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The effect of communication on individual preferences for common property resources: A case study of two Canadian First Nations

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ABSTRACT

Increasingly, Indigenous Peoples are being re-empowered to make decisions about whether to approve development on their lands. But how these decisions are made has received little attention in the literature. Oftentimes, referenda or the solicitation of individual preferences through surveys may be used as input into the acceptability of proposed development. However, the focus on individuals does not necessarily incorporate how community members perceive the collective benefits associated with these land use decisions, nor recognize the collective deliberation procedures employed by many of these cultures. Drawing on the results from a choice experiment with two Canadian First Nations groups, this paper examines whether communication in a group-setting influences individual preferences for three land use alternatives: *Industrial Development*, *Tourism Promotion,* and *Conservation* & *Restoration*. These alternatives had different economic and environmental attributes, expressed at more individual and collective levels. While respondents preferred land use alternatives that generated higher compensation and jobs, they preferred *Conservation & Restoration* activities over *Tourism Promotion* and *Industrial Development* ranked last. Introducing communication in a group context led to a change in individual preferences, where respondents switched their votes from the other two alternatives to *Tourism Promotion*. The results offer important insight into the role of 'collective reflection' in research methods to assess Indigenous Peoples land use preferences, and for the design of nascent processes for Free, Prior and Informed Consent (FPIC).

1. Introduction

Decisions over how to use common property resources too often leads to conflict and tension among affected populations. This is because decision makers typically come to decisions without involving affected peoples in any meaningful way, which fosters suspicion, conflict and litigation. Research shows that focusing on the structure of decision making processes, or *how* decisions are made, is crucial to mitigating conflict, and is typically more of a priority than *what* is decided (Wondolleck 1985). Wondolleck documents that when government decision makers involve stakeholders in structured processes to facilitate communication, parties can together evaluate competing interests and alternatives and make trade-offs, fostering consensus and mutual trust. Participatory processes and the importance of communication between the state and affected stakeholders have been well-documented in land-use literature, and Webster (2016) identifies the importance of meaningful collaboration and communication between the state and Indigenous Peoples for land use planning that meets the needs of Indigenous Peoples. However, we understand little about how these processes function within the context of Indigenous Peoples and their own collective deliberations for common property resources. These collective processes are important to Indigenous Peoples' planning efforts, and can allow groups to evaluate trade-offs and integrate social and cultural imperatives into land-use plans, thereby enhancing the legitimacy of these plans (Lane, 2006). These planning efforts can also strengthen institutional development and self-determination among participating Indigenous Peoples (Prusak et al., 2015).

1.1. Land use and Indigenous Peoples: the importance of consent

Since colonization, Indigenous Peoples across the globe have largely been ignored in land use and resource management decisions, but have been subject to largely negative externalities from resource activity (Giddings et al., 2002; Bodley, 1998). However, the issue of Indigenous Peoples' preferences for development has taken

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on increased importance in recent years for three reasons. First, advancements in international law to protect Indigenous Peoples and their rights has expanded their voice in decisions about natural resource extraction, including the International Labour Organization (ILO) Convention 169 and the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP, 2008). Among many things, the UNDRIP calls for good faith and free, prior and informed consent (FPIC) to be obtained from Indigenous Peoples in resource development in their territories (Nikolakis et al., 2014; Nikolakis and Grafton, 2014). Second, these shifts have also been accompanied by legal decisions in many jurisdictions, policy changes and other actions increasing the amount of jurisdiction and land held by Indigenous Peoples. Third, even where domestic law does not support this requirement, non-state market driven governance mechanisms are legitimating norms and values to support FPIC among firms and NGOs (Nikolakis et al., 2014).

Consequently, Indigenous Peoples are re-securing their collective right to decide on development in their territories. However, this 'right to decide' is still strongly contested by states and resource companies—but, in Canada the trend is towards a consent paradigm, evinced in the recent Supreme Court of Canada decision of *Tsilhqot'in Nation vs. British Columbia*,[1] and reflected in a commitment by the newly elected Federal government to implement the UNDRIP. The movement towards consent means that it is important for the state and firms to understand what Indigenous Peoples want in terms of land use and the kinds of outcomes they prefer.

A key concern in implementing consent and FPIC regimes is around developing procedures that ensure integrity in reaching agreement on land use decisions, and to create decision-making processes that reflect the free will of each individual in the Indigenous collective. Economic development is now recognized as a priority for Indigenous groups to achieve goals of self-governance and self-sufficiency (Anderson et al., 2006; Nikolakis, 2010). However, development can be contested within communities as there are tensions between development goals and the environmental and cultural impacts—thus reaching consensus within Indigenous collectives can be challenging (Wuttunee, 2004; Nikolakis and Nelson, 2015; Nikolakis and Grafton, 2015; Nikolakis et al., 2013). Where development involves natural resource extraction, such as mining or logging, it can create revenues for the community and employment for members, but there can also be important trade-offs with cultural activities, like hunting and fishing and access to culturally significant sites (Venn and Quiggin, 2007; Gregory and Trousdale, 2009). It is this choice between competing alternatives that Wuttunee (2004) describes as a paradox; for as Indigenous groups pursue development to improve their social outcomes there are the inevitable externalities that have social, cultural, spiritual and ecological impacts, which in turn, require further development and income to mitigate these problems. The duality of conservation and development, and the choice between either is not always clear, nor is it binary.

The collective nature of Indigenous lands and resource rights means that identity and collective orientation are important factors in decisions to manage these lands and resources. However, this collective orientation is surprisingly absent in studies investigating Indigenous Peoples preferences for land use. Implicitly, it is assumed that individual preferences in aggregate can be used to rank socially preferred alternatives for collectives (Zander and Straton, 2010) and determine thresholds of acceptability for development (see Spyce et al., 2012). However, these studies offer a potentially incomplete picture, as these alternatives may not explicitly include collective outcomes, or allow individuals the opportunity to collectively assess those alternatives against community aspirations. This study seeks to enhance understanding about how land use decisions and the associated trade-offs are evaluated by Indigenous Peoples in their decision-making processes for collectively held resources. The study pays particular attention to the issue of whether individual preferences for development (which has been the focus of previous assessments) are different when evaluated after communication in a group setting. The study helps answer these questions by applying the findings from a field experiment conducted in British Columbia (BC), Canada. The experiment involved two First Nations groups, where the rights to lands and resources are held collectively, and both of whom are faced with controversial choices in reality between conservation and proposed development in their territories.

Respondents were given a choice experiment where they could choose among different development options: *Conservation & Restoration*; *Industrial Development*; *Tourism Promotion*; or, if respondents do not prefer any of these three options they could vote for 'None', which we refer to as the *Status Quo*. A subset of the respondents had the opportunity to deliberate their choices collectively in a group setting. This group deliberation offers insight into how collective outcomes may mediate individual interests, where individual payoffs and jobs to the First Nation (which the individual may obtain albeit indirectly), are balanced against access to territories and sustaining the environment. This is the first time a choice experiment has been applied in this context of comparing individual preferences of Indigenous Peoples and the effect of face-to-face-communication on these preferences. The findings from this study are of practical and theoretical importance to Indigenous collectives, governments and academia.

1.2. Organization of paper

A background section that describes the context and First Nations is provided next. Then at Section 3 a review of literatures is presented, followed by the method, then the results, and finally the discussions and conclusions.

2. Background on context

The two First Nations involved in the study are Tla-o-qui-aht and Ahousaht, both of whom are located in Clayoquot Sound on the West Coast of Vancouver Island, BC. Clayoquot Sound, is a designated UNESCO Biosphere Reserve that has some of the largest remaining stands of old-growth temperate rainforest in the world (Hayter and Barnes, 2012). During the last half of the 20th Century, Clayoquot Sound was the scene of "one of the most heated and protracted environmental conflicts in Canadian history" (Lertzman and Vredenburg, 2005, p. 239) culminating in a truce of sorts in 1994. The truce resulted in a transfer of logging rights to local First Nations, which are an important economic driver for these communities. However, tourism has expanded in the region to become the economic lifeblood of the local economy; but tourism businesses are typically non-First Nations owned, while tourism values can be impacted by First Nations logging. Recently, several large-scale mines have been proposed for the region, which has some groups concerned about the further effect on social and ecological values. Clayoquot Sound has an important place in the imagination of Canadian society but it is also a working environment for First Nations and the resources sector. The problem for First Nations remains as to how to balance the multiple and oft-competing land use activities with their own values and objectives.

[1] 2014 SCC 44, [2014] 2 SCR 257. In this case, the Supreme Court of Canada determined that the government should obtain the consent of Aboriginal groups where it will infringe on their land claims. There have also been decisions by superior courts across the colonized world that emphasise the importance of obtaining FPIC in development on Indigenous people's lands (Doyle, 2014).

2.1. Description of the First Nations

Ahousaht First Nation and Tla-o-qui-aht First Nation are both autonomous members of the Nuu-Cha-Nuulth Tribal Council and Nuu-Cha-Nuulth language group, residing side-by-side in Clayoquot Sound. Both First Nations are subject to the *Indian Act*, a complex piece of legislation that governs First Nations across Canada and their reserve lands. Reserve lands are inalienable lands that are held collectively by First Nations, many of whom may also reside on these lands. These First Nations also have rights to land and water that the Crown asserts sovereignty over, which may include the need to obtain the First Nations' consent for land use decisions.

While the two First Nations have reserve lands, there has been a migration of community members living off-reserve, a trend evinced across BC where people have sought to find better employment and education opportunities (Wilson and Peters, 2005). Please see Appendix A for demographic statistics for both First Nations.

Evidence shows that both First Nations have been living side-by-side in the Clayoquot Sound region for millennia. The perspective of *Hishuk ish Tsawalk*, 'everything is one and all is interconnected', and *Iisaak*, 'a respect for all living things', are driving principles and values for the Nuu-cha-nuulth worldview (Atleo, 2007). Both First Nations have been able to demonstrate a strong claim for collective Aboriginal rights and title in their territories, which has been contested by the Crown who claims sovereignty to these territories. Both First Nations are actively seeking to regain control over their land base and self-governance. However, in order to regain self-governance, the First Nations must have revenues to support service delivery, as well as sufficient revenues to manage their land base effectively. Both the First Nations own and operate a logging company together. Both have also been subject to the impacts of industrial forestry and mining proposals. Also, both First Nations are largely excluded from the tourism sector, and Tla-o-qui-aht is acutely impacted by tourism (in a terrestrial sense) as the main regional centre of the town of Tofino is located in their territories.

Both First Nations are formally governed by an elected Chief and Council system under the *Indian Act*. The Chief and Council are elected by constituents in a secret individual ballot. The elected Chief and Councillors are empowered to make land use decisions, but plebiscites are also used to make important land use decisions and these decisions are typically discussed collectively in 'community meetings'. Traditionally both First Nations were governed by a hereditary chief system. A hereditary chief is called a *Ha'wiih*. Hereditary chiefs (plural *Ha'wilth*) were responsible for governing their *Hahoulthee* (ancestral territory and natural resources) and the members of their 'House' called *Muschim* (citizens). In effect the *Ha'wiih* were stewards of the *Hahoulthee* and the *Muschim* benefited under this rule and stewardship by accessing the *Hahoulthee* for food, water, fibre, materials and medicines (Masso, 2005). The hereditary chiefs still play a role, both formally and informally, in governance, though this co-existence can sometimes be uneasy. The influence of hereditary chiefs is particularly important on land management decisions. Both elected and hereditary leaders in both communities were interested in seeking their members' opinions about proposed activities in the area.

3. Literatures

3.1. The role of communication in managing common property resources, social dilemmas and public goods

The sustainable and efficient use of common property resources, such as forests, fisheries and irrigation systems, often requires individuals within a group to make decisions and cooperate about the extractive use of the resource. Resource users then face 'social dilemmas' in making decisions, due to perverse incentives invoked by biophysical, social and economic factors (Cardenas and Ostrom, 2004), and where individuals make "independent choices in an interdependent situation" (Ostrom, 1998). Under a rational economic perspective, an individual will make choices that seek to maximise their own short-term self-interest, and when these individual interests run counter to collective interests it can lead to conflict and a *Pareto* inferior outcome. The optimal outcome can only be achieved when the individuals involved in a group cooperate in forming a mutually agreeable decision (Ostrom, 1998).

Economic experiments have been extensively used to understand decision-making heuristics and cooperation in the context of social dilemmas and have consistently found that face-to-face communication is the most powerful factor in determining cooperation among individuals (Ostrom, 1998; Ostrom, 2006). A meta-analysis that involved more than 100 experiments and 5000 subjects found that the opportunities to communicate face-to-face increases the cooperation rate by more than 45 percentage points in a one shot game and 40 percentage points in a repeated game (Sally, 1995). Kerr and Kauffman-Gilliland (1994) also found that intra-group communication promotes cooperation in social dilemmas.

In these models communication solves the "social dilemma" through individuals recognizing it is in their self-interest to cooperate. Any benefits that accrue to the larger group are a by-product of this rational calculation. However, Ostrom and others have also noted that this may be too limiting in how it views human motivation; individuals may have broader range of factors influencing their decisions beyond this simple calculus. Alternatively, respondents may be motivated by altruism or by resolving the public goods problem by reducing the incentives of others to free ride, thereby supporting existing institutional norms and rules (Ostrom, 2010; Shogren and Taylor, 2008). In the broader context of First Nations in Canada, communities are redefining their collective identity as they rebuild their political institutions. This dynamic process of rebuilding institutions and redefining identity means that there is an active discussion and involvement of community members in how community goals are framed. For example, economic objectives such as generating revenue or employment are evaluated against a range of cultural and social objectives, such as how an activity can contribute to long-term self-sufficiency while ensuring cultural integrity (Nikolakis and Nelson, 2015; Nikolakis and Grafton, 2015; Booth and Skelton, 2011). At the same time First Nations' governing institutions are challenged by political instability, low levels of trust and socio-economic disadvantage. While this may affect respondents perceptions of whether or not institutions can effectively deliver on the collective goals, this should not influence respondents individual preferences. Instead, what is being assessed in this study is whether individuals alter their preferences where they have the opportunity to engage in collective deliberation, where it is culturally consistent with traditional decision-making procedures, in which respondents can reflect on norms, values and employ the appropriate heuristics.

Wondolleck and Yaffee (2000) observe that competing resource users will collaborate where the existing institutional environment is fixed and they can communicate in a structured process. Communication allows resources users to share their worldviews, interests and opinions (cognitive models and heuristics), and through this process social and political learnings are produced. Over time these collaborations and learnings, underpinned by facilitated communication, can establish new shared cognitive models and decision making heuristics between these disparate groups (Wondolleck and Yaffee, 2000). Our study differs in that we are examining within-group communication among a population that has a shared identity and collective orientation, but the institutional environ-

ment is not fixed as these First Nations are in the process of rebuilding their decision-making institutions and heuristics which makes the evaluation of these processes novel.

3.2. Choice experiment

In a choice experiment research design, respondents are asked a series of questions in which a unique set of alternatives, or a scenario, is presented each time. Random utility theory suggests that individuals obtain utility from the specific attributes that make up a scenario, rather than deriving satisfaction from the scenario itself (Fishburn, 1988). Attributes in each scenario can include income, employment, land access or ecological outcomes. Inferences can be made from the level of utility gained by individuals from the attributes favoured in each scenario, which can be predictive of a person's behaviour, particularly as it relates to people making trade-offs between competing land and resource management alternatives (Gregory, 2000). The answers from choice questions demonstrate that when individuals repeatedly choose between different alternatives, their preferences are stable enough to construct measures on public preferences for land and resource management outcomes (Louviere et al., 2000). Such measures can then guide policy development and decisions over land and resource management.

The use of choice experiments to understand Indigenous Peoples preferences between development and conservation has received limited attention with less than a handful of studies (Spyce et al., 2012; Zander et al., 2010). These studies have typically involved both Indigenous and non-Indigenous groups, and the comparisons focus on different preferences between these groups for different land management outcomes (Spyce et al., 2012; Zander et al., 2010; Zander and Straton, 2010; Zander and Garnett, 2011). The results from these studies show a general preference for conservation among Indigenous and non-Indigenous peoples alike, suggesting shared socio-cultural norms and values for conservation.

Spyce et al. (2012) in their choice experiments in Yukon Territory, Canada, found there was little heterogeneity between the preferences for development and conservation among Aboriginal (n = 67) and non-Aboriginal peoples (n = 129), and that, in aggregate, a strong conservation scenario was ranked highest by both groups. However, there was significant variation in the level of support for conservation coupled with a higher preference for a strong development scenario, suggesting there were no social thresholds placed on development. But, all respondents placed a slightly negative discount rate on development, suggesting they favoured sustainability and intergenerational equity, which has been identified as a signature value of Indigenous Peoples in previous research (Gregory and Trousdale, 2009).

In Australia, a series of choice surveys, involving both a mixture of face-to-face and mail out approaches, were conducted of individual Indigenous and non-Indigenous Australians with a focus on the management of tropical rivers in northern Australia (Zander et al., 2010; Zander and Straton, 2010). In terms of managing north Australia's rivers, a conservation focused approach was preferred by most respondents: Indigenous respondents were indifferent to water extraction for irrigated agriculture while non-Indigenous Australians preferred moderate development to low or high development scenarios (Zander and Straton, 2010). Zander and Garnett (2011) sought to understand the public's willingness to directly pay for Indigenous Peoples to engage in NRM and found that most respondents were willing to pay, primarily to enhance biodiversity, reduce carbon emissions and to manage feral animals, but that the social benefits accruing to Indigenous Peoples' was not a significant motivator for respondents (Zander and Garnett, 2011).

Rolfe and Windle (2003) using a choice experiment sought to estimate the non-use values of Indigenous cultural heritage protection in the Fitzroy Basin in central Queensland sampling three groups: Indigenous Peoples in the Rockhampton region; and general populations from Rockhampton and Brisbane (the state's capital). What was found, perhaps unsurprisingly, is that Indigenous Peoples valued the protection of cultural heritage values more than the general population groups who were focused on environmental values.

4. Materials and methods

4.1. The experimental design

A choice experiment was designed to understand First Nations members' preferences for land use alternatives in Clayoquot Sound. Leadership in both First Nations were interested to understand what land use options and attributes their membership preferred, as well as the perceived risks on the landscape, hence there was a mutual benefit to both parties, essential to research collaborations with Indigenous Peoples (Smith, 1999). In each choice question respondents could choose between *Industrial Development*, for which there was a substantial negative impact on local ecosystems; *Tourism Promotion*, with a small negative impact on local ecosystems; and *Conservation & Restoration*, with a substantial positive impact on local ecosystems. Each alternative had different levels of economic activity and restrictions on access to the land base. If the respondent did not agree with any of the proposed alternatives or was unsure they could chose 'None,' which means they preferred the *Status Quo*. These alternatives reflect the different land-use alternatives open to both First Nations in this context, where forestry and mining development has been proposed in their respective territories, as have conservation-based projects, as well as opportunities to participate in the tourism-based regional economy.

The attributes used in this experiment were: *Jobs* to the Nation's members; *Compensation* (a yearly payment to the Nation); *Contract* duration; and land use *Restriction*. Table 1 lists and defines the attributes and their levels, as well as the sources of priors in literature. Alternative specific attribute levels were chosen to reflect the difference in the nature of each attribute across alternatives. *Industrial Development* was characterized by a relatively higher range of compensation and full-time jobs as opposed to a *Conservation and Restoration* program, that involves relatively lower compensation and seasonal jobs. *Conservation and Restoration* involved a relatively longer contract duration compared to *Industrial Development* and *Tourism Promotion,* reflecting the nature of such projects (like carbon abatement programs). *Tourism Promotion* was moderate with respect to both compensation and jobs (part-time). Compensation would not be directly received by the community members but would go to the collective, however, the individuals would obtain the indirect benefits such as improved education, health services and infrastructure. *Jobs*, *Compensation* and *Contract* had alternative specific levels. Land use *Restriction* was a generic attribute.

The researchers pre-tested the land use options, scenarios, attributes and attribute levels to ensure these were realistic, with a select group of community liaison staff at the two First Nations, First Nations cohorts at the University of British Columbia (all of which have worked in land use and natural resource management roles in this context), and a select group of experts in the region (from NGOs and industry).

A provision rule is important to a choice experiment as it provides incentives for truthful preference revelation by explicitly mapping responses to actual policy outcomes (Collins and Vossler, 2009). We used a straightforward plurality vote implementation

Table 1
Attributes and their levels.

Attributes	Definition	Tourism Promotion	Industrial Development	Conservation and Restoration	Source of prior
Jobs	Jobs made available to members of the First Nation	5, 8, 10, 15	5, 8, 10, 15	2, 5, 8, 10	Spyce et al. (2012)
Compensation	Compensation paid to the First Nation per year (C$)	10,000; 20,000; 30,000; 40000; 50,000	30,000; 40,000; 50,000; 80,000; 100,000	10,000; 20,000; 30,000; 40000; 50,000	Horne (2006)
Contract	The number of years the arrangement will be in place	10, 20, 30, 40,50	10, 20, 30, 40,50	20, 30, 50, 80,100	Horne (2006)
Restriction	The number of months per year the area cannot be accessed by members of the First Nation	High, Medium, Low	High, Medium, Low	High, Medium, Low	Horne (2006)

rule that indicated that the option that receives the highest votes will be implemented for the whole group (Collins and Vossler, 2009). Plurality voting is the most commonly used provision rule in stated choice experiment survey. This rule was also easy to explain to our respondents as it is commonly used to make decisions within the First Nations. Another important reason for using the plurality rule is that under this provision rule the incentive compatibility property of a three-option choice experiment does not differ from a two-option or dichotomous choice referendum type elicitation method (Collins and Vossler, 2009).[2]

Following the guidelines outlined in Hensher et al. (2005) and Bliemer et al. (2008), an alternative specific (or labelled) 'Db-optimal efficient design' was constructed in Ngene software. The generation of an efficient experimental design requires *a priori* knowledge of the parameter values. Information about these 'priors' were collected from the existing literature (Table 1) then validated with experts. Inaccurate prior values may cause an efficiency loss by increasing the value of the D-error. However, a Bayesian efficient design (also known as a Db-optimal design) allows the researcher to incorporate information from an *a priori* distribution of parameters and hence is less sensitive to prior values and model misspecification (Bliemer et al., 2008).

The experimental design had 18 choice combinations randomly divided into three blocks. Each respondent was asked six choice questions. Fig. 1 presents an example of a choice question. The order of appearance of the choice questions, the position of the attributes and the alternatives were randomized across respondents to control for potential order bias. A scenario description was presented before introducing these questions. The description contained a qualitative explanation of each land use alternatives and their corresponding payoffs to the First Nation (Appendix C).

4.2. Quasi experiment

The quasi experiment involved using a treatment and control setting to allow 'pre-post' and 'with-without' communication comparisons across three respondent groups[3] (see Table 2). Respondents were first asked to complete six unique choice tasks (Round I). Then they were given 20 minutes to reflect on their choices. After 20 minutes the treatment groups were able to discuss their choices with their fellow group members, while the control group respondents were not allowed to communicate with others. Both treatment and control groups were then asked to complete the entire sequence of the six choice questions again (Round II). This resulted in 12 choice sets per respondents.

Table 2
Quasi experimental setting.

First Nations	Treatment (with communication)	Control (without communication)
Tla-o-qui-aht	Round I 20 min interval Round II	Round I Round II
Ahousaht (On reserve)	Round I 20 min interval Round II	Round I Round II
Ahousaht (Off reserve)	Round I 20 min interval Round II	Round I Round II

A structured questionnaire survey was administered in Rounds I and II. The questionnaire used during Round I contained 30 questions and was divided into three sections. The first two sections comprised socio-demographic and attitudinal questions such as respondents' age, sex, education, income and their perceptions of ecological risks and the relative importance they attach to different land use outcomes. The third section included the choice questions. Round II of the questionnaire contained 14 questions, including the repeated choice questions, followed by 8 questions on social cohesion, including trust and confidence in their community and First Nations Council.

Two in-depth key informant interviews were administered with elected leadership. The questions asked for information on important characteristics for their First Nation such as: the electoral system; the level of difficulty in leaders fulfilling their responsibilities; the nature of disputes and who resolved them; key norms; sanctions for breaking norms; levels of trust and cooperation; and economic data such as unemployment and the number of members living below the poverty line.

4.3. Utility framework

The underlying structural model encompassing the discrete choice behaviour is called the 'random utility maximization model'. Due to unobservable effects, (indirect) utility is partitioned in to an observable (V) and an unobservable part (ε) for each alternative ($k = 1, 2, 3, 4$). Thus:

$$U_{ik} = V_{ik} + \varepsilon_{ik} \quad (1)$$

In this study, the observed component of the indirect utility function of an individual i takes the following forms:

$$V_{ik} = ASC_{ik} + \beta_{ik}\text{Pay-off}_{ik} + \alpha_{ik}\text{Treatment} \quad (2)$$

In Eq. (2), *ASC* stands for alternative specific constant. Since an alternative specific (or a labelled) experiment was used, the indirect utility function contains three constants including one constant for each land use alternative (Hensher et al., 2005). The *ASC* variable absorbs and isolates the (non-zero) mean utility associ-

[2] A binary discrete choice elicitation format with a plurality vote implementation rule is incentive compatible (Carson and Groves, 2007).

[3] There were three discrete groups involved in experiments. One on-reserve Tla-o-qui-aht group. The second was an Ahousaht on-reserve group. The third was an Ahousaht off-reserve group.

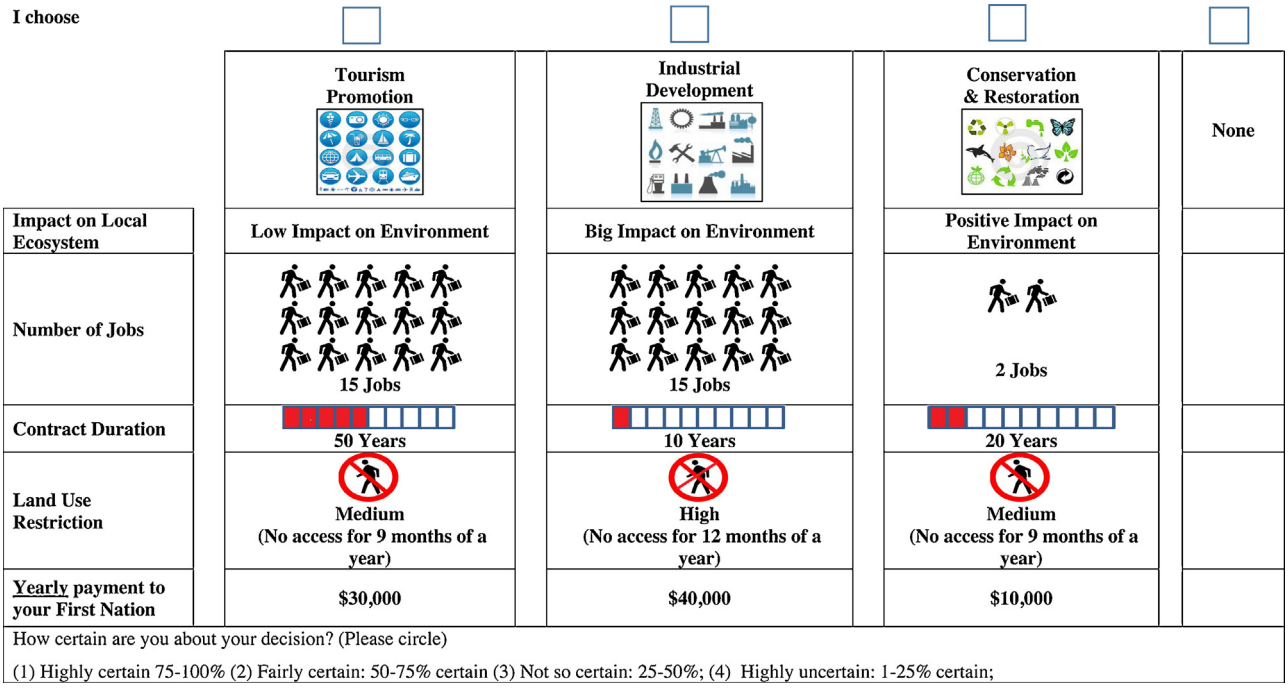


Fig. 1. Example of a choice question.

ated with unobserved attributes of the land use alternatives that are not explicitly included in the choice experiment such as the implicit environmental impacts associated with tourism versus industry. Our experiment involves three non-monetary payoffs (jobs, restriction and contract duration) and one monetary pay-off (compensation). Separate utility parameters are assigned for jobs and compensation to account for their alternative specific nature. Jobs in *Conservation & Restoration* are part-time and seasonal, while *Tourism* related jobs are full-time and seasonal. *Industrial Development* jobs are full-time and available all year round. The amount of compensation offered to the community for *Industrial Development* projects are relatively higher than the *Tourism* and *Conservation & Restoration* projects. *Contract* duration and land use *restriction* are treated as generic attributes. α estimates the treatment effect in the model that measures the mean difference in utility between the treatment and control groups across the land use alternatives. A naïve approach to estimate α would be to simply combine the treatment and control samples and employ a standard random parameter logit model technique. However, the noise or scale parameters, or the inverse of the standard deviation of the error tem ε_{ik}, from the treatment and control data are likely to be different due to the different setting used for the data collection process (Swait and Louviere, 1993). For example, one can argue that the treatment data contains more (or less) noise as it allowed respondents to communicate and vice versa. The difference in the scale parameter will cause the estimated model coefficients to differ across the treatment and control datasets leading to biased conclusions about the influence of communication on land use preferences. Hence, controlling for scale heterogeneity across the two datasets is critical.

A generalized mixed logit (GML) model,[4] proposed in Fiebig et al. (2010), is used for data analysis as this model allows to control for both preference and scale heterogeneity across individuals as well as across different datasets. In a GML model (Greene and Hensher, 2010):

$$\beta_i = \sigma_i[\beta + \theta z_i] + [\gamma + \sigma_i(1-\gamma)]\,\Gamma v_i \quad (3)$$

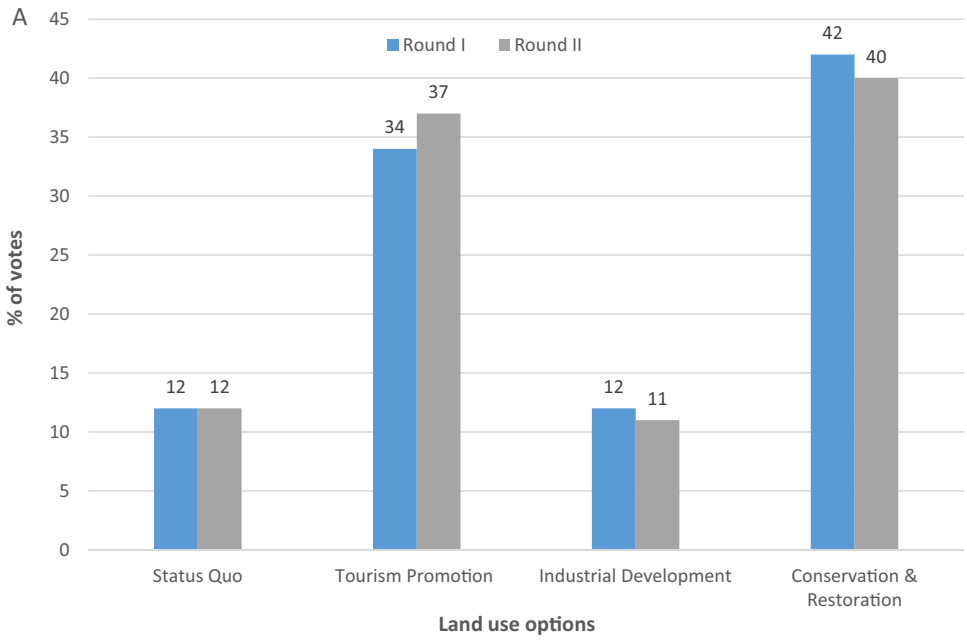
In Eq. (3), σ_i is the individual specific standard deviation of the idiosyncratic error term such that $\sigma_i = \exp(-\tau^2/2 + \tau w_i)$, where τ is the coefficient on the unobserved scale heterogeneity and w_i is the unobserved heterogeneity [$w_i \sim N(0,1)$]. z is a set individual specific characteristics that influence the mean of the preference parameters, θ is a vector of parameters, ν is the error term with zero mean and known variance, Γ is the lower triangular Cholesky matrix. γ is a weighting parameter varying between 0 and 1. γ determines the relative importance of the overall scaling of the utility function versus the scaling of the individual preference weights contained in the diagonal elements of Γ (Greene and Hensher, 2010).

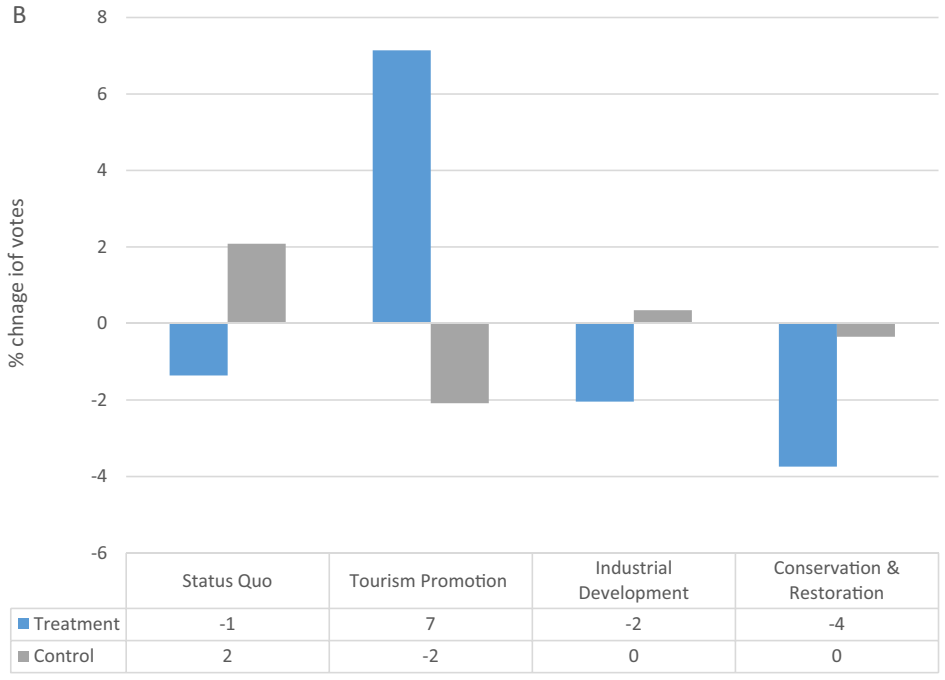
In Eq. (3), $\tau = 0$ implies $\beta_i = \beta + \Gamma \mathbf{w}_i$ which is the random parameters logit model specification which accounts for only preference heterogeneity. Since the scale heterogeneity in our sample is dataset specific, a dataset-specific covariate of mean scale is needed to control for the possible noise led by the presence (or absence) of communication. Following Hensher et al. (2012), we model τ by using a dummy variable such that: $\tau = \tau + \eta$ *Treatment* where η is a dataset specific scale parameter and *Treatment* = 1 for the treatment sample and zero otherwise.

4.4. Sampling

Respondents were randomly selected by a liaison officer in the First Nation from a members list and personally invited to attend the survey on the day scheduled. Transportation was arranged to mitigate respondent inconvenience. Where the individual could not attend, another individual was selected and invited to attend. In total 104 surveys were completed and of these 97 were usable. Of the 97 surveys completed, 25 were from Tla-o-qui-aht (representing 12.5% of the total voting age population for Tla-o-qui-aht), and 75 were from Ahousaht, of which 32 were surveyed on-reserve in Ahousaht (8% of the total voting age population on-reserve), and 43 from off- reserve in Port Alberni and Victoria (5% of the total

[4] An important property of this model is that it avoids the IID assumption (*i.e.* the error tem is independently and identically distributed) and thus allow attributes to be correlated across alternatives.





	Status Quo	Tourism Promotion	Industrial Development	Conservation & Restoration
Treatment	-1	7	-2	-4
Control	2	-2	0	0

Fig. 2. (a) Votes for land use alternatives in Rounds I and II. (b) Changes in votes for land use alternatives from Rounds I to II between Treatment and Control groups.

voting age population off-reserve). A comparison of respondents' socio-demographic characteristics in each community is available in Appendix D.

5. Group cohesion, trust and norms

From the two in-depth key informant interviews it is observed that the two First Nations varied with respect to group cohesion. In response to the question, 'how often do wealthier households help poorer households?' one key informant answered 7 out of 10 (10 being "All the time"), while the other informant ranked it lower, at 3 of 10 (1 being "Not at all"). However, of the direct responses from respondents show no differences between the two First Nations, where trust was equally quite low. In the survey questionnaires slightly over a quintile (22%) of the sampled respondents agreed (or strongly agreed) with the statement "Trust is strong in my First Nations" but over half (52%) of the sampled respondents disagreed with the statement, while the rest (26%) neither agreed nor disagreed. A similar trend was observed with the statement "I have full confidence in my First Nations council's ability to make the right decision for its people", for which 37% disagreed, 40% neither agreed nor disagreed and 23% agreed. As expected, the level of trust among the community members and community leadership were highly positively correlated ($r = 0.50$, $p < 0.001$) implying a higher trust among the community members is likely to be associated with a higher trust on community leadership.

Group cohesion was closely and positively linked with trust. Respondents who strongly agreed with the group cohesion state-

ment, "I could rely on my community and council members in case of crisis and emergency", were also more likely to agree with the statements "Trust is strong in my First Nations" (r = 0.40, $p < 0.001$) and "I have full confidence in my First Nations council's ability to make the right decision for its people" (r = 0.57, $p < 0.001$).

For both Tla-o-qui-aht and Ahousaht, respect for culture and environment were two of the key norms by which the communities are governed. Conformity to these norms was reflected through respondents placing a higher value on cultural and environmental preservation as a land management outcome. Almost three quarters (72%) of the respondents placed the highest value on culture, followed by 60% of the respondents who prioritized environment the most, while a quarter of the respondents believed culture and environment are inseparable.

Conformity to norms and perceived ecological risks were found to be significantly and positively correlated. Particularly, those respondents who placed a higher value on the environment, were more likely to believe that the ecological assets such as forests (r = 0.37, $p < 0.001$), fisheries (r = 0.24, $p < 0.001$) and wildlife (r = 0.32, $p < 0.001$) are at a high risk of extinction and were also more likely to perceive a high threat to Indigenous cultural integrity (r = 0.26, $p < 0.001$).

6. Results

6.1. Votes for land use alternatives

Fig. 2a summarizes the proportion of votes received by each of the land use alternatives in the overall sample across Rounds I and II. In general, *Conservation & Restoration* was the most preferred land use option (42% of votes), followed by *Tourism Promotion* (34% of votes) in Round I. Both *Industrial Development* and *Status Quo* were among the least preferred alternatives, receiving 12% of votes each. The distribution of the preferred alternatives in Round II changes as support from *Conservation & Restoration* and *Industrial Development* declined and support for *Tourism Promotion* increased. Fig. 2b shows the percentage change in votes among different alternatives across the treatment and control groups between Rounds I and II. No substantial shift in voting occurred for the control group in Round II. The proportion of the total votes received by *Conservation & Restoration* and *Industrial Development* remained unchanged while *Tourism Promotion* received 2% less votes and the *Status Quo* received 2% more votes in the control group. For the treatment group, the changes in voting intention between Rounds I and II are substantial. In Round II, votes declined from *Status Quo*, *Industrial Development* and *Conservation & Restoration* by 7%, and increased for *Tourism Promotion* by 7%.

Significant preference heterogeneity was observed across the First Nations (Fig. 3). On average, in both Rounds I and II, respondents from Ahousaht were significantly more likely to vote for the *Status Quo* and *Industrial Development* and less likely to vote for *Conservation & Restoration* (Chi Square = 41, $p < 0.001$). Further, respondents who lived off-reserve significantly favoured maintaining the *Status Quo* as opposed to undertaking any development activity (Chi Square = 27, $p < 0.001$). No significant difference in land use preference was observed between the on- and off-reserve respondents in terms of the non-*Status Quo* options.

6.2. Choice experiment results

Table 3 presents the GML regression results obtained from the combined observations of the treatment and control samples.[5] The GML model was estimated in NLOGIT version 5.0, accounting for the panel data structure of the choice questions. The model is significant with a pseudo R^2 value of 40%. The estimated coefficient of the scale variance (τ) is significantly different from zero implying the presence of significant scale heterogeneity in the sample. The significant negative coefficient of η indicates that the preference of the treatment sample is associated with lower scale variance than the control sample. This means that the respondents' choices in the treatment sample is less random. Given that sampling was random, this difference in scale can be attributed to communication.

The results presented in Table 3 shows the respondents preferred land use alternatives that were associated with higher

Table 3
Generalized mixed logit regression results.

	Coefficient (SE)	SD (SE)
Random parameters		
ASC (Tourism Promotion)[a]	2.00*** (0.52)	0.41 (0.33)
ASC (Industrial Development)[a]	−6.98*** (1.83)	3.12*** (1.57)
ASC (Conservation & Restoration)[a]	0.55 (0.41)	4.21*** (0.61)
Restriction (high = 3, medium = 2, low = 1, none = 0)	−1.43*** (0.30)	1.92*** (0.28)
Constant parameters		
Jobs (Tourism Promotion)	0.05*** (0.015)	
Jobs (Industrial Development)	0.19*** (0.03)	
Jobs (Conservation & Restoration)	0.15*** (0.02)	
Length of contract (in years)	0.01*** (0.002)	
Compensation (Tourism Promotion and Conservation & Restoration)	0.018*** (0.003)	
Compensation (Industrial Development)	0.01* (0.005)	
Treatment effect		
[b]Round II*ASC (Tourism Promotion)	0.27 (0.32)	
[b]Round II*ASC (Industrial Development)	0.60 (0.60)	
[b]Round II*ASC (Conservation & Restoration)	0.33 (0.30)	
[c]Round II*Treatment*ASC (Tourism Promotion)	0.91** (0.41)	
[c]Round II*Treatment*ASC (Industrial Development)	−0.22 (0.71)	
[c]Round II*Treatment*ASC (Conservation & Restoration)	0.42 (0.46)	
Structural parameters		
τ	1.60*** (0.17)	
η	−0.48*** (0.13)	
γ	0.67D-06 0.06	
σ	1.00 (2.10)	
Model statistics		
Number of groups	97	
Number of replications	100	
Log likelihood	−971	
LR Chi^2	1285 (df = 23, $p < 0.001$)	
McFadden Pseudo R^2	0.40	
AIC	1988	
AIC/N	1.71	

Notes:
* p < 0.10.
** p < 0.05.
*** p < 0.01.
[a] Base category = Status quo.
[b] Base category = Round I.
[c] Base category = Round II*Control.

[5] Before proceeding to the GML model, a Swait-Louviere test for equality between attribute parameters was performed comparing the pooled model with two separately estimated models (Swait and Louviere, 1993). The value of the chi-squared test statistic was 27 (degrees of freedom = 12) which means that the null hypothesis of equal attribute parameters were rejected at the one percent level of statistical significance. This means that the attribute parameters in the treatment and control data sets are significantly different but given that the scale and attribute parameters are confounded, it is not possible to disentangle whether the differences in either the beta parameters alone or the beta and scale parameters (Louviere et al., 2000).

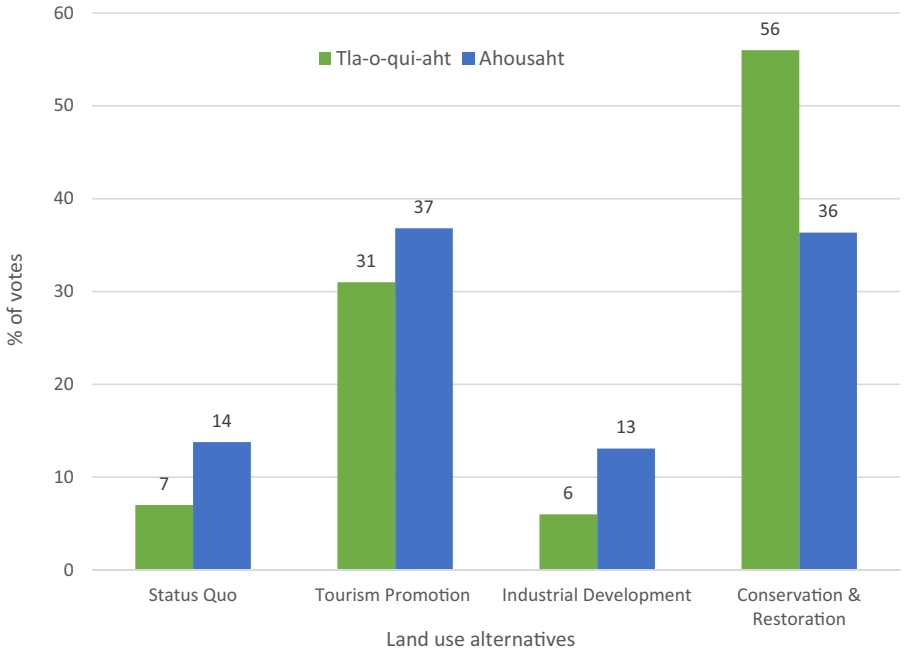


Fig. 3. Votes for land use alternatives across First Nations communities.

Table 4
Mean implicit prices of the land use attributes (C$/year).

Attribute	Units	Mean implicit prices (95% confidence interval)
Jobs (Tourism Promotion)	C$ per job	2753 (576–4929)
Jobs (Industrial Development)	C$ per job	19,749 (−5500 to 44,999)
Jobs (Conservation & Restoration)	C$ per job	8415 (4631–12,200)
Contract (Industrial Development)	C$ one extra year of contract	1129 (−78 to 2335)
Contract (Conservation & Restoration and Tourism Promotion)	C$ one extra year of contract	600 (218–983)
Restriction (Industrial Development)	C$ per level (none-low-medium-high)	−38,067 (−56,183 to −19,952)
Restriction (Conservation & Restoration and Tourism Promotion)	C$ per level (none-low-medium-high)	−80,533 (−124,096 to −36,970)

compensation, lower restriction, longer contracts and higher jobs. This finding suggests trade-offs are most acute between livelihood outcomes and access for traditional purposes.

$\beta_{ASC(Conservation)}$, $\beta_{ASC(Tourism)}$ and $\beta_{ASC(Industry)}$ estimate utility obtained from the specific nature of the land use options independent of the attributes. This may reflect respondents' preferences for the environmental impacts associated with these alternatives and other unobservable factors that are not captured by the choice experiment attributes. These coefficients were treated random using a normal distribution. The mean utility associated with *Tourism Promotion* [$\beta_{ASC(Tourism)}$] is positive and *Industrial Development* [$\beta_{ASC(Industry)}$] is negative. Both coefficients are significantly different than zero. The mean utility gain from *Conservation and Restoration* [$\beta_{ASC(Conservation)}$] is positive but not significantly different than zero implying that the sampled respondents' utility gain (loss) from *Conservation and Restoration* independent of its monetary and non-monetary pay-offs, are not significantly different than the utility of the *Status Quo*. Respondents viewed *Tourism Promotion* as an improvement over the *Status Quo*.

The estimated standard error of $\beta_{ASC(Conservation)}$ and $\beta_{ASC(Industry)}$ are significant at the one percent level reflecting significant preference heterogeneity among respondents regarding the two land use options, *Conservation and Restoration*, and *Industrial Development*. Interestingly, the estimated standard error of $\beta_{ASC(Tourism)}$ is not significant at the ten percent level implying the absence of preference heterogeneity regarding *Tourism Development*.

Six variables were included in the regression model to test for (1) 'before-after' and (2) 'with-without' effects. The first three variables test the before-after effect between Rounds I and II. None of the coefficients of the three interaction effects were significantly different than zero implying no significant difference in respondents' voting intentions between Rounds I and II. The remaining three variables measure the effect of communication (*i.e.* treatment effect) in Round II. The coefficients of *Round II*Treatment*Tourism* is positive and significant at the five percent level. This means the respondents in the treatment groups were significantly more likely to choose *Tourism* in Round II compared to those who were in the control groups. The mean coefficients of *Round II*Treatment*Industry* is negative and *Round II*Treatment*Conservation* is positive but none of the mean coefficients are statistically significant at the ten percent level.

6.3. Implicit prices and compensating surplus

Implicit prices, also known as part-worth or marginal willingness to pay/accept, were estimated using the parameter estimates obtained from a main-effect model (Appendix E). The following formula was used:

$$\text{Implicit Price} = -1 * \left(\frac{\beta_j}{\beta_{monetary}} \right) \quad (4)$$

where β_j is the coefficient of the non-monetary attribute obtained from the utility model and $\beta_{monetary}$ is the estimated coefficient of the monetary attribute. The estimated implicit prices of *Jobs*,

Table 5
Mean compensating surplus (CS) derived from the land use alternatives (C$/year).

Land use alternatives	Mean Compensating Surplus (95% confidence interval)
Tourism Development	58,133 (12,471–103,795)
Industrial Development	−797,146 (−1,818,164 to 223,870)
Conservation & Restoration	−722 (−1213 to −231)

Notes: CS calculated for the following attribute values: Jobs = 3; Contract = 30 years; Restriction = Low.

Contract and *Restriction* and their 95% confidence intervals were estimated using the Wald procedure (Delta Method) are presented in Table 4.

Compensating surplus (CS) is the amount of income paid or received that leaves households at the initial level of well-being. CS can be obtained by using the following equation for different land use options:

$$CS = (-1) * \frac{V_0 - V_1}{\beta_{monetary}} \quad (5)$$

where V_0 and V_1 represent the conditional indirect utility associated with the *Status Quo* and the changed situation respectively. Since the *Status Quo* alternative in our experiment was defined as *None*, this means $V_0 = 0$. Compensating surplus thus only represents the conditional indirect utility (V_1) obtained from each land use option. In order to estimate and compare CS of the presented land use options, the following hypothetical values were assigned to the attributes of all alternatives: *Jobs* = 3; *Contract* = 30 years; *Restriction* = Low. Note that these numbers are used strictly for illustration purpose. The implicit prices can be used to compute CS under a large number of different scenarios where the attribute levels of the land use options may or may not coincide. Table 5 presents the CS estimates and their 95% confidence intervals. The CS values estimated for *Conservation & Restoration* is negative and *Tourism Promotion* is positive. They are statistically significant at the five percent level. The CS estimated for *Industrial Development* is negative but not statistically significant at the five percent level. These imply a significant welfare gain can be achieved from *Tourism Promotion*, while *Industrial Development* and *Conservation & Restoration* are likely to cause welfare loss on the First Nations.

6.4. Research limitations

Generalizing the findings from this study is limited beyond this unique context because of the sample size and restrictions form working with only two First Nations. There are also two sources of bias that should be acknowledged when interpreting the results although the researchers actively sought to mitigate these in the research design. The first is social desirability bias in a group setting, where individuals alter their answers to appease others in the group as well as the researchers. By providing anonymity to respondents when answering the survey in both the with-communication and without-communication groups, we mitigated social desirability bias. The second is hypothetical bias, or the degree to which the hypothetical nature of the choice experiment influenced respondent's answers. We sought to mitigate this bias by producing scenarios, attributes and attribute levels in collaboration with community liaison staff and experts that reflected those in reality. We also asked respondents how certain they were with their decision in each choice question to offer insight into the level of certainty in the response (see Fig. 1).

7. Discussion and conclusions

The first study objective was to understand respondents' land use preferences and what attributes are of importance. While respondents ranked *Conservation & Restoration* highest, followed by *Tourism Promotion* and then *Industrial Development* and *Status Quo* the results also show land use preferences are not polarized around either development or conservation, but that individually respondents prefer land use alternatives that generate higher economic outcomes, similar to that found by Spyce et al. (2012) in Yukon among both Aboriginal and non-Aboriginal peoples. The socio-economic disadvantage in First Nations communities, particularly for those living on-reserve, likely underpins this desire for improved livelihood outcomes. Conversely, we found those respondents who live off-reserve, where there are more employment and education opportunities, significantly favoured maintaining the *Status Quo* rather than pursuing development opportunities.

The second study objective was to determine whether or not group communication affected an individual's preferences, or voting intentions, for a land use alternative. Consistent with the theoretical expectation and empirical evidence from literature, our findings demonstrate that individuals will change their preferences where there is communication in a group context. Respondents' with-communication were more likely to switch their vote to *Tourism Promotion*, and their choices were less random than the control group. Previous empirical work offers that communication enables cooperation among disparate groups and individuals in collaborative decision making processes, typically between the state and stakeholders. This is because these groups can share their opinions and worldviews, evaluate the alternatives, and decide among trade-offs in a transparent way, which generates social and political learnings and builds trust between parties (Wondolleck, 1985). We hypothesise that group communication helps mediate between the interests of individuals and the collective when Indigenous Peoples make collective land-use decisions, thus helping to resolve a collective action dilemma by identifying the appropriateness of collective outcomes to individual members when weighing their own preferences. Group communication offers a mechanism to inform individual members of the collective of the land-use trade-offs and alternatives, and may foster a convergence or social-equilibrium on land-use decisions. Group communication also provides an opportunity to re-affirm collective values, espoused in teachings such as 'Hishuk ish Tsawalk' which means 'everything is connected'. Incorporating the values of how 'Tsawalk' is expressed helps the collective define both itself while also offering a means of social control, a way to guide land use decisions, encourage sustainable use of collective resources, and offers constituents a basis for evaluating collective decisions. Land use decisions that run counter to these values may lack social legitimacy and can erode institutional legitimacy.

In group communication settings individuals are able to identify the important collective outcomes of decisions, which helps articulate and reinforce collectively held values to achieve collective goals and overcome any potential free-rider effects. Although the survey results reveal low trust levels among respondents and priority placed upon cultural and environmental attributes, the effects of group communication reveals a recognition that there is an important collective aspect to economic involvement that also brings collective benefits beyond just individual benefits. In this study *Tourism Promotion* represented more intermediate socio-economic outcomes with moderate ecological and associated cultural impacts than the two other alternatives, offering more collective benefits. This preference may also capture nascent efforts of these First Nations to rebuild their governance and economic systems. Ostrom (2006) observes that reaching consensus and sustaining cooperation through communication is dependent on the level to which group members are homogenous and self-identify with the group, and part of the effect of communication may be to re-inforce self-identification, that here-to-for has been weak or absent.

An important insight for practice is that individual land use preferences obtained through individual-level surveys cannot simply be aggregated to determine collective land use preferences in the Indigenous context. Rather, these individual preferences may be subject to change through communication and collective deliberation, and any research design should account for this by producing collective decision making processes (where these are relevant) to better understand land use preferences. These collective decision making processes will not be homogenous for all Indigenous Peoples, as they will be unique and reflect local institutions, norms and values. Thus, an important objective of further research should be to assess the kinds of collective deliberation processes Indigenous Peoples may use (and prefer), the degree to which these reinforce local values and norms, and how group deliberation supports information access for individuals. This last point is particularly important as processes for FPIC are implemented. To maintain the integrity of consent processes it will be important to ensure that individuals are not intimidated or coerced in forming their decisions, and give their consent freely. How coercion and intimidation are mitigated through local institutions and customary laws is worthy of further research, in particular how these institutions interact with western institutions. Another area for future inquiry is whether collective decision making processes must occur in ways that are considered 'traditional' to foster cooperation, or what Cornell and Kalt (2000) describes as a 'cultural match', or can new forms of structure and institutions (or more 'Western' forms) achieve similar results of cooperation.

Authors contribution

William Nikolakis co-ordinated the research project and wrote Sections 1–3, 7 and parts of Sections 4 and 6. Sonia Akter designed the choice experiment, analysed the data and prepared Sections 4 and 5 and wrote most of Section 6. Harry Nelson contributed to Sections 1–3, 6 and 7.

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Appendix A. Ahousaht and Tla-o-qui-aht Demographic Data

In Tla-o-qui-aht's main village of Opitsaht there were 155 residents in the most recent census, including 90 males and 65 females. Of these 155, some 95 were over 19 years of age and 36.4% were employed. Statistics Canada was unable to provide income data for Opitsaht (Statistics Canada, 2013b). All of those working in Opitsaht were employed full time, shared equally between agriculture, forestry and fishing, retail trades, accommodation and food services, and public administration (Statistics Canada, 2013b). There are another 175 members of Tla-o-qui-aht that live off-reserve, making for a total of 330 members (Statistics Canada, 2013b).

In Ahousaht's main village of Marktosis there were 725 residents, 370 males and 355 females, and the vast majority having lived there for three generations or more. Of these 725,396 were over 19 years of age, and 49.5% were employed and the average income was $20,583. This income level places an estimated 605 of the 725 residents in Marktosis, in the bottom half of the Canadian distribution of adjusted after-tax family income (Statistics Canada, 2013a). Government services were the biggest employer (85 people) followed by education services (45 people), health services (35) then agriculture forestry and fishing (25 people) (Statistics Canada, 2013a). Most of the employment is part time, with only 105, of the 230 people employed in 2010 working full time. Additionally, 927 Ahousaht live off-reserve of a voting age scattered across BC and the US (pers. comm, 2014), for which data is difficult to aggregate.

Appendix B. Administration of Surveys

The experiment was applied in the two First Nations in one-day sessions during 2013 (August on-reserve in Ahousaht and Tla-o-qui-aht in September) and 2014 (January and March for off-reserve Ahousaht groups from Port Alberni/Victoria). Three control group and three treatment groups were conducted for a total of six survey sessions. Each session lasted one and a half hours on average.

At the beginning of each session the respondents were told by a researcher that they would be given six-choice questions that would ask for their land use preferences in the form of a vote, and the land use option that received the highest votes would be implemented for the whole group. The respondents were given instructions on each of the attributes and what these meant. The respondents were told that the researchers were available to assist with any questions from the respondents.

The first control group session was held at the Band Council offices on Opitsaht, Tla-o-qui-aht's largest reserve. Thirteen individuals attended the control group session, which included three sub-groups of 4, 4 and 5. Individuals were randomly allocated to the sub-groups. As was protocol, three researchers instructed the group on the purpose of the survey (including a brief overview of payment for ecosystem services and the format of the choice survey). The treatment group session was held at Tla-o-qui-aht's treaty office. The structure of the sub-groups were 5, 4 and 3 (1 of the surveys in the group of 3 could not be used as the participant could not complete the survey). The instructions to this group followed that of the control group, however, upon completing Round I of the survey the participants were told that they had 20 min to discuss their answers and to consult with the researcher. The groups seemed a little reluctant to discuss their answers at first, however, once we engaged respondents in discussion debates flowed and people sought to justify and argue the reasons for choosing their responses.

In Ahousaht on-reserve, the surveys were conducted at a three rooms set aside at the local medical clinic. In the morning, a group of 5, 6 and 6 participants (2 of the surveys were not usable) completed the control survey. The treatment group was also divided in three sub-groups in three different rooms, with 6 participants in each group (and 1 of the surveys was not usable). During the 15 min discussion there was lively discussion on the answers particularly given the relevance of mining and forestry issues in the community. The issues raised included the need to address poverty in communities and the need for jobs through industrial development, however there was also acknowledged the tension of wanting to act as stewards for the land.

The Ahousaht off-reserve control group had 7, 6 and 7 individuals. The sessions were held outside of work hours (lunch and evening), because off-reserve members were more likely to have full time jobs that required them in the office from 9 am to 5pm. In the treatment group in the evening there were three groups again with 7, 5 and 8 members (2 surveys could not be used from the group of 5 as they were not complete). Discussion was lively again with participants debating the need for economic development and the desire to conserve the land base. The participants, most whom worked full time, also lamented their lack of involvement in decision making for their Nation (because they were not living on-reserve in their territories). They wanted better engagement with the First Nation.

Appendix C. Description of choice scenario

We will now ask you SIX questions about future land management options in Clayoquot Sound (with focus on your nation's territory).

Each question will ask you to choose among the following three different options for land management in your nation's territory:

1. *Tourism Promotion* means increased tourist numbers, accommodation, restaurants and tours. **These will have a small negative impact on Clayoquot's local ecosystems**.
2. *Industrial Development* means an increase in mining and logging activities. **These will have a substantial negative impact on local ecosystems.**
3. *Conservation and Restoration* means improved forest conservation and salmon habitat restoration. **These will have a substantial positive impact on local ecosystems.**

Each program will deliver different monetary ($) and non-monetary benefits (jobs and environmental outcomes) to your First Nations. However, different choices may restrict your Nation's members' access to territory during the period of the contract.

- High restriction = no access of First Nations
- Medium restriction = some access for part of the year, but restrictions on cultural and traditional use (such as hunting and fishing)
- Low restriction = access allowed but may be limited at times.

Please carefully compare the alternatives with respect to the number of jobs, the payment ($) to the First Nations, restriction on land access and the length of contract. Also, please consider the environmental impacts of your choice.

Please let us know if you have any question about the programs.

Next, we will present you SIX questions. We would like you to vote for the alternative you like most in each of the six questions. If you don't like any tick "None". The program that receives highest votes will be recommended for implementation.

Appendix D. Sample characteristics.

	Tla-o-qui-aht	Ahousaht (On-reserve)	Ahousaht (Off-reserve)
Sample size	25	33	39
Female (%)	44	42	54
Average age (years)	43	46	48
Secondary education and above (%)	60	48	46
Average (median) gross income p.a (C$)	45,000	45,000	30,000
Employed (%)	80	73	49
Looking for work (%)	16	40	41
Average (median) household size	4	3	3
Number of respondents with individual land ownership	1	7	7
Number of respondents with official positions in FN council	7	3	2
Number of respondents with traditional decision making power	5	12	5

Appendix E. Results of the main-effect model (random parameter logit).

	Coefficient (SE)	SD (SE)
Random parameters		
Compensation (Conservation & Restoration and Tourism Promotion)	0.012*** (0.004)	0.012*** (0.004)
Compensation (Industrial Development)	0.024*** (0.004)	0.024*** (0.004)
Restriction (high = 3, medium = 2, low = 1, none = 0)	−0.90*** (0.19)	1.43*** (0.16)
Constant parameters		
Jobs (Tourism Promotion)	0.013 (0.018)	–
Jobs (Industrial Development)	0.11*** (0.03)	–
Jobs (Conservation & Restoration)	0.06*** (0.024)	–
Contract (in years)	0.005** (0.002)	–
ASC (Tourism Promotion)[a]	2.51*** (0.30)	–
ASC (Industrial Development)[a]	−0.73 (0.50)	–
ASC (Conservation & Restoration)[a]	2.34*** (0.28)	–

Notes: ***: $p < 0.01$; **: $p < 0.05$.

[a] Base category = Status quo.

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