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Exploring community and key stakeholders' perception of scientific tourism as a strategy to achieve SDGs in the Ecuadorian Amazon

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ABSTRACT

This research examines the perception regarding scientific tourism (ScT) and its contribution to the UN Sustainable Development Goals (SDGs). Data were collected in two stages. In the first stage, a survey was conducted in the Kichwa community of San José de Payamino within the buffer zone of the Sumaco Biosphere Reserve (SBR) in the central northern Ecuadorian Amazon. In the second stage, workshops and interviews were conducted with key actors interested in the Timburi Cocha Biological Station (TCBS). The results showed that both the local population and the key actors perceived that the activities carried out by the TCBS contributed to achieve at least eight SDGs, empowering the community, especially by recognizing their cultural and ancestral values. This supported the sustainable and economic development of the community. The TCBS had contributed to the community an annual average of USD 5000 in the past 8 years, in addition to other social and cultural benefits provided from the different activities carried out by the TCBS.

1. Introduction

In 2015, the United Nations launched the 2030 Agenda for Sustainable Development, which outlines 17 Sustainable Development Goals (SDGs) (UN, 2015) and the aim of increasing social, economic, and environmental integrity. Since then, several studies have examined how and whether SDGs can be achieved from various perspectives. For instance, Menton et al. (2020) focus on environmental justice while James, Irudaya, and Srinivas (2020) examine SDGs from several demographics and health indicators. Others have examined the role of agrobusiness and food production (Derek & Fanzo, 2019; Hinson, Lensink, & Mueller, 2017) or construction (Goubran, 2019) in achieving the SDGs. So far, little attention has been paid to the role of tourism on achieving the SDGs.

Recently, Scheyvens (2018, p. 1) calls upon scholars "to consider how we might utilize the SDGs to analyze the linkages between tourism and sustainable development in a wide range of contexts and at different scales". Tourism is an important component in the new global economy (World Bank, 2012). Tourism has increasingly played an important role in the economies of many countries (Tsung-Pao & Hung-Che, 2016) by maintaining and creating employment for local and regional development. There are different categories of tourism, such as sun and beach, cultural, scientific, religious and ecological (Jafari, 2005; Vega and Muñoz Vega & Muñoz, 2007; OMT, 2016; Scheyvens & Biddulph, 2017). While some of these categories are quite popular, scientific tourism (ScT) is a more recent type of activity that originates from biological and anthropological science researchers showing interest in community tourism, visiting communities for exploratory and scientific purposes (Bourlon, Bórquez, & Moreno, 2019; Bourlon & Mao, 2011; Izurieta et al., 2019). ScT has been seen as having the potential to contribute to SDGs through scientific knowledge acquisition and exchange and activities supporting local socio-ecological system development.

To help local communities transitioning toward a more sustainable future, McCloskey (2015) argues the importance of involving scientists.

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When trying to integrate sustainable tourism into this transition, more research is needed to understand issues and challenges (Bramwell, Higham, Lane, & Miller, 2017). Central to this transition, especially in local communities, is the role of Indigenous peoples (Boluk, Cavaliere, & Higgins-Desbiolles, 2019). While traditionally and systematically relegated and dispossessed, now many Indigenous peoples have organized themselves into organizations or groups to defend their rights and culture, values and resources (Bebbington & Perreault, 1999; Perreault, 2003). They also want to be part of the transition toward a sustainable future. Indigenous views of land, forest and community greatly differ from the pure economic perspective of western societies (Coq-Huelva, Torres, & Bueno-Suárez, 2017; Stocks, McMahan, & Taber, 2007). Hence, it is not surprising that Indigenous lands are considered crucial for conservation (Garnett et al., 2018; Nepstad et al., 2006). In this context, sustainable tourism emerges as an alternative to promote sustainable development since it generates sustainable income while preventing rural people from depleting natural resources (Tsung-Pao & Hung-Che, 2016). While scientific tourism may bring some benefits such as improving livelihoods and promoting the conservation of natural resources (Buzinde, Manuel-Navarrete, & Swanson, 2020; Izurieta et al., 2019), conflicts and cultural shock may arise when interacting with foreigners, especially when locals are considered merely as objects of study and western knowledge considered as superior (Gaudry, 2011). In this sense, knowing locals' perception of ScT and its implications is important for policymakers promoting ScT as sustainable income generating activity.

The present study analyzed people's perceptions of ScT and its contribution to the SDGs as well as the conservation of natural and cultural heritage among key stakeholders involved in scientific research and forest conservation in an area of high biodiversity, the Ecuadorian Amazon. The research is based on the analysis of the four types of ScT reported in the literature: a) exploration and adventure; b) cultural experiences; c) eco-volunteering; and d) scientific investigation (Bourlon & Mao, 2011). The aim was to investigate the importance of ScT and its relationship to SDGs and forest conservation in the Sumaco Biosphere Reserve (SBR). Our study offers insights into the potential of scientific tourism activities to achieve at least eight SDG, in a case study with Indigenous populations.

In this context, the study examined the contribution of ScT's approach toward achieving the following SDGs: SDG 1 - End poverty in all its forms everywhere; SDG 2 - Zero hunger; SDG 4 - Quality education; SDG 8 - Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all; SDG 13 - Take urgent action to combat climate change and its impacts; SDG 15 - Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss; SDG 16 - Promote peaceful and inclusive societies for sustainable development and SDG 17 - Partnerships to Achieve the Goal, partnership for sustainable development.

2. Community tourism and its evolution toward scientific tourism

Community-based tourism can contribute to the conservation of natural resources by improving the local people's economy, developing environmental conservation policies to revitalize their customs and traditions (Coca, 2016). Conserving and preserving natural resources, which goes hand in hand with communities' customs, traditions and lifestyles (Pilquiman, 2016), can be most beneficial to small-scale tourism (Coca, 2016; Coriolano, 2006; Sampaio, 2005). Currently, community-based tourism has become a strategy with the aim of revaluing cultural heritage, allowing societal participation and generating cultural spaces (Bohórquez, Jurado, & Duarte, 2015; Coca, 2012; Cox, 2012; Pilquiman, 2016; Ruiz & Solis, 2007). Thus, community-based tourism is defined by the International Ecotourism Society as responsible travel to natural areas that conserves the environment and supports the well-being of local people (WWF, 2001).

National and international organizations have accepted that the existence of communities within protected areas can be an important part of Community-Based Natural Resource Management (Goodwin & Santilli, 2009). It acknowledges the view of "nature and people" can be integrated in the same landscape and as stated by Mace (2014, p. 1559) "the science has moved fully away from a focus on species and protected areas and into a shared human-nature environment, where the form, function, adaptability, and resilience provided by nature are valued most highly". It is therefore clear that sustainable tourism can be acceptable in this context.

The tourism industry should promote the integration of tourism with sustainable development for the benefits of the current and future generations. This has given sustainable tourism a high level of political relevance and has ignited interest among researchers and academics (Hall, 2011; Saarinen & Gill, 2019) who seek to improve lifestyles at an intergenerational level (Broche & Ramos, 2014). The term sustainable tourism has become increasingly popular since 2000 with the support of the United Nations and the creation of the World Tourism Organization (UNWTO, 2005), which formally establishes regulations on sustainable economic activities focused on tourism (Lalangui, Espinoza, & Pérez, 2017). In this regard, according to Saarinen (2019), the tourism industry can work on several of the SDGs to promote sustainable development, social inclusion, poverty reduction, environmental and cultural protection, mutual understanding, peace, and security.

Within Latin America, Ecuador is considered a leader in such an approach. Ecuadorian Indigenous and rural communities have slowly started being involved in tourism first through "community-based tourism" at the end of the 1990's (Ruiz & Solis, 2007). In this process, communities have been empowered and their self-esteem increased, while creating equitable policies and improving quality of life (Amstrong, 2012). Economically, it has reduced poverty, generated employment for local people and promoted the strengthening of local governance (Bursztyn & Gruber, 2009).

Since 2013, Ecuador has initiated a development strategy based on community tourism with a scientific research objective to demonstrate the essence of Indigenous groups' daily experience, culture, worldview and authenticity of life. This vision is to implement a tourism that manages to balance the environment and culture with local communities acting as protagonists and objects of development rather than subjects of it (Ruiz & Solis, 2015).

Over time, several community tourism activities have been specializing and transforming into what Bourlon and Mao (2011) categorize as ScT. Scientific tourism was first associated with ecotourism, Laarman and Perdue (1989) coin the name science tourism to differentiate the research component of such tourism versus ecological one and suggested science tourism as a subcomponent of nature tourism. ScT is more promoted in the mid-1990s with the interest of promoting scientific culture, fighting poverty, reducing social exclusion while promoting conservation, and fostering environmental respect (García & Martinez, 2017). The ScT industry has since intensified and has increased research in those communities in recent years (Corral & Canoves, 2014). Adventure tourism, exploration, or ecotourism have also been added as a learning perspective for those conducting scientific research (García & Martinez, 2017). An example of such tourism and scientific exploration is promoted by the Center for Research on Patagonian Ecosystems (CIEP for its Spanish initials) in Chile since 2009 (Bourlon, Mao, & Quezada, 2013).

In the context of ScT, students, teachers, and researchers visit various places with natural characteristics to conduct scientific research (Quesada, 2010). However, ScT is not always well known by tour operators and often confused with business tourism, conferences, and seminars. The confusion comes most likely due to having these scientific activities linked to conservation and awareness of resources and conducted by professionals (Bourlon, Mao, & Osorio, 2012), although the

community is also involved in such activities (García & Martinez, 2017). It represents a win-win approach as it contributes to local development while, at the same time, researchers produce and disseminate knowledge through scientific journals thus indirectly contributing to society's transformation and development (Elias, 2017). Nevertheless, it is worth mentioning that there exists a body of literature (Buzinde et al., 2020; Gaudry, 2011) arguing that ScT not always entails a win-win approach, as sometimes scientists are more concerned about studying the community in order to get new insights to be published, with little or no participation of the locals, who become merely informants and do not benefit from the results to be obtained. Something that Gaudry (2011) labels as "intellectual colonialism".

According to Bourlon and Mao (2011) there are four main forms of scientific tourism.

a) *Exploration and adventure tourism with a scientific dimension*, where exploration and adventure are combined with a scientific dimension. It can start as an exploration activity and end up as having scientific aspects or vice versa and these aspects can be geographical, climatological, naturalistic, etc. Or it can start as a purely scientific activity and become an adventure.
b) *Cultural tourism and scientific interpretation,* similar to ecotourism and industrial tourism, provides information about cultural heritage with a scientific approach, interpretation, animation and scientific mediation. Interpretation and cultural heritage can be through visits to museums or places such as World Heritage Sites.
c) *Scientific eco-volunteering*, in which the tourist-volunteer becomes the protagonist and seeks to integrate valorization, species protection and natural habitat conservation with an ecological approach and research development. The volunteer can play a fundamental role in contributing new scientific research and data. In some cases, these activities are done through specific organizations or in groups such as birdwatching.
d) *Scientific research tourism,* where people are motivated purely by scientific research with the aim of publishing the results obtained in seminars, symposiums, meetings, etc. (Bourlon & Mao, 2011).

2.1. The context of the Ecuadorian Amazon

The Ecuadorian Amazon Region (EAR) comprises about 48% of Ecuador's total surface area. It is one of the most biodiverse regions in the world (Lessmann, Fajardo, Muñoz, & Bonaccorso, 2016), with outstanding richness of amphibians, birds, fish, reptiles, bats, and trees (Bass et al., 2010; Jenkins, Pimm, & Joppa, 2013; Mittermeier, Myers, Thomsen, da Fonseca, & Olivieri, 1998; Myers, 1988; Myers, Mittermeier, Mittermeier, da Fonseca, & Kent, 2000). It also hosts a diversity of cultures encompassing ten Indigenous nationalities, including two voluntarily isolated groups - the Tagaeri and Taromenane (Brackelaire, 2006; CONAIE, 2013).

The government came up with the slogan "Ecuador loves life" a brand that communicates well-being and diversity (Chicaiza, Lastra, & Yánez, 2014) to promote and revalue these treasures. Indeed, governmental and non-governmental organizations have increasingly supported community tourism to help protect ancestral and cultural knowledge as well as natural resources and balance the management of communities' rights and equality (Ruiz, Hernandez, Coca, Cantero, & del Campo, 2008). Community tourism is based on local community participation in showcasing their cultures and livelihoods (Dodds, Alib, & Galaskic, 2016). For some of these Indigenous groups, such tourism plays an important role as a dynamic agent of the local economy, as it takes place in a special autonomous environment of territorial and cultural claims (Pilquiman, 2016). Many environmentalists perceive tourism as a sustainable approach to improve awareness and the conservation of biodiversity and natural resources (Ashley, Boyd, & Harold, 2000).

In the EAR, Indigenous communities are pioneers in the development of community tourism, taking advantage of this income to benefit their families economically, improving their quality of life and, in some cases, avoiding the exploitation of natural, mining and oil resources (Coca, 2016). In this way, community tourism also becomes sustainable tourism, aimed at protecting communities' values and knowledge (Ruiz et al., 2008).

The study targeted the Kichwa community of "*San José de Payamino*", located in the buffer zone of the Sumaco Napo Galeras National Park (SNG-NP) and the Sumaco Biosphere Reserve (SBR). Since 2012, ScT activities have been carried out, based on an agreement signed between the Universidad Estatal Amazónica (Ecuador) and Manchester University (England). This agreement was motivated by research and conservation needs of this important biological and cultural ecosystem where the Kichwa community of San José de Payamino is located. The agreement signed between the two academic partners aimed at developing the Timburi Cocha Biological Station (TCBS), where volunteers, students and scientists can carry out specialized summer courses, expeditions for academic purposes and/or studies on the biodiversity of the Payamino tropical forest.

3. Materials and methods

3.1. Study area

This work was carried out in the Kichwa community of *"San José de Payamino"*, located in the canton of Loreto, province of Orellana. within the buffer zone of the Sumaco Napo Galeras National Park (SNG-NP) and the Sumaco Biosphere Reserve (SBR) area. The community is at 304 m.a.s.l. and has an area of 17,000 ha (Fig. 1). It is considered to be a "leading hotspot" for biodiversity and endemic species (Mittermeier et al., 1998; Myers et al., 2000), as well as the home of the Amazonian Kichwa nationality (Torres, Günter, Acevedo, & Knoke, 2018) (Fig. 2).

3.2. Community survey

Data were collected in two stages. In the first stage, a household-level survey (Appendix A) was conducted during October 2018 in the San José de Payamino Community. A template of the Poverty and Environment Network (PEN) questionnaire developed by CIFOR (Angelsen et al., 2014) was adapted to obtain information on household demographic characteristics, perception of science tourism carried out by the TCBS inside the community and participation in the scientific tourism activities. The questionnaire was applied to the heads of households and lasted an average of 45 min. The survey model was approved by the Ethics Committee at Universidad Estatal Amazónica, as well as the free, prior and informed consent from the general Assembly of the Community was obtained. All interviewees were asked for oral approval before conducting the survey. Prior to the household survey, a sample was calculated to consider the 75 households registered in the San José de Payamino Kichwa community at the time of the study, using the formula for finite populations from Murray and Larry (2009). This resulted in a sample of 62 households that were randomly surveyed in order to measure the inhabitants' perception of the scientific tourism activities carried out for about the last 10 years through the Timburi Cocha Biological Station.

3.3. Stakeholder network's perception

In the second stage, workshops were conducted using a form (Appendix B) and interviews with the participation of key stakeholders (including members of the existing community assembly as another key actor) involved or interested in the proper functioning of the TCBS, all interviews were conducted by a member of the research team (J P), to assess their perceptions of ScT activities conducted at the TCBS. The main key stakeholders involved were defined as follows: community

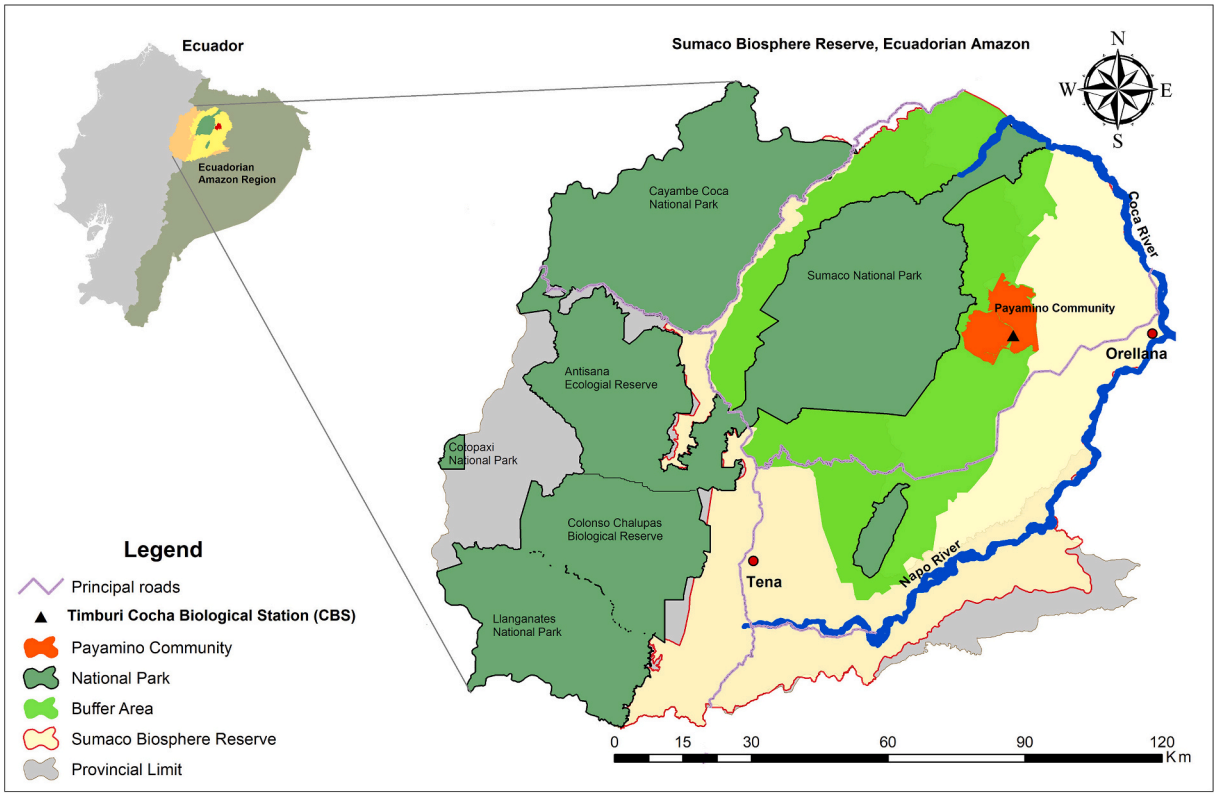

Fig. 1. Geographical location of the study area: Ecuador and Sumaco Biosphere Reserve; In red the Kichwa community of San José de Payamino and the TCBS, Loreto canton, Orellana, Ecuador, 2018. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Fig. 2. Timburi Cocha Biological Station, UEA/MMU, the Kichwa community of San José de Payamino, Loreto canton, Orellana, Ecuador, 2018. Photo: Henry Navarrete, 2018.

representatives (current community Assembly), scientific organizations (who are part of the TCBS and station visitors), local government (local government organizations interested in development and conservation) and the national government (offices of the ministries with competence in these activities) (Fig. 3). Through a group workshop and interviews conducted during 20 days in October 2018 in the community, data were collected on those perceptions related to the six indicators of community acceptance (Fig. 4) and consequently SDG 1, SDG 2, SDG 4, SDG 8, SDG 13, SDG 15, SDG 16 and SDG 17. The TCBS has an operating and research permit with the requirements of the national authority and a direct agreement with the community of San José de Payamino to carry out the activities, where members of the community participate, with the free and informed consent of the community.

This study analyzed the relationships between the forms of ScT, using the classification of Bourlon and Mao (2011), as well as the six indicators of community engagement: a) participation of community members in activities; b) empowerment or respect for cultural identity; c) mutual learning; d) respect and conservation of natural resources; e) respect for ancestral knowledge; and f) promotion of the Kichwa language, using the following conceptual framework (Fig. 4).

3.4. Economic benefits calculation

In order to determine the economic benefits of ScT activities at the TCBS, a review was made of the records of income and payments made to the community of San José de Payamino due to visits from students and researchers from 2011 to 2018, as well as the description of other income obtained by any of the scientific tourism activities involving people from the households members of the community.

4. Results

4.1. Perception of ScT at the community household level

Fig. 5 shows household heads' perception of scientific tourism. Community members perceived that the exploration, adventure, tour guiding, use of camera traps and research activities carried out by the TCBS empowered the community in terms of celebrating their traditions and customs. It especially supported the recognition of their cultural and ancestral values. They believed that volunteers or scientists appreciated their traditional knowledge in, for example, the management of the *chakra* system (explained in the discussion section) and conservation of the forest (17,000 ha).

Most of the local population (66%) stated that they participated in at least one of the TCBS's activities (Fig. 6). For instance, they were involved as canoe boat drivers, cooks, and cleaners. Moreover, 65% responded that they had participated in some specific exploration activities carried out by the TCBS, such as in flora and fauna monitoring, tour guiding, and placing camera traps.

While a significant percentage of the population participated in different activities related to the TCBS, only 48% perceived that they knew about the specific ScT activities being carried out by the station. Indeed, 45% reported not knowing about the activities carried out by volunteers at the TCBS (Fig. 6).

4.2. Stakeholders' perception of ScT's forest conservation strategy

The focus groups with the key stakeholders confirmed the common interest of the San José de Payamino community in the management and conservation of their natural resources. These stakeholders also expressed positive opinions about the management of TCBS, both in terms of managing natural resources and improving livelihoods in the community. The results of each of the key stakeholder groups are described in the following subsections.

4.2.1. Perception of scientific organizations

The scientific organizations, member of the Timburi Cocha Biological Station, perceived that ScT actions contributed not only to sound and sustainable community management of natural resources, but also to the dissemination and promotion of the community and its Indigenous values and traditions that promote conservation. The results of their research have been published papers and books, presented at conferences as well as through the station's website. They believed that the dissemination of science had a positive impact on all other stakeholders. The dissemination provided primary information for decision-making in the interest of natural resources, such as the integration of the importance of ancestral traditional knowledge on the use of the forest, management of the traditional chakra system, useful plants transmitted from generation to generation, promoting sustainable Indigenous development and respect for the *pacha mama* (mother

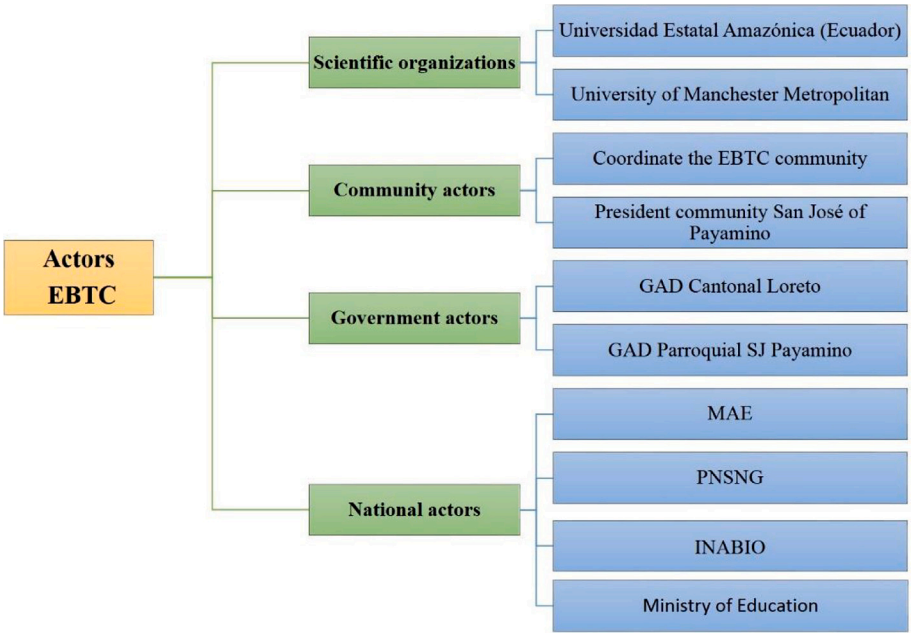

Fig. 3. Network of stakeholders involved in the management of the TCBS, San José de Payamino, Loreto canton, Orellana, Ecuador, 2018.

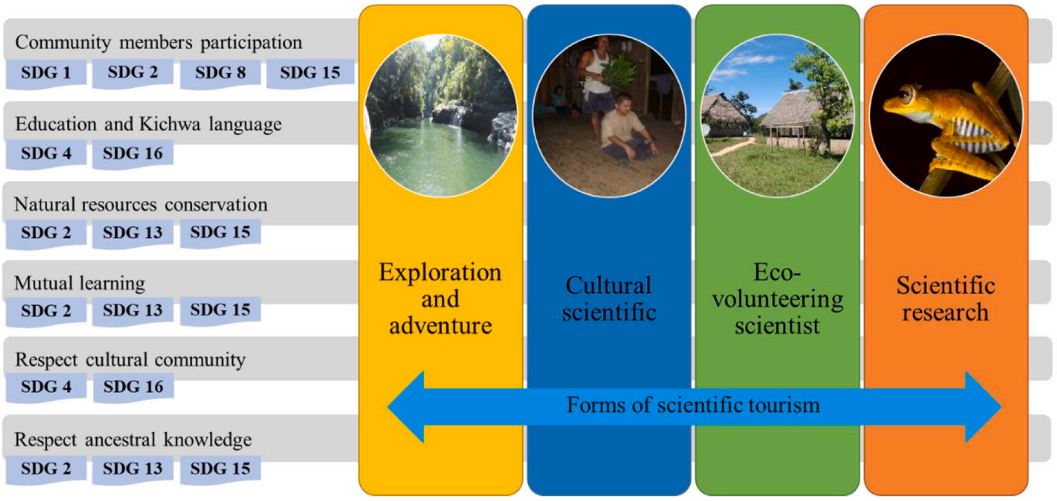

Fig. 4. Relationship between the forms of the ScT (Bourlon & Mao, 2011), the elements of community acceptance and the SDGs.

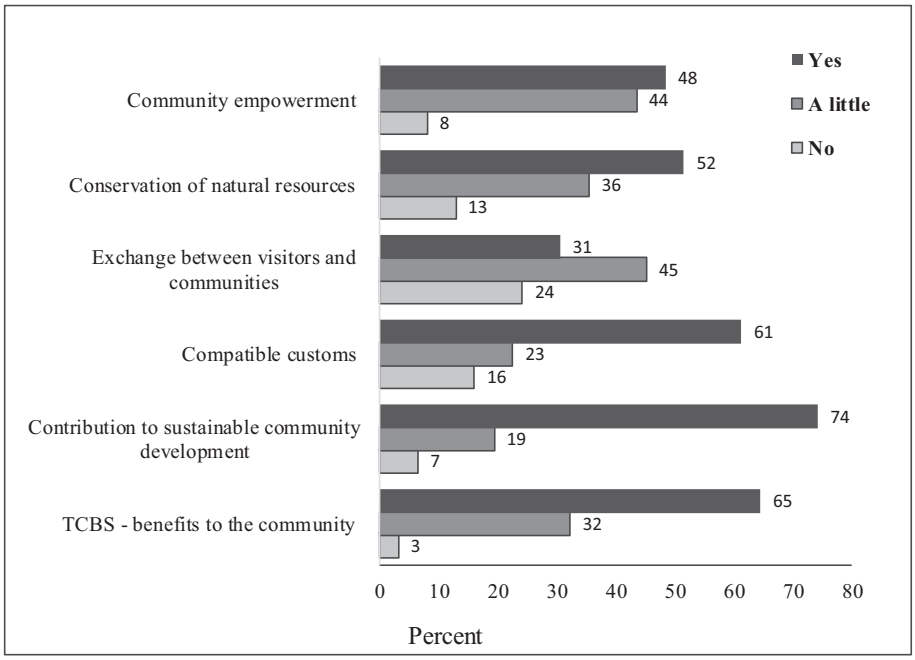

Fig. 5. Perception of San José de Payamino inhabitants regarding ScT carried out by the TCBS, Loreto canton, Orellana, Ecuador, 2018.

nature).

For this sector, the highest value of all forms of ScT was given to the conservation of natural resources (Fig. 7). This value was related to the visitors' level of specialization, as most were coming for summer courses in biological sciences or related sciences from three British universities (Manchester Metropolitan University, the University of Sheffield and the University of Glasgow), two American institutions (Alma College and Biodiversity Group) and one Ecuadorian university (Universidad Estatal Amazónica). These stakeholders also had a high appreciation for all the forms of ScT determined by Bourlon and Mao (2011) (Fig. 7), although, the value of respect for cultural identity was slightly lower for the exploration and adventure ScT as well as lower value of participation of community members in activities for the eco-volunteer participation.

4.2.2. Perception of local government actors

The local government deemed that the elements of "participation of community members", "respect for ancestral knowledge", "conservation of natural resources" and "respect for cultural identity" are the ones most related to the forms of scientific tourism mentioned by Bourlon and Mao (2011). There appeared to be less interest for all forms of ScT regarding mutual learning (Fig. 8).

4.2.3. Perception of national government actors

The national government stakeholders perceived the Scientific Research form of ScT with the highest values for all Indigenous worldviews (Fig. 9). Interestingly, cultural scientific ScT and exploration and adventure ScT were not perceived as high under the respect for cultural identity and community members participation worldviews as the other ScT forms.

4.2.4. Perception of community stakeholders

The key community stakeholders had in general positive perceptions of the four forms of ScT (Fig. 10), regarding the various Indigenous worldviews being promoted in the community. However, there are some

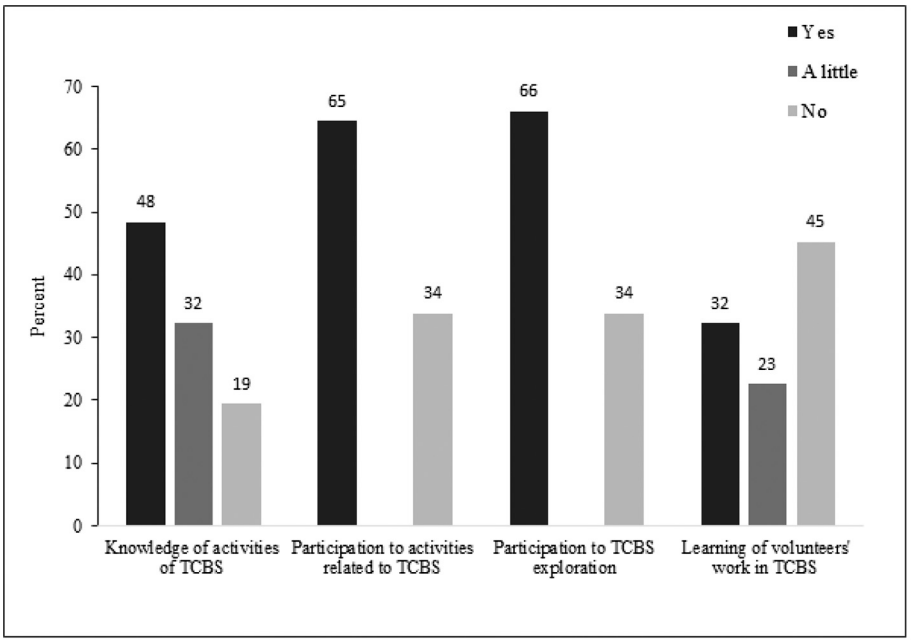

Fig. 6. Level of involvement of the Kichwa community with TCBS activities, Loreto canton, Orellana, Ecuador, 2018.

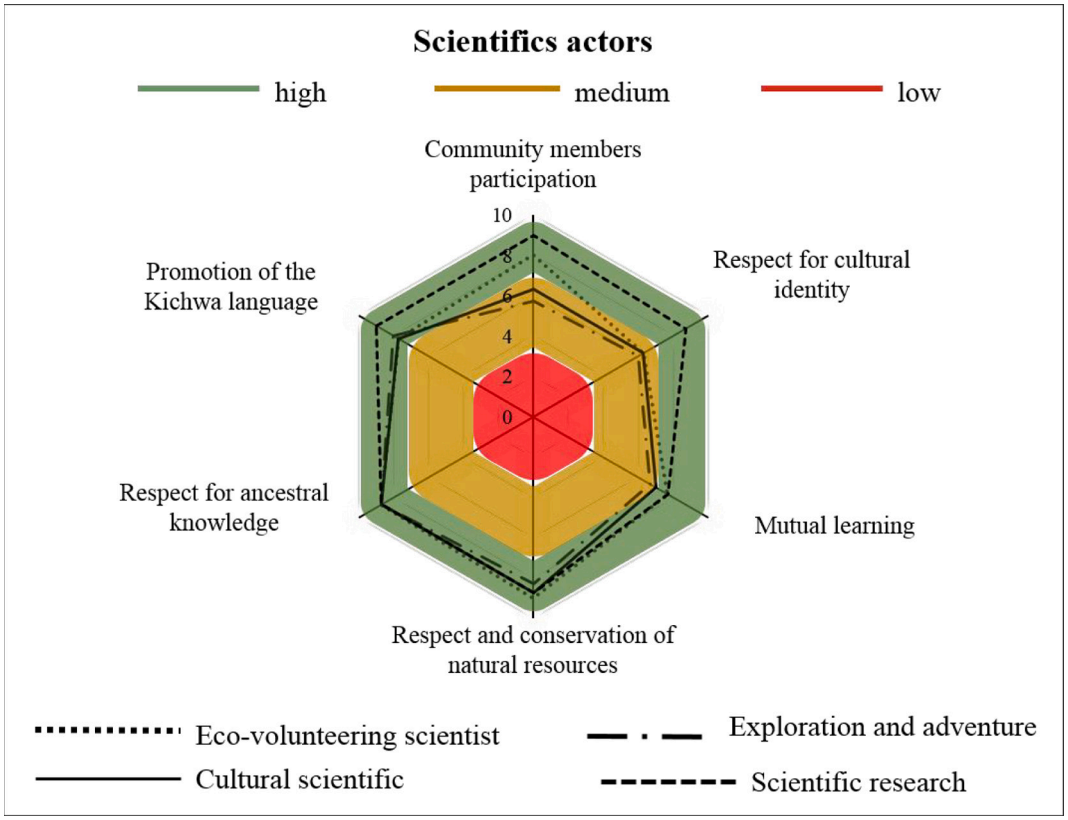

Fig. 7. Perceptions of stakeholders from scientific organizations about the relationship between forms of ScT and the indigenous worldview in San José de Payamino, Loreto, Orellana, Ecuador, 2018.

variation among them. For instance, eco-volunteer scientists working in ScT were perceived as less interested by Kichwa language and participation of community members than the other forms of ScT. The other forms of ScT supported directly to San José de Payamino though the promotion and respect for ancestral knowledge and cultural identity, and conservation of natural resources.

4.3. Economic benefits of ScT to the community

The economic revenues derived from ScT carried out at the TCBS were managed by the San José de Payamino leadership team. One of the most important revenues generated by the various activities considered in this document as ScT at the TCBS was the admission fees to the

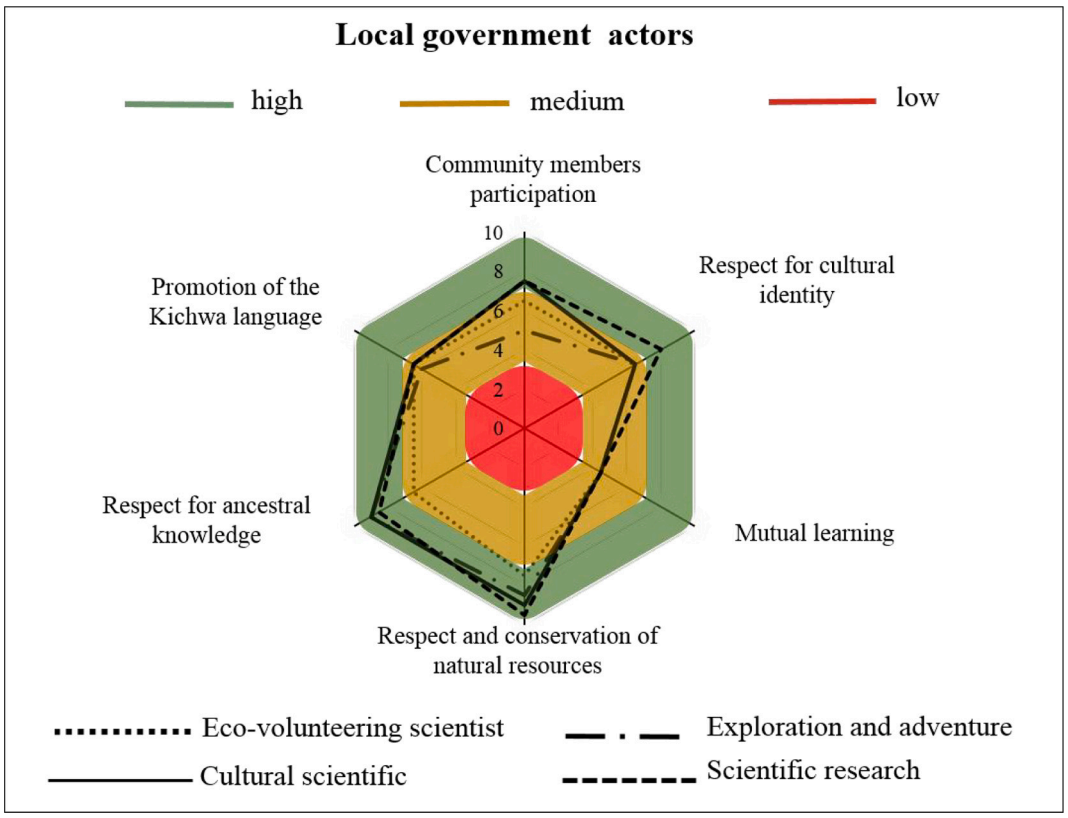

Fig. 8. Perceptions of local government stakeholders on the relationship between forms of ScT and the indigenous worldview in San José de Payamino, Loreto canton, Orellana, Ecuador, 2018.

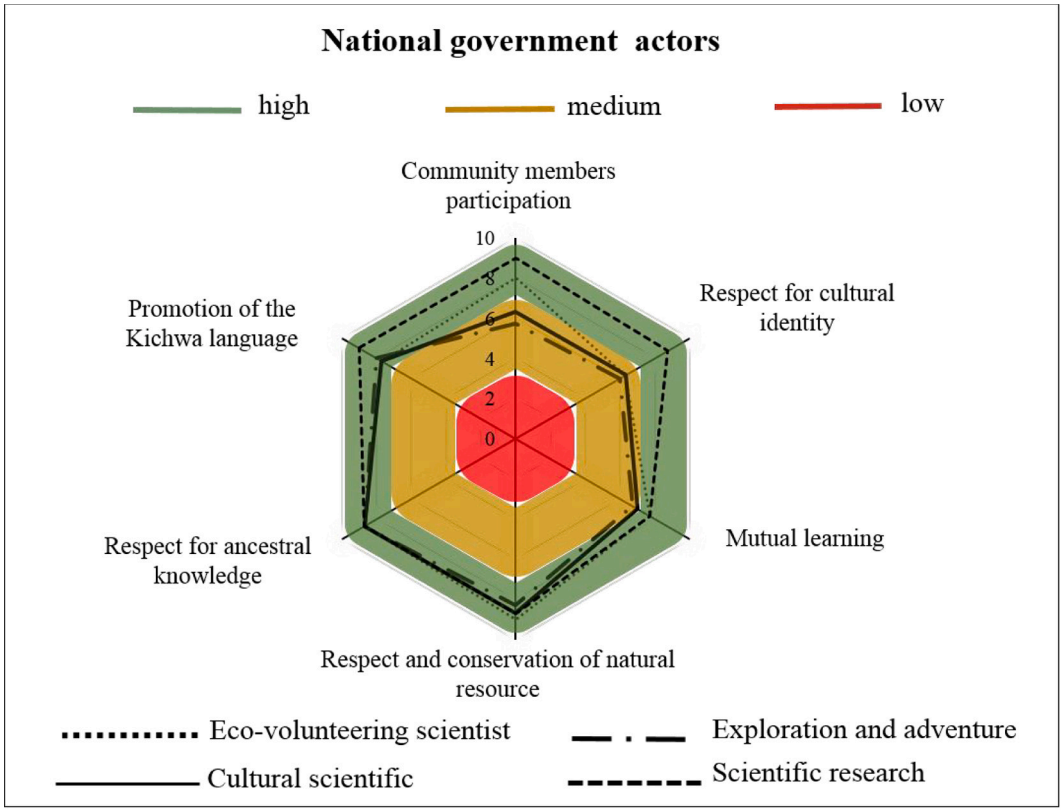

Fig. 9. Perceptions of national government stakeholders on the relationship between forms of ScT and the indigenous worldview in San José de Payamino, Loreto canton, Orellana, Ecuador, 2018.

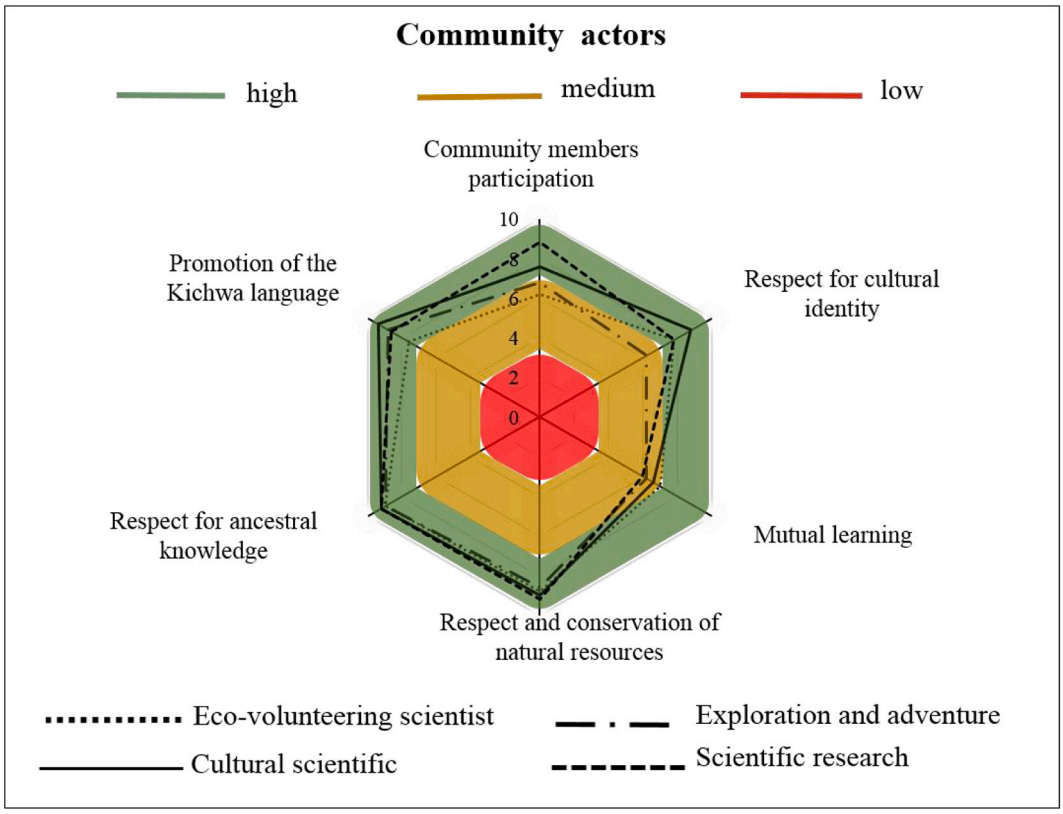

Fig. 10. Community stakeholders' perceptions of the relationship between forms of ScT and the indigenous worldview in San José de Payamino, Loreto, Orellana, Ecuador, 2018.

community and its sites for research trials and exploration activities. These fees were regulated and agreed upon between the community and the TCBS administration team, starting with a daily entrance fee of $3USD from 2011 to 2012, rising to $5 from 2013 to 2015, and an increase in 2016 to $7 per person per day. These entrance fees to the TCBS generated an average annual income ranging from $3474 to $5000 for San José de Payamino (Fig. 11). Overall, from 2011 to 2018, the community received $31,995 just by the entrance fee.

In addition to the fees from TCBS to the community, community members also obtained income derived from different ScT activities. Each person involved received an income: $17 person/day for general labor, $25 p/d for kitchen services, and $20 p/d for the kitchen assistant (Table 1). Other incomes included transportation of visitors to various sites and comprised the costs for drivers and wages of the canoe boat driver's assistant. For instance, a trip to the parrot saltlick observation point brought $100 p/d, while a visit of the caves and lagoon of the

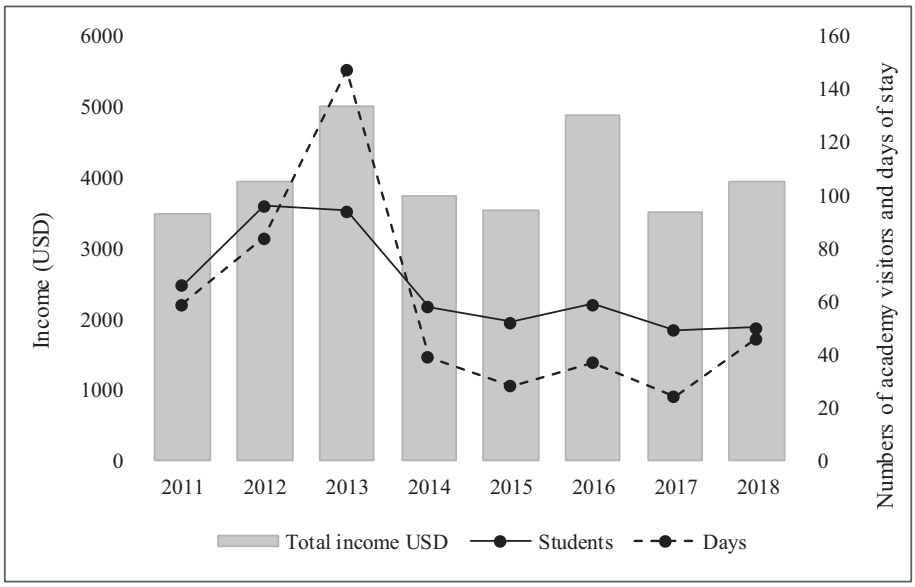

Fig. 11. Average annual income (in USD) obtained from ScT activities at the TCBS for the benefit of the San José de Payamino community, Loreto canton, Orellana, Ecuador, 2018.

Table 1
Table of activities related to the TCBS and wages paid in USD/day to community members of San José de Payamino, Loreto, Orellana, Ecuador, 2018.

Activity	(USD/day)
Tour guide	17
Canoe boat driver	17
Assistant canoe boat driver	17
Chef	25
Kitchen assistant	20
Cleaner	17
Builder	17
Maintenance person	17
Field guide	17
Secretary	–
Researcher alongside volunteers	17

Cachiyacu River was $135 p/d and the Timburi Cocha lagoon and other waterfalls, $200 p/d.

.

5. Discussion

The current study demonstrated the importance of ScT in the community of San José de Payamino and the crucial role that TCBS played in this support. Perceptions were overall positive for both households and key stakeholders. ScT could be in this case a positive approach for biological and cultural conservation as well as local sustainable development and thus contributing to SDGs. Although Ecuador has an average SDG index 74 (Sachs et al., 2020) across the 17 SDGs, this number represents the national average. Here, the discussion is limited to the specific local reality of the Indigenous populations of the Ecuadorian Amazon.

5.1. The Community

The local population expressed their support to keep the TCBS operating in the community, since it contributed to sustainable development, awareness of their natural resources and the preservation of their traditional knowledge. One community member summarizes the advantages of the presence of TCBS inside the Payamino Community as a follow: *"I personally think that the TCBS should stay within the community, because it helps us in the knowledge of our natural resources and at the same time, we have jobs and income as guides for the students and researchers. As members of the community, we want to continue working and providing maintenance to the station"* (B J, 19/10/2018). These results are in line with UNESCO's Man and the Biosphere Programme, which views biosphere reserves as sites of learning and information exchange for conservation and sustainable development (UNESCO, 1996).

The activities carried out at the TCBS empower the community in terms of forest conservation, alongside respecting cultural identity, and ancestral knowledge. This is also aligned with the objectives of the Ecuadorian Government's National Development Plan (PND, for its Spanish initials) 2017–2021, which promotes the recognition of the rights of nature, natural heritage protection and ancestral knowledge (SENPLADES, 2016). For instance, many volunteers and researchers who visited the TCBS recognized the importance of the traditional local agroforestry system called "*chakra*", as was clearly stated by a former president of the San José de Payamino Community *"The volunteers appreciate the knowledge of the ancestral chakra system and the use of natural medicine* (Shamanism)*, they want to help the community members to improve their productive systems, helping to identify seeds and planting fruit plants, teaching about the nutritional values of the plants of the SJP community"* (L P, 19/10/2018). The majority of the Amazonian Kichwa population uses this type of productive system on their farms (Coq-Huelva, Higuchi, Alfalla-Luque, Burgos-Morán, & Arias-Gutiérrez, 2017; Coq-Huelva, Torres, & Bueno-Suárez, 2017; Torres et al., 2014; Torres, Jadan, Aguirre, Hinojosa, & Günter, 2015; Torres, Vasco, Günter, & Knoke, 2018). The *chakra* is considered a polyculture (Vera, Cota-Sánchez, & Grijalva, 2019; Coq-Huelva, Torres, & Bueno-Suárez, 2017), characterized by high level of biodiversity conservation (Vera et al., 2017) and high timber and fruit production (Jadán, Günter, Torres, & Selesi, 2015; Torres et al., 2015). The management of the *chakra* is a livelihood and an integral part of the culture and traditions of the households in Payamino (Torres, Vasco, et al., 2018; Coq-Huelva, Higuchi, et al., 2017, Coq-Huelva, Torres, & Bueno-Suárez, 2017), supplying them with food, medicine, building materials, etc. Visitors to the TCBS appreciate and are looking to exchange knowledge about the application of the useful plants of the Payamino chakra and forest (Doyle et al., 2019).

Synergies have also appeared. For instance, the knowledge of the presence of animals by examining their footprints, feces, etc. by the local people has helped improve the use of camera traps by research, by locating them more effectively. Thus, the researchers can more easily identify the species of animals that have passed or remained in each location and, with the help of the community members, recognize the local ancestral knowledge. Community members can also recognize and confirm the identity of these recorded species and discuss the presence of a wide variety of specimens in the community's surroundings.

Given that more than half of the population of Payamino has participated in activities at the TCBS, these actions to value the *chakra* system, as well as the synergies and exchange of knowledge in other activities allow the community to empower themselves with their culture and traditions (García & Martinez, 2017). This traditional farming system has attracted volunteers and researchers to contribute in local activities of producing edible plants, this engaging with SDG 2 "End hunger, achieve food security and improve nutrition and promote sustainable agriculture" (Scheyvens, 2018). This system also supports SDG 1 "No poverty" by selling sustainable products and receiving daily wages aligning as well with SDG 8 "Decent work for all and economic growth" and SDG 16 "Peace and justice strong institutions" promoting inclusive decisions embodied in the decisions taken in the community assemblies. As the system enhances biodiversity and promotes tree growth, it contributes to SDG 13 in climate change through carbon sequestration and SDG 15 "Life on land", through promoting forest conservation and halt biodiversity loss.

5.2. The stakeholders

Respect for traditional knowledge (SDG 2) and conservation of forest resources (SDG 13 and SDG 15) were in the most important aspects for all the key stakeholder groups. This finding is important since in Ecuador, most of the native forests (65%) is controlled by indigenous peoples (Morales, Naughton-Treves, & Suárez, 2010; Palacios, 2005). In this respect, the ScT may emerge as a new strategy to promote forest conservation in indigenous communities and avoid unsustainable practices, including the overexploitation of timber (Bremner & Lu, 2006) whether legal or illegal (Vasco, Torres, Pacheco, & Griess, 2017). These patterns are clearly confirmed by the statement of a Park ranger of the Sumaco Napo Galeras National Park who explained that *"The presence of the Biological Station (TCBS) helps us to sensibilize the local population about the significance of the community's forests for the conservation of the Sumaco Napo Galeras National Park, that is to say the community members are also interested in taking care of the park and sometimes they tell us if someone is harvesting trees or invading the area of Sumaco National Park"* (E C, 19/10/2018). However, more resources may be needed to adequately regulate this new livelihood activity. This would also mean integrating governance elements such as rules and incentives to ensure forest conservation (Davis, Williams, Lupberger, & Daviet, 2013; Larson & Petkova, 2011).

The key stakeholders' perceptions revealed a common interest in the management and conservation of the natural resources in the San José de Payamino community. These stakeholders also expressed positive

opinions about the administration of the TCBS for both the management of natural resources and the livelihoods of the community. Similar perceptions have been reported for others scientific stations, such as the Yasuní scientific station (Navarrete et al., 2015) and the San Francisco Scientific Foundation (Paladines, 2003). In all these cases, the sustainable use of natural resources converts communities into guardians and defenders of nature (Fundación Científica San Francisco, 2003).

5.3. Partnership for sustainable development

According this study, the revenues coming from the TCBS inside the San José de Payamino community support SDG 17 "Partnership for sustainable development". Manchester State University, Manchester Metropolitan University and the University of Glasgow (UK), Alma College (USA), Biodiversity Group (USA) and the Universidad Estatal Amazónica (Ecuador) have regularly visited the TCBS to carry out summer courses with different activities related to ScT. Through all these activities, 50–150 students and academics visit the TCBS annually, staying at the station for 20–150 days a year, generating an income for the community of up to $5000 per year. One of the leaders of the community stated that *"With the funds that we receive from the scientific station, TC helps us to cover the needs in the development of the mingas* (compulsory communal work projects)*, community projects, also serves to cover expenses for emergencies of illnesses within the villagers, and in the same way serves to carry out legal paperwork and arrangements to the different institutions such as: municipality, provincial council, MAGAP, etc."* (W B, 18/10/2018).

This research also reports at least four main types of investments that the community has made in the last 10 years with the resources obtained from the TCBS: a) development of legal and administrative procedures in the towns of Loreto and Coca; b) support of community households implementing agricultural crops; c) provision of funds for mingas; and d) cover of medical emergencies or illnesses within the community. In 2014 and 2015, the funds obtained from ScT activities was used to buy school supplies for the community's children, effectively targeting SDG 4 "Quality education".

6. Conclusions

The perception of the population is that the activities carried out by the TCBS do contribute to the sustainable development of the community and to the management of natural resources, reconciling the ScT activities with the traditions of the community. Community members also agree that the TCBS should continue to operate, as it benefits the local population in a sustainable, scientific, and economic way and raises awareness of management of natural resources. While the current agreement with Manchester University is finished for now, other options are being contemplated to sustain the research activities of the station.

The 2015 SDGs are key for strengthening sustainable tourism and development in the Kichwa community San José de Payamino. Communities and developing countries need motivation and incentives in order to find a way to optimize tourism development compared to developed countries. Charities and scientific stations can support communities in environmental and scientific ways, awareness in the management of their natural resources and employment to those communities.

As more than half of the population participated to TCBS activities, household heads perceived that the activities carried out by the TCBS empowered the community by recognizing their cultural and ancestral values. When volunteers or scientists appreciate their traditional knowledge, their management of the chakra system and their conservation of the forest, the community becomes empowered.

The key community, national, local, and scientific stakeholders, as well, saw the activities of the TCBS in a positive light, because the activities combined Indigenous knowledge with ScT. The scientific organizations wanted that these activities help the community to manage natural resources. The activities also have a scientific benefit when research results are published, producing a positive effect on other stakeholders. The research provides primary information for decision-making that benefits the local population's natural resources and sustainable development.

Since the beginning of the work of the TCBS, there has been no evidence of intercultural conflict. This can be attributed to three main points: a) there is an agreement between the community and the TCBS, which is updated every 2 years and requires the approval of the entire community assembly; b) the TCBS has been involved with almost 70% in science tourism activities with permanent participation in community activities and c) the TCBS has supported the community during disasters or crises, and has provided school supplies for all the children in the school, and d) the community receives on average USD 5000 per year in income from science tourists coming to the TCBS.

The sustainable benefits of the TCBS are important for the community of San José de Payamino, since its economic, environmental, and social contributions are fundamental for the conservation of the community's culture, resources and well-being all related to SDGs. Its presence enhances the sustainability of the community in the long term.

Author contribution statement

Gabriela Izurieta: conceptualization, metodology, investigation data curation, formal analysis, software and writing - original draft.

Alexandra Torres: methodology, investigation; writing - original draft, project administration, supervision and funding acquisition.

Cristian Vasco: metodology, validation, visualization, writing - review & editing.

Liette Vasseur: supervision, validation, visualization and writing - review & editing.

Héctor Reyes: investigation, software, visualization.

Bolier Torres: conceptualization, methodology, investigation, formal analysis, software, writing - review & editing.

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Additional information

No additional information is available for this paper.

Conflicts of interest

The authors declare no conflict of interest.

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Appendix A. Household survey project: science tourism in the Kichwa community San José de Payamino

1. Información de Control

Task	Date(s)	Surveyor?	¿Good condition? If not, provide comment
1. Survey of the questionnaire			
2. Review of the questionnaire			
3. Coding			
4. Entry of information			
5. Review and approval of information entry			

2. Household composition

A. ¿Who are the members of the household?

1. Number of personal identifications (PIN)	**Household member´s name**	**2. Relationship with the head of household 1**[1]	**3. Sex** *0= man 1=woman*	**4. Year of birth**	**5. Etnicity**[2]	**6. Commonly spoken language**[3]	**7. Estado civil** [4]	**8. Education** *(number of years completed)* (for 5 years and more)	**9. Can read and write** *((0=no 1=yes)*	**10. ¿Were you born in this community?**
1		Household head = code 0								
2										
3										
4										
5										
6										
7										

1) *Codes: 1=wife; 2 child; 3=son-in-law/daughter-in-law; 4=grandson; 5=mother/father; 6=father/mother in law; 7=brother/sister; 8=brother/sister in law; 9=uncles; 10=nephew; 11=seated/adopted children; 12=other family members; 13=unrelated (ej: servant).*

2) *1=Mestizo; 2=White; 3=Kichwa; 4=other, specify.*

3) *1=Spanish; 2=Native; 3=Foreign.*

4) *1=Single; 2=married/united; 3=separated/divorced; 4=widowed.*

3. Perception of Timburi Cocha Biological Station (TCBS)

A. Perception of science tourism

1. ¿Do you consider that the TCBS benefits the community?
   1=NO *2=A LITTLE* *3=YES*
2. ¿Do you know about the activities that take place in the TCBS?
   1=NO *2=A LITTLE* *3=YES*
3. ¿ Have you or any family member participated in any TCBS-related activity?
   0= NO *1= YES*
   ¿If yes, what?.....
4. ¿ Are you aware of the activities at TCBS?
   1=NO *2=A LITTLE* *3=YES*
   ¿If yes, which ones?.....
5. ¿Do you think it is important for TCBS to continue to function within the community??
   1=NO *2=A LITTLE* *3=YES*
6. ¿Do you believe that the EBTC has contributed to the economic, environmental, social and cultural development of the community?
   1=NO *2=A LITTLE* *3=YES*
7. ¿Do you think it is important to make an inventory of the tourist attractions that the community has?
   0= NO *1= YES*

B. Participation in scientific tourism activities

1. ¿Have you or any member of your household participated in any exploration or adventure activities with TCBS visitors?
   0= NO *1= YES*
   ¿If yes, what?.....

2. ¿Do you consider this activity compatible with your cultural customs?
   1=NO *2=A LITTLE* *3=YES*
   ¿ ¿If yes, what?.....

3. ¿Do you know what the volunteers who come to TCBS do?
   1=NO *2=A LITTLE* *3=YES*
   ¿If yes, what?.....

4. ¿Do you think there is a learning exchange between volunteers and community members?
   1=NO *2=A LITTLE* *3=YES*
   ¿If yes, what?.....

5. ¿Do you consider that the activities of the EBTC contribute to the management of the natural resources of the Payamino community?
   1=NO *2=A LITTLE* *3=YES*
   ¿ ¿If yes, why?.....

6. ¿Do you consider that TCBS's cultural-scientific activities contribute to the empowerment of Kichwa culture in the community?
   1=NO *2=A LITTLE* *3=YES*
¿ ¿If yes, how?.....

¡Thanks!

. (*continued*).

Appendix B. Perception of the Timburi Cocha Biological Station (EBTC)

Form for the analysis of the key actors (using in workshops and interviews conducted with the participation of key stakeholders (including members of the existing community assembly as another key actor) involved or interested in the proper functioning of the TCBS.

a) **Scientific tourism (ScT) perception at the TCBS on the conservation of natural resources management and SDGs**

1. ¿What is your perception of the functioning of the TCBS in the Payamino community?
2. ¿Do you think the TCBS ScT forms are benefiting the community?
3. ¿Do you think TCBS's ScT is creating ecological awareness among community members?
4. ¿Do you think the TCBS ScT promotes care of natural and cultural resources?

5. ¿ Do you think the TCBS model of ScT can be transferred to another community?

b) **Perception of ScT in TCBS and improvement of living standards in the community and contribution to SDGs**

6. Do you think that the TCBS's ScT activities contribute in any way to improving the economy of the households in Payamino?
7. Do you think that other institutions should be involved to contribute to the ScT management model at TCBS?

c) **Relationship of forms of scientific tourism (ScT) with elements of community acceptance and SDGs**

ScT forms	Elements of community acceptance and SDGs	Ranking 1 al 10	Observations
Exploration and adventure	Participation of community members in activities		
	Empowerment or respect for cultural identity		
	mutual learning		
	Respect and conservation of natural resources		
	Respect for ancestral knowledge		
	Promotion of the Kichwa language		
Cultural scientific	Participation of community members in activities		
	Empowerment or respect for cultural identity		
	mutual learning		
	Respect and conservation of natural resources		
	Respect for ancestral knowledge		
	Promotion of the Kichwa language		
Eco-volunteering scientist	Participation of community members in activities		
	Empowerment or respect for cultural identity		
	mutual learning		
	Respect and conservation of natural resources		
	Respect for ancestral knowledge		
	Promotion of the Kichwa language		
Scientific research	Participation of community members in activities		
	Empowerment or respect for cultural identity		
	mutual learning		
	Respect and conservation of natural resources		
	Respect for ancestral knowledge		
	Promotion of the Kichwa language		

d) **Relationship of scientific tourism (SCT) to Conservation and Sustainable Development (SDGs)**

What is your perception of the contribution of ScT forms with: Conservation, sustainable rural development SDGs, tourism development?

ScT forms	Biodiversity conservation	Sustainable Rural Development SDGs	Scientific development	Tourism development	Average
	1–10	1–10	1–10	1–10	
Exploration and adventure					
Cultural scientific					
Eco-volunteering scientist					
Scientific research					

¡Thanks!

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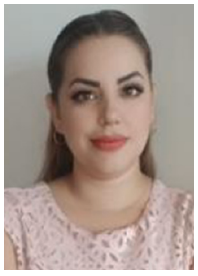

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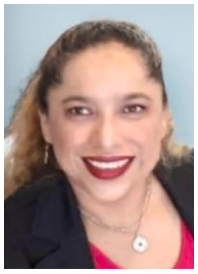

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