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Defining Biodiversity: A Local Assessment of the Tahuayo River, Peru Using Self-directed Photography

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DEFINING BIODIVERSITY: A LOCAL ASSESSMENT OF THE TAHUAYO RIVER, PERU USING SELF-DIRECTED PHOTOGRAPHY

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by

Rozsika Danielle Steele

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ABSTRACT

DEFINING BIODIVERSITY: A LOCAL ASSESSMENT

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The Área de Conservación Regional Comunal Tamshiyacu Tahuayo (ACRCTT), located in Loreto, Peru, protects 420,000 hectares of the Amazon basin. In 2009, the ACRCTT received formal government recognition after three decades of advocacy and conservation work by resident communities. Local resource users who live a subsistence lifestyle possess sophisticated Traditional Ecological Knowledge (TEK) that can be used to identify which constituents of biodiversity are culturally relevant. This information can help resource managers develop an operational definition of biodiversity. Self-directed photography is a research method that allows participants the opportunity to direct data collection and empowers them to visually communicate their perceptions. This article demonstrates how self-directed photography can be used to access TEK and facilitate the development of holistic resource management plans that advocate local stewardship. Thirty-three participants (a 47% sample of households) in the rural Amazonian communities of Buena Vista and El Chino on the Tahuayo River, were given cameras and two weeks, and asked to photograph the people, places, or things that were most important to them. Participants sorted their photographs in order of relative importance and then provided a narrative description of each image. The images identified as being

the ten most important, a total of 320 photographs, were considered for analysis. Plants and trees represented 63% of these images, with 74 distinct species identified.

ACKNOWLEDGEMENTS

I would like to thank my translator Jhonatan Erik Rodrguez Macuyama and my local field guides Samuel Huayllahua, Samuel Memao, and Freddy Flores Tello, who kept me safe from poisonous snakes and helped me find an endless variety of tropical fruit.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Biodiversity is claimed as a global resource and responsibility (Sarkar & Montoya, 2010) but because it is bound by geography, it is managed at the local level, though not always by the local people (Vermeulen & Koziell, 2002). Reasons for conserving biodiversity range from economic considerations for ecosystem services and species diversity, to the intrinsic and spiritual value of landscapes (Sarkar, 1999). There is disagreement between conservationists, not only about best management practices, but also what the essential purpose of biodiversity conservation should be (Naughton-Treves, Holland, & Brandon, 2005). This disagreement reflects differences in cultural norms and values (Sarkar, 2008; Guha, 1989).

It is crucial to recognize the different value systems and interests that motivate stakeholders. Social conservationists view the human species as being inextricably integrated within the natural environment and believe community stewardship and sustainable use are the most practical solutions to the problem of biodiversity conservation (Miller, Minteer, & Malan, 2010). Strict biological preservationists believe natural landscapes, like the Amazon Rainforest, are pristine wilderness that must be protected from human exploitation (Terborgh, 1999). This mandate has led to the physical and economic displacement of local resource users, who commonly are of indigenous origins (Agrawal & Redford, 2009; Brockingham & Igoe, 2006), and has created a contentious atmosphere that is contributing to the failure of conservation efforts (Chapin, 2006). Conservationists need to cultivate relationships with stakeholders that

will promote a balance between biodiversity conservation and respecting the rights of local resource users (Chapin 2004; Chicchon, 2009).

The conservation of biodiversity is further complicated by the comprehensive nature of its definition. The International Convention of Biological Diversity (2003) defined biodiversity as "the variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems." The scale of this definition is equal parts staggering and intangible. Without an operational definition of biodiversity, attempting to develop a pragmatic resource management plan is unfeasible (Sarkar, 2008).

Using an umbrella term that encompasses all life on Earth creates a problem of complexity for the development of conservation policy. Faith (2005) considered the term biodiversity to symbolize a gap in our knowledge about the natural world. He argued that the conservation of biodiversity is ultimately about preserving global option values so that we may continue to receive the benefit of species and ecosystem services that we have not yet discovered or do not fully comprehend. However, the ambiguity of the definition of biodiversity substantially limits any practical application of the concept (Hamilton, 2004).

Sarkar and Montoya (2010) discussed the need to narrow the scope of this definition by identifying which constituents of biodiversity will be targeted for conservation. These targets can vary widely depending on the focus of the conservation and their designation often hinges on educated intuition (Sarkar, 1999). For this reason, biodiversity conservation is progressively focused on the interactions of stakeholder

groups, particularly local resource users. There cannot be a universal definition of biodiversity that encompasses the values of Western conservationists without considering the diversity of cultures represented by local resource users (Sarkar, 2008).

The perception that indigenous people are spoiling utopia is unfairly casting them as the villains of their own story (Gupta & Ferguson, 1992), and making them scapegoats for environmental degredation that is the result of global overconsumption of natural resources (Guha, 1979). Hayes and Ostrom (2005) discussed the efficacy of collaborative partnerships with resident communities. When local resource users are involved in the development of policy, rulemaking, and enforcement, there is a significant and positive correlation to high vegetation density in conservation zones (Hayes & Ostrom, 2005). Bureaucrats may be capable of developing broad institutional frameworks for protected areas but it is the people on the ground who determine whether conservation will succeed (Berkes, 2007; Hayes & Ostrom, 2005).

Resident communities should not be seen as obstacles to success but rather as authorities on their environment, who can provide meaningful insight into areas targeted for conservation (Berkes, 2007; Hayes & Ostrom, 2005). Indigenous perspectives on biodiversity conservation reflect a cumulative knowledge that is acquired incrementally through generations of resource use. An understanding of antecedent conditions contextualizes fluctuations in resource availability. Self-regulatory mechanisms often develop when subsistence communities must adapt to periods of resource scarcity (Gadgil, Berkes, & Folke, 1993). This intrinsic awareness of ecosystem dynamics is the result of local resource users' shared cultural experience (Gomez-Baggethun, Corbera, & Reyes-Garcia, 2013).

Local level assessments of environmental conditions involve a similar process as modern science; however, this kind of knowledge is not readily available in scientific literature because it is learned in situ by way of cultural transmission (Vermeulen & Koziell, 2002). Research has shown that Traditional Ecological Knowledge (TEK) can parallel scientifically collected botanical data more than 80% of the time (Jinxiu et al., 2004; Halme & Bodmer, 2007). The development of holistic resource management plans that capture the interconnectedness of local resource users and their landscape would benefit from the inclusion of TEK and community stewardship (Barthel, Crumley, & Svedin, 2013; Berkes, Colding, & Folke, 2000; Boillat & Berkes, 2013; Boissiere et al., 2013; Oteros-Rozas et al., 2013; Ruiz-Mallen & Corbera, 2013).

Vermeulen and Koziell (2002) describe the value of ethnographic field studies that investigate the connection between humans and their environment. These studies require extensive fieldwork and immersion into a culture to interpret local values and perceptions. Unfortunately, this method is not often practical due to time and financial constraints. This article demonstrates how the application of self-directed photography in conservation planning can serve as means to rapidly access TEK while still maintaining some of the integrity of ethnographic field studies.

Self-directed photography (Markwell, 2000; Moore et al., 2008), also known as resident-employed photography (Beckley et al., 2007), or Photovoice (Beh, Bruyere, & Lolosoli, 2013), has been used to understand place attachment across disciplines. This method requires participants to photograph a set of images that will become the basis for an interview about their choices. Markwell (2000) described this as an advantage of self-directed photography because control of the data collection is turned over to the

participant through their decisions about what is photographed. The camera is a way to empower participants by enabling them to document their perceptions (Moore et al., 2008). This process requires participants to be introspective so they can effectively communicate their stories to the researcher. The absence of the researcher during the photography process allows the participant more time to form responses that fully articulate their intentions behind each image (Beckley et al., 2007). Self-directed photography can give researchers access to a participant's life in a way that would not normally be possible in an abbreviated timeframe (Moore et al., 2008). Beh, Bruyere, and Lolosoli (2013) described this process as a legitimate way of incorporating resident communities into the resource management planning process, particularly in areas with high biodiversity where local resource users may be semiliterate.

This article demonstrates how self-directed photography can be used to identify constituents of biodiversity that are culturally relevant so they can be prioritized in resource management plans. This methodology was employed to interpret local connections to the environment in the Amazonian communities of El Chino and Buena Vista on the Tahuayo River in Loreto, Peru. The Tahuayo river borders the Área de Conservación Regional Comunal Tamshiyacu Tahuayo (ACRCTT), a reserve that was formally recognized by the government after decades of advocacy and conservation work by resident communities. Self-directed photography can initiate a dialogue between conservationists and local resource users that will help to create and sustain participatory conditions.

CHAPTER II

LITERATURE REVIEW

This literature review prioritizes the impacts of different strategies for conserving natural resources in Peru. Conservation policies that aim to control unsustainable land use, such as parks and reserves, have at times resulted in increased impoverishment risks for local resource users. Insufficient funding for conservation and poor relationships with resident communities creates a contentious atmosphere contributing to the failure of conservation efforts (Agrawal & Redford, 2009; Cernea & Schmidt-Soltau, 2003; Naughton-Treves, Holland, & Brandon, 2005). In the proceeding pages, I review the literature relevant to situating conservation strategies in Peru.

The Peruvian government assigned formal protection to 31% of the Amazon Rainforest between the years of 1999-2005, during a neoliberal period that mutually emphasized establishing conservation areas and natural resource development or extraction (Oliveira et al., 2007; Young & Rodriguez, 2006). Oliveira et al. (2007) utilized satellite imagery to examine changing rates of forest disturbance and deforestation in and near restricted areas of the Amazon Rainforest over a six-year period. The research examined images from before and after protected areas and extractive concessions were established to identify a baseline from which changes in resource use could be determined. Forest damage was found to be low within natural protected areas, titled indigenous territories, and some sanctioned extractive concessions, suggesting these types of land-use allocations may be useful for conservation. However, they found evidence that forest disturbances and deforestation increased significantly in the area surrounding a restricted zone. This phenomenon is referred to in the literature as

leakage, or the displacement of extractive pressures to areas nearby a protected zone once resources use has been restricted (Oliveira et al., 2007). The perception that areas of restricted use are an effective strategy for conserving natural resources is confounded by evidence of leakage (Ewers & Rodrigues, 2008).

Historically, displacement of local resource users has occurred with the designation of a new protected area (Brockington & Igoe, 2006; Naughton-Treves, Holland, & Brandon, 2005). Displacement occurs when land is expropriated from resident communities for development or conservation. Restricting access to resources in communities that depend on the land for their livelihood has the same economic impact as forced resettlement (Cernea, 2005). Agrawal and Redford (2009) estimated that between 10.8 and 173 million people were displaced in the name of conservation as of 2009. Displacement is disproportionately imposed on impoverished communities and recurrently is achieved through the use of force. These "conservation refugees" face significant impoverishment risks that violate their basic human rights, resulting in a contentious backlash against conservation efforts (Cernea & Schmidt-Soltau, 2003; Chapin, 2004). A marked increase in poaching and vandalism of protected areas results when displaced people no longer have access to their home territories. India's Project Tiger is a notable example of this retailiation. Communities displaced by the creation of a tiger reserve joined forces with poachers to eradicate all tigers living within the boundary of the reserve (Sarkar & Montoya, 2010).

Another example of this backlash occurred after the creation of Peru's largest national reserve, Pacaya-Samiria. When the reserve was established the state forcibly removed entire villages from within the reserve's interior, displacing them to its

boundaries. Poaching significantly increased and eventually led to violent conflict that resulted in the death of two biologists and a park guard. After the conflict, the state incorporated community participation into their management strategy. This significantly decreased illegal poaching within Pacaya-Samiria National Reserve (Bodmer & Puertas, 2003). Cernea and Schmidt-Soltau (2003) discussed the need to address "double sustainability" when proposing a new protected area by taking into consideration the conservation of both biodiversity and the socio-economic integretity of resident communties.

Cardozo (2011) examined local attitudes toward the 2004 establishment of the Allpahuayo-Mishana National Reserve in Peru. Communities shared resources prior to the creation of the reserve. After its creation, communities residing within the reserve were granted exclusive usufruct rights and were awarded community titles in exchange for abiding by extractive quotas. Communities living in the buffer zone were banned from extracting resources. Cardozo found a significant difference between the attitudes of those living within the reserve and those living in the buffer zone. His data indicate this disparity is a result of the allocation of rights to extract resources and the capacity of households to adapt following economic displacement. The majority of those who were opposed to the reserve's creation cited a lack of community participation in the decision to restrict resource access as their reason for disapproval. Eighteen percent of buffer zone residents admitted to continued extraction of resources from the reserve. These residents did not consider their activities to be poaching because their families traditionally extracted resources from the area. Furthermore, there is evidence that leakage is occurring in the buffer zone.

Conservation-related displacement due to the creation of the Allpahuayo-Mishana National Reserve left evicted communities seeking areas where resources were still accessible. This has contributed to an increase in immigration to the ACRCTT and increased extractive pressures on the Blanco River (Newing, 2009). The consequences of displacement not only affect those who are forced to resettle, but also those communities who are forced to host displaced people and experience strain on natural resources due to sudden overpopulation (Cernea & Schmidt-Soltau, 2003).

Differences in cultural values and social customs have created distance between conservationists and indigenous people. The history of land reform in Latin America demonstrates a general disregard for traditional indigenous territories and lifestyles. Approximately eight-five percent of protected areas have indigenous populations residing within their boundaries (Colchester, 2000). Despite this fact, land conservation policies treated wilderness as vacant space that was available for development and indigenous people were marginalized and displaced from their territories (Chicchon, 2009; Naughton-Treves, Holland, & Brandon, 2005). Extractive industries (i.e., logging, mining) are encroaching on the rainforest and further threatening the livelihoods and landscapes of isolated indigenous populations. Chicchon (2009) suggested this is where indigenous people and conservationists have common ground. She urges these groups to form an alliance and establish a mosaic of land tenure that will work to both protect the biodiversity of the region and the integrity of indigenous cultures isolated within the Amazon Rainforest. Pagdee et al. (2006) found that when land tenure was defined community management of a common's resource was more likely to succeed because the owners felt secure in the benefits they would receive from the land.

Rural development and conservation initiatives are frequently considered as having conflicting agendas. Bodmer and Lozano (2001) found that unsustainable resource use often results when rural development projects attempt to produce immediate economic benefits for communities. Changing the focus of rural development projects to achieving long-term benefits from natural resources by way of sustainable use, might act to resolve this dilemma (Bodmer & Lozano, 2001).

Rainforest conservation can preserve the livelihoods of indigenous people through sustainable use. Economic cycles have shaped the composition of the forest through extractive industries. Natural and cultural effects are not easily separated from one another. Decisions regarding resource extraction are shaped by community circumstance. A community's ability to turn to improved technology or more labor-intensive methods will be restricted by poor capital. When constrained by poverty communities will turn to their most abundant resource, the land. It is critical to examine the factors that may uncover subtle nuances between communities' resource-use patterns so effective conservation policies can be developed (Coomes & Barham, 1997).

Conservationists partnering with indigenous organizations must be cautious to develop alliances from the bottom up to ensure the most vulnerable do not suffer the consequences of displacement (Chapin, 2004). When establishing relationships it is crucial to recognize the different value systems and interests that motivate stakeholders. Furthermore, it is important to acknowledge that every group of stakeholders is composed of individuals who may have different perspectives on the same issue. At the center of this relationship there must be an understanding that no group of people wants

to be displaced from their home, nor do they want to be excluded from decisions that will affect their livelihood (Chicchon, 2009).

The concept of community conservation is based on the premise that both conservationists and local resource users have a common goal: to protect natural resources from overexploitation and to preserve areas for the future (Newing & Bodmer, 2003). There is a divergence between conservationists who favor strict biological preservation and those who favor community participation and sustainable use. Conservationists who ascribe to the assumption that human presence negatively impacts biodiversity call into question the efficacy of community conservation (Agrawal & Redford, 2009; Terborgh, 1999). Others argue that humans are an integral part of the ecological equation (Guha, 1989; Chapin, 2004; Sarkar & Montoya, 2010), and landscapes such as the Amazon Rainforest are actually anthropogenic environments where resources are culturally managed by indigenous people for more than 5,000 years (Coomes & Barham, 1997).

It is important for external institutions and researchers to establish trust to overcome the challeges that arise when attempting to reconcile cultural differences. Chapin (2004) argued that too often, powerful conservation organizations place the burden of establishing trust on indigenous people and that these relationships frequently have a looming ultimatum to conform or be forcibly removed. Stakeholders must engage in open discussion to develop inclusive conservation programs that will preserve both biological and cultural diversity. This is not simply a matter of environmental justice, but also one of pragmatism (Chapin, 2004).

Sarkar and Montoya (2010) examined the case study of the Kandozi indigenous group in Peru, which provides an example of how a community's self-determination can yield tangible results for conservation. In 1945, Peru's Ministry of Fishery seized control of Kandozi territory and allowed commercial fishing operations to deplete fish stocks. Decades later, the Kandozi were able to successfully force out the Ministry of Fishery. A three-year moratorium on commercial fishing was self-imposed by the communities to allow fish stocks the time needed to recover. Since then, the Kandozi have collaborated with the Ministry of Fishery and Non-Governmental Organizations (NGOs) to develop a management plan that will secure their access to natural resources. Meanwhile, however, the Ministry of Energy and Mining has granted petroleum concessions that overlap with Kandozi territory without consulting or gaining permission from the communities themselves. This circumstance mirrors challenges faced by the communities of the ACRCTT. See Appendix A for a map of the ACRCTT that includes zoning for conservation and oil concession (Gobierno regional de Loreto, 2010-2015, pg 81).

The social ecology (SE) model of reserve management has advantages that provide for a more pragmatic approach to conservation. The most fundamental assumption of the SE model is that resident communities are not just stakeholders, but landowners with a privileged status. External entities, including conservation NGOs, are not considered as having a vested interest in biodiversity conservation (Sarkar & Montoya, 2010). The SE model is not a win-win solution for conservation. Win-win solutions, although highly marketable, are hindering honest and sober discussion about the necessary compromises that must be made when attempting to conserve biodiversity (McShane et al., 2010).

Ostrom (2007) warned against the application of panaceas to resolve complex social ecological problems and discussed the need for adaptive policies that have the capacity to evolve as we further our understanding of the problems we face. Ostrom developed a multi-tiered ontological framework for the analysis of SE systems to help overcome the problems associated with performing a meta-analysis on results from diverse fields of research that examine inconsistent variables, often in the form of case studies (Pagdee et al., 2006; Ostrom, 2007). Ostrom's framework can be used to identify what combinations of variables indicate human behavior that promotes sustainability and which behaviors lead to ecological collapse. She applied her framework to Hardin's theory of the commons in laboratory experiments where participants made decisions about a common pool resource. She found that enabling participants to discuss decisions about resource use allowed them to achieve optimal extractive quotas. Face-to-face communication facilitated the building of social norms and encouraged conformance (Ostrom, 2007).

Conservationists must facilitate constructive communication between stakeholders with varying cultural backgrounds and perspectives on environmental stewardship. The challenge stakeholders on both sides is how to engage in a dialogue that permits compromise and clearly discusses trade-offs, while simultaneously gaining understanding of and making clear the fundamental ideals that should not be compromised (Berkes, 2007; McShane et al., 2010). Conservation objectives must be explicitly stated and indigenous perspectives should be incorporated into resource management plans (Chicchon, 2009).

These perceptions have led to critical research on environmental degradation and the various applied approaches to the conservation of biodiversity. Ultimately, conservationists need to cultivate relationships with stakeholders that will promote a balance between biodiversity conservation and respecting the rights local resource users (Chapin 2004; Chicchon, 2009).

Given the challenges mentioned, which provide a context for conservation of biodiversity in Peru (and around the world), the question of how to identify what is unique, relevant, and valued by local resource users remains. It is for this reason that the following research article was written. Using the methodology of self-directed photography outlined in the manuscript, I was able to access TEK from local resource users in the Área de Conservación Regional Comunal Tamshiyacu Tahuayo (ACRCTT) about what is valued and conserved for sustainability in their lands.

CHAPTER III

JOURNAL ARTICLE

Defining Biodiversity: a local assessment

of the Tahuayo River, Peru using self-directed photography

1. Introduction

Biodiversity is claimed as a global resource and responsibility (Sarkar & Montoya, 2010) but because it is bound by geography, it is managed at the local level, though not always by the local people (Vermeulen & Koziell, 2002). Reasons for conserving biodiversity range from economic considerations for ecosystem services and species diversity, to the intrinsic and spiritual value of landscapes (Sarkar, 1999). There is disagreement between conservationists, not only about best management practices, but also what the essential purpose of biodiversity conservation should be (Naughton-Treves, Holland, & Brandon, 2005). This disagreement reflects differences in cultural norms and values (Sarkar, 2008; Guha, 1989).

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2. Methods

2.1 Study Area

The ACRCTT is located in northeastern Peru within the state of Loreto. Covering an area of 420,000 hectares, the ACRCTT benefits 4000 inhabitants in approximately 18 different communities located within the catchment area of the reserve (Gobierno regional de Loreto, 2010-2015). The ACRCTT consists of primarily continuous *terra firma* rainforest with areas that experience seasonal flooding (Gobierno regional de Loreto, 2010-2015). The complex forest mosaic has contributed to high biological diversity, including 14 identified primate species (Puertas & Bodmer, 1993).

A tributary of the Amazon River called the Tahuayo River is located in the upper Amazonian floodplain. The Tahuayo River borders the ACRCTT and the communities residing along its banks were integral to initial conservation efforts that led to the formal recognition of the reserve. Running approximately 80 km, the black waters of the Tahuayo River are characterized as being acidic, nutrient poor, and lacking the sediment that is typical of the white waters of the Amazon River. The cyclical hydrologic patterns of the Tahuayo River are influenced by the rise and fall of the Amazon River rather than by annual precipitation. The ecosystem of the Tahuayo River is predominately a *varzea*, or floodplain. The communities on either side of the river channel experience seasonal flooding where an influx of approximately 6-8 meters of water temporarily submerges the forest and the villages (Pinedo et al., 2000), with only a limited area of elevated ground, locally referred to as *restingas*, above water. These cycles of flooding allow water resources to reach inland, restocking the region's lakes with a variety of fish species. This

greatly enhances the productivity of the fishing industry and in turn impacts both economic and subsistence activities in these communities (Pinedo et al., 2000).

The neighboring villages of El Chino and Buena Vista located along the Tahuayo River are the focal communities for this project. The inhabitants of these communities are referred to as *ribereños*. The ethnic heritage of residents is diverse, with many being descendants of indigenous people who worked on the numerous rubber estates that existed along the Tahuayo River in the 1900s. During seasonal flooding events approximately 90% of the land in these villages may be inundated with water (Pinedo et al., 2000). The continuous transformation of the *varzea* ecosystem results in a dynamic economic system that is highly malleable. *Ribereños* must seasonally adapt their strategies for sustaining their livelihoods as the environment dictates resource availability (Pinedo et al., 2000).

2.2 History of the ACRCTT

During the 1980s, community leaders of villages along the Tahuayo and Blanco Rivers became concerned that the increasingly intensive exploitation of the area's natural resources was not sustainable. They began to organize their communities through local meetings and strategically constructed guard posts along the river to expel outsiders, in particular commercial fishing operations from Iquitos (Newing & Bodmer 2003), the largest urban city in the Peruvian Amazon located approximately 40 km away (Pinedo et al., 2000). The local people took action to safeguard their natural resources from overexploitation, beginning a conservation movement that led to the creation of one of Peru's first communal reserves (Newing & Bodmer, 2003).

In 1991, the Reserva Comunal Tamshiyacu Tahuahyo (RCTT) was established by Regional Executive Resolution No. 080-91-CR-GRA-P (Gobierno regional de Loreto, 2010-2015), only the second of its kind in Peru (Newing & Bodmer, 2003). The category of communal reserve was meant to benefit resident communities by conserving wildlife that served as traditional sources of food. Each community agreed on and signed a communal agreement describing how they would achieve sustainable use of their natural resources. Permanent settlements were purposefully excluded from within the perimeter of the reserve to avoid land use disputes. Each community was designated an area of influence from which they were permitted to extract resources within the guidelines of their communal agreement (Newing & Bodmer, 2003; Pinedo et al., 2000).

The communal agreement outlines rules for who is granted access to the reserve, what resources can be extracted, penalties for violation of the rules, and details describing how penalties will be enforced. The communities distinguish between exploiting resources for commercial profit and extracting resources for subsistence use. The rules set quantitative limits on extraction of game species and establish open and closed hunting seasons. The rules also specify the type of technology that can be used to harvest resources from the reserve; for example, the use of the poisonous barbasco root (*Lonchocarpus spp.*) is forbidden during fishing activities. Enforcement of these rules is flexible and can vary depending on periods of abundance or scarcity, as well as the social and political situation in the community (Newing & Bodmer, 2003; Pinedo et al., 2000).

After years of advocacy by resident communities and conservationists, the regional government formally recognized the RCTT by Supreme Decree No. 010-2009-MINAM, on May 17, 2009. The reserve was expanded in both size and strength of

protection, and renamed the Área de Conservación Regional Comunal Tamshiyacu Tahuayo (ACRCTT). In October 2010, the ACRCTT received final approval and recognition from the federal government (Gobierno regional de Loreto, 2010-2015).

The ACRCTT is the only regional reserve that includes the word *communal* in its name. Community leadership insisted that the new name of the reserve include the title of the RCTT. To them, the word *communal* represented decades of hard work that the resident communities had invested in conservation for the benefit of their children. The leadership was concerned that if the reserve lost its name, community members would also lose their sense of ownership over the reserve, and consequently their commitment to conservation may waver.

The management responsibility of the ACRCTT still lies in the hands of the resident communities. Advised by collaborative biological research, management decisions integrate TEK and scientific data to determine a management strategy that ensures ecological sustainability. The resident communities have full control over how research findings are used to prescribe management regulations. All moratoriums on resource extraction and extractive quotas are self-imposed. There is typically some compromise between the best interest of the local economy and maximum sustainability of natural resources. The degree to which local people retain control over the ACRCTT's management decisions is unusual, particularly in a government-protected reserve (Newing & Bodmer, 2003; Pinedo et al., 2000).

2.3 Data Collection

Data collection took place January 2-March 24, 2012. An ecotourism company called Amazonia Expeditions provided logistical support during fieldwork, including an

English translator and local guide. Amazonia Expeditions has an interest in conservation and community sustainability. They were drawn to the Tahuayo River by the conservation efforts of the local people and have developed long-standing relationships with resident communities. In addition to employing villagers through their ecotourism venture they have created a non-profit organization called Angels of the Amazon devoted to providing humanitarian assistance to the communities of the Tahuayo, while promoting environmental and economic programs in the region.

This project was part of a larger investigation into the resident communities' participation in the creation and management of the ACRCTT. The focal communities of Buena Vista, El Chino, San Pedro, and Diamante were chosen due to their high level of community engagement in the creation of the ACRCTT, and their ongoing participation in its management and protection. The majority of my time in the field was spent engaged in participant observation in these four communities.

I began by mapping the focal communities to assess the number of households. Using convenience sampling, each household was approached once and their participation was requested. Every household in these four communities was given the opportunity to participate. I sampled 74% of households for the first phase of this investigation (El Chino 70%, Buena Vista 78%, San Pedro 100%, Diamante 62%). In total, I conducted 67 semi-structured interviews with participants regarding their household economy, utilization of forest resources, the history of the community's conservation efforts, and their community's participation in the reserve's management.

The focus of this article is the result of the second phase of this investigation. In the communities of Buena Vista and El Chino, following the initial interview with

participating households, I requested participation in a project using self-directed photography. This phase was designed to assess local connections to the environment. Forty-seven percent of households in Buena Vista and El Chino were sampled for this phase of the investigation. A total of 24 men and eight women were invited to participate. Their ages ranged from 23 to 70 with a mean age of 45. Participation was limited by the number of cameras (33) available in the field.

2.4 Self-Directed Photography

Thirty-three single-use disposable cameras (27 exposures, 35 mm film, 800 speed) were distributed to participants in the communities of Buena Vista and El Chino. This method was chosen because it allowed for participation by individuals with varying degrees of literacy. All participants were trained how to use the cameras and instructed to take pictures of the people, places, or things most important to them. If prompted for further explanation participants were told that there was no right answer and that they were free photograph whatever they wanted. They were also made aware that they would receive printed copies of their photographs. Participants were given two weeks to complete the photography portion of the project before cameras were collected.

In total, 631 photographs were developed. During a post-photography interview, participants provided a narrative description of each image. Participants were only prompted with the questions, “what is this photograph of?” and “why is this important to you?” After describing each of their images participants were asked to sort their photographs in order of relative importance (Figure 1).

Several participants identified photographs that were missing because of problems with the exposure, typically that the film was underexposed making the image too dark to

recognize. To remedy this situation participants were provided with a note card to substitute for the photograph during the sorting process. The name of the missing image was written on the note card following the participant's description. I kept digital copies of the photographs and the participants were given the printed copies.

Figure 1. Participant sorts images in order of relative importance

3. Analysis

For the purpose of this article a "photograph" will refer to the physical print and "image" will refer to what is depicted on the photograph. Images identified as being the ten most important in each photoset were considered for analysis. If an image was represented multiple times within the top ten photographs, only the photograph with the highest rank was considered, resulting in ten distinct images in each photoset. After one participant was excluded for having fewer than ten images, 320 images were considered. Participants assigned a number of points to each image corresponding to how it was

ranked in order of importance The most important image in each photoset was assigned ten points and the least important image was assigned one point. Each participant could assign a total of 55 points to their photoset, for a cumulative total of 1,760 points. The photographs were then sorted into seven discernible categories of images: animals, conceptual images (e.g., images representing good health), material possessions, people, places, plants and trees, and skills. Refer to Appendix A for details on the number of images in each category and the corresponding number of points assigned by participants.

4. Results

Fourteen percent of the images taken by participants were of animals. Typically these images were of a source of food (78%) although a few of the images were of wildlife (15%) or family pets (7%). Chickens were depicted in 42% of the photographs of animals. A participant described the value of chickens:

> Glory to God! This hen was bitten by a bat. One of the babies was close to death but we cared for them. They are present like a human being. The way we treat them is a reflection of who we are. We earn income from them and they help to sustain our family so it is important that we care for them. This rooster is the father of our chickens. He has accomplished his mission and so one of these days he will die for our meal. From this rooster we have another rooster, his son, so we can keep our farm going. If you have a chicken farm you can earn a lot of money and completely support your family. Your life will be better because you can buy all that you need. With two chickens they can easily reproduce and your wealth will grow. They create security in your life. You can give education to your children, buy them shoes and clothes. I gave an education to my children with this bird. Before there was a secondary school in the village I had to send them to Iquitos. With these birds it is like having a bank in your home. It is safety money.

Eighteen percent of the images of animals were of fish. Fish fulfill a very important subsistence need in these communities. Figure 2 illustrates how one participant

represented fish. This participant described the value of the reserve as it relates to the Oscar fish:

> This fish was close to extermination in this river but we have seen an increase in the population because of the reserve, because we have rules and management.

Figure 2. Participant image representing fish

Ninety-one percent of the images of material possessions were related to transportation (e.g., rubber boots, canoes, paddles, ferry boat). The canoe is vital to being able to navigate the *varzea* ecosystem during the winter season. Rubber boots are a safety measure for protecting yourself against snakebites while walking in the rainforest, or on your farm.

The images of people (6% of the total photographs) portrayed children in the community (40%), as well as family (30%), friends (10%), and neighbors (20%). One participant described an image that depicted a process called *minga*:

> You call on people, your neighbors, to help you work in your farm. You give them food and drink but not pay. This photo was taken when we were taking a break together. We were sweaty and tired and drinking *masato*.

The skills category included four percent of the total photographs. These images included techniques for farming, hunting and weaving, as well as daily life skills. Farming techniques represented 46% of the images in the skills category.

Three photographs were categorized as conceptual images, representing only one percent of images. Two of the images represented good health:

> I am sitting with my wife on our front porch watching the landscape and passing time. We have good health. This is a beautiful photo.

Another participant described the photo he ranked as the most important:

> Here I am beside my wife and you can see the houses of the community. This picture is important because it shows the houses facing the river. This picture shows the position of my village in the reserve.

Images of different places represented eight percent of the photographs. The most photographed images of place were of houses (23%), farms (19%), and the river (15%). A participant described the value of the river:

> From the river we use the water to drink with, to cook with, to bathe... It is home to the dolphins and anacondas. It is very important. This photograph is a good reminder that I live in a beautiful place.

The rest of this article will be devoted to discussing the category that included the overwhelming majority of images. Plants and trees represented 63% of the images, with 74 distinct species depicted (see Appendix B for a complete list of identified species). A total of 1061 points were assigned to the plants and trees category, or 60% of total points. Based on the narrative description of each image, each species was further broken down into five subcategories of use: Building Material, Food, Income, Medicinal, and Wildlife

Habitat. Species that were discussed as having multiple uses were included in each of the corresponding subcategories (Table 1).

Table 1

Plants and Trees: Subcategories of Use

Category of Use	Number of Species
Building Material	19
Food	34
Income	33
Medicinal	32
Wildlife Habitat	14

If a species was valued as food, for generating income, or as building material, it typically overlapped with another subcategory (Table 2). For example, plants or trees that produce edible fruit often doubled as a source of income because the fruit could both be sold in the market and consumed by the family. The majority of species valued for their medicinal properties were only included in one subcategory (53%).

One assumption I had when I started this phase of the project was that the simple instructions to take pictures of the people, places, or things that are most important would result in images of material possessions such as their canoes, or places like their home. I assumed that in a flooded rainforest, shelter and a boat to navigate the river would be highly valued. However, none of these images feature prominently in the photographs. When I first looked through the images I saw entire photosets that as far as I was concerned were just images of the rainforest. After participants provided narrative descriptions of the images it was clear that almost all of them did take pictures of their homes, just from another perspective. Rather than photographing the structures

themselves they provided images of the raw materials needed to build and maintain their homes as they degrade in the humid environment of the Amazon Rainforest.

Table 2

Plants and Trees: Number of Uses

Number of Uses	Number of Species
One	34
Two	25
Three	13
Four	1
Five	1

Forty-three percent of the plant species depicted in the images held value as building material. Three separate palm species were identified for weaving the thatch roofs of their homes. A participant discussed the value of the irapay palm (*Lepidocaryum tenue*):

> When you weave the leaves it is called *crisneja*. It is used to make a roof for your house. It protects our home from the rain and the sun.

The husai palm (*Euterpe precatoria)* was the third most valued plant species and the only species that held value in all five subcategories. The bark of the husai palm is used to construct the walls of a house. Both of these species are significant to conservation and represent solid common ground between resource managers and local resource users.

The rest of this section discusses the two trees species that were assigned the highest value by participants (Table 3): the aguaje palm (*Mauritia flexuosa*) and chambira palm (*Astrocaryum chambira*).

Table 3
Highest Ranked Images in Plants and Trees Category

Name of Plant	Total number of photographs of each image	Total number of points assigned by participants	Average points if included by participant	Percent (%) of total photographs
Aguaje Palm	23	142	6.2	7
Chambira Palm	12	107	8.9	4
Husai Palm	14	77	5.5	4
Banana	8	43	5.4	3
Camu Camu	9	42	4.6	3
Yucca	11	35	3.2	3

Note. Results are from 29 of 32 participants. Points correspond to the rank of the image (10 being most important, one being least important).

The most photographed image in this category was the aguaje palm (Figure 3). This species was photographed by 72% of participants and represents 7% of total photographs. Participants assigned a total of 142 points that corresponded to how the aguaje palm was ranked, averaging 6.2 points for the 23 participants who included the image.

The aguaje palm is an important fruiting tree that grows in high densities in the Amazon *varzea* in areas called *aguajals*. It is considered a keystone species because the vast stands provide critical habitat and a source of food for many species of primates, large ungulates, and birds, especially macaws (Manzi & Coomes, 2009). The aguaje palm also plays an important socio-economic role in rural Amazonian communities. The fruit produced by the aguaje fulfills a subsistence need and is a cash crop that contributes significantly to the household economy.

Figure 3. Aguaje palm (*Mauritia flexuosa*).

Each aguaje palm can reach heights greater than 30 meters as it competes for light in the forest canopy. The single trunk is smooth and slick, making it difficult to scale the tree to access the fruit produced at the crown. This difficulty has led to the destructive harvesting method of felling wild trees (Manzi & Coomes, 2009).

The aguaje palm has been the focus of a NGO Rainforest Conservation Fund, (RCF) sponsored agroforestry program in the focal communities of this project. Aguaje palms are not often cultivated due to the availability of wild trees (Manzi & Coomes, 2009). However, localized extinctions due to tree felling had conservationist and local resource users seeking better options. When aguaje palms grow in open fields where they do not need to compete for light, the trees will only reach 2-5 meters in height (Bodmer, 1994). This allows for safer and easier harvesting and takes only the fruit from the tree. With this technique the trees will continue to produce year after year and can be

harvested multiple times each season. Until the aguaje palms planted in farms reach the age where they will produce fruit, the RCF has provided farmers with climbing harnesses so they can safely scale wild trees. These harnesses are made of simple materials and the farmers were taught how to make them.

A participant describes the image of his four hectare aguaje farm:

> This tree is 16 years old. It has been giving me fruit for six years now. In a natural system you have to wait around 40 years for a tree to fruit. The wild tree must compete for light and wait for other trees to fail before it can grow tall and produce fruit. In total I have 2,000 aguaje palms on my farm. At one point I planned on planting 5,000 trees on my farm but I am too old. Not all of them produce fruit yet. You have to wait about seven years after you plant the tree to know if it is a female that will produce fruit. I can harvest from more than 50 palms. Every year five or six new trees make fruit. One of my palms gives me 14-16 sacks of fruit that I can sell in the market. Sometimes I can get five *soles* for a sack, sometimes 10-15 *soles*, and at one time of the year I can get 40 *soles* for each sack of fruit. It depends on how many people are selling aguaje fruit. Nearby we have an *aguajal*, a place where the aguaje palms grow wild. People come from the Amazon to collect the fruit there. This place is outside of the reserve but it is on the Tahuayo River. They cut the trunks of the trees because they do not know the systems for protecting them.

The chambira palm received the second highest ranking of all images. Thirty-eight percent of participants photographed the chambira palm, assigning it a total of 107 points. While almost twice as many participants photographed the aguaje palm, those who photographed the chambira palm (12 participants) assigned higher value to it, with an average of 8.9 points assigned.

The chambira palm fibers are strong and used to create a variety of items, both functional and decorative. The villages of Buena Vista and El Chino are nearby Amazonia Expedition's eco-tourism lodge. Amazonia Expeditions urged the women in El Chino to form a cooperative and work on creating high quality, decorative baskets and other crafts that could be sold to tourists at their lodge. The cooperative calls themselves

the Asociación de Artesanos Manos Amazónicas. They create palm-fiber baskets using only local, sustainably harvested forest products (Figure 4). Partnering with Amazonia Expeditions, Manos Amazónicas has developed a strong and consistent consumer demand, with approximately 2,000 tourists passing through their market annually. They have outlined rules meant to conserve traditional cultural knowledge by promoting artistic expression and sustainable, renewable resource extraction.

The market for chambira fiber crafts has lifted families out of poverty and given women an economic voice in their communities for the first time. An artisan tearfully described how weaving has impacted her household economy:

> We have prosperity and we are changing our lives. We are simple women who work very hard and we are becoming successful. I feel very happy that now I have an income to support my kids with what my hard work brings. From selling my artwork. I have five children. I can buy all the things I need at home. *Now I have. Now I have.* My household income has improved. Before I worked as an artisan, before I weaved, I didn't have even a piece of soap. Now I can support myself. I can support my family.

Another artisan described the challenges she faced when learning to weave:

> I came to live with my sister-in-law and I watched her weaving. I asked her "where did you learn this?" and she told me about a woman from Jerusalem who taught her. I thought this woman was like an angel who passed through our lives giving us her knowledge of weaving. I started learning from my sister-in-law and one day I went to sell at the lodge to tourists. I put out my baskets and they sold like hot bread. Immediately before you had a chance even to barely finish and people were buying it. I got so excited. I was so excited. I was so encouraged. I wanted to continue making baskets and weaving more… I made my own design…Other artisans added to what I created and we started working together to improve. We started having meetings and our husbands started to question what we were doing? Why are we getting together? We are wasting time. We are not working. We are just gathering and doing nothing. We would talk openly about these problems that we were having at home. A lot of the women decided that they were going to stick with it. We were not going to back down. It is what we wanted to do, even if we got hit, or if we got beat up. We decided that we were going to stick with it because it was something that we wanted to do. We wanted to learn and we needed

> to encourage each other. We would talk openly about our husbands being mad, or if I had a problem. But I was not going to give up. I was going to continue. I wanted to learn. I knew this was going to benefit me and my family. Eventually these things improved, when they saw the money that we were making and realized that our household economy was improving. Many of the pioneers, the women who started weaving, are no longer in the community.

Figure 4. Decorative baskets woven from chambira palm fiber

The chambira palm faces similar extractive pressures as the aguaje palm due to the spiny trunk that makes it impossible to climb. Inspired by the agroforestry program for the aguaje palm the artisans are starting to create their own chambira palm farms to provide them with easier access to their materials. A participant described her chambira palm farm:

> My husband works on the farm and I stay home and process the fibers. I take one frond from the palm at a time. I won't harvest this same palm again for six months. Each year I harvest about 30 palm fronds. When you plant a tree it will take seven years before you can harvest from it. We

> plan to reforest this area but in the lowlands the young trees will die when it floods. In this photo my daughter is working on the farm. She is clearing the area so the tree can have more light to grow tall. I am already teaching her to weave. I have been weaving since I was 18 years old. When my father died, my mother and I were struggling. I saw a lot of tourists buying crafts from girls. I watched the other girls weaving and so I found a book so I could learn to weave and learn the designs. Now I create my own designs. Usually I sell about 40 baskets each year but last year I sold 60 of my large baskets. This is an important tree for supporting the children.

The artisans also identified a variety of natural dyes and decorative seeds as holding value. For example, the seeds of the achira (*Canna indica*) and carrizo (*Gynerium sagittatum*) plants are used as beads and the achiote (*Bixa orellana*), huito (*Genipa americana*), and mishqui panga (*Renealmia spp.*) are used to create colored dyes. A participant describes the value of mishqui panga:

> This plant gives color to the chambira fibers. If you mix this plant with a citrus fruit it will give it one color, if it is mixed with ginger it will give another color. It is very versatile. If it is mixed by itself it will turn the fibers purple. My wife is an expert at color mixing.

5. Discussion and Future Work

Landscapes such as the Amazon Rainforest are anthropogenic environments where indigenous people have culturally managed resources for more than 5,000 years (Coomes & Barham, 1997). Economic cycles have shaped the composition of landscapes through extractive industries (e.g., reforesting aguaje and chambira palms). Consequently, natural and cultural effects cannot easily be separated from one another (Coomes & Barham, 1997). This complicates the assessment of biodiversity, particularly in highly diverse ecosystems like the Amazon Rainforest (Halme & Bodmer, 2007).

The development of holistic resource management plans that capture the interconnectedness of local resource users and their landscape will benefit from the inclusion of TEK and community stewardship. An understanding of TEK and how it

adapts and evolves with changing environmental conditions, will facilitate constructive communication between stakeholders with varying cultural backgrounds and perspectives on environmental stewardship. This will not only benefit biodiversity conservation but it will also contribute to the cultural survival of local resource users, who commonly are of indigenous origins.

Self-directed photography can be used to rapidly access TEK to identify which constituents of biodiversity are culturally relevant. The results of this project demonstrate that when provided with the means to direct data collection, participants are capable of providing researchers with a picture of biodiversity as it is seen through the lens of local resource users. Self-directed photography could be paired with techniques like participatory mapping to enhance the richness of the data and reveal a more complete picture of the local experience.

This method is a technique that can easily be replicated to elucidate connections between people and their landscape. Repeating the project at various times of the year may reveal the social-ecological adaptations and resource use patterns that participants are embedded within. This project took place during the beginning of the winter season. If it were to be repeated with the same participants during the summer months, I would expect different images in the photosets. A participant illustrates this point with their description of the cycles of food in the rainforest:

> The fruit of the pijuayo can be used to eat or to prepare masato. This is very important to me and my family. We grow this in our farm. Before the flooded season we pick up all of the produce, yucca for example. But in this season the pijuayo fruit begins to mature. All year there are cycles of fruiting plants so we have a continuous source of food. We can harvest different fruits during the different seasons. Then, in the dry season we can plant again. We always have something to eat. Rice, beans, we harvest these, save some for the winter season and then sell the rest.

Additionally, repeating this project with more focused instructions could help funnel the information to target a more specific research question. For example, rephrasing the instructions to say "take pictures of the aspects of the environment that are most important to you" could result in photosets that depict how resident communities define biodiversity. However, this should be done only to uncover additional layers of information. It is recommended to begin with broad, open-ended instructions to capture anything the community may be willing to reveal to the researcher.

It is necessary to contextualize the photographic data in relation to the local cultural experience. An understanding of the socio-economic and political situation in a focal community is vital to interpreting the data productively. Furthermore, this type of data may be limited to the area where it was collected, as TEK cannot be generalized across regions and cultures (Halme & Bodmer, 2007).

Self-directed photography has widespread application potential both in academia and real world settings. This method can be used to enhance civic engagement by allowing stakeholders the opportunity to visually express their interests and concerns. A photograph can be a powerful representation of emotions that translates across cultures and generations. An image can give an audience a deep, visceral understanding of an issue in a way that the most eloquently composed statement may fail to do. Utilizing self-directed photography can create an inclusive atmosphere where ideas are shared in a meaningful, authentic manner.

6. Conclusion

The success of community conservation is not a linear process (Pinedo et al., 2000), as with any good story there are a lot of twist and turns. Conservationists need to cultivate relationships with stakeholders that will promote a balance between biodiversity conservation and respecting the rights of local resource users (Chapin 2004; Chicchon, 2009). Resident communities should be regarded as authorities on their environment, who can provide meaningful insight into areas targeted for conservation (Berkes, 2007; Hayes & Ostrom, 2005). The challenge to stakeholders on both sides is how to engage in a dialogue that permits compromise and clearly discusses trade-offs, while simultaneously gaining understanding of and making clear the fundamental ideals that should not be compromised (Berkes, 2007; McShane et al., 2010). Self-directed photography can help initiate this dialogue.

The camera allows participants to share aspects of their lives with the researcher without the risk of an unknown presence imposing on them. This gives the researcher a glimpse into the lives of multiple participants without necessitating their presence, enabling them to make a rapid assessment of conditions. The use of self-directed photography partially frees participants from the barrier of language by empowering them to visually communicate their perceptions. In this way the camera may prove itself to be a powerful tool in conservation planning.

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CHAPTER IV

CONCLUSION

Landscapes such as the Amazon Rainforest are anthropogenic environments where indigenous people have culturally managed resources for more than 5,000 years (Coomes & Barham, 1997). Economic cycles have shaped the composition of landscapes through extractive industries (e.g., reforesting aguaje and chambira palms). Consequently, natural and cultural effects cannot easily be separated from one another (Coomes & Barham, 1997). This complicates the assessment of biodiversity, particularly in highly diverse ecosystems like the Amazon Rainforest (Halme & Bodmer, 2007).

The development of holistic resource management plans that capture the interconnectedness of local resource users and their landscape will benefit from the inclusion of TEK and community stewardship. An understanding of TEK and how it adapts and evolves with changing environmental conditions, will facilitate constructive communication between stakeholders with varying cultural backgrounds and perspectives on environmental stewardship. This will not only benefit biodiversity conservation but it will also contribute to the cultural survival of local resource users, who commonly are of indigenous origins.

Self-directed photography can be used to rapidly access TEK to identify which constituents of biodiversity are culturally relevant. The results of this project demonstrate that when provided with the means to direct data collection, participants are capable of providing researchers with a picture of biodiversity as it is seen through the lens of local resource users. Self-directed photography could be paired with techniques like

participatory mapping to enhance the richness of the data and reveal a more complete picture of the local experience.

This method is a technique that can easily be replicated to elucidate connections between people and their landscape. Repeating the project at various times of the year may reveal the social-ecological adaptations and resource use patterns that participants are embedded within. This project took place during the beginning of the winter season. If it were to be repeated with the same participants during the summer months, I would expect different images in the photosets. A participant illustrates this point with their description of the cycles of food in the rainforest:

> The fruit of the pijuayo can be used to eat or to prepare masato. This is very important to me and my family. We grow this in our farm. Before the flooded season we pick up all of the produce, yucca for example. But in this season the pijuayo fruit begins to mature. All year there are cycles of fruiting plants so we have a continuous source of food. We can harvest different fruits during the different seasons. Then, in the dry season we can plant again. We always have something to eat. Rice, beans, we harvest these, save some for the winter season and then sell the rest.

Additionally, repeating this project with more focused instructions could help funnel the information to target a more specific research question. For example, rephrasing the instructions to say "take pictures of the aspects of the environment that are most important to you" could result in photosets that depict how resident communities define biodiversity. However, this should be done only to uncover additional layers of information. It is recommended to begin with broad, open-ended instructions to capture anything the community may be willing to reveal to the researcher.

It is necessary to contextualize the photographic data in relation to the local cultural experience. An understanding of the socio-economic and political situation in a

focal community is vital to interpreting the data productively. Furthermore, this type of data may be limited to the area where it was collected, as TEK cannot be generalized across regions and cultures (Halme & Bodmer, 2007).

Self-directed photography has widespread application potential both in academia and real world settings. This method can be used to enhance civic engagement by allowing stakeholders the opportunity to visually express their interests and concerns. A photograph can be a powerful representation of emotions that translates across cultures and generations. An image can give an audience a deep, visceral understanding of an issue in a way that the most eloquently composed statement may fail to do. Utilizing self-directed photography can create an inclusive atmosphere where ideas are shared in a meaningful, authentic manner.

The success of community conservation is not a linear process (Pinedo et al., 2000), as with any good story there are a lot of twist and turns. Conservationists need to cultivate relationships with stakeholders that will promote a balance between biodiversity conservation and respecting the rights of local resource users (Chapin 2004; Chicchon, 2009). Resident communities should be regarded as authorities on their environment, who can provide meaningful insight into areas targeted for conservation (Berkes, 2007; Hayes & Ostrom, 2005). The challenge to stakeholders on both sides is how to engage in a dialogue that permits compromise and clearly discusses trade-offs, while simultaneously gaining understanding of and making clear the fundamental ideals that should not be compromised (Berkes, 2007; McShane et al., 2010). Self-directed photography can help initiate this dialogue.

The camera allows participants to share aspects of their lives with the researcher without the risk of an unknown presence imposing on them. This gives the researcher a glimpse into the lives of multiple participants without necessitating their presence, enabling them to make a rapid assessment of conditions. The use of self-directed photography partially frees participants from the barrier of language by empowering them to visually communicate their perceptions. In this way, the camera may prove itself to be a powerful tool in conservation planning.

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APPENDIX A

Categories of Participant Images

Category	Participants who included images	Different types of images in each category	Total photographs	Total photographs, percent (%)	Total points assigned by participants	Average points if image was included by participant
Animal	23	8	45	14	248	10.8
Conceptual Images	2	2	3	1	29	14.5
Material Possessions	10	5	11	3	40	4
People	14	5	20	6	137	9.8
Places	14	11	26	8	158	11.3
Plants & Trees	32	74	202	63	1061	33
Skills	10	6	13	4	87	8.7

Note. Points correspond to the rank of the image (10 being most important, one being least important).

APPENDIX B

Complete List of Plants and Trees Identified by Participants and their Sub-Categories of Use.

Local Name	Scientific Name	Sub-Categories of Use
Achiote	*Bixa orellana*	M, I
Achira	*Canna indica*	I
Aguaje Palm	*Mauritia flexuosa*	F, I, H
Aguajilla	*Mauriteilla acuelata*	F, I
Albaca	*Hyptis recurvata*	M
Anihuayo Tree	*Plinia clausa Mc Vaugh*	F, B
Arazà fruit	*Eugenia stipitata*	F
Ayuhuasca, Soga de Muertos	*Banisteriopsis caapi*	M, I
Banana	*Musa spp.*	F, I
Bijao plant	*Calathea lutea*	F, I
Cacahuillo	*Erisma calcaratum*	F
Cagüena	*Eupatorium triplinerve*	M
Caimito Tree	*Chrysophyllum cainito*	F, I
Camu Camu	*Myrciaria dubia*	M, F, I
Canela Moena	*Ocotea aciphylla*	B
Caoba Tree	*Sweitenia macrophylla*	I, B
Carrizo	*Gynerium sagittatum*	I
Castaña Tree	*Artocarpus altilis*	F, I, B
Catahua	*Hura crepitans*	B
Caterina Palm	*Attalea microcarpa*	F, B, H
Cedro Tree	*Cedrela odorata*	I, B
Chambira Palm	*Astrocaryum chambira*	I
Charapita	*Capsicums frutenses*	M, F
Culantro	*Coriandrum sativum*	M
Cocona	*Solanum sessiliflorum*	M, F, I
Coconut	*Cocos nucifira*	M, F, I, H
Copal Tree	*Protium spp.*	B
Granadilla Plant	*Passiflora spp.*	M
Guayaba	*Psidium guajava*	F, H
Hierba del aire	*Trixis californica*	M
Huayra Caspi	*Cedrelinga sp.*	I, B
Huingo Tree	*Crescentia cujete*	I, B
Huito Tree	*Genipa americana*	I
Husaí Palm	*Euterpe precatoria*	M, F, I, B, H
Inayuga Tree	*Attalea maripa*	I

Irapay Palm	*Lepidocaryum tenue*	I, B
Leche Caspi Tree	*Couma macrocarpa*	M, B, H
Limon	*Citrus limon*	M, F, I
Llanten	*Plantago major*	M
Macambo Tree	*Theobroma bicolor*	F
Maize	*Zea mays*	F, I, H
Malva Plant	*Malva spp.*	M
Mamey Tree	*Pouteria sapota*	F
Mandarina	*Citrus spp.*	F
Medicinl Plant, Unknown	Unknown	M
Metohuayo Tree	*Caryodendron orinocense*	F, H
Mishqui Panga	*Renealmia spp.*	I
Mohena Tree	*Aniba spp.*	B
Mucura	*Petiveria alliacea*	M
Obijo	*Pouroma cecropiifolia*	F, I, H
Ojè Tree	*Ficus insipida willd.*	M, H
Orégano	*Oreganum vulgare*	M
Pandisho	*Artocarpus altilis*	M, F
Papaya	*Carica papaya*	M, F
Patiquina	*Dieffenbachia spp.*	M
Pichirina Tree	*Vismia angusta*	M
Pijuayo palm	*Bactris gasipaes*	F, I, H
Pinapple	*Ananas comosus*	F, I
Piñon Plant	*Jatrapha spp.*	M
Ponilla Tree	*Iriartella stenocarpa*	I, B
Quillosisa Tree	*Vochysia vismifolia*	B
Rosacisa	*Tagetes erecta*	M, I
Sacha Ajos	*Mansoa alliacea*	M
Sangre de Grado	*Croton lechleri*	M
Shapaja	*Attalea phalerata*	B, H
Shimbillo	*Inga spp.*	F
Sinamillo	*Oenocarpus mapora*	F, B, H
Sugar Cane	*Saccharum officinarum*	M, F, I
Toé Blanco	*Brugmansia suaveolens*	M
Toé Negro	*Brugmansia spp.*	M
Toronja	*Citrus spp.*	M, F
Ungurahui Tree	*Oenocarpus bataua*	F, I
Yarina Palm	*Phytelephas aequatorialis*	F, B
Yucca	*Manihot esculenta*	F, I, H

Note. Sub-categories (B) Building Material, (F) Food, (I) Income, (M) Medicinal, (H) Wildlife Habitat

APPENDIX C

Map of the Área de Conservación Regional Comunal Tamshiyacu Tahuayo (ACRCTT)