What motivates communities in developing countries to adopt conservation behaviors? A Sumatran orangutan case study

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Abstract: Community-based conservation programs in developing countries often assume that heteronomous motivation (e.g. extrinsic incentives such as economic rewards and pressure or coercion to act) will motivate local communities to adopt conservation behaviors. However, this may not be as effective or sustainable as autonomous motivations (e.g. an intrinsic desire to act due to inherent enjoyment or self-identification with a behavior and through freedom of choice). This paper analyses the comparative effectiveness of heteronomous versus autonomous approaches to community-based conservation programs, using the example of Sumatran orangutan (*Pongo abelii*) conservation in Indonesia. Comparing three case study villages employing differing program designs, we found that heteronomous motivations (e.g. income from tourism) led to a change in self-reported behavior towards orangutan protection. However, they were ineffective in changing self-reported behavior towards forest (i.e. orangutan habitat) protection. The most effective approach to creating self-reported behavior change throughout the community was with a combination of autonomous and heteronomous motivations. Individuals who were

heteronomously motivated to protect the orangutan were found to be more likely to have changed attitudes than their self-reported behavior. These findings demonstrate that the current paradigm of motivating communities in developing countries to adopt conservation behaviors primarily through monetary incentives and rewards should also consider integrating autonomous motivational techniques which promote the intrinsic values of conservation. Such a combination will have a greater potential to achieve sustainable and cost-effective conservation outcomes. Our results highlight the importance of in-depth socio-psychological analyses to assist the design and implementation of community-based conservation programs.

Introduction

The predominant paradigm of community-based conservation is to motivate conservation behaviors through extrinsic economic incentives such as monetary or development rewards and benefits, and is referred to as heteronomous motivation (Decaro & Stokes 2008). Individuals who are heteronomously motivated engage in conservation behaviors for reasons outside their core values, such as to avoid fines or obtain economic or social rewards (Decaro & Stokes 2008). Examples include payments for ecosystems services, Reduced Emissions from Deforestation and Degradation (REDD+), and to a lesser extent ecotourism, contributing to advances in the community's economy. However, economics is not the only determinant of individuals' decision-making (Villamor & van Noordwijk 2011), and therefore challenges remain in identifying sustainable and reliable motivators of behavior change.

Sustainable behavior change with extrinsic incentives relies on programs being economically sustainable in order to maintain motivation for community involvement in conservation (Ogutu 2002; Stem et al. 2003; Alexander & Whitehouse 2004; Honey 2009). Otherwise, labor and financial constraints can lead to land-use decisions detrimental to conservation goals (Villamor & van Noordwijk 2011). Economic incentives can introduce notions that forests, wildlife and other natural resources only need to be conserved if economic incentives are provided, undermining community governance and creating unsustainable programs dependent on monetary return or investment (Kovacevic 2012). Furthermore, economic incentives can undermine social progress through encouraging selfishness and inhibiting intrinsic motivations (Bowles 2008). Cardenas et al. (2000) found evidence that providing regulatory, external interventions for environmental dilemmas based on standard economic theory can be ineffective and even problematic compared to allowing individuals to collectively address environmental problems, due to crowding out group-regarding behaviour in favour of self-interest. However, in developing countries, providing monetary or

63 development rewards and benefits can be a useful tool for initially engaging community
64 participation and support in conservation programs (Stem et al. 2003; Durrant & Durrant
65 2008; Macfie and Williamson 2010). For these reasons, the current paradigm of community-
66 based conservation needs to take into account more sustainable forms of motivation.

67 Under the right conditions, non-economic incentives and strategies that promote community
68 autonomy can be more effective in changing behaviors than monetary rewards. They are
69 referred to as autonomous motivation, and are non-coercive in nature (Decaro & Stokes
70 2008). Examples include empowerment of local communities through inclusion in
71 conservation decision-making, access to local natural resources, and sustainable use of these
72 resources leading to local development (Watkin 2003). Individuals who are autonomously
73 motivated are incentivized because of intrinsic values and the opportunity to apply self-held
74 values (Deci & Ryan 2004; Decaro & Stokes 2008). Participatory conservation programs that
75 promoted autonomous motivation were found to be more effective than programs that
76 promoted heteronomous motives (Decaro & Stokes 2008). However, external features of
77 public participation such as high levels of involvement and power over decision-making,
78 whilst well intentioned, may not always match the local social-ecological context, and as
79 such thwart intrinsic motivation and behavioral changes (Decaro and Stokes 2013). Much of
80 this research surrounding autonomy and its effect on motivation has been undertaken in
81 developed countries with different socio-economic and cultural contexts to developing
82 countries. These differences can influence decision-making processes and behavioral
83 outcomes and therefore warrant investigation (Decaro and Stokes 2013).

84 Here, we hypothesize that in developing countries, where livelihood and income-generating
85 opportunities are limited, heteronomous motivation may have an important role in catalyzing
86 conservation actions due to the direct and more immediate benefit associated with conservation
87 and sustainable livelihoods (World Conservation Union 1980). In addition, we hypothesise that

autonomous motivation is required to sustain these changes in the long term. However, the relative benefits of each approach have not been definitively evaluated from a psychological perspective. For example, Wich et al. (2011) state that "a reframing of the way incentive-based mechanisms are perceived, and a deeper analysis of the social and psychological dimensions of human decision making in response to external signals are required." In this paper we pose the question: in a developing country context, are heteronomous or autonomous motivations more likely to create a change in self-reported conservation behavior? Using examples of community-based conservation programs designed to protect the Sumatran orangutan (*Pongo abelii*) we analyse the self-reported behavioral responses of community members to different incentive mechanisms, and make recommendations for the future design of such schemes.

Methods

Study Area

The Sumatran orangutan is critically endangered due to habitat loss, fragmentation, illegal and legal logging, hunting, and the pet trade (Singleton et al. 2008; Davis et al. 2013). If current population trends continue, the Sumatran orangutan is predicted to be the first great ape species to go extinct (Wich et al. 2008), hence the design of effective conservation programs is critical to survival of the species (Meijaard et al. 2012).

The study was conducted on the perimeter of Gunung Leuser National Park, located within the larger Leuser ecosystem, North Sumatra, Indonesia (Fig. 1), which contains 78% of the Sumatran orangutan's remaining habitat (Wich et al. 2011). We selected three villages which

had community-based orangutan conservation programs: Halaban, Tangkahan and Bukit Lawang (Table 1).

Halaban has a history of illegal clearance of National Park by oil palm companies. However, a reforestation program was implemented in 2008 with the help of a local non-government organization (NGO). A local farmers' group was formed to enact local management and operation responsibilities of the restoration program, including a small number who would benefit economically from employment arising from the program. The program was designed around community involvement in all aspects of project implementation. The NGO also engaged in education and outreach activities to build better relationships and encourage pro-conservation behavior towards the forest and orangutans.

In Tangkahan, illegal logging had previously been the main income for the local community. However, severe flash flooding exacerbated by deforestation occurred in neighboring Bukit Lawang in 2003, convincing the Tangkahan community that illegal logging was both economically and environmentally unsustainable. In 2001 a small number of locals had formed a group, Lembaga Pariwisata Tangkahan (LPT), concerned with the economic and environmental sustainability of the village. The group subsequently halted illegal logging and instead engaged in community outreach and education and, with the help of NGOs, began small-scale ecotourism focused on orangutans and Sumatran elephants. The program has since won a prestigious award from the Indonesian Ministry of Tourism for excellence in pioneering community-based ecotourism. LPT oversee all tourism activity, with external NGOs only offering support and advice. However, all tourism activities require approval from the National Park with a MOU between Tangkahan and the National Park to take responsibility for patrolling the 17,500 ha of adjacent park, which can then be utilized for tourism activities.

In Bukit Lawang, the conservation program began as a rehabilitation site for orangutans in the 1970s, which became a tourist attraction where visitors could have close interaction with semi-wild orangutans at feeding platforms. This has become a mass tourist destination and a large income generator for the community. Tourism is officially regulated and controlled by the National Park authority, and HPI, an association which certifies and licenses guides. However, a lack of enforcement of regulations by both parties has resulted in negative practices being undertaken, such as tourism encroachment into the National Park. Furthermore, tourism practices have been found to be unsustainable and detrimental to orangutans due to feeding, loud and disruptive behavior, and contact with wild and semi-wild orangutans (Dellatore 2007). NGOs are involved only on an advisory basis. There has been little integrated planning and effective management of tourism which has led to conflicts within and between communities, NGOs and other stakeholders.

[Insert Figure 1]

[Insert Table 1]

Conceptual Model

We developed a conceptual model which comprised alternative hypotheses (H) of how conservation programs were implemented in each village to motivate behavior change.

H1. Promoting heteronomous motivation will lead to greatest positive behavior change

156 This hypothesis accounts for traditional incentive based approaches (Spiteri & Nepal 2006),
157 which utilise economic or social reward to obtain results (Pelletier et al. 1998; De Young
158 2000), often through linking conservation to revenue for the local economy and development
159 (e.g. Watkin 2003). It also reflects approaches that have greater reliance on a control and
160 regulation to achieving outcomes such as through fines and monitoring (Kubo & Supriyanto
161 2010).

162 .

163 *H2. Promoting autonomous motivation will lead to greatest positive behavior change*

164 Decaro and Stokes (2008) application of the self-determination theory to the conservation
165 literature contradicts the efficacy of instrumental motivation compared to autonomous
166 reasoning. Therefore, this second hypothesis is in contrast to the initial hypothesis and
167 reflects the power of intrinsically motivated activities in achieving outcomes.

168 .

169 *H3. Promoting both autonomous and heteronomous motivation will lead to greatest positive*
170 *behavior change.*

171 The final hypothesis is a combination of H1 and H2, and recognises the identified potential of
172 intrinsic motivation (H1), but also the limitations of a developing country context that may
173 require extrinsic benefits (H2) to be provided in economically and developmentally
174 challenging conditions (Decaro and Stokes 2008). Furthermore, it is hypothesised that
175 regulatory approaches involving incentives such as monetary benefits, monitoring and fines
176 could increase internalised or intrinsic forms of motivation if used in ways that empower or
177 protect members of the public (Thøgersen 2003).

178

Community Surveys

To test these hypotheses, we gathered data from community members in the three villages using a questionnaire. This research was approved by the University of Queensland Behavioral and Social Sciences Ethical Review Committee.

1. How much do you want to protect orangutans?

2. How much do you want to protect the forest?

Possible responses were read out to the participant, based on a 4 point Likert scale of 'none', 'a little', 'mostly', or 'all' (meaning wanting to protect completely). Participants were then asked to elaborate on their response to this question for both the conservation of the orangutan and forest separately. We also asked:

3. Have you changed your behavior to protect the orangutan since the (*conservation program in their village*) has been in your village?

4. Have you changed your behavior to protect the forest since the (*conservation program in their village*) has been in your village?

Possible answers were either 'yes', 'no', or 'don't know'. If the answer was 'yes', a follow up question was posed:

5. How have you changed your behavior?

Examples regarding orangutans include: no longer hurting or killing orangutans, instead reporting conflicts to appropriate authorities to address; using non-violent methods to manage orangutan conflict or simply leaving them alone; no longer destroying orangutan habitat; and following ecotourism guidelines for ensuring the health and safety of orangutans. Examples

200 regarding forest protection include: no longer cutting down trees; or taking illegal resources
201 from the forest; avoiding littering inside forest; and stopping illegal logging.

202 An earlier version of the questionnaire was tested through a pilot study carried out in Bukit
203 Lawang and Tangkahan with 15 randomly selected individuals. This highlighted different
204 issues regarding motivations for protecting orangutans and the forest. Specific to orangutans
205 was the problem of human-wildlife conflict, caused by orangutans raiding crops,
206 consequently they were regarded by some villagers as pests (Campbell-Smith et al. 2010). As
207 a result, we separated questions 1 and 2. The pilot study also demonstrated the need to
208 simplify questions due to difficulties with comprehension. The questionnaire was reviewed
209 and translated by a local NGO representative fluent in English and Bahasa Indonesia and with
210 direct experience working with the communities.

211 The first author was accompanied by Indonesian translators local to North Sumatra, research
212 assistants from Australia and a local guide from each village. Data were collected in
213 February-May 2013. Each village community was randomly sampled for adults 18 years and
214 older but stratified by age (18-25, 26-35, 36-45, 46-55, 56-65, 65+ years) and gender. We
215 sampled a minimum of 10% of the total population in each village (Bukit Lawang n=110;
216 Tangkahan n=70; Halaban n=60). The project and its objectives were explained to selected
217 participants. Verbal consent to participate was sought, and if granted the questionnaire began.
218 Participants were shown a photo of an orangutan to clarify the species in question. The
219 translator then explained our definition of 'protecting' the forest and orangutan: "by
220 'protecting the orangutan' we mean not harming or taking any orangutans from the forest. By
221 'protecting the forest' (defined as Gunung Leuser National Park) we mean ensuring
222 individuals do not take any resources they are not supposed to from the forest and keeping it
223 clean (of human rubbish)."

Statistical Analyses

We coded the responses on why the participants wanted to protect the orangutan and the forest based on the autonomous and heteronomous motivational styles. Responses were either autonomous, heteronomous, both autonomous and heteronomous, or unclear/no motivation. Below describes key words and phrases which defined each category and determined the coding of each response (sensu Decaro and Stokes 2008).

Heteronomous motivation: reasons for engaging in behavior primarily concern influences outside one's core values, to obtain economic or social reward, experience pressure or coercion to act. (e.g. "Orangutan is useful to my job", "Because it is essential to our ecotourism", "For the ecosystem services it provides and the prevention of natural disaster", "Because it is forbidden to damage the forest, it is National Park".)

Autonomous motivation: behavior is freely self-endorsed (freedom of choice), has intrinsic value, participant sees behavior as part of self-identity, desirable for its own sake and as exercising self-held values. (e.g. "Orangutan is just like us, I feel sympathy for it", "I love orangutan, I like it, so I want to protect it, it's unique according to me", "I was born in the place, the forest is a part of my nature and environment", "I can't even stand people cutting down the trees. The forest is a haven for me".)

Unclear/No motivation: any responses that did not fit into either autonomous or heteronomous, or were unclear. (e.g. "I used to hate orangutan because it disturb my durian and other fruit plantation but now even though I hate it, I control myself not to harm it but to protect it", "I'm busy, don't have time to do it".)

There was a total of 240 questionnaire respondents. Table 2 displays the dependant variables and their considered categories. The categorical response variable was self-reported behavior

247 and/or attitude change of the participants with regard to orangutans and to forests. Attitude
248 change was also included, as when answering question 5 many participants did not provide
249 details of self-reported behavior changes but rather responded that their attitude had changed,
250 such as having sympathy for, respecting the orangutan and/or forest. Hence, we were cautious
251 in coding self-reported behavior change to provide greater assurance of reliability. This
252 variable included the three categories: (0) no self-reported behavior or attitude change; (1)
253 positive change of attitude as a result of the programs; and (2) positive change of self-
254 reported behavior as a result of the programs. The survey also investigated the four major
255 types of motivation – autonomous, heteronomous, autonomous + heteronomous, and no
256 motivation – for the indicated self-reported behavior changes. Unless the response was no
257 change, motivation types were recorded as positive, i.e. creating a tendency towards positive
258 changes of attitude or self-reported behavior. Therefore, unless expressly stated otherwise,
259 the terms 'autonomous' and 'heteronomous' motivations were regarded as 'positive
260 autonomous' and 'positive heteronomous'. Very few people reported both autonomous and
261 heteronomous motivations and those who did reported either change of attitude or behaviour,
262 with no one reporting no change. Therefore, there were too few people (and too little
263 variability in attitudes/self-reported behaviour measures) for significant statistical conclusions
264 to be possible ($p > 0.6$). Therefore, these records were removed from the analyses. The
265 resulting Motivation Type categorical variable served as another predictor variable for the
266 self-reported Behavior/Attitude Change variable.

267 Participants who did not change their self-reported behavior or attitude were subdivided into
268 three sub-categories: (1) those who responded that there was no change in their self-reported
269 behavior or attitude ('clear answer'); (2) those who did not provide a clear response in
270 relation to changing or otherwise of their self-reported behavior or attitude ('no clear
271 answer/no answer'); and (3) those whose self-reported behavior and attitude did not change

because of no interaction with orangutans or forest, or because no opportunities to change were presented ('no opportunity to change'). The additional category 'Behavior/Attitude Previously' included the participants who already had positive self-reported behavior or attitude towards orangutans or forest prior to the commencement of the programs. This category, as well as the 'no opportunity to change' sub-category were discarded from the subsequent analyses, as not relevant to the evaluation of the impact of the programs on the self-reported behavior or attitude of the participants. One participant with self-reported negative behavior change was also removed from the analyses as an assumed outlier.

Multinomial logistic regression

All statistical analysis was conducted using Stata version 13 data analysis and statistical software (StataCorp 2013). First, we used multinomial logistic regression (Long & Freese, 2006) to conduct exploratory data analysis of the relationships between the response variable self-reported Behavior/Attitude change, the Village predictor variable, and the demographic and socio-economic data (see Supplementary Information for more detail). Log odds of the response variables of self-reported Behavior or Attitude Change were modelled as linear combinations of the predictor variables and Motivation type variable. The results showed statistically significant effects for several demographic variables (see Supplementary Information for more detail) but further analysis was undertaken to investigate the specific research questions more thoroughly.

Generalized Structural Equation Modelling

We used generalized structural equation modelling (GSEM) (Acock 2013) to quantify the relationship between the dependent attitude and self-reported behavioral change response variables and the mediating Motivation type variable. This analysis was guided by our hypotheses where the response variable depended on the predictor variables and Motivation

Type. We used GSEM for path analysis and the identification of direct and indirect effects in each of the two models for the orangutan and forest data for each village (each program). All the model outcomes in relation to Motivation Type and the different villages (programs) were adjusted for the demographic and socio-economic variables: Gender, Education, Income, Years in Village. This means that these potentially confounding factors were taken into account so that the independent effect between Motivation Type and different villages (programs) only remained. The GSEM identified the direct and indirect effects in the models for the orangutan and the forest data for each village (each program). A direct effect occurs directly between two variables, and is calculated at the base categories of all other categorical variables. For example, in our GSEM models, the direct effect of the Village variable on self-reported Behaviour/Attitude Change shows how the probabilities of different outcomes of the self-reported Behaviour/Attitude Change response variable vary from the village which is regarded as the base category to another village for those inhabitants who did not report any motivation to change their behaviour or attitude. An indirect effect occurs through a mediating variable, which means that the different outcomes of the response variable are dependent upon the motivation categories. For example, the indirect effect of the Village variable on self-reported Behavior/Attitude Change shows how the probabilities of different outcomes of the response variable vary from the village which is regarded as the base category (i.e., Halaban) to another village for respondents reporting either Autonomous or Heteronomous motivation types. In this regard, it is important to note that if a direct or indirect effect is not statistically significant, this does not mean that the probabilities of different outcomes of the response variable (in our case, self-reported Behavior/Attitude Change) are not significant. Rather, it means that the differences between these probabilities for the different categories of the predictor variable are not statistically significant (for more detail see Supplementary Information).

The identification of Motivation Type as a mediating variable allowed determination of probability paths (for explanation of the determination of the probability paths and their significance see Supporting Information) from the different villages (programs) to the three different outcomes of the self-reported Behavior/Attitude change response variable for the orangutan (Fig. 2) and the forest (Fig. 3) data. The sum of all the presented probabilities for each of the villages (Figs 2a-c and 3a-c) is close but not necessarily equal to 1, because insignificant paths are not shown.

Results

The results presented and discussed are in relation to the probability paths identified in Figures 2 and 3 that were calculated after obtaining the necessary GSEM outcomes.

Orangutan protection

Heteronomous motivation was important in the formation of attitude and self-reported behavior towards orangutans in Tangkahan and Bukit Lawang (particularly Bukit Lawang – Fig. 2c), but not in Halaban where its effect was not statistically significant (compare Fig. 2a with 2b,c). Autonomous motivation appears somewhat less important (Figs 2b,c), but not in Halaban, where it plays the major role for both attitude and self-reported behavior change (Fig. 2a). These significant differences in probability paths for different villages can be attributed to the differences among the implemented programs. In Halaban, few people benefit economically from the conservation program, therefore little, if any, heteronomous motivation is provided to protect the orangutan compared to the tourism linked with protection of the orangutan in Bukit Lawang and Tangkahan.

When considering the cumulative effect of probability in changed self-reported behavior through both autonomous and heteronomous motivations within the community, changed self-reported behavior to protecting orangutans was more likely in Tangkahan than Halaban, and least likely in Bukit Lawang. There was both autonomous and heteronomous motivation leading to a change in self-reported behavior in Tangkahan, whereas in Bukit Lawang there was only heteronomous motivation leading to a change in self-reported behavior. Furthermore, in Halaban only autonomous motivation was observed leading to a significant probable change in self-reported behavior. However, in Bukit Lawang there was a greater probability of the community changing their attitude towards protecting orangutans because of heteronomous motivation than in Tangkahan and Halaban.

Forest protection

Autonomous motivation was important and significant in the formation of self-reported behavior and attitude change towards forest whereas heteronomous motivation was consistently not statistically significant for changes in both attitude and self-reported behavior (Fig. 3). The significant difference between the villages in the forest model is that in Tangkahan there is little (if any) probability of an average person having autonomous or heteronomous motivation and still report no change in attitude or self-reported behavior (Figs 2a-c and 3b). At the same time, there are large probabilities of ~ 0.41 and ~ 0.34 that a person from Halaban or Bukit Lawang, respectively, has autonomous motivation but still reports no change in attitude or self-reported behavior towards forest (Figs 3a,c). This could be attributed to the past livelihoods of the participants in Tangkahan, where a large proportion of the locals were once illegal loggers and therefore have a greater opportunity to change their behavior. However, in Bukit Lawang and Halaban there was less opportunity for participants not previously engaging in any destructive practices to change behavior. Regardless of when

367 the greater opportunity existed, as in Tangkahan, it was autonomous motivation rather than
368 heteronomous motivation which led to a change in self-reported behavior and attitude.

369

370 **Discussion**

371 This study showed that promoting autonomous motivation has the potential to create a greater
372 change in self-reported behavioral outcomes of community-based conservation programs
373 than promoting heteronomous motivations alone. These findings support shifting the current
374 focus on predominantly heteronomous motivation, through means such as monetary
375 incentives, to an approach that uses additional non-financial incentives and strategies to
376 motivate communities to change their self-reported conservation behavior. We found
377 autonomous motivation to be significant in changing self-reported behaviors for both
378 orangutan and forest protection. Autonomous motivation has also been found in research
379 outside developing countries to be an important element in achieving sustainable behavioral
380 changes (Dwyer et al. 1993; De Young 2000). This is supported by human behavior research
381 which proposes a more sustainable form of motivation is to be intrinsically connected to
382 one's self-identity (Decaro & Stokes 2008).

383 However, our results also show that heteronomous motivation had a significant effect in
384 changing self-reported behavior to protect orangutans, highlighting its importance in
385 community-based conservation programs. This is most likely due to the limited opportunities
386 for livelihoods and income generation in rural and remote regions of developing countries,
387 and exploitation of wild resources provides options. Previous studies have found that
388 monetary incentives and rewards can be beneficial in incentivising community participation
389 and adopting conservation behaviors and more positive attitudes (Stem et al. 2003; Kiyingi &
390 Bukenya 2010). However, monetary incentives are not always successful in changing

391 conservation behavior (Winkler 2011; Villamor & van Noordwijk 2011). This view is
392 supported by our study, which found that heteronomous motivation did not have a significant
393 effect on changing self-reported behavior to protect the forest, while autonomous motivation
394 did. Whilst this finding was significant, there were very few people who did report
395 autonomous motivation towards the forest, and many reported heteronomous motivation.
396 This is likely due to the absence of intrinsic traditional systems towards the forest and rather
397 viewing the forest as an economic source as a result of the conservation program or the
398 forests providing ecosystem services such as flood mitigation. This finding provides an
399 example of the potential power and value of facilitating intrinsic motivation compared to
400 providing extrinsic incentives (e.g. Thibault & Blaney 2001) and is encouraging for regions
401 where traditional systems inherently contain intrinsic motivation towards forest protection.
402 However, due to the small sample size of respondents in our study who were autonomously
403 motivated, caution should be taken in generalizing this finding. Further research is required to
404 focus on villages that have greater intrinsic value and traditional systems towards the forest
405 that exist in other regions of Sumatra (McCarthy 2005). This will help illuminate the specific
406 reasoning behind why heteronomous motivation is not necessarily linked to self-reported
407 behavior change.

408 Whilst heteronomous motivation was not significant in self-reported forest protection, both
409 heteronomous and autonomous motivations were significant to self-reported orangutan
410 protection. This highlights that it may be important to promote differing motivations to
411 address individual differences within the community. The orangutan can be considered a pest
412 species due to its crop raiding, and is feared due to its size (Campbell-Smith et al. 2010). In
413 these instances, where the social-ecological context may create barriers to forming
414 autonomous motivation for some individuals, heteronomous motivation may be essential as
415 another suitable form of motivation. Decaro and Stokes (2013) also identify the complexities

within social-ecological systems and the importance of understanding the effect of individual and cultural differences.

While autonomous motivation has many intrinsic factors, it is possible to promote this form of motivation through the careful design and implementation of conservation programs. Decaro and Stokes (2008) suggest that autonomous motivation is best promoted through a supportive environment, including provision of choice, non-coercive social interaction and substantive recognition of stakeholder identity. These characteristics mirror aspects of adaptive co-management of natural resources between communities and government stakeholders, which can facilitate human-wildlife conflict resolution (e.g. Butler et al. 2008, 2011; Butler 2011).

We found that the greatest cumulative effect in changing self-reported behavior to protect the orangutans was through a combination of both heteronomous and autonomous motivation in Tangkahan. This is likely representative of the largely autonomy-supportive approach and design of the program in Tangkahan, which also provides extrinsic benefits through tourism. Comparatively, solely autonomous motivation was significant in Halaban where minimal extrinsic incentives are provided, and solely heteronomous motivation was significant in Bukit Lawang, where economics is the main focus, to protect the orangutan. Heteronomous motivation is likely to last only as long as the extrinsic incentives systems are present (De Young 2000; Thibault & Blaney 2001; Osbaldiston & Sheldon 2003) whilst autonomous motivation is self-sustaining (Dwyer et al. 1993). In Tangkahan, the program forms an additional, even essential, contribution to the community's economy and development. Therefore, while livelihoods remain dependent on these programs, it is important these incentive structures remain in the long term. Despite this, autonomous motivations complement heteronomous motivations by positioning intrinsic values within the community with the potential of creating new social norms. This is essential to the sustainability of the

441 program, especially in times when the extrinsic incentive structures may be struggling to
442 maintain funding support or where exploitation of the system occurs.

443 Our study highlights the importance of distinguishing between attitude change and self-
444 reported behavior change. Social science research in conservation has focused on how to
445 change attitudes, but there is evidence that this does not necessarily result in behavior change
446 (Lai & Nepal 2006; Waylen et al. 2009). Our study supports this finding by identifying a
447 large proportion of participants who reported a positive change in attitude but who did not
448 report a change in self-reported behavior. We found that primarily heteronomous motivations
449 can lead to a greater change in positive attitudes towards protecting orangutans but not
450 actually result in a positive change in an individual's self-reported behavior towards
451 protecting them (for example, in Bukit Lawang). Ultimately, behavior change should be the
452 primary outcome, and changing attitudes is one strategy to achieve this, but should not be
453 used as a measure of program success or failure.

454 Whilst self-reported behavior used in this study limits the certainty of actual behavior change,
455 we believe the cautions taken in correctly identifying self-reported behavior overcomes these
456 limitations. Studies that measure actual rather than self-reported behavior could strengthen
457 this research, and caution should be taken in interpreting these findings until such studies are
458 able to support these results. Despite these limitations, we believe our conclusions are further
459 strengthened by the comparative case study design. Further research is required to identify
460 specific strategies for the design, implementation and adaptive co-management of a
461 conservation program that can test and refine motivational approaches relevant to the local
462 context.

463 In conclusion, we suggest that when designing or improving community-based conservation
464 programs, promoting or combining autonomous motivation may be more effective and

sustainable in the long-term than promoting only heteronomous motivation. We recommend preliminary socio-psychological studies to understand the locally-relevant complex drivers of human behavior. Although these are rarely undertaken (Decaro & Stokes 2008; Villamor & van Noordwijk 2011), such preparatory research could potentially save valuable resources, and achieve more effective conservation outcomes. The current monetary-focused paradigm needs to include alternative and more sustainable incentives and strategies that promote autonomous motivation when required. This paper demonstrates that in the example of the Sumatran orangutan, promoting greater autonomous motivation to protect both the orangutans and forest is necessary to achieve greater self-reported behavior change.

Supporting Information

A detailed description of the multinominal logistic regression analysis (Appendix S1), and results (Appendix S2), as well as a more detailed description of the generalized structural equation modeling analysis (Appendix S3) and results (Appendix S4) are available online. The authors are solely responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.

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596 Table 1. Characteristics of case study villages and corresponding community-based
597 conservation programs.

Characteristics	Halaban	Tangkahan	Bukit Lawang
Program	reforestation program of National Park	small scale tourism	mass tourism
Incentives provided	minimal economic and development	moderate economic and development	large economic and development
Motivation style within program	predominantly autonomous	mixed autonomous and heteronomous	predominantly heteronomous
Socio-economics	majority farmers (rubber, oil palm trees) and plantation labourers	majority farmers (rubber, oil palm trees) and plantation labourers, small number involved in tourism	majority farmers (cocoa, rubber, oil palm trees), smaller number work in tourism
Culture	predominantly Javanese culture	Karonese culture dominant	predominantly mixture of Karonese and Javanese people but more modernized and tolerant of Western influences
Traditional system towards forest	none	forest valued as source of traditional medicine, some trees scared thus needing protection	forests viewed largely as source of income for tourism

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Table 2. The dependent variables and their considered categories.

Variable	Category		Number of people	
			Orang-utans	Forest
Behavior / Attitude Change	(0) No change	clear answer	13	6
		no clear answer / no answer	61	58/11
		no opportunity to change*	29	2
	(1) positive Attitude Change		68	41
	(2) positive Behavior Change		28	70
	positive Behavior/Attitude Previously*		40	52
Motivation type	(0) No Motivation		74	30
	(1) Autonomous		78	10
	(2) Heteronomous		82	193
	Autonomous + Heteronomous		6	7

Footnote: Numbers in brackets show the respective categories. Categories and sub-categories indicated by (*) were removed from the analysis.

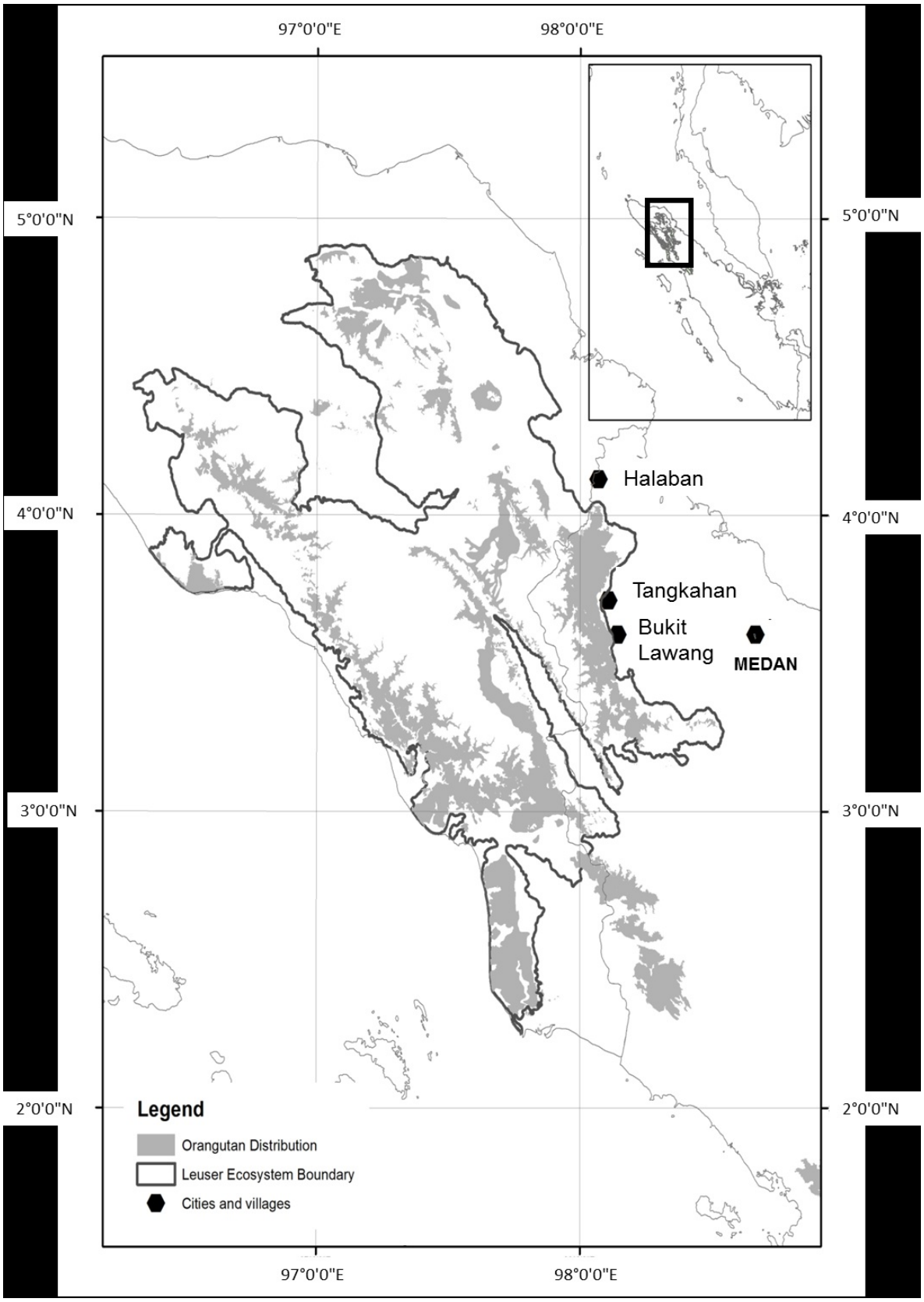
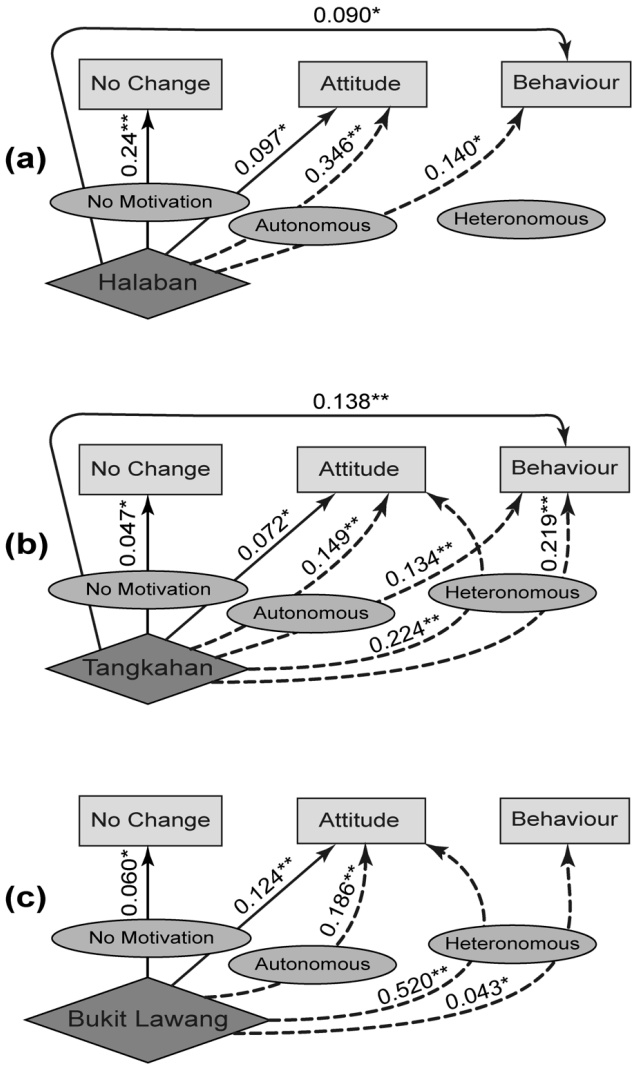


Figure 1. Locations of case study sites, North Sumatra, Indonesia.



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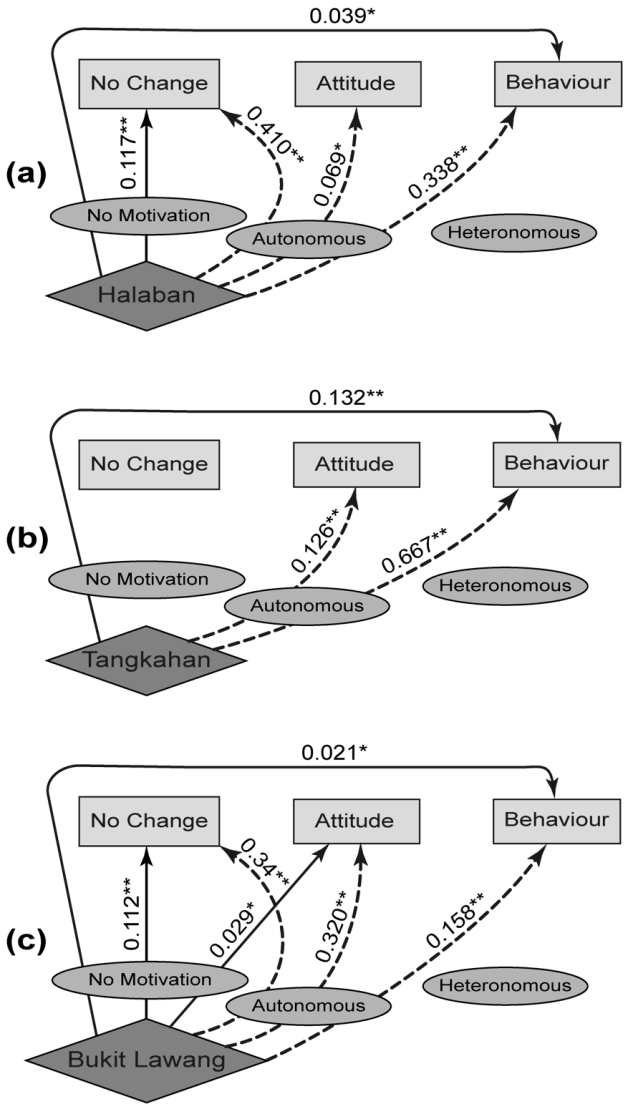
622 Figure 2. Probability paths for the GSEM model with the orangutan data for the three villages
623 participating in the study: (a) Halaban; (b) Tangkahan; and (c) Bukit Lawang. The probability
624 paths corresponding to the direct effects (through the base category of the Motivation Type
625 mediating variable) are shown by the solid arrows, while the probability paths corresponding
626 to the indirect effects are shown by the dashed arrows. The corresponding average (over all
627 other predictor variables) probabilities for the considered paths are presented next to the
628 arrows together with the indicated levels of statistical significance: (*) $p \leq 0.05$; and (**) $p <$
629 0.01.



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631 Figure 3. Probability paths for the GSEM model with the forest data for the three villages
632 participating in the study: (a) Halaban; (b) Tangkahan; and (c) Bukit Lawang. The probability
633 paths corresponding to the direct effects (through the base category of the Motivation Type
634 mediating variable) are shown by the solid arrows, while the probability paths corresponding
635 to the indirect effects are shown by the dashed arrows. The corresponding average (over all
636 other predictor variables) probabilities for the considered paths are presented next to the
637 arrows together with the indicated levels of statistical significance: (*) $p \leq 0.05$; and (**) $p <$
638 0.01.

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