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# SWM SUSTAINABLE The Karaawaimin Taawa

Insights from a biocultural assessment led by the Wapichan people in Guyana

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# The Karaawaimin Taawa

Insights from a biocultural assessment led by the Wapichan people in Guyana

Food and Agriculture Organization of the United Nations Rome, 2023

The beautiful view from above the canopy of the Karaawaimin Taawa area.



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# Acknowledgements

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With the permission and assistance from the village council and people of Aishalton, the ground and logistical planning and setups were completed in a timely and safe manner.

This study could not have happened without the dedication of community members, local experts, researchers from various institutions, technical staff from the SWM Programme in Guyana, the professional photographer and the support staff (line openers, carpenters, bike men, guides, cooks, load men) to whom we extend our sincere gratitude.

Finally, we would like to extend our gratitude to the European Union, for their constant involvement and support to the Sustainable Wildlife Management Programme in Guyana since 2018.





# Foreword

This biocultural assessment is the product of the fruitful collaboration between community experts and scientists from around the world. It draws attention to the region's biodiversity and its cultural ties to the Wapichan people. It is hoped that the assessment's findings hopefully help highlight the unique role that communities play in safeguarding their lands and resources.

Michael Thomas SRDC chair/current Aishalton Village Toshao

A Burgundy bird eater (*Theraphosa stirmi*) is seen on a branch within the bush.





















## **Participants and authors**

#### South Rupununi experts

**Brown, Phillip – Anthropology and archaeology team** A resident of Aishalton, Phillip has been part of the SRDC's Monitoring Programme for about a decade. Concerned for the care and protection of the environment, Phillip has been active in the various environmental management programmes of the SRDC. *del Aguila Guerrero, Marlon – Photography team* A self-taught wildlife photographer, he is the first Peruvian to be part of the International League of Conservation Photographers.

**Domingo, Januario – Photography team** An active resident of Aishalton, he was a camera assistant for this assessment. Januario has an interest in literature and reading.

*Edwards, Jarius – Aquatic beetles team* Jarius comes from the village of Maruranau. He is an active part of the SRDC's youth arm and holds the title of SRDC Monitor. Jarius has a keen interest in visual arts, and has been one of the key artists for the organization.

*Fernandes, Elvis – Dung beetles team* A villager from the satellite border village of Baitoon, Elvis actively partakes in the monitoring of the Guyana/the Federative Republic of Brazil border as part of the SRDC's Monitoring Programme. A resource person and village leader, Elvis also actively partakes in the management of village affairs.

*Gomes, Benedict – Dung beetles team* An active SRDC Monitor, Benedict Gomes, from the village of Potarinau, has played a key role in the monitoring of the open Guyana/the Federative Republic of Brazil border. He has been part of many of the SRDC's activities over the past years, and continues to do so with passion.

*Henry, Vianney – Anthropology and archaeology team* A youth leader and activist, and part of the youth Programme of the SRDC, Vianney also hold the cap of being an active SRDC Monitor. Vianney holds interests in cultural heritage research, and aspires to be an anthropologist. He hails from the village of Karaudarnau.

*Issacs, Chrisostom – Fish and bats and small mammals team* Hailing from the village of Karaudarnau, Chrisostom is passionate about reviving the traditional skills of the Wapichan. He holds vast knowledge of the forest and its products, and of different areas of the landscape. He is an active SRDC Monitor.

Jeffrey, Ezra – Large mammals (camera traps) team Ezra comes from the village of Awarewaunau, and has been an active SRDC Monitor for about a decade. Equipped with vast knowledge of Wapichan territory, Ezra continues to be a resourceful person for the SRDC. He is also a certified drone operator for the organization. Johnny, Angelbert – Fish team Angelbert is a villager of Sawariwau, who possesses invaluable knowledge of the geography, cultural heritage, and sociocultural characteristics of the South Rupununi. A key

resource person for the SRDC, he actively contributes to the organization's Monitoring Programme.

**Realine, Christopher – Large mammals and bats and small mammals team** A villager and two-time member of the village council of Aishalton, Christopher is an active and functioning youth leader who assists in the administration of village affairs. He has recently been part of the SRDC's monitoring activities. **Realine, Sylvan – Photography team** Is from Aishalton Village, he helped greatly as a camera assistant for the duration of the assessment. Sylvan is a farmer and partakes in many village activities.

A collage of the local Indigenous team members of the Karaawaimin Taawa biodiversity expedition.

*St. Hill, Clarence – Reptiles and amphibians team* Passionate for the care of the environment, Clarence hails from the village of Rupunau. An active community member, he continues his invaluable contribution towards the management of village affairs.

*Wilson, Asaph – Birds team* A villager of Katoonarib, Asaph is one of a few local resource persons who specializes in the identification of bird species. He has been working alongside many researchers over the years across the South Rupununi in this specialized field.

*Winter, Gavin – Field coordinator* A key figure and leader from the village of Aishalton, Gavin holds the title of Monitoring Coordinator for the SRDC. With about a decade of experience and with vast and invaluable knowledge of the South Rupununi, he has been actively partaking in the organization's various environmental management programmes.

#### **Researchers**

Akin, Daniel has a Master of Science degree from Auburn University, where he studied systematics and evolution of South American pencil catfishes. He is continuing his career in a PhD program at the University of Louisiana at Lafayette, advised by James Albert, a world authority on knifefishes. The Karaawaimin Taawa expedition was his first in South America, and he is excited to continue studying the systematics, evolution, ecology and conservation of South American fish while documenting the accumulation of methylmercury contaminants in fish that results from gold mining.

**Daggers, Louisa** is an archaeologist who began her career at the Walter Roth Museum of Anthropology. Her Rupununi connection began while she was a university student more than a decade ago, ultimately influencing her contributions to understanding the cultural landscape of the Rupununi with emphasis on the archaeology and ethnography of the region. Daggers has published on several topics, including the petroglyphs of Aishalton, the archaeology of the Rupununi, and Climate-Smart Agriculture.

*de Souza, Lesley* is Lead Conservation Scientist at the Field Museum of Natural History. Her research focuses on understanding fish diversity in the Amazon basin and utilizing this scientific research for community-based conservation efforts. Lesley has been researching fish in Guyana since 2003 from the Essequibo, Rupununi, Takutu, Ireng, Rewa and Potaro Rivers, to list a few. In collaboration with Rewa Village, she conducted a study to track movement patterns of arapaima in the Rupununi. Lesley has several scientific publications describing new species to science, community ecology of the Rupununi portals, and fish distributions.

Hallett, Matthew has a PhD in Interdisciplinary Ecology from the University of Florida, where he studied large mammal ecology and community-based conservation. He is the co-founder of the Rupununi Wildlife Research Unit, facilitating projects over the last 12 years that have spanned across much of the Rupununi Region, as well as collaborations with partner Regions 1, 2, 3, 4, 7, 8 and 10. Matt's research focuses on the effects of habitat, hunting, logging and livestock on the abundance and distribution of medium- and large-bodied Neotropical mammals, as well as the efficacy of approaches that integrate community participation into research, conservation and management.

Lachmansingh, Hanan is a Research Assistant at the Guyana Wildlife Conservation and Management Commission. She holds a BSc in Environmental Science with a minor in Anthropology from the University of the West Indies. Her passions include intersectional environmentalism, biomimicry, tropical fieldwork and Guyanese development. Hanan is dedicated to finding ways of addressing inequalities in Guyana's environmental sector, to ensure a more inclusive management framework for conservation.

*Lim, Burton* is Assistant Curator of Mammalogy at the Royal Ontario Museum. His research is primarily on the evolution and biodiversity of mammals with a particular focus on Neotropical bats. He has been conducting

fieldwork in Guyana since 1990, when his first expedition was to the rainforest of Iwokrama before its establishment and prior to the construction of the road connection to Lethem. Burton has published almost 200 papers including peer-reviewed articles, invited publications, book reviews, magazine stories and newspaper articles.

*O'Shea, Brian* is an ornithologist specializing in the ecology and conservation of birds of the Guiana Shield, where he has worked for more than two decades. Based at the North Carolina Museum of Natural Sciences, he holds a PhD from Louisiana State University and has conducted extensive fieldwork throughout the Neotropics. His many partnerships and collaborations in the Guianas include projects on biodiversity assessment, tourism development, citizen science, endangered species conservation, fire ecology and long-term dynamics of rainforest bird communities.

*Pereira, Gerard* is an archaeology technician who began his career in archaeology and museology working for the Rupununi Weavers Society Museum, Guyana's first Indigenous museum, in Lethem in southwestern Guyana. His contributions span areas of museum conservation, collections management, ethnography and archaeology field surveys. Gerard has published on several topics including: Archaeology, Rupununi Forts, Cassava and the Wapishana, Ethno-meteorology, and the Parishara Dance.

**Roopsind, Indranee** is a Guyanese field biologist, living in the Rupununi, who has conducted field expeditions all over Guyana over the last 22 years, studying large and small mammals with special focus on riverine and semiaquatic species, as well as other vertebrate taxa. She started her field biology career at the lwokrama International Centre for Rain Forest Conservation, working on developing and implementing monitoring systems for wildlife management, and wetland systems within the Iwokrama Forest and the North Rupununi Wetlands. She has a keen interest in working with Indigenous Peoples on strategies that link the science of traditional knowledge with strategies for natural resources management.

Short, Andrew is professor and senior curator of entomology

at the University of Kansas, where his research focuses on the diversity and evolution of aquatic beetles. He has more than 20 years of fieldwork experience in Central and South America, with a particular focus on the Guiana Shield region. Dr. Short has published more than 120 papers and described more than 300 new species to science.

*Snyder, Andrew* is a biologist who has been studying amphibians and reptiles in Guyana since 2011. He holds a PhD in biology from the University of Mississippi and is presently the Key Biodiversity Areas Coordinator for Re:wild. He supports international efforts to identify Key Biodiversity Areas and promote them as a tool to identify areas of conservation importance and contribute to halting biodiversity loss.

van Vliet, Nathalie is associate researcher at CIFOR, focusing on the links between wildlife and livelihoods. She has worked for the last fifteen years on wildlife and its contribution to food security and local economies in Central Africa, the Amazon and the Caribbean region. Working at local, national and international levels, she conducts research aimed at providing more visibility to current wild meat use and providing objective data for innovative management policies that include ecological, cultural and socioeconomic sustainability. Since 2016, she has been coordinating the SWM Programme in Guyana.

Werneke, David is the Fishes Collections Manager at the Auburn University Museum of Natural History. He has been studying ichthyology in Guyana since 2002 when he first visited the Rupununi Savannah. Since then, David has surveyed fishes all over Guyana including the Potaro, Rupununi and Ireng Rivers. David has numerous publications on Guiana Shield fishes including species descriptions, occurrence checklists and molecular systematics.

*Willadsen, Peter* has a Master of Science degree in Entomology from North Carolina State University. He is currently a PhD student at the University of Kansas studying aquatic beetle systematics and evolution. He previously spent two summers surveying dung beetle communities in and around the Iwokrama Forest in Guyana. Peter is broadly interested in studying insect biodiversity and working with local communities to develop sustainable conservation methods.





A collage of the local Indigenous team members of the Karaawaimin Taawa biodiversity expedition.

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Karaawaimin Taawa is part of a mountain ridge which is connected to a series of other mountains, all related to each other. This interconnection is important to Wapichan cultural and spiritual connectedness to the land.

– Gavin Winter, Field Coordinator

Everisto Lawrence holds up a large haimara (*Hoplias aimara*) that he has just caught.



## Introduction

#### by Timothy Williams

One of the mountain ranges with strong cultural ties to the Wapichan people is the Karaawaimin Taawa, or Blue Mountain, located within the Wapichan territory in the Aishalton extension area, where it forms part of the greater Marudi Mountain range. The Karaawaimin Taawa is a traditional fishing, hunting and gathering ground that also serves as a significant watershed, forming a significant portion of the headwater system of the Essequibo River, Guyana's largest and longest river and its main freshwater source. Unsustainable land uses and, particularly, irresponsible mining, are increasingly threatening this ecosystem and the services that Karaawaimin Taawa provides to the Wapichan people and to the wider community.

Several years ago, the necessity to safeguard this mountain range gave rise to a decision at a public meeting in Aishalton, where community members decided to take action to preserve the Karaawaimin Taawa and administer it in accordance with Wapichan customs and history.

Following the premises of the Wapichan Wiizi territorial management plan and the Wapichan Wiizi Wildlife Management plan, Aishalton Village Council and the South Rupununi District Council (SRDC) decided to take the lead in organizing, planning and implementing a communityled biocultural assessment of the Karawaaimin Taawa. This was their first time coordinating a scientific activity of this magnitude, and they were fortunately supported by the SWM Programme in this endeavour.

In this book, we present the results of this community-led biocultural assessment, encompassing different taxonomic groups and also describing the cultural and historical importance of these mountains for the Wapichan people. Scrolling through the pages, the reader will meet the most secretive, splendorous and curious mammals, birds, reptiles and amphibians, fish and insects. We hope to take the reader to the deepest and most secret side of the Karaawaimin Taawa.

Elvis Joseph carries his arrows and bow as he travels through the bush to camp, with his *warashi* (Indigenous backpack) slung from his head.

### Figure 1: A map of the Karaawaimin Taawa area.



#### KARAAWAIMIN TAAWA

The beautiful view from above the canopy of the Karaawaimin Taawa area.

> "This mountain should not be destroyed, and we should start valuing our mountains. Other groups of people see our mountains as money, but we see them as our life, life that depends on even the tiny resources around us. Let us visit our spirit beings, but quietly, so as not to disturb the spirits."

– Uncle George Simon



# A story of the Karaawaimin Taawa

As told by the ancestors of the Wapichan people, Karaawaimin Taawa is the resting place of the *Koyararar* (rainbow). It is a pillar that supports the earth and the heavens, a source of rich, colourful clay that emerges from the mountain through springs and underground channels. It is home to spirit beings such as *Inii*, *Orapiroo*, *Bichi dukuzo* and *Marutu dukuo*. The mountains belong to several *Orapiroo* (serpents), however, the great *Marunao* has tied them to the mountain with strong iron chains and heads pointing towards to sky. They swallow the earth, filter it, grind it, and pass it through their anuses, causing the earth's soil to vary in colour. This is the reason why the mountain lies flat like a snake in the forest. The *Marutu dukuo* is one of the exit mountains where it is believed that the filtered substance comes out as gold, dye and other minerals.

The Atorada, Dawazai, and Powishana Nao people had once lived alongside the mountain; bartering, hunting, fighting tribal wars and extracting the dye, gold and other precious minerals. They exchanged these minerals for the Powizi (annatto) with the Tarumas, which they used to ritually paint themselves once they extract the red dye. Only adult men can extract the dye during rituals where they fast and communicate with the Marunao.

Customary law states that all journeys to this mountain must be accompanied by a *Marunao* and a proper offering (preferably tobacco) must be made. Hunters who go near the mountain often encounter heavy rainfall with strong breezes, an indication that the spirits sense the presence of humans nearby.

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Our children will benefit and care about Karaawaimin Taawa as did our grandparents; it is time to pay attention to this part of our ancestral land.

– Michael Thomas, Aishalton Village Toshao



By Nathalie van Vliet

## The community-led Karaawaimin Taawa biocultural expedition:

A tale of passion and commitment

The idea of protecting and conserving Karaawaimin Taawa and the surrounding mountain chain has been a longstanding dream of the Wapichan people, who hold a strong cultural and spiritual connection to the area. On the day that Toshao Michael Thomas made the above statement, the official decision was made: Aishalton would lead the expedition to assess biodiversity in this ancestral mountain: The Karaawaimin Taawa ("Karaawai" meaning blue clay or blue/purple berries; "min" meaning "being next to/partner of"; and "Taawa" meaning mountain in Wapishana). These days, the people simply call it "Blue Mountain". This is a known fishing, hunting and gathering ground for Wapichan people from Aishalton and other southern Rupununi Indigenous villages, but in recent generations, fewer families have used the area.

Rato, as he is called, a fisherman from Aishalton, is one of the few elders who still knows how to penetrate the bush to get to Tooto Wa'o River, and reach the Kwitaro River where he has his fishing camps. Water on the Tooto Wa'o used to be crystal clear. He could shoot fish using a bow and arrows on the many rapids along the river. With gold mining happening in the headwaters, in the southern part of the mountain, the water of Tooto Wa'o is now full of sediment. Fish do not have the same colour, and fishing with bow and arrow is no longer an option: "Water is so dark that you can't even see the fish". Nowadays, he has to travel farther, to the Kwitaro River, to get big haimara, butterfish and bigger catfish to take home.

There was no time to be lost. The Karaawaimin Taawa needed urgent attention from its owners, and showing

(from left to right) Beetles researcher Andrew Short and amphibians and reptiles researcher Andrew Snyder make notes at the end of a hard day's work.

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the beauty and richness of this area to the rest of the world was part of it.

However, organizing a biodiversity expedition was not a simple task. Aishalton sought support from the Wapichan Wiizi Wildlife Committee (WWWC) of the South Rupununi District Council (SRDC), to lead the expedition. In response, the SRDC Monitoring team, having extensive local knowledge of the land, including different animals, trees and fishes, as well as cultural uses and practices of the area, were put to the task of executing this expedition. They came from different communities within the Wapichan Wiizi. Each of them not only knew wildlife from their own daily routines in the forests and savannahs where they had grown up, but many of them had worked closely with scientists in the past and therefore knew how to handle technology and were familiar with taxonomy.

The focus of this expedition would be on all animals important for Wapichan culture, livelihoods and medicine. Wapichan people have a strong connection with animals through food. Fish and wild meat are part of the Wapichans' identity and represent their culture and way of life. This connection is also evident in the various traditions of people, especially stories, myths and beliefs embodied in different cultural practices. All traditional Wapichan livelihood activities are conducted according to a seasonal calendar, which is based on natural indicators. The biodiversity survey in the Karaawaimin Taawa would include different types of animals, from beetles and bats to reptiles, amphibians, birds, mammals and fish.

To support the monitoring team, the WWWC partnered with the SWM Programme and scientists from different known research organizations and academia. Together, this motivated team of local monitors and scientists could only be stronger. It took them six months, with monthly Zoom calls, at a moment in time when the world was still trying to find solutions to the worldwide COVID-19 pandemic, to collectively finalize the team members, the taxonomic groups to be surveyed, the date and timing, and the logistics required, and finally to secure funding from the

The SWM Programme team plan their next steps of the assessment along with SRDC team members. TOMMY

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SWM Programme. By January 2022, the team had a clear road map and was more than ready to reveal the hidden beauty of Karaawaimin Taawa.

Gavin Winter, one of the most experienced monitors, was chosen to organize the logistics of a team that would include ten local monitors, nine scientists, nine load men, four cooks, four helpers and a photographer. A reconnaissance team, composed of courageous line openers and carpenters, was sent in advance, one month prior to the expedition, to prepare the logistics. They rode fast on their motorbikes through the savannah to the bush mouth (where the forest starts). From there, leaving their motorbikes behind, the team cleared the only existing trail taking them to Kamadwid Wao, building little bridges over the many creeks on their way until they reached the edge of the Tooto Wa'o. From there, they would begin the slow climb to the top. Four camps were built: one camp on the left bank of Tooto Wa'o (close to Turro Falls), a second one just at the northern foothills of Karaawaimin Taawa, a third just across the mountain top to the east, and the last along the left bank of the Kwitaro River, close to Crack Falls. Rain, mud, heavy loads, snake bites and long journeys on the steep slopes of Karaawaimin Taawa became routine for this committed team, who spent three weeks deep in the forest to prepare for the coming expedition team.

On 8 March 2022, everyone was ready. The monitors were equipped with binoculars, Global Positioning Systems (GPS), nets, camera traps, satellite phones, first aid kits and rubber boots. Researchers from abroad had landed in Lethem and then travelled to Aishalton with their field guides, notebooks, plastic containers and formalin. The photographer was there with his lenses, lights and drone. The cooks had packed tasso, salt, rice and oil for the daily rations. And foremost, the research permits from the Environmental Protection Agency (EPA) and the Ministry of Amerindian Affairs (MOAA) had been received the day before, keeping the suspense alive until the last minute. But that day, nothing could stop this dream anymore: the Karaawaimin Taawa biodiversity survey, led by Wapichan communities, was to become a reality. Adrian Abbensetts rides his motorbike through the rough and muddy terrain.

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Lester Croft carries his load through the bush in a rapidlywoven *warashi* made from palm. This material used to create *warashis* will eventually deteriorate; however it is fast and easy for the locals to create. Other, stronger materials include *mukru* and *nibbi*. 7

Karaawaimin Taawa is home to more than one spirit being that resides in certain big trees. This forms part of, and is essential to, our wider territorial management system.

Philip Browne, anthropology and archaeology team



By Brian O'Shea

## Between mist and stars:

The majestic Karaawaimin Taawa forest

In the hushed predawn darkness, the first sounds of day begin to filter through the forest understorey. As the trees take shape against faint light in the eastern sky, a troop of Guianan red howler monkeys (*Aloutta macconnelli*) awakens with a mighty roar, their voices fading in and out on the soft breeze. A Marail guan (*Penelope marail*), the namesake *marudi* of these hills, launches from a high perch with a few loud flaps, displaying to a female hidden in the canopy below. As the last of the night's frogs retire to their daytime haunts, a chorus of birds – woodcreepers, forestfalcons, toucans, antpittas – swells amid the shadows. The first sunlight reaches the highest canopy crowns, where flowers begin to swarm with an army of insects eager for nectar. Daylight advances, and the forest comes alive.

The Karaawaimin Taawa forms a narrow ridge that divides the headwaters of the Kwitaro River. A northeastern extension of the larger Marudi Mountain massif to the south, the Karaawaimin Taawa was named for the blue rocks discovered along its summit by the region's first inhabitants, thousands of years ago. From its slopes, one descends into the vast, wild landscape of southern Guyana, the birthplace of the country's many rivers, a land of huge trees, clean water, abundant wildlife and unparalleled biodiversity.

The rich resources of the Karaawaimin Taawa are a vital source of sustenance to the Wapichan people. Its lush forests are full of Brazil nuts, nourishing palm fruits and medicinal plants. Wildlife provides protein for hunters and their families. Perhaps most significantly, creeks flowing from the Karaawaimin Taawa feed into the Kwitaro River, a wild, blackwater stream punctuated by rock-strewn rapids, where prized food fish abound. The route across the Karaawaimin Taawa is the most direct path between Aishalton and these rich fishing grounds. The habitats of the Karaawaimin Taawa reflect both its natural complexity and its history of use by the Wapichan people. Along the western approach are many old farms, which eventually transition to tall rainforest with a completely closed canopy that obscures the crowns of massive emergent trees, with trunks up to three metres in diameter. Some of these trunks are balata trees and bear the scars of the balata bleeders that were active in this area decades ago. In this forest, numerous sandybottomed creeks crisscross the relatively flat terrain. As the ground begins to rise at the base of the mountain, steep-sided ravines and patches of swamp forest appear, and shortly afterward the terrain becomes very steep, angling relentlessly upward before levelling out along the top of the ridge, where the trees are slightly smaller and the air somewhat cooler and moister, and where wisps of moss adorn the trunks and branches. Descending toward the Kwitaro, our trail passes through large clearings filled with bamboo. The origins of these clearings are uncertain, but it is not difficult to imagine that they may once have been farms and homesteads, whose residents lived off the bounty of the forest. They provide an intriguing glimpse into the long history of this area.

Read on for a deeper look into the majestic forest of the Karaawaimin Taawa, a true natural and cultural treasure of the Wapichan *wiizi*.



The Marail guan is the signature bird of the Karaawaimin Taawa area.

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A team member carries a *haimara* along with some bones of mammals he has found, packed into his warashi as he travels back to camp.



A team member stands next to the huge base of a silk-cotton tree. Silk-cotton trees can grow to a height of 80 ft (24.3 m) or more and for this reason are a popular tree of choice for harpy eagles (*Harpia harpyja*) to nest.

There is no trapping or hunting of birds because access is very difficult. We found at least 15 species of parrots and 16 species of raptors during the assessment. Many birds of prey are strong indicators of a healthy ecosystem.

– Asaph Wilson, birds team

Crested oropendolas (Psarocolius, decumanus) and red-rumped caciques (Cacicus haemorrhous) build their hanging bag-shaped nests from branches, often near an active wasp nest for protection from predators.



By Brian O'Shea

## A world of feathers:

Birds of the Karaawaimin Taawa

Birdlife abounds in the endless forest of the Karaawaimin Taawa. Hundreds of species can be found here, each of them uniquely adapted for their particular ecological niche, from the forest floor to the highest canopy crowns. Many of these species only occur in the tall rainforests of the Guiana Shield. But the abundance of particular species is what makes the Karaawaimin Taawa special. Protected from disturbance and inaccessible by road, its forests offer safe haven for many species that have been overexploited in other places.

One of the most striking aspects of the Karaawaimin Taawa is its abundance of parrots, and especially of the beautiful scarlet macaw (*Ara macao*). At least 15 species of parrots are confirmed to occur here, and future surveys would undoubtedly reveal more. Places like these, where parrots can raise their young free from the threat of trappers, are vital to ensure that these birds will continue to fly over southern Guyana's forests for years to come.

Birds of prey are solid indicators of ecosystem health. Robust populations of hawks, eagles, owls and falcons reflect an abundant and diverse prey base encompassing a wide range of taxa, from insects to monkeys. The Karaawaimin Taawa supports at least 16 species of raptors, and probably several more. On the community-led survey expedition, we had some spectacular encounters with these birds, including a curious immature slaty-backed forest-falcon (*Micrastur mirandollei*) who was not at all frightened by our presence, and a magnificent harpy eagle exploring a possible nest site in a giant silk-cotton tree. Our late mornings were often punctuated by the shrill whistling of both black hawk-eagles (*Spizaetus tyrannus*) and ornate hawk-eagles (*S. ornatus*) soaring high over the canopy.

A scarlet macaw flies from its nest as it hears the team approach.




Nights were filled with the trills of tawny-bellied screech owls (*Megascops watsonii*) and the muffled hooting of mottled owls (*Ciccaba virgata*). It was a thrill to find so many of these birds in such a short time.

As an extension of the Marudi Mountains, it is only appropriate that the bird for which those mountains are named – the Marail guan – is common on the Karaawaimin Taawa. Large-bodied frugivores like guans and their close relatives, curassows (*powis*), are vital seed dispersers for many rainforest trees whose seeds cannot be spread by smaller animals. In many places where logging and mining bring large numbers of people into the forest, these birds quickly disappear, as they are vulnerable to overhunting. For now, thanks to the ongoing stewardship of the Karaawaimin Taawa by the Wapichan people, their populations in this region are secure. Hundreds of bird species can be found in the great forest of the Karaawaimin Taawa. But not all of them may be found everywhere in the area. On the mountain itself lives a small set of bird species that are typical of hilly regions in the southern Guianas but are much less common elsewhere. The names of these birds are evocative - strongbilled woodcreeper (Xiphocolaptes promeropirhynchus), sharpbill (Oxyruncus cristatus), white-chested puffbird (Malacoptila fusca), to name just a few – and these species not only contribute to the overall diversity of this area, but also highlight the different forest types that blend into one another as one crosses over the mountain. Many bird species in the Karaawaimin Taawa are endemic to the Guiana Shield – they occur only in Guyana, Suriname and French Guiana, as well as neighbouring regions of the Federative Republic of Brazil and the Bolivarian Republic of Venezuela. Keeping the region's forests intact and free of exploitation is the only sure way to safeguard these species for future generations.

A white-chested puffbird sits on a branch.

Gavin Winter finds the remains of a bush cow skull on the jungle floor.



– Ezra Jeffery, large mammals team

By Matthew Hallett

#### From scales to fur:

Mammals of the Karaawaimin Taawa

Terrestrial mammals may be the most secretive species group inhabiting Karaawaimin Taawa. Mammals are highly attuned to forest life and even the most common species are notoriously difficult to spot with the naked eye. Their highly developed hearing and sense of smell allow them to detect even the slightest potential threat from a distance and retreat to safety. Many restrict their movements to the darkness of night or the disorienting twilight of dawn and dusk. Those that do move during daylight hours are careful with the placement of each step and effortlessly disappear into the dappled shadows of the forest floor. This highly elusive nature of rainforest mammals has made motion-sensored cameras (also known as camera traps) the preferred tool of research teams the world over.

The camera trap survey of Karaawaimin Taawa documented a diverse and abundant mammal community that is representative of a true Neotropical wilderness. Large mammals in particular require more space and resources than other taxa, making remote areas with ample highquality habitat and connectivity within an intact system of forests, mountains and rivers particularly important for sustaining healthy populations. Camera trap and visual surveys in Karaawaimin Taawa recorded at least 48 species of terrestrial mammals, including five "near threatened", four "vulnerable" and one "endangered" species, proving that this area serves as a vital refuge for many of South America's most iconic and threatened species.

Karaawaimin Taawa's forests are plentiful, abounding with the fruits, seeds and nuts that make up much of the base of the food chain. Seven species of monkeys, including the golden-handed tamarin (*Saguinus midas*), brown capuchin (*Sapajus apella*), squirrel monkey (*Saimiri*  sciureus), red-backed bearded (*Chiropotes chiropotes*) and white-faced saki (*Pithecia pithecia*), red howler and black spider monkey (*Ateles paniscus*), navigate the maze of branches of the forest's upper canopy. On the forest floor, small and medium-sized rodents, such as lowland paca (*Cuniculus paca*), red-rumped agouti (*Dasyprocta leporina*), red acouchi (*Myoprocta acouchy*) and Guianan squirrel (*Sciurus aestuans*) are abundant. Agoutis serve as a particularly important indicator of healthy forests, as they disperse the seeds of the forest's largest trees. These clever rodents cache seeds underground when trees are fruiting, but they bury so many seeds that they misplace some, planting the next generation of large forest trees.

The existence of a healthy prey base of abundant small and medium-sized mammals is paramount for supporting a robust predator community. Karaawaimin Taawa is home to all six species of wild cats found in Guyana – jaguar (Panthera onca), puma (Puma concolor), ocelot (Leopardus pardalis), margay (Leopardus wiedii), jaguarundi (Puma yagouaroundi) and oncilla (Leopardus tigrinus). Individuals of these species can maintain home ranges of more than 100 km<sup>2</sup> and require the presence of a thriving prey base to survive. Besides being some of the most beautiful, revered and quintessential species of the rainforest, these predators play a key role in stabilizing healthy ecosystems. The effect of predation by wild cats along with smaller carnivores also found at Karaawaimin Taawa, like bush dogs (Speothos venaticus), grison (Galictis vittata), tayra (Eira barbara) and coati (Nasua nasua) ripples through food webs to regulate the populations of herbivores that would otherwise overgraze on grasses, overbrowse on leaves, and overharvest fruits and seeds. The diverse and relatively abundant suite of carnivores documented during our camera trap surveys provides a strong indicator of the high level of health and function of the Karaawaimin Taawa's forests.

The remoteness of this area fosters an abundance of large-bodied game species. Compared to their smallerbodied counterparts, these species are more susceptible



A red-faced spider monkey watches the team as they collect samples of the biodiversity of the Karaawaimin Taawa. Ezra Jeffery sets one of the many camera trape to be left over the next few months to see what terrestrial mammals are present within the area.

Everisto Lawrence finds a puma tooth and claw while walking through the bush. Two squirrel monkeys look down at the team as they pass through the trail.

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to the effects of overhunting because they have slow reproductive rates and are long-lived, highly visible and relatively slow moving. Lowland tapir (Tapirus terrestris), red brocket deer (Mazama americana), white-lipped peccary (Tayassu pecari) and giant armadillo (Priodontes maximus) are all abundant in the Karaawaimin Taawa. The combination of the absence of roads that would provide easy access to outside hunters and effective traditional management by Wapichan communities appears to have helped maintain healthy populations of species that are in decline elsewhere in South America. These species are so important to tropical forests that they are considered to be ecosystem engineers. Tapir specialize in long distance dispersal of fruits and seeds. Rooting, trampling and wallowing by peccaries fertilizes soil, alters plant survival and recruitment, affects water movement, and creates breeding sites for amphibians. Armadillo (four species were detected during the assessment) burrows provide a wide variety of species with refugia from predators and temperature extremes. These species are also important prey for large carnivores and human communities, and their presence helps to maintain a thriving forest ecosystem in and around the Karaawaimin Taawa.

Karaawaimin Taawa is part of a massive tract of intact Guiana Shield forest that stretches across southern Guyana into Suriname and the Federative Republic of Brazil - right at the heart of one of the world's last frontier forests. The presence of wide-ranging species like jaguars, bush dogs and white-lipped peccaries shows that Karaawaimin Taawa forests provide enough space and resources to maintain populations of even the Guiana Shield's most mysterious and wide-ranging species. Intact wilderness areas, such as the Karaawaimin Taawa, that are not only large and undisturbed, but also maintain connectivity with nearby areas of similar size and habitat quality, are increasingly rare in this world. Wilderness areas are critical in that they support populations of many species that are culturally and economically important to the Wapichan people and the world.

## Karaawaimin Taawa is one of the three pillars that uphold Wapichan landscapes.

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– Angelbert Johnny, fish team



By Daniel Akin, David Werneke and Lesley de Souza

# Beneath depths and in shallows:

Fishes of the Karaawaimin Taawa

The intricate waterways of the Karaawaimin Taawa form part of the headwaters of Guyana's largest river, the Essequibo. Meandering through the forests of the Guiana Shield, these waterways provide habitats for a tremendous diversity of aquatic life while also providing water to Guyanese communities.

Guyana is one of the few strongholds of healthy rainforest left in the world. Healthy rainforests rely on healthy rivers, and sampling the freshwater fishes in the waterways of Karaawaimin Taawa is vital to its protection. The fish team sampled fishes in two rivers and their tributaries draining Marudi Mountain: Tooto Wa'o and the Kwitaro Rivers. Our team also collected vegetation, aquatic insects and fish muscle preserved in salt to test for mercury contamination.

Preliminary findings reveal at least 75 fish species were found during this survey, although we estimate the Karaawaimin Taawa likely supports double that number. We found 182 individuals of at least 35 species on the mainstem of the Tooto Wa'o, compared to 292 individuals of at least 46 species in the Kwitaro. On the tributaries of these rivers, we found 116 individuals of at least 22 species (Tooto Wa'o) and 102 individuals of at least 21 species (Kwitaro). These initial findings suggest that the mainstem of the Tooto Wa'o has fewer fish and fewer species than the Kwitaro River, yet the tributaries are guite similar in richness and abundance. Both rivers appear to have healthy populations of food fishes such as piranhas, haimara and long-whiskered catfishes. However, community fishermen have observed that the haimara of the Totoo Wa'o are less abundant and smaller than in years past.



Several Guyana endemics were recorded during this expedition, such as this *Hypostomus hemiurus* caught in the Kwitaro River. 0.000

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It was quickly evident that the Tooto Wa'o is being impacted by mining due to the presence of fine sediments that affected water clarity, creating a slimy film on most surfaces that smothered aquatic vegetation like water lettuce. These factors can greatly reduce the fish diversity in a river, and indeed we caught very few fish in the areas suffering from these effects. Despite these impacts, we found fish diversity was higher in areas near rocks and roots where the water flow was strong enough to clean the sediments from the substrate.

In contrast, the Kwitaro had no indication of impact from mining. The habitat we sampled had an extensive fast-flowing shoal with clean sand and gravel, abundant aquatic vegetation and clear water. These healthy river characteristics were also evident in the tributaries of both rivers. Sampling in tributaries of the Kwitaro, we collected several species not collected elsewhere on the expedition.

Many of the species we found during our expedition were represented by only a single individual. Some species are rare or difficult to sample, such as the one individual of Leporellus vittatus caught in the Kwitaro. However, other species collected from the Tooto Wa'o should have appeared more often in our collection, such as Tetragonopterus argentus, which is typically collected in groups. We continued to add species to our list at every new survey site. This suggests a tremendous diversity we were not able to collect in the short time. Likewise, we found four species endemic to Guyana: these include armoured catfishes; *Hypostomus hemiurus* and Lithoxus lithoides, and characins; Roeboides thurni and Phenacogaster megalostictus. The finding of so many endemic fishes in a short period of time is significant, and suggests the likelihood of other endemic species in the Karaawaimin Taawa.

> Several Guyana endemics were recorded during this expedition, such as this juvenile *Hypostomus hemiurus* caught in the Kwitaro River.



The team of international scientists and local experts consisted of (from left to right) David Werneke, Angelbert Johnny, Eustace Martin and Daniel Akin.

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Day and night, the team worked to gather as many samples of fishes as they could for the assessment of the Karaawaimin Taawa waterways.

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Our community-led assessment gave us a glimpse into the pristine forests and rivers of Karaawaimin Taawa, as well as a clear view of the impacts that large-scale mining operations have on downstream river habitats. Further explorations should include sampling at multiple points along the mainstems of the Tooto Wa'o and Kwitaro River, as well as downstream of their confluence. This would allow for a more thorough comparison of the fish communities in these rivers and an assessment of mercury accumulation in migratory fishes. Fishes, rivers and people are all tightly linked together. Right now is a critical time to act in order to preserve the vast diversity of fishes of Karaawaimin Taawa and ensure that future generations of Wapichan people can experience the clean, fast-flowing waters that connect humans to nature.

(from left to right) Andrew Snyder and Clarence St. Hill work together to gather data on amphibians and reptiles in the diverse Karaawaimin Taawa area.

Karaawaimin Taawa holds an abundance of diversity, and therefore can contribute to a more national approach to biodiversity conservation.

- Clarence St. Hill, reptiles and amphibians team By Andrew Snyder

### Cold-blooded creatures:

Amphibians and reptiles of the Karaawaimin Taawa

Amphibians and reptiles are important denizens of the lush forests and aquatic habitats of the Karaawaimin Taawa. The amphibian and reptile survey team encountered some spectacular and unique species on this community-led survey expedition, including several amphibians which may represent undescribed species. Preliminarily, we recorded almost 60 species, though estimates indicate these forests and associated habitats likely support more than 100 species.

The study of amphibians and reptiles offers a window into the environment in which they live. Human activities directly impact the abundance, species composition and distribution of amphibians and reptiles. Owing in large part to their unique life history, low dispersal ability and permeable skin (which allows them to breathe through their skin), amphibians in particular are highly sensitive to pollution and climate change, and are therefore important indicators of the health of the environment in which they live. Amphibians and reptiles also play key roles as middle players in food webs and food chains, serving as both important predators and as prey items for larger predators.

Amphibians and reptiles have evolved unique adaptations that allow them to colonize all ecological niches of the Karaawaimin Taawa – from the leaf litter and swamps to the top of the forest canopy. Explorations like this one help unravel the complexities of amphibian and reptile distributions across the Guiana Shield. Sheltered by their remote location free of roads and human disturbance, these forests offer a glimpse into the past, and provide new clues about the different forms of interactions that humans have had with nature over centuries.

During the expedition, we learned that the Karaawaimin Taawa supports at least 30 species of amphibians and 29 species of reptiles – including one species of caiman, one tortoise, 13 snakes and 14 lizards. Unquestionably, this area harbours more species, as new records were encountered daily, even during our hike out of the forest at the end of the expedition.

Our morning and nightly surveys provided a different glimpse into the amphibian and reptile communities. During our morning walks, the leaf litter was alive with the iconic brilliant-thighed poison frogs (Allobates femoralis), while the repeating peeps of male three-striped poison frogs (Ameerega trivittata) echoed from their elevated perches. Several adult vellow-footed tortoises (Chelonoidis denticulata) were found, providing further evidence of the low hunting pressure in Karaawaimin Taawa, as this species is considered a delicacy in our local communities. The night-time forest came alive with a cacophony of calling amphibians - from the trills of South American common toads (Rhinella margaritifera) along forest creeks to the bellows of slender-legged tree frogs (Osteocephalus spp.) from hidden cavities within the canopy. The presence of large predatory snakes like the green anaconda (Eunectes murinus), emerald tree boa (Corallus caninus) and bushmaster (Lachesis muta), reflects an abundance and diversity of larger prey species like agouti and birds.

Sometimes the most fortuitous encounters took place unexpectedly, right in camp. One of the most notable encounters occurred in the early evening while awaiting dinner as a small, grey-brown snake slithered into camp. This surprise guest turned out to be a short-nosed leaf-litter snake and represents the first time this species has been recorded from Guyana.

The Karaawaimin Taawa is bursting with biodiversity, and future explorations would unquestionably reveal more of its special secrets. The assorted forest types and aquatic ecosystems across the mountain are responsible for the remarkable diversity, which is strengthened by the lack of human disturbance over generations. Ensuring that these forests and their aquatic systems remain unimpacted and unexploited is the only way to guarantee these species will persist long into the future.



A giant waxy-monkey treefrog (*Phyllomedusa bicolor*) can be seen relaxing on a large leaf.

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A South American common toad (*Rhinella margaritifera*) blends in with the foliage of the forest floor.

The bushmaster is extremely venomous, the largest viper globally and the longest venomous snake in the Americas.



A smooth-fronted caiman (*Paleosuchus trigonatus*) can be seen floating in the creek during the assessment.

The green anaconda is large in size, but is non-venomous.

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The team was delighted to discover a species new to Guyana, the short-nosed leaf-litter-snake (*Taeniophallus brevirostris*).

The emerald tree boa is uses its prehensile tail to hold onto the tree branch.



(from left to right) Local expert Jarius Edwards and international scientist Andrew Short stand in their research area with the equipment they are using to capture aquatic beetles.

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Karaawaimin Taawa is important to the future livelihoods of nearby villages; therefore, further intervillage discussion and agreements will be needed, to control entry and access to this area.

– Jairus Edwards, aquatic beetles team

By Andrew Short

### In waters large and small:

Aquatic beetles of the Karaawaimin Taawa

Aquatic beetles can be found anywhere, and even in the smallest amount of water in the Karaawaimin Taawa. From the small pool of rainwater that collects in the depression of a fallen leaf to the margins of the raging rivers that cross the region, aquatic beetles are a diverse and ever-present element of the aquatic fauna. With more than 13 000 described species worldwide, there are more aquatic beetles than birds around the globe. They have an enormous range of behaviours and habitats, with some species being voracious predators capable of eating small fish and tadpoles, while others feed on detritus or algae. The aquatic beetle team recorded more than 101 species in 53 genera from a broad range of habitats. These species include some that were not previously known to occur in Guyana and others that represent undescribed species.

Aquatic beetles and other insects found in the water are often used as effective indicators of water quality in freshwater systems due to their sensitive and varying response to ecological disturbance. Many species rely on oxygen dissolved in the water, to breathe while they are swimming. Any pollution or environmental changes that reduce levels of dissolved oxygen can harm or alter aquatic insect communities. Increases in water temperature – which can be caused by high sediment loads from mining, loss of canopy cover from deforestation, or overall warming due to climate change – reduce levels of dissolved oxygen and therefore stress aquatic life. Additionally, aquatic beetle communities are also effectively used to discriminate among different types of aquatic habitat (e.g. between running and standing waters).

Aquatic beetles in Guyana have historically been very poorly known. Some recent surveys over the last decade have helped increase our knowledge of this fauna, but much remains to be learned. Guyana is home to several hundred species of aquatic beetles. Primary fieldwork like this expedition is critical to establishing baseline data on these organisms and better understanding the community composition of the forest and how it is imperilled by potential threats such as climate change.

The 53 genera and 101 species we found during the Karaawaimin Taawa expedition are typical for what one would expect for a survey of this type in a pristine Guiana Shield tropical forest. Of particular note was an area of rocky streambed that formed a flat "slide" that we encountered unexpectedly while following several otherwise dry stream channels through dense forest. This particular kind of rocky pool and seepage habitat often holds a number of rare or unusual species, and this one was no exception: we found the elegantly patterned Platynectes decemnotatus, which had not been found in Guyana before. Additionally, we collected several other rare species from this seepage including species in the genera Quadriops and Tobochares. We were also excited to find several undescribed species of the genus Novochares, which hide among the fallen leaves that accumulate in forest pools throughout the Karaawaimin Taawa, as well as a curious new species of the genus Chasmogenus, which has never before been collected and may be endemic to the region.

There is no question that further exploration would reveal yet more aquatic beetle diversity in the region. The pristine, intact nature of the forest combined with the numerous and varied aquatic habitats found in the Karaawaimin Taawa are no doubt the cause for the high level of diversity and intact communities that are found here.



After using the net to collect the aquatic beetles, team members then spread out what they find over a screen above a pan. The aquatic beetles will jump down into the water after some time.

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The team use an aspirator to suck the aquatic beetles into the transparent plastic tubing. The plastic tubing has both a filter and a screen to keep the team from sucking the beetles into their mouths.


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The team sorts samples of aquatic beetles late into the night with the aim of establishing baseline data.



Surveying dung beetles is important because they perform important ecosystem services and are a good indicator group. By surveying dung beetles, we were able to learn about the health of the forest.

- Benedict Gomes, dung beetles team

Coprophanaeus lancifer is a beautiful beetle and is the largest dung beetle in South America. By Peter Willadsen

## Custodians of the forest:

Dung beetles of the Karaawaimin Taawa

Dung beetles may not always make their presence known, but they can be found all over the Karaawaimin Taawa. These beetles are most often seen scrambling across the ground, perched on the leaves of understorey plants, or flying clumsily through the forest. While most people might not consider their lifestyle glamorous, many of these beetles have beautiful, brightly coloured or iridescent bodies, such as Coprophanaeus lancifer, which is the largest species of dung beetle found in South America. Dung beetles are highly diverse, with over 6 000 described species found around the world. While most dung beetles feed on dung, as their name suggests, a few species are known to eat fungi or decaying fruit and at least one species is a specialist predator of millipedes. The dung beetle team recorded at least 11 genera collected across the four main sites surveyed in the Karaawaimin Taawa.

Dung beetles are often divided into three groups based on how they interact with dung and where they lay their eggs. First is the group known as rollers, which form a ball from a fresh pile of droppings and roll it to a promising nest site on soft ground. The beetles then dig under the ball to bury it and break off little chunks, each of which receives one egg. Tunnelers cut out the rolling step and dig directly beneath a dung pile, making several tunnels under the dung. Chunks of dung are dragged into the tunnels where eggs are laid. The third group are the dwellers, which skip the digging entirely and just lay their eggs on top of fresh dung heaps.

Dung beetles rely heavily on mammal dung, so large and diverse dung beetle populations are a good indicator of healthy local mammal populations. Big dung beetle species also need large tracts of continuous forest, so the presence of large species can be an indicator of a healthy, undisturbed forest. Dung beetles perform several important ecosystem services and we often fail to appreciate the benefits dung beetles provide because, just like the beetles themselves, their actions often go unobserved. By digging tunnels and burying dung, tunnelers and rollers aerate the soil and recycle nutrients, providing fertilizer to plants. Rollers help plants disperse to locations they might not otherwise reach, by rolling dung balls containing seeds across the forest. Burying dung also helps keep the forest floor clean, thereby reducing the spread of many parasites to humans and the mammals which provide dung to the beetles. Dung beetles are an important group to survey since their diversity and abundance can be useful indicators of strong mammal populations and they contribute so much to the overall health of forest ecosystems.

Surveys of dung beetles in Guyana have increased in the past 20 years or so, likely because of their growing popularity as a useful indicator group. However, our knowledge of dung beetle diversity in the region is still very lacking regarding both species diversity and behaviour, with many species in the region remaining undescribed. The first species of dung beetle found to be a specialized predator was described based on observations in Peru, and it seems likely that novel diets and behaviours may also be discovered during future surveys of dung beetles in Guyana. Future surveys in the Karaawaimin Taawa would doubtless uncover many more species and likely undescribed species as well. The diversity of dung beetles across sites, and the presence of several large species, underscores the pristine vitality of this forest community and the importance of preserving its intact nature through sustainable usage practices.



(from left to right) Local expert Benedict Gomes, international scientist Peter Willadsen and local expert Elvis Fernandes hold up the equipment they will be using to capture and preserve dung beetles.

Once caught in the trap, dung beetles are placed into a bottle of bleach to be preserved for later analysis.

Elvis Fernandes sets a dung beetle trap, consisting of fresh dung suspended above a container of water.

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I really enjoyed working with the bats of Taawa. While taking them out of the nets, and making specimens, I learned that there are so many types of bats. They may look alike at first but when you really understand them, you see how different they are, and the different roles they play in the environment.

 Christopher Realine, Large mammals, bats and small mammals team F THE WORLD

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By Indranee Roopsind and Burton Lim

## Mastering the night sky:

Bats of the Karaawaimin Taawa

Bats, the only mammals that truly fly, are one of the more difficult groups of animals to study. In addition to being small and secretive, bats are also nocturnal, making them difficult to detect. Yet they are abundant and diverse: unbeknownst to most people, bats comprise more than half of the 225 species of mammals known to occur in Guyana. Prior to our community-led assessment, there had never been a biodiversity survey of Karaawaimin Taawa for bats, so this was one of the main objectives of the project.

Bats provide beneficial ecosystem services in the rainforest of the Karaawaimin Taawa. Nectar-feeding bats are ecologically similar to hummingbirds, but are active during the night. While getting their sweet treat from flowers, they pick up pollen on their faces and are responsible for cross-pollinating many different species of plants, which is important for the natural process of forest succession and regrowth. Nectar-feeding bats are small-bodied, but they have several anatomical adaptations, including a long snout and long tongue that can be extended the equivalent length of their heads. Many species of bats specialize in fruit, and are good at dispersing small seeds because they don't eat their food at the parent tree, and excrete the seeds intact in other parts of the forest. Still others consume insects, and a few even eat fish and frogs!

Bats possess the amazing evolutionary adaptation of echolocation that allows them to transit their way through the dense maze of the forest in total darkness. They literally see with their ears because an acoustic picture is created in their brain by high-frequency echoes that are beyond the range of human hearing. The primary method for catching bats is to use fine-mesh mist nets set across creeks or trails that different species use to fly easily through the rainforest, as opposed to navigating through the clutter of branches and thick vegetation.

During seven evenings of netting, we documented 14 species of bats, so with more surveying effort we would expect to find many more species at Karaawaimin Taawa. The most common species we documented was the flat-faced fruit-eating bat (*Artibeus planirostris*). This species specializes in figs and is a primary seed disperser of many important trees in the forest ecosystem.

Although the survey of bats was short compared to the other groups, the diversity of feeding guilds included species that were frugivores, nectarivores, aerial insectivores that capture their prey in flight, and gleaning insectivores that snatch stationary prey on vegetation. This last group is never found in abundance, but they represented one-third of the bat species documented. The presence of these bats has been used by researchers as an indicator of healthy forest ecosystems. This suggests that the habitats of Karaawaimin Taawa are in good shape now, and that long-term surveying of the bat fauna can be an appropriate method for monitoring the environment in the future.





Indranee Roopsind uses a mist net to capture the bats during the Karaawaimin Taawa biodiversity assessment.

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A flat-faced fruit-eating bat successfully removed from the net by Christopher Realine.



Releasing a flat-faced fruit-eating bat back into the rainforest.

George Bush looks up at the canopy, at a small shaft of light coming through.

Blue Mountain, a significant landmark in Wapichan Wiizi, hosts untouched flora and fauna in abundance, which are of key importance to the Wapichan – It is a key area that we will always protect.

– Michael Thomas, Aishalton Village Toshao

By Louisa Daggers

## The value of the Karaawaimin Taawa

for the Wapichan people

The cultural landscape of the South Rupununi is associated with lived experiences, events and people. It possesses deep cultural and spiritual values, all of which are intertwined and reflected in the worldview of the Wapichan people. Aishalton and its surrounding land – together with its extension, the Karaawaimin Taawa landscape – stimulate emotional engagement, expressed as fondness, pleasure, respect and love of time and place. This engagement exemplifies the meaning of perpetual cultural continuity and social memory which is reflected in both prehistory and the Anthropocene.

As in many cultures worldwide, it is believed that rocks play a significant role among the Indigenous nations of the South Rupununi. The recent ethnoecological and archaeological assessment of Aishalton and Karaawaimin Taawa provided insight into a range of cultural sites associated with rocks within the landscape, including sacred sites.

Rocks are intimately incorporated into the cultural lifeway of the Wapichan people in the form of folk tradition; for example, "Granny Rock" is one of many historical petroglyph sites. The value of rocks is further demonstrated in the prehistory of the area, which is evident in the Aishalton petroglyph complex, an open-air savannah museum comprising 33 archaeological sites and a total of 693 petroglyphic elements or rock art features. More recently the Karaawaimin Taawa archaeological assessment documented an impressive range of ground stone features or polissoirs together with fish holes and sacred sites at river rapids. A total of five prehistoric archaeological sites were recorded along major rivers and creeks, featuring circular and elongated grinding grooves which were once used in the production of stone tools. While these features are not uncommon in the Rupununi landscape, they provide important insight into past tool manufacturing and Indigenous land use practices. One additional stone site associated with the historic period was documented during the archaeological survey: a cluster of triangular sharpening rocks left on old balata trails used by travellers to sharpen metal tools. Collectively, these items represent the past and recent use of the landscape in the vicinity of the Karaawaimin Taawa.

Among the notable archaeological sites in the vicinity of the Karaawaimin Taawa is an old balata bleeder camp site. The balata industry of British Guiana had numerous impacts on Indigenous Peoples. It is a reminder to many Indigenous Peoples of hardship, endurance, creativity and trade. This period required extensive travel by men and women into unexplored areas of Guyana, where exploitation of Indigenous Peoples and their resources by merchants was common. Remnants of the balata industry in the Karaawaimin Taawa also provide a glimpse of the changing economics of the region, as the opening of a new economy coincided with a cross-cultural experience reflected in various expressions including art. It was events such as the balata trade and the establishment of temporary camps and trails in the Karaawaimin Taawa and along the Kwitaro River that played an invaluable role in the transmission of intangible cultural heritage through dialogue and cultural expressions from one generation to the next. Families worked closely together, engaging children through language and stories while teaching the art of craftsmanship through basketry and the manufacturing of toys and rubber balls. It was within this context that traditional methods of resource use, hunting and fishing practices, and ethnobotany were shared, ultimately enabling cultural continuity to the present day. Following the end of the balata industry in 1982, the Karaawaimin Taawa continued to be an important seasonal source of subsistence for the Wapichan people, accommodating prolonged fishing and hunting trips and









exploitation of forest resources including the prized Brazil nuts. Along the Totoo Wa'o and Kwitaro Rivers, at least four such camps were noted.

There is an intimate connection between the contemporary population and the cultural landscape, one which is demonstrated through beliefs, stories, subsistence practices and spirituality. For example, recent interviews with Wapichan elders during the ethnoecological survey brought to light how many people still feel a strong spiritual connection to their surroundings. In fact, one of our guides mentioned how one elder always came back to Karaawaaimin Taawa to look after the balata base camp after the balata industry ended, until he passed away several years ago. Another elder, Granny Louisa, a former bleeder who worked with her husband and parents in the balata industry, is a reminder of the power of social memory as she related her experiences of cultural taboos and teachings received as a young woman interacting with the environment and sacred sites along the balata trails. Such is people's connection to place, one which is humbling. The Karaawaimin Taawa landscape is one of resilience, survival and identity.

Scars can still be seen many years on from the balata trade industry that ended in 1982. Ĩ.



The thick shell of a Brazil nut has been cut open by a team member to reveal the contents. Besides humans, agoutis are great dispersers of the Brazil nut seed as they are the only mammal with teeth strong enough to break the shell.

Calvin Antone weaves a traditional backpack called a *warashi*. This particular one is made from *mukru*, which is a natural material found in the forest. Everisto Lawrence moving across the fast-flowing Tooto Wa'o River, carrying his bow and arrow in the event of any hunting opportunity.

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Hanan Lachmansingh walks over a log to get across the creek.

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Deep in the Karaawaimin Taawa bush many different species of plants grow.

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