The recognition of traditional ecological knowledge in the forest rangers program

A case study of Suriname

Tukuispan (a community house) in the village of Kwamalasamutu

Sarah Dikker
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Thesis supervisor: dr. C.Y. Aoki Inoue
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Preface

With great pleasure I hereby present the final version of my thesis about the recognition of TEK in the forest ranger program of South Suriname, for which I have travelled to the Indigenous Trio village Kwamalasamutu. Through my youth I have heard amazing stories about Suriname from my grandfather and my mother, and I have always wanted to visit the country that my family comes from. I have also always believed that the Western way of thinking and doing things cannot be the only way. This has caused me to form an interest in other forms of knowledge and what kind of wisdoms these bring.

I want to use this preface to thank a number of people. First, I want to thank the Trios for welcoming me and allowing me to experience and stay in their beautiful village. In addition, I would also like to thank the traditional authority for allowing me to be present in Kwamalasamutu, to interview the rangers, and to be present at their Krutus. I would also like to thank the rangers for their answers and their time. In addition, I would also like to thank Green Growth Suriname for their support in my research and the trip to and stay in Kwamalasamutu. I would also like to thank the board members of Green Growth Suriname. I want to express my gratitude to Gwendolyn Smith for her guidance and helpful feedback. Additionally, I want to thank Lindsay Goossens for her guidance and the wonderful time we had in Suriname. Furthermore, I would like to thank both Gwendolyn Smith and Lindsay Goossens for introducing me to this beautiful topic for my research. I would also like to thank Mike Reeders for the beautiful conversations in Kwamalasamutu and being an interpreter during the interview. In addition, my greatest thanks go to Cristina Aoki Inoue for her helpful feedback and support.
Furthermore, I would also like to thank the ACT's tribal regional coordinator, ACT's country manager and Rachelle Bang a Jong for their interviews and the data materials that I received.

Lastly, I would like to thank my family for the beautiful stories about Suriname, which fostered my interest and to Marlies Goossens for bringing me upon this path.

I hope you will enjoy reading this thesis.

Summary

The Amazon is an important biome in the world and is home to 60% of the rainforests of the world. However, deforestation is a problem in the Amazon with the consequence of reducing the contributions that the Amazon produces, resulting in an increase in biodiversity loss, an intensification of precipitation and droughts across the entire Amazon, higher carbon emissions, and social impacts such as decreased health due to the spread of infectious diseases and a decrease in agricultural yields.

A solution against the deforestation of the Amazon is forest conservation. Other advantages of conserving forests include the protection of biodiversity and watersheds, as well as benefits for people who depend on forests. One country for which forest conservation would also be crucial and advantageous is Suriname, due to its high degree of biodiversity, the Amazon's 93% coverage of the country, and about 2,000 Indigenous people living in South Suriname. A group of people who are trying to achieve forest conservation and protection in Suriname are the 8 leaders of the Trio and Wayana Indigenous communities who signed a declaration on March 5th 2015 to protect 7.2 million hectares of the rainforest in South Suriname. This area is also known as TWTIS. The northern Amazon Region, which is partially located in South Suriname, is home to the Trios and the Wayanas. The Trios and Wayanas not only inhabit the forest, but they also hold traditional ecological knowledge (TEK), which is recognized to benefit forest conservation and potentially further our understanding of forest ecology and conservation. TEK is a type of knowledge that is place-based and gathered over generations, and is about the relationship between living beings and their living environment. Additionally, by adhering to TEK and its principles, just the forest resources required for your livelihood are taken, ensuring that future generations will also be able to support themselves. Furthermore, TEK plays a significant role in the cultural heritage of the Indigenous peoples.

In order to protect tropical forests and maintain traditional culture, ACT, an NGO, works in collaboration with the local populations to conserve forests. The Amazon conservation rangers (ACRs), which are made up of members of the Indigenous and Maroon communities, are one way that ACT works to fulfill this mission. ACRs work in a forest ranger program, and are agents with field experience who work in protected areas. They are tasked with protecting and preserving the region's natural and cultural resources. Additionally, they serve as a conduit between nearby communities, protected areas, and the area's management. Next to holding TEK, the ACRs are frequently trained using Western scientific knowledge (WSK). TEK has great benefits for forest conservation. It is unclear, nevertheless, whether TEK is applied and recognized within the forest ranger program. The goal of this study's research was to determine how TEK has been recognized within the forest ranger program and its training program for forest rangers up to this point. A case study involving ACRs from the Trio community in Kwamalasamutu was carried out to learn more about this. The following research question has been developed from this study objective:

How is traditional ecological knowledge recognized within the forest ranger program?

In order to answer the research question, four subquestions were created:

1. How is traditional ecological knowledge recognized in other cases of forest management and what are the results?
2. Are the ways through which TEK is recognised in the forest ranger program considered sufficient and adequate?
3. What are the stakeholders within the forest ranger program in TWTIS, how do they relate to each other and what are the power relations between them?
4. What is a suitable framework for the recognition of TEK in forest ranger programs?

Indigenous peoples and their TEK have a long history of being viewed as inferior to Western knowledge. This is owing, among other things, to a history of colonization. Through the reach of colonialism, Western knowledge has come to count as the basic standard in the world. Due to the lack of scientific validation and thus subsequently not upholding to the Western standard, TEK is seen as inferior. As a result, many conservation programs, such as forest conservation, do not recognize TEK because it is not considered as scientifically validated. However, this is unfortunate because Indigenous peoples generally live in sustainable symbioses with their environment. The Trios of South Suriname also follow this lifestyle, adhering to ideals that balance the growth of the population while also maintaining the health of the environment. Furthermore, for the Trios, TEK is an integral element of their culture and way of life. Because TEK is not considered valid and scientific ecological knowledge remains the dominant knowledge system in conservation efforts.

The inferior position that the Indigenous peoples often hold is also reflected the analysis of the rangers' interview.

Ten criteria were selected to investigate how TEK is acknowledged in forest management. These criteria also helped to address the first subquestion. The criteria are: "Interdisciplinarity", "Active participation of the Indigenous community", "Worldviews", "Knowledge co-production", "Preservation of TEK", "Trust", "Share power", "Political factors", "Respect for TEK holders" and "Mutual benefits and incentives". By determining whether each criterion had been satisfied or not, it was feasible to determine how and to what degree TEK is recognized. Thus, to determine this for the case study the aforementioned ten criteria were also applied to the ACT's forest ranger program. This subsequently aided in answering the second subquestion.

From assessing whether a criterion was met or it was concluded that there was no consensus on whether not most of the conditions are met. While ACT claims that nearly all the criteria have been met, the Trios find that not one criterion has been entirely met. The Trios believe that "Active participation of the Indigenous community", "Incentives and mutual benefits", "Trust", "Respect for TEK holders" and "Knowledge co-production" are

criteria that are not being satisfied. Additionally, the criteria "Interdisciplinarity" and "Share power" are partially met from the rangers' perspective but are entirely met from ACT's standpoint. The only criteria that both ACT and the rangers agree are either met or not are "Political factors", "TEK preservation," and "Worldviews," all of which are partially met.

The rangers' perception that not one criterion is met stems from a variety of problems they face, such as a lack of community respect, a lack of tools, unfulfilled promises, unclear communication, and the feeling that they are not being heard.

To better understand why ACT and the rangers have such a different viewpoint, a stakeholders analysis was conducted. This way it could also be derived how the issues experienced by the rangers originated. The power dynamics between the stakeholders were also investigated. This stakeholders analysis helped with answering the third subquestion. The following stakeholders were identified: rangers, ACT, traditional authority, Indigenous community, the government (DNA, GBB, ROM, ROS), funders, TWTIS partners and Trijana. Trijana is a collaboration between the traditional leaders of the Trios and Wayanas who promote the recognition of TWTIS.

Also, here the rangers had a different viewpoint on the stakeholders analysis than ACT. While ACT would consider the rangers to be stakeholders with high influence, the rangers disagreed, believing they had little influence. ACT does have a high influence from both the rangers' and their own perspectives. This difference of influence demonstrates the rangers' and ACT's unequal power distribution.

Other stakeholders who also have a high influence are the funders and the government. The funders have a high influence because the program depends on their donations to function. The government has high influence through its legal power. These powerful stakeholders determine how the forest ranger program is run and what restrictions may be placed on it. This creates a dependence for the rangers. However, there are other stakeholders that support empower the Trios, such as Trijana and the TWTIS partners.

The answer to the main question was deduced from the answers to the first three subquestions. A recurring theme in the interview conducted with the rangers were the issues experienced by the rangers, whereby their wishes and needs are not recognized. These issues are also the reason why, in the rangers' eyes, none of the criteria have been fully satisfied. On the surface, it may appear that ACT does not address the issues that the rangers face rather than TEK recognition, but this is not the case. TEK is ingrained in the Trios' way of life and culture. They are inextricably linked to their traditional territories. It is part of their culture to protect their territories. As a result, when ACT disregards these needs and wishes in regard to forest conservation, they also disregard their culture and, hence, their TEK.

An important societal relevance of this study is that it assists the NGO Green Growth Suriname (GGS) in assessing the current forest ranger program. The goal is to identify potential issues and create a program that has its foundation on the Trios culture and needs. To answer this question the fourth subquestion was created.

The framework that was determined to be appropriate is based on the criteria for TEK recognition that, in the eyes of the rangers, are not entirely satisfied. Additionally, the framework needed to have a few characteristics to address the rangers' recurrent issues. Open communication, regular meetings to discuss needs and preferences, and shared decision-making procedures are some examples of these qualities. Adaptive co-management (ACM), which includes Indigenous peoples through shared decision-making, recognizes the various needs present, fosters trust between actors, recognizes Indigenous peoples and their knowledge systems, and shares power, is a conservation method that includes these characteristics and satisfies the unmet criteria. Additionally, ACM uses the learning-by-doing methodology, which enables program adaptation.

The budgetary ambiguity surrounding the ACT's forest ranger program was encountered during the study. Further research into ACT's budget is necessary to determine how much of the rangers' problems are related to financial concerns and to better understand why fewer tools are being provided now than in the past. Future studies should also examine how much ACT depends on other stakeholders to carry out its projects and programs, as well as how problems associated with this could be resolved. Other conservation NGOs that are in a similar predicament may find this research to be helpful. Finally, there is little literature on South American Indigenous peoples' efforts to conserve forests. The literature on these activities could be expanded with the help of future studies.

List of Abbreviations

ACRs	Amazon Conservation Rangers
ACT	Amazon Conservation Team
ACM	Adaptive Co-Management
BBS	National Herbarium of Suriname
CI	Conservation International
DNA	Parliament of Suriname
GGS	Green Growth Suriname
LEK	Local Ecological Knowledge
OIS	Organisation of Indigenous People in Suriname
RGB	Ministry of Spatial Planning, Land and Forestry Management
ROM	Ministry of Land and Forest Management
ROS	Ministry of Regional Development and Sport
SSCC	South Suriname Conservation Corridor
TEK	Traditional ecological knowledge
TWTIS	Tarëno Wajana Tinonokon Ikurumane Soire Weinje (formerly known as SSCC)
WSK	Western Scientific Knowledge
WWF	World Wide Fund for Nature

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1. Research framework

1.1 Introduction

The Amazon is home to thousands of species of plants and animals and likely over a million insect species. It is rich in biodiversity, accounting for 10% to 15% of all land species, as well as being extremely significant for freshwater biodiversity - the Amazon basin contains 15% of all freshwater fish in the world. Furthermore, the Amazonian carbon storage contains approximately 150 billion to 200 billion tons of carbon. Since 60% of the rainforest are located in the Amazon it is an essential biome for the hydrological cycle, preserving biodiversity and global climate. This great rainforest is situated in South America and covers Brazil, Peru, Colombia, Venezuela, Bolivia, Guyana, Suriname, Ecuador and French Guiana. However, deforestation is a problem in the Amazon with the consequence of reducing the contributions that the Amazon produces, resulting in an increase in biodiversity loss, an intensification of precipitation and droughts across the entire Amazon, higher carbon emissions, and social impacts such as decreased health due to the spread of infectious diseases and a decrease in agricultural yields (Bennett, 2017; Jézéquel et al., 2020; Nobre et al., 2016; Sobral-Souza et al., 2018; WWF, n.d.).

A solution against the deforestation of the Amazon is forest conservation. Additionally, forest conservation benefits biodiversity and watershed preservation, as well as forest-dependent populations (IPCC, 2007). One country for which the protection of the Amazon is crucial and advantageous, is Suriname. This is due to Suriname's high degree of biodiversity and the Amazon's 93% coverage of the country. Furthermore, there are about 2,000 Indigenous people living in South Suriname (Green Growth Suriname Foundation, 2022; Heemskerk & Delvoye, 2007; Mittermeier et al., 2021). To secure the protection of the forest the leaders of 8 Trio and Wayana Indigenous communities came together on March 5th, 2015, to sign a declaration stating the protection of 7.2 million hectares of the rainforest in the South Suriname Conservation Corridor (SSCC), and now known as Tarëno Wajana Tinonokon Ikurumane Soire Weinje (TWTIS) (Green Growth Suriname Foundation, 2022; Tropenbos International Suriname, 2018).

The Trio and Wayana Indigenous people occupy a large area of the northern Amazon Region, which is partly situated in South Suriname. The Trios dwell on both sides of the Suriname-Brazil border, whereas the Wayanas' territory includes Suriname, Brazil, and French Guiana (Heemskerk et al., 2007; Heemskerk & Delvoye, 2007).

According to Ban et al. integrating traditional ecological knowledge (TEK) with forest management has positive effects on forest conservation (Ban et al., 2018). This positive relation has also been found across Amazonia (Paneque-Gálvez et al., 2018). Berkes (1993) defines TEK as follows:

> *"Traditional ecological knowledge or TEK is a cumulative body of knowledge and beliefs, handed downthrough generations by cultural transmission, about the*

> *relationship of living beings (including humans) with one another and with their environment. Further, TEK is an attribute of societies with historical continuity inresource use practices; by and large, these are non-industrial or less technologically advanced societies, many of them indigenous or tribal."* (Berkes, 1993, p. 3)

As mentioned by Berkes, one of the holders of TEK are Indigenous communities. Their long history of place-based knowledge, gathered over generations, could aid in expanding the knowledge of forest conservation (Ban et al., 2018; Cheveau et al., 2008). To relativize the quote above, it is worth noting that TEK holders are considered less advanced in the Western worldview.

Traditional ecological knowledge ensures that the needs of the Indigenous community are met while also considering the needs of the future generations. This way of living is quite similar to how sustainability is defined by the Brundtland Commission (Cheveau et al., 2008), namely "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* (UN, n.d.). The Trio and Wayana tribes both live by this principle in their daily lives. Both communities only take the resources of the forest that they need for their livelihood. Their belief is that both people and animals depend on the forest's resources. Furthermore, they reserve areas that will provide food for future generations (Tropenbos International Suriname, 2018).

Thus, applying TEK not only increases our understanding of ecology, but also ensures sustainable forest management. The knowledge of the place, but also the connection to it, could help with the conservation and the protection of the forest and the Indigenous' cultural heritage. An NGO that focusses on these aspects is the Amazon Conservation Team (ACT). Their mission is to collaborate alongside local populations, both Indigenous and non-Indigenous, to safeguard tropical forests and preserve traditional culture. To achieve this mission in Suriname, ACT introduced amazon conservation rangers (ACRs) who consists of Indigenous and Maroon community members (Amazon Conservation Team, n.d.-b). ACRs are agents trained for field work and work within protected areas. The rangers are engaged in conserving and preserving the natural and cultural resources of a certain area. Moreover, they are the link between local communities, protected areas and the management of the area (Equipe de Conservação da Amazônia, 2018). Often these rangers are trained with Western scientific knowledge (WSK), such as national and international models and concepts of management (Equipe de Conservação da Amazônia, 2009). This is also the case for the 55 Indigenous rangers that are active in the Trio area, with the objective of identifying areas for protection and existing threats. They receive a training in communication, field skills and the use of various forestry instruments such as a computer or a drone. Furthermore, they are trained to and receive the equipment to up- and download data onto the internet (Green Growth Suriname Foundation, 2022). In this study the terms ACRs and (forest) rangers will be used interchangeably.

1.2 Research objective

As mentioned before, ACRs are often trained with Western scientific knowledge. However, the ACRs, who are members of the Indigenous or Maroon community, hold TEK (Amazon Conservation Team, n.d.-b). The application of TEK could be of great benefit to the protection of the forest, through the inherent sustainable forest management. It is still unknown, though, if and to what extent ACRs' TEK is acknowledged within the forest ranger program. By researching how TEK is combined within the forest ranger program and its training program, it can be determined to what extent TEK and its positive effects on forest protection are recognized. Thus, in short, the research objective is to find out how the recognition of the traditional ecological knowledge within the forest ranger program and its training program of the ACRs has been thus far.

In order to achieve this objective, the research will be framed to a specific case. The focus will be on the ACRs of the Trio Indigenous community and their respective area, namely TWTIS. TWTIS is also inhabited by the Wayana Indigenous peoples. However, for this research the focus will be on the Trios because they live according to the principles that balance the growth of the population while also maintaining the health of the environment. This is in great contrast to the how the Wayana live. The Wayanas have less of a connection with nature and sometimes participate in destructive activities (Green Growth Suriname Foundation, 2022). Furthermore, it is critical to study ACT, the organization for which ACRs work, in order to better understand the recognition of TEK inside the forest ranger program. This allows for the investigation of the NGOs willingness and capacity for TEK recognition.

When there is collaboration or participation between the Indigenous peoples and Western scientists, it is important to focus on how the researcher frames the Indigenous knowledge they have received. In this study I look at two different types of knowledge: Western knowledge and traditional knowledge. Western knowledge is seen as having universal validity and is able to provide a theoretical framework, while traditional knowledge is described as being void of that, having only local applicability and no scientific validity, nested in the empirical. This distinction that is made between the two knowledges is called coloniality of knowledge, whereby the non-Western knowledge is seen as inferior to Western knowledge and void of scientific validity (Álvarez & Coolsaet, 2020). The two knowledges are not seen as equal. This hierarchization of knowledges are called a misrecognition. To avoid this hierarchization, space should be provided for the cultural diversity of knowledges (Coolsaet, 2016), creating "equality between different ways of knowing the world" (Martin et al., 2013, p. 123). This equality between knowledges is also called recognition (Coolsaet, 2016) .

Using the term "integration" does not necessarily imply that there is an equality between the two knowledges. Thus, in this research from now on the term "recognize" or

"recognition" will be used to refer to the integration of the traditional ecological knowledge within the context of training of forest rangers.

1.3 Research question

In order to reach the objective for this framework a research question is formed:

How is traditional ecological knowledge recognized within the forest ranger program?

Four subquestions have been established in order to arrive at a conclusion. First and foremost, before determining whether traditional ecological knowledge (TEK) is recognized in the context of the forest ranger program in South Suriname, it is necessary to define which criteria ensure that TEK is recognized in forest management. Because there has not been enough research on forest ranger programs and TEK recognition, the focus will be on forest management as a whole. This will also serve as a fundamental foundation for the theoretical framework in Chapter 2. As a result, the first subquestion is:

1. *How is traditional ecological knowledge recognized in other cases of forest management and what are the results?*

By having established the criteria, it can be determined to what extent TEK is recognized within the case of the forest ranger program in South Suriname. Furthermore, why and how it is acknowledged or not is investigated. To accomplish this, data is utilized, which is acquired using various methods as described in the methodology (Chapter 3). As a result, the second subquestion addressed in Chapter 4 is:

2. *Are the ways through which TEK is recognised in the current forest ranger program considered sufficient and adequate?*

However, only determining how TEK is recognized by using the criteria determined in subquestion 1 is insufficient. Indigenous peoples are frequently marginalized and their TEK is frequently regarded as less legitimate than Western scientific knowledge. In addition, the Trios' traditional lands (TWTIS) are not legally recognized by the government (Green Growth Suriname Foundation, 2022). To completely comprehend how TEK is recognized, it is necessary to investigate what the power relations are between the ACRs and other stakeholders. It is crucial to understand who is involved in this process. It is also crucial to figure out how the stakeholders interact with one another and what their power dynamics are. With this information it can be determined who and how the stakeholders influence the rangers' position in the power field. As a result, the third subquestion addressed in Chapter 5 is:

3. *What are the stakeholders within the forest ranger program in TWTIS, how do they relate to each other and what are the power relations between them?*

Potential factors that may form a problem inside the forest ranger program can be determined by answering the second and third subquestions. By knowing these factors, a suitable framework for the recognition of TEK in forest ranger programs can be found. This also aids in forming recommendations for the NGO Green Growth Suriname. As a result, the fourth subquestion addressed in Chapter 6 is:

4. *What is a suitable framework for the recognition of TEK in forest ranger programs?*

1.4 Scientific relevance

According to Joa et al. TEK and its role in development and empowering the marginalized, Indigenous people has been widely discussed. This is not the case for TEK and its relevance for biodiversity conservation (Joa et al., 2018). This lack of research is also reflected in the training manuals of the forest rangers, where the focus lies more on communicating with the Indigenous communities and the policies that are in place to empower them (Equipe de Conservação da Amazônia, 2018). In addition, not many studies have been done on TEK, its recognition within forest practice and an assessment of this (Joa et al., 2018). This study will fill in the gaps and provide recommendations on how to recognize the TEK in forest rangers training.

1.5 Societal relevance

The NGO Green Growth Suriname (GGS) wants help with evaluating the current forest rangers' program. GGS deems the current program no longer a good fit to the developing situation of the Trios and there being little ownership for the Trio community. As a consequence, GGS would like to build programs on the people's cultural foundations and needs. To make this possible, they want to know how to best integrate TEK with the current forest rangers' program. However, to achieve this, it is necessary to understand what the problem is. This research will help with this. By researching how TEK has been recognized within the forest ranger program and its training programs, problems can be uncovered.
Moreover, a recommendation can be given by answering the fourth subquestion, which asks what framework is suitable for recognizing TEK and Western knowledge into ranger programs.

In addition, a new Sustainable Nature Law that permits co-management within forest management is also being worked on in Suriname. Through co-management, the Indigenous peoples gain more control and responsibility over the preservation of the forest in their traditional lands By permitting this, the ACRs can also be acknowledged and hired by the government. It is important to look into how to combine the rangers' TEK with the WSK they are trained with in order to fill the ranger role in the best way possible. Studying

the present recognition of TEK in the ACT Forest Ranger Program is crucial to achieving this and informing on how to best combine these two knowledge systems.

2. Theoretical framework

This chapter explains the important concepts used in this study. There are three paragraphs in this chapter. To begin, Chapter 2.1 discusses the two knowledge systems that are the focus in this study: Western scientific knowledge and traditional ecological knowledge. The differences and similarities between them are investigated, along with the challenges that the two knowledge systems pose to one another. Chapter 2.2 discusses the necessary criteria for the recognition of TEK in forest management practices. As a result, Chapter 2.2 answers the first subquestion. In Chapter 2.3 the conceptual model that has been derived from Chapter 2.2 is shown.

2.1 Knowledge systems

2.1.1 Western scientific knowledge

There is not one clear definition for Western scientific knowledge. Science is primarily based on two main traditions. First, on the positivist/reductionist perspective which holds to the foundation that all processes can be traced back to physiological, chemical or physical events. The scientific method can measure this. Second, science is rooted in the hypothetico-deductive method, whereby through gathering empirical data hypotheses can be tested for their validity (Weiss et al., 2013). From the abovementioned traditions, the following definition is used for WSK: knowledge that is formed through the scientific method that finds a theory valid when it is tested against a hypothesis. Furthermore, scientific knowledge is gathered by building on previously tested theories, working in a systematic, objective and analytical manner (Agrawal, 1995).

The Western community looks at nature as consisting of resources. Nature can be seen as an instrument. These “resources” can be controlled and exploited for their aesthetic or economic benefits. Additionally, nature is viewed as separate from the people by Western society. These attitudes toward nature are all rooted in the same Western philosophy (Pierotti & Wildcat, 2000).

2.1.2 Traditional ecological knowledge

In literature various terms are found for describing local-based knowledge: Indigenous ecological knowledge, traditional ecological knowledge, local ecological knowledge (LEK), traditional forest-related knowledge, traditional knowledge, traditional forest knowledge, Indigenous knowledge, Indigenous forestry knowledge and practical, experience-based or experiential knowledge.

Following the definition of TEK given by Berkes (Chapter 1.1) (Berkes, 1993), TEK is chosen to be the most accurate term for the knowledge that is to be researched in this study. Moreover, although all terms fit under the same umbrella and can be applied to the knowledge that will be researched, TEK is the term most encountered in papers. Another term that is often used in studies is LEK. However, this term is not as applicable because it

does not specifically address the knowledge of the Indigenous communities. While LEK and TEK both address the same local-based knowledge, the holders of LEK can be both Indigenous communities and local communities. LEK may eventually become traditional ecological knowledge (Joa et al., 2018).

The majority of studies view the relevance of TEK as a vital conservation resource and more specifically, a contribution to biodiversity conservation, as is also reflected by the United Nations Convention on Biological Diversity (UNCBD) (Charnley et al., 2007; Joa et al., 2018). Article 8(j) within the Convention states "that the knowledge and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity should be respected, preserved and applied." (Charnley et al., 2007, p. 14). Moreover, the relevance is especially high when there is no science-based data. Furthermore, the specific place-based data and how TEK scale goes from species-specific to data on ecosystem dynamics brings a higher value to TEK. TEK brings insights previously unobtainable for regular ecological research (Joa et al., 2018).

TEK's relevance for forest biodiversity conservation is shown through two kinds of drivers: a spiritual driver and a utilitarian driver. A spiritual driver ensures the protection of sacred natural sites due to their spiritual meaning. This protection is normally ensured through customary rules, prohibitions and regulations. But also, a taboo can ensure the protection of such an area. Compliance to these rules is safeguarded through sanctions and social convention. The utilitarian driver ensures biodiversity conservation through the management of forest and landscapes (Joa et al., 2018).

TEK is valuable for various reasons and to various groups. It can be important for the knowledge holders themselves, the traditional people, and how it is a representation of a way of life. Likewise, TEK holds a value for the rest of the world, mainly for practical reasons apart from the reason to preserve cultural diversity (Berkes, 1993). The IUCN Programme on Traditional Knowledge for Conservation has made a list on the practical significance of TEK. The following is listed:

1. Traditional knowledge for new biological and ecological insights.
2. Traditional knowledge for resource management.
3. Traditional knowledge for protected areas and for conservation education.
4. Traditional knowledge for development planning.
5. Traditional knowledge for environmental assessment. (IUCN, 1986, as cited in Berkes, 1993)

Following from the points listed above, it can be concluded that TEK is seen as a vital conservation asset. In addition, the IUCN program's point 1 states that TEK provides for new biological and ecological discoveries, which subsequently advance science. This demonstrates how TEK is relevant to science (Berkes, 1993).

In addition, TEK and its management systems can help forming the environmental impact assessment of TEK holders' traditional lands. The taxonomic knowledge that the

Indigenous people hold is big and can aid in understanding the importance of some sources such as medicine, food and sacred entities. However, to be able to study the taxonomy within TEK it is essential to learn the local language. Moreover, essential to conducting the environmental impact assessment is mapping of the spatial distribution of living and non-living resources and other amenities. This local knowledge can be integrated with information obtained from satellite imagery. This way, for example, by doing mapping exercises with the local people, endangered or rare species will likely be sooner identified than if the same exercises were carried out by outside researchers. Additionally, Indigenous people hold knowledge about important biological events and their location and timing, while for an environmental impact assessment it would take years to gather this type of information. Lastly, the traditional conservation ethic of the local people, can be included in the environmental impact assessment to know the potential impact of certain actions on the surrounding environment (Johannes, 1993).

2.1.3 Similarities and differences between TEK and WSK and challenges

TEK and WSK have some similarities. One such commonality is, that both TEK knowledge holders and ecologists – who are part of the Western scientific discourse – share a mutual interest in understanding environmental and ecological forces that have an influence on the diversity and abundance of organisms such as animals and plants. Furthermore, following disruptive activities caused by humans, TEK and science also try to predict changes in the flora and fauna (Ban et al., 2018). Moreover, Indigenous peoples have an intrinsic relationship with their environment (Smith, 2013), which is also reflected in scientific ecological knowledge and that there this is an interconnection of all physical and biological entities (Ban et al., 2018).

However, there are more contrasts than parallels between TEK and WSK. Table 1 summarizes the general distinctions.

TEK and WSK have different methods for gathering and testing knowledge. Western scientific knowledge is frequently generalizable and not necessarily location specific. The scientific method is utilized to develop knowledge, with theoretical models and hypothesis testing and generating a theory. Furthermore, the results are recorded. This is not the case with TEK, which is passed down orally or by demonstration rather than being written down. Furthermore, the purpose of TEK is to acquire information that will help the community survive and preserve their natural resource-based livelihoods, rather than to generate or test a hypothesis. This knowledge is gained from actual experience with the environment rather than scientific information. Furthermore, the knowledge is location-specific (Charnley et al., 2007; Eythorsson, 1993). Additionally, TEK accumulates at a slower rate than WSK and its ability to verify predictions is limited (Berkes, 1993).

Table 1 Differences between TEK and WSK (Berkes, 1993, p.4)

TEK	**WSK**
Qualitative	Quantitative
Intuitive	Rational
Holistic	Reductionist
Unification of mind and matter	Separation of mind and matter
Moral	Value-free
Spiritual	Mechanistic
Based on empirical observations and accumulation of facts by trial-and-error	Experimentation and systematic, deliberate accumulation of fact
Data is generated by resource users themselves	Data is gathered by specialized researchers
Diachronic data	Synchronic data

While there are multiple differences between Western knowledge and TEK, the two knowledge system can also be complementary to each other, informing both the Indigenous peoples as the Western scientist on potential gaps in their knowledge. A big difference between TEK and WSK that may also complement each other is the research methodology. TEK is qualitative while WSK is quantitative, however, with the information that both sides miss, they can complement each other. The difference in research methodology is reflected in for example how changes in the environment are detected. Indigenous peoples use their sensatory apparatus, such as smell and sound, to do this, whereas within Western science the senses are not used when making observations. Furthermore, while the scope of the Indigenous is local-regional that of the Western scientists is local-global. Combining TEK and WSK results in a more comprehensive scope. While Western scientists seek for a local-global scope to predict novel phenomena more correctly, such as the consequences of climate change, Indigenous peoples base their local-regional scope on their knowledge obtained from their experiences living in the forest (Ban et al., 2018; Smith, 2013).

One can say that both Western knowledge and TEK have the same process of creating order out of disorder, where traditional people conduct research out of necessity. However, the validity of TEK has been put into question by the persons that regard TEK as irrational (Berkes, 1993). The scientific discourse is dominant over the knowledge of the Indigenous, giving the TEK a lower status. TEK is associated by the scientific world to be held with a marginalized community and not knowledge conducted in high technology laboratories (Smith, 2013).

One important difference that has implications for the management of biodiversity conservation and how to preserve it, is the worldview of the different knowledge holders (Charnley et al., 2007; Joa et al., 2018). These different views can lead to a difference of

what the goal of biodiversity conservation is, leading to the creation of obstacles that prevent collaborative conservation (Charnley et al., 2007). For example, the objective of TEK is not to control nature, unlike WSK (Berkes, 1993). Furthermore, this is worsened by the barrier of translating ideas and concepts from one knowledge to the other (Cheveau et al., 2008). TEK has a broader social context than scientific knowledge and is a unified system of knowledge, practice, and beliefs (Berkes, 1993). Often the scientists' worldview is dominant over the Indigenous one, causing an uneven power balance and leading to traditional people having to conform to the scientific worldview. Add it to the fact that science is sometimes incomprehensible to Indigenous peoples, and it is possible that the Indigenous withdraw from collaboration (Smith, 2013). In addition to the uneven power balance, both traditional people and Western scientists also have little respect for the value of one another's knowledge systems (Cheveau et al., 2008).

Other challenges that may be encountered while integrating TEK into forest biodiversity conservation is how TEK is not conserved and thus rapidly disappearing. Partly this is due to economic, political and social factors that constrain its use. Furthermore, as mentioned before, often it is not documented (Charnley et al., 2007; Cheveau et al., 2008). However, many knowledge holders are reluctant to share their knowledge because they question whether the knowledge will be used responsibly or to their advantage, and they have concerns about the intellectual property rights (Charnley et al., 2007).

Moreover, integrating the two knowledge systems requires long-term research due to the practices, beliefs and knowledge that form the knowledge system and thus needs to be understood first. Furthermore, TEK is place-specific, dependent on a specific cultural context and may change over time, making it not a generalizable knowledge to be applied to multiple cases. In other words, over time that knowledge may become irrelevant as a data source for forest conservation (Charnley et al., 2007).

2.2 Criteria for the recognition of TEK

In this paragraph the answer to the following subquestion is given: *How is traditional ecological knowledge recognized in other cases of forest management and what are the results?* To find an answer to this question, criteria for successful recognition of TEK are determined. This is done through a literature review in which different criteria were distilled.

2.2.1 Interdisciplinarity

To successfully recognize TEK into forest management it is important to gain a deep understanding of TEK through their relationship with their natural environment with the help of an interdisciplinary team who could obtain this knowledge (Cheveau et al., 2008). Ericksen and Woodley (2005) proposed that this should be done by a team of ecological scientists and social scientists. Furthermore, they recommend that TEK and Western scientific knowledge be evaluated and validated through a cross-validation of local experts

validating scientific knowledge and Western academics validating TEK (Ericksen & Woodley, 2005). Important in a cross-validation process is to determine the epistemological values and beliefs of the various stakeholders before validation begins. This way what is seen as valid is determined and clear beforehand (Raymond et al., 2010).

By taking an interdisciplinary approach one can overcome the difference in worldviews and the language barrier between the researchers and Indigenous people. Often the Indigenous people are asked to adjust their worldview to that of the Western researcher. However, in order to gain an appreciation for another's knowledge, it is important for both Western scientists and Indigenous people to learn about each other's knowledge system. By gaining an appreciation for each other's knowledge and knowing the strengths and weaknesses, the recognition of both systems can begin (Johnson, 1992).

While interdisciplinary research can address the challenge of involving multiple knowledge systems, it still is a time-consuming practice. Furthermore, by using an interdisciplinary approach the different epistemological standpoints are not necessarily addressed, resulting in there still being the possibility of one worldview dominating over the other (Raymond et al., 2010). To avoid this, Raymond et al. (2010) advocate for a broader approach: epistemological pluralism. Which is expanded upon in Chapter 2.2.3.

2.2.2 Active participation of the indigenous community

The acknowledgement of TEK in forest conservation, according to Charnley et al. (2007), is most likely to be successful if the knowledge holders are directly involved as active participants. There are several levels of participation. One model of participation that can be applied in environmental management is that of Luyet et al. (2012) with five levels: information, consultation, collaboration, co-decision and empowerment (Luyet et al., 2012). By achieving the level of empowerment for the Indigenous participants, they will also gain more power to influence decision-making (Poto, 2017). This is when the highest level of active participation is reached because they are actively involved with decision-making. Furthermore, by active participation and empowerment of the Indigenous community, the challenge of involving multiple knowledge systems, can be partly addressed, since mutual learning will occur (Charnley et al., 2007; Cheveau et al., 2008).

Subsequently, this will enhance the interdisciplinarity level of the project. How this is done partly depends on the case and how TEK is transmitted (Charnley et al., 2007). According to Cheveau et al. (2008) several criteria are needed to achieve a high level of participation and recognition of TEK: "recognition of alternative knowledge systems, a greater open-mindedness, and support for inter-cultural education (in both directions)" (Cheveau et al., 2008, p. 241). Furthermore, it is crucial for the local people to be trained in running the project once it is done (Cheveau et al., 2008).

One method to accomplish this is to use a collaborative or participatory management approach (Charnley et al., 2007; Shackeroff & Campbell, 2007). The focus of

participatory management is on the collaboration between the researcher and the subject of the research, in this case the Indigenous community. Methods that recognize and empower their knowledge would be used (Matiku et al., 2013; Shackeroff & Campbell, 2007). There are various forms of collaborative or participatory management, including, community-based conservation, collaborative conservation, community forestry and collaborative learning (Matiku et al., 2013).

2.2.3 Worldviews

According to Joa et al. "before effective integration of knowledge systems can take place, an alignment across differing interpretations of reality is needed […]" (Joa et al., 2018, p. 526). This criterion is difficult to meet because the Indigenous and Western worldviews are so dissimilar, specifically in relation to the definition of biodiversity. As a result of these divergent viewpoints, there may be disagreement on what the goal of biodiversity conservation is (Charnley et al., 2007). These different ways of knowing determine what is seen as the universal truth and therefore what is seen as valid (Raymond et al., 2010).

Additionally, how nature is perceived is also different between Indigenous peoples and Westerners. Both parties have diverse attitudes toward and values regarding nature. On the one hand, there is Western society, which believes that biodiversity should be preserved in its natural state, free of human intervention. Indigenous communities, on the other hand, have a different perspective on nature and value it differently, living in a far more symbiotic relationship with it. By eliminating the views and values of Indigenous communities and defining living nature entirely in accordance with the scientific definition, social injustice is produced, which in turn causes conflict. Working with a single understanding of biodiversity creates a fragile foundation for collaboration with other conservation partners, such as Indigenous people, who value and have other views on living nature and how it should be defined and managed. Biodiversity must therefore be defined in a pluralistic way, recognizing different perspectives (Pascual et al., 2021).

One solution towards this challenge of different worldviews is epistemological pluralism. Epistemological pluralism "recognizes that there may be several valuable ways of knowing, focuses on the social processes and values involved in the production of knowledge and employs a continuous process of negotiation between researchers" (Raymond et al., 2010, p. 1770). By recognizing the several ways of knowing, and thus the diverse interpretations of biodiversity and the different values it holds to different people, one can make biodiversity conservation part of a wider engagement (Pascual et al., 2021). One way to make epistemological pluralism in relation to biodiversity possible is through achieving four other criteria: "Interdisciplinarity", "Active participation of the Indigenous community", "Knowledge co-production" and "Share power". It should be noted, though, that the first three criteria are merely a means of achieving plurality and are not required. The four criteria subsequently also promote recognition of TEK within forest conservation (Pascual et al., 2021; Raymond et al., 2010).

The criteria “Interdisciplinarity”, “Active participation of the Indigenous community” and “Share power” and their relationship with epistemological pluralism are briefly discussed in this chapter and explored in more detail in Chapters 2.2.1, 2.2.2, and 2.2.6 respectively. In addition, this chapter goes into greater detail about knowledge co-production.

The TEK holders can be recognized into forest management by forming an interdisciplinary management team. Through this interdisciplinary team the Western forest management actors can get a deeper understanding of Indigenous worldviews. This way, epistemological pluralism is possible. Furthermore, with the active participation of the Indigenous people, different epistemological ideas can be discussed and negotiated (Raymond et al., 2010). Furthermore, for a pluralistic perspective of biodiversity to flourish, the Western conservation movement would have to relinquish its position of power and moral authority. This is related to the Western movement's position of power, which values scientific information as superior since it is scientifically produced (Pascual et al., 2021), as opposed to TEK, which is obtained via hands-on experience with the environment (Charnley et al., 2007).

Another way to include various knowledge systems and achieve epistemological pluralism is through knowledge co-production (Pascual et al., 2021). Wyborn et al. define co-production as follows: “Processes that iteratively unite ways of knowing and acting – including ideas, norms, practices, and discourses – leading to mutual reinforcement and reciprocal transformation of societal outcomes.” (Wyborn et al., 2019, p. 320). Co-production is thus a way of involving multiple participants so that multiple outcomes are produced including the integration and co-production of knowledge systems. By doing this, co-production offers a framework that aids action and decision making for sustainability by integrating different worldviews and knowledge (Wyborn et al., 2019). In addition to knowledge co-production aiding in epistemological pluralism it also aids in successfully recognizing TEK into forest biodiversity conservation (Charnley et al., 2007).

However, this approach does not come without critique. One critique is that the benefits may be overshadowed by the costs of co-production. Compared to other methods of knowledge production co-production costs more money, time, facilitation expertise and engagement from participants (Lemos et al., 2018; Wyborn et al., 2019).

Another challenge often encountered with the use of co-production is the unequal power relations between the scientific oriented stakeholder and other stakeholders. The involvement of other participants within this method is what ensures that the knowledge produced is of a high scientific standard and socially robust. Equality among participants, however, is not a given. Elite actors, such as scientists or NGOs often have more power. They often start and determine the scope of the project, with the possibility of adapting it to their interests. Usually, they have more time and resources at their disposal. This unequal power relation is further exacerbated by the higher value that

is placed on scientific knowledge in comparison to other knowledge systems, specifically TEK. As a consequence, TEK is often translated into scientific terms so that it fits the dominant policy frameworks. The risk of this is that TEK will be excluded or lose its meaning. As an effect, those with less power, such as Indigenous peoples, are marginalized (Turnhout et al., 2020; Wyborn et al., 2019).

2.2.4 Preservation of TEK

For TEK to be successfully recognized within forest conservation it is key for TEK to flourish and persist (Charnley et al., 2007). Usually, TEK is transmitted through demonstration or orally (Cheveau et al., 2008; Senanayake, 2006). This information is passed from generation to generation, intergenerational transmission, via social learning and direct contact with nature (Cristancho & Vining, 2009). However, TEK is in danger of disappearing, putting communities who rely on the natural environment for existence at a disadvantage (Cristancho & Vining, 2009).

Cultural assimilation, technology, incorporation into the market economy, poverty, environmental deterioration, loss of traditional areas, modernization, death of the elderly, and the Western schooling system are all contributors in the disappearance of TEK (Cheveau et al., 2008; Cristancho & Vining, 2009; Gómez-Baggethun & Reyes-García, 2013; Senanayake, 2006).

There are numerous approaches to stop this process and preserve TEK. Ensuring that younger generations learn TEK from older generations is one example. Often the elders hold the traditional ecological knowledge and with their passing, TEK also slowly disappears. To make sure that TEK does not disappear, it is essential that the Indigenous people themselves initialize the research of TEK. To make sure that TEK is relevant or stays relevant, the participation of the youth and the guidance of the elders are required (Johnson, 1992). This can be accomplished by providing incentives for older generations to teach younger generations using traditional teaching methods rather than forcing the Indigenous people to use the Western environmental education approaches. Furthermore, incentives for the younger generations could encourage them to spend more time in the natural environment (Cristancho & Vining, 2009; Okui et al., 2021).

Another important approach is to document TEK (Charnley et al., 2007; Cheveau et al., 2008). However, there are a few risks of documenting this knowledge in text, as fundamental properties of TEK can be changed. Furthermore, TEK is generated within a cultural and social context (Berkes, 1993; Johnson, 1992; Senanayake, 2006). Taking it from its context might also change its meaning (Nasasdy, 1999). However, by letting the Indigenous people document it themselves, the knowledge is interpreted accurately, based on their particular social and cultural context (Johnson, 1992). Furthermore, another risk with the documentation and storing of TEK is that there is also a fear of misusing the knowledge (Charnley et al., 2007). However, knowledge can be preserved from exploitation by documenting it (Lindh & Haider, 2010). By creating databases where it can be stored the Indigenous people receive the recognition for their knowledge and be recognized as the

proprietors of the knowledge system (Okorafor, 2010; Sen, 2005). However, TEK documented in written formats such as books and scientific articles may have limitations when applied. This is due to it being local-based and thus difficult to generalize. Furthermore, skills and knowledge derived from cultural history are key in applying TEK (Charnley et al., 2007). This cannot be learned from a written format. Additionally, while conserving TEK in data bases should benefit the Indigenous peoples and allow them more power over their knowledge and how it is applied, the opposite might also occur. The risk of misappropriating Indigenous knowledge and failing to benefit Indigenous peoples exists when creating such databases (Agrawal, 1995).

2.2.5 Trust

A study done by Young et al. (2016) suggests that the recognition of TEK is contingent on the development of trust. For the knowledge holders of TEK to share their knowledge with the organizations and individuals, a foundation of trust is needed. There have been cases in the past where public land managers received TEK only to exploit or ignore it, causing harm to the TEK knowledge holders and weakening their trust. As a consequence, there is the possibility that their knowledge will not be shared again in the future. The distrust may originate from a past where forest management policies and practices disadvantaged them and their livelihood (Charnley et al., 2007). Furthermore, a lack of trust in institutions might stem from a lack of shared values or procedural fairness (Young et al., 2016).

For trust to be reached it is essential to share the power when knowledge is applied, or decisions are made. This is especially true when TEK knowledge holders have information about the natural resources in case and are reliant on them. Interpersonal trust, which is acquired through increased interactions, is another important aspect in creating trust (Young et al., 2016).

2.2.6 Share power

The criterion "Share power" has been mentioned in the criteria "Worldviews" and "Trust" as a requirement for meeting these two criteria, which helps to recognize TEK in forest management. However, the sharing of power is not just an indirect but also a direct condition for TEK recognition (Joa et al., 2018). The challenge in sharing power within forest management is that there is an unequal power distribution between the Indigenous people and the scientists. Academics hold a significant position in TEK research, as evidenced by a number of factors. Firstly, the Western world has a stronger position over the non-Western world within the field of practices, meanings and values due to the colonial history. As a result, alternative perspectives are often marginalized. Despite the recent promotion of TEK, TEK is still seen as less universal and validated (Joa et al., 2018; Shackeroff & Campbell, 2007; Smith, 2013). Secondly, the research process is often decided by the Western academics, giving them a powerful position. Naturally, the research will benefit the ones who conduct it, who are nearly always Western scientists. This can also be seen in how TEK is incorporated into a Western framework, effectively removing TEK from its cultural

context. This places the power with the Western institutions instead of the Indigenous people. Finally, power lies within knowledge itself. When a scientist gathers TEK data, the scientist also has influence on how the results are interpretated, as well as how the conclusion is presented and to whom. As a result, they have an influence on how the Indigenous people – who are the subject of interest – are represented (Shackeroff & Campbell, 2007).

Scientists must be conscious of the unequal power distribution and critically analyze their intentions for gathering TEK in light of the aforementioned concerns. There is a danger of using TEK in ways that are incompatible with Indigenous peoples' worldviews or cultural practices, or for purposes that they would reject. This has happened to Indigenous peoples countless time in the form of misappropriation of their TEK (Shackeroff & Campbell, 2007).

According to Shackeroff & Campbell (2007) a more equal distribution of power between the Indigenous people and the researchers is achieved, by a thorough methodological process throughout the study (Shackeroff & Campbell, 2007, p. 347). Partnerships, such as co-management, are one way to achieve this. Power sharing is the product of mutual learning, negotiation and a problem-solving process (Shackeroff & Campbell, 2007).

2.2.7 Political factors, respect for TEK holders and mutual benefits

There are other criteria that aid in the recognition of TEK but have not been researched in studies as thoroughly as the ones listed above. “Political factors” is one of them. Political factors that can limit the use of TEK or limit Indigenous people’s access to or control over forest resources can have an impact on how or whether TEK is recognized within forest management. These political factors can include policies or land problems around land tenure (Charnley et al., 2007). Another criterion that is essential is the respect necessary for the TEK holders and their beliefs and practices (Joa et al., 2018; Molnár & Babai, 2021). Finally, for the incorporation of various knowledge systems it is useful to determine mutual benefits and incentives (Joa et al., 2018; Molnár & Babai, 2021).

2.3 Conceptual model

Ten criteria were found that would aid in the recognition of TEK in forest management, namely: “Interdisciplinarity”, “Active participation of the Indigenous community”, “Worldviews”, “Knowledge co-production”, “Preservation of TEK”, “Share power”, “Trust”, “Political factors”, “Respect for TEK holders” and “Mutual benefits and incentives”. Moreover, the majority of these criteria encounter challenges described in Chapter 2.1.3.

These found criteria are illustrated in Figure 1 and form the conceptual model of this study. As illustrated in Figure 1, the majority of these criteria are interrelated. The main criterion "Worldviews" is made possible by four other criteria. Furthermore, logic suggests that active participation of the Indigenous is required for an interdisciplinary team to be possible. Additionally, as discussed in Chapter 2.2.5, increasing contacts between stakeholders is one way to build trust. The Indigenous people's active engagement is

required to achieve this. As a result, active participation and trust are interrelated. The material read and the content written provide additional relationships between criteria.

These interrelations show how nearly all criteria are partially dependent on one another, and therefore meeting only a portion of these criteria will not results in successful TEK recognition. All conditions must be completed in order for TEK to be recognized successfully.

While these criteria have been highlighted in various research, this does not indicate that they can be applied in every circumstance. There may be contextual differences because not all forest management practices are the same and Indigenous groups differ. Furthermore, not all criteria may be applicable in this situation. Political factors, for example, vary in each country, therefore there may be no political obstacles in a case, rendering the criteria "Political factors" useless. Finally, it is possible that in the reviewed literature a criterion was overlooked that will be observed in this study (Charnley et al., 2007; Cheveau et al., 2008; Joa et al., 2018; Pascual et al., 2021; Raymond et al., 2010; Shackeroff & Campbell, 2007; Young et al., 2016).

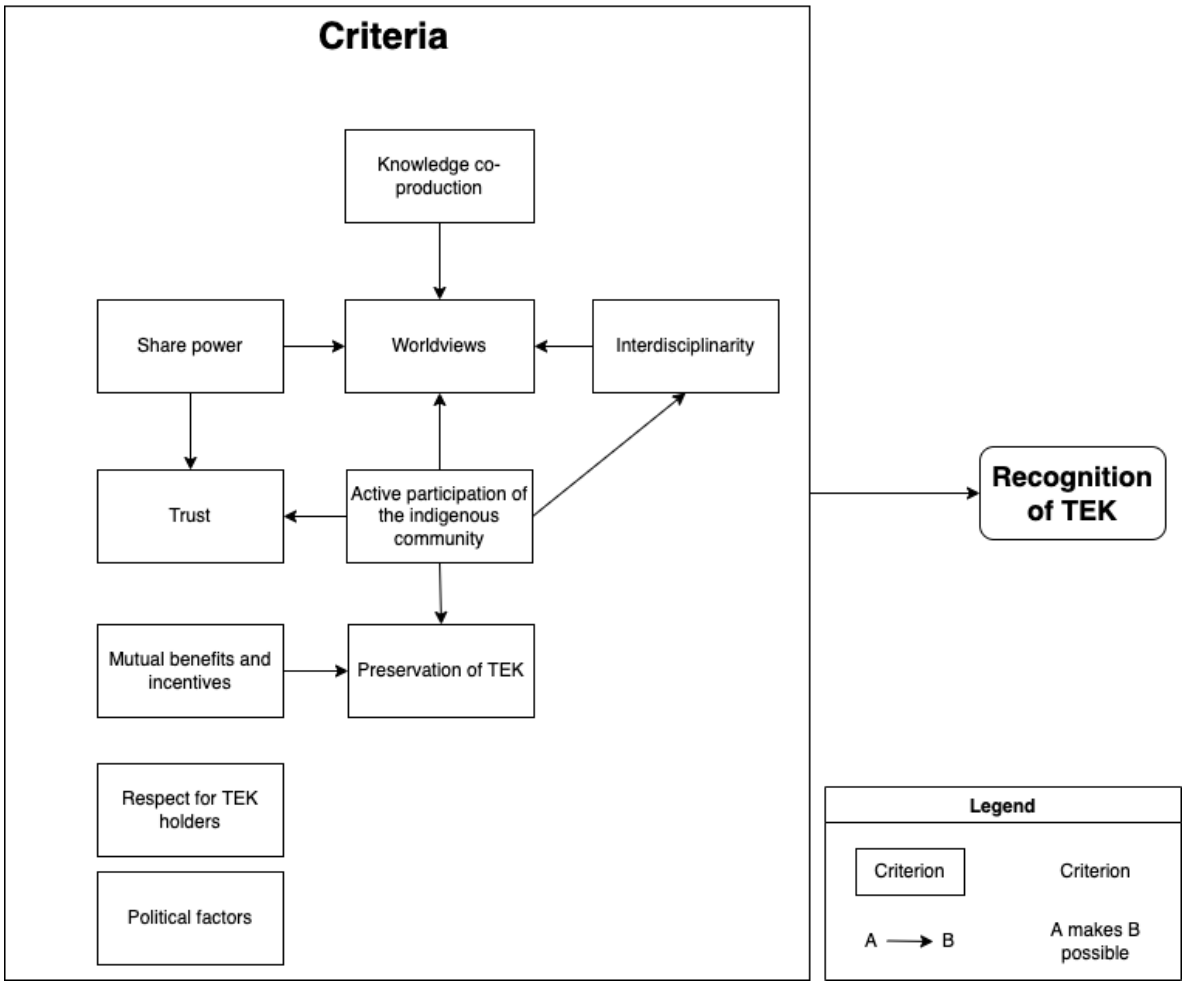

Figure 1 Conceptual model

3. Methodology

3.1 Research method

By doing qualitative research the researcher is investigating the perspectives of those involved in a situation. Furthermore, conducting qualitative researcher entails using a holistic approach, which implies looking at the research subject as a whole. It is not the intention to choose to discard certain elements or to isolate them for a separate study. These aspects of a qualitative research are why this method was chosen. However, qualitative research is known for its iterative approach. The research process begins with multiple interviews and observation, which is then followed by reflection. Later on, the researcher returns to the field and repeats the process to see if his earlier findings are still valid. By collecting more empirical material, concepts and theories are formed that are grounded in empirical reality (Vennix, 2019). However due to being able to only visit the village Kwamalasamutu once, it will not be possible to do multiple observations and interviews. Nonetheless, to substitute the process of iteration, multiple papers about the Trios and interviews with the Trios were read and analyzed. Through this triangulation it is possible to ground the interviews in some empirical findings and subsequently increase the validity and trustworthiness of the results of the study (Moore et al., 2012).

One research method typically associated with qualitative research is a case study. Within a case study a specific case is analyzed from different angles and in depth. This type of study is suitable for questions about how processes occur and why certain phenomena take place (Vennix, 2019). To know which research method to choose, or whether you have chosen the correct one, is contingent on three factors: how a research question is formed, whether behavioral events must be controlled, and whether the focus is on historical or contemporary events. The research question in a case study is usually formulated as a why or how question. This is also true in this study, where the research question takes the form of a how-question. Furthermore, a case study requires no control over behavioral events. This factor also applies to this study, where there is no need for control over the actors within the study group. Finally, a case study focusses on contemporary events, which is done in this research as well (Yin, 2018). Following these conditions comes the conclusion that a case study is ideal for this research.

A case study has multiple categorizations: explanatory, exploratory and descriptive. This study can be categorized as exploratory. Furthermore, a case study can be a single or multiple case study (Vennix, 2019). Since this study only focusses on the Trios, this was a single case study.

3.2 Data collection

A case study draws on a variety of evidence, such as reports, academic papers, existing interviews, as well as data collected by the researcher itself, namely interviews and direct observations, which is unique to a case study (Yin, 2018). This study also made use of primary and secondary material. A semi-structured interview uses an interview guide

where a list of subjects is predetermined as well as the order and formulation of the questions (Vennix, 2019). The primary material is collected through semi-structured interviews. One of these interviews was conducted with the forest rangers in Kwamalasamutu. Moreover, an interview was conducted with the person that established the program of the forest rangers of ACT. In addition, an interview was held with the current tribal regional coordinator and the current country manager of ACT Suriname. However, doing direct observations of the forest rangers was not possible because the duration of the visit did not coincide with the forest rangers' activities. A list of interviewees is added to Appendix A.

Secondary material is collected from papers, books, reports and internet documents. Data about ACT's forest ranger program is limited. The most current annual report about ACT and their operations was released in 2020. However, the information written about the ACRs within these annual reports is limited. There are reports on the ACRs, although the most recent one found was only published between 2008 and 2012. As a result, the data may be out of date. However, some data could be replaced by the current data gathered through the conducted interviews with ACT's current and former employees. Additionally, details from the ACT website add to the knowledge about the rangers.

3.3 Fieldwork

3.3.1 Research site

The research is conducted in the Trio village Kwamalasamutu in South Suriname also known as TWITIS. The village is situated in a hilly landscape and along the Sipaliwini River. Kwamalasamutu has an airstrip which is used on a weekly basis (Tropenbos International Suriname, 2018).

To get to the research site GGS chartered a flight. The duration of the stay at the village was from May 13, 2022, to May 16, 2022. Furthermore, prior to visiting the village and starting data collection, the permission of the traditional authority was asked. On the day of arrival, a Krutu (meeting) was held to notify the Trio community about the research goals and to plan for when the interviews could be conducted. At this Krutu the interview with the forest rangers was set for May 15, 2022.

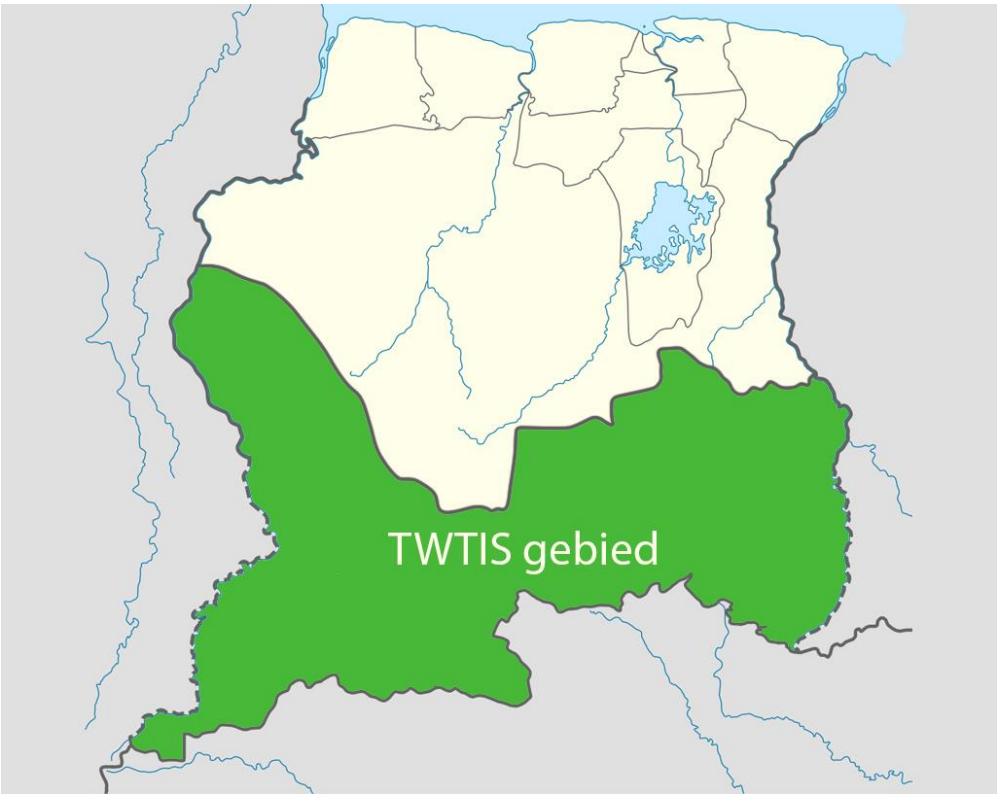

Figure 2 TWTIS area in Suriname (Source: https://www.tuhka.sr/duurzaamheid)

3.3.2 Interviews

As mentioned before, interviews were conducted with the forest rangers, an employee that established the forest ranger program and worked from 2006 until 2013, and the current ACT team that coordinates the forest ranger program. The interview guide created for the forest rangers was created with help of Dr. Gwendolyn Smith, who has an experience of 15 years with the Trios. Only a small number of Trios can speak Dutch or Sranang Tongo. The language of the Trios is Carib-based that is often metaphoric, with a frame of reference focused on the forest. This language differs from the Western language English used in this study with a Northern frame of reference, and thus hard to understand for the Trios (Smith, 2013). Thus, with the help of Dr. Smith an interview guide was created that would fit the language and epistemological world of the Trios. The interview guides are available in Appendices B and C.

The interviews with the current ACT team and a former ACT employee were conducted through the help of the video conferencing application Zoom. The interview with the forest rangers was held in their workspace and was done with the help of three interpreters: a board member of the NGO GGS and a forest ranger. The forest ranger would translate from the Trio language to Sranan Tongo and the interpreter of GGS would translate from Sranan Tongo to Dutch. At the end of the interview an interpreter of Kwamalasamutu that could translate from Trio to Dutch was also present. Allowing the questions and answers to be interpreted by two people has the potential to skew the research's validity and reliability. These two translators may have differing interpretations of the questions and replies. This

is especially true if one translator first translates the question, allowing the other translator to interpret his translation differently. As a result, the validity – or the accuracy of the measure or in this case, the questions – and reliability – or whether the results accurately reflect what they are designed to measure, or in this case, the answers – are in danger. Through triangulation, this is mitigated in this study. The responses from the interview are compared with other data sources, such as literature regarding the forest ranger program, the Trios and the Trios' TEK. The credibility of the interpretations of the responses is increased when the literature and the interview responses are consistent. When these are not consistent, possible explanations for these inconsistencies are identified (Vennix, 2019). Furthermore, the rangers also validated the study's analysis and if it accurately reflected the answers they gave, which further increases the reliability of the study.

3.4 Transcription and coding

Four interviews had to be transcribed. This was partly done with the help of the web application Happy Scribe and OTranscribe. All the interviews were transcribed in Dutch. The transcripts have been modified to increase readability and make it grammatically correct. Following the transcription, the coding could start. The coding process was a combination of free coding and applying codes to previously made code groups. The names of these code groups correspond to the criteria listed in Chapter 2.2. A code book is added in the Appendix D.

3.5 Researchers' positionality

I shall not only explore Indigenous knowledge and its related ontology and epistemology as part of this study, but I will also physically interact with it. Before proceeding, it is necessary to state that I acknowledge and respect the various ways of knowing, doing, and being within the Trio group, and that I hope this is reflected in my study. However, because I am from the Western world and was educated and raised with a Western worldview, I cannot guarantee that the analysis will not be influenced by my Western worldview. While I hope to analyze the interviews as objectively as possible and learn from their perspectives, I cannot guarantee that the analysis will not be influenced by my Western worldview.

4. Recognition of TEK in the forest ranger program

With the aid of the criteria determined in Chapter 2.2, the second sub-question can be answered: *Are the ways through which TEK is recognised in the current forest ranger program considered sufficient and adequate*? Through the found criteria in sub-question one, the level of recognition of TEK in the current training of rangers in Suriname can be determined. Furthermore, in this chapter it will be determined why a criterion is fulfilled or not.

4.1 Active participation of the Indigenous community

"Recognition of alternative knowledge systems, a greater open-mindedness, and support for inter-cultural education (in both directions)" (Cheveau et al., 2008, p. 241) are conditions needed for a high degree of participation and recognition of TEK, according to Cheveau et al. (2008). Inter-cultural education in both directions, as further described in Chapter 4.2, is achieved through the Trios' elementary school, ACT learning some TEK and interactions between the Indigenous community and ACT. As a result, of the interactions, more open-mindedness is developed. Furthermore, according to interviewee Bang a Jong, ACT recognizes the Trios' Indigenous knowledge.

> *"[…] ACT recognizes that Indigenous knowledge so there's no doubt about that."* (Rachelle Bang a Jong, 25-04-2022, translated)

Furthermore, as mentioned before, it is critical for the knowledge holders directly involved to be active participants in order for TEK to be successfully recognized within forest conservation projects. This, according to ACT, has been accomplished. The implementation of a program necessitates community participation. The participation of trainees is equally crucial. The argument for this is that only the residents of the village can determine what should be included in the training program.

Lastly, as discussed in Chapter 2.2.2, for a high level of participation it is also crucial for the local people to be trained in running the project once it is completed. This will be accomplished in accordance with ACT's goal, as evidenced by the following quotes:

> *"Only then have we achieved our goal. That they don't need us anymore."* (ACT, 22-04-2022, translated)

> *"So, you want to empower people to be able to do it themselves, because if they can do it themselves then they are also proud."* (Rachelle Bang a Jong, 25-04-2022, translated)

An effective approach to accomplish active participation is through collaborative or participatory management. According to ACT, the organization is in a direct partnership

with the Indigenous community. While it is not specifically stated in both interviews and reports of ACT what type of direct partnership they are in, it is stated in both interviews and reports that the goal of ACT is to contribute to the empowerment of the Indigenous communities and other tribal communities in Suriname (Amazon Conservation Team, 2010, 2012). As is indicated in Chapter 2.2.2, empowering these groups is a crucial part in collaborative or participatory management.

While ACT perceives active participation from the Trios, the rangers do not perceive active participation of the community. Despite the fact that the community is aware of the rangers' work, there is no interest in the ranger program or what they are doing.

> *"When Ariphio wants to tell something at the Krutu about what he does, only 2 or 3 people show up. People are not interested."* (Rangers, 15-05-2022, translated)

This uninterest runs counter to the ACT's plans for the rangers. The rangers being able to tell about the ranger program was thought to be beneficial by ACT. Since the rangers are doing the work and are involved, they are qualified to speak on the subject.

One possible explanation for the community's lack of interest in the program is that the rangers have lost the community's respect. This is due to the fact that they lack the necessary tools to perform their duties. Because there is fewer equipment accessible, the rangers' actions are similarly limited. Why they do not get the tools needed from ACT, is unclear to them. The rangers did, however, note that they had heard there is not enough money for the tools they need. This viewpoint is confirmed by ACT:

> *"We are an NGO, and we depend on resources. Every request also has a cost. And sometimes we don't have the resources."* (ACT, 22-04-2022, translated)

4.2 Interdisciplinarity

As previously stated, an interdisciplinary team of ecological and social scientists is one way to gain a deep understanding of TEK. Although it was not explicitly stated in the interviews with ACT whether such scientists are used or not, ACT did mention employment requirements. Having the appropriate education or prior experience engaging Indigenous communities is one of these requirements. As a result, one may argue that the ACT staff involved with the Indigenous communities have been trained or have expertise working with Indigenous. Furthermore, while ACT did not specifically state whether or not they are experts in ecology, it was said that they had learned the names of the flora and animals in both scientific and Trio languages, implying that they had learned some Trio ecological knowledge.

> *"[…] a prerequisite is that you must come to know, study and respect culture." (ACT, 19-05-2022, translated)*

This comment demonstrates how having the correct basis for the job is just as crucial as having a profound understanding of Indigenous culture. Gaining this deeper understanding, happens over a longer period of time, with interactions and forming relationships as the foundation for learning. Additionally, before interacting with the Trios an ACT staff member is informed about the Trios' culture and what they are allowed and prohibited to do in the village. This also reflects the social aspect of an interdisciplinary team. Furthermore, this also demonstrates that ACT gains a deeper understanding of the Trios knowledge system.

This deeper understanding also comes from the part of the Trios. Over time, Kwamalasamutu has become more westernized, with residents wearing Western clothing, listening to Western music, and using cell phones. One can learn about the Western culture's knowledge system by interacting with it. Furthermore, practically all children (> 95%) in South Suriname attend elementary school. They receive the same education as children in Suriname's elementary schools (Heemskerk & Delvoye, 2007), meaning a Western education (Nuffic, n.d.).

Furthermore, it is critical for interdisciplinarity to be achieved, that Indigenous peoples are active participants in the project. However, according to Chapter 4.1, whether or not this is accomplished is uncertain. While ACT believes there is an active participation from the community, the rangers do not agree, as is reflected by the quote given in Chapter 4.1

4.3 Incentives and mutual benefits

The rangers think that the project in itself is good, and they appreciate the facilities it provides. Furthermore, the rangers receive an incentive, namely a salary. Through doing their job the rangers have less time to attend to their daily activities to fulfill their basic needs, such as hunting and tending their vegetable garden. To compensate that gap, the rangers thus receive a salary.

Furthermore, according to ACT, both the organization and Trios received benefits from the collaboration. ACT Suriname derives its benefits by achieving its vision: "[…] to preserve our ecosystem and the rich biodiversity it encompasses by engaging indigenous and maroon communities" (Amazon Conservation Team, 2012, p. 3). As the quotation below illustrates, the Trios were once engaged in environmentally harmful activities. However, ACT demonstrates that it is possible to profit from nature as well, leading to the protection of the forest. The Trios' livelihood is better as a result of this earning from nature, and the Trios thus benefit. Furthermore, the empowering of the Trios by ACT is also a benefit.

> *"I think in the past the thought was of okay; I can only earn from nature if I destroy it or if I export or sell animals and plants. [...] And with ACT I think it is made clear that you can also earn from nature. That you create jobs for people, for*

> *communities. That you can strengthen communities without destroying that nature."* (Rachelle Bang a Jong, 25-04-2022, translated)

However, these benefits are not necessarily felt by the Trios. As mentioned before, the Trios cannot conduct their operations as long as they do not receive the necessary materials. Many times, throughout the interview with the rangers, it is said that things were better in the past and that the training back in the day was thought to be superior. They were given the tools they needed to carry out their tasks. Furthermore, in the past, they were given more authority in their workplace. As a result of changes in the program, rangers are now unable to respond appropriately in situations such as illegal goldmining. These developments results in the rangers perceiving a decline of quality of the program. For them this also means that there are not many benefits to the program, because they also lost the respect of the community. Mostly, there are lot of wishes from the rangers in how to improve the training and the program. Furthermore, because the rangers cannot carry out their activities, the forest is less protected and this results in ACT not achieving its vision, namely conserving the forest.

4.4 Political factors

For the criterion "Political Factors" to be analyzed in the context of the Indigenous forest rangers in Suriname, background information about the current situation is important. From now on, the terms state and government are used interchangeably.

The land rights of the Indigenous peoples in Suriname, including their grounds, living area and resources, are not recognized by the state of Suriname. No form of a collective title to their land or living area is held by the Indigenous communities (Forest Peoples Programme, 2007). While ACT also confirms that the traditional grounds of the Trios and Wayanas are not recognized, they say that it is not experienced as a problem by the Indigenous:

> *"They do have a right to their land. It's more about recognition. They have land, in the whole south, they can build there and do whatever they want. Nobody can touch that. So, they actually have claim over their activities. […] So, the land is not an issue with which they have claim. It's more about the recognition. The government saying: it really belongs to you. But in their perception, they just live in the forest. They go to Guyana and to Brazil. For them, there are no borders."* (ACT, 22-04-2022, translated)

However, as ACT also points out, the problem arises when the government gives a concession for resource exploitation on Indigenous territory. Indigenous peoples are powerless in this scenario. Because it is declared by law that all unreleased land is the state's property. As a result, the government has the authority to grant concessions. There is, however, legislation that recognizes the Indigenous' right to claim their settlements and

existing “kostgrondjes” (vegetable gardens). However, the do not have any rights over them. However, this claim can be revoked at any time if the government decides that the area will be used for other purposes. The traditional people do not have access to appropriate administrative or legal tools (Forest Peoples Programme, 2007; Heemskerk & Delvoye, 2007).

One solution that is in the works to protect the Trio land from concessions is TWTIS. On March 5, 2015, traditional leaders from nine communities declared that the TWTIS area (Figure 2), formerly known as the South Suriname Conservation Corridor (SSCC), would be protected. The purpose of the TWTIS program, which is run in partnership with nature conservation organizations, Indigenous organizations, and other institutes, is to safeguard the forest and its water system while also empowering Indigenous people through the establishment of Indigenous businesses. Furthermore, the goal includes strengthening Indigenous peoples’ leadership and capacity, and achieving official recognition of TWTIS (Conservation International, 2018; Stichting Tuhka Alalapadu, n.d.). By declaring this region protected, it will also be safeguarded against concessions for activities such as gold mining. However, for the legal recognition of TWTIS, the revision of the Nature Protection Laws of Suriname from 1954 is necessary. The law of 1954 focuses solely on strict nature protection, leaving no room for human actions and/or economic models. To revise this old law a “Project Our Nature at Number One” was started. A draft law, Sustainable Nature Management Law, followed from this project. Under this law nature areas could get a protection status based on the IUCN categories for protected areas allowing for nature management that considers people, nature and sustainable coexistence of activities. With the law co-management and sustainable livelihoods for Indigenous communities will become possible within protected areas. The first draft version was submitted August 2018. A second draft version was submitted in March 2021 to adapt to the passed Environmental Framework Law. When the Sustainable Nature Management Law is passed, the rangers will be able to work for the government and not be dependent on conservation organizations to get the tools they need (Conservation International, n.d.-b, n.d.-a; *Herziene Versie Concept Wet Duurzaam Natuurbeheer*, 2021; *Project Onze Natuur Op 1 (Natuurwet)*, n.d.; *Tijdlijn van Het Proces van Ontwikkeling van Natuurbescherming Wetgeving*, n.d.).

4.5 Share power

Power sharing is an important criterion to meet in order to combat the unequal power distribution between Indigenous and Western stakeholders. Based on the interviews, it can be determined that the ACT considers this to be accomplished. According to ACT, ACT serves the community, and the trainees' and community's input is used to tailor the forest ranger program to the community's requirements. However, the rangers deem this criterion not accomplished. One important factor of unequal power distribution is the fact that the research process, or in this case the project, is frequently decided by Western actors. Western institutions, rather than Indigenous peoples, wield power in this way and naturally will also receive the benefits. This is a factor that can be found in the ranger

program as well. The ranger program helps ACT fulfill its mission, which benefits the organization. Another benefit to ACT is how ACT employs rangers to collect samples (e.g., water or soil samples) for scientists at the university, for example. This demonstrates how the rangers are also exploited to perform work that benefits Western scientists or institutions but not the rangers. However, this incidence contrasts with ACT's claim to work in the community's best interests, which should benefit the community. But, as previously said in Chapter 4.3, the rangers do not believe that the community receive these benefits. Additionally, the rangers perceive a decline of quality of the ranger program. As a result, even though the rangers may have originally greatly benefited from the program, this has diminished. However, the project in and of itself, as well as the amenities it provides and the salary that is received, are all seen as positively by the rangers.

The facilitating role that ACT plays is another indicator of power disparity. ACT facilitates the acquisition of the tools needed However, as the tool facilitator, you can choose whether or not to facilitate certain tools. The adverse effects of this are felt by the rangers. They are reliant on resources that ACT does not provide. However, it becomes clear from the interviews with both the present ACT staff and the rangers that the lack of funding prevents the ACRs from receiving those tools. Sometimes a project's money is depleted, and it must be postponed for a year. Bang a Jong also stated that due to funding challenges, there was no funds for the forest ranger program in the years 2012 and 2013. So not only are the Trios dependent on ACT for doing their activities, so is ACT dependent on external benefactors for financing.

> *"We are an NGO and we depend on resources. Every request also has a cost. And sometimes we don't have the resources."* (ACT, 22-04-2022, translated)

Another indicator that shows the power imbalance is the rangers' dependence on organizations or institutions for the protection of their lands. The rangers do not have the authority to act against loggers or miners, for example, as this is prohibited by law (see Chapter 5.4). To stop them, the Trios must first notify ACT, who will then notify the proper authorities or institutions. This creates a reliance that the rangers do not want. The rangers want to do more to preserve their territory, but they don't know how far their authority extends, and they lack the required tools to do so.

However, ACT does have to get the traditional authorities approval. This is because ACT has to adhere to Free, Prior and Informed Consent (FPIC) which is recognized by the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). Through this right the Indigenous have the power to determine whether projects on their lands get consent to start. Furthermore, once given the consent, the Indigenous have the right to withdraw their consent at any time. Lastly, with FPIC they can negotiate the terms of the project's design, implementation, monitoring and evaluation (Food and Agriculture Organization of the

United Nations, n.d.). The Trios gain additional power as a result of this. However, because FPIC is a tool based on a Western framework, it is uncertain whether they are aware of how to use it to defend their rights.

Another area where the Trios have more power is in the selection of ACRs for the program, which is done by the traditional authority. As a result, the ACRs are traditional authority's employees. Furthermore, if the traditional authority assigns a duty to the rangers, that task takes precedence over ACT's actions.

While it is evident that there is a power imbalance between ACT and the rangers, other stakeholders, such as benefactors and the government, are also contributing to the imbalance. The funding for ACT's programs is provided through donations. In addition, the government has law enforcement jurisdiction in the forest. Only the government has the authority to grant this privilege to the rangers, not ACT. Chapter 5 delves more into these power dynamics and how they contribute to a power imbalance.

4.6 Trust

According to ACT, there is trust between ACT and the Trios. However, trust does not develop overnight; it takes time. There is a mutual respect and relationship-building process. And ACT has earned that trust throughout the course of its 20-year engagement with the Trios. This developing of trust through the formation of relationships highlights a crucial criterion for building trust, namely multiple interactions between the people involved. This demonstrates how the condition "Active participation of the Indigenous community" which is required for building trust, is met.

> *"Important in the whole thing is that relationships are built. The whole program, the whole interactions are based on relationships, relationships of mutual respect, mutual understanding and a trust comes out of that."* (ACT, 22-04-2022, translated)

While from the ACT side it is certainly assumed that trust has been formed, this is not the case on the rangers side, as the quote below demonstrates. They cannot trust ACT to keep their promises. Furthermore, the feeling of being tricked does not imply trust in ACT. According to the rangers, this trend of broken promises is linked to a pattern of ambiguous communication between ACT and them. The rangers also stated that things used to be different, but they are unsure what has changed.

> *"They feel like they are being tricked by ACT. Too often promises are made that are not kept."* (Rangers, 15-05-2022, translated)

Power sharing is another crucial element in developing trust. However, as discussed in Chapter 4.5, whether this power sharing is achieved is disputed. The rangers' trust in ACT is influenced by this unequal power allocation. Rangers rely on ACT for the tools they need

to protect their lands, and if they aren't provided, they lose faith in ACT and its purpose of forest conservation.

4.7 Respect for TEK holders

The formation of trust was built on relationship and mutual respect, as stated in a quote in Chapter 4.6. Furthermore, a prerequisite for working on the field with Indigenous people is to among other respect the culture. From the perspective of ACT, the condition of respecting TEK holders and their beliefs and practices are achieved. However, from the Trios' perspective this respect is not held for the wishes and needs that the Trios express. This feeling of disrespect is created through unfulfilled promises and the feeling of being fooled, which form the same foundation for the distrust on the side of the Trios, as is described in Chapter 5.6.

4.8 Preservation of TEK

Indigenous knowledge is disappearing. This is confirmed by both ACT and the Trios. According to the rangers TEK is no longer present among the younger people. They have stopped learning from the forest and its medicines. However, older generations have a wealth of TEK expertise. Unfortunately, many people who possess such information have perished as a result of COVID-19. For this loss of knowledge to be stopped, it is important to them to act before the last knowledge dies with the last people. Thus, it is crucial to work with the older generations and involve the younger generation. The Trios' response is to establish a cultural school. There have already been made commissions by the traditional authority to start this. In this cultural school they will learn about cultural traditions that will help them sustain them in their livelihoods, such as braiding caskets but also knowledge from the forest. The rangers will also receive such training about knowledge from the forest and subsequently also teach the younger generations. This type of solution corresponds to the proposed solutions in Chapter 2.2.4, in which the older and younger generations interact so that the newer generations might learn from the elder. Furthermore, this cultural school would co-exist with the villages' existing elementary school.

ACT is well-known for collecting and empowering communities' cultures. One of the ranger program's goals is to conserve Indigenous people's traditional knowledge and skills (Amazon Conservation Team, 2012). Documentation is ACT's strategy for preserving this. With the use of GPS data, the Trios and Wayanas mapped the environment and what was significant to the Indigenous people at the start of the ACT ranger program. Land-use, such as fishing areas and vegetable gardens, as well as key timber species, were all surveyed. Basically, everything there is to know about the forest. All of this was captured with Western technology. What knowledge is published is decided together with the Trios.

A challenge when documenting TEK, is commonly TEK is transferred orally, which is also the case for the Trios. When documenting the knowledge in text, part of the context can be lost because TEK is situated in a cultural context which cannot be read through text.

By also using footage, such as images as videos as documentation the knowledge is better transferred, containing more of the cultural context the knowledge is situated in. ACT attempted to record the context of TEK in a variety of methods, including using GPS technology to create maps and gathering footage during expeditions. Project Cobra is one endeavor that was undertaken to capture TEK with footage. ACT participated in this project in the years 2012 and 2013. The countries that make up the Guiana Shield were the focus, including Suriname. The Indigenous knowledge and their traditions were recorded though video reports and interviews using the storytelling method (Cobra Collective, n.d.). This project was outside of the forest ranger program.

4.9 Knowledge co-production

While there are no indicators of active knowledge co-production in the forest ranger program, there are times when knowledge systems are integrated and co-produced. An example is when a joint definition of forest conservation was created by the ACT. Forest conservation is defined by the ACT as: *"[…] careful use of the forest and everything in it. You may use it but enough must remain so that the forest and everything in it can regenerate itself and multiply."* (ACT, 19-05-2022, translated). However, for the Trios the forest is a place where they can thrive and survive. From these two definitions, ACT has formed a joint definition: *"make good and careful use of* [the forest]*, so that no damage occurs in the long run."* (ACT, 19-05-2022, translated). This is an illustration of how knowledge is co-produced in order to arrive at a shared understanding of what forest conservation entails.

Furthermore, knowledge co-production also occurs when ACT adjusts their projects based on the needs of the Indigenous people. This occurs as a result of acquiring new perspectives:

> *"You can learn by getting different perspectives, and that's how we learn to adapt our work." (ACT, 19-05-2022, translated).*

The Trios, on the other hand, do not experience the listed benefits of knowledge co-production by ACT, such as shared conservation goals and program adaptation to their needs. As previously stated, the rangers do not consider that the projects are tailored to their needs because the tools needed to carry out the activities that they deem essential are not given. As a results, while knowledge co-production may occur, the Trios do not feel that they experience the produced benefits claimed by ACT.

4.10 Worldviews

As mentioned before, when the Indigenous and Western worldview meet, challenges may arise. Language, which is also identified by other researchers to be an indicator of a worldview conflict, is one issue faced by ACT (Smith, 2013). Due to different worldviews language is used and conveyed differently. The Indigenous, for example, have a different

meaning for the word “work”. For an Indigenous person “work”, such as gathering food from the vegetable garden, is essential to stay alive. For a Surinamese, “work” means working from 8 a.m. until 4 p.m. As a result, when both sides use the same words, yet it explains something different, communication might become difficult. This different use of language also reflects the difference in life perspectives. Work is viewed differently, but also wealth, for example. All of these different perspectives lead back to how one of the cultural characteristics of the Trios is survival oriented (Smith, 2013). However, the challenge related to language becomes less each time due to the increased number of interactions.

The Trios and their traditional way of life have changed through time as a result of contact with the Western world, becoming more westernized in some areas, such as clothing and the use of cell phones. This is aided in part by traditional authorities who undertake activities aimed at bridging the cultural difference between the traditional and modern world, as viewed from the Western world (Smith, 2013). However, their way of life is still mostly traditional. This blend of Western and traditional can, according to Bang a Jong, coexist in a symbiotic relationship. According to Bang a Jong, this is an area where ACT excels:

> *“They can enjoy all the benefits and convenience of what a Western culture brings. But at the same time, this does not have to be at the expense of their traditions.”* (Rachelle Bang a Jong, 25-04-2022, translated)

Thus, while retaining the traditional culture, one can benefit from all of the perks and comforts that the Western world provides. This viewpoint of retaining the traditional culture is consistent with one of ACT’s goals, namely the preservation of Indigenous customs and culture. While not all Trio customs align with ACT’s worldview, such as the eating of primates, which contradicts ACT’s position on no hunting of wildlife, ACT respects this as part of their culture. This acceptance is consistent with ACT’s bio-cultural approach. ACT wants to preserve the forest through empowering the indigenous peoples.

“[...] the focus is not only nature conservation, but also cultural conservation. So, one accepts that humans have certain baggage and that humans engage in certain activities that could be to the detriment of nature. But at the same time, you could [...] also strengthen those communities so that they can also be a benefit of nature and at the same time a benefit to themselves.” (Rachelle Bang a Jong, 25-04-2022, translated)

One instance where an alignment across different worldviews is created, as described in Chapter 4.9, is inside the forest conservation definition. The formation of a clear definition minimizes disagreements over what biodiversity's purpose is. ACT also changes the program based on what it learns from diverse perspectives, which contributes to

knowledge co-production. However, given the rangers' complaints about not being able to carry out activities that they consider important due to a lack of necessary tools, logic indicates that the rangers' objectives have not been satisfied. This demonstrates how the objectives of both ACT and the rangers do not align. One explanation for why there is not an alignment on the objectives is that ACT's and the rangers' joint definition of forest conservation no longer matches one another's definition of forest conservation. This then may also result in a difference on what the ranger program should entail.

Part of epistemological pluralism is achieved by seeking symbioses between the two knowledge systems and respecting the Trios' culture and perspective of nature. What is notable, however, is that the four criteria necessary for achieving epistemic plurality are met from ACT's perspective, but not from the rangers' perspective (see Table 2). Furthermore, from the rangers' perspective, another symptom of worldviews clashing is that the rangers do not believe their objectives are being realized. In summary, opinions disagree on whether or not the criteria for epistemological pluralism are being satisfied.

4.11 Conclusion

Table 2 summarizes which TEK recognition criteria are satisfied, partially met, or not met within the forest ranger program. The perspectives of ACT and the rangers are separated.

As can be seen, there is no consensus on whether or not most of the conditions are met. While ACT claims that nearly all criteria have been met, the rangers find that not one criterion has been entirely met. One possible explanation for the difference on ACT's side is that the organization as a whole promotes a particular worldview. When doing interviews, it is understandable that ACT would prefer to portray their program in a positive light and avoid mentioning some issues that demonstrate that their vision is not being fulfilled. Because, if their vision is met, which is to *"[...] maintain our ecosystem and the rich biodiversity it comprises by* ***engaging indigenous and maroon communities*** [emphasis added]" (Amazon Conservation Team, 2012, p. 3), all other criteria would be met save for "Political factors". For this criterion to be met ACT and the Trios are dependent on the state. Another possibility is that the ACT is unaware of the rangers' opinions, therefore ACT does not meet all of the criteria in their eyes. This could be owing to their failure to listen, the rangers' failure to inform them of their feedback, or a combination of the two.

The only criteria for which ACT deems that they are partially met are those for which ACT does not have complete control over the outcome. These requirements are "Political factors", "Preservation of TEK" and "Worldviews," and they all rely on the state or the Trios to meet them completely.

Furthermore, the usage of TEK is only addressed as something that rangers inherently employ in their work in the interviews with ACT. However, many of the goals of their work are similar to those of Western methods: collecting samples and setting up camara traps. While they may use their TEK to move around the forest, this does not mean that the TEK is always included into their activities' goals.

However, for the rangers not one criterion is fully met. The reason for this, according to the rangers, is due to a number of issues, including a lack of community respect, a lack of tools, unfulfilled promises, ambiguous communication, and the sensation of not being heard. A lack of tools is what was mentioned the most through the whole interview. The complaints about a lack of tools and unfulfilled promises may be traced directly to ACT's financial model, which relies on donations. Follow-up investigation into ACT's budget, how much of it is invested in the forest ranger program, and what they lack in funding for the program, should be done to determine how much of the complaints are actually related to budgetary concerns. In addition, further research should be conducted to determine if ACT is unable to secure funds for the forest ranger program. If this is indeed the case, the root of this problem should be further investigated. Furthermore, the rangers also wished for being able to practice more law enforcement. However, this is not possible due to political factors.

Furthermore, the rangers stated that in the past, the training and program were perceived better, but that this has changed, and they are unsure why. A change of ACT staff with new values and standards could be one cause for the shift. While interviews with current personnel and a prior staff member who was there at the start of the program were done for this study, no variations in how the program was implemented were discovered. However, in order to fully comprehend what has happened, it would be beneficial to conduct additional research into what has changed within the ACT organization in relation to the forest ranger program.

While TEK recognition is almost achieved in ACT’s view, this is not the case for the rangers. Even though there are several causes for why there are differences in opinions about whether the criteria are met or not, it is necessary to conduct more research, such as a stakeholder analysis, to be certain of the cause. In Chapter 5, part of a stakeholder analysis is conducted.

However, it should be noted that, from the rangers' perspective, it appears that their wishes for how the program should be run, rather than their TEK, are not being recognized. However, one could argue that TEK is incorporated in their wishes, and hence their TEK is not acknowledged indirectly.

Table 2 Criteria for TEK recognition

	ACT's view			Rangers view		
	Met	Partly met	Not met	Met	Partly met	Not met
Active participation of the Indigenous community	☒	☐	☐	☐	☐	☒
Interdisciplinarity	☒	☐	☐	☐	☒	☐
Incentives and mutual benefits	☒	☐	☐	☐	☐	☒
Political factors	☐	☒	☐	☐	☒	☐
Share power	☒	☐	☐	☐	☒	☐
Trust	☒	☐	☐	☐	☐	☒
Respect for TEK holders	☒	☐	☐	☐	☐	☒
Preservation of TEK	☐	☒	☐	☐	☒	☐
Knowledge co-production	☒	☐	☐	☐	☐	☒
Worldviews	☐	☒	☐	☐	☒	☐

5. Stakeholders and their power dynamics

The following subquestion is addressed in this chapter: *What are the stakeholders within the forest ranger program in TWTIS, how do they relate to each other and what are the power relations between them?* To answer this subquestion achieve a descriptive stakeholder analysis is conducted on the stakeholders within the forest ranger program. This analysis is carried out in three steps: "identifying the stakeholders, differentiating between and categorizing stakeholders and investigating relationships between stakeholders" (Reed et al., 2009, p. 1936). Figure 4 shows the possible methods that can be utilized to complete the three steps.

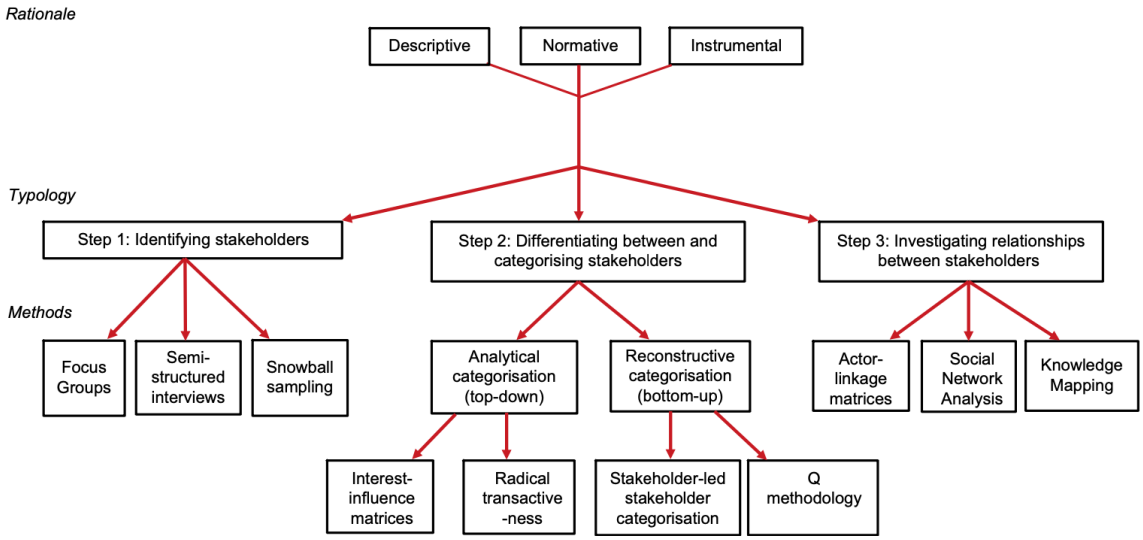

Figure 3 Schematic representation of rationale, typology and methods for stakeholder analysis (Source: Reed et al., 2009)

5.1 Actors

In this subchapter the stakeholders and their roles are described. While active participation of all the stakeholders is desired in the research (Reed et al., 2009), this is not possible due to time constraint. However, some stakeholders were identified during the ACT interviews. In addition, several stakeholders were identified through the analysis of ACT's website material and annual reports. While there are numerous players involved, not all of them are considered in this stakeholder's analysis. The criterion on which the analysis is based are stakeholders who have an impact on the forest rangers' power and empowerment.

Within the forest ranger program, there are a number of parties involved. ACT and the forest rangers are the two key stakeholders. ACT Suriname's main role is forest conservation, culture conservation and traditional medicine conservation through a partnership and empowerment of Indigenous peoples in South Suriname (Amazon Conservation Team, n.d.-a). Following that, the programs' primary goal is to conserve the forest though strengthening Indigenous Peoples' capacity though activities such as ecosystem monitoring and control (Amazon Conservation Team, 2012). ACT also supplies the ACRs with training and the required equipment. When disruptive activities are

reported, ACT serves as a mediator between the Trios and the institutions to take the appropriate actions against these disruptive activities.

The training and programs that ACT organizes have an impact on the forest rangers' power and empowerment. The rangers' equipment and their work activities are under the control of ACT. These factors have a big impact on how much power the ACRs have. Furthermore, the empowerment of Indigenous peoples is mentioned in ACT's mission, influencing the empowerment of the forest rangers.

Forest rangers, also known as community monitors, are responsible for monitoring the forest (camara traps, water samples, and soil tests), as well as reporting any disruptive activities. They are also giving technical and computer skills training to aid in carrying out their responsibilities. The rangers also took part in a sub-program aimed at preserving traditional knowledge, collecting data on forest change indicators, using Indigenous knowledge and GPS data as input for land management plans, and doing research on biodiversity, food security, and sustainable livelihoods (Amazon Conservation Team, 2012). In addition, the rangers are there to help the community.

The rangers' power and empowerment are decided by ACT, as described in the previous paragraph.

A significant stakeholder is the traditional authority. Following the FPIC's principles, the Indigenous community's permission, particularly that of the traditional authority, is critical. The selected rangers were also chosen based on the traditional authority's nominations. In addition, the rangers are not ACT employees but of the traditional authority. As a result, when the authority needs them, it frequently surpasses their ordinary ranger duties.

The Indigenous community is also a stakeholder. ACT values their opinion on the forest ranger program. The ranger program's actions also have an impact on the community. For example, through the forest rangers' program, ACT is documenting some of their Indigenous knowledge, which could have an impact on individuals and how their information is used by others. However, it is important to note that the documentation is done with the permission of the Indigenous community. Furthermore, the rangers' operations have an impact on them since when disruptive behaviors are reported, they rely on the ACT and the appropriate authorities to act.

The parties involved in creating the revision of the 1954 Nature Protection Laws of Suriname are also significant stakeholders. The law of 1954 focuses solely on strict nature protection, leaving no room for human actions and/or economic models. The draft law, Sustainable Nature Management Law, will make it possible for nature areas to get a protection status based on the IUCN categories for protected areas allowing for nature management that considers people, nature and sustainable coexistence of activities. When this law is passed co-management will be possible and the rangers will be able to work for

the government and not be dependent on conservation organizations to get the tools they need. As employees of the state the rangers will be able to enforce the law. This gives them power to protect their territory and protect the forest from disruptive activities. Finally, the legal recognition of TWTIS could be achieved through the revision of the law of 1954. (Conservation International, n.d.-a, n.d.-b; *Herziene Versie Concept Wet Duurzaam Natuurbeheer*, 2021; *Project Onze Natuur Op 1 (Natuurwet)*, n.d.; *Tijdlijn van Het Proces van Ontwikkeling van Natuurbescherming Wetgeving*, n.d.).

The stakeholders responsible for the modification of the law are the parliament (DNA) and the ministry of Spatial Planning, Land and Forestry Management (RGB). However, in 2020 RGB split up in the ministry of Spatial Planning and Environment (ROM) and the Ministry of Land and Forest Management (GGB). Both ministries have a focus on forest conservation (*Republiek Suriname*, n.d.).

RGB raised the issue of modifying the 1954 law and DNA passed the bill. In Suriname's protected areas, the government is in charge of the protection of the nature, as well as the monitoring and enforcement of environmental laws (Conservation International, n.d.-a). However, in the current situation, the government also grants concessions that have the potential to disrupt Indigenous areas. To prevent this from happening the legal recognition of TWTIS is necessary, as explained in Chapter 4.4.

Other stakeholders involved in the revision of the law were the environmental organizations Conservation International (CI) and WWF Guianas (Conservation International, n.d.-a; *Tijdlijn van Het Proces van Ontwikkeling van Natuurbescherming Wetgeving*, n.d.).

Lastly, there is the ministry of Regional Development and Sport (ROS), which focusses among other things on the sustainable development of the Indigenous peoples of Suriname and thus influence over the power that the Indigenous peoples have (*Republiek Suriname*, n.d.).

The Trijana, a collaboration involving all heads of the 9 Trio and Wayana villages, is another key stakeholder. Trijana represent all Indigenous communities and their goal is to implement their vision, namely that TWTIS is legally recognized, that their territory is protected, that Indigenous peoples' leadership and capacity are strengthened, and that Indigenous peoples' livelihoods are empowered through the establishment of Indigenous businesses. Other stakeholders involved in TWTIS are conservation NGOs (ACT, CI, GGS, WWF) and Indigenous-led organizations such as Organization of Indigenous People in Suriname (OIS). Furthermore, the National Herbarium of Suriname (BBS) involved in TWTIS (Amazon Conservation Team, n.d.-a; Conservation International, 2018; Green Growth Suriname Foundation, 2022; Stichting Tuhka Alalapadu, n.d.).

Donors and benefactors are another significant stakeholder. 62% of the funds in 2020 are received from foundations. Their financial contributions and grants are vital to ACT's biocultural conservation work in South America. The conservation of the environment and

biodiversity, as well as the empowerment of marginalized communities, are the overarching goals of these foundations. Other donations and services received are from ACT's corporate partners. However, ACT is selective with choosing which corporate partners they collaborate with. Partners are chosen based on shared values, such as environmental sustainability. Furthermore, donations are received through in-country grants, in-kind contributions and individuals (Amazon Conservation Team, n.d.-b).

ACT's programs can continue to run as a result of their donations. However, if a program loses interest and so receives fewer or no donations, it has an impact on the operation of a program (Vincent, 2006).

5.2 Categorizing stakeholders

To categorize the stakeholders the method of top-down "analytical categorization" is used. By using this method, the categorization is conducted by the researcher based on the observations done and the theoretical basis of the study (Reed et al., 2009). However, due time constraint no observations were done. Instead, the conducted interviews and ACT's website material and annual reports were used as the basis for the categorization. One example of analytical categorization is the applying levels of interest and influence, whereby a popular method is to group stakeholders into "Key players", "Context setters", "Subject" and "Crowd" (Reed et al., 2009). "Key players" have high influence and high interest over what is happening in a project they are related to. As a result, these stakeholders should be involved in the process. "Context setters" are stakeholders that should be consulted for the potential risk that they form through their high influence but low interest. A "Subject" lacks the capacity for impact because they have low influence. They are supportive, however, due to their high level of interest. Forming partnerships with other stakeholders may help a "Subject" to acquire more influence. A "Subject" is frequently the marginal stakeholder who is sought to be empowered by development projects. Lastly, there is the "Crowd" classification of stakeholders. They have little influence or interest over desired outcomes. There is minimal need to interact with them or consider them in depth for this purpose (Reed et al., 2009). Table 3 is created to assist in classifying the stakeholders correctly into the interest-influence matrix. Furthermore, in Table 3 the stakeholders are categorized as direct or indirect stakeholders. Direct stakeholders are those who are directly involved in the forest ranger program and its activities. Indirect stakeholders are those who have an interest or an intermediary role in forest ranger program.

Table 3 Stakeholder characteristics

Stakeholder	Interest	Sources of power	Interaction
Direct stakeholders:			
Forest rangers	Forest conservation; Protection of their traditional lands	Give input on the content of the ranger program	Ranger activities: gathering samples, monitoring forest
Traditional authority	Forest conservation; Protection of their traditional lands	The power to reject a project or not according to FPIC; The rangers are employees of them	Accepts a project or not; Selects the rangers
ACT	Forest conservation; Monitoring of the forest; Building capacity of the Indigenous peoples; Culture conservation (Amazon Conservation Team, 2012)	Funding; Western worldview; Tools; Training; Facilities	Provides and organizes the ranger training and programs; Gathers and organizes the funding
Indirect stakeholders:			
Indigenous community	Forest conservation; Protection of their traditional lands	Give input on the content of the ranger program	Sometimes, ranger assistance is required
DNA	Controlling the government (*Republiek Suriname*, n.d.)	Legal power	Pass or reject bills
Government (GGB, ROM, ROS)	Land rights of the Indigenous; Forest conservation; Sustainable development of the Indigenous peoples (*Republiek Suriname*, n.d.)	Legal power; Granting concessions	Gives out concessions

Funders (Gordon and Betty Moore Foundation)	Environmental sustainability; Empowerment of marginalized communities (Amazon Conservation Team, n.d.-b)	The power to fund a project or not	Fund programs
TWTIS partners: environmental organizations (WWF, CI, GGS, ACT) and other organizations (OIS, BBS)	Empowerment of the Indigenous; Land rights of the Indigenous; legal recognition of TWTIS (Conservation International, n.d.-a, 2018; *Tijdlijn van Het Proces van Ontwikkeling van Natuurbescherming Wetgeving*, n.d.)	Expertise in jurisdiction and promoting forest conservation	Aid in organizing the Indigenous peoples to protect their land and aid in the bills
Trijana	Legal recognition of TWTIS; Protection of traditional lands; Empowerment of the Indigenous (Conservation International, 2018)	Collaboration of all Indigenous communities	Promote legal recognition of TWTIS

Table 4 Interest-Influence matrix from the rangers perspective

High interest	Subject:			Key players:		
		Rangers Indigenous community	Traditional authority		Funders	ACT
Low interest	Crowd:			Context setters:		
		Trijana	TWTIS partners			Government
	Low	**Moderate**	**High**	**Low**	**Moderate**	**High**
	Low influence			**High influence**		

Table 5 Interest-influence matrix from ACT's perspective

High interest	Subject:			Key players:		
					Rangers Indigenous community Funders	ACT Traditional authority
Low interest	Crowd:			Context setters:		
		Trijana	TWTIS partners			Government
	Low	**Moderate**	**High**	**Low**	**Moderate**	**High**
	Low influence			**High influence**		

As can be seen, the key difference between Table 4 and Table 5 is how the Trios are classified. Rangers would classify themselves as “Subject”, according to the conducted interviews. However, concluding from the interviews and the annual reports, ACT would classify them as “Key players”. The high interest of the Trios in the forest ranger program is logical. The Trios rely on the forest for their survival, and forest rangers are the ones who will safeguard the forest and their area, ensuring their future. The difference, however, is whether the rangers have high or low influence. This difference of categorization is reflected in the interviews as well. The rangers are reliant on ACT for receiving tools to carry out their duties, as stated in Chapter 4 and reflected in the criterion "Share power". Additionally, to protect their land from disruptive activities the rangers are dependent on ACT to alarm the appropriate institutions. This shows a dependency, resulting in low influence.

However, ACT would categorize the Trios as having high influence. ACT works in direct partnership with the Trios (Amazon Conservation Team, 2010, 2012), particularly the traditional authority. In addition, before starting a project ACT also has to adhere to the FPIC, which also states that a community can decide whether to participate with a project and can stop at any time. This would indicate that the Trios do have high influence on the forest ranger program.

The traditional authority has a higher level of influence than the rangers and the Indigenous community because ACT must first obtain the approval of the traditional authority. The influence of the community and the rangers lies only in their input.

ACT is a “Key player”. Being the organizer of the forest ranger program, it is logical to assume that the interest in the program is high. Also, because they control the funds, they have a lot of authority over providing the tools and facilities. Furthermore, ACT having the Western worldview, which is regarded as superior in the Western world gives them more influence in the outside world. This Western worldview may also partly determine what the ACRs learn in their training.

However, as discussed in Chapters 4.4 and 4.5, "Political Factors," and "Share Power", the Trios' limited influence is caused not only by ACT, but also by the government and funders. The government has a say in whether or not concessions are granted. However, by granting a concession, the government risks making it more difficult to protect the forest, which would be detrimental to both the Trios and ACT because it contradicts their vision. The acknowledgment of TWTIS would be the way to avoid granting concessions. However, the government has the legal power to let this happen or not.

While the state has a high level of influence, they do not need to be actively included in the project. This results in the government being a “Context Setter”, who do need to be consulted for the risk they pose by having high influence. However, there are overlapping interests between the ministries responsible for forest management and environment, and the ranger programs objectives, namely responsible nature management and forest conservation (Ministerie van GGB, n.d.; *ROM En SCF Gaan Samen Voor Behoud Biodiversiteit*, 2021). Furthermore, the government did aid in developing a curriculum for training of the Indigenous rangers (Amazon Conservation Team, n.d.-b).

The funders also have high influence. The funding for ACT’s programs is provided through external funding such as donations (Amazon Conservation Team, n.d.-b). However, such funding is not necessarily neutral. Donors can make demands and in order for NGOs to keep their funds, these requests must be met. This creates a lack of financial autonomy, which has many consequences. One consequence is that often only the projects are funded and not the long-term program plans. There is no interest for long-term funding, and often the projects are financed for periods between one and three years (Vincent, 2006). The NGOs become financial dependent as a result of this. To be sure that these negative implications also apply to ACT, more research into the organization’s finances should be conducted.

However, according to a conducted interview with the former ACT employee, ACT had earlier financial issues in 2012/2013, which had a detrimental influence on project funding. This also indicates a degree of financial reliance.

Furthermore, the funders share values with ACT. So, one could say that there is an interest from the donators in the programs. This is particularly true if the donations are directed at specific projects. Between 2008 and 2012, this was the case for the ranger program. The Gordon and Betty Moore Foundation was the primary funder of the forest ranger program (Amazon Conservation Team, n.d.-b, 2012). However, if there is currently a high interest from the donators is unknown. For this more information on the donators for the forest ranger program should be provided.

The TWTIS partners have low interest and low influence in the forest ranger program itself. However, due to their supporting TWTIS and Trijana and aiding in creating the Nature Protection Laws, they do aid in forest protection and the Trios having more future power. Trijana also aids in making TWTIS legally recognized. However, they are still in the starting process and thus less influential then the TWTIS partners. Moreover, the NGOs – who are TWTIS partners – are subsidiaries of the big American NGOs and thus have more funding to their disposal.

5.3 Power relationships between the stakeholders

There are three main methods for studying the relationships between stakeholders, as shown in Figure 3. A useful method for this study would be social network analysis. To research the links between stakeholders, social network analysis employs relational ties and assesses the strength of these ties (Reed et al., 2009). However, due to time constraint applying social network analysis is not possible. Instead, an influence schematic (Figure 4) and a power relation schematic (Figure 5) is made that illustrate the influences and dependencies that the stakeholders have on the programs. Furthermore, the concepts/programs described within the schematic are important to the rangers. This is to illustrate the uneven power relationships as experienced by the rangers. The key stakeholders who contribute to the unequal power distribution are identified.

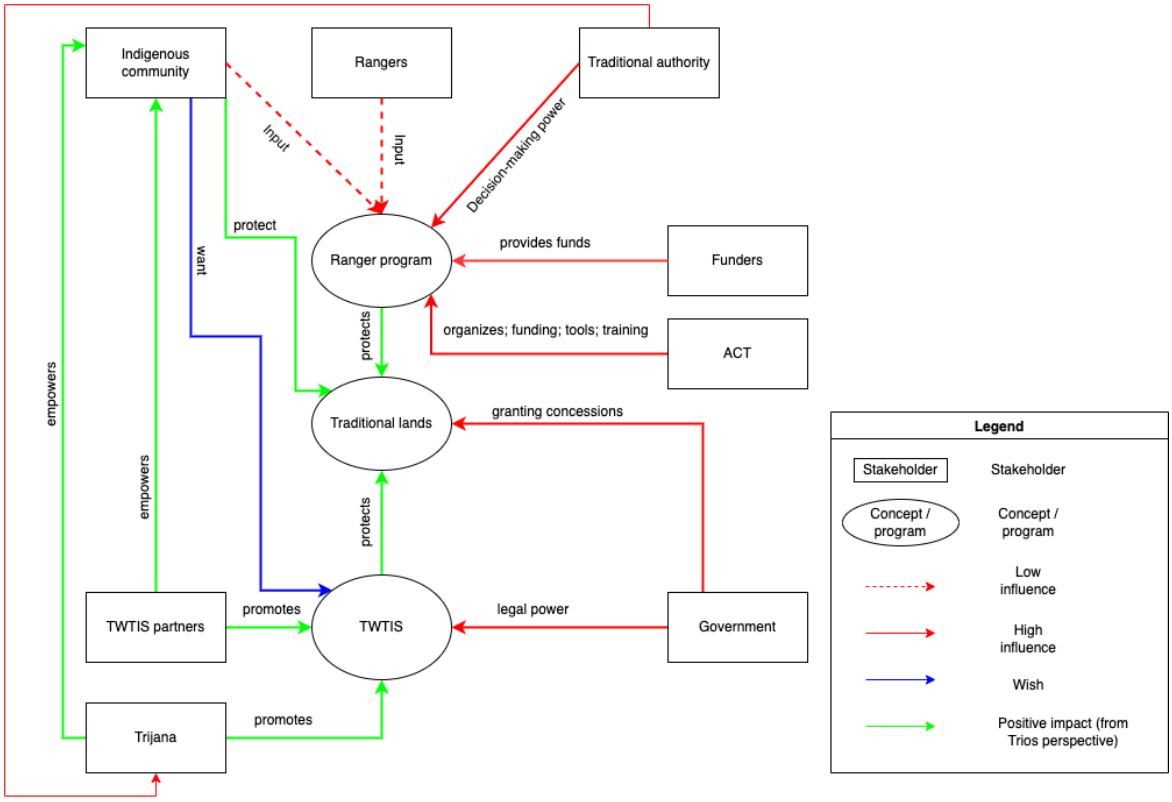

Figure 4 Influence schematic

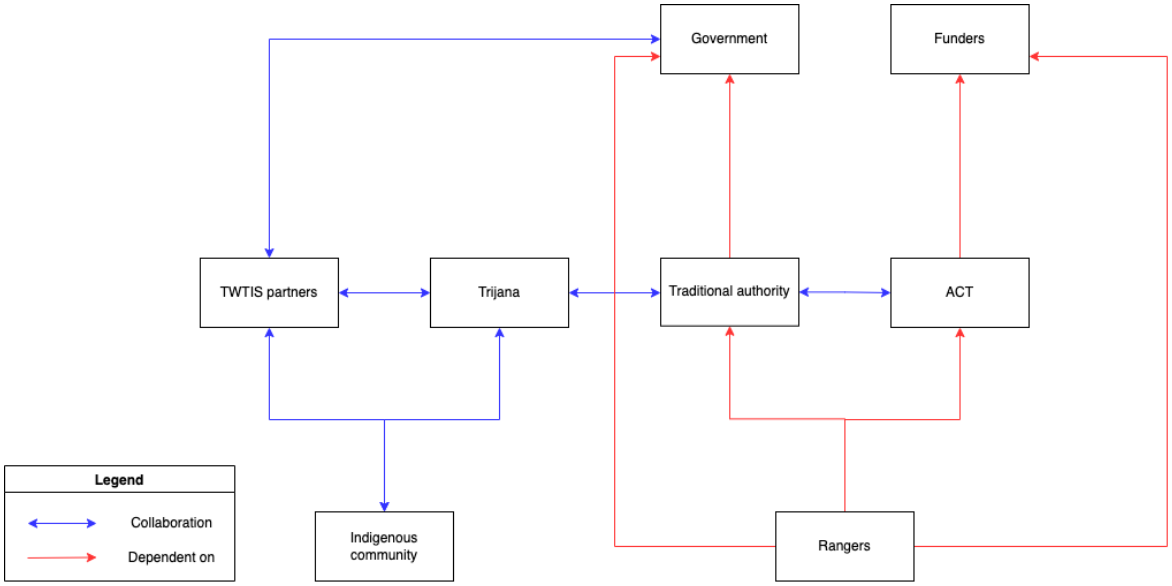

Figure 5 Power relation schematic

The forest is important in the life of the Trios. According to the Trios, there is an intrinsic connection between them and their traditional lands. To sustain life in the forest several factors are crucial, among them is the health of the forest. The Trios already protect their forest as part of their culture (Smith, 2013). In addition, there are various programs in place to protect the forest. The ranger program and TWTIS are two of these programs. TWTIS is an important initiative within the ranger program because it ensures that rangers have more rights to protect their area, such as law enforcement.

The Trios have three linkages of influence on the ranger program, as shown in Figure 4, two of low influence and one of high influence. The ranger program is heavily influenced by both the funders and ACT. The ranger program would not exist if these stakeholders did not contribute funding and organize the program. This demonstrates the rangers' and, indirectly, the Trios' dependency on these two ranger program stakeholders. However, ACT is also dependent on the funders not only to keep the ranger program running, but also to pay the ACT staff (Vincent, 2006).

The government, which has the legal authority to recognize or deny the Trios' traditional lands, is the most powerful stakeholder in the TWTIS initiative. Trios are reliant on the government to bring TWTIS to completion. Other stakeholders – TWTIS partners and Trijana – on the other hand, have little control over TWTIS but help the Trios promote it and provide legal support. The Trios are also empowered by these stakeholders.

Furthermore, for the health of their traditional lands, the Trios are partly dependent on the government. The government has the authority to grant concessions in their lands, which have a negative impact on the area.

In short, the Trios rely on a number of parties, including the government, funders, and ACT, to maintain the traditional lands. The Trios' only significant influence on the ranger program is the traditional authority's ability to accept or reject a project. However, there remains the question of whether a project is approved or not by their values or the Westerns. The Trios think that the Western world lifestyle is superior to their way of life, placing them in an inferior position and fostering a negative social identity. The Trios desire to better their social status and become like those who live according to Western principles in order to overcome their negative social identity (Smith, 2013). The question is thus whether they undertake projects in accordance with their own values or those of the West. This feeling of being inferior to the Western world, reflects an unequal power distribution. Furthermore, the Trios are at a disadvantage when negotiating the terms of the projects because they are not fully proficient in the Western language utilized for negotiating (Smith, 2013), which in this case is often Dutch.

However, the Trio and Wayana authority also have created Trijana, to aid them in protecting their traditional lands, indicating they desire to occupy a stronger power position, expressing their own values rather than Western values.

5.4 Conclusion

The forest ranger program has many stakeholders, however not all of them were included in the stakeholder analysis. Only the stakeholders who have an impact on the forest rangers' power and empowerment were researched. Table 3 lists the stakeholders identified.

The two most influential stakeholders in the forest ranger program are the funders and ACT. The Trios are reliant on them to keep the program going. However, this implies

that ACT is also reliant on the funders to keep the project functioning and for the ACT staff to receive a salary.

In addition, Trios are dependent on the government for the legal recognition of TWTIS. If TWTIS is legally recognized, the rangers will be able to better preserve their area and enforce the law. Furthermore, the TWTIS initiative is aided by the TWTIS partners and Trijana, who also empower the Trios. TWTIS is important because, like the ranger program, it is especially important to the Trios to protect their land. If the forest were to disappear, the TEK, and hence the Trio culture, would vanish as well. Thus, by protecting their land, the Trios also preserve their culture (Smith, 2013). Legally recognizing TWTIS would thus aid in the recognition of TEK.

The only strong influence that the Trios hold is through their traditional authority and their power to accept a project or not. However, as mentioned in the previous Subchapter 5.3, the Trios view themselves as inferior to the outside world, wanting to live like those in the West to change their negative self-identity. This may result in the Trios changing their own values, which could subsequently have a potential influence on the choice of accepting a project. Furthermore, the Trios are at a disadvantage when negotiating the terms of a project, due to their not full proficiency in Western language. The influences of the stakeholders and power relations are also illustrated in Figures 4 and 5.

Chapter 6 Framework for the recognition of TEK in forest ranger programs

The following subquestion is addressed in this chapter: *What is a suitable framework for the recognition of TEK in forest ranger programs?* The criteria presented in the conceptual model (Figure 1) provide for a suitable framework for the recognition of TEK in forest rangers programs. First, various forest conservation management approaches that meet these criteria are discussed. Then, it is determined which forest ranger's criteria in the case of Suriname still have to be met and what kind of framework might be appropriate for this in the context of Suriname. By answering this question, it will also aid in providing a recommendation to GGS who wanted assistance in creating a program that is based on the Trios culture and needs and addresses the potential issues in the current forest rangers program.

6.1 Suitable framework

The criteria established in Chapter 2.2 and depicted in the conceptual model (Figure 1) are applied in order to find a suitable framework for TEK recognition in forest ranger programs. Given the hegemonic position of Western scientific knowledge over other knowledge systems and the dominance of the Western worldview, no unique framework for this knowledge type is required, as it is inherent in everything.

"Share power" and "Active participation of the Indigenous community" are two key criteria for determining a suitable framework. There is an unequal power distribution between Indigenous peoples and scientists. It is therefore critical to share power in order for TEK to be recognized. Furthermore, TEK recognition cannot begin without the active participation of the knowledge holder (Charnley et al., 2007; Joa et al., 2018; Shackeroff & Campbell, 2007). These two criteria also aid in meeting other criteria, such as "Worldviews", "Trust", "Interdisciplinarity" and "Preservation of TEK".

To share power, it is important that partnerships are created where mutual learning, negotiation and a problem-solving takes place (Shackeroff & Campbell, 2007). To achieve active participation, collaborative or participatory management is useful, such as community-based conservation, collaborative conservation, community forestry and collaborative learning (Matiku et al., 2013). A few of these management styles criteria are explained in the following subparagraphs.

6.1.1 Community-based conservation

Community-based conservation tries to link conservation and the improvement of the livelihoods of the local communities. This form of conservation emerged in the 1990s, as a reaction to the conservation approach before the 19th century, which held that the forest was for non-consumptive purposes and that humans should not interfere (Berkes, 2007; Smith, 2013). However, this approach never took off as a widely used approach due to a few challenges. The natural resources that are under protection, will be used by the Indigenous if the Indigenous' livelihood comes under pressure. Furthermore, traditional

authority manages the actions of the community members, resulting in a weak institution in the Western worldview. Moreover, cultural understanding takes time to understand for the conservationists. They would not only be researching ecological knowledge but also knowledge about the culture of the Indigenous people. Few conservationists are willing to do this (Smith, 2013).

Community forestry is one example of community-based conservation. The basic principle behind this style of conservation is that the local community is actively involved, and that outside intervention is supporting rather than directive. Forest conservation and ecological sustainability can be increased while increasing the livelihood of the communities and empowering them, thanks to the intrinsic relationships that the locals have with the forests and their interdependence with it (Maryudi et al., 2012). An underlying theory of community forestry is that a change of governance occurs. The devolution or decentralization of the authority, rights and responsibility associated with forest management takes place from government to forest communities (Charnley & Poe, 2007).

By placing more of the control with the locals it is also hypothesized that it will bring community benefits, such as a better equitable distribution of forest management rights and responsibilities, as well as more equal control over forest resources; capacity building and alleviation of poverty (Charnley & Poe, 2007).

6.1.2 Co-management

Following community-based conservation, co-management was created to include Indigenous communities in forest conservation (Smith, 2013). There are several definitions for co-management. A definition that reflects the core content of many definitions is that of Berkes: "*the sharing of power and responsibility between the government and local resource users"* (Berkes, 2009, p. 1692). Co-management is based on the premise that people whose lives are influenced by management decisions should have power in decision-making (Berkes, 1993; Castro & Nielsen, 2001). Or, in other words, the core of co-management is the collaboration between different institutions for the management or use of a natural resource (Castro & Nielsen, 2001; Smith, 2020). Attributes of co-management are: (1) shared commitment and action of these actors; (2) the recognition of diverse input and interest, resulting in pluralism; (3) different knowledge systems and inputs determine the decision-making; (4) social learning; (5) and communication and negotiating results in shared understanding or consensus (Plummer & Fitzgibbon, 2004).

Within co-management projects a government agency often shares its management responsibilities with the communities involved, including Indigenous communities, and parties, such as NGOs or corporations. Despite the fact that these stakeholders may have conflicting interests, power-sharing between different stakeholders is the core idea of the co-management. By sharing power, the resource management process will be enhanced, making it more responsive to various interests (Castro & Nielsen, 2001).

Co-management has several benefits for the participating institutions. For example, a co-management project including the government and local people, can generate more knowledge shared between the two parties. The local people will increase their knowledge about science, business and institutions, while the government will gain more knowledge about the community and the area where they live. Furthermore, through co-management local people will gain more ownership over their place, taking on more responsibility. This benefits the government, the local people and other parties involved (Smith, 2020). The gained empowerment and decision sharing can generate a sense of community empowerment. However, the opposite can also be achieved. Instead of empowering the local community, they can be further marginalized. The end result then is not sharing of power between stakeholders, but the strengthening of the governments control over the resource. This potential negative consequence emphasizes the cultural, political and legal barriers that the local communities face when attempting to negotiate co-management agreements (Berkes, 2009; Castro & Nielsen, 2001). Other challenges encountered are the high start-up costs and obstacles for participation; the unequal distribution of costs and responsibilities which falls disproportionally on the local communities; and the uniform and inflexible legal frameworks that are difficult to modify and influence (Cronkleton et al., 2012).

However, there are various strategies to improve or facilitate co-management, such as knowledge co-production, collaborative monitoring, bridging knowledge and participatory research. These methods reflect collaboration with the resource users, and the recognition and shared learning of TEK (Berkes, 2009).

6.1.3 Adaptive co-management

A variation on co-management is adaptive co-management (ACM), which is created from adaptive management and co-management. A definition often adopted by research is that from Folke et al (2002*).: "a process by which institutional arrangements and ecological knowledge are tested and revised in a dynamic, ongoing, self-organized process of learning-by-doing."* (Folke et al., 2002, p. 20). Three core attributes of ACM are: vertical interaction of communities with actors, horizontal interaction among stakeholders and iterative learning. Other facets of ACM are the involvement of various knowledge systems and the co-production of such knowledge; the fostering of trust and social learning; recognition of various needs; to further build on culturally embedded rules and norms; and shared decision making (Armitage et al., 2009; Berkes, 2009; Plummer & Fennell, 2009). The difference of adaptive co-management from co-management is that co-management does not focus on the learning-by doing approach when addressing emerging problems. Learning-by-doing should be done through interaction, increasing the effectiveness through working together. This way mutual learning takes place between actors. Through ACM local knowledge is recognized within decision-making. Furthermore, the temporal scope is longer than that of co-management and ACM is more concerned with learning and adaptation (Berkes, 2009).

According to Armitage et al. (2009) ten criteria need to be met for a successful adaptive co-management: "(1) well-defined resource system; (2) small-scale resource use contexts; (3) clear and identifiable set of social entities with shared interests; (4) reasonably clear property rights to resources of concern; (5) access to adaptable portfolio of management measures; (6) commitment to support a long-term institution-building process; (7) provision of training, capacity building, and resources for local-, regional-, and national-level stakeholders; (8) key leaders or individuals prepared to champion the process; (9) openness of participants to share and draw upon a plurality of knowledge systems and sources; (10) national and regional policy environment explicitly supportive of collaborative management efforts." (Armitage et al., 2009, p. 101).

However, adaptive co-management, like co-management, is not assurance of resource sharing justice or fairness. Furthermore, learning does not always guarantee adaptation (Berkes, 2009)

6.1.4 Knowledge co-production

Knowledge co-production has been declared within this study as a criterion to meet TEK recognition, as well as a tool for establishing epistemological pluralism. It could, also, help achieve mutual learning, which is critical for power sharing. Furthermore, adopting co-production in co-management projects can foster learning between stakeholders and their various worldviews (Armitage et al., 2011).

6.1.5 Conclusion

The above named are popular conservation methods where the involvement of the local communities is crucial. With these methods several criteria that were identified as key criteria for TEK recognition in Chapter 2.3 are addressed. These are "Share power", "Knowledge co-production", "Active participation of the Indigenous community" and "Mutual benefits and incentives". Several criteria are addressed indirectly. Firstly, "Trust", which is not one of the attributes of the methods but is created through the increased interactions between the stakeholders. Secondly, "Respect for TEK holders", which is also fostered through increased interactions and the mutual learning of both knowledge systems. Lastly, "Worldviews", which is achieved through involving various knowledge systems and achieving the four related criteria (Figure 1).

However, not all criteria are addressed with these methods, namely "Preservation of TEK" and "Political factors". But, as discussed in Chapter 2.2.4, there are methods for the preservation of TEK, such as documentation or elder generations teaching younger generation TEK. Furthermore, the state is the only entity that genuine power over the political factors in a conservation project. The state, for example, has the legal authority to issue land rights. Furthermore, the government's engagement in the above-mentioned conservation methods is unavoidable. The (adaptive) co-management is based on a power-sharing relationship between the local community and the government. Hereby it is important that there is a policy in place that supports collaborative management initiatives.

Within community forestry a change of governance occurs, whereby the government becomes devolved or decentralized.

6.2 Suriname

Before deciding on a suitable framework for the forest ranger case, it is necessary to determine out which criteria should be addressed in the case of South Suriname and where the gaps are within these criteria. To do that, it is necessary to look at Table 2 and whether or not the criteria are met. The suitable framework is determined by the rangers' assessment of whether the criteria have been met or not. This is because Indigenous peoples are marginalized, and it is critical to consider their needs and perceive them as equal to those of others in order to attain equality. Furthermore, if a suitable framework were built on ACT's viewpoint, there would be no need to update their current framework because it meets nearly all of the criteria.

6.2.1 What is needed in a suitable framework based on the criteria?

The criterion “Preservation of TEK” is partly met. TEK is disappearing in the Trio community due to the death of elders during COVID-19. However, the Trios are already undertaking action by establishing a cultural school. Furthermore, ACT has diverse programs that documents the Trios knowledge with their approval. Thus, this criterion is not necessary to include in the framework.

“Respect for TEK holders” is not met. The rangers feel as being fooled by ACT and that their wishes and needs are not being respected. Thus, for the rangers to feel respected, they need to be feel heard and listened to. These framework prerequisites could also be applied to the criterion “Trust”. The rangers have lost faith in ACT because of unfulfilled promises and confusing communication on ACT’s behalf. Creating clear communication between the two parties and being open about the decision-making process and include them in it should be added to the prerequisites. Clear and honest communication may also help to meet "Worldviews". Part of the criterion has been met. Creating an alignment across various worldviews is not instantaneously created but takes time. This is mostly realized through the collaboration between ACT and the Trios. Where this is not done, though, is in recognizing the Trios' needs, as is reflected by the rangers not having the appropriate tools. However, as previously stated, this could be accomplished by open dialogue.

Due to a lack of interest in the forest ranger program, "Active participation of the Indigenous community" is not realized. In addition, because the criterion is not met "Interdisciplinarity" is also not met. One probable explanation is that the rangers have lost the respect of the community as a result of their inability to fulfill their responsibilities without the proper equipment. "Mutual benefits and incentives," "Share power," and "Knowledge co-production" are other criteria that are (partly) not being met owing to a lack of instruments. However, gaining the essential instruments is also contingent on money. Conservation methods or an appropriate framework cannot influence the quantity

of funding received. However, the rangers also stated that the reason for not receiving the necessary tools was not adequately disclosed. They had heard about the lack of funding from somewhere but were unsure about it. As a result, a partial solution could be to be transparent about the funding received and to give the Trios decision-making authority over the funding. This keeps people informed about funding while also empowering them by allowing them to be more self-sufficient.

Additionally, "Share power" is not met due to not obtaining program benefits and so performing work that is not beneficial to the community. Rangers could express their wishes and requirements and have a say in their activities if they were included in the decision-making process.

Another negative phenomenon of “Share power” is the government’s ability to grant concessions in disruptive forest activities. The Trios cannot act against this because the forest is not legally theirs. In Suriname's political system, Indigenous peoples do not have any land rights. The state is the only stakeholder with legal authority to change this. The adaptive co-management is a management technique that could help in this situation. With co-management, the government forms a cooperation with the various parties involved in conservation efforts, including local communities, such as the Trios in this case. These communities are included in the decision-making and thus power is shared. Adaptive co-management is also known for revising the program if necessary. By being able to do this, the program can be changed if there is some feedback from one of both parties. Furthermore, the objectives of a program or what a stakeholder deems important can change. By adopting an adaptive method, the project can change if objectives or needs change.

6.2.2 Suitable framework for the forest ranger program in Suriname

A recommendation of which conservation approach, based on the conservation methods discussed in Chapter 6.1, is made based on the criteria that still need to be met, as mentioned in Chapter 6.2.1.

The criteria that still need to be met according to the rangers are “Respect for TEK holders”, “Trust”, "Worldviews", "Active participation of the Indigenous community", "Interdisciplinarity", "Mutual benefits and incentives," "Share power," and "Knowledge co-production". Potential solutions for the issues raised by the criteria are identified in Chapter 6.2.1. These include openness about the decision-making process, clear and honest communication, and including Indigenous people in the decision-making process. Additionally, it would be crucial to be open and honest about the funding and to involve the Trios in the financial decision-making process.

The best approach from those mentioned in Chapter 6.1 would be adaptive co-management. As was indicated in Chapter 6.1.3, one aspect of ACM is the inclusion of Indigenous peoples in the process through shared decision-making. Additionally, the rangers feel as like their needs are not being met, and it is crucial for ACM to recognize the various needs present. The fostering of trust between actors is also given importance.

Additionally, the foundation of ACM is to recognize Indigenous peoples and their system of knowledge and to build forest conservation on it (Armitage et al., 2009; Berkes, 2009; Plummer & Fennell, 2009). Thus, the promotion of TEK recognition would result from the application of ACM. Additionally, by increasing TEK recognition and the associated requirements, the ACM and its elements of power sharing and including Indigenous peoples are also encouraged in being met (Figure 1).

6.2.3 Adaptive co-management in Suriname

The question of whether ACM is relevant in Suriname nonetheless persists. Co-management as an approach for bio-cultural conservation in Suriname has been studied by Smith (2020). The difficulties unique to Suriname are identified, and suggestions are made with regard to Suriname. Although Smith's research is centered on co-management, since ACM is a variation of it, it can also be applied in the context of ACM. The difference between both methods is that ACM has a learning-by-doing approach when encountering problems, which is not the case for co-management (Berkes, 2009).

A few challenges exist when Suriname attempts to implement co-management. Decentralization of the government is one of them. The sharing of power through decentralization of the government over decisions about resource management is a crucial component of co-management partnerships. But in Suriname, this is still a work in progress (Smith, 2020). Additionally, as stated in Chapter 4.4, the Surinamese government does not recognize the land rights of the country's Indigenous peoples, and all land belongs to the state (Forest Peoples Programme, 2007). This lack of land rights is also the main reason for conflict between the Indigenous community and the state, which may complicate cooperation between the two parties. In addition, the state is also limited in its capacity with respect to technical personnel who can perform the work. The state often has a limited budget and relies primarily on donations to start new initiatives. This may make it more challenging to launch a co-management initiative. Moreover, Suriname consists of over 15 ethnic groups, from Europe, Asia, and Africa, who all live together in a peaceful society. But to maintain the peace costs time for the government and can thus results in delays in decision-making, which also may makes collaboration more difficult. Even though it is a peaceful community, there is an internal divide between those who live along the coast and those who dwell inland, including the Indigenous peoples. The Indigenous peoples of Suriname are still one of the most marginalized populations, which puts them at a disadvantage with regard to conservation, among other things. Additionally, the government formerly operated under the assumption that forests were a common good for the preservation of biodiversity. However, this is now slowly changing, and a more holistic view of forests is being created, whereby the preservation of Indigenous cultures and livelihoods is now considered important. However, this development is still recent and so co-management is seen as one of many conservation methods and so there is not yet a clear picture about a conservation model (Smith, 2020).

In short, in Suriname there are issues that must be resolved before co-management may be put into practice. Additionally, it's critical that a policy supporting collaborative management activities be in place for co-management to be possible (Armitage et al., 2009). Fortunately, a law is being drafted that, if passed, will permit co-management in Suriname.

Co-management has been practiced before in Suriname, namely through Trijana, a TWTIS co-management partnership where the Indigenous communities and other partners came to an agreement to protect 7.2 million hectares of South Suriname. The cornerstone for establishing the co-management system was the common goal between the partners to preserve the forest. However, two years after the partnership agreement was signed, the co-management project stalled because of poor planning and execution. There were several reasons behind this inadequate planning and execution, among which lack of institutional preparation, the decision-making being top-down or centralized and a reluctance to share power. Furthermore, because there was no overall process guidance and there were unresolved issues between the parties, the process failed. In addition, there was a deterioration of trust and cohesion between the partners. The partnership still exists but it is still in the phase of establishing a workable relationship (Smith, 2020).

This co-management partnership serves as an illustration of possible difficulties the forest ranger program can experience.

Smith (2020) developed a set of recommendations to help co-management become feasible and to address any difficulties that a Suriname-based co-management partnership may run into. According to Smith (2020), when these recommendations are followed, co-management holds the potential to become a win-win method for all main conservation actors in Suriname. The Indigenous peoples get support for managing the land for future generations and get one step closer to obtaining the land rights of their traditional lands. The government will profit for being able to oversee areas for which they are short in resources. Additionally, by safeguarding vast areas of natural resources for the future of the earth, conservation NGOs are helped in their mission (Smith, 2020).

Seven recommendations were formed by Smith (2020) to implement co-management. First of it is important to clarify the definitions of certain terms, such as the terms “conservation” and “co-management”. These terms are understood differently by the Indigenous people, the state and NGOs. Second, establish an agreed upon roadmap for achieving long-term objectives. This roadmap may change but it provides an idea for the partners of what is planned for in the future. Third, rights-based approaches should be utilized within the co-management partnership. This means that a permission process with the Indigenous peoples should be started before conservation actions are undertaken. Fourth, the focus of the collaboration should be on the social processes. The weakest partner’s pace and capacity should be taken into account as the partnership develops. Fifth, the partners’ capacity should increase as the collaboration grows. This means that each

partner develops awareness through building capacity so that there is understanding of the other's culture and method of conservation. When awareness is reached, focus should be on effective collaboration techniques and the technical aspects of conservation. Sixth, institutional approaches should be collaborative rather than centralized. This means that each partner should adapt its institutional procedures and mode of thinking to interact with the other partners, especially the Indigenous peoples. Lastly, it is important to create a sustainable framework for financing co-management initiatives, so that long-term funding is accounted for (Smith, 2020).

6.2.4 Conclusion

The criteria that still need to be met in the case of the forest ranger program in South Suriname are "Respect for TEK holders", "Trust", "Worldviews", "Active participation of the Indigenous community", "Interdisciplinarity", "Mutual benefits and incentives," "Share power," and "Knowledge co-production". To battle the issues raised by the criteria potential solution were named, such as openness about the decision-making process, clear and honest communication, and including Indigenous people in the decision-making process. Furthermore, it would be important to be open and honest about the funding of the ranger program and to involve the Trios in the financial decision-making process. ACM is determined to be the most effective conservation method because it includes the Indigenous peoples, recognizes the Indigenous' knowledge system and needs, and uses shared decision-making. However, when applying ACM in Suriname a few challenges exist. The recommendations proposed by Smith in Chapter 6.2.3 could help elevate these challenges and make ACM a viable option in Suriname.

7. Conclusion

The Surinamese forest ranger program of ACT, which employs members of the Indigenous Trios community as forest rangers, has been the subject of this paper's case study. This study concentrated on TEK and how it is recognized in the forest ranger program. This focus was formulated into the following research question: *How is traditional ecological knowledge recognized within the forest ranger program?*

This question is answered through the four subquestions and their conclusions.

7.1 Criteria for the recognition of TEK

The first subquestion is: *How is traditional ecological knowledge recognized in other cases of forest management and what are the results?*

Through a literature review ten criteria were established to determine what makes TEK recognition successful, which are summarized in Table 6. These criteria are also interconnected, impacting whether or not other criteria are met (Figure 1). Furthermore, these criteria served as the foundation for the study's conceptual model.

Table 6 Criteria, their explanation and the situation of the criteria in the forest ranger program

Criteria	**Explanation**	**The situation of the criteria in the forest ranger program**
Interdisciplinarity	A team of people or researchers that are both trained in the ecological and social part of conservation. Interdisciplinarity can help in overcoming the difference in worldviews and the language barrier between the researchers and Indigenous peoples. To achieve this the active participation of the Indigenous peoples is necessary.	When engaging with Indigenous people, ACT considers it essential that their staff have the appropriate training or prior experience in addition to ecological knowledge. Furthermore, there is a deeper understanding from both ACT and the Trios for each other's culture and knowledge system.
Active participation of the Indigenous community	The knowledge holders are directly involved as active participants. This can help overcome the worldview difference, enhance disciplinarity, be a starting point for trust and aid in preserving TEK.	Community participation is a requirement from ACT's part before starting a program. In addition, ACT works in a direct partnership with the Indigenous community. However, there is a lack of interest in the ranger program from the Trio community,
Worldviews	An alignment of different knowledge systems and perception of nature. Epistemological pluralism can aid in this by recognizing multiple ways of knowing. Interdisciplinarity, active participation of the Indigenous community, knowledge co-production and power sharing are	Language and how it is used and expressed differently between ACT and the Trios are one source of worldview conflict. The Trios and their traditional way of life have changed through time as a result of contact with the Western world, becoming a mix of Western and traditional. Furthermore, the joint definition of forest conservation may no

	important criteria to be met to achieve epistemological pluralism.	longer match one another's definition of forest conservation due to the objectives of both ACT and the rangers not aligning. Whether epistemological pluralism is achieved differs from ACT's and the rangers standpoint.
Knowledge co-production	A way to involve multiple participants to recognize multiple worldviews and knowledge systems.	There are no indicators of active knowledge co-production in the ranger program. However, according to ACT, there are times when knowledge systems are integrated and co-produced, (e.g., joint definition of forest conservation, program based on Indigenous' needs). However, the rangers would not say the knowledge co-production happens.
Preservation of TEK	TEK is in danger of being lost, thus it is important to preserve it. This can be done through documentation of TEK and the elder Indigenous people passing on their TEK to the younger generations.	The Indigenous knowledge of the Trios is disappearing. There are solutions at work to prevent the loss of TEK, including the establishment of a cultural school where TEK is taught and ACT's documentation of TEK.
Trust	Trust is necessary before Indigenous peoples share their TEK. To achieve this, sharing power and active participation of both the Western people and the Indigenous peoples is necessary.	According to ACT there is trust between ACT and the Trios, which has been built over time and through mutual respect. The rangers do not agree with this, saying that ACT does not uphold their promises, have ambiguous communication and that they feel tricked by ACT.
Share power	There is an unequal power distribution between the Indigenous people and the scientists. To overcome this the sharing of power between the two parties is necessary.	ACT considers this criterion as achieved because the ranger program is to benefit the community and is based on the input of the rangers and the community. Furthermore, ACT must follow FPIC and obtain the traditional authorities' clearance before beginning a project. Additionally, the traditional authority chooses the rangers. The Trios do not think of this criterion as achieved, because they do not benefit from the program, and because the rangers depend on ACT to acquire the necessary tools and protect the forest. The unequal power distribution is also caused by the funders – who control the financing and thus whether programs are run or not – and the government – who has legal power on whether the rangers could get law enforcement jurisdiction and whether TWTIS is recognized.

Political factors	Political factors can limit the use of TEK and the access to or control over forest resources.	The Trios do not have land rights. Because of this the government can grant concessions on their traditional lands. One solution that is in the works to protect the Trio land from concessions is TWTIS.
Respect for TEK holders	The respect for the TEK holders and their beliefs and practices.	ACT says that there is mutual respect between them, and the Trios and that respect is a prerequisite for the ACT staff for working with the Trios. The Trios do not agree with this, saying that ACT does not respect their wishes and needs.
Mutual benefits and incentives	Mutual benefits and/or incentives can aid in the incorporation of various knowledge systems.	The rangers receive a salary as an incentive. However, they do not perceive additional benefits. ACT does perceive mutual benefits, namely through forest protection which benefits ACT's mission and the rangers living environment.

7.2 Recognition of TEK in the forest ranger program

The second subquestion is: *Are the ways through which TEK is recognised in the current forest ranger program considered sufficient and adequate?* To determine whether the current forest ranger program could be considered sufficient and adequate the criteria that formed the basis of the conceptual framework and listed in Table 6 were applied. This way it could be determined if TEK is acknowledged in the South Suriname forest ranger program. Website material and conducted interviews were used to determine if the criteria were met. Table 2 showed a summary of whether the criteria are met or not. In addition, Table 6 illustrates the situation of the criteria in the forest ranger program. While all or portion of the criteria were met or partially met from ACT's perspective, this was not the case from the rangers' perspective. The Trios view the following criteria as not being met: "Active participation of the Indigenous community", "Incentives and mutual benefits", "Trust", "Respect for TEK holders" and "Knowledge co-production". Furthermore, criteria that are partly met from the rangers' perspective but fully met from ACT's perspective are "Interdisciplinarity" and "Share power". The only criteria that both ACT and the rangers agree are either met or not are "Political factors", "TEK preservation", and "Worldviews", all of which are partially met. There are a variety of factors that could account for this disparity in experience. It is possible that ACT will promote a particular viewpoint that aligns with their mission. To point out aspects or obstacles in the forest rangers' program that contradict that viewpoint would be to cast a bad light on their work. Another option is that ACT is oblivious of the rangers' opinions, and hence is unaware of which criteria remain unmet.

That not one criterion is achieved in the eyes of the rangers is derived from a number of issues experienced by the rangers, including a lack of community respect, a lack of tools, unfulfilled promises, ambiguous communication, and the sensation of not being

heard. Lack of tools and unfulfilled promises may be traced back to ACT's financial model, which relies on donations. In addition, the rangers hoped for being able to engage in more law enforcement activities. However, due to political constraints, this is not possible. Additionally, the program in the past is perceived as better to the current one since rangers had access to more equipment and resources.

The analysis of the conducted interviews leads to the conclusion that the forest ranger program is not viewed as sufficient and adequate from the standpoint of the rangers. ACT's viewpoint, which would come to the conclusion that it is sufficient and adequate, is in sharp contrast to this.

7.2.1 Updated conceptual model

Analyzing the interviews also resulted in finding more interconnections between criteria than was illustrated in Figure 1. As a result, the conceptual model has been modified to account for the criteria's interdependencies (Figure 6). New links have been added. One of these links is from "Share power" to "Mutual benefits and incentives". The Trios do not experience many benefits due to not having the tools necessary to carry out their work and thus protect the forest. If more power was shared between ACT and the rangers, they could have more power to get the tools needed. Furthermore, due to not being able to carry out their work, they lose the respect of the community. By sharing more power with the rangers, this will in turn also benefit the rangers in receiving more respect of the community. In addition, a link has been added between "Political factors" and "Share power". "Political factors" has an influence on the amount of power that can be shared. The rangers are now dependent on ACT and other institutions for acting against disruptive activities. However, if they get land rights and the authority to practice law enforcement, they would be able to react immediately. This would also result in the rangers having more power. "Political factors" is also of influence on the "Active participation of the Indigenous community". Because the Trios' active participation would be stimulated by giving them land rights and more authority to act. Finally, "Respect for TEK holders" influences "Trust". According to ACT, before trust can be reached, mutual respect is also important.

It can be argued from this revised conceptual model that the criterion "Political factors" has a greater impact on other criteria than previously considered and thus has a greater influence on the recognition of TEK in forest management. The current political climate in Suriname restricts the Trios from achieving more power and protecting their forest.

Moreover, in Chapter 2.3, it was said that in the reviewed literature a criterion may have been overlooked that would be observed in this study. It can be said that no criterion was overlooked based on the analysis of the conducted interviews.

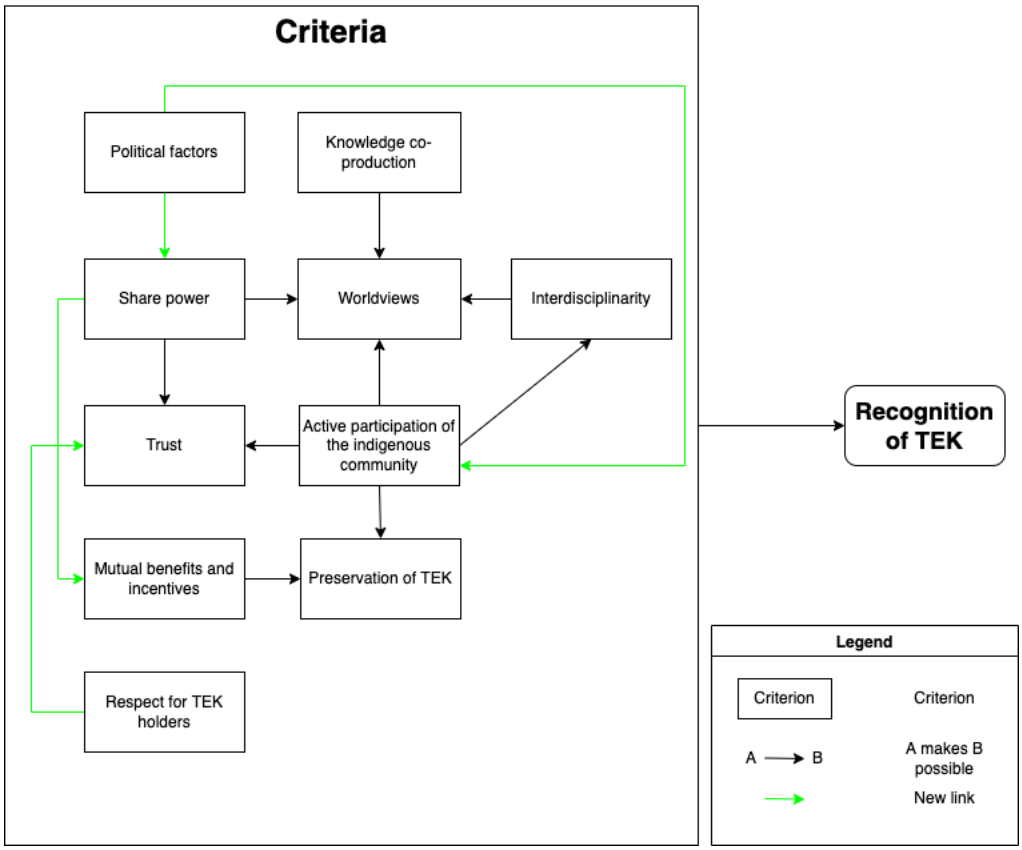

Figure 6 Updated conceptual model

7.3 Stakeholders and their power dynamics

The third subquestion is: *What are the stakeholders within the forest ranger program in TWTIS, how do they relate to each other and what are the power relations between them?*

To better understand the power dynamics among all stakeholders, their relationships with one another and the forest ranger program were categorized and evaluated. A stakeholder analysis was applied to accomplish this. Table 3 showed a list of stakeholders. They were picked based on their ability to influence the power and empowerment of forest rangers.

While ACT would consider the Trios to be key players with a high level of influence and interest who should be part of the process, the rangers did not consider themselves to be key players. Instead, they cast themselves in the role of subjects. That is, they have a lot of interest but little power. Frequently, the subject is a marginalized stakeholder who is seeking empowerment through development programs. As a result, while ACT assumes that the Trios in the forest ranger program have been empowered, the rangers do not believe this has occurred. This also illustrates the rangers' and ACT's unequal power allocation. Funders, on the other hand, are additional key players, as seen in Tables 3 and 4. Funders wield considerable control over whether or not a program may be implemented as a result of their donations. Figures 4 and 5 showed the dependencies that this produces, including the rangers' and ACT's dependency on the funders. Additionally, it is illustrated how the rangers and traditional authority are reliant on the government, which reflects the criteria "Political factors". The government has the legal authority to provide the Trios more

privileges, and hence more power. However, as illustrated in Figures 4 and 5, there are some stakeholders who also collaborate with the Trios and aim to empower them such as the TWTIS partners. Additionally, the Trio and Wayana authorities, including the traditional authority of Kwamalasamutu, empower themselves as well as their communities through the establishment of Trijana.

The traditional authority does have the authority to approve or reject an ACT-proposed project. The question remains, however, whether the Trios carry out the approved projects in accordance with their own principles or those of the West. The Trios put themselves in an inferior position, cultivating a negative social identity. To overcome this, it is possible that the authority accepts the project to reap the benefits and be able to live according to Western principles. Furthermore, the Trios are at a disadvantage while negotiating since they do not speak the negotiation language, which is a Western language.

However, the Trio and Wayana authority also have created Trijana, to aid them in protecting their traditional lands, indicating they desire to occupy a stronger power position, expressing their own values rather than Western values.

7.4 Framework for the recognition of TEK in the forest ranger programs

The fourth subquestion is: *What is a suitable framework for the recognition of TEK and Western scientific knowledge in forest ranger programs?* To find an answer to this subquestion multiple forest conservation methods were discussed: community-based conservation, co-management, adaptive co-management and knowledge co-production. The choice of which method is the most suitable is based on two factors. Firstly, the method should address the recurring issues with the collaboration between ACT and the rangers. Secondly, the method should help in achieving the criteria that are not met in forest ranger program (Table 2).

The Trios' ability to act is limited by their reliance on funding and on the government to provide them legal authority, which is a theme that runs throughout Chapters 4 and 5. This is reflected in the rangers' work, where there are a lack of tools and their desire to enforce the law is not achievable. These are issues over which ACT has little control and on which it is also reliant. What ACT has an impact on is the rangers' perception of not being heard and ambiguous communication. Better communication could be achieved through open communication and holding meetings on a regular basis to discuss each other's needs and wishes. Additionally, developing shared decision-making procedures that include the Trios might be advantageous. By developing open and transparent communication and a shared decision-making process, the rangers can feel appreciated by ACT once more, and their trust in one another can also be restored. Additionally, it would be advantageous to involve the rangers in financing decision-making and grant them control over it. This could empower them by allowing them to be more self-sufficient.

These above named forest conservation methods help to recognize and empower the rangers by giving them more power. Furthermore, these approaches would help in

meeting the criteria that are not met in the ranger program: “Respect for TEK holders”, “Trust”, "Worldviews", "Active participation of the Indigenous community", "Interdisciplinarity", "Mutual benefits and incentives," "Share power," and "Knowledge co-production".

An appropriate conservation method for applying the above named solutions is adaptive co-management. While there are some challenges to applying this method in Suriname, appropriate recommendations have been done to make ACM a viable option in Suriname, as done in Chapter 6.2.4.

7.5 Conclusion on research question

The research question of this study is: *How is traditional ecological knowledge recognized within the forest ranger program?*

To come to an answer to this question ten criteria were identified through a literature review. These criteria are “Interdisciplinarity”, “Active participation of the Indigenous community”, “Worldviews”, “Knowledge co-production”, “Preservation of TEK”, “Trust”, “Share power”, “Political factors”, “Respect for TEK holders” and “Mutual benefits and incentives”. The conceptual framework was also built on these criteria (Figure 1). These criteria allowed for the assessment of TEK's level of recognition as well as how TEK is recognized. Based on these criteria the recognition of TEK within the forest ranger program could be determined.

After analyzing the conducted interviews, it was determined which criteria were met, partly met or not met from both ACT’s and the rangers perspective, as illustrated in Figure 2. According to ACT, each criterion was entirely or partially met. This leads to the conclusion that, from the perspective of ACT, TEK is almost fully recognized in the forest ranger program. However, this belief is not shared by the rangers, who say that not one criterion is entirely met. There are a number of issues experienced by the rangers that can explain that not one criterion is met, among which, ambiguous communication, the sensation of not being heard, a lack of tools, a lack of community respect and unfulfilled promises. Lack of tools and unfulfilled promises may be caused by ACT’s financial model, which relies on donations. Additionally, the rangers want to be able to take part in more law enforcement activities. However, this is not feasible because of political constraints.

Multiple stakeholders are involved in the aforementioned issues. To determine which stakeholders are at play a stakeholders analysis was done, where the following stakeholders were identified: rangers, ACT, traditional authority, Indigenous community, the government (DNA, GBB, ROM, ROS), funders, TWTIS partners and Trijana. The stakeholder analysis led to the conclusion that there is an unequal power allocation between the rangers and ACT, with the rangers having less power over the forest ranger program than ACT. However, ACT disagrees and would argue that they hold the same power in the forest ranger program. This demonstrates once more how the two parties have different ideas about how power is currently distributed in the ranger program. Other stakeholders that have influence on the forest ranger program are the funders, who wield

considerable control over whether or not a program may be implemented. Furthermore, the government also holds a significant stake in the forest ranger program because of its legal authority to provide the Trio additional privileges and thus more power. However, there are stakeholders who work with the Trios and want to empower, such as the TWTIS partners. Additionally, the Trio and Wayana authorities, including the traditional authority of Kwamalasamutu, empower themselves as well as their communities through the establishment of Trijana. Through the influences that the stakeholders have on the forest ranger program and the rangers, power relations between the stakeholders are also formed. The power relations that exist between the stakeholders (Figure 5) are either as one stakeholder being dependent on the other or in collaboration with each other. Most significant is how the rangers are dependent on ACT, the government and the funders. This dependency shows how the rangers may also not be in a position to demand more recognition of TEK in the forest ranger program.

As previously said, the reason for not one criterion being met in the eyes of the rangers is due to various issues. These issues were also a recurring theme in the interviews with the rangers. So, from first impressions, it appears like the rangers' preferences and requirements, rather than TEK, are not being addressed in the current ranger program in South Suriname. This, however, is not the case. Everything the Indigenous peoples do is infused with TEK; it is ingrained in their culture. The Trios have an intrinsic connection with their traditional lands, and it is part of their culture to protect them. However, by ACT failing to recognize their preferences and requirements in connection to forest conservation, their culture, and thus their TEK, is ignored by ACT in the current forest ranger program in South Suriname.

8. Reflection

In conducting this study, a number of caveats could be made. First, in conducting the interviews. The initial idea was that an interpreter would be present to translate the rangers' answers from Trio to Dutch. This might have already had an impact in that an interpreter might interpret the answer differently than intended. Next he would have to translate this answer to a Western worldview which also involves some interpretation. However, due to the absence for the original interpreter, there were two interpreters present. These first translated from Trio to Sranan Tongo and from Sranan Tongo to Dutch. This therefore brings multiple interpretations within the interviews before it is analyzed.

As mentioned before in Chapter 3.3.2, the Trio language is Carib-based and is often metaphoric, with a frame of reference focused on the forest (Smith, 2013). Due to me not living in the forest and not being dependent on it, I experience it differently. This may have influenced how the data of the interviews was interpretated and thus could have an effect on the results and conclusion of the study.

Furthermore, it would have been better if there had been several interview moments with the rangers so that there could be some depth to my data. This could have for example helped in expanding more upon why the rangers felt that the past ranger program was better. Furthermore, I also lost time myself by first getting used to the way of interviewing the Indigenous.

Lastly, the stakeholder analysis done in Chapter 5 could have some stakeholder bias due to no direct participation of the stakeholders. If a stakeholder analysis was done with the active participation of the stakeholders themselves, more depth could be obtained in the interests of the stakeholders and their level of influence, especially with regard to the funders.

9. Recommendations for future research and practice

9.1 Recommendations for practice

As mentioned in the societal relevance (Chapter 1.5), GGS sought assistance in assessing the current forest ranger program in order to identify potential problems and create a program build on the Trios cultural foundation and needs. To find a suitable framework for such a program the fourth subquestion was created: *What is a suitable framework for the recognition of TEK and Western scientific knowledge in forest ranger programs?*

The conservation method adaptive co-management was identified as the best framework for forest ranger programs. The Surinamese forest ranger program's current state and the criteria for TEK recognition that still need to be met—including "Respect for TEK holders," "Trust," "Worldviews," "Active Participation of the Indigenous Community," "Interdisciplinarity," "Mutual Benefits and Incentives," "Share Power," and "Knowledge Co-Production"—led to the selection of this method. By choosing ACM, the multiple issues that the rangers experience will also be addressed, including issues such as ambiguous communication from ACT's part and the feeling of the rangers of not being heard in their needs and wishes.

There are several characteristics of ACM which make it a suitable framework for the forest ranger program and to address the issues, among which the inclusion of the Indigenous peoples through shared decision-making, the recognition of the various needs present, the fostering of trust between actors, the recognition of Indigenous peoples and their knowledge systems, and power sharing. An especially important attribute of ACM is the learning-by-doing approach, which allows for program customization based on changes in the needs or preferences of the actors. Furthermore, for a successful ACM in the forest ranger program, it is especially important to adhere to the following conditions:

- Open communication.
- Regular meetings to discuss needs and preferences, and make sure everyone still has the same vision.
- Include shared decision-making processes.

There are some challenges when applying ACM in Suriname. However, appropriate recommendations haven been done by Smith (2020) to make ACM a viable option in Suriname, as is also expanded upon in Chapter 6.2.3.

9.2 Future research

The study encountered a few challenges regarding budgetary ambiguity surrounding the ACT's forest ranger program. The reason why the rangers now receive fewer tools than before is unknown. This follow-up examination into ACT's budget should thus be conducted to learn how much of the rangers' complaints are genuinely connected to financial issues.

Furthermore, it would be interesting to look into how much ACT actually depends on outside stakeholders, like donors and the government, to carry out projects. If this is the case, other conservation NGOs may be in a similar situation. Such research could help identify the power dynamics at play in forest conservation initiatives and paint a clearer picture of where the problems lie when possible roadblocks in such initiatives are identified.

When conducting the literature research, it was also surprising to discover how little was known about the forest conservation efforts made by Indigenous peoples in South America. It is essential to carry out additional follow-up research on this topic.

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Appendices

Appendix A – List of interviewees

The following is a list of the interviewees that were spoken with. The interviewees who did not want their names mentioned, are described with only their function within the organization they work for.

ACT

- Rachelle Bang a Jong – established the program of the forest rangers of ACT
- Tribal regional coordinator of ACT Suriname
- Country manager of ACT Suriname

Rangers

- Nautaur Ariphio
- Koemoe Keens
- Shkohpe Oesleina
- Teihpe
- Pantodina Jherapha

Appendix B – Interview guide for ACT

The program

- How much influence did the Trios have with setting up the program? Maybe in percentages?)
    - How often is the program revised?
        - If so, are the indigenous people included?

- Was it necessary to create trust between the ACT and the indigenous community before starting the forest rangers program?
    - If yes, what did the ACT do to create this?
    - What did the indigenous people do to create this?

- What is organized by the indigenous people themselves in the forest ranger program? (Or what are they solely responsible for?)
    - If they do not organize anything themselves → How do the Trios get involved (types of participation, types of activities)?
    - What is organized by ACT?

- Are some activities supervised by ACT?
    - Which ones and why?

Through doing a literature review I have found several criteria, that determine whether TEK is successfully recognized within forest management.

- I have read that the Trios and Wayana do not have a claim to their lands due to Suriname not recognizing indigenous land rights in any form. This can lead to a lack of control over and access to forest resources. How does land tenure, to your opinion, influence how much they depend on you as an organization?
    - How different would the partnership be if they had a claim to their lands? (This shows if to their opinion there is a power imbalance)

Collaboration

- What have you learned from them? To what extent has the rangers program changed over the years due to feedback from the indigenous people?
    - If yes, can you name examples?

- By working together and learning from each other your organization also gains indigenous knowledge. There are cases where this knowledge is appropriated or misused for other purposes. Has ACT undertaken actions to prevent that?
    - If so, what kind of actions?

- To what extent are there challenges encountered due to the different worldviews between the Trios and the ACT?
    - Which are the challenges?
    - How does ACT pursue ways to overcome challenge?

- To what extent are there opportunities encountered due to the different worldviews between the Trios and the ACT?
    - Which are the opportunities?
    - How does ACT pursue ways to consider the opportunities?

Monitoring and protection of area

- If I understood it correctly from my literature review, the park rangers trained for monitoring the protected areas are indigenous to that area. Do you think that the indigenous people that were chosen to be rangers already possessed the indigenous knowledge necessary for the program? Or does it vary from person to person, meaning that they still need to be trained with some knowledge?
    - If yes, by whom is it decided which TEK is useful in the program?

- Within the training they are also trained to work with different devices such as drones and mapping technologies. Which are the challenges encountered along the way due to the different worldviews that have to work with and in western frameworks?

- The park guards are there to monitor the protected area and to protect it from deforestation, mining etc. This will also help forest conservation. However, is there a difference in the definition of forest conservation between rangers and ACT?

    - If yes, which are the different views that exist? Who holds these views?
    - Had this an effect on how both groups want the ground protected and what the goals are?
        - Are there some animal or plant species that are endangered or put on a protected list but are used by the indigenous?

End question:

- I read that empowering the forest rangers is important in your organization. Do you think that that goal is reached?
    - If so, through what actions?
    - If not, what is still necessary to change?

- How much should they be able to do themselves in the future, what is the vision?

Appendix C – Interview guide for the rangers

Introduction

I am going to ask you questions about knowledge and how it is used within the rangers program. So, we are going to talk about traditional knowledge and western knowledge.

By traditional knowledge (TEK) is meant your knowledge. Example: how animals are not hunted when certain animals mate.

By western knowledge (pananakiri knowledge) is meant the knowledge brought by organizations like ACT, GGS and CI. Knowledge in which nature is not so important (little respect) and more focused on what nature can give to people. Examples are measuring water quality, GPS training, counting animals)

I will ask what knowledge you use as a ranger, in your daily work. I would especially like to know what it is like to be a ranger.

Training

- What did you learn at the training? (Examples: GPS training; practical and theoretical lessons: wildlife management, protected area management, introduction to biodiversity, environmental science, environmental laws and regulations, first aid, firefighting and prevention, the use and maintenance of outboard motor and chainsaw, leadership and conflict resolution, monitoring and patrolling the area; computer training)
- How did you find the training (Good, bad, interesting, fun, boring, no new knowledge gained)?
- What western knowledge did you learn?
- Did ACT learn about traditional knowledge?

Program

- What do you do each day?
- What knowledge of yours is included within the program?
    - Is there knowledge you have of animals that is included?
    - Is there knowledge you have of plants that is included?
- What knowledge of the pananakiri (the west) is included within the program?
- Do you think the traditional knowledge you use is important within the rangers program?
- Is the use of traditional knowledge more or less than pananakiri knowledge?
- Are you listened to when you have ideas and or comments on the program?
    - If so, how do you see that happening?
- Were you allowed / allowed to have a say in activities / decisions in the program?
- - Does the community help you in your work? Are they familiar with your work?

Collaboration and worldviews

- Are there times when you and ACT do not understand each other because you think differently or have different knowledge?
- Have there been problems with the cooperation between you (rangers) and ACT?
- Have there been good experiences of collaboration between you (rangers) and ACT?
- Do you trust ACT as a partner?
- Does ACT respect your ways of doing things?

Knowledge

- Which of the 2 groups has the most traditional knowledge within the community: adults or youth?
- Do you think the traditional knowledge people have is disappearing?
    - Why?
    - If so, what are you trying to change about that?

Land rights

- If you get land rights for the TWTIS area what would change for the rangers?

Appendix D – Codebook

Code group	Description
Interdisciplinarity	Codes related to the interdisciplinarity of the ACT staff are added to this code group. Interdisciplinarity is achieved when the ACT staff has knowledge about ecological knowledge and Indigenous knowledge.
Active participation of the Indigenous community	Codes related to the active participation of the Indigenous community or the absence of active participation are added to this code group. Codes that mention potential reasons for this or also added.
Worldviews	To this code group, codes are added that mention or describe worldviews of the Western people or the Indigenous. Also added, are the challenges related to worldviews or when it is said that alignment between worldviews does or does not take place.
Knowledge co-production	Codes related to knowledge being co-produced are added to this code group.
Preservation of TEK	In this code group, codes are added that describe whether TEK is disappearing, the consequences and challenges of this, and potential solutions.
Trust	In this code group, codes are added that describe situations when there is trust or distrust between ACT and the rangers. The potential causes or consequences of this trust or distrust are also added.
Share power	To this code group, codes are added that motion or describe situation were power between ACT and the Trios is shared or not shared. Also, the codes related to the power relations present in the forest ranger program are added.
Political factors	Codes that describe or mention parts of the political context in Suriname that have an influence on or related to the forest ranger program are added to this code group.
Respect for TEK holders	In this code group, codes are added that describe situations when there is respect or disrespect between ACT and the rangers. Codes that are also added are the

	ones that describe the causes or consequences of respect or disrespect.
Mutual benefits and incentives	Codes that describe received benefits or incentives for the rangers or ACT are added to this code group.