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Tourist Perceptions of Climate Change Impacts on Mountain Ecotourism in Southern Mexico

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Abstract: Climate change impacts on tourism are well documented, with most studies focusing on challenges facing ski or beach tourism. While non-ski, mountain tourism accounts for almost one fifth of tourism worldwide, there is a dearth of research on tourists' perceptions of climate change impacts and their effects on tourism demand in these areas. This study, conducted at the ecotourism destination of the Pueblos Mancomunados in the Sierra Norte Mountains of southern Mexico, helps to fill that gap by identifying important tourist decision factors and determining how tourists' decisions to visit may change under different climatic conditions. Using on-site intercept survey research methodology involving 188 tourists, we found that some climate change scenarios affect tourists' perceptions of the desirability of visiting nature-based tourism sites. Results indicate that community-based ecotourism businesses, such as the one that operates in the Pueblos Mancomunados, need to specifically plan for climate change impacts, as they may need to alter tourism offerings to sustain demand.

Keywords: mountain ecotourism; Mexico; contingent behavior; climate change; community-based ecotourism; tourists' perceptions

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1. Introduction

The current and potential effects of climate change on the tourism industry, in terms of changes to natural attractions and shifts in the length and quality of available seasonal activities, are well documented [1–6]. However, the bulk of extant research has focused on ski and beach tourism, where measurable environmental changes linked to climate change have direct and dramatic effects on tourism revenue. Although non-ski, mountain tourism accounts for almost 20% of tourism worldwide and represents an increasingly important sector of the industry [7,8], the few studies that address climate change and mountain tourism focus on sites in Europe or Asia and often analyze data concerning season length, habitat and species impacts, and other aspects of tourism that ignore the human dimensions [9]. Furthermore, there is considerably less research on climate change and tourism in the Global South than in the Global North [10,11], and when separating Mexico from the U.S. and Canada, there is a clear gap in research in that country [12]. Although important for determining potential impacts of climate change in situ, the focus of most existing studies leaves unaddressed the perceptions of the tourists themselves concerning climate change impacts on key pull factors and the pivotal role these perceptions play in their decision-making processes.

Knowing tourists' perceptions about a destination's climatic and environmental characteristics is important for tourism-related businesses to plan successfully for potential

changes in tourism flows due to a changing climate. In particular, understanding how tourists' beliefs about the effects of climate change might impact their travel and recreational activity decisions is "essential to anticipating the potential geographic and seasonal shifts in tourism demand, as well as the decline or increase of tourism markets" [13] (p. 37). The range of beliefs that tourists hold concerning the impacts of climate change on potential destination sites has received limited attention [14–17], and the importance that tourists give these considerations in making travel decisions is, to date, an understudied phenomenon, especially outside of Western countries [12,18,19]. Thus, there remains a gap between what researchers know of tourists' perceptions of climate change impacts and how these perceptions affect travel choices, particularly at non-ski mountain tourism sites.

This study aims to fill that gap by identifying important pull factors and assessing how climate-induced changes in environmental conditions might affect tourists' travel decisions to visit natural landscapes such as mountain regions. We conducted the study within an ecotourism destination in the mountains of southern Mexico, which was at the time the seventh most-visited country in the world [20] and is now the sixth most visited country in the world [21]. Additionally, we enhanced the depth of our analyses by comparing festival and non-festival goers, and domestic and international visitors, within our sample of tourists to the Pueblos Mancomunados of Oaxaca, Mexico. Differences among these subgroups may have important implications for the climate adaptation planning of ecotourism operations, such as the Indigenously owned and operated Expediciones Sierra Norte, which operates in the ecotourism destination under investigation.

1.1. Climate Change and Ecotourism

Ecotourism usually integrates natural and cultural heritage protection through recreational and educational opportunities organized around showcasing and protecting localized ecosystems that contain interesting or unique terrain, flora, or fauna [22]. Climate change can directly affect ecotourism through alterations to the temperature and precipitation ranges required by the flora or fauna that tourists travel to see [23,24]. Climate change can also have an indirect effect on ecotourism sites through physical changes to the natural areas involved, such as the "perceived attractiveness" of mountain vistas [6] (p. 571), which can impact tourists' visitation decisions [25]. Additionally, expected seasonal demand for access to ecotourism sites could be disrupted by climate change-induced alterations in the phenological cycles traditionally associated with certain seasons, such as changes in the fruiting season of trees that attract birds [26] or changes in fall color in the northeastern United States [27]. However, not every ecotourist enjoys the same activity or is drawn by the same pull factor [28], and knowing the preferences of ecotourist types, such as origin or preferred activity, may help an ecotourism destination decide how to best meet different tourist needs when confronted with a potential shift in tourism demand [14].

Indigenous ecotourism destinations are not different in this regard. Some Indigenous communities, traditionally dependent on subsistence agriculture for their livelihood, now include ecotourism in their diversification portfolios as a way to provide extra income, particularly when their crops fail [29,30]. The literature is replete with studies of ecotourism used as a strategy for conservation and economic development [31]. Yet given the potential for significant impacts on ecotourism in the face of climatic change, these communities have a need for understanding not only the climate-related risks to ecotourism but also their options for adapting to climate-related changes in tourism patterns. A critical component of this information is an understanding of what pull factors draw ecotourists to mountain regions, how ecotourists perceive potential climate change impacts, and how those impacts may affect their travel plans. This knowledge may enable Indigenous communities to successfully adapt their ecotourism enterprises to accommodate potential changes in tourism demand.

1.2. Climate Change in Mountain Regions

The Intergovernmental Panel on Climate Change has recognized that one of the greatest dangers to mountain tourism is climate change [1]. Recent global studies have addressed the challenge of climate change impacts in mountainous regions, but most are focused on ecosystems or a particular species or group of species [32–35]. More attention is now being given to the human dimensions of climate change impacts in mountains [36–40], but this research is under-represented in the literature, particularly those conducted in developing countries [9,39,41].

Few examples of extant research of climate change impacts on nature-based tourism in mountain areas includes tourists' perceptions [5,6,26,42] and how changes might affect visitation [43]. Such demand-focused studies are essential for enhancing the adaptive capacity of tourism enterprises, but there is limited research on how community-based tourism enterprises will adapt to these changes, especially in low–middle income countries [44–46]. With almost two decades passing since Scott [47] (p. 72) stated that "research on visitor responses to environmental change needs to be conducted in mountainous regions around the world, particularly in developing nations where tourism is a vital component of local or regional economies", these knowledge gaps persist.

2. Materials and Methods

We designed our study to answer the following research questions: (a) what types of changes in ecotourism demand may occur from alternate climate futures in mountain regions of Latin America? and (b) do climate-induced changes to tourism demand differ by tourist types? To answer these questions, we received permissions from *Expediciones Sierra Norte*, an ecotourism company owned and operated by the *Pueblos Mancomunados*, to visit the region and conduct on-site intercept survey research (English and Spanish versions of the questionnaire) with tourists. The survey questionnaire was designed to elicit the importance of key pull factors and the ways in which visitors may change their travel behaviors given projected alterations to the climatic and environmental conditions of the region, using a contingent visitation analysis to estimate changes in future tourism demand. It was also designed to determine if pull factors and contingent behaviors differ depending on tourist type (i.e., domestic versus international tourists, and festival goers versus non-festival goers). The contingent behavior model has been used in various studies on tourists' perceptions and climate change [5,6,48–50], but to date, not in Latin America.

2.1. Study Site: The Pueblos Mancomunados

The Pueblos Mancomunados, or "Commonwealth Communities", are a group of eight Indigenous communities located in the Sierra Norte region of the Sierra Madre de Oaxaca Mountains in the Mexican state of Oaxaca (Figure 1). Following social and political traditions linked to their Zapotec culture, the natural resources of these communities are managed communally and since the early 1990s, the inhabitants of six of the pueblos have invested a large amount of collective energy and capital in developing a nature-based tourism business. The aim of the business, Expediciones Sierra Norte, is job creation to stem out-migration and protect their culture, as well as their abundant natural and cultural resources. With elevations ranging from 1200 to 3300 m above sea level, biodiversity in the different ecosystems found among the Pueblos is extraordinarily high and provides a recreational focus for visitors. Persistent, low-level cloud cover over much of the higher-elevation forests provides habitats for many endemic species, but these cloud forests are extremely vulnerable to long-term changes in seasonal temperatures and rainfall [34,51].

Expediciones Sierra Norte's main office is in the city of Oaxaca, which is about two hours by bus from the closest community in the Pueblos Mancomunados, Cuajimoloyas. Each community has its own affiliated ecotourism office that arranges activities for tourists, but most coordination takes place in the main office. About 17,000 visitors arrive each year and Expediciones Sierra Norte provides a variety of ecotourism opportunities for them, including hiking, mountain biking, birdwatching, camping, and cultural tours and festivals.

The festivals, the Wild Mushroom Festival (la Feria de los Hongos) in Cuajimoloyas and the Apple Festival (la Feria de la Manzana) in Latuvi, take place each year in July and draw about 300–400 tourists each. All communities offer between six and twelve rustic cabins or camping facilities to visitors; some also offer homestays. Additionally, each community has a restaurant that is part of Expediciones Sierra Norte.

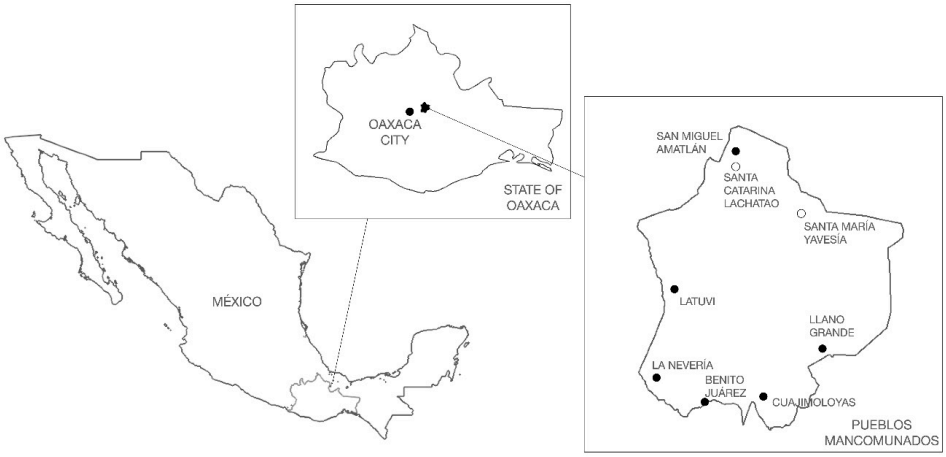

Figure 1. Location of the Pueblos Mancomunados. Solid dots represent the six pueblos that participate in the ecotourism business.

2.2. Sampling

Due to the dispersed nature of the tourists and tourism activities in the region, researchers utilized convenience sampling methods to intercept visitors on-site at various locations throughout the Pueblos Mancomunados. During a four-week period of data collection in July 2015, two researchers stayed in the Pueblos Mancomunados and intercepted tourists at popular attractions, restaurants, and ecotourism offices, as well as at two large festivals. These locations were determined during a preliminary visit in December 2014 and in conversations with the ecotourism coordinator and members of the ecotourism offices. Specifically, the researchers approached the first tourist or group of tourists encountered at a location, solicited participation in the study, acquired consent, and provided willing individuals or groups of tourists with one survey questionnaire. The researchers requested that upon completion, the tourist return the paper survey questionnaire to the researcher. Then, the researchers approached the next tourist or group of tourists encountered and repeated the sampling approach. If a tourist or group of tourists declined participation, the researchers recorded the incident, which included asking for a reason for not participating in the study, and they continued the sampling approach.

2.3. Instrument

A paper survey instrument was developed in English and Spanish with questionnaire items developed from existing literature, expert review, and structured interviews with tourists in December 2014 (see Supplementary Materials). The instrument was pilot-tested on native and non-native speakers of both languages prior to data collection with necessary changes made to enhance clarity, reduce burden, and increase the likelihood of completion. The survey instrument included items designed to document tourists' characteristics, identify the key factors that draw tourists to the Pueblos (trip purpose), and assess how projected climate change impacts on the area might affect future visitation patterns, among other questions not reported in this paper.

Trip purpose was first measured by determining if attending a festival was the primary reason for the visit (binary response option), and then asking respondents to indicate the importance of several decision factors related to tourism (7-point Likert-type scale, anchored at "not at all important" and "extremely important"). The factors were determined from

conversations with tourists and Expediciones Sierra Norte staff during the preliminary visit in 2014 and included Temperature, Rain, Biodiversity, Extent of forest fires, Extent of cloud forest, Zapotec culture, Ease of travel to/within the Pueblos Mancomunados, Working landscapes, and Natural beauty. Short definitions were provided for technical words included in the scale (e.g., Biodiversity: Number of plant and animal species; Working landscapes: visible agriculture, use of forestry products).

To determine how tourists' perceptions of climate change impacts affect their decisions, we structured questionnaire items to assess contingent visitation. Similar to Scott, Jones, and Konopek [6], we developed two different hypothetical yet plausible scenarios describing potential future impacts of climate change on the Pueblos Mancomunados environment and attractions. Respondents were asked to rate the likelihood of future visits to the site based on these two hypothetical scenarios. The survey included a table describing current climatic and environmental conditions and two different future scenarios (Table 1). The future scenarios used in the survey instrument were developed from data provided by a custom climate data server created by Nicholas Crookston and Gerald Rehfeldt at the USDA Forest Service and Virginia Tech [52]. We used an ensemble of global climate models (GCMs) to provide a more robust estimate of climate change [53] and the Representative Concentration Pathway of 8.5 W/m^2 (RCP 8.5) for the years 2030 (scenario one) and 2060 (scenario two) to reflect a future based on increasing greenhouse gas concentration levels, similar to the rates of increase being experienced now [54]. The years 2030 and 2060 represent multi-year averaging periods, 2026–2035 and 2056–2065, respectively. There are 17 GCMs used in the ensemble. Results were averaged using one latitude/longitude coordinate for each of the six pueblos shown in Figure 2. "Current conditions" are based on the climate normal period of 1961–1990. More details of the custom climate data server used in this study can be accessed at: http://charcoal.cnre.vt.edu/climate/customData/ (accessed on 6 June 2023). The future dates were not revealed to the tourists surveyed.

Table 1. Climate change scenarios displayed in the questionnaire.

Climate Variables	Current Conditions	Scenario 1	Scenario 2
Average maximum temp in warmest month (April)	21° C (70 °F)	23 °C (73 °F)	24 °C (75 °F)
Average maximum temp in coolest month (January)	17 °C (63 °F)	18 °C (64 °F)	19 °C (66 °F)
Seasonal variation (October–April)	Cool and sunny	Warmer and sunny	Warm and sunny
Season variation (May–September)	Cold and moderately rainy	Cold and moderately rainy	Cool and less rain
Biodiversity (plants and animals)	High—over 1870 species present	Fewer overall numbers and species	Far fewer overall numbers and species
Occurrence of forest fires (in the state of Oaxaca)	Average of 257 fires per year, with 44,000 Ha or more burned in a bad year	Somewhat higher chance for more fires	Much higher chance for more fires
Extent of cloud forest (in the state of Oaxaca)	516,000 Ha (1.28 million acres)	Moderate decrease	Large decrease

To understand tourists' perceptions of how these alternative climate futures might impact their decisions to return, the survey included a series of questions that asked them to look at the table and then determine their behavioral response (i.e., "Would you change your travel plans?", with response categories of "No, Maybe", and "Yes"). Respondents who answered "Maybe" or "Yes" were instructed to then answer questions on length of stay ("Would you stay…?" Longer, Shorter, No Change) and the number of days they would stay—shorter, longer, or no change.

The survey also included questions about current length of stay (with response options of either "For the day" and "For more than one night", which was followed by an open-ended response for entering the number of nights). Additionally, the survey included questions to record prior visitation, the Pueblos visited during the current trip, and the types

of activities during the current trip. The survey concluded with a series of demographic questions that included sex, age, origin, and number in party.

2.4. Analysis

After concluding sampling, results were entered into an Excel spreadsheet, cleaned, and uploaded to SPSS v. 24 for analysis. Descriptive statistics were calculated for all questionnaire items. Due to the ordinal nature and the non-normal distribution of most of the responses, we performed non-parametric statistical analyses when exploring within response distributions and between sample subgroups. Specifically, we explored differences between types of tourists (festival and non-festival goers, and domestic and international visitors) for dominant pull factors using Mann–Whitney U Tests. Given the exploratory nature of the study, we did not perform a multiple comparisons adjustment and set the significance level at 0.05. Additionally, we used one-sample Chi-square tests (X^2) to explore for differences between visitation response categories for each of the two future scenarios, and post-hoc Chi-square tests to identify specific differences, using a Bonferonni correction in our post-hoc test comparisons. We ran a Kruskal–Wallis test (i.e., Chi-square test of independence, X^2) to evaluate differences in responses to scenarios by tourist types: domestic and international, and non-festival and festival tourists. We used Wilcoxon signed rank tests to explore changes to respondents' visitation behaviors (duration and timing of trips) under each scenario, and by tourist type (domestic and international, and non-festival and festival) for each scenario [55].

3. Results

During data collection, field researchers solicited participation from 238 tourists, with 32 individuals' refusing (response rate of 74%). The majority of refusals (n = 29, or 91%) were from festival goers who refused to take the survey due to time constraints. Of those questionnaires that were returned, 188 were used in the analyses (23 were removed for missing data). Although a non-response bias check was not conducted, the proportion of international and domestic tourists included in our sample (33% and 67%, respectively) is similar to the proportion within annual visitation numbers reported to researchers by Expediciones Sierra Norte (30% and 70%, respectively). Of note was the fact that another researcher was sampling tourists at the same festivals, and it is likely that there was survey fatigue [56] among festival tourists.

3.1. Tourist Characteristics

The majority of respondents (67%) were domestic tourists and the median age of respondents was 37 years. About 48% of our sample were female, and about one-half were returning visitors (51%). The returning visitors were overwhelmingly domestic tourists (91%). Most respondents (92%) were staying in the Pueblos Mancomunados for five days or less, with one-half (52%) of the total sample being day visitors. Most respondents were planning to visit just two communities (60%), predominantly Cuajimoloyas (67%) and Benito Juárez (52%) (Figure 2). Three-quarters (75%) of respondents were planning on hiking during their visit and 28% were planning to partake in cultural activities. Just over one-third of the sample (37%) planned to partake in festival activities (i.e., festival goers).

3.2. Pull Factors to the Pueblos Mancomunados

Survey responses identified natural beauty ($\overline{x} = 6.6$, SD $= 0.96$), biodiversity ($\overline{x}$ = 6.0, SD = 1.40), and the Zapotec culture ($\overline{x} = 5.5$, SD $= 1.56$) as the three most important factors tourists considered when deciding to visit the *Pueblos Mancomunados* (Table 2). To determine differences between tourist types (i.e., festival tourists and non-festival tourists, international and domestic), we compared mean responses from each group and found that both festival tourists and domestic tourists considered all factors as more important than non-festival tourists and international tourists. A Mann–Whitney U Test revealed the statistically significantly higher importance of culture in the decision to visit for festival

tourists (Md = 6, n = 91) than for non-festival tourists (Md = 5, n = 91), U = 3401, z = −2.146, p = 0.03, r = 0.16 (small effect size), and it was the only variable in which there was a statistically significant difference between the two groups (Table 2). A Mann–Whitney U Test comparing international and domestic tourists revealed that all variables—temperature, rainfall, biodiversity, fire, cloud forest, ease of travel, working landscapes, and natural beauty—except culture were found to have a statistically significant higher importance for domestic visitors than for international visitors when making a decision to travel (Table 2).

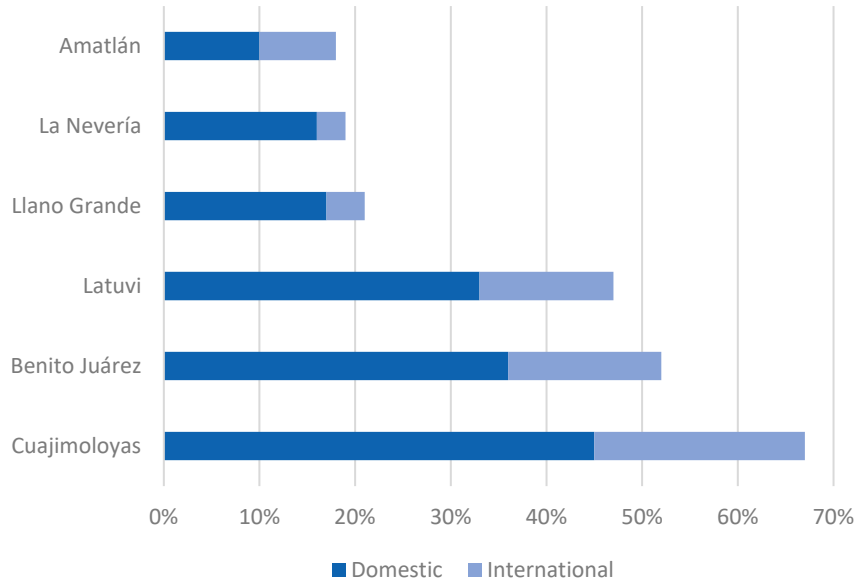

Figure 2. Percentage of tourists (domestic and international) who visited each pueblo on this trip. (Many tourists visited more than one pueblo; results will not total 100%.)

Table 2. Mean decision factors by sample and comparison by subsamples of tourist types.

Decision Factor	Total Sample			F		NF		MW U *[1]	D		I		MW U [1]
	n	*x*	SD	*x*	SD	*x*	SD	*p* (*r*)	*x*	SD	*x*	SD	*p* (*r*)
Temperature	182	4.34	1.94	4.47	1.96	4.2	1.92	3768 0.282 (0.08)	4.71	1.99	3.59	1.68	2383 **<0.01** (0.27)
Rain	177	4.35	1.81	4.51	1.61	4.19	1.98	3646 0.417 (0.06)	4.79	1.72	3.48	1.71	2108 **<0.01** (0.31)
Biodiversity	182	6.04	1.40	6.16	1.27	5.91	1.51	3820 0.322 (0.07)	6.32	1.32	5.46	1.39	1949 **<0.01** (0.40)
Extent of fire	173	3.42	2.11	3.48	2.17	3.37	2.07	3608 0.682 (0.03)	3.65	2.17	2.89	1.82	2586 **<0.05** (0.17)
Extent of cloud forest	179	4.88	1.93	5.07	1.89	4.70	1.97	3590 0.221 (0.09)	5.21	1.85	4.25	1.91	2398 **<0.01** (0.24)
Culture	182	5.45	1.56	5.67	1.50	5.23	1.60	3401 **0.032** (0.16)	5.54	1.64	5.33	1.41	3008 0.11 (0.12)
Ease of travel	182	5.28	1.69	5.46	1.65	5.11	1.71	3619 0.132 (0.11)	5.58	1.64	4.64	1.62	2275 **<0.01** (0.30)
Working landscapes	182	5.10	1.83	5.29	1.73	4.90	1.91	3665 0.171 (0.10)	5.40	1.74	4.43	1.84	2367 **<0.01** (0.27)
Natural beauty	184	6.63	0.96	6.70	0.82	6.55	1.08	4001 0.374 (0.07)	6.78	0.74	6.29	1.25	2600 **<0.01** (0.31)

F = festival tourist; NF = non-festival tourist; D = domestic tourist; I = international tourist; SD = Standard Deviation; * Mann–Whitney U statistics are rounded; [1] Mann–Whitney U Test (*Z*) significant at the $p < 0.05$; boldface indicates statistical significance.

3.3. Climate Change and Visitation Decisions

We assessed how different future scenarios might affect tourists' decisions to visit, particularly in relation to duration and trip timing. Under scenario one, just over one-third (36%) of respondents indicated that they would ("yes") or might ("maybe") change their trip plans. Under scenario two, almost two-thirds of respondents indicated that they would ("yes") or might ("maybe") change their trip plans. A Chi-square goodness-of-fit test revealed that there were statistically significant differences in the distribution of the answers for both scenario one (X^2 = 101.719, p = < 0.01) and scenario two (X^2 = 10.247, p = < 0.05; Table 3).

Table 3. Differences in influences of climate change scenarios on tourists' decisions to visit.

Climate Scenario [1]	***n* (%)**	X^2	p
Scenario 1		101.719	<0.01
Yes [a]	6 (3)		
No [b]	118 (64)		
Maybe [c]	61 (33)		
Scenario 2		10.247	<0.05
Yes [a]	39 (23)		
No [b]	73 (43)		
Maybe [ab]	58 (34)		

[1] One-sample Chi-square test (X^2) significant at the $p < 0.05$. Response categories that do not share superscripts differ at $p < 0.017$ (Bonferroni correction) in post-hoc Chi-square test (X^2) comparisons.

We ran a Chi-square test of independence to evaluate differences in responses to scenarios by tourist types: domestic and international, and non-festival and festival tourists (Table 4). We found there was no significant difference between domestic and international tourists under either scenario (S1, X^2 = 2.889, p = 0.236; S2, X^2 = 4.524, p = 0.104), nor were there significant differences between festival tourists and non-festival tourists under either scenario (S1, X^2 = 1.207, p = 0.547; S2, X^2 = 1.453, p = 0.484).

Table 4. Comparison of tourist types by decision to visit under different climate change scenarios.

	Scenario 1				**Scenario 2**			
	D	**I**	**F**	**NF**	**D**	**I**	**F**	**NF**
Behavioral Response	*n* (%)	*n* (%)	*n*(%)	*n* (%)	*n* (%)	*n* (%)	*n*(%)	*n*(%)
Yes	4 (3)	1 (2)	4 (4)	2 (2)	21 (19)	18 (31)	16 (19)	23 (26)
No	84 (68)	34 (57)	61 (66)	57 (61)	53 (48)	19 (33)	36 (44)	37 (43)
Maybe	35 (29)	24 (41)	28 (30)	33 (36)	37 (33)	21 (36)	31 (37)	27 (31)
Chi-square	2.889		1.207		4.524		1.453	
p	0.236		0.547		0.104		0.484	

D = domestic tourist; I = international tourist; F = festival tourist; NF = non-festival tourist.

To further explore how respondents' perceptions of the climatic and environmental conditions projected within each scenario would impact their visitation behaviors, we asked respondents who indicated that they would ("yes") or might ("maybe") change their trip plans under each scenario how it would change the length of their stay (duration) or the timing of their trip (Figures 3 and 4). A Wilcoxon Signed Rank Test revealed a statistically significant reduction in visitation duration under scenario two (z = 3.87, $p < 0.001$), with a medium effect size (r = 0.36). There were no significant differences between trip duration response categories in relation to scenario one. While a visual inspection shows a large difference between those who would not visit and those who would experience no change, a Wilcoxon Signed Rank test revealed no significant difference in the timing of visits (z = −1.53, p = 0.126, r = 0.21).

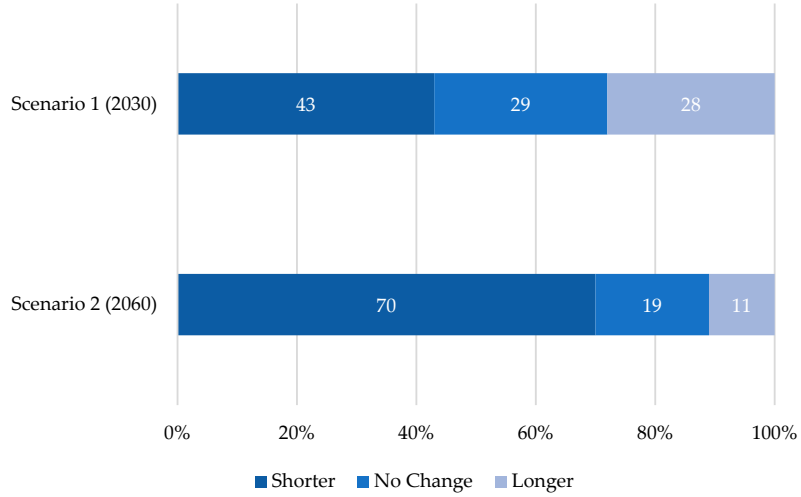

Figure 3. Proportion of respondents changing their length of stay under the two climate change scenarios.

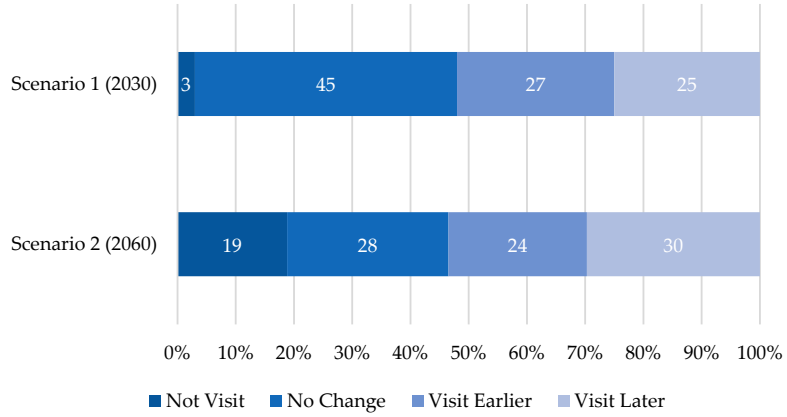

Figure 4. Proportion of respondents changing the timing of their visit under the two climate change scenarios.

To examine differences within festival and non-festival tourist groups, we conducted a Mann–Whitney U Test to discover if different scenarios would affect the number of days these types of tourists would stay (Table 5). The distribution of the number of days for both groups was similar, as assessed by visual inspection. The median number of days spent under scenario one was not statistically significantly different for either group (origin, $U = 162$, $z = -0.580$, $p = 0.562$; festival, $U = 218$, $z = -0.559$, $p = 0.576$), nor was it for either group under scenario two (origin, $U = 324$, $z = -1.355$, $p = 0.176$; festival, $U = 392$, $z = -0.872$, $p = 0.383$).

Table 5. Comparison of tourist types by number of days spent under different climate change scenarios.

	Scenario 1				Scenario 2			
	D	**I**	**F**	**NF**	**D**	**I**	**F**	**NF**
Median	2	2	2	2	1	2	1	2
U	162		218		324		392	
Z (u)	−0.580		−0.559		−1.355		−0.872	
p	0.562		0.576		0.176		0.383	
(*r*)	0.06		0.06		0.14		0.09	
n	41		44		60		60	

D = domestic tourist; I = international tourist; F = festival tourist; NF = non-festival tourist.

4. Discussion

This study assessed the types of changes in ecotourism demand that may occur from climate change impacts in mountain regions of Latin America, and if climate-induced changes to tourism demand might differ by tourist types in the ecotourism site of the Pueblos Mancomunados in the southern Mexican state of Oaxaca. This area has one of the highest concentrations of biodiversity in the world and the highest cultural diversity in the country. Findings not only provide additional information about climate change impacts in mountainous regions, particularly in an area with Indigenously owned ecotourism businesses in Latin America, but also specific information for the community ecotourism businesses in mountain regions, such as Expediciones Sierra Norte, to assist in developing future climate adaptation strategies.

4.1. The Culture of Nature and the Nature of Culture

In our analysis of decision factors for what brings tourists to the Pueblos Mancomunados, natural beauty, biodiversity, and culture were rated as the top three pull factors. Natural beauty and biodiversity as important factors for visitation are hardly surprising, as those factors help define ecotourism [57]. This connection to nature by visitors to the Pueblos Mancomunados is also illustrated by the fact that 80% of tourists surveyed indicated that during their visit they either participated in or planned to participate in hiking, a common way to enjoy natural beauty and biodiversity [58].

The observance of culture as the third most important pull factor is consistent with the notion of culture being considered a part of ecotourism [59–61], but the domestic tourists in our study listed it lower than travel ease for importance in their decision to visit. Elsewhere, culture has been shown to be the primary reason for a domestic travel experience [62]. Given the abundance of culture in the study region, and that the majority of tourists surveyed were from the same region (34% from the state of Oaxaca), perhaps the domestic market has arrived at cultural tourism saturation [63] and prefers the ease of access—and time spent in nature—over cultural offerings.

4.2. Shifting Climates, Shifting Demands

Results from this study indicate that tourists who come to the Pueblos Mancomunados are not likely to definitively change their travel plans based on changes in climate projected for the region by the year 2030. Thus, in the near future, climate change impacts may not affect visitation patterns (but this does not indicate that there is no risk in the near term, particularly given that one-third of visitors were undecided). However, descriptions of the more pronounced environmental changes projected for 2060 demonstrate that a substantial proportion of visitors who would or might change their travel behaviors would shorten their travel duration (70%) and some would no longer visit the destination (19%) (compared to 43% and 3%, respectively, in the 2030 scenario). This finding is consistent with similar studies on tourists' perceptions and decisions in nature-based mountain tourism settings [6,26,64]. Furthermore, significantly more domestic visitors (the far greater number of tourists that Expediciones Sierra Norte receives) than international visitors would change plans under the second scenario, which is a critical finding for destination planning.

Another key insight of our results is that, as climate change alters the conditions of the region, about one-half of those visitors who would or might change their travel plans in the near-term (36%) and long-term scenarios (57%) would change the timing of the visit (nearly equal amounts visiting earlier and later than the peak season). These results provide the ecotourism committees in the Pueblos Mancomunados with information on potential tourism flows that are essential for developing their organizational climate adaptation plan.

The high response percentage of "maybe" under both scenarios (33% for scenario one and 34% for scenario two) is worthy of further consideration. It is possible that those who answered "maybe" did not think the scenarios were plausible, or they lacked sufficient detail to inform their decisions. Yet this substantial level of indecision could have drastic impacts on tourism flows, a result which was also found by Seekamp, Jurjonas,

and Bitsura-Meszaros [65] in a U.S. nature-based tourism destination when tourists were asked to consider destination disruptions from natural hazards. In the case of the Pueblos Mancomunados, this is particularly concerning as no significant differences were found for contingent visitation between festival goers and non-festival goers or between domestic and international visitors.

5. Conclusions

In this study, we uncovered that (a) changes in ecotourism demand may occur from alternate climate futures in mountain regions of Latin America, particularly under more extreme changes in climatic and environmental conditions, and (b) the more extreme climate-induced changes will particularly alter the timing of demand within the domestic tourist market. Although statistically significant differences between tourist types were not found (except for cultural pull factors being more important for festival tourists than non-festival tourists), the patterns of the results suggest several implications for mountain and Indigenously run ecotourism businesses, reveal some study limitations, and highlight future research needs in an era of climatic change.

5.1. Implications

Previous studies on climate change and tourism have had similar results as those presented here, finding that the near-term, non-drastic effects of climate change do not have much of an effect on tourists' perceptions of the desirability of visiting nature-based tourism sites [26,64] and do not result in considerable changes in tourism demand [51]. However, these results do not preclude the possibility that more severe changes can take place in the near term. Based on tourists' responses to the long-term climate model projections for the region in our survey, the Pueblos Mancomunados and Expediciones Sierra Norte may need to alter tourism offerings to accommodate a different type of visitor than those seeking ecotourism experiences affiliated with specific agricultural festivals, while simultaneously marketing efforts for ecotourism activities present in accordance with changing conditions and seasons, as communities that innovate are more likely to sustain their tourism options [66].

Two key planning implications emerge related to the regional tourist market: (1) ensure travel infrastructure is adequate and well maintained, especially around high season events such as the festivals in July, and (2) develop a larger variety of tourism products that highlight and conserve the natural amenities for regional tourists to help sustain or increase visits by regional visitors. Given the top pull factors, managers at Expediciones Sierra Norte should emphasize conserving natural beauty and biodiversity when planning for climate adaptation and continue to develop marketing materials that highlight these aspects of the area.

Implications of the differences between domestic and international tourists also emerged. Domestic tourists, in general, could be considered as "easier tourists" since they often contribute to the host community economy without requiring special treatment—they often speak the same language as the hosting communities and they can more easily find local transportation, often using their own vehicles [67]. Even though the *Pueblos Mancomunados* are located in a more temperate region of Mexico, the country is still considered a tropical destination and international travel to those destinations is expected to decline in the face of a warming planet [68]; hence, the domestic tourism market may become even more important for Expediciones Sierra Norte. There is a scant amount of literature on the domestic tourism consumption of culture, and what exists is conflicting [62,69,70].

Within the international tourism market, culture is ranked nearly as high as natural beauty and biodiversity. As such, climate change impacts could have a larger effect on tourism in the Pueblos Mancomunados. Gossling and colleagues [13] hypothesize that "future tourists" may not have the same frame of reference for natural beauty or biodiversity given the climatic changes that are underway, potentially reducing the impact of climate change on future tourism flows. However, the Pueblos Mancomunados receives

international visitors who are interested in both nature and culture. Part of the cultural tourism pull from this area is dependent on traditional agricultural production, which is highly dependent on climate. Even small increases in temperature may alter the ability to continue traditional agricultural practices. Therefore, changes in agricultural production due to climate change could mean that tourism in this mountain destination could be more heavily impacted by climate change than destinations that are visited purely for natural beauty or biodiversity. This topic also deserves further study, as out-migration for employment has been steady in this region for decades [71,72] and a change in food production due to climate change may drastically decrease the number of community members able to support tourism.

One of the main goals of most ecotourism ventures, including in the Expediciones Sierra Norte, is to increase employment opportunities for Indigenous communities [73]. As such, expanding research on contingent visitation demand under changing climatic conditions to include economic studies of tourists' expenditures related to expected length and timing of stay would help Indigenous communities, like the Pueblos Mancomunados, determine when and where they would need to change staffing patterns to better accommodate (and market for) potential changes in tourism flows.

This study begins to fill the gap in tourism and climate change research regarding tourists' perceptions by examining potential changes to tourism patterns in a tropical mountainous region with an Indigenous-owned and -operated ecotourism business. An important methodological contribution is its geographical focus. This study broadens the discourse of climate change impacts on tourism by including research on tourism in Latin America, as few climate change studies have taken place in mountainous regions of Latin America [9,19] and those that are focused on tourism were predominantly conducted in the Andes [42,74,75]. Practically, our findings highlight actions that Expediciones Sierra Norte managers could take to enhance visitor experience under changing climatic conditions, and we provide suggestions for further study in this area. We hope that the people of the Pueblos Mancomunados, as well as other businesses similar to Expediciones Sierra Norte, will be able to use the results of this research to protect their environment, sustain their culture, and provide jobs in their communities. Ultimately, the uncertainty of the timing and severity of climate change impacts, as well as tourist responses to those impacts, necessitate ongoing research to enhance adaptive responses and build climate readiness.

5.2. Limitations

The sample of this survey was limited to tourists who were visiting the Pueblos Mancomunados, decreasing generalizability of results [55]. However, the findings of the study are relevant to other Indigenous ecotourism businesses in other mountainous regions of Latin America, as changes in tourism flows will likely follow similar, and uncertain, trends. Additionally, the age of the data could be a limiting factor when considering their relevance to a dynamic phenomenon such as climate change. However, the results from this investigation, which was undertaken in 2015, before the COVID-19 pandemic, remain relevant today. Climate change is still projected to cause the same conditions for this region—warmer temperatures, less rain, more frequent forest fires, decrease in cloud forest, and diminished biodiversity [76]. The importance of biodiversity and natural beauty to ecotourists is unlikely to lessen [77]. Furthermore, the COVID-19 pandemic only increased tourists' desires to spend time outdoors [78] and demonstrated the importance of outdoor recreation on improved mental health and wellbeing [79]. It also provided time for reflection and planning in the way that ecotourism is practiced [80,81]. Considering that research on tourists' perceptions of climate change and how such perceptions affect travel decisions continues to be limited, especially in Latin America [9–12], the information presented in this study is a good starting point for similar ecotourism businesses to begin to plan for potential climate change impacts or for researchers to conduct similar studies.

Although we did not analyze our sample by demographic information, future studies could consider doing so. For example, one anonymous reviewer of this paper suggested that the level of education may be an important consideration for future research. Although we could not find evidence in the literature that demonstrates significant differences among ecotourists in terms of visitation demand under changing climatic conditions, studies suggest that younger and more educated visitors show higher interest in learning about nature conservation and local cultures e.g., [82].

5.3. New Avenues of Research

Several areas touched upon by this study merit further research. The domestic tourism consumption of culture needs further exploration, especially in Latin America and Indigenous mountain ecotourism destinations such as the Pueblos Mancomunados. The ongoing monitoring of seasonal visitation numbers and demographic changes among visitors is also needed as climate change impacts are realized to enable adaptive responses by mountain ecotourism businesses such as Expediciones Sierra Norte. Continued research on climate change impacts on ecotourism in mountainous regions is necessary to increase the resilience of community-owned ecotourism businesses, particularly with Indigenous communities facing high out-migration and loss of cultural practices.

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