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### **Economic incentives for biodiversity conservation: What is the evidence for motivation crowding?**

*Julian Rode, Erik Gómez-Baggethun, Torsten Krause*

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# **Economic incentives for biodiversity conservation: What is the evidence for motivation crowding?**

Julian Rode

*Helmholtz-Center for Environmental Research – UFZ, Leipzig*

Erik Gómez-Baggethun

*Inst. of Env. Science and Technology (ICTA), Universitat Autònoma de Barcelona*

Torsten Krause

*Lund University Centre for Sustainability Studies*

**Abstract:** As economic incentives for biodiversity and ecosystem service protection (e.g., payments for ecosystem services) have become widespread in environmental science and policy, a major concern among conservationists and environmental scientists is that economic incentives may undermine people's intrinsic motivations to conserve biodiversity. In this paper we review the theoretical insights and empirical findings on motivation crowding effects with economic instruments for biodiversity protection. First, we synthesize the psychological mechanisms behind motivation crowding effects relevant for environmental behavior as identified in the specialized literature. We then conduct a systematic review of the empirical evidence. Our results show that, although several empirical studies suggest the existence of crowding-out and crowding-in effects, evidence remains inconclusive due to i) methodological limitations for empirical studies to demonstrate crowding effects, ii) lack of adequate baseline information about pre-existing intrinsic motivations, iii) weak comparability of results across case studies resulting from inconsistent terminology and methods, and iv) the complexity stemming from cultural and contextual heterogeneity. We conclude that, as economic instruments for conservation are increasingly implemented, it becomes paramount to develop robust methodologies for assessing pre-existing intrinsic motivations and changes in people's motivational structures. To address possible detrimental long term effects for conservation outcomes we call for caution in situations where high uncertainties remain.

**Keywords:** biodiversity, policy instruments, economic incentives, motivation crowding

## 1. Introduction

Over the last decade, economic incentives have gained increasing leverage in environmental policy as a means to promote biodiversity and ecosystem services protection<sup>1</sup> (Vatn et al. 2010; Pirard 2012; WBCSD 2011). While these developments are often regarded as an important impetus for biodiversity protection and an opportunity for “mainstreaming biodiversity” (TEEB 2012), critical voices raise doubts on their potential for halting biodiversity loss (McCauley 2006; Redford and Adams 2009; Child 2009). A frequently raised concern is the hypothesis that economic incentives may “crowd-out” intrinsic motivations, such as people’s moral commitment towards biodiversity protection (e.g., Luck et al. 2012, Muradian et al. 2013). Thus, the effectiveness of economic incentives for biodiversity protection remains contested, and some authors suggest that the changes they can induce in motivational structures could, in the long term, undermine conservation efforts (Kosoy and Corbera 2010; Vatn 2010; Gómez-Baggethun and Ruiz-Pérez, 2011).

The crowding-out hypothesis is often traced back to Titmuss' (1970) argument that blood donors are typically motivated by moral concerns rather than money, and that monetary compensation for donating blood could hence decrease its supply (see also Mellström and Johannsson 2008). Motivation crowding theory is based on the psychological notions of intrinsic vs. extrinsic motivation (Deci 1971, Deci 1975, Deci et al. 1999). Intrinsic motivation refers to doing an activity for its inherent satisfaction, meaning that an individual is moved to act for the fun, challenge, or personal conviction entailed. Extrinsic motivation, on the other hand, pertains whenever an activity is done for its instrumental value or capacity of attaining some separable outcome in form of products, pressures, or rewards (Ryan and Deci's 2000). Counter to a common assumption in economics, motivation crowding suggests that the effects of extrinsic motivators such as monetary incentives do not necessarily complement intrinsic motivations (Bowles 2008). Instead, they may undermine (“crowd-out”), or, under different conditions, strengthen (“crowd-in”) intrinsic motivation.

Frey (e.g., 1992, 1993, 1997) introduced the crowding-out hypothesis to the economic literature, arguing that these effects could under certain conditions even outweigh the stimulating effect of monetary incentives and reduce the propensity to engage in the desired activity. Since then, work in behavioral and experimental economics has discussed the crowding-out effect for a variety of contexts, including people’s motivation at the workplace

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<sup>1</sup> We treat “biodiversity” and “nature” as equivalent, and for the sake of brevity we write “biodiversity protection” instead of “biodiversity and ecosystem service protection”.

(Frey 1997, Gneezy and Rusticini 2000b, Heyman and Ariely 2004), communities' willingness to host a nuclear energy facility (Frey and Oberholzer-Gee 1997), parents' effort to arrive on time for picking up their children from day care (Gneezy and Rusticini, 2000a), and voluntary effort to raise funding for humanitarian causes (Gneezy and Rustichini 2000b). Bowles & Polanía-Reyes (2012) report 50 experimental studies presenting motivation crowding effects across many domains.

The relevance of the crowding-out hypothesis for environmental policy contexts has had frequent mention (e.g., Frey 1992, 1993, Frey and Oberholzer-Gee 1997, Bowles 2008), typically with respect to behaviors such as resource use (recycling, saving water), modes of mobility (driving slow, use of public transport or bicycle vs. automobile), or consumption decisions, including boycotts of environmentally harmful products (Gawel 2000, Frey and Stutzer 2008). For corporate behavior, the hypothesis has been related to the inclination to pollute or prevent harm to the environment (Frey 1992, Gawel 2000). Recently, a growing number of studies address motivation crowding for economic incentives for biodiversity protection, such as for instance fines for over-use of forest products in Colombia (Cardenas et al 2000), a payment scheme for landowners planting trees in Uganda (Fisher 2012), or incentives for forest management and conservation in Mexico (García-Amado et al 2013). Yet, the motivational aspect of economic instruments such as Payments for Ecosystem Services (PES) remains “a very under-researched area” (Vatn, 2010, p. 1250). While economic instruments for conservation are increasingly implemented worldwide, our understanding of their long term effects on motivational structures remains elusive. Ultimately, understanding motivation crowding effects is of critical relevance for appraising the overall efficacy of economic instruments, also because motivational changes have sometimes been shown to be irreversible, at least in the shorter term (Gneezy and Rusticini, 2000a). The aim of this paper is to advance our understanding on how far and under which conditions the use of economic instruments in environmental policy can lead to motivation crowding effects. We i) synthesize key findings in the economic literature regarding the psychological mechanisms through which external incentives can lead to motivation crowding effects, ii) categorize existing empirical research on motivation crowding with economic instruments for biodiversity protection, and iii) report and discuss the empirical evidence and associated implications for environmental policy and research.

The paper is organized as follows. Section 2 explains the methodology used in the literature review. Section 3 reports our findings regarding the psychological mechanisms through which

motivation crowding effects are expected to operate and the empirical evidence of motivational changes with economic incentives for biodiversity and ecosystem services conservation. Section 4 discusses the findings and derives implications for environmental research and policy agendas.

## **2. Methodology**

Our review was conducted in two stages. The first stage consists of a literature review of the economic literature on motivation crowding to synthesize possible psychological mechanisms behind motivation crowding effects. We focus on those mechanisms that were identified as relevant for environmental behavior, classifying them depending on whether they are expected to trigger crowding-out or crowding-in effects. The second stage consists of a systematic review of peer-reviewed articles searching for evidence of motivation crowding effects. Specifically, we review papers that are i) presenting an empirical study, ii) addressing economic instruments for biodiversity protection, and iii) testing for motivation crowding effects. We conducted a *title search* for articles at the ISI web of knowledge using the following combinations of keywords: ‘economic incentives and biodiversity’, ‘economic incentives and conservation’, ‘motivation, crowding, and biodiversity’, ‘motivation, crowding, and conservation’, ‘motivation, crowding, and environment’, and ‘motivation and crowding’, as well as a *topic search* for articles with the keywords ‘motivation, crowding, and biodiversity’, ‘motivation, crowding, and conservation’ and ‘motivation, crowding, and environment’. We then conducted an equivalent online search through Google scholar, using the keyword combinations as above. Last, we searched the reference lists of the previously identified studies for further relevant empirical work.

The selected empirical studies are analyzed according to the following criteria: i) type of economic incentive, ii) targeted behavior, iii) target population, iv) geographical location, v) type of intrinsic motivation affected by the incentive, vi) methods and data, and vii) reported findings on motivation crowding effects. Economic incentives are divided into positive (e.g., rewards, subsidies, payments for ecosystem services) and negative types (e.g., fines, taxes). For targeted behaviors, the specific conservation practices are reported (e.g., propensity to refrain from logging or to engage in practices to protect biodiversity). Target populations are classified as urban, rural, or indigenous communities. Geographical location is specified by country and economic context (developed vs. developing country). Types of intrinsic motivations affected by the incentive are classified as *pro-social motivations*, defined here as

those that refer to social relations with other people or the larger community (e.g., altruism, reciprocity, social norms), and ii) *pro-nature motivations*, defined here as those that refer to values for, or relationships with, the non-human natural world (e.g., care-based ethics, intrinsic value of species). We only report motivations explicitly mentioned in the respective article. Following the taxonomy by Harrison and List (2004), empirical methods used to test for motivation crowding effects are divided into *framed field experiments* on social dilemmas, *natural field experiments*, and *natural experiments*. In framed field experiments on social dilemmas, local people are invited to participate in interactive tasks representing a situation where the environmental status of a common pool resource (CPR) or a public good (PG) is affected by individual decisions on resource extraction. In natural field experiments, a “real world” setting, such as the possibility to participate in a community activity or farmers’ choice between different agricultural practices, is manipulated by introducing an economic incentive, and people do not know that they are in an experiment. Natural experiments investigate effects of actual policy interventions involving economic incentives. Empirical data used to assess effectiveness of incentives and motivational crowding effects are classified as *behavioral data*, where behaviors are observed for making inference on status and changes in motivations, and *survey data*, where inferences on motivations are derived from reported attitudes, or statements on intentions to act. Finally, evidence on motivation crowding is divided into either *crowding-out*) or *crowding-in* effects. When applicable, we record the evidence for motivation crowding reported by the authors. Where authors do not explicitly refer to crowding effects, we check whether the presented analyses include implicit indications for or against the prevalence of motivation crowding effects.

### **3. Results**

#### 3.1 Psychological mechanisms underlying motivation crowding effects

Table 1 categorizes and describes the different psychological mechanisms behind crowding-out and crowding-in that were identified as most relevant for environmental behavior in the specialized literature. The table further includes examples from the environmental domain provided in the reference literature. We also indicate whether the psychological mechanisms are likely to be relevant for positive or negative incentives, or both.

*Table 1. Mechanisms through which regulations and economic incentives erode or strengthen intrinsic motivations for environmental protection*

<i>Effect</i>	<i>Psychological mechanism</i>	<i>Explanation</i>	<i>Regulations for which this mechanism seems relevant</i>	<i>References and examples provided</i>
Crowding-out	Control aversion	Individuals with a sense of autonomy and self-determination dislike feeling controlled.	All incentives.	Bowles 2008, Frey and Stutzer 2008
	Frustration	Individuals are frustrated when they perceive regulations as a signal of distrust that they will do the right thing.	All incentives.	Gawel 2001, Gneezy et al 2011
	Reduce Image Motivation	Others cannot distinguish if one undertakes a social activity voluntarily or by pressure.	All incentives.	Gneezy et al 2011 Image concerns can be a motivation for recycling.
	Frame-shifting	An individual's attention is shifted towards a focus on economic reasoning (short-term).	All incentives.	Bowles 2008
	Release from moral responsibility	Allowing monetary payments to compensate for environmental harm releases individuals from feelings of responsibility and guilt.	Negative incentives.	Frey 1992, Goodin 1994, Gawel 2001, Rodriguez-Sickert et al 2008, Spash 2010 Tradable permits (e.g. for corporate CO2 emissions) to obtain the right to pollute or to damage ecosystems generate "prices" for environmental impacts.
	Changes in values or mindsets	The focus on economic reasoning affects attitudes and mindsets in the longer term.	All incentives.	Frey 1992, Vatn 2010, Gómez-Baggethun et al 2010, García-Amado 2013 PES schemes change people's conservation logic from moral obligation or community norms towards conservation for profit.
Crowding-in	Enhanced self-esteem through social recognition	Individuals perceive rewards as supporting and acknowledging their behavior.	Positive incentives (in particular unexpected rewards)	Frey and Jegen 2008 Stewardship awards for communities are seen as acknowledgement of their traditional conservation activities (Hecken and Bastiaensen 2010).
	Prescriptive effect	Individuals receive a normative signal of what constitutes desirable societal action.	All incentives.	Frey 1992, Rodriguez-Sickert et al 2008, Bowles and Póltona-Reyes 2012 Implementation of a negligible fee reduces significantly the use of plastic bags (Rosenthal 2008).
	Reducing pressure by forcing non-moral individuals to compliance	Intrinsically motivated individuals can more easily act upon their motivation when not facing the bad example or even "exploitation" of non-moral individuals.	All incentives.	Gawel 2001 A fine in a common pool resource situation prevents that conditional cooperators with intrinsic motivation also overuse the resource when observing that others do so (Rodríguez-Sickert et al 2008, Narloch 2012). It is easier for environment-minded car drivers not to "speed" on the highway when a general speed-limit and fine prevents others from passing them (Gawel 2001).

### 3.1.1 Crowding-out effects

We identified six psychological mechanisms underlying crowding-out effects for environmental behavior, mainly from articles presenting general reviews on crowding-out effects across domains (Gawel 2001, Frey and Jegen 2001, Frey and Stutzer 2008, Bowles 2008, Gneezy et al 2011, Bowles and Polanía-Reyes 2012). The first mechanism - *control aversion* - refers to the observation that many people dislike feeling controlled by economic regulation as they feel such controls impinge upon their sense of autonomy and self-determination (Deci and Ryan 1985, Bowles 2008, Frey and Stutzer 2008). Second, people can feel *frustration* when they perceive regulations as a signal of distrust from above that they will do the right thing (Gawel 2001, Falk and Kosfeld 2006, Gneezy et al 2011). Third, the introduction of economic incentives may *reduce image motivation* of people who engage in pro-environmentally behavior (e.g., recycle) because they are concerned about their social image (Benabou and Tirole 2006, Gneezy et al 2011). In the presence of incentives, others can no longer distinguish whether one undertakes an activity voluntarily or for economic reasons. Fourth, *frame shifting* occurs when an economic incentive changes the cognitive concept behind acting environmentally friendly (Bowles 2008). In line with Heyman and Ariely's (2004) "tale of two markets", an individual's attention and decision frame is shifted towards a focus on economic reasoning, thereby reducing the influence of non-economic motivations. A related fifth category, *release from moral responsibility*, is relevant specifically for negative incentives based on the "polluter-pays principle". Compensation payments can act as "environmental indulgencies" (Goodin 1994), where people believe to follow the "ethic of a market" (Frey 1992) and no longer feel the moral responsibility to refrain from doing harm (Gawel 2001, Frey and Stutzer 2008, Spash 2010). This mechanism has been related to corporate actors who can purchase permits to pollute or to impact ecosystems within market-based schemes, e.g., CO2 emissions trading or biodiversity offsets. Last, the focus on economic reasoning in specific decision contexts could in the longer term result in *changes in values or mindsets* for environmental protection (Frey 1992). This mechanism is reflected in concerns that PES schemes change people's conservation logic from moral obligation or community norms towards conservation for profit (Vatn 2010, Gómez-Baggethun et al 2010, García-Amado 2013).

### 3.1.2 Crowding-in effects

Three psychological mechanisms for crowding-in were identified. First, intrinsic motivation can increase when positive incentives lead to *enhanced self-esteem through social*

*recognition*. For instance, stewardship awards for community conservation activities entail symbolic appreciation of people's efforts (Hecken and Bastiaensen 2010). This effect may be stronger when rewards are not expected (Frey and Jegen 2008). Second, regulations can have a *prescriptive effect* by providing a normative signal of what constitutes desirable societal action (Bowles and Polanía-Reyes 2012). For instance, Frey (1992) argues that pro-environment subsidies convey that ethical behavior towards nature is acknowledged by wider society. Rosenthal (2008) provides an empirical indication from Ireland, where a small tax on plastic grocery bags enacted in 2002 resulted in a 94 percent decline in their use within two weeks. According to the third mechanism - *reducing pressure by forcing non-moral individuals to compliance* - intrinsically motivated people find it easier to act upon this motivation when regulation prevents others from benefiting from non-moral behavior or even "free-ride" (Gawel 2001). For instance, an environment-minded car driver may find it easier to restrict her speed when others are not constantly passing her. Analogously, in a CPR or PG situation many people act as "conditional cooperators" who are intrinsically motivated but do not accept others to exploit their benevolent action (Rodriguez-Sickert et al 2008, Narloch 2012).

### 3.2. Empirical evidence of motivation crowding with economic incentives for biodiversity protection

We identified sixteen articles that fulfilled all three criteria of our review. The table in Appendix 1 presents an overview of our analysis.

#### 3.2.1 Type of economic incentive measure and targeted behavior

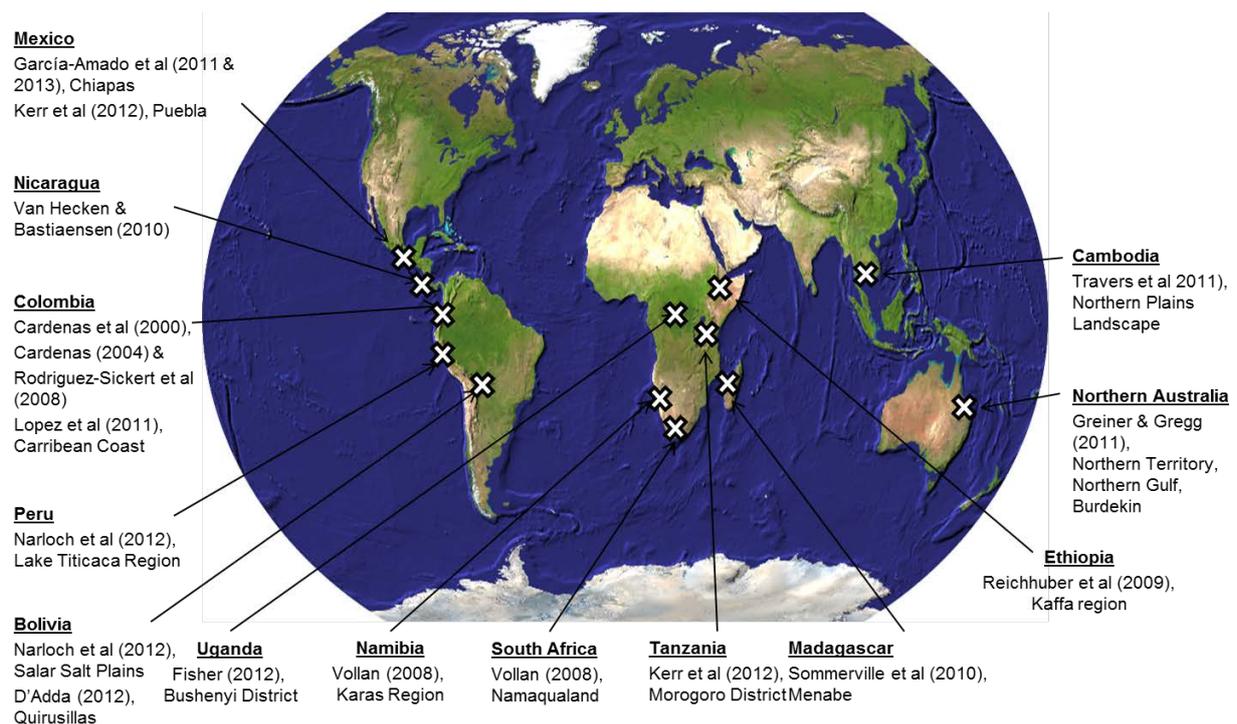
Eleven studies investigate the effects of positive incentives on biodiversity protection. In four cases the interventions are simply formulated as rewards, usually for limiting exploitation of natural resources. Seven studies explicitly refer to PES schemes that incentivize land use or other activities to support conservation efforts, e.g., forest management, tree-planting, or silvo-pastoral activities. Nine studies test negative incentives (disincentives) implemented to discourage environmentally harmful behavior, of which seven refer to fines or sanctions and two refer to taxes.

#### 3.2.2 Target population and geographical location

No studies address urban communities. Although several studies refer to their populations as "traditional", none clearly indicates that the intervention targeted indigenous people. Hence,

all studies were classified as rural communities. With the exception of one study conducted among Australian cattle farmers, target actors in all studies were conducted in developing countries. Six studies were conducted among communities in Africa (Uganda, Namibia, South Africa, Tanzania, Madagascar, Ethiopia), two in Central America (Mexico, Nicaragua), three in South America (Peru, Bolivia, Colombia), and one in Asia (Cambodia). The geographical locations of the studies are illustrated in Figure 1.

Figure 1. Geographical location of empirical studies



### 3.2.3 Type of intrinsic motivation affected by the incentive

Fourteen studies refer to pro-social motivations, mentioning social norms (8), reciprocity (4), altruism (2), social image/shame (2), guilt (2), reputation (1), trust (1), and public spiritedness (1). Eight studies refer to pro-nature motivations, mentioning notions such as attitudes toward conservation (3), existence values (2), stewardship (1), care-based ethics (1), aesthetics (1), or respect for nature and wild animals (1).

### 3.2.4 Methods and data

Nine studies employ framed field experiments on social dilemmas with participants from local communities. Extraction or contributions of tokens in the experimental tasks are verbally framed as decisions in a locally relevant setting where natural resource extraction has

implications for biodiversity protection (e.g., hours spent collecting firewood, number of sheep to graze, number of bee hives harvested, quantity of extracted fish, number of planted trees). All nine studies analyze behavioral data from the experiments (i.e., extraction or contribution level); only one study complements with survey data. Two studies use natural field experiments, where economic incentives are introduced into a real setting explicitly for the purpose of experimental testing, and both combine behavioral and survey data. Four studies rely on natural experiments, all of them looking explicitly at motivational changes through PES schemes and exclusively using survey data. One social survey study was not classified.

### 3.3. Reported findings on motivation crowding effects

#### 3.3.1. Evidence on motivation crowding-out

Ten studies report crowding-out effects, but only three of them present statistically significant results. One of the studies that obtain statistically significant effects stems from a series of CPR experiments with introduction of weakly enforced fines.<sup>2</sup> In a study conducted among rural communities in Colombia, Cardenas et al. (2000) find that resource extraction initially decreases when the fine is introduced, but that the effect subsequently wears off and returns to pre-intervention level. Measured in terms of deviations from Nash best-responses, extraction in the last rounds is above pre-intervention level. Vollan (2008) presents a similar effect among small-scale life-stock farmers in traditional communities in Namibia, though only with one specific group of the study population, characterized by low support for the intervention and high trust among group members. Here, extraction rates in the last three rounds are slightly above average extraction in the baseline condition, but this “over-shooting” is not statistically significant. Overall, CPR experiments introducing fines lead to mixed results. Reichhuber et al. (2009) observe a dynamic consistent with the two studies above, but have no data on baseline condition for comparison. In contrast, among communities studied in Cardenas (2004), Rodriguez-Sickert et al. (2008), as well as among the remaining population studied by Vollan (2008), weakly enforced fines reduce extraction rates for the entire duration of the regulatory intervention. The remaining two statistically significant effects stem from survey data investigating the introduction of positive incentives. In a stated choice experiment in Tanzania, Kerr et al. (2012) find that with low monetary rewards fewer people state they would participate in a collective activity compared to a baseline where no monetary rewards

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<sup>2</sup> “Weak enforcement” means that fines or detection rates are low, so that it remains economically rational not to cooperate.

are offered, whereas high payments lead to an increase in the stated participation rate. In a survey conducted among people in a Mexican Biosphere Reserve where PES schemes had been introduced in some communities and not in others, García-Amado et al. (2013) find that the longer PES schemes have been established, the more people state economic reasons to explain their willingness to conserve nature, indicating a shift from reasons reflecting intrinsic motivations to reasons reflecting utilitarian and monetary motivations.

Six more studies present suggestive empirical evidence for crowding-out effects, usually based on qualitative data from interview responses, or data with weak statistical significance. In a CPR experiment among rural villagers in Cambodia, Travers et al. (2011) find rewards to be more effective when self-organized by resource users, providing indirect indication that crowding-out effects can be expected when external regulation replaces a well-functioning internally organized mechanism. In contrast, Narloch et al. (2012) conclude from a PG experiment with farmer in Bolivia and Peru that collective rewards seem to spur free-riding behavior, thereby undermining collective action. In a field experiment among community members in Tanzania, Kerr et al. (2012) find that participants who were paid for planting trees in a school yard state less work satisfaction than those who participated for free. This did not lead to differences in work effort, but authors speculate that people with less work satisfaction may be less likely to participate in communal activities in the future. In a study conducted among rural farmers in Nicaragua, Van Hecken and Bastiaensen (2010) find “worrying indications” (p.438) that after the introduction of a PES scheme farmers are demanding compensation also for areas which they had previously conserved for free. From an interview-based study among forest-adjacent communities in Uganda, Fisher (2012) suggests that a PES scheme for tree planting may lead to conservation activities below the initial level once the PES scheme has ended. The survey conducted by Greiner and Gregg (2011) indicates that Australian farmers have multiple motivations for conservation, including intrinsic ones, and that different motivations correlate with perception of barriers and preferences for policies.

### 3.3.2 Evidence on motivation crowding-in

Four papers report empirical findings indicating crowding-in effects. Rodriguez-Sickert et al. (2008) present the only statistically significant result. In a CPR game investigating over-fishing among rural communities in Colombia, participants play ten initial rounds without an economic intervention, and are then asked whether they want a weakly enforced fine to become effective. Since participants vote against it, the fine is not imposed, yet the mere suggestion reduces extraction rates for several experimental rounds. Two other studies report

qualitative data from interview responses suggestive of crowding-in effects. Based on interviews with farmers and NGO staff in Madagascar, Van Hecken and Bastiaensen (2010) report that PES act as a symbolic factor by signaling that biodiversity protection is valued from the outside. Sommerville et al. (2010) report that payments for conservation efforts awarded at the annual fund party of the NGO-led PES scheme had a strong positive effect on peoples' general attitude toward conservation. Last, authors of two CPR studies provide evidence that by forcing non-moral individuals to compliance, the intervention makes it easier for intrinsically motivated "conditional cooperators" to act upon their motivation. Again Rodriguez-Sickert et al. (2008) report for the context of over-fishing that a "low fine stabilizes cooperation by preventing a spiral of negative reciprocation" (p.223). Narloch et al. (2012) mention the same effect for rewards to promote agro-biodiversity through crop-rotation schemes.

## **4. Discussion**

### **4.1. Growing evidence of motivational crowding effects**

The most important finding from our review is that several empirical studies suggest the existence of motivation crowding effects with economic incentives for biodiversity protection, supporting the hypothesis that economic instruments can have important impacts on relevant motivations and conservation logics. Studies indicating crowding-out effects outweigh studies indicating crowding-in effects, both regarding the absolute number of reported effects (10 versus 4) and the number of statistically significant effects (3 versus 1).<sup>3</sup> It is also noteworthy, however, that many of the reviewed studies with the potential to demonstrate crowding-out effects did not find any - or at least could not provide statistically significant results. From our perspective, the most convincing results are that "small" positive incentives can lead to an overall adverse effect (Kerr et al. 2011), reinforcing Gneezy and Rusticini's (2000b) recommendation to "pay enough or don't pay at all", and that PES schemes involving positive incentives for communities can shift people's perceived reasons for conservation from those reflecting intrinsic motivations to reasons reflecting utilitarian and monetary motivations (Garcia et al 2013). Beyond that, the evidence remains inconclusive, in particular about the conditions under which incentives can undermine or reinforce intrinsic motivation.

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<sup>3</sup> This numerical difference shall not be over-emphasized, since more studies set out to demonstrate crowding-out effects, and the variation in empirical methods and datasets do not permit comparison of robustness and strength between crowding-out and crowding-in effects.

A general implication of our results is the need to be aware, prior to any policy intervention, of any existing intrinsic motivations for protecting biodiversity and social norms among people who will be affected by a policy intervention. As stated by Van Hecken and Bastiaensen (2010), “if these are few, there is not much to destroy in terms of ‘social markets’ and ‘intrinsic motivation’ (p.439)”, and indeed, the practical relevance of motivation crowding effects for environmental policy has been questioned on the grounds that people’s level of intrinsic motivations may often be negligible (Stern 2008, Gawel 2000, 2001). Where intrinsic motivations and norms are strong, on the other hand, economic arguments and instruments should be handled with care. Hence, there is a need to assess baseline information before any economic incentives are implemented, as well as for monitoring purposes. In addition, survey-based or experimental pre-tests can be useful for a better understanding of the effectiveness of policy interventions, including possible interactions between economic incentives and intrinsic motivation. As emphasized by Bowles and Polanía-Reyes (2012, p.416), “crowding out does not follow from the use of incentives per se but rather from the meaning that the incentives convey to the participants”. This meaning needs to be assessed for the particular context and relevant population. To our knowledge, such assessments or pre-tests are rarely conducted as an integral part in the design of PES and other economic policy instruments.

#### 4.2 Large uncertainties remain due to lack of data and methodological limitations

Despite of the growing amount of research suggesting motivation crowding effects with economic instruments for biodiversity conservation, empirical evidence remains limited and fraught with uncertainty, mainly due to i) lack of adequate baseline information about pre-existing intrinsic motivations, ii) weak comparability of results across case studies resulting from inconsistent terminology and methods, and iii) the complexity stemming from cultural and contextual heterogeneity of crowding effects.

The first limitation relates to the fact that the baseline of potentially relevant intrinsic motivations prior to the implementation of economic incentives is in most cases poorly understood or documented. A wide variety of intrinsic motivations for the protection or sustainable use of biodiversity is mentioned in the reviewed studies. In particular the motivations labeled as “pro-nature”, such as appreciation and respect for nature or stewardship ethics, are specific to this context and have not been examined in previous work on motivation crowding effects. Yet few empirical studies discuss the nature of the preexisting intrinsic motivations for biodiversity protection they are addressing. A majority of

studies use social dilemma games to investigate whether economic incentives erode “pro-social motivations” (e.g., altruism, reciprocal obligations, social approval/peer pressure, or internalization of rules) expected to support norm compliance in social dilemma situations (cf., Fehr and Falk 2002, Frey and Stutzer 2008). As demonstrated by Ostrom (1990), social norms and conventions are indeed paramount for regulating the provision of local public goods and the sustainable use of natural resources in small societies. However, such norms do not necessarily rely on an intentional effort to protect biodiversity, and in such cases the experimental dilemma games are unlikely to capture pro-nature motivations (Smith and Wishney 2000).

The second limitation relates to weak comparability across case studies, in part due to the absence of a consistent terminology and common classification categories (e.g. for intrinsic motivations or for psychological mechanisms inducing behavioral changes), remaining an obstacle for deriving robust conclusions. For instance, only four of the reviewed studies provide hints towards psychological mechanisms behind crowding effects. Travers et al. (2011) refer indirectly to “control aversion” by stating that rewards may be more effective when self-organized by the community. Rodriguez-Sickert et al’s (2008) refer to the guilt-relief effect leading to crowding-out and to the “prescriptive effect” of policy measures as cause for crowding-in. Kerr et al (2012) explicitly and Garcia-Amado et al (2013) implicitly refer to a change of values or mindsets as explanations for crowding-out.

Last, the geographical distribution of the reviewed studies illustrates that, while economic instruments such as PES and biodiversity offsets and markets are mainly theorized and promoted by actors from developed countries, communities in developing countries across the globe remain the playing field where the short and long term effects of such instruments of conservation policy are tested. These communities differ widely with respect to mindsets, values and social norms governing the use of natural resources and human-nature relationships. Hence, cross-cultural differences and the context-dependence of conservation behaviors and relevant motivation add to the complexity of the issue, and empirical results obtained in a specific context may be more difficult to generalize than for environmental behaviors commonly studied in the developed world, such as recycling, choice of transport modes, or ecological consumption decisions.

#### 4.3. Improving research methodology for robust evidence on motivation crowding effects

Despite recent progress in methodologies for testing motivation crowding effects, challenges remain for appropriate research design, assessing base line situations, and establishing sound methodologies to detect and monitor changes in motivations. As demonstrated by Harrison and List (2004), the characteristics and merits of different empirical approaches deserve considerable reflection. Fisher (2012) suggests that a “first best” design for testing motivation crowding would apply longitudinal studies, e.g., following a PES scheme over the entire duration, with reasonable control over causality of outcomes. However, longitudinal studies using “natural experiments” require long time periods before motivational changes and their behavioral implications can be observed. Another option are cross-sectional studies where different instruments are applied in comparable populations (see e.g., van Hecken and Bastiaensen 2010, and Garcia-Amado et al. 2013). Field experiments, on the other hand, provide the opportunity for targeted design and increased control over variables. Here, convincing inference from experimental data to “real world” behavior requires both a representative study population and that the experimental decision task is sufficiently similar to the relevant natural decision of interest (Hogarth 2005). *Framed* field experiments using Public Goods or Common Pool Resource games conducted with local communities are likely to meet the criterion of a representative study population, but it is not clear whether the experimental decision task (i.e., extraction of tokens in an abstract game with verbal framing) adequately triggers all motivations that drive biodiversity conservation behavior. *Natural* field experiments are conducted with a representative population directly in the relevant setting, but they tend to be more resource-intensive and complicated to conduct (including the permission and support for introducing a “real” conservation relevant policy), and it is more difficult to maintain experimental control of relevant variables (e.g., of people’s level of attention or the information they take into account for making decisions).

Another challenge for empirical research is that motivation per se is not directly observable and has to be measured by appropriate proxies. Economists commonly measure behavioral data, and indeed behavioral data may be directly relevant for assessing the effectiveness of economic policies. However, observed behavior does not allow isolating different motivations, which creates difficulties for drawing conclusions on motivation crowding. For instance, when an incentive is introduced and behavior remains unchanged, this can imply either i) that there is a crowding-out effect where the positive effect on extrinsic motives and the negative effect on intrinsic motivation are canceling each other out, or ii) that both

intrinsic and extrinsic motivations are unaffected. The same holds for crowding-in effects. When incentives lead to net positive effect on conservation behavior, as e.g. the fines in Cardenas (2004), Vollan (2008), and Travers et al (2011), it is difficult to disentangle the influence of extrinsic motivation from additional intrinsic motivation. In order to draw conclusive inferences for crowding-out from behavioral data, empirical studies need to present a clear counter-effect, i.e., where the incentive reduces the propensity to engage in the conservation activity. Alternatively, studies can measure non-behavioral proxies for motivations. García-Amado et al. (2013) elicit the reasons people provide for biodiversity conservation and observe the frequency of occurrence of different reasons to shed light on people's perceptions or mindsets. Psychological theory (e.g., Ajzen and Fishbein 1975) predicts that changes in perception affect the motivational basis and may ultimately result in behavioral change. Yet such correlations remain a controversial issue, as is the correlation between attitudes and behavior (Diekmann and Preisendörfer 1998). Nevertheless, psychological and anthropological work may offer further guidance for future work on non-behavioral proxies. For instance, the potential of survey measures on non-anthropocentric motives for biodiversity protection (Spash 2000, Butler and Acott 2007, Spash et al 2009; Martín-López et al. 2008), psychological scales of environmental values and attitudes (Gagnon-Thomson and Barton 1994, de Groot and Steg 2008), and studies on people's emotional connectedness with nature (e.g., Mayer & Frantz, 2004) has not yet been sufficiently exploited for research on motivation crowding effects.

Last, empirical approaches should be able to separate the crowding hypothesis from alternative explanations for interaction between intrinsic and extrinsic motivation. Consider the evidence that certain individual characteristics correlate with responsiveness to economic incentives. People with high civic values (cf., d'Adda 2011) or high intrinsic motives towards biodiversity protection (cf., Fisher 2012) have been shown to be less responsive to positive incentives. This could imply that their intrinsic motivation has been crowded out, but also that people with these particular characteristics simply care less about the monetary aspect. Or, consider the following alternative explanation for the erosion of the incentive effect after a weakly enforced fine is introduced (Cardenas et al 2000, Vollan 2008): the probabilistic information on expected gains and losses entailed in a "weakly enforced" fine is too complex for participants to calculate, so that participants first overrate the fine's financial implication and realize only over time that enforcement of the fine is weak. Once they realize it, some participants return to non-cooperative behaviors and others (i.e., "conditional cooperators")

follow, along the usual dynamics in experimental dilemma games (see e.g., Fehr and Gächter 2000).

## 5. Conclusions

Motivation crowding is a well-established phenomenon and relevant in many contexts where intrinsic motivations play a role for determining behavior. For economic incentive measures meant to spur biodiversity protection, our literature review shows that the empirical research on motivation crowding effects is growing, and that a number of studies provide some evidence both for crowding-out effects and for crowding-in effects. Yet empirical evidence remains inconclusive, largely due to methodological and data limitations, including a lack of appropriate baseline information about existing intrinsic motivation against which motivational changes can be assessed, lack of common terminology and methodologies across studies, and complexities arising with variations across different environmental and socio-cultural contexts. We conclude that it is worthwhile to undertake further efforts towards understanding motivation crowding effects by economic incentives for biodiversity and ecosystem services protection, and to widen the scope of empirical approaches. For conservation policy and management practitioners who are considering monetary incentive measures, it is recommendable to carefully assess existing intrinsic motivations and potentially adverse effects of proposed incentive measures. Given that crowding-out effects can have detrimental impacts in long-term conservation of biodiversity that can be difficult to reverse once they have occurred, we call for caution in cases where uncertainties remain, especially when pre-existing intrinsic motivations and biodiversity values at risk are high.

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## Appendix 1. Overview of empirical studies on crowding effects for the biodiversity context

	<i>Article</i>	<i>Economic incentive measure and targeted behavior</i>	<i>Target population and geographical location</i>	<i>Type of intrinsic motivation mentioned</i>	<i>Method and data</i>	<i>Reported findings on motivation crowding effects</i>
1	Cardenas et al (2000)	Government imposed quota with weakly enforced <b>fin</b> es to limit the over-use of forest resources.	Rural Colombian communities	public spiritedness	<b>Framed field experiment:</b> CPR game with local population, verbal framing of token extraction as “time to collect firewood in the forest”  <b>Behavioral data:</b> amount of tokens extracted	<b>CO:</b> Introducing sanctions initially reduces extraction levels, but subsequently extraction rises back to pre-intervention level. Authors argue that “the regulation appeared to crowd out other-regarding behavior (p.1719) and that “Looking at the earnings of this group apart from the rest provides a dramatic illustration of the welfare consequences of the crowding out effect of regulation.” (p.1730).
2	Cardenas (2004)	External regulations with random monitoring and high or low <b>fine</b> to limit over-use of forest resources.	Rural Colombian communities	altruism, fairness, reciprocity, reputation	<b>Framed field experiment :</b> CPR game with local population; verbal framing  <b>Behavioral data:</b> amount of tokens extracted	All treatments (high fine, low fine, self-governance) significantly reduce extraction rates over the entire 10 periods. There is no evidence for crowding effects..
3	Rodríguez-Sickert et al (2008)	Authority imposes high or low <b>fine</b> for resource over-use (fish or water). Additional setting where people can vote for or against the fine.	Rural Colombian communities	moral norms, guilt	<b>Framed field experiment:</b> CPR game with local population, verbal framing.  <b>Behavioral data:</b> amount of tokens extracted	Authors state that “a guilt relief effect appears when norms are enforced” (p.227), but there is no support in the data.  <b>CI:</b> The suggestion of a fine reduces extraction initially, but is not stable. Authors write that “When fines are rejected, internalization of a social norm explains the increased cooperation (p.215)”. Authors also conclude that “Low fines stabilize cooperation by preventing a spiral of negative reciprocation” (p.215).
4	Vollan (2008)	Quota with external <b>sanctions</b> or <b>rewards</b> to limit over-use of collectively owned natural resources (over-grazing).	Small-scale life-stock farmers in traditional communities in South Africa and Namibia.	culturally internalized social norms of trust and reciprocity.	<b>Framed field experiment :</b> CPR game with local population, verbal framing of token extraction as “number of sheep to own” , “trust game” to study effect of trust on cooperation;  <b>Behavioral data:</b> amount of tokens extracted	<b>CO:</b> Author states that he “did not obtain the crowding-out effect for the complete sample.” (p.569), but that “there is a crowding-out effect in the penalty scenario occurring in groups where the penalty rule had been chosen with the lowest possible group support for the rule” (p.570), concluding that “Penalty works significantly the best in the low trust region but crowds-out co-operation in a high trust area.” (p.571)
5	Reichhuber et al (2009)	Collective <b>taxes</b> and <b>subsidies</b> to discourage overharvesting NTFP (honey, firewood).	Subsistence farmers in three villages with access to forests in Ethiopia.	cooperative behavior	<b>Framed field experiment:</b> CPR game with local population, verbal framing of extraction as “number of bee hives harvested”. Only collective behavior observable;  <b>Behavioral data:</b> amount of tokens extracted	Even under a low tax there is initially significant cooperation, but it wears off over time. Authors state that “cooperative behavior is crowded out by short-term individual payoff maximization” (p.653). However, since there is no baseline treatment without intervention for comparison, crowding-out cannot be analyzed.
6	Van Hecken &	<b>PES</b> rewarding households for silvo-pastoral practices;	Rural farmers in	social norms, enjoyment and	<b>Natural field experiment:</b> households subdivided into	<b>CO:</b> No crowding effects in behavioral data., but “In a neighboring nature reserve, which plays a critical role in the local urban water

	Bastiaensen (2010)	in addition, effectiveness of technical assistance is tested.	Nicaragua.	satisfaction from the existence of natural resources	three groups: PES, PES + technical assistance, Control <b>Behavioral data:</b> land use change to silvo-pastoral practice; <b>Survey data:</b> Interviews with participating farmers and project staff	supply, farmers are at present strategically expressing this threat, allegedly demanding compensatory PES for protecting the remaining forests on their properties.” (p.438) <b>CI:</b> From interview data, authors state that “PES payments were an additional objective and symbolic factor” (p.441).
7	Sommerville et al (2010)	<b>PES</b> scheme to promote a forest management plan that forbids activities (agric. expansion, hunting) and restricts others through limited <b>permits</b> (timber and NTFP harvesting).	Traditional forest using communities in Madagascar.	attitudes towards conservation	<b>Natural experiment:</b> Within PES scheme, (relatively small) payments to communities were awarded at annual party <b>Survey data:</b> Comparing self-reported frequencies of stopping harmful forest-use activities (in communities with and without PES); elicitation of attitudes towards conservation and of reasons for stopping activities	<b>CI:</b> Payments have no significant direct effect on behavior, but survey data indicates that the annual Fund party and payment awards have strong effect on attitudes toward conservation, and they “create the positive attitudes and trust that lay the groundwork for voluntary local acceptance of monitoring, which ultimately acts as the motivational tool“. (p.1496)
8	Travers et al (2011)	Individual <b>rewards</b> (either from outside or within group) and weakly or strongly enforced <b>penalties</b> to stop over-use of resources (over-fishing).	Rural villagers in Cambodia.	cooperation, reciprocity, norms	<b>Framed field experiment :</b> CPR game with local population, verbal framing of extraction as “fishing from pond”; <b>Behavioral data:</b> Amount of tokens extracted	<b>CO:</b> Regulations differ in effectiveness, but no direct indication of crowding effects. Possibly indirect indication since rewards are more effective when self-organized.
9	García-Amado et al (2011)	<b>PES</b> schemes to promote forest conservation (no hunting and logging, surveillance patrolling).	Agro-forestry farming community in a biosphere reserve in Mexico.	Environmental awareness, appreciation of ecosystem services	<b>Natural experiment:</b> Interviews eliciting whether people will continue conservation activities without PES, depending on allocation of PES income within community. <b>Survey data:</b> stated expectation to continue with conservation activities after PES	No evidence for crowding effects in the data, authors state that it is “unclear whether PES can strengthen or work against intrinsic values” (p.2367).
10	Greiner & Gregg (2011)	A <b>series of policy measures</b> for on-farm conservation, e.g., income tax incentives, government regulation, cost-sharing for conservation, management plans.	Cattle farmers in northern Australia.	stewardship goals, care-based ethic	Social survey eliciting motivational orientation towards conservation, perceived importance of impediments to conservation, perceived effectiveness of regulations and incentives for conservation. <b>Survey data:</b> economic, conservation, social motivations, incl. “look after the environment”, “pass on land in good condition”, “improve resource/land condition”, “live and work on a grazing property”	<b>CO:</b> Authors speculate that “graziers, particularly those with high stewardship & lifestyle motivation, may have experienced the crowding out of intrinsic motivation by financially driven policy programs” (p.264), and “conclude that well-designed laws and public policies can harness self-interest in conservation, while incentives that primarily appeal to financial self-interest may fail when they undermine the fundamental values that lead farmers to act altruistically or in conservation-spirited ways (p.265)”. <b>Behavioral data:</b> Amount of contribution
11	D’Adda (2011)	Monetary <b>punishment</b> by community or public revelation of actions (reputational) as measures	Villagers in rural communities in	civic values, social norms, social image, conservation	<b>Framed field experiment:</b> PG situation with individual contributions to a real reforestation project <b>Behavioral data:</b> Amount of contribution	External incentives are more effective for individuals with low intrinsic motivation for norm compliance. The author writes that the results “suggest that motivation crowding occurs through the effect of external incentives on social image. Experimental results, though

		against deforestation and overexploitation of land.	Bolivia.	specific intrinsic motivation	<b>Survey data:</b> individual environmental and civic values	of limited statistical significance due to the small sample, are nonetheless valuable (p.2094).
12	Fisher (2012)	NGO-driven carbon <b>PES</b> scheme that pays land-owner during 10 years for planting trees on private land.	Forest adjacent communities in Uganda.	regulating services, aesthetic value, existence value, bequeath value	<b>Natural experiment:</b> Interviews with 81 community members <b>Survey data:</b> motivations for tree planting, environmental values and future perspectives for conservation; benefit ranking exercise	<b>CO:</b> Author states that “PES may be less temporally sustainable than more integrated interventions unless payments are maintained in perpetuity” (p. 53).  Data indicates that several non-financial (including existence and bequeath) values of trees are present and that people with high non-use values respond less to incentives.
13	Narloch et al (2012)	Individual or community <b>rewards</b> for agro-biodiversity conservation (crop rotation).	Farming communities in Bolivia (commercially oriented) and Peru (subsistence farming).	norms, altruism, reciprocity	<b>Framed field experiment:</b> PG game with local population, verbal framing of contributions as “land units allocated for planting a threatened crop variety”; elicitation of individual characteristics  <b>Behavioral data:</b> amount of contributions	<b>CO:</b> Authors conclude that “collective rewards could be ineffective and crowd-out social norms” (p.2096) and that “data from the Peruvian site indicate that collective rewards spur free-riding behavior, thereby undermining conditional cooperativeness and the potential for collective action”. (p. 2104)  <b>CI:</b> Authors explain that “individual rewards seem to provide an additional incentive to unconditionally cooperative farmers, thus strengthening conservation by altruistic farmers” (p.2103).
14	Kerr et al (2012)	<b>PES</b> schemes with high or low monetary payments to individuals or groups (through village leaders), rewarding voluntary participation to manage a communal forest.	Communities in Tanzania and Mexico.	social norms	<b>Natural field experiments</b> (and survey) with invitations to help collect litter from streets (Mexico) and plant trees in schoolyard (Tanzania). Stated choice experiment on participation slashing grass in schoolyard (Tanzania).  <b>Behavioral data:</b> number of people showing up for collecting litter (Mexico); work effort for tree planting (Tanzania)  <b>Survey data:</b> number of people stating they would show up for activity (Tanzania choice experiment); stated work satisfaction (Tanzania field experiment)	<b>CO:</b> Authors write that in the Tanzania choice experiment “a low payment yielded a lower positive response than no payment at all” and that the “field experiment yielded a similar finding, whereby subjects who were not offered individual payment overwhelmingly expressed satisfaction with the work and for having done something useful for the village, whereas most of those who received payment expressed dissatisfaction with the work and the task. This finding, though only suggestive, supports the motivation crowding-out effect of monetary rewards” (p.225)
15	Lopez et al (2012)	Public revelation, campaign, and high or low <b>penalties</b> for not keeping beaches and wharves clean.	Fishermen on islands off the Caribbean coast of Colombia	guilt, shame, social norms	<b>Framed field experiment:</b> PG game with local population  <b>Behavioral data:</b> amount of contributions	The authors state that results “point to an interesting question for future work—does regulatory pressure complement or crowd-out social emotions in the management of natural resources?” (p.141)
16	García-Amado et al (2013)	<b>PES</b> schemes with community payments for conservation activities and compensation of restrictions vs. Integrated Conservation and Development Projects	Rural communities in a biosphere reserve in Mexico	respect for nature, benefits from ecosystem services	<b>Natural experiment:</b> 713 structured interviews in a project area where PES and ICDP were introduced; motivations are analyzed along type of program (PES, ICDP), years receiving PES, education, age, land tenure, conservation status of the community land.	<b>CO:</b> Authors conclude that “PES recipients tend to show more appreciation for the utilitarian and monetary aspects of conservation than farmers involved in ICDP activities. Moreover, the longer the time having been receiving PES, the less likely it is that people will support an intrinsic, culturally based principle for conservation that gradually becomes replaced by monetary interests.” (p.99). The

		(ICDP) (adaptive management, education, technical assistance)			<b>Survey data:</b> Participant are asked to provide reasons justifying that “there will be conservation in the community in the future”. Reasons are clustered as reflecting “intrinsic”, “utilitarian”, or “monetary” motivation.	authors further state that their data “supports the idea that PES are contributing to shifting from a “culture of conservation” to a “culture of monetary criteria” (p.98).
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CI = noteworthy results on crowding-in; CO = noteworthy results on crowding-out