Lower risk reduction intentions among households exposed to landslide risk: a tentative explanation

Abstract

Natural hazards have a large impact on household livelihoods worldwide, especially in the Global South. Yet, literature on the adoption of risk reduction measures at individual level remains scattered and inconclusive. This study combines geographical data with an original cross-sectional household survey to investigate the effects of both exposure to and experience with landslides on the intention to plant trees to reduce landslide susceptibility. Logit regressions are used to test the protection motivation theory (PMT) and to investigate the link between intentions to plant trees against landslides and past experience, actual exposure, perceived threat and perceived capacity to prevent landslides. The results show that respondents in our study area are well aware of landslide risk and believe trees are effective in landslide susceptibility reduction. Yet, those farmers that would benefit most from reducing landslide susceptibility by planting trees have the lowest intention to do so. A strong, negative correlation is found between exposure and intention to plant trees. A low self-efficacy among these respondents and the presence of a non-protective response trap is proposed to explain this result. This finding has implications for policies for poverty reduction and public communication about landslides.

Landslide, protection motivation theory, self-efficacy, sub-Saharan Africa, mitigation intention

1 Introduction

The Sendai Framework for Disaster Risk Reduction (DRR) stresses the importance of an “all-of-society engagement”, fostering an “inclusive, accessible and non-discriminatory participation” towards disaster risk reduction (UNISDR, 2015). This aligns with the idea of an integrated risk management, which combines risk reduction measures at both household and aggregated level, and thereby attributes some of the responsibility for risk reduction to the individual or household level (Bubeck et al., 2013; De Moel et al., 2011). Recent studies have indeed shown that measures adopted at household level can be cost-effective and can effectively reduce risk (Galve et al., 2016). Disaggregated measures are particularly relevant in the case of localized hazards which only affect a few households at a time, as well as in remote and developing regions where protection provided by the state is low (Maes et al., 2016a).

Recent research finds, however, that the adoption of precautionary measures, *i.e. ex ante* prevention and mitigation measures, among exposed populations is often limited (Bubeck et al., 2012). Moreover, correlations between risk perceptions and the intention to adopt mitigation measures is generally weak (Bubeck et al., 2012; Wachinger et al., 2013). A first possible reason for this ‘risk perception paradox’, is related to a methodological problem of unaddressed reversed causality in cross-sectional studies (Wachinger et al., 2013; Weinstein and Nicolich, 1993). Previously adopted DRR measures among exposed populations likely negatively affect the current intention to take measures. Cross-sectional studies that do not take this into account can therefore erroneously find that more exposed individuals have a low intention to take measures (Siegrist, 2012).

Another set of explanations for this ‘paradox’ relates to individual decision making: the benefits of not taking measures might outweigh costs, individual households could not feel responsible for taking precautionary measures (lack of agency) or they could lack the access to necessary resources (Wachinger et al., 2013). Finally, the protection motivation theory (PMT), as well as studies with a different theoretical framework (eg. Lin et al., 2007), have proposed non-rational psychological explanations for the lack of precautionary measures among exposed households (Grothmann and Reusswig, 2006; Rogers, 1983, 1975). In the PMT, developed by Rogers (1983), decision making in response to threats is determined by the individuals’ threat appraisal as well as their coping appraisal. The model has been widely used in health psychology and is increasingly being used to explain protective behaviour in the presence of natural hazards (Grothmann and Reusswig, 2006; Milne et al., 2000; Poussin et al., 2014).

Concordantly, a growing body of literature stresses the importance of coping appraisal for the intention to adopt mitigation measures against natural hazards (Grothmann and Reusswig, 2006; Poussin et al., 2014; Zaalberg et al., 2009). Frequently, these studies argue that both threat appraisal and coping appraisal should be high in order to foster protective behaviour (e.g. de Boer et al., 2015; Grothmann and Reusswig, 2006). While this suggests the presence of an interaction between threat appraisal and coping appraisal, several studies in hazard research and in health psychology argue that the relation between threat appraisal and coping appraisal is merely additive (Bubeck et al., 2013; Milne et al., 2000).

As climate change is expected to increase the frequency and intensity of hazards, understanding the factors that determine the adoption of mitigation measures at household level is important for developing adequate policies around the world. This is particularly relevant for countries in the Global South, as these are likely to be most severely affected by climate change (UNISDR, 2015). Yet, a major shortcoming of the literature on the decision response to natural hazards is that most studies currently focus on floods in Western countries (Kellens et al., 2013; Tierney et al., 2001)[1]. Yet, it is recognized that differences in culture, institutional context and nature of the risk are all likely to be important in determining responses to threats (Tansey and O'riordan 1999; Kellens et al. 2013).

The objective of the current study is to contribute to the literature by investigating responses to threat for landslide hazard in the socio-economic and cultural context of Uganda. This study explores various explanations for the risk perception paradox and tests both a multiplicative and an additive relation between threat and coping appraisal. Geographical information on landslide susceptibility is combined with subjective perceptions and actual hazard experiences at the household level, thereby allowing to disentangle the effect of exposure from actual experience and perceptions. Our database is unique, in the sense that it combines information from a structured household survey with an estimation of landslide exposure and a mitigation measure at plot level.

2 The protection motivation theory and landslides

2.1 The protection motivation theory

The protection motivation theory (PMT), as developed by Rogers in 1975 and 1983, relates the intention of an individual to adopt protective measures to its threat appraisal and its coping appraisal (Grothmann and Reusswig, 2006; Rogers, 1983, 1975)[2]. The threat appraisal factor consists of a perceived susceptibility and a perceived severity component, which respectively measure the perceived likelihood that a hazard occurs and the perceived impact this hazard can have upon occurrence. The coping appraisal factor, on the other hand, consists of an individual's self-efficacy, which is the perceived capacity of this individual to take action, and the protective response efficacy, which is the perceived efficacy of a specific protective response (Grothmann and Reusswig, 2006; Zaalberg et al., 2009). The concept of self-efficacy is related to the concept of locus-of-control (LoC), but differs from the latter in that it directly refers to a specific behavioural capability (Smith, 1989).

Besides threat appraisal and coping appraisal, it is believed that the actual experience of a disaster influences the protection motivation through a pathway which is not fully mediated by these two elements alone (Wachinger et al., 2013). Experiential decision-making is determined by affect and emotions, which are linked to direct and indirect experiences of a certain disaster and therefore influences willingness to take measures in a way which is not only mediated by cognitive threat appraisal and coping appraisal (Slovic et al. 2004; Zaalberg et al. 2009; Miceli et al. 2008; Peek and Mileti 2002).

Additionally, various studies mention various component of 'trust' as important determinants of mitigation intentions (Lin et al. 2007; Schad et al. 2011). As these studies have not made use of the PMT, it is not clear how this trust is mediated by threat and coping appraisal. On the one hand, trust in public risk reduction measures, and related, a lack of sense of personal responsibility, have been shown to be negatively correlated with mitigation intentions (Kellens et al. 2013; Schad et al. 2011).

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[1] An important exception is the recent on drought in Ethiopia (Gebrehiwot and van der Veen, 2015).

[2] There several alternative models to explain protective intentions, like the Protective Action Decision Model (PADM) and the Trans-theoretical model (TTM). Lindell et al. (2012) compare the PADM and the PMT. They argue that the PMT's emphasis on self-efficacy might be more relevant in case the focus is on one single protective action, while a focus on task demands, like in the PADM, is more relevant when several measures are to be compared (Lindell and Perry, 2012). As we will look at one single protective response, we make use of the PMT. Some researchers have integrated the PMT with the Trans-theoretical model (TTM) to investigate differences between individuals at various stages of preparedness (Martin et al. 2007; Gebrehiwot & van der Veen 2015). As we investigate one specific hazard reduction measure, instead of a general stage of preparedness, the PMT-TTM combination is not relevant for our research.

While public risk reduction is limited in developing countries, reliance on social networks and NGO's could have a similar effect for response measures (Maes et al. 2016). Throughout the manuscript we will call this aspect of trust "reliance on others". On the other hand, trust in media and other potential sources of information about disaster risk have been shown to have a positive effect on mitigation intentions (Lin et al. 2007; Reid and Vogel 2006; Tierney et al. 2001). In our study area, information about landslide risk is mainly provided by people in the close surroundings, like family, neighbours and potentially extension agents. In the subsequent sections we will call this aspect of trust "trust in information sources".

Some confusion exists on the presence of interactions between the components of the PMT. In his original model Rogers proposed a multiplicative relation between the various components of the model (Rogers, 1975). In the revised version of the PMT he nuanced this by arguing that the effect of the components within threat appraisal and within coping appraisal should be additive, while second order interactions could arise between the aggregate factors of threat and coping appraisal (Rogers, 1983). Yet, according to later studies, empirical support for a multiplicative relation between both factors has been lacking and Rogers has been cited as if no interaction effects were to be expected (e.g. Bubeck et al., 2013; Norman et al., 2005). Meanwhile, recent studies that make use of the PMT argue that a high threat appraisal combined with a low coping appraisal could lead to a non-protective response, like fatalism and wishful thinking (e.g. Grothmann and Reusswig, 2006; Zaalberg et al., 2009). A non-protective response arises among individuals who know there is a hazard, but do not trust their own capacity to do something about it. Such an interpretation of the PMT supposes some form of interaction between threat appraisal and coping appraisal[3].

The strength of this interpretation of the PMT is that it does not assume strict rationality of the agents and allows for heuristics and biases (Martin et al. 2007; Tierney et al. 2001). As the non-protective response trap is included in the model, it does not make the frequent assumption that high risk perception will automatically lead to personal protection, cfr. the risk perception paradox (Tierney et al., 2001; Wachinger et al., 2013). Strong correlations have been shown between intentions and actual behaviour (Fishbein and Ajzen, 1975 in Lindell and Whitney, 2000)

Previous applications of the PMT have not taken into consideration the possibility of a feedback loops between previously adopted risk reduction measures, threat appraisal and intentions to adopt measures. Such a feedback loop could explain the low correlations that are generally found between threat appraisal and intention to take measures (Siegrist, 2012; Weinstein and Nicolich, 1993). While time-series data are most suitable to address this concern, a careful formulation of the question and the inclusion of previously adopted measures as control variables in the analysis partially addresses this concern (Bubeck et al., 2012; Siegrist, 2012).

[3] Figure a represents the case of a purely additive relation between threat appraisal and coping appraisal, while Figure b represents a multiplicative relation. According to the latter relation, a non-protective response arises when threat appraisal is high, while coping appraisal is low.

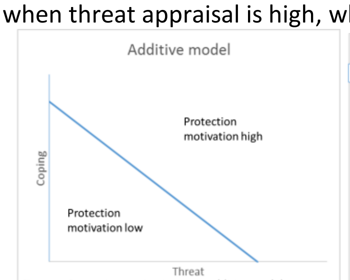

Figure a: Protection motivation in an additive model

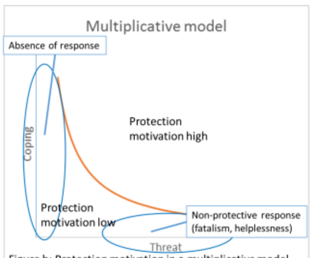

Figure b: Protection motivation in a multiplicative model

2.2 Landslides

Landslides are defined as "the movement of a mass of rock, debris or earth down a slope" and mostly constitute small, but sometimes frequent events affecting millions of people worldwide (Cruden and Varnes, 1996). In the our study area landslides occur frequently and have a significant impact on the income and livelihoods of the affected households (Mertens et al. 2016; Jacobs et al. 2016a). Lack of formal insurance mechanisms, as well as other coping mechanisms, compels farmers to rely on social networks and emergency measures to cope with income shocks after landslides (Mertens et al., 2016).

Landslides have received limited attention in the literature on the intentions to adopt measures against risks. This is surprising, as the spatial distribution of landslide susceptibility is quantifiable and therefore provides an interesting, external source of spatial variability. Moreover, as landslide susceptibility can be modified by local measures, individual households can take steps towards hazard prevention, rather than preparedness alone (Maes et al., 2016a). This distinguishes small-scale landslides from large-scale natural hazards, like floods, earthquakes and droughts, against which individual households cannot take hazard-preventing measures. The few studies that investigated the willingness to adopt measures against landslides have neither exploited the spatial factor in landslide susceptibility, nor the preventive potential of individuals with regard to this susceptibility (e.g. Damm et al. 2013; Lin et al. 2007; Nathan 2008).

Many structural and non-structural mitigation measures exist against landslides (Vaciago 2013; Maes et al. 2016), yet most of these measures are neither technically nor financially feasible for farmers in remote rural areas in the Global South. While not being a silver bullet, planting trees stands out as one prevention measure that is within reach of local farmers and that has been proposed for landslide hazard reduction in Uganda (Knapen et al. 2006; Mugagga et al. 2012). As long as they do not become too large and heavy, trees stabilize slopes by increasing cohesion with their roots and by increasing evapotranspiration (Claessens et al., 2007; Sidle and Ochiai, 2006). Considering their other benefits, like affordability, provision of food and fuel and soil erosion control, planting trees is therefore an attractive preventive measure against shallow landslides which remains within technical and financial reach of the households in the study area. As far as we know, no other measure against landslides is currently frequently adopted in our study area.

3 Materials and methods

3.1 Study area

We conducted our study in the Rwenzori mountains in Western Uganda. These mountains cover an area of approximately 3000 km^2, spread over four districts, Bundibugyo, Kabarole, Kasese and Ntoroko, which together consist of over 31 sub-counties (Fig. 1).

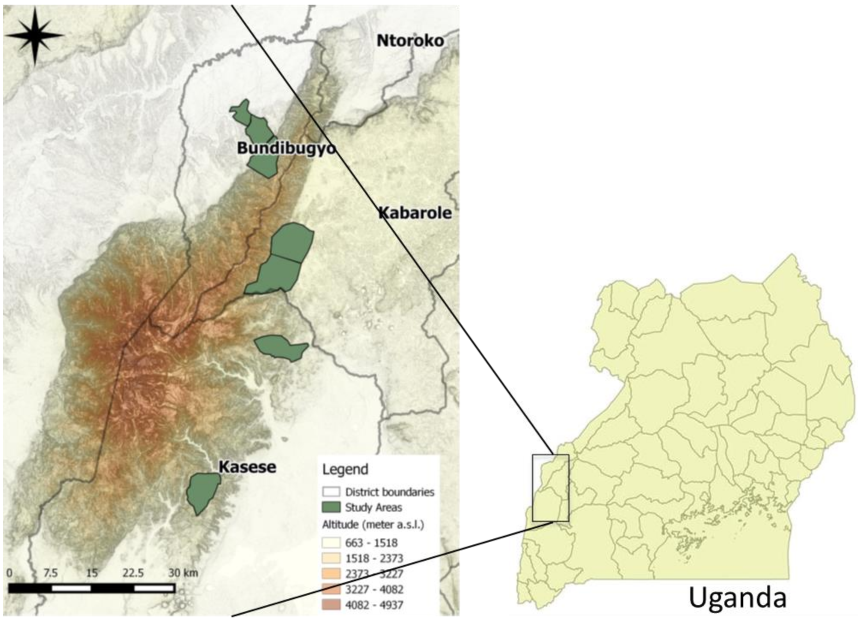

Figure 1: Overview of the study area. Darker areas have a steeper slope (adapted from Mertens et al. (2016))

During the two rainy seasons, which typically last from September to December and from March to May (Taylor et al., 2009), and following seismic activities, shallow and deep-seated landslides frequently occur both high into the mountains and on the foot-slopes, in the lower valleys (Jacobs et al. 2016b). A recent study has shown that landslides have a significant impact on household income in the region, therefore seriously affecting people's livelihoods (Mertens et al., 2016). Moreover, landslides and flash floods in the Rwenzori are known to have caused at least 55 fatalities and rendered over 14,000 people homeless in the region over the last 50 years (Jacobs et al. 2016a; Jacobs et al. 2016c). This suggest that landslide risk reduction measures are limited or dysfunctional in the area.

3.2 The survey

A questionnaire was administered to a stratified two-stage random sample of 461 households in 47 villages in the area. The villages were purposefully stratified on the presence of recent landslides, while also the households in each village were stratified on whether they had been affected by a landslide in the previous 15 years. Villages and households affected by landslides were identified upfront, respectively through workshops at district level and village-level interviews with local chairmen (see Mertens et al. 2016). An overview of the sample characteristics is given in Table 1.

The interviews were conducted in the local languages, while the questionnaires were in English. Therefore we carefully selected our enumerators to include native speakers for each the three major languages in the region (Lukonzo, Lutooro and Lubwissi). During the training of the enumerators all questions were verbally translated by the group into each of the languages. The translation of the questionnaires, followed by a field try-out, allowed us to improve the clarity and performance of the questionnaire.

Whenever possible, interviews were conducted with the person identified as the head of the household. In our region most of the household heads were male, except for single headed households. Whenever the household head was not available, questions were asked to his spouse. For 27 households in our sample nor the household head nor its spouse could be present for the interview and questions were answered by uncles or aunts or by the eldest child above 16. We have not included these households in this analysis. We also dropped one additional household for which we have missing data because the household head did not allow us to finish the whole questionnaire.

The questions for current study were part of a questionnaire that collected information on socio-demographics, subjective wellbeing and perceptions, plot management, past experience with landslides and agricultural production. The first two sections of the questionnaire introduced the researcher and inquired about household demographics. Subjective questions on self-efficacy, perceptions of landslide threat, perceived efficacy of resilience measures against landslides, as well as on the intention to adopt such measures were asked in the third section (Table 2). Care was taken not to reveal our interests in landslides in particular before the end of the third section. Therefore questions about perceptions on landslides were altered with questions about soil erosion (not shown or analysed here). A question on the perceived landslide susceptibility was asked at plot level in section four. Finally, GPS points were taken in front of the houses and on the corners of each plot owned or cultivated by the households. Because some plots could not be mapped due to refusal by the owner or excessive distance from the house, in total 776 plots, or 91.5 % of the 848 plots in our sample, were mapped with a GPS.

The actual landslide susceptibility was obtained from a landslide susceptibility map, which was constructed for the Rwenzori mountains using statistical modelling (Jacobs et al., 2017). The average landslide susceptibility was calculated at plot level in a buffer of 30 meters around each plot, and subsequently averaged at household level.

3.3 Statistical methods

The respondent's willingness to plant trees was explicitly enquired for with the question "If I had plots in landslide-prone area, I would plant trees to prevent landslides from happening", rated on a five-point bipolar Likert scale. This general and hypothetical wording aimed at making the answer independent of the actual perception on landslide susceptibility or the effect of tree planting actions previously taken.

The perceived landslide susceptibility was asked with a yes/no question at plot level and then averaged at household level. The other psychological variables, like perceived severity of landslide impact, perceived efficacy of planting trees, self-efficacy with regard to preventing landslides, trust in information sources and reliance on others were grasped by a combination of several questions (Table 2). For practical and interpretational purposes we formulated all these questions on a five-point bipolar Likert scale. Consequently, regarding self-efficacy we did not strictly follow the recommendations made by A. Bandura (2012), who argues that a unipolar Likert scale should be used. Yet, we formulated our questions in such a way that differences between bipolar and unipolar Likert scales were minimal (Sitzmann and Yeo, 2013).

Following Lin et al. (2007) we first used an exploratory factor analysis on all our questions to confirm whether they indeed measured perceived severity, perceived efficacy, trust in information and reliance on others. Subsequently, we grouped the relevant questions into their respective variables by simple summing of the Likert values. As compared to recent applications of the PMT on the adoption of disaster risk mitigation measures, the Cronbach' alpha coefficients in Table 2 are good, except for "trust in information" and "reliance on others", which yield only moderate alphas (Martin et al. 2007; Gebrehiwot and van der Veen 2015).

In order to control for the presence of trees, we inquired for each plot cultivated by the household whether it had trees and whether trees had ever been planted on that plot. Two different ways of aggregating this information at household level have been considered. First, a simple proportion ($\frac{\sum(plots\ with\ trees)}{\sum(plots)}$) was calculated, but this measure does not really account for whether trees are present on the plots with a high landslide susceptibility. Therefore also the proportion of landslide susceptibility 'addressed' by trees ($\frac{\sum(Susceptibility*plots\ with\ tree)}{\sum(susceptibility\ on\ plot)}$) was calculated. Both proportions are reported in Table 1.

Table I. Overview of the sample characteristics (standard deviations between brackets)

	Acronym	All Mean (sd)
Exposure		
Calculated landslide exposure	Exposure	0.00 (1.00)
Past experience with landslides (=1 if had a landslide)	Landslide	0.39 (0.49)
Respondent information		
Education respondent	Education	4.40 (2.64)
Age respondent	Age	41.90 (15.12)
Respondent not HH head (yes = 1)	Spouse	0.34 (0.47)
Human, social and financial capital		
Household size (adult equivalents)	Household size	3.35 (1.15)
Female-headed household (=1)	Female head	0.08 (0.27)
Income (Ush) per adult equivalent per day	Income	3068.13 (4137.05)
Total area (Ha) cultivated by the household	Total Area	0.80 (0.71)
Total number of plots cultivated by the household	Total Plots	1.94 (1.03)
The household head nor his spouse are from this or neighboring village (=1)	Migrant	0.16 (0.37)
Other factors potentially related with attitude towards trees		
Has coffee, cocoa or fruit trees on plots (=1)	Coffee, cocoa, fruit trees	0.90 (0.30)
Average distance of plots to 4WD roads (km)	Distance road (km)	1.78 (1.11)
Distance between house and closest national park (km)	Distance park (km)	4.68 (1.99)
Proportion of the plots cultivated by the households that have trees	Trees	0.46 (0.42)
Proportion of the plots cultivated by the household on which household has once planted trees	% Planted	0.63 (0.41)
Proportion of the landslide susceptibility addressed by trees	% Susceptibility Tree	0.53 (0.43)
N		**433**

Table II: Overview of the questions used to elicit the factors from the PMT. Except the question on perceived landslide susceptibility, all questions were rated in a bipolar 5-point Likert scale ranging from "Strongly disagree/Not at all" to "Strongly agree/A lot". The perceived landslide susceptibility was asked with a yes/no question at plot level and then averaged at household level.

Questions	Acronym	Cronbach Alpha	Average (sd)	Min	Max
Intention to plant trees	[WilTree]				
1. If I had plots in landslide prone area, I would plant trees to prevent		N/A	1.24	-2	2

landslides from happening		(1.30)		
Perceived landslide susceptibility [Perc. Susceptibility] 1. Could a landslide happen on this plot? [yes/no question asked for each plot, averaged]	N/A	0.48 (0.42)	0	1
Perceived severity of landslide risk [Perc. Severity] 1. To what extent could landslides affect the wellbeing of your HH? 2. To what extent could landslides cause financial losses to your HH? 3. To what extent would landslides threaten your life? 4. In general, how afraid are you of landslides? 5. Landslides are an important discussion topic in our family 6. During the rainy season my HH members frequently worry about landslides 7. In the next 12 months it is likely that my HH members will face hunger due to landslides 8. During heavy rains some of the HH members sleep outside our house due to the fear of landslides	0.87	5.77 (8.46)	-16	16
Perceived efficacy of planting trees to reduce landslide susceptibility [Efficacy Tree] 1. What is the effect of planting traditional trees against landslides? 2. What is the effect of planting eucalyptus trees against landslides	0.73	2.06 (1.87)	-4	4
Self-Efficacy [Self Efficacy] 1. Landslides can be prevented by individual households 2. My HH can take concrete measures to prevent landslides (e.g. planting trees)	0.80	-2.32 (2.31)	-4	4
Trust in information [Trust Info] 1. In general, I would trust a member of the government if s/he would advice me on landslide risk 2. In general, I would trust a member of the local NGO's and organisations if s/he would advice me on landslide risk 3. In general, I would trust my neighbour if s/he would advice me on landslide risk	0.69	4.51 (2.31)	-6	6
Reliance on others [Reliance others] 1. If my HH would be affected by a landslide our family would help us with shelter, food or money 2. If my HH would be affected by a landslide our neighbours would help us with shelter, food or money 3. If my HH would be affected by a landslide, the government would help us with shelter, food or money 4. If my HH would be affected by a landslide, an NGO or other organisation would help us with shelter, food or money	0.66	2.05 (4.35)	-8	8

The variables thus obtained have been used to investigate correlations between exposure and intention to plant trees (Equation 1).

$$Y_{ije} = \alpha + \beta Exp_{ije} + \gamma X_{ije} + \mu_j + \pi_e + \varepsilon_{ije} \qquad \text{Eq. 1}$$

In this equation Y_{ije} represents the intention to plant trees of individual *i*, in village *j*, interviewed by enumerator e. Exp_{ije} is the calculated exposure to landslide susceptibility at household level. X_{ije} represents a vector of covariates, as well as household and respondent characteristics, while μ_j and π_e are sub-county and enumerator fixed effects respectively. The error term is represented by ε_{ije}.

Our variable on the intention to plant trees is limited to a five-point Likert scale and thus requires ordered logit or ordered probit estimation. As both the explanatory and the dependent variable are likely correlated with the enumerator asking the questions, as well as the region, we included fixed effects. This complicates the estimation of the model and required us to either transform our dependent variable in a dichotomous variable, either use the blow-up and cluster estimator proposed by Mukherjee et al. (Baetschmann et al., 2015; Mukherjee et al., 2008). This latter method fits a fixed effects logit model on each level of the dependent variable, including the subcounty and enumerator fixed effect, while clustering at the level of observation (Baetschmann et al., 2015). The results presented in this paper use the latter estimation, as this estimation gave us the most conservative, i.e. least pronounced, results, but we have also estimated equation 1 with an ordinary least squares regression and with a fixed effects logit after dichotomizing our dependent variable (results of the ordinary least squares are shown in appendix A). As fixed effect logistic regressions do not estimate the intercept, the interpretation of the coefficients is limited to their sign and relative size as compared to other coefficients.

The extent to which a household is exposed to landslide risk is not exogenous to the household's socio-economic characteristics and individual choices, and these are, in turn, likely correlated with the household's head willingness to take measures against landslides (Lindell and Hwang, 2008; Mertens et al., 2016). We therefore did not aim at identifying a causal relation between exposure and intention to plant trees. Yet, by including a set of control variables, we could test whether the correlation that was found between exposure and intention to plant trees withstood the inclusion of observables.

A first set of covariates included into Equation 1 are 'experience with landslides' and 'the presence of trees'. Experience with landslide is measured by a dummy indicating whether the household had a landslide on one of its plots in the past 15 years. Including this dummy alongside our measure of exposure allowed us to disentangle the effect of exposure to landslide risk from the effect of actual experience with landslides. Our second control variable, the presence of trees allowed us to partially address the issue of reversed causality which is caused by previously taken measures'[4].

A second set of covariates concerns characteristics of the respondent, including its age, education level and whether this person is the household head, as well as proxies for human, social and financial capital at household level. Besides the respondent's education level, human and social capital are proxied by the household size, the migration status of the head and spouse, as well as the gender of the household head. Households' financial capital is proxied by total household income, as well as total land holding (in Ha) and total number of plots owned or cultivated by the household. We controlled for whether the households have coffee, cocoa or fruit trees, as this can positively affect the respondent's general attitude towards trees. We also took into account the average distance between plots and a road, as this determines whether trees can be sold as construction poles. Finally, as the commercial utility of trees, as well as perceptions on trees, can be affected by the presence of a forest, we controlled for the distance to the Rwenzori and Semliki national parks.

In a second step we used equation one to investigate the relation between exposure to landslide susceptibility and the subjective variables from the PMT. In this step Y_{ije} alternately represents the "landslide susceptibility appraisal", "perceived severity of landslides", "perceived efficacy of trees", "perceived self-efficacy", "trust in information sources" and "reliance on others".

In a third step, the relation between the subjective variables and the intention to plant trees was investigated. We therefore fitted the following model (Equation 2).

$$WilTree_{ije} = \alpha + \beta_1 SusApr_{ije} + \beta_2 PercSev_{ije} + \beta_3 EffTree_{ije} + \beta_4 SelfEff_{ije} + \beta_5 TrustInfo_{ije} + \beta_6 Reliance_{ije} + \rho X_{ije} + \mu_j + \pi_e + \varepsilon_{ije} \qquad \text{Eq. 2}$$

In this equation $WilTree_{ije}$ represents the intention to plant trees, while our explanatory variables are the different variables from the PMT. We included the same set of covariates as in equation one, as well as enumerator and sub-county fixed effects.

[4] Including different ways of aggregating the presence of trees at household level (see Table 1) did not affect our results. The results presented below control for the proportion of landslide susceptibility 'addressed' by trees.

To test whether interaction effects are present between the various components of the PMT model, Equation 3 includes an interaction term between the different components.

$$WilTree_{ije} = \alpha + \beta_1 SusApr_{ije} + \beta_2 PercSev_{ije} + \beta_3 EffTree_{ije} + \beta_4 SelfEff_{ije} + \beta_5 TrustInfo_{ije} + \beta_6 Reliance_{ije} + \delta Interaction_{ije} + \rho X_{ije} + \mu_j + \pi_e + \varepsilon \qquad \text{Eq. 3}$$

The interpretation of the interaction term in logistic models has fuelled some debate among scholars. Ai and Norton (2003) have demonstrated that the coefficient of interaction terms can be biased (Ai and Norton, 2003). The results that are presented here should therefore be interpreted with care. Yet, as our simple ordinary least squares regression yields similar results, we are comforted about the validity of the trend suggested by our model.

4 Results

4.1 Exposure and intention to plant trees

On average, the intention to plant trees among households in our sample is relatively high (Table 2). So is the average perceived efficacy of trees against landslides and the trust people have in their sources of information about landslides. Self-efficacy, which is the perceived capacity that one has to do something against landslides is low on average. These findings suggest that, while people believe trees can reduce landslide susceptibility, they have a low confidence that they can or will take the necessary steps to plant trees to reduce landslide risk. This is similar to people who believe in the beneficial effects of physical activity for reducing weight, but do not trust their own capacity to start doing a specific sport (Bandura, 2012).

The major, and compelling, finding of this study is that farmers that are more exposed to landslide risk in our sample have a lower intention to plant trees against landslides (Regression 1 in Table 3). Regardless of any causality, this finding suggests that those households who would benefit most from the stabilizing effect of trees are the least likely to be actually willing to plant trees against landslides. Two potential explanations for this trend are ruled out in Regression 2 of Table 3. First, the direct experience of landslides, which is correlated with the exposure to landslide risk, does not a significant reduction in intention to plant trees. Secondly, including a control variable for the presence of trees on the plots does not affect our results either, suggesting that the result is not a consequence of reversed causality caused by previously taken measures among exposed households. The inclusion of additional control variables in regression three does not change the trend found in regressions 1 and 2. One should note, however, that the explained variability is rather low, illustrated by the McFadden R-squared.

Table III: Results of blow-up and cluster estimation with enumerator and sub-county fixed effects (FE) of exposure on intention to plant trees with and without control variables. The variables are the same as in Table 2. Z-statistics are in parentheses. As the R square values are rather low, a large proportion of the variability is not captured by these regressions.

	(1) Intentions to plant trees	(2) Intentions to plant trees	(3) Intentions to plant trees
Exposure	-0.59***	-0.54***	-0.55***
	(-3.75)	(-3.81)	(-3.03)
Landslide		-0.39	-0.39
		(-1.46)	(-1.24)
Trees		-0.12	-0.18
		(-0.28)	(-0.38)
Education Respondent			0.03
			(0.55)
Age Respondent			0.02
			(1.44)
Household size			0.09
			(0.55)

Female head			-1.44***
			(-2.71)
Respondent not head			0.14
			(0.36)
Log(Income)			0.36*
			(1.96)
Total Area			-0.62**
			(-2.16)
Total Plots			0.17
			(0.97)
Coffee, cocoa or fruit trees			-0.05
			(-0.09)
Migrant			-0.39
			(-0.90)
Distance road (km)			-0.37
			(-1.21)
Distance park (km)			-0.23
			(-0.91)
Subcounty FE	Yes	Yes	Yes
Enumerator FE	Yes	Yes	Yes
# Households	433	433	433
McFadden's R2	0.04	0.05	0.15
chi2	14.03	16.00	27.16

z statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.2 Exposure and PMT variables

In this study the variables of the PMT are used to come to a tentative explanation of the result found in Table 3. We do not aim at demonstrating a causal effect, but give a tentative explanation for the results. Therefore, correlations between the variables of the PMT are presented in Table 4, while Table 5 shows the results of the regressions of exposure on these variables.

The perceived severity of landslides is highly correlated with the respondents' landslide susceptibility appraisal on their plots. This correlation confirms the intuition behind the PMT that perceived severity and susceptibility appraisal are two components of an overall perception of threat. Similarly, perceived efficacy of trees against landslides is correlated with perceived self-efficacy, suggesting that these two variables are components of an overall coping appraisal. The two components of threat appraisal are not correlated with the components of coping appraisal. Both the susceptibility appraisal and the perceived efficacy of trees are positively correlated with trust in information sources. The negative correlation between reliance on others and perceived severity suggests that farmers that have less confidence in support from their surrounding also consider landslides as a more serious threat. Interestingly, there is no correlation between the intention to plant trees and the variables measuring threat appraisal, while a clear positive relation exists between this intention and the variables measuring coping appraisal. This seems to confirm recent studies stressing the greater importance of coping appraisal over threat appraisal.

Table IV. Pairwise correlations between variables of the PMT

		SusApr	PercSev	EffTree	SelfEff	Trust	Reliance	WilTree
Perceived landslide susceptibility	SusApr	1						
Perceived severity of landslide impact	PercSev	0.438***	1					
Perceived efficacy of trees	EffTree	-0.011	-0.055	1				
Self-efficacy	SelfEff	0.049	0.024	0.145***	1			
Trust in information sources	TrustInfo	0.151***	0.064	0.140***	0.065	1		
Reliance on others	Reliance	-0.048	-	-0.008	-0.047	0.287***	1	

			0.167***					
Intention to plant trees	WilTree	-0.062	0.007	0.145***	0.103**	0.165***	0.019	1

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Both landslide susceptibility appraisal and perceived severity of landslides are positively correlated with previous experience with landslides, while perceived severity of landslides is positively correlated with exposure (Table 5). These correlations suggest that both direct experiences with landslides and indirect experiences, through observing it on neighbouring plots, reasoning or discussions with family and friends, effectively increase the threat appraisal. This trend contrasts with the absence of correlation between exposure and our measures of coping appraisal. Self-efficacy is not correlated with exposure nor is it correlated with direct experience of landslides.

The perceived efficacy of planting trees does not seem to be affected by exposure to landslide susceptibility, but is negatively correlated with direct experience with landslides, at a significance level of 10%. As trees are not a silver bullet, a substantial part of the households in our sample could have experienced a deep-seated landslide on a plot with trees, thereby decreasing the trust these people have in the capacity of trees to reduce landslide susceptibility. Alternatively, the result could be due to reversed causality, in the sense that people with a lower perceived efficacy of trees are less likely to plant trees and have therefore more often experienced a landslide. Yet, we controlled for the presence of trees on the plot.

Finally, a strong, positive correlation exists between exposure and trust in information about landslides, while farmers who experienced a landslide do have less confidence in receiving support after the landslide. As exposure in itself is not correlated with "reliance", the latter correlation suggests that support after a landslide might be lower than expected, leading to disappointment and difficulties to cope with the shock among those affected by a landslide.

Table V. Results of blow-up and cluster estimation with enumerator and sub-county fixed effects (FE), as well as control variables, of exposure to landslide susceptibility on psychological variables, including "landslide susceptibility appraisal", "perceived severity of landslides", "perceived efficacy of trees", "perceived self-efficacy", "trust in information sources" and "reliance on others". Z-statistics are in parentheses.

	Threat		Coping		Trust	
	(1) Perceived landslide susceptibility	(2) Perceived severity of landslide impact	(3) Perceived efficacy of trees	(4) Self-efficacy	(5) Trust in information sources	(6) Reliance on others
Exposure	0.23	0.93***	-0.14	0.06	0.47***	-0.02
	(1.33)	(4.93)	(-0.79)	(0.36)	(2.70)	(-0.11)
Landslide	2.37***	2.70***	-0.48*	-0.24	0.23	-0.71***
	(7.56)	(7.80)	(-1.91)	(-1.00)	(0.75)	(-2.94)
Trees	-0.20	-0.24	0.27	0.05	0.04	-0.21
	(-0.76)	(-0.97)	(0.86)	(0.16)	(0.12)	(-0.78)
Control variables, subcounty FE and enumerator FE	Yes	Yes	Yes	Yes	Yes	Yes
# Households	433	433	433	433	433	433
McFadden's R2	0.30	0.39	0.05	0.06	0.07	0.07
chi2	84.00	130.98	19.67	29.76	36.53	41.36

z statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.3 PMT variables and the intention to plant trees

The results in Tables 2-5 show that households that are more exposed to landslide risk in our sample have a lower intention to plant trees, while being well aware of this risk and having a higher threat appraisal than less exposed households. From Table 4, it is also clear that a positive correlation exists between both components of coping appraisal and the intention to plant trees, while no correlation exists with the actual exposure to landslide susceptibility. Our analysis thus far does not explain these results, nor does it dare to attribute a causal relation between exposure and intention to plant trees. Table 6 presents the results of ordered probit regressions of the subjective variables from the PMT on the intention to plant trees, thereby providing a tentative explanation. Yet, as further clarified in the discussion, we do not have conclusive evidence and cannot assert a causal pathway from exposure to intention to plant trees.

In a similar way as exposure to landslide risk is negatively correlated with the intention to plant trees, also perceived landslide susceptibility is negatively correlated with this intention (Regression 1 in Table 6). This may seem surprising, as it implies that farmers who are well aware of the landslide susceptibility on their plots have a lower intention to do something about it. No other relation, positive or negative, is found between the PMT variables and intentions to plant trees.

According to recent interpretations of the PMT, the intention to take measures against landslides is high when both threat appraisal and coping appraisal are high. Among households with a high exposure in our sample, both perceived susceptibility and perceived severity of landslides, i.e. the components of threat appraisal, are high, while perceived efficacy of trees and perceived self-efficacy, i.e. coping appraisal, are similar to the ones of households with a lower exposure. Therefore a potential explanation for the negative correlation between exposure and willingness to plant trees is that farmers with a threat appraisal above a certain threshold fail to adopt protective responses because, according to the PMT, they fall into the non-protective response trap. This happens because coping appraisal does not increase with increasing exposure and one of its components, self-efficacy, is generally low. Additionally, perceived efficacy of trees is reduced among households that experienced a landslide in the past.

According to this interpretation of the PMT, the intention to plant trees among households that have a coping appraisal that is sufficiently high should be positively, or at least not negatively, correlated with threat appraisal. To test this hypothesis, we interacted susceptibility appraisal with self-efficacy in Regression 2 from Table 6. Alternatively, in Regression 3, susceptibility appraisal was interacted with a dummy which is 1 if self-efficacy is above average and 0 otherwise. The positive interaction term in these regressions suggests that the negative relation that was found between exposure to landslide susceptibility and intention to plant trees only holds when self-efficacy is low. Among households with a high self-efficacy, intention to plant trees remains high if exposure to landslide susceptibility increases. Other interactions between the various psychological variables were also tested, but did not give any significant result.

By simple summing we also combined the components of the PMT into two variables, threat appraisal and coping appraisal. These two variables, as well as their interaction term, had the same effect on willingness to plant trees as presented in Table 6 (see Appendix B). We did not include this sum in the main part of the manuscript, as literature on the PMT does not explain how the various components of the two factors should be combined.

Table VI. Results of blow-up and cluster estimation with enumerator and sub-county fixed effects (FE), as well as control variables, of psychological variables from PMT on intention to plant trees. Regression 1 considers each of the variables separately, while regressions 2 and 3 include an interaction term between susceptibility appraisal and a continuous and a discrete version of self-efficacy respectively. Z-statistics are in parentheses.

	(1) Intention to plant trees	(2) Intention to plant trees	(3) Intention to plant trees
Perceived landslide susceptibility	-0.42** (-2.15)	-0.37* (-1.82)	
Perceived severity	0.05	0.06	0.02

of landslide impact	(0.17)	(0.22)	(0.09)
Perceived efficacy of trees	0.05 (0.25)	0.05 (0.25)	-0.01 (-0.03)
Self-efficacy	0.04 (0.47)	-0.01 (-0.10)	
(Self-efficacy) * (Perceived landslide susceptibility)		0.17** (2.49)	
Perceived landslide susceptibility if Self-efficacy >= 0			0.19 (0.59)
Perceived landslide susceptibility if Self-efficacy < 0			-0.73*** (-3.03)
Trust in information sources	0.01 (0.05)	0.00 (0.02)	0.02 (0.10)
Reliance on others	0.04 (0.23)	0.05 (0.30)	0.01 (0.09)
Landslide	0.04 (0.21)	0.03 (0.19)	0.01 (0.05)
Control variables, subcounty FE and enumerator FE	Yes	Yes	Yes
# Households	433	433	433
McFadden's R2	0.14	0.16	0.18
chi2	41.87	37.63	35.25

z statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5 DISCUSSION

5.1 Interpretations of results

The first key result of our analysis is a negative correlation between exposure to landslide susceptibility and intention to plant trees. By investigating the relation between exposure and subjective variables, we subsequently showed that the respondents are well aware of the threat caused by landslides and consider planting trees as an efficient measure to reduce the susceptibility. Additionally, we found that exposure to landslide susceptibility was only negatively related to intention to plant trees among households with a low self-efficacy. Such a trend was not found among households with higher levels of self-efficacy. Our findings were explained by means of the PMT, asserting that individuals who feel highly threatened by landslides and have a low self-efficacy resort to non-protective responses.

Some alternative explanations for our findings definitely exist. First, planting trees could be considered as a long-term investment for the production of wood or fruits. Farmers might be less willing to plant trees in more landslide prone regions because of the higher risk of losing this investment. By explicitly asking for "the willingness to plant trees to prevent landslides from happening" we tried to prevent this problem. Second, the commercial value of trees is highly dependent on the potential for easy transportation and thus the distance from the plot to an accessible road. If remote areas are more susceptible to landslides, the willingness to plant trees could be lower because of the larger distance to roads. We have tried to address this problem by including a control variable for the distance to roads. Finally, despite significant efforts to address this problem, our finding could still be attributed to the presence of risk reduction measures among exposed households. While we have not found any evidence for such measures during our fieldwork, only long-term panel data could provide a definite answer on this.

It is important to stress that the trend that is found does not imply a causal relation between exposure and intention to plant trees. An obvious risk reduction measure which is not taken into account in our analysis is to get rid of plots in landslide prone area. This can be done by selling these plots, or migrating out, but also by only buying plots that are outside landslide prone areas. Similarly, many processes could both determine exposure and intention to plant trees and therefore prevent us from making any causal claim. Yet, regardless of any causality, the results shown in this manuscript illustrate that those farmers that would benefit most from reducing landslide susceptibility by planting trees have the lowest intention to do so.

5.2 Comparison with literature

Most studies on the intentions to take mitigation measures against landslides find a positive correlation between threat appraisal and mitigation intention (Gebrehiwot and van der Veen 2015; Zaalberg et al. 2009; Lin et al. 2007). Our study demonstrates an opposite trend among households with a low coping capacity. This trend is not found among households with a high coping capacity. The difference with other studies can be attributed to several reasons.

First, average self-efficacy in other studies could have been higher than in our sample, above the hypothesised threshold which causes threat appraisal to lead to non-protective responses. While most studies have found that coping appraisal, or what Lin et al. (2007) called 'sense of power', is positively correlated with mitigation intentions, they did not include an interaction term between threat appraisal and coping appraisal. Secondly, the cultural, economic and environmental context in our study area is very different from studies in the Global North, as we deal with landslide susceptibility in a remote rural area in Uganda. Finally, other studies have considered the intention to adopt preparedness measures, rather than preventive measures. Perceptions with regard to preparedness measures could be different from the perceptions on preventive measures.

5.3 Implications for landslide risk communication

Besides increasing our understanding of human behaviour in the presence of risks, the PMT is particularly useful to guide policies that aim at increasing the adoption of disaster reduction measures at the individual or household level. In the past, information and sensitization campaigns with regard to natural hazards have been found to be very ineffective in fostering concrete action at individual level (Tierney et al., 2001). In the Rwenzori region, it is sometimes mentioned that awareness about landslide risk should be increased. Yet, according to the results presented in this manuscript, there is no need to further increase this awareness, as farmers seem to be well informed about the landslide susceptibility on their plots and its potential consequences.

At the same time, self-efficacy with regard to planting trees against landslides is very low in our study area. It might be an option for policy maker to attempt to increase farmers' self-efficacy with regard to taking specific measures against landslides. This is a challenging task. Self-efficacy is enhanced by "enactive attainments", "vicarious experiences", "verbal persuasion" and "psychological state" (Bandura, 1982). Enactive attainments, or *own experience*, and vicarious experiences, or *observing others*, are most influential in determining self-efficacy, but the most problematic with respect to landslides as well. As trees are not a silver bullet, a farmer that has planted trees on his/her plot can still be confronted with a landslide. This event would negatively affect the farmer's self-efficacy, as well as the self-efficacy of its neighbours and friends. A similar problem could arise with demonstration plots. A development agent aiming at increasing self-efficacy among farmers in the Rwenzori region could therefore opt for verbal persuasion. Workshops and agricultural trainings in the region could include a session informing the farmers about their capacity to plant trees to prevent landslides.

6 CONCLUSIONS

In this manuscript we combined a theoretical framework, the PMT, with statistical data analysis to derive a tentative explanation for the negative correlation between exposure to landslide susceptibility and willingness to plant trees to reduce this susceptibility. We show that farmers are well aware of the threat caused by landslides and consider planting trees as an efficient measure to reduce the susceptibility. Yet, individuals with a low self-efficacy in our sample have a lower intention to plant trees if they are more exposed to landslide susceptibility. We argue that these farmers fall into the non-protective response trap proposed by the PMT.

This finding entails some policy recommendations. While further increasing awareness about landslide risk in the region might not be useful, campaigns to improve self-efficacy among exposed farmers seem desirable, as well as policies to overcome financial, political, social or cultural barriers towards effective adoption of disaster risk reduction measures. Further research on effective measures that increase farmers' self-efficacy might be required.

7 Acknowledgements

This study would not have been possible without the dedicated effort of all the enumerators involved in the data collection, as well as the support of local chairmen in the region and local field guides and translators. We would also like to thank the logistical support provided by the Mountains of the Moon University (MMU). Of course, the insights in this research are all based on the information and time shared with us by the many farmers that were interviewed.

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9 Appendix

9.1 Appendix A

Results of an ordinary least squares estimation method.

Table VII: Ordered probit regression with enumerator and sub-county fixed effects (FE) of exposure on intention to plant trees with and without the full set of control variables. The variables are the same as in Table 2. Z-statistics are in parentheses. AS the R square values are rather low, a large proportion of the variability is not captured by these regressions.

	(1) Intention to plant trees	(2) Intention to plant trees	(3) Intention to plant trees
Exposure	-0.20***	-0.18***	-0.15**
	(-3.11)	(-3.09)	(-2.29)
Landslide		-0.03	-0.08
		(-0.26)	(-0.59)
Trees		-0.13	-0.09
		(-1.41)	(-0.98)
Education Respondent			0.01
			(0.78)
Age Respondent			0.01
			(1.11)
Household size			0.04
			(0.92)
Female head			-0.43**
			(-2.07)
Respondent not head			0.04
			(0.32)
Log(Income)			0.12*
			(1.96)
Total Area			-0.19*
			(-1.77)
Total Plots			0.03
			(0.54)
Coffee, cocoa or fruit trees			-0.00
			(-0.02)
Migrant			-0.16
			(-1.27)
Distance road (km)			-0.06
			(-1.01)
Distance park (km)			-0.05
			(-0.83)
Subcounty and enumerator fixed effects	Yes	Yes	Yes
N	433	433	433
r2_w	0.03	0.03	0.09
F	9.70	3.77	1.65
Prob > F	0.00	0.01	0.08

Table VIII: Ordered probit regression with enumerator and sub-county fixed effects (FE) of exposure to landslide susceptibility on psychological variables, including "landslide susceptibility appraisal", "perceived severity of landslides", "perceived efficacy of trees", "perceived self-efficacy", "trust in information sources" and "reliance on others". Z-statistics are in parentheses.

	(1) Perceived landslide susceptibility	(2) Perceived severity of landslide impact	(3) Perceived efficacy of trees	(4) Self-efficacy	(5) Trust in information sources	(6) Reliance on others
Exposure	0.10*	0.30***	-0.04	0.01	0.13**	-0.01
	(1.81)	(5.05)	(-0.69)	(0.13)	(2.30)	(-0.11)
Landslide	0.99***	0.82***	0.00	-0.08	0.06	-0.35***
	(9.65)	(6.83)	(.)	(-0.86)	(0.67)	(-3.03)
Trees	-0.10	-0.09	0.00	0.05	0.03	-0.12

	(-1.03)	(-0.92)	(.)	(0.38)	(0.22)	(-0.87)
Education Respondent	0.00	-0.01	0.00	0.01	0.01	-0.03
	(0.22)	(-0.46)	(0.16)	(0.63)	(0.75)	(-1.42)
Age Respondent	-0.00	-0.00	0.00	-0.01	-0.01	-0.01*
	(-0.63)	(-0.70)	(0.05)	(-1.49)	(-1.66)	(-1.91)
Household size	0.02	0.02	0.04	0.07	0.08*	0.06
	(0.62)	(0.49)	(1.27)	(1.51)	(1.93)	(1.18)
Female head	0.22	-0.23	0.06	0.29	-0.03	0.08
	(1.18)	(-1.60)	(0.22)	(1.37)	(-0.16)	(0.47)
Respondent not head	-0.02	-0.19**	-0.02	-0.09	-0.02	-0.07
	(-0.19)	(-2.16)	(-0.23)	(-0.75)	(-0.14)	(-0.65)
Log(Income)	-0.01	-0.04	0.06	0.04	-0.01	0.13**
	(-0.12)	(-0.77)	(1.03)	(0.72)	(-0.16)	(2.49)
Total Area	0.05	-0.02	-0.04	0.11	0.01	0.10
	(0.69)	(-0.19)	(-0.45)	(1.11)	(0.20)	(1.16)
Total Plots	-0.20***	-0.03	0.05	-0.08	-0.08	-0.05
	(-3.96)	(-0.61)	(0.99)	(-1.42)	(-1.52)	(-0.90)
Coffee, cocoa or fruit trees	0.09	0.02	0.11	-0.20	0.17	0.29
	(0.47)	(0.14)	(0.65)	(-1.06)	(1.00)	(1.40)
Migrant	0.04	0.14*	0.16	-0.28***	0.01	-0.11
	(0.29)	(1.74)	(1.28)	(-3.00)	(0.04)	(-0.93)
Distance road (km)	0.08	0.08*	0.08	-0.02	-0.09	-0.12**
	(1.35)	(1.74)	(1.41)	(-0.33)	(-1.61)	(-2.22)
Distance park (km)	-0.02	-0.06	-0.02	0.03	-0.07	-0.08*
	(-0.36)	(-1.35)	(-0.43)	(0.58)	(-1.35)	(-1.88)
Subcounty and enumerator fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	433	433	433	433	433	433
r2_w	0.33	0.38	0.03	0.05	0.05	0.10
F	10.87	8.76	1.33	1.89	1.64	3.01
Prob > F	0.00	0.00	0.21	0.04	0.08	0.00

Table IX: Ordered probit regression with enumerator and sub-county fixed effects (FE) of psychological variables from PMT on intention to plant trees. Regression 1 considers each of the variables separately, while regressions 2 and 3 include an interaction term between susceptibility appraisal and a continuous and a discrete version of self-efficacy respectively. Z-statistics are in parentheses.

	(1) Intention to plant trees	(2) Intention to plant trees	(3) Intention to plant trees
Perceived landslide susceptibility	-0.10*	-0.10*	
	(-1.78)	(-1.72)	
Perceived efficacy of trees	0.02	0.02	0.01
	(0.39)	(0.31)	(0.25)
Self-efficacy	-0.01	-0.02	
	(-0.14)	(-0.49)	
Perceived severity of landslide impact	0.03	0.04	0.04
	(0.52)	(0.59)	(0.64)
Trust in information sources	0.01	0.01	0.01
	(0.20)	(0.15)	(0.13)
Reliance on others	0.02	0.02	0.01
	(0.24)	(0.28)	(0.23)
Landslide	-0.06	-0.07	-0.09
	(-0.44)	(-0.53)	(-0.65)
(Self-efficacy) * (Perceived landslide susceptibility)		0.09**	
		(2.37)	
Perceived landslide susceptibility if			-0.19***
			(-2.77)

Self-efficacy >= 0			
Perceived landslide			0.05
susceptibility if			(0.61)
Self-efficacy < 0			
Trees	-0.08	-0.07	-0.07
	(-0.62)	(-0.54)	(-0.53)
Education	0.01	0.01	0.01
Respondent	(0.75)	(0.75)	(0.57)
Age Respondent	0.01	0.01	0.01
	(1.20)	(1.31)	(1.29)
Household size	0.04	0.04	0.04
	(0.88)	(0.87)	(0.84)
Female head	-0.38*	-0.38*	-0.39*
	(-1.89)	(-1.85)	(-1.87)
Respondent not	0.05	0.05	0.03
head	(0.33)	(0.33)	(0.25)
Log(Income)	0.14**	0.14**	0.14**
	(2.09)	(2.12)	(2.15)
Total Area	-0.19*	-0.19*	-0.18*
	(-1.70)	(-1.76)	(-1.73)
Total Plots	0.00	0.00	0.00
	(0.02)	(0.06)	(0.08)
Coffee, cocoa or	0.01	0.01	0.01
fruit trees	(0.04)	(0.03)	(0.03)
Migrant	-0.18	-0.18	-0.18
	(-1.29)	(-1.35)	(-1.39)
Distance	-0.07	-0.08	-0.08
road (km)	(-1.05)	(-1.18)	(-1.22)
Distance	-0.07	-0.08	-0.07
park (km)	(-1.22)	(-1.35)	(-1.25)
Subcounty and enumerator fixed effects	Yes	Yes	Yes
N	433	433	433
r2_w	0.08	0.09	0.10
F	1.88	1.95	2.37
Prob > F	0.03	0.02	0.00

9.2 Appendix B

Results of grouped variables for threat appraisal and coping appraisal.

	WilTree
ThreatApp	-0.48***
	(-2.58)
CopingApp	-0.09
	(-0.34)
Interaction	0.57**
	(2.11)
Trust	0.01
	(0.05)
Reliance	0.12
	(0.78)
EducResp	0.02
	(0.32)
AgeResp	0.02
	(1.58)
RespNotHHH	-0.05
	(-0.11)
AdEq	0.20
	(1.22)
Female	-1.56***

	(-2.83)
IncomeDay	0.00**
	(2.20)
TotArea_New	-0.63**
	(-2.44)
TotPlots	0.02
	(0.10)
CoCoFr	0.13
	(0.24)
AvDistRoadOSM	-0.32
	(-0.98)
DistParc	-0.36
	(-1.53)
N	433
r2_p	0.15
chi2	40.76