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Motivation crowding by economic incentives in conservation policy: A review of the empirical evidence

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ABSTRACT

The paper seeks to advance our understanding of the extent to which the use of economic incentives can undermine ("crowd out") or reinforce ("crowd in") people's intrinsic motivations to engage in biodiversity and ecosystem conservation. We first synthesize and classify the psychological mechanisms behind motivation crowding effects. Then we conduct a systematic review of empirical studies that test for motivation crowding effects triggered by economic incentives to encourage nature conservation. Based on eighteen empirical studies, we identify evidence of motivation crowding out and, to a lesser extent, crowding in effects. Finally, we discuss the implications for environmental policy and research. We note that the limited comparability of results across studies, the lack of baseline information about pre-existing intrinsic motivations, and a complexity stemming from cultural and contextual heterogeneity appear to be the main challenges when it comes to establishing more conclusive evidence. We conclude that, as economic instruments for conservation are increasingly being used worldwide, it is crucial to assess existing intrinsic motivations and expected changes in people's motivational structures prior to large-scale implementation. We call for caution with economic incentives in situations involving considerable uncertainty regarding the detrimental impacts on intrinsic motivation.

1. Introduction

Economic incentives have increasingly gained prominence in environmental policy as a means to promote biodiversity and ecosystem services conservation[1] (Vatn, 2010; Pirard, 2012; WBCSD, 2011). While these developments are often regarded as an impetus for biodiversity conservation and an opportunity for "mainstreaming biodiversity" (TEEB, 2010), critics have started to voice doubts about their potential to halt biodiversity loss (McCauley, 2006; Redford and Adams, 2009; Child, 2009). One concern frequently raised is that economic incentives may "crowd out" intrinsic motivations, such as people's moral commitment towards nature conservation (e.g. Luck et al., 2012). Thus the effectiveness of economic incentives in achieving biodiversity conservation remains contested, and some authors suggest that the changes they can induce in motivations may, under certain conditions, undermine long term conservation efforts (Kosoy and Corbera, 2010; Vatn, 2010; Gómez-Baggethun and Ruiz-Pérez, 2011; Muradian et al., 2013).

The crowding out hypothesis is often traced back to Titmuss' (1971) argument that blood donors are motivated by moral concerns rather than money, and that monetary compensation for donating blood could lead to a decrease in supply (see also Mellström and Johannesson, 2008). Motivation crowding theory is based on the psychological notion of intrinsic vs. extrinsic motivation (Deci, 1971, 1975; Deci et al., 1999). Intrinsic motivation refers to doing an activity for the inherent satisfaction it brings, meaning that an individual is moved to act for the fun or challenge involved or else due to personal conviction. Extrinsic motivation, on the other hand, is given whenever an activity is done for its instrumental value, that is, in order to attain a separable outcome, be it of a material or monetary nature or related to perceived benefits of a non-material kind (Ryan and Deci, 2000). Contrary to a common assumption implicit in economic theory, 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 intrinsic motivations ("crowding out") and in other circumstances reinforce them ("crowding in").

It was Frey (1992, 1993, 1997) who first introduced the crowding out hypothesis to the economic literature, arguing that the effects described might also outweigh the stimulating effect of monetary incentives and so reduce a person's propensity to engage in the desired activity. Since then, work in behavioural and experimental economics has discussed the crowding out effect in relation to a variety of contexts,

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[1] We treat "biodiversity" and "nature" as equivalent, and for the sake of brevity we often write "biodiversity conservation" instead of "biodiversity and ecosystem conservation".

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including people's motivations in the workplace (Frey, 1997; Gneezy and Rustichini, 2000b; Heyman and Ariely, 2004), communities' willingness to host a nuclear energy facility (Frey and Oberholzer-Gee, 1997), parents' efforts to arrive on time to pick up their children from day care (Gneezy and Rustichini, 2000a), and voluntary efforts to raise funds for humanitarian causes (Gneezy and Rustichini, 2000b). Bowles and Polonía-Reyes (2012) review some 50 experimental studies that demonstrate motivation crowding effects across many domains.

The relevance of the crowding out hypothesis in relation to environmental policy has frequently been mentioned (e.g. Frey, 1992, 1993; Frey and Oberholzer-Gee, 1997; Bowles, 2008), typically with respect to behaviours such as resource use (recycling, saving water), modes of mobility (driving slowly, using public transport or a bicycle as opposed to a car), and consumption decisions, including boycotts of environmentally harmful products (Gawel, 2000; Frey and Stutzer, 2008). For corporate behaviour, the hypothesis has been related to polluting the environment (Frey, 1992; Gawel, 2000). Although economic instruments for biodiversity conservation are increasingly being implemented worldwide, an understanding of their effects on motivational structures remains elusive. In 2010 Vatn described the motivational aspect of economic instruments such as payments for ecosystem services (PES) as "a very under-researched area" (Vatn, 2010, p. 1250). Over recent years, a growing number of studies have addressed motivation crowding arising from economic incentives implemented in a variety of contexts to encourage biodiversity conservation, including rewards for using traditional crop varieties in Bolivia and Peru (Narloch et al., 2012), a payment scheme for tree planting in Uganda (Fisher, 2012), and incentives for forest management and conservation in Mexico (García-Amado et al., 2013). Ultimately, understanding motivation crowding effects is of crucial relevance when it comes to appraising the overall efficacy of economic instruments — not least because motivational changes have been shown to be persistent (Gneezy and Rustichini, 2000a).

The aim of this paper is to advance our understanding of the extent to which economic instruments used in biodiversity conservation policy can lead to motivation crowding effects and under what conditions this occurs. To begin, we synthesize key findings in the economic literature regarding the psychological mechanisms through which economic incentives can lead to motivation crowding effects. We then review existing empirical research on motivation crowding arising from economic instruments used to encourage biodiversity and ecosystem conservation, before finally presenting and discussing the empirical evidence and the associated implications for environmental policy and research.

2. Methodology

Our review was conducted in two stages. The first stage consisted of a survey of the economic literature on motivation crowding in order to summarize the psychological mechanisms behind motivation crowding effects that have been identified as relevant for environmental behaviour. We classify the mechanisms according to whether they are expected to trigger crowding out or crowding in effects. The second stage consisted of a systematic review of peer reviewed articles with the aim of searching for evidence of motivation crowding effects. Specifically, we reviewed papers published up until 2013 that i) present an empirical study, ii) address economic instruments for biodiversity or ecosystem conservation, and iii) test for motivation crowding effects. We conducted a *title search* for articles in 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. Finally, we searched the reference lists of the previously identified studies for further relevant empirical work.

In the second stage of the review we began by characterizing the studies according to the environmental behaviours affected by economic incentives, the study populations, and the geographical locations where the studies were conducted. We then classified the types of intrinsic motivation mentioned in the articles. Following this, we analysed the studies according to the following criteria: i) type of economic incentive, ii) methods and data, iii) reported findings on motivation crowding effects, and iv) psychological mechanism behind motivation crowding effect.

Regarding the types of incentives, we follow Pannell's (2008) categorization of economic policy instruments, distinguishing between positive incentives that seek to encourage sustainable natural resource management and conservation activities (e.g. rewards, subsidies, payments for ecosystem services) and negative incentives that seek to limit harm to biodiversity or to prevent the over-use of natural resources (e.g. fines, taxes). Research indicates that positive and negative incentives may have distinct consequences in terms of motivation crowding if, for instance, positive incentives are perceived as supportive while negative ones are perceived as controlling (Frey and Stutzer, 2008; Vollan, 2008).

Following the taxonomy created by Harrison and List (2004), the empirical methods used to test for motivation crowding effects are divided into framed field experiments, natural field experiments, and natural experiments. In framed field experiments, local people are invited to participate in interactive tasks, here typically representing a "social dilemma" 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 opportunity to participate in a community activity or a farmer's choice between different agricultural practices) is manipulated by introducing an economic incentive, and the people involved do not know that they are part of an experiment. Natural experiments investigate the effects of actual policy interventions involving economic incentives. Empirical data used to assess the effectiveness of incentives and motivation crowding effects are classified as behavioural data, where behaviours are observed in order to derive inferences regarding the status of and changes in motivations, and survey data, where inferences regarding 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 available, we record the evidence for motivation crowding reported by the authors. Where authors do not explicitly refer to crowding effects, we checked whether the analyses included implicit indications for motivation crowding effects. We also report whether the results are statistically significant or only suggestive of an effect (e.g. from qualitative interview data). Finally, we report whether the studies relate their results to psychological mechanisms behind motivation crowding effect, based on the categories established in the first stage of our review, and how they do so.

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 effects that are mentioned in the literature as being relevant to environmental behaviour. Several papers propose typologies with sub-sets of the mechanisms and different terminologies (Gawel, 2001; Frey and

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

Psychological mechanism	Explanation	Regulations for which this mechanism seems relevant	References and examples from broader literature	References and examples from reviewed articles of motivation crowding in the context of biodiversity conservation
Crowding-out				
Control aversion	Individuals with a sense of autonomy and self-determination dislike feeling controlled.	All incentives.	Bowles (2008), Frey and Stutzer (2008)	d'Adda (2011)
Frustration	Individuals are frustrated when they perceive regulations as a sign of distrust that they will do the right thing, or as unfair.	All incentives, but mainly negative ones.	Gawel (2001), Gneezy et al. (2011) A tax that penalizes even low levels of emissions can be perceived as unfair by environmentally conscious individuals Goeschl and Perino (2012).	
Reduced internal satisfaction (reduced "warm glow")	Individuals no longer feel good about themselves for acting morally on a voluntary basis.	All incentives.	Bowles and Polonía-Reyes (2012), Frey and Stutzer (2008)	Kerr et al. (2012)
Reduced image motivation	Incentives undermine the desire for image as "good person" ("signalling") since others can no longer distinguish if one undertakes a social activity voluntarily or due to external incentives.	All incentives.	Gneezy et al. (2011) Image concerns can be a motivation for recycling.	d'Adda (2011), Kerr et al. (2012)
Release from moral responsibility	Compensating for environmental harm via monetary payments releases people from feelings of responsibility and guilt.	All incentives, but mainly negative ones.	Frey (1992), Goodin (1994), Wells (1998), Gawel (2001), Frey and Stutzer (2008), Spash (2010) Tradable permits or offsetting mechanisms (e.g. for corporate CO_2 emissions, biodiversity impacts) generate "prices" for environmental impacts and give polluters a right to pollute or to damage ecosystems.	Rodríguez-Sickert et al. (2008), Van Hecken and Bastiaensen (2010), d'Adda (2011), Lopez et al. (2012), Narloch et al. (2012)
Frame shifting	An individual's attention is shifted towards a focus on economic reasoning (short term).	All incentives.	Heyman and Ariely (2004), Bowles (2008), Kallis et al.(2013) When described as market setting (as opposed to community cooperation) people are less likely to contribute to a public good (Liberman et al., 2004). Introducing a competitive mechanism (tender) reduces voluntary contributions to a public good (Reeson and Tisdell, 2010)	Cardenas et al. (2000), Van Hecken and Bastiaensen (2010) Shifting from social to a monetary way of thinking can explain why low payments reduce participation in a community activity compared to no payments (Kerr et al., 2012).
Changes in values or mindsets	The focus on economic reasoning affects attitudes and mindsets regarding conservation (long term).	All incentives.	Frey (1992), Vatn (2010), Gómez-Baggethun et al. (2010)	Greiner and Gregg (2011), Fisher (2012) PES schemes seem to contribute to shifting from a culture of conservation to a culture of monetary criteria (García-Amado et al., 2013).
Crowding-in				
Enhanced internal satisfaction (self-esteem or "warm glow") through social recognition	Individuals feel better about their behaviour when they perceive rewards as supporting and acknowledging their behaviour	Positive incentives.	Frey and Jegen (2001)	Stewardship awards for communities are seen as acknowledgement of their traditional conservation activities (Van Hecken and Bastiaensen, 2010).
Reinforced positive attitudes or trust	Rewards can enhance people's general attitudes towards conservation and trust in regulating institutions.	Positive incentives.	Frey and Stutzer (2008)	Payments for conservation action create the positive attitudes and trust that lay the groundwork for voluntary local acceptance of monitoring (Sommerville et al., 2010).
Prescriptive effect	Individuals are sent a "message" indicating what constitutes desirable societal action, potentially in the longer term changing perceptions, values and norms.	All incentives.	Frey (1992), Rodríguez-Sickert et al. (2008), Bowles and Polonía-Reyes (2012) Implementation of a negligible fee reduces significantly the use of plastic bags (Rosenthal, 2008).	Rodríguez-Sickert et al. (2008) PES signal to farmers who have previously seen trees as a hindrance to development that environmental protection is highly valued by outsiders (Van Hecken and Bastiaensen, 2010).
Reinforcement achieved by compelling non-intrinsically motivated individuals to comply	Intrinsically motivated individuals can more easily act upon their motivation when not faced with the bad example or even exploitation of individuals who are not intrinsically motivated.	All incentives.	It is easier for environmentally minded car drivers not to "speed" on the highway when a general speed limit and fine prevents other drivers from overtaking them (Gawel, 2001).	Narloch et al. (2012) A fine in a common pool resource situation prevents conditional cooperators with intrinsic motivation from also overusing the resource when observing that others do so (Rodríguez-Sickert et al., 2008).

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Jegen, 2001; Frey and Stutzer, 2008; Bowles, 2008; Gneezy et al., 2011; Bowles and Polonía-Reyes, 2012). Our proposed typology is one among several possible ones that can be chosen depending on the level of aggregation of related mechanisms. An argument can be made in favour of combining categories into more general phenomena or, alternatively, establishing finer ones, based on more or less subtle psychological differences. In Table 1, we further indicate whether the psychological mechanisms are likely to be relevant in relation to positive or negative incentives. We also name the sources documenting the respective mechanisms and state which examples appeared in the empirical studies we reviewed and which ones derive from the broader literature on environmental policy.

3.1.1. Crowding Out Effects

We identified seven psychological mechanisms underlying crowding out effects. 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 need for autonomy and self-determination (Deci and Ryan, 1985; Bowles, 2008; Frey and Stutzer, 2008). Second, people can feel frustration when they perceive regulations as either a sign of distrust that they will do the right thing or else as unfair (Gawel, 2001; Falk and Kosfeld, 2006; Gneezy et al., 2011). Third, the introduction of economic incentives may reduce image motivation among people who engage in pro-environmental behaviour (e.g. recycle) (Benabou and Tirole, 2006; Gneezy et al., 2011), because in the presence of economic incentives other people can no longer distinguish whether they are engaging in an activity voluntarily or for economic reasons. Fourth, incentives may reduce people's internal satisfaction, sometimes referred to as the "warm glow effect" (Andreoni, 1990; Bowles and Polonía-Reyes, 2012), when acting on a voluntary basis made them feel good about themselves. The fifth category, release from moral responsibility, is especially relevant in relation to negative incentives based on the "polluter pays principle". Compensation payments can act as "environmental indulgences" (Goodin, 1994), where people believe that they are adhering to 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 that act as "rights" to pollute or to impact ecosystems within market-based schemes, e.g. CO_2 emissions trading or biodiversity offsets. Sixth, frame shifting occurs when an economic incentive changes the cognitive concept behind acting in an environmentally friendly way (Bowles, 2008, Neuteleers and Engelen, in press). 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 considerations. Liberman et al. (2004) provide an experimental demonstration of this effect for a PG dilemma game, where labelling the situation as a "Wall Street game" resulted in significantly fewer contributions compared to labelling it a "community game". Finally, changes in the focus towards economic reasoning following frame shifting may in the longer term result in changes in values or mindsets relating to environmental protection (Frey, 1992). This mechanism is reflected in concerns that PES schemes may change people's conservation logic from moral obligation or community norms towards conservation for profit (Vatn, 2010; Gómez-Baggethun et al., 2010; García-Amado et al., 2013). Although the two last mechanisms are related, we deemed it appropriate to keep them as separate categories, since frame shifts may be only temporary, while changes in values and mindsets refer to longer term effects.

3.1.2. Crowding in Effects

Four psychological mechanisms were identified as operating behind crowding in effects. 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 (Van Hecken and Bastiaensen, 2010). This effect may be stronger when rewards are not expected (Frey and Jegen, 2001). Second, reinforced positive attitudes or trust refers to the observation that rewards or payments for conservation actions can improve people's general attitudes towards conservation and strengthen their trust in regulating institutions (Sommerville et al., 2010). Third, institutions and regulations can have a prescriptive effect by providing a normative sign of what constitutes desirable societal action (Bowles and Polonía-Reyes, 2012). For instance, Frey (1992) argues that pro-environment subsidies convey the message that ethical behaviour towards nature is recognised and supported by the wider society. Bowles and Polanía-Reyes cite Rosenthal's (2008) example from Ireland, where a small tax on plastic grocery bags enacted in 2002 was followed by a 94 percent decline in their use within two weeks. According to the fourth mechanism, reinforcement achieved by compelling non-intrinsically motivated individuals to comply, intrinsically motivated people find it easier to act upon their motivation when regulatory action restricts the behaviour of others who are not intrinsically motivated. For instance, an environmentally minded car driver may find it easier to restrict her speed when other drivers are not constantly overtaking her (Gawel, 2001). Analogously, in a CPR or PG situation many people act as "conditional co-operators" who are intrinsically motivated but do not accept any "free riding" on the part of others who exploit their positive action (Rodríguez-Sickert et al., 2008; Narloch et al., 2012).

3.2. Empirical Evidence of Motivation Crowding Arising from Economic Incentives

We identified eighteen peer reviewed articles that fulfilled all three criteria of our review, i.e. empirical studies that addressed economic incentives aimed at encouraging biodiversity and ecosystem conservation and that tested for motivation crowding. Table 2 presents the overview of our analysis and shows an increase in the number of empirical studies in recent years, with only six studies published between 2000 and 2009 and twelve new studies between 2010 and 2013.

3.2.1. Targeted Behaviours, Study Populations and Geographical Locations

The economic incentives in the studies we reviewed were intended either to decrease pressure on natural resources (fish, water, timber, non-timber forest products and pastures) or to promote conservation activities such as improved forest management, tree planting, silvopastoral agriculture and agrobiodiversity. All the papers present studies conducted among rural populations, and although several studies refer to "traditional" populations none clearly indicates that the intervention targeted indigenous people. With the exception of one study with Australian cattle farmers (Greiner and Gregg, 2011), all studies were conducted in so-called developing countries. Six of the studies we reviewed were conducted among communities in Africa (Uganda, Namibia, South Africa, Kenya, Tanzania, Madagascar, Ethiopia), three in Central America (Mexico, Nicaragua), seven in South America (Peru, Bolivia, Colombia), and one in Asia (Cambodia). The geographical locations of the studies are illustrated in Fig. 1.

3.2.2. Types of Intrinsic Motivation

The studies selected for review mention a variety of intrinsic motivations, some describing similar phenomena in different terms. As suggested by d'Adda (2011), we divide types of intrinsic motivation into the categories pro-social (defined as those that relate to social relations with other people or the larger community) and pro-nature (defined as those that relate to values attributed to, or relationships with, the natural world). Thirteen studies refer to pro-social motivations, mentioning most often norms (9), reciprocity (4), and cooperation (4). Six studies refer to pro-nature motivations. Some of them refer to ecosystem services, reflecting an instrumental value of biodiversity for humans,

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Table 2
Overview of empirical studies on crowding effects for the biodiversity context.

Article Description of targeted behaviours, study population and geographical location	Economic incentive measure	Method and data	Reported findings on motivation crowding effects	Reference to psychological mechanisms
Cardenas et al. (2000) Over-use of forest resources by rural communities in Colombia	**Negative**: quota with weakly enforced **fines**	**Framed field experiment**: CPR game with local population, verbal framing of token extraction as "time to collect firewood in the forest" **Behavioural data**: amount of tokens extracted	**CO — stat. significant:** 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 behaviour" (p.1719).	**CO:** Authors refer to frame shifting.
Cardenas (2004) Over-use of forest resources by rural communities in Colombia	**Negative**: quota with weakly enforced **fine** (high or low)	**Framed field experiment** : CPR game with local population; verbal framing **Behavioural data**: amount of tokens extracted	**No effect:** All treatments (high fine, low fine, self-governance) significantly reduce extraction rates over the entire 10 periods.	None
Rodríguez-Sickert et al. (2008) Resource over-use (fish or water) by rural communities in Colombia	**Negative:** quota with weakly enforced **fine** (high or low); incl. a setting where people can vote for or against the fine.	**Framed field experiment**: CPR game with local population, verbal framing. **Behavioural data**: amount of tokens extracted	**CI — stat. significant:** Then participants vote against the fine, the suggestion reduces extraction (initially). Authors write that In the low fine setting, they conclude that "Low fines stabilize cooperation by preventing a spiral of negative reciprocation" (p.215).	**CO:** Authors refer to the "guilt-relief effect" which reflects what we label as "release from moral responsibility". **CI:** Authors refer to the prescriptive effect of policy measures by stating that "when fines are rejected, internalization of a social norm explains the increased cooperation" (p.215). They also refer to reduced pressure by forcing non-moral individuals to compliance by stating that a "low fine stabilizes cooperation by preventing a spiral of negative reciprocation" (p.223).
Vollan (2008) Over-grazing by small-scale life-stock farmers in traditional communities in South Africa and Namibia	**Negative** and **positive**: Quota with external **sanction**s or **rewards**	**Framed field experiment** : 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; **Behavioural data**: amount of tokens extracted	**CO — suggestive:** Author states that he "did not obtain the crowding-out effect for the complete sample." (p.569), but observe (although without a test for statistical significance) "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)	None
Reichhuber et al. (2009) Overharvesting of forest products (honey, firewood) by subsistence farmers with access to forests in Ethiopia	**Negative** and **positive**: Collective **taxes** and **subsidies**	**Framed field experiment**: CPR game with local population, verbal framing of extraction as "number of bee hives harvested". Only collective behaviour observable; **Behavioural data**: amount of tokens extracted	**CO — suggestive:** Even under a low tax there is initially significant cooperation, but it wears off over time. Authors state that "cooperative behaviour is crowded out by short-term individual payoff maximization" (p.653). However, since there is no baseline treatment without intervention for comparison, there is no conclusive evidence.	None
Jack (2009) Paying compensation for upstream watershed conservation by downstream communities in Kenya	**Negative**: Within a hydro **PES**, a weakly enforced **fine** on downstream water users who do not compensate upstream land users	**Framed field experiment:** Investment game between local upstream (first mover) and downstream population (second mover). **Behavioural data**: Amount of tokens invested (first mover) and returned (second mover) **Survey data:** Elicitation of expectations of the counterpart's behaviour; questionnaire with demographic variables, identity, perceptions of social norms.	**CO — stat. significant:** Behaviour of downstream individuals is unaffected by the enforcement, but investments by upstream individuals decrease when the enforcement is removed, while they increase in the control group. The author writes that "the removal of enforcement in the second round seems to crowd out preference-based transfers by upstream first movers." (p.1819)	None
Van Hecken and Bastiaensen (2010) Silvo-pastoral practices by rural farmers in Nicaragua	**Positive: PES** rewarding households; in addition to technical assistance	**Natural field experiment**: households subdivided into three groups: PES, PES + technical assistance, control **Behavioural data**: land use change to silvo-pastoral practice;	**CO — suggestive:** Authors find "worrying indications" (p.438) that the introduction of market logic leads farmers to demand compensation for areas which they previously protected for free. **CI — suggestive:** From interview data, authors state that "PES payments	**CO:** Authors describe frame-shifting towards a market logic and release from moral responsibility. **CI:** Authors seem to describe enhanced internal satisfaction when observing that stewardship awards for communities are seen as acknowledgement, but also the

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Table 2 *(continued)*

Article Description of targeted behaviours, study population and geographical location	Economic incentive measure	Method and data	Reported findings on motivation crowding effects	Reference to psychological mechanisms
		Survey data: Interviews with participating farmers and project staff	were an additional objective and symbolic factor" (p.441).	prescriptive effect when explaining that PES can signal to farmers who previously see trees as a hindrance to development that environmental protection is highly valued by outsiders.
Velez et al. (2010) Overfishing by fishermen in Colombia	**Negative:** Individual quota with weakly enforced **fines** (low or medium), with and without group communication	**Framed field experiment:** CPR game with local population. **Behavioural data:** Amount of tokens extracted **Survey data**: Questionnaire eliciting basic individual characteristics and expectations of what others harvest	**CO — stat. significant:** Authors state that "of the six possible combinations of regions and regulations, we observe three instances in which a regulation combined with communication produced more conservative harvests than communication alone, one case in which a regulation actually crowds out communication, and two cases in which the combination of communication and a regulation did not produce a significant difference in harvests than communication alone". (p.263).	None
Sommerville et al. (2010) Compliance with forest management plan that forbids activities (agric. expansion, hunting) and restricts others (timber and NTFP harvesting) by forest using communities in Madagascar	**Positive: PES** scheme with rewards for compliance	**Natural experiment:** Within PES scheme, (relatively small) payments to communities were awarded at annual party **Survey data:** 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	**CI - suggestive:** Payments have no significant direct effect on behaviour, but survey data indicates that the annual Fund party and payment awards have strong effect on attitudes towards conservation.	**CI:** Authors state that payments "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).
Travers et al. (2011) Over-fishing by rural villagers in Cambodia	**Negative** and **positive**: Individual **rewards** (either from outside or within group) and weakly or strongly enforced **fines**	**Framed field experiment :** CPR game with local population, verbal framing of extraction as "fishing from pond"; **Behavioural data:** Amount of tokens extracted	**CO — suggestive:** Regulations differ in effectiveness, but no direct indication of crowding effects. Possibly indirect indication since rewards are more effective when self-organized.	None.
García-Amado et al. (2011) Forest conservation (no hunting and logging, surveillance patrolling) by agro-forestry farming community in Mexico	**Positive: rewards** within **PES** schemes	**Natural experiment:** Interviews eliciting whether people will continue conservation activities without PES, depending on allocation of PES income within community. **Survey data:** stated expectation to continue with conservation activities after PES	**No effect:** 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).	None
Greiner and Gregg (2011) On-farm conservation activities by cattle farmers in northern Australia	**Negative** and **positive**: various policy measures, e.g., income tax incentives, government regulation, cost-sharing for conservation, management plans	**Social survey** eliciting motivational orientation towards conservation, perceived importance of impediments to conservation, perceived effectiveness of regulations and incentives for conservation. **Survey data**: 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"	**CO — suggestive:** Authors speculate that "grazers, particularly those with high stewardship & lifestyle motivation, may have experienced the crowding out of intrinsic motivation by financially driven policy programs" (p.264).	**CO**: Authors refer loosely to a change of values and mindsets by stating that "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).
d'Adda (2011) Reforestation efforts by villagers in rural communities in Bolivia	**Negative:** Monetary **punishment** by community or public revelation of contribution	**Framed field experiment:** PG situation with individual contributions to a real reforestation project **Behavioural data:** Amount of contributions	**CO — suggestive:** External incentives are more effective for individuals with low intrinsic motivation for norm compliance. The author writes that "though of limited statistical significance due to the small sample"	**CO:** Author states that incentives can reduce the signalling value of prosocial decisions, i.e., reduced image motivation.

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Table 2 *(continued)*

Article Description of targeted behaviours, study population and geographical location	Economic incentive measure	Method and data	Reported findings on motivation crowding effects	Reference to psychological mechanisms
		Survey data: individual environmental and civic values	the results "suggest that motivation crowding occurs through the effect of external incentives on social image" (p.2094).	
Fisher (2012) Planting trees on private land by forest adjacent communities in Uganda	**Positive**: payments within NGO-driven carbon **PES** scheme	**Natural experiment:** Interviews with 81 community members **Survey data:** motivations for tree planting, environmental values and future perspectives for conservation; benefit ranking exercise	**CO — suggestive:** 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.	**CO:** Author makes a loose reference to change of values and mindsets by mentioning that payments may "foster an attitude of 'no pay, no care' (p.46)."
Narloch et al. (2012) Agro-biodiversity conservation by farming communities in Bolivia (commercially oriented) and Peru (subsistence farming)	**Positive**: **rewards** paid to individual or to the community	**Framed field experiment:** PG game with local population, "verbal framing of contributions as" land units allocated for planting a threatened crop variety"; elicitation of individual characteristics **Behavioural data**: amount of contributions	**CO — suggestive:** Authors conclude that "collective rewards could be ineffective and crowd-out social norms." (p.2096) **CI — suggestive:** Authors explain that "individual rewards seem to provide an additional incentive to conditionally cooperative farmers, thus strengthening conservation by altruistic farmers" (p.2103).	**CO:** Author refer to release from moral responsibility by speculating that "introducing collective reward systems might raise expectations among individual farmers that others in their community will bear the burden of conservation" (p.2104). . **CI:** Authors refer to reduced pressure by forcing non-moral individuals to compliance by stating that "individual rewards seem to provide an additional incentive to conditionally cooperative farmers, thus strengthening conservation by altruistic farmers" (p. 2103).
Kerr et al. (2012) Communal forest management by communities in Tanzania and Mexico	**Positive: PES** schemes with high or low monetary payments to individuals or groups (through village leaders)	**Natural field experiments** (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). **Behavioural data**: number of people showing up for collecting litter (Mexico); work effort for tree planting (Tanzania) **Survey data**: number of people stating they would show up for activity (Tanzania stated choice experiment); stated work satisfaction (Tanzania field experiment)	**CO — stat. significant:** Authors write that in the Tanzania stated choice experiment "a low payment yielded a lower positive response than no payment at all" (p.225).; **CO — suggestive**: 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).	**CO**: Authors refer to frame-shifting from "social market" to "monetary market" (p.225).
Lopez et al. (2012) Cleaning of beaches and wharves by fishermen on islands off the Caribbean coast of Colombia	**Negative:** Public revelation, campaign, and high or low **fines**	**Framed field experiment**: PG game with local population **Behavioural data**: amount of contributions	**No effect:** 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)	**CO:** Authors suggest that guilt and shame are important stabilizers of cooperation, implying that crowding-out could occur via release from moral responsibility to comply with group norms.
García-Amado et al. (2013) Conservation activities by rural communities in a biosphere reserve in Mexico	**Positive: PES** schemes with community payments and compensations, compared to. Integrated Conservation and Development Projects (ICDP) (adaptive management, education, technical assistance)	**Natural experiment**: 713 structured interviews in a project area where PES and ICDP were introduced; motivations are analysed along type of program (PES, ICDP), years receiving PES, education, age, land tenure, conservation status of the community land. **Survey data**: 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.	**CO — stat. significant:** 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).	**CO:** Authors refer to a change of values and mindsets by stating 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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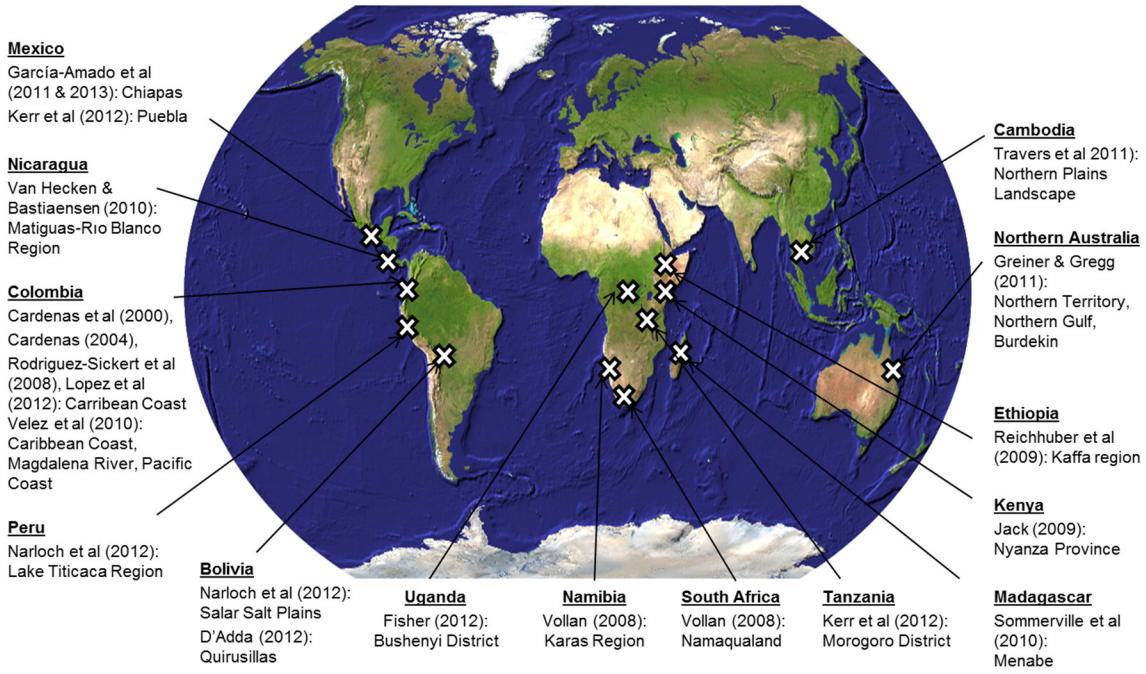

Fig. 1. Geographical location of the empirical studies.

whereas others reflect non-instrumental approaches to valuing nature (O'Neill et al., 2008; Jax et al., 2013; Luck et al., 2012), such as stewardship, moral duty, or respect for nature and wild animals. Table 3 presents an overview of the intrinsic motivations.

3.2.3. Type of Economic Incentive

Eleven studies investigate the effects of positive incentives to encourage biodiversity and ecosystem conservation and eleven investigate the effects of negative incentives to discourage environmentally harmful behaviour (so four studies investigate both types). With regard to positive incentives, four studies describe the interventions as rewards, one as subsidies, and seven explicitly refer to PES schemes that incentivize land use or conservation efforts. Within the studies focusing on negative incentives, eight refer to fines or sanctions and two studies refer to taxes.

3.2.4. Methods and Data

Twelve studies employ framed field experiments with participants from local communities. The extraction or contribution of tokens (the currency used in the experiment) is verbally framed as decisions in a locally relevant setting where natural resource extraction has implications for biodiversity and ecosystem conservation (e.g. hours spent collecting firewood, number of grazing sheep, number of bee hives harvested, quantity of extracted fish, number of planted trees). All twelve studies analyse behavioural data from the experiments (i.e. extraction or contribution level); three of them complement behavioural data 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 behavioural 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 (Greiner and Gregg, 2011) was deemed not to fit into the categories.

3.3. Reported Findings on Motivation Crowding Effects

3.3.1. Evidence of Motivation Crowding Out

Thirteen studies report crowding out effects, of which five present statistically significant results, either for the entire sample or a subsample of their study population. Two studies with statistically significant results stem from CPR experiments with the introduction of weakly enforced fines.[2] In an experiment 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. Measured in terms of deviations from Nash best responses, extraction in the last three out of the ten experimental rounds involving intervention is above pre-intervention level. Velez et al. (2010) study the interplay between communication and high or low fines among fishermen in three Colombian regions. They find a crowding out effect in one of six possible cases, where a low fine combined with communication among fishermen led to more extraction than the situation involving communication alone. Jack (2009) uses an "investment game" experiment in Kenya to study the effect of introducing a fine that punishes downstream water users who do not pay compensation to upstream land users for their investments in favourable land use activities. The compensation decisions of those who stand to be punished remain unaffected, but the introduction of the fine results in a significant reduction of upstream participants' propensity to invest in land use change. 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 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 running in a community, the more people state utilitarian and monetary reasons to explain their willingness to conserve nature and fewer reasons reflecting intrinsic motivations.

Nine studies present suggestive empirical evidence for crowding out effects, usually based on qualitative data from interview responses, or quantitative data without statistical significance. The first two are again CPR experiments where fines are introduced. Vollan (2008)

[2] "Weak enforcement" means that fines or detection rates are low, so that it remains economically rational not to cooperate.

Table 3
Overview of intrinsic motivations mentioned in the reviewed articles.

Classes of motivations		Specific intrinsic motivations	References
Pro-social motivations These motivations refer to social relations with other people or the community. The relationship to nature is indirect, in the sense that the motivations support compliance with norms that regulate the provision of public goods and the sustainable use of natural resources.		Social norms/rules	Rodríguez-Sickert et al. (2008), Vollan (2008), Reichhuber et al. (2009), Van Hecken and Bastiaensen (2010), Travers et al. (2011), d'Adda (2011), Narloch et al. (2012), Kerr et al. (2012), Lopez et al. (2012)
		Cooperation	Reichhuber et al. (2009), Travers et al. (2011), Jack (2009), Velez et al. (2010)
		Reciprocal obligations	Cardenas (2004), Vollan (2008), Travers et al. (2011), Narloch et al. (2012)
		Social approval/image / reputation / shame	Cardenas (2004), d'Adda (2011), Lopez et al. (2012)
		Guilt	Rodríguez-Sickert et al. (2008), Lopez et al. (2012)
		Equity/fairness	Cardenas (2004), Jack (2009), d'Adda (2011)
		Altruism	Cardenas (2004), Jack (2009), Narloch et al. (2012)
		Impure altruism ("warm glow")	Kerr et al. (2012)
		Trust	Vollan (2008), Sommerville et al. (2010)
		Public spiritedness/Civic values	Cardenas et al. (2000)
Pro-nature motivations These motivations refer directly to the relationship between people and nature and reflect human values relating to the natural world.	**Instrumental value of nature to humans**	Benefits from ecosystem services	García-Amado et al. (2011, 2013), Fisher (2012)
		Bequeath value	Fisher (2012)
		Beauty of the environment	Fisher (2012)
	Non-instrumental approaches to valuing nature	Existence value	Van Hecken and Bastiaensen (2010), Fisher (2012)
		Care-based ethics / stewardship	Greiner and Gregg (2011)
		Respect for nature and wild animals	García-Amado et al. (2013)
		Moral duty of conservation	d'Adda (2011)

presents an effect in a sub-group of his sample of traditional small-scale livestock farmers in Namibia, characterized by low support for the intervention and high trust among group members. Here, extraction rates in the last three out of ten rounds involving intervention are above average extraction rates in the baseline situation, but this "over-shooting" is not statistically significant. Reichhuber et al. (2009) observe a similar dynamic but lack a baseline situation that would allow comparison for conclusive evidence. In a CPR experiment with rewards among rural villagers in Cambodia, Travers et al. (2011) find that rewards are more effective when self-organized by resource users, providing suggestive evidence that crowding out effects can be expected when external regulation replaces a well-functioning internally organized mechanism. From a PG experiment with farmers in Bolivia and Peru, Narloch et al. (2012) conclude that collective rewards (as opposed to rewards paid to individuals) seem to encourage free-riding behaviour and thereby undermine 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 the 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 additionally for areas which they had previously conserved for free. d'Adda (2011) presents results from a PG experiment in Bolivia which, "though of limited statistical significance due to the small sample" (p.2094), […] "suggest that motivation crowding occurs through the effect of external incentives on social image" (p.2095). 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. A 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 a perception of barriers and preferences for certain policies.

3.3.2. Evidence of Motivation Crowding In

Four papers report empirical findings indicating crowding in effects. Rodríguez-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 studies report qualitative data from interview responses suggestive of crowding in effects. On the basis of interviews with farmers and NGO staff in Madagascar, Sommerville et al. (2010) report that payments for conservation efforts awarded at the annual fundraising party of an NGO-led PES scheme had a reinforcing effect on people's trust in conservation agencies and on their general attitude towards conservation. Van Hecken and Bastiaensen (2010) report from Nicaragua that PES act as a symbolic factor by signalling that biodiversity conservation is valued by outsiders. Finally, the authors of two CPR/PG studies provide evidence that by compelling non-intrinsically motivated individuals to comply, the intervention makes it easier for intrinsically motivated "conditional cooperators" to act upon their motivation. Rodríguez-Sickert et al. (2008) report for the context of overfishing that a "low fine stabilizes cooperation by preventing a spiral of negative reciprocation" (p.223). Narloch et al. (2012) mention the same effect for individual rewards to promote agrobiodiversity.

3.4. Psychological Mechanisms

As part of their results eleven studies provide explanations or at least an indication of the psychological mechanisms that underlie motivation crowding. Using a variety of terms to describe it, nine studies do so for crowding out, referring to "release from moral responsibility" (4),

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"frame-shifting" (3), "changes in values and mindsets" (3), "reduced image motivation" (2), and reduced internal satisfaction (1). For crowding in, four studies refer to psychological mechanisms such as "prescriptive effect" (2), "reinforcement achieved by compelling non-intrinsically motivated individuals to comply" (2), "reinforced positive attitudes and trust" (1), and "enhanced internal satisfaction" (1). Some studies mention additional mechanisms in their review section but do not relate them to their own results (see Table 1).

4. Discussion

4.1. Growing Evidence of Motivational Crowding Effects

The most important finding from our review is that a growing body of empirical studies supports the hypothesis that economic incentives can impact on intrinsic motivations for engaging in biodiversity and ecosystem conservation. Studies indicating crowding out effects outweigh studies indicating crowding in effects, both in absolute number of reported effects (13 versus 4) and in the number of effects with statistically significant results (5 versus 1).[3] It is also noteworthy, however, that many of the studies we reviewed did not find any effects — or at least could not provide statistically significant results. The five studies that introduced fines into framed CPR field experiments illustrate this mixed picture: Cardenas et al. (2000) find a crowding out effect, Velez et al. (2010) find an effect for just one out of six sub-samples, Vollan's (2008) results are suggestive of an effect only in a sub-sample, and there is no effect in Cardenas (2004) and Rodríguez-Sickert et al. (2008). In our view, the most robust finding is that "too small" positive incentives can lead to an overall adverse effect (Kerr et al., 2012), 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 those reflecting utilitarian and monetary motivations (García-Amado et al., 2013). Overall, however, the available evidence remains inconclusive with regard to the specific conditions under which incentives may undermine or reinforce intrinsic motivation.

A general implication of our results is the importance of being aware, prior to any policy intervention involving economic incentives, of existing intrinsic motivations for protecting biodiversity and ecosystems and of the social norms governing resource use among the people who would be affected by the intervention. As stated by Van Hecken and Bastiaensen (2010), "if these are few, there is not much to destroy (p.439)". Indeed, the practical relevance of crowding out effects for environmental policy has been questioned on the grounds that people's level of intrinsic motivation may often be negligible (Gawel, 2000, 2001; Stern, 2008). Where intrinsic motivation and relevant social norms are strong, however, economic arguments and instruments should be handled with care. It is important, therefore, to assess baseline information on intrinsic motivations and on expected motivation changes before any large-scale implementation of incentive measures takes place. To our knowledge, such scoping studies are rarely conducted as an integral part of the design of PES and other economic policy instruments, and appropriate methods and guidance for practitioners have yet to be developed. This could be done using surveys, stakeholder consultations or workshops and making use of ethnographic, anthropological, or psychological methods. In controversial cases, the triangulation of data using different methods can be useful. In order to minimize potential biases and variability related to shifting baselines, subsequent assessments to monitor changes should ideally address the same sample population as the baseline assessment.

[3] We do not want to over-emphasize this numerical difference, since more studies were designed to demonstrate crowding out effects, and the variation in empirical methods and datasets does not permit a comparison of robustness between crowding out and crowding in effects.

4.2. Lack of Baseline Information and a Shared Framework Limits Conclusive Evidence

Despite the growing body of research indicating the motivation crowding effects of economic instruments relating to biodiversity and ecosystem conservation, our understanding of the specific conditions in which they are more likely to occur remains limited. The main obstacles we can currently identify are i) the lack of baseline information about pre-existing intrinsic motivations, ii) limited comparability of results across case studies resulting from inconsistent terminology and methods, and iii) the complexity stemming from cultural and contextual heterogeneity.

With respect to the lack of baseline information on intrinsic motivations, the studies we reviewed mention a variety of intrinsic motivations for the conservation or sustainable use of biodiversity and ecosystems (see Table 3), but few discuss or even assess which intrinsic motivations exist prior to the implementation of the incentive measure. It is also noteworthy that a majority of studies use social dilemma games to investigate whether economic incentives erode "pro-social motivations" (e.g. social norms, altruism, reciprocal obligations, or social approval) expected to support norm compliance (cf. Fehr and Falk, 2002; Frey and Stutzer, 2008). As noted by Ostrom (1990), social norms and conventions are paramount for regulating the provision of PG and the sustainable use of CPRs in small-scale societies. However, such norms do not necessarily rely on an intentional effort to protect biodiversity (Smith and Wishney, 2000), and experimental dilemma games are unlikely to capture pro-nature motivations.

The second obstacle to obtaining robust conclusions relates to limited comparability across case studies. We believe that comparability could be improved by introducing consistent terminology and common categories for intrinsic motivations and attention to the psychological mechanisms inducing behavioural change. In many cases multiple psychological mechanisms may be at play. For instance, when a fine is introduced in a CPR setting, crowding out can potentially occur due to control aversion, frustration, reduced internal satisfaction, release from moral responsibility, and reduced image motivation, but there may also be crowding in due to a prescriptive effect or reinforcement achieved by compelling non-intrinsically motivated individuals to comply. Payments for specific action on conservation, on the other hand, can potentially lead to crowding out via control aversion, frustration, reduced image motivation or internal satisfaction and frame-shifting, but can also trigger crowding in via enhanced self-esteem, reinforced positive attitudes and trust and a prescriptive effect. While thirteen of the eighteen empirical studies offer suggestive comments regarding the psychological mechanisms behind crowding effects, only d'Adda (2011) explicitly tests whether motivation crowding works through the impact of an incentive on social image. Understanding the psychological mechanisms that can be expected in a particular context and for a specific population may make it easier to design incentives in a way that prevents crowding out and fosters crowding in; it will also help in predicting the likely persistence of crowding effects over time. For instance, crowding out due to frame-shifting may influence behaviour only temporarily and subside after incentive schemes have ended (Goeschl and Perino, 2012), whereas changes in values and mindsets are more persistent, with potential long term consequences for biodiversity conservation (Barton, 2014). Further research to investigate how different mechanisms interact would also be beneficial. Such research could investigate, for instance, the conditions in which short-term crowding out effects due to frame-shifting can be expected to crystallize into changes in values and mindsets.

Finally, the geographical distribution of the studies we reviewed illustrates that, while economic instruments such as PES and biodiversity offsets are mainly theorized and promoted by actors from developed countries, populations in developing countries across the globe remain the "playing field" on which the effects of such instruments of conservation policy are tested. These populations differ widely with respect to

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mindsets, values and the social norms governing the use of their natural environment as well as their relationships with it. Moreover, the signal sent by a payment or a fine can vary considerably across different cultures and populations. As noted by Bowles and Polonía-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 social meaning needs to be assessed in relation to the particular cultural context and the population concerned. Until larger numbers of comparable case studies reveal broader patterns in the conditions in which crowding effects occur, cross-cultural differences and the context-dependence of conservation behaviour call for caution in the extrapolation of results across cultural and geographical domains.

4.3. Improving Research Methodology for Testing Motivation Crowding Effects

Despite recent progress in methodologies for testing motivation crowding effects, major challenges remain for research design, both in terms of assessing baseline situations and monitoring changes in motivations. The characteristics and merits of different empirical approaches deserve reflection (Harrison and List, 2004). Fisher (2012) suggests longitudinal studies as a "first best" design for testing motivation crowding, e.g. following a PES scheme over the entire duration. However, longitudinal studies using "natural experiments" require long time periods and significant research funding before motivational changes and their behavioural implications can be observed. A less resource-intensive option would be cross-sectional studies where different instruments are applied in comparable populations (see, e.g., van Hecken and Bastiaensen, 2010, and García-Amado et al., 2013). Field experiments, on the other hand, allow for targeted design and greater experimental control. Here, any convincing inference from experimental data to "real world" behaviour requires both a representative study population and that the experimental decision task is sufficiently similar to the corresponding natural decision of interest to the researchers (Hogarth, 2005). Framed field experiments that invite local communities to participate in interactive decision tasks (e.g. CPR, PG, investment game) allow the highest level of experimental control. They are likely to meet the criterion of a representative study population, but it is often not clear whether the experimental decision (i.e. extraction of tokens in an abstract CPR game with verbal framing) adequately triggers all the motivations that actually drive biodiversity and ecosystem conservation behaviour on the ground. In these experiments, a three-stage study design (pre-intervention, intervention, post-intervention) seems the most promising approach to reveal crowding effects in the behavioural data (see, e.g., Reeson and Tisdell, 2010; Goeschl and Perino, 2012). Natural field experiments are conducted with a representative population in the relevant setting, but they tend to be more resource-intensive and require permission and support for introducing a "real" conservation relevant policy. Moreover, 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 when making decisions). Natural experiments that reveal how interventions play out directly in the relevant natural situation typically offer even less experimental control of variables. For instance, the small tax on plastic grocery bags in Ireland (Rosenthal, 2008) was accompanied by an awareness raising campaign, rendering it difficult to separate the mechanisms behind the behaviour change.

Another challenge for empirical research is that motivation per se is not directly observable and has to be measured by proxies. Economists commonly prefer behavioural data, which may indeed be most appropriate for assessing the effectiveness of economic policies. However, observing behaviour does not make it possible to isolate economic from intrinsic motivations. For instance, when an incentive is introduced but behaviour remains unchanged, this may imply either that there is a crowding out effect where the expected positive effect on economic motives and the negative effect on intrinsic motivation are cancelling each other out, or that both economic and intrinsic motivations are unaffected. The same holds for crowding in effects. When incentives lead to a net positive effect on conservation behaviour, as did the fines in Cardenas (2004), Vollan (2008), and Travers et al. (2011), it is not possible to disentangle the influence of economic motivation from additional intrinsic motivation. In order to draw conclusive inferences for crowding out from behavioural data, empirical studies need to find an effect that is contrary to the one expected, i.e., where the introduction of the incentive reduces the propensity to engage in the conservation activity. Alternatively, studies can measure non-behavioural proxies for motivations. García-Amado et al. (2013) focus on the different reasons community members give for engaging in biodiversity and ecosystem conservation, which are assumed to reflect either monetary, utilitarian or intrinsic motivations. Psychological theory (e.g. Ajzen and Fishbein, 1975) predicts that changes in perceptions of reasons and in attitudes affect the motivational basis and may ultimately result in behavioural change, but such correlations remain a controversial issue (Diekmann and Preisendörfer, 1998). Psychological and anthropological works may offer further guidance for future work on non-behavioural proxies. For instance, the potential of survey measures of non-anthropocentric motives for biodiversity conservation (e.g. Spash, 2000; Butler and Acott, 2007; Spash et al., 2009; Martín-Lopez et al., 2008), psychological scales of environmental values and attitudes (e.g. Gagnon Thompson and Barton, 1994; de Groot and Steg, 2008), and studies on people's emotional connectedness with nature (e.g. Mayer and Frantz, 2004) have not yet been fully exploited for research on motivation crowding effects.

Finally, empirical research should strive to separate the crowding hypothesis from alternative explanations. Consider the evidence that certain individual characteristics correlate with responsiveness to economic incentives. People with high civic values (d'Adda, 2011) or high intrinsic motivations regarding biodiversity conservation (Fisher, 2012) have been shown to be less responsive to positive incentives. This could imply that their intrinsic motivation has been crowded out; but it may also be that people with these characteristics simply care less about the monetary aspect. Or, consider the following alternative explanation for the erosion of the incentive effect after the introduction of a weakly enforced fine (e.g. Cardenas et al., 2000; Reichhuber et al., 2009), based on limited cognition rather than motivational changes. The probabilistic information on expected gains and losses entailed in a "weakly enforced" fine is too complex for participants to calculate, so that participants initially overrate the fine's financial implication. When they realize over time that enforcement is weak, some participants return to non-cooperative behaviour and others (i.e. "conditional co-operators") follow them, according to the usual dynamics in experimental dilemma games (see e.g. Fehr and Gächter, 2000).

5. Conclusions

The motivation crowding effects of economic incentives are particularly relevant in contexts where intrinsic motivations to engage in biodiversity and ecosystem conservation play an important role. Our review shows that the empirical research on motivation crowding effects is growing, with empirical studies providing evidence for both crowding out and, to a lesser extent, crowding in effects. Overall, however, the empirical evidence with regard to when and in what particular circumstances motivation crowding occurs remains inconclusive due to methodological and data limitations. These include a lack of appropriate baseline information about intrinsic motivations prior to policy intervention, a lack of common terminology and methodologies across studies, and the complexities arising from variations across different socio-cultural contexts.

It is critical to undertake further efforts to advance our understanding of motivation crowding effects arising from economic incentives, to widen the scope of empirical approaches, and to improve

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comparability of results. A framework with consistent terminology should allow for greater comparability across studies in order to achieve more robust, precise and conclusive findings. The overview of relevant intrinsic motivations and the typology of psychological mechanisms behind motivation crowding effects presented in this paper are but the first steps in this direction.

Given the complexity regarding the conditions in which motivation crowding can be expected, one remaining task is to develop guidance for practitioners to assess existing intrinsic motivations and the potentially adverse effects of proposed incentive measures. We recommend that such a scoping of base line motivations and expected motivation changes should be a requirement prior to any large-scale implementation of environmental policies that use economic incentive measures. Crowding out effects can have detrimental impacts on long term biodiversity and ecosystem conservation which are difficult to reverse. Therefore, we call for caution in cases where uncertainties regarding the negative effects of incentive measures remain, especially when existing intrinsic motivations among the targeted population are strong and the biodiversity values at risk are high.

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