CIFOR

Food and Agriculture Organization of the United Nations

cirad

WCS

SWM Technical Report Series: August 2022

SWM SUSTAINABLE WILDLIFE MANAGEMENT PROGRAMME

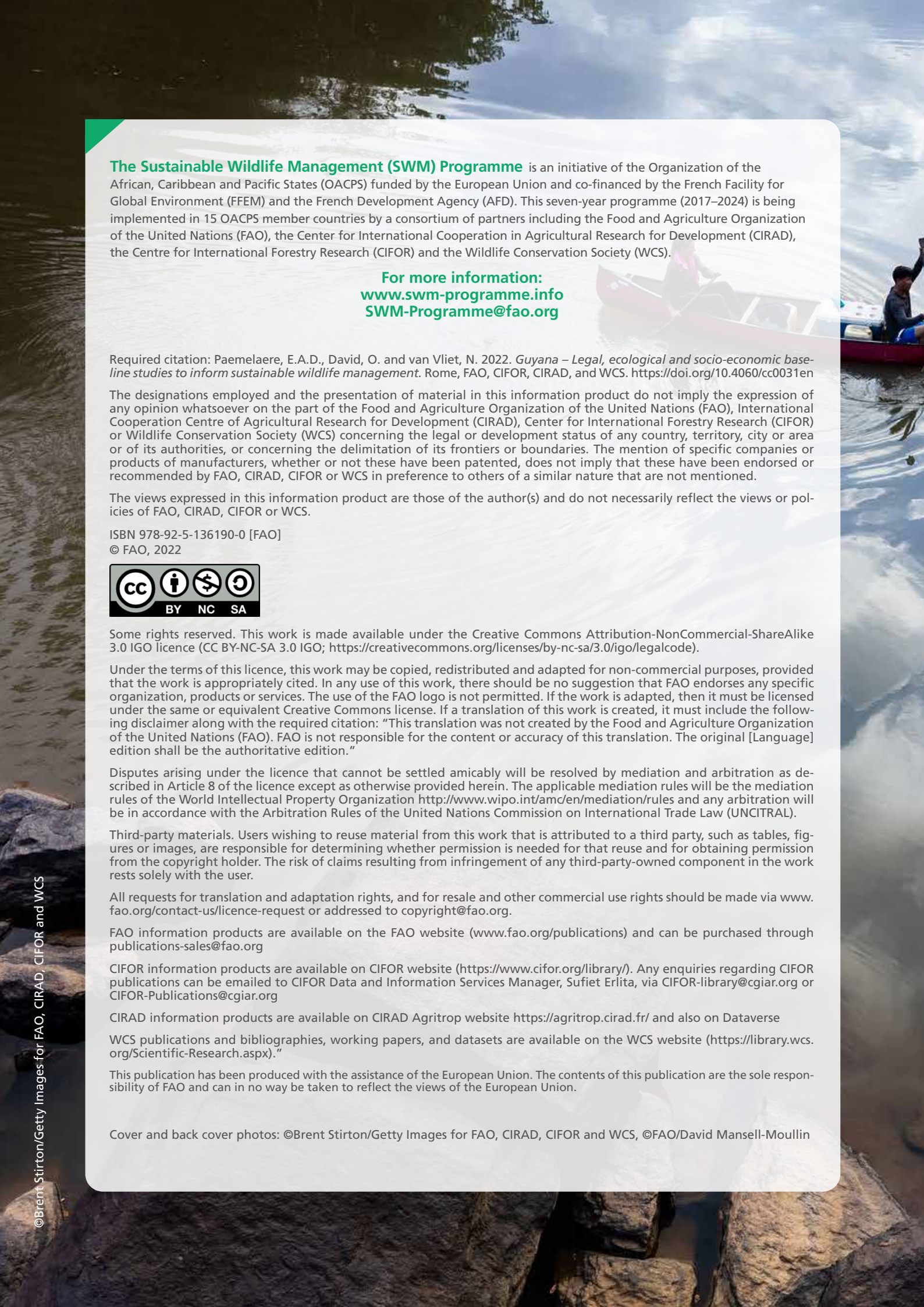
Guyana

Legal, ecological and socio-economic baseline studies to inform sustainable wildlife management

Supported by

Funded by the European Union

National partner



The Sustainable Wildlife Management (SWM) Programme is an initiative of the Organization of the African, Caribbean and Pacific States (OACPS) funded by the European Union and co-financed by the French Facility for Global Environment (FFEM) and the French Development Agency (AFD). This seven-year programme (2017–2024) is being implemented in 15 OACPS member countries by a consortium of partners including the Food and Agriculture Organization of the United Nations (FAO), the Center for International Cooperation in Agricultural Research for Development (CIRAD), the Centre for International Forestry Research (CIFOR) and the Wildlife Conservation Society (WCS).

For more information:
www.swm-programme.info
SWM-Programme@fao.org

Required citation: Paemelaere, E.A.D., David, O. and van Vliet, N. 2022. *Guyana – Legal, ecological and socio-economic baseline studies to inform sustainable wildlife management.* Rome, FAO, CIFOR, CIRAD, and WCS. https://doi.org/10.4060/cc0031en

ISBN 978-92-5-136190-0 [FAO]

This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of FAO and can in no way be taken to reflect the views of the European Union.

Cover and back cover photos: ©Brent Stirton/Getty Images for FAO, CIRAD, CIFOR and WCS, ©FAO/David Mansell-Moullin

Guyana

Legal, ecological and socio-economic baseline studies to inform sustainable wildlife management

Rupununi – Region 9

Published by
Food and Agriculture Organization of the United Nations
Center for International Forestry Research
International Cooperation Centre of Agricultural Research for Development
and Wildlife Conservation Society

LIST OF CONTRIBUTORS

Oswin David, is from the Rupununi and has 10 years of experience in environmental management. He has worked as a wildlife and resource manager officer at the Environmental Protection Agency (EPA) and since 2018 as the site manager for the SWM Project in Guyana. He has a BSc in environmental studies from the University of Guyana.

Kayla de Freitas, MSc, is Guyanese and is pursuing her PhD on Indigenous Peoples' fire management at the Royal Holloway University of London, United Kingdom. She is affiliated with the South Rupununi Conservation Society and has worked in conservation, sustainable development and with Indigenous Peoples in the Rupununi for 10 years.

Eleonore Devillers, MSc, is a sustainable tourism expert from France, with a degree in agro-economics. She has worked on sustainable tourism as a tool for rural development and conservation for 16 years in 14 countries, with UN agencies, international cooperation, government bodies, the private sector, non-governmental organizations and rural communities. She has worked in the Rupununi for 3 years.

Erin Earl, MSc, with Master's in Natural Sciences. She currently is the Giant Anteater Research and Conservation Project Manager for South Rupununi Conservation Society (SRCS), where she has worked since 2011, including on the red siskin project. Living at Wichabai Ranch in the South Rupununi, she aims to use conservation and ecotourism to bring sustainable livelihoods to the people of the South Rupununi.

Kevin Edwards is the fisheries coordinator for the North Rupununi District Development Board's implementation of the fisheries management plan with support from SWM. Kevin was a student of the Youth Leadership Programme at Bina Hill Institute. Formerly senior councillor of Kwaimatta, his North Rupununi home, he is committed to community development, conservation and sustainable use.

Juanita Gómez is a Colombian lawyer specialized in environmental law. She has consulted for more than 4 years for CIFOR projects on wildlife in South America, conducting research on the wildlife legal framework of Colombia and Guyana. She has co-authored over 15 publications on wildlife use and management.

Matthew Hallett, PhD, is a large mammal ecologist from the United States of America and works as an Assistant Research Professor at the University of Florida. He is also the manager of the Guyana Conservation Initiative at the Jacksonville Zoo and Gardens. He focuses on the monitoring of medium and large mammals and has over 10 years' experience in Guyana. He has published several papers on the impact of hunting on game species, presence of rare species and the population density of large carnivores.

Deirdre Jafferally, PhD, is an independent Guyanese consultant whose work focuses on community-based resource management and use of traditional knowledge in environmental management. He has a PhD in human geography and has worked in the Rupununi for over 20 years.

Michelle Kenyon was born in the Rupununi, where she currently lives. She has a Bachelor of Law degree from the University of Guyana and has 10 years of work experience in multi-dimensional projects within the Rupununi in public health, social development, environment and livelihoods development sectors.

Elford Liverpool, BSc, MSc, is a biologist and museum specialist with a master's degree in forest biology from the University of Guyana in collaboration with the Royal Ontario Museum, Canada. He is a PhD student in the Biodiversity Conservation Program at University of Guyana in collaboration with Austin State University, United States of America. He focuses on freshwater and marine ecology, fish taxonomy and biodiversity, museum conservation and the impact of environmental degradation on flora and fauna.

Andy Mahadeo, MBA, is the country coordinator for SWM. He has a Bachelor of Engineering and a Master of Business Administration. His experience spans over 10 years both in private and public sectors in project management, procurement, strategic management, engineering and health care.

Timothy McIntosh, MSc, is Guyanese. He enjoys designing and implementing projects that support sustainable rural livelihoods. He has worked closely with women's agroprocessing groups and the Indigenous People's Organization since 2008. Timothy holds the equivalent of a BSc in food technology and a MSc in business management.

Melanie McTurk, BSc, is a community development specialist and business administrator with over 20 years' experience of working in the tourism sector. She is president of Visit Rupununi, managing director of Karanambu Lodge and serves on the board of the Tourism and Hospitality Association of Guyana. She is a trustee of Bina Hill and was appointed in January 2021 as trustee representing the private sector in Guyana to the National Protected Areas Trust.

Samantha Meiwa James (MLIS), has over 17 years' experience of working in the North Rupununi Wetlands. She specialises in community-based resource management with a focus on monitoring, conservation leadership, stakeholder engagement and community communications.

Angela Mejía, MSc, is a biologist and spatial analyst with a master's degree in ecology and conservation from the Institute of Ecology (INECOL A.C.), Mexico. She is a PhD student in the geography programme at Temple University, United States of America. She focuses on the influence of landscape characteristics on fauna and how wildlife populations can be maintained in modified landscapes.

Neal Millar from Scotland is the programme coordinator for SRCS. He holds a BSc in sustainable development from the University of St Andrews. He was a research assistant with the Energy, Environment and Resources Department in London. His interests include conservation, natural resource governance and the circular economy.

Micheal Morisson is a Guyanese student at the University of Guyana. He is currently completing his studies in environmental sciences and worked with the SWM Project in Guyana as an intern in 2019.

Brian O'Shea holds a PhD in biological sciences from Louisiana State University and has more than 20 years of research experience in the Guiana Shield. He is currently the collections manager for ornithology at the North Carolina Museum of Natural Sciences.

Evi Paemelaere, PhD, is a Belgian wildlife research and management consultant. She has worked for more than 10 years in wildlife conservation focusing on coexistence in human-dominated landscapes around various themes, such as road impacts, hunting and living with large predators in Guyana and South America.

Anupana Puran, MSc, is a Guyanese conservation biologist who works on protected areas management. For the past 5 years, she has worked in the fields of ecological monitoring and the wild meat trade research in Guyana.

Alona Sankar is the commissioner of the Guyana Wildlife Conservation and Management Commission. She focuses on natural resources management and has been working in wildlife management and regulation in Guyana for over 16 years.

Michele Singh, PhD, is a Trinidadian wildlife scientist, specializing in neotropical animal production. She is currently the animal scientist and country representative at the Caribbean Agricultural Research and Development Institute (CARDI) in the Bahamas. She has nearly 10 years of experience as a lecturer at the Department of Food Production, Faculty of Food and Agriculture, University of the West Indies, St. Augustine, and has focused on neotropical animal conservation, production and utilization.

Nathalie van Vliet, PhD, is a Dutch associate researcher at CIFOR, who has worked extensively on the links between wildlife and human livelihoods. She has worked for the last 15 years on wild meat and its contribution to food security and local economies in Central Africa, the Amazon and the Caribbean regions at local, national and international levels.

Nicholas Waldron is a Guyanese livestock expert with almost 30 years of experience in livestock production and animal health. He is a practising veterinarian with his own veterinary clinic and is an expert consultant in Georgetown, Guyana.

Timothy Williams is the technical coordinator for the South Rupununi District Council (SRDC)/ South Central Peoples Development Association (SCPDA) conducting the SWM Project in Guyana activities. Timothy hails from Aishalton, a village in South Rupununi, Guyana. He has a bachelor's degree in geography from the University of Guyana.

Jose Zammett is Guyanese and has lived most of his life in the Rupununi. He is concerned about human impact on the region's resources and wishes to be part of a sustainable future for the Rupununi. Jose has been working with the SWM Project in Guyana since 2019.

Contents

Executive summary

Wild meat is an important source of protein, fat and micronutrients, particularly for Indigenous Peoples and local communities in tropical and subtropical regions of Latin America, Africa and Asia. However, the demand for wild meat has exploded, especially in urban areas. The Sustainable Wildlife Management (SWM) Programme in Guyana (hereafter "the Project") was started in 2017 with the aim of improving the conservation and sustainable use of wildlife. The SWM Programme empowers resident communities to exercise traditional rights of access and long-term use of wildlife resources as a source of food and livelihood, without depleting them. To achieve this, the SWM Programme is active in 15 countries in Africa, the Caribbean and the Pacific.

The Project seeks to ensure that the Rupununi region (administrative Region 9) can continue to offer sustainable options for food security and livelihoods in accordance with traditional lifestyles. Simultaneously, it aims to maintain healthy wildlife populations through integrated sustainable co-management models. This can inform a national-level scale-up, which will serve as an example to neighbouring Caribbean and Amazonian countries. The main objectives are:

1) To ensure that comprehensive, harmonized and efficient institutional and legal frameworks for wild fish and terrestrial wildlife management are in place and operational through a participatory process.
2) To ensure that fish and terrestrial wildlife are managed sustainably through the implementation of existing fisheries management plans, the development of a regional strategy for terrestrial wildlife management, education and capacity building for sustainable wildlife management, and the monitoring of fish and wildlife populations.
3) To improve local livelihoods and food security through the development of small-scale poultry production, the promotion of the Rupununi ranching system and the development of wildlife-based tourism as an economic alternative to the consumptive use of wildlife.
4) To ensure that the use of wild meat becomes sustainable through monitoring along the wild meat value chain, implementation of behavioural campaigns and food safety practices.

The Project builds upon existing strategies, visions and development plans at the local and national levels. The in-country partner is the Guyana Wildlife Conservation and Management Commission (GWCMC), which is strengthening its role in overseeing sustainable wildlife management and consolidating legislation. The Project collaborates with non-governmental organizations (NGOs) and community representative groups in the Rupununi. These are also part of the Site Steering Committee (SSC) and participate in decision-making with the Project to ensure the long-term sustainability of Project outcomes.

Guyana is part of the highly biodiverse Guiana Shield in northern South America, where Caribbean and Amazon cultures meet. Fewer than 800 000 inhabitants live primarily along the coast, leaving the interior sparsely populated with large expanses of largely unmodified natural habitats. The Rupununi region, with a mix of seasonally flooded savannah and forest, is the

largest region in the south of the country bordering Brazil. The region has roughly 24 000 inhabitants, mostly from three Indigenous tribes: Makushi, Wapichan and Wai Wai. Local livelihoods are principally based on subsistence resource use. This non-cash income contributes around half of their total income. Land ownership is Amerindian titled lands, government land (some of which is leased to private ranches) or protected areas (Kanuku Mountains National Park, Iwokrama Reserve and the Kanashen Community-Owned Protected area).

Results Objective 1

The analysis of current regulations from a statutory law perspective highlights several opportunities to increase clarity in terms of the competences of the different institutions in charge of wildlife management, fisheries, agriculture, Amerindian people's rights, tourism and food safety. Inland fisheries in Guyana are not regulated but the Department of Fisheries is committed to enabling environments, co-management arrangements, such as the one developed by the North Rupununi District Development Board (NRDDB) with support from the Project in Guyana. An evaluation of current knowledge of the recently developed wildlife regulations showed that much effort is still required to increase awareness on the regulations; this process could also allow for better participation of Indigenous Peoples and wildlife users in the development or refinement of current regulations.

Results Objective 2

The Project in Guyana conducted a baseline study on hunting and wild meat use. This was based on existing literature, additional surveys along the wild meat value chain, and a Rupununi-wide camera-trapping programme to monitor wildlife abundance and distribution. Hunting is an important contributor to local livelihoods, and appears to be sustainable for many species. However, some of the most heavily hunted species and large mammals may be declining in numbers. These include savannah deer (*Odocoileus cariacou*), tapir (*Tapirus terrestris*), armadillos (*Dasypus* spp.), capybara (*Hydrochoerus hydrochaeris*) and red-footed tortoise (*Chelonoidis carbonarius*). Monitoring of two emblematic, threatened species, giant anteater (*Myrmecophaga tridactyla*) and red siskin (*Spinus cucullatus*), is executed by the partner organization the South Rupununi Conservation Society. Environmental education was identified by the Project as key to supporting sustainable practices and the curriculums developed are being piloted in several schools. The Project has facilitated the creation of the Wapichan Wiizi Wildlife Committee (WWWC) under the South Rupununi District Council (SRDC), a local NGO partner.

Fish is a very important protein source among Indigenous people in the Rupununi, constituting 60 percent of animal protein in the diet of the North Rupununi tribe, the Makushi. Generally, men from most households fish, typically with hook and line, but seines are gaining popularity. As with wild meat, a few species constitute the majority of biomass consumed. River turtles are often considered part of the fisheries and ranked among preferred species to eat. Prior to the Project, efforts to ensure sustainable consumption of fish and turtles were made. The Project builds upon these efforts and supports NRDDB in developing simple and enforceable management plans and fisheries monitoring systems in the Rupununi. In addition, the Project also supports turtle conservation efforts in situ (in the south) and ex situ (in the north).

Aside from wildlife harvest and consumption, habitat degradation and human–wildlife interactions are essential to guaranteeing sustainable wildlife management in the Rupununi. The Project conducted a landscape-level road impact study on wildlife and made recommendations for priority sites that would render roads in the region more wildlife friendly. The Project is supporting research on the impacts of fire on mammals and birds to support ongoing community efforts to improve fire management.

Results Objective 3

By volume, chicken imported from Brazil dominates the market in the Rupununi, accounting for approximately 82 percent by weight of all meat sold. Beef sales are a distant second. Most meat is imported, despite beef and chicken production in Guyana. The cattle industry is part of the Rupununi culture, but no longer thrives. Many households keep livestock for their own use, and most have at least yard fowl. A few commercial broiler operations also exist in the Rupununi. The Project helped to establish a livestock support hub and the construction of poultry support and production facilities, which were run by the Rupununi Livestock Producers Association (RLPA). The latter is a registered not-for-profit company and the main representative of livestock producers in the Rupununi with a direct link to government. The Project's review of wildlife farming suggested labba *(Cuniculus paca)* and capybara *(Hydrochoerus hydrochaeris)* as potential wild species that could be captively bred for consumption. In October 2019, the Project organized a learning trip to Trinidad and Tobago for eight Rupununi citizens to gain hands-on experience at working in peccary, agouti, labba and deer farms.

Tourism development in general, and community-based, sustainable tourism development in particular, are seen by local communities as a basis for a viable sustainable economy in the region. This is in keeping with the region's culture and in support of wildlife-friendly habitats and livelihoods. The Rupununi offers nature, wildlife, community and adventure tourism. There are 19 established lodges, some private, others community owned. Visit Rupununi (VR) is a regional destination management organization that groups different tourism sector providers and helps promote development and marketing of ecotourism in the Rupununi. The Project conducted a needs assessment, prioritizing ten needs for action in the tourism sector. These included training (in management, among others), and developing and promoting unique wildlife-based tourism products. A tourism action plan was developed by VR with support from the Project. The plan

included the need to agree on a set of guidelines on wildlife-friendly tourism practices to ensure that tourism is respectful of wildlife and wildlife habitats and contributes to wildlife conservation.

Results Objective 4

Wild meat is common throughout Guyana, in both urban and rural areas. The coastal region with the highest population has the greatest demand for wild meat. This is harvested in the interior region. Labba and deer are favoured on both the coast and in the interior, whereas iguana and capybara are more popular along the coast. Half of the vendors on the coast obtain their meat directly from hunters, while the rest hunt themselves. In the Rupununi, Indigenous hunters may sell (part of) their catch on an irregular basis to vendors, and commercial use is much less common than on the coast. Prices of wild meat vary widely, being equal to or only slightly more expensive than domestic meat sources. Vendors on the coast sell wild meat because it is a family business, or because they enjoy their business. However, they usually do not depend on wild meat sales for their full income. Consumers strongly associate wild meat with tradition, culture or family.

General conclusions

The results of the baseline data collected directly by the Project or gathered from existing literature are presented in this report. Based on the knowledge obtained and lessons learnt in context, the Project team has adapted the theory of change for Guyana. The main assumptions and strategies that guide the intervention are:

- By strengthening local governance structures, we increase ownership, promote sustainable use of terrestrial wildlife, fish and turtles, and decrease risks from illegal activities.
- By promoting knowledge and pride in traditional practices and identity, we increase the likelihood that sustainable practices are maintained and transmitted to the next generation.
- By generating data and raising awareness of wildlife population trends and important biodiversity hotspots, and assessing the impact of different threats, we influence decision-making on external factors affecting wildlife. These include infrastructure development, unmanaged fires and the expansion of mining.
- By increasing the economic value of wildlife-friendly landscapes (through ecotourism, wildlife-friendly livestock production systems and mitigation of human–wildlife conflicts), we reduce unsustainable use of wildlife and threats from other more intensive or destructive land uses (mining, industrial agriculture).
- By increasing awareness and supporting the implementation of local and national regulations on fishing, hunting and wild meat trade, we reduce unsustainable wildlife use.

Acronyms and abbreviations

BHI	Bina Hill Institute
CARDI	The Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Community
CI	Conservation International
CIFOR	Center for International Forestry Research
CIRAD	Center for International Cooperation in Agricultural Research for Development
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CRBA	community rights-based approach
EPA	Environmental Protection Agency, Guyana
FAO	Food and Agriculture Organization of the United Nations
FPIC	free, prior and informed consent
GFC	Guyana Forestry Commission
GLDA	Guyana Livestock Development Association
GTA	Guyana Tourism Authority
GWCMC	Guyana Wildlife Conservation and Management Commission
GYD	Guyana dollar (USD 1~ GYD 200)
IUCN	International Union for Conservation of Nature
IUCN/SULi	International Union for Conservation of Nature/Sustainable Use and Livelihoods Specialist Group
KAPA	Kanashen Amerindian Protected Area
KMCRG	Kanuku Mountain Community Representative Group
LoA	Letter of Agreement
LPC	Lethem Power Company
MoU	Memorandum of Understanding
NASA	National Aeronautics and Space Administration
NGO	non-governmental organization
NRDDB	North Rupununi District Development Board
OACPS	Organization of the African, Caribbean and Pacific States
PAC	Protected Areas Commission
PARD	Plan of Action for Regional Development
RAI	Relative Abundance Index
RDC	Regional Democratic Council
REDD	Reducing emissions from deforestation and forest degradation
RLPA	Rupununi Livestock Producers Association

SCPDA	South Central Peoples Development Association
SRCS	South Rupununi Conservation Society
SRDC	South Rupununi District Council
SSC	Site Steering Committee
SWM	Sustainable Wildlife Management
ToC	theory of change
UNCAC	United Nations Convention Against Corruption
VIIRS	Visible Infrared Imaging Radiometer Suited
VR	Visit Rupununi
WCS	Wildlife Conservation Society
WHC	World Heritage Convention
WWWC	Wapichan Wiizi Wildlife Committee

I. GENERAL INTRODUCTION

A. General context regarding the SWM Programme

Millions of people depend on wild meat for food and livelihoods. Wild meat is an important source of protein, fat and micronutrients, particularly for Indigenous Peoples and local communities in tropical and subtropical regions of Latin America, Africa and Asia. However, the demand for wild meat has risen dramatically in recent years, especially in urban areas. If hunting to meet this demand is not reduced to a sustainable level, populations of targeted species will decline and food insecurity will rise in rural communities. Recent studies show that hunting of wildlife in many parts of the world is unsustainable and already threatens hundreds of species with extinction.

In this context, the Sustainable Wildlife Management (SWM) Programme was initiated in 2017 to improve conservation and sustainable use of wildlife in forest, savannah and wetland ecosystems. More specifically, the SWM Programme promotes wildlife management that empowers resident communities. These groups of people are considered to have traditional rights of access and use of wildlife resources. They engage in customary practices that can help ensure continued use of these resources without depleting them. This will support their well-being and livelihoods in the long term.

To achieve this, the SWM Programme implements projects in 15 countries in Africa, the Caribbean and the Pacific. Using a community rights-based approach and a free, prior and informed consent (FPIC) protocol, the SWM Programme works with stakeholders at the national level and within carefully chosen pilot field sites. Sustainable community-based wildlife management is promoted by:

- a collective understanding of and adherence to the principles of sustainability within rights-holding communities;
- the legal existence and/or proper application of participatory management regimes and hunting rules adapted to the social, economic and ecological contexts;
- appropriate technical solutions and support to build community capacity for the adaptive management of wild meat offtake;
- appropriate support to limit the impact of other threats to wildlife, including hunting by non-rights holders and hunting for the supply of unsustainable urban wild meat chains;
- measures to compensate communities and other stakeholders of the wild meat value chains for reduced income and protein supply that may result from reduced sustainable hunting and urban demand for wild meat.

In the selected countries, different models of sustainable community-based wildlife management, adapted to the jurisdictional context of the pilot field sites, are being developed and tested within an integrated landscape management approach.

B. Context and objectives of this report

This report is a comprehensive summary of the baseline findings to be used in the implementation of sustainable wildlife management in Guyana. It covers all intervention areas of the Project. Section II presents the Project in terms of objectives, the theory of change and assumptions, as well as the intervention model and general approach towards the beneficiaries. Section III describes the intervention site (the Rupununi region), its geographic location, socio-economic background and biophysical characteristics. Section IV addresses the institutional and normative framework pertaining to sustainable wildlife management. Section V presents information on the hunting system, and Section VI on the fishing system. Section VII assembles information on the consumption of wild meat in urban areas and the wild meat trade chain. Section VIII focuses on other anthropogenic factors that affect sustainable wildlife management (fire, roads), including issues such as food safety linked to wild meat consumption. Sections IX and X describe alternative economic activities that can be promoted in the Rupununi to increase the value of this wildlife-friendly landscape and decrease the dependence on wildlife for food and income: livestock production (cattle and chicken), wildlife farming and wildlife-based tourism. Section XI concludes and offers recommendations about future directions.

This report was produced at the mid-term of the implementation of the Project in Guyana. Its main aim is to inform the implementation of the Project and validate or adjust the theory of change based on the information presented here. This new information has improved our understanding of the wildlife-use system and its wider context. This baseline report describes the adaptive management strategy of the SWM Programme in support of data-driven decision-making.

Summary

The Project was launched in Guyana on 9 November 2018, after a continuous and comprehensive consultation process with governmental agencies, non-governmental organizations (NGOs), community representatives and members across the region that lasted over 2 years (2017–2018). The Project builds upon existing strategies, visions and development plans at the local and national levels. The in-country partner is the Guyana Wildlife Conservation and Management Commission (GWCMC), which is strengthening legislation on sustainable wildlife management. The Project has collaboration agreements with NGOs and community representative groups in the Rupununi; these are also part of the Site Steering Committee. The Site Steering Committee participates in decision-making with the Project team to safeguard the long-term sustainability of the Project outcomes. The Project seeks to ensure that the Rupununi continues to have sustainable options for food security and livelihoods in accordance with traditional lifestyles, while maintaining healthy wildlife populations. The specific objective is to pilot integrated sustainable co-management models for sustainable wildlife and fisheries management in multiple-use savannah–forest landscapes of the Rupununi region. This will inform a national-level scale-up and serve as an example to neighbouring Caribbean and Amazon countries.

II. PRESENTATION OF THE SWM PROJECT IN GUYANA

Nathalie van Vliet[1], Andy Mahadeo[2], Oswin David[3], Michelle Kenyon[4], Alona Sankar[5]
[1] CIFOR, Colombia, nathalievanvliet@yahoo.com
[2] Guyana Wildlife Management and Conservation Commission, Georgetown, Guyana, andy.mahadeo@live.com
[3] Guyana Wildlife Management and Conservation Commission, Lethem, Guyana, david.wyn100@gmail.com
[4] CIFOR, Lethem, Guyana, m.kenyon89@yahoo.com
[5] Guyana Wildlife Management and Conservation Commission, Georgetown, Guyana, alonasankar2@gmail.com

A. The SWM project in Guyana

The Project in Guyana seeks to ensure that the Rupununi region can continue to offer sustainable options for food security and livelihoods in line with traditional lifestyles while maintaining healthy wildlife populations (Figure 1). The specific objective is to pilot integrated sustainable co-management models for wildlife and fisheries management within multiple-use savannah–forest landscapes of the Rupununi region. This will inform a national-level scale-up, which will serve as an example to neighbouring Caribbean and Amazonian countries.

To achieve this, the Project is articulated around the following four results:

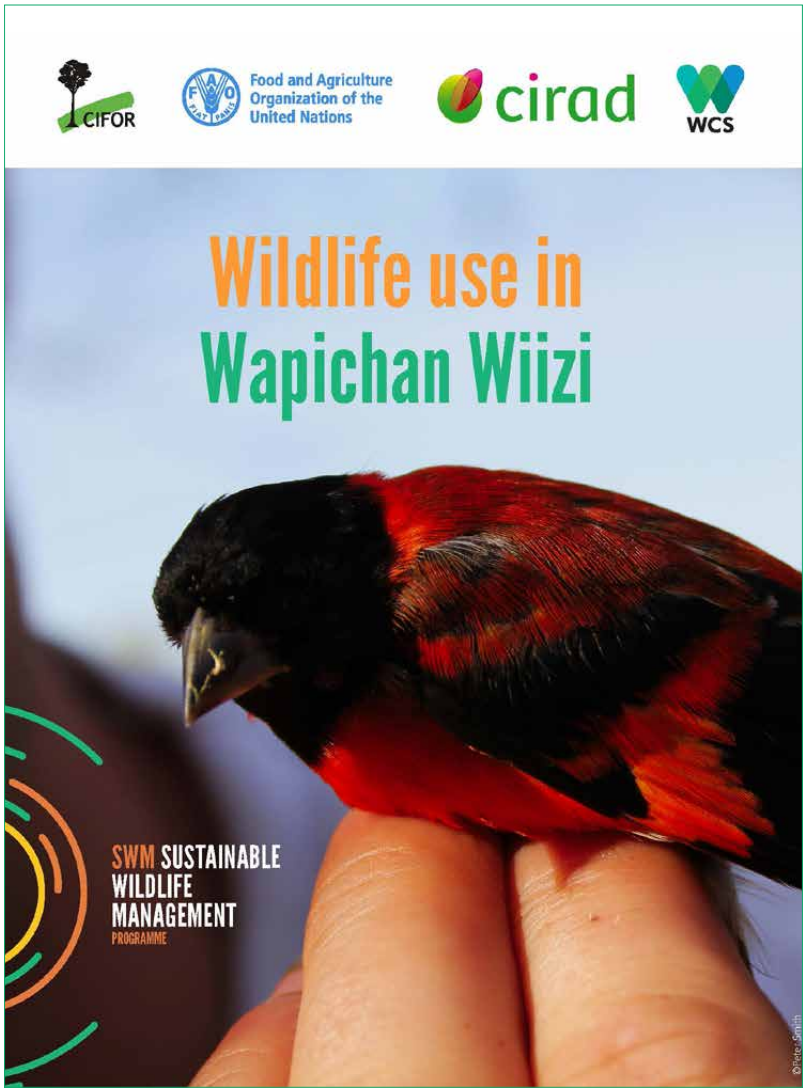
R1: The institutional and legal framework for the sustainable use of meat from wild species resilient to hunting or fishing is being improved. The Project is implementing several actions that aim to ensure that comprehensive, harmonized and efficient institutional and legal frameworks for wild species (fish and terrestrial wildlife) management are in place and operational. This is done through a participatory process.

R2: Management of wild species resilient to hunting or fishing is being improved. To ensure that fish and terrestrial wildlife are managed sustainably, several activities are being implemented, including implementation of existing fisheries management plans, development of a regional strategy for terrestrial wildlife management, education and capacity building for sustainable wildlife management, monitoring of fish and wildlife populations, and generation and sharing of knowledge about wildlife management across the Caribbean and Amazon region.

R3: Supply of alternative protein is being improved. Several livelihood activities that support wildlife management and improve local livelihoods and food security are being supported. The main activities carried out under this result are the development of small-scale poultry production, the promotion of the Rupununi ranching system and the development of wildlife-based tourism as an economic alternative to the consumptive use of wildlife and as a strategy to increase the value of wildlife-friendly landscapes. Other initiatives such as the development of aquaculture and wildlife ranching will be explored.

R4: Consumption of wild meat is becoming sustainable. Based on the lack of available quantitative knowledge on the wild meat trade in Guyana, the Project will contribute to a monitoring system to assess, quantify and monitor the wild meat trade from the interior to the coast. It will also propose measures to mitigate negative impacts on those species that appear to be unsustainably traded. In addition, the Project will support the development of food safety methods to increase the quality of wild meat and reduce zoonotic risks.

Figure 1. Project brochure 'Wildlife use in Wapichan Wiizi'. The Project in Guyana promotes food security and livelihoods in accordance with traditional lifestyles. It focuses on strengthening national and local legal frameworks, supporting initiatives for sustainable use and management of fish and wildlife, improved production of alternative protein, and is underpinned by knowledge sharing and awareness building.



B. Site model and hypothesis

The Project in Guyana builds upon existing strategies, visions and development plans at the local and national levels. The Project will demonstrate the potential for sustainable use of wildlife resources to contribute to biodiversity conservation and preserve the rights of local communities in terms of their food security and livelihoods. New technologies, evidence-based science and the full recognition of local knowledge are important components of this project. This will ensure that innovative approaches can be used to guarantee sustainable wildlife management. The success of the Guyana model will lie in the strengthening of existing local governance structures that are legitimized by civil society. The local governance context in Guyana in general, and in the Rupununi in particular, allows advanced models for the devolution of rights and responsibilities for the use of wildlife to be tested, based on a human rights approach to conservation. FPIC will be mainstreamed through a series of protocols that help operationalize a human rights-based approach all along the implementation process. Based on a strong partnership between CIFOR, on behalf of the Project, and the GWCMC,

this project will be implemented as a regional pilot in the Rupununi to be scaled up nationally. The expanded mandate of the recently created Guyana Wildlife Conservation and Management Commission will enable the replication of models developed in the Rupununi in other regions of Guyana. In addition, the Project is designed so that lessons learnt in this project can be applied in other Caribbean and Amazonian countries, thus allowing the exchange of experiences through capacity building and information sharing within the Amazon and Caribbean regions.

C. Theory of change and assumptions

The Project in Guyana will contribute to:

- managing hunting and fishing in a sustainable manner for the benefit of future generations;
- ensuring that trade in wildlife is regulated for sustainability;
- ensuring that local efforts to conserve wildlife are supported at a national level by efficient institutions, policies and regulatory frameworks for the sustainable use of wildlife;
- improving income that communities obtain from wildlife-friendly activities, such as ecotourism;
- improving the production and availability of other healthy sources of meat and fish.

A theory of change (ToC) was developed during the inception phase in 2018 around the general objective of the Project. Some adjustments were made during the first years of implementation, following the results of feasibility studies, or based on opportunities and barriers encountered as the Project started to operate (Figure 2). For example, aquaculture was initially part of the ToC, but after the feasibility analysis, the Site Steering Committee decided not to prioritize this activity. Another example of adjustment refers to wildlife tourism. Initially, the role of tourism as an opportunity to diversify incomes while supporting wildlife was foreseen as a major activity of the Project. However, with COVID-19-related restrictions on travel, this activity was no longer prioritized, and expectations have been revised. The following are just some examples of how the ToC has been shaped based on an adaptive management process and decisions validated by the Site Steering Committee, which meets twice a year.

The ToC and assumptions described below represent the most recent common vision of the rationale behind the intervention in Guyana. The following assumptions guide the ToC developed for the Project:

- By strengthening local governance structures, we increase ownership, promote sustainable use of terrestrial wildlife, fish and turtles, and decrease risks from illegal activities.
- By promoting knowledge and pride in traditional practices and identity, we increase the likelihood that sustainable practices are maintained and transmitted to the next generation.
- By generating data and raising awareness about wildlife population trends, special biodiversity hotspots and impact assessment, we influence decision-making regarding the most influential external factors that affect wildlife, such as infrastructure development, unmanaged fires and mining expansion.
- By increasing the economic value of wildlife-friendly landscapes (through ecotourism, wildlife-friendly livestock production systems and mitigation of human–wildlife conflicts), we reduce the unsustainable use of wildlife and the threats from other more intensive or destructive land uses (mining, industrial agriculture).
- By increasing awareness on the risks of unsustainable use and supporting the implementation of local and national regulations on fishing, hunting and wild meat trade, we reduce unsustainable wildlife use.

Figure 2. Theory of change diagram for the Project. The ToC is subject to changes every year as part of the adaptive management process inherent to the Project.

Overarching ToC for Guyana with threats as identified at the workshop in Lethem, 27th November 2019

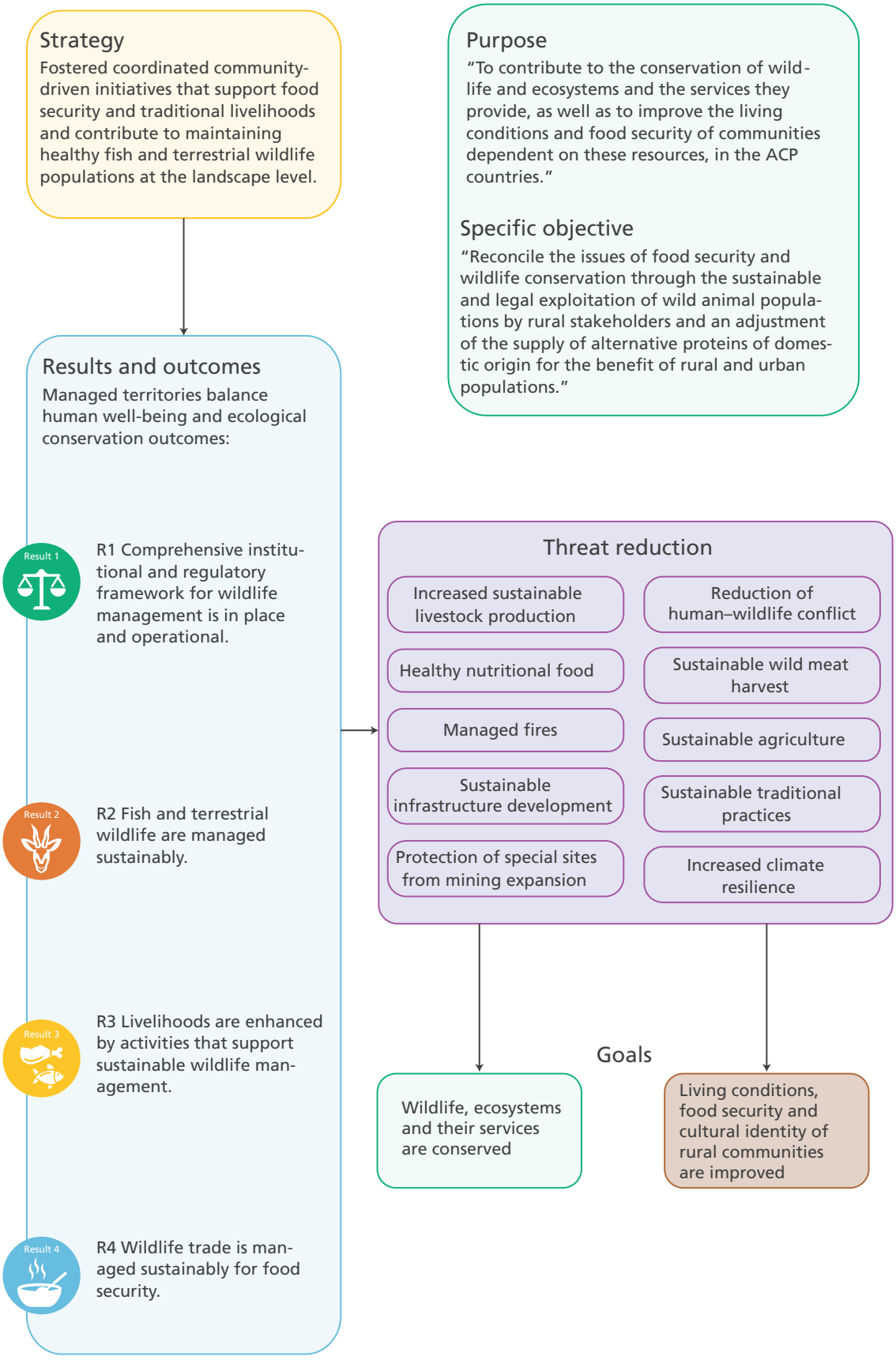


Figure 3. The FPIC process. A free, prior and informed consent process was held at the inception of the Project involving nearly all Indigenous villages and communities in the Rupununi, as well as other stakeholders. Of these, 41 signed an FPIC agreement, and the Project has Letters of Agreement for collaboration with community representative groups and local NGOs. (In photo from left to right; Oswin David/SWM Programme, Michelle Kenyon/CIFOR, Leroy Ignacio/SRCS) ©FAO/Tomás Méndez

D. Project approach towards local beneficiaries

D.1. Community rights-based approach

The SWM Programme community rights-based approach (CRBA) aims to: (i) promote the empowerment of people (rights holders) to claim and exercise their rights; (ii) strengthen the capacity of actors (duty bearers) who have a particular obligation or responsibility to respect, protect and fulfil these rights; and (iii) consider the human rights situation of target populations, particularly women and Indigenous Peoples, while implementing SWM Programme activities. The CRBA framework document developed by the SWM Programme provides a conceptual framework to ensure that any activities developed under the SWM Programme contribute to the progressive realization of human rights, as well as the empowerment of rights holders and particularly of marginalized groups.

The CRBA was subsequently adapted to the Guyana context to ensure that a CRBA is followed throughout the yearly work plans (SWM-Guyana 2020). In Guyana, the social safeguards developed follow a community rights-based approach, and emphasize FPIC, gender mainstreaming and the development of a grievance mechanism to address potential violation of human rights by the Project.

In the Project, rights holders are Indigenous villages (with titled lands) but, in most cases, they do not hold titles to the full extent of their customary lands. Their traditional hunting, harvesting, fishing and farming grounds are often beyond the limits of demarcation, causing legal restrictions to using those resources. Mining, logging and other extractive concessions, as well as leases for farmers, have been granted over customary lands without ensuring the FPIC of communities. Indigenous communities, which do not hold titles for their land and currently have land claims, are also rights holders. In addition, the Project considers non-Indigenous families that have insecure tenure of their farmlands and have land conflicts with Indigenous villages and communities, since leases are sometimes located in customary Indigenous lands. They depend on farming, fishing and hunting, and some also depend on tourism to ensure their livelihoods, and these activities are dependent on land tenure. Due to Indigenous claims on land demarcation, the government has not renewed private leases, thus creating an insecure tenure that affects their livelihoods.

D.2. Community engagement and involvement through FPIC

There is no standard protocol for the FPIC process in Guyana, although communities have a general understanding of FPIC as their fundamental right. The Project began the FPIC process during the inception phase (2017–2018) when several consultations were carried out during the design of the Project. Consultations with 55 of the 57 Indigenous villages and communities in the Rupununi were held in the region's five sub-districts. The project also organized a consultation workshop in Georgetown with governmental institutions, local and international NGOs, and the private sector (Figure 3). A FPIC road map was developed setting out steps for consultations with communities (Kenyon, 2019, 2020). Following the road map, the site manager and focal point for FPIC presented the Project at board-level meetings (the Kanuku Mountain Community Representative Group, KMCRG; North Rupununi District Development Board, NRDDB) and SRDC meetings during which village leaders and the Project team agreed on dates to begin community consultations. During Year 1 of the Project (August 2018–July 2019) the FPIC team visited 55 of the 57 communities in Region 9 (the Rupununi). Of the 55 communities visited, 39 signed an FPIC agreement with the Project in the first year, one additional community joined in Year 2, and another one joined in Year 3. Project updates by the FPIC focal point and site manager are given at every district meeting for all districts (SRDC, KMCRG, NRDDB). Village leaders, women representatives, youth, community monitors and working partners, including government representatives are present at these meetings. Partners and stakeholders also present ongoing activities, challenges and successes. Any new activities developed in FPIC signatory villages require prior meetings to ensure appropriate feedback and consent.

D.3. Grievance management

The overall SWM Programme is committed to ensuring that its activities are implemented in accordance with the Food and Agriculture Organization's (FAO) Environmental and Social Standards. To this end, the SWM Programme's grievance redress mechanism (GRM) was developed. This aims to facilitate the resolution of complaints regarding alleged or potential violations of environmental and/or social standards. It offers individuals and groups impacted by the Project an effective, timely, accessible and transparent process for expressing and resolving Project-related concerns and complaints. Further, it promotes trust between the SWM Programme and its stakeholders, and ensures adequate delivery of mutually agreed work plans.

A grievance redress mechanism specific to the Project was developed in which three levels are differentiated (Kenyon *et al.,* 2020):

- For first-level complaints, the site manager is the focal point in the Rupununi, and the country coordinator serves as the focal point at national level. First-level complaints may range from but are not limited to grievances emanating from site-level activities, staff, consultants or working partners of the Project. This includes communities and district councils. Complaints can be first reported verbally, via telephone or email, in writing (delivered to a PO Box), text messaging (including WhatsApp) or in person, but must be formally recorded and signed by the focal point in the grievance logbook within two to five calendar days of the initial report. During this time, confirmation of receipt of the complaint must also be given, together with a time frame and the main contact person for following up. A complaint emanating from a community member follows the established customary institutions and their mechanisms of conflict resolution for communities within Region 9, with the inclusion of the site manager. Nevertheless, community members have the option of directly reporting a complaint to the site manager without informing the village council. For national-level complaints, the country coordinator will include the site coordinator in reviewing and resolving. If a conflict of interest arises in which one of the focal points is involved, the other focal point or the Site Steering Committee will facilitate, as appropriate. If the complaint is not remedied at this first level, the complaint is elevated to the second level by the site coordinator.
- For second-level complaints, letters of appeal can be submitted directly to the SWM Programme Management Unit either by email or by post. Receipt of the complaint must be confirmed within 10 working days. The FAO Environmental and Social Management Unit will assist with the assessment and an action plan. In those cases where a complaint is not resolved at the Programme/Project management level, a third-level complaint can be filed.
- Third-level complaints can be submitted in writing to the FAO Office of the Inspector General. In exceptional and particularly serious cases, where handling and resolution of a complaint have not been possible/appropriate at the SWM Programme management level, an independent review of the complaints will be conducted by the Office of the Inspector General following FAO's *Guidelines on Compliance Reviews Following Complaints Related to the Organization's Environmental and Social Standards.* All complaints must indicate what steps the complainant has taken to try to resolve their complaints with the Programme/Project management, and the results of those attempts.

D.4. Gender

Gender guidelines were developed to provide basic information on what, why and how better to understand and integrate gender into sustainable wildlife management (SWM-Guyana 2019). The guidelines are divided into four steps: (1) understand and examine gender dimensions of the Project and setting; (2) adapt and develop project elements and activities; (3) adapt and develop project indicators for monitoring gender integration; and (4) develop broader institutional processes for further gender integration. In addition, the Project has partnered with Conservation International–Guyana (Lethem Office) the lead organization in developing the Plan of Action for Regional Development (PARD) to gather data on gender dynamics related to PARD priorities (where lack of gender consideration was highlighted as a major gap) at the sub-district level. The aim is also to tease out practical gender considerations/activities that could be incorporated into the PARD and the work of stakeholders working within the region, such as the Project. Thus far, the Project has employed a total of 107 women, or 36 percent of all hires. Of these, 15 are in management positions, 53 in technical positions, 16 are thematic experts and 59 have received technical training.

According to the Project data, women are involved in different ways along the wild meat trade chain:

- Approximately 25 percent of wild meat vendors on the coast are women.
- At the community level in the Rupununi, women decide on the meal in 78 percent of the households and wild meat is among the most consumed meats in 14 percent of the households.

After 2 years of implementation, the Project has built the capacity of 170 women, on topics ranging from tourism and business to fish and wildlife research and monitoring techniques.

D.5. Engagement with other local beneficiaries (duty bearers)

The Project was launched on 9 November 2018 after a continuous and comprehensive consultation process over 2 years (2017–2018) with governmental agencies, NGOS, community representatives and members across the region (Figure 4). The consultation process allowed the definition of objectives, activities and organizational set-up of the Project. In 2018, GWCMC was established as the government focal point for the Project. CIFOR, on behalf of the Project, and GWCMC signed a Letter of Agreement (LoA) and a Memorandum of Understanding (MoU) to jointly implement the Project and agreed that the approach would be to build upon existing community-driven initiatives that contribute to maintaining healthy fish and terrestrial wildlife populations at the landscape level. To this effect and to ensure full participation and partnership in the implementation of activities, several LoAs were signed with local partners and beneficiaries, including locally based NGOs (Visit Rupununi, VR; RLPA; the South Rupununi Conservation Society, SRCS) and local governance bodies representing Indigenous communities (NRDDB, SRDC/the South Central People's Development Association, SCPDA).

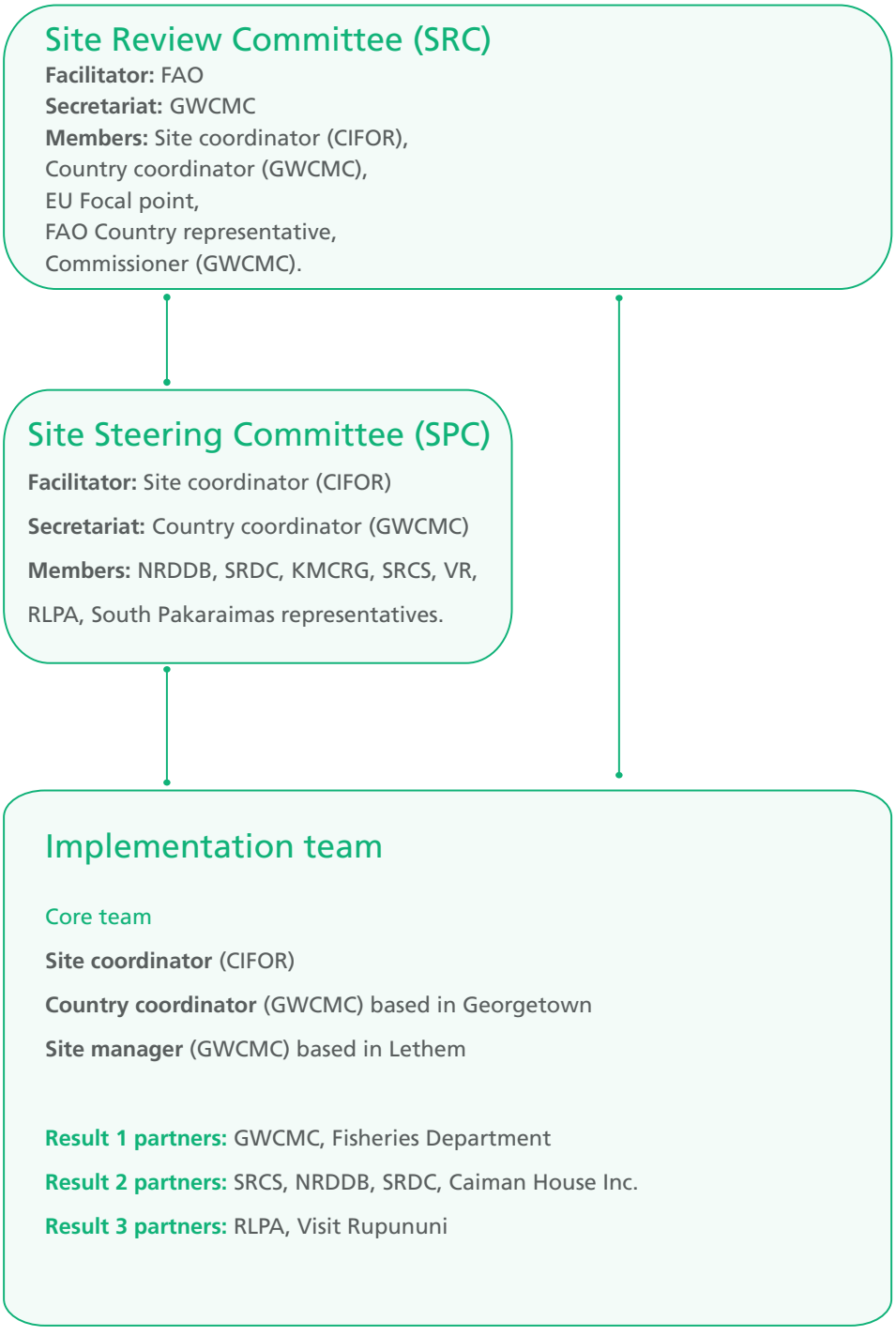
A **Site Steering Committee** was set up to meet twice a year in Lethem. Its mission is to ensure that Project objectives are followed, local partners (particularly local communities) are adequately involved in the implementation and decision-making processes, and the execution of activities follows the social safeguards established by the Project. The committee also

verifies the implementation timeframe, validates the annual work plans and budgets, reviews and validates project activities and, when appropriate, proposes strategic re-orientations of the Project according to the changing national and international context. The committee includes representatives of the Project Coordination Unit, the GWCMC, local NGOs (VR, SRCS, RLPA), two representatives for each of the Indigenous community boards at the district level (NRDDB, SRDC, KMCRG), a representative of the Ministry of Indigenous Peoples Affairs and a representative of the regional district council.

To ensure that project activities carried out at the local level are supported and implemented in accordance with national policies, the Project has also facilitated the signing of MoUs between beneficiary organizations and national government bodies; for example, RLPA and the Guyana Livestock Development Association (GLDA), VR and the Guyana Tourism Authority (GTA), and NRDDB and The Fisheries Department. An overview of the Project's structure with local partners is provided in Figure 5.

Figure 4. The Project launch with local stakeholders. The Project builds upon existing efforts, collaborating with a broad range of local partners. The Project was launched in November 2018 after 2 years of consultations with national and local interest groups. ©FAO/Tomás Méndez

Figure 5. Organigram for the Project.



©FAO/David Mansell-Moullin

Summary

Guyana is part of the highly biodiverse Guiana Shield in northern South America, where Caribbean and Amazon cultures meet. Fewer than 800 000 inhabitants live primarily along the coast, leaving the interior sparsely populated. This area contains large expanses of largely unmodified natural habitats. The Rupununi region, the largest administrative region in the south of the country, bordering Brazil, has a mix of seasonally flooded savannah and forests. Roughly 24 000 people from three Indigenous tribes (Makushi, Wapichan and Wai Wai) live in the region. These Indigenous groups' livelihoods are principally based on subsistence resource use. This non-cash income has been estimated to contribute around half of their total income. Food insecurity and gender inequality are major issues. The only town in the region is Lethem, which is connected to the capital Georgetown by a mainly unpaved road. Job opportunities are limited and largely based on retail, livestock and agriculture. If not employed in agriculture, many seek jobs elsewhere in the country or in neighbouring Brazil. The region's strategic location makes it a target for agricultural development. Land ownership is Indigenous titled lands, government land (some of which is leased to private ranches) or protected areas (Kanuku Mountains National Park, Iwokrama Reserve and the Kanashen Amerindian Protected Area).

III. PRESENTATION OF THE INTERVENTION SITE

Paemelaere Evi AD [1], van Vliet Nathalie [2]
[1] CIFOR, Colombia, pwsolutions.main@gmail.com
[2] CIFOR, Colombia, nathalievanvliet@yahoo.com

A. Geographic and political environment

Guyana is situated in northern South America, and forms part of the highly biodiverse Guiana Shield; it is one of the world's last great wild places containing some of the globe's oldest geological formations. A small nation, 215 000 km^2, Guyana is bordered by the Atlantic Ocean to the north, Brazil to the south and southwest, Venezuela to the west and Suriname to the east. The country gained independence in 1966 as a presidential representative democratic republic. Together with the National Assembly of Guyana, the president has legislative power, sharing his executive power with the government.

The country is divided into ten administrative regions, typically referred to by their number: (1) Barima-Waini, (2) Pomeroon-Supenaam, (3) Essequibo Islands-West Demerara, (4) Demerara-Mahaica, (5) Mahaica-Berbice, (6) East Berbice-Corentyne, (7) Cuyuni-Mazaruni, (8) Potaro-Siparuni, (9) Upper Takutu-Upper Essequibo, (10) Upper Demerara-Berbice. These subdivisions are under the jurisdiction of the regional democratic councils (RDCs). The largest region is Region 9, locally referred to as "the Rupununi" or "the Rupununi region", after its major river. In this report, the names "the Rupununi" or "Region 9" are used interchangeably, referring to the same administrative region (Figure 6).

The Project focus is the Rupununi (Figure 7). Located in the southwest of the country and bordering Brazil, the region covers 57 750 km^2. For administrative purposes, the Rupununi region is divided into five sub-districts comprising a total of 57 Indigenous communities. The communities have overarching representative groups that correspond with the geographic divide. This roughly corresponds with ethnic groups: NRDDB in the north (all Makushi) and the SRDC for the south (mostly Wapichan, some Makushi). The South Pakaraimas do not yet have an overarching governing body. Additionally, the region includes private homesteads and ranches, a large ranch owned by the Rupununi Development Company, as well as public lands.

The region is home to three national protected areas that are managed in close collaboration with Indigenous communities: the Kanuku Mountains Protected Area (KMPA), the Kanashen Amerindian Protected Area (KAPA) and the Iwokrama Forest. The Iwokrama Forest is a 3 710 km^2 forested area in the heart of Guyana that technically falls within Region 8, bordering Region 9, but can be considered part of the Rupununi due to its ecological association and close links to Region 9 communities. These communities also have traditional user rights to resources inside Iwokrama. Iwokrama was created to demonstrate the potential of the sustainable use of tropical forests. The area is half wildlife reserve, half multi-use area. It is managed by the Iwokrama International Centre for Rainforest Conservation and Development under the 1996 Iwokrama Act, rather than by the Protected Areas Commission (PAC) under the 2011 Protected Areas Act. The Kanuku Mountains Protected Area is a forested mountain range of 6 110 km^2 that divides the Rupununi savannahs into two: a northern and a southern part. These mountains have

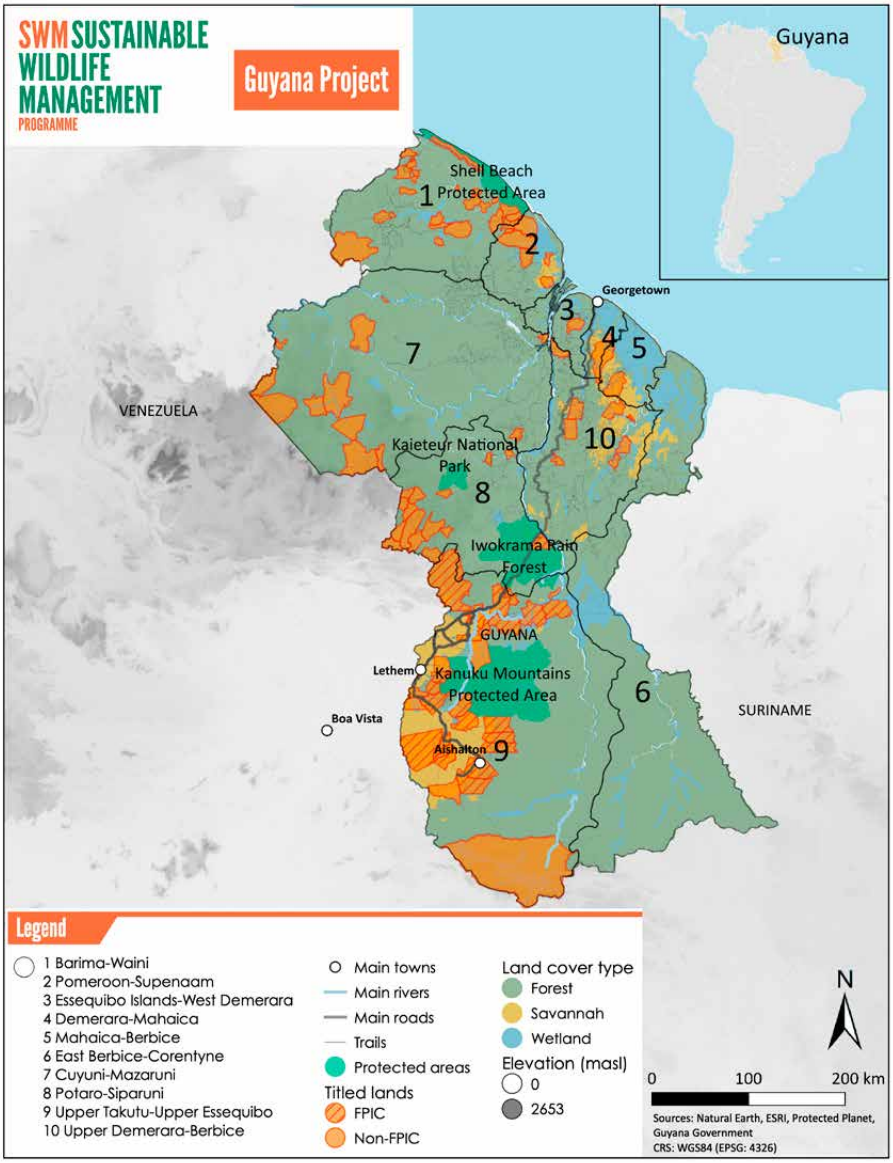


Figure 6. Map of Guyana. Guyana consists of ten administrative regions that are often referred to by their number. Region 9: Upper-Essequibo-Upper-Takutu in the south, bordering Brazil is the largest. It is usually referred to as 'the Rupununi', after the river with the same name in this region. The region consists of seasonally flooded savannah and forests with mountains in the north, centre and south, and is home to Indigenous Peoples of three different tribes (Makushi, Wapichan and Wai Wai) who inhabit the area. The region is connected to the coastal capital Georgetown through the main road, of which the majority is still unpaved. The protected area of Iwokrama borders the region to the north, but due to its intricate relationship with the Makushi, it is often considered part of the Rupununi.

traditionally been used by the 21 surrounding villages for farming, hunting and fishing, and include sacred sites. Representatives from surrounding villages form a committee, the KMCRG. After designation as a protected area, a management plan was developed by PAC together with the KMCRG. The plan identified priorities for research and actions (PAC, 2019). The area remains a multi-use zone, an International Union for Conservation of Nature (IUCN) category VI protected area, where Indigenous Peoples maintain the right to harvest resources for subsistence use. KAPA is managed by the village council and collaborates with PAC on management issues.

KAPA covers 6 485.67 km^2 of forest in the deep south of Rupununi, bordering Brazil. The area is a titled land inhabited by the Wai Wai tribe. In 2017, the site was officially integrated into the national protected areas system (The Guyana Chronicle, 2018; Stabroek News, 2017). Existing communities already had well-established fishing seasons and subsistence practices (hook and line) (Alonso *et al.*, 2008). Wai Wai are more accepting of no-take zones than of quotas (Shaffer *et al.*, 2017b). The Wai Wai manage the site, to protect their culture and traditional lifestyle, but with support of the PAC.

Figure 7. Map of the intervention site and distribution of activities.

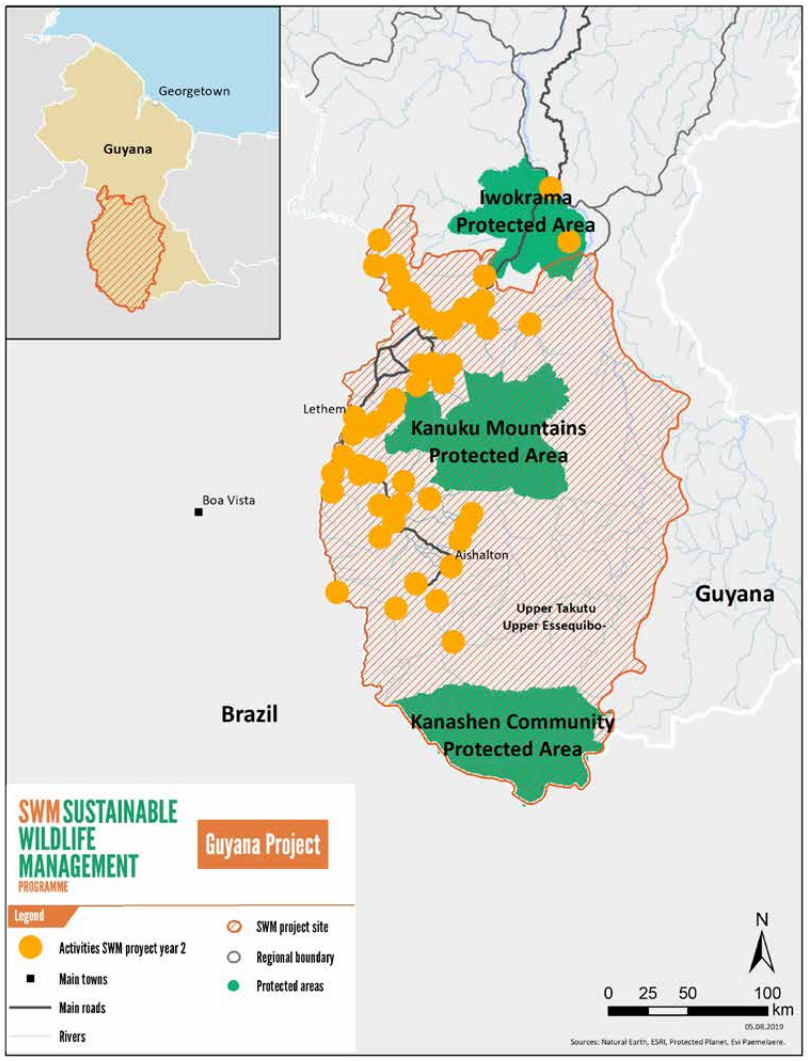


Figure 8. River crossing on the main road to enter the Project intervention site. The mostly unpaved road from Georgetown to Lethem has a pontoon crossing over the Essequibo River that gives access to the 70 km long road through Iwokrama Forest before reaching the Rupununi all the way to Lethem. There are plans to build a bridge over this river, increasing connectivity between the Rupununi and the rest of Guyana. ©FAO/Evi Paemelaere

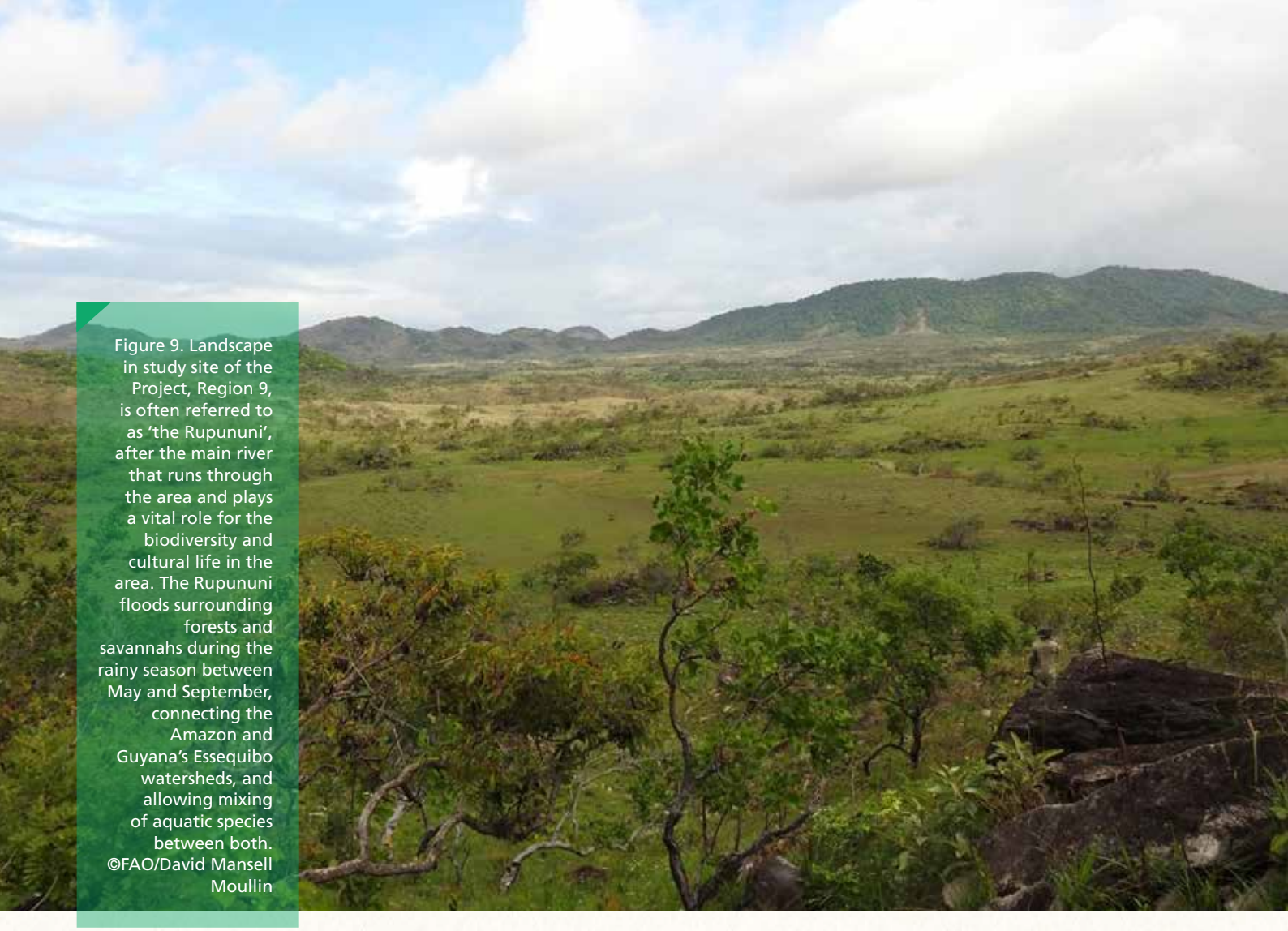


Figure 9. Landscape in study site of the Project, Region 9, is often referred to as 'the Rupununi', after the main river that runs through the area and plays a vital role for the biodiversity and cultural life in the area. The Rupununi floods surrounding forests and savannahs during the rainy season between May and September, connecting the Amazon and Guyana's Essequibo watersheds, and allowing mixing of aquatic species between both. ©FAO/David Mansell Moullin

B. Biophysical environment

Guyana's forests and savannah lie among its mountains and valleys. These range in elevation from 0 to 2 835 m above sea level (EPA, 2010). The four major natural regions are: the coastal zone, containing mangroves, coastal swamp forest, seasonally flooded palm marsh and swamp forest, and forests of the former coastal plain; the white-sand plateau; forests on white sands, uplands and the Southern Peneplain; and savannah. As a result of low population density and effective traditional management by the country's Indigenous Peoples, Guyana maintains ~80 percent natural forest cover. Guyana is rich in biodiversity because it straddles the Caribbean and Amazon regions in the centre of the Guiana Shield. As a result, biodiversity and endemism are high in the country. Within Guyana alone, as many as 814 birds (Braun *et al.*, 2007; Hollowell and Reynolds, 2005), over 225 species of mammals (Amacuro and Guiana, 2008; Hollowell and Reynolds, 2005), over 500 species of freshwater fish and 324 species of reptiles and amphibians (Cole *et al.*, 2013) have been recorded. The country has five protected areas: Kaieteur National Park (1929), the Iwokrama International Centre for Rainforest Conservation and Development (1996), Shell Beach Protected Area (2011), the KMPA (2011) and the KAPA (2017).

Region 9 where the Project is implemented, is referred to as "the Rupununi", after the river that runs through the entire region from the deep south, connecting to the Essequibo to the north of this region (Figures 8, 9). The Rupununi consists mostly of large tracts of primary forest, and about 20 percent savannah that includes seasonally flooded wetland (Figure 10). Forests

diversify into mixed forest, swamp forest, mountain forest and wallaba/dakama/muri shrub (Conservation International Guyana and IDB, 2015). Regional temperatures vary between 22.5 and 33.6 °C. Annual rainfall ranges from 1 600 to 1 900 mm, with a marked rainy season from April to September, and a shorter rainy season in December and January (locally known as the "cashew" or "turtle" rains). Elevation varies from less than 100 m to >1 000 m above sea level.

Due to the diversity of habitats, low density human populations, and long history of conservation and traditional management, the Rupununi is the best conserved region of the country. As many as 643 bird species, 2 800 plant species, 120 species of reptiles and amphibians, 400 species of fish, >150 mammal species, and innumerable species of invertebrates have been recorded in Region 9 (Watkins, Oxford and Bish, 2010). The Rupununi is also often referred to as the "Land of Giants" in supporting arguably still healthy populations of large-bodied neotropical species such as the jaguar (*Panthera onca*), lowland tapir (*Tapirus terrestris*), giant anteater (*Myrmecophaga tridactyla*), giant armadillo (*Priodontes maximus*), giant otter (*Pteronura brasiliensis*), capybara (*Hydrochoerus hydrochaeris*), jabiru (*Jabiru mycteria*), harpy eagle (*Harpia harpyja*), green anaconda (*Eunectes murinus*), black caiman (*Melanosuchus niger*), giant river turtle (*Podocnemis expansa*), gladiator tree frog (*Hypsiboas rosenbergi*), arapaima (*Arapaima gigas*), lau lau catfish (*Brachyplatystoma filamentosum*), and the giant water lily (*Victoria amazonica*). The South Central Rupununi was declared an Important Bird Area (IBA) in 2019. The North Rupununi – the savannahs to the north of the Kanuku Mountains – has been considered for inclusion as an Important Bird Area, and for protection as a Ramsar wetland. This relatively small area provides a key habitat for migratory birds and is an important breeding ground for one of the world's most diverse assemblages of freshwater fish. Importantly, during the rainy season, the Amazon and Essequibo watersheds meet in the North Rupununi, permitting fish migrations and crossover between the two river basins. Currently, only the forested Kanuku Mountains and Wai Wai territory are protected, but discussions are underway on protecting the North Rupununi Wetlands.

Figure 10. Rivers in the study site of the Project. The Rupununi (Region 9) in the southwest of Guyana has a matrix of open savannah, tree savannah, forest, and mountains, with seasonally flooded wetlands. It is home to a human population density of only 0.4 inhabitants/km². This vast natural landscape harbours a highly diverse fauna. ©FAO/David Mansell-Moullin

In recent years, there have been signs of climate change affecting the region with extreme droughts and flooding that do not correspond to the typical, historical weather patterns. Such changes affect wildlife, particularly fish populations that depend on annual migratory movements for their migration and reproduction between the Essequibo watershed in Guyana and the Amazon watershed. Moreover, these extreme weather patterns severely affect accessibility to wild protein by the communities and impact crops, therefore decreasing food security.

C. Human environment

C.1. Demography and cultural background

Guyana has fewer than 800 000 inhabitants, most of whom live along the coast in and around the capital, Georgetown. Guyana's population density in the hinterland is very low (Guyana Bureau of Statistics, 2016a). The country's overall population size has remained fairly stable in the last few decades (Guyana Bureau of Statistics, 2016a). Along the coast, East Indian and Afro-Guyanese ethnic groups dominate, while the interior is largely inhabited by several Indigenous groups: Arawak, Warrau, Carib (Makushi, Patamona, Arrecuna, Akawaio, Wai Wai) and Wapichan. Although each ethnic group retains its own language, nowadays most people speak English as a second language; English is the official language of the country. Other ethnicities in Guyana include small numbers of Portuguese and Caucasian descendants, Asian (mostly Chinese) and people of mixed descent, spread throughout the country. With such ethnic diversity, the mix of cultures influences Guyanese customs and traditions. Along the coast, Christianity, Hinduism

Figure 11. Indigenous Peoples at the Project intervention site. Indigenous Peoples of three different tribes – Wai Wai, Wapichan and Makushi – mostly inhabit the Rupununi. Many live on titled lands where Indigenous rights apply. The culture represents a mix of traditional practices and more recent cultural influences. Subsistence resource use is still very much part of daily life and represents an equal portion of income to cash. ©FAO/Barbara Fraser

and Islam dominate. Indigenous groups in the interior have mostly converted to some form of Christianity, while maintaining traditional belief systems to some degree.

The Rupununi has approximately 24 000 inhabitants (3.2 percent Guyanese), or an average of 0.4 persons/km^2 (Guyana Bureau of Statistics, 2016b), the lowest density in Guyana (Guyana Bureau of Statistics, 2014). A large portion of the region, however, remains uninhabited, as most people live in the savannah or at the savannah–forest edge, an area of roughly 6 500 km^2. At the same time, the human population in Region 9 doubled between 1980 and 2012 (Guyana Bureau of Statistics, 2016a, 2016c). At a rate of 2.5 percent per annum, the region has the highest recorded growth rate in Guyana (Guyana Bureau of Statistics, 2014). More than 50 percent of the population is under 20 years of age (Guyana Bureau of Statistics, 2016b), suggesting that the population increase is associated with births, not migration. Indeed, households are the largest in the country, with an average of around five individuals (Guyana Bureau of Statistics, 2014). Most inhabitants belong to one of three Indigenous groups (Guyana Bureau of Statistics, 2016c): Wai Wai in the forested deep south, Wapichan in the south savannahs, and Makushi in the north savannahs, of whom most live on titled lands. Much of the region falls under these Indigenous titles, with approximately 57 Indigenous villages (titled) and non-titled communities (Figures 11 and 12).

Aside from the Indigenous population, the region has several large ranches that were established by European settlers over a century ago. These ranches maintained between a few hundred to several thousand head of cattle within an extensive free grazing system, employing Indigenous *vaqueros* (cowboys). Some of the current villages started as ranch outstations. Although cattle herd sizes have declined considerably, these family-owned ranches remain a

Figure 12. Way of life. The mostly Indigenous population of the Rupununi lives at low population densities in houses mostly built using natural materials. ©FAO/Evi Paemelaere

traditional part of Rupununi culture and society. More recently, a small number of new ranches have been established, particularly along the Georgetown–Lethem Road. These new farms are geared towards high crop yields and intensive livestock production, rather than the traditional extensive cattle rearing system. Additionally, the region includes some public land. The town of Lethem, located on the border with Brazil, is the only non-Indigenous urban settlement with an estimated 2 000 inhabitants (Luzar and Fragoso, 2013). It has had a mayor since 2015.

C.2. Local livelihoods

The total economic contribution made by the Indigenous population in Region 9 constitutes roughly 4 percent of the nation's total monetary income. The majority (71 percent) of the Rupununi inhabitants earn an annual income equivalent to less than USD 3 110. Households that generate less than USD 2 a day, which is roughly 60 percent of the population, are engaged in traditional activities such as hunting, fishing and gathering as well as cassava cultivation for their own consumption. Non-cash income is about equal to cash income, both adding to an average of about USD 6 000 per household per annum, about three times the Guyanese minimum wage.

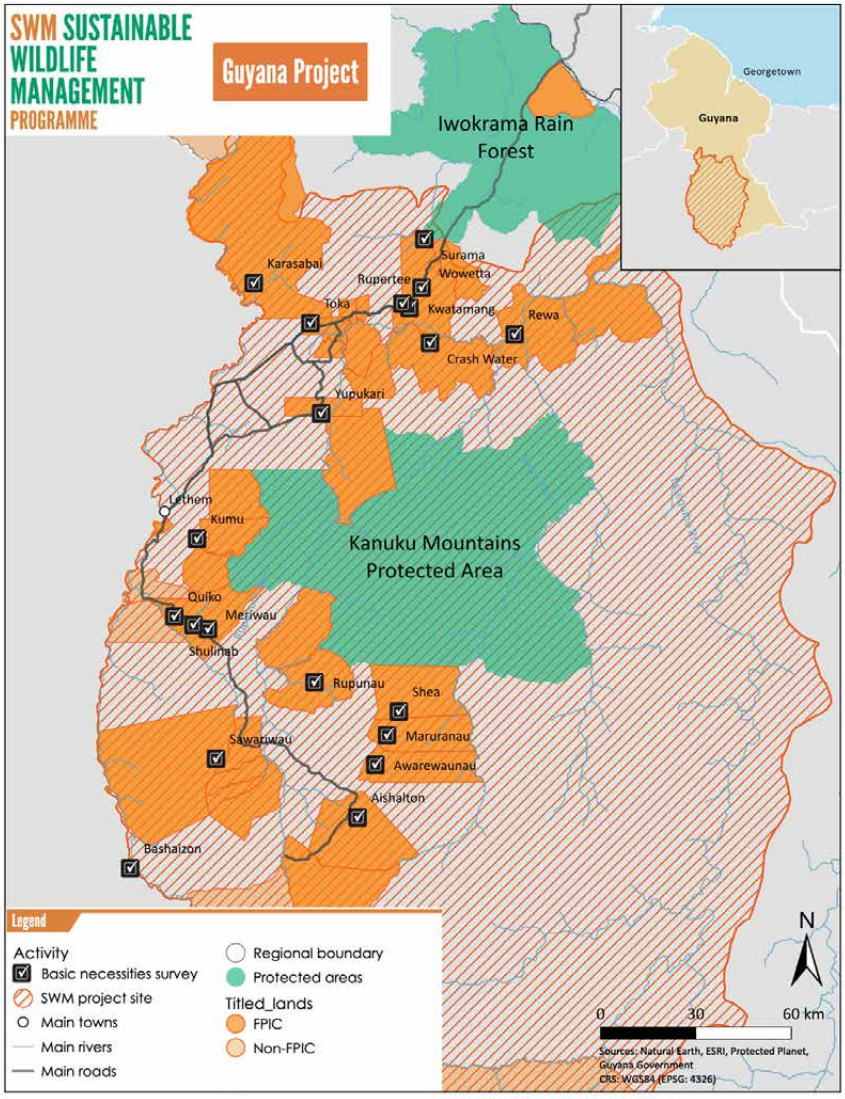
Many Indigenous villagers have mixed livelihoods that include subsistence and cash-earning activities, but levels of market dependence vary within and among communities (Conservation International Guyana, 2015). Mixed farming involves the cultivation of crops such as cassava, peanuts, bananas, and a variety of other fruits and vegetables. Selling of fish and wildlife for meat or the live animal trade also contribute supplementary income to many subsistence resource users. Paid labour (teachers, health workers and other governmental positions) generates most income (33 percent) followed by logging (18 percent), agroprocessing and crops (11 percent). Other forms of income generating activities include employment in cattle ranches, tourism, small-scale mining and production of non-timber forest products and crafts. Work is largely gender partitioned, with men generating most of the cash income (mostly linked to the harvest of wildlife and small-scale agricultural plots in forest land) and women involved in agroprocessing. An increasing number of households also own village shops or offer transport services.

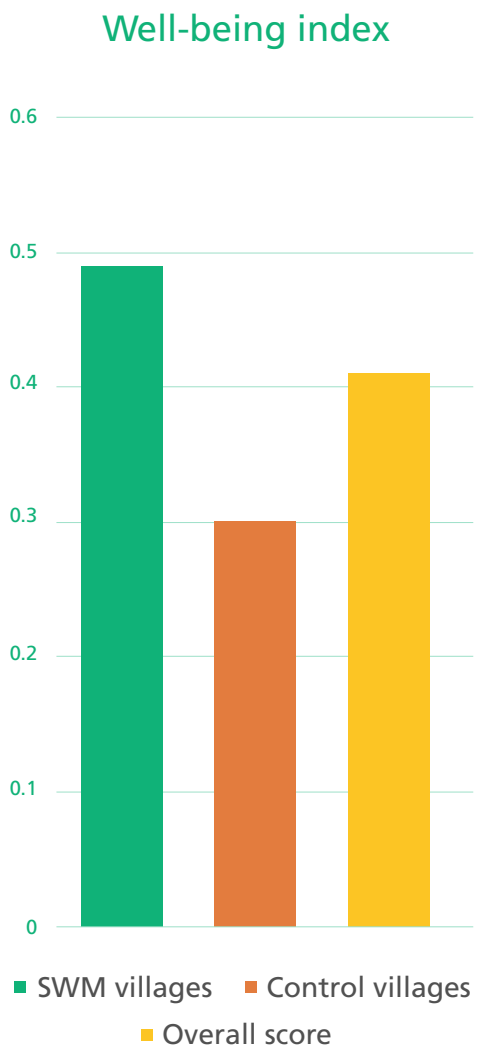
That a significant source of income is labour outside the community points to the increase of outmigration from communities, as villagers, especially the youth, move in search of jobs and income elsewhere (Conservation International Guyana, 2015). Many people, especially young men, are forced to leave home for months to work in logging or mining areas in other regions, or to travel to Brazil to work in construction, large-scale agriculture or ranches. The lack of qualified employment opportunities at a local level also creates a motive for adolescents to drop out of school and to seek menial jobs, mainly in logging and mining, outside their villages.

Region 9 has the highest percentage of the population within the poorest quintile (93 percent) of Guyana's wealth index (Guyana Bureau of Statistics, Ministry of Public Health and UNICEF, 2015). Nevertheless, the report on the State of Food and Agriculture in the Rupununi states that most residents enjoy a high quality of life, disagreeing with their status of being among the poorest Guyanese (Conservation International Guyana and IDB, 2015).

The Project's Basic Necessity Survey applied to 1 207 households throughout the Rupununi found a well-being index of 0.41 (Figure 13). Comparing villages that have chosen to be part of the Project (sample size 11) to control sites (sample size 8), the overall well-being index was higher

Figure 13. Participating Indigenous villages. The Project in Guyana conducted a basic necessity survey throughout the Rupununi with 1 207 households both from villages where the Project is conducting activities and from villages that had decided not to participate. Results showed a slightly higher well-being index for those that are part of the Project.





for project villages. A leading characteristic of the five villages with a well-being index above 50 percent is the continuous and constant work from organizations working in the South Rupununi. Those villages are usually chosen for developmental work, as they are versed in conservation work, accepting of projects (easy to work with) and are involved with the SRDC. Shulinab is the secretariat of SRDC, while Aishalton has an SRDC office with many employees. All five villages are also considered large villages: one has a secondary school and hospital (Aishalton). Shulinab has easier access to Lethem (main town) compared with other villages since it is located on the main highway to Lethem. Other factors that may be of influence, such as gender of heads of households, location of villages and diversity of livelihoods, are yet to be analysed.

Figure 14. Lethem. This is the only town in the Rupununi, situated at the border with Brazil (formed by the Takutu River to the right). Lethem is connected to Guyana's capital through a more than 500 km long, mostly unpaved road. Upgrades to the road are proposed due to the strategic connection between Georgetown and Brazil with urban centres Boa Vista and Manaus. The town is rapidly expanding and attracting Brazilian and Chinese vendors to its shopping area (large, coloured buildings in centre). Commerce is now closely linked to Brazil, and less dependent upon arrival of goods from Georgetown, as was the case before the bridge over the Takutu River was completed in 2010. ©FAO/Matthew Hallett

C.3. Main economic sectors

The Rupununi has seen several boom-and-bust industries over its history, with the natural rubber and cattle industries both having heydays that have long passed. The region is particularly known for its extensive cattle ranches, which formed the centre of socio-economic activity for about a century, until a brief revolution ("the uprising") in the late 1960s and an outbreak of foot-and-mouth disease in the 1970s. Ranch lands are managed as long-term leases, rather than as permanent ownership. In the South Rupununi, a gold mine managed by the Romanex Guyana Exploration Ltd. at Marudi Mountain attracts mining workers from across the region, but also from elsewhere in Guyana and even from neighbouring countries. The Rupununi has been off-limits to the riverine mining practices that are common elsewhere in Guyana to protect the headwaters of major rivers through a 1996 decree by then President Dr Cheddi Jagan. More recently, large-scale agriculture focused on rice (and soy) has been introduced to the region on private lands allocated by the central government. In the North Rupununi, several communities also engage in logging, which in Guyana follows strict low impact guidelines. Furthermore, Iwokrama, the protected management area bordering the region, has its own logging operation.

Lethem, seen as the "gateway to Brazil", is developing rapidly (Figure 14). Due to its strategic location, it is a growing trade centre for the region, for both Guyana and Brazil. In the last decade, a rapid increase has been seen in the number of investors opening shops, particularly Brazilian and Chinese vendors. They sell anything from furniture and toys to hardware and food items.

C.4. Food security

Despite the seemingly high availability of wild meat, fish and multiple domestic protein sources, food insecurity has been reported, with both adults and children cutting meals (Conservation International Guyana, 2015). Around 70 percent of households have concerns over food sufficiency (Conservation International Guyana, 2015). Of these, a quarter have this worry weekly, and slightly more are concerned about food supply in some months, with the other half indicating that they experience this occasionally. Skipping meals or reducing meal size occurs among adults in more than half of the households, although most (53.6 percent) only do so occasionally. Still, nearly 15 percent experience this weekly. In similar proportions, meals of children are also reduced in size or frequency. Combined with dietary changes, there is also a shift to eating processed foods containing high sugar and refined carbohydrates. As a result, people's health in Region 9 may be compromised as they move further away from traditional lifestyles and accessibility to natural resources declines (Conservation International Guyana and IDB, 2015).

The 2014 Multiple Indicator Cluster Survey highlighted significant cause for worry (Guyana Bureau of Statistics, Ministry of Public Health and UNICEF, 2015). across most nutritional indicators. In particular, Indigenous children under 5 years old are worse off than the national average (Table 1).

Table 1. Nutritional status of children in Guyana 0–5 years old (Guyana Bureau of Statistics, Ministry of Public Health and UNICEF, 2015)

	Underweight (moderate to severe)	Stunted (moderate to severe)	Wasted (moderate to severe)	Overweight
Indigenous	12.9%	33.0%	5.6%	4.7%
Country average	10.7%	15.4%	8.1%	5.3%

According to the *Situational Analysis of Indigenous Women and Children in Guyana*, Indigenous children suffer from poor nutrition linked to deprived socio-economic and environmental conditions (UNICEF, 2017). Aside from limited energy and nutrient intake, poor sanitary conditions may also contribute to being underweight and stunted growth in children. Furthermore, low birth weight (less than 2.5 kg) has been recorded for 16 percent of Indigenous children in Guyana. This may also be associated with anaemia in mothers, as about a third of women of reproductive age were diagnosed as being anaemic. Dietary variation is also an issue, with 54 percent of children under the age of 2 years old consuming only four of the seven food groups. The trend of importing food into the hinterland, and a corresponding rise in the cost of food, is contributing to food consumption patterns in the general population (UNICEF, 2017).

Despite these data, research with focus groups in six villages indicated that people in the Rupununi generally feel that enough food is available, as long as there are no strong climatic impacts, such as floods or droughts (Conservation International Guyana and IDB, 2015). Participants considered that their natural resource-based livelihoods help ensure food security through farming, fishing, hunting and gathering in their large natural surroundings. Most grow their own food (86 percent of households in that study), and of these, half consume food they have grown weekly. The study also indicated that community still plays an important role in food

security; support from family and friends is important for more than half of the households and 15 percent depended on these gifts every week. About a third of those households still engage in barter, although not frequently. Purchase of food is very common (88.3 percent purchase food weekly). A very small percentage (4 percent) occasionally receives official food aid, mostly households in South Central (55 percent) and Central Rupununi (18 percent).

C.5. Gender equality in the Rupununi

The sex ratio of the Rupununi population is almost 1:1. Marriage before 18 years of age is 17.1 percent higher in the Rupununi than in the rest of Guyana. Specifically, 41.3 percent of girls are married before the age of 18 and 6.1 percent by age 15 (International Labour Organization, 2018). This affects educational achievements (Guyana Bureau of Statistics, Ministry of Public Health and UNICEF, 2015). More than one-fifth of girls give birth by age 19, leading to pregnancy-related death and malnutrition of the child (UNICEF, 2017).

Violence against women and girls in the region is common, with half of the cases of violence reported in 2017 relating to rape. Much more so than women from other regions, more than a quarter of Rupununi women feel that sometimes a man hitting his wife is justified, and nearly a third of men feel the same (Guyana Bureau of Statistics, Ministry of Public Health and UNICEF, 2015). Both adolescent pregnancies and violence against women are closely associated with alcohol abuse, and the use of corporal punishment has also been linked to this (UNICEF, 2017). The topic remains mostly taboo, rendering evaluations and solutions difficult.

Women are a minority in decision-making processes. Leadership positions in villages and beyond are mostly held by men. Among Toshaos (village leaders) in the Rupununi, only 8.8 percent are women, while at the regional council level, 33 percent of members are women (Regional Democratic Council Region 9, 2019). Even at the household level, income and expenditure are typically controlled by men; in only a quarter of the households do women oversee finances (Conservation International Guyana, 2015).

Nevertheless, women perform well in formal education. Most women between 15 and 25 years old can read and write (98.6 percent). Women also play an important role in the local economy, with 47.4 percent of businesses registered with the Rupununi Chambers of Commerce and Industry owned by women (Regional Democratic Council Region 9, 2019).

Although women's empowerment within the region seems low, the PARD has laid out key actions to be taken within the region to enhance women's empowerment and gender equality (Regional Democratic Council Region 9, 2019). Three main themes are: equal inclusion of men and women in development; eradication of violence and discrimination against women and girls; and equal social and economic opportunities for women. Furthermore, in January 2020, SCPDA and NRDDB organized the first ever Rupununi Indigenous Women's Conference, inspiring the SRDC to develop its own gender policy (IUCN, 2020). This has resulted in increasing participation of women in the decision-making process in the South Rupununi as this has allowed women to have more opportunities to amplify their voices.

©FAO/David Mansell-Moullin

©Brent Stirton/Getty Images for FAO, CIRAD, CIFOR and WCS

Summary

The analysis of current regulations from a statutory law perspective has highlighted several opportunities to increase their clarity in terms of the competences of the different institutions in charge of wildlife management, fisheries, agriculture, lands, Indigenous Peoples' rights and food safety. Furthermore, it points to the need for further clarification of current gaps in the regulations especially in relation to the subsistence rights of Indigenous communities and the absence of regulations for inland fisheries. In addition, the Project can contribute to the incorporation of local knowledge and customary rules into statutory law to overcome current gaps. An evaluation of the current knowledge of the recently developed wildlife regulations showed that much effort for awareness raising is still required. This process could also allow for better participation of Indigenous Peoples and wildlife users to develop or refine current regulations.

IV. INSTITUTIONAL AND NORMATIVE FRAMEWORK

Juanita Gómez González[1], Alona Sankar[2], Andy Mahadeo[3], Evi AD Paemelaere[4], Nathalie van Vliet[5]
[1] Stockholm Environment Institute, Bogotá, Colombia, juanita.gomez@sei.org
[2] Guyana Wildlife Management and Conservation Commission, Georgetown, Guyana, andy.mahadeo@live.com
[3] Guyana Wildlife Management and Conservation Commission, Georgetown, Guyana, alonasankar2@gmail.com
[4] CIFOR, Colombia, pwsolutions.main@gmail.com
[5] CIFOR, Colombia, nathalievanvliet@yahoo.com

Materials and methods

The information presented in this chapter is the result of a desktop review of the legislation and legal texts listed in Annex 1. The methodology is built on a comprehensive framework structured into three different sections to collect and analyse all existing rules and regulations, both statutory and customary. Customary rules were compiled both from existing literature and from interviews with local experts and leaders.

The Project assessed current knowledge of wildlife legislation and the institutions in charge of wildlife. Because the wildlife regulations were only introduced in 2018, the results partly reflect the reach of awareness efforts by GWCMC. A survey was conducted through telephone interviews, face-to-face interviews, and online–offline submissions through the Kobo toolbox website from September to December 2020. A total of 245 interviewees represented various government departments, NGOs and the public. Respondents were between the ages of 18 and 50 and lived mostly in the greater Georgetown area (Region 4) and Lethem, as well as in nearby Indigenous villages in the Rupununi (Region 9). A small percentage lived in other villages in Region 9 and a few in other regions of the country.

A. Historical and political background

Guyana is a semi-presidential parliamentary republic. It achieved full independence from Great Britain in 1966 and became part of the Commonwealth in 1970. The executive power is exercised by the president, while legislative power is vested in the president and the National Assembly. The judiciary is independent (Guyana Election Centre, 2021). Guyana's legal system is based on British common law with some influences from the Dutch legal system inherited from colonial times. The influence of the civil law system is particularly strong on land tenure issues (Glenn, 2008). Currently, several acts passed during colonial times are still in force through subsequent amendments. The Constitution of Guyana signed in 1980, is the supreme law of the country (art. 3). Regarding international law, the country has a dualist system, requiring the enactment of domestic legislation to incorporate international treaties (Pegus, 2007).

According to Guyana's Constitution, the country's ten regions are governed by RDCs, which are the supreme government organs in each region (arts. 71, 73). These councils are responsible for managing and administrating the region and coordinating activities with other local democratic organs (Ministry of Local Government and Regional Development, 2021). Within regions, there are three types of local government organs: municipal councils, neighbourhood democratic councils, and Amerindian village councils. Guyana has six municipalities and 65 neighbourhood

democratic councils. These operate under the Ministry of Local Government and Regional Development and are governed by the Municipal and District Councils Act of 1969 and the Local Democratic Organs Act of 1998 (Ministry of Local Government and Regional Development, 2021).

The Guyana Lands and Surveys Commission Act of 2001 establishes the function of the Lands and Surveys Commission for the preparation of land use plans and land tenure. It has the power to concede grants, leases and permits over State lands. The Town and Country Planning Act of 1948 regulates the preparation and adoption of land schemes to control the development of lands. The Central Housing Planning Authority is designated by the Act as the national competent authority for such matters, while local councils exercise those functions at local levels.

There are 75 Amerindian village councils, which are governed by the Amerindian Act of 2006 and managed by the Ministry of Amerindian (Indigenous People's) Affairs (CLGF, undated). Among its functions, the council manages the sustainable use of village lands and their resources, and develops rules governing these. The village council also manages and regulates the occupation of village lands. The powers provided by the Amerindian Act in relation to land management are exclusive to village councils within their Village Lands (titled lands). Each community has a leader and a spokesperson, known as Toshao, who makes decisions about the use of resources through consultation processes and in compliance with customary laws (South Central and South Rupununi Districts Toshaos Councils, 2012). The Amerindian Act recognizes such functions within village titled lands, while customary law includes all the customary territory, which is much larger than the current titled areas. All the communities that are part of the Project have claimed land extension, as the total extent of customary lands are not included in the land titles. In this sense, there is a conflict with statutory law.

A group of villages might form a district with its own representation. In the Rupununi, the SRDC and NRDDB were created to reinforce traditional jurisdiction over shared farming, hunting, fishing and gathering lands. All the communities within the Project are also part of SCPDA. The aim of this latter organization is to secure and sustainably manage the Wapichan traditional lands and to improve the communities' livelihood. The South Central Rupununi District Council and the SCPDA supported the development of the Wapichan management plan "Thinking together for those coming behind us" (South Central and South Rupununi Districts Toshaos Councils, 2012).

Prior to 2016, the Environmental Protection Agency (EPA) was responsible for national-level wildlife management. The main regulations for the management and use of wildlife resources were established in the Wildlife Management and Conservation Regulations of 2013, which were issued under the Environmental Protection Act of 1996. The Wildlife Division, on the other hand, managed the wildlife trade. Both agencies fell under the Ministry of Natural Resources. Since 2016, wildlife management no longer fell under the mandate of the EPA, but under the newly created GWCMC from the former Wildlife Division. In 2016, EPA and the renamed GWCMC were incorporated under the newly formed Ministry of the Presidency within the Department of Environment, separate from the Ministry of Natural Resources, which continued to oversee only the extractive industries (oil, gold, mining and forestry). The then president decided that matters of biodiversity protection and management of extractive resources were best separated. Although after the 2020 elections, the Department of Environment was combined with other departments, wildlife management still falls under the same ministry.

B. Normative systems governing sustainable wildlife management (terrestrial wildlife and freshwater fish)

The GWCMC was created through the 2016 Act 14 (The Wildlife Conservation and Management Act) to ensure compliance with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Before the establishment of the GWCMC, the Management Authority operated under the administrative authority of the Ministry of Agriculture. A separate Scientific Authority operated within the Ministry of Agriculture. At that moment, only the trade of wild birds was regulated by legislation. CITES expressed several concerns about the implementation of the convention by Guyana before the enactment of the Wild Life Act (2006). This Act was the first regulation that implemented CITES in the country. Before that, Guyana was not complying with the obligations under the convention.

Under the 2016 Wildlife Conservation and Management Act, the GWCMC was designated as the CITES Management Authority. Among its functions the Act establishes the granting, amending and cancelling of licences, permits and certificates related to wildlife. The Commission is also responsible for implementing policies and procedures for the protection, conservation, management and sustainable use of wildlife, among other related functions. Moreover, the Act created the Wildlife Scientific Committee and designated it as the CITES Scientific Authority. The Scientific Authority's function is to advise the Management Authority on issues related to wildlife. The Act of 2016 only became operational on 1 June 2017; thus provisions were only recently implemented. The Wildlife Conservation, Management and Sustainable Use Regulations were issued in 2018 under the Wildlife Act. They provide some regulations on management and conservation of wildlife and establish the permits and licences for wildlife internal use and trade. The Wildlife Holding Premises Regulations and the Wildlife Zoo Regulations were also issued in 2018 under the Wildlife Act.

GWCMC is entitled to attach terms and conditions, approved by the Ministry, to licences, permits and certificates. All permits are subject to the payment of a fee, which is fixed by the Commission with the written approval of the minister. GWCMC can also determine and publish the annual closed season for hunting, trapping and trade of wildlife. This season is to be determined through a process of consultation with stakeholders and scientific research of species. The Commission also issues export quotas, with the advice of the Scientific Committee. The annual export quota is published in the Gazette. The Minister is competent to delete from the lists or re-classify any species. The Wildlife Management and Conservation Regulations also granted competence to the Minister to classify an area as a wildlife conservation area. Priority will be given to places containing critically endangered or endangered species. Currently, there is no evidence of areas in Guyana classified for wildlife conservation, besides national parks and protected areas.

The Wildlife Regulations of 2018 and the Wildlife Act of 2016 include fish, amphibians, reptiles, birds and mammals under the concept of wildlife. Nevertheless, the rules are more focused on wild animals and it is not clear which regulations are applicable to fisheries. The Fisheries Act of 2002 "provides for the promotion, management and development of fisheries". It establishes responsibilities and powers of the Ministry of Health and the Chief Fisheries Officer (within the Ministry of Agriculture) in respect to fisheries. Fisheries officers may be appointed as necessary to give effect to the Act. The Minister may also appoint a Fisheries Advisory Committee to advise on the management and development of fisheries. Further regulations have been issued under the Fisheries Act, such as the Fishery Products Regulations, the Fisheries Regulations of 2018 and the Fisheries (Exemption from Registration and Licensing) Order 2018. There are other regulations governing fisheries, which were issued under the former Fisheries Act (1957) but were left in force by the Fisheries Act of 2002, as if they were issued under the later Act. Those are the Fisheries (Aquatic Wild Life Control) Regulations 1966 and the Fisheries Pin Seine Regulations of 1962. Despite there being no explicit provisions under the Fisheries Act and subsequent regulations on their applicability either to marine or inland fisheries, they were designed to be applied only to marine fisheries. In this sense, there are no current regulations in Guyana for inland fishing activities.

Guyana counts five protected areas in the hinterland, four of which are part of the National Protected Areas System governed by PAC, which was established in 2011 under the Protected Areas Act. The Act incorporates previous individual protected areas' management laws: The National Parks Commission Act of 1977 and Kaieteur National Park Act of 1930. The Commission governs Shell Beach, Kaieteur, Kanuku Mountains and Kanashen protected areas, as well as the urban national park and the zoo in Georgetown. The Iwokrama International Centre for Rain Forest Conservation and Development Act of 1996 provides for the protection and management of the Iwokrama protected area under governance of the Iwokrama International Centre.

There are no hunting, fishing and ecotourism areas delineated in Guyana, nor criteria on which to establish them. The sector regulations can establish areas where scientific research and hunting might be allowed; however, those areas are not designated or delimitated. The Wildlife Conservation, Management and Sustainable Use Regulations of 2019 give powers to the Commission to establish wildlife conservation areas through agreements with private landowners and other governmental agencies. The Fisheries Act allows the Minister to establish marine reserve areas where scientific research can be promoted, but protection of inland waters, such as rivers, lakes or wetlands, are not included. No marine reserve areas have been declared thus far.

Legal instruments from other sectors also regulate matters related to wildlife such as the Forest Act of 2009 and the Protected Areas Act of 2011. The Guyana Forestry Commission is the management authority of all state forest lands. At the level of Amerindian villages, the Amerindian Act of 2006 establishes the functions of the village councils in relation to the management of natural resources within village lands. Among its functions, the council makes rules governing wildlife, including restrictions on hunting, fishing and trapping.

Despite ecotourism not being specifically regulated within the legal framework, it is mentioned in the Forests Act and the Protected Areas Act. GTA oversees developing the tourism industry in the country. The Guyana Tourism Authority Act of 2002 establishes the functions of the organization in relation to tourism, but no specific functions in relation to ecotourism are provided.

B.1. Hunting regulations

Hunting is permitted for non-protected species, provided a licence is obtained from the GWCMC. Any person collecting, holding, hunting or killing protected wildlife is committing an offence and is liable to sanction. The First Schedule of the Wildlife Management and Conservation Regulations establishes a list containing vulnerable, endangered and critically endangered species in Guyana based on the IUCN listing. The Minister may decide to add other species to this schedule. Collection of wildlife within designated wildlife conservation areas is forbidden unless there is a Special Wildlife Licence, issued for scientific research, zoological parks or botanical gardens, museums and similar institutions; and any other purpose assigned by the competent authority (Guyana Chronicle, 2016a).

According to the Wildlife Regulations, it is not unlawful for any person to kill or wound wild animals in self-defence or in defence of any other person when necessary. The regulations also establish some provisions related to the rights and obligations of private landowners with regards to wildlife causing a nuisance over their lands. Private landowners or occupiers may kill animals causing or threatening to cause damage to livestock, crops, water installations or fences in their land. Such killings must be reported as soon as possible to the nearest officer or police station. The Wildlife Commission may relocate or authorize the relocation of nuisance wildlife. No compensation mechanism exists in Guyana for loss of livestock or crops caused by wildlife.

Some of these regulations do not apply to Indigenous Peoples on titled lands (see below).

B.2. Fishing regulations

According to the Fisheries Act, "fishing" from on-board or off-board vessels means capture of any biological resources from maritime or inland waters, including for research. Any "pre-" and "post-" catch operations are also considered part of fishing. The law distinguishes between five different types of fishing: commercial, subsistence, scientific or technical, sport and recreational. Fishing is further classified as either artisanal or industrial depending on the gear/methods used. Small-scale fishing is carried out by pirogue-type vessels, with no mechanical means to wet or raise the fishing gear on board. They store their catch on board in ice or salt. Artisanal fishing can also be by off-board vessels. As mentioned above, however, such regulations only apply to marine fisheries.

©Brent Stirton/Getty Images for FAO, CIRAD, CIFOR and WCS

C. Normative systems governing animal production

The Wildlife Conservation and Management Act of 2016, the Wildlife Holding Premises Regulations of 2019 and the Wildlife Zoo Regulations of 2019 establish provisions related to keeping wild animals in captivity to ensure their welfare. These regulations establish requirements for clean food and water, and proper conditions of premises, including ventilation characteristics, sizes and conditions of cages, proper hygienic conditions, dietary requirements and inspection of animals by veterinarians. Holding premises may include arrangements with veterinarians to look after the health of animals. Distressed, sick or injured animals shall be treated. Zoos shall also have a programme of preventive and curative veterinary care and nutrition. Both legal instruments provide for the control and means to avoid disease risks, and to ensure that prey and predators are not kept in the same facilities.

Holding Premises and Wildlife Ranching Operations must be licensed. There are no specifications on sizes of facilities involved; any operation irrespective of size requires a licence. The Wildlife Commission registers all operations licensed as captive breeding operations. The Wildlife Holding Premises Regulations require records to be kept on wild animals, including births, acquisitions, sales, disposals and deaths of all animals. The records registered on animals in holding premises are submitted to the Commission every year by 31 January. In this respect, the Wildlife Commission oversees wildlife regulation, including animal breeding operations, which might include aspects related to the production of wild animals. Nevertheless, the legal framework does not provide for the Commission to establish a database for identification and traceability purposes.

Regulations are also established in relation to personnel capacities. Holding premises must be managed by a person with adequate training, knowledge and experience of the behaviour, biology, food and health requirements of every species held or intended to be held at the premises. They must also be staffed with adequately trained personnel. The Zoo Regulations specify the staff required: at least one full-time officer in charge, one full-time curator looking after the animals and a veterinary practitioner (might be a part-time arrangement).

The Criminal Offences Act establishes offences related to the unlawfully and maliciously killing or wounding of animals. The sanction for this offence is imprisonment. The Wildlife Zoo Regulations establish fees and imprisonment as sanctions when there is a general breach of the regulations. There is a Bill from 2017 on animal welfare (not available online). Nevertheless, it has not been enacted to date.

Aquaculture is not sufficiently regulated in the legal framework. The only legal instrument containing provisions on aquaculture is the Fishery Products Regulations, with some provisions on aquaculture products.

There are other legal instruments regulating the production of livestock such as the Slaughter of Cattle (Control Act) of 1974; the Georgetown (Abattoir) By-laws of 1952; the City (Markets) By-laws of 1952; and the New Amsterdam (Markets) By-laws of 1954, which were issued under the Municipal and District Councils Act of 1970.

The Animal Health Act includes feed as part of the definition of animal commodities. Importers of commodities require a permit and shall be registered as authorized importers, which means that those requirements are also applied to importers of feed. The Animal Health Fees Regulations of 2016 establishes the cost for obtaining a permit to import feed; however, the process is not specified in the legal framework.

There are some minimum requirements related to the disposal of feed. The Environmental Guidelines Poultry Rearing Operations provide general guidelines for the disposal of feed for poultry. Additionally, the Wildlife Holding Premises provides for the daily removal of leftover feed and other waste. The legal framework lacks clear regulations or obligations on the disposal of feed or medicated feed. The few regulations on this are very general and do not provide for specific obligations and producers.

There are no specific safety requirements for wildlife. The Animal Health Act of 2011, the Food and Drugs Act of 1971 and the Public Health Ordinance (Chapter 145) regulate some safety requirements applicable to wildlife. There are some rules pertinent to aquatic wildlife such as the Fisheries (Aquatic Wildlife Control) Regulations of 1966 and the Maritime Boundaries (Turtle Excluder Device) Order of 1977. General regulations regarding wildlife ranching are contained in the Wildlife Management and Conservation Act of 2016. At the institutional level, it is not clear which entities should carry on animal health functions at the local-level and which are the mechanisms to coordinate activities with other national and local-level authorities with powers on wildlife, fisheries and livestock. Local-level entities are only mentioned to assist authorized officers in the performance of their functions.


©FAO/David Mansell-Moullin

D. Normative systems governing the distribution of wildlife, aquaculture and livestock food products and their safety

D.1. Distribution

The Animal Health Act of 2011, with GLDA as the implementing authority, regulates the movement of animals (wild and domestic) into and within Guyana to prevent the introduction and spread of animal diseases. It also regulates the importation and production of animal products and livestock products. The responsibility for the administration of the Act lies with the Minister of Agriculture. Regarding livestock, there are no regulations either on transportation or livestock products.

Both the Fisheries Act and the Fisheries Regulations provide a commercial fisher's licence to engage in the trade of fishery products within the territory of Guyana and a licence to operate fish processing establishments. The Fisheries Act also establish regulations and conditions for the sale of fishery products and import and export licences. The Act regulates the discharge of fish and the sale in the Fish Marketing Centre. The Fishery Products Regulations prescribe different conditions for the transportation of fish products, providing for a "supplier quality assurance agreement" in which species, weight, origin, temperature and other conditions are registered. Among these, the regulations define adequately equipped vessels, refrigeration tools, easy-to-clean material and other hygiene conditions. Vessels must be cleaned after each fishing trip. The regulations also require that the means of transport used for fishery products may not be used for transporting other products likely to transmit harmful properties or abnormal characteristics, contaminate or otherwise impair fishery products, except where the fishery products can be guaranteed uncontaminated because of such transport being thoroughly cleaned and disinfected. Vehicles can only transport fishery products suitable for human consumption, and the transport of waste and by-products in fishing vehicles is prohibited.

The Wildlife Act regulates the international trade of wildlife and wildlife products. It establishes import permits and licences and provides for permits under the CITES convention. The Wildlife Regulations provide for a licence to buy, sell, or otherwise deal in wildlife on a local commercial basis. The licence is valid in respect of a single place of business and should be exhibited there. It may specify the sizes, numbers and species of wildlife to be acquired and the area in which the activity is to take place. Furthermore, every holder of a licence shall maintain a record of all receipts and disposals of wildlife, including wild meat. The Wildlife Act establishes a Commercial Import Licence and Commercial Export Licence as a requirement to engage in the international trade of wildlife. Commercial licences are, in general, required to trade in live specimens as well

as wild meat. In this sense, there are no specific licences to trade wild meat. The GWCMC is the institution in charge of granting such permits and licences for both internal and international trade.

Regulations on wildlife only provide for transportation conditions of live animals, and not for wild meat or animal products. The Wildlife Act establishes as an offence the failure to comply with the International Air Transport Association Regulations for imports, exports and re-exports of live animals. In addition, CITES permits must comply with adequate transportation arrangements to minimize the risk of injury or damage of wildlife. A captive wildlife licence authorizes the transportation of animals, but there are no specific requirements established. The Zoo Regulations provide requirements for the transportation of animals, including conditions of the facilities used for this purpose. It establishes that facilities must be designed properly and secured for the transportation of animals; they shall be free of structures that might pose a risk of injury, shall be suitably ventilated and equipped with secure flooring and adequate supply of food and drinks.

The Wildlife Regulations establish as an offence penalized with fines, the trade, possession for sale, exposure or offer for sale of any wildlife except in accordance with the terms and conditions of a wildlife commercial licence. The Fisheries Act establishes fines for offences committed against commercial, import, export and fish-processing establishment licences. The requirements established for retail, as well as for the transformation of wildlife, fisheries and livestock products, do not differentiate in terms of the scale of the trade. Regulations are focused on industrial production, but there are no specifications on the applicability of such provisions to small-scale household farming.

The institutional framework mentioned before for animal production and animal health is also relevant in the distribution of wildlife, livestock, fisheries and aquaculture products.

D.2. Animal health and food safety

The Animal Health Act of 2011 designates GLDA as the national authority in charge of implementing its provisions. Among its functions in relation to livestock, it presents schemes to the minister for approval, and implements and executes such schemes. It registers livestock farmers, processors and traders, establishes standards for the purpose of grading any livestock or livestock products, and provides services and products to livestock farmers. This entity is competent to issue health certificates for imports and exports of wildlife. The Animal Health Fees Regulations of 2016 were issued under the Act and establish the fees for the different permits and certificates. The Act also designates a National Advisory Committee on Animal Health and a National Committee on Aquatic Animal Health Management to advise and aid the National Authority. Members of the committee may include representatives from the livestock, fisheries and aquaculture industry, food producers and consumers. The authority may designate authorized officers and official analysts to support the implementation of the Act. The Act also establishes that local authorities shall assist authorized officers in the performance of their functions and exercising of their powers.

Some other regulations contain provisions related to animal health. These include the Veterinarians Act of 2003, which regulates the practice of veterinary health; the Pharmacy Practitioners Act of 2003, which includes provisions on veterinary medicine products; the Food and Drugs Act of 1971 and the Food and Drug Regulations of 1977, which regulate the production and distribution of drugs, including veterinary medicine products. Regarding safety requirements, the

regulations contained in the Animal Health Act of 2011 are also applicable to wildlife. The Guyana Livestock Development Authority is thus the competent authority on wildlife health.

While the Animal Act establishes the authority to develop and implement an animal identification system and an animal traceability system, it does not give details on such system. According to the Animal Health Act, importers and exporters of aquatic animals and commodities should be registered as authorized importers/exporters to lawfully perform their duties. This registration obligation is only established for importers/exporters of aquatic animals and does not include importers/exporters of terrestrial animals.

The regulatory framework establishes provisions on ante-mortem and post-mortem inspections. The Georgetown (Abattoir) By-laws provide mandatory inspection of animals prior to slaughter. They mandate that animals in the slaughterhouse must be inspected the same day they are to be slaughtered. Similarly, they order that the animal must be in the slaughterhouse for at least eight hours before slaughter. They further require that a record is kept of the animals that enter the slaughterhouse, identifying the characteristics of each one.

With regards to post-mortem inspection, the Slaughter of Cattle (Control) Act empowers a veterinary officer or police officer to perform post-mortem examinations, at any time, of carcasses of slaughtered cattle. Similarly, the Food and Drugs Regulations require post-mortem inspection of animal carcasses intended for trade. With respect to fisheries, the Fishery Products Regulations require that post-mortem inspections are conducted on animal carcasses intended for trade to identify potential risks to human health. They also prescribe post-mortem tests that must be performed and corresponding judgement criteria. Inspections are not stated in the legal framework for wild animals intended for human consumption.

The legal framework also regulates the keeping of carcasses for inspection purposes. According to the Cattle Stealing Prevention Act, everyone who slaughters in any place other than the Georgetown market, or any other abattoir owned by local authorities shall be bound to keep the skin of the animal for 48 hours after it has been slaughtered.

The 2003 Fishery Products Regulations require the establishment operator to maintain the identity of the fishery product and other relevant parts until inspection is completed. The Guyana Livestock Development Authority Act, the Animal Health Act, the Georgetown (Abattoir) By-laws and the New Amsterdam (Markets) By-laws empower inspectors to dispose of animal products and/or to declare meat suitable for consumption. The Fishery Products Regulations empower inspector to declare fish either fit or unfit for human consumption.

Marking is also regulated to ensure traceability. The Fishery Products Regulations require that fish deemed fit for human consumption following post-mortem inspection must be assigned a certificate delivered by the competent authority. They also require that the country and establishment of origin are clearly indicated on the fish product packaging to facilitate traceability. Similarly, the Georgetown (Abattoir) By-laws, the New Amsterdam (Markets) By-laws and the City (Markets) By-laws require that meat deemed fit for human consumption following post-mortem inspection must be clearly marked in a manner approved by the council.

The Environmental Guidelines for poultry and swine rearing operations provide some technical instructions to promote the effective management of husbandry practices. Measures are identified to reduce or prevent pollution-related issues associated with poultry and swine

rearing, such as correct management and disposal of waste, handling of carcasses and animal diseases, conditions of facilities and mitigation of emissions.

The Food and Drugs Act regulates the materials in food for human consumption and not specifically in feed.

The Fishery Products Regulations prescribe several requirements in respect to processing. They establish conditions in which fish products must be stored after post-mortem inspection and prior to transportation to market or export. They also require that, during processing, non-edible by-products must be removed from spaces where edible fish products are held as quickly as possible. All water used in the processing of fish products must be of potable quality. The regulations establish requirements for additives that may be used in fishery products and conditions for the storage and use of packaging materials in a manner that minimizes the risk of contamination. According to these regulations, the person responsible for an establishment shall keep records of each lot of fish processed and shall keep a register of the processing carried out.

Fewer provisions are established for the processing of livestock or livestock products. According to the Georgetown (Abattoir) By-laws, no skin shall be removed or carried in the same container as any fresh meat. The Food and Drugs Regulations also prescribe some provision on processing. They establish that potable water must be used as an ingredient in the manufacturing or preparation of any food. Furthermore, they provide requirements for additives that may be used in food processing and prescribe requirements for the storage and use of packaging materials in a manner that minimizes the risk of contamination.

No provisions are established specifically for the transformation of wildlife into products for consumption.

Figure 15. National policies and regulations for sustainable wildlife management. Guyana's legal framework for wildlife management has made great advances recently, but awareness of new laws and regulations is still much needed. ©FAO/Arianne-Elise Harris

E. Regulations for Indigenous rights regarding wildlife and wildlife use

Guyana's Constitution recognizes Amerindians as the Indigenous Peoples of the country and provides special rights and representation organs. While customary law is not expressly stated, the Constitution establishes that Indigenous Peoples have the right to the protection and preservation of their culture and way of life (art. 149g). The Constitution also provides for the sustainable development and use of natural resources as a duty of the state to ensure all citizens' rights to a healthy environment (Figure 15). The diversity of plants, animals and ecosystems are recognized as necessary elements for the well-being of the nation.

The 2006 Amerindian Act regulates the recognition and protection of collective rights from Amerindian villages and communities, the granting of lands, and local governance. The Ministry of Indigenous Peoples' Affairs (alternated with Ministry of Amerindian Affairs) has the purpose of enhancing the economic, social and environmental well-being of Indigenous populations, while ensuring the preservation of their culture and traditional knowledge. The Amerindian Act of 2006 assigned duties to the village councils of reporting many administrative activities and decisions within Amerindian territories to the Ministry. Moreover, the Act assigned to the Ministry some intervention powers within Amerindian Village Lands. For instance, the Ministry has authority to remove members of the local authorities, may conduct financial audits within the villages and approves any rule made by the village council. The Ministry is also responsible for conducting some activities at the request of the villages, such as the resolution of disputes, granting of state lands, among other functions designated by the Act. The Amerindian Lands Commission Act of 1966 established an Amerindian Lands Commission to make a report to the Ministry and address recommendations on subjects related to the granting of land titles to Amerindian communities.

Currently, the 2006 Amerindian Act is the main regulatory instrument regarding Amerindian rights. Nevertheless, there are other regulatory instruments referring to the rights of Amerindians. The State Lands (Amerindians) Regulations issued from 1910 to 1949 under the

State Lands Act, provided rules on the occupation of state lands not granted or licensed to Amerindians for residence purposes and the lawful activities and restrictions within such lands. Moreover, the Protected Areas Act of 2011 established the process for Amerindian villages to obtain recognition of protected Amerindian Areas. Because of this process, the Amerindian Village of Kanashen (Protection, Management, Operation and Research in the Conservation Area) Rules of 2007, issued under the Amerindian Act, declared a protected area within the Amerindian village of Kanashen and established the management objectives per zones. The Kaieteur National Park Act of 1930, indicates the traditional rights that can be exercised by Amerindians within the areas of the park. The same is true for Iwokrama.

Formalized and coordinated wildlife management efforts in Guyana's interior began with the passing of the Iwokrama Act in 1996. Perhaps Iwokrama's greatest legacy is their support of the communities with which they share the region. As part of the initial community engagements with Iwokrama, NRDDB was created to provide an umbrella organization that represents community interests in the management of the Iwokrama forests, as well as other authorities and enterprises.

Following the creation of the reserve, Iwokrama negotiated resource use agreements with NRDDB communities that included guidelines for the use of key resources within buffer zones between the communities and the reserve itself. Today, Iwokrama also maintains collaborative management agreements that outline shared responsibilities for monitoring illegal activities with the communities with which the reserve shares a boundary (Surama, Apoteri, Fairview), as well as supporting key education, monitoring and governance initiatives in the North Rupununi. The Iwokrama and NRDDB model has proven successful for promoting conservation and sustaining livelihoods and has been replicated (to some degree) with the expansion of the protected areas system into the Kanuku Mountains and the creation of KMCRG.

The rights of Amerindians over lands in Guyana are intrinsically linked to the land title. The Amerindian Act established different rights to Amerindian communities and villages, which has consequences for the management of natural resources. Amerindian communities are defined under the Act as "a group of Amerindians organized as a traditional community with a common culture and occupying or using the State lands that they have traditionally occupied or used". (Amerindian Act, 2006). In this sense, the Amerindian communities are the ones that have not obtained a land title and occupy untitled State lands. On the other hand, the Amerindian village is defined as a group of Amerindians occupying village lands. Those lands are referred to the Act as "owned communally by a village under title granted to a village council to hold for the benefit of the village". (Amerindian Act, 2006). The local authority in charge of administering the village is the village council. Amerindian Customary law also recognizes village councils as the authorities in charge of land planning and management. The formal recognition of village councils, the management of lands and resources, and the formulation of local regulations (including regulations on wildlife) are exclusive rights of Amerindian villages, which are the ones with formal land titles. In the same way, the mentioned rights are granted over village lands (titled lands), leaving aside customary areas that are not part of the land title. The Amerindian Act does not establish obligations for Amerindians to preserve natural resources over their lands.

The Amerindian Act recognizes traditional rights as subsistence rights or privileges. Nevertheless, there is a conflict between this Act and the Wildlife Regulations. The regulations establish that the Minister can exempt Amerindians or groups of Amerindians from the provisions of

the regulations to ensure the continuance of traditional rights. Nevertheless, the exemption is limited to the use of wildlife for subsistence and medicinal purposes, or any other purpose specified by the Minister within the boundaries of village lands. This creates a confusion on whether subsistence hunting is a given traditional right or a right only granted as an exemption by the Minister. The Wildlife Regulations also limit the exemptions for Amerindians within the boundaries of village lands, which might be interpreted as only Amerindian villages can exercise subsistence rights (as a granted exemption) and only over titled lands. This would leave aside customary lands that are not part of the demarcation. Under customary law, commercial hunting is not allowed without first getting agreement from the village council and the traditional local headmen. Hunting is rarely carried out for commercial purposes. Hunters may occasionally sell surpluses of bushmeat to a community with full-time paid work, or to passing pork knockers (informal miners) and itinerant traders and contractors. The bushmeat trade in the South Rupununi is very occasional and small scale (David *et al*., 2006).

The government has been issuing mining rights over untitled traditional lands without the FPIC, ignoring customary rights over those territories. Those mining rights have been granted even over lands subject to legal dispute. Moreover, some land titles granted to Amerindians allow mining concessions, which were previously granted to non-Indigenous miners, to continue those activities within the granted area; thus restricting the rights of Amerindians over their granted lands.

F. Implementation of international and regional tools

Guyana is a dualist country; for international agreements, Guyana must develop national legislation for these agreements to become legally binding at the national level. The country has ratified several international treaties related to biodiversity, such as CITES (1977), the World Heritage Convention (1977), the Convention on Biological Diversity (1994), as well as their protocols: Cartagena Protocol (2008) and Nagoya Protocol (2014). The Ramsar Convention has not been ratified.

The Convention on Biological Diversity has been incorporated into domestic legislation through several policies, regulations and even the National Constitution. The Constitution recognizes the biodiversity of plants, animals and ecosystems as necessary elements for the nation's well-being. The main policy implementing the convention is Guyana´s National Biodiversity and Action Plan 2012–2020. It provides a general framework and strategic objectives for the country on biodiversity, conservation practices and sustainable use. The convention has also been implemented through several acts governing issues, such as protected areas (Protected Areas Act of 2011, Iwokrama International Centre for Rain Forest Conservation and Development Act of 1996, National Parks Commission Act of 1977, Kaieteur National Park Act of 1930), forests (Forests Act of 2008, Forests Regulations of 2018), wildlife resources (Wildlife Conservation and Management Act of 2016, the Wildlife Conservation, Management and Sustainable Use Regulations of 2019), fisheries resources and aquatic ecosystems (the Fisheries Act of 2003, the Fisheries Regulations of 2019, the Maritime Zones Act of 2010) and environmental permits (Environmental Protection Act of 1996), among others.

Guyana developed a National Policy on Biotechnology, Biosafety and Biosecurity in 2007. A National Biosafety Framework was also developed the same year. Nevertheless, the policy

contained only very general provisions and required implementation through regulations to have a real effect. The country reported the following draft regulations in the last report on the implementation of the protocol: (i) Biosafety Bill; (ii) Biosafety (Placing on the Market) Regulations; (iii) The Use of GMOs or their Derivatives as Food - Biosafety (Labelling) Regulations; (iv) Biosafety (Environmental Release) Regulations; and (v) Biosafety (Contained Use) Regulations. Nevertheless, since the report was submitted in 2017, the country has not yet issued any of the mentioned regulations. The enactment of the draft bills is an opportunity for Guyana to fully comply with the protocol.

Within the Nagoya Protocol, the country assigned the EPA as the National Focal Point, which was established by the Environmental Protection Act of 1996. A National Policy on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from its Utilization was issued in 2007. The provisions of the policy are very general and require further regulations to be implemented. Guidelines for Biodiversity Research were issued in 2017 and contain the terms of academic and commercial research agreements with the Government of Guyana including aspects of access and benefit sharing. Some other regulations contain provisions on access and benefit sharing; the Amerindian Act of 2006 requires a research permit granted by the village council for research related to biological diversity in Amerindian village lands. The use of any material derived from the research requires approval from the EPA and the village council and a negotiation to enter a benefit-sharing agreement with the village council. The Iwokrama Act of 1996 provides for protection, recognition and rewarding of the intellectual knowledge and contributions of Indigenous communities in the field of sustainable forest management through an appropriate intellectual property rights system. Despite these advances, the protocol has not been fully incorporated in the national legal framework. An act and/or subsequent regulations are required to implement the protocol integrally and through more specific and biding provisions.

Unlike the abovementioned conventions, CITES requirements have been sufficiently regulated through domestic legislation. The Wildlife Conservation and Management Act of 2016 broadly regulates the international trade of CITES listed species in compliance with the provisions of the Convention. The Act establishes a first, second and third schedule, which follows the CITES appendices respectively, and provides guidance on obtaining permits for the import, export, re-export and introduction from the sea of the listed species. The provisions of the Act are fully in accordance with the Convention.

The World Heritage Convention has been implemented through the Protected Areas Act of 2011, the Maritime Zones Act of 2010, the Amerindian Act of 2006 and the National Trust Act of 1972. The definition of natural heritage is included in the Protected Areas Act. It also provides for the protection and conservation of Guyana's natural heritage and archaeological sites. The legal framework does not provide definitions on cultural heritage, despite the term being included in the Maritime Zones Act. The Amerindian Act establishes that the National Toshao Council advises the Minister on the protection of Amerindian culture and heritage, including the identification and designation of Amerindian monuments. The National Trust Act was issued to preserve monuments, sites, places and objects of national importance.

While cultural and natural heritage are regulated in different instruments, the country might develop a more general policy that aims to articulate current sector regulations to provide a more comprehensive framework. The legal framework might also be developed to integrate the

natural and cultural heritage into single policies or plans, considering the intrinsic relationships. Cultural and natural heritage could be developed in the legal framework on wildlife to incorporate the role of those concepts in wildlife management.

In respect to the institutional framework, Guyana ratified the United Nations Convention Against Corruption (UNCAC) in 2008. Before ratification, Guyana issued different regulations to combat corruption, which also incorporated some elements from the convention, such as the Public Service Commission Rules of 1998, the Public Service Rules of 2004, the Integrity Commission Act of 1997, the Procurement Act of 2003, the Fiscal Management, and Accountability Act of 2003, among others. After the ratification of the UNCAC, the country issued the Access to Information Act of 2011, the State Assets Recovery Act of 2017, the Protected Disclosures Act of 2018 and the Anti-Money Laundering and Countering the Financing of Terrorism Act 2017.

Sector regulations on wildlife and environmental aspects incorporate provisions from the UNCAC in respect to the institutional framework. The Wildlife Act includes some institutional provisions that support the transparent management of the Wildlife Commission. It also provides for public scrutiny in relation to permits; the Commission keeps records on wildlife-related permits and this information is open for inspection by the public. Similarly, the Environmental Protection Act includes public participation in decisions related to environmental authorizations. Although some provisions on corruption have been incorporated in the sector, more regulations are required with respect to the institutional framework to fully comply with the UNCAC.

The legal framework should be updated to fully comply with the provisions from Article 7-1 of the UNCAC. The legal framework on wildlife or specific policies of the sector could regulate staff selection criteria based on merit and aptitude, and also for the provision of training on specific corruption risk that might face the sector and its institutions at different levels. The wildlife legal framework might include provisions to promote public participation in decision-making related to wildlife use. It should also make the bribery of foreign public officials and/or officers of public international organizations a criminal offence. The legal framework should include exemptions to the bank secrecy law when dealing with domestic criminal investigations of offences related to corruption.

G. Knowledge on hunting regulations

Current level of awareness of recent hunting regulations in Guyana was assessed from interviews applied to different stakeholders (Materials and Methods in Section IV.A of this chapter). About half of the interviewees had heard of the Wildlife Conservation and Management Act (51 percent, *n* = 245). Most learnt about the Act through meetings, outreach or workshops, followed by social media. Similarly, half of the respondents indicated that they knew which agency was responsible for wildlife management. Of those, 56 percent answered correctly that GWCMC was responsible (*n* = 118). From the Rupununi respondents, 69 percent correctly identified GWCMC. Another 31 percent stated that the village council was responsible. Other answers included the Ministry of Indigenous People's/Amerindian Affairs, the police force, the EPA, conservation NGOs or non-existent entities. A majority thought that the same GWCMC oversaw managing wildlife on Indigenous lands (56 percent, *n* = 245), although this is only the case for commercial use of wildlife. Almost a third of all respondents correctly stated that the village council held

this responsibility (31 percent). Among Rupununi citizens (*n* = 111), 49 percent stated GWCMC was responsible for wildlife management on titled lands, while 38 percent indicated the village council and a few mentioned the Ministry of Indigenous/Amerindian Affairs. When only considering Indigenous villagers (*n* = 64), this shifted to roughly 50–50 between the Commission and the village council. For hunting and trapping of wildlife, 83 percent identified GWCMC as the responsible agency. For permits and establishing hunting seasons, most interviewees correctly referred to GWCMC.

When asked about species that are illegal to hunt or trap, 45 percent did not know of any or were not certain. Of the remaining 56 percent, nearly all listed the jaguar (82 percent, *n* = 136). Other species listed by at least 50 percent of the respondents were: harpy eagle (*Harpia harpyja*), arapaima (*Arapaima gigas*), giant sea turtles (leatherback *Dermochelys coriacea*, green *Chelonia mydas*, and hawksbill *Eretmochelys imbricata*), giant river otter (*Pteronura brasiliensis*), and anteater (presumably *Myrmecophaga tridactyla*). Some commonly consumed species not under total protection were also mentioned erroneously as protected, all by 6 percent or less of interviewees: capybara (*Hydrochoerus hydrochaeris*), deer (either *Odocoileus sp*. or *Mazama sp*.), peccary (*Pecari tajacu* or *Tayassu pecari*), and labba (*Cuniculus paca*).

Interviewees were not sure about hunting or trapping seasons, although 40 percent said it existed (*n* = 245). Wild birds in general, for which closed season has existed the longest, were mentioned by 54 percent (*n* = 98). Deer, tapir and armadillo (*Dasypus spp*.), which are all commonly hunted and for which a hunting calendar has recently circulated on social media, were listed by 51 percent, 41 percent and 39 percent, respectively. Nearly a quarter of responders thought that some hunting methods were prohibited (23 percent). While there are some humane methods that are applicable when hunting or trapping wildlife, the GWCMC does not have any prohibited methods in place currently, but prior regulations did specify this.

When asked about required permits for hunting or trapping, 44 percent were not aware of the categories (*n* = 245). Others correctly mentioned at least one. But, when asked about what a hunting or trapping permit covers, 55 percent did not know what the permit covers (*n* = 245). The majority (63 percent, *n* = 245) did not know how to obtain a licence. Many believed that a permit is not required for subsistence hunting (44 percent), although it is, but many may have confused this with, for example, hunting on titled lands by Indigenous Peoples. Indeed, 38 percent correctly stated that they could hunt on their titled land without a permit. Among the Indigenous Peoples in the Rupununi, 80 percent answered correctly. Nevertheless, when asked about "without a permit", some may have considered a village permit as well. Respondents mostly selected correctly that the hunting licence /permits should be renewed yearly (48 percent, *n* = 245). Many knew that a permit was required to hold or house wildlife (57 percent, *n* = 245), but fewer knew that this is now also required for wild meat (43 percent). That a licence would be needed for captive breeding of wildlife was clear to a majority (59 percent). For trading in general and internationally, most people were aware of the need for a permit (72 percent and 88 percent, respectively); this legislation has been enacted the longest.

Most people correctly identified GWCMC or the police force as the entity to contact regarding illegal wildlife activity (84 percent).

H. Lessons learnt, recommendations and first actions

H.1. Lessons learnt and recommendations

- For wildlife consumption, there are no legal guidelines to ensure food safety. The same is true for fisheries. Wild meat is not typically slaughtered in slaughterhouses and, therefore, health and safety regulations for those are not applied to wild meat. The Animal Health Act is not enough to guarantee safe handling of wildlife products for human consumption.
- Fisheries regulations are focused on marine resources, not on inland fisheries, such as those of the Rupununi. Regarding inland fisheries and considering the importance of artisanal fishing, regulations should provide more adequate guidelines and support. Local guidelines on inland fisheries, such as restrictions on fishing gear, quotas for local trade and lists of harvestable wildlife species, developed by NRDDB communities should be tested and upscaled. The possibility for those guidelines to become regulations at the national level should be evaluated. The Fisheries Department should be supported in the development of a national-level inland fisheries policy.
- Aquaculture is not sufficiently regulated within the country's legal framework, and only some provisions on aquaculture products are contained in the Fishery Products Regulations.
- Subsistence use for both fish and wildlife is poorly defined. Clear regulations on when permits are required by Indigenous Peoples are needed.
- The process of land titling should be improved to grant formal titles to communities over the whole area of customary use. Furthermore, traditional rights should not be limited to the existence of a land title.
- Most respondents were not aware of the GWCMC's mandate and the legal instruments which empower them. Further sensitization efforts need to be placed on licence requirements by the GWCMC to garner better awareness and compliance.

H.2. First actions

Based on the comprehensive knowledge generated through the analysis of statutory and customary laws in Guyana, the Project can explore different avenues for support, to be discussed and validated through a series of workshops involving the relevant government agencies and local partners in the Rupununi. Given the COVID-19 restrictions, these events are planned as online workshops. Proposed avenues include but are not limited to:

- Support the development of species-specific management plans at the national level: tapir, tortoise (*Chelonoidis* sp.), caiman, capybara, savannah deer (*Odocoileus cariacou*) and armadillo, and define management units, no harvest zones, quotas or hunting bags.
- Facilitate the process to obtain exemptions of titled lands from the regulations on hunting seasons and licensing that can be issued by the Ministry of Indigenous Peoples Affairs.
- Continue to support village-level rules for wildlife use.
- Actively participate in the development of inland fisheries and aquaculture regulations and policies.

The Project baseline survey on knowledge of new hunting regulations showed that further dissemination of legal requirements for hunting, trapping and selling of wildlife are much

needed. Therefore, the Project has engaged with GWCMC to develop an awareness-raising strategy that will target wild meat consumers and vendors, hunters, trappers, traders, miners, local leaders and civil society in the Rupununi (the Rupununi Livestock Producers Association, SRCS, VR), government entities directly or indirectly involved in enforcement, and specialist groups (e.g. National Rifle Association, animal welfare groups). The strategy includes dissemination of awareness materials through social media and printed media, such as hunting calendars, fact sheets, stickers, brochures and posters with key information. A reference booklet with a simplified version of the regulations is also proposed. Additionally, radio programmes and face-to-face interactions will take place. All these products are awaiting validation by the GWCMC board, which was established at the time of writing this chapter.

©Brent Stirton/Getty Images for FAO, CIRAD, CIFOR and WCS

Summary

The Project conducted a baseline study on wildlife use. This was based on existing literature, additional surveys at the household level and a Rupununi-wide camera-trapping programme to monitor wildlife abundance and distribution. Hunting is an important contributor to local livelihoods and appears to be sustainable for many species. However, some of the most heavily hunted species, as well as large mammals, show declines or behavioural avoidance of hunting, which causes decreased observations locally. These include savannah deer, tapir (*Tapirus terrestris*), armadillos, capybara (*Hydrochoerus hydrochaeris*) and the red-footed tortoise (*Chelonoidis carbonarius*). Although some wild meat is legally hunted and sold at restaurants and markets throughout Guyana, hunting is largely a subsistence activity. Village councils together with community representative groups oversee customary rules. Over the past 20 years, the increasing recognition of the need to manage wildlife has led to multiple initiatives, with varying levels of success. These can provide a series of lessons on which to build the Project's interventions. The Project has facilitated the creation of the Wapichan Wiizi Wildlife Committee (WWWC) under SRDC. The WWWC will support sustainable wildlife management in the South Rupununi and has already started raising awareness and encouraging villages to develop wildlife-use rules. A monitoring system of terrestrial wildlife and additional monitoring systems for two emblematic, threatened species such as the giant anteater (*Myrmecophaga tridactyla*) and red siskin (*Spinus cucullatus*) are ongoing. Environmental education has been identified as a key process to support sustainable practices and prepare younger generations for a more sustainable world. The Project has developed curriculums that are being piloted in various schools. A biodiversity survey of a culturally important mountain, the Karawaiman Tawaa area, is planned by the WWWC to support the protection of this area from mining expansion. A district-level wildlife management plan covering the Wapichan territory will be developed to provide coherence and synergies between those different wildlife management and conservation activities.

V. THE HUNTING SYSTEM

Evi AD Paemelaere[1], Matthew Hallett[2,3], Timothy Wiliams[4], Erin Earl[5], Neal Miller[6], Nathalie van Vliet[7]
[1] CIFOR, Colombia, pwsolutions.main@gmail.com
[2] Department of Wildlife Ecology & Conservation, University of Florida
[3] Conservation Department, Jacksonville Zoo, mhallett2320@ufl.edu
[4] SRDC/SCPDA, Guyana, williamstimothy75@yahoo.com
[5] SRCS, Guyana, earl.erin@gmail.com
[6] SRCS, Guyana, srcs.rupununi@gmail.com
[7] CIFOR, Colombia, nathalievanvliet@yahoo.com

A. Hunters and hunting practices

Hunting in Guyana is typically undertaken by men (Conservation International Guyana and IDB, 2015). Three types of hunters can be distinguished in Guyana: (Indigenous) subsistence hunters, who may sell wild meat on occasion, although the main purpose is for personal consumption; sports hunters, who target a limited number of species, are well-equipped and keep most of the meat for their personal use; and commercial hunters, who typically hunt with well-equipped hunting vehicles or engine boats with the aim of selling most of their quarry to markets, restaurants, bars and customers abroad.

Materials and methods

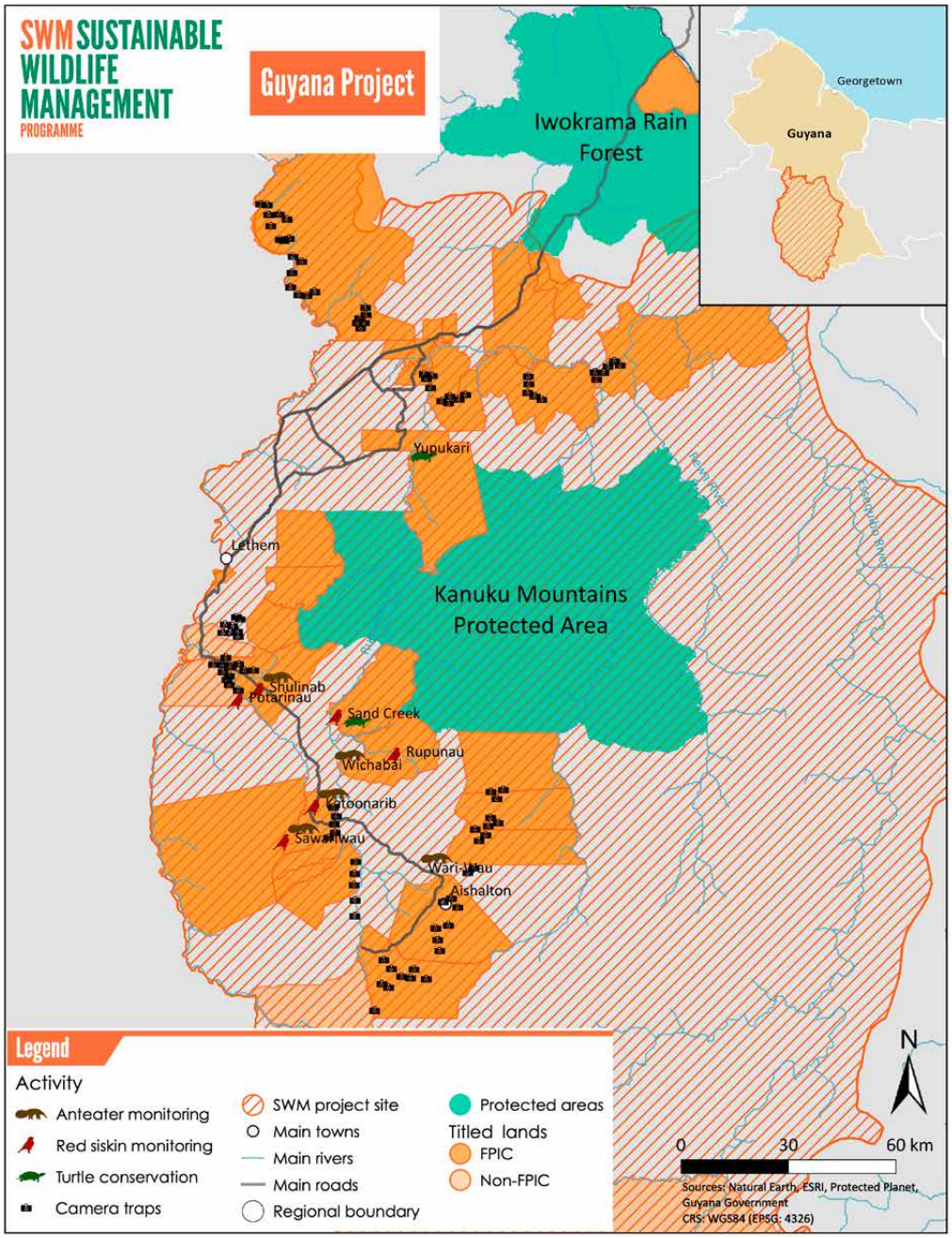
Hunting. A literature review produced a comprehensive overview of the hunting system in Guyana in general, and in the Rupununi specifically. Data on trade were collected by the Project team following the methodology presented in Chapter VIII (Puran, 2019; Paemelaere, 2020). Information on customary hunting was gathered based on existing literature and project interviews with village leaders (Doraisami, 2020).

Species populations. The Project complemented published information from a project literature review with a comprehensive camera-trapping effort that covered all the Rupununi region. The locations of the camera clusters were chosen to ensure equal distribution across five major subregions of the Rupununi: North, Central, South, and Deep South Rupununi and South Pakaraimas. Site selection also ensured equal distribution across the major habitat types of the Rupununi. Single camera-trap stations were set 2–3 km apart in clusters of 20 stations functioning for 120 days at a time (Figure 16). For species detected, relative abundance and naïve occupancy were calculated for the wet and dry seasons separately (Hallett, 2020).

In addition, the Project established a partnership with SRCS to monitor giant anteater *(Myrmecophaga tridactyla)* and red siskin *(Spinus cucullatus)* as representative species of savannah and bush island ecosystems. In addition, they have an emblematic status in the Rupununi and are of great importance for tourism. The team conducted 24 interviews in Katoonarib village during October 2019 to establish where anteaters had been seen in the area and what people's attitude was towards the species. Pilot transects and camera trapping for the anteater took place in the Katoonarib and Wichabai Ranch areas (Earl, 2020). Red siskins were monitored between October 2019 and July 2020, with a total of 251 hours of mist-netting at 11 sites within previously identified red siskin habitat, which is very patchy, in the South Rupununi (Millar, 2020). Mist-netting at the sites was done for 4 hours in the morning and 4 hours in the afternoon to evening. Additionally, behavioural observations were recorded.

The results presented here come from the literature review and from the data collected by the Project until June 2020. Monitoring has been ongoing since then.

Figure 16. Wildlife monitoring sites for the Project: mammal, anteater and red siskin monitoring in the Rupununi.



In the Rupununi, most hunters are Indigenous belonging to the first hunter category. Some are guides for sport and commercial hunters that visit from the coastal regions (authors, pers. obs.). The Project interviews recorded that 50–60 percent of Indigenous households have at least one hunter. Hunting by Indigenous Peoples mostly occurs within the community titled lands, although these lands are smaller than the ancestral use areas; hunting thus also occurs outside of titled land, but with little overlap between communities, perhaps reflecting respect for traditional use areas (Conservation International, 2002; Read *et al.*, 2010). Local hunters typically have their own hunting trails ("lines", which may be passed down within the family)

(Henfrey, 2002). Because hunting also occurs when farming or fishing, many hunting sites are in the vicinity of farms and fishing camps. Hunting often occurs in or near the village, although the distance from the village may be greater for those living in the savannah compared with those living in or near forested sites (Read *et al.*, 2010; Shaffer *et al.*, 2017a). Average hunting distance from the village is 9.9 km (Ingwall-King, 2013; Read et al., 2010). Hunters typically select wildlife feeding sites as their hunting grounds, but may also use tracks, drinking ponds and, to a lesser extent, nesting sites to hunt animals (Conservation International, 2002). Forest and mountain sites are favoured over savannah and forest–savannah ecotone sites for hunting, in part due to decreasing availability of prey species in the savannah and savannah–forest ecotone (Conservation International, 2002). Nevertheless, targeted hunting trips select certain preferred areas. For savannah deer, a highly preferred species, hunting occurs in open habitats near savannah–forest edges, the preferred habitat of this ungulate. The same is true for the nine-banded armadillo (*Dasypus novemcinctus*), although this species is hunted more frequently by citizens from villages located in the savannah. For most other species, hunters travel to gallery forests, "bush islands" and deep forest.

Bows and arrows are widely used by Indigenous hunters (Figure 17), although most villages have access to guns and used them for hunting according to Conservation International (2002). In a 2011 study (Paemelaere, 2012), most hunters interviewed reported they still use bows and arrows, with less than 6 percent employing guns. Additionally, about 20 percent of the hunters own and use trained hunting dogs. The relatively limited use of guns was attributed to the stricter regulations on gun ownership and the cost of ammunition. Sometimes locally designed live traps are used (Conservation International, 2002), but knowledge on how to construct and use these have declined with the increased availability of more effective methods. Because commercial hunting also requires motorized transport, this practice is limited among Rupununi citizens. A variety of other methods is used. Shauling – shining with a bright light from a boat or vehicle along rivers and roads – is common. This is also the standard technique for sports and

Figure 17. Traditional hunting. Hunting remains an integral part of Rupununi Indigenous livelihoods. Many hunt with traditional bows and arrows. ©FAO/ David Mansell Moullin

commercial hunters from other parts of the country. The wabbani – an elevated platform usually erected near fruiting trees – typically targets labba. Another traditional technique is burning savannah vegetation or forest edges to hunt by forcing wildlife to leave the protective cover (Conservation International, 2002; South Central and South Rupununi Districts Toshaos Councils, 2012). In Wapichan tradition (South Central and South Rupununi Districts Toshaos Councils, 2012), this occurs at the start (April) and end (August) of the dry season. In September and October, fire is used on savannah hills to hunt for iguana (*Iguana iguana*) eggs (South Central and South Rupununi Districts Toshaos Councils, 2012). For some animals, traps may be used, for example, the collared peccary (*Pecari tajacu*) trap used by the Wai Wai (Donkin, 1985).

Organized community hunts have become less common over time, a trend that was reported in the early 2000s, although no time reference was provided (Conservation International Guyana and IDB, 2015). About 40 percent of hunters only hunt a few times a year, while 30 percent hunt monthly and only 5–10 percent hunt daily (Conservation International, 2002), although the Project surveys showed that this varies between villages. Hunting generally happens in groups of 2–5 men, often family members, although some hunt alone (Conservation International, 2002; Read *et al.*, 2010). The Project found that in four villages in the South Rupununi (Katoonarib, Sawariwau, Aishalton and Karaudarnau), 55 percent of households hunted and hunted at a higher frequency than reported in this earlier study: 36 percent hunted weekly, 22 percent biweekly, 24 percent monthly, 10 percent bimonthly, and for others frequency varied. Only one household reported hunting daily. These villages, however, are the most remote of the Rupununi, and may depend more on subsistence goods.

Trips may take anywhere from a few hours to multiple days (Conservation International, 2002; Paemelaere, 2012). Most hunts last one day or less (Paemelaere, 2012; Read *et al.*, 2010). This relates to location. Horseback or the now more popular motorbike are the main means of transportation used for hunting trips. These have limited fuel costs. The number of motorbikes in the area has increased, and this explains the increase in hunts on motorbike as opposed to horseback or walking compared with a decade ago (Read *et al.*, 2010).

During the rainy season, many animals gather on the elevated islands in the flooded savannah, rendering hunting easier (Paemelaere, 2012). Together with the decline in fishing during this time, this resulted in an increase in hunting. Furthermore, certain religious and other festive occasions are popular for hunting. These include Easter (which coincides with Rupununi Rodeo), St John's in June, Heritage Month in September, and Christmas. Nevertheless, hunting occurs year-round for most wildlife (Conservation International, 2002). People also hunt when the opportunity arises while fishing or farming. Animals entering and damaging farm crops are easy targets. Based on the hunting calendar for villages bordering the Kanuku Mountains (Conservation International, 2002), the following observations can be made. Among mammals, most species are hunted year-round. The same is true for birds, although species commonly trapped for international trade (macaws, parrots, toucans and song-birds) are not hunted in January and February, sometimes extending into March, corresponding to the legal closed season for birds (1 January–31 May)(Guyana Chronicle, 2016b). Among reptiles (turtles, lizards), harvesting is much more seasonal. This is related to their strong seasonal reproductive patterns. Harvesting typically occurs during the reproductive season. For tortoises, however, no specific season exists. Iguana eggs and caiman eggs are collected in September. Peccary tend to enter the savannah during August–October when they are hunted in large numbers (Conservation

International, 2002; South Central and South Rupununi Districts Toshaos Councils, 2012). Primates are typically hunted by Wai Wai during the rainy season. Hunting of the red howler monkey (*Alouatta macconnelli*) may extend into the early dry season, when their meat is said to taste better.

Informal open interviews with key hunters carried out by the Project in the region revealed that sports hunters started coming to the Rupununi for holidays to visit family or friends in the area in the late 1980s–'90s, and they still appear to be a limited group all tied by family bonds. On occasion, they would bring new friends. But, to keep hunting areas for themselves, the number of outsiders has been kept to a minimum. Sports hunting has grown into a business where local hunters serve as guides, a practice that has been around for about two generations.

Aside from village hunters and visiting sports hunters, several local ranch owners engage in hunting activities as well. This too is mostly for personal use, as a sport. At least one rancher, an avid sports hunter, sells wild meat to people in neighbouring Brazilian towns, particularly Normandy, and other ranchers and hunters do the same. The Brazilian buyers purchase for personal use rather than selling in restaurants or shops; this may be related to the illegality of wild meat in Brazil.

B. Offtake levels

Although in terms of number of individuals ungulates and rodents are comparable, ungulates constitute nearly 75 percent of the biomass harvested and rodents only 12 percent (Fragoso *et al.*, 2016). Fragoso *et al.* (2016) showed that tapir contributes the largest proportion of hunted biomass (28 percent), followed by the two peccary species. Primates are negligible compared with other animals killed (0.1 percent biomass). Agouti (*Dasyprocta leporina*) and labba are killed in the highest numbers, but being smaller species, they rank much lower in terms of total biomass.

The full list of species of wildlife consumed by the Wapishana tribe consists of 169 species that are referred to as *wunii* or animals eaten by people (Henfrey, 2002). This list is likely to be similar for the other two tribes in Region 9. A long-term study among Makushi and Wapishana villages recorded 107–127 species killed, but there may be more that are considered edible (Fragoso *et al.*, 2016; Read *et al.*, 2010). The same study found 14 percent of kills to be labba, and the same percentage for both agouti and white-lipped peccary (*Tayassu pecari*). Collared peccary constituted 10 percent of animals killed. Bush deer (*Mazama americana*), nine-banded armadillo (*Dasypus novemcinctus*), red-footed tortoise *(Chelonoidis carbonarius)* and white-tailed or savannah deer each contributed around 5 percent. In a Rupununi-wide study on resource use, 74 species of mammals, birds, reptiles and amphibians were listed as hunted (Conservation International, 2002). Most of the *wunii* species are rarely eaten, with a small selection comprising most of the wild meat consumed (Read *et al.*, 2010; Table 2). The Wai Wai may include more species not commonly eaten by the Wapichan or Makushi, in part due to their higher dependence on wild meat. A major difference is their cultural association with the consumption of primates, and particularly spider monkeys *(Ateles paniscus*) (Fredericks, Buckley and Persaud, 2016; Henfrey, 2002; Shaffer *et al.*, 2017a). Their diet also includes anteaters and sloths, which are only eaten by others in the Rupununi on rare occasions. A recent study listed 32 species hunted by Wai Wai (Shaffer *et al.*, 2017a), but this does not necessarily represent all species consumed by this tribe.

Table 2. Preferred species in the Rupununi (Alonso, Persaud and Williams, 2016; Conservation International, 2002; Panthera Guyana, 2015; Read et al., 2010). Species sold to markets outside of the village are indicated with an asterisk (*).

Species	Local names
*Cuniculus paca**	labba
*Odocoileus cariacou**	savannah deer
*Mazama americana** (*M. nemorivaga* avoided due to taboos)	bush deer
*Tapirus terrestris**	tapir
Dasyprocta leporina	agouti, akuri
Chelonoidis sp.	yellow-footed & red-footed tortoise, land turtle
Dasypus spp.; *Cabassous* sp.	armadillo, kapash
*Hydrochoerus hydrochaeris**	capybara, watrush
Tayassu pecari; *Pecari tajacu**	peccaries, bush hogs

Due to most of the hunting occurring for subsistence, species and quantities hunted and consumed within the region go hand in hand (Figure 18). Lists of most hunted species differ among tribes and even between Indigenous villages, although it is more similar among north villages (Paemelaere, 2012). In the North Rupununi, top five prey species (groups) are: 1. deer (*O. cariacou*, *M. americana*), 2. labba (*C. paca*), 3. agouti, 4. peccary (unknown species), 5. armadillo, followed by tapir and turtle (*Geocheleone* spp., may include *Podocnemis* spp.) (Paemelaere, 2012; South Central and South Rupununi Districts Toshaos Councils, 2012). For the south, the ranking changes, with peccary third and agouti fourth, while capybara scores fifth place (Paemelaere, 2012). Several bird species are also commonly consumed, particularly marudi (*Penelope spp.*) and ducks (*Cairina moschata*, *Dendrocygna viduata*) (South Central and South Rupununi Districts Toshaos Councils, 2012; Table 2).

There are differences between a savannah village (e.g. Katoonarib) and one located at the foot of the forested Kanuku Mountains (e.g. Sand Creek). Peccaries are more commonly hunted near the Kanukus, while in the savannah, armadillo constitutes a large portion of prey, a species not even listed by Sand Creek (Paemelaere, 2012). Around Christmas, many target giant river turtles (*Podocnemis* spp.), which are nesting, and their eggs. Some villages rank tortoise high, and river turtles rank among preferred species by some (Read *et al.*, 2013a, 2013b). Capybara only ranks high for a single community in the south, and tapir is more popular in the south than in the north, except for Katoka and, to some extent, Fairview and Wowetta; tapir is associated with cultural taboos (Conservation International, 2002; Read *et al.*, 2013c, 2013d, 2013a, 2013e). In the South Pakaraimas, the spectacled caiman (*Caiman crocodilus*) is an important wild meat source (Read *et al.*, 2011a). The 2010 study also highlights the importance of powis (*Crax alector*) as one of the main species hunted in forest-based villages (Conservation International, 2002; Read *et al.*, 2010), even though it is not frequently mentioned in other studies.

For Wai Wai, primates are the most commonly hunted prey after rodents; that is labba and agouti (Shaffer *et al.*, 2017a). Wai Wai prefer spider monkeys. Primates are typically hunted during the rainy season. Hunting of red howler may extend into the early dry season, when their meat apparently tastes better (Shaffer *et al.*, 2017a). Primates are also used for medicinal purposes but are not typically targeted for this use. Monkeys are not hunted by Wapichan or Makushi due to taboos, although they may be taken in secret (Conservation International, 2002; Henfrey, 2002). Earlier studies show similar hunting patterns in terms of species and variation among villages, with few exceptions (Conservation International, 2002; Read *et al.*, 2010).

Figure 18. Most commonly hunted and consumed species in the Rupununi registered in the Project's region-wide camera-trap survey in 2019–2020.

Based on a detailed hunting study (Read *et al.*, 2010, 2011b), Indigenous villagers consume an estimated 5–10 kg of wild meat per person per year (Read *et al.*, 2011a, 2011b, 2013a, 2013b, 2013c, 2013d, 2013e, 2013f, 2013g, 2013h). Otherwise stated, on average, Indigenous Rupununi citizens consume wild meat once every 1–2 weeks. This corresponds with the estimate from a 2015 study (Paemelaere and Puran, unpublished data). Nevertheless, this estimate is very rough; some villages focus more on fish, others more on wild meat and others on domestic protein sources (Iwamura *et al.*, 2014).

C. Ecology and population status of hunted species

C.1. Hunting in the Rupununi

Hunting in the Rupununi appears sustainable for most species under current hunting levels, population density and habitat availability. A recent study on wildlife in and around the KMPA, where Indigenous Peoples have the right to hunt, indicates only small shifts in activity pattern and distribution patterns of the most hunted species at hunting sites, and hunting pressure was not a significant predictor in the occurrence of any species (Hallett *et al.*, 2019). An earlier study of Wai Wai in Deep South Rupununi also demonstrated sustainability of hunting, despite some localized declines (Shaffer *et al.*, 2017a, 2017c). As stated by all these authors, the human population density of less than 1 person per km^2 with large stretches of natural habitat, and the continued reliance on traditional hunting methods, like bows and arrows, help prevent overhunting.

An assessment of hunting behaviour in early 2000, however, revealed that a large majority (78 percent) of hunters already had to move further to find certain prey. They admitted to a change in resource availability, even though the overall quality of hunting was generally considered to be good (Conservation International, 2002). Hallett *et al.* (2019) did find that distance to village was a significant predictor of presence for tapir and armadillo, and the Project's recent landscape analysis for roads (see Chapter VIII) also found this factor to have a significant, negative effect on the presence of labba, which may be related to the high hunting pressure, as well as other disturbance factors, in and around villages. Droughts and fires in the last few years have also possibly affected wildlife populations. Dwindling fish populations, as mentioned in anecdotal reports, may also have increased hunting pressure (Paemelaere, 2012). Even in a study from nearly two decades ago, the most mentioned threats reported by villagers included overhunting due to population growth and use by outsiders, combined with climate change impacts (Conservation International, 2002). Fire, new hunting methods and competition from 'tiger' (jaguars) were mentioned by a few at that time.

Table 3. Wildlife species of concern in the Rupununi due to hunting for meat, trade or conflict (Alonso, Persaud and Williams, 2016; Conservation International, 2002; Conservation International Guyana, 2014a; Panthera Guyana, 2015). These species are at risk of unsustainable harvest. Species only threatened by factors not related to harvesting are not included here; only hunting (H), trade (T) and hunting associated with conflict over crops or livestock (C) are considered. Refer to other reports for a detailed overview of species under threat (Conservation International Guyana, 2014a; Pierre and Paemelaere, 2018).

Species	Common name	North Rupununi	South Rupununi	Deep South & Wai Wai	Threat
Odocoileus cariacou	white-tailed deer/savannah deer	X	X	X	H
Mazama americana	red brocket deer, bush deer	X	X	X	H
Tapirus terrestris	tapir/bush cow	X	X	X	H
Cuniculus paca	labba	X	X	X	H
Hydrochoerus hydrochaeris	watrush/capybara	X	?	X	H
Dasypus spp., *Priodontes maximus*; *Cabassous* sp.	armadillos	X	X	X	H/C
Pecari tajacu; *Tayassu pecari*	peccaries	X	X	X	H/C
Ateles paniscus	spider monkey			X	H
Myrmecophaga tridactyla	giant anteater	X	X		H/T
Saimiri sciureus	squirrel monkey	X	X		T
Panthera onca	jaguar	X	X		C
Psittacidae	macaws, parrots	X	X	X	T/C
Crax alector	powis	X	X	X	H/T
Cairina moschata	muscovy duck	X	X	X	H/C
Dendrocygna viduata	white faced duck	X	X	X	H/C
Dendrocygna autumnalis	whistling-duck (blackbelly)	X	X	X	H/C
Oryzoborus angolensis	chestnut-bellied seed finch, towa-towa	X	X	X	T
Ramphastos sp.	toucans/white throated toucan	X	X	X	T
Penelope marail	marudi	X	X		H
Tinamus sp.	tinamus				H
Podocnemis expansa	giant river turtle	X	X	X	H
Podocnemis unifilis	yellow-spotted Amazon river turtle	X	X	X	H
Boa constrictor	boa constrictor	X	?		T
Epicrates cenchria	rainbow boa	X	?		T
Chelonoidis sp.	tortoise	X	X	X	H
Iguana iguana	iguana	?	X	X	H

Species reliant on savannah habitat or otherwise specific habitat characteristics are likely to be under greater threat from hunting and pressures such as agriculture, increasing droughts and fires, which in turn are associated with improved roads and expansion of villages. Rupununi hunters have reported declines of prey species in the savannah and savannah–forest ecotone (Conservation International, 2002). These include savannah deer, armadillos, capybara and red-footed tortoise. Savannah deer, for example, are already considered threatened in neighbouring countries (van Andel, Banki and MacKinven, 2003), and stakeholders in the Rupununi have expressed similar concerns (Conservation International, 2002; Panthera Guyana, 2015). Peccary sightings are also reportedly decreasing in savannah areas; although no specific time reference is given, this is within the lifespan of current hunters (M. Hallett, personal communication, 2016).

In the forest, local declines may be seen around popular hunting sites. In Wai Wai territory in Deep South Rupununi, which is entirely forested, local depletion of primates is seen around the village centre. This is driven by the increased use of shotguns (Shaffer, Marawanaru and Yukuma, 2017). The same is true for black caiman and tortoises (Alonso *et al.*, 2008). Nevertheless, forested areas throughout Guyana are well connected, helping to prevent extinction at a larger scale. Caution must be taken, however, because as a village gets older, more forest habitat is converted to grassland and the diversity of species in hunts decreases. This is closely associated with human population size in the village (Iwamura *et al.*, 2014). Species considered to be of concern in the Rupununi are listed in Table 3.

Sports hunters and commercial hunters from outside the region typically take the blame for declines in wildlife population, especially for ducks, deer, tapir and capybara. A study in the late 1990s, just years after the road between Georgetown and Lethem had been completed, reported declines in some species (Henfrey, 2002), suggesting that local pressures are at least partially responsible. Similarly, villagers also reported having to travel further from the village for successful hunts (Read *et al.*, 2010).

In the Project interviews, vendors in the North Rupununi said that labba meat was less available now compared with 5–10 years ago, while those in the South Rupununi had noticed no change. All other species were said to be less available now than 5–10 years ago, except by respondents from the mining company, which was only established 5 years ago. Therefore, wild meat may be becoming less available over time, and more so in the north than in the south. Whether this is a result of wildlife declines or of reduced hunting effort or both, remains to be determined.

C.2. Wildlife monitoring

Based on camera-trap data from the Project research in 2019 and 2020, functional and biological diversity were assessed. In terms of functional diversity, camera traps documented a total of 10 species of carnivores, 16 omnivores, 16 herbivores and 5 insectivores (Annex 2). Diversity indices were calculated for all sites (Annex 2). The South Pakaraimas subregion and Deep South villages in the savannah showed the highest species diversity. For every detected species of mammal, bird and reptile, relative abundance and naïve occupancy were also calculated (Annex 2).

The relative abundance index (RAI) tends to overrepresent common species, and underrepresent small and non-terrestrial species, as it does not account for species detection probabilities. Thus, RAI is more of a reflection of the effectiveness of the research design for photographing various species than it is a reflection of true abundance (Sollmann *et al.*, 2013). Species from the

order Rodentia made up approximately 55 percent of the total captures. Agouti had by far the highest RAI. Tapir was most commonly detected during the dry season in the South Pakaraimas and Central Rupununi, and was only absent in Manari. Savannah deer was most common in the north. Armadillo was also common throughout the region, although less so than agouti. Labba was detected and relatively common throughout, in spite of it being less common near villages. Red brocket or bush deer (*Mazama americana*) was common throughout the region, except at Manari, which is also closest to Lethem. White-lipped peccaries were not common, and mostly seen in South Pakaraima. The collared peccary was more common throughout the region, but again not at Manari. The abundance of peccaries, however, seemed to vary seasonally, indicating movements throughout the region. Among predators, the mesocarnivores ocelot (*Leopardus pardalis*) and savannah fox (*Cerdocyon thous*) were most detected.

The Project also compared activity patterns of indicator species at camera-trap sites with regular hunting activity (hunted) and those not exposed to regular hunting activity (non-hunted). Lowland tapir, red brocket deer and labba, all frequently targeted by hunters, showed shifts of approximately 30 percent, 20 percent and 10 percent, respectively, in activity pattern towards increased nocturnal behaviour and/or away from peak human activity and hunting times early in the morning (Hallett *et al.*, 2019). Puma (*Puma concolor*) is not targeted by hunters and is known to be tolerant of human activity. It did not show a discernible shift in activity pattern between hunted and non-hunted sites.

The presence of juveniles under the parental care of females was documented. Timing and duration of parental care documented by camera-trap photos were applied to information about the reproductive biology of species of interest (gestation period, birthing interval, number of offspring, weaning period and parental care) to develop a calendar of critical life events relevant to game management. Months where juveniles of game species were observed in association with adult females are shown in Table 4.

While there are variations between species, peaks in birthing and parental care for many species (red brocket deer, brown brocket deer, labba, agouti, acouchi (*Myoprocta acouchy*), armadillo, powis) coincide with the influx of food produced during the long rainy season. For labba, agouti, acouchi, and armadillo this means that breeding is likely triggered by fruiting events during the short rainy season, which makes the period from December to September the most important in the lives of these species as females conceive (December–January), carry (December–April), birth (May–July) and wean (June–August) their offspring.

For forest deer species, breeding peaks in the dry season (September–November) and females carry their offspring for almost two-thirds of the year before birthing peaks during the long rainy season. White-tailed deer show a reverse trend, with breeding triggered by the long rainy season and birthing occurring during the short rainy season and weaning shortly after. Tapir and both species of peccaries have year-round breeding that is not well known but they seem to be the least affected by climatic events. As fruits make up a large proportion of the tapir's diet, it is unsurprising that major reproductive events also coincide with the influx of these resources. Peccaries feed on a much wider variety of food sources, including roots, insects, reptiles and amphibians. Breeding may respond to annual changes in precipitation, but peccaries are also prolific breeders that may produce offspring multiple times per year. Capybara primarily feed on grass, which makes the survival of their offspring far less tied to annual fruiting events. Nevertheless, peaks in their year-round breeding occur during the rainy season, with birthing occurring just prior to and weaning occurring during the short rainy season.

While seasonal reproduction is restricted to only a few of the key species of game mammals and birds (white-tailed deer, long-nosed armadillo – *Dasypus kappleri*, powis), these seasons overlap with peaks in the reproductive output of many species that reproduce year-round.

Table 4. Months during which young were observed in camera-trap photos in the 2019–2020 Project study as an indication of breeding and parental care time. Peak breeding season was calculated based on these data and reproduction information on the species (indicated in green). Although for some species, breeding coincides with the long or short rainy season, many appear to breed year-round, although some peaks are seen even for those species.

	Light Rains		RAINY SEASON									Light Rains
Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lowland tapir			X				X	X			X	
Red brocket deer	X					X	X		X			
Brown brocket deer				X		X	X	X				
White-tailed deer	X	X										X
White-lipped peccary			X	X								
Collared peccary	X	X	X		X	X	X	X	X			X
Capybara	X					X					X	
Labba		X	X	X	X	X	X	X	X			
Red-rumped agouti	X	X	X	X	X	X	X	X	X	X	X	X
Red acouchi					X	X	X	X				
Giant armadillo												
Long-nosed armadillo						X	X					
9-banded armadillo												
Powis (black curassow)						X	X	X				
Crestless curassow		X	X									

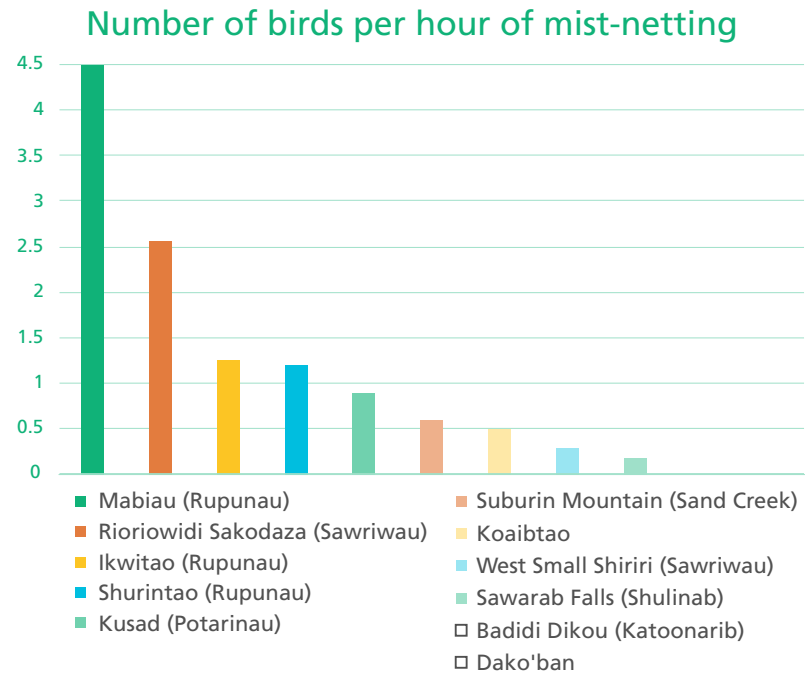
C.3. Monitoring emblematic species from the savannah and bush island ecotones

The giant anteater and the red siskin are emblematic species of the Rupununi. The anteater is listed as vulnerable, whereas the siskin is endangered and has a narrow distributional range. Moreover, both species are a vital part of tourism in the region, with special tours organized to observe the species (see Chapter X). SRCS was founded upon the discovery of the red siskin in the Rupununi in 2003 (Robbins, Braun and Finch, 2003), and has conducted several research projects to establish its range and habitat use. The giant anteater remains a poorly known species and there are no estimates of its population or evaluation of its threats in the region.

The study led by the Project and its local partner SRCS determined through interviews that giant anteaters, a species listed as vulnerable by IUCN, is considered to be under threat in the Rupununi due to sporadic hunting for food by Indigenous people, trade and killing animals out of superstition, indiscriminate burning of vegetation, roads, human pressure on savannah and forest habitat, and climate change. However, these threats have not been quantified. SRCS identified some sites where the species was regularly seen in or near Katoonarib. SRCS also revealed that 88 percent (n = 24) of people consider the anteater potentially dangerous, although typically only when the animal is disturbed or has young. Fear of seeing one at night corresponded with the belief in 'kanaima', where anteaters are people transformed to the animal to trick or kill other humans. All but one person stated that they had not eaten it; consumption of the anteater is taboo among the Wapichan (Roth, 1915). The species is often kept as a pet, and among interviewees, four said they had kept one, three of which had been taken from the mother. To the question about trade of anteaters, most said no, while a few mentioned this happened in the past. Nevertheless, SRCS has heard reports of anteaters sold out of the Rupununi on at least two recent occasions. Either the respondents were unaware of such activities, or, if they were aware, they may not have wished to disclose such information to the interviewers. Most people would care if anteaters were to disappear from their village (88 percent) with tourism and future experiences of children topping the list of reasons why, and were in favour of its research and conservation. SRCS rangers were trained by the Project to set camera traps across Katoonarib, Shulinab, Sawariwau and Wariwau villages. To date 35 giant anteaters have been individually recognized. SRCS in collaboration with the Wapichan Wiizi Wildlife Committee has proposed the delineation of an anteater safe zone over these territories.

Red siskin surveys by the Project team in the South Rupununi resulted in a total of 160 captures (6.4 captures per hour), 51 percent of which were male and 14 of which were juveniles (Figures 16 and 19). These are baseline data that can be used for comparison in future assessments. Individual birds could not be identified, because they do not have natural individual markings and the captured birds were not banded. Locations with the highest capture rates were Mabiau in Rupunau village and Rioriowidi Sakodaza in Sawariwau village (Figure 19). Most captures occurred during the short rainy season (December–January). High capture rates were mostly recorded on rocky outcrops, followed by bush islands (forest patches in savannah) and the forest–savannah ecotone. There was always a high frequency of Kaimbe trees (*Curatella americana*) present at these sites. Although SRCS had already banded 158 birds in the years just prior to this Project activity, none of the birds captured during the Project survey had bands. Re-sightings of red siskins are thus not common. A potential explanation could be that the sample was small in comparison with the actual population. Alternatively, banded siskins could have been captured by trappers, given the reported rise of red siskins being trapped by villagers from

Figure 19. Capture rates (number of birds per hour of mist-netting) of red siskin at different monitoring sites in the South Rupununi. SRCS monitored the endangered red siskin over 256 mist-netting hours resulting in 160 captures total.



the six villages that SRCS is working with under this project. Another explanation is that siskins may have large home ranges and do not often return to the same spot that they were banded. SRCS in collaboration with the WWWC has proposed the implementation of a community-based conservation management zone within the Wapichan Wiizi to permanently protect the red siskin from habitat destruction and illegal wildlife trapping. To do this, the committee decided that further data must first be collected on movements of the red siskin so that an accurate boundary for the conservation zone can be established.

D. Economic importance of the hunting sector

Hunting and fishing are invariably listed among the top five sources of livelihoods throughout the Rupununi, scoring higher in the south (Conservation International Guyana, 2015). Households with an income of less than USD 2 per day consistently depend on traditional practices of hunting, fishing and farming for non-cash income (Conservation International Guyana, 2015). This non-cash income per capita in the Rupununi has been estimated to be almost as much as cash income, USD 482 and USD 513, respectively (Conservation International Guyana, 2015). The total income (cash plus non-cash) per household per year in the Rupununi (USD 6 031/year/household) is therefore three times the national minimum wage (USD 2 100/year/household) (Conservation International Guyana, 2015). Hunting (and fishing) contribute significantly to food security and well-being for the region.

A region-wide survey revealed that 12 percent of households generate income from hunting (Conservation International Guyana, 2015). Some villages are more active in the sale of wild meat if located close to good hunting grounds for commercial species and potential markets (mines, Lethem, forest). Nevertheless, most hunters in the Rupununi consume their catch or share it with family or friends (Conservation International, 2002). The Project survey in the Deep South villages

indicated that 83 percent (n = 77) of surveyed households with hunters consumed at least part of the catch; 51 percent shared wild meat with family or friends, and only 5 percent sold (part of) their catch. Selling within villages is now more common than sharing from community hunts (Conservation International, 2002; Conservation International Guyana and IDB, 2015). The Project's recent data similarly showed that sales within the village were the most common. To sell wild meat to outside markets, hunters transport their prey to Lethem. Around 10 percent of families sells or has sold wildlife (mostly deer, labba and the higher-priced peccary), making an average of USD 317 annually (Conservation International Guyana and IDB, 2015).

Informal interviews by the Project team with hunters suggested that the limiting factors for wild meat to be sold outside of the villages were refrigeration and storing of the meat and accessibility. Meat was typically brought out fresh the day after a night of hunting. Reduced availability of guns and vehicles may also be limiting factors. Those selling wild meat bought from Region 9 on the coast do not live exclusively from wild meat sales, investing a week or less per month in this activity. Their main income comes from other sources, for example, farming, shop ownership and work as a ranger.

A shift in protein sources from wild to domestic has been observed, attributed to the increased availability of packaged foods in shops, a shift to a cash economy with less time to hunt and loss of hunting skills among youth (Conservation International, 2002). Furthermore, gun licences and ammunition are very difficult to obtain, so that hunters often need to rely on traditional methods, which require greater skill and time.

E. Hunting governance setting

E.1. Governance at the national, regional and district levels

At the national level, the GWCMC is the regulating entity for wildlife management. Enforcement of wildlife legislation has long focused on CITES-related international wildlife trade, and the GWCMC is currently making efforts to spread awareness on the new legislation that also includes hunting for national use (for more in-depth analysis of the governance at national level, see Chapter IV).

Wildlife management legislation on Indigenous titled lands, however, falls under the Amerindian Act (Government of Guyana, 1953), and differs from that of the rest of the territory. The Act is overseen by the Ministry of Amerindian Affairs (sometimes called Indigenous Peoples Affairs). It states that within the boundaries of titled lands, those belonging to the village can use traditional practices, which implicitly extends to hunting, fishing and keeping wildlife as pets. When commercialization of fish and wildlife occurs, the activities are subject to national law (Chapter IV). The same is true when non-traditional methods for fishing and hunting are used. Due to lack of definition of "traditional use" and ongoing disputes on the boundaries of titled lands, there is much ambiguity. For example, killing an animal to provide food for the family outside of the titled land but within customary use land would not be permitted by statutory law. Furthermore, waterways are a public good rather than part of titled lands, limiting the rights of Indigenous groups.

The RDC of Region 9 has developed the PARD, which includes environmental aspects, and provides an enabling environment for wildlife management including four main goals: prioritize development and implementation of key regional environmental governance; strengthen monitoring, evaluation and enforcement systems to improve impacts of conservation policies, plans and programmes; establish partnerships and incentives to improve knowledge of environmental systems; test and promote sustainable livelihood models that can meet both development and conservation goals (Regional Democratic Council Region 9, 2019).

The Rupununi has known various initiatives for management and protection of fish and wildlife undertaken by communities or local NGOs consisting of community members (Table 5). In the South Rupununi, SRCS consists of citizens from different villages. Many started as tourist guides in wildlife tourism. They formed an organization originally to study the endangered red siskin, but now fulfil a general role in conservation research, applications and education. In the North Rupununi, Iwokrama plays a similar role. In the north, there is also Caiman House Inc, which leads caiman and turtle conservation and research efforts, and Karanambu Trust, which focuses on giant river otters.

At the district level, overarching Indigenous governing bodies help oversee environmental, social, cultural and economic issues in Region 9. Councils vary between localities in their involvement in overseeing hunting and fishing activities. Overall, the Indigenous communities reflect a desire to conserve areas for fish and wildlife within their territories, requiring laws at national and local scales for the protection and sustainable use of natural resources (Berardi *et al.*, 2013). In the north, NRDDB has received long-term support from Iwokrama International Centre for the development of various wildlife management activities, including environmental education, the development of a fisheries management plan in 2011 and the Arapaima management plan in 2002 (Table 5). In the south, the SRDC guides wildlife management and oversees SCPDA. The Wapichan territory is managed under a general land use management plan developed in 2012, which offers a strong basis for the general management of fish and wildlife resources for 13 villages and 8 communities and details areas for specific use, including agriculture, hunting, fishing, tourism and conservation of wildlife and cultural sites (South Central and South Rupununi Districts Toshaos Councils, 2012). KMCRG co-manages wildlife within the Kanuku Mountains.

E.2. Customary laws at the village level

At the village level, village councils have more direct oversight of wildlife use rules. Hunters can use communal hunting grounds without access restrictions. Owners of 'hunting lines' have prior access rights to the lines they own and other hunters must ask their permission to access and hunt within those areas. Line owners oversee hunting activities within their lines and advise other hunters about activities they should not do. Outsiders are not normally allowed to hunt within the Wapichan territory. If outsiders are seen hunting or using resources over customary lands without prior permission, local traditional authorities or community members shall report this to the Toshao (David *et al.*, 2006). Nevertheless, outsiders can become part of the community through a rights claim secured by family or friendship linkages or marriage with residents of the main villages or satellite communities and homesteads. Once they are approved as part of the community they can hunt and use the resources without any restrictions (David *et al.*, 2006). No permission or licence is required for village members to hunt or access wildlife resources for

personal use or sharing among family and friends. As mentioned before, everyone has the same rights. Nevertheless, wildlife trade is not allowed unless there is an express authorization granted by the village council.

Communities reject the use of some traditional methods that are now applied, such as hunting at night, as poor visibility increases the likelihood of killing pregnant game. They also disapprove the introduction of guns, as this has made it easier to kill larger numbers of animals (Doraisami, 2020). The guidelines developed by Parabara within the Project encourage the use of arrows to avoid scaring away animals with gunshots. In the same way, the guidelines developed by Sawariwau encourage the use of traditional hunting methods (bows and arrows) more often. Maruranau has reduced the use of guns for hunting (Doraisami, 2020).

Under Wapichan customary law, people should not kill water eels, stingrays, anacondas (*Eunectes murinus*) or caiman because this might scare the fish. They cannot kill animals considered as decorative, such as marmoset, giant anteater and golden-hand tamarin monkey (*Saguinus midas*) (South Central and South Rupununi Districts Toshaos Councils, 2012; Paemelaere, 2018). In Maruranau, the village guidelines also specifically state that hunters are not allowed to kill animals that are not eaten, such as the giant anteater and silky (pygmy) anteater (*Cyclopes didactylus*) (Doraisami, 2020). In Sawariwau, animals considered as 'fish-keepers' or predatory species (e.g. anacondas, caiman, eels) are not killed, since it is believed that they help protect and maintain healthy fish populations. There are several taboos around the consumption and harvesting of certain species. Wapichan beliefs caution against the regular consumption of wild meat from particular animals, such as tapir and brown bush deer (*Mazama gouazoubira*) (Gomes and Wilson, 2012). After the birth of a child, dietary restrictions are imposed on the household until the infant reaches a certain age designated by the shaman. The periods of dietary restrictions vary according to different species. For instance, the period of abstinence may be short for the two peccary species and longer for animals with stronger spirits such as the *sowai* (brown bush deer). Some animals are believed to have supernaturally high levels of spiritual powers, such as anacondas and land camoudi (*Constrictor constrictor*). Anyone killing these species is subject to the revenge of their spirits and thus they are avoided (Henfrey, 2002).

Breeding grounds are protected under the 2012 Wapichan Management Plan. In the same way, the guidelines developed by Sawariwau within the Project prohibit hunting in multiplying grounds (Doraisami, 2020). The Wapichan have established customary rules to avoid the establishment of hunting grounds near sensitive places and sacred areas (Gomes, 2012). Quotas are not established under Wapichan law; however, community members can hunt only what they will consume. Taboos also reinforce this rule as Wapichan believe that the spirit keepers of the animals "feel hurt" when their children are wasted or tormented (David *et al.*, 2006).

Under Wapichan law, large kills cannot be carried out during high waters. Village councils can decide to set up a closed season over an area, or ban hunting until animal numbers increase, if hunters identify that a place does not have enough game (South Central and South Rupununi Districts Toshaos Councils, 2012). Rules on seasons have also been established in the guidelines developed by each community under the Project. In Parabara, hunters cannot hunt labba when they are pregnant (usually from January to April). They cannot hunt pregnant deer (usually in the rainy months of April, May and June) (Doraisami, 2020). The Project has also supported communities in the development of a hunting calendar according to their customary rules and traditional knowledge.

Table 5. Fish and wildlife projects in the Rupununi prior to the start of the Project.

Project	Year	Institutions	Objectives	Successes/failures*
The Guiana Shield Initiative (GSI)	2000–current	United Nations Development Programme; Netherlands Committee for IUCN Governments: Guyana (GFC), Suriname (The National Institute for Environment and Development) French Guiana (Direction de l'Environnement de l'Aménagement et du Logement de Guyane), Colombia (von Humboldt Institute), Brazil (Amazonas State Secretary of Environment and Sustainable Development)	Promote ecologically, socially and economically sustainable management in the region. set up a sustainable financial mechanism for the Guiana Shield	
Iwokrama Resource Use Agreements		Iwokrama, NRDDB	Manage resources in buffer zone between communities and Iwokrama reserve	
Arapaima management plan (North Rupununi District Development Board, 2002)	2002	NRDDB	Promote recovery of Arapaima	Arapaima counts. Quota set. Recovery seen. Poor enforcement, lack of support.
Surama Village bird trapping regulations	1990s	Surama village	Regulate bird trapping and shift to tourism	
Surama land use regulations		Surama village	Boost wildlife for tourism	
Giant otter rehabilitation	70s–2016	Karanambu Trust	Raise and release orphaned giant otters	Otters released (number?) Fate of released individuals unknown. Awareness (McTurk and Spelman, 2005)?
Fisheries management plan (North Rupununi District Development Board and Iwokrama International Centre for Rainforest Conservation and Development, 2011)	2011	NRDDB	Manage freshwater fish in Rupununi	Plan was written but not implemented.
Sun Parakeet project		Karasabai village	Recover sun parakeet population in Karasabai	Trading ban. Apparent recovery. (Monitoring ongoing?)
Black Caiman Project	2007–current	Caiman House Inc	Monitor caiman populations; increase environmental education	Monitoring and awareness. Population recovery; tourism, income (Pierre, unpublished data)
Red siskin project	Current	SRCS	Monitor red siskin populations in South Rupununi	Population monitoring. Awareness, data for IBA formation, banding, no population estimate.

Project	Year	Institutions	Objectives	Successes/failures*
Turtle project Yupukari – yellow-spotted river turtle	2011–current	Caiman House/ Rupununi Learners Inc.	Increase river turtle population; raise awareness	Nest monitoring. Successful head-starting and release. Awareness. Turtle festival. No measure of population status. Project sustainability challenges.
White-tailed deer hunting restrictions–Toka		Toka village council	Recover dwindling population of white-tailed deer	Temporary ban. Population recovered. Change of Toshao. Current project status unknown.
Katoka Conservation Zone		Katoka village	Support tourism	Needs enforcement.
Massara village conservation area		Massara village		
Simoni Management Plan	2011	Villages fishing and hunting at Simoni Karanambu	Protect the area from overfishing and overhunting	Progress of plan uncertain.
Hunting management		Sawariwau	Avoid overhunting any area within village	Rotation system implemented.
Awariku Management		Yupukari village	Manage fishing to ensure sustainability	Little community support.
"Wa Wiizi"	2012	SCPDA; Forest Peoples Programme	Demonstrate use and management of Indigenous lands (titled and non-titled) in the South Rupununi	Land use mapping and management plan. Village-level detailed plans based on this, e.g. Shulinab fire management. Remaining issues with land titles; no further implementation.
By-Laws for the Management of Natural Resources	2005	Darwin Initiative – Wetlands Partnership: NRDDB, Iwokrama, the University of Guyana, Wildfowl & Wetlands Trust; EPA; Royal Holloway University; The Open University	Manage the North Rupununi adaptively to promote stakeholder engagement in setting goals and activities	Research on North Rupununi Wetlands; stakeholder meetings; series of documents produced.
Inland fisheries management plan	2015	Ministry of Agriculture	Start to manage fisheries in Guyana's freshwater sources	Draft concept written.
Participatory, Intercultural Fire Management Network			Adapt traditional fire management actions to more closely reflect current climate realities	
Management research by others	2007–current	Rupununi Wildlife Research Unit; Project Fauna, Panthera	Research locally relevant wildlife management issues	Baselines for wildlife populations; training field technicians; awareness/ education.
Community Monitoring and Verification Programme (cMRV)	2012	NRDDB, Norwegian Agency for Development Cooperation, Google Cloud Platform, Iwokrama, GFC; Second project: World Wildlife Fund, Conservation International	Develop a community-based system to monitor and manage natural resources; focus on carbon stock	Capacity building; data contributed to GFC report on carbon for REDD+

*Only included where information was available

F. Lessons learnt, recommendations and first actions put in place

F.1. Lessons learnt and recommendations

- Hunting in the Rupununi contributes to food security of Indigenous communities. It continues to be part of local livelihoods despite the introduction of livestock rearing, the increased access to industrial foods in the last few decades and changes in traditional lifestyles.
- Hunting in the Rupununi by Indigenous Peoples seems sustainable for most species and is mostly practised with bows and arrows. Nevertheless, changes in hunting techniques, habitat degradation due to road development and increased access, mining, increased size of villages and farms associated with population growth, as well as fires set outside the recommended burning seasons and locations put additional pressure on wildlife populations. In the future, the potential transformation of wild savannahs into large agribusiness production areas, as is already the case on the Brazilian border, may further contribute to reduce wild habitats and compromise the sustainability of hunting. Species that are perceived as having reduced in numbers include savannah deer, tortoise, capybara and armadillo. There is also concern for white-lipped peccary and tapir. Popular wild meat species that can continue to be harvested at current levels for consumption, provided some monitoring occurs, are labba, agouti and bush deer.
- Access to markets and changes in lifestyles are reducing interest in hunting by the younger generation and increase the consumption of industrial and processed meats.
- Environmental education in the region has played an important role in promoting sustainable practices and is successful because of the incorporation of both traditional and scientific knowledge in awareness raising.

Figure 20. Education activities. The Project identified education as one of the key elements of sustainable wildlife management now and into the future. ©SRCS/Neal Millar

- Overall, camera-trap data produced during the Project Large Mammal Monitoring Programme confirm that Indigenous titled lands in the Rupununi region remain a stronghold for a suite of large and medium-sized mammals native to the Guiana Shield. Gallery forests and savannahs support stable populations of a relatively low number of species during the rainy season. However, during the dry season these habitats serve as corridors and stepping-stones for forest species dispersing between large, forested habitats like the Iwokrama Forest and Kanuku Mountains to adjacent habitats in the Pakaraima Mountains and Roraima State, Brazil. South Pakaraimas has been identified as an area rich in wildlife, perhaps due to the presence of a variety of a habitat types (savannah, wetland, upland forest) in an area with greater restrictions to access due to the rugged terrain. The RAIs of nearly all hunted species were higher at non-hunted sites when compared with hunted sites, but the largest differences in RAI were shown in those species that have a greater predisposition to overhunting, species such as lowland tapir and deer.
- Limiting the harvest of adult females while pregnant, nursing and caring for their young has long been recognized as the most important action to sustain game populations under harvest. Timing of pregnancies guides seasonal hunting restrictions for both sexes in species with limited sexual dimorphism. Findings from the Project Large Mammal Monitoring programme suggest that, while a number of key game species breed year-round, peaks in important breeding and birthing events coincide with annual fruiting events in the short (December) and long (May–August) Rupununi fruiting seasons. To sustain populations of game species under harvest, restrictions on the harvest of females would best be focused on the period from December to August for labba, agouti, acouchi, armadillo and powis, and potentially October/November to August for red and brown brocket deer. These periods of restricted harvest of females would also support populations of year-round breeders such as white-lipped and collared peccaries. For white-tailed deer, restrictions on the harvest of females are best focused from May/June to February/March.
- Current hunting seasons do not correspond to recommendations based on camera-trap data for some species, such as armadillo and bush deer. For some commonly hunted species, no hunting seasons exist, such as for labba and agouti, but these seem to breed year-round. Incorporating Indigenous knowledge in the development of seasonal restrictions is recommended.
- Red siskins require a specific habitat with Kaimbe trees (*Curatella americana*) and a mix of savannah, trees and rocky outcrops. The low recapture rate and increase in reports of illegal trapping of the bird require further research. The restricted habitat availability and potential threat from illegal harvest warrants additional protection of this bird.

F.2. First actions

Since 2018, village monitors in the different districts of the Rupununi have been trained by the Project in camera-trapping methods. This has been done through various training sessions that aim to build capacity throughout the region in monitoring species that are important for local livelihoods through tourism and nutrition. It means that people from the villages can be employed in research activities. A camera-trapping module was created to that effect. In total, 45 men and 8 women from Indigenous villages participated in eight training sessions. Of those,

26 participated in the camera-trap research activity together with an additional 39 persons who also received training in the field or had been trained previously.

Similarly, anteater monitoring is ongoing through transects and camera trapping. The team has already recorded 35 individuals. It has also observed tree-climbing behaviour that is poorly understood, but appears to happen mostly during the night.

Environmental education has been identified by the Project as key to supporting sustainable practices and preparing younger generations for a more sustainable world (Figure 20). The Project supports environmental education through two environmental education plans, developed by NRDDB for North Rupununi, and by SRCS in South Rupununi (Figure 21). The environmental education programmes promote passion in Rupununi students for their environment and wildlife, as well as best practices. They also enhance the youth's knowledge and skills on wildlife conservation and sustainable use. In the north, the themes are large mammals, fish and fisheries management, river turtles, birds, fire, and leadership and career skills. The programmes are implemented through six village-level wildlife clubs (96 children). In 2019, NRDDB visited 19 schools to explain and introduce the concepts of sustainable use (347 children) and carried out two working sessions with six community-led wildlife club coordinators who mentor their clubs. A radio programme developed by the NRDDB Project team features monthly bilingual segments on fisheries and sustainable resource use and is regularly broadcast by the locally run radio station, Radio Paiomak. Copies of material are also sent to the National Communications Network for further national distribution. In 2020, a *Handbook for Wildlife Clubs* was developed to cover a diversity of themes related to sustainable use, including club administration, taxonomy, wildlife monitoring skills and data analysis. In South Rupununi, a curriculum called "My Rupununi and Me" was developed to cover a diversity of themes related to the environment and wildlife. Through SRCS, the Project is working closely with governmental education services to support the incorporation of those themes into the school curriculum. In 2019, SRCS piloted its Environmental Education Curriculum in four schools (Shea Primary, Sand Creek Secondary, Shulinab Primary and Kumu Primary). A total of 104 children participated (Figure 22). The curriculum consists of 27 classes and is split over three terms. In 2020, SRCS promoted sustainable wildlife-use practices through a radio programme and developed extracurricular activities to encourage youth to learn about traditional practices (crafting of bows and arrows, traditional use of and stories about animals and plants, etc.; Figure 23).

In 2019, with support from the Project, the SRDC established the WWWC in charge of the strategic planning of wildlife management activities within the Wapichan territory. The objectives of the committee are to: promote the care, conservation and sustainable management of wildlife species and habitats across Wapichan Wiizi; network with communities and local groups to take special action to protect and conserve rare and endangered species; raise public awareness through activities that promote the conservation and sustainable management of wildlife; promote the use of traditional knowledge in conservation and sustainable management of wildlife; empower communities to make informed wildlife management decisions through studies of species with high conservation value; explore wildlife livelihood opportunities; recognize communities' conserved areas for the protection of wildlife and fragile ecosystems; and identify the importance of key wildlife species to the well-being of our ecosystems. By empowering communities and their district-level organizations to collect and analyse critically important data, the Project is supporting land extension claims by Amerindian communities.

Figure 21. The Project's locations for education initiatives. The Project has education activities in the North and South Rupununi, developed and implemented by local partners NRDDB through wildlife clubs and SRCS through the school curriculum, respectively. Education has been identified as key to supporting sustainable practices.

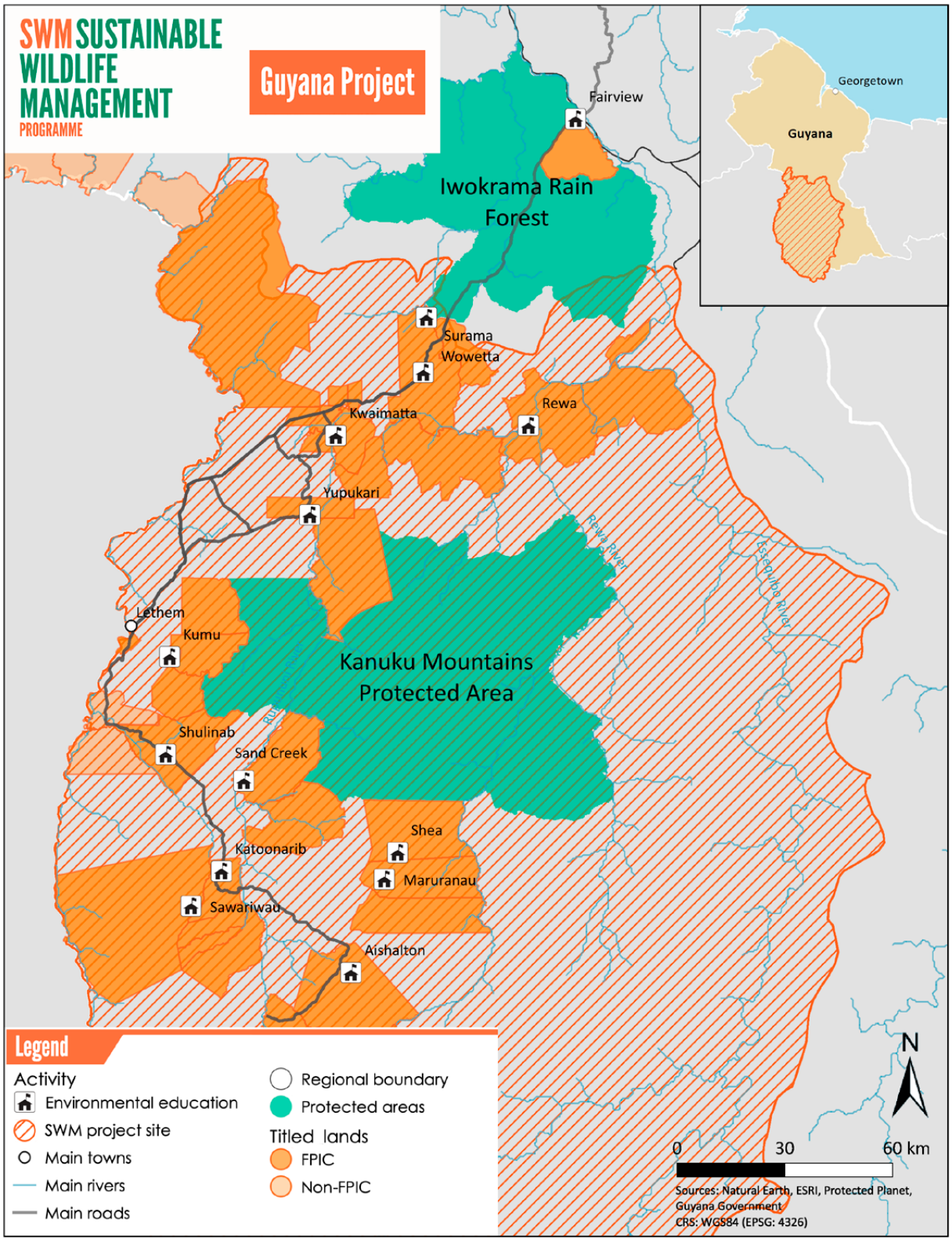


Figure 22. The South Rupununi Conservation Society. SRCS is one of the Project's partners in Guyana. They have developed an environmental and cultural education curriculum implemented already in pilot schools. They are also part of wildlife monitoring (giant anteaters, red siskin, fire).

In 2019, the outreach team from the Wapichan Wildlife Committee developed two posters on the Wapichan Seasonal Calendar (Figure 24) and Wapichan customary norms (Figure 25) related to sustainable wildlife management. They also carried out awareness raising on the role of the WWWC and on its mandate in eight villages. In 2020, the first village-level wildlife guidelines were developed in eight pilot villages: Aishalton, Awarewaunau, Potarinau, Katoonarib, Maruranau, Parabara, Sawariwau, and Shea. These guidelines may become village-level rules in the future.

A biodiversity survey of a culturally important mountain in the Karawaimen Tawaa area is planned to support the protection of this area from mining expansion. With an approximate extent of 480 km^2, this special site includes the Karawaimen Mountain and its associated lowlands. This area is not under the jurisdiction of any village council but falls under Aishalton's proposed land title extension. It protects a portion of the headwaters of a major tributary of the Essequibo River, and its ecosystem provides critical resources for local communities. More generally, as it is a relatively undisturbed lowland tropical forest ecosystem, it should harbour exceptional biodiversity across many taxonomic groups. Several Indigenous communities adjacent to Karawaimen Taawa are heavily dependent on its natural resources for basic livelihoods: farming, gathering, hunting, collecting medicine and so forth. The southern part of the Karawaimen Taawa area is currently subject to active and increasing deforestation rates linked to mining activities.

A district-level wildlife management plan covering the Wapichan territory will be developed to provide coherence and synergies between those different wildlife management and conservation activities.

Figure 23. Local information dissemination. The Project communicates updates and information on sustainable wildlife management practices through regional radio stations, one of the main means of communication in the Rupununi where internet and phone signals are still limited. ©FAO/Nathalie van Vliet

In order to start creating a network to share experiences and benefit from lessons learnt in other countries from the region, the Project organized a community representative meeting in Aishalton (8–10 September 2019) with representatives from Guyana, French Guiana, Suriname, Brazil, Colombia and Peru (Figure 26; Melville, 2019a). The group produced a community voices document translated into four languages and presented at the International Union for Conservation of Nature/Sustainable Use and Livelihoods Specialist Group (IUCN/SULi) conference in Lima in October 2019 and at the Illegal Wildlife Trade conference for Latin America and the Caribbean regions (Melville, 2019b). Existing community-led experiences for the management of wildlife show that successful management is based on the following four fundamental principles, as determined by the Indigenous representative group at the IUCN/SULi meeting in Peru, 2019: (1) land security, (2) unity and self-organization, (3) legal recognition, and (4) co-management and network. The document calls for governments to recognize and respect security of land rights for Indigenous and traditional peoples and to amend existing legislation and policies to support and recognize customary laws and traditional knowledge on hunting, use of natural resources and importance of traditional territories for wildlife conservation. The document also calls for governments and the international community to increase their support for locally driven sustainable hunting initiatives, particularly through technical support and financial resources for monitoring and management.

Figure 24. Traditional hunting and resource management calendar of Wapishana People (South Rupununi).

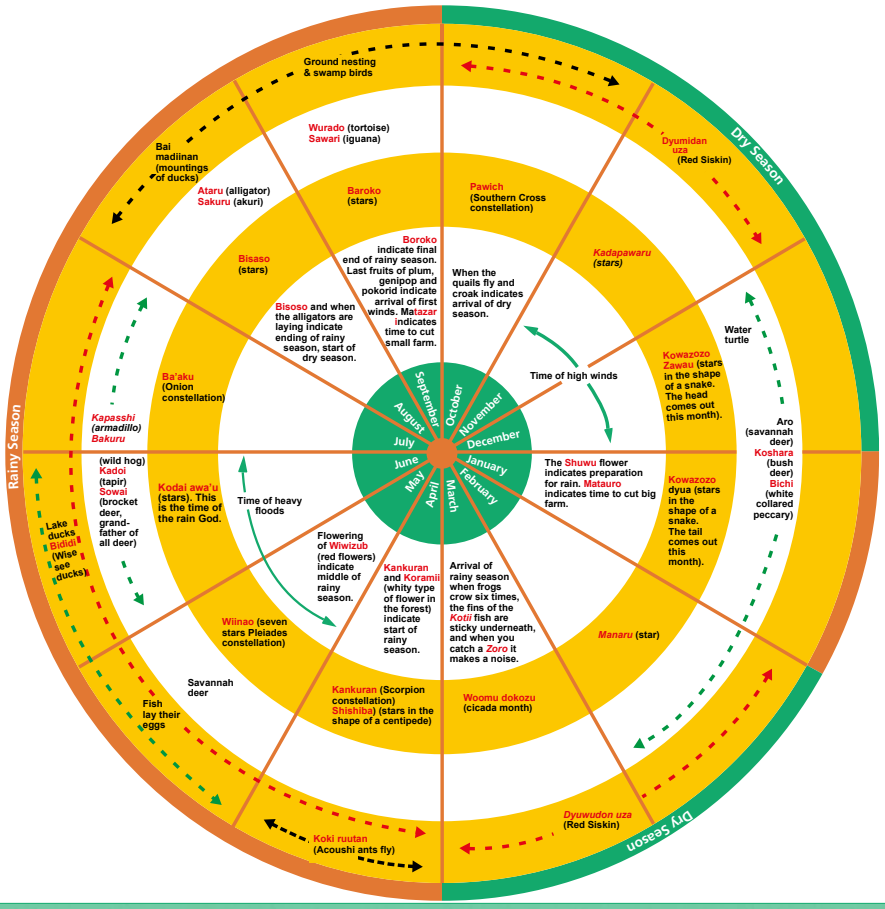


Figure 25. Wapichan Customary Law in English and Waphishana.

Aonaa pukaiwa'ana'o amazada mapidankiaka. Aonaa maitapinakadaun man.
You must not use the land foolishly. You must not use without knowing

The Wapichan people strongly believe that our traditional resource use is sustainable. Our forefathers have lived on these lands since time immemorial and our natural environment is still intact and healthy today.

Ma'ozaka wapichannao mishidan ikaiwaan na'a'oraz naa aimaakankida imi'i baara an kaimanaiman, atii kai pakawan nai'iki ziwu aimaakankida mashaapan.

Some of our customary norms which promote the sustainable use of resources are:
Wakaduzu waikiwaa kinaa na'a'ora'a naa wawiizi aimaakankida:

- Pukaiwaa amazada kotu'ainao kaiwaan kawan **"Use the land as the ancestors did"**
- Aonaa pusha'apata'ana'a madiwautapaka **"Do not act without reason"**
- Puwa'aka kaiman wiizai ana'o amaakankida wadauniinao ati'o nii **"Leave resources in a good state for those generations that "come behind"**

TIWAAPAKARU: "HUNTING"

- Aonaa puba'ia'ana'a ka'azootina'o wunui **"Do not shoot pregnant game"**
- **Puzowii pu'aiapa nii na'iki punikan ni'o "Kill only what you need and can consume (hunt only when there is no meat)"**
- Aonaa puba'ia'ana bichinao kuo ikodiipan don **"Do not shoot the ikuo "leader" of a moving group of bichi "bush hogs"**

KOPAUTAPAKARU: "FISHING"

- Puzaamata soo punikan nii karikaonan **"Only catch what you can eat and use"**
- Mana'a pu'okota'ana'a yarunaakida, nii tuzakizai, nii kaokopakizai baoko kida **"Do not poison deep pools nor drinking and bathing waters"**
- Zaida'o kida kopau aonaa kizi izaamatakao sawaiko ida'an, nii kizi i'okotakao, nii kizi isairotakao **"Fish moving upstream to spawn should not be trapped, poisoned or netted"**

ZAKAPUAPAKARU: "FARMING"

- Aonaa puwakuda'ana'a amazada (pubaroo puka'iitan kawan ati pupaowan) **"Do not waste the land (Cut only enough for your capacity and needs)"**
- Puparauda puzakapun danom pudanamaitan ua'ii puzakapun **"Sweep around the field before burning"**

ZOWAIDAPKARU "GATHERING" (CONSTRUCTION, CRAFT, FRUITS ETC): KABAUNU ATAMUNUZINAAKIDA, TUZUUKARU NI'O DIZOOKARUKADUKIDA, KASHORO NI'O

- Puwa'akata pa'inaakida'o usodan (dyuukida'o pusa'uka) **"Leave the young shoots (take mature plants)"**
- Pu'abatanaka zii aitapa'o dyuwu dau'o **"Consult with one who knows"**

Monitoring terrestrial wildlife populations in the Rupununi will continue. The protocol to establish the baseline will be repeated towards the end of the Project as part of the wildlife population evaluation. In the meantime, additional camera-trapping and transect surveys are taking place for the monitoring and behavioural research of giant anteaters by SRCS (see Chapters IX, X); 14 cameras had been used for about 400 trap nights to monitor and count anteater populations and now 42 cameras have been added. Their red siskin research also continues. The area of land monitored by the Project and SRCS for flagship species (red siskin and giant anteater) thus far is about 150 000 ha. SRCS continued household surveys with local residents in four villages on local perceptions of anteaters, sightings, local knowledge, possible threats, behaviour and known locations.

Figure 26. International meeting on sustainable wildlife management in the Rupununi, supported by the Project. Representatives from Guyana, Suriname, French Guiana, Brazil, Colombia and Peru shared experiences and developed a document in all participating languages for presentation at the 2019 IUCN/SULi conference in Peru. ©FAO/Nathalie van Vliet

©Brent Stirton/Getty Images for FAO, CIRAD, CIFOR and WCS

Summary

Fish is a very important protein source among Indigenous Peoples. Fish constitutes 60 percent of animal protein in the diet of the North Rupununi tribe, the Makushi. Among the Indigenous population, fishing is often undertaken by men, but women also fish, with most households engaging in this activity. Hook and lines are the most important fishing method nowadays, followed by the traditional bow and arrow fishing. Seines and cast nets are now also commonly used. During the rainy season (April–August), there is less fishing due to flooding of rivers and creeks causing fish populations to be more dispersed. Out of a total of 343 fish species recorded in the Rupununi drainage, between 70 and 100 species (groups) are consumed by the Makushi. River turtles, typically considered part of fisheries, are a preferred species for their meat and eggs, but are also used for other products. Prior to the Project, several efforts had been put in place to ensure that fishing remains sustainable. The Project actions build upon existing efforts and support NRDDB in developing a simple and enforceable management plan. This includes a monitoring system for fisheries in the Rupununi. In addition, the Project also supports turtle conservation efforts in situ (in the south) and ex situ (in the north).

VI. THE FISHING SYSTEM

Deirdre Jafferally[1], Samantha Meiwa James[2], Elford Liverpool[3], Neal Millar[4], Kevin Edwards[5], Evi AD Paemelaere[6], Nathalie van Vliet[7]

[1] NRDDB, Guyana, deirdre.jafferally@gmail.com
[2] NRDDB, Guyana, samantha.meiwa@gmail.com
[3] University of Guyana, Guyana, elfordliverpool@gmail.com
[4] SRCS, Guyana, srcs.rupununi@gmail.com
[5] NRDDB, Guyana, kevinedwards868@gmail.com
[6] CIFOR, Colombia, pwsolutions.main@gmail.com
[7] CIFOR, Colombia, nathalievanvliet@yahoo.com

Materials and methods

The data presented are based on a detailed review of published and grey literature, combined with research conducted by the Project during Years 1 and 2 on subsistence and, to some extent, commercial fishing and fish consumption. Data on fish consumption have been collected in all communities of the North Rupununi covering 787 households in 2019–2021. Fishing and consumption by these households is being monitored, and some of the preliminary results of these, up to December 2020, are reported here. Additionally, results are presented from 67 supermarket managers interviewed in the North Rupununi to better understand the market chain and availability of fish. Follow-up consumption surveys are ongoing with North Rupununi households to assess current fishing behaviour with questions on frequency of fishing, distance travelled, species, destination of fish caught and gear used (Figure 27). Detailed methods on assessing fish consumption, sales and fish stock are described in the internal report by Jafferally (2018).

Interviews on river turtle consumption were conducted with 35 people from Yupukari village by Caiman House team members. Questions addressed knowledge on the turtle conservation activities, which started in 2011, and questions about consumption and harvest.

A. Fishers and fishing practices

Among the Indigenous population, fishing for subsistence and commercial purposes is often carried out by men, but women also fish (Conservation International Guyana and IDB, 2015). The Project surveys found only 10.1 percent of women engaged in fishing. Most households engage in this activity, at least occasionally. Different fishing methods are used to catch different fish. Traditionally, fish are hunted with bows and arrows (Figure 28), a practice that still exists. At certain times of the year, when river levels allow, fishers hold their breath and dive to feel for catfish, which live in holes in rocks or wood; the fish are removed by hand. Other diving techniques include spear fishing. The use of plant poison, which asphyxiates animals in the water in temporarily dammed pools, is also a traditional method applied to pools in rivers. Kumani balls, another plant poison, are tossed into fast-flowing water where the pellets are eaten by fish. Temporarily deprived of oxygen, the fish float to the surface and the fisher must dive and swim to catch the stunned prey before it recovers. The use of poison is now discouraged in the

Figure 27. Map of fish and fish consumption survey sites. The Project supports NRDDB in conducting surveys on fishing, fish consumption and fish sale as part of the implementation of the fisheries management plan for the North Rupununi.

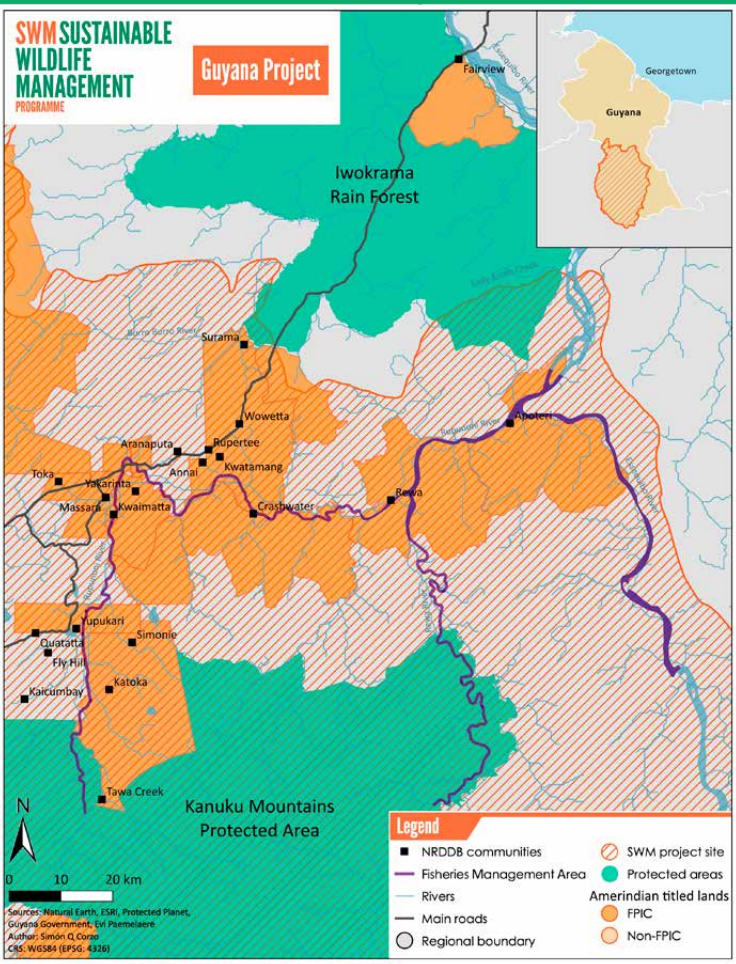


Figure 28. Traditional fishing with bows and arrows is still a common practice in the Rupununi; traditional traps and poison are also still used. ©Brent Stirton/Getty Images for FAO, CIFOR, CIRAD, WCS

Figure 29. Cast nets and handlines are commonly used among Indigenous Peoples in the Rupununi. ©FAO/Quadad de Freitas

north (North Rupununi District Development Board and Iwokrama International Centre for Rainforest Conservation and Development, 2011), and there is a call for strict regulation in the South (South Central and South Rupununi Districts Toshaos Councils, 2012). An overview of fish poisons for north-west Guyana is described by van Andel (2000). which likely has much overlap with poisons used in the Rupununi. Another method for fishing is shining light at the edges of water bodies at night to locate fish and killing them with a cutlass. Spring traps with rods and woven fish traps are also used, as well as stop offs made with logs which may be set in barriers across creeks.

Cast nets, seines and hook-and-line fishing are now commonly used (Figure 29). Cast nets, in particular, serve for gathering fish from ponds drying out at the end of the rainy season. Seines are increasingly used for both subsistence and commercial purposes to increase the number of fish caught. Another common method is cadel, similar to long lines used in marine fishing where a series of hooks are tied to a main line and dropped into the waterbody with floaters. Fishing rods are more commonly used by visiting sports fishers, but rods made from slim, flexible yari yari trees (Chrysobalanaceae) are often used to catch small fish. Trolling (dragging a baited fishing line behind a boat) targets large predatory fish, such as baiara (*Hydrolycus armatus*), lukunani (*Cichla ocellaris*), black piranha (*Serrasalmus rhombeus*), sword fish (*Boulengerella cuvieri*), and Pimelodidae catfishes (often called 'skin fish').

The Project's 2020 surveys in North Rupununi highlighted the growing popularity of seines, with 61 percent of households owning a nylon one and 9 percent of households one made of twine. Most households owned a hook and line (96.3 percent). Many households (68 percent) also owned a bow and arrows. A canoe (dugout) was owned by 46 percent of households, while only 12 percent owned a boat with an engine. Fishing sites were reached by walking or riding a bike to a water source and fishing from the shore.

During the rainy season (April–August), fishing decreases as rivers and creeks extend into the forest and savannah, which flood almost entirely, and fish populations become more widespread. This affects which species are caught. Fishing increases at the beginning of the rainy season, when fish migrate to spawn, and at the end, when water retreats and fish remain in drying pools. Fishing is often carried out at night to avoid catching piranha, which can damage fishing lines.

Fishing is conducted in rivers, creeks, (oxbow) lakes and (seasonal) ponds. In villages surrounding the Kanuku Mountains, creeks are the most popular water bodies for fishing, followed by rivers and ponds (Conservation International, 2002). The Project survey showed that for the North Rupununi, the river is the main fishing location for households (79 percent), followed by ponds (63 percent) and creeks (31 percent). Rivers provide much larger catches of greater diversity, although fishing in ponds is common. Historically, taboos restricted fishing in certain locations, mostly ponds. Similarly, there used to be taboos around certain fish; for example, arapaima, cullet (*Pseudoplatystoma* spp.) and lau lau catfish. But, at least for Makushi, most of these restrictions have disappeared.

Generally, subsistence fishing occurs in water bodies closest to the homestead or farming sites. Because the village is typically dispersed, there tends to be some separation in fishing location between community members (Ingwall-King, 2013). Nevertheless, fishing trips may lead to other locations near or far from the village. For commercial purposes, fishermen tend to move away further from the village (Ingwall-King, 2013), although the 2020 project data did not show such a pattern. Families on subsistence fishing trips select preferred spots where certain fish can be targeted, often lukunani, but also arowana (*Osteoglossum bicirrhosum*), among others. Sports fishing by outsiders occurs in a few very specific locations in the Rupununi River, the Essequibo River around Apoteri, and up the Rewa River.

B. Offtake levels

Fish is an important subsistence protein but is also caught to sell as a source of income. Fish is more important than wildlife in terms of food security for the three peoples in the Rupununi. Fish increased in importance after the 1960s when livestock production declined (North Rupununi District Development Board and Iwokrama International Centre for Rainforest Conservation and Development, 2011). Among the Makushi, 80 percent identified fish as an important ecosystem service, whereas only 30 percent felt the same about wildlife and hunting. Among the Wai Wai and Wapichan, fish ranked highest in importance of protein resources in both younger and older generations (Fredericks, Buckley and Persaud, 2016).

Of the 343 fish species recorded in the Rupununi drainage (De Souza, Armbruster and Werneke, 2012), between 70 and 100 species (groups) are consumed by the Makushi (Conservation International, 2002; Conservation International Guyana and IDB, 2015), but 10 species make up more than 70 percent of the fish catch (Table 6). Several fish species are seasonal, such as pacu (*Myleus pacu*), cartabac (*Myloplus* sp., *Myleus* sp., *Pristobrycon* sp.) and dare (*Leporinus* sp.). The top five fish species caught in the North Rupununi is similar between the wet and dry seasons, except for huri (*Hoplias malabaricus*; most common in the dry season) and imehri (*Trachycorystes* sp.; most common in the rainy season). In both seasons, baiara provided the

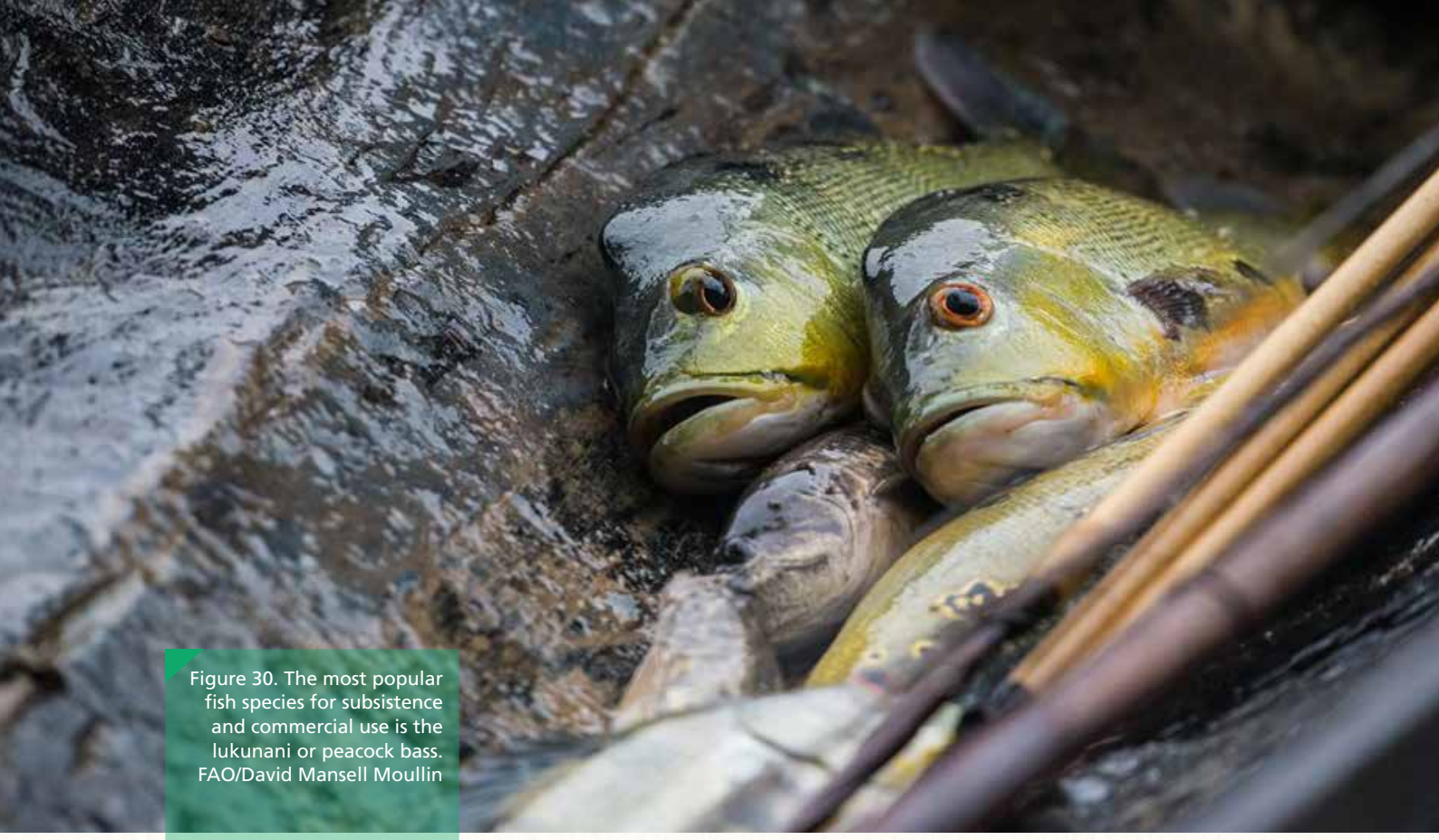


Figure 30. The most popular fish species for subsistence and commercial use is the lukunani or peacock bass. FAO/David Mansell Moullin

highest biomass. Species used as bait include: serebe (*Astyanax* sp.), sau sau (*Curimata* sp.) and redtail fish (*Chalceus macrolepidotus*). Piranha may also be cut to be used as bait (authors, pers. obs.). Makushi prefer lukunani and arowana for their taste, although the latter is not a common catch. Haimara (*Hoplias aimara*) and yakutu (*Prochilodus rubrotaeniatus*) are also popular for consumption (Conservation International, 2002). The fish commonly sold in markets are basha (*Plagioscion squamosissimus*), haimara, yakutu, tiger fish (*Pseudoplatystoma fasciatum*), arapaima, baiara, huri, lukunani and pacu (Conservation International, 2002). A total of 31 species were listed as targets for commercial fishing in the North Rupununi during the 2020 interviews. The most commonly sought out species was lukunani (Figure 30), followed by pacu, haimara, tiger fish, baiara and pakupa basha. Dawalu (*Ageneiosus inermis*), cullet, amuri, cartabac and arowana were also targeted by more than 10 percent of commercial fishermen (Table 6). Grocery stores interviewed as part of the Project in the Rupununi also listed lukunani as a favourite among sellers, with 75 percent listing the species as preferred, followed by tiger fish and basha, with 40 percent and 29 percent, respectively (n = 55).

Wai Wai focus on about 20 species of fish from the Essequibo headwaters (Alonso *et al.*, 2008), including haimara, tiger fish, Kururú (*Curimata cyprinoides*), and cartabac pacu (*Myleus rhomboidalis*). These most commonly consumed species differ from what is caught in the Rupununi River and the North Rupununi Wetlands due to the different terrestrial and aquatic habitats; haimara are confined to flowing, black water creeks and cartabac pacu prefer fast-flowing, deep, black water rivers, but may migrate up the Rupununi River during the rainy season.

Consumption of fish differs considerably between villages. With the exception of Annai, villages along the Georgetown–Lethem Road catch less fish than others (Wetlands Partnership, 2006). This may reflect access to alternative protein sources. In fact, fish catch decreases downriver along the Rupununi River from Yupukari (Wetlands Partnership, 2006).

Table 6. Most commonly caught fish in the North Rupununi based on the study by the Project and on previous research (Ingwall-King, 2013)*, which also found that the top ten represent over 70 percent of total catch.*

Common name	Scientific name	Comments
lukunani	*Cichla ocellaris*	Ranked highest in taste preference; arowana came second (but not caught often due to declines). Also popular for commercial purposes, within Guyana and internationally.
ihmeri (black)	*Trachycorystes* spp.	Rainy season (requires diving in dry season, which is not commonly practised).
huri	*Hoplias malabaricus*	Dry season; hides in savannah during rainy season.
baiara	*Hydrolycus armatus*	Also high ranking for commercial use.
patwa	*Cichlasoma bimaculatum*	Other species with similar names include: *Geophagus* sp., *Satanoperca* sp., *Guianacara dacrya* and smaller size species, such as *Apistogramma* sp., *Aequidens* sp..
daray	*Leporinus sp.*	
tiger fish	*Pseudoplatystoma fasciatum*	Also popular for commercial purposes, within Guyana and internationally.
dawalu	*Ageneiosus inermis*	
piranha (red-bellied, black)	*Pygocentrus natteri*, *Serrasalmus rhombeus*	Red-bellied piranha is an easy catch, staple, but not preferred for taste.
takutu	*Prochilodus rubrotaeniatus*	
basha	*Plagioscion squamosissimus*	More popular for commercial purposes.
serebe	*Astyanax sp.*	Bait fish only.

Fishing effort in the Rupununi increases in the rainy season but catch per unit effort decreases due to floods (Ingwall-King, 2013), which is consistent with the 2020 data showing little variation in total catch between seasons. Using data from the Wetlands Partnership (Wetlands Partnership, 2006), the annual fish catch for the North Rupununi was calculated at 137–290 tonnes, not including the village of Katoka. This translates into 27–64 kg per person annually, ranging within estimates for protein consumption by other sources (FAO, 2018, 2020). The Project's fish consumption data showed that this high fish consumption has not changed, with 50.7 kg of fish eaten per person annually. Per capita monthly fish consumption in the dry season was about two to three times the consumption during the rainy season, from data in Mistry *et al.* (2004) and Ingwall-King (2013).

Aside from fish, freshwater river turtles are considered part of fisheries by the 1966 Aquatic Regulations. Due to their large size, two species are hunted: the giant river turtle (*Podocnemis expansa*) and the yellow-spotted river turtle (*Podocnemis unifilis*), which is listed as vulnerable by IUCN. The carapace of large, old, river turtles (*P. expansa*) can measure up to 75–80 cm, but these specimens are rarer due to overharvesting and recent unseasonable flooding of nesting sand banks and nests. Due to overharvesting, giant river turtles are now only found in remote areas of the Essequibo and Rewa rivers and were not considered during the Project's work in Yupukari and Sand Creek as they no longer appear there. Turtle meat and eggs are rich in fat and river turtles are considered a delicacy. They are ranked among preferred species for consumption by some (Read *et al.*, 2013a, 2013b). Their oil is also rendered and the plastron is used to make spindles for spinning cotton (NRDDB, 2000).

Turtles and their eggs are typically harvested during fishing trips in the dry season when sandbanks for laying eggs are exposed from December to March. Considering this coincides with Christmas and Easter celebrations, the speciality of the harvest is recognized for celebratory meals. The Project surveys confirmed that the majority of people in Yupukari harvested river turtles at Christmas time (74 percent, *n* = 35) and/or in the dry season in general (34 percent, *n* = 35). Similarly, SRCS reported that the consumption of river turtle meat is a cultural tradition, and in Sand Creek village, South Rupununi, every Christmas an unofficial "turtle feast" is organized where villagers hunt for river turtles and try to secure as many as possible for consumption. In the Central and South Rupununi, the species most commonly consumed is the yellow-spotted river turtle (*Podocnemis unifilis*), because the giant river turtle is no longer found there (authors, pers. obs.). Of the villagers interviewed, only 23 percent admitted to ever eating turtle meat. Among consumers, all agreed they were eating less turtle meat now than in the past, although no time reference was provided. Six out of eight consumers harvested turtles for food, and only one to sell. All those agreed that this was a once-a-year event. Methods used to catch the turtles included hook, bows and arrows, or nets. They may also be caught by jumping on them and turning them upside down, and sometimes they are bycatch in fishing nets.

C. Ecology and population status of fished species

Although fish populations have not been specifically monitored, with the exception of the arapaima, most communities agree that fish populations have declined in the Rupununi. Decreased catches, the need to travel further to be successful and a change in species caught are all indicators that fish populations are indeed in decline. These perceptions are further confirmed by the size of fish caught; large sizes were less common in fish surveys, indicating high pressure (Ingwall-King, 2013). Reduced size in fish further leads to the need for increasing numbers of smaller fish to be caught to meet protein needs. Since the 2013 publication by Ingwall-King, drought and increased commercial fishing have caused further declines, expressed by many fishermen finding it difficult to catch anything (Panthera Guyana, 2015). A study completed 10 years earlier did not see an immediate impact on fish (Mistry *et al.*, 2004), although around the same time villagers had expressed the need to go further to fish and that fish availability had changed, mentioning various species of concern (Conservation International, 2002). Among Wai

Wai in the KAPA, a 2008 report states there were some local declines in haimara near the village and potential future threats to tiger fish (Alonso *et al.*, 2008); by 2011, both species, along with four others, were considered threatened by the Wai Wai (Alonso, Persaud and Williams, 2016). Species mentioned to be of concern in various sources are listed in Table 7.

The yellow-spotted Amazon river turtle is listed as vulnerable by IUCN. The Project surveys indicated that consumption of the species has decreased, although this is not necessarily only because of changes in availability. SRCS reported that over the past few decades, this species has gone from being a common sighting to one that is notably in decline, based on discussions with local residents and confirmed by the authors. The suspected reasons for the decline in turtles are overharvesting of eggs during the nesting season, overharvesting of meat and also harvesting of shells, as is well-known by the villagers.

Table 7. Fish species of concern in the Rupununi (Alonso, Persaud and Williams, 2016; Conservation International, 2002; Conservation International Guyana, 2014a; Panthera Guyana, 2015) due to potentially unsustainable harvest locally or regionally. These species have shown declines and/or experience threats that, under the current circumstances, can be expected to increase, rendering harvest unsustainable. Species threatened only by factors not related to harvesting are not included here.

Species	Common Name	North Rupununi	South Rupununi	Deep South/ Wai Wai
Cichla ocellaris	lukunani/peacock bass	X	X	X
Arapaima gigas	arapaima	X	X	?
Osteoglossum bicirrhosum	arowana	X	X	X
Perrunichthys perruno	tiger fish	?	X	X
Ageneiosus inermis	dawalu			X
Boulengerella cuvieri	swordfish/mori			X
Hoplias macrophthalmus	haimara	X		X
Plagioscion squamosissimus	basha	X		
Pseudoplatystoma spp.	cullet (short and long headed)	X		

D. Economic importance of the fishing sector

Fish in the Rupununi are an important subsistence protein source, but also offer income through the sale of fish, mostly locally, and through fishing trips offered by the private and community-based Rupununi tourism industry. Fish is often shared among friends and family.

Fish constitutes 60 percent of animal protein in the diet of the Makushi in the North Rupununi (Mistry *et al.*, 2004). Luzar *et al.* (2012) came to a similar conclusion, demonstrating that more than half of the households in the Rupununi consume fish as the main source of protein. Fishing occurs frequently, with 15–30 percent of households from villages bordering the Kanuku Mountains fishing daily (Conservation International, 2002), although fishing is most common in the North Rupununi Wetlands. The Project surveys showed that 23 percent of households fish daily, 63 percent weekly, and 12 percent monthly. Only 2 percent have never fished. There was some variation between villages in frequency of fishing, with citizens from riverine communities of Crashwater and Kwaimatta fishing most frequently, with more than 60 percent engaging in this activity daily. The lowest fishing frequency was seen in Surama,

Kwatamang, Aranaputa and Annai with more than 30 percent going only once a month. Proximity to shops and rate of employment may influence subsistence fishing as all of these communities are riverine.

Overall, 29 percent of fishermen sell their fish (Conservation International Guyana, 2015; Henfrey, 2002), mostly within the village. Now, two decades later, the Project survey found that this has not changed, with 27 percent (n = 786) of North Rupununi households selling their fish. Region-wide surveys showed that fishing contributes to income for 28 percent of households (Conservation International Guyana, 2015; Henfrey, 2002). Still, 94 percent of households in the Project surveys caught (some of) their own fish, and 32 percent purchased (some of) the fish they consumed. Although no quantitative data are available on commercial trade, the sale of fish caught by villagers is thought to have increased in the last 5–10 years. Main factors include the improved roads, more access to motorized transportation and the need for more cash income in a cultural shift with limited job opportunities in the region.

The Project surveys showed that most grocery stores in the North Rupununi sell fish (82 percent, n = 67). Most seem to sell less than 50 kg per month (67 percent, n = 39). Fish is typically sold fresh (78 percent of stores, n = 55), but also frozen (45 percent) or salted (42 percent). Canned, smoked and roasted fish are available, but to a lesser extent, with 11 percent, 9 percent and 5 percent of stores selling these. This is also reflected in sales, with last month's fish purchases (at time of interview) being 61 percent fresh (n = 43), followed by 41 percent frozen. Only 21 percent of fish sold is salted. Most stores buy their fish (72 percent, n = 55), whereas 22 percent catch their own, and 5 percent get their supply through both methods. Purchasing of fish for their stocks is mostly opportunistic (78 percent, n = 55). One-fifth of stores has a regular supplier. Those catching their own fish rank among those having opportunistic supplies, although two have regular supplies. Still, most receive fish at least once monthly (68 percent), whereas 36 percent can supply their fish stock daily. For 71 percent of stores, the fish they sold was caught in the water considered part of the same village territory where the store was located. Another 13 percent obtained fish from both their own village and other locations. Only 16 percent of shops sourced their fish from elsewhere. Most sell fish for GYD 600–800 (~USD 3–4) per kg (83 percent, n = 53), others are slightly more expensive at GYD 800–1 000 (~USD 4–5) per kg. Half of the stores selling fish did not sell any in the month prior to the survey, and this was independent of the price.

E. Local governance setting

NRDDB is the representative body for 20 North Rupununi communities. Nevertheless, decisions to implement at the village level are the responsibility of Toshaos (village leaders). In the absence of national inland fisheries legislation or guidelines, the NRDDB developed the first fisheries management plan for the North Rupununi in 2011 through consultations with villages and with support from Iwokrama (North Rupununi District Development Board and Iwokrama International Centre for Rainforest Conservation and Development, 2011). The proposal was very detailed with specific actions, addressing subsistence, commercial and sports fishing. The document called for a permitting system and specific limits in quantities and methodology for fishing. A closed season for each type of fishing was also included. Furthermore, the document called for the protection of specific sites, prohibiting fishing in certain areas where only

ecotourism activities could take place. Regarding aquaculture, the proposal warned against the introduction of tilapia and extreme caution if they were introduced; safeguards must be in place to prevent tilapia release into the rivers, where they can damage the local ecosystem and its native fish population. Although the formulation of the fisheries plan provided opportunities for awareness raising on sustainability of fisheries and discussion on specific guidelines for this, the plan was never implemented. This may have been because of the complexity of the management measures proposed with too many details and different rules, the lack of adequate human resources with the capacity to coordinate the implementation of the fisheries management plan, the lack of active involvement of village leaders for enforcement, or the absence of a formal agreement with the Guyana Fisheries Department.

F. Lessons learnt, recommendations and first actions put in place

F.1. Lessons learnt

- Fish is the most important source of protein in the Rupununi.
- Fishing is clearly a seasonal activity: there is more fishing during the dry season, particularly when waters go up and fish travel upstream to spawn (April) and when waters go down at the end of the rainy season (September).

Figure 31. Fisheries management. In the North Rupununi, NRDDB had developed fisheries management plans between 2000 and 2011, but these were hampered by a lack of resources. The Project has supported implementation of this plan through dissemination of simplified guidelines, awareness activities, and fish and fish consumption monitoring. ©Brent Stirton/Getty Images for FAO, CIFOR, CIRAD, WCS

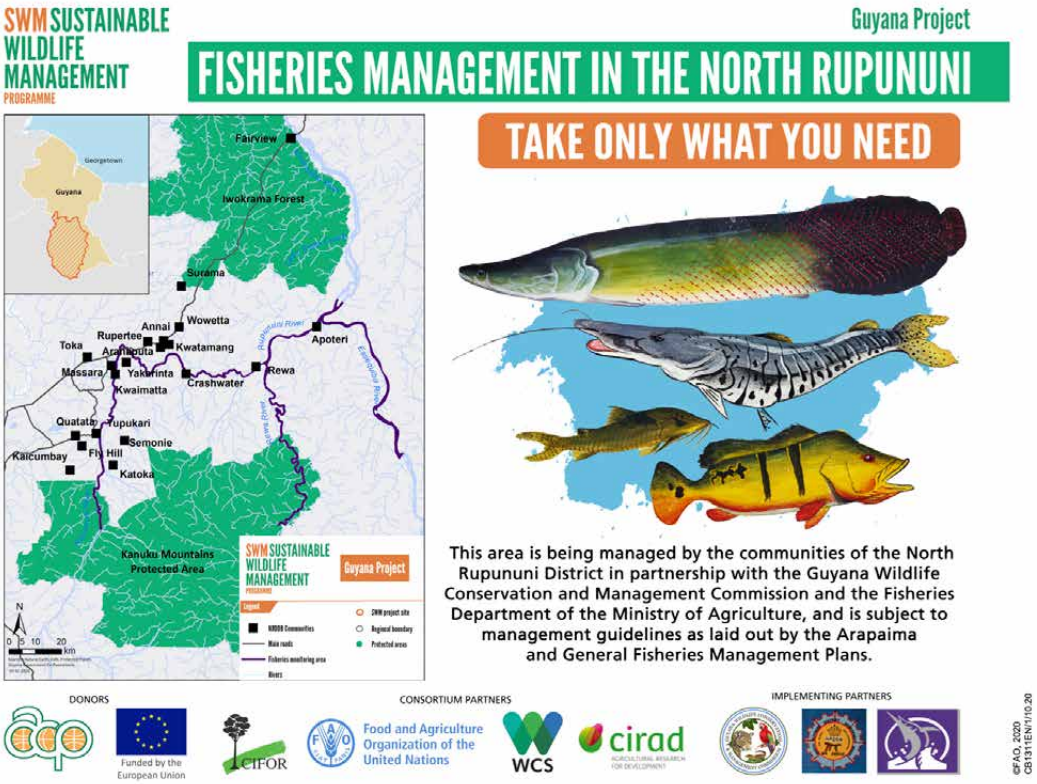
- The NRDDB drafted a fisheries management plan in 2011 but never implemented it. This raised awareness about the need for more sustainable practices (Figure 31). One of the major lessons learnt was that a closer collaboration among villages and between villages and the Fisheries Department was needed to ensure buy-in and support with know-how and resources in the implementation process. Furthermore, the rules proposed under the previous plan were very detailed, which added complexity and made enforcement very complicated and costly.
- Yellow-spotted river turtles are in decline, in part because of the overharvest of adults and eggs: some conservation efforts have started in the Rupununi but require further support.
- Giant river turtles have declined and they no longer exist near the communities who are now involved in turtle conservation. Conservation of this species could be addressed in Rewa village where the species still lives.

F.2. First actions

The Project builds on past experience and efforts in the sustainable fisheries sector in the Rupununi. It takes advantage of the existing governance set-up and the existing draft fisheries management plan at NRDDB. In 2018, with support from the Project, NRDDB developed a simplified version of the management plan, which includes a simple set of guidelines for sustainable fishing, establishes a comprehensive monitoring system and involves village Toshaos and leaders in river patrols for awareness raising and enforcement (Figure 32). A team of four people is employed full-time in the implementation of this updated version of the management plans. Project representatives signed a Memorandum of Understanding with the Fisheries Department to ensure that lessons learnt by NRDDB can be used to develop the inland fisheries policy and regulations. Capacity-building sessions were organized to train the NRDDB team on fisheries management and develop a monitoring protocol. A training course on the use of KoboCollect to develop survey forms and collect and analyse data was organized. In 2019, the implementation of the plan began with awareness raising about fisheries management in all 20 NRDDB communities. Copies of a simplified management plan and a poster presenting it were disseminated. Information about the implementation of the management plan was also shared on local radio, and monthly radio productions about different aspects of fisheries management are now produced. River patrols started in February 2020 and are carried out monthly. Sport fishing and fish trade in local grocery stores are also being monitored monthly. A first fish stock assessment was carried out in September 2021 at high waters and will be repeated in low water season in March 2021, together with a specific arapaima count. Capacity building and awareness raising represent an important component of the fisheries management plan. An environmental education session, including sustainable fisheries aspects was implemented in 17 primary schools for 471 children to introduce the concepts of sustainable fishing. An environmental education curriculum was developed for six wildlife clubs covering different themes, including fish and fisheries management. In addition, a fisheries curriculum for students at the technical school of Bina Hill was developed.

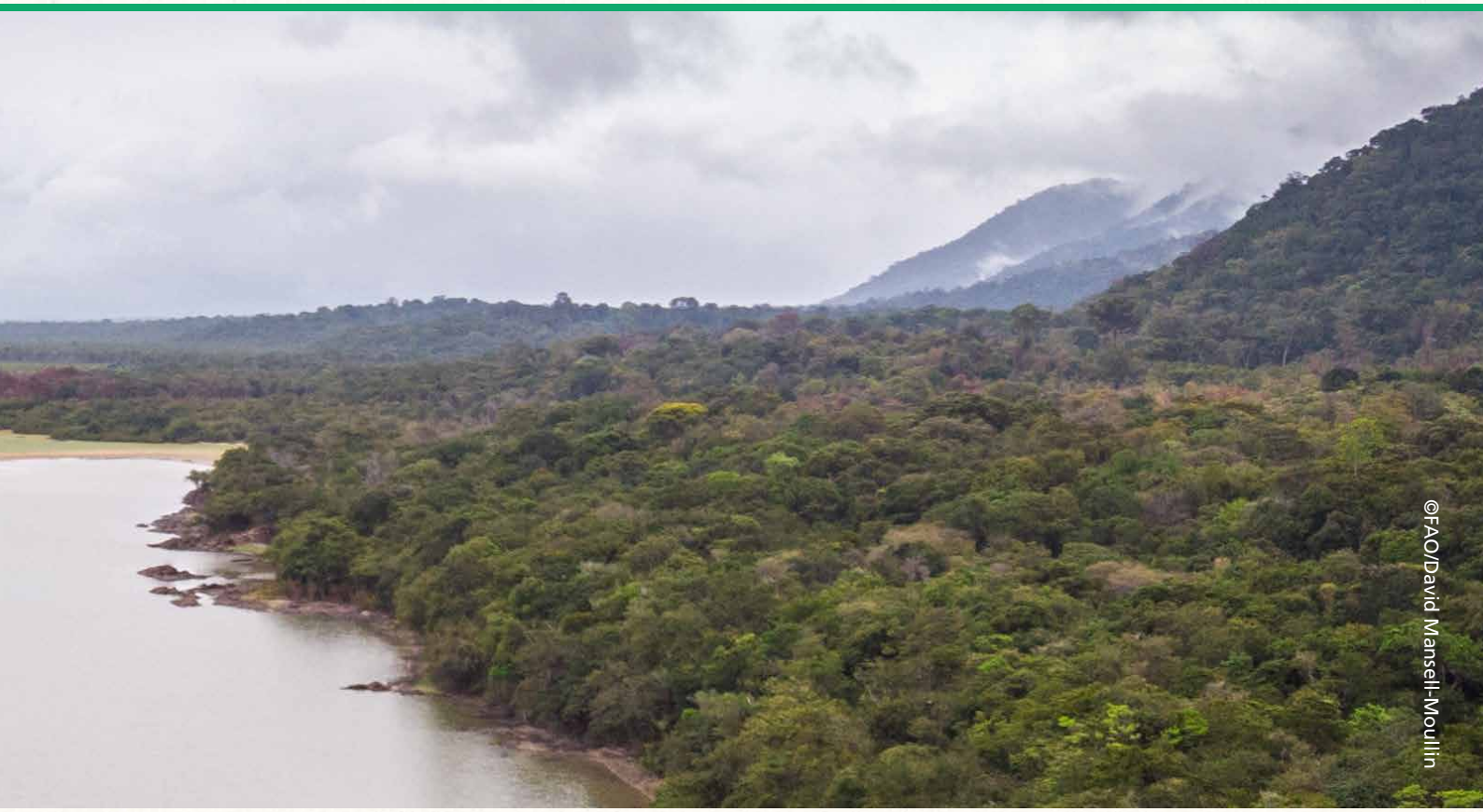
The Project and SRCS have partnered to monitor the yellow-spotted river turtle population in the South Rupununi. A monitoring plan has been developed focused on the Sand Creek village area, where nesting beaches are known and harvesting of turtles and eggs is common (Figure 33).

Figure 32. The Project is supporting NRDDB with awareness on sustainable fisheries in the Rupununi.



The Project supported river turtle conservation efforts by Caiman House Inc in Yupukari. With the Project's support they are monitoring turtles and nesting beaches and have improved the equipment of their hatching facilities. The Project also supports the Turtle Festival, which is an environmental education event happening on a yearly basis since 2012, where recently hatched turtles are released into the wild by the children of different communities from all the Rupununi region. Additional environmental activities are also organized over a one- or two-day event, making it one of the most popular wildlife festivals in the region. In 2019, the Project supported different activities at this festival where children learnt how to set camera traps and retrieve the data, went on bird observation tours to identify different bird species, and participated in an experimental class on black caimans.

Figure 33. Turtle conservation efforts. The Project is supporting monitoring and sustainable management of the vulnerable yellow-spotted river turtle, a species in decline. The meat of this turtle and its eggs are typically consumed around Christmas, particularly in villages near nesting beaches along the Rupununi River. ©SRCS/Chung Liu



Summary

Wild meat is common throughout Guyana, in urban as well as in rural areas. The coastal region with the highest concentration of human populations has the highest demand for wild meat harvested in the interior. Labba and deer are wild meat favourites throughout the country, whereas iguana and capybara are more popular along the coast as commercial species. Half of the vendors on the coast obtain their meat directly from hunters, while the other half hunts themselves. In the Rupununi, Indigenous hunters will sell (part of) their catch on an irregular basis to vendors, and commercial use is much less common than on the coast. Prices of wild meat vary widely, being equal to or only slightly more expensive than domestic meat sources. Prices of meals prepared with wild meat are not necessarily different from those with domestic meat. Wild meat vendors on the coast sell because it is a traditional family business, or because they enjoy their business, but most do not depend on these sales for their full income. Consumers associate wild meat with tradition and culture or family. A survey to assess wild meat handling and conservation practices was carried out to provide baseline information for the development of a draft food safety manual. Collaborations for analysis of micro-bacterial and virological content in wild meat are currently being developed between the Project and the Caribbean Centre for Biosecurity Studies in Trinidad and Tobago.

VII. URBAN CONSUMPTION AND TRADE PATTERNS OF WILD MEAT

Anupana Puran[1], Jose Zammett[2], Michele Singh[3], Evi AD Paemelaere[4], Nathalie van Vliet[5]
[1] Protected Areas Commission, anupanapuran@gmail.com
[2] CIFOR, jzammett92@gmail.com
[3] CARDI, Trinidad and Tobago, michele.singh@gmail.com
[4] CIFOR, Colombia, pwsolutions.main@gmail.com
[5] CIFOR, Colombia, nathalievanvliet@yahoo.com

Materials and methods

Wild meat consumption and trade in urban areas: The baseline review report considered existing literature on wild meat and fish consumption and trade. To complement the existing information, the Project conducted a wild meat value chain analysis in the Rupununi and on the coast (Puran 2019; Paemelaere 2020), which constitutes the most populated region of Guyana and therefore the largest demand hub. Structured and unstructured surveys were conducted with key actors in the value chain, which further indicated source and destination of their products to help complete the value chain. Interviewees included commercial and subsistence wild meat consumers at sell points and households, vendors and hunters in the Rupununi region. Detailed interviews were conducted in four villages in the South Rupununi that are also part of a wildlife management pilot: Aishalton, Karaudarnau, Sawariwau and Katoonarib. On the coast, the Project team interviewed vendors and consumers. Vendors included markets, restaurants and bars. During restrictions posed by the COVID-19 pandemic in 2020, these interviews were continued by phone and through an online form shared in a snowball system, and methods were updated to incorporate the impact of COVID-19 on hunting. Questions addressed quantities, species, costs of purchase and sale, source and destination of wild meat, values of wildlife, attitude towards farmed wild meat and personal values associated with lifestyle decision-making, as well as potential changes in behaviour and attitudes due to the pandemic caused by a zoonosis.

Animal and human health: The Project carried out a survey among wild meat vendors on the coast to understand wild meat conservation and handling practices. Surveys were first conducted with registered wild meat vendors listed by the GWCMC. The KoboCollect structured questionnaire included questions about the general wild meat trade and safety practices, such as preservation techniques, transportation and spoilage of meat. The Project complemented the study with additional surveys carried out in key trading locations and sites chosen in major markets, meat shops, restaurants and other small businesses (bars or small shops) to access most wild meat vendors and hunters involved in the wild meat trade along the coast, since not all wild meat vendors operate their business through a public venue (market, meat shop, restaurant, etc.). The Project team also conducted interviews with wild meat vendors who carry out their sales from their homes because of security concerns and the availability of the meat. Out of the 83 vendors identified, 73 were interviewed.

A. Wild meat consumed in Lethem and on the urban coast of Guyana

A.1. Coastal urban areas

Wild meat consumption on the coast is common; more than 60 percent of the population consumes wild meat (Puran, 2015; Puran and Paemelaere, 2017; Figure 34). In a smaller resampling, the Project's surveys in 2020 found 56 percent of the population consume wild meat. On the other hand, frequency of consumption is low, and wild meat only constitutes a minor portion of the coastal diet. For Region 4, the most populated region of Guyana including the capital Georgetown, the amount of wild meat consumed reached an estimated minimum of 625 tonnes or 1.2 kg per person annually. Compared with general meat consumption patterns, this would mean less than 4 percent of meat consumption or an estimated 1 percent of total animal protein. Men consume twice as much wild meat as women (Paemelaere and Puran, 2017); the Project showed that nearly 70 percent of men ate wild meat, whereas for women this dropped to 44 percent. This is linked to cultural and labour factors, with men often working in the extractive industry based in the interior or socializing with male companions over "cutters" (small roasted pieces of wild meat or other meat) and drinks. Most consumers in Region 4 obtain wild meat from the markets, and to a lesser extent from hunters, who sell or gift the meat; a small percentage hunt their own (Puran, 2015; Puran and Paemelaere, 2017).

Consumption and sales occur openly, because the wild meat trade is still unregulated in Guyana, despite recent decrees regulating the trade through a licensing system that is currently moving into its awareness and implementation phase. Labba and peccary (*Pecari tajacu* or *Tayassu pecari*) are among the most commonly consumed along the coast, together with iguana, capybara (*Hydrochoerus hydrochaeris)* and deer of unspecified species (Paemelaere and Puran, 2017; Puran and Paemelaere, 2017). Alongside these, tapir, powis, caiman (*Caiman crocodilus*) and turtles and tortoises (Cheloniidae) score high in preferences (Paemelaere, 2012). Along the Georgetown–Berbice road, sale of agouti can commonly be observed.

The Project surveys on the coast revealed that all wild meat consumers chose wild meat because of its taste; a few added that they consumed it for a change in flavour or as an exotic meat, or that it was healthy. Most consume wild meat at special events, particularly Christmas and birthdays. Wild meat was mainly consumed at home, closely followed by gatherings with friends or family, and at heritage celebrations (September). In general, consumers mentioned that they felt good about eating wild meat. A handful of people felt it should not be eaten, without stating a reason, or mentioning religion. Nearly 10 percent mentioned some level of concern for wildlife populations, and one person voiced health concerns due to potential disease from the animals. A couple of people also pointed at the importance of wild meat for their heritage, even if not consumed regularly.

A.2. Lethem

Among the consumers interviewed by the Project in Lethem, 65 percent consumed wild meat (n = 100), although most consumed it only a few times a year and this was similar among men and women. Frequency of wild meat consumption was low. Most consumers ate it a few times a year or on special occasions (83 percent, n = 65), such as heritage (September), birthdays and Christmas.

Figure 34. Wild meat. Consumption and sales of wild meat occur throughout Guyana. The coastal area, due to its human population size, has the largest demand for wild meat. While many people purchase their wild meat, hunting or gifts from friends are still common ways to obtain the occasional wild meat. ©Brent Stirton/ Getty Images for FAO, CIFOR, CIRAD, WCS.

Two people consumed wild meat almost weekly, and 14 percent consumed monthly. In a similar study conducted 5 years earlier, the overall proportion of consumers was higher (75 percent of the interviewees) (Paemelaere and Puran, 2020). Among those consuming wild meat monthly or weekly, 56 percent said that the availability of wild meat was a limiting factor to consumption. Limited access was also mentioned by 60 percent of the interviewees from Lethem in the 2015 study as the limiting factor to consuming wild meat (Paemelaere and Puran, 2020).

In Lethem, consumers interviewed by the Project associated wild meat with a healthy diet, because of the absence of chemicals and the variety it offered (Figure 35). They expressed enjoyment, with links to childhood memories, although many also expressed concern for animals and wildlife populations. Various consumers associated wild meat with tradition and culture. A few mentioned having allergies to wild meat or other related health concerns ("disease"). When asked about memories associated with wild meat in Lethem, most non-wild meat consumers (n = 18) associated a sense of sadness related to care for wildlife, a sense of fear and health concerns. Among wild meat consumers, the majority associated happiness with wild meat. The happy memories were all related to sharing the meals with parents or other family members, or to hunting with a close family member, in their youth. Although sample size was limited, this suggests that a positive association with wild meat is nurtured during childhood.

Fifteen percent of the interviewees stated that there was a hunter in their household. Among consumers, 62 percent know which location the wild meat they consume comes from. Source locations include Deep South, villages bordering the Kanuku Mountains, Apoteri and Annai. Wild meat was principally attained through gifts from family or friends (80 percent, n = 65). Only 12 percent purchased wild meat at a shop or market. In contrast, in the 2015 study, purchase

Figure 35. Value of wild meat in the Rupununi.

was the most common means of obtaining wild meat and only a third received it as a gift (Paemelaere and Puran, 2020). This suggests that the sale of wild meat may have seen a decrease in the last 5 years.

The Project asked Lethem consumers about special events, and 55 percent (*n* = 66 wild meat consumers) ate wild meat at those times, mostly during Indigenous Heritage Month (81 percent, *n* = 36), followed by Christmas. Birthdays and village events, such as sports games, were also popular for wild meat consumption. Surveys among customers at the heritage celebrations showed that the event was mostly attended by Indigenous villagers (63 percent, *n* = 91), followed by Lethem citizens (21 percent), coastal inhabitants (13 percent) and a handful of foreigners. Many participated in the event every year (77 percent, *n* = 52). Most participants consumed wild meat (80 percent, *n* = 84), which was higher than in the urban setting alone. This can be explained by the mix of attendees and the nature of the event. Among consumers, nearly half ate wild meat at least once a month (45 percent). Reasons for never eating wild meat were lack of availability, allergies and dislike. At the 2019 event, however, wild meat consumption was low (19 percent, *n* = 89), even though many had expected to be eating wild meat (70 percent, *n* = 30). Not surprisingly, many were displeased with the availability of wild meat (67 percent, *n* = 30). Agouti, armadillo and labba had each been consumed by half of the interviewees; four had eaten tacoma worm (*Rhynchophorus palmarum*), three powis and one had eaten duck. Most consumers preferred labba (49 percent, *n* = 67) and deer (30 percent). Other favourites were peccary (7 percent), armadillo (6 percent), agouti (3 percent) and tapir (1 percent).

Men mentioned a wider variety of wild meat species they ate compared with women, with on average 5.1 and 3.7 species for men and women, respectively, but this difference was not significant. Among species consumed, bush deer, labba and savannah deer were most common. Powis was consumed more by men than women. The remaining species were listed by only a few consumers. Among wild meat users, 76 percent (*n* = 30) had a species preference, and men showed a wider variety of species in their preference than women. All but one associated preference with taste, followed by texture. One person mentioned a general preference for wild meat because it was considered healthier than commercial meat. Preference corresponded well with the ranking of species consumption, indicating people mostly ate the wild meat they preferred. Comparing data with a similar study in Lethem in 2015, species use and preference show a similar pattern, but the ranking of labba and bush deer was inverted, and tapir ranked as the third preferred and most consumed species, instead of savannah deer (Paemelaere and Puran, 2020).

B. Wild meat trade

B.1. Coastal urban areas

Along the coast, wild meat is sold at market stalls, restaurants, rum bars, traders' homes and other small shops, as well as along the roadside (Figure 36). In the coastal area, the Project has identified 83 wild meat vendors, of which 73 could be interviewed in 2019. Interviews with vendors indicated that the income provided by wild meat sales and the enjoyment of being involved in this trade were the two main motivations for selling wild meat. For a few, they continued this as a traditional family business.

Restaurants along the coast typically purchase from hunters who go on trips to the interior (Sanchez *et al.*, 2016). The Project interviews showed that 51 percent only sold wild meat, while 49 percent were hunters that also acted as vendors. Most vendors and hunters do not depend on wild meat sales as their main source of income, but 15 percent (*n* = 73) do. Wild meat sold along the coast is sourced from various locations around Guyana. Most comes from just outside of the coast and surrounding areas along the mayor rivers that flow from the interior to the coast. Because hunters travel on outboards with coolers full of ice, they can travel long distances into the forest along the major rivers to hunt for commercial purposes. Approximate distance travelled is about 120–160 km by road or river from Georgetown (Sanchez *et al.*, 2016). Linden and the Berbice River are the most frequently mentioned sources of wild meat. According to the Project survey, only five of the interviewed vendors source their wild meat from the Rupununi. Wild meat sold along the coast is typically transported from the hunting site in the interior to the point of sale in vehicles (88 percent), or outboard engine boats (65 percent), which are also the main means for commercial hunting (*n* = 68 vendors). Motorcycles and canoes are also used, but to a lesser extent.

According to the Project survey, the top five species sold are labba, deer (*Mazama* spp.), tapir, peccary (unknown species), and capybara (*Hydrochoerus hydrochaeris*). Iguana and caiman are the only two reptiles, whereas powis is the only bird species. Because vendors do not know which species of peccary, deer, caiman, or armadillo they sell, information is only available for groups of species (Figure 37).

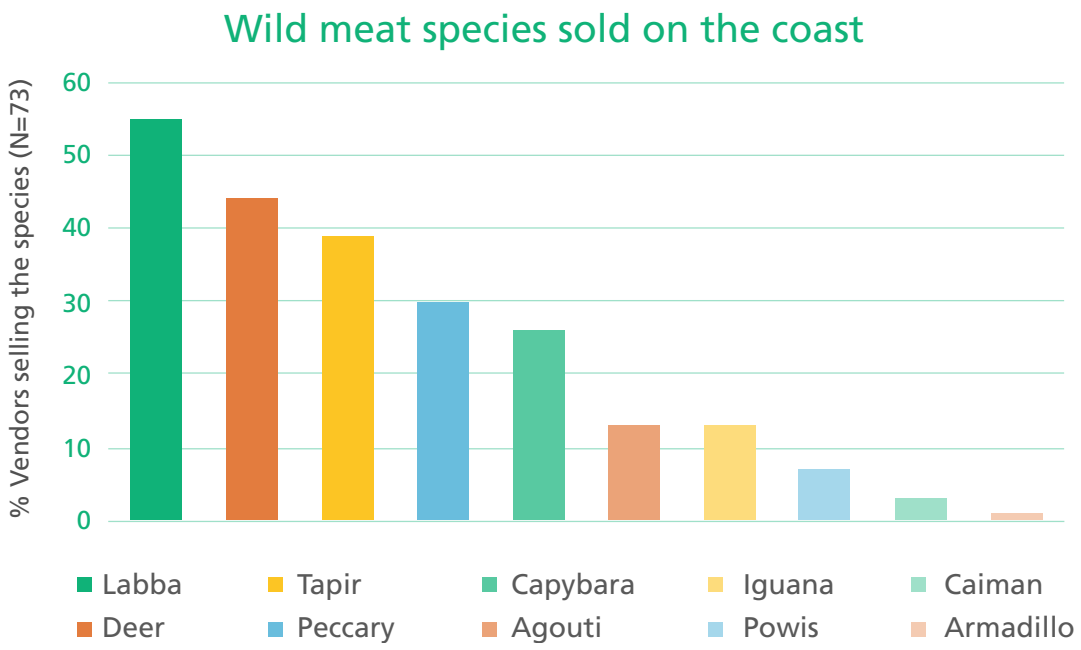
Figure 36. Urban wild meat trade. Wild meat along the coast is commonly sold in restaurants and bars. Prices vary widely and wild meat can be more expensive than domestic meat, but this is not always the case. ©Brent Stirton/Getty Images for FAO, CIFOR, CIRAD, WCS

The Project survey reports an average weight of 15.15 kg of wild meat sold per trader per day. The average number of clients purchasing wild meat per day is eight. When extrapolating these data from 73 vendors to the 83 that had been identified, this results in more than 450 tonnes of wild meat sold per year. If considering that about 60 percent of wild meat consumers purchases their wild meat, whereas others receive it as gifts from hunting (Puran, 2015; Puran and Paemelaere, 2017), this leads to a similar amount of wild meat being consumed by the coastal citizens as was estimated through consumer interviews in a previous study (Puran, 2015; Puran and Paemelaere, 2017). During the months of December (Christmas season, when people require wild meat for pepperpot, a Christmas dish) and August (increase in tourists), sales in wild meat increase drastically. During these high seasons, an average of 63 kg was sold per day.

B.2. Lethem

Although in the Rupununi wild meat remains an important subsistence protein, it is also sold at village markets, and in shops and restaurants along main roads and in Lethem. Some ecotourism lodges also serve wild meat, as do staff kitchens for resource extraction companies. The Project identified 11 wild meat vendors in the region, focusing on public places or village sites with public transport, and not considering village markets only selling to people from the same village. These included one tour operator, one meat shop, two lodges that served wild meat to staff, one family ranch and a lodge serving to both staff and guests, five restaurants/shops, and one mining camp serving to staff. They mostly sell wild meat on an irregular basis. Two additional vendors selling wild meat regularly are no longer active due to stopping hunting; one because of a change in management.

Figure 37. Species sold by wild meat vendors along the coast in Guyana based on the Project's survey of 73 sale points.



Of wild meat vendors, 75 percent has been selling wild meat since the opening of the business, while the others started selling in the last few years. One business had stopped selling wild meat because the customers, mostly foreigners, did not like to eat the animals they could also see in the attached mini zoo. Those that had never sold wild meat stated conservation as the reason; one mentioned lack of availability and two stated it does not sell. Proportionally, fewer eco-lodges sell wild meat compared with other types of vendors. Nearly all (86 percent, *n* = 14) have Guyanese customers from regions other than the Rupununi. Many cater for foreigners from neighbouring countries or elsewhere in the world (71 percent). The least common customers are those from the region (64 percent of businesses) and this dropped further for Indigenous villagers (50 percent).

Species commonly sold by vendors interviewed are armadillo, duck (*Cairina moschata* or *Dendrocygna* sp.), white-lipped peccary, collared peccary, tapir, bush deer (*Mazama* spp.), savannah deer and labba, mirroring results of an earlier study (Conservation International, 2002). The latter two species are the most sold species, with 50 percent and 62.5 percent of businesses selling them (*n* = 8), respectively, either as meat or as prepared meals. None of the businesses sell only wild meat. Wild-caught fish is sold by all but one business, including those not selling wild meat. For domestic meat, beef is sold by all, and chicken and pork are sold by most (93 and 86 percent, respectively, *n* = 14).

Most businesses selling wild meat obtain their products through purchase from hunters from nearby Indigenous villages, except for two that have a staff member who hunts. One community eco-lodge only purchases wild meat from hunters of their own community (Surama). Businesses purchasing the meat have no agreement with any hunter, and they only purchase when the hunters pass through to offer wild meat.

Wildlife is sourced in the native hunting grounds of the village hunters, although further information from the hunters is needed to verify this. Hunters from villages located near the Marudi mining area hunt in the mining area and sell wild meat to workers in the mines. One restaurant along the Georgetown–Lethem Road sells wild meat sourced from neighbouring Region 8.

Wild meat is common during special events, specifically Easter (Rupununi Rodeo), Indigenous Heritage Month (September) and Christmas. During Heritage Month, Indigenous heritage is celebrated with culture, sports and food at events throughout the region. Our interviews suggested that wild meat, although an important part of local culture, may not be a large-scale commercial practice over Heritage Month. Of 27 participating vendors in five villages throughout the region (Aishalton, Shulinab, Kumu, St. Ignatius, Karasabai) during Heritage 2019, only three were selling wild meat. In equal proportions, vendors sold fish, beef, pork and chicken during celebrations. Of those selling wild meat, two were annual participants in the festival, while the other was serving meals for the first time. None sold wild meat every year. The wild meats sold included labba, agouti, armadillo and tacoma worm. They were sold at GYD 500 per meal (~USD 2.5). Meats had been purchased from a local hunter. Only nine responded to the question about reasons behind wild meat availability, and the majority (67 percent) thought that there was limited hunting nowadays, and that pre-ordering was required to ensure availability. The others thought it was available.

The value chain for wild meat is presented in Figure 38. Based on vendor interviews, quantities of wild meat sold or served were low. Except for labba, species were served at rates of less than 4.5 kg per month. For labba, the highest reported quantity was 18 kg per month, which corresponds with 2–4 animals, depending on its size.

A trend in prices could not be established (Table 8). Chicken was by far the cheapest and most available commercial protein throughout the region. Vendors stated in about equal proportions that wild meat had become more expensive or that price had not changed for all the species. Most sellers agreed that the price of beef had increased (75 percent, n = 8). Beef delivered to the mining site by villagers was, naturally, more expensive than beef purchased in the villages, with the cost being 1.7 times higher. The price of chicken showed no trend and appeared to be highly variable. Sales prices of wild meat varied greatly. Dishes prepared with wild meat were slightly more expensive than those prepared with domestic meat, particularly in the north. A meal with domestic meat typically costs GYD 1 000 (~USD 5), while those with wild meat varied in the range of GYD 1 500–1 800 (~USD 7.5–8.5). In the south, no distinction seemed to be made between prices of domestic or wild meat. Restaurants purchased the wild meat at GYD 1 300–1 800/kg (~USD 6.5–8.5/kg), while domestic meat costs around GYD 1 000/kg (~USD 5/kg). Wild meat dishes may thus be less profitable for the businesses.

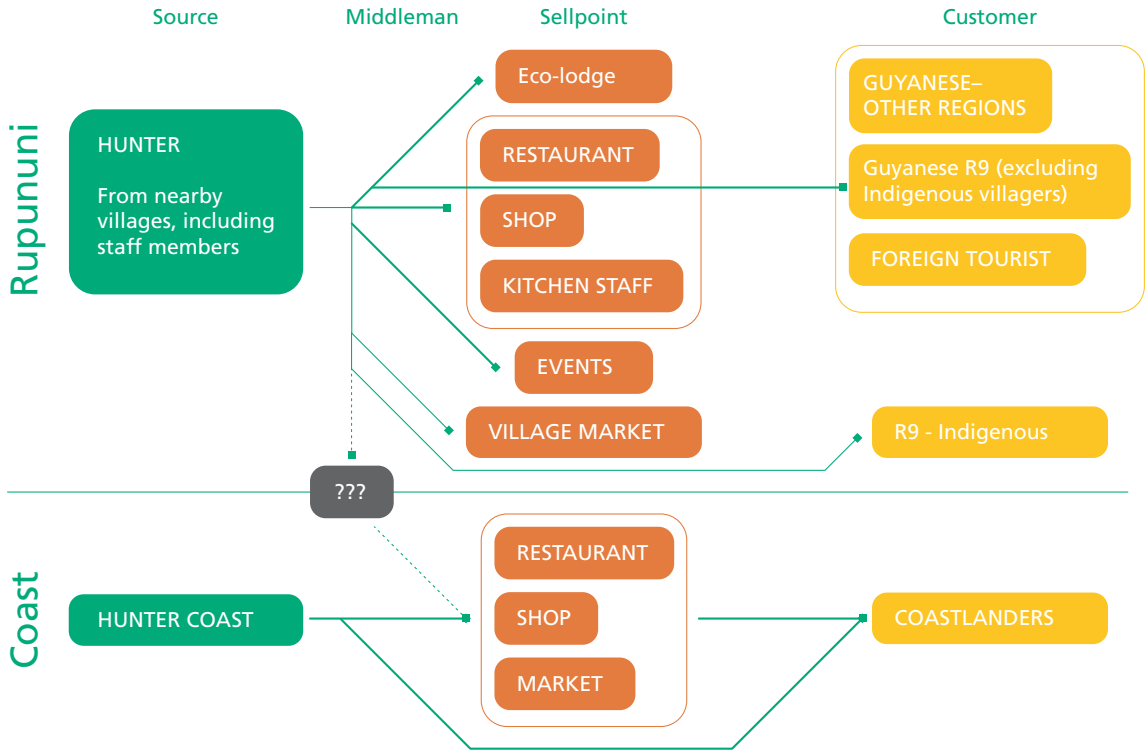


Figure 38. Value chain for wild meat in the Rupununi (Region 9) of Guyana. Customers are listed from most to least common. The value chain is rather direct, from hunter to vendor to customer, without any middlemen involved and, for locals, even the vendors are often skipped in a hunter-to-consumer direct trade, although this is not typically commercial. The thickness of the arrows reflects the approximate level of importance. Dotted arrows indicate an unknown chain. Arrows in grey will be addressed in Year 3.

Table 8. Prices of most commonly sold wild meat and domestic meat, with average (x) in GYD. USD 1 ~GYD 200.

	Species	Scientific name	Purchase price (GYD)	Sales price (GYD)
WILD MEAT	armadillo	*Dasypus spp.*	500/animal	2 200/kg
	bush deer	*Mazama sp.*	1 100–1 800/kg (x=600)	1 500–2 000/meal*
	savannah deer	*Odocoileus cariacou*	660–1 100/kg (x= 400)	1 500–2 000/meal*
	labba	*Cuniculus paca*	1 000–1 500/kg (x=510)	1 000–2 000/meal
	white-lipped peccary	*Tayassu pecari*	1 100/kg	
	collared peccary	*Pecari tajacu*	1 100/kg (x=500)	5 000/meal*
	tapir/bush cow	*Tapirus terrestris*	1 100/kg	5 000/meal*
	duck	*Cairina moschata or Dendrocygna sp.*	1 500/kg	1 200/meal
DOMESTIC	beef butcher purchase price high-end cuts @ restaurant (imported)		800–1 300/kg (x=424) 800–1 000/kg Up to 17 000/kg	1 000-5 000*/meal
	chicken (creole, free ranging higher value)		400–900/kg (x=333)	1 000–5 000*/meal
	pork		700–900/kg (x=355)	1 000–5 000*/meal
	mutton		1 000–1 600/kg (x=575)	1 200/meal

*Prices of GYD 5 000 per meal come from an eco-lodge catering to international tourists. **GYD 200 ~ USD 1

In the mining area, chicken and beef cost GYD 1 100/kg.

In Normandy, wild meat prices were:

- river turtle per animal – 50 REALES ~ GYD 2 800 (~GYD 600/kg including the carapace)
- giant river turtle – 500 REALES ~ GYD 27 900 (~GYD 500/kg including the carapace)
- labba (per animal) – 150 REALES ~ GYD 8 400 (~GYD 800/kg)
- deer – 15 REALES per kg ~ GYD 800/kg
- arapaima salted – 25–30 REALES per kg ~ GYD 1 500/kg

At Marudi, pickled meats sell for ~GYD 1 100/kg)

Box: Wild meat consumption and trade during the COVID-19 pandemic

The Project carried out a follow-up survey with traders in 2020 asking questions about the impacts of COVID-19 on their business. Surveys of consumers on the coast, in Lethem and in four Indigenous communities from South Rupununi were also carried out to assess the impacts of the pandemic on quantities of wild meat consumed, handling practices, awareness of zoonotic diseases, hunting frequency and so forth.

In general, the responses revealed the following trends during the COVID-19 pandemic:

- On the coast, the number of vendors decreased by 76 percent and vendors sold lower volumes of wild meat because restrictions in movement translated into a severe lack of supply.
- Only 58 percent of the consumers on the coast were more aware about the safety of handling and consuming wild meat as a result of the COVID-19 emergency.
- Availability and prices of meats did not change in Lethem, but consumers had more time available and less purchasing power because of the loss of their job. As such, many invested more time in fishing and hunting both as a pastime or as a source of food.
- In remote rural areas, where food security is based on fishing, hunting and farming, and is not dependent on market products, the majority did not change their meat consumption during the pandemic (96 percent). Most interviewees said prices of meats had not changed except for wild meat and fish.

C. Animal and human health

There are no data available in Guyana on the biological pathogens present in wild meat or the zoonotic risks related to wild meat. As an initial step in the development of food safety measures for the handling and conservation of wild meat, the Project carried out a survey among wild meat traders on the coast to understand wild-meat handling, transformation and conservation measures.

Project surveys indicated that most hunters selling wild meat on the coast choose to preserve their wild meat gutted on ice or freshly intact from hunting grounds to sale points (Figures 38 and 39). Fewer people freeze, smoke and salt their meat. On the other hand, the majority of the vendors surveyed on the coast chose to freeze the meat they bought until sold to consumers, while a smaller portion of the interviewees chose to preserve their meat on ice, smoked, salted or intact fresh. The percentage of meat that vendors along the coast lose to bad preservation practices is low. On average only 5 percent of all wild meat sold is lost due to spoilage as a result

of bad preservation. Loss of wild meat is only associated with power outage and only occurs once or twice per year. People in areas without electricity rarely experience losses since they sell their meat fresh or adopt techniques such as salting and smoking.

Wild meat in the Rupununi is typically sold fresh or frozen as well, either as an entire animal or as cuts. Dried wild meat is less common, although for fish, dried salted slabs are typical. Because of limited electricity, wild meat for subsistence use in the Rupununi is typically transported fresh. This may be the underlying reason for limited commercial hunting: ice and fast transportation to sell points are not commonly available.

D. Lessons learnt, recommendations and first actions

D.1. Lessons learnt and recommendations

- Of the total animals identified as part of the wild meat trade, the top five species sold on the coast were labba, deer (*Mazama* spp.), tapir, peccary (unknown species) and capybara (*Hydrochoerus hydrochaeris*). Iguana was the most frequently sold reptile. Because vendors were unaware of the species sold, this limited our ability to identify pressures being placed on vulnerable species, such as the white-lipped peccary and white-tailed (savannah) deer. In Lethem, only about eight species were in circulation, two or three of which were more common: labba and deer (savannah and bush).
- Tapir, due to their large size and associated low reproductive rate, are sensitive to human disturbance (Purvis *et al.*, 2000), and fluctuations in their consumption rate require attention as they may reflect changes in their populations. The differences in the ranking of tapir among most hunted species in the past decade can, however, also be explained by other factors, such as changes in number of active hunters and extractive activities in the forest.

Figure 39. Wild meat in Guyana is often sold fresh (chilled) or frozen. ©Brent Stirton/ Getty Images for FAO, CIRAD, CIFOR and WCS

- Wild meat sold along the coast is mainly sourced from the interior along rivers and roads, on average 120–160 km from Georgetown, but as far away as the Rupununi, in areas such as Aishalton, Lethem and the Rupununi River. Although the supply of wild meat is quite high, the majority of the vendors surveyed reported having difficulties in obtaining the quantity of meat needed for sales. Demand on the coast was highest during the Christmas season and tourist season (August), and lowest during the rainy season (June) and just after Christmas.
- Wild meat was mostly sold from hunter to vendor or sometimes directly to the consumer along the coast, as well as in the Rupununi. Although commonly sold on the coast, it was occasionally sold in Region 9, but supply was limited and irregular. Whereas many coastal citizens purchase their wild meat, people in the Rupununi (even in Lethem) obtain their wild meat from friends or family rather than from a shop.
- Availability of wild meat for sale at restaurants or shops appears to have decreased in the Rupununi. Even during Heritage Month, a time of the year where Indigenous traditions are celebrated, wild meat is now rarely served. Many believe that this is caused by the lack of interest in hunting by the younger men and the reduction of hunting. Nevertheless, participants in Heritage Month festivities continue to desire wild meat and expect to eat wild meat during the event. Wild meat is appreciated for its health benefits and taste as well as for the importance of maintaining traditions.
- Prices of wild meat varied greatly in the Rupununi but were similar for all species. Although the purchase price of wild meat was slightly higher than that of domestic meat, sales prices were very similar, suggesting that the gains may be lower for wild meat than for domestic sources.
- Farmed wild meat could be one way of ensuring supply, but people in Lethem were somewhat divided about willingness to buy or consume this alternative source of meat. The biggest drawback, however, was well-being of the animals, which could be addressed through best practices. Nevertheless, the regional market may be limited, as current consumption rates are low. A potential coastal market for farmed wild meat will need further research, as only half of wild meat consumers said they would be willing to consume it.
- The Rupununi identity lived strongly among the region's citizens, and food stood as a central theme in this identity. Culture and tradition, as well as a love for nature were also strongly associated with this identity. These values showed great similarity with those associated with wild meat, where tradition and concern for wildlife were also important. Along with health and the general relaxed lifestyle of the Rupununi, these values must stand as central themes in wildlife management and wild meat campaigns. The association with childhood also highlights education programmes in schools and youth programmes as essential vehicles to ensure responsible use of wildlife.
- In Guyana, most of the wild meat is sold chilled or frozen (Figure 39). Losses due to poor storage methods are insignificant because the distance travelled by the meat from source to place of consumption is short enough to maintain sufficient ice in the coolers used to store the meat. Nevertheless, wild meat vendors expressed intertest in increasing their knowledge on food safety practices.

D.2. First actions

- The Project has produced a value chain analysis of the wild meat trade chain in the Rupununi and up to the coast.
- The Project has surveyed wild meat trade at the level of wild meat vendors on the coast in 2019. The monitoring continued by telephone in 2020 due to COVID-19 restrictions to assess whether COVID-19 has prompted any changes in wild meat use. In 2021, and until the end of the SWM Programme, wild meat trade will be monitored to assess changes in volumes and species.
- The Project is developing a behavioural change strategy to discourage excessive hunting particularly of sensitive fauna, such as savannah deer, tapir, capybara and tortoises, and promote the consumption of more resilient species or of beef and chicken produced locally (Figure 40).
- The Project prepared simple guidelines to ensure that wild meat is kept safe and hygienic during the transportation, storage and handling of the meat before consumption.

These include:

- Bleed animals properly so that the blood will not contaminate the meat.
- Remove shotgun-damaged flesh when cleaning.
- Bury or burn intestines.
- Prevent raw wild meat from dripping on other foods.
- Clean and store wild meat properly to avoid the chances of contamination.
- Prevent wild meat contamination from plastics, wood, chemicals and metals (e.g. bullets).
- Freeze, salt, smoke or dry meats as soon as possible.
- When using hunting dogs, ensure they are free from diseases.

Figure 40. Promoting sustainable wild meat. Poster to reflect one of the goals of the Project to support only legally and sustainably harvested wild meat and reduce demand for vulnerable species. The Project has now developed a behavioural change strategy to promote sustainable wild meat use, which will be implemented at the end of Year 3. ©FAO/Arianne-Elise Harris

These guidelines have been distributed in wild meat sale points (Figure 41).

In addition, the Project is collaborating with the Caribbean Centre for Biosecurity Studies in Trinidad and Tobago to analyse wild meat from a microbacterial and virological point of view.

Figure 41. Best practices for wild meat handling based on the guidelines developed by the Project and distributed for display at sale points.

©Brent Stirton/Getty Images for FAO, CIRAD, CIFOR and WCS

Summary

Aside from wildlife harvest and consumption, habitat degradation and human–wildlife interactions were deemed essential elements in sustainable wildlife management in the Rupununi. The planned upgrade of the Georgetown–Lethem Road with increased access to the Rupununi was identified as a priority, because of its expected impacts on wildlife. The Project conducted a landscape-level road impact study on wildlife in the Rupununi and presented recommendations for priority sites that would render roads in the region more wildlife friendly. Roads are also associated with fire in the region, as the Project analysis demonstrated. Fire forms an intricate part of Rupununi ecology and culture, with unknown impacts on wildlife. The Project is supporting research on mammals and birds in relation to fire to support ongoing community efforts of improving fire management. In terms of human–wildlife conflicts, communities experience conflicts both on land (wild felines preying on livestock; ungulates, monkeys and rodents raiding farming grounds) and water (giant otter competing for fish and turtles, caiman and otters destroying fishing equipment). A survey of Rupununi village leaders indicated that each year residents can lose 10–25 percent of their total herd. Loss of livestock permeates through these communities, resulting in 80 percent of households identifying jaguars as the most problematic wild animal in their lives. The Project designed a study to better understand this "conflict" in the Rupununi and to develop collaborative solutions to mitigate it.

VIII. ADDITIONAL ANTHROPOGENIC FACTORS IN SUSTAINABLE WILDLIFE MANAGEMENT

Matt Hallett[1,2], Evi AD Paemelaere[3], Anupana Puran[4], Angela Mejía[5], Kayla de Freitas[6], Brian O'Shea[7], and Nathalie van Vliet[8]

[1] Department of Wildlife Ecology & Conservation at the University of Florida
[2] Conservation Department, Jacksonville Zoo, mhallett2320@ufl.edu
[3] CIFOR, Colombia, pwsolutions.main@gmail.com
[4] Protected Areas Commission, Guyana, anupanapuran@gmail.com
[5] CIFOR, Colombia, angelamejiagonzalez@gmail.com
[6] Royal Holloway, University of London, UK, Kayla.DeFreitas.2019@live.rhul.ac.uk
[7] North Carolina Museum of Natural Sciences, USA, boshea2@gmail.com
[8] CIFOR, Colombia, nathalievanvliet@yahoo.com

Materials and methods

Roads – The Project assessed how the Georgetown–Lethem Road (GTLR) section crossing the Rupununi Region and a major branch from the GTLR in Lethem towards the south may be impacting, now and in the future, wildlife that is important for local livelihoods, and offered recommendations for mitigation strategies (Paemelaere, 2019). In a desktop analysis for the road impact evaluation, existing research was used to compile a list of vertebrates existing in the habitat bordering the Georgetown–Lethem Road. The project considered terrestrial, arboreal and semi-aquatic species, as well as representative bird species. These species were initially prioritized based on the following categories: IUCN conservation status, CITES category, existing stakeholder-based prioritization (Conservation International, 2002; Fredericks, Buckley and Persaud, 2016; Pierre and Paemelaere, 2018). Species were then evaluated following Jacobson (Jacobson et al., 2016; Kintch, Jacobson and Cramer, 2015). They were assigned to 'Non-responders', 'Pausers', 'Speeders', 'Avoiders' (Jacobson et al., 2016). The Project combined spatial connectivity models for 17 priority species with roadkill surveys and an evaluation of bridges and culverts conducted in 2019 within this animal behaviour framework.

Fire – Fire data from NASA Visible Infrared Imaging Radiometer Suited (VIIRS) were analysed by the Project (Mejía González 2020). These data indicate active fire perimeters within an area of 375 meters of pixel, offering a first approach to number of fires in Region 9 prior to the start and during the early years of the SWM Programme, for a period from 1 January 2016 until 17 May 2020. The study focused on the titled lands of the villages Sawariwau, Shea, Sand Creek and Shulinab, and in a 10 km buffer around the non-titled community Katoonarib and private property Wichabai. From 2021-2022, the impacts of fire on wildlife was analysed using transects and camera traps set in representative habitats from South Rupununi.

Human–wildlife conflict - Existing information was gathered from a very limited number of studies available on human–wildlife conflict in the Rupununi. Data existed only in the grey literature and are based on interviews and communications with ranchers and village leaders. To shift behaviours of livestock managers and mitigate conflict, it is paramount to increase our understanding of the specific, dynamic factors driving the behaviour of livestock, livestock managers, and large carnivores and engage stakeholders directly in developing their own solutions that encourage coexistence. The Project will investigate the movement patterns of free-roaming cattle herds, patterns in the frequency and distribution of current and historic predation events, spatial overlap between livestock and large carnivores, and the attitudes of livestock managers and drivers of their response to predation events – data that will be presented to livestock managers during workshops with the goal of developing collaborative solutions to mitigate conflict.

A. Habitat degradation

A.1. Roads

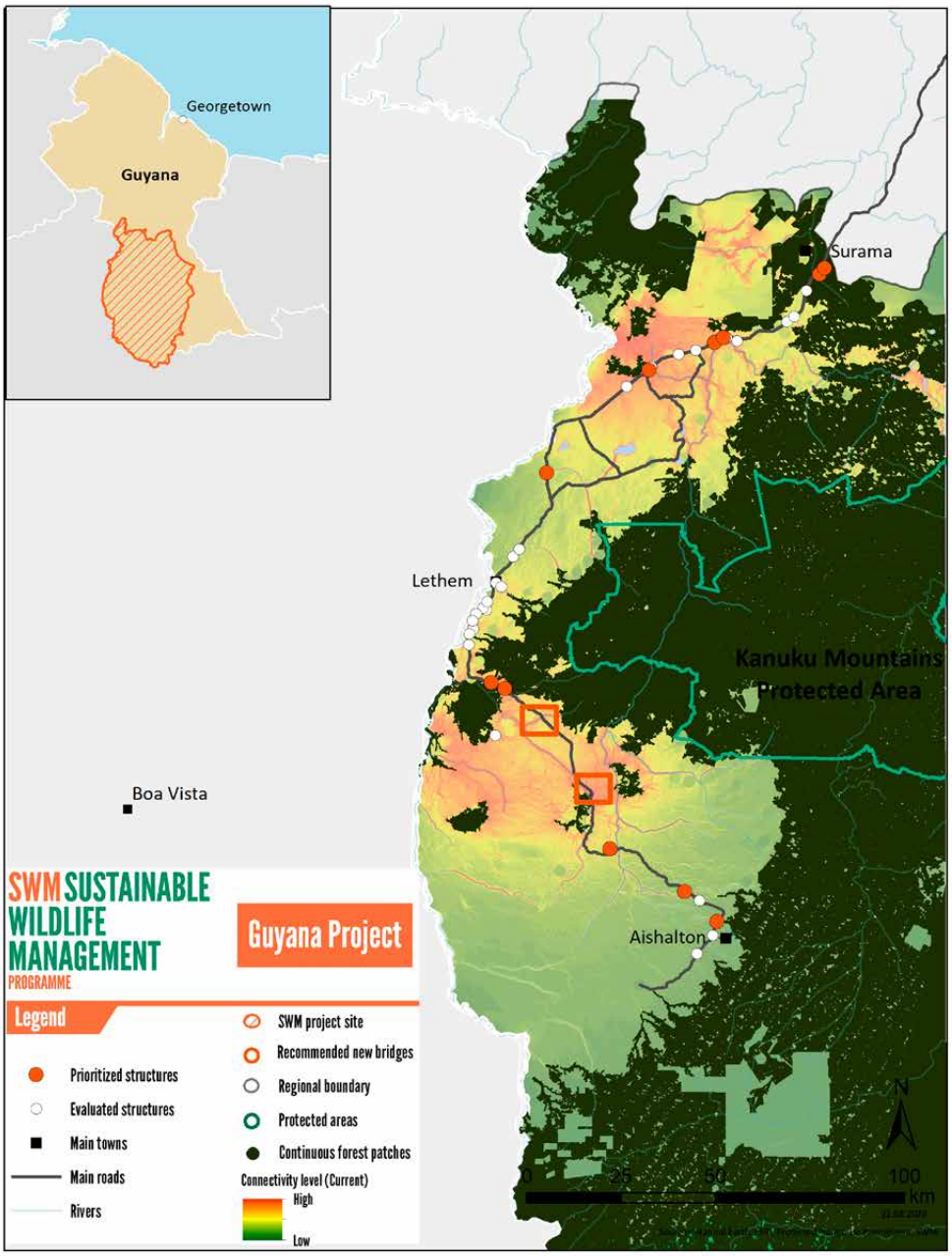
Projection for road development and its potential impact on wildlife has raised global concern (van der Ree *et al.*, 2015). In countries such as Guyana, road networks are limited, but can be expected to expand, and upgrades to existing dirt roads are already planned. Road networks are developing rapidly to provide access to resources such as timber, gold and oil, and are important for socio-economic development. At the same time, they negatively impact biodiversity and ecosystem services that are also important to healthy livelihoods. Roads are the main drivers of habitat degradation, fragmentation and loss of connectivity between wildlife populations (Laurance *et al.*, 2002), leading to genetic isolation and local extinction of species (Jackson and Fahrig, 2011). With a projected global road network expansion of 25 million kilometres by 2050 mostly in the developing world (Dulac, 2013), where some of the last roadless areas exist (Ibisch *et al.*, 2016), measures for mitigation of road impact on wildlife are more important than ever.

The Georgetown–Lethem Road is the only road traversing the country and connecting a large part of the hinterland to the capital. It is part of Guyana's mostly unpaved 4 000 km long road network (Taddia *et al.*, 2005). Along the Georgetown–Lethem Road, the first 105 km to Linden are paved, while the remaining 438 km from Linden to Lethem are unpaved (Taddia *et al.*, 2005). The road traverses logging and mining areas, the protected area of Iwokrama and the wetlands of the Rupununi region before reaching Lethem. An upgrade of the road with extensions to Amaila Falls and Region 8 is projected to increase deforestation at the national level by 1–18 percent, including in protected areas (Reymondin *et al.*, 2014). Although an upgrade could provide improved market access, cost–benefit analyses have repeatedly indicated that the upgrade of the road is not viable unless specific actions are taken to prevent secondary deforestation and degradation of ecosystem services (Claramunt, 2012; Conservation International Guyana, 2014b). Moreover, such cost–benefit analyses have not included the value of wildlife for local livelihoods and ecosystem services, further arguing for the need to mitigate impact on habitat and fauna for the road to have any benefits. The upgrade of the Georgetown–Lethem Road with increased access to the region was identified as a priority during the consultation process by the Project in drafting the country's strategy, because of its expected impacts on wildlife.

A comprehensive overview of road impacts on wildlife has been presented by various authors (Coffin, 2007; Forman and Alexander, 1998; Goosem, 2007; Laurance, Goosem and Laurance, 2009; Trombulak and Frissell, 2010). Road impacts on wildlife can be divided into four categories: habitat degradation, resource inaccessibility, population isolation and traffic mortality (Jaeger *et al.*, 2005). Such impacts can result directly or indirectly from the road during both the construction and operational phases (Coffin, 2007; Laurance, Goosem and Laurance, 2009). Road mortality from wildlife–vehicle collisions is the most visible and easily recorded impact, but concerns for most wildlife species result from habit degradation, accessibility by hunters and barrier effects, whereby animals can no longer safely cross the road and genetic isolation occurs.

The Project surveys along the Lethem–Surama Road resulted in 32 records of roadkill, mostly birds (15) and reptiles (14), but also 2 amphibians and 1 mammal. A similar pattern showed along the Lethem–Aishalton Road: 15 birds, 12 reptiles, 8 amphibians and 5 mammals, for a total

Figure 42. Wildlife-friendly roads. The map of priority sites recommends interventions to promote connectivity between wildlife populations and ensure wildlife-friendlier roads based on an impact study by the Project, including a spatial analysis on wildlife movements and field data on roadkill, live crossings and existing bridges and culverts that could potentially serve as wildlife underpasses.



of 40 individuals. Roadkill encounter rate for the north was 0.94 per survey day; for the south this was 1.25. Per 100 km surveyed, 0.70 carcasses were counted in the north and 0.78 in the south. These rates were low compared with other studies in similar habitats and not considered a major issue for any species at this time. The Project identified several roadkill hotspots associated with forest cover and presence of water. Live sightings, mostly birds and some mammals, occurred chiefly before 08.00 hours and near the roadkill hotspots. A negative association of live sightings and roadkill with population hubs suggests that wildlife avoids these areas. Low roadkill may partially be explained by current transit. Traffic volume was low: 3.34 and 2.82 motorized vehicles per hour, which is expected to increase and change from motorbikes to four-

wheeled vehicles as already seen in the north, particularly after completion of the Georgetown–Lethem Road upgrade. Traffic speed was relatively high and may not change much with further upgrades. With intensifying traffic volume, however, an initial increase in mortality of pausers is expected (e.g. tortoises, armadillos) and speeders (e.g. foxes, deer), followed by a decline due to a barrier effect. For non-responders (many snakes), roadkill is expected to increase. Giant anteaters, and perhaps tortoises and some snakes, would be of particular concern under such a scenario.

Connectivity models produced by the Project highlighted clear priority areas (Figure 42): the wetland zone between Toka and Yakarintha in the north, and Saurab, Sawariwau and the junction with the Rupununi River in the south. With minor modifications (mostly lengthening), existing bridges could serve as part of a wildlife-friendly road design at these sites, except for the Sawariwau area, where culverts lined the road, which would not be sufficient for the larger species, such as deer, giant anteater, tapir or jaguar. Under a road upgrade or traffic volume intensification in the future, replacement of some culverts with bridges should be considered here. Detected levels of human use (e.g. fishing, swimming, hunting) under existing bridges could be a limiting factor in their usefulness as underpasses. A solution for faunal passages during the rainy season will need further attention, considering most structures flood during this time. Any widening of the road and its associated bridges and culverts would also undermine the functionality of these structures as underpasses and maintaining a width of less than 10 m at connectivity hotspots is recommended.

Further research is needed to evaluate seasonality of wildlife movements and to test the true functionality of underpasses, particularly for priority species. Importantly, essential connectivity hotspots across the new road approved for construction through Yupukari will need appropriate underpasses and further evaluations.

A.2. Fire

Fire forms an intricate part of Rupununi ecology and culture. While climate and low soil fertility have played an important role in the formation of these pockets of savannah amid dense forest (Eden, 1986; Medina, 1982), fire assists in maintaining this unique habitat (Jansen-Jacobs and ter Steege, 2000; Mistry *et al.*, 2005). Moreover, the habitat mosaic includes flora that is fire adapted (Furley, 1999).

Indigenous communities use fire for a multitude of purposes, including protection of habitat through prevention of uncontrolled fires, protecting houses, clearing farmland and hunting. With the introduction of ranching, fire has also been used in cattle management, for example, to stimulate new vegetation growth for grazing. A detailed list of the use of fire in Indigenous culture of the Rupununi is provided elsewhere (Rodríguez *et al.*, 2011). Burning occurs mostly between October and April, which is the dry season. Fire rarely happens during the rainy season, when large tracts of the savannah are flooded, although patterns are changing.

Changes in fire patterns are partially ascribed to changes in climate patterns (Rodríguez *et al.*, 2011). With fluctuating weather patterns, predicting the best time to burn has become more difficult. Furthermore, spells of drought have increased the risk of uncontrolled fire. In addition to climate, the loss of traditional knowledge and skills in younger generations has also affected fire patterns. For example, large communal burns to hunt have changed to a practice by small family groups, resulting in absence of community-level planning and causing higher risk with

Figure 43. Poster with actions for wildlife-friendlier roads to be distributed for display at public places and to be used in education programmes.

fewer people to tend to safety, a role originally assumed by the women (Rodríguez *et al.*, 2011). Loss of traditions over time has also led to fires being lit accidentally, or for fun (Rodríguez *et al.*, 2011). Nevertheless, communities are striving to reinstate safe fire management, respecting traditions such as no burning at spiritual sites or important resource sites (e.g. ité palm tree groves, wildlife breeding areas). They use targeted fire management areas to help protect habitat, such as bush islands, and patch burning to avoid large-scale habitat destruction (South Central and South Rupununi Districts Toshaos Councils, 2012).

According to the traditional hunting calendar of the Wapichan in the South Rupununi, hunting with fire was seasonally bound for a select set of target species and their associated habitat (South Central and South Rupununi Districts Toshaos Councils, 2012). Species hunted using fire included the iguana (*Iguana iguana*; and their eggs), deer (*Odocoileus cariacou*), agouti, armadillo and tortoise (and their eggs). Easter hunts occurred in savannahs and swamps; Christmas hunts in swamps; and August hunts in the forest–savannah ecotone. In September–October, iguana would be hunted. Hunting with fire for commercial purposes, such as tortoises and finches (towa-towa *Oryzoborus angolensis*) for the wildlife trade was also reported (Rodríguez *et al.*, 2011). Another important non-traditional use of fire is to herd cattle from the ranches to Lethem, where a rodeo takes place during the Easter weekend.

Interestingly, a study on fire knowledge suggested that, although the Wapichan generally have a good understanding of the impact of fire on vegetation, contradicting views exist on its

impact on wildlife (Rodríguez *et al.*, 2011). Even though declines of wildlife have been reported (Henfrey, 2002; Rodríguez *et al.*, 2011), the role of fire in decreasing wildlife populations is not known and generally not considered important. Birds expected to decline due to fire are the ocellated crake (*Micropygia schomburgkii*) and the near-threatened bearded tachuri (*Polystictus pectoralis*). Some concern also exists for ground-nesting birds, although elders said that traditional burning occurs outside of their breeding season and should therefore not pose any threat (Rodríguez *et al.*, 2011). Another species of concern in the fire discussion is the red siskin. Burning has reportedly decreased in edge habitat, which this endangered bird seems to prefer, but this habitat is also fire prone and lack of controlled burning may increase fire hazards. Although fire is often thought of as having negative impacts on wildlife, fire is also thought to benefit wildlife because it helps avoid large, uncontrollable fires that could cause significant damage to habitat and wildlife alike (Rodríguez *et al.*, 2011).

The analysis of satellite imagery conducted by the Project showed that the average amount of fire perimeters in Region 9 during a year is 3 955. The years with fewest fire points were 2016 and 2018 with 3 508 and 3 893, respectively (Table 9). Shulinab, however, showed a different pattern from the whole of Region 9 and the communities included in the study. Here, a peak of fires was seen during 2016, while in 2017 and 2019 fewer fires than average were recorded. The fires were recorded mostly in the savannah areas close to the main roads: the Georgetown–Lethem Road and the Lethem–Aishalton road. The increased likelihood of fire near roads is not unexpected, but merits further attention in relation to the combined effects of road impacts and fire on wildlife.

Table 9. Number of fire perimeters and mean from 2016 to 2020. The mean does not cover 2020 data.

Community	2016	2017	2018	2019	2020	Mean
All region 9	3 508	4 408	3 893	4 013	3 088	3 956
Sawariwau	277	611	295	339	425	381
Shea	43	58	62	45	19	52
Sand Creek	43	63	51	47	29	51
Shulinab	224	61	193	119	50	149
Katoonarib buffer 10 km	84	109	97	103	36	98
Wichabai buffer 10 km	56	83	67	69	61	69

B. Human–wildlife conflict

In the Rupununi, communities experience conflict both on land (terrestrial predators preying on livestock or pets, and terrestrial herbivores raiding farming grounds) and water (aquatic predators competing for fish and turtles, destroying fishing equipment, and preying on livestock and pets to a lesser extent). In terms of species, jaguars and pumas are known to kill cattle, sheep, pigs and dogs. Ocelots, other small cats, fox and opossum are known to target chickens. Caiman and giant river otters raid and destroy fishing nets. Agoutis, deer, labba and peccaries raid farms. Agoutis and labba chew at cassava stalks and stems. Deer eat fresh leaves. Peccary herds may destroy an entire farm in a single event.

Responses to these events vary by person and circumstances. Some people are very patient, while others do not tolerate any loss of animals or crops. Typical retaliation for predation of livestock

is to set a tree stand near a fresh kill, shooting predators that return to feed. People will actively hunt, flush with dogs or set traps for animals that raid farms. Natural methods, such as pepper and sugar cane stalks help protect crops from monkeys (Conservation International, 2002). Monkeys are not typically eaten by Wapishana or Makushi people. Giant river otters are typically left alone, but some people will throw rocks and attempt to chase them away. Many people shoot arrows at any caiman indiscriminately. As such, hunting does not only occur for wild meat or trade, but also in retaliation for conflict.

A survey of Rupununi village leaders indicated that each year residents can lose 10–25 percent of their total herd (Hallett, 2015). In a survey of 102 Rupununi households (Hallett, 2015), 52 percent indicated that conflict occurs a few times per year, 33 percent a few times per month and 16 percent a few times per week. Loss of livestock permeates through these communities, resulting in 80 percent of households identifying jaguars as the most problematic wild animal in their lives, 66 percent saying that they do not like having jaguars around and 53 percent indicating that they would actively try to kill jaguars in response to livestock predation (Hallett, 2015). The same survey indicated that retaliatory killings occur every year, with some villages averaging three to five jaguars and/or pumas killed every year in response to predation of livestock (Hallett, 2015; Paemelaere and Payán Garrido, 2012). Extrapolated across the 46 communities and a region that covers over 57 000 km^2, it is possible that carnivore mortality rates become unsustainable, turning suitable habitat in the Rupununi savannahs into a population sink.

Although these results vary across space and time, human–carnivore conflict is clearly a far-reaching problem that is among the most important facing Indigenous communities and large carnivore populations in Guyana's vast interior.

C. Lessons learnt, recommendations and first actions

Human–wildlife conflict:

Human–wildlife conflict considerably influences the relationship between people and wildlife in the Rupununi, particularly with jaguars, otters and caimans. The Project's focus is on jaguars, and the conflicts that arise with livestock production. To understand the conflict between livestock and jaguars or other big cats, the Project has developed a methodology that will be articulated along the five main objectives below:

A better understanding of movement, activity pattern and habitat selection of free-roaming cattle herds

The use of global positioning system (GPS) collars to study the movements of domestic and wild animals is well established (Handcock *et al.*, 2009; Polojärvi *et al.*, 2011). Although cattle can be surveyed using other methods (visual surveys, camera traps), GPS collars provide the most efficient method for collecting accurate, high-resolution data on movement, activity patterns and habitat use across space and time. GPS collars are often considered too expensive, but the Project will use low-cost, custom-built research-grade GPS collars developed by the Giant Armadillo Project in the Pantanal of Brazil, as described by Foley and Sillero-Zubiri (2020). GPS collars will be deployed on

dominant bulls at five private (Point Ranch, Red Hill, Saddle Mountain, Atkinson, Wichabai) and five community-based (Karasabai, Katoka, Aranaputa, Nappi, Karaudarnau) livestock producers in the Rupununi. Collars were be deployed in January 2021 and remained on individual animals for up to 3 months with collars collecting location data at four-hour intervals.

The description of current and historic frequency and distribution of livestock predation

Identifying areas with the highest human–wildlife conflict is a key step for understanding factors that may drive conflict across the landscape (Inskip and Zimmermann, 2009). To understand how conflict varies across the Rupununi, the Project will use a participatory risk mapping process.

Identification of the spatial overlap of livestock and large carnivores

Camera traps will be used to assess the spatial overlap of livestock and large carnivores, using the distribution of perceived predation risk and important livestock resources to guide trap placement. Five to ten cameras will be set within each survey area for the duration of the study, with cameras focused on important resources within high-risk conflict areas. Cameras will be set on video in an effort to gain further insight into livestock–carnivore interactions at these locations.

Description of attitudes towards large carnivores and drivers of human–wildlife conflict

Data on the attitudes of cattle owners towards large carnivores and predation of cattle can help identify areas of most severe conflict and drivers of responses to predation (Dickman, 2010). Previous studies have shown that a variety of factors contribute to the response of cattle owners to predation and that understanding site-specific drivers is important (Dickman, 2010). Semi-structured interviews will be conducted to understand attitudes towards large carnivores and drivers of human–wildlife conflict. Semi-structured interview questions will first be piloted with a subsection of the survey population in the community survey sites to ensure instrument reliability.

Development of conflict mitigation measures and livestock management planning

Associations in the data collected from GPS collars, documentation of predation events, camera traps and semi-structured interviews will be used to identify drivers of cattle predation events across space and time. Data will be presented at workshops with private and community-based livestock managers, regional groups, government agencies and NGOs, with each partner providing feedback on results and suggestions for solutions. The management strategies that emerge from this collaborative process will form recommendations that will then be presented to cattle owners across the region to seek partnerships for implementation. The planning for these workshops will take place at the end of Year 3.

Roads

The road impact study implemented by the Project in 2019 identified most likely road crossing locations, typically associated with the presence of bridges or culverts. Roadkill was low, which was expected under current low traffic conditions, but is also expected to increase in case of the planned road upgrade, particularly for savannah species such as the giant anteater.

Based on these results, bridges could play an important role in safe wildlife movement across the roads, provided these bridges have the appropriate dimensions and characteristics for the different species to use them. The Project recommends an evaluation of these bridges at the identified

key crossing sites for their use by wildlife. In the development of the Region 9 road network, the road alignment through the wetland, road density and potential secondary impacts must be carefully revised and managed to ensure that implementation of the proposed strategies will offer maximum benefits to wildlife. The Project developed a strategy to influence decision-making. A poster for the general public in the Rupununi (Figure 43) and an automated presentation for a technical and decision-maker audience were produced to raise awareness of road stakeholders and influence road users' behaviour towards wildlife. These will also to be used in the education programme of SRCS, for which two wildlife-friendly road activities were developed.

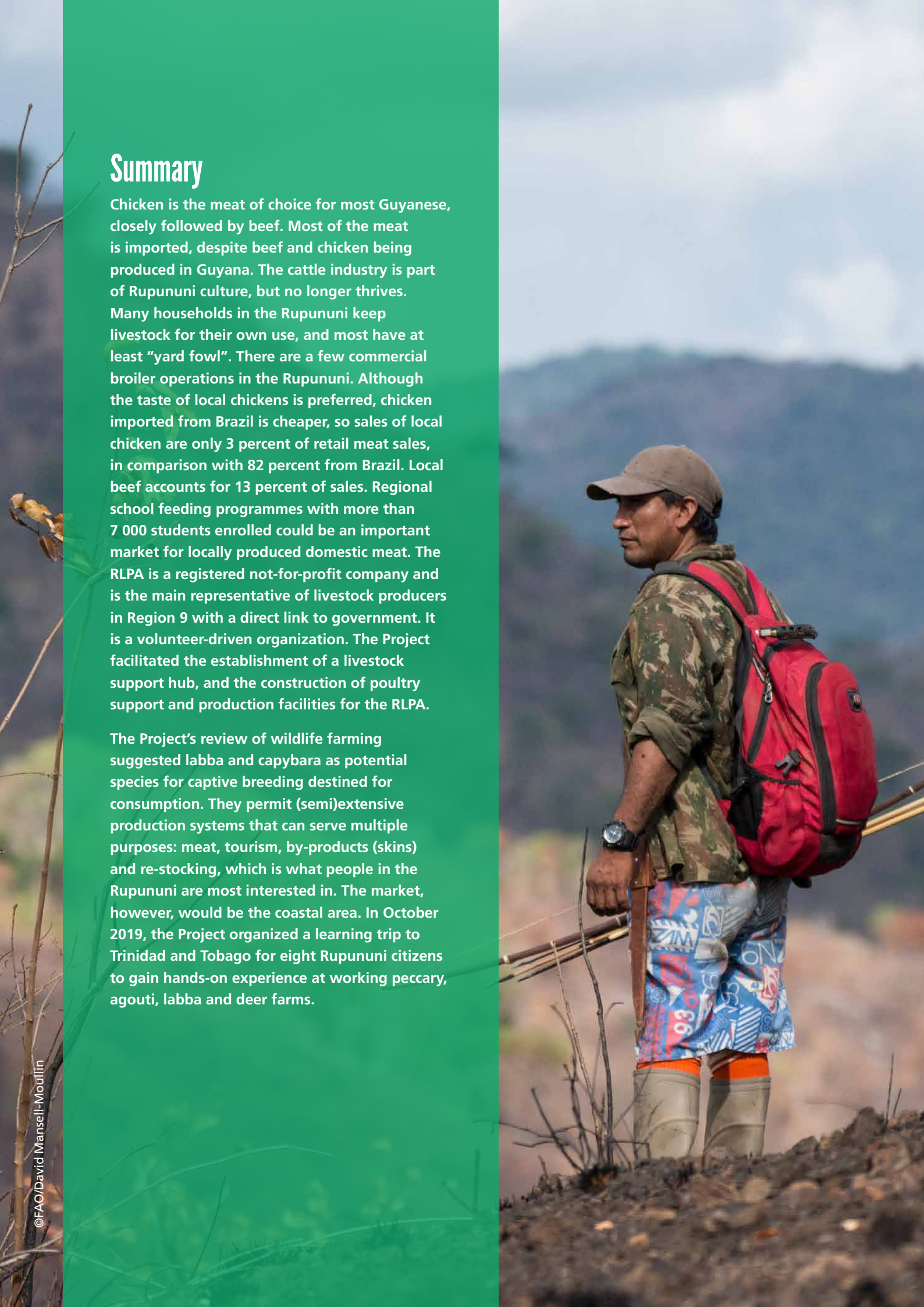
Fire

Concerning the impacts of fire on wildlife, collaborations with a PhD student from the Royal Holloway University of London have evolved into the definition of Terms of Reference and methods for a study on impacts of fires on wildlife in South Rupununi. Two pilot communities have been identified. The study will begin in January 2021 in collaboration with SRCS to ensure much needed long-term monitoring of wildlife in relation to fire and sustainability of the activities beyond the life of the Project.

Summary

Chicken is the meat of choice for most Guyanese, closely followed by beef. Most of the meat is imported, despite beef and chicken being produced in Guyana. The cattle industry is part of Rupununi culture, but no longer thrives. Many households in the Rupununi keep livestock for their own use, and most have at least "yard fowl". There are a few commercial broiler operations in the Rupununi. Although the taste of local chickens is preferred, chicken imported from Brazil is cheaper, so sales of local chicken are only 3 percent of retail meat sales, in comparison with 82 percent from Brazil. Local beef accounts for 13 percent of sales. Regional school feeding programmes with more than 7 000 students enrolled could be an important market for locally produced domestic meat. The RLPA is a registered not-for-profit company and is the main representative of livestock producers in Region 9 with a direct link to government. It is a volunteer-driven organization. The Project facilitated the establishment of a livestock support hub, and the construction of poultry support and production facilities for the RLPA.

The Project's review of wildlife farming suggested labba and capybara as potential species for captive breeding destined for consumption. They permit (semi)extensive production systems that can serve multiple purposes: meat, tourism, by-products (skins) and re-stocking, which is what people in the Rupununi are most interested in. The market, however, would be the coastal area. In October 2019, the Project organized a learning trip to Trinidad and Tobago for eight Rupununi citizens to gain hands-on experience at working peccary, agouti, labba and deer farms.



IX. LOCAL PRODUCTION AND IMPORT OF WILD AND DOMESTICATED MEAT AND FISH PRODUCTS

Timothy McIntosh[1], Evi AD Paemelaere[2], Andy Mahadeo[3], Micheal Morisson[4], Nicholas Waldron[5], Michele Singh[6], Nathalie van Vliet[7]

[1] The Consultancy Group, tmcintosh@theconsultancygroupguyana.com
[2] CIFOR, Colombia, pwsolutions.main@gmail.com
[3] GWCMC, Guyana, andy.mahadeo@live.com
[4] CIFOR, Guyana, michealmorrison30@gmail.com
[5] The Consultancy Group, nwaldron@theconsultancygroupguyana.com
[6] CARDI, Trinidad and Tobago, michele.singh@gmail.com
[7] CIFOR, Colombia, nathalievanvliet@yahoo.com

Materials and methods

Livestock and imported meat. A review of livestock production and markets was completed based on a literature review, interviews with producers, meat traders, vendors and school feeding programme operators, as well as a workshop with relevant stakeholders, including RLPA and GLDA (Waldron and McIntosh, 2019a, 2019b).

Wild meat production. Because of the lack of information on wild meat farming in Guyana, the Project carried out an analysis of existing systems in South and Central America based on a literature review (Morrison, 2019). In addition, in October 2019, the Project organized a learning trip to Trinidad and Tobago with eight participants from the Rupununi. This allowed them to experience some working peccary, agouti, labba and deer farms and understand the technical, economic, legal and institutional challenges and opportunities offered by wildlife farming. In addition, as part of the feasibility analysis, the Project conducted interviews with consumers to understand their attitude towards these farmed animals. These looked at general attitudes, willingness to purchase and willingness to consume.

Aquaculture. An aquaculture feasibility study was completed in the North Rupununi with the villages and locations that had shown strong interest in developing this: Karasabai, Kwaimatta, Yakarinta, Aranaputa, Annai, Surama, Wowetta, the local technical institute Bina Hill Institute (BHI) and farmer Ernesto Farias (Jafferally, 2019). Specific questions were addressed during focus group meetings. Questions addressed vision, target markets, division of responsibilities, existing know-how and type of support needed.

A. Domestic meat preferences and avoidance

Chicken is the most popular protein source throughout Guyana, followed by beef. The average Guyanese consumes 35.4 kg of chicken meat per annum (HelgiLibrary, 2021). Guyana has a diverse ethnic and religious make-up, and several religions maintain restrictions on certain types of meat, creating differences in demand. Hindus, some 25 percent of the population, do not eat beef because cows are viewed as sacred. Therefore, many Hindu-owned businesses do not sell beef (in retail and in hospitality). Many Christians and Muslims also do not eat pork for

religious reasons. This includes Christians of the Seventh Day Adventist tradition (5 percent of the population), who are urged to avoid meat. At the Eid al-Adha "Feast of the Sacrifice", cattle, sheep and goats are sacrificed by practising Muslims, and the meat shared with friends and family. Rastafarians (0.5 percent of the population) generally practise a vegetarian diet. Based on sales reported to the Project by a leading supermarket in Georgetown in 2018, there has been a strong rise in demand for meats and eggs during the last month of the year, driven by increased meat eating and baking over the Christmas holidays. For sales of all meats, January represents the slowest month, likely as part of a broader post-holiday slow-down in consumption.

The relative importance of domestic meat in the Rupununi has increased and some villages, particularly those with easier access to markets, rely almost entirely on this protein source. Cattle and other domestic animals are more common among the Wapichan and Makushi than among the Wai Wai. Particularly among the younger generation, domestic meat is more important than wild sources of meat (Fredericks, Buckley and Persaud, 2016). An aversion to pork exists among the Wapichan (Roth, 1915), which may also exist among the other tribes as this is associated with Shamanism, as well as with Western religions (Read *et al.*, 2010). Goat and sheep meats are often mentioned as causing an allergic reaction, as is skin fish (i.e. fish without scales), although this is more associated to taboos than to an actual allergy (Luzar, Silvius and Fragoso, 2012).

B. Local livestock production system and value chains

B.1. Overview of livestock production in Guyana and in the Rupununi

Guyana produces cattle, goats, sheep and pigs for meat markets. In terms of production rates, poultry tops the charts with over 1 million chickens countrywide, accounting for more than 92 percent of all registered meat production. Production volumes and farmgate prices of chicken fluctuate through the year and, until recently, imports of cheap chicken cuts from the United States of America have been used to close supply gaps. There is an estimated 220 000 to 250 000 head of cattle reported for the country (The South American Commission for the Fight Against Foot and Mouth Disease, undated). Sheep average around 130 000 head; goats 79 000 and pigs 20 000 (The South American Commission for the Fight Against Foot and Mouth Disease, undated). There are roughly 100 commercial broiler farms and another estimated 3 000 small farmers. Pig farmers are numerous: 2 500 farmers live in the coastal regions. Dairy is only produced along the coast. Although Guyana produces these meats, some are still imported. Emerging markets for Guyana's beef include Grenada and Brazil. There have been small exports of poultry meat (less than GYD 50 000 (~USD 250) per annum) to neighbouring Suriname over the last 5 years (United Nations, 2021), but otherwise there are no noteworthy exports of meat from Guyana.

In Region 9, a survey of farming households undertaken in 2016 suggested that almost two-thirds of households own livestock (Figure 44), but only 5 percent view livestock as their main agricultural activity (The Consultancy Group and Conservation International Guyana, 2016). This confirms previous research (Conservation International, 2014) that suggested livestock was only responsible for 8 percent of cash incomes in the region. Production has been improving slowly after the devastations caused by foot-and-mouth disease in the 1970s. The region is self-sufficient in beef, pork, mutton, fish and wild meat. Chicken and eggs are mostly imported from Brazil and periodically from Georgetown to meet local consumption (Conservation International Guyana and IDB, 2015).

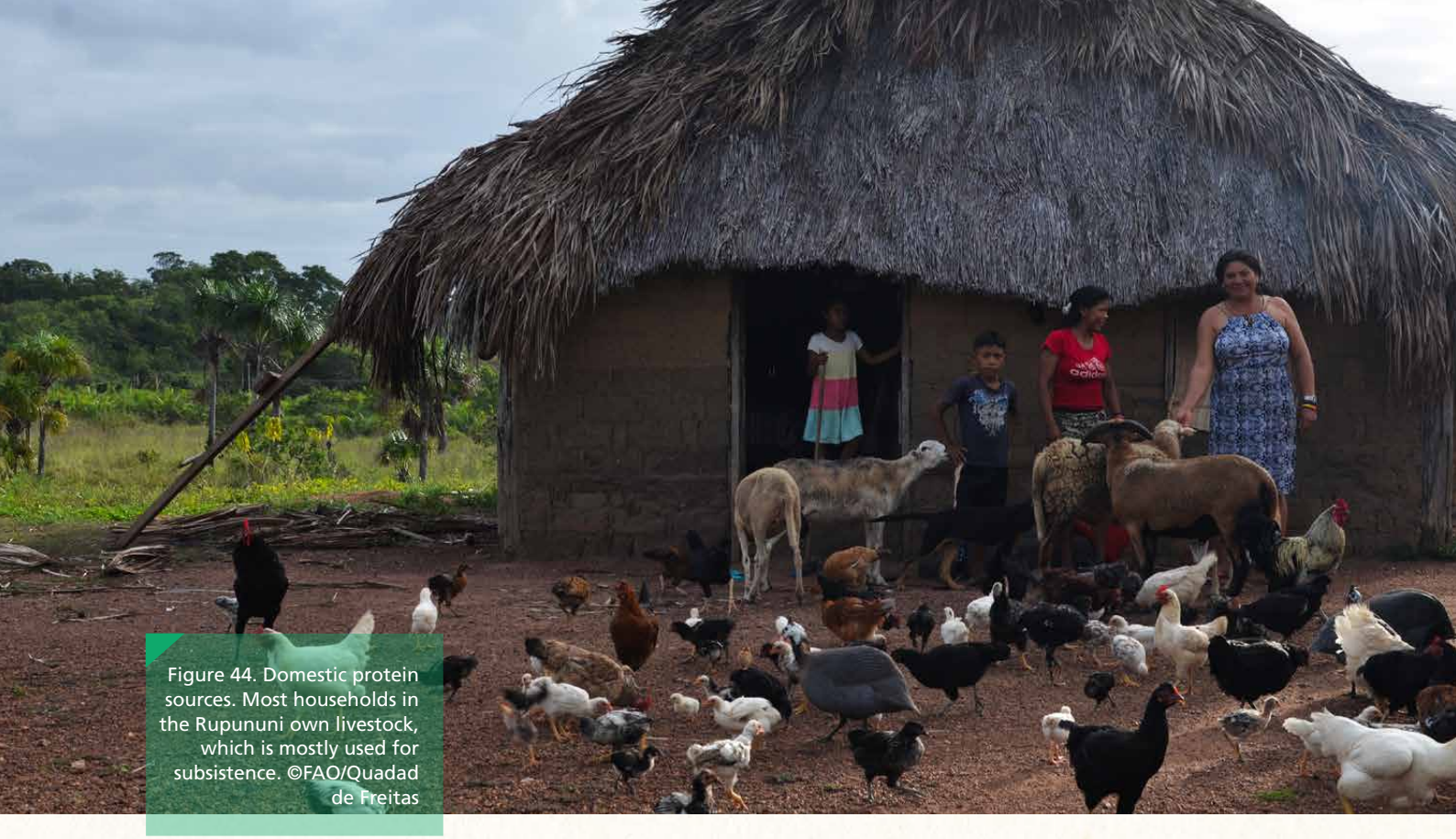


Figure 44. Domestic protein sources. Most households in the Rupununi own livestock, which is mostly used for subsistence. ©FAO/Quadad de Freitas

Most village councils and several private individuals own small herds of cattle. Traditional, large cattle ranches (e.g. Dadanawa Ranch, Pirara Ranch) have declining numbers of animals. Production is severely challenged by outdated grazing systems and production technologies, and high rates of cattle rustling. Chicken meat, beef and eggs are the dominant livestock products in the market. Table 10 provides a more detailed description of cattle and poultry.

Table 10. Livestock population in Region 9 based on 357 households interviewed (The Consultancy Group and Conservation International Guyana, 2016).

Livestock	Percentage of those owning livestock (228 households)
cows	52%
bulls	19%
young bulls	29%
heifers	41%
oxen	5%
calves	32%
pigs	41%
sheep	14%
goats	1%
donkeys / mules	1%
horses	15%
chickens	53%
ducks	7%
other	1%

Figure 45. Cattle ranching is an integral part of Rupununi culture. ©FAO/ David Mansell Moullin

B.2. Cattle in the Rupununi

Historically, economic activity in the Rupununi has centred on cattle ranching (Figure 45). At the peak of cattle ranching in the Rupununi, the savannahs were home to some of the largest tropical cattle ranches in the world, producing about 450 tonnes of beef yearly. Markets were mainly the Guyana coastland, but significant amounts were also sold to the Roraima territories in neighbouring Brazil and to miners and foresters in Guyana's interior. At that time, large investments were made to develop overland routes to the coastal markets; later, airstrips were built and the beef was flown out. The Amerindians of the area proved to be excellent "cowboys" or vaqueros, a skill and tradition that survives today. The industry went into serious decline in the 1970s and '80s due to loss of markets, rustling and the threat of foot-and-mouth disease from neighbouring Venezuela and Brazil. Today, even though many of the ranches still exist, they have very small herds, poor infrastructure and generally operate at a subsistence level.

Typically, there are three types of herds in the Rupununi: the old, traditional ranch herds, smaller herds owned by individuals/villagers and the herds owned by village councils. Historically, herds have numbered between 600 and 1 500 head with large private ranches like Dadanawa managing 10 000 head of cattle. Cattle roam freely on large expanses of land held by ranch owners. Based on abattoir data, the Rupununi produces about 8 200 kg of commercial beef monthly (Conservation International Guyana and IDB, 2015).

Round-ups, branding and other routine management practices are carried out sporadically and the offtake is also low. Herds are small, despite the low offtake, because ranchers no longer find it feasible to invest in labour, infrastructure, breed improvement, supplemental feeding and other appropriate technologies. Mortality rates are high and nutrition is poor. Consequently, fertility rates and average body weights are also poor. The inability to move live animals to Georgetown, the cost of freight to ship beef, the need to maintain the cold chain during

transportation and storage of the beef, and the inability to trade in beef with Brazil all combine to make it extremely difficult to market beef outside of Region 9. The local market is small and possibly saturated. Income from cattle rearing is low and so there is no motivation to invest. Cattle rustling is cited as a major impediment to production and its control is made difficult by vast expanses of land, porous borders and ready recipients for the stolen animals. Predators such as jaguars and pumas attack livestock in the Rupununi. Vultures attack and kill new-born calves. Another issue cited as a serious impediment to the development of the cattle industry in the Rupununi is land tenure. Ranchers are reluctant to invest in fences and planted pasture without having title to the land. In many areas, land that has been traditionally ranched is being claimed as ancestral land by Indigenous villages. Land rates are also exorbitant and are a deterrent to any expansion investment.

Village council herds and privately owned small herds range from < 20 to 200 head but are typically around 40 to 60 animals. Usually there is a paddock or pen where these animals are locked up at night. A "Kapatash" is responsible for the care of the animals. He takes them out to graze, watches them while they graze, moves them to new grazing areas when necessary, takes them to water, carries out minor treatment and so forth. The area used as the paddock is usually changed on an annual basis after the ground in the pen has deteriorated. This area is used to plant crops in some cases. Manure from the pen area is also collected and sold or given away to gardeners.

Sustainable cattle ranching in the Rupununi is compatible with the local ecosystem, ecotourism and the traditional way of life of the Rupununi. The vast grasslands of the savannahs do not require the clearing of large tracts of forest to convert to pastures, a common practice in the global cattle industry, which contributes significantly to deforestation and climate change. The current low input, low output approach along with the comparatively low stocking rates also contribute to a reduced negative environmental impact.

B.3. Poultry in the Rupununi

The most observed system of poultry rearing in Region 9 is an extensive, subsistence, scavenger system utilizing local, semi-feral creole chickens. It is an extremely low input, low output system but nonetheless plays an important role in the food security of many households. Little or no supplemental feeding is done and any scraps or other food that is made available is competed for with other domestic animals. In some cases, rudimentary shelters may be made available for the birds at night, but generally they roost in trees, on fences or on any other available perch that offers some shelter from the elements and safety from predators.

The hens lay their clutches under bushes and in other sheltered spots on the ground. The eggs are vulnerable, and many are lost to predation, physical damage and exposure. Eggs are gathered and used by the family as they are found. Eggs that are not gathered may be brooded by the hens. Hens lay two to four eggs per week on average. Clutches are small and survivability of the chicks is very low, mainly due to domestic, feral and wild predators, in particular domestic cats and dogs, and hawks. Typically, diseases include respiratory diseases, viral diseases (such as fowl pox, Newcastle disease and Gumboro), and internal and external parasites. Only a very small percentage of chicks survive to adulthood (estimated <50 percent). Birds are slaughtered for meat from time to time, usually the cockerels first. Carcasses are small and lean, and the meat

is tough. Poor carcass size and quality are related to breed, age at slaughter and the amount of physical activity these birds must exert in scavenging to survive. This system has merit in that it requires little or no effort in either time or money from the owner. Women, children and other underrepresented groups usually participate in this form of poultry rearing and it requires no expensive imported inputs. Most importantly, these birds convert otherwise inedible waste material to valuable protein and energy for human consumption, contributing to food security at a very basic level.

The Project observed a few commercial broiler operations in and around Lethem, Moco-Moco and St. Ignatius. These are relatively small operations (<500 birds), reared in fairly well-constructed, simple open-sided pens. The operation is labour intensive with the use of hanging tubular feeders and manual waterers. Commercial feed is used, and feed is generally fed in two stages: broiler starter for the first 2–3 weeks, then grower ration until the end of the cycle. Some operators do three phases, switching to a finisher ration for the final 2 weeks. Some also just stick to starter throughout the production cycle, while others have experimented with mixing their own feeds. A typical cycle lasts between 6 to 8 weeks. Final live-weights average 2.7 kg, and due to the relatively small number of birds reared mortality is very low (<10 percent). Finished birds are held in the pen and sold as the market demands. This results in birds being kept past the ideal slaughter age and weight. There is no cold storage to hold large quantities of plucked chicken. Batches are usually staggered to guarantee a continuous supply to satisfy regular markets. Feed and equipment are trucked in from Georgetown or purchased in Boa Vista, Brazil. Some chicken farmers expressed a preference for the feed from Georgetown, claiming that it gave better results. Chicks are flown in from hatcheries in Georgetown. Transportation of feed by trail was identified as the major constraint to production as a constant supply depends on the condition of the roads. Often, the trucks are unable to get through and supplies are delayed. The cost of transportation is also considered prohibitive. Competition from cheap frozen chicken imported from Brazil is another constraining factor, but the fresh local chicken is preferred by the general population because of its superior taste and quality. This is a factor that could be exploited in developing the local poultry industry.

There are a few small layer operations around Lethem, none of them with an excess of 1 000 birds. The system of rearing is based on the conventional open house system. Water and feeding systems are all manual. Commercial layer ration is fed and is purchased either from Georgetown or from Boa Vista. Both brown and white hybrid commercial layers are reared. Birds are replaced at about 2 years old. Day-old chicks are reared as replacements, and first laying is between 20 and 22 weeks of age. A relatively high percentage of feather picking was observed in all flocks, which may indicate nutritional or stress issues in the flock. In one instance, birds had access to an outdoor run. Both hired labour and family labour are used on the farms. Eggs are collected daily and sold locally and in Lethem. Egg production is a promising production area for the region given the large amounts of eggs imported from Brazil. Eggs are a nutrient-rich, relatively cheap food source that is easy to prepare and is readily accepted by a wide cross-section of the population. They are also easy to produce at the household level and easily form part of a mixed farming system. Specialized technical assistance is urgently needed to deal with the production issues the farmers are facing.

B.3. Inputs for livestock production

Water: Piped, potable water is available in Lethem and environs from the Guyana Water Inc. for 14 hours per day (2017). In most other areas, piped water is not available. Drinking water is sourced from wells, using solar-electric-, electric-, gasoline- or diesel-driven pumps. Water availability is one of the main constraints to agriculture and livestock development in the hinterlands (Region 9) (The Consultancy Group and Conservation International Guyana, 2016). The region is home to an annual pattern of flooding and prolonged dry spells, complicated by poor water management technologies and increasingly unpredictable climatic conditions. Ice is available in Lethem at GYD 1 500 (~USD 7.5) per 45 kg (Lincoln International Trading).

Electricity: The Lethem Power Company (LPC) provides electricity to households and businesses in Lethem, Moco-Moco, and St. Ignatius. Costs are GYD 80 (~USD 0.4) per kWh (2017), compared with GYD 43 (~USD 0.2) per kWh in Georgetown, reflecting the costs of transporting fuel overland from the coast to Lethem. Power is supplied 24 hours per day and is reported to be very consistent. To supply back-up power in Lethem, and for areas beyond the LPC network, self-generation using diesel or gasoline is widespread. With diesel at approximately GYD 250–290 (~USD 1.25–1.45) per litre, the Project estimates direct self-generation costs of at least GYD 145 (~USD 0.73) per kWh.

Chicks and feed: The Rupununi Livestock Producers Association has recently made it possible for local producers to order chicks through the Lethem-based RLPA livestock hub. These chicks are then delivered from Georgetown to Lethem in bulk orders. Commercial producers fly in chicks from Georgetown to Surama or Lethem for their own operations. In Boa Vista, broiler and layer chicks are available at GYD 300 (~USD 1.5) each, black giant chicks at GYD 390 (~USD 1.9) each and creole chicks at GYD 225 (~USD 1.13) each. For comparison, in Georgetown, chicks are available at GYD 140 (~USD 0.7; broiler), GYD 200 (~USD 1; black giant) and GYD 335 (~USD 1.68; layers). In the Rupununi, chicken feed is available in Lethem (on order), Aishalton and Karasabai.

Veterinary supplies: There is a limited amount of basic veterinary supplies available from stores in Lethem. Boa Vista has a wide selection of veterinary supplies, but importers require a permit from the GLDA for transport into Guyana. A large number of well-stocked veterinary supply shops can be found in Boa Vista, Brazil. They carry a wide range of products of various brands. The selection includes injectable, oral and topical preparations of antibiotics, anti-parasitic drugs, supplements, anti-inflammatories and sedatives for swine, cattle, poultry, small ruminants and pets. The personnel in the stores were also very knowledgeable about the applications, use and dosages of the products.

Labour: In central Rupununi on-farm labour rates are GYD 45 000 (~USD 225) per month with meals provided and a 5.5 day working week. In a similar arrangement, a foreman or Kapatash receives approximately GYD 80 000 (~USD 380) per month. Skilled labour receives about GYD 6 000 (~USD 30) per day.

The abattoir: The facility does not meet international standards, which prevents meat slaughtered here from being exported (RLPA, personal communication, 2016). The facility is basic and does not offer cold storage or ageing rooms. The abattoir has facilitated the slaughter of an average of 485 animals per year over the past 5 years. Typically, the facility slaughters 35–45 animals per month. There are slaughter poles established in Shulinab (South Central), Little Seven and Point Ranch (both North Rupununi), Dadanawa Ranch (South) and Burning Hills (Deep South) to accommodate the slaughter of animals beyond Lethem, but key informants suggest that they are not frequently used.

C. Imported meat production value chain

Guyana is a net importer of livestock products, with hatchery eggs, beef and skins (skins, hides and leather) dominating imports. There are no noteworthy exports of livestock products from Guyana. Imports of beef slightly exceeded USD 200 000 per annum in 2016 and 2017 before falling to USD 132 000 in 2018. Boneless cuts account for a rising percentage of imports, accounting for just over 75 percent of imports in 2018. The United States of America has consistently been the main supplier (Trade Department of the Guyana Bureau of Statistics personal communication). Noticeable too is a strong shift from frozen to fresh or chilled beef.

For the Rupununi, the Port Health Department of the Ministry of Health maintains detailed records of declared imports of meat and meat products into the Rupununi from neighbouring Brazil. It is fair to assume that these imports are predominantly destined for consumption within the region; national trade statistics consistently show no imports of chicken meat or eggs into Guyana from Brazil. Instead, it is likely that these imports are largely within the informal "Rupununi Free Zone" for local consumption. There are no legal imports of fresh, chilled or frozen beef or swine into Guyana from Brazil, but key informants have pointed, for example, to the availability of packets of minced beef in Lethem stores, and suggest some beef and pork enters Guyana illegally. The ban on imports of beef and pork stem from attempts to maintain Guyana's foot-and-mouth disease-free (without vaccination) status. Brazil has been declared free of foot-and-mouth disease but with vaccination.

Figure 46. Declared imports of chicken meat (left) and eggs (right) from Brazil into the Rupununi. Source: Port Health, MoH.

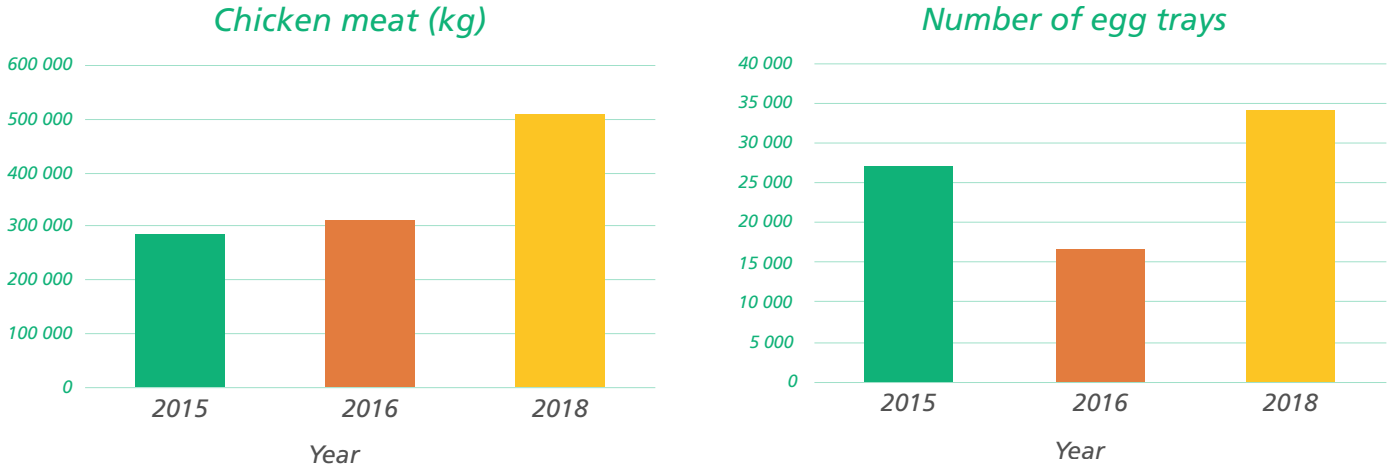


Figure 47. Rupununi imports of chicken meat (kg) per month in 2018 (Port Health Authority Officer, Lethem, personal communication).

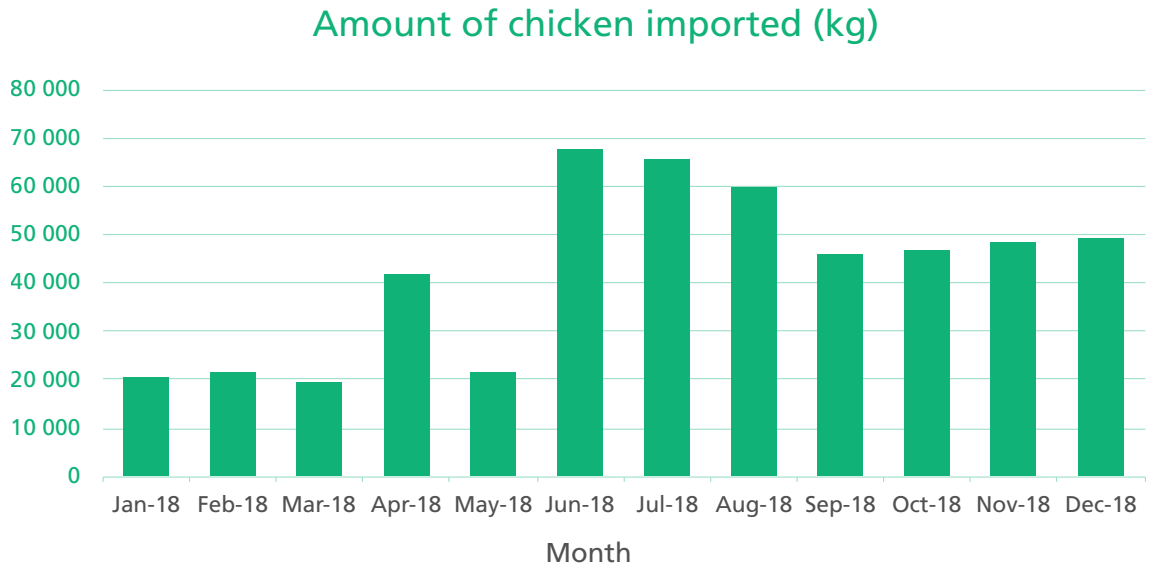
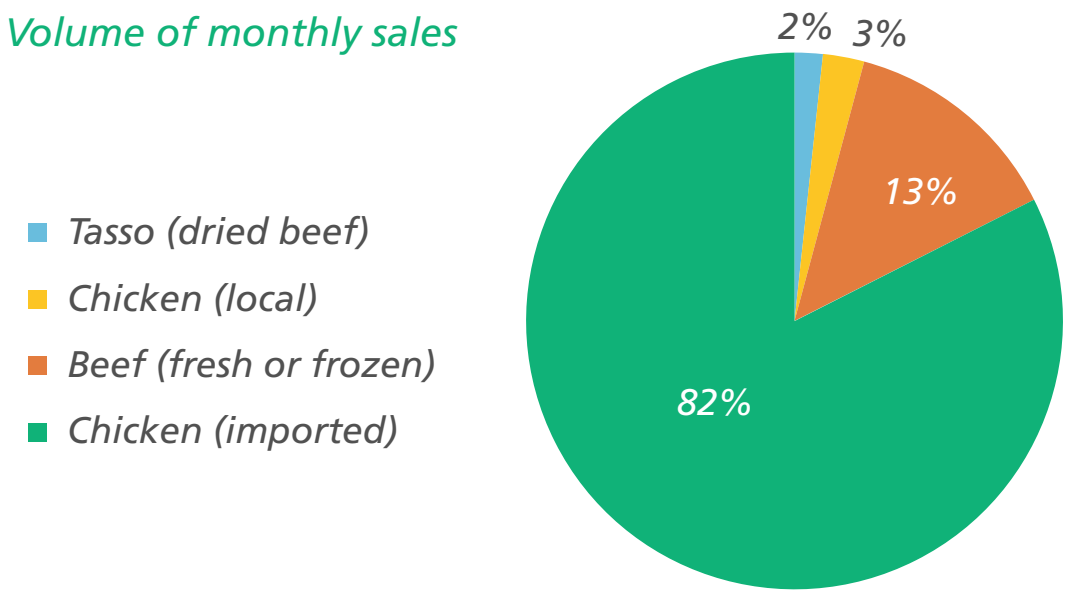


Figure 48. Total monthly sales, by volume, of main livestock meats at 16 retailers in Lethem & St. Ignatius (December 2018)



Chicken meat and eggs dominate imports of livestock products into the Rupununi from Brazil, with chicken meat import averaging 11 100 kg/month. Both chicken and egg imports climbed significantly between 2015 and 2018 (Figure 46), with imports of chicken meat increasing by 80 percent and eggs by 26 percent over the period. Importantly, based on data from 2018, the Rupununi imports an estimated GYD 271 million (~USD 1.36 million) and GYD 35 million (~USD 0.175 million) worth of chicken meat and poultry eggs, respectively. It is fair to assume that these amounts do not represent the total volume of imports of eggs and chicken into Region 9 from Brazil. Key informants in the retail and hospitality sectors in Lethem indicate that they regularly move smaller quantities of chicken (<100 kg) and eggs (<12 trays) across the border into Guyana. One retailer interviewed for this study smuggles chicken 'back-track' from Brazil into Guyana.

Both imports of chicken meat and eggs show marked fluctuations across the year (Figure 47) translating to comparatively low demand in the first quarter and peak demand in the summer months, which is sustained in the latter half of the year. Some key informants suggest that the mid-year rise in imports of chicken meat may be driven by the hardships associated with bringing cattle to the market during the rainy season. The Project was not able to gather production data from northern Brazil, but key informants in the poultry sector indicate that for chicken meat, the cost-of-production in Brazil is approximately three-quarters of that in Guyana. Feed and electricity costs are lower, and chicken rearing is more commonly done in smaller pens as a second source of income. Feeds are of better quality. Key informants estimate contract growers in Brazil receive approximately two-thirds less per kilogram than contract growers in Guyana, significantly increasing their cost advantage.

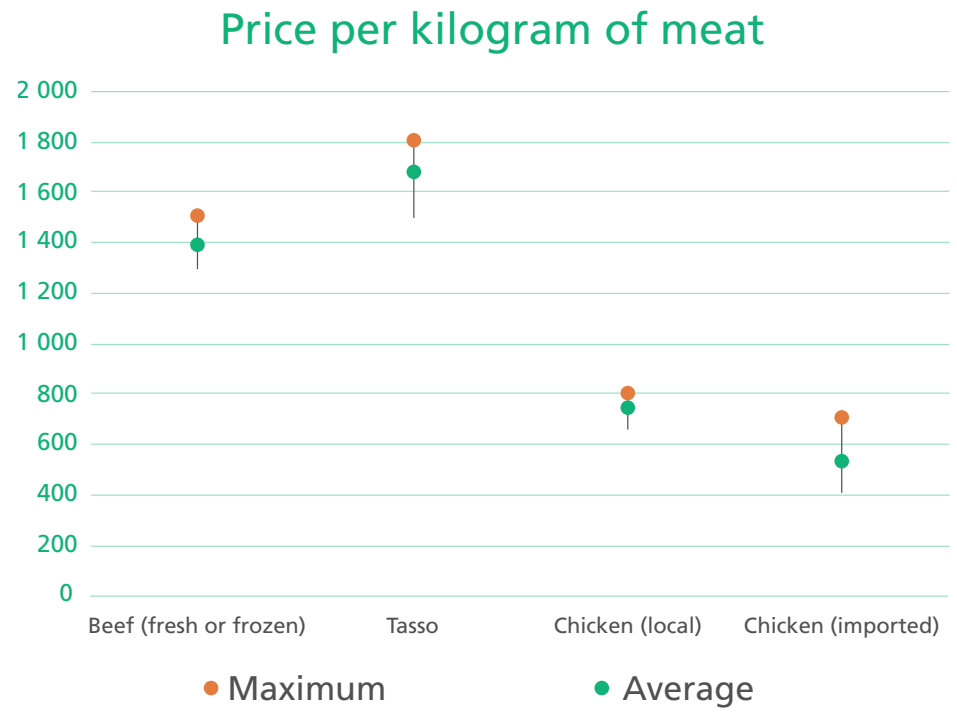
D. Markets

By volume, chicken imported from Brazil dominates the market in the Rupununi, accounting for approximately 82 percent of weight of meat sold. Beef sales are a distant second, with fresh and frozen beef accounting for 13 percent, and tasso (dried beef) for 2 percent. Local chicken accounts for 3 percent (Figure 48).

Average mark-ups, calculated as the difference between average purchase price and average sales prices, are highest for imported chicken, earning retailers on average GYD 46 (~USD 0.23) for every GYD 100 spent. Beef and tasso attract average mark-ups of 38 percent and 27 percent on the purchase price the retailer pays to the supplier. The Project could not calculate a mark-up for local chicken meat as all retailers interviewed sourced from their own farms/ranches. The market for chicken eggs is somewhat less skewed, but nevertheless dominated by imports. Out of our 16 Lethem-based retailers, six sold almost 3 800 trays of imported eggs per month, while eight retailers sold approximately half this amount in local eggs (almost 1 900 trays). Average retail prices are quite close – GYD 1 030 (~USD 5) per tray of imported eggs and GYD 1 150 (~USD 5.75) per tray of local eggs – when one considers average mark-ups for local eggs are 21 percent, while retailers only mark up imported eggs by 11 percent. Comparing retail prices with sales volumes suggests a very price-conscious market for meat.

Consumers can buy imported chicken in Lethem for as low as GYD 408 (~USD 2) per kg (with an average retail price across stores of GYD 533 (~USD 2.5) per kg). Local chicken at its most

Figure 49. Average retail price (per kg) in Lethem and St. Ignatius, including average highest and lowest prices



affordable costs GYD 660 (~USD 3.3) per kg. Both beef and tasso, with average retail prices of GYD 1 387 (~USD 6.9) and GYD 1 672 (~USD 8.3) per kg, respectively, are three to four times more expensive than the cheapest meat options (Figure 49). Prices vary widely among villages in large part due to the high transportation cost. Prices can be nearly double those of Lethem.

The volume of imports represents an underserved market and a sizeable income loss for local farmers. The consumption of chicken and eggs is geographically distributed across the region, and between institutional consumers (school feeding programmes, hospitals, etc.) and households. This creates an opportunity to increase incomes across the region.

There were no shortages of beef reported; the supply was generally rated as good, with some issues during the rainy season. Tasso, on the other hand, attracts more buyers than the current supply. Some retailers are backward integrated, operating their own farms and ranches. When they have no animals to slaughter, they turn to suppliers, or source from other ranches via the abattoir. The time at which meat from the abattoir becomes available is an issue for many retailers. Key informants suggest that delays in the arrival of the environmental health officer, the police and the veterinarian to oversee slaughter, often means that meat gets delivered after 13.00 hours to waiting customers. A small number of traders dominate the import market for chicken meat and eggs. Foremost amongst them, Lincoln International Trading Retails is a wholesale supplier to smaller stores, and to institutional and feeding programmes. A handful of butcher shops supply the main Lethem market, retailing directly, and supplying school feeding programmes and institutional customers.

School feeding programmes encompass both programmes that provide a rounded cooked meal each school day to nursery, primary and post-primary students, and school kitchens in

secondary schools with a live-in population, which provide three meals per student per day for the duration of the school term. Based on a limited sample, hot meal kitchens would appear to use predominantly chicken and beef, spending on average 40 percent of the budget on beef and tasso, and 57 percent on chicken (local and imported). This contrasts sharply with spending on meat at retailers, where sales of chicken meat vastly outstrip those of beef. The Project found no kitchens using other meats (pork, mutton, etc.) and the use of eggs was unexpectedly low. On average, hot meal kitchens sourced livestock products equivalent to about GYD 500 (~USD 2.5) per student per month. Based only on information provided by one school with a live-in school population, it is estimated that these schools procure livestock products worth approximately GYD 3 000 (~USD 15) per student per day.

More than 7 000 students are enrolled in schools in the Rupununi for daytime education, and about 700 in dormitories, suggesting that this market segment is worth between GYD 60 million and GYD 70 million (~USD 300 000–350 000) per annum in livestock product purchases. The Project has not explored other institutional markets, which anecdotal evidence suggests are likely to be somewhat smaller, but still warrant further exploration. These include the Guyana Defence Force Garrison at Lethem, the Lethem Public Hospital and the Bina Hill Institute at Annai.

E. Local governance and support

National laws apply across Region 9. Additionally, Indigenous villages are empowered to make village rules, which, when approved by the minister and gazetted, are legally binding. For more information on national institutions in charge of livestock and national regulations, please refer to Chapter IV.

Through RDC, the Region 9 PARD (Regional Democratic Council Region 9, 2019) sets out the region's vision for agriculture. It recognizes agriculture, including livestock, as a principal economic sector that also plays a strong traditional role ("providing food, employment, income, building materials and general support to all livelihoods"). The region envisions integration into national value-added agricultural production and market systems, while maintaining the ecological systems, enhancing food security and welfare, and substantiating local traditions and culture. Some priorities relevant to the livestock sector and a potential livestock programme focus on:

- training residential agricultural extension officers ('indigenization' of extension workers);
- providing technical assistance to agricultural producers to proactively manage productivity challenges from increased climate variability and associated impacts (e.g. pests, diseases) and to build resilience to impacts of natural disasters;
- adopting a market systems approach (production chain, support services, enabling environment) to inform strategic decisions and prioritization of key activities;
- researching and securing markets for products at prices that are fair and reflect sustainable use of resources;
- establishing storage facilities and trading hubs;
- encouraging collaboration to achieve economies of scale, reduce vulnerability to risks and increase access to financing and extension services;

- agroprocessing for its ability to increase income for small- and medium-scale producers, and to target high-end markets that source products bearing ecological certification and fair-trade standards.

RLPA is a registered not-for-profit company and the main representative of livestock producers in Region 9 with a direct link to government. It is a volunteer-driven organization, originally founded in the early 1980s by a group of ranchers. In 2015–2016, the RLPA was reconstituted by a younger generation of leaders, and now has 70 members on record, with meetings typically attracting around 30 members. Membership has expanded past private ranchers to include villages and goes beyond cattle to other livestock. The organization has engaged local and national government, including President Granger, on issues affecting the Rupununi livestock, chief among them rustling, land tenure and land fees, rodeo, the state of the abattoir, access to supporting services and financing.

RLPA has managed and operated the government-owned Lethem Abattoir since 1994 and hosts the annual Rupununi Rodeo. It provides the rodeo site as a holding facility for cattle transiting through Lethem. It currently has no structured outreach or extension services and does not operate an office of its own. It employs two trained vets (based in St. Ignatius), and three extension staff, one each in Karasabai, Sand Creek and Aranaputa. It has historically set a "beef-price" across the Rupununi, in line with a practice of regulated prices still common in many villages in the Rupununi. Income is derived predominantly from the rodeo and donations, and to a lesser extent, abattoir fees and membership dues. GLDA suffers from resource constraints typical of the public service in Guyana (absence of vehicles in working order, limited supplies of fuel, etc.).

As part of its Hinterland Development Black Giant Poultry Programme (Guyana Information Agency, 2016), GLDA has distributed more than 1 000 chicks to farmers and institutions across the Rupununi. Priority targets have included schools with a resident population (Bina Hill, Sand Creek) and community projects funded by the American Development Fund at Karasabai and Tiger Pond. In Region 9, GLDA has a feed mill and an incubator, but neither are in use at this time. GLDA is open to discussing collaborations or public–private partnerships to operationalize these two pieces of equipment (discussion with Dr Haley, 18 December 2018). GLDA previously offered an artificial insemination service for cattle in the region, but this has been scaled back to some ranches only. GLDA is currently boosting its veterinary and production staff in the region. It has indicated that there are no qualified private vets in the region.

There is an existing arrangement in Region 9, introduced under the previous administration that provides a form of location-specific incentive for enterprises situated in this Region. The practice, observed by the consultant in 2016 and confirmed verbally by key informants in 2017 and 2018, allows for a waiver of customs duty on imports from Brazil, if they are for consumption and use within Region 9. Should the importer attempt to subsequently transport these items beyond Region 9, duties become payable.

Additionally, there is a national-level incentive regime, comprising general and special incentives, facilitated by GoInvest. General incentives can include zero-rating on both customs duty and value-added tax on most machinery and equipment, raw materials and packaging inputs. Fiscal incentives include unlimited loss carry-over, accelerated depreciation and potential benefits of double taxation treaties with the United Kingdom, Canada and CARICOM countries. Special

incentives, in addition to general incentives, are provided to firms producing non-traditional products for export to markets outside of CARICOM.

In six priority sectors, including agribusiness, manufacturing and tourism, GoInvest can facilitate further incentives (i.e. in addition to general incentives), granted under specific conditions. Generally, the incentive regime emphasizes value-adding activities and is geared less towards incentivizing primary production.

F. Livestock and culture

Indigenous communities value the ability to freely meet subsistence needs through the goods and services provided by the land and nature (e.g. food, building materials for houses), rather than reliance on outside actors (Regional Democratic Council Region 9, 2019). Livestock, particularly cattle, plays an important role in Indigenous culture and traditions in the Rupununi. Since cattle were first introduced to the Rupununi in the 1800s, Indigenous Peoples have worked with them, as cowboys, ranch workers and owners (de Freitas, 2018). Cattle are used as draft animals and for beef, tasso, hides, bones, fat, milk, manure and leather for lassos, saddles, bull whips, belts, shoes, hats, leggings, hobbles, sheaths, clothing, ornaments and medicine. Cattle also act as a "bank" because they can be bartered or sold in times of need. Ranching is considered part of the way of life in the Rupununi, where the savannahs and swamps are foraging grounds for livestock as much as for wildlife, and the annual rodeo and horse racing are part of social life (South Central and South Rupununi Districts Toshaos Councils, 2012). The same source also mentions the importance of skills youth acquire through their work at ranches. Cattle are thus a form of social and financial capital, but are also a source of wealth inequality due to differences in access to cattle (de Freitas, 2018).

Livestock may be an important aspect of sustainable wildlife management, because it reduces the need for hunting. Some livestock-owning households in the Rupununi appear to hunt less (David *et al.*, 2006). On the other hand, our key informant interviews suggested that better access to farmed meat and increased income from small-scale livestock farming may, in fact, increase hunting, as farmers have more free time and resources (e.g. shotguns, motorcycles) that allow them to hunt more efficiently and access far-off hunting grounds. Research in Amazonian towns of Brazil and Colombia has shown that social relations that are strengthened through the sharing of food, are a strong predictor of the consumption of wild meat (Morsello *et al.*, 2015), quite similar to the role of beef in Wapichan tradition in the southern Rupununi (de Freitas, 2018). It is also suggested that (wild) free-range cattle are seen in the same way as wild animals, to be stalked and hunted (de Freitas, 2018).

G. Wild meat production

For neotropical countries and other regions across the world, wildlife farming is gaining increasing attention as an economic alternative for meeting rural and urban demands for wild-sourced animals and their products. Wildlife farming can be defined as the captive rearing of non-domesticated animals for the supply of meats and other products. It yields many benefits; however, using wildlife farming as a conservation tool for protecting species that are threatened

by overhunting while at the same time fostering sustainable livelihoods is perhaps the most important. Nevertheless, its effectiveness has been strongly debated and its success depends on a number of different factors (Damania and Bulte, 2007; Tensen, 2016). Wildlife farming does not exist in Guyana, even though recent legislation incorporates clauses on the theme (see Chapter IV), indicating a strong interest at the national level in developing production of wild meat. The Project has provided a review to explore its potential.

Different neotropical wild mammalian species of varying geographic ranges have been traditionally exploited for their meat, skins and other by-products. These species have been introduced into captive-bred systems for maximized and sustained production. Of interest to the Project are the capybara, labba, red-rumped agouti and collared peccary, as they are all native to Guyana (Morrison 2019). Agouti and labba are well suited for intensive production systems and can be implemented in peri-urban areas. Capybara and collared peccary are suited for semi-extensive or extensive production systems.

Consumers in the Rupununi were asked about their attitude towards farmed wild meat and willingness to purchase. Half of the interviewees said they would be willing to buy farmed wild meat (n = 52). The main reason for being opposed to or unsure about farmed wild meat was the well-being of the wildlife (54 percent, n = 26). Interestingly, of those in favour of farmed wild meat, 35 percent still mentioned the well-being of wildlife as a condition. A few mentioned the importance of the culture of hunting as opposed to farming, while jobs and reduced pressure on wild populations and increased availability were arguments for farmed wild meat. Importantly, of those never eating wild meat, a third were open to farmed wild meat. On the coast, a third of all interviewees were willing to consume and purchase farmed wild meat, whereas among current wild meat consumers, this was 55 percent (n = 64).

H. Aquaculture

Aquaculture in Guyana as a whole constitutes only 1 percent of total fisheries (FAO, 2018). In the early 2000s, aquaculture decreased and has fluctuated strongly in the last decade. Some aquaculture occurs in brackish water, but is extensive and involves existing sluices and dams in Corentyne and Berbice (Unknown, 1996). Freshwater ponds for aquaculture exist along the coast and to some extent in the hinterland. The most common species in aquaculture include tilapia (*Oreochromis mossambicus*, *O. niloticus*), giant river prawn (*Macrobrachium rosenbergii*) and armoured catfish (*Hoplosternum littorale*). Fish farmers typically sell their products directly at local markets. Export is limited. The Botanical Garden Fish Culture Station was set up by the government as a demonstration farm and fingerling supplier, but this no longer exists.

In the Rupununi, aquaculture started in Aranaputa (Rockview Lodge). With years of drought, more villages and individuals are exploring aquaculture (NRDDB, undated). Aquaculture has mainly involved introduced tilapia. Farmed fish are often imported from Brazil. About 540 kg of tambaqui (*Colossoma macropomum*), the most commonly imported fish, crosses the border from Brazil, and is sold at GYD 800/kg (~USD 4/kg). Most of this import, however, is destined for Georgetown (Conservation International Guyana and IDB, 2015).

In December 2000, the NRDDB and Iwokrama convened a meeting with community leaders to discuss fish management issues (North Rupununi District Development Board and Iwokrama

International Centre for Rainforest Conservation and Development, 2011). The meeting, attended by local and international experts, discussed management of arapaima, the aquarium fish trade, a legal framework for fisheries in Guyana and fish farming. At the time, people in the region were experimenting with fishponds with little or no experience or expertise, although the Fisheries Department provided some information. The main interest, however, was in farming certain predatory species such as lukunani and haimara, and insufficient expertise was available in Guyana to guide this process. A number of communities have received funding for aquaculture development projects since. However, they have not been able to get those projects running successfully. These communities and those that indicated an interest were the focus for a feasibility study by the Project.

Many villages were mostly interested in extensive multi-species fish farming, with the enhancement of natural ponds. They would recruit mainly herbivorous species until they understand what it would take to manage a mixed structure community that includes predators like lukunani and haimara. The main target species would be daray (*Leporinus* sp.), pacu, cartabac, hassa (*Hoplosternum* sp.), cootie and patwa (Family Cichlidae). Four villages, Aranaputa, Wowetta, Rupertee and Yakarinta, are considering intensive monoculture aquaculture with fish stocks obtained from Brazil. This would focus on tambaqui. The BHI was considered for a demonstration pond. These villages aim to produce fish for their own communities, rather than for larger outside markets. Monoculture intensive fish farms target regional stores and supermarkets. Taste preference is an important consideration as community members prefer their local species of tambaqui.

Much technical advice will be required to support aquaculture in the Rupununi, and know-how for some of these systems is lacking. Factors to consider include water supply and soil characteristics in the feasibility and construction of ponds. Not all villages had the necessary conditions in place, while others required water supply systems and soil testing. The natural floods would also have to be considered. Another important consideration is transportation for recruitment of materials and selling products. Transportation costs are extremely high in the region, even more so when this service needs to be outsourced. Staffing is another cost factor that will require further consideration; with cost of living being very high in the area, a reasonable salary may limit the potential profit margin considerably.

I. Lessons learnt, recommendations and first actions put in place

I.1. Lessons learnt

Livestock. Chickens and cattle are common livestock in the Rupununi, owned by nearly half of households. This suggests that local knowledge and experience of working with these groups of livestock is present in local communities. Working with these species increases the likely reach of any programme.

Livestock are owned by different groups (individuals, producer groups, village councils, private companies), with different and overlapping motivations (generate steady income, store of wealth, food security, tradition and cultural significance), in varying production systems. Support needs to enable the widest mix of owners, motivations and production systems.

There is tension between the traditional economy in the Rupununi, and the cash-based economy. Some suggest a one-way "transition" to a cash economy, while others suggest that Indigenous Peoples will assimilate aspects of the cash economy, while holding firm to traditional culture. It is also possible that the fault line runs between the older generations holding to traditional values, and younger generations, seeking opportunities in the cash economy. A livestock programme should be structured to enable livestock production without giving preference to either the cash or the traditional economy.

Commercial poultry producers in Region 9 are exposed to a level of competition from cheaper Brazilian imports to which producers in other parts of Guyana are not exposed. Where coastal producers are protected from imported (North American) chicken meat by a system of import permits issued by the Ministry of Business and a tariff of 100 percent, this is not the case in the Rupununi. Any programme to support commercial poultry production in the region needs to address this inconsistency.

It is unlikely that livestock producers in Region 9 can compete on price with the Brazilian agro-industry. To attempt to do so would probably ruin the fragile and diverse ecosystem that is the Rupununi. Rupununi livestock producers need to deliver a different value proposition to secure a good return in the market.

The cattle sector faces complex challenges (including rustling, abattoir facilities and grazing rights) that are compounded by mounting concerns about the environmental impacts of beef consumption. Given the importance of cattle in Rupununi culture, support for cattle needs to consider the environmental footprint, and maximize (cash and non-cash) returns from each animal.

From previous and current programming in the hinterland (not limited to livestock), we draw the following conclusions:

- Supporting livestock owners in the Rupununi means supporting two systems: traditional low input approaches to livestock, where animals serve as a food and cash bank that largely looks after itself ("the animals minding the farmer"), and market-oriented production systems, where market access, productivity and management practices are more important ("the farmer minding the animals"). The boundary between these systems is fluid, but the extent to which the "farmer" is willing to commit labour is probably the defining feature.
- Rural producers and processors with inherently high costs of production need to avoid competing on cost, and instead deliver value in other ways, including to customer segments where price is not the only consideration.
- Related to the above, branding can play a critical role in carving out market space for small producers. Small producers need to tackle niches that deliver returns capable of offsetting high costs of production.
- Economies of scale are critical for staying competitive; working together, including across value chains (horizontal linkages) is necessary.
- Where competing in price-conscious markets is necessary, a combination of approaches is needed to carve out a space for local producers. This is likely to involve creative solutions at the production level (e.g. scavenging chickens), in marketing (e.g. short value chains) and in the enabling environment (e.g. lobbying for enforcement of existing regulations).
- In the Rupununi, transportation costs are high. They need to be reduced wherever possible.

This includes finding innovative ways of supporting producers and processors that rely on expensive 1:1 face-to-face models only in limited cases.

- Working with groups is not the only and not necessarily the best way to deliver benefits to communities. It is important to balance our respect for the egalitarian nature of Indigenous communities with respect for the capacity and desires of individuals and small groups.

Wildlife farming. The literature provides contradictory conclusions about the feasibility of wildlife farming and its capacity to replace meat from the wild (Damania and Bulte 2007; Tensen 2016). Experiences in wildlife farming in South and Central America since the 1980s provide positive results for a number of game species from a production standpoint. Nevertheless, several authors question the economic sustainability of wildlife farming and whether it can compete with hunting (Rushton *et al*. 2004). They also mention the complex institutional and regulatory set-up that needs to be in place to ensure traceability, manage restocking, and control food safety and zoonotic spill-overs (Damania and Bulte 2007; Tensen 2016). Successful experiences nowadays are based on multipurpose systems, where wildlife is used for meat, pelts, restocking and tourism.

In the Rupununi, potential farmers are ranchers that are already used to meat production. Those farms often combine cattle production with ecotourism. Of the five species examined, the labba and capybara are the best candidates to include in pilot Rupununi wildlife farms. Labba and capybara are among the preferred meats on the coast and would find easy markets there. Moreover, ranchers expressed a preference for semi-extensive or extensive production systems that can serve multiple purposes: meat, tourism, by-products (skins) and restocking. Capybara populations in the Rupununi are thought to be in decline and there is local interest in recovering wild populations. Collared peccary production may be feasible, but not sufficiently economically viable in an extensive system. Agouti is a preferred meat but works best in intensive production systems

I.2. First actions

Livestock. Under the Project, RLPA's activities support the production and accessibility of affordable protein (poultry meat, eggs and beef, and to a lesser extent other livestock) in Rupununi communities. They build on a history of livestock production in the region, in a growing market for farmed sources of protein. In line with the implementation plan developed in Year 1, awareness raising about the RLPA action plan was launched in January 2020. This was done through community workshops (125 participants from six communities informed about RLPA activities in February 2020), the RLPA website, a WhatsApp group created to communicate and share information with members and three radio programme broadcasts on Radio Lethem. A campaign to promote local livestock products within the Rupununi has been developed and is being implemented. This campaign entails development and distribution of communication materials: fliers, posters, stickers, radio programmes and social media promotions.

The Project facilitated the construction of poultry support and production facilities for the RLPA (Figure 50). This included breeding pens, general housing paddocks and incubator facilities. RLPA also opened its first livestock hub in Lethem to help provide easier access to livestock feed, equipment, veterinary support, chicks and hatchlings in the region. Cumulatively, by December 2020, RLPA has supplied: 9 830 chicks, 22 895 kg of chicken feed and an estimated 13 762 kg of chicken to the region since the inception of the Project. A coordinator for livestock activities and

Figure 50. Alternative protein sources. The Project supports local poultry production to reduce dependence on chicken imported from Brazil and create alternative livelihoods. ©FAO/Oswin David

a hub manager have been recruited by RLPA. RLPA signed an MoU with GLDA to ensure national support to the activities implemented by the Project through RLPA in the Rupununi.

The curriculum for the training of trainers on poultry production was developed together with a technical booklet with tips and recommendations for poultry production. Two capacity building sessions took place to introduce participants with best practices for building coops, preventing predators and recording feed consumption, weight, vaccinations and mortality of birds. Two veterinary outreach clinics were conducted on 10 January 2020 and 27 February 2020 to provide technical backstopping regarding veterinary issues of poultry production.

Wildlife farming. In October 2019, the Project organized a learning trip to Trinidad and Tobago with eight participants from the Rupununi to experience some working peccary, agouti, labba and deer farms. They explored the technical, economic, legal and institutional challenges and opportunities offered by wildlife farming. Participants interned at a wildlife farming and research facility, Sugar Cane Feeds Centre, where they experienced practical issues involved with wildlife farming. Discussions with personnel from the Trinidad Ministry of Agriculture, who are the authority on wildlife farming, were conducted. These discussions sought to ascertain how policies and regulations supported (or not) wildlife farming. Discussions with the University of the West Indies, Faculty of Agriculture, were also conducted to learn about educational programmes which support this initiative and possible collaboration with the Project through training. Two of the participants in the learning trips that are ranch owners in the Rupununi agreed to develop a proposal for a pilot wildlife ranching facility which was to be shared at the end of Year 2. Nevertheless, due to COVID-19, the order of priorities changed in the Project and the pilot was postponed to Year 4.

Aquaculture. Aquaculture was not prioritized by the Site Steering Committee held in Year 1 because the feasibility analysis indicated too many uncertainties in the success of such activity and implied larger amounts of funding than those available for the Project. Legislation for aquaculture is not developed in the country. It was agreed that the Project will partner with other projects and institutions to explore co-funding opportunities in the future.

Summary

Tourism development in general and community-based tourism development in particular are seen by local communities as a basis for a viable sustainable economy in the region. This would be in keeping with the culture of the region and would support wildlife-friendly habitats and livelihoods. The Rupununi offers nature, wildlife, community and adventure tourism. There are 19 established lodges, some private, others community owned. VR is a regional destination management organization that groups different providers in the tourism sector and helps promote sustainable ecotourism in the Rupununi. Wildlife-based tourism options in the Rupununi are based on bird watching (e.g. red siskin (*Spinus cucullatus*), sun parakeet (*Aratinga solstitialis*), cock-of-the-rock (*Rupicola rupicola*)) anteater spotting, black caiman watching, turtle nest counting (during the dry season), giant otter spotting and tours along the river or on horses to potentially observe capybara, tapir, monkeys, agouti or deer. Sport fishing is also a developing sector. Handicraft based on wildlife parts (mostly feathers) is part of the ecotourism offer. Wild meat is served in some community-managed lodges (agouti, deer, labba). The Project conducted a needs assessment, prioritizing ten needs for action to develop the tourism sector, which included training (in management-related themes, among others), and developing and promoting unique wildlife-based tourism products. A tourism action plan was developed by VR with support from the Project. The plan also included the need to agree on a set of guidelines on wildlife-friendly tourism practices to ensure that tourism is respectful of wildlife and wildlife habitats and contributes to wildlife conservation.

X. NON-CONSUMPTIVE USE OF WILDLIFE: TOURISM

Melanie McTurk[1], Eleonor Devillers[2], Nathalie van Vliet[3], Evi Paemelaere[4]
[1] Karanambu, Guyana, melanie.karanambulodge@gmail.com
[2] CIFOR, Colombia, eleonore_devillers@yahoo.fr
[3] CIFOR, Colombia, nathalievanvliet@yahoo.com
[4] CIFOR, Colombia, pwsolutions.main@gmail.com

Visit Rupununi

Visit Rupununi (VR) was established in July 2015 with the support of Conservation International Guyana (CI-Guyana) in response to a recommendation from the region's stakeholders to have one body to coordinate tourism efforts in the region.

Visit Rupununi's vision is to develop international and local tourism. It aims to do this through capacity building of communities and tourism service providers, marketing the destination, raising awareness within local communities and supporting the establishment of tourism services. The goal is to provide quality, diversified and safe tourism and conserve the nature-based, traditional heritage of the Rupununi.

It is a membership-based organization that represents the Rupununi as a destination in national, regional and international markets. Its members are grouped into categories based on services they provide and include private and community-owned lodges, transportation operators, tour operators, other tourism service providers, hotels and restaurants.

When the Project was launched, VR was based on voluntary staff. With support from the Project, it is now functioning with a full-time coordinator and is in the process of recruiting an assistant. Office equipment and office space have been provided to VR to enable their more active operation.

A. General description of tourism in the Rupununi

Due to the variety of fauna from the Amazon and Guiana Shield found in the region, the Rupununi savannah has very high species diversity, with over 2 000 vertebrates and many threatened species. Species count is much higher than expected, given its size. There are at least 600 species of fish, along with 600 species of bird, and over 200 species of mammal (Watkins *et al.* 2010). The main attraction of the Rupununi is its intact nature. The area offers domestic and international visitors the opportunity to experience dramatic vistas, wetlands, untouched tropical rain forests, majestic rivers and savannah plains. There are opportunities to see numerous species of flora and fauna, including threatened species such as the jaguar, caiman, harpy eagle, giant river otter and giant anteater. Fishing tours are offered by some, and ranches offer lifestyle experiences. Indigenous communities run some of the lodges and share their local knowledge and skills with guests, who are willing to pay a high price for this experience. The nature experience combined with the management of tourism by local communities is highly rated by tourists.

Tourism in Guyana's southern Rupununi region has long been a small business aimed at foreign visitors, mostly from Canada, the United States of America and Northern Europe. Growing demand for experiences that combine wildlife watching with cultural activities is creating further opportunities that can benefit local communities. Tourism development in general and community-based tourism development in particular are seen by local communities as a possible basis of a viable sustainable economy in the region in keeping with the culture of and supporting wildlife-friendly habitats and livelihoods. The industry not only creates jobs in rural villages where employment opportunities are scarce, but it also provides incentives to protect birds and other animals that visitors will pay to see, such as giant otters, giant anteaters and jaguars (Figure 51).

"With the spread of community-based tourism and the increased interest internationally in experiential travel, it is as if the Rupununi has found its moment," says Melanie McTurk, president of VR. After two or three decades of being told that no one would want what the Rupununi has to offer, she adds, "all of a sudden, it is exactly what everyone wants."

The introduction of ecotourism as an alternative livelihood and income-generating opportunity in the region has led to a proliferation of community-based conservation and management initiatives (Figure 52). The work initiated by Karanambu Lodge with giant river otters was the first conservation project in the region. Through support garnered from tourism, it was instrumental in raising awareness to support giant otter conservation. Other community-driven efforts in conservation have focused on prohibiting bird trapping in Surama, nest protection and head-starting of yellow-spotted river turtles in Yupukari by Caiman House Inc, monitoring and conservation of red siskin in the south savannahs by SRCS and sun parakeets by villagers in Karasabai. These community-driven efforts have also been applied to fish (a critical resource for subsistence and tourism). They include the implementation of the arapaima management project, which resulted in the rebound of dwindling regional populations of this protected

Figure 51. The Rupununi's rich biodiversity and presence of threatened species, such as the endangered giant river otter, are key attractions in the region. ©FAO/David Mansell-Moullin

Figure 52. Falls near Lethem in Moco-Moco and Kumu offer an excellent half-day trip for locals and international visitors. ©FAO

species, and efforts to improve the management of key fishing areas like Awarikuru (Yupukari) and the Simoni Lakes (Karanambu Ranch/Massara Village/Simoni community).

Despite these opportunities, community-based tourism in the Rupununi is at its early stages and only 2.4 percent of households depend on tourism for their livelihoods (Conservation International Guyana and IDB 2015). Tourism generates only 2 percent of the income in the region. Substantial support is needed for it to develop into a healthy, sustainable, eco-friendly market-based activity. A number of factors influence the development of the sector, both nationally and regionally. A lack of direct international flights limits the volume of tourism. Domestic airports and strips are of a low standard, which means that costs to get in and out of the hinterland are high and group sizes limited. The lack of paved roads, especially in the Rupununi, makes overland travel uncomfortable and very expensive and therefore only appeals to a small percentage of the market. In the region, accommodation is limited and unregulated (no standards). Bringing the market to hinterland communities, where most of Guyana's nature tourism products are located, is costly. A return ticket from Ogle International Airport (Georgetown) to Lethem currently costs as much as GYD 100 000 (~USD 480). Flights to Surama, arguably Guyana's premiere ecotourism experience, are only available as charters; the alternative, overland from Lethem adds a further GYD 30 000 (~USD 145) to GYD 70 000 (~USD 335) (one way) and effectively increases travel time by one day.

B. Co-benefits and impacts of tourism on wildlife

Beyond the economic benefits that tourism can provide for the local economy, wildlife-based tourism can also be seen as an alternative to wildlife hunting and wildlife trade. It may generate more revenue than those potentially non-sustainable activities and release pressure on wildlife. Also, the tourism sector may increase the economic value of wildlife-friendly landscapes and reduce the likelihood of those habitats being converted to other less biodiversity friendly uses of land such as agribusiness, mining and logging. Well-designed wildlife tourism products encourage people to enjoy and protect animals in the wild. Tourism helps maintain and share

knowledge around flora and fauna, raise awareness about the threats to biodiversity and the importance of wildlife for local livelihoods, and contributes to the preservation of Indigenous culture and maintenance of traditional ways of life.

Nevertheless, tourism may also have negative impacts on wildlife and those impacts depend on the destination's vulnerability, the type of tourism activity, the number of tourists visiting the site, and tourist behaviour. Direct impacts on wildlife include disturbance of animal behaviour, changes in feeding and breeding patterns, increased vulnerability to competitors and predators, disruption of parent–offspring bonds, transmission of diseases, and death of individual animals due to road collisions (Newsome, *et al.*, 2013). Other negative effects of tourism on wildlife include poaching, egg collection, human–wildlife conflict, animals being locked up and kept as pets, habitat loss, littering, and poor solid waste and wastewater management.

C. Wildlife-based tourism products in the Rupununi

The broad term "wildlife-based tourism products" includes non-consumptive and consumptive wildlife tourism activities that contribute to conserving the environment, protecting wildlife and improving the well-being of people. The broad term is used to describe an extensive range of wildlife-based tourism activities, where tourists travel to natural areas to appreciate and enjoy wildlife (Tremblay 2001).

Wildlife tourism includes:

- Non-consumptive wildlife tourism: For instance, bird watching, photographic and walking tours, and observations of rare, endemic species or species that are part of a conservation project, such as turtles.
- Consumptive wildlife tourism: Animals or animal parts being used as tourism products such as trophy hunting, sports fishing (excluding catch and release), handicrafts, and local cuisine of wild meats and fish.

Wildlife-based products in the Rupununi include consumptive and non-consumptive uses of wildlife. They can be classified as follows:

Wildlife spotting. Wildlife spotting is the most important wildlife-based tourism product. The most emblematic wildlife that tourists travel to see in the Rupununi are endemic or rare birds, such as red siskin, harpy eagle, sun parakeet, cock-of-the-rock, rufous-winged ground cuckoo (*Neomorphus rufipennis*), capuchin bird (*Perissocephalus tricolor*), and also giant anteaters, black caiman and giant river otters. In fact, bird watching is the oldest and most developed tourism product offered in the Rupununi. Wildlife spotting can take place during walking tours, horseback riding, car drives or along the river in canoes or powered boats (Figure 53). They are organized in the forest, open savannahs, along rivers and creeks, in bush islands or in caves and rocks depending on the habitat of the species that is specifically sought. While those species are the most advertised, other wildlife can also be seen during the wildlife spotting trips: snakes, capybaras, monkeys, agoutis, tamanduas (*Tamandua tetradactyla*), savannah deer, tapirs, jaguars and so forth.

Figure 53. Horseback riding in the savannahs is a great way to explore the area and spot wildlife, such as the threatened giant anteater. ©FAO

Catch and release. Sports fishing is a category of tourism that is growing in the Rupununi, and is offered by lodges, like Rewa and Apriabo, as well as in the form of organized trips by outfitters, like King Solomon Adventures and others. The most successful example of the introduction of sports fishing has been in the community of Rewa, where catch and release for the endangered arapaima comes at a premium price and has successfully transformed a community of arapaima hunters into the guardians of their former prey.

Wildlife-based handicrafts. Handicrafts made by Indigenous communities constitutes a source of income, particularly for elderly women. The handicraft industry uses a large variety of non-timber forest products, including wildlife-based products such as leather to make belts, hats and even horse-riding equipment, and feathers for earrings, necklaces and other jewellery. Massara in the North Rupununi are best known for their embroidery of traditional and nature scenes. At Surama, jewellery from seeds and embroidery also revolves around local culture and wildlife, as do the balata (rubber) figures from Nappi. Parishara produces carved wood products from the letterwood tree (*Piratinera guianensis*). Near Lethem, in the villages of Kumu and St. Ignatius, craft focuses on cotton and feathers. Feathers have traditionally been part of headdresses, but there are legal restrictions on exporting these. In the south, Aishalton and Sand Creek are more

active in handicrafts, as are the Wai Wai. Leather products made from wildlife, such as jaguar, are typically restricted to heritage regalia, although this is declining, particularly among Makushi. Claws and teeth of jaguars and caiman are seen in pendants, but rarely sold.

Wildlife-based cuisine. Fish meals are regularly offered in lodges. Typical fish meals include lukunani, tiger fish or piranha and are served most often with traditional farine, a granular starch product made from the bitter cassava. While some wildlife products are not necessarily developed for tourism purposes, they may be offered during the tourism experience. For example, wild meat is served in two community-based lodges and in some traditional events that usually attract tourists, such as those organized for Heritage Month or the rodeo. But, in general, wild meat is not promoted locally as a tourism product and, when on the menu, is presented as part of a cultural experience linked to the traditional Indigenous lifestyle. Increased demand for wild meat and wild fish, especially among border and coastal communities, has fuelled the increased use of nets for fishing and fostered overfishing in many sites critical to local food security, such as Simoni Lake.

Wildlife conservation/Research and tourism activities. Yupukari village is an example of one community that has been able to leverage its conservation projects effectively to sustain a profitable tourism product. Initially through the Caiman Project, Yupukari first started offering tourists the opportunity to tag along with researchers conducting research on black caiman. Growth in the popularity of the caiman tagging experience allowed local researchers to continue their study well beyond the original period of funding and to support the induction of a second conservation project that engaged the community even more widely: the programme for turtle rearing and re-introduction. Yupukari has also developed the popular Turtle Festival, which, in 2020, was recognized by VR for its significant contribution to both conservation and tourism in the region.

At Wichabai Ranch, tourism and conservation are seen as linked and interdependent. In the first instance, many tourists travel to Wichabai to see giant anteaters and red siskins. Once they have visited, they might post on social media about their experience, which raises the profile of the two species. In addition, the tourists might give a small donation to SRCS, which is based at Wichabai, allowing research and monitoring work to continue. As this work continues and is further publicized, it attracts more tourists and the cycle continues with possibilities of expanding the work of SRCS to protect other threatened species. Wichabai Ranch also allows for researchers to stay and collaborate with SRCS, thereby increasing the skills of the rangers and the capacity of the organization.

Rewa is home to the international arapaima conservation research programme. This has drawn attention to Rewa, and the Rupununi in general as an important site for conservation through various media outlets. Karanambu has had a longstanding programme on otter rehabilitation and release. Iwokrama, Surama, Karanambu and Yupukari all receive international student groups for research projects.

Trophy hunting is not a product on offer in the Rupununi and is frowned upon by local stakeholders.

Figure 54. Cattle ranches with Indigenous vaqueros from surrounding villages are an integral part of local culture and also function as eco-lodges in the Rupununi, offering lodging, meals and tourist packages. ©FAO

D. Typology of stakeholders involved in tourism

The Rupununi offers 19 established lodges, some private, others community owned. Eco-lodges typically offer packages that include lodging, meals and tours.

Communities. Some villages in the Rupununi (e.g. Wowetta, Surama, Sand Creek, Karasabai) have established tourism committees that manage community-based tourism at the village level in close relation with the village council. Generally composed of five people (chairman, vice-chairman, treasurer, secretary and assistant), and accompanied by representatives of the different tourism-related groups (tour guides, bird guides, culture, crafts, youth, agro-processing, catering, accommodation, etc.), the tourism community is in charge of developing the local tourism strategy and policy and its action plan or tourism master plan. It defines the tourism products to be developed and sets rules and regulations – in terms of sustainable natural resources and environmental management, conservation of cultural heritage, as well as carrying capacity.

Ranches. A few private ranches in the region have chosen to diversify their economy and offer the 'vaquero' experience to their visitors. Most of these ranches offer lodging facilities and horseback riding, bird watching, or anteater spotting, as part of the experience (Saddle Mountain, Karanambu, Wichabai, Dadanawa, etc.; Figure 54).

Private lodges and providers. A relatively new trend is private lodges and bed and breakfast sites. Rock View (Annai) is a private lodge that was established in 1992. More recent additions are the Pakaraima Mountain Inn (Yakarinta) and New Views (Shulinab). These are not ranches or community-owned lodges, but rather they are run by private individuals. Some ranches also function more in this capacity nowadays than as a ranch (e.g. Karanambu, Manari), drawing most of their income from tourism and not from cattle. Some providers do not offer lodging, but provide activities and meals.

Local tour operators. Adventure and waterfall tours are offered by local tour operators

(Rupununi River Drifters, Rupununi Trails, Untamed Adventures, Bush Masters, Sky Valley). Some villages offer tours, even if they do not have lodging for guests, such as Wowetta and Shulinab. Some communities have MoUs with private individuals within the community who operate specific sites (e.g. Kumu, Moco-Moco, Ariwa Beach). Additionally, there is a small group of private guides that organize tours, such as hiking trips and waterfall excursions, predominantly for local tourism and visitors from Brazil.

Support services. *Transport providers:* With its untamed terrain and seasonal roads, the Rupununi depends on reliable transportation services as an integral link between the region's main airport in Lethem and the region's most visited tourism sites, which can be in the range of 1–5 hour's travel time. This has led to the emergence of the industry subsector of 4x4 operators who specifically offer safe transport between locations and from Lethem to tourism destinations across the region.

Increased business and domestic operations within the region have led to the development of small restaurants and snackettes along the length of the main Rupununi roads with focuses in Annai and Lethem. Serving miners, minibus travellers and local communities, these eateries have reported increased numbers of domestic travellers choosing the self-drive option to explore the region. They often see significant numbers of consumers during festival periods, such as Heritage Month or the rodeo. This has led to an increased demand for wildlife and fish, though wild meat is rarely on offer.

Cultural committees: Committees are formed to organize special events, such as Indigenous Heritage Month celebrations and the rodeo.

Governmental institutions. GTA, operating under the Ministry of Business, is a semi-autonomous governmental organization established on 11 June 2002. GTA's mission is to develop and promote sustainable tourism in Guyana through collaboration to maximize local socio-economic and conservation outcomes and improve the visitor experience. More recently, GTA has extended its mandate to develop and promote community-based tourism, which has led to increased investment in project support and training targeting Indigenous communities.

The RDC also supports the regional mandate for tourism development. It helps communities to implement and source funding for tourism projects articulated within community development plans. With the support of RDC, VR has been acknowledged as the regional tourism body for Region 9. Furthermore, the Ministry of Indigenous Peoples Affairs, through its community development officers, supports communities in their project development and funding.

Local NGOs. In the South Rupununi, SRCS consists of citizens from different villages in their conservation efforts. While SRCS is a conservation organization, its members are tour guides in wildlife tourism. They formed a conservation organization originally to study the endangered red siskin but now fulfil a general role in conservation research, applications, and education. Caiman House Inc is a community-managed NGO based in Yupukari village. It is involved in research, conservation and tourism, particularly focused on black caiman, river turtles and environmental education.

E. Needs assessment for tourism activities in the Rupununi

In 2010 CI-Guyana in partnership with the IDB published a seminal study entitled 'Community tourism enterprise development in the Rupununi: A blueprint'. This study assessed the current rate of community tourism marketing and development, and provided several recommendations for individual and regional tourism support and development. At that time, 11 lodges were operating in the Rupununi. The following three areas were identified as requiring most urgent support: training and capacity building; marketing, promotion and dissemination of information (including a website); and a local business representation or in-bound operator for the Rupununi. From this initiative, VR was born.

In 2018, the Project carried out the most recent needs assessment based on the criteria and indicators of the community-based tourism standard, simplified and adapted to the Rupununi. Among the needs expressed by the 19 stakeholders, a list of the **top ten priority tangible actions** was developed. Training (on community-based tourism standards, digital marketing, business plan development, catering, safety, tour guiding, record keeping and pricing), access to funding and an improved network with the nature-based tourism industry were among the topics that were identified as requiring most urgent attention. In addition, VR identified the need to develop guidelines for wildlife-friendly tourism operations, to ensure that tourist and tourism operators continue to operate and grow, without becoming a threat to wildlife and natural habitats.

F. Lessons learnt, recommendations and first actions taken

F.1. Lessons learnt and recommendations

The Rupununi offers clear opportunities to develop tourism as an alternative economic activity that can compete with wildlife trade. It also contributes to increasing the economic value of this wildlife-friendly region and discouraging the transformation of wild savannahs into agro-industries. Tourism in the Rupununi has been fully linked to conservation efforts since the start and, as such, tourism also offers opportunities to enhance conservation in the region. VR, as an umbrella organization for tourism stakeholders, can channel and lead the development of tourism in the region and has been identified by the Project as the main local partner for implementation. Nevertheless, this young organization needs to be strengthened in order to play its role and become a recognized agent of change in the region.

F.2. First actions

The first action taken to support ecotourism has been to strengthen VR as the umbrella organization. The Project has secured funds for a full-time VR coordinator and an assistant. The Project has also facilitated the development of the VR Action Plan from Year 1 to Year 3 in close collaboration with local stakeholders (particularly members of VR), including detailed activities and budget (Ramnouth 2020).

The following objectives have been outlined in the tourism plan:

- strengthen VR's organizational structure and reach financial sustainability;
- strengthen the networking between tourism stakeholders and VR as a tourism representative at national and international levels;
- enhance tourism stakeholders' capacities to deliver a quality and sustainable tourism product that promotes conservation;
- enhance the capacity of VR to market, promote and sell a diverse collection of sustainable Rupununi tourism products, to reach international brand recognition and increase the Rupununi operators' revenues;
- develop engaging and pioneering communication mechanisms and materials.

In addition, the Project has provided capacities in different fields, including first aid, pricing and record keeping. As part of the Project's support for capacity building, the Project with VR carried out a 'Learning Trail' to provide hands-on experience in wildlife-based tourism, allowing ten newly established community tourism operators to experience well-established tourism products in the Rupununi and exchange ideas and best practices. They learnt about various accommodation styles, general necessities required by tourists, challenges faced as operators and the strong link between wildlife conservation and tourism in the Rupununi.

Finally, as the Rupununi prepares to promote wildlife tourism in the region, local providers must also prepare to ensure that their business does not negatively affect wildlife, but rather enhances the potential to conserve. As such, the Project, with VR and its members, decided to develop guidelines to ensure that, as the numbers of tourism stakeholders and products increase, tourism continues to support wildlife and vice versa. The objectives are to provide guidance to tourism operators on how to ensure that their business does not harm wildlife and contributes to wildlife conservation. Further, they aim to guide tourism operators in ensuring that their visitors understand and respect wildlife.

©Brent Stirton/Getty Images for FAO, CIRAD, CIFOR and WCS

©Brent Stirton/Getty Images for FAO, CIRAD, CIFOR and WCS

XI. GENERAL CONCLUSION AND RECOMMENDATIONS

All the information available from previous studies was compiled and analysed during the inception phase of the Project and used to develop the intervention strategy and the theory of change (ToC) . In addition, the ToC has been constantly adapted to the available data generated by the baseline studies, the circumstances, relevance, urgencies, performance and opportunities that have arisen as the Project is implemented. All throughout the Project, and particularly during the Site Steering Committee (SSC) meetings, which are held every 6 months, we make the necessary changes to the ToC. The last version of the site's ToC dates from the end of December 2020.

Based on the new knowledge generated through the first years of the Project, compiled in this report, three minor changes have been introduced, all under Result 2:

1) "Reduce human–wildlife conflicts" has been added as part of R2.2, in line with our initial project document. Indeed, human–wildlife conflict was identified as an issue in the inception phase; however, it was not prioritized by the SSC members for Years 1 and 2. By the end of Year 2, the SSC members recommended that activities to tackle human–wildlife conflicts should be included in Year 3 plans.
2) "Community conservation efforts to maintain turtle populations are strengthened" has been added as part of R2.1 activities. Indeed, while turtles are freshwater animals, and their management was initially included under fisheries management, the activities that are carried out for the conservation and management of turtles are very specific and differ from the general fisheries management plan. As such, the SSC decided that more visibility should be given to those activities in the ToC.
3) "Reduction of mining" has been changed to "Protection of special sites from mining expansion".

The main assumptions and strategies are presented here:

- By strengthening local governance structures, we increase ownership, promote sustainable use of terrestrial wildlife, fish and turtles, and decrease risks from illegal activities.
- By promoting knowledge and pride in traditional practices and identity, we increase the likelihood that sustainable practices are maintained and transmitted to the next generation.
- By generating data and raising awareness about wildlife population trends, special biodiversity hotspots and impact assessment, we influence decision-making regarding the most influential external factors that affect wildlife, such as infrastructure development, unmanaged fires and mining expansion.
- By increasing the economic value of wildlife-friendly landscapes (through ecotourism, wildlife-friendly livestock production systems and mitigation of human–wildlife conflicts), we reduce the unsustainable use of wildlife and the threats from other more intensive or destructive land uses (mining, industrial agriculture).

- By increasing awareness on the risks of unsustainable use and supporting the implementation of local and national regulations on hunting and wild meat trade, we reduce unsustainable wildlife use.

Based on the main results of the baseline studies, the following section presents the constituent elements of the ToC and makes recommendations for its implementation.

The model proposed for Guyana is confirmed and maintained based on the findings of the first three years of implementation: "Foster coordinated community-driven initiatives that support food security and traditional livelihoods and contribute to maintaining healthy fish and terrestrial wildlife populations at the landscape level."

Inland fisheries:

- The sustainable fisheries management plan initiated by NRDDB was updated in Year 2 and implemented in Years 2 and 3. The plan will be adapted in Year 4 based on the information generated and lessons learnt from Years 2 and 3.
- NRDDB is continuously empowered, and its internal capacities enhanced, to ensure the successful implementation of the fisheries management plan. This is done through training, capacity building and coaching by external experts and in close consultation with traditional knowledge holders.
- Monitoring of fishing activities, fish use, and trade and monitoring of fish stocks by NRDDB has been in place since Year 2 to monitor the impacts of its sustainable fisheries management plan.
- Local guidelines on inland fisheries developed by NRDDB communities will be adapted based on lessons learnt from Years 1–3. The possibility for those guidelines to be integrated in the inland fisheries regulations at the national level will be evaluated. They include restriction on fishing gears, quotas for local trade and lists of harvestable wildlife species, among others.
- Close coordination with Guyana's Fisheries Department will be encouraged to ensure that lessons learnt by NRDDB can inform the development of a national-level inland fisheries policy.

Subsistence hunting:

- The WWWC created by the Project under SRDC is now fully operational and recognized as a central management body for wildlife in the South Rupununi.
- Wildlife-use guidelines will continue to be developed in villages from South Rupununi and proposed as rules to ensure that hunting continues to play a key subsistence role and does not evolve into a commercial practice.
- Village-level rules are based on customary law and local knowledge.
- Conservation efforts for a number of emblematic species, such as the red siskin and the giant anteater, are encouraged. Special management zones for specific species will be developed by the villages in collaboration with local conservation NGOs to preserve the species and increase the economic value of the landscape for tourism purposes (giant anteater, red siskin, river turtles).
- Sacred places with high biodiversity and cultural value for the Wapichan will be assessed and a plan for their protection formulated.

- Environmental education based on traditional and scientific knowledge will be used to foster sustainable practices among children and the young generation.
- Other anthropogenic factors that affect wildlife, such as road construction and fires will be studied to inform management strategies for impact mitigation.
- Conflicts with jaguars and other cats will be reduced to downsize the losses of cattle due to predation and avoid retaliatory responses to jaguars, which are protected in Guyana.

Wild meat trade:

- Wild meat trade on the coast and from the Rupununi to the coast is monitored to ensure that wild meat trade does not increase in the Rupununi.
- Behaviour change strategies will be put in place to discourage hunting of vulnerable game species and promote the consumption of national chicken and beef.
- Food safety practices will be mainstreamed among wild meat vendors and commercial hunters.

Alternative sources of meat and alternative sources of income:

- Local chicken production is encouraged as a diversification strategy for farmers and ranchers to increase the availability of locally grown chicken in the local market.
- The traditional Rupununi beef production system is promoted through a targeted marketing strategy.
- The economic benefits derived from tourism will be increased and the wildlife-based offer in the Rupununi improved. The Project's capacity to make a difference in that particular economic sector may be compromised if COVID-19 measures continue over the long run.
- Business models will be developed to ensure that alternative sources of income can contribute to wildlife conservation in the region.

Statutory law and national institutions:

- The development of species-specific management plans at the national level will be supported for: tapir, tortoise, caiman, capybara, savannah deer and armadillo, with definition of management units, no harvest zones, quotas or hunting bags.
- The Project will actively participate in the development of inland fisheries and aquaculture regulations and policies.

The empowerment of marginalized groups and capacity building will be transversal aspects that the Project will continue to put high in the agenda during the implementation.

LITERATURE

Internal SWM references

Doraisami, M. 2020. *Supporting Wildlife Management in Wapichan Wiizi.* Internal document. Georgetown, Guyana, SWM Programme. 49 pp.

Earl, E. 2020. *Giant anteater research and conservation in the South Rupununi.* Internal document. Georgetown, Guyana, SWM Programme. 54 pp.

Hallett, M.T. 2020. *Large mammal monitoring*. Internal baseline final report: Year 2. Internal document. Georgetown, Guyana, SWM Programme. 156 pp.

Jafferally, D. 2018. General fisheries management of the North Rupununi: proposed work plan. Internal document. Georgetown, Guyana, SWM Programme. 22 pp.

Jafferally, D. 2019. *Aquaculture feasibility study in selected communities of the North Rupununi and South Pakaraima*. Internal document. Georgetown, Guyana, SWM Programme. 21 pp.

Kenyon, M. 2019. *Review of the free, prior informed consent process of the Sustainable Wildlife Management Project Guyana based in the Rupununi.* Internal document. Georgetown, Guyana, SWM Programme. 37 pp.

Kenyon, M. 2020. *Review of the free, prior informed consent (FPIC) process of the Sustainable Wildlife Management Project, Guyana (Year 2).* Internal document. Georgetown, Guyana, SWM Programme. 29 pp.

Kenyon, M., Sartoretto, E., Gruca, M., Mahadeo, A. & van Vliet, N. 2020. *Grievance redress mechanism (GRM): Guyana site.* Internal document. Georgetown, Guyana, SWM Programme. 21 pp.

Mejía González, Á.M. 2020. *Fires in Region 9.* Internal document. Georgetown, Guyana, SWM Programme. 10 pp.

Melville, A. 2019a. *Regional Community Representatives Meeting Report for the Guiana Shield and Amazon regions.* Internal document. Georgetown, Guyana, SWM Programme. 38 pp.

Melville, A. 2019b. *SULi-Latin America and Caribbean Community Representatives meeting report. Internal document.* Georgetown, Guyana, SWM Programme. 26 pp.

Millar, N. 2020. *Red siskin monitoring and research in the South Rupununi*. Internal document. Georgetown, Guyana, SWM Programme. 39 pp.

Morrison, M. 2019. *A synthesis of available technical and scientific knowledge on captive breeding of the capybara, paca, agouti, collared peccary and white-tailed deer. Internal document.* Georgetown, Guyana, SWM Programme. 91 pp.

Paemelaere, E.A. 2019. *Evaluation of road impacts on wildlife in Region 9.* Internal document. Georgetown, Guyana, SWM Programme. 101 pp.

Paemelaere, E.A. 2020. *Wildmeat trade study: final report. Internal document.* Georgetown, Guyana, SWM Programme. 19 pp.

Puran, A. 2019. *Food safety practices. Wildmeat market survey.* Internal document. Georgetown, Guyana, SWM Programme. 35 pp.

Ramnauth, J. 2020. *VR technical report.* Internal document. Georgetown, Guyana, SWM Programme. 46 pp.

SWM-Guyana. 2019. *Short report providing guidelines for gender inclusion in the Sustainable Wildlife Management Project – Guyana.* Internal document. Georgetown, Guyana, SWM Programme. 14 pp.

SWM-Guyana. 2020. *Community Rights Based Approach (CRBA).* Internal document. Georgetown, Guyana, SWM Programme. 56 pp.

Waldron, N. & McIntosh, T. 2019a. *Livestock market assessment.* Internal document. Georgetown, Guyana, SWM Programme. 79 pp.

Waldron, N. & McIntosh, T. 2019b. *Livestock component plan*. Internal document. Georgetown, Guyana, SWM Programme. 33 pp.

References external to SWM

Alonso, L.E., Mccullough, J., Naskrecki, P., Alexander, E., Wright, H.E. & Wright, H.E. 2008. *A Rapid Biological Assessment of the Konashen Community Owned Conservation Area, Southern Guyana. RAP Bulletin of Biological Assessments 51.* Arlington, VA, USA, Conservation International.

Alonso, L.E., Persaud, J. & Williams, A. 2016. *Biodiversity Assessment Survey of the South Rupununi Savannah, Guyana. BAT Survey Report No 1.* Georgetown, Guyana, WWF-Guianas, Guyana Office.

Amacuro, D. & Guiana, F. 2008. Preliminary Checklist of the Mammals of the Guiana Shield. *Delta*: 1–13.

Amerindian Act. 2006. Parliament.gov.gy. [online] https://parliament.gov.gy/documents/acts/4680-act_no_6_of_2006.pdf

Berardi, A., Tschirhart, C., Mistry, J., Bignante, E., Haynes, L., Albert, G., Benjamin, R., Xavier, R. & Jafferally, D. 2013. From resilience to viability: a case study of indigenous communities of the North Rupununi, Guyana. *EchoGéo*(24): 1–17. https://doi.org/10.4000/echogeo.13411

Braun, M.J., Finch, D.W., Robbins, M.B. & Schmidt, B.K. 2007. *A Field Checklist of the Birds of Guyana*. 2nd edition. Washington, DC, USA, Smithsonian Institution.

Claramunt, J.M. 2012. *The net present value of paving the dirt road between Linden and Lethem in Guyana*. University of Amsterdam

CLGF (Commonwealth Local Government Forum). n.d. undated. *Country Profile Guyana 2017-2018* [online]. http://www.clgf.org.uk/default/assets/File/Country_profiles/Guyana.pdf

Coffin, A.W. 2007. From roadkill to road ecology: A review of the ecological effects of roads. *Journal of Transport Geography*, 15(5): 396–406. https://doi.org/10.1016/j.jtrangeo.2006.11.006

Cole, C.J., Townsend, C.R., Reynolds, R.P., MacCulloch, R.D. & Lathrop, A. 2013. Amphibians and reptiles of Guyana, South America: illustrated keys, annotated species accounts, and a biogeographic synopsis. *Proceedings of the Biological Society of Washington*, 125(4): 317–578. https://doi.org/10.2988/0006-324X-125.4.317

Conservation International. 2002. The Kanuku Mountains Protected Area process: The community resource evaluations. Georgetown, Guyana.

Conservation International Guyana. 2014a. Expansion of Pre-Investment Georgetown-Lethem Road Study (GY-T1081): Biodiversity and Ecosystem Services Assessment - Final Report. Georgetown, Guyana225 pp.

Conservation International Guyana. 2014b. Expansion of pre-investment Georgetown-Lethem Road Study - Biodiversity and ecosystem services assessment: Inception Report. Georgetown, Guyana74 pp.

Conservation International Guyana. 2015. The Rupununi economic and environmental Baseline Report. Georgetown, Guyana63 pp.

Conservation International Guyana & IDB. 2015. The State of Food and Agriculture in the Rupununi, Guyana. Georgetown, Guyana93 pp.

Damania, R. & Bulte, E.H. 2007. The economics of wildlife farming and endangered species conservation. *Ecological Economics*, 62(3–4): 461–472. https://doi.org/10.1016/j.ecolecon.2006.07.007

David, B., Isaacs, P., Johnny, A., Johnson, L., Pugsley, M., Ramacindo, C., Winter, G. & Winter, Y. 2006. Our Territory. Our Custom. Customary use of biological resources and related traditional practices within Wapichan Territory in Guyana. Guyana. 59 pp. (also available at https://www.cbd.int/doc/world/gy/gy-nr-04-en.pdf).

Dickman, A.J. 2010. Complexities of conflict: the importance of considering social factors for effectively resolving human – wildlife conflict. *Animal Conservation*, 13: 458–466. https://doi.org/10.1111/j.1469-1795.2010.00368.x

Donkin, R.A. 1985. The peccary - with observations on the introduction of pigs to the New World. *Transactions of the American Philosophical Society*, 75(5): 1–152.

Dulac, J. 2013. Global Land Transport Infrastructure Requirements: Estimating Road and Railway Infrastructure Capacity and Costs to 2050. (also available at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.378.8623&rep=rep1&type=pdf).

Eden, M.J. 1986. Monitoring Indigenous shifting cultivation in forest areas in southwest Guyana using aerial photography and LANDSAT. *In* M.J. Eden & J.T. Parry, eds. *Remote sensing and tropical land management*, pp. 255–278. London, John Wiley and Sons.

EPA. 2010. Guyana fourth national report to the Convention on Biological Diversity. 90 pp. (also available at https://www.cbd.int/doc/world/gy/gy-nr-04-en.pdf).

FAO. 2018. National Aquaculture Sector Overview Guyana. (also available at http://www.fao.org/fishery/countrysector/naso_guyana/en).

FAO. 2020. *FAO Yearbook. Fisheries and Aquaculture Statistics 2018*. 110 pp. (also available at http://www.fao.org/documents/card/en/c/cb1213t).

Foley, C.J. & Sillero-zubiri, C. 2020. Opensource, low-cost modular GPS collars for monitoring and tracking wildlife. *Methods in Ecology and Evolution*, 11: 553–558. https://doi.org/10.1111/2041-210X.13369

Forman, R.T.T. & Alexander, L.E. 1998. Roads and Their Major Ecological Effects. *Annual Review of Ecology and Systematics*, 29(1): 207–231. https://doi.org/10.1146/annurev.ecolsys.29.1.207

Fragoso, J.M.V., Levi, T., Oliveira, L.F.B., Luzar, J.B., Overman, H., Read, J.M. & Silvius, K.M. 2016. Line transect surveys underdetect terrestrial mammals: Implications for the sustainability of subsistence hunting. *PLoS ONE*, 11(4): 1–18. https://doi.org/10.1371/journal.pone.0152659

Fredericks, P., Buckley, C. & Persaud, J. 2016. A natural resource use assessment in the South Rupununi Savannah, Guyana. *In* L.E. Alonso, J. Persaud & A. Williams, eds. *Biodiversity assessment survey of the South Rupununi Savannah, Guyana. BAT Survey Report No. 1*, pp. 203–225. Georgetown, Guyana, WWF-Guianas, Guyana Office.

De Freitas, K. 2018. *Traditional Development and The Development of Tradition: The political ecology of cattle rearing among the Wapichan people in Maruranau Village, South Rupununi, Guyana*. University College London.

Furley, P.A. 1999. The Nature and Diversity of Neotropical Savanna Vegetation with Particular Reference to the Brazilian cerrados. *Global Ecology and Biogeography*, 8(3/4): 223–241. (also available at http://www.jstor.org/stable/2997885).

Glenn, J.M. 2008. Mixed Jurisdictions in the Commonwealth Caribbean: Mixing, Unmixing, Remixing. *Electronic Journal of Comparative Law*, 12(1): 1–23.

Goosem, M. 2007. Fragmentation impacts caused by roads through rainforests. *Current Science*, 93(11): 1587–1595.

Government of Guyana. 1953. Amerindian Act. http://www.guyaneselawyer.com/lawsofguyana/Laws/cap2901.pdf

Government of Guyana. 1996. Chapter 31: Fisheries Policy - Draft

Guyana Bureau of Statistics. 2014. Guyana Population and Housing Census 2012 - Preliminary Report. Georgetown, Guyana. 68 pp.

Guyana Bureau of Statistics. 2016a. Compendium 1: National Population Trends - National Size and Growth. Georgetown, Guyana. 18 pp.

Guyana Bureau of Statistics. 2016b. 2012 Population & housing census: final results. Georgetown, Guyana. 7 pp.

Guyana Bureau of Statistics. 2016c. Compendium 2: Population composition. Georgetown, Guyana0–38 pp.

Guyana Bureau of Statistics, Ministry of Public Health & UNICEF. 2015. Guyana Multiple indicator cluster survey 2014 - Monitoring the Situation of Children and Women. Georgetown, Guyana490 pp.

Guyana Election Centre. 2021. *Guyana Government Structure* [online]. http://www.caribbeanelections.com/gy/education/government_structure.asp).

Guyana Information Agency. 2016. *GLDA's initiative will increase hinterland poultry production* [online]. https://dpi.gov.gy/gldas-initiative-will-increase-hinterland-poultry-production

Hallett, M.T. 2015. *Survey of human-wildlife conflict, resource use and attitudes towards conservation and sustainable development in the Kanuku Mountains, Rupununi, Guyana* [online]. http://dx.doi.org/10.6084/m9.figshare.1287792

Hallett, M.T., Kinahan, A.A., McGregor, R., Baggallay, T., Babb, T., Barnabus, H., Wilson, A., Li, F.M., Boone, W.W. & Bankovich, B.A. 2019. Impact of Low-Intensity Hunting on Game Species in and Around the Kanuku Mountains Protected Area, Guyana. *Frontiers in Ecology and Evolution*, 7(November): 412. https://doi.org/10.3389/fevo.2019.00412

Handcock, R., Swain, D., Bishop-Hurley, G.J., Patison, K., Tim, W., Valencia, P., Corke, P. & O'Neill, C. 2009. Monitoring Animal Behaviour and Environmental Interactions Using Wireless Sensor Networks, GPS Collars and Satellite Remote Sensing. *Sensors*, 9(5): 3586–3603. https://doi.org/10.3390/s90503586

HelgiLibrary. 2021. *Poultry meat consumption per capita* [online]. https://www.helgilibrary.com/indicators/poultry-meat-consumption-per-capita/

Henfrey, T.B. 2002. *Ethnoecology , resource use , conservation and development in a Wapishana community in the South Rupununi, Guyana.* University of Kent at Canterbury

Hollowell, T. & Reynolds, R.P. 2005. Checklist of the terrestrial vertebrates of the Guiana Shield. *Bulletin of the Biological Society of Washington*, 13: 106.

Ibisch, P.L., Hoffmann, M.T., Kreft, S., Pe'er, G., Kati, V., Biber-Freudenberger, L., DellaSala, D.A., Vale, M.M., Hobson, P.R. & Selva, N. 2016. A global map of roadless areas and their conservation status. *Science*, 354(6318): 1423–1427. https://doi.org/10.1126/science.aaf7166

Ingwall-King, L. 2013. *The implications of spatial and temporal scale on the supply, distribution and value of ecosystem services in Guyana*. Royal Holloway University of London

Inskip, C. & Zimmermann, A. 2009. Review Human-felid conflict: a review of patterns and priorities worldwide. *Oryx*, 43(1): 18–34. https://doi.org/10.1017/S003060530899030X

International Labour Organization. 2018. Gender at work in the Caribbean. Country Report Guyana. Trinidad and Tobago. 62 pp.

IUCN (International Union for Conservation of Nature). 2020. *Addressing issues of gender and social inclusion in sustainable ecosystem management in Guyana (Part 4.2)* [online]. https://www.iucn.org/news/gender/202006/addressing-issues-gender-and-social-inclusion-sustainable-ecosystem-management-guyana

Iwamura, T., Lambin, E.F., Silvius, K.M., Luzar, J.B. & Fragoso, J.M.V. 2014. Agent-based modeling of hunting and subsistence agriculture on indigenous lands: Understanding interactions between social and ecological systems. *Environmental Modelling and Software*, 58(August): 109–127. https://doi.org/10.1016/j.envsoft.2014.03.008

Jackson, N.D. & Fahrig, L. 2011. Relative effects of road mortality and decreased connectivity on population genetic diversity. *Biological Conservation*, 144(12): 3143–3148. https://doi.org/10.1016/j.biocon.2011.09.010

Jacobson, S.L., Bliss-ketchum, L.L., De Rivera, C.E. & Smith, W.P. 2016. A behavior- based framework for assessing barrier effects to wildlife from vehicle traffic volume. *Ecosphere*, 7(4): 1–15.

Jaeger, J.A.G., Bowman, J., Brennan, J., Fahrig, L., Bert, D., Bouchard, J., Charbonneau, N., Frank, K., Gruber, B. & Von Toschanowitz, K.T. 2005. Predicting when animal populations are at risk from roads: An interactive model of road avoidance behavior. *Ecological Modelling*, 185(2–4): 329–348. https://doi.org/10.1016/j.ecolmodel.2004.12.015

Jansen-Jacobs, M. & ter Steege, H. 2000. Southwest Guyana: a complex mosaic of savannahs and forests. *Plant diversity in Guyana, with recommendations for a national protected area strategy*, pp. 147–157

Kintch, J., Jacobson, S. & Cramer, P. 2015. The wildlife crossing guilds decision framework: a behavior-based approach to designing effective wildlife crossing structures. *Proceedings of the 2015 International Conference on Ecology and Transportation (ICOET 2015)*. p. 34044. Paper presented at, 2015.

Laurance, W.F., Albernaz, A.K.M., Schroth, G., Fearnside, P.M., Bergen, S., Venticinque, E.M. & Da Costa, C. 2002. Predictors of deforestation in the Brazilian Amazon. *Journal of Biogeography*, 29(5–6): 737–748. https://doi.org/10.1046/j.1365-2699.2002.00721.x

Laurance, W.F., Goosem, M. & Laurance, S.G.W. 2009. Impacts of roads and linear clearings on tropical forests. *Trends in Ecology and Evolution*, 24(12): 659–669. https://doi.org/10.1016/j.tree.2009.06.009

Luzar, J.B. & Fragoso, J.M.V. 2013. Shamanism, Christianity and Culture Change in Amazonia. *Human Ecology*, 41(2): 299–311. https://doi.org/10.1007/s10745-012-9515-2

Luzar, J.B., Silvius, K.M. & Fragoso, J.M.V. 2012. Church Affiliation and Meat Taboos in Indigenous Communities of Guyanese Amazonia. *Human Ecology*, 40(6): 833–845. https://doi.org/10.1007/s10745-012-9521-4

McTurk, D. & Spelman, L. 2005. Hand-rearing and rehabilitation of orphaned wild giant otters, Pteronura brasiliensis, on the Rupununi River, Guyana, South America. *Zoo Biology*, 24(2): 153–167. https://doi.org/10.1002/zoo.20042

Medina, E. 1982. Physiological Ecology of Neotropical Savanna Plants. *In* B.J. Huntley & B.H. Walker, eds. *Ecology of Tropical Savannas. Ecological Studies (Analysis and Synthesis)*, pp. 308–335. Berlin, Heidelberg, Springer. (also available at https://doi.org/10.1007/978-3-642-68786-0_15).

Ministry of Local Government and Regional Development. 2021. *Regional Democratic Council* [online]. https://mlgrd.gov.gy/regional-democratic-councils/

Mistry, J., Berardi, A., Andrade, V., Krahô, T., Krahô, P. & Leonardos, O. 2005. Indigenous fire management in the cerrado of Brazil: The case of the Krahô of Tocantíns. *Human Ecology*, 33(3): 365–386. https://doi.org/10.1007/s10745-005-4143-8

Mistry, J., Simpson, M., Berardi, A. & Sandy, Y. 2004. Exploring the links between natural resource use and biophysical status in the waterways of the North Rupununi, Guyana. *Journal of Environmental Management*, 72(3): 117–131. https://doi.org/10.1016/j.jenvman.2004.03.010

Morsello, C., Yagüe, B., Beltreschi, L., van Vliet, N., Adams, C., Schor, T., Quiceno-Mesa, M.P. & Cruz, D. 2015. Cultural attitudes are stronger predictors of bushmeat consumption and preference than economic factors among urban amazonians from Brazil and Colombia. *Ecology and Society*, 20(4): 21. https://doi.org/10.5751/ES-07771-200421

Newsome, D., Moore, S.A. & Dowling, R.K. 2013. *Natural area tourism: Ecology, impacts and management, second edition*. D. Newsome, S. Moore & R. Dowling, eds. Bristol, UK, Channel View Publications. 480 pp.

North Rupununi District Development Board. 2002. Management Plan for Arapaima (Arapaima gigas) in the North Rupununi, Guyana: A Pilot Project under the Fisheries Act (2002). Guyana.

North Rupununi District Development Board & Iwokrama International Centre for Rainforest Conservation and Development. 2011. Building Individual Organisational and Institutional Capacities for Ecological Sustainable Tourism Development and Fisheries Management in the North Rupununi Wetlands Co-Management Plan for Fisheries in the North Rupununi Wetlands. Guyana. 1–29 pp.

NRDDB (North Rupununi District Development Board). n.d. *Communities* [online]. [Cited 6 January 2018]. www.nrddb.org

NRDDB (North Rupununi District Development Board). 2000. Local ecological knowledge of some of the large mammals in the North Rupununi and Iwokrama Forest - Draft. 62 pp.

Paemelaere, E.A.D. 2012. The Panthera Jaguar Corridor Initiative: Wildlife populations of the Rupununi - an assessment of relative abundance, Karanambu - Dadanawa. Unpublished report.

Paemelaere, E.A.D. & Payán Garrido, E. 2012. The panthera jaguar corridor initiative: Wildlife populations of the rupununi - an assessment of relative abundance. Georgetown, Guyana.

Paemelaere, E.A.D. & Puran, A. n.d. The urban sink for wildlife: wildmeat demand among urban, rural and indigenous people in Guyana, South-America. *International Journal of Forestry Research - In Prep.*

Paemelaere, E.A.D. & Puran, A. 2017. Wildmeat in Guyana. *ICCB 2017: Insights for sustaining life on Earth*. Paper presented at, 2017, Cartagena, Colombia.

Panthera Guyana. 2015. Workshop Report: Hunting sustainability and hunter awareness as a foundation for managing wildlife harvest in South Guyana and Roraima (USFWS). Manari, Lethem, Guyana.

Pegus, C. 2007. Review and Analysis of Compliance of the National Labour Legislation of Guyana with CARICOM Model Laboour Legislation. Geneva, Switzerland. 1–31 pp.

Pierre, M. & Paemelaere, E. 2018. Wildlife Management Assessment: Region 9 - Upper Takutu - Upper Essequibo, Guyana - Plan of Action for Regional Development (PARD), Region 9. Georgetown, Guyana.

Polojärvi, K., Colpaert, A., Matengu, K. & Jouko, K. 2011. GPS Collars in Studies of Cattle Movement: Cases of Northeast Namibia and North Finland. *In* S.D. Burn, ed. *Engineering Earth: The Impacts of Megaengineering Projects*, pp. 173–187. New York, USA, Springer.

Protected Areas Commission. 2019. Kanuku Mountains Protected Area Management Plan 2015-2019. Georgetown, Guyana.

Puran, A. 2015. *The economic impact and conservation issues of wildmeat trade in the coastal area of Region 4, Guyana*. University of Guyana

Puran, A. & Paemelaere, E.A.D. 2017. Evaluation of drivers and impacts on wildmeat consumption in coastal Guyana, South America. *ICCB 2017: Insights for sustaining life on Earth*. Paper presented at, 2017, Cartagena, Colombia.

Purvis, A., Gittleman, J.L., Cowlishaw, G. & Mace, G.M. 2000. Predicting extinction risk in declining species. *Proceedings of the Royal Society of London B*, 267(1456): 1947–1952. https://doi.org/10.1098/rspb.2000.1234

Read, J.M., Fragoso, J.M., Silvius, K.M., Luzar, J., Overman, H., Cummings, A., Giery, S.T. & de Oliveira, L.F. 2010. Space, Place, and Hunting Patterns among Indigenous Peoples of the Guyanese Rupununi Region. *Journal of Latin American Geography*, 9(3): 213–243. https://doi.org/10.1353/lag.2010.0030

Read, J.M., Fragoso, J.M. V, Luzar, J.B. & Overman, H. 2011a. Pai Poing, Pai Pong Head, and Tiger Pond Villages, Rupununi, Guyana, Project Fauna Community Atlas. Unpublished Report. Syracuse, NY, USA32 pp.

Read, J.M., Fragoso, J.M. V, Luzar, J.B. & Overman, H. 2011b. Kwaimatta Village, Rupununi, Guyana, Project Fauna Community Atlas. Unpublished report. Syracuse, NY, USA. 32 pp.

Read, J.M., Fragoso, J.M. V, Luzar, J.B. & Overman, H. 2013a. Fairview Village, Rupununi, Guyana, Project Fauna Community Atlas. Unpublished report. Syracuse, NY, USA. 34 pp.

Read, J.M., Fragoso, J.M. V, Luzar, J.B. & Overman, H. 2013b. Aishalton Village, Rupununi, Guyana, Project Fauna Community Atlas. Unpublished report. Syracuse, NY, USA. 34 pp.

Read, J.M., Fragoso, J.M. V, Luzar, J.B. & Overman, H. 2013c. Katoka Village, Rupununi, Guyana, Project Fauna Community Atlas. Unpublished report. Syracuse, NY, USA. 34 pp.

Read, J.M., Fragoso, J.M. V, Luzar, J.B. & Overman, H. 2013d. Karaudarnau Village, Rupununi, Guyana, Project Fauna Community Atlas. Unpublished report. Syracuse, NY, USA. 34 pp.

Read, J.M., Fragoso, J.M. V, Luzar, J.B. & Overman, H. 2013e. Wowetta Village, Rupununi, Guyana, Project Fauna Community Atlas. Unpublished report. Syracuse, NY, USA. 34 pp.

Read, J.M., Fragoso, J.M. V, Luzar, J.B. & Overman, H. 2013f. Awarewanau Village, Rupununi, Guyana, Project Fauna Community Atlas. Unpublished report. Syracuse, NY, USA. 34 pp.

Read, J.M., Fragoso, J.M. V, Luzar, J.B. & Overman, H. 2013g. Para Bara Village, Rupununi, Guyana, Project Fauna Community Atlas. Unpublished report. Syracuse, NY, USA. 26 pp.

Read, J.M., Fragoso, J.M. V, Luzar, J.B. & Overman, H. 2013h. Tipuru Village, Rupununi, Guyana, Project Fauna Community Atlas. Unpublished report. Syracuse, NY, USA. 34 pp.

van der Ree, R., Smith, D.J., Grilo, C., Laurance, W.F., Selva, N., Switalski, A., Kreft, S., Ibisch, P.L., Roberts, K., Sjölund, A., Jaeger, J.A.G., Stokes, J., Chee, Y.E., Weller, C., van der Ree, R., Tonjes, S., Weller, C., van der Ree, R., Jaeger, J.A.G., Rytwinski, T., van der Grift, E.A., Smith, D.J., van der Ree, R., Guinard, É., Prodon, R., Barbraud, C., Gunson, K., Teixeira, F.Z., Sunnucks, P., Balkenhol, N., van der Grift, E.A., van der Ree, R., van der Grift, E.A., van der Ree, R., Jaeger, J.A.G., van der Ree, R., Tonjes, S., Blackwell, B.F., DeVault, T.L., Seamans, T.W., Parris, K.M., van der Ree, R., Gagnon, J.W., Smith, D.J., Smith, D.J., van der Ree, R., Rosell, C., van der Ree, R., van der Grift, E.A., Mata, C., Bencini, R., Chambers, B.K., Malo, J.E., Huijser, M.P., Mosler-Berger, C., Olsson, M., Strein, M., D'Angelo, G., van der Ree, R., Dorsey, B., Olsson, M., Rew, L.J., Latham, A.D.M., Boutin, S., Rytwinski, T., Fahrig, L., Reck, H., van der Ree, R., Muller, R., Misso, M., Hamer, A.J., Langton, T.E.S., Lesbarrères, D., Andrews, K.M., Langen, T.A., Struijk, R.P.J.H., Kociolek, A., Grilo, C., Jacobson, S., Abbott, I.M., Berthinussen, A., Stone, E., Boonman, M., Melber, M., Altringham, J., Grilo, C., Smith, D.J., Klar, N., Pallares, E., Manterola, C., Conde, D.A., Colchero, F., Gubbi, S., Poornesha, H.C., Whittington-Jones, B., Davies-Mostert, H., Ascensão, F., LaPoint, S., van der Ree, R., Soanes, K., van der Ree, R., Donaldson, A., Cunneyworth, P., Cramer, P., Olsson, M., Gadd, M.E., van der Ree, R., Sielecki, L.E., Weeks, S., Wagner, P.J., Ottburg, F., Blank, M., Milton, S.J., Dean, W.R.J., Sielecki, L.E., van der Ree, R., Lee, E., Croft, D.B., Achiron-Frumkin, T., Jones, D., Bekker, H., van der Ree, R., Goosem, M., Bager, A., Borghi, C.E., Secco, H., Fearnside, P.M., Seshadri, K.S., Ganesh, T., Rajvanshi, A., Mathur, V.B., Collinson, W., Parker, D., Patterson-Abrolat, C., Alexander, G., Davies-Mostert, H., Epps, C.W., Nowak, K., Mutayoba, B., Gadd, M.E., Wang, Y., Kong, Y., Chen, J., Olson, K.A., van der Ree, R., Trocmé, M., White, P., Wagner, P.J., Seiler, A., Shilling, F., Perkins, S.E. & Collinson, W. 2015. The Ecological Effects of Linear Infrastructure and Traffic. https://doi.org/10.1002/9781118568170.ch1

Regional Democratic Council Region 9. 2019. PLAN OF ACTION FOR REGIONAL DEVELOPMENT (PARD). Lethem, Guyana. 134 pp.

Reymondin, L., Navarrete, C., Watkins, G. & Coca, A. 2014. Potential impact of road projects on habitat loss and greenhouse gas emissions in Guyana from 2012 to 2022. Inter-American Development Bank, 45 p. Technical Note No. IDB-TN-632. Guyana.

Robbins, M.B., Braun, M.J. & Finch, D.W. 2003. Discovery of a population of the Endangered Red Siskin (Carduelis cßucullata) in Guyana. *The Auk*, 120(2): 291–298. https://doi.org/10.1642/0004-8038(2003)120[1211:DOAPOT]2.0.CO;2

Rodríguez, I., Albert, P., Rose, C. La & Sharpe, C.J. 2011. A Study of the use of fire and by Amerindian communities the South Rupununi, Guyana, with recommendations for sustainable land management. Guyana. http://wapichanao.communitylands.org/1505780518117-rupununi-fire-study-web.pdf

Roth, W.E. 1915. *The animism and folklore of the Guiana indians*. 2011 Editi edition. The Caribbean Press. (also available at http://www.sacred-texts.com/nam/sa/aflg/index.htm).

Sanchez, M., Vanegas, L., Sandrin, F., Puran, A., Benn, V. & Paemelaere, E. 2016. Curry labba for dinner? Internal report. Guyana.

Shaffer, C.A., Marawanaru, E. & Yukuma, C. 2017. An Ethnoprimatological Approach to Assessing the Sustainability of Nonhuman Primate Subsistence Hunting of Indigenous Waiwai in the Konashen Community Owned Conservation Concession, Guyana. *In* K.M. Dore, E.P. Riley & A. Fuentes, eds. *Ethnoprimatology: a practical guide to research at the human-nonhuman primate interface*, pp. 232–250. Cambridge, Cambridge University Press. (also available at http://ebooks.cambridge.org/ref/id/CBO9781316272466A107).

Shaffer, C.A., Milstein, M.S., Yukuma, C., Marawanaru, E. & Suse, P. 2017a. Sustainability and comanagement of subsistence hunting in an indigenous reserve in Guyana. *Conservation Biology*, 31(5): 1119–1131. https://doi.org/10.1111/cobi.12891

Shaffer, C.A., Milstein, M.S., Yukuma, C., Marawanaru, E. & Suse, P. 2017b. Sustainability and comanagement of subsistence hunting in an indigenous reserve in Guyana. *Conservation Biology*, 31(5): 1119–1131. https://doi.org/10.1111/cobi.12891

Shaffer, C.A., Yukuma, C., Marawanaru, E. & Suse, P. 2017c. Assessing the sustainability of Waiwai subsistence hunting in Guyana by comparison of static indices and spatially explicit, biodemographic models. *Animal Conservation* (August): 148–158. https://doi.org/10.1111/acv.12366

Sollmann, R., Mohamed, A., Samejima, H. & Wilting, A. 2013. Risky business or simple solution - Relative abundance indices from camera-trapping. *Biological Conservation*, 159: 405–412. https://doi.org/10.1016/j.biocon.2012.12.025

South Central and South Rupununi Districts Toshaos Councils. 2012. *Thinking together for those coming behind us: An outline plan for the care of Wapichan territory in Guyana*. P. Gomes & H. Wilson, eds. Region 9, Guyana. 108 pp. (also available at https://www.lifemosaic.net/images/uploads/Territories_of_Life/TOL_Resources/Plan_de_Vida/Thinking_Together_For_Those_Coming_Behind_Us.pdf).

De Souza, L.S., Armbruster, J.W. & Werneke, D.C. 2012. The influence of the Rupununi portal on distribution of freshwater fish in the Rupununi district, Guyana. *Cybium: International Journal of Ichthyology*, 36(1): 31–43.

Staff Reporter. 2016a. Wildlife enthusiasts. *Guyana Chronicle*, 14 February 2016. (also available at https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjRo9Swsf_vAhU7ElkFHWWOCkwQFjAAegQIBBAD&url=https%3A%2F%2Fguyanachronicle.com%2F2016%2F02%2F14%2Fwildlife-enthusiasts%2F&usg=AOvVaw2GMRLc-4-4llMixvN_c37s).

Staff Reporter. 2016b. Closed season for hunting of wild birds - from January 1 to May 31, 2016. *Guyana Chronicle*, 16 November 2016. (also available at http://guyanachronicle.com/2015/11/16/closed-season-for-hunting-of-wild-birds-from-january-1-to-may-31-2016).

Staff Writer. 2017. Konashen to be declared a National Protected Area. *Stabroek News*, 13 July 2017. (also available at https://www.stabroeknews.com/2017/news/stories/07/13/konashen-to-be-declared-a-national-protected-area/).

Taddia, A., Tamayo, C., Gomez, J.R., Vicentini, V.L., Frigerio, G., Persaud, C. & Cardona, I. 2005. Guyana - Pre-investment Georgetown-Lethem Road (Guyana Segment): Plan of Operations. Guyana.

Tensen, L. 2016. Under what circumstances can wildlife farming benefit species conservation? *Global Ecology and Conservation*, 6: 286–298. https://doi.org/10.1016/j.gecco.2016.03.007

The Consultancy Group & Conservation International Guyana. 2016. Baseline farm survey in support of the design of loan GY-LI060 support of sustainable agricultural development program. Georgetown, Guyana. 51 pp.

The South American Commission for the Fight Against Foot and Mouth Disease. n.d. *The livestock industry in Guyana: Perspectives for improvement* [online]. [Cited 27 March 2018]. www.paho.org

Tremblay, P. 2001. Wildlife tourism consumption: consumptive or non-consumptive? *The International Journal of Tourism Research*, 3(1): 81–86.

Trombulak, S.C. & Frissell, C. a. 2010. Review of ecological effects of roads on terrestrial and aquatic communities. *Conservation Biology*, 14(1): 18–30. https://doi.org/10.1046/j.1523-1739.2000.99084.x

UNICEF (United Nations Children's Fund). 2017. Study on Indigenous women & children in Guyana. Georgetown, Guyana. 172 pp. (also available at https://www.unicef.org/lac/media/4691/file/PDF Study on indigenous women and children in Guyana.pdf).

United Nations. 2021. *UN Comtrade Database* [online]. https://comtrade.un.org/data

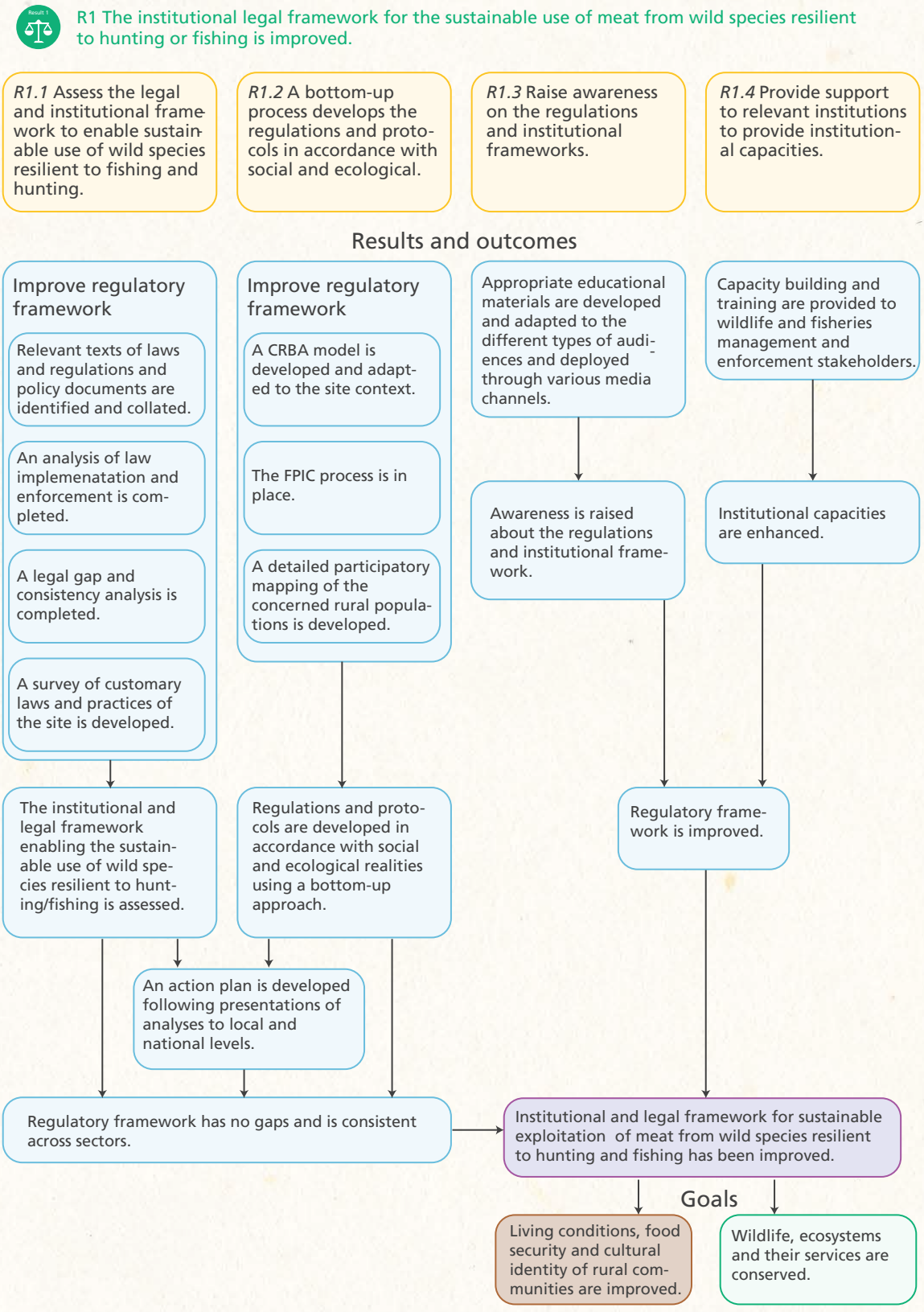
van Andel, T. 2000. The Diverse Uses of Fish-Poison Plants in Northwest Guyana. *Economic Botany*, 54(1): 500–512.

van Andel, T., Banki, O.S. & MacKinven, A. 2003. *Commercial non timber forest products of the Guiana Shield: An inventory of commercial NTFP extration and possibilities for sustainable harvesting*. Amsterdam, the Netherlands, Netherlands Committee for IUCN - Guiana Shield Initiative. 190 pp.

Watkins, G., Oxford, P. & Bish, R. 2010. *Rupununi rediscovering a lost world*. A. Williams, ed. Earth in Focus Editions. 284 pp.

Wetlands Partnership. 2006. State of the North Rupununi Wetlands Report. Guyana. 217 pp.

ANNEX 1 – THEORY OF CHANGE DIAGRAM FOR THE SWM PROJECT IN GUYANA



R2 Fish and terrestrial wildlife are managed sustainability.

R2.1 Sustainable fish management is enhanced.

R2.2 Sustainable terrestrial wildlife management is enhanced.

R2.3 Terrestrial wildlife and fish populations are monitored.

R2.4 Knowledge generation on wildlife.

Results and outcomes

Community conservation efforts to maintain turtle populations are strengthened.

NRDDB fisheries management plan is updated.

Environmental educational curriculum is implemented.

Roadkills and road crossing are evaluated.

Wapichan Wiizi Wildlife committee is established.

Monitoring protocol for fish and terrestrial wildlife is implemented.

Impact of fire on wildlife is evaluated.

Knowledge of wildlife management is generated and shared.

Village rules are updated and adopted according to management plan.

Awareness is raised among community members.

Community is empowered to monitor & enforce the guidelines/rules.

Improved capacities on sustainable wildlife management are put in place.

Measures are put in place to reduce the impacts of fire.

Village rules are established for conservation & sustainable management of wildlife.

Regional collaborations are in place.

Measures are put in place to reduce human–wildlife conflict.

Measures are put in place to reduce roadkills and improve connectivity.

The impact of roads and habitat loss on wildlife is mitigated.

Important stakeholders and policy-makers are aware of the recommendations on how to improve connectivity and reduce the impacts of roads on wildlife.

National Policy is influenced.

Dependence on hunting for income has decreased.

Important conservation areas are identified for protection.

Terrestrial wildlife is hunted sustainably.

Impact of fire is reduced.

Human–wildlife conflicts are reduced.

Lessons learnt are shared across the Amazon and Caribbean regions.

Fish and wildlife are managed sustainably

Fish consumption remains stable.

Wildmeat consumption has remained stable.

Terrestrial wildlife is managed sustainably.

Fish are used sustainably.

Improved sustainable fishing practices.

Managed fires.

Fewer fishing violations/less illegal fishing.

Sustainable infrastructure development.

Sustainable hunting practices.

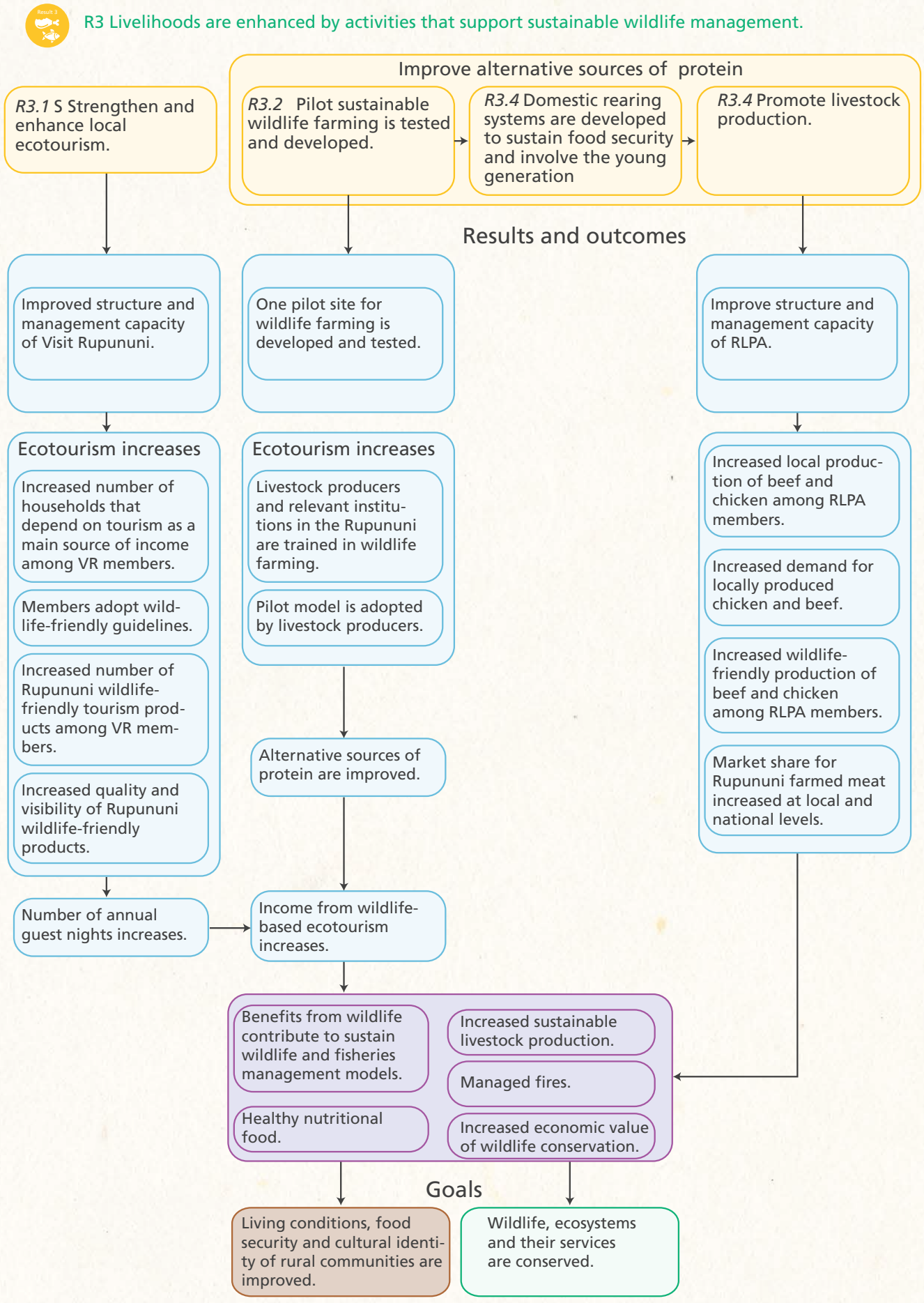
Goals

Terrestrial wildlife populations remain.

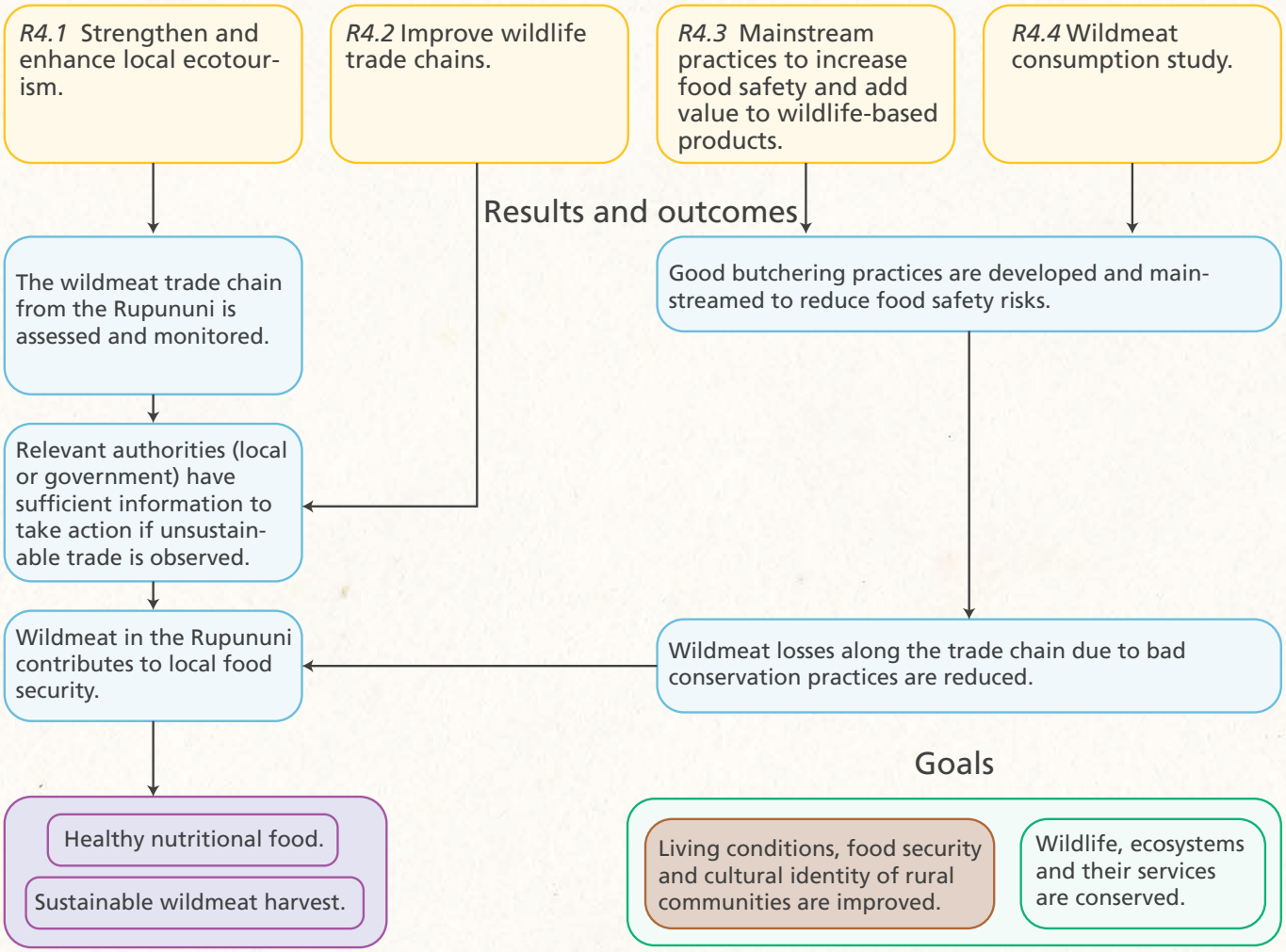
Fish stock/populations are improved.

Living conditions, food security and cultural identity of rural communities are improved.

Wildlife, ecosystems and their services are conserved.


R3 Livelihoods are enhanced by activities that support sustainable wildlife management.
Improve alternative sources of protein
R3.1 S Strengthen and enhance local ecotourism.
R3.2 Pilot sustainable wildlife farming is tested and developed.
R3.4 Domestic rearing systems are developed to sustain food security and involve the young generation
R3.4 Promote livestock production.
Results and outcomes
Improved structure and management capacity of Visit Rupununi.
One pilot site for wildlife farming is developed and tested.
Improve structure and management capacity of RLPA.
Ecotourism increases
Increased number of households that depend on tourism as a main source of income among VR members.
Members adopt wildlife-friendly guidelines.
Increased number of Rupununi wildlife-friendly tourism products among VR members.
Increased quality and visibility of Rupununi wildlife-friendly products.
Ecotourism increases
Livestock producers and relevant institutions in the Rupununi are trained in wildlife farming.
Pilot model is adopted by livestock producers.
Increased local production of beef and chicken among RLPA members.
Increased demand for locally produced chicken and beef.
Increased wildlife-friendly production of beef and chicken among RLPA members.
Market share for Rupununi farmed meat increased at local and national levels.
Alternative sources of protein are improved.
Number of annual guest nights increases.
Income from wildlife-based ecotourism increases.
Benefits from wildlife contribute to sustain wildlife and fisheries management models.
Healthy nutritional food.
Increased sustainable livestock production.
Managed fires.
Increased economic value of wildlife conservation.
Goals
Living conditions, food security and cultural identity of rural communities are improved.
Wildlife, ecosystems and their services are conserved.

R4 Consumption of wildmeat becomes sustainable.



ANNEX 2 – RESOURCES FOR CHAPTER IV INSTITUTIONAL AND NORMATIVE FRAMEWORK

Livestock/Pastoralism

- The Pounds Act 1866
- Cattle Stealing Prevention Act 1887
- Crops and Livestock Registration Act 1917
- Livestock Improvement Act 1949
- Livestock (Loans for Development) Act 1971
- Guyana Livestock Development Authority Act 2010
- Animal Health Act 2011
- Veterinarians Act 2003
- Cattle Trail Regulations 1929
- Animal Diseases (Conditions of Importation of Birds) Order 1950
- Foot and Mouth Disease (Prohibition of Importation) Order 1954
- Animal Diseases (Prohibition of Importation) (Wild Carnivores) Order 1955
- Animal Diseases (Prohibition of Importation) Order 1956
- Pounds Order 1960
- Poultry Carcasses (Conditions of Importation) Order 1965
- Poultry and Poultry Eggs (Conditions of Importation) Order 1965
- Animal Health Fees Regulations 2016
- Environmental Guidelines Swine Rearing Operations 2011
- Environmental Guidelines Poultry Rearing Operations 2013

Food/Nutrition/Public health

- Food and Nutrition Security Strategy for Guyana 2011
- A National Strategy for Agriculture in Guyana 2013–2020
- Health Vision 2020 "Health For All in Guyana" A National Health Strategy for Guyana 2013–2020
- Food and Drugs Act 1971
- Slaughter of Cattle (Control) Act 1974
- Caribbean Food Corporation Act 1977
- Mahaica Mahaicony Abary Agricultural Development Authority Act 1977
- National Agricultural Research Institute of Guyana Act 1984
- Caribbean Agricultural Research and Development Institute Act 1988
- Pharmacy Practitioners Act 2003
- Georgetown (Abattoir) By-laws 1952
- City (Markets) By-laws 1952
- New Amsterdam (Markets) By-laws 1954
- Food and Drugs Regulations 1977

Fisheries/Aquaculture

- Fisheries Act 2003
- Fisheries (Exemption from Registration) Order 1957
- Fisheries (Pin Seine) Regulations 1962
- Fishery Products Regulations 2003
- Fisheries (Turtle Excluder Device) Regulations 2006
- Fisheries Regulations 2018

Forestry

- Revised National Forest Policy Statement 2018
- National Forest Plan 2018
- Iwokrama International Centre For Rain Forest Conservation and Development Act 1996
- Guyana Forestry Commission Act 2007
- Forests Act 2009
- Forest Regulations 2018
- Guidelines for Forest Operations State Forest Authorizations – State Forest Permission (SFAs-SFPs) 2018
- Guidelines for Forest Operations for State Forest Authorizations – Timber Sales Agreements, Wood Cutting License Holders, State Forest Exploratory Permits (SFA-TSAs, SFEPs) 2018
- Code of Practice for Forest Operations for State Forest Authorizations: Timber Sales Agreements, Wood Cutting License Holders, State Forest Exploratory Permits, State Forest Permissions, Community Forestry Management Agreements (SFA-TSAs, WCLs, SFEPs, SFP, CFMAs) 2018

Land/Land-use planning

- Guyana National Land Use Plan 2013
- Guyana´s National Action Plan (NAP) to Combat Land Degradation Aligned to the UNCCD´s 10-year (2008–2018) Strategy 2015
- Guyana (Division into Counties) Act 1838
- Land Surveyors Act 1891
- Public Lands (Private Roads) Act 1893
- Plantation (Proprietors) Government Loans Act 1893
- Land Department Act 1903
- State Lands Act 1903
- State Lands Resumption Act 1906
- Acquisition of Lands for Public Purposes Act 1914
- Geological Survey Act 1918
- Deeds Registry Act 1920
- District Lands Partition and Re-Allotment Act 1926
- State Grants (President Signature) Act 1930

- Public Notaries Act 1932
- Immovable Property (Sale of Interest) Act 1937
- Local Government Act 1945
- Landlord and Tenant Act 1947
- Town and Country Planning Act 1948
- District Lands Partition and Re-Allotment (Special Procedure) Act 1948
- Title to Land (Prescription and Limitation) Act 1952
- Guyana Credit Corporation Act 1954
- Acquisition of Lands (Land Settlement) Act 1957
- Land Bonds Act 1959
- Land Registry Act 1960
- Property Tax Act 1962
- Agricultural Loans Act 1966
- Amerindian Lands Commission Act 1966
- The Municipal and District Councils Act 1970
- Surveys (Special Provisions Act) 1970
- Land Registry (Validation of Awards) Act 1972
- Vesting of Property (Acquisition By Purchase) Act 1975
- Regional Development Authorities Act 1977
- Produce Protection Act 1978
- Acquisition of Lands (Not Beneficially Occupied) Act 1984
- Registration of Landlords Act 1994
- Deeds Registry Authority Act 1999
- Guyana Lands and Surveys Commission Act 2001
- Amerindian Act 2006
- Valuation of Property for Rating Purposes (Validation) Act 2007
- Local Government Commission Act 2013
- Local Government (Amendment) Act 2015
- Deeds Registry Authority (Amendment) Act 2017
- Property Tax (Amendment) Act 2019
- State Lands (Amerindian) Regulations 1910
- Marking and Fencing of Lots By-laws 1917
- State Lands Regulations 1919
- Terms and Conditions of Lease of State Lands for Agricultural Purposes 1919
- Property Tax (General) Regulations 1963
- Property Tax (Government Securities) Regulations 1966
- Property Tax Exemptions 1968
- Land Registry Rules 1973
- Regional Development (Matthews Ridge/Arakaka/Kaituma) Authority Order 1979
- Land Bonds Regulations 1985
- Acquisition of lands for Public Purposes (Land Settlement Scheme) Order 1991
- Property Tax (Exchange of Information) (United States of America) Order 1992
- Matarkai Development Authority (Dissolution and Transfer of Assets and Liabilities) Order 1995

Other sectors

- Criminal Law (Offences) Act 1894
- Income Tax Act 1929
- Firearms Act 1940
- Industries Aid and Encouragement Act 1951
- Income Tax (In Aid of Industry) Act 1951
- Customs Act 1952
- Trade Act 1958
- Racial Hostility Act 1964
- Minerals Act 1971
- National Trust Act 1972
- Guyana Geology and Mines Commission Act 1979
- Constitution of the Cooperative Republic of Guyana 1980
- Export and Import (Special Provisions) Act 1986
- Equal Rights Act 1990
- CARICOM Enterprises Regime Act 1991
- Mining Act 1991
- Integrity Commission Act 1997
- Prevention of Discrimination Act 1997
- Ethnic Relations Commission Tribunal Act 2000
- Guyana Tourism Authority 2002
- Fiscal Management and Accountability Act 2003
- Procurement Act 2003
- Investment Act 2004
- Value-Added Tax Act 2005
- Access to Information Act 2011
- Firearms (Amendment) Act 2016
- Income Tax (In Aid of Industry) (Amendment) Act 2017
- Income Tax (Amendment) Act 2017
- State Assets Recovery Act 2017
- Anti-Money Laundering and Countering the Financing of Terrorism Act 2017
- Witness Protection Act 2018
- Protected Disclosures Whistleblower Act 2018
- Value-Added Tax (Amendment) Act 2019
- Income Tax (Amendment) Act 2019
- Income Tax (In Aid of Industry) (Amendment) Act 2019
- Customs (Amendment of Schedules) Act 2019
- Offensive Trades Regulations 1944
- Firearms Regulations 1968
- Export and Import (Special Provisions) Regulations 1986
- Public Service Commission Rules 1998
- Public Service Rules 2004

- Value Added Tax Regulations 2005
- Guyana Tourism Authority (Tour Operators) Regulations 2008
- Guyana Tourism Authority (Tourism Accommodation Establishment) Regulations 2008
- Guyana Tourism Authority (Tourist Guides) Regulations 2008
- Guyana Tourism Authority (Lodges and Resorts) Regulations 2008
- Firearms (Licensing) Regulations 2010
- Mining (Special Mining) Regulations 2014
- Mining Environmental Management CODES OF PRACTICE. Environmental Effects Monitoring Program 2019–2020
- Guide for Investors. Guyana Open for Investment 2019

Water

- Water and Sanitation Sector Strategic Plan 2017–2021
- Water Commissioners Act 1886
- Creeks Act 1888
- Boerasirie Creek Act 1889
- Hobaboe Creek (Diversion) Act 1902
- East Demerara Water Conservancy Act 1935
- Public Utility Undertakings and Public Health Services (Arbitration) Act 1956
- Demerara River (Mackenzie) Bridge Act 1965
- Guyana Water Authority Act 1972
- Drainage and Irrigation (Declaration of Areas) Act 1995
- Water and Sewerage Act 2002
- Demerara Harbour Bridge Corporation Act 2003
- Berbice River Bridge Act 2006
- Drainage and Irrigation Act 2006
- Maritime Zones Act 2010
- Public Utilities Commission Act 2016
- Drainage of Lots By-laws 1884
- Boerasirie Water Commission By-laws 1889
- East Demerara Water Conservancy Loan Regulations 1936
- Georgetown Water Supply By-laws 1938
- Drainage and Irrigation By-Laws 1994
- East Demera Water Conservancy (Annual Payment by Georgetown City Council) Order 1954
- Drainage and Irrigation (Regulation of Traffic on Dams) By-laws 1964
- Mackenzie Bridge By-laws 1967
- Guyana Water Authority (Acquisition) (La Reconnaissance-mon repos, Soesdyke) Order 1974
- Guyana Water Authority (Acquisition) (Lochaber, West Canje) Order 1975
- Guyana Water Authority (Acquisition) Order 1977
- Guyana Water Authority Supply Regulations 1977
- Demerara Harbour Bridge Regulations 1978
- Boerasirie Creek Order 1981

- Exclusive Economic Zone (Designation of Area) Order 1991
- Water and Sewerage (Vesting of Assets, Liabilities, etc.) Order 2002
- Water and Sewerage (Rates and Service Quality) Order 2003
- Berbice River Bridge (Amendment of Toll) Order 2009
- Berbice River Bridge (Commencement of Operations) Regulations 2009
- Maritime Zones (Internal Waters and River Closing Baselines (Regulations) 2015

Environment/Wildlife

- National Policy on Biotechnology, Biosafety and Biosecurity for Guyana 2005
- National Biosafety Framework for Guyana 2007
- National Policy on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization 2007
- Low Carbon Development Strategy Update – Transforming Guyana´s Economy while Combating Climate change 2013
- Putting Waste in its Place: A National Solid Waste Management Strategy for the Cooperative Republic of Guyana 2013–2024
- Guyana´s National Biodiversity Strategy and Action Plan 2012–2020
- Guyana´s Revised Intended Nationally Determined Contribution 2015
- Green State Development Strategy: Vision 2040. 2019
- Kaieteur National Park Act 1930
- Fire Prevention Act 1954
- Animals (Control of Experiments) Act 1957
- National Parks Commission Act 1977
- Environmental Protection Act 1996
- Kaieteur National Park (Amendment) Act 2000
- Protected Areas Act 2011
- Wildlife Conservation and Management Act 2016
- Offensive Matter Removal By-laws 1904
- Cleansing of Tanks By-laws 1905
- Keeping of Animals (Georgetown) Regulations 1942
- Fisheries (Aquatic Wild Life Control) Regulations 1966
- National Parks By-Laws 1982
- Maritime Boundaries (Turtle Excluder Device) Order 1994
- Environmental Protection (Hazardous Wastes Management) Regulations 2000
- Environmental Protection (Authorisations) Regulations 2000
- Environmental Protection (Water Quality) Regulations 2000
- Environmental Protection (Litter Enforcement) Regulations 2013
- Protected Areas (Board of Trustees Additional Members) Regulations 2014
- Environmental Protection (Expanded Polystyrene Ban) Regulations 2015
- Wildlife Conservation, Management and Sustainable Use Regulations 2019
- Wildlife Holding Premises Regulations 2019
- Wildlife Zoo Regulations 2019

- Operational Manual Guyana REDD-plus Investment Fund (Grif) 2011
- Environmental Guidelines Removal, Treatment & Disposal of Oily Sludge 2011
- Environmental Guidelines Transportation, Storage and Occupational Handling of Chemical / Industrial Hazardous Waste 2011
- Environmental Guidelines. Storage, Transportation & Occupational Handing of Biomedical Waste 2011
- Environmental Guidelines for Preparation of an Environmental Management Plan 2013
- Terms of Reference for Continuing to Develop Capacities for a National Forest Monitoring and Measurement, Reporting and Verification System to Support REDD+ Participation of Guyana 2014
- Guidelines for Biodiversity Research 2017
- Wildlife Licensing Procedure 2019
- A Low-Carbon Development Strategy. Transforming Guyana´s Economy While Combating Climate Change. Important Information for Amerindian and Forest Communities 2016
- Guyana Wildlife Conservation and Management Commission: Strategic Plan 2019–2029

ANNEX 3 – WILDLIFE OBSERVATION AND DIVERSITY STATISTICS IN THE RUPUNUNI BASED ON THE SWM CAMERA TRAP STUDY OF 2019–2020

Table A3.a – Number of species detected by camera traps during the 2019–2020 SWM study during the wet and dry seasons in all subregions. This list includes seven species of non-native, domestic mammals (domestic cat, dog, horse, donkey, cow, pig, and humans). Not all species counted are terrestrial species that are reliably detected by camera traps. Further details on the relevant species are provided in Table 7.

Location	Mammals	Birds	Reptiles and Amphibians
Rupununi Region: All	47	82	14
Rupununi Region: Dry	43	51	9
Rupununi Region: Wet	37	22	4
DETECTIONS PER SUB-REGION			
South Pakaraima	33	22	4
North Rupununi	30	40	7
Manari Ranch (near Lethem)	21	14	4
Central Rupununi	32	15	3
South Rupununi	33	14	4
Deep South Rupununi	34	34	6

Table A3.b – Functional diversity: number of species per trophic level during the different camera trapping seasons of the SWM Programme. Not all sites were sampled at every time (indicated with n/a).

	Carnivore	Omnivore	Herbivore	Insectivore
South Pakaraimas				
Dry Season	7	9	8	4
Rainy Season	7	7	7	4
Year 1	n/a	n/a	n/a	n/a
North Rupununi				
Dry Season	5	9	10	3
Rainy Season	6	8	5	4
Year 1	n/a	n/a	n/a	n/a
Central Rupununi				
Dry Season	7	11	8	3
Rainy Season	7	7	8	3

Year 1	n/a	n/a	n/a	n/a
Manari Ranch				
Dry Season	n/a	n/a	n/a	n/a
Rainy Season	n/a	n/a	n/a	n/a
Year 1	4	4	3	4
South Rupununi				
Dry Season	4	11	9	5
Rainy Season	6	7	8	4
Year 1	5	7	8	3
Deep South Rupununi				
Dry Season	5	11	11	3
Rainy Season	7	8	6	4
Year 1	n/a	n/a	n/a	n/a

Table A3.c – Overall species richness and diversity indices comparing the structure of native mammal communities in the South Pakaraimas, North Rupununi, Central Rupununi, South Rupununi, and Deep South Rupununi sub-regions based on SWM's study.

	Richness (s)	Shannon's Index (H)	Evenness (SEM)	Simpson's Index (D)
South Pakaraimas				
Dry Season	56 (33/19/4)	2.524	0.452	7.370
Rainy Season	56 (30/22/4)	2.171	0.637	5.052
Year 1	n/a	n/a	n/a	n/a
North Rupununi				
Dry Season	60 (30/25/5)	2.305	0.613	5.434
Rainy Season	72 (25/40/7)	1.926	0.773	4.054
Year 1	n/a	n/a	n/a	n/a
Central Rupununi				
Dry Season	50 (32/15/3)	1.981	0.938	3.590
Rainy Season	45 (28/14/3)	1.986	0.766	4.2
Year 1	n/a	n/a	n/a	n/a
Manari Ranch				
Dry Season	n/a	n/a	n/a	n/a
Rainy Season	n/a	n/a	n/a	n/a
Year 1	39 (21/14/4)	2.31	0.82	6.63
South Rupununi				
Dry Season	49 (33/14/2)	2.284	0.683	4.930
Rainy Season	45 (29/12/4)	2.003	0.718	4.539
Year 1	37 (27/9/1)	2.05	0.64	4.90
Deep South Rupununi				
Dry Season	74 (34/34/6)	2.460	0.507	6.705
Rainy Season	47 (29/13/5)	1.671	0.870	2.799
Year 1	n/a	n/a	n/a	n/a

Table A3.d – Relative abundance indices and naïve occupancy of key species detected in the Rupununi during Years 1 and 2 camera trapping of the SWM Programme.

Scientific name	Common name	IUCN	Size (kg)	Trophic group	Sampling period	Analysis	PAK	NOR	MAN	CEN	SOU	DEP
Panthera onca	Jaguar	NT	94.5	CARN	Year 2	RAI	0.30	0.21	n/a	0.08	0.21	0.15
					Dry	Naïve Ψ	0.29	0.11	n/a	0.06	0.17	0.12
					Year 2	RAI	0.37	0.07	n/a	0.05	0.4	0.14
					Rainy	Naïve Ψ	0.17	0.06	n/a	0.06	0.16	0.21
					Year 1	RAI	n/a	n/a	0	n/a	0.65	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0.20	n/a
Puma concolor	Puma	LC	74.5	CARN	Year 2	RAI	0.60	0.36	n/a	0.22	0.15	0.15
					Dry	Naïve Ψ	0.29	0.28	n/a	0.19	0.06	0.12
					Year 2	RAI	0.53	0.21	n/a	0.81	0.96	0.57
					Rainy	Naïve Ψ	0.33	0.19	n/a	0.33	0.42	0.16
					Year 1	RAI	n/a	n/a	0	n/a	0.74	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0.35	n/a
Leopardus pardalis	Ocelot	LC	11.25	CARN	Year 2	RAI	1.70	0.67	n/a	2.10	0.87	1.96
					Dry	Naïve Ψ	0.67	0.39	n/a	0.63	0.39	0.47
					Year 2	RAI	1.06	1.99	n/a	1.19	3.11	2.49
					Rainy	Naïve Ψ	0.56	0.63	n/a	0.67	0.79	0.63
					Year 1	RAI	n/a	n/a	0.76	n/a	2.58	n/a
						Naïve Ψ	n/a	n/a	0.21	n/a	0.55	n/a
Leopardus wiedii	Margay	NT	6	CARN	Year 2	RAI	0.25	0.05	n/a	0.60	0	0.15
					Dry	Naïve Ψ	0.19	0.06	n/a	0.13	0	0.06
					Year 2	RAI	0.26	0.43	n/a	0.92	1.13	0.57
					Rainy	Naïve Ψ	0.22	0.38	n/a	0.44	0.47	0.32
					Year 1	RAI	n/a	n/a	0.33	n/a	0.28	n/a
						Naïve Ψ	n/a	n/a	0.14	n/a	0.15	n/a
Leopardus tigrinus	Oncilla	VU	2.25	CARN	Year 2	RAI	0.05	0	n/a	0.08	0	0
					Dry	Naïve Ψ	0.05	0	n/a	0.06	0	0
					Year 2	RAI	0.05	0.07	n/a	0.05	0	0.07
					Rainy	Naïve Ψ	0.06	0.06	n/a	0.06	0	0.05
					Year 1	RAI	n/a	n/a	0.43	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0.07	n/a	0	n/a
Puma yagouaroundi	Jaguarundi	LC	6.75	CARN	Year 2	RAI	0.60	0.10	n/a	0.15	0.22	0.07
					Dry	Naïve Ψ	0.29	0.11	n/a	0.13	0.17	0.06
					Year 2	RAI	0.11	0.29	n/a	0.22	0	0.43
					Rainy	Naïve Ψ	0.06	0.13	n/a	0.22	0	0.21
					Year 1	RAI	n/a	n/a	1.30	n/a	0.09	n/a
						Naïve Ψ	n/a	n/a	0.64	n/a	0.05	n/a
Felis catus	Domestic cat	LC	4	CARN	Year 2	RAI	0	0	n/a	0	0	0
					Dry	Naïve Ψ	0	0	n/a	0	0	0
					Year 2	RAI	0	0	n/a	0	0	0
					Rainy	Naïve Ψ	0	0	n/a	0	0	0
					Year 1	RAI	n/a	n/a	0.11	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0.07	n/a	0	n/a

Scientific name	Common name	IUCN	Size (kg)	Trophic group	Sampling period	Analysis	PAK	NOR	MAN	CEN	SOU	DEP
Speothos venaticus	Bush dog	NT	6	CARN	Year 2	RAI	0	0	n/a	0	0	0
					Dry	Naïve Ψ	0	0	n/a	0	0	0
					Year 2	RAI	0	0	n/a	0.11	0.23	0
					Rainy	Naïve Ψ	0	0	n/a	0.06	0.05	0
					Year 1	RAI	n/a	n/a	0	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0	n/a
Cerdocyon thous	Crab-eating fox	LC	5.75	OMNI	Year 2	RAI	0	0.16	n/a	0.08	0.22	0.95
					Dry	Naïve Ψ	0	0.11	n/a	0.06	0.17	0.06
					Year 2	RAI	0.58	0.07	n/a	0	0	2.78
					Rainy	Naïve Ψ	0.11	0.06	n/a	0	0	0.26
					Year 1	RAI	n/a	n/a	1.52	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0.36	n/a	0	n/a
Canis familiaris	Domestic dog	LC	10	OMNI	Year 2	RAI	0.50	0.26	n/a	0.38	0.15	0.87
					Dry	Naïve Ψ	0.24	0.22	n/a	0.19	0.06	0.24
					Year 2	RAI	0.69	0.07	n/a	0.27	2.21	3.27
					Rainy	Naïve Ψ	0.44	0.06	n/a	0.17	0.16	0.47
					Year 1	RAI	n/a	n/a	0.43	n/a	2.77	n/a
						Naïve Ψ	n/a	n/a	0.21	n/a	0.05	n/a
Eira barbara	Tayra	LC	4.85	OMNI	Year 2	RAI	0.55	1.14	n/a	0.68	4.0	1.31
					Dry	Naïve Ψ	0.29	0.67	n/a	0.44	0.44	0.29
					Year 2	RAI	1.48	1.07	n/a	2.86	1.02	1.07
					Rainy	Naïve Ψ	0.5	0.38	n/a	0.78	0.37	0.26
					Year 1	RAI	n/a	n/a	0	n/a	0.28	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0.15	n/a
Galictis vittata	Greater grison	LC	2.6	CARN	Year 2	RAI	0.20	0	n/a	0.08	0	0
					Dry	Naïve Ψ	0.10	0	n/a	0.06	0	0
					Year 2	RAI	0.21	0.07	n/a	0	0	0.07
					Rainy	Naïve Ψ	0.11	0.06	n/a	0	0	0.05
					Year 1	RAI	n/a	n/a	0	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0	n/a
Lontra longicaudis	Neotropical river otter	NT	10	CARN	Year 2	RAI	0	0	n/a	0	0	0
					Dry	Naïve Ψ	0	0	n/a	0	0	0
					Year 2	RAI	0	0	n/a	0	0	0.07
					Rainy	Naïve Ψ	0	0	n/a	0	0	0.05
					Year 1	RAI	n/a	n/a	0	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0	n/a
Procyon cancrivorus	Crab-eating raccoon	LC	5.4	OMNI	Year 2	RAI	0.25	0.10	n/a	0.75	0.07	0.87
					Dry	Naïve Ψ	0.14	0.06	n/a	0.25	0.06	0.29
					Year 2	RAI	0.42	1.49	n/a	0.11	0	0.14
					Rainy	Naïve Ψ	0.17	0.25	n/a	0.11	0	0.11
					Year 1	RAI	n/a	n/a	1.73	n/a	0.09	n/a
						Naïve Ψ	n/a	n/a	0.29	n/a	0.05	n/a

Scientific name	Common name	IUCN	Size (kg)	Trophic group	Sampling period	Analysis	PAK	NOR	MAN	CEN	SOU	DEP
Nasua nasua	South American coatimundi	LC	5.1	OMNI	Year 2	RAI	2.49	2.07	n/a	0.45	3.20	10.47
					Dry	Naïve Ψ	0.33	0.22	n/a	0.06	0.33	0.65
					Year 2	RAI	5.62	1.56	n/a	2.91	1.42	0.07
					Rainy	Naïve Ψ	0.17	0.13	n/a	0.22	0.21	0.05
					Year 1	RAI	n/a	n/a	0	n/a	1.75	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0.10	n/a
Tapirus terrestris	Lowland tapir	VU	238.5	HERB	Year 2	RAI	2.10	1.61	n/a	1.80	0.22	0.07
					Dry	Naïve Ψ	0.24	0.44	n/a	0.38	0.11	0.06
					Year 2	RAI	0.05	0	n/a	0.16	1.87	0
					Rainy	Naïve Ψ	0.06	0	n/a	0.06	0.47	0
					Year 1	RAI	n/a	n/a	0	n/a	1.57	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0.45	n/a
Equus caballus	Domestic horse	LC	400	HERB	Year 2	RAI	0.10	0	n/a	0	0	0
					Dry	Naïve Ψ	0.05	0	n/a	0	0	0
					Year 2	RAI	3.18	0	n/a	0	0.17	0
					Rainy	Naïve Ψ	0.06	0	n/a	0	0.05	0
					Year 1	RAI	n/a	n/a	0.11	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0.07	n/a	0	n/a
Equus asinus	Domestic donkey	LC	250	HERB	Year 2	RAI	0.05	0	0	0	0	0
					Dry	Naïve Ψ	0.05	0	0	0	0	0
					Year 2	RAI	0	0	n/a	0	0	0
					Rainy	Naïve Ψ	0	0	n/a	0	0	0
					Year 1	RAI	n/a	n/a	0	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0	n/a
Mazama americana	Red brocket deer	DD	36	HERB	Year 2	RAI	4.14	1.71	n/a	5.63	3.63	1.82
					Dry	Naïve Ψ	0.52	0.72	n/a	0.63	0.56	0.29
					Year 2	RAI	6.47	2.91	n/a	2.64	5.39	3.13
					Rainy	Naïve Ψ	0.5	0.5	n/a	0.5	0.78	0.47
					Year 1	RAI	n/a	n/a	0	n/a	4.70	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0.55	n/a
Mazama nemorivaga	Amazonian brown brocket deer	LC	18	HERB	Year 2	RAI	0.60	0.16	n/a	0.08	0.58	0.29
					Dry	Naïve Ψ	0.10	0.11	n/a	0.06	0.11	0.12
					Year 2	RAI	0.95	0	n/a	0.59	5.22	0
					Rainy	Naïve Ψ	0.22	0	n/a	0.17	0.79	0
					Year 1	RAI	n/a	n/a	0	n/a	2.95	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0.5	n/a
Odocoileus cariacou	Venezuelan white-tailed deer	LC	40	HERB	Year 2	RAI	0.55	2.38	n/a	0.60	0.80	1.67
					Dry	Naïve Ψ	0.29	0.39	n/a	0.31	0.28	0.29
					Year 2	RAI	0.32	1.63	n/a	n/a	0	0.92
					Rainy	Naïve Ψ	0.17	0.25	n/a	n/a	0	0.26
					Year 1	RAI	n/a	n/a	4.12	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0.64	n/a	0	n/a

Scientific name	Common name	IUCN	Size (kg)	Trophic group	Sampling period	Analysis	PAK	NOR	MAN	CEN	SOU	DEP
Tayassu pecari	White-lipped peccary	VU	35	OMNI	Year 2	RAI	2.84	0	n/a	0	0	0
					Dry	Naïve Ψ	0.10	0	n/a	0	0	0
					Year 2	RAI	0	0	n/a	0	0.57	0
					Rainy	Naïve Ψ	0	0	n/a	0	0.05	0
					Year 1	RAI	n/a	n/a	0	n/a	1.01	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0.05	n/a
Pecari tajacu	Collared peccary	LC	26	OMNI	Year 2	RAI	2.44	6.42	n/a	11.19	1.96	1.02
					Dry	Naïve Ψ	0.14	0.39	n/a	0.38	0.22	0.24
					Year 2	RAI	5.14	0.43	n/a	3.56	4.99	12.17
					Rainy	Naïve Ψ	0.22	0.13	n/a	0.31	0.63	0.22
					Year 1	RAI	n/a	n/a	0	n/a	2.03	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0.3	n/a
Sus scofra	Domestic pig	LC	100	OMNI	Year 2	RAI	0	0	n/a	0	0.22	7.27
					Dry	Naïve Ψ	0	0	n/a	0	0.06	0.18
					Year 2	RAI	1.22	0	n/a	0.81	0	0.07
					Rainy	Naïve Ψ	0.06	0	n/a	0.06	0	0.05
					Year 1	RAI	n/a	n/a	4.01	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0.14	n/a	0	n/a
Bos taurus	Domestic cattle	LC	700	HERB	Year 2	RAI	10.17	0	n/a	0.08	0.07	10.54
					Dry	Naïve Ψ	0.24	0	n/a	0.06	0.06	0.18
					Year 2	RAI	0.32	0	n/a	0	0.51	6.19
					Rainy	Naïve Ψ	0.33	0	n/a	0	0.05	0.11
					Year 1	RAI	n/a	n/a	1.08	n/a	0.74	n/a
						Naïve Ψ	n/a	n/a	0.07	n/a	0.05	n/a
Hydrochoerus hydrochaeris	Capybara	LC	50	HERB	Year 2	RAI	0.85	0.93	n/a	0	0	0
					Dry	Naïve Ψ	0.14	0.17	n/a	0	0	0
					Year 2	RAI	0	0	n/a	0	0	0.07
					Rainy	Naïve Ψ	0	0	n/a	0	0	0.05
					Year 1	RAI	n/a	n/a	0.87	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0.29	n/a	0	n/a
Cuniculus paca	Lowland paca	LC	9	HERB	Year 2	RAI	3.54	2.75	n/a	5.26	5.01	1.53
					Dry	Naïve Ψ	0.29	0.67	n/a	0.63	0.5	0.29
					Year 2	RAI	1.8	3.77	n/a	8.47	17.13	10.32
					Rainy	Naïve Ψ	0.44	0.5	n/a	0.72	1.00	0.42
					Year 1	RAI	n/a	n/a	11.16	n/a	15.77	n/a
						Naïve Ψ	n/a	n/a	0.5	n/a	0.85	n/a
Dasyprocta leporina	Red-rumped agouti	LC	4.45	HERB	Year 2	RAI	16.90	28.07	n/a	45.80	30.74	19.55
					Dry	Naïve Ψ	0.62	0.78	n/a	1.00	0.89	0.71
					Year 2	RAI	29.78	35.89	n/a	52.43	51.62	80.78
					Rainy	Naïve Ψ	0.89	0.75	n/a	1.00	1.00	0.79
					Year 1	RAI	n/a	n/a	0	n/a	36.99	n/a
						Naïve Ψ	n/a	n/a	0	n/a	1.00	n/a

Scientific name	Common name	IUCN	Size (kg)	Trophic group	Sampling period	Analysis	PAK	NOR	MAN	CEN	SOU	DEP
Myoprocta acouchy	Red acouchi	LC	1.25	HERB	Year 2	RAI	0	6.89	n/a	0	3.49	2.18
					Dry	Naïve Ψ	0	0.44	n/a	0	0.44	0.24
					Year 2	RAI	0	0	n/a	2.48	69.99	0
					Rainy	Naïve Ψ	0	0	n/a	0.28	1.00	0
					Year 1	RAI	n/a	n/a	0	n/a	43.54	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0.95	n/a
Sciurus aestuans	Brazilian squirrel	LC	0.19	HERB	Year 2	RAI	0	0.57	n/a	0.08	0.22	0.14
					Dry	Naïve Ψ	0	0.17	n/a	0.06	0.17	0.06
					Year 2	RAI	0	0	n/a	0.76	1.16	0
					Rainy	Naïve Ψ	0	0	n/a	0.39	0.11	0
					Year 1	RAI	n/a	n/a	0	n/a	0.55	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0.1	n/a
Echimys sp.	Tree rat sp.	LC	0.65	HERB	Year 2	RAI	0	0.05	0	0	0	0.15
					Dry	Naïve Ψ	0	0.06	0	0	0	0.06
					Year 2	RAI	0	0	n/a	0	0	0
					Rainy	Naïve Ψ	0	0	n/a	0	0	0
					Year 1	RAI	n/a	n/a	0	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0	n/a
Echimys sp.	Terrestrial spiny rat sp.	LC	0.28	HERB	Year 2	RAI	8.58	7.77	n/a	5.41	3.92	5.74
					Dry	Naïve Ψ	0.52	0.83	n/a	0.94	0.67	0.71
					Year 2	RAI	9.86	20.4	n/a	27.67	9.87	3.99
					Rainy	Naïve Ψ	0.83	0.94	n/a	0.89	0.94	0.53
					Year 1	RAI	n/a	n/a	0.87	n/a	3.60	n/a
						Naïve Ψ	n/a	n/a	0.14	n/a	0.75	n/a
Sylvilagus brasiliensis	Brazilian cottontail rabbit	LC	1	HERB	Year 2	RAI	0	0	n/a	0	0	1.45
					Dry	Naïve Ψ	0	0	n/a	0	0	0.18
					Year 2	RAI	0	0	n/a	0	0	0
					Rainy	Naïve Ψ	0	0	n/a	0	0	0
					Year 1	RAI	n/a	n/a	0	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0	n/a
Priodontes maximus	Giant armadillo	VU	25.6	INSECT	Year 2	RAI	0.20	0.10	n/a	0	0.51	0
					Dry	Naïve Ψ	0.19	0.11	n/a	0	0.22	0
					Year 2	RAI	0.53	0	n/a	0	0.11	0
					Rainy	Naïve Ψ	0.22	0	n/a	0	0.11	0
					Year 1	RAI	n/a	n/a	0	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0	n/a
Dasypus sp.	Long-nosed armadillos	LC	4.5	INSECT	Year 2	RAI	2.44	2.33	n/a	3.15	4.8	1.02
					Dry	Naïve Ψ	0.52	0.56	n/a	0.63	0.61	0.35
					Year 2	RAI	5.72	6.18	n/a	9.22	5.5	9.96
					Rainy	Naïve Ψ	0.72	0.44	n/a	0.89	0.89	0.63
					Year 1	RAI	n/a	n/a	2.93	n/a	4.80	n/a
						Naïve Ψ	n/a	n/a	0.29	n/a	0.65	n/a

Scientific name	Common name	IUCN	Size (kg)	Trophic group	Sampling period	Analysis	PAK	NOR	MAN	CEN	SOU	DEP
Cabassous unicinctus	Southern naked-tailed armadillo	LC	3.2	INSECT	Year 2	RAI	0	0	n/a	0	0.22	0
					Dry	Naïve Ψ	0	0	n/a	0	0.11	0
					Year 2	RAI	0	0.07	n/a	0	0	0.07
					Rainy	Naïve Ψ	0	0.06	n/a	0	0	0.05
					Year 1	RAI	n/a	n/a	1.08	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0.14	n/a	0	n/a
Myrmecophaga tridactyla	Giant anteater	VU	30.5	INSECT	Year 2	RAI	2.05	0.73	n/a	2.25	0.87	4.58
					Dry	Naïve Ψ	0.33	0.39	n/a	0.69	0.33	0.71
					Year 2	RAI	2.17	1.35	n/a	0.43	0.68	7.62
					Rainy	Naïve Ψ	0.5	0.5	n/a	0.28	0.26	0.84
					Year 1	RAI	n/a	n/a	3.47	n/a	0.46	n/a
						Naïve Ψ	n/a	n/a	0.64	n/a	0.15	n/a
Tamandua tetradactyla	Southern tamandua	LC	6	INSECT	Year 2	RAI	0.15	0	n/a	0.15	0.44	0.22
					Dry	Naïve Ψ	0.14	0	n/a	0.06	0.22	0.12
					Year 2	RAI	0.05	0.14	n/a	0.7	0.06	0.07
					Rainy	Naïve Ψ	0.06	0.06	n/a	0.33	0.05	0.05
					Year 1	RAI	n/a	n/a	1.41	n/a	0.18	n/a
						Naïve Ψ	n/a	n/a	0.21	n/a	0.1	n/a
Didelphidae	Opossums						PAK	NOR	MAN	CEN	SOU	DEP
Didelphis marsupialis	Common opossum	LC	1.09	OMNI	Year 2	RAI	1.25	4.20	n/a	2.63	5.74	2.33
					Dry	Naïve Ψ	0.43	0.72	n/a	0.75	0.72	0.65
					Year 2	RAI	2.12	1.78	n/a	4.42	7.54	2.28
					Rainy	Naïve Ψ	0.5	0.63	n/a	0.89	0.84	0.47
					Year 1	RAI	n/a	n/a	1.30	n/a	5.44	n/a
						Naïve Ψ	n/a	n/a	0.36	n/a	0.6	n/a
Philander opossum	Four-eyed opossum	LC	0.43	OMNI	Year 2	RAI	0.05	2.9	n/a	0.38	1.31	2.54
					Dry	Naïve Ψ	0.05	0.39	n/a	0.13	0.28	0.18
					Year 2	RAI	0	4.26	n/a	1.73	3.35	0.07
					Rainy	Naïve Ψ	0	0.38	n/a	0.39	0.74	0.05
					Year 1	RAI	n/a	n/a	0.22	n/a	3.23	n/a
						Naïve Ψ	n/a	n/a	0.07	n/a	0.6	n/a
Marmosops sp.	Mouse opossum sp.	LC	0.02	OMNI	Year 2	RAI	0.05	0.57	n/a	0.08	0.36	0.44
					Dry	Naïve Ψ	0.05	0.22	n/a	0.06	0.17	0.12
					Year 2	RAI	0	0	n/a	0	0	0
					Rainy	Naïve Ψ	0	0	n/a	0	0	0
					Year 1	RAI	n/a	n/a	0	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0	n/a
Saguinus midas	Golden-handed tamarin	LC	0.54	OMNI	Year 2	RAI	0	0	n/a	0	0.15	0.07
					Dry	Naïve Ψ	0	0	n/a	0	0.12	0.06
					Year 2	RAI	0	0	n/a	0	0	0

Scientific name	Common name	IUCN	Size (kg)	Trophic group	Sampling period	Analysis	PAK	NOR	MAN	CEN	SOU	DEP
					Rainy	Naïve Ψ	0	0	n/a	0	0	0
					Year 1	RAI	n/a	n/a	0	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0	n/a
Cebidae	Small monkeys						PAK	NOR	MAN	CEN	SOU	DEP
Saimiri sciureus sciureus	Common squirrel monkey	LC	0.94	OMNI	Year 2	RAI	0	0	0	1.35	0.15	0.07
					Dry	Naïve Ψ	0	0	0	0.31	0.11	0.06
					Year 2	RAI	0	0	n/a	0	0	0
					Rainy	Naïve Ψ	0	0	n/a	0	0	0
					Year 1	RAI	n/a	n/a	0	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0	n/a
Cebus apella	Brown capuchin	LC	3.08	OMNI	Year 2	RAI	0	0.52	n/a	1.20	0.44	0.29
					Dry	Naïve Ψ	0	0.28	n/a	0.25	0.11	0.18
					Year 2	RAI	0	0	n/a	1.46	0	0.78
					Rainy	Naïve Ψ	0	0	n/a	0.39	0	0.11
					Year 1	RAI	n/a	n/a	0	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0	n/a
Cebus olivaceus	Wedge-capped capuchin	LC	2.66	OMNI	Year 2	RAI	1.30	0	n/a	0.53	0	0
					Dry	Naïve Ψ	0.29	0	n/a	0.13	0	0
					Year 2	RAI	0.58	0.07	n/a	0	0.11	0
					Rainy	Naïve Ψ	0.17	0.06	n/a	0	0.05	0
					Year 1	RAI	n/a	n/a	0	n/a	0	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0	n/a
Alouatta macconnelli	Guianan red howler monkey	LC	7.35	HERB	Year 2	RAI	0	0	n/a	0	0	0
					Dry	Naïve Ψ	0	0	n/a	0	0	0
					Year 2	RAI	0	0	n/a	0	0	0
					Rainy	Naïve Ψ	0	0	n/a	0	0	0
					Year 1	RAI	n/a	n/a	0	n/a	0.09	n/a
						Naïve Ψ	n/a	n/a	0	n/a	0.05	n/a

FIND OUT MORE

SWM-programme@fao.org
www.swm-programme.info

ISBN 978-92-5-136190-0
9 789251 361900
CC0031EN/1/09.22