is the context-specific relation of aesthetic appreciation in that nature-based setting. This relation is not subject of exchange or commodification, and even its monetarization could be socially rejected. The classification of relational values as instrumental values has promoted its expression in monetary terms. For example, cultural ecosystem services research has focused on ecosystem services such as recreation and ecotourism that are easily quantified and monetized (Milcu et al. 2013). However, most cultural ecosystem services cannot be represented by monetary metrics because they represent deep human-nature relations (e.g. sacred and spiritual experiences, aesthetic enjoyment and inspiration) and thus their importance is expressed by relational values.

### **5.5.3. The complex and placed-based nature of environmental values**

This study shows that environmental motivations and socioeconomic factors can influence the expression of environmental values in many ways (**Table 5.5**). A higher prioritization of the egoistic motivation was associated with a lower probability of expressing intrinsic values. This result is consistent with studies that have reported the negative effect of egoistic motivations on pro-environmental concerns (Steg et al. 2011, Raymond and Kenter 2016). By contrast, a higher prioritization of the altruistic motivation was associated with a higher probability of expressing relational values (**Table 5.5**). This result supports the notion that relational values embrace concerns about human relationships (Chan et al. 2016). For example, a rural respondent expressed: “Downstream people drink water and here the river is born, we must take care of the water in benefit of the downstream people” (#466R).

An interestingly result is that respondents who reported visited the mid-upper stream for

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<sup>6</sup> Yet, relational values have been addressed through the concept of cultural ecosystem services (Chan et al. 2012, Daniel et al. 2012, Milcu et al. 2013) and socio-cultural valuations of ecosystem services (Oteros-Rozas et al. 2013, Iniesta-Arandia et al. 2014, Zagarola et al. 2014, Castro et al. 2016)

aesthetic appreciation were more likely of expressing intrinsic values (**Table 5.5**). Recently, Piccolo (2017) brought the question as ‘how relational and intrinsic values coexist’. Our results provide empirical insights that relational and intrinsic values can emerge in intricate relationships. The aesthetic appreciation (relational value) of ecosystems is an anthropocentric activity. However, in our study this activity was positively related to the expression of intrinsic values (**Table 5.5**). Similarly, Winter (2007) found that some respondents express spiritual (a relational value) and intrinsic values together.

We also found that people living in rural areas were more likely to attribute intrinsic and relational values, and less likely to attribute instrumental values to the ecosystems of the mid- and upper-stream of the Otún River watershed (**Table 5.5**). This result contrasts with those of previous studies which have attributed higher pro-environmental concerns to urban than to rural people (e.g. Van Liere and Dunlap 1980, Arcury and Christenson 1993). Scholars have argued that rural people have more economic dependence on natural resources and, thus, more often express instrumental values (Huddart-Kennedy et al. 2009). Instead, we support the view that the strong connection of rural people with ecosystems, in terms of their cultural relations and their material dependence on ecosystems (Martínez-Alier 2002, Anguelovski and Martínez Alier 2014) can explain why they primarily express the importance of ecosystems in terms of relational and intrinsic values.

It is important to mention that although the relative differences found between rural and urban respondents, both samples presented the same pattern on the prioritization of environmental motivations (i.e. they prioritized biospheric and altruistic motivations over egoistic ones, **Table 5.3**). Additionally, both groups mentioned more frequently relational values and intrinsic values than instrumental ones (**Figure 5.3**). The identification of such common ground of agreement is essential for environmental management (Ives and Kendal 2014, Jones 2016)



#### 5.5.4. Insights for environmental management

Scholars have stressed the importance of analyzing public motivations for designing environmental policies (Steg et al. 2005, 2011, Ives and Kendal et al. 2014, Jones et al. 2016). Biospheric and altruistic motivations have shown to be positively associated to the social acceptance of environmental policies (Steg et al. 2005, 2011). Although conflicts and tensions have been reported between rural actors and management institutions in the mid-upper stream of the Otún River watershed (Barragán and Valdés 2011, Monsalve 2012, Rincón-Ruíz et al. 2014), our results suggest that these do not result from the clash of anti-environmental motivations: rural people prioritized biospheric and altruistic motivations over egoistic ones (**Table 5.3**). In the last decades, rural actors have supported conservation goals through their engagement in environmental community-based associations (Monsalve 2012). Furthermore, in the ecotourism management plan (UAESPNN 2013) and the new management plan of the Otún River watershed (CARDER 2016), the main claim of rural actors has been the generation of income sources and the promotion of the peasant culture while conserving ecosystems. However, during the last decades, the management of the Otún River watershed has emphasized the provision of water for urban areas which emphasized a subsistence value for urban people (Barragán and Valdés 2011, Monsalve 2012, Rincón-Ruíz et al. 2014). This research shows the need of including rural people in environmental management because their concern for other relational values. Precisely, the environmental problems that rural people identified in the Otún watershed management plan (CARDER 2016) embrace relational values: restriction of productive activities (values of subsistence and livelihoods, meaningful occupation); loss of local ecological knowledge (values of cultural heritage and cognitive development) and loss of sense of place and identity (sense of place and identity values). Our results evidence that environmental management conflicts can emerge due to a weak integration of the relational values of rural people in environmental management.

Environmental management can rely on pluralistic valuation, as the one developed here, aimed at identifying those values that are outside current management objectives. These values can become new management objectives that may contribute in aligning environmental policies with people' values and thus minimize social conflicts (Ives and Kendal 2014, Jones 2016). Additionally, management institutions can foster approaches

such as the management plan of UNESCO World Heritage Coffee Cultural Landscape (Ministerio de Cultura 2011, Barbero 2012) which covers some areas of the mid-stream of the Otún River watershed. This plan focuses on cultural values and also integrates environmental and economic objectives, while promoting relational values (e.g. environmental sustainable coffee production; promotion of social and institutional networks; conservation of architectural heritage and local ecological knowledge). Finally, the development of a program of payments for ecosystem services in the mid-upper stream of the Otún River watershed, targeting the relational values of rural people, can devise the way of integrating the salient biospheric and altruistic motivations. Local institutions and norms relying on such motivations and relational values could be the basis for such program instead of focusing merely in monetary incentives (Kerr et al. 2014). The integration of relational values in the design of payment for ecosystem services may result in more effective conservation programs (Chan et al. 2016) and also in fairer ones, as they may recognize the multiple ways in which the environment is important for multiple social actors.

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## **CHAPTER 6 Valuing ecosystem services beyond money and self-oriented motivations: A willingness to give up time approach**

### **Abstract**

'Willingness to give up time' (WTT) has been proposed as an approach that can overcome some limitations of monetary approaches to environmental such as willingness to pay (WTP), including the assumption that decisions are narrowly based on self-oriented motivations and the reluctance by some people to express their values in monetary terms. However, WTT studies have not yet analyzed the influence of self- (i.e. egoistic) and others-oriented motivations (i.e. altruistic and biospheric) on WTT. This research analyzes the influence of motivations and socio-economic factors on WTT for conservation of ecosystem services. We collected 589 questionnaires in the mid-upper stream of the Otún River watershed, Colombia. We found that rural people and those who reported to visit the watershed for recreational purposes, stated a higher WTT for conserving ecosystem services. Age and time restriction negatively influenced the probability of WTT. Further, the variable that measured the balance between self and others-oriented motivations positively influenced the amount of time respondents were willing to give up. We discuss these results in terms of i) how WTT can articulate shared concerns and others-oriented motivations, ii) multiple motivations underlying ecosystem services valuation; and iii) how WTT studies can reflect the importance that rural and low-income people attribute to ecosystem services. We contend that although WTT share some of the limitations of the WTP studies, it represents an alternative valuation method that can i) more effectively integrate others-oriented motivations in environmental valuation; ii) better represent the values of low-income people with limited ability to pay, and iii) promote collective action for ecosystems conservation.

**Keywords:** Dual-motive theory; Environmental motivations; Environmental volunteering; Metaeconomics; Non-monetary valuation; Willingness To Pay; Value orientations

## 6.1. Introduction

Valuation of ecosystem services, i.e. the benefits that ecosystems provide to humans, is increasingly used tool in ecosystems and biodiversity conservation (Daily et al. 2009, MEA 2005). Despite the multiple disciplinary approaches endorsing the notions of environmental values and valuation (Gómez-Baggethun and Martín-López 2015, Kelemen et al. 2014, Pascual et al. 2017), monetary valuations remain the dominant valuation language in ecosystem services research (Arias-Arévalo et al. in press, Chan et al. 2012, Schröter et al. 2014, Vihervaara et al. 2010). Monetary valuation expresses instrumental values of nature by measuring the alleged contributions of ecosystems to individuals' utility (Pearce and Turner 1990). Particularly, the contingent valuation method (Bateman et al. 2002, Carson and Hanneman 2006, Mitchell and Carson 1989, Pearce and Turner 1990) has been widely used to measure the willingness to pay (WTP) for preserving or enhancing the quality and quantity of ecosystem services (Bartkowski 2017, Christie et al. 2012). In WTP studies, respondents are typically framed as *Homo economicus*, where individuals are expected to act as consistently rational and narrowly self-interested agents who pursue to maximize their individual utility (Carson and Hanneman 2005). However, the suitability of WTP measures to capture the importance people attribute to ecosystem services has been put into question, particularly when extended to values that are not articulated from a *Homo economicus* position, such as emotional, inspirational or spiritual values (Arias-Arévalo et al. in press, Gómez-Baggethun et al. 2014). In fact, research shows that many respondents reject WTP questions on the basis of ethical and justice concerns (García-Llorente et al. 2011, Kenter et al. 2011, Spash 2000). Further, that case has been made that WTP risks to underrepresent low-income people because WTP is limited by income, i.e. low-income people express lower WTP than high-income ones because they have less ability to pay (e.g. Abramson et al., 2011; Bandara and Tisdell 2003, Spash et al. 2009, Zhongmin et al. 2003). For these reasons, scholars have warned of using WTP in contexts with relevant ethical and social concerns towards the environment or with income restrictions (Chan et al. 2012, Christie et al. 2012, Baveye et al. 2013, Kenter et al. 2011, Saarikoski et al. 2016).

Some scholars have proposed 'willingness to give up time' (WTT) as a non-monetary valuation method that can overcome key limitations of WTP studies (see García-Llorente et al. 2011, 2016, Higuera et al. 2012, Lankia et al. 2014, Notaro and Paletto 2011, Rai et al.

2015, Schiappacasse et al. 2013, Stallman and James 2015, Tilahun 2009)<sup>7</sup>. This method uses the stated time people are willing to contribute to maintain or restore ecosystem services, as a proxy of the importance (value) people attribute to them (García-Llorente et al. 2011, 2016). Some of these studies have also shown that many? respondents prefer WTT than WTP when expressing their values towards nature (Higuera et al. 2012, Notaro and Paletto 2011). Challenging the premises of WTP studies, WTT do not necessary frame respondents as *Homo economicus* neither as consumers but rather as citizens that behave on the basis of both self-oriented and others-oriented motivations. In fact, research on volunteering for environmental protection i.e. time donation for environmental protection activities) and other civic causes has shown that WTT is primarily motivated by others-oriented motivations (Jones 2006, McDougle et al. 2015, Measham and Barnett 2009, Randle and Dolnicar 2015, Rehberg 2005).

The emerging literature on WTT for ecosystem protection have focused in analyzing the influence of socio-demographic characteristics (i.e. gender, age, education) and environmental attitudes and behaviors on WTT responses (e.g. Casiwan-Launio et al. 2011, García-Llorente et al. 2011, Higuera et al. 2012, Notaro and Paletto 2011, Schiappacasse et al. 2013). However, WTT studies have not yet analyzed the influence of self- (i.e. egoistic) and others-oriented motivations (i.e. altruistic and biospheric). In this research, we analyze the different and often conflicting motivations underpinning WTT for ecosystem services conservation by integrating a dual-motive theory on decision making. The dual-motive theory relies on the assumption that individuals' decision-making is based in both the self-oriented (e.g., egoistic) and the others-oriented (e.g. altruistic and biospheric) motivations (Cory 2006, 2015, Lynne 1999, 2006a, 2006b). The dual-motive theory also states that individuals try to balance self- and others-oriented motivations in decision-making (e.g. Beretti et al. 2013, Sheeder et al. 2011).

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<sup>7</sup> WTT studies have been applied in environmental valuation contexts since the late 90's- (see Echessah et al. 1997) in less developed countries (e.g. Abramson et al. 2011, Casiwan-Launio et al. 2011, Gibson et al. 2015, Tilahun et al. 2015, Vásquez 2014).

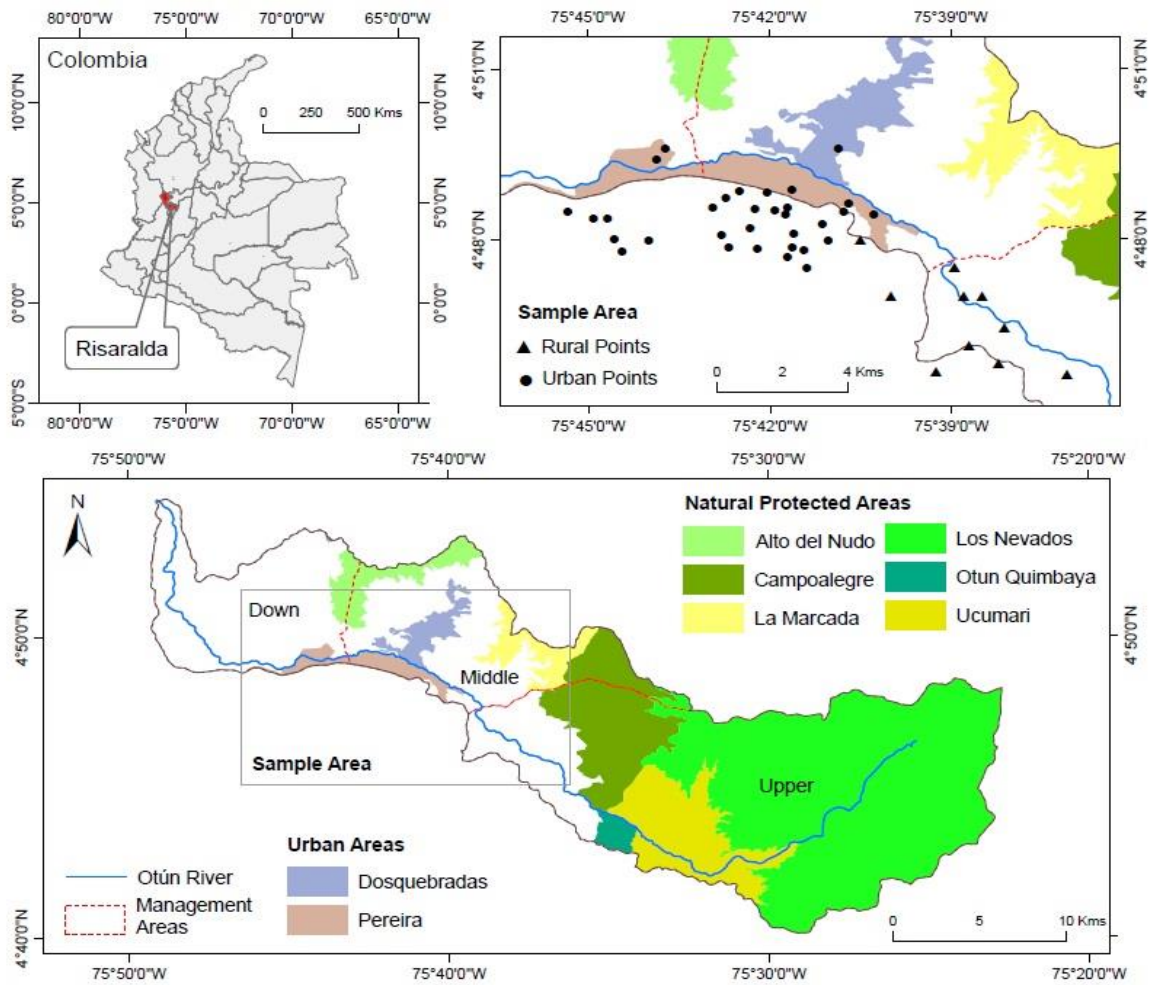


In this study, we analyze motivations and socio-economic factors that influence WTT for ecosystem services protection. Specifically, i) we assess self-oriented (egoistic) and others-oriented (i.e. altruistic and biospheric) motivations shaping stated preferences and values of rural and urban people towards ecosystem services. Second, we assess the influence of the balance of self- and others-oriented motivations, as well as socio-economic factors on the WTT for ecosystem services conservation. This research is motivated by the necessity of i) developing ecosystem services valuation approaches that does not rely on money as the measure to express the multiple ways in which people value nature, ii) considering the plural motivations that exists in the individual when takes decisions, and iii) reflecting the importance that low-income, rural and indigenous people attribute to ecosystem services.

## **6.2. Study Area**

The Otún River watershed is located in the central Andes mountain range, in the state of Risaralda, Colombia (**Figure 6.1**). The watershed has an extension of 480.6 Km<sup>2</sup>. The Otún River rises at 3980 m.a.s.l. in and flows into the Cauca River at 875 m.a.s.l. (CARDER 2008). The watershed hosts 423.130 inhabitants (if you give such an accurate figure you should refer to year census), distributed in the municipalities of Pereira (51.6%) and Dosquebradas (47.5%), Santa Rosa de Cabal (0.5%) and Marsella (0.4%) (CARDER 2017). The Otún River watershed has been considered as a strategic conservation area due to the presence of ecosystems such as paramos, high andean and subandean forests and agroecosystems (CARDER 2008). The Otún River watershed is divided into three main areas: upper- mid- and down-stream areas (**Figure 6.1**). Our research focuses on the mid- and upper-stream, which range from 1400 to 5200 m.a.s.l. The mid- and upper stream of the Otún River watershed provides critically important ecosystem services to local people, such as freshwater, food, habitat for species, climate regulation, hydrological regulation and opportunities for leisure, recreation and aesthetic appreciation.

**Figure 6.1 Study area map and sampling points**



Triangles for rural population and circles for urban population.

### 6.3. Methods

#### 6.3.1. The dual-motive theory and environmental motivations

The dual-motive theory integrates self and others-oriented motivations among the factors that influence environmental decisions (Lynne 1999, 2006a, 2006b). Self-oriented or egoistic motivations are those guided by the maximization of individual interest while others-oriented motivations are guided by the sense of walking-in-others-shoes (Hayes and Lynne 2013). The dual-motive approach rest on the assumption that decisions are not guided only by self-oriented motives but also by empathic motivations towards *others*, which moderate self-oriented motivations. Under this approach environmental intentions and decisions are not only considered as an economic matter but also as a moral one.

The dual-motive theory recognizes that in decision-making contexts individuals may face conflict between motivations. When taking decisions, the individual will be find a disjunctive between what she/he *prefer* and what she/he *should* do (Lynne 1999, 2006b). The resolution of this disjunctive is not a rational choice but a heuristic process which seeks a ‘peace of mind’, that is found in the balance of the self- and others-oriented motivations (Bishop et al. 2010, Lynne, 1999, 2006b). In fact, it has been found that the variable representing the balance of the two motivations has a positive effect on pro-environmental intentions and behaviors (Bishop et al. 2010, Czap et al. 2012, 2015, Kalinowsky et al. 2006, Ovchinnikova et al. 2006, 2009, Sautter et al. 2011, Sheeder and Lynne 2011). In this study, we hypothesize that the balance between self- and others- oriented motivations, positively influences the WTT for ES conservation.

We proxied self-oriented motivations through the measurement of the egoistic motivations and the others-oriented motivation through the measurement of altruistic and biospheric motivations. In environmental psychology research, these three motivations are considered to influence environmental intentions and decisions (de Groot and Steg 2008, 2010, Steg et al. 2011). Egoistic motivations give priority to the maximization of individual gain; altruistic motivations embrace concerns towards other humans, and biospheric motivations extend these concerns to non-human species and the biosphere (**Table 6.1**). For instance, a personal with a high level of self-oriented motivation will prioritize as guiding principles in her/his life the motivation components of social power, influence, ambition, authority and wealth. Environmental psychologists have empirically tested the reliability and validity of motivations and its components (de Groot and Steg 2007, 2008, 2010, Steg et al. 2011). We followed the classification of motivations and components proposed by de Groot and Steg (2008). Respondents were asked to rate the importance of motivations’ components as guiding principles for action on a nine-point scale: -1 ‘contrary to my life motivations’; 0 ‘not at all important’ to 7 ‘of supreme importance’. We measured self-oriented motivations through the average rating of egoistic motivation, whilst others-oriented motivation through the average rating of both the altruistic and biospheric motivations. By integrating biospheric motivations along with altruistic motivations in the measurement of others-oriented, we want to stress that people walk-in- others humans-shoes, but also in nature’s-shoes.

**Table 6.1 Self- and Others-oriented motivations and its components**

**(based on de Groot and Steg, 2008)**

Interest	Motivation	Component	Description
Others-oriented	Biospheric	Preventing pollution	Protecting natural resources
		Respecting the earth	Harmony with other species
		Unity with nature	Fitting into nature
		Protecting the environment	Preserving nature
	Altruistic	A world at peace	Free of war and conflict
		Being helpful	Working for the welfare of others
		Social Justice	Correcting injustice, care for the weak
		Equality	Equal opportunity for all
		Social power	Control over others, dominance
Self-oriented	Egoistic	Influence	Having an impact on people and events
		Ambition	Hard-working, aspiring
		Authority	The right to lead or command
		Wealth	Material possessions, money

The dual motive theory suggests that self- and others-oriented motivations are inseparable and incommensurable in relation to one another (Ovchinnikova et al. 2006). Therefore, the dual motive theory contradicts the assumption of neoclassical economics approach that all human's motives proceed from the self-oriented motive and that they are only means to maximize individual utility (Cory 2015). Scholars supporting the dual-motive theory consider others-oriented motivations as ends in themselves (Cory 2015).

Empirical analysis of how motivations influence decisions usually integrate an interaction term of the self- and others-oriented motivations rather than analyzing these motivations as separate measurements. This interaction term represents that human decisions are based on balancing these two opposite motivations (Ovchinnikova et al. 2006, Sautter et al. 2011). Empirically, this interaction term is measured by multiplying both types of motivations (Sheeder and Lynne 2011). This measurement approach "allows compensating low values of one motive by the high value of another, resulting in a moderate value of the interaction term" (Ovchinnikova et al. 2006:14). In this study, the scale of the egoistic motivation was inverted so that both egoism and altruistic-biospheric motivations could be conceptually evaluated in the same direction (e.g. Czap et al. 2012, Sheeder and Lynne, 2011). The variable used as proxy of the balance that individuals search between self and others-oriented motivations (i.e. motivations balance) was constructed multiplying both the (inverted) egoistic scale and the altruistic-biospheric scale.

### 6.3.2. Data collection

A survey consisting of 589 direct face-to-face surveys was conducted in June and July 2014. A simple random sampling was applied to represent both rural and urban people. Then purposive sampling was conducted in order to select sampling points that covered different urban (33 sample points) and rural (10 sample points) settlements (Figure 1). We selected rural and urban samples because they may develop different nature-based experiences (e.g. food production vs recreation activities), that influence the value of ecosystem services. Six hundred individual questionnaires were conducted, of which 11 were disregarded for not being complete, leaving a final sample size of 589 questionnaires.

The questionnaire consisted of 5 sections. The first section aimed to identify whether the respondent was suitable to fill the survey: older than 16 years old and an inhabitant of the watershed. In the second section, respondents were asked to rate the importance of the motivations of self- (i.e. egoistic) and others-oriented (i.e. altruistic and biospheric) as guiding principles for action. The third section addressed whether the respondent knew the mid and upper stream of the Otún River watershed and collected information about the respondent's activities in the study area (e.g. bathing, hiking, landscape appreciation, or environmental education). In the fourth section we asked respondents about their willingness to spend time in projects preserving ecosystem services. First, respondents were asked through a 'yes' or 'no' question if they were willing to spend time in projects for preserving ecosystem services in the mid- and upper-stream of the Otún River watershed. These projects included: agroecology, agroforestry and reforestation programs, promotion of local ecological knowledge, waste collection and isolation of streambanks, wildlife trade control, environmental education and ecotourism, and community associations support. Each of these projects was associated with the maintenance of particular ecosystem services (**Table 6.2**). Respondents were also asked to provide an estimation of the distribution of time in daily activities (i.e. paid and unpaid work, personal activities, education, transportation, leisure activities), in order to estimate their daily time available. Then, respondents were asked to state the number of hours per week that they were willing to spend in those projects for conserving ecosystem services. Whilst the 'yes' or 'no' question resulted in the first dependent variable (hereafter WTT\_Yes), the amount of time stated by the respondents comprised the second dependent variable (hereafter WTT\_Hours). The fifth and final section

included questions of the respondents' socio-economic characteristics such as employment status, personal and household income or education level. Appendix 1: presents the questionnaire used in this research.

**Table 6.2 Prioritized ecosystem services in the mid-upper stream of the Otún River watershed and related projects for their conservation**

<b>Ecosystem Services</b>	<b>Related Projects</b>
Biodiversity Refugee	Control and education of wildlife trade
Ecotourism, Recreation and scenic beauty appreciation	Demarcation and signaling of trails and roads; support the project of sustainable tourism in the mid-upper stream of the Otún River watershed
Environmental education and research	Support local ecological groups
Food	Promotion of agroecology, peasants markets and care and exchange of seeds
Local ecological knowledge	Support of community based associations working with local ecological knowledge (medicinal plants, agroecology)
Maintenance or improvement of drinking water quality	Reforestation programs; support of community associations on the treatment of domestic wastewater
Prevention and mitigation of flooding, torrentiality, landslides, avalanches	Reforestation of streambanks
Quality of air; micro and global climate regulation	Reforestation programs
Soils (soil formation and fertility, nutrient fixation and cycle)	Agroforestry programs
Water regulation	Reforestation of streambanks

### 6.3.3. Data Analysis

A factor analysis and a Cronbach's alpha were applied to assess the internal consistence of self-oriented motivation (i.e. egoistic) and others-oriented (i.e. altruistic-biospheric) motivations. The reliability (i.e. internal consistency) of each motivation group was estimated through the Cronbach's alpha. Then, differences between rural and urban population regarding the average rating of self- and others-oriented were explored through the non-parametric U-Mann-Whitney test.

We carried out a Heckman selection model to determine which factors influence WTT for ecosystem services maintenance. The factors that influence WTT for ecosystem services maintenance were analyzed through a. We chose a Heckman selection model because the analysis of WTT may imply a sample selection bias. This means that the number of hours

that a person is willing to spend (i.e. WTT\_Hours) is only observed when respondents provided a positive response to the binary question of WTT (i.e. WTT\_Yes). It has been argued that the factors that influence a negative response to the binary question are endogenous and are not the result of a bias in data collection. Therefore, WTT\_YES should be modeled first and then the number of hours a person is willing to spend (i.e. WTT\_Hours) (Jones, 2006). To do so, we conducted Heckman selection model (Heckman 1979), which has been used in former WTT studies for ecosystem services valuation (García-Llorente et al. 2016, Higuera et al. 2012). We selected the best model using the Akaike's information criteria -AIC (Akaike 1974). We transformed the continuous independent variables (i.e. age and time restriction) as well as WTT\_Hours by applying the natural logarithm in order to avoid heteroscedasticity and non-normality problems (Cameron and Trivedi 2010).

## **6.4. Results**

### **6.4.1. Sample Characteristics**

Of the total sample, 58.7% of respondents were women (n = 346) and 41.2% were men (n=243). Two hundred and twenty-four surveys (38%) were collected in rural areas and 365 (62%) in urban areas. The average age of the respondents was 39 years old (standard deviation, SD=16.2). The majority of the respondents (59.1%) stated to have primary or high school education. Of the total sample, 60% of the respondents (n = 356) expressed that they were willing to give up time in ecosystem services conservation projects. In average, respondents were willing to give 1.92 (SD=2.28) hours per week. Within the group of respondents that were willing to give up time for ecosystem services conservation (WTT\_Yes =1), the stated mean of WTT\_Hours was of 3.17 hours (SD=2.15). **Table 6.3** presents the main descriptive characteristics of the total sample, as well as rural and urban respondents.

**Table 6.3 Descriptive statistics of the sample population. Socioeconomic and WTT variables are presented for rural, urban and the total sample (n=589)**

		Total sample		Rural		Urban	
Description		Mean $\bar{x}$ (SD)	% (n)	Mean $\bar{x}$ (SD)	% (n)	Mean $\bar{x}$ (SD)	%(n)
<i>Socio-economic variables</i>							
Age	Age in years	39.43 (16.6)	-	41.17 (16.92)	-	38.36 (15.6)	-
Employed	Dummy variable: employed, yes=1, no=0	-	54% (319)	-	18% (107)	-	36% (212)
Income*	Individual income in \$USD	185.9 (332.7)	-	140.68 (177.6)	-	217.60 (220.8)	-
Years of education	Number of years	9.8 (4.2)	-	7.64 (4.16)	-	11.25 (3.7)	-
Scenic beauty	Dummy variable: visits to enjoy the scenic beauty, yes=1, no=0	-	51% (298)	-	23% (136)	-	28% (162)
Rural	Dummy variable: living in rural area=1, urban=0	-	38% (224)	-	100% (224)	-	0% (0)
Time restriction	Number of hours used per day	22.2 (2.6)	-	21.66 (2.9)	-	22.48 (2.3)	-
Women	Dummy variable: women=1, men=0	-	59% (346)	-	22% (132)	-	36% (214)
<i>WTT variables</i>							
WTT_Yes	Dummy variable: Willing to give up time, yes=1, no=0	-	60% (356)	-	26% (152)	-	35% (204)
WTT_Hours	Number of hours willing to spend per week	1.92 (2.28)	-	2.41 (2.45)	-	1.61 (2.12)	-
WTT_Hours if WTT_Yes =1	Number of hours willing to spend when positive WTT_Yes	3.17 (2.15)	-	3.56 (2.18)	-	2.88 (2.08)	-

\* Calculated based on the exchange rate of April 2016: \$3003 COP= \$1USD

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#### 6.4.2. Environmental motivations across rural and urban population

Overall, the self-oriented motivation ( $\bar{x}$ = 4.25; SD=1.39) was rated lower than the others-oriented motivation ( $\bar{x}$ = 6.39; SD=0.77). All the components of the others-oriented motivation were rated with a higher value than 6, which corresponds to a very high level of



prioritization (Table 4). Across the components of the self-oriented motivation, respondents rated ‘ambitious’ as the most important principle ( $\bar{x}= 5.45$ ;  $SD=2.06$ ), whereas ‘social power’ was rated as the less important one ( $\bar{x}= 2.50$ ;  $SD=2.72$ ). Across the components of the others-oriented motivation, ‘protecting the environment’ was the highest rated component by respondents ( $X=6.51$ ;  $SD=1.00$ ), whereas the less prioritized component was social justice ( $X=6.17$ ;  $SD=1.25$ ) (Table 4). The Cronbach's alphas revealed that the two environmental motivations were internally consistent (i.e. self-oriented:  $\alpha= 0.60$  and others-oriented:  $\alpha= 0.85$ ).

The U-Mann Whitney tests showed significant differences of environmental motivations between rural and urban respondents. Rural respondents rated the others-oriented motivation and its components higher than the urban ones (Table 6.4). Regarding the self-oriented motivation, no significant difference was found between rural and urban population. However, statistical differences were found for the components of ‘ambition’ and ‘influence’ which were rated higher by rural people (Table 6.4).

The mean of the variable of motivations balance was 10.91 ( $SD=8.69$ ). The mean of the motivations balance was higher for the urban respondents (11.06;  $SD=8.821$ ) than for rural respondents (10.66;  $SD=8.49$ ), although we did not find statistical differences (Table 6.4).

**Table 6.4 Environmental motivations across the total, urban and rural sample**  
 (\*\*\*) = p-value < 0.01; \*\*= p-value < 0.05; \*= p-value < 0.1 )

Motivation	Total Sample		Rural		Urban		U de Mann-Whitney	p-value
	Mean	SD	Mean	SD	Mean	SD		
<i>Self-oriented</i>	4.255	1.389	4.376	1.301	4.181	1.436	37738	
Social power	2.500	2.721	2.438	2.817	2.538	2.664	39516.5	
Influence	4.819	2.082	5.343	1.900	4.498	2.126	30487	***
Ambition	5.454	2.065	5.652	2.116	5.333	2.026	35096	***
Authority	4.439	2.035	4.444	2.059	4.436	2.023	40665	
Wealth	4.065	1.977	4.004	1.916	4.102	2.015	39385	
<i>Others-oriented</i>	6.393	0.771	6.632	0.594	6.246	0.830	28483.5	***
<i>Biospheric</i>								
Preventing pollution	6.487	1.021	6.679	0.963	6.370	1.039	32596.5	***
Respecting the earth	6.495	1.013	6.703	0.874	6.367	1.070	32834.5	***
Unity with nature	6.385	1.143	6.671	0.891	6.209	1.242	32083	***

Protecting the environment Altruistic	6.515	0.997	6.723	0.855	6.388	1.057	32251	***
A world at peace	6.505	1.032	6.739	0.801	6.362	1.129	33140.5	***
Being helpful	6.228	1.200	6.461	1.028	6.085	1.276	33801	***
Social Justice	6.170	1.252	6.488	0.961	5.976	1.366	31860.5	***
Equality	6.357	1.248	6.589	0.924	6.214	1.393	34534.5	***
Motivations Balance	10.906	8.693	10.658	8.494	11.058	8.821	39736	

### 6.4.3. Two-step Heckman model

The selected model for explaining WTT according to the AIC was:

$$WTT\_Yes = \gamma_0 + \gamma_1 Motivations\_balance + \gamma_2 Scenic\_beauty + \gamma_3 Rural + \gamma_4 Age + \gamma_5 Time\_restriction + u_2 \quad Eq.(1)$$

$$WTT\_Hours = \beta_0 + \beta_1 Motivations\_Balance + \beta_2 Scenic\_beauty + \beta_3 Rural + u_1; \text{ if } WTT\_YES > 0 \quad Eq.(2)$$

The results of the Heckman model evidenced the sample selection bias. The Rho statistic (-0.284) showed that the correlation between the error terms of the selection equation and the ordinary least squares (OLS) equation is different from 0 (**Table 6.5**). The inverse Mills ratio is significant ( $p$ -value < 0.05) supporting the hypothesis of selection bias in the decision of WTT for ecosystem services conservation projects in the mid and upper streams of the Otún River watershed.

**Table 6.5 Heckman model results for willingness to give up time (WTT) for conservation of ecosystem services.**

\*\*\* = p-value < 0.01; \*\* = p-value < 0.05; \* = p-value < 0.1. Standard deviations were estimated with bootstrap.

	Probit WTT_Yes		OLS WTT_Hours		
	Observed Coefficient	***	Bootstrap p SD	Observed Coefficient	Bootstrap SD
Constant	22.55171	***	1.73227	0.8020319	*** 0.0740957
Motivations Balance	0.0062069		0.0074005	0.0070837	** 0.0033977
Scenic Beauty	0.3319168	***	0.104936	0.1615727	*** 0.0577492
Rural	0.2134126	*	0.1212253	0.1837806	*** 0.0590284
Age (Ln)	-	***	0.1481918	-	-
Time Restriction (Ln)	-6.166133	***	0.524575	-	-
N	589			356	
Log-Likelihood	-			-317.6266	
Chi-squared	319.26834	***			
Pseudo R-squared	152.11				
% of correct predictions	0.1924				
AIC	68.93%			643.2531	
Heckman:	650.5367				
Wald chi-squared	30.16	***			
Mills	-	**	0.083134		
Rho	0.1701556		1		
	-0.28427				

In the selection equation, the appreciation of the scenic beauty of the mid-upper stream watershed (scenic beauty; p-value < 0.01) and living in rural areas (rural; p-value < 0.1) had a positive influence in the probability of giving up time in ecosystem services conservation projects. On the other hand, age (p-value < 0.01) and daily individual time restriction (p-value < 0.01) had a negative influence on the probability of giving up time (**Table 6.5**). In the OLS equation, the appreciation of the scenic beauty of the mid-upper stream watershed (scenic beauty; p-value < 0.01) and the balance of self and others-oriented (motivations balance; p-value < 0.05) had a positive and significant influence in the number of hours a person is willing to give up for ecosystem services conservation projects in the mid and upper stream of the Otún River watershed (**Table 6.4**).

## 6.5. Discussion

### 6.5.1. Methodological reflections of willingness to give up time

In this study, 60% of the respondents were willing to give up time in projects for ecosystem services maintenance (**Table 6.3**). This result is consistent with other studies showing that the majority of respondents accept to reveal their willingness of spending time in projects for preserving ecosystem services (García-Llorente et al. 2016, Higuera et al. 2012, Notaro and Paletto 2011, Rai et al. 2015, Schiappacasse et al. 2013). However, WTT studies should also acknowledge the possible bias between reported intentions and actual behavior, which has been widely discussed in WTP studies (Ajzen et al. 2004, Loomis 2011, Murphy et al. 2005). To reduce this bias, future WTT studies could analyze the actual time spent by individuals in ecosystem services conservation activities.

Over recent years, researchers have used WTT as an alternative approach to WTP (García-Llorente et al. 2011, 2016, Higuera et al. 2012, Schiappacasse et al. 2013). One important shift from WTT to WTP is the intended abandonment of money as metric of value. When scholars use WTP for valuing nature they are framing nature as a commodity (Gómez-Baggethun and Ruiz-Pérez 2011). By contrast, WTT studies use the time people are willing to spend in ecosystem services conservation. This alternative framing may have relevant influence on the valuation outcome. For example, experimental research in psychology found that when people think in money, they act more individualistic and show less pro-social behavior (Vohs 2015, Vohs et al. 2006). By contrast, when people think in terms of time, they feel more socially bonded and are more likely to show pro-social behavior (Liu and Aaker 2008, Mogilner 2010, Mogilner and Aaker 2009). In this sense, WTT may articulate values related to social concerns, such as relational values (Chan et al. 2016) or shared values (Kenter et al. 2015). Consequently, WTT for ecosystem services conservation might not represent the value of nature as a commodity but as a shared concern.

### **6.5.2. Influence of motivations on WTT for ecosystem services conservation: recognizing the moral dimension of environmental intentions and behaviors**

The variable used as proxy of the balance that individuals search between self and others-oriented motivations (i.e. motivations balance) had a positive and significant influence on the number of hours a person is willing to spend for ecosystem services conservation (Table 4). This result supports other studies showing the positive influence of the motivations balance on recycling behavior, farmers' conservation behavior and adoption of environmental technology (Bishop et al. 2010, Kalinowsky et al. 2006, Ovchinnikova et al. 2006, Sautter et al. 2011, Sheeder et al. 2011). In this study, the significance of the motivations balance indicates that WTT for ecosystem services conservation is not only a decision associated with the opportunity cost and time available, but also a moral one. Indeed, research on environmental volunteering has found that time donation decisions are influenced by both self- and others-oriented motivations. Self-oriented motivations include achieving personal realization (Rehberg 2005) or acquiring work experience (Omoto et al. 2000). Motivations related to others-oriented are related to improving social wellbeing (Rehberg 2005) and restoring ecosystems (Handelman 2013). The analysis of motivations in WTT studies can highlight the plurality of motivations behind environmental intentions and behaviors. In traditional WTP studies, motivations have been treated as individual utility maximization. As Carson et al. (2001, pp. 7) stated "it is utility whatever its source that matters for total [economic] value. Motives are essentially irrelevant and acceptance of consumer sovereignty is one of the most enshrined principals of economics".

By accounting the plural motivations that influence values, scholars can pave the way towards designing a plural set of instruments for ecosystem services conservation. As Sautter et al. (2011, pp. 144) expressed: "We cannot separate the motives, nor can we separate the policy considerations related to these motives". For example, management institutions could encourage collective action by establishing programs where people invest time in ecosystem services conservation, and thus articulate others-oriented motivations (altruistic and biospheric). In fact, collective action for the provision of public services was an important social institution (called *convites*) during the first half of the 20th century in the Otún River watershed. These *convites* were used to build the aqueduct, the railroad or the church in Pereira (Angel 2014). More recently, the public water company of Pereira (*Aguas y Aguas*)

promoted the restoration of rivers through applying *convites* (El Tiempo 2008). The promotion of *convites* for ecosystem services conservation can represent the operationalization of WTT valuation studies, which seem to be less contentious than operationalizing WTP in payments for ecosystem services. In fact, payments for ecosystem services have raised ethical concerns regarding the commodification of ecosystem services and equity issues (Gómez-Baggethun and Ruíz-Pérez 2011, Pascual et al. 2014).

### **6.5.3. Influence of socio-economic factors on WTT for ecosystem services conservation**

Our results show that age and time restriction negatively influence the probability of supporting WTT for ecosystem services conservation (WTT\_Yes) (**Table 6.5**). Time restriction has been included in some WTT studies for ecosystem services conservation and have shown a negative influence on WTT (García-Llorente et al. 2011, Schiappacasse et al. 2013). The negative effect of age on WTT found in this study and formerly (e.g. Casiwan-Launio et al. 2011, García-Llorente et al. 2011, Higuera et al. 2012, Lankia et al. 2014, Schiappacasse et al. 2013) may be due to the physical work that ecosystem services conservation activities involve (Ahlheim et al. 2010). Accordingly, ecosystem services valuations through WTT should be transparent in recognizing and including social groups that are marginalized when expressing ecosystem services values through a time metric (e.g. women, elderly people or people with high time restrictions). Therefore, some limitations should be raised here because WTT can result in lower values for these social groups. For example, although women tend to show stronger environmental concern and behaviors (Eisenberg 2002, Gilligan 1982, Schultz 2001, Stern et al. 1993), women are willing to give up less hours than men (Ahlheim et al. 2010, Casiwan-Launio et al. 2011, Das and Mahanta 2013, Echessah et al. 1997, Notaro and Paletto 2011, Medina and Arche 2015, Tilahun et al. 2015, Vondolia et al. 2011). This situation illustrates how valuation methods frame not only the conception of what is of value but also who can value.

Those who visited the mid-upper stream of the Otún River watershed to enjoy its scenic beauty present a higher probability of giving up time and a higher number of hours that are willing to give up for ecosystem services conservation (**Table 6.5**). This result supports other studies showing a higher WTT when respondents has a previous relation with the ecosystems or ecosystem services at stake (Casey 2004, Casiwan-Launio et al. 2011, Das and Mahanta

2013, García-Llorente et al. 2011; Lankia et al. 2014, Notaro and Paletto 2011). Experiences in nature have been proved to be positively related to environmental concerns and behavior (Clayton et al. 2016). Therefore, promoting ecotourism or other nature-based experiences, may reconnect people relations with nature and influence the way people perceive and value them.

Finally, rural people presented a higher probability of giving up time and also a higher number of hours that are willing to spend than urban ones (**Table 6.5**). This result was also found in other WTT studies of ecosystem services (García-Llorente et al. 2011, Higuera et al., 2012). Rural people have shown more participation in environmental volunteering than urban ones due to their felt responsibilities towards the environment and the community (Haski-Leventhal et al. 2008, Knoke et al. 1998, Ziemek 2006). The fact that rural people are willing to spend more time in conservation projects is an outstanding result. In WTP studies rural people generally are WTP less amount of money than urban ones (e.g. Abramson et al. 2011, Bandara and Tisdell, 2003, Spash et al. 2009, Zhongmin et al. 2003). This study demonstrates that WTT studies are suitable to embrace the perspective that poor or margined groups seek to protect the environment usually by deploying other valuation languages beyond monetary ones (i.e. ‘the environmentalism of the poor’; Martinez-Alier 2002). Because is not inherently related to income distribution, this method might contribute to future research on ecosystem services valuation by eliciting the importance of nature beyond monetary metrics.

## **6.6. Conclusions**

Although sharing some limitations with contingent valuation related with the differences between stated intentions and actual behavior, WTT represents an alternative valuation method that can contribute to the valuation of ecosystem services in at least xx novel ways. First, by using time instead of money, WTP frame ecosystem services conservation as a shared concern. Therefore, WTT studies are suitable in socio-cultural contexts in which others-oriented motivations are salient. Second, WTT studies do not place the multiple motivations that influence environmental concerns and behavior under the supremacy of self-oriented motivations and the maximization of individual utility (often assumed in WTP studies). In this research, we found that WTT intentions are influenced by the balance that

individuals search in their self- and others-oriented motivations. Finally, we show that WTT may not be inherently related to income distribution, this is important because many ecosystem services are not valued as commodities but as conditions for surviving and good quality of life.

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## **CHAPTER 7 General discussion and conclusions**

In this chapter I will discuss the main findings of this dissertation and draw overarching conclusions. This section is structured as follows. First, I present the contributions to plural ES and Nature valuation. These contributions are presented under the three research questions of this research. Second, I summarize these contributions by presenting a proposal of the ontological, epistemological and normative assumptions of plural ES valuations under an Ecological Economics perspective. Third, I discuss general methodological reflections. Fourth, I propose avenues of future research. Finally, I present the general conclusions of this dissertation.

## **7.1. Contributions to plural ES valuations: An Ecological Economics approach**

### **7.1.1. How ES valuations can recognize and incorporate multiple human-nature relationships, value notions, and valuation methods?**

ES valuations have traditionally focused on revealing ES and Nature monetary values (Vihervaara et al. 2010, Seppelt et al. 2011, Abson et al. 2014, Gómez-Baggethun et al. 2014). In the last years, ES scholars have developed analytical and conceptual frameworks to integrate the multiple values of ES and nature beyond monetary ones (e.g. Chan et al. 2012, Kenter et al. 2015, Pascual et al. 2017, Tadaki et al. 2017). In Chapter I I contribute to this effort by providing a taxonomy of value notions (e.g. principles, intrinsic value, monetary value), value domains stemming from plural human-nature relationships (e.g. intrinsic, relational and instrumental values) and valuation methods (e.g. monetary and non-monetary valuation methods). Chapter 1 advances in the field of ES plural valuation by depicting the ontological, epistemological and ethical features of the endeavor of integrating plural values in ES valuation. Precisely, this contribution has been identified as a fundamental challenge for ES valuations in order to mainstream value pluralism in ES valuations (Hejnowicz and Rudd 2017). Chapter 1 can aid ES practitioners in reflecting how the value notions and methods they choose are positioned in relation to value pluralism and incommensurability.

One of the current challenges of ES valuations is to combine multiple disciplines to obtain more comprehensive valuation results (Jacobs et al. 2016). This dissertation contributes to identify a set of disciplinary value definitions that can be integrated in ES valuation (**Table**

**4.1).** I further contribute to empirically show how multiple disciplinary value definitions can be integrated in the practice of ES valuation. In Chapter 5, I use the i) notion of value in Ecological Economics as the different ways in which nature is important for people from (O’neill et al. 2008, Arias-Arevalo et al. in press), ii) value domains (i.e. intrinsic, relational, instrumental) from Environmental Ethics (Muraca 2011) and iii) environmental motivations from Social and Environmental Psychology (de Groot and Steg 2008, 2010). This multi-disciplinary approach provided a rich picture of the plural values attributed to ES and Nature.

A further challenge in ES valuation is to integrate plural values beyond instrumental values, including relational and intrinsic values (Chan et al. 2016, Muraca 2016, Batavia and Nelson 2017, Pascual et al. 2017, Piccolo 2017). This dissertation contributes to the integration of intrinsic, instrumental and relational values by providing examples of their articulated values (**Table 4.2**) and an empirical exploration of such values (Chapter 5). To my knowledge, Chapter 5 is one of the first empirical valuation exercises using the three notions of intrinsic, instrumental and relational values. The empirical insights presented in Chapter 5 are relevant if we take in account that IPBES have endorsed the notions of intrinsic, relational and instrumental values and will promote its use in cross-national valuations exercises (Díaz et al. 2015, Pascual et al. 2017).

An interesting result of Chapter 5 was that relational values were the most frequently mentioned value domain by the respondents of the mid-upper stream of the Otún River watershed (**Figure 5.3**). In Chapter 5 I also discussed how the weak integration of the relational values of rural people in environmental management approaches has contributed to a historical environmental conflict between rural people and management institutions. These results support the recent call of ES scholars of mainstreaming relational values in ES valuations and management (Jax et al. 2013, Chan et al. 2016, Muraca 2016, Pascual et al. 2017, Tadaki et al 2017).

A significant contribution to the ES valuation practice was to explicitly delineating the ontological differences between relational values and instrumental values (Chapter IV and Chapter V). Relational values have been wrongly classified as instrumental values due to their anthropocentric nature (e.g. Justus et al 2009). I argue that this conflation prompts the use of monetary valuations and obscures the meaning and importance attributed to ES and



nature under a relational value frame.

Finally, this dissertation identifies a broad set of methods that can be used in ES and nature valuation, beyond monetary ones (**Table 4.3**). In Chapter 4, I provided insights on how to reflect on the assumptions of valuation methods through broadly classifying them along how they define ‘value’ (i.e. monetary and non-monetary) and how value is constructed and held (i.e. individually or socially). Furthermore, ES scholars have highlighted the priority of developing non-monetary valuation approaches to capture values beyond monetary and instrumental ones (Kelemen et al. 2014, Jacobs et al. 2016, Hejnowicz and Rudd 2017). In this dissertation I contribute in this regard by developing a novel mixed-method valuation approach in which quantitative and qualitative methods were combined (Chapter 5 and Chapter 6)

### **7.1.2. How the socio-cultural context influences the attribution of plural values of ES and Nature?**

In this dissertation I specifically explore the influence of socio-cultural context in terms of how socio-economic factors and environmental motivations influence the expression of values. In chapters 5 and 6 I provided evidence that socio-economic factors (e.g. place of residence, age, education) and environmental motivations (e.g. egoistic, altruistic, biospheric) influences the attribution of values (**Table 5.5; Table 6.5**). One of the current priorities of ES valuations is to include the multiple worldviews, interest and values of social actors that are usually hidden in traditional monetary valuations (Kenter et al. 2011, Jacobs et al. 2016). In this dissertation I found that rural people expressed salient environmental values: in relation to urban respondents, rural ones gave a higher prioritization to altruistic and biospheric motivations (Table 5.3), mentioned more frequently intrinsic and relational values (**Table 5.5**) and were willing to spend more time in ES protection (**Table 6.5**). Providing attention to the usually hidden and non-monetary valuation languages of social groups that are excluded from monetary valuations, is a necessary step towards enhancing value pluralism in ES valuation.

Further, this research provided evidence that environmental motivations are a significant sociocultural dimension underpinning environmental values (**Table 5.5; Table 6.5**).

Although the relevance of environmental motivations for the understanding values, they have been scarcely applied in ES valuation (but see Hicks et al. 2015, Raymond and Kenter 2016). Scholars have stressed that one of the current challenge of ES valuations is to identify the underlying basis of people values and behavior as a Hejnowicz and Rudd (2017). As this dissertation show, the research on motivations contributes to highlight the people relate with Nature mediated through multiple motivations, which in turn influences the expression of plural and often conflicting values.

Scholars have stressed that ES valuations that rely on self-interest as the mains motivation fail to capture the complexities of human's decision- making (Parks and Gowdy 2013). Therefore, a new frontier in ES and nature valuation is to recognize the social nature of values (Parks and Gowdy, 2013) There have been relevant advances in this front through the field of non-monetary valuation and deliberative monetary valuation (Howarth and Wilson 2006, Kenter et al. 2011, Gómez-Baggethun et al. 2014, Kelemen et al. 2014, Kenter et al. 2016). Chapter 5 and 6 contributes to this line of research by departing from self-interest (e.g. egoism) as the main human motivation, and by acknowledging multiple motivations including biospheric and altruistic ones.

### **7.1.3. How do different valuation methods frame valuation outcomes?**

Reflexivity on the valuation practice and the role of researchers “still one of the missing cornerstones in ES valuation” (Jacobs et al. 2016: 215). In this dissertation I empirically explore how the methods of narratives (Chapter V) and WTP for ES protection (Chapter VI) frame the valuation outcomes. In the narrative valuation method, ‘value’ was defined as the multiple ways in which ES and nature are important for people (Chapter 4). Instead of asking about the importance of particular ES (which are anthropocentrically framed), I asked about the importance of ‘ecosystems’ and ‘landscapes’ of the mid-upper stream of the Otún River watershed. This framing allows respondents to express anthropocentric (instrumental and relational) and non-anthropocentric values (intrinsic). These results supports that plural values can be integrated in ES valuations by using narrative valuation methods and by relying on other concepts and scales of nature (e.g. landscapes, territory, ecosystems). Rather than adapting the complexity of the multiple values attributed to Nature in a purely anthropocentric and instrumental framework (e.g. asking for WTP), ES valuations should be

flexible enough to reflect the plural, complex and placed-based nature of values.

In the case of the WTT valuation method, ‘value’ was proxied as the time people are willing to donate for ES protection. Although this method captures the values of rural people, it also restricted elderly and people with time restrictions to express a higher WTT (**Table 6.5**). As highlighted in Chapter 6, ES valuations should also reflect on how valuation methods frames who can value in order to integrate all the voices and values at stake. Towards this end, WTT and other ES valuation methods (e.g. preference rankings) can be combined with a narrative valuation approach (e.g. Chapter V) or deliberative methods.

#### **7.1.4. Proposal of pre-analytical positions for plural ES valuations from an Ecological Economics approach**

Since recent developments, ecological economics have called to take a critical look to the pre-analytical positions that frames our relations with nature (Martinez-Alier and Muradian 2015). Pre-analytical positions (the glasses through which we enter the world) reflect a *system of values* that determine the way we cognitively interpret the world. I therefore consider important to synthesize in this discussion the pre-analytical positions of plural environmental valuation under an Ecological Economics perspective (**Table 7.1**). Some of these pre-analytical positions have been addressed in this dissertation while other were outside of the scope of this research. **Table 7.1** contrast the pre-analytical positions of environmental valuation in Ecological Economics to the ones of Neoclassical Economics monetary valuations. These pre-analytical positions may be subject of debate. However, I hope this synthesis can be useful for mainstreaming ES valuations as value articulating institutions with embedded positions on sustainability, justice and ethics (Farley 2012). In these sense ES and Nature valuations can be also considered as political projects on sustainability.

**Table 7.1 Pre-analytical positions on ES and Nature valuation: Ecological Economics and Neoclassical Economics Perspectives**

	Ecological Economics	Neoclassical Economics
<i>Nature of reality, humans and values</i>		
Nature of reality	Embedded systems: (i.e. economy embedded in the social system and the social system embedded in the biophysical one)	Independent systems. Focus on the economic system.
Hierarchical organization of systems	Economy and social systems are bounded by biophysical constrains	Economy can growth infinitely without any social or biophysical constrains
Value pluralism or value monism?	Plural and often conflicting values, non-reducible to each other nor to an ultimate value (pluralism)	All values in the world are means to achieve the ultimate value of utility (monism)
How values are related?	Values can relate to each other in relations of coexistence, synergy or conflict	Values can be clearly ordered in terms of utility gains
Where does value resides?	Relational space between the subject and object of valuation	Individuals attribute values to entities (subjective approach)
Universal or placed based values?	Context-and place based values	Comparable across different contexts
Meaningful aspirations for human existence	Flourishing	Pleasure-seeking, consumerism
Nature of human wellbeing	Plural-dimensional wellbeing (health, knowledge, subsistence, aesthetic enjoyment)	Mono-dimensional wellbeing: Economic welfare
Human motivations	Self- and others-oriented motivations	Self-interest
Definition of Nature values	Multiple ways in which nature is important for people, emerging from the multiples ways of engaging with nature	The monetary measure of the strength of the preference for a marginal change of the quantity or quality of environmental goods and services
Value of the non-human world	Considered as end in-it-self; moral obligations to the non-human world	Subjective to human preferences; a matter of ‘tastes’

Kind of Human nature relationships	<ul style="list-style-type: none"> <li>• Moral duties towards nature on the basis of its intrinsic value</li> <li>• Fundamental relations for ecological and social resilience (e.g. ecological integrity; identity)</li> <li>• Relations constituting the notion of a good life (e.g. aesthetic enjoyment)</li> <li>• Instrumental relations (means to ends)</li> </ul>	Instrumental relations (means to ends)
How values are constructed	Social institutions construct and frame values but individuals and social groups have also the agency to shape values	Individually
How value are held and expressed?	Individually and socially	Individually

### ***Knowledge and decisions about values***

Knowledge systems and values	Values are embedded in knowledge systems; assessing values implies integrating the multiple knowledge systems at stake	Scientific approach is value-free and is able to elicit values objectively. No focus on integrating multiple knowledge systems
Metaphors for framing nature	Multiple metaphors representing multiple knowledge systems (e.g. Nature, ecosystem services, ecosystems, biodiversity, Mother Earth, Territory, Landscape)	Commodity metaphor
Role of the researcher	Value framer, value constructor	Impartial observer
How to elicit values?	Plural disciplines and methods coherently integrated under pre-analytical positions	Monetary valuation methods
How social values can be elicited?	Deliberation, social institutions and norms	Aggregation of individuals values (e.g WTP)
Commensurability of values	Incommensurability of values	Strong commensurability trough the measurement rod of money
Value measures required for decision making	Multiple measures representing the plural values at stake	All value measures (e.g. health impacts) are translated to a monetary value measure (monetary cost of health impacts)
How to orient decision-making	Public deliberation supported on multi-criteria decision making or future scenarios design	Cost-Benefit analysis
Focus of decision making:	Recognition of value conflicts, losers and winners	Net economic benefits, decisions are framed as a social winning scenario
Policy recommendations	Plural instruments (i.e. policy mix) according to plural values and motivations	Economic incentives and market based instruments

### ***Normative positions***

General	<p>Researchers reflexivity and transparent communication of the valuation framing</p> <p>Give voice to valuation languages of less-powerful groups</p>	Consider valuations as objective and not normative
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	Consider biophysical valuations as fundamental for recognizing biophysical boundaries and to protect the life-support system.	
	Attention to inequity between, within and across social groups	
	Uphold democratic principles of fairness and justice, including international human rights and protection of the innocent from harm	
	Promotes autonomy, self-determination and participatory decisions	
	Used when is required in the decision contexts and not as silver-bullet	
Normative positions regarding monetary valuation	It will not dominate, suppress or obscure other valuation languages	Consider valuations as objective and not normative
	It will likely improve environmental conditions	
	It will reduce inequality and redistribute power	
	It will not serve to process of enclosure of the commons or raise ethical concerns of ES commodification	

Source: Author based on insights of this dissertation and from insights of Vatn 2005, 2009, Martinez-Alier et al. 1998, Wegner and Pascual 2011, Luck et al. 2012, Spash 2012, Jax et al. 2013, Kallis et al. 2013, Martín-López et al. 2014, Gómez-Baggethun and Martín López 2015, Kenter et al. 2015, Martinez-Alier and Muradian 2015, Jacobs et al. 2016, Muraca 2016.

## 7.2. General methodological reflections

The methodological approach used in this dissertation have some limitations and caveats that deserve attention. First, the classification of value notions, value domains, articulated values and valuation methods in specific taxonomies (Chapter 4 and 5) reduces the complex relations and blurred boundaries across these notions. However, I used these classifications with the goal of facilitating the operationalization of a plural and multidisciplinary approach to ES valuation. Second, I elicited ES and nature values with individual surveys therefore they may not represent negotiated and collective agreements on values. Valuation outcomes from methods with individual consultation, such as the ones applied in this dissertation (**Table 4.3**) can be integrated in participative and deliberative process in order to frame them as collective values (e.g. Kenter et al. 2016). Third, the quantitative measurement of a limited set of environmental motivations may not capture the broad range of motivations relevant to socio-cultural context at stake (Tadaki et al. 2017). Further, the measurement of motivations through pre-determined statements can contrast with the way people may prefer to express

a particular motivation (Tadaki et al. 2017). These limitations can be addressed by using qualitative methods for eliciting environmental motivations (e.g. focus groups, interviews deliberative methods). For instance, the quantitative measurement of motivations conflicts and balance (Chapter 6) can be supported with focus groups in which people can reflect about how they resolve conflicts between motivations.

Significant methodological contributions of this dissertation can also be underlined. First, Chapter 5 provides a novel way of combining qualitative and quantitative methods. By coding narratives in ‘articulated values’ I was able to use multivariate regressions to analyze the variability of value expression in relation to the quantitative variables also collected in the questionnaire. Second, the methodological approach of chapter 5 contributes to the fields of social and environmental psychology, because motivations measurements have been often used to explain environmental concerns and behavior elicited from close-ended questions (e.g. levels of agreement on beliefs or yes or no answers). Third, environmental motivations measurement (Chapter 5 and 6) was applied to a diverse sample in terms of factors such as age, place of residence, income and education levels. This contributes to the general discussion on motivations, because researchers of the field of psychology often rely on student’s samples. Finally, this research, contributes to WTT studies, by introducing for the first time- to my knowledge- the influence of environmental motivations on WTT responses (Chapter 6).

### **7.3. Future research**

The findings from this dissertation provides insight on future research on ES and Nature valuations. Scholars have used the notion of integrated valuation to embrace valuation approaches that evidence how multiple values relates to each other (conflict, synergies, coexistences) and how this information can influence decision-making towards sustainability (Gómez Baggethun et al. 2014, Jacobs et al. 2016). Some questions to resolve in this front are: How non-monetary valuation methods as the ones applied in this research (i.e. narratives and WTT) can be integrated and mainstreamed in decision making? For instance, can WTT studies be operationalized in time banks or collective actions for ES protection? How conflicts between instrumental, relational and intrinsic values can be addressed in decision making contexts? How to design policy instruments that integrate

intrinsic, instrumental and relational values? How social institutions and norms integrates intrinsic, relational and instrumental values?

A second line of future research is address environmental values from a historical and political perspective. How the values attributed to ES and Nature have changed over time? Which events or actors influenced changes in the attribution of values? Which sustainability lessons can be drawn from a historical research on values? How power influences the articulation of values in decision-making contexts?

#### **7.4. General Conclusions**

The main goal of this dissertation was to contribute to the ES valuation practice by assessing how plural values can be recognized and integrated in nature and ES valuation. To this end, I first defined a taxonomy of values and valuation methods that can widen the evaluative space of ES and Nature valuation. Then, I developed a novel non-monetary valuation approach, to empirically analyze the place-based, plural and incommensurable values people attribute to ES and nature. The main conclusions of this dissertation are the following.

##### **Conceptual**

- Understanding the importance of nature, ecosystems or ES for people involves dealing with multiple and, often, conflicting valuation languages.
- This dissertation contributes to depicting the ontological, epistemological and ethical features of the endeavor of integrating plural values in ES valuation.
- In a context where monetary valuations remain the dominant valuation language, the taxonomy of values and valuation methods presented in this research can help ES scientists and practitioners with the aim of representing people's multiple and context-specific ways of valuing nature and values and



- Integrating value pluralism in ES valuations implies a departure from ES as the only object of valuation and the use of other scales of nature and metaphors of human-nature relationships.
- From an environmental ethics perspective, beyond recognizing instrumental and intrinsic values, people can also value ES and nature because they are fundamental in human-nature relationships and because they fulfil a ‘good human life’ (i.e. relational values).
- ES valuations can enhance the integration of value pluralism by addressing relational values.
- Intrinsic and relational value domains represent non-instrumental relations with nature and a sense of collective meaning (i.e. shared values); therefore, they might be better addressed with non-monetary valuation methods.
- This research provided evidence that intrinsic, instrumental and relational values coexist in people’s narratives about the importance of ES and nature. This holistic worldview contrasts with the dichotomy between intrinsic and instrumental values as the main argument for ecosystems conservation.
- The influence of socio-cultural factors (e.g. place of residence, age, education) and environmental motivations on values, supports the place-based and context specific nature of values.
- Providing attention to the usually hidden and non-monetary valuation languages of rural and indigenous people, is a necessary step towards enhancing value pluralism in ES valuation.
- Rural people primarily express the importance of ecosystems in terms of relational and intrinsic values, this support the view that rural people material dependency on ES and the cultural relations they stablish with ecosystems can explain their salient environmental values.

- Non-monetary valuation methods are suitable to embrace the perspective that poor or margined groups seek to protect the environment usually by deploying other valuation languages beyond monetary ones
- The research on environmental motivations contributes to highlight the people relate with Nature mediated through multiple motivations, which in turn influences the expression of plural and often conflicting values.
- Towards enhancing value pluralism, ES valuations can depart from approaches that considers self-interest (e.g. egoism) as the main human motivation, and acknowledge multiple motivations including biospheric and altruistic ones.
- Non-monetary valuation methods also frame who can value. ES valuation practice can provide better attention to how valuation methods frame who can value and address ways to integrate the broad spectrum of voices and values at stake.
- ES valuations can endorse the pre-analytical positions of Ecological Economics in order to integrate value pluralism and incommensurability and also to explicitly highlight normative positions embedded in valuation practices.
- The meaning of a ‘good life’ and ES and Nature values have an inherently collective nature. Valuation outcomes from methods with individual consultation, can be integrated in participative and deliberative process in order to negotiate them as collective values
- Through the discussion of the ontological, epistemological and ethical assumptions, ES valuations cannot be further framed as technical tools but as political projects on sustainability. I argue that framing ES and nature valuations from Ecological Economics can contribute to depict a more sustainable and just future.

## **Methodological**

- In this research I provide insights on how multiple disciplinary value notions and valuation methods can be combined to depict a more complex picture of why and how people value ES and Nature.
- This research provides an example of how to explore in the ground the categories of intrinsic, relational and instrumental values, also endorsed by IPBES valuation guide.
- The narrative valuation method is a simply approach towards capturing the plurality of environmental values

## Management

- The multiple values of ES and Nature expressed by rural and urban societies should be included in environmental management in order to tackle socio-environmental conflicts and consider the diverse needs and interests of different social actors.
- By accounting the plural motivations that influence values, scholars can pave the way towards designing a plural set of instruments for ES conservation. Further, environmental management approaches can rely on social institutions and norms that actually integrate plural values and motivations.

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## APPENDICES

### Appendix 1: Questionnaire for ecosystem services valuation in the Otún River watershed

QUESTIONNAIRE FOR ECOSYSTEM SERVICES VALUATION IN THE OTÚN RIVER WATERSHED						
  	Survey N°:					
	Date:					
	Day:			Month:		
Location/address:						
Interviewer's name:		Cod:		Start time:		
Survey Status:		01	Complete	02	Incomplete	

#### INTRODUCTION:

Good day/afternoon. My name is: (Interviewer: mention your name) and we are conducting a research with the Autonomous University of Barcelona. The aim of the research is knowing public opinion about the importance of the Otún River watershed. It is important to mention that there are **NO CORRECT OR INCORRECT ANSWERS**. Your participation is **VOLUNTARY** and the information you provide is completely **ANONYMOUS** and **CONFIDENTIAL** and it will be used strictly for academic purposes. Do you want to participate in this study?

Thank you for your collaboration:

¿Can I talk with the head of household or the person in charge when he/she is not at home?

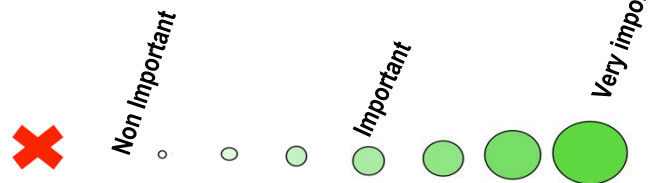
#### SECTION 1: IDENTIFICATION OF THE RESPONDENT

<b>I.1. Are you the head of the household?</b> <table border="1"> <tr> <td>01</td> <td>YES</td> <td>Go to question I.3</td> </tr> <tr> <td>02</td> <td>NO</td> <td>Go to question I.2</td> </tr> </table>			01	YES	Go to question I.3	02	NO	Go to question I.2	<b>I.2. What is your relationship with the head of household?</b> <table border="1"> <tr> <td>01</td> <td>Husband/Wife</td> </tr> <tr> <td>02</td> <td>Partner</td> </tr> <tr> <td>03</td> <td>Mother/Father/Parents-in-law</td> </tr> <tr> <td>04</td> <td>Daughter/Son/Stepchild</td> </tr> <tr> <td>05</td> <td>Sister/Brother</td> </tr> <tr> <td>06</td> <td>Daughter/Son-in-law</td> </tr> <tr> <td>07</td> <td>Other Which one? _____</td> </tr> <tr> <td>99</td> <td>Not apply</td> </tr> </table>			01	Husband/Wife	02	Partner	03	Mother/Father/Parents-in-law	04	Daughter/Son/Stepchild	05	Sister/Brother	06	Daughter/Son-in-law	07	Other Which one? _____	99	Not apply
01	YES	Go to question I.3																									
02	NO	Go to question I.2																									
01	Husband/Wife																										
02	Partner																										
03	Mother/Father/Parents-in-law																										
04	Daughter/Son/Stepchild																										
05	Sister/Brother																										
06	Daughter/Son-in-law																										
07	Other Which one? _____																										
99	Not apply																										
<b>I.3 In which year were you born?</b> <table border="1"> <tr> <td>1</td> <td>9</td> <td></td> <td></td> </tr> </table> For people born before 1998			1	9			<b>I.4 Respondent's gender</b> <table border="1"> <tr> <td>01</td> <td>Men</td> </tr> <tr> <td>02</td> <td>Women</td> </tr> </table>			01	Men	02	Women														
1	9																										
01	Men																										
02	Women																										

**SECTION 2: ENVIRONMENTAL MOTIVATIONS**

Now I want to know your opinion about which principles are important for **you**, that is, which principles guide your life and which ones are less important for **you**.

[INDICATE TO THE RESPONDENT TO READ ALL THE PRINCIPLES LIST FIRST. HE / SHE THEN HAVE TO PICK THE MOST IMPORTANT VALUE OF THE ENTIRE LIST AND ASSIGN IT A SCORE. CONTINUEDLY, HE/SHE HAS TO CHOOSE THE MOST OPPOSITE OR CONTRARY PRINCIPLE TO HIS/HER LIFE AND ASSIGN A RATING OF -1. IF THERE IS NOT SUCH A PRINCIPLE, HE/SHE THEN HAVE TO CHOOSE THE LESS IMPORTANT PRINCIPLE AND QUALIFY IT WITH A 0 OR 1 SCORE. THEN HE/SHE MUST RATE THE REMAINING PRINCIPLES]



MOTIVATIONS	Contrary to my values	0	1	2	3	4	5	6	7
<b>SOCIAL POWER</b> (Control over others, dominance).									
<b>EQUALITY</b> (Equal opportunity for all).									
<b>PREVENTING POLLUTION</b> (Protecting natural resources) i.e. Avoid buying pollutants, throwing waste to water sources).									
<b>WEALTH</b> (Material possessions, money)									
<b>SOCIAL JUSTICE</b> (Correcting injustice, care for the weak).									
<b>RESPECTING THE EARTH</b> (Harmony with other species- animals and plants).									
<b>INFLUENTIAL</b> (Having an impact on people and events).									
<b>A WORLD AT PEACE</b> (Free of war and conflict)									
<b>UNITY WITH NATURE</b> (Fitting into nature) i.e. Going to countryside, to natural parks)									

<b>AUTHORITY</b> (The right to lead or command).
<b>HELPFUL</b> (Working for the wellbeing of others).
<b>PROTECTING THE ENVIRONMENT</b> (Preserving nature)
<b>AMBITIOUS</b> (Hard-working, aspiring).



<b>SECTION 3: ACTIVITIES IN THE MID-UPPER STREAM OF OTÚN RIVER WATERSHED</b>			
A1. How many times do you visit the mid-upper stream of the river watershed? ____ times at <b>YEAR / MONTH</b>			
A2. When you visit the mid-upper watershed, which are the main activities you carried out there? <b>[ALLOW THE RESPONDENT TO MENTION ANY OPTIONS WITHOUT READ THEM TO SHE/HE]</b>			
01	River bath	08	Biking
02	Ecological hiking	09	Photography
03	Fauna and flora observation	10	Sports
04	Falls and waterfalls observation	11	Lunch in town
05	Camping	12	Research activities
06	Lunch at the river	13	Interpretation and environmental studies
07	Scenic beauty and landscape appreciation	14	Traditional festivals
99	Others, ¿which ones?		
SE1. Why it is important to conserve and protect the ecosystems and landscapes of Otún River watershed? <b>[SHOW CARD 1: LANDSCAPES AND ECOSYSTEMS OF OTÚN RIVER WATERSHED]</b>			

<p><b>SECTION 4: WILLIGNESS TO GIVE UP TIME FOR ECOSYSTEM SERVICES CONSERVATION</b></p> <p><b>[SHOW CARD 2. ENVIRONMENTAL SITUATIONS]</b></p> <p>Currently the mid-upper Otún River watershed presents different situations that affect the provision of ecosystem services to society (e.g. food, water quantity and quality, water regulation, erosion control, flood and landslide protection, biodiversity). Some of these situations are:</p>
--



01	water and soil pollution due to agrochemicals use	
02	Decreased biodiversity through the introduction of non-native species (trout, eucalyptus, pine, <i>mataandrea</i> )	
03	Deforestation	
04	Wildlife trade by visitors (orchids, palm wax)	
05	Loss of peasant identity (loss of traditional knowledge)	
06	Lack of citizen participation in conservation processes	
07	Waste disposal to the river stream and paramo	
08	The river banks are not protected with forest increasing the risk of landslides and floods	
09	Other problems. Which?	
98	Does not feel affected by the environmental problems of the Otún River	

S.2. Do you or your home feel directly or indirectly affected by these problems? Which?

In order to counteract these situations and to ensure the provision of ecosystem services, the following actions have been considered: **[SHOW CARD 3: IMPLEMENTATION OF CONSERVATION ACTIONS IN OTÚN WATERSHED]**

- Support to organic agriculture, peasant markets and traditional knowledge.
- Recovery and reforestation of the Natural Forest
- Develop environmental education programs
- Reforest river banks
- Implement domestic wastewater treatment systems
- Promote integrated solid waste management
- Strengthen and foster community-based organizations
- Promote rural tourism and nature in the watershed

W1. A strategy that has been considered to develop this projects, is to form 'convites' for the conservation and recovery of the mid-upper stream Otún River watershed. These *convites* are formed by the voluntary work of people.

W.2. Would you be willing to give up hours of work to conform these convites?

01	YES	
02	NO	Go to question W6

## SECTION FIVE: SOCIO-DEMOGRAPHIC CHARACTERISTICS

<p>D1. What is your current civil status?</p> <table border="1"> <tr> <td>01</td> <td>Single</td> </tr> <tr> <td>02</td> <td>Married</td> </tr> <tr> <td>03</td> <td>Consensual union</td> </tr> <tr> <td>04</td> <td>Separated, Divorced</td> </tr> <tr> <td>05</td> <td>Widowed</td> </tr> </table>	01	Single	02	Married	03	Consensual union	04	Separated, Divorced	05	Widowed	<p>D2. Which of the following describes best your current employment situation?</p>
01	Single										
02	Married										
03	Consensual union										
04	Separated, Divorced										
05	Widowed										

		01	Employee with contract	
		02	Employee without contract	
		03	Independent (pays health and pension)	
		04	Self-employed worker	
		05	Retired	
		06	Study and work	
		07	Disability pensioner	
		08	Student	
		09	Housekeeper	
		10	Unemployed looking for a job	
		11	Unemployed not looking for work	
		12	Other? Which?	
		98	Do not know/not answer	

<b>D3.</b> What is the stratum of the house where you live? <table border="1"> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>98</td> <td>DN/NA</td> </tr> </table>								1	2	3	4	5	6	98	DN/NA	<b>D4.</b> How many people live in your home? <b>D5.</b> How many children under 5 years? _____ <b>D6.</b> How many people in your household work (including you)?	
1	2	3	4	5	6	98	DN/NA										

<b>[Note: show the income card]</b> D7 Which of the following cells describes your monthly <b>personal income</b> ? Please indicate the number associated with the income range D8. Which describes the monthly <b>household income</b> , (including your income in case you work)?				D9. What is the last level of education that you reached or what educational level are you currently doing?			
		<u>P</u>	<u>H</u>	01	None		
				02	Preschool		
				03	School	Last year approved	
				04	High school	Last year approved	
				05	Technician without title	Last semester approved	
				06	Technician with title	Last semester approved	
				07	Technology without title	Last semester approved	
				08	Technology with title	Last semester approved	
				09	University with title	Last semester approved	
				10	University without title	Last semester approved	
				11	Specialization with title	Last semester approved	
				12	Specialization without title	Last semester approved	
				13	Master's Degree	Last semester approved	
				14	Master without degree	Last semester approved	
				15	Doctorate with title	Last semester approved	
				16	Doctorate without title	Last semester approved	

D10. Do you participate in any group or association conformed by members of the community? Community Action Boards, Political Organizations, Sports, Others.			
		Yes	No
01	You		
02	Household member		

<p>Do you think the questions in this survey were ... ?</p> <table border="1" data-bbox="434 315 625 504"> <tr> <td>0</td> <td>Very clear</td> </tr> <tr> <td>1</td> <td></td> </tr> <tr> <td>0</td> <td>Moderately clear</td> </tr> <tr> <td>2</td> <td></td> </tr> <tr> <td>0</td> <td>Little clear</td> </tr> <tr> <td>3</td> <td></td> </tr> </table>	0	Very clear	1		0	Moderately clear	2		0	Little clear	3		<p>Would you like to be contacted for provide your more information on the conservation programs in the Otún River watershed? Phone/email:</p>
0	Very clear												
1													
0	Moderately clear												
2													
0	Little clear												
3													
<p><b>[Finish the survey by thanking the respondent and record the termination time].</b></p> <p>End time _____AM / PM</p>													

**OBSERVATIONS**

**Appendix 2: Appendices Chapter: Exploring intrinsic, instrumental and relational values for the sustainable management of socio-ecological systems.**

**Appendix 2.1. Factor analysis results for environmental motivations.**

**(SD: standard deviation;  $\alpha$ : Cronbach's alpha)**

Environmental motivations		Total Sample		Rural		Urban		
	Factor Loading	Mean	SD	Mean	SD	Mean	SD	
<b><i>Biospheric</i></b>	<b>Description</b>	<b>6.471</b>	<b>0.830</b>	<b>6.694</b>	<b>0.705</b>	<b>6.333</b>	<b>0.871</b>	
Preventing pollution	Protecting natural resources	0.766	6.487	1.021	6.679	0.963	6.370	1.039
Respecting the earth	Harmony with other species	0.830	6.495	1.013	6.703	0.874	6.367	1.070
Unity with nature	Fitting into nature	0.799	6.385	1.143	6.671	0.891	6.209	1.242
Protecting the environment	Preserving nature	0.784	6.515	0.997	6.723	0.855	6.388	1.057
<b><i>Altruistic</i></b>		<b>6.315</b>	<b>0.877</b>	<b>6.569</b>	<b>0.669</b>	<b>6.159</b>	<b>0.951</b>	
A world at peace	Free of war and conflict	0.749	6.505	1.032	6.739	0.801	6.362	1.129
Helpful	Working for the welfare of others	0.765	6.228	1.200	6.461	1.028	6.085	1.276
Social Justice	Correcting injustice, care for the weak	0.752	6.170	1.252	6.488	0.961	5.976	1.366
Equality	Equal opportunity for all	0.697	6.357	1.248	6.589	0.924	6.214	1.393
<b><i>Egoistic</i></b>		<b>4.255</b>	<b>1.389</b>	<b>4.376</b>	<b>1.301</b>	<b>4.181</b>	<b>1.436</b>	
Social power	Control over others, dominance	0.631	2.500	2.721	2.438	2.817	2.538	2.664
Influential	Having an impact on people and events	0.549	4.819	2.082	5.343	1.900	4.498	2.126
Ambitious	Hard-working, aspiring	0.502	5.454	2.065	5.652	2.116	5.333	2.026
Authority	The right to lead or command	0.778	4.439	2.035	4.444	2.059	4.436	2.023
Wealth	Material possessions, money	0.716	4.065	1.977	4.004	1.916	4.102	2.015

**Appendix 2.2. Environmental values attributed to the mid- and upper-stream of the Otún River watershed**

<b>Articulated values</b>	<b>Urban Respondents (n)</b>	<b>%</b>	<b>Rural Respondents (n)</b>	<b>%</b>
<b>Instrumental</b>	<b>12</b>	<b>3.3</b>	<b>1</b>	<b>0.4</b>
<b>Intrinsic</b>	<b>138</b>	<b>37.8</b>	<b>102</b>	<b>45.5</b>
Life	32	8.8	32	14.3
Moral duties towards ecosystems	120	32.9	80	35.7
<b>Relational</b>	<b>332</b>	<b>91.0</b>	<b>216</b>	<b>96.4</b>
Ecological balance resilience	48	13.2	68	30.4
Subsistence and livelihoods	270	74.0	179	79.9
Mental and physical health	81	22.2	53	23.7
Identity	7	1.9	7	3.1
Sense of place	5	1.4	13	5.8
Cultural heritage	18	4.9	9	4.0
Sacredness, religious value	6	1.6	8	3.6
Symbolic value	6	1.6	12	5.4
Social Cohesion	1	0.3	2	0.9
Human Wellbeing	32	8.8	21	9.4
Meaningful occupation	0	0.0	8	3.6
Altruism	118	32.3	100	44.6
Environmental justice	1	0.3	5	2.2
Aesthetic	28	7.7	26	11.6
Recreation	10	2.7	14	6.3
Cognitive development	5	1.4	10	4.5

### Appendix 3: Econometric approach for estimating Willingness to Donate time for Ecosystem Services conservation

The Heckman model consists in two equations (Heckman 1976, Sigelman and Zeng 1999). The first equation addresses the YES or NO decision of WTT time through a probit model. The second equation is an ordinary least squares (OLS) model of the positive values of WTT, which is conditioned by the selection of the first equation.

Probit selection equation

$$z_j = Z_j\gamma + u_{2j} \quad \text{Eq.(B.1)}$$

OLS regression equation

$$y_j = X_j\beta + u_{1j} \quad \text{Eq. (B2)}$$

Where  $y_j$  is only observed if:  $z_j > 0$  and  $j = 1, \dots, N$ . The independent variables of the model are  $Z_j$  and  $X_j$  vectors.  $\beta$  and  $\gamma$  are the coefficient vectors.  $u_{1j}$ ,  $u_{2j}$  are the error terms that follow a bivariate normal function with a correlation parameter  $\rho$ :

$$u_1 = N(0, \sigma) \quad \text{Eq.(B3)}$$

$$u_2 = N(0,1) \quad \text{Eq.(B4)}$$

$$\text{corr}(u_1, u_2) = \rho \quad \text{Eq. (B5)}$$

The expected value of the dependent variables is:

$$E(y > 0) = Z\gamma + \rho\sigma_\varepsilon\lambda(-X\beta) \quad \text{Eq. (B6)}$$

$$\lambda(-X\beta) = \frac{\varphi(-X\beta)}{1 - \phi(-X\beta)} \quad \text{Eq.(B7)}$$

Where,  $\varphi$  is the density function of the standard normal distribution and  $\Phi$  the standard normal distribution function. The estimation process of the Heckman model calculates the inverse Mills ratio( $\lambda$ ) from OLS consistent parameters( $\beta$ ). Thus, the expected value of the dependent variable would be  $X\beta$ , only if Eq.(B1) and Eq. (B2) are not correlated and therefore it would not be the case of a sample selection bias.

In the Heckman two step model, the set of independent variables in both equations can be different. Thus, collinearity problems can be reduced for the case when  $Z_j = X_j$  (Cameron and Trivedi 2010). However, the independent variables in the OLS regression (Eq. B2) must be a subset of those in the selection equation (Eq. B1). At least one variable in  $Z_j$  in not included in  $X_j$ , which is known as the exclusion restriction (Wooldridge 2009). The Two step model specifies efficient estimations of the variance-covariance matrix, standard errors and parameters (Heckman 1979).

## References

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