

A Study of the Use of Fire by Amerindian Communities in South Rupununi, Guyana, with Recommendations for Sustainable Land Management



Study prepared for the South Central and South Rupununi District Toshaos Councils

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CONTENTS

EXECUTIVE SUMMARY

INTRODUCTON	1
1. THE STUDY AREA: SOUTH RUPUNUNI	3
2. AIMS AND OBJETIVES OF THE STUDY.....	6
3. METHODOLOGY.....	7
4. RESULTS.....	8
4.1. The Wapichan and Makushi fire management system.....	8
4.1.1. Uses and meanings of fire to the Wapichan and Makushi People.....	8
4.1.2. The proper way of using fire.....	18
4.1.2.1. Fire regimes according to the seasons.....	20
4.1.2.2. Times of the day to burn.....	28
4.1.2.3. Wind speed and direction.....	28
4.1.2.4. The rain.....	30
4.1.2.5. The colour of the grass.....	31
4.1.2.6. Size of the fire: patch-burning and natural barriers.....	31
4.1.2.7. Fire breaks and other fire prevention/control methods.....	32
4.2. Changes and impacts in the use of fire.....	37
4.2.1. Impact of fire use on the vegetation.....	39
4.2.2. Impacts of fire use on wildlife.....	45
4.3. Causes of the impacts of fire.....	50
4.3.1 Socio-cultural change.....	50
4.3.2. Changes in the use of fire in different livelihood practices.....	53
4.3.2.1. Cattle grazing.....	53
4.3.2.2. Farming.....	56
4.3.2.3. Hunting.....	58
4.3.3. Climate change and the use of fire.....	59
5. DISCUSSION.....	62
6. RECOMMENDATIONS.....	65
7. POSSIBLE NEXT STEPS.....	67
8. REFERENCES.....	72
9. ANNEXES.....	76

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EXECUTIVE SUMMARY

This study discusses the environmental and social factors influencing both controlled and uncontrolled burning of savannah and other vegetation in South Rupununi and provides practical recommendations for fire/land management. It compiles, for the first time, baseline information about the traditional Wapichan and Makushi knowledge, norms and beliefs about the use of fire, which are essential to inform the long term management plans for this territory. Research was carried out using a participatory methodology which involved 20 days of fieldwork in 5 of the 10 communities of South Rupununi. The results and recommendations were validated in an intercommunity meeting which took place in Shurinab on January 2011.

The study shows that traditional Wapichan and Makushi fire management system is a highly complex and diverse one, based on a wide variety of uses and timings of different types of fires, according to the season, times of the day, type of ecosystem and livelihood practices involved. The wide variety of uses given to fire include: domestic use, medicinal/healing and spiritual use, safety, animal husbandry, fishing, agricultural use, hunting, gathering, stimulating vegetation growth and abundance (both in savannah and forest environments), communication, craft making and perhaps most significantly, environmental protection. The landscape is being continuously shaped, by all and not just only one, of these different types of fires. Thus, eliminating or reducing the use of fire in the area is simply not possible nor would it be desirable. In this type of human shaped landscape, fewer fires can be more of a problem to the environment than more.

However, the study reveals that the fire regimes are changing as a consequence of a combination of factors, which include: increase in population, a more permanent settlement pattern, cultural change, change in livelihood practices (cattle grazing, hunting and farming), inappropriate environmental policies promoted by external agencies and climate change. Results suggest that the area is currently being subject to more dry season fires and that these are not being accompanied by enough late rainy season ones. Or in other words, less or insufficient protective or preventative fires are being carried out. This seems to be causing some undesirable impacts of burning practices, such as repeated burns in some mountain slopes, the conversion of some forests into savannah, the degradation of its groves near to community areas and the decline in local abundance of some animal species.

The study concludes that in order to ensure a sustainable use of fire in South Rupununi it is crucial to maintain alive the traditional Wapichan and Makushi methods for adequate uses of fire, which include:

- Ensuring the regular maintenance of a **savannah patch-burning** mosaic and **forest edge burns** during the late rainy season and early dry season.
- Prior to carrying out burns, paying attention to natural factors, such as: the season of the year, time of the day, wind speed and direction, seasonal and daily variations in the rainfall, soil humidity, the colour of the grass, the size of the fire and natural barriers such as roads, rivers, creeks, swamps and lakes.
- Using double firebreaks in agricultural areas.
- Making regular use of traditional fire prevention/control methods, such as wetting the land before burning, extinguishing or “outing” fires (particularly in fire places set to cook during fishing and hunting trips) or fighting fire with fire (when a fire has become too big and has gone out of control).
- Paying attention to critical fire management areas, such as *shakaru* and swamps where a potentially hazardous natural build up of organic matter normally takes place.
- Ensuring that the traditional preventative measures are also regularly used in new adaptive approaches to land use such as cattle grazing, where there is an intensive use of fire in the height of the dry season. If there is an adequate maintenance of the savannah mosaic and of forest edge fire breaks during the end of the rainy season and the beginning of the dry season, there is less chances that the fires set from cattle grazing activities set in the middle of the dry season may turn into uncontrollable and damaging ones.

INTRODUCTION

In December 2007, a meeting of the South and South Central District Toshaos Councils (DTCs) of the South Rupununi area in Guyana decided to:

“...work together to develop a collective management plan for the sustainable use of land and all natural resources within (Wapichan) traditional territory, based on customs and scientific information...”¹

With the support of the community-based NGO *South Central Peoples Development Association* (SCPDA) and the Forest Peoples Programme the DTCs have sought funding to develop an outline management plan for Wapichan traditional lands in the South Rupununi. In late 2009, the DTCs obtained a grant from the EC delegation office in Guyana for the Project “Securing and sustainably managing Wapichan traditional lands in Guyana (2010-11)”. Forest Peoples Programme is supporting the South Central Peoples Development Association (SCDA) and South Central and South Rupununi District Toshaos Councils to implement the above project.

One part of the project involves carrying out natural resource management (NRM) studies on priority topics identified by the communities. In the first phase of this project in early 2010, the participating communities duly identified two topics for investigation, which they hope will generate useful findings and recommendations that may help strengthen their plans for sustainable land management and community-driven development. One of them is: “A Study of the use of fire by Amerindian communities in the South Rupununi”². This report presents the results of this study, carried out between 4 and 23 January 2011.

Fire is an important part of cultural identity of the Wapichan People, and is an indispensable tool in their different livelihood practices, but they are increasingly concerned about its current and potential impact on their homelands and natural resources. Some of these concerns seem to have been created by government agencies and conservation organisations in an attempt to conserve natural resources in the Rupununi Region and to reduce carbon emissions in Guyana (Guyana Forestry Commission 2009, Herold & Bholanath 2009, Government of Guyana 2008, Parker *et al.* 1993); others stem from a sense of loss of control in the use of fire in the area. In recent years,

¹ DTC meeting statement, Aishara Toon Village, 7 December, 2007

² The other study was “Use, management, ecology and health of natural fisheries in the South Rupununi (waters in savannah and forest areas)”

wildfires started during the dry season have damaged people's farms, houses and mountain slopes. Particularly during unusually dry years, such as 1998 and 2007, wildfires have burned for several weeks, affecting many areas that should be carefully looked after according to the Wapichan belief system. This causes the community to be confused about whether it is appropriate to use fire in present day life. As Nick Fredericks from Shurinab Village council says: *"currently we don't know if fire is good or bad any more"*.

This report seeks to help the Wapichan clarify their doubts about the use of fire by studying current uses and impacts of burning practices in the South Rupununi. An important part of this study was to gather for the first time baseline information on traditional Wapichan knowledge, norms and beliefs about the use of fire. Contemporary indigenous knowledge of the use of fire has been poorly documented around the world, although it is a subject that is increasingly receiving attention in environmental management literature (McGregor *et al.* 2010, Rodriguez & Sletto 2009, Rodriguez 2007, Mistry *et al.* 2005, Kull 2002). Visiting researchers and land managers often assume that fire is detrimental to the environment and because of that rarely study local practices. Yet, studies carried out in other parts of the world indicate that indigenous peoples have a detailed and sophisticated knowledge of fire use. Local burning practices tend to become a threat to the environment when local knowledge and traditional uses of fire start to disappear as a result of modern development and changing perceptions of the environment among younger generations. Hence the importance of understanding how fire should be used according to the Wapichan norms and belief system as part of the study of current uses and impacts of burning.

The findings of this study are not conclusive, as the research area is vast and the subject is complex. Yet the report provides a body of knowledge that is likely to help the Wapichan think and reflect collectively about the current situation with regards to the use of fire and make decisions regarding its sustainable use.

The report is divided in six sections. Section 1 presents the study area, with an emphasis on explaining the role that fire has historically played shaping the Rupununi landscape and currently has in the livelihoods of the Wapichan and Makushi people, the two main inhabitants of South Central Rupununi. Section 2 and 3 lay out the study aims and objectives and the research methodology respectively. The study results are discussed in section 4, starting with a description of the Wapichan and Makushi fire management system, followed by an analysis of the changes

and impacts in the use of fire and closing with a discussion of the causes of the impacts of fire. In section 5 we discuss the overall study findings and in the last two sections we recommend actions that can be taken to improve the use of fire in the area.

1. THE STUDY AREA: SOUTH RUPUNUNI

The Rupununi Region in Southern Guyana (Region 9) encompasses 5,000 square miles (13,000 km²) of grassland, swamps and forested mountains. The Region is divided by the Kanuku Mountains into the North Rupununi and South Rupununi. It is bordered by the rainforests of the Essequibo River to the South East, by the Pakaraima Mountains to the North and by the Rio Branco savannahs located in the Brazilian State of Roraima in the west (see Figure 1).



Figure 1: Location of the Rupununi Region in Southern Guyana

Historically, the North and South Rupununi has been home to a wide variety of indigenous peoples from the Arawak family of languages, such as the Atoradnao, Parau Yanao, Daozai, Taruma and the Wapichan and as well as from the Karib family of languages like the Burokotano and the Makushi (David *et al.* 2006, Edwards & Gibson 1979). During the eighteenth and nineteenth centuries, with the arrival of Dutch and Portuguese colonisers in the area, the population of these different groups suffered a heavy loss due to introduced diseases such as small pox, measles and influenza and slave raids. In the later colonial period, the surviving populations began to regroup in parts of the Rupununi and some mixed communities of Wapichan, Atorad, Daozai and Makushi origin were established. Gradually the Atorad and Daozai intermarried with the Wapichan, and today the population of the region is predominantly Wapichan, with a smaller proportion of Makushi.

Thus, today the North and South Rupununi are considered the homelands of two mayor territorial groups of the Wapichan people: the western and north Wapichan and the southern and eastern Wapichan; and to a lesser extent the Makushi.

This study was concentrated in the South Rupununi, particularly in the South Central area. The indigenous population in the South Rupununi is 8,395 people, half of which reside in the South

Central area. Although the area is mostly (94.5%) inhabited by the Wapichan people, a small proportion of Makushi live intermixed with the Wapichan, particularly in the northern area (Shurinab village and surroundings) (David *et al.* 2006).

The Wapichan and Makushi of the South Central Rupununi are settled in combination of major villages, which vary in size from 90 to 583 inhabitants (Shizizi and Potarinao, respectively), smaller satellite settlements, larger homesteads and hamlets, thousand of individual households and semi-permanent and temporary farms, hunting and fishing encampments that are widely dispersed in the territory (David *et al.* 2006). Over the last 50 years, an increasing number of communities and households have taken up cattle-raising, and more recently commercial peanut farming, as an alternative to the traditional subsistence activities of small-scale farming, hunting, fishing and gathering.

The landscape of the South-Central Rupununi is a forest-savannah mosaic, which is divided according to the Wapichan into a variety of components (see Table 1)

Table 1: Wapichan classification of landscape components

Wapichan name	Literal translation	Technical translation
<i>Kanoko</i>	Forests	
<i>Midikuo</i>	Mountains	
<i>Baraazi</i>	Savannah	
<i>Katonaru</i>	bush-islands	patch of forest in savannah
<i>midiku-baraazi</i>	savannah mountains	
<i>kanoko-baraazi</i>	forest-savannah	forest-savannah edge
<i>waozi-kanoko</i>	creek forest	gallery forest in savannah
<i>wa'ozu danamada</i>	creek edge	
<i>u'waozi</i>	river/creek	
<i>Karishi</i>	lake/pond	
<i>baawizi</i>	Swamp	
<i>ite groves</i>	palm swamps	moriche palm (<i>Mauritia flexuosa</i>)

Source (David *et al.* 2006).

Five distinctive types of savannah vegetation can be recognised, ranging from entirely herbaceous savannah to closed savannah woodland. In terms of area, herbaceous savannah and open savannah woodland are most widespread. The dominant species is the grass *Trachypogon plumosus*, which is found in association with less abundant species of grasses, sedges, forbs and herbs. The dominant woody species is the sandpaper tree or *imiara*, *Curatella americana* (Henfrey 2002)

Forest types include low semi deciduous forest along the savannah forest boundary and as forest patches or “bush-islands” surrounded by savannah; medium height mixed evergreen and semi deciduous gallery forests along the banks of the Rupununi; tall ever green flooded rain forest on the low lying parts on the upper Rii wa’o river and Upper Essequibo; semi deciduous lower mountain forests in the Kanuku foothills; and evergreen lower mountain rainforest above 300 m on mountainous terrain (Huber *et al.* 1995 cited in David *et al.* 2006).

The origin of this type of mixed forest-savannah landscape, and particularly of the savannahs, has been of great interest and bewilderment to many naturalists and ecologists over the last centuries in the whole of the Guyana Shield Region. For a long time, it was assumed that the use of fire by indigenous peoples was the main cause of the existence of savannahs in this area, having converted areas that were originally forested into a mixed forest-savannah landscape. Although fire does play a role maintaining the present landscape, ecological and paleoecological studies carried out in the Guyana Shield in both the Guyanese and Venezuelan borders have shown that the origin of the savannahs are rather a consequence of a variety of factors, of which climatic fluctuations during the last 12,000 years and low soil fertility are amongst the most important (Leal 2010, Eden 1964). Charcoal deposits found in paleoecological studies carried out in the neighbouring Venezuelan forest-savannah mosaics (in Canaima National Park) and in the Brazilian *cerrado* savannahs, show that fire has been a permanent feature of these type of landscapes for at least the last 6,000 years (Leal 2010, Mistry *et al.* 2005). This suggests that although fire did not cause the savannahs, it has played a role maintaining this landscape for thousands of years. Although these studies do not include the Rupununi Region, one could assume, given the wide variety of indigenous groups that lived in this region before the colonial times, that fire has been a permanent component of this landscape for more or less the same period of time.

The day-to-day subsistence strategy of the Wapichan and Makushi people is adapted to the exploitation of resources offered by forests and savannahs. Forests are used for agriculture, hunting, lumbering, fishing, and gathering of foods, medicines, firewood and the raw materials for buildings and crafts. Savannahs are the main sites of permanent settlement, and are used for fishing, livestock rearing, hunting, gathering of plant and animal foods and non-food items such as building materials, firewood, craft material and medicines (Henfrey 2002). As will become clear in the following section of this report, fire is an indispensable tool in making use of the economic potential that these two types of ecosystems offer the Wapichan and Makushi.

2. AIMS AND OBJECTIVES OF THE STUDY

The main aim of this study was to understand the environmental and social factors influencing both controlled and uncontrolled (harmful) burning of savannah and other vegetation. A secondary goal was to provide practical recommendations for fire management and control.

The research objectives according to the terms of reference were therefore:

- to assess the impacts of past and current burning practices on plant and animal communities in the savannah grasslands and adjacent bush islands and tropical forests
- to identify environmental, socio-economic and cultural factors that affect the scale and degree of ecological impacts
- to actively involve customary land owners, holders of traditional knowledge and the community organisations in carrying out the study and in the development of proposals for improved fire control and sustainable land management to compile findings and recommendations in a summary report for the South and South Central District Toshaos Councils as input to an outline territorial management plan for *Wapichan wiizi* , “Wapichan territory”.

On the basis of the team’s previous knowledge, before embarking on these four objectives it was considered necessary to compile for the first time baseline information on traditional Wapichan knowledge, norms and beliefs about the use of fire. Thus, an additional objective was added as a first step of the study before evaluating the current impacts of fire and the socio-cultural and economic factors affecting the scale and degree of the impact:

- to ascertain how fire should be used according to Wapichan and Makushi culture and belief systems and to test this knowledge against the current situation.

3. METHODOLOGY

The *South Central Peoples Development Association* (SCPDA) was the local organization in charge of coordinating this study with the support of two external researchers (Iokiñe Rodriguez as field-work facilitator and Chris Sharpe as ecological/technical support). In order to follow the work philosophy and vision of the Wapichan Management Plan, it was agreed that the study would be carried out using a participatory research methodology. Thus, a research team was formed between Iokiñe Rodriguez and two members of the SCPDA team: Paulinus Albert and Caudine de La Rose.

Fieldwork was carried out between 7 and 21 January 2011 and consisted of the following activities:

- Planning meeting with SCPDA directive to discuss and agree objectives and research methods
- Design and discussion of research tools
- First round of fieldwork
- Evaluation of community responses and adjustments to methods
- Second round of fieldwork
- Processing of information
- Writing up of preliminary results
- Validating local meeting in order to share and discuss preliminary results

Work was carried out in 5 of the 10 mayor villages of South Central Rupununi: Shizizi, Potarinao, Sawari wa'õ, Shurinab and Parikwarinao. Although most of the people interviewed in this study were Wapichan, we also worked with a representative number of Makushi, particularly from Shurinab and its satellite villages.

Research tools consisted of (see Table 2 for details):

- a) a detailed fire interview guide directed at elders (men and women), who are knowledgeable about past and present burning practices and their ecological impacts. These interviews were typically carried out with husband and wife at the same time in their household setting,

- b) focus group discussions and mapping exercises with groups of men and women separately in order to identify critical fire problems and vulnerable areas for fire management.
- c) interviews with young people and community leaders on specific topics
- d) site visits to burned and unburned areas
- e) a fire demonstration exercise which was aimed at aiding the researchers' understanding of the way fire is used and also testing if the system works in practice, and
- f) a final community validating meeting in which preliminary results were presented and discussed. Three people from each participating village were invited to this meeting.

Table 2: Research Methods used by community

COMMUNITIES	Detailed fire interview	Focus group discussion (mapping)	Specific topic interviews	Site visits	Fire use demonstration
Shizizi	6	2		2	
Potarinao	5	2	1	1	
Parikwarinao	2	1	1	2	
Shurinab	2	1	4	2	1
Sawari wa'o	1	1			
TOTAL	16	7	6	7	1

Most of the interviews and focus group discussion were carried out in Wapichan language with a simultaneous translation into English in order for the study facilitator to be involved in the discussions. Interviews held with Makushi were carried out in English. All interviews and discussion were recorded for future use and analysis.

4. RESULTS:

4.1. The Wapichan and Makushi fire management system:

4.1.1. Uses and meanings of fire to the Wapichan and Makushi People

The Wapichan and Makushi people have historically lived in mixed savannah and forest environments, to the extent that the Wapichan people of the South Rupununi in particular, are

known as the *Toadaz sanao* “the people of the forest edge”³. In recent historical times the Wapichan seemed to have developed a much closer association to forests than to savannahs, as since mid 19th century up until very recently they had many of their settlement areas inside forested areas. As explained by some of the elders this had to do with protecting themselves from enemies and slave raids in the colonial times. Yet, it seems that living deeper in the bush was also in part a function of economics (extraction of balata for 70 years or more). Well into 1970s many Wapichan continued to have family settlements deep in the bush where they managed extensive forest pathways (lines) for balata bleeding (David *et al.* 2006), to the extent that some of the elders interviewed claim that they only saw the savannah well into their childhood:

“I grew up in the jungle, if you ask me about the jungle I could tell you. But in old times there were people in the savannahs. These areas had people living here long, long, long time ago. I hear my grandfather say that there was lady called *Arokumay*⁴, she use to live in the savannahs, the people living in the mountain came down to meet them, they were like *Warapiri*. The mountain people use to invite them for Christmas holiday and the savannah people use to invite them. I was a little boy when I first saw the savannah”. (Uncle Morris Adolf, Koiko)

Today most of the Wapichan and Makushi of the South Rupununi are settled in savannahs in permanent villages, though they maintain ties and carry out traditional activities in their ancestral farming areas in the bush and mountains.

Given the relatively recent settlement of open savannah environments in the South Rupununi by the Wapichan, it was not possible to ascertain how much of their knowledge of the use of fire in savannah environments has been acquired over the last centuries and how much of it may come from periods in which they may have been settled in savannahs prior to the colonial times. Yet, as will become apparent below, they hold a detailed knowledge of the use of fire, both in savannah and forest environments.

³ In the mid-19th century (1835-39) Robert Schomburgk found Wapichan on savannah forest edge near what is today Aishalton.

⁴ Wapichan spellings included in this report are taken from fieldwork notes and might need checking in accordance with the WWA Writing System.

As in the case of other indigenous peoples of the Guyana Shield and the Venezuelan and Brazilian Amazonian Region (Rodriguez & Sletto 2009, Mistry *et al.* 2005), fire has great cultural significance for the Wapichan and Makushi.

When discussing the meanings of fire with the different Wapichan and Makushi elders, many repeatedly stressed the heritage and cultural responsibility they have in using fire, as it is something handed on to them from many generations back. As one of the elders commented: “It is what our grandparents left for us, so it is something we must cherish”. There is also a very strong individual connection with fire, as another elder mentions: “Fire is with us since we are born, we are connected to it since the very beginning of our life. My mom used fire coal to dry my naval cord”.

This strong cultural and individual connection with fire has to do with the fact that *tikazi*, as the Wapichan call it, or *apök* to the Makushi, is present in almost all aspects of their daily life. Through this study we were able to identify nearly 40 different uses of fire which can be grouped in the following categories: a) domestic use, b) medicinal/healing and spiritual use, c) safety, d) animal husbandry, e) fishing, f) agricultural use, g) hunting, h) gathering, h) stimulating vegetation growth and abundance, j) environmental protection, k) communication, and l) craft making (see Box 1 for details). This explains why for most of the Wapichan and Makushi interviewed fire is “something we cannot do without”, “a companion to where ever I go”, “a help in our lives” and also why others say “I feel helpless without fire”.

In the household, fire has conventional uses such as cooking, producing light and heat as well great medicinal and spiritual value. Fire is used to warm medicinal leaves or barks applied to a person in case of injuries or snakebites, as well as to smoke out evil spirits when a person is ill.

Fire is an indispensable land use/management tool. In farming (rotational agriculture) the men use it to cut down and burn trees, thus opening space in the forests for cultivation. The ash produced in this process fertilises the land before cultivating. Once the land has been sown, women use fire in the weeding of the farms. Fire is also useful to chase away pests, such as acoushi ants (*koki*) once the crops have started growing. In hunting it is used to flush out animals from swamps or overgrown savannahs, both, in individual hunts or in circle hunting (*irampüm* in the Makushi

Box 1: Uses of fire by the Wapichan and Makushi People.

<p>Domestic use: Cooking (making cassava bread, farine, etc) Heating <i>Parakari</i> To keep us warm To produce light To produce fire-wood To clean around the homes To burn rubbish Preserving our food (smoking fish, meat) For making and burning clay bricks</p> <p>Medicinal/healing and Spiritual use: For currying (to warm medicinal leaves and bark) For healing (smoking out evil spirits when a person is ill) For ceremonial practices –for example St. John’s Day For chasing away dangerous spirits or in some cases for calling them (e.g. the rain spirits) When a baby is born, if the legs and hands are curling up, fire is used to straighten them.</p> <p>Safety: Clean our paths Clear around the houses To chase away dangerous animals (jaguars, snakes) and mosquitoes</p> <p>Animal Husbandry: Grazing cattle (to produce fresh green grass) To prevent cows from straying far away in search of green grass. To find our lost pigs Getting rid of ticks For branding cows To make cows move during round-up</p> <p>Fishing: As light when fishing at night (the <i>pokoridi</i> is used as the stalk and the <i>ite</i> as a torch).</p>	<p>Agriculture use: Burning of the farms Fertilizing the land in our farms. To weed our farms Used with petrol to chase away <i>koki</i> „acoushi ants“</p> <p>Hunting: Flushing out the animals (hunting) Circle burning (<i>irampüm</i> in Makushi language)</p> <p>Gathering natural resources: Before cutting ite leaves, to burn along swamps and create space to dry the leaves Smoking bees before collecting honey</p> <p>Stimulating vegetation growth and abundance: There are some fruits and trees that benefit from the use of fire.</p> <p>Environmental protection (wildfire prevention): To prevent large fires entering bush-lands, farming areas, ite areas, homes, no-go zones (savannah patch burning and fire breaks) For calling the rain (when there is large fire, fire is used to burn pepper in certain places: lakes, pools, no go zones and make spirits angry and provoke the rains) To fight big hazardous fires when approaching (fighting fire with fire) To burn potentially dangerous overgrown swaps and savannahs</p> <p>Communication: Signals in hunting, grazing, emergencies</p> <p>Crafts: Shaping crafts: heating, bending and straightening arrow cane, bows and fishing rods</p>
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language), which is carried out in group⁵. In gathering activities, such as honey collection, fire is used to smoke away the bees from the beehives. When collecting *ite* palm leaves (*Mauritia flexuosa*), which are used for the making of roofs and for crafts, fire is used to burn the savannah

⁵ Circle hunting or *irampüm* refers to the setting of fire in various places in open savannahs in order to surround the game and drive it into small areas where they can be more easily captured by waiting marksmen.

along swamps and create space to place the dry the leaves and also to protect the leaves from being burned by an eventual savannah wildfire. By keeping the savannah low in the area where the ite palm leaves are placed, an eventual savannah fire will stop before reaching the area where the ite palm leaves are being dried. Fire also assists in the production and collection of firewood, as many of the livelihood practices generate firewood as a side-product.

Fire e is also used for safety purposes in the different livelihood practices in the maintenance of the walking paths (known as hunting and fishing lines), to keep them clean and free from dangerous animals such as snakes. It is also used around the homes to keep away dangerous animals, clear rubbish and maintain the savannahs low in order to prevent a savannah fire from reaching the homes (see Figure 1).

Figure 1: Use of fire around homes



According to the elders, fire is also beneficial for the growth of certain savannah and bush plants of regular use. For instance, in forest areas it stimulates the growth of certain edible fruits like *potorai*, an unidentified orange fruit that is used for drinks, and in the deep forests a wide variety of trees used for construction, medicinal purposes and crafts become more plenty full with the action of fire (see Table 3 for more details)⁶. In savannah areas, the *iminaru* or sandpaper tree (*Curatella americana*) - which has a variety of medicinal purposes as well as being used for crafts and making utensils and saddles - benefits from fire (see Figure 2).

⁶ The use of fire by indigenous people to stimulate the abundance and quality of materials, specially basketry materials has also been reported in other places (see for example Charnley *et al.* 2008)

Figure 2: *Iminaru* or sandpaper tree (*Curatella Americana*)



Table 3: Useful plants that benefit from fire (in Wapichan language)

FORESTS	SAVANNAH
<p><i>Tapuzai</i> (construction material) <i>Mizau</i> (construction material) <i>Shuiu</i> (construction material) <i>Saporudai</i> (construction material) <i>Pokorid</i> (used for roofing houses) <i>Wozu</i> (used for making fans) <i>Pukuret</i> <i>Kokobi</i> <i>Kamuaaru</i> (used for making crafts) <i>Buru</i> tree (edible fruit) <i>Mokoro</i> plant (stem fibres are used for weaving, making crafts and <i>matapee</i> (cassava press)) <i>Manoru taba</i> (hard wood used to make sieves) <i>Azauz</i> Dako (medicinal). <i>Aturub</i></p>	<p><i>Iminaru</i> (Sandpaper tree: has medicinal properties for cuts, used for crafts, making sanded) <i>Iripi</i> Savannah grass (it comes green with fire if burned when brown)</p>

This knowledge of fire dependent plants is buried in the Wapichan belief system in old time stories, such as that of “The *Mokoro*⁷ and the *Candlefly* (Firefly)”. This story tells how the firefly, in order to imitate the beneficial effect that human made fires have on the *mokoro* plant, threw itself into a fire. But unlike the *mokoro*, instead of becoming more beautiful as a result of the flames, the firefly was burned and since then has a light at the end of its body (Story told by Uncle Raymond Griffith, Shizizi)⁸.

Fire is also an indispensable land management tool for several aspects of cattle ranching. First of all it is essential to produce fresh savannah re-growth to feed the cattle. Cattle in the South-Central Rupununi are grazed in common lands. Therefore, in order to discourage cattle from grazing too far away and to keep the herd together, each cattle owner or rancher must regularly burn new re-grown savannah areas in small patches close to their households or grazing areas (see Figure 3).

Figure 3: Use of fire for cattle grazing



⁷ The *mokoro* “mukru cane” is a plant used as a weaving material (see Table 3 for more details).

⁸ Interestingly, a similar old time story is also present among the Pemon indigenous people that inhabit the Venezuelan side of the Guyana Shield in the Gran Sabana, Canaima National Park, called the “Wild-blackberry and the firefly” (Rodriguez & Sletto 2010). Yet the wild blackberry is found in savannahs, in contrast to the *mokoro* which is found in deep forests.

As explained by uncle Yede Laurence from Shurinab:

“We use fire to make the grass look green, for the animals, to graze the savannahs, because if you don’t do that it causes the cows to be moving astray more, more far. If you go check today, if there is any little patch where you see a fire burn, the green grass comes in and that is where the cows are grazing. They don’t really go on the dry side. They are on the green grass all the time. That is why we do it so, burn one patch, burn another piece and another piece”.

Most commonly *vaqueros* (hired horsemen) carry out this task. Fire is also used during round-ups, when cattle are collected and taken back to the paddocks either for branding, milking, castration of bulls, carrying out regular veterinary inspections or for keeping them away during the wet season. On these occasions, fire allows *vaqueros* to inform others of their location and whether they have been successful in herding their part of the herd. During round ups, fire is also used to burn certain savannah areas that may be overgrown and thus prepare land for future grazing. During rodeo and slaughter times large numbers of cattle are shipped from eastern and southern areas of the South Central Rupununi into Lethem (the main commercial town in the area). Fire is also used here for communication, to produce fresh grass and clean the savannahs along the “cattle roads”. At the beginning of the dry season, fire is also used to kill ticks in the grazing areas.

However, fire is not only used for practical, medicinal or spiritual purposes. It also has great environmental importance, particularly for the prevention of large and destructive fires. Like other indigenous communities that live in savannah-forest mosaic environments (Rodriguez & Sletto 2009, Mistry *et al.* 2005), the Wapichan and Makushi use fire not only to facilitate their daily practices, but also to continuously maintain the forest-savannah landscape by ensuring that fires do not accidentally enter bush-islands, farms, *ite*, sacred or special set-aside areas where many medicinal plants and construction materials are found. According to one of the elders: “When the grass is too high and dry, when a fire comes, it will be very dangerous”.

In order to avoid this they use fire to create natural firebreaks in the savannah landscape, through two fire prevention methods. These practices are **savannah patch burning** and **forest edge burning**. The main principle behind these two practices is to keep the savannah vegetation low in the open savannahs and in the edge of forest, farming and *ite* areas, as overgrown savannah

vegetation contains a lot of highly combustible organic matter. Savannah patch burning prevents the formation of a homogenous savannah landscape that would be more prone to hazardous fires. Because only small portions of savannah are burned at a time, fire helps to create a mosaic of small portions of burned savannah vegetation in different stages of growth (or different fire histories) (see Figure 4). In this way, fires die out naturally when they reach the border of a previously burned area, thus leaving some patches that may burn regularly and others that might not. As explained by Edna Daniels from Parikwarinao:

“I go and set fire before piece by piece, before a fires come so it outs when it reaches there. It stops on its own. I do that before a big fire comes”.

Figure 4: Savannah patch-burning



Although at times premeditated burns are required to maintain the savannah mosaic in place when certain patches look too over-grown or brown, the system functions and is also perpetuated through regular burns linked to the other uses of fire such as communication, the cleaning of hunting and fishing lines, hunting, or cattle grazing, as shown from Uncle Yede Laurence’s comment:

“That is why we do it so, burn one patch, and burn another piece and burn another piece. The thing is that when it is over dry, if it burns, that is when it can go into the mountain. And now is the time to burn, it is green yet, so it will burn piece by piece. That is how we try to do it. We don’t really do it to burn the whole thing because we need the grass. That bush you see there is really high, so we burn it so the bush can drop down and we can see the cattle graze

and the swamp. That is how we like their grassing ground. And now is the time to do it, because if we wait to long, when it is over dry, when a fire comes it will go right down the big swamp and it can burn my whole thing.” (Uncle Yed Laurence, Shurinab)

The maintenance of the forest edges in bush or ite areas does however generally involve the setting of specific burns for that specific purpose (See Figures 5 and 6).

Figure 5: Forest edge burning



Figure 6: Ite edge burning



Savannah patch burning and forest/ite edge burning are key in the traditional Wapichan and Makushi fire management system. In order to work at their bests, they rely on a combination of factors, which we now turn to examining in detail.

4.1.2. The proper way of using fire

Despite the fact that the Wapichan and Makushi could not live without fire, they are well aware of the dangers that its use entails (see Box 2). To most of the elders interviewed the word “fire” is a very fighting one because it can cause a great deal of harm. In order to avoid this, it is essential to know how to use it properly, as reflected in some of the comments made by the elders when asking them about the meanings of fire:

“Fire is a good servant but a bad master.”

“It is something good but also bad if not used properly.”

“It is something frightening, but also very good. It is no good when it destroys the forests, bush islands. It is good if we know how to use it wisely.”

“Fire is very dangerous, I am afraid of the word fire. So, when using fire, be cautious.”

“Fire can be dangerous to the environment when there is over burning. We must know how and when to burn.”

Box 2: Potential threats of fire according to the Wapichan and Makushi people

- If not used properly it can:
 - burn houses, bush-islands, ite bush and farming areas
 - scare animals away
 - chase away spirits
 - kill small animals
 - destroy nesting areas of birds, craft material and medicinal plants.
- It can expose the soil and encourages landslides when the rain comes
- It can spread with the wind.
- It can kill and burn us when a fire gets out of control.
- It can burn other peoples’ farms when they are not ready to be burned.
- It can damage our forests, bush-islands and timber.
- When you *over use* fires it damages the mountains, creating pure savannahs and shrubs.
- It can destroy and kill young *ite* plants
- When the grass is too high and dry, when a fire comes, it will be very dangerous.
- Forest undergrowth can become bushy due to the continual use of fire, making it more difficult to walk.

The Wapichan people believe that they have great responsibility to *karodapan* (“care for”) the land and its natural resources in order to maintain abundance for present generations as well as for those that will come in the future (David *et al.* 2006). Part of this responsibility involves using fire adequately. In the words of one elder: “my grandfather always used to tell me do not trouble or play with fire; it is not something to be used carelessly”.

Apart from the fact that fire can cause direct harm to people or natural resources, the requirement for caution in its use also has to do with the fact that many of the customary norms and rules that regulate the relationship of the Wapichan with the environment and natural resources are based on their belief that their whole territory is populated by spirit beings. Sites occupied by spirit keepers and other spirits are sensitive and should not be disturbed. Places such as big lakes, certain mountains, sites with rock engravings, rocky outcrops and some springs are particularly sensitive. Each species of animal or plant is believed to have a specific grandfather spirit (*doko*) or keeper (*tapiki*). These spirits and keepers watch over their “children” and suffer when their children are wasted or tormented. Any abuse that might upset the bush spirits can lead to sickness or misfortune for those responsible (David *et al.* 2006). In the case of misuse of fire, for example:

“When fire goes into certain areas, such as *Chawu toon* or *Mapuzu Toon*, it causes red eyes and diarrhoea. Even today, nobody extracts material without leaving a gift for the bush spirits” (Uncle Maurice Adolf, Koiko)

In their rage, spirits may manifest themselves in the shape of strong winds or small tornadoes, thunder and lightning, and torrential rain. The cure for spirit-related sicknesses and misfortunes can only be provided by the *marunao* (shaman) who is able to communicate with the grandfather spirits of savannah, mountains and bush in order to pacify or tame them (David *et al.* 2006). In the words of Uncle Raymond Griffith, from Shizizi:

“The Shizizi Mountain has a snake spirit on the top that can get very angry with fire, but the shaman stopped it from getting angry. Before there was a lot of breeze up there, the spirit of the snake used to come out in the shape of a small tornado”.

If not used properly, fire is believed to be potentially a very disturbing element for the grandfather spirits of all living creatures, as it has the power to destroy their homes and breeding places or even to “chase them away”. Even the smell of smoke may provoke some grandfather spirits. Thus, using fire correctly is of great importance to the Wapichan.

However, due to the wide variety of uses of fire, determining the proper and most effective way to use fire is not a straightforward task. Correct uses vary according to the type of activity and to many conditioning factors. These include: the season of the year, time of the day, wind speed and

direction, seasonal and daily variations in the rainfall, soil humidity, the size of the fire and natural barriers such as roads, rivers, creeks, swamps and lakes.

4.1.2.1. Fire regimes according to the seasons:

The South Rupununi is marked by two distinct seasons: the dry season, from October to March, and the rainy season, from April to September. In common with many other indigenous peoples (see for example Butt-Colson & Armellada 2001, McGregor *et al.* 2010), the Wapichan and Makushi use the different stellar constellations and other environmental indicators such as the flowering of certain trees, the croaking of frogs, the laying of fish and alligator eggs and more subtle details such as the texture beneath the fins of certain fish as indicators of seasonal changes (see Figure 7). The different burning regimes depend on, and are at the same time adapted to, these seasonal variations.

The only time of the year in which there is very little fire is between May and June when the area is heavily flooded. This time of the year is known among the Wapichan as “the time of the rain god”. The rest of the year, fire is an integral feature of the landscape, because it is connected with different livelihood practices.

Proper seasons to burn vary according to the activity (see Figure 8). According to the elders interviewed in this study, the right time to carry out the savannah patch and the forest edge burning, which are the key practices that prevent the potential damaging effects of fire in the dry season, is at the end of the rainy season, between August and October, when the soil is still moist from the rains. Thus, the savannah will burn “patch-patch, not completely”, as George Domingo from Potarinao noted. Nina Laurence from Shurinab also commented:

“That grass that was burning now, you see, where it ended, it’s where it was burned before, it came to the green part. So what was dry before, what was left dry from a previous fire is what that fire caught today, and where it found the green part it stopped. That is how we prevent high, high fire. But if you burn it in the dry season, all is climbing up, because you don’t know how to stop it”.

Some of the elders explained that in some areas, depending on the rate of growth of the vegetation, it might be necessary to burn again a second time in the same year. Different elders mentioned different times for this second burn, presumably because it depends on the specific month in which the first burn was made (as mentioned previously, always between August and October) but also on the humidity of the site and the weather conditions.

The burning of farms also takes place twice a year as most families have two farms, a big or main farm and a small farm. The big farm (between 0.5 and 4 acres in size), is where the main staple crop, bitter cassava (*Manihot esculenta*), is cultivated alongside a variety of other edible tubers, fruits and vegetables. This farm is burned between February and March, at the height of the dry season. In the months that follow (April and May), fire plays an important part in the weeding of the farm, in disposal by burning of piles of collected organic material. The small farm (usually less than 1 acre in size), where fruits like watermelons are produced, is burned between September and October, at the end of the wet season and beginning of the dry season. The fire from big farms is potentially more dangerous than that from small farms and may cause a lot of damage to adjoining farms and forest areas if not set correctly, because these are burned in the middle of the dry season. Other factors, such as the time of the day and carrying out adequate prevention methods, which will be discussed below, play an important part in ensuring an adequate use of fire in the big farms.

Hunting with fire is a common practice among the Wapichan and Makushi, although other methods that do not involve the use of fire are also used, such as bow and arrow, the blow-pipe (gradually being replaced by the shot gun), hunting dogs, trapping techniques and construction of hides or platforms at specific sites where animals are known to feed and drink (David *et al.* 2006).

The uses of fire for hunting vary according to the species being hunted and the purpose of the hunt. During September and October, savannah mountain hills are burned in the search for iguana eggs; fire is used to expose the nesting areas and thus collect the eggs. An important part of the hunting takes place around swamps (*baawuzi*), where animals concentrate in the search of water. Other areas commonly burned for hunting are the forest edges (*kanoko danoma*) and the forest inlets of bush-island (*shakaru*). Popular species hunted with fire around swamps, in *shakaru* and in forest edges include the deer, agouti and armadillo. Fire is used to flush out the animals and make them easy prey. Fire is also used for hunting turtles and turtle eggs in savannahs and swampy areas in a similar fashion to iguana eggs. This means that swampy areas and *shakaru* are subject to regular burns and their ecology and wildlife are shaped by fire.

Many elders pointed out that hunting with fire in swamps and *shakaru* should only take place at certain times of the year: December, April and August were generally mentioned as the proper months for hunting with fire. They were critical of an indiscriminate use of fire for hunting,

particularly when being carried out as an individual or household activity. The use of fire for hunting is generally approved when carried out as a group activity, in circle hunting (*irampüm* in the Makushi language) to provide food for special festivities. According to one elder:

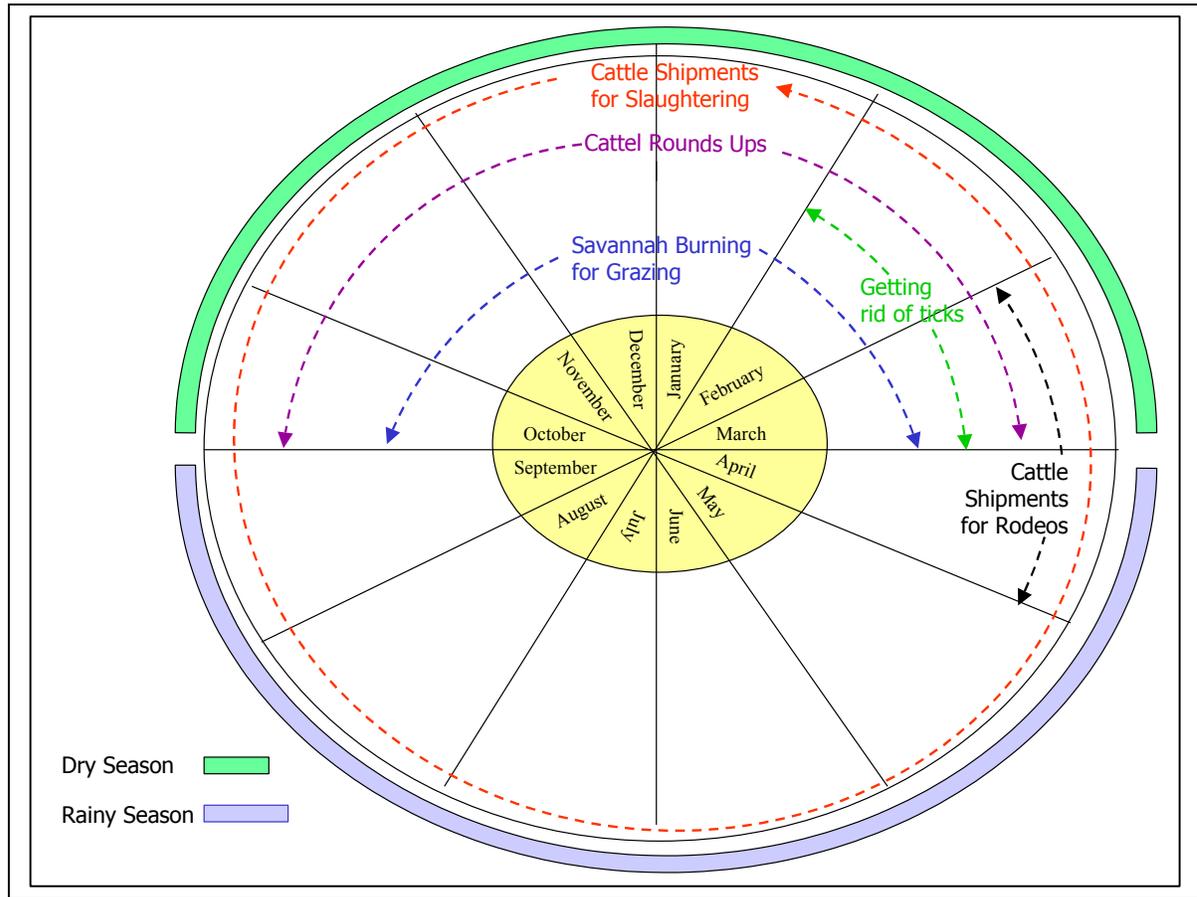
“We generally hunt in Caterpillar Mountain, Plum Savannah and Kamudi Savannah, but only for special occasions, but this year it has been burned already, but not by group hunting but by individuals”. (Uncle Morris Adolf, Koiko Village).

In the old times these special festivities were the *Parichara* dance and other traditional ceremonies, but today circle or group hunting is also carried out during Christmas, Easter holidays and the Freedom Day. This explains why December, April and August are identified as the proper months for circle hunting.

While many of the burns linked to traditional activities take place during the end of wet season, thus contributing to a large extent to preventing the damaging effect of fires in the dry season, the burning for cattle raising takes place almost exclusively in the dry season, and because of that it is potentially more hazardous (see Figure 9).

Of all the months of the dry season, February, March and April are the ones in which there is the most intensive use of fire in cattle grazing related activities. Apart from the regular burns carried out for grazing and during the rounds ups, many ranchers burn the savannahs in order to get rid of ticks during February and March. Branding of cows also takes place at the beginning of the dry season (February-March) and fire is used to herd the cows into the paddocks. Bulls are castrated in March and April. The savannah is burned just before in order to stimulate growth of fresh grass for the bulls after the castrations have taken place in order to help them recover before the rainy season arrives. Rodeo time takes place between March and April, and during these two months cattle are shipped from Easter and Southern areas of the South Central Rupununi into Lethem, Marudi and Aishalton. Fire is used here for communication, cleaning the savannahs along “the cattle roads” and in some occasions, as some vaqueros interviewed admitted, simply “to make the cows move”.

Figure 9: Seasonal burning calendar for cattle grazing



Based on information gathered at Shizizi, Potarinao, Shurinab and Parikwarinao, 09-17 January 2011.
Validated in an intercommunity meeting held in Shurinab, 20-21 January 2011.

Because all these activities take place at the height of the dry season, an adequate use of fire in cattle grazing depends on factors such as the time of the day in which the burns are set, the size of the burn, the direction of the wind, but also to a very great extent on what happens to the savannah during the rest of the year. If there is an adequate maintenance of the savannah mosaic and of forest edge fire breaks during the end of the rainy season and the beginning of the dry season, there is less chances that the fires set from cattle grazing activities set in the middle of the dry season may turn into uncontrollable and damaging ones.

Despite all that has been said, the Wapichan and Makushi increasingly lose confidence in their traditional knowledge about correct times of the year to burn, due to marked climate change over the last ten years. As one of the elders said: “Nowadays, the weather is changing so much that it

is not possible to know when to burn according to the months any more. You just have to look at the weather...and see if it is the right time to burn”. More attention will be paid to this point in section 4.3.3.

4.1.2.2. Times of the day to burn:

Ideal times of the day to burn vary according to activity. For prescribed burning, early morning or late evening is considered the best time since fire burns less fiercely and tends not to spread. This includes burns in the open savannah, in the border of forests, *ite* areas or farms as well as around the homes. The adequate time to burn in the farms, however, is midday, as the heat of the sun makes the fire hot but short.

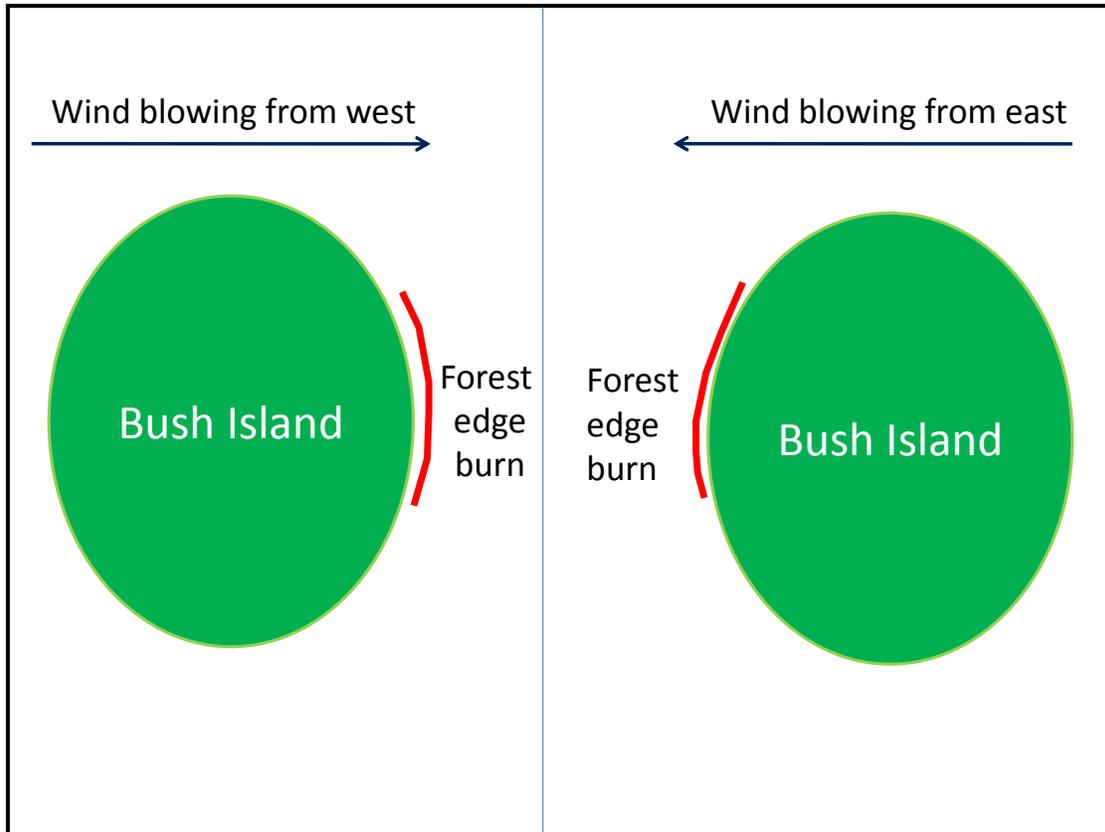
4.1.2.3. Wind speed and direction:

Both the direction and speed of the wind are important factors to consider when starting a fire. Wind speed depends on time of day. The earlier or later in the day that a fire is set, “when the place is quiet” and little wind is blowing, the better for most activities, except farming, as explained above.

In open savannahs, burns are made against the wind by facing into the prevailing wind and ensuring that the fire front is always naturally driven away from areas that are not to be burned, such as bush islands. It is important not to stand upwind of the blaze and thus run the risk of fire escaping and becoming an uncontrollable wildfire. Thus the Wapichan and Makushi say that the rule is to always have the wind against you, never in your back:

“you look at the bush islands and when the wind is blowing from the direction of the bush island, the wind has to blow from the west to the east, that is if you are in the east of the bush islands; if you are in the west, the winds have to blow from the east to the west.” (Angelbert Johnny, Sawariwa“o) (see Figure 10)

Figure 10: Illustration of correct location of burns in bush-islands in relation to wind direction



Between November and December the winds are very strong, so it is advisable not to burn or burn very little, taking great care that the fire does not go out of control.

However, the Wapichan and Makushi find the wind direction largely unpredictable, not only because of the natural factors (changes in the weather, seasons, etc) but also because the wind, in the Wapichan and Makushi belief systems is a force that forms part of the spiritual world of the all living creatures. As said before it is through the wind and the rain that many of the Grandfather spirits of trees, animals, rivers and creeks manifest their anger if nature is being tampered with. The wind may act in your favour if you respect the rules of nature or against you if you do not. It also means that winds can suddenly change, according to what others may be doing in the land.

In particular activities such of burns in the farms, which depend to a great extent on the wind direction and intensity of the wind, it is important to seek collaboration of the wind in order to ensure a successful burn. Thus, just before setting fire to the cut-down trees, it is a common practice to say a prayer to call the winds and ask them to blow in a way that an intense but short burn takes place.

4.1.2.4. The Rain:

Rain plays an important part in ensuring an adequate use of fire, because the humidity left in the soil after the rain has fallen prevents the fire from expanding too much. Thus, it is a common practice to burn after the rain, particularly when it rains after there has been sunny spell of a couple of days.

However, the rain also plays an important part putting out fires, and this is why many of the burning practices take place at the end of the rainy season, when odd showers can always be expected. As two elders commented:

“Before the rain is coming you light the fire, so when the rain comes it puts out the fire to prevent it from getting into the bush. But if you set the fire without rain, and the sun is hot, hot, hot, then the whole *kanoko* can burn.” (Uncle Basil Edmund, Shizizi)

“Our ancestors would not burn just like that.... There were times to burn, like when the rain was coming, so that the rain would help them.” (Uncle Ronald Joseph, Shizizi)

As in the case of the wind, proper care has to be taken not to upset the rains or grandfather spirits through burning too much or too close to sensitive places. Yet on occasions, when a fire has gone out of control, some elders explain that upsetting the grandfather spirits can actually help control the fire:

“When there is a big fire, you burn pepper in certain places (lakes, pools or sacred areas in the mountains) to make the spirits angry and provoke the rain.” (Uncle Hilary Saba, Shizizi)

4.1.2.5. The colour of the grass:

The colour of the savannah grass is also an important indicator of the right time to burn, as Raymond Edwin from Potarinao mentions:

“If you allow the grass to get really brown, if you start a fire it can get really dangerous. When the grass is still green, then it’s the good time to burn”.

4.1.2.6. Size of the fire: patch-burning and natural barriers:

The size of the burn also plays an important part in an adequate use of fire. As said before, the whole principle behind savannah patch burning is that small areas are burned at a time.

“We don’t really burn large areas. In this place here we are trying to avoid the burning, so we drop the fire where we see a little dry place, next time we drop it in another place, before the whole thing burns. Sometimes if you are going to that area every day, every day you drop a fire in a different place, because if you drop fire all around, the whole thing will burn. So you drop fire in a patch, so the next time you go, you drop fire in another patch. The next time can be the next day or in a week or two. That is how we do the burns in the savannah.” (Uncle Yede Laurence, Shurinab).

This principle applies for all burns in the savannah, even for cattle grazing. Ranchers explained that it is not their custom to burn a large extension of a savannah on one go. They generally burn small areas at a time, according to where they want the cattle to move to, either to drink or eat fresh grass (Men focus group, Potarinao).

Although fires generally stop where they meet an area that has been previously burned, natural barriers, such as creeks, lakes, swamps or roads also play an important part in preventing the fire from expanding too much. When setting a fire is it important to take note of both, the natural barriers and previously burnt patches, to predict the area that is going to be affected by a fire.

4.1.2.7. Fire breaks and other fire prevention/control methods:

Fire-breaks:

Although an important part of the factors that the Wapishan and Makushi must take into account to ensure an adequate use of fire are natural (season, time, rain, wind, color of the grass, natural barriers), their fire management system also relies on creating the adequate conditions to burn. The firebreaks along the forest and its areas are part of this premeditated and planned effort that the Makushi and Wapichan must make when using fire. In many cases, before a specific area is to be burned previous preparatory burns must be set. Yet, working with the forces of nature (such as the rain) is always part of this system, as explained by Uncle Ronald Joseph from Shizizi:

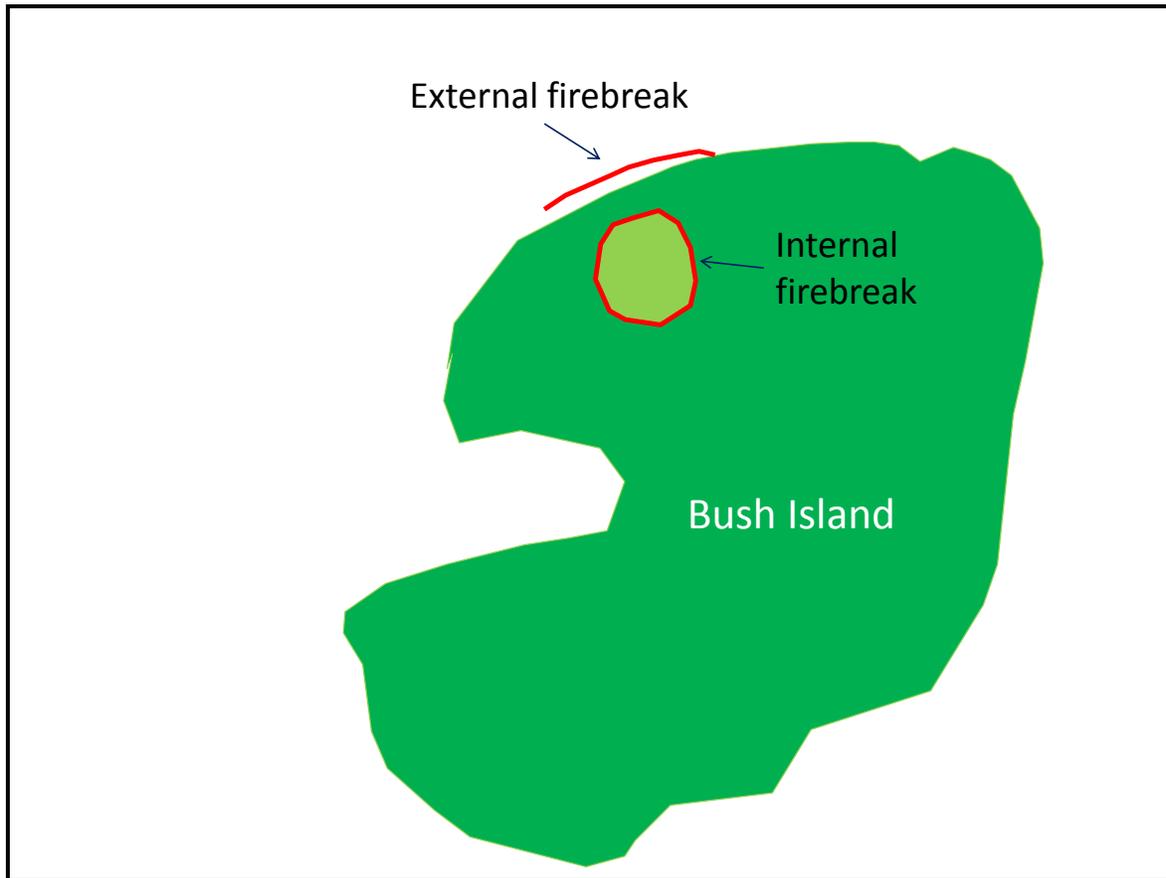
“Before if they wanted to burn a certain area they would burn a fire break like, to prevent to the fire from getting out of control. Later if they wanted to burn a certain area it would just go until there. And they would burn when it would rain”.

For certain activities such as farming, double firebreaks are necessary to ensure effective protection of the land. Many elders explained that before burning a farm, they first set firebreaks along the bush islands and then inside the farming area (See Figure 11). “In order to protect your farming areas from wildfires and to protect neighbours” adjoining farms, it is advisable for these two fire prevention methods to be carried out together” (Uncle Raymond Griffith, Shizizi).

Sweeping around the farming areas was also mentioned by many of the elders as a common fire prevention technique before burning the farms.

“When you sweep around the forest before you burn, you start the fire around the farm and the fire will come right to the middle. But if you start the fire in the middle, the fire will spread into the forest. That is why you have to start it first right around the farm. It comes to the middle and it finishes in the middle” (Uncle Yede Laurence, Shurinab)

Figure 11: Double firebreaks in farming activities



Wetting the land:

Another fire prevention technique mentioned was wetting certain areas before setting fires. This technique, we were told, was a common practice in the past in circle hunting (*irampüm*). It was an activity carried out mostly by women, who would walk the area before the hunting would take place with traditional bags with water hanging on their backs, skirting water along the savannah in order to ensure it was damp before the burn. The women also took care to extinguish the fire after the hunt had finished (Women Focus Group discussion, Shurinab).

Extinguishing fires:

There are also techniques to control fires once they have been set. Extinguishing fires (or outing them, as locally said) is a common practice, particularly when fires are still not big enough to be out of control. Many of the elders stressed the importance of “outing certain fires”, such as those

set in fire-places during hunting or fishing trips, in order to avoid them spreading and getting out of control after the people leave their camp. Sand and water are used to out these fires. During fieldwork we were able to witness first-hand people extinguishing fires with water around the homes in the villages that had been set to control savannah growth and to burn rubbish.

Fighting fire with fire:

A big fire is much more difficult to put out, so it is so important to avoid fires growing too large. According to some elders, apart from making the godfather spirits angry, a way of controlling large fires that have got out of control is to start a smaller one in the direction of the bigger one, thus creating a fire break that will eventually make the big fire stop (Uncle Allan Fredericks, Shurinab). This is literally “fighting fire with fire”.

Critical areas to burn:

In the vast savannah-forest mosaic of the South Central Rupununi, there are critical areas that need to be burned regularly. If not, they can be dangerous when hit by a fire. These areas are the swampy areas (see Figure 12) and the *shakaru* (see Figure 13), which are inlets or inside valleys in the bush island and forest borders where very dense vegetation grows due to the humidity and dampness of the soil¹⁰.

Figure 12: Recently burned swamps



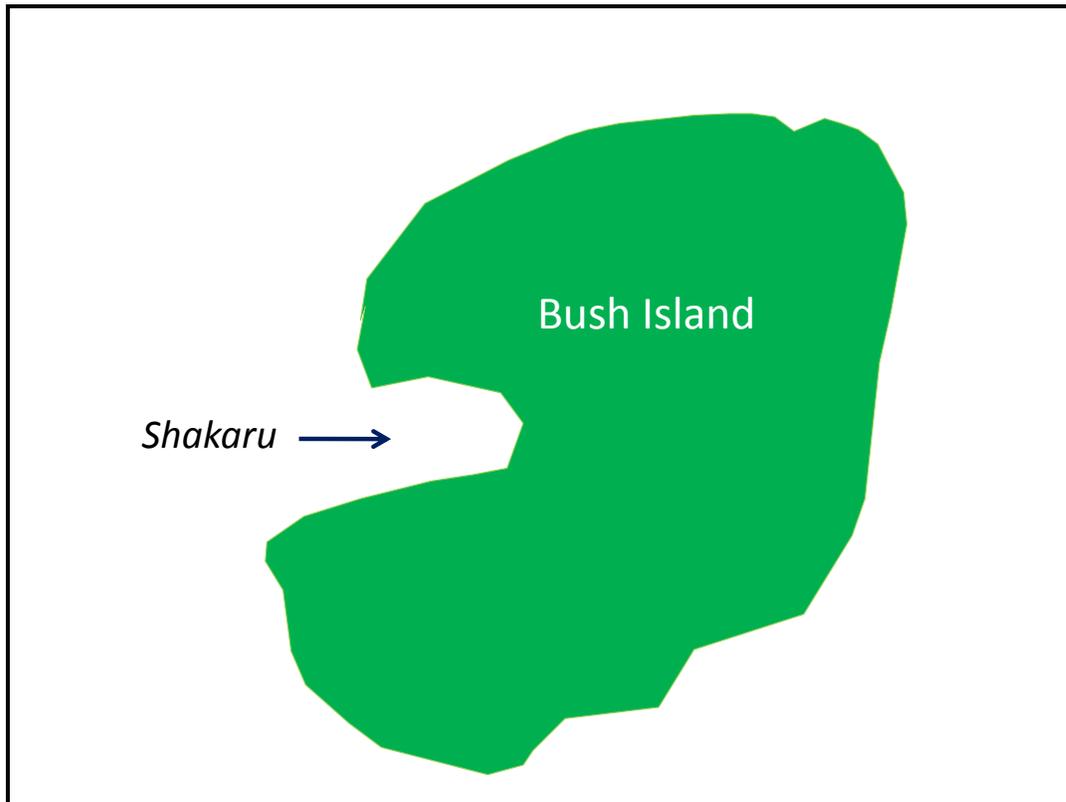
On the cattle shipment road (behind Parikwarinao)



On the Potaninao-Shurinab road

¹⁰ In Wapichan language the word *Shakaru* stems from the word for „corner“. In this case it is referring to a wedge between hills in bush islands and mountains bordering the savannah.

Figure 13: Explanatory diagram of a *Shakaru*



The *shakaru* are a transition zone between the savannah and the forest, leading eventually into the forest. Some of the elders explained that if hit by a fire during the dry season, and the vegetation has been let to grow too much, the fires may enter into forests with great force. This is why it is important to burn them regularly. According to some elders, fire benefits these areas:

“The *shakaru* are moist and very humid areas. When this areas are burned, they grown really green again. Because they are so damp, when you burn them, they don’t get out of control”.
(Uncle Raymond Edwin, Potarinao)

Shakaru and swamps are also popular places for hunting and this is why they are often burned. Yet at the same time they are critical fire management areas to avoid damaging forest fires:

“I burn *shakaru* for hunting purposes, but at the same it can be burned to prevent fire from going into the mountain. I do that in August.” (Uncle Ivan Isacks, Parikwarinao)

However, it is important to mention that we found certain disparity of views over the appropriateness of burning *shakaru*. Not all the elders agreed with this, as expressed by Ronald Joseph, from Shizizi:

“One area that I think should not be burned is *Tomere Shakaru*. It is really thick there and it leads into the forest. Lately I saw it burned, and it should not be burned. In a community meeting we talked that these areas should not be burned because they house a lot of animals.”

However, in the final validation meetings of this study, when this issue was publicly discussed, the general agreement was that *shakaru* must be regularly burnt as well as many of the swampy area. The frequency that was agreed was once a year, not more.

While burning of swamps generally take place once they are have dried up, *shakaru* must be burned at the end of the rainy season, when the grass is still green and they still have water.

No mention was made in the interviews of specific methods used for burning swamps and *shakaru*, but in other parts of the world where indigenous people also regularly burn swamps for hunting, the burning of wetlands generally takes place in stages. As the swamp are generally burned when fire conditions are at their extreme (dry season), care is taken to burn the margins early in the dry season during the months that the swamps are drying out. This prevents fires set to the main area of the swamp in the dry season escaping into the surrounding savannah and woodlands. As well as in the case of savannah, this creates a mosaic of patches of burned and unburner areas in the border of the swamps (McGregor *et al.* 2010). Future research and discussion at the community level could help clarify if the Wapichan and Makushi also use this burning method.

5. Changes and impacts in the use of fire

As can be noted above, the traditional Wapichan and Makushi fire management system is a highly complex and diverse one, based on a wide variety of uses and timings of different types of fires, according to the season, times of the day, type of ecosystem and livelihood practices involved. The landscape is being continuously shaped, by all and not just only one, of these different types of fires.

Yet, the Wapichan and Makushi fire management system as described above seems to be undergoing important changes. Despite the detailed knowledge of fire management that the elders hold and the multiple types of burning practices used, we found great concern among them due to a perceived sense of loss of this knowledge and of control and care in the use of fire in the area.

The younger generations take a great part of the blame in this process of change in the use of fire. The elders perceive them as increasingly disrespectful to fire and unaware of its dangers and threats:

“Nowadays the young start a match very easily. Before, fire was cherished, looked after with care. Before when they would burn the forest, everybody would be there and they would take care that the fire would not go right through. But today, when we set the fire, it goes right through the forest. That is what people dislike. This new generation don’t care for the Kanuku Mountains, when you try to stop them they suck their teeth and they are gone. They want to do anything they want.” (Aunt Nina Laurece, Shurinab)

The *vaqueros* take another part of the blame because they are the ones that use fire most intensively during the dry season and are believed to set the example of a rampant use of fire among the young ones:

“Now you see children using fire more carelessly because they see *vaqueros* burning and when they walk into the savannah or go fishing, they throw a match just like the *vaqueros* do.” (Angelbert Johnny, Sawari wa’o)

However, the changes in the use of fire are multi-causal. It is not possible to identify a single cause or a particular group as responsible for these changes due to the wide variety of activities that involve the use of fire and to the differentiated changing uses in each community.

As shown in Table 4, the activities that generate wildfires in each community area are varied. While passing *vaqueros* are mentioned in all the communities as the initiators of wildfires, and children playing with fire or young people going fishing are mentioned in four, there are also other activities that involve other user groups, such as hunting and agriculture, which also play an important part in the problem. Also, while in Parikwarinao, cow shipments during rodeo times are perceived as particularly critical in starting wildfires, as the “shipment road” is directly at the

back of the village, this was not perceived as such a big problem in other communities. Similarly, while in Shurinab, the burning of savannahs in search of lost pigs was recurrently mentioned as a problem, in other villages this was not mentioned at all.

Table 4: Causes of wildfires per community

Activity	Shizizi	Potarinao	Parikwarinao	Shurinab	Sawari wa"o
By people from the community					
Vaqueros during round ups	X	X			X
People going fishing		X	X	X	X
Hunters	X	X		X	
Children playing with fire		X	X	X	X
People looking for lost pigs				X	
Agriculture/fire escaping to other plots and forest			X	X	
Passers by					
Hunters	X				
People throwing cigarettes along the road				X	
Vaqueros during Shipments/Rodeo			X		
Vaqueros from other ranches during round ups	X	X	X	X	X

Identifying the people who start wildfires is of little use without understanding what drives them to it. Carelessness and ignorance are inadequate explanations. Rather than specific activities and users, the problem could be that the fire management system is suffering important changes. This would explain why Uncle Ronald Joseph, from Shizizi Village says “today there is no system for fire management, today we don’t follow that”. In order to understand what is changing we must first take a closer look at the specific impacts of fire in the plant and animal communities.

4.2.1. Impact of fire use on the vegetation

Fire is affecting the vegetation in different ways. Some areas are burning too much, others too little. There are also areas that seem to be recovering from the impact of fire.

Areas with too much fire:

Areas that burn too much include some of the mountain slopes (principally some parts of the Kanuku Mountains and Shizizi Mountain) (see Figure 14), most of the *ite* groves close to the villages and some of the bush islands, both in their borders (known as bush corners) and within them (in the farming areas).

Figure 14: Impacts of fire on mountain slopes



As a result of recurrent fires, some previously forested areas have turned into savannah. Equally, there are forested areas that due to frequent fires have become more “bushy”, making it very difficult to walk underneath them in the traditional walking lines. Most of the *ite* groves near villages are said to have degraded over time due to the impact of fire and over-use (see Table 5).

Table 5: Impacts on vegetation due to repeated fires

COMMUNITY	PLACE
Areas that have turned from forest into savannah due to continuous burning	
Shizizi	Sahaoramniz Shakar (Shiriri Slope) Dukuban (the western side)
Potarinao	Kosharara Bush island- Eastern part of Kosharara lake (a big lake at the west of Potarinao) Allan Machiu’s land Korichicharo (Mato Baton)
Shurinab	Warabuda Creek, past public landing. Kukuri Creek Shurinab Creek. Boat Landing, both banks of the Sawarab River The banks of the Oröreutü Creek (in Koiko)
Parikwarinao	A bush on the way to Edna Daniels’ farm
Forested areas that have turned more bushy due to fire	
Shizizi	Tomara (South-western side of the Shiriri Mountain-the forest has moved higher). Use to have big trees, now it is bush. After this couple of years it is getting normal again.
<i>Ite</i> areas that have degraded over time due to fire and over use	
Between Potarinao and Shurinab	Kamao wa’o, Korara wa’o, Kotu’I wa’o

The fact that some resource use areas nearby the communities (principally forests-mountains, bush islands and *ite* groves) are frequently hit by wildfires seems to suggest that the fire prevention methods (fire breaks and savannah patch burning) are not being correctly maintained.

Concern over this issue has already been raised in some villages, such as Sawari wa’o and Shizizi. As a result in community meetings that took place in 2010 as part of the consultations of the Wapichan Management Plan, it was decided that different people would be assigned the responsibility of looking after certain areas in order to make sure that savannah patch-burning and forest-edge fire breaks were regularly burned to prevent wildfires entering forests, bush islands and *ite* areas. According to the interviews and groups discussion carried out during the field trip

of this study, by the beginning of 2011 this fire management decision was already having some noticeable results, particularly in Sawari wa'ŋo. In Shizizi, success had been achieved in protecting some areas but not all. In the Shizizi Mountain for instance, which is used by many of the nearby villages, it had not yet been possible to ensure an adequate protection from wildfires.

Early indications suggest that allocating fire management of a large area to just to one person, such as Shizizi, which is subject to use by many different villages, is complicated and can be ineffective. Thus, this community decision may need revisiting in order to ensure share management responsibility between villages in areas that are subject to the use of fire by different villages.

Areas with insufficient fire:

Although there is too much fire in some areas, there is too little in others. The interviews showed that some parts of the savannah, but principally some swamps and *shakaru*, are growing to hazardous levels. Overgrown savannah, swamps and *shakaru* can produce large uncontrollable wildfires, says Uncle Ronald Joseph from Shizizi:

“There is a source here, a creek, and there is an area that has not been burned for a long time, so if a fire comes, it will be very dangerous. It is overgrown and also the swamps as well are overgrown, so if a fire comes it will be very dangerous.”

Depending on their location, fires from overgrown swamps and *shakaru* may extend either through savannahs or forest, but in general wildfires that originate from overgrown swamps tend to expand more through savannah areas, while fire that hit *shakaru* tend to enter with great force into forests and mountains. Table 6 shows some examples of areas that are overgrown to hazardous levels due to the lack of fire.

Interestingly enough, swamps and *shakaru* were not included in the critical fire management areas selected for preventive burning in the community meetings carried out in Sawari wa'ŋo and Shizizi in 2010, as seen form the following interview extract with Angelbert Jhonny, from Sawari wa'ŋo Village Council:

“I went out hunting yesterday, and because we are talking that fire should not be used carelessly, now it is dangerous. There are areas behind *Waronaam*, it is a swamp, and the grass goes into the mountain. When we did our management plan, we did not talk about those areas. And when we have our public meeting, I want to put a local manager to do that burn, because it is dangerous. If that area gets fire, half of the area will be burned. It is a swamp that goes into the mountain. It is dangerous. *Maporon*, another swamp, it is dangerous, it needs burning right now. In the savannah, the local managers are looking after the land properly, but these areas are dangerous if we don’t put anybody to look after them, because we neglected them.”

Table 6: Areas that are overgrown to hazardous levels due to the lack of fire.

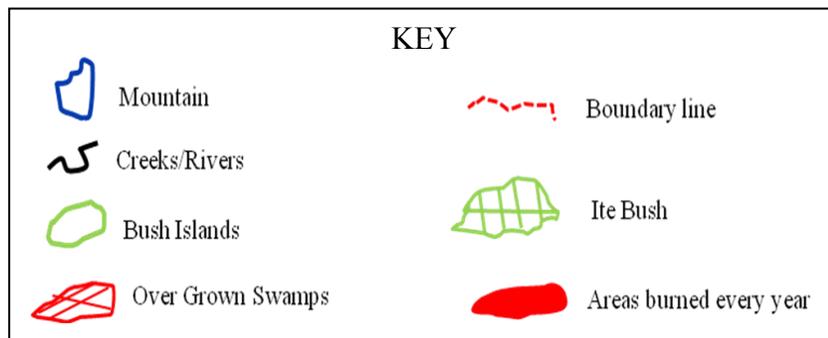
COMMUNITY	PLACES
Sawari wa’o	<i>Maporon</i> and <i>Waronaam</i> (swamps)
Shizizi	<i>Tazubaana Tachapzizi</i> (on Shiriri upper slopes) <i>Baarai wao kuwuzu baarazun</i> (slopes of Shiriri)
Shurinab	Mira Mountain (an area being protected for birds [Red Siskins], but it dangerous because it is overgrown). House Lake
Potarinao	Tawanawa Kasashiz (swampy area around a mountain, east of <i>Irimonn Toon</i>)
Parikwarinao	<i>Atorub Wao</i> (the swamps around it are over grown and some fire could burn the big trees inside the Wao if fire catches them). <i>Patarina Karashiz</i> : that area use to be lots of birds, crane family, the thrush, but today there are no birds there. From overgrowth, a fire came and chased the animals away.

Figure 15 shows the critical areas for fire management identified in Sawari wa’o during fieldwork in a focus group discussion. The figure shows both, areas that are recurrently hit by fires and areas with overgrown vegetation. It is clear that many of the overgrown swamps are located close to mountains and in some cases to areas that are being repeatedly affected by wildfires.

All this suggests that the South Central Rupununi could currently be subject to too many dry season fires and not enough late wet season ones. Many of the wildfires could be occurring because there is not enough savannah patch burning and forested-edge burning in the late wet

season and because certain swampy areas and *shakaru* are not being burnt as regularly as necessary.

Figure 15: Critical areas for fire management on Sawari wa’o Village traditional lands



These sorts of changes in land management may sometimes occur when settlement patterns change and life becomes more sedentary, both of which lead to fewer people walking around to do the adequate maintenance of the land. Such changes could also be because of an increase in activities carried out during the dry season (hunting, cow shipments, round ups, etc), which are not being accompanied by the necessary preventative methods in the late rainy season. For

instance, rodeo and shipment times were repeatedly cited as the most damaging times for wildfires. We were told that during those events in the dry season *vaqueros* are always setting fire: “if they see a brown savannah they have to burn it” (Toshao John Daniels, Parikwarinao). However, we were also told by some of the elders that: “if you allow the grass to get really brown, if you start a fire it can get really dangerous; when the grass is still green, then it’s the good time to burn” (Raymond Edwin, Potarinao). It would be important to ascertain whether the greater impact of fires during rodeo and shipment times is caused by the savannahs being “too brown” when burned (in which case late wet season fires in these areas would be necessary) or if the savannah patch burning and forest-edge areas adjoining the shipment and rodeo roads are not being maintained. Perhaps it’s a combination of both factors.

All this would require a more thorough field investigation and discussion at the community level in order to arrive at a comprehensive explanation (see Section 6 for follow up research questions on this topic). In section 4.3 we will discuss some socio-cultural changes, changes experienced in cattle grazing, agriculture and hunting as well as in the climate, which could be contributing to this alteration in the landscape and in the fire management system.

Areas that recover over time:

It would be inadequate to imply that change in the use of fire is creating a mosaic of areas with too much fire, which are being gradually degraded from forests to savannahs, and areas that receive insufficient fire. As can be seen from Figure 15 (above), this is not the case. Between these two extremes there is still a large proportion of forests that are only occasionally affected by fire, many of which eventually recover.

For instance, according to some of the elders, forest-edge tends to recover from fire, when the burns are not too intense and when the forest-edge firebreaks are cleared at the right time of the year. Indeed, analysis of changes in the forest-savannah boundary in the South Rupununi over the period 1952-1983 using aerial photography and satellite images show it to have remained stable over time, despite increased population and permanence of settlement (Eden 1986).

Also, there are areas in which a succession from savannah vegetation to forest seems to be taking place as fires recede. In the interviews mention was made of one particular case (*Kamotowaru*, the bush edge of Potarinao farming area) in which the vegetation had turned from savannah to

forest. In other parts of South Rupununi, the advancement of forests into uncultivated savannahs has also been observed (Eden 1986).

In other parts, such as *Tomora*, the southwestern side of the Shizizi Mountain, which used to have big trees and was turned into bushy vegetation by fire, “after this couple of years it is getting normal again”.

Thus, when considering a long-term fire management plan for the area it is important to recognize the dynamic nature of the Rupununi ecosystems and their adaptability and resilience to fire. Fire will affect some areas, but with due time they might recover. The key issue is to determine the ideal frequency and intensity in which fires should hit different types of vegetation and the rate in which the vegetation recovers.

More recent studies of the vegetation cover using geographical information systems could help to determine the current rate of change in the vegetation cover of the area, and ascertain whether the stability in the forest-savannah boundary reported in 1986 persists, or if on the contrary it may be decreasing due to changes in the use of fire and an increase of damaging fires.

The DTCs and village councils might consider approaching LCDS-REDD project leaders in Guyana regarding possible future monitoring of fires and vegetation change in “bush-islands and swamps” with the new monitoring systems they are in the process of setting up.

4.2.2. Impacts of fire use on wildlife

Although people agreed about the impacts of wildfires on vegetation, there was less of a consensus about the effects of fire on wildlife. Though there was a general perception that some animal populations have diminished, this was not always attributed to fire. The explanations for this are various.

For instance, in the final validation meeting, participants identified hunting and trapping as the main causes of the reduction in the population of some species, although fire was mentioned as a contributing factor.

Animals that are perceived by some people to be less abundant now include *kapash* (armadillo), *wurada* (Red-footed / Yellow-footed Tortoise *Geochelone carbonaria* / *denticulata*), *aro* (savannah deer = White-tailed Deer *Odocoileus virginianus*), *dakari* (quail = Crested Bobwhite *Colinus cristatus*), *bididi* (wiseesee ducks = Whistling-Ducks *Dendrocygna* spp.), *tawa-tawa* and *wamoro*.

Commercial hunting and trapping usually takes place in swamps, as seen from the following extract:

“In a swampy area we call Plum Savannah, every year people used to burn it, and not long ago there were some people buying the turtles, and a man went and used fire to chase them out, so when the turtles came they just collected them, and today, you can’t find them: if you see one, that is plenty. A lot of people used to do that. I never sell if I catch, just catch for my own use. In the same swamp, they trap birds to sell. Towa-towa, there used to be plenty, you don’t see them any more.” (Uncle Yede Laurence)

Repeated burning of some swamps for hunting was often mentioned as a possible cause of reduction in the numbers of armadillo, quails, tortoise, *wamoro* and Towa-towa.

The reduction in the population of wiseesee duck, is thought to be the result of over-hunting, though some claim that it is a consequence of over-exploitation on the Brazilian border, where the duck is in great demand (Uncle Allan Fredericks, Shurinab).

Other species, such as the savannah deer, are believed to have retreated from human settlements to more undisturbed areas. This was confirmed by the Project Fauna, which carried out a study to assess the population of game in the area and concluded that the deer population remains stable, though they have become more wary (Read et. Al 2010).

Though the participants of the final validating meeting agreed that “fire has not finished the animals”, the interviews, group discussion and previous scientific research suggest that there are some wildlife resources that could be degrading over time due to fire. One particular resource is bee-hives. In the women group discussion held in Potarinao the point was made that wild savannah fires have permanently destroyed bee-hive areas where honey was regularly collected. This is seen as the result of people not paying attention anymore to the right times of the day or

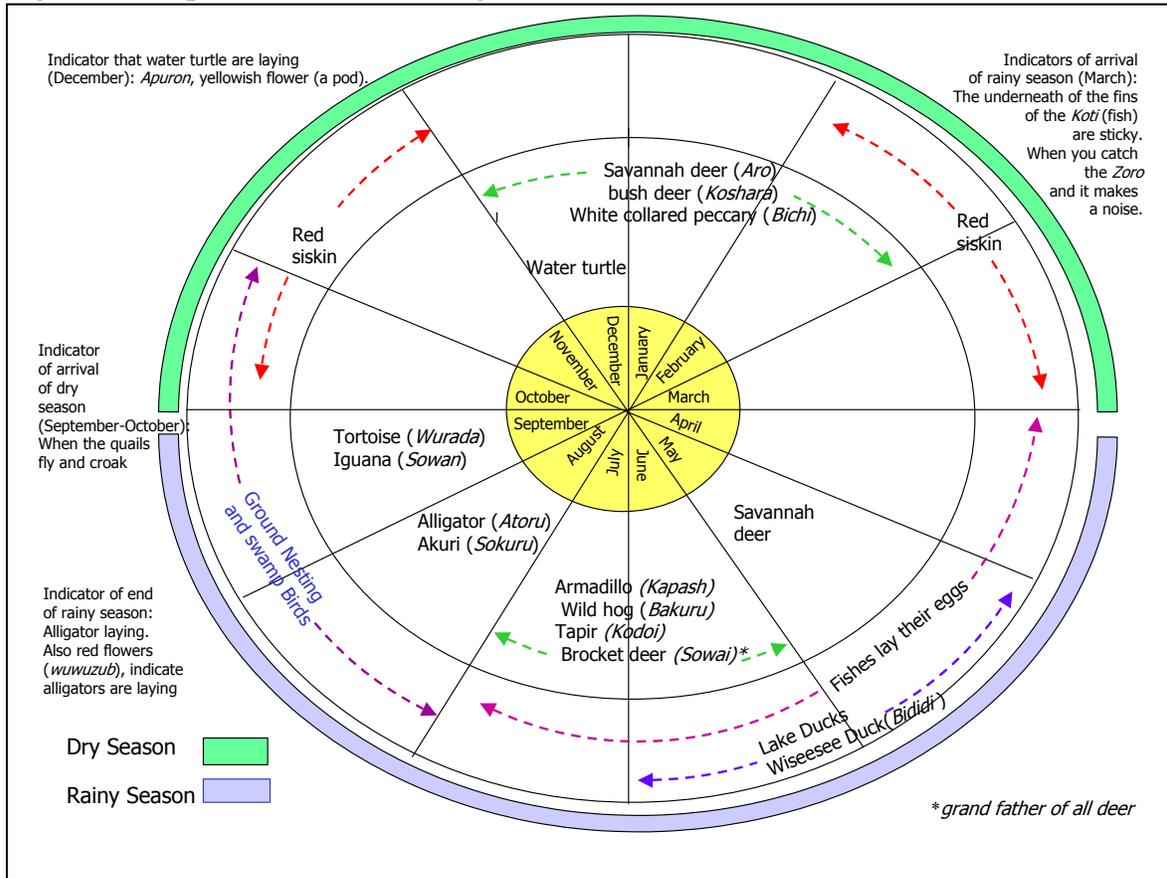
seasons to burn, i.e. of the savannah patch burning system not being properly maintained, thus favouring more damaging wildfires in the dry season. Likewise, two scarce and poorly-known bird species, the Ocellated Crake *Micropygia schomburgkii* and the near threatened Bearded Tachuri *Polystictus pectoralis*, are good indicators of high quality wet grassland. Both are found in tall, low-lying, wet savannah habitat. They are presumed to have been “more widespread and common in the Rupununi before burning became a widespread and annual practice” (Robbins *et al.* 2004).

While over-burning seems to a problem for wildlife diversity in some cases, in others the problem is too little burning, just as in the case of the impacts of fire on vegetation. The latter was specially noted in Parikwarinao, where a link was made between reduction of wildlife, overgrown vegetation and wildfires. Mention was made here of place called *Patarina Karashiz*, “where there used to be lots of birds, crane family, the thrush, but today there are no birds there. From overgrowth, a fire came and chased the animals away” (Ivan Isacks and Helen Isacks, Parikwarinao). This observation accords with research carried out on indigenous uses of fire in Australian Kakadu National Park, which shows that in wetlands, bird abundance and richness decreases in long unburned sites, and increases again in recently burned areas due to dramatic changes in the composition and structure of vegetation following burning (McGregor *et al.* 2010). Water turtles have also been seen to benefit from periodic savannah and wetlands burns in Kakadu National Park, as they are less likely to be trapped in the dry season in accumulated dead grass, and therefore be susceptible to burning when fire does occur, if the vegetation is regularly managed with fire (*Idem*).

In general we found that younger Wapichan and elders hold different views on the impact of fire on wildlife, especially on bird populations. As some of the younger generations have had more contact with the conservationists, ecologists and resource management institutions that work in the area, they are becoming more concerned about this issue. There was concern over the possible impact of savannah fires on ground-nesting birds in particular.

When raising the issue with the elders during the validation meeting, their view was that savannah fires have no impact on ground nesting birds because they lay their eggs between August-October, towards the middle and end of the rainy season, while the burning season starts after most ground-nesting birds have already hatched and “gone, flown away” (see Figure 16).

Figure 16: Wapichan wildlife breeding calendar



Ground nesting birds mentioned include:
 Forest Birds: *Wamoro* (Maam = Undulated Tinamou), *Namachi* (Trumpet bird = Grey Winged Trumpeter)
 Savannahh Birds: *Daakari* (Quail =Crested Bobwhite), *Orido* (Dove = Common Ground Dove),
Bididi (Wiseesee Duck), *Diri Diri* (Lapwing =Southern Lapwing)
Swamp birds mentioned include:
Onoro (Pinnated Bitern)

Based on information gathered at Shizizi, Potarinao, Shurinab and Parikwarinao, 09-17 January 2011.
 Validated in an intercommunity meeting held in Shurinab, 20-21 January 2011.

In fact, one common indicator of the start of the dry season and when to start burning is when the quail fly and croak. In support of this, it is interesting to note that ornithologists that studied the area in 2003 did not encounter the ground-nesting Plain-breasted Ground-Dove *Columbina minuta* in the area during March-April (dry season), but it “was ubiquitous and breeding throughout the south Rupununi savannah” in October-November (when savannah patch burning practices take place) (Robbins *et al.* 2004).

Even if there were an overlap between fire and nesting periods, the elders say that the fires set burn only small patches at a time, as the soil is still moist in this time of the year. The diversity in the savannah landscape and the patch burning system reduces the effect of fire on these nesting areas. In swampy areas, one elder claimed that fire passes right over the eggs leaving them unharmed, as swamps are full of water at this time of the year.

However, more field research would be necessary to determine if the savannah patch burning system effectively prevents all ground-nesting birds from being affected by fire. If savannah patch burning is not being properly carried out as suggested above, the places where ground-nesting birds lay their eggs might become more homogenous and fire might cause more damage to eggs and/or chicks. Similarly, in swampy areas, a more thorough investigation of the burning methods being used and the periodicity of the burns would help ascertain with more precision the impact that too much fire, or too little is having in the wildlife.

Another area of contention is the possible impact of fire on a newly recorded bird species for Guyana: the Red Siskin. In 2000, a previously unknown population of the Red Siskin *Carduelis cucullata* thought to number in the “low hundreds to low thousands” was discovered in the Rupununi savannahs (Robbins *et al.* 2003), very close to Shurinab. The species is globally endangered (BirdLife International 2011) due to collecting of wild birds for the cage bird trade. Although numerous and well-known in our study area, there was no mention of capture of Red Siskins. Indeed, the bird was mentioned as a source of local pride, especially by the young generations. Robbins *et al.* (2003) believe that the species survives in forest island patches that are less subject to burning and that an increase in the frequency of burns to generate fresh pasture for cattle-ranching is detrimental to its survival. Thus, due to increasing interest from younger generation to protect the species, over the last years there has been less burning in the savannah adjacent to the forested areas where the species is found (known as Mara Creek). However, some elders pointed out that less-frequent burning has made those savannahs “very dangerous” due to overgrown vegetation and an increase in the population of venomous snakes. In the long run, less fire in the savannahs adjoining the Red Siskin population could end up causing more harm to the species, as well as to others that live in the same forest habitat.

4.3. Causes of the impacts of fire:

The changes in the fire regimes discussed above have to be understood against the background of a wider process of socio-cultural, economic and environmental change that the Wapichan and Makushi have been experiencing over the last decades.

4.3.1 Socio-cultural change:

Cultural change is affecting the use of fire in different ways. Perhaps the most evident of them is through knowledge loss. The everyday handing down of knowledge of fire use from older to younger generations seems to be disappearing due to changes in the education system and lifestyle:

“Young people do not go to the farm and do not learn how to use fire properly. They spend much of their time in school and are learning other ways of living. They don’t want to go to the farm. Me and my wife have to collect all the fire wood ourselves. They say they prefer gas. They don’t help us in fire break burning.” (Uncle Ivan Isacks and Helen Isacks, Parikwarinao)

“The younger generation is not asking questions, trying to get the knowledge of how the older generations used fire. If they did they would learn how and when to use fire.” (George and Nelly Domingo, Potarinao)

When younger people do not accompany their parents and grandparents in the different traditional livelihood practices and cease “asking questions”, they fail to learn all the varied array of uses of fire, including the necessary preventive fire management methods that must be carried out through out the year to avoid damaging fires. Additionally, if younger people now spend most of their time in school, there are fewer people to carry out the maintenance of the savannah patch-burning system, which might explain the apparent tendency towards more dry-season damaging fires.

This loss of knowledge of the proper way to use fire is also perceived as a problem in a relatively new livelihood practice among the Wapichan and Makushi people, such a cattle grazing¹¹. According to Uncle Alan Fredericks, one of the largest cattle grazers in the area:

“You don’t find real *vaqueros* anymore. The young people go to high school in Lethem or in Georgetown and when they come back they think that just by getting on a horse they can become *vaqueros*. The good *vaqueros* have gone to work in the mines or in Brazil because that can make more money that way.”

This might explain why *vaqueros* are frequently singled out as responsible for many of the wild savannah and forest fires.

In addition to the loss of knowledge, through a more regular contact with State natural resource management officials, environmental organisations and world-wide anti-fire discourses, new values of fire are being adopted, which also seem to be contributing to an alteration of the fire regimes. During field-work young Wapichan and Makushi and some community leaders were in general critical about the widespread use of fire, partly because of the impacts that they have noticed, but also because they have started to be exposed to growing criticisms from outsiders.

Outside pressure to reduce or control the use of fire in the area springs both from the national and international level. Some attribute it to the arrival of US organisation Conservation International (CI), following a Rapid Ecological Assessment carried out by a team of biologist in 1993, which recommended the establishment of the Kanuku mountains as a National Park due to its rich biodiversity. Wildfires were singled out by CI as one of the principal threats for the long-term conservation of the Kanuku Mountains (Nick Fredericks, Shurinab, pers. comm.). Though the proposal to declare the Kanuku mountains national park failed to gain local support, partly out of fear of losing the right to continue carrying out traditional activities in the area, CI has continued to carry out some outreach work in some communities adjacent to the Kanuku mountains. Fire management has been one of the topics addressed in past activities (Uncle Allan Fredericks, Shurinab, pers. comm.). Additionally, community leaders are increasingly being invited to form part of national and international meetings to define national strategies for environmental conservation in Guyana. Fire generally stands out in these meetings as one of the principal threats

¹¹ Cattle ranching has been on the Rupununi savannahs since the 1890s, though it seems Amerindian families did not take it up until much later – around 1930s

for environmental conservation (Nick Fredericks, Shurinab, pers. comm.). Over the last decade, some young Wapichan have also had the opportunity to participate as field work assistants in biological studies carried out in the area, absorbing part of the external concerns over the impacts of fire on biodiversity.

As a result, discussions about the use of fire have become more frequent in community meetings and community leaders have become increasingly vocal discouraging people to use fire carelessly. Although the intention is to ensure an adequate use of fire and reduce wildfires, this pressure seems to be leading to the contrary results, as seen from the following interview extract:

A-The other day a fire came down the big swamp, and it nearly burned my house, because it was too dry. They had asked us, no fire burning, and eventually somebody dropped a fire there and fire just took off.

Q-Who asked for no fire burning?

A- The village council, they is always telling us they don't want no fire burning. But still it happens, because people is always dropping fire. They tell us if you start a fire it must not set a big place.

Q- Why did the village council ask for no fires to be set?

A- Somebody been around before and said it is against the law to burn the savannah, or even burning the mountains. I don't know who it was. It was from some organisation that was around, and they asked for no fire burning. They appointed somebody to look after that, some rangers, walking around to see that there must be no fire burning. That was around three years ago. My son became trained as one of the rangers. That was the time they were talking about no fire burning.” (Uncle Yede Laurence, Shurinab)

Discouraging people from burning seems to be leading to the late rainy season and early dry season burns not being properly carried out. Thus, when a dry season fire occurs and savannah patches have not been burnt, the destructive force of fire is greater. This in turn encourages further criticism of fire and seems to be giving rise to a self-perpetuating cycle of tension among the community members over the use of fire.

These changing perceptions of fire, when combined with knowledge loss, can be very threatening for the continuation of the fire management system. Apart from eroding even further local knowledge and practices by placing a negative value judgement on the use of fire, they can give

rise to simplistic solutions to the problem, which rather than decreasing the damaging impacts of fire, end up increasing them even further. As Angelbert Johnny from Sawari wa'o village council recognises: "...because we are talking that fire should not be used carelessly, now it is dangerous".

Rather than the end result of the problem -wildfires in the dry season- much more attention needs to be given to its cause - not enough fires in the late rainy season and early dry season. Interestingly, in November 2010 the Guyana Forestry Commission launched a pilot Fire Monitoring Programme in various communities of South Rupununi, including Shurinab and Sand Creek, among others. However, the monitoring period only includes the dry season, and the data collection sheet takes no account of prescribed burning as a possible cause of fire.

4.3.2. Changes in the use of fire in different livelihood practices

Apart from cultural change, there are also important changes in the livelihood practices that seem to be pushing towards a less sustainable use of fire in the area.

4.3.2.1. Cattle grazing:

Although the use of fire in the shaping of the South-Central Rupununi landscape is a very old practice amongst the Wapichan and Mukushi people, the degree to which is being used at present is not. Almost all the people interviewed agreed that the widespread use of fire in savannahs began after Europeans introduced cattle grazing in the last decade of the 19th Century.

Apart from increasing the use of fire, cattle-ranching has produced a more homogenous savannah landscape:

"Before they did not have no cows. There were *capash* and deer just behind the door. Before the cattle the savannah was high, the cows are mashing the savannah. That is why there were *capash* in the savannahs and turtle around. There were more savannahs, they were high, high, high, but the cows are mashing the savannahs and the animals go into the mountain." (Uncle Maurice Adolf, Koiko)

Thus, it is not surprising that cattle-grazing is identified as the main activity causing wildfires. A more widespread use of fire combined with a more uniform savannah landscape increases the possibilities of damaging fires.

Yet, even though cattle-grazing has been practised in the area for over a century, local concern over wildfires seems to be a relatively new phenomenon. When asking people how far back they remembered wildfires being a problem, the answer almost invariably was that “it never used to be like this before”. It is only in the last decade or so that this situation has started to create local alarm.

So what could be causing this? There seem to be two import contributing factors: a) an increase in the number of locally owned cattle, and b) lack of agreements amongst the different villages and with cattle ranchers over the use of fire for cattle grazing.

Increasing number of locally owned cattle:

Though some of the people interviewed attribute more wildfires to population increase and to an increase in the total number of cattle being grazed in the South Central Rupununi, there are now fewer cattle than 40 years ago. “Economic stagnation, caused by persistent transport and marketing difficulties has lead to a decline in heads, to an estimated 15% of their size in the 1970s” (Henfrey, 2002).

However, local ownership of cattle appears to be increasing. Originally, the cattle were owned solely by one company, The Rupununi Development Company, whereas today there are several big cattle ranches (Dadanawa, Sandcreek and Red Hill) as well as owners in the communities. In every community at least a few families keep cattle. At the same time most village councils maintain a village herd (David *et al.* 2006). Although the total number of cattle grazed in the area has decreased since the 1970s, some people that took part in the validation meetings undertaken as part of this study consider that the number of village cattle seems to be increasing (Shurinab, 20-21 January 2011). These perceptions are backed up by local records in some cases: as seen in Table 7, between 2005 and 2010 the number of heads managed by Shurinab’s village council alone almost tripled, and according to current community development plans, the prospects are that they will increase even further in the coming years.

Table 7: Shurinab Village Council Heads of Cattle

Village	2005	2006	2007	2008	2009	2010
Shurinab	17	25	38	42	48	61
Meriwab	12	12	15	22	23	23
Red Hill	10	10	13	13	15	18
Koiko	3	3	3	1	4	5
Total	42	50	69	78	90	107

Source: Data collected by Yede Laurece, in charge of Shurinab's village herd

More individual families and village councils owning cattle implies more people starting fires (Uncle Allan Fredericks, pers. comm.). Taken from the discussions in the final validation meeting, though fires for cattle grazing activities in the dry season are perceived to be increasing, these changes are possibly not being accompanied by sufficient fire prevention methods in the late rainy season and early dry season. This is why uncle Yede Laurence, the *vaquero* in charge of managing Shurinab's village council's herd, stressed the importance of assigning special people to make sure the necessary prescribed burning practices are carried out:

“I think we should get somebody to do that work, in times like now is the right time. Keep burning along side, before its over dry, get somebody to do the burning, not only the *vaquero*, I would say, not only me to go there. We should get somebody special to go doing that job. Do the burning along the side, because we have, remember we have fence around the bush island, so to avoid the fire from going into the fence, into the mountains or into the farming areas, we should get somebody to do that work, burn along side. That would be good, before it dries too much, and this is the right time. We still have some green grass so it can burn.”

Lack of agreements over fire uses amongst the different villages and with cattle ranchers

In the same way that it is becoming necessary to put in place at the community level more prevention fire methods to counteract the pressure of dry season cattle ranching fires, coordination in this direction amongst different communities and with the bigger cattle ranches is becoming imperative.

Some community members feel that they can keep control of their own cattle grazing activities, but that they can do little to control *vaqueros* from other villages and the large cattle ranches.

Vaqueros are seen to be much less concerned and cautious about the use of fire when they are not looking after cows in their own community land. The truth behind this perception is that when grazing in other people's lands, it is much less probable that *vaqueros* will devote time to setting fires for fire breaks and protective measures.

On the other hand, even if people from one community take care to set fire breaks to protect the lower slopes of mountains and forests, these can be futile if people from adjoining villages fail to do the same, as fires started by *vaqueros* can go up mountain slopes on a side that is not being protected and enter the areas that are being protected from the top or from the side. This suggests the need for further intercommunity agreements to try to promote coordinated management activities in cattle grazing.

4.3.2.2. Farming:

Some changes in the farming practices, may also lead to fires getting out of control. Unlike cattle ranching, where fires that get out of control originate in savannahs, in the case of farming these generally originate within the forests and bush islands, where farming areas are located.

One of the fire-related problems mentioned during the interviews in farming areas was that of agricultural plots being burned by fires that had escaped from adjoining farms. The most common explanation for this was that currently there were fewer people abiding with customary laws requiring the need to sweep around their plots and make firebreaks prior to burning the farms and that less attention was being paid by some people to controlling and extinguishing the fires. Though this could be partly true, there are other factors that need to be examined.

One factor that could be affecting the risk of uncontrolled fires is the distance being left between plots. Reports that fire is sometimes escaping from one plot to another suggest that in some cases farms may be being opened quite close to each other. An important principle of rotational agriculture is that an ample swathe forest needs to be kept between agriculture plots to encourage forest regeneration after the agricultural plot has been used.

Research carried out in the North Rupununi and in Canaima National Park, Venezuela, has shown a trend in the reduction of the distance between agriculture plots in other Wapichan, Makushi and

Pemon communities. Cultivators generally choose to reduce or eliminate the band of forests that was traditionally maintained between groups of fields when there are limited supplies of old growth forest around indigenous communities (Kingsbury 2003). Other possible change in the farming system, such as an overall reduction of the fallow period, which generally accompanies a reduction in forest areas between crops, could also be taking place. If this were to be the case in the South Rupununi, it could mean that in the areas where fires are escaping from one plot to another the local agricultural system is under some degree of stress. If such stress is occurring, it could be linked to multiple factors, including land tenure issues and various social factors.

Another factor to consider is the size of crops. Anecdotal evidence from many older farmers is that farms have become smaller in the last fifty years (as people have less time to farm). However, most people report that cash cropping in the case of peanuts has increased field size (Tom Griffith, pers com). Bigger farms can make forest regeneration more difficult and slower.

The location and distribution of land for agriculture among the communities must also be considered. Land over use could be more of a problem in communities that are more dependent on bush-islands to carry out their agricultural activities than in those that use forest borders, as bush-islands set a greater limit in the long-term availability of land for agriculture.

However, due to the limited time for fieldwork, we were not able to ascertain on the ground the degree to which the agriculture system in the area is under stress due to overuse and/or new land use practices and how this could be linked with more fires getting out of control during agricultural practices.

Research carried out twenty years ago to evaluate the impact of shifting cultivation system in the forest areas of South Rupununi using aerial photography and Landsat images indeed revealed the start of a tendency of intensification of land use, expressed in a reduction of fallow periods in some areas (Eden 1986).

Taken from the interviews, fire escaping from agriculture areas is considered a common problem by some people in Shurinab and in Parikwarinao, but not so much in the other villages. In some parts of the South Rupununi farmers report that there is an increasing intensity of land use where land titles granted by the state have been too small and have excluded traditional farming

grounds. In some of these reduced titled areas, much of the land that is left for agriculture is second bush (David *et al.* 2006), which is more vulnerable to fire damage. However, like the study done by Eden in the 1980s, more recent information indicates that there is little evidence of forest degradation resulting from agriculture in the South Rupununi. In the village of Maruranao, for instance, an ethno-ecological study showed that only in limited occasions there is evidence of forest turning into shrub-land due to the land having been cultivated for excessively long periods (Henfrey 2002).

More detailed and up to date monitoring studies of the shifting cultivation system would be necessary in order to determine the exact relationship between land use and forest fires.

4.3.2.3. Hunting:

There are two important changes in hunting practices that may increase the risk of fire damage and uncontrolled wildfires. One of them is the use of fire in commercial hunting, which is more prevalent in some villages than in others (Shurinab being one of them). Unsustainable commercial hunting can lead to over-exploitation of animals, and may involve the over use of fires in specific areas, as seems to be occurring with tortoise harvest for trade.

The other change is the increase in the use of fire in individual or small family hunting groups. As mentioned before, the use of fire in hunting is normally approved when carried out in groups and for special occasions. We were told that when fire hunting is carried out collectively there are more people to look after the fire and make sure it does not go out of control into the forests or open savannahs. This is less possible in small groups. This study has found a widely shared perception in the study villages that individuals and small groups are making increased use of fire for hunting when compared to the past. For instance, local people report that areas like the Shizizi Mountain and the slopes of the Kanuku Mountains, are subject to an increasing pressure from individuals or households hunting with fire. If this is correct, changing hunting practices may be responsible for an increased number of hunting-related fires set throughout the year.

4.3.3. Climate change and the use of fire

During the last 10 years the weather in South Rupununi has been subject to extreme seasonality due to El Niño and la Niña events, with alternating years of droughts and heavy non-seasonal rains becoming more frequent. This weather pattern has caused great disruptions to the lives and livelihood practices of the Wapichan and Makushi people, and hence in the use of fire.

The 1998 drought is remembered as particularly strong one, which led to crop failure, forest fires and a widespread death of livestock and fish populations:

“The rivers were dry, dry, from the Sawara mouth to Awara Landing. It was completely dry, and the area was completely burned. This is a farming area. That is when the animals burned. The animals use to soak the water from the leaves because the place was so dry. Animals really famished. That is when this place was damaged, savannah and the mountain. The rainy season would not come at that time, only fire, fire, fire, fire, and smoke, smoke, smoke. That is the time I remember the savannah and mountain burned”. (Uncle Maurice Adolf, Koiko)

This was repeated in 2007 but not as severely. In both cases, the drought has been followed by years of prolonged rainy season. In 1999 and 2000 non-seasonal rains caused “flooding of many low-lying fields, disrupted the annual migration patterns of fish and caused severe transportation difficulties at unusual times of the year” (Henfrey 2002). A similar pattern followed the 2007 drought; 2010 and 2011 have been two consecutive years of unusually prolonged rainy periods ones:

“Like now, the whole savannah is supposed to be dry, dry, dry, but it is still green, because of the rain. What the rain is doing now, it is good because we still have fish, the cattle have water. The weather now is nice, our farm is healthy. Less burning, the grass is green but the fire can’t go through. But last year there was too much rain. (Uncle Yede Laurence, Shurinab)

As a result of the prolonged rainy season, in January 2011, when this study took place, many of the lakes, creeks and swamps that normally should be dry by this time of the year, still had water. Some flowers such as the *shiu* and lily had already started blossoming, when normally this take place in March, and fish were spawning again.

There are two threatening aspects of this recent unpredictable weather pattern in terms of the use of fire. First of all, during droughts fires are more likely to enter into forested areas, both from savannah fires and from farming areas due to a lack of humidity in the soil in the forest borders. Once they do, they can expand through large tracts of forests without limits through the roots of the trees, burning the dry leaves and other highly combustible organic matter:

“I believe it was about 5 years ago, the fire came from the east from the Rupununi, the leaves were too dry, and the fire came from underneath the trees in the mountain, that is when no body can stop the fire. Smoke, smoke, smoke from the east to the west”. (Uncle Maurice, Koiko)

Ecological studies have shown that the most important effects of forest fires in tropical forests is the increased probability of further burning in subsequent years, as dead trees topple to the ground, opening up the forest to drying by sunlight, and building up the fuel load with an increase in fire-prone species, such as grasses. Generally, the most destructive forest fires occur in areas that have burned previously (Cochrane *et al.*, 1999 cited in Secretariat of the Convention on Biological Diversity 2001). In other parts of the world where similar events have been occurred, such as Borneo, many of the forests that burned in a period of drought (1982-83), burned again in the following El Niño droughts in 1997-98 (Hoffmann *et al.* 1999 cited in Secretariat of the Convention on Biological Diversity 2001). Thus, if droughts become more frequent or regular one could expect to see more forest fires in South Rupununi and subsequently more gradual conversion into shrub or savannah vegetation.

Yet, the probability of fires affecting the same area depends on the intensity of the burn, the type of forest that was affected and on the rate of recovery between fires. According to studies carried out in tropical forests in Indonesia, in undisturbed primary forest a full recovery of the forest can be expected within a few years (Schindele *et al.* 1989 cited in Secretariat of the Convention on Biological Diversity 2001). However, in the disturbed forests, the prognosis for recovery in the presence of fire is much slower.

As far as we know, no studies have yet been undertaken to assess the impact that these fires have had on the forest of the area. Our overall impression from conversations we had during fieldwork with some of the elders was that the forests affected after the 1998 and 2007 droughts have recovered or are in the process of recovering. However, more in depth studies on this subject

would be necessary in order to have a clearer picture of the exact areas that has were affected as well as of the rate of recovery of the forests and/or of conversion into other types of vegetation.

The other threatening aspect of this changing weather pattern is the disruption that a prolonged rainy season may cause to the fire management practices that normally go along with the different livelihood practices. In farming for instance, the excessive rain experienced during the last two years has lead to an increasing uncertainty about the right time of the year to burn the big farms, and in some cases to doubts as to weather the farms will be burned at all:

“The rain is not giving persons time to burn their farms.” (Uncle George Domingo, Potarinao)

“It is confusing to make farms, because you have the rains for two or three days and then you have sun, so people are on the look out, confused as to when to under-bush.” (Uncle Oscar Stevens, Potarinao)

“The weather is not allowing the fire to burn. People cannot farm their lands because they can’t burn.” (Angelbert Johnny, Sawari Wa’o)

A prolonged rainy season also means that the protective fires and savannah patch burning cannot be carried out in time before the dry season arrives.

“The rain is not stopping, so the savannah will burn but not completely.”(Raymond Edwin, Potarinao)

“Right now the rain does not let the fire burn how it should. Right now it would burn, but only until a certain distance, but it would meet a swamp and it would stop.” (Angelbert Johnny, Sawari Wa’o).

The men focus group discussion in Shizizi indeed revealed that many of the swamps in the community lands were over grown because during the last two years it had not been possible to burn them due to excessive rain. During field work we also noted some forest-savannah edges where burning had been unsuccessful due to the vegetation not being dry enough and the soil being too moist.

We see then that apart from giving rise to large forest and savannah fires during droughts, changes in the weather pattern could also be affecting the extent to which prescribed fire practices are being carried out at the end of the rainy season in order to be well prepared to manage fires in the dry season.

5. DISCUSSION:

The situation that the Wapichan and Makushi face today regarding the use of fire is not all that different from that facing other indigenous peoples throughout the world. Cultural and economic change has been responsible the world over for mayor changes in traditional resource management activities; fire use being only one of them.

In some cases cultural assimilation and premeditated fire suppression policies have had such an impact on local livelihoods that indigenous knowledge of fire management seems to be something from the past. Ironically, as the impacts of the lack of fire have become evident through more frequent uncontrollable wildfires, resource managers from different corners of the world have been faced with the challenge of reviving and reintroducing traditional indigenous burning practices that in the past helped to shape and maintain dynamic, healthy and diverse forest and savannah ecosystems.

The situation in South Rupununi has not reached that point yet. Despite the elders' concern about the loss of knowledge of fire use among the younger generations, this study shows that fire is still the most powerful tool that the Wapichan and Makushi have to shape the landscape and carry out most, if not all, their livelihood practices. This is reflected in the wide variety of uses still given to fire in different types of ecosystems and times of the year, including: domestic use, medicinal/healing and spiritual use, safety, animal husbandry, fishing, agricultural use, hunting, gathering, stimulating vegetation growth and abundance (both in savannah and forest environments), communication, craft making and perhaps most significantly, environmental protection.

Fire is a permanent feature of the Rupununi landscape the year through, except in the time of the "rain god", when it is practically impossible to burn. Eliminating or reducing the use of fire in the area is simply not possible nor would it be desirable. In this type of human shaped landscape,

fewer fires can be more of a problem to the environment than more. The challenge in the long term is to ensure that proper uses of fire are maintained and that the changing conditions that are pushing towards less sustainable uses are properly understood and addressed.

Indeed, among the Wapichan and Makushi communities visited in this study there is widely shared view that fire used in different livelihood practices is causing undesirable impacts in the vegetation in some areas. These include repeated burns in some mountain slopes, the conversion of some forests into savannah and the degradation of its groves. Fire associated with hunting practices is also considered to be a possible cause of a decline in local abundance of some animal species. Both types of impacts seem to be linked (although not exclusively) to a change in the burning regimes: more dry season fires are not being accompanied by enough late rainy season ones. Or in other words, less or insufficient protective or preventative fires are being carried out. Thus, in the future, actions will need to be taken to ensure that preventative fires (or prescribed burns) are systematically carried out throughout the area at the right time of the year and in the right places. Conversations among some villages in this respect have already started to take place as a result of consultations on the Wapichan management plan. Yet this effort must continue and be enhanced through more thorough and widespread discussions among the different villages and across different types of resource groups: hunters, farmers, ranchers and fishermen from different genders and generations.

The alteration in the fire regimes cannot be attributed only to one cause. It is rather the consequence of a combination of factors, such as: increase in population, a more permanent settlement pattern, cultural change, change in livelihood practices (cattle grazing, hunting and farming), inappropriate environmental policies promoted by external agencies and climate change. Yet, one of the most critical of all these factors is without doubt cultural change and particularly the gradual loss of knowledge of fire use. As said before, the Wapichan and Makushi elders still hold a very detailed knowledge of proper uses of fire, but this does not seem to be so much the case among the younger generations due to changes in the education system and in the way of life of the Wapichan and Makushi people. Thus, it is of utmost importance to ensure ways to pass down this knowledge and that young Wapichan and Makushi put it into practice in their daily activities.

Changing perceptions of fire among younger generations and some leaders, together with increasing external pressure to reduce the use of fire, rather than helping to find solutions to the problem, seem to be creating confusion and tensions at the community level with regards to the

use of fire and constraining burning practices by raising doubts in the minds of the Wapichan and Makushi over whether they are doing “the right thing”. As a result, wrong community fire management decisions are being made, such as the call for “no burning”, which can increase even further the possible damaging impacts of fire. This can also lead to undervaluing the richness of local knowledge of fire use and enhance even further its gradual disappearance. In order to avoid all this, more attention and importance needs to be given to the Wapichan and Makushi traditional knowledge of fire management when defining future uses.

As the damaging effects of fire are also directly linked to changes that are being experienced in the different livelihood practices (more ownership of cattle at the community level, increase in hunting for commercial purposes, and apparent intensification of agricultural land use in some areas), attention also needs to be paid to dealing with these changes. In some cases, such as in the case of cattle grazing or hunting, intra and inter community agreements might be enough to make sure that a change in a livelihood practice is accompanied with adequate fire uses. But in others, such as agriculture, more structural solutions to land use practices such as matters linked to land tenure security, not related to the use of fire as such, might be necessary.

Climate change poses great challenges for an adequate use of fire in the area, particularly because of its unpredictability and the little time that exists between the seasons in order for there to be any possible adjustments to the normal practices. Fire management requires a degree of predictability in the climate, as do all land use practices. If the present trend of alternating warmer years with wetter ones continues, it could become much more difficult to practice all the preventive fire management methods (savannah patch burning and forest edge fire breaks) during the end of the rainy season and start of the dry season. The Wapichan and Makushi will have to remain alert in the following years and perhaps start thinking about possible adaptations to the fire regimes or land uses in order to respond to this change.

6.RECOMMENDATIONS FOR A SUSTAINABLE USE OF FIRE IN SOUTH RUPUNUNI LAND MANAGEMENT

A sustainable use of fire in South Rupununi depends to a very great extent on maintaining alive the traditional Wapichan and Makushi methods and knowledge about adequate uses of fire.

The main traditional principle behind the use of fire is that in order to make use of its potential utilitarian and practical benefits as a land and natural resource use tool, equivalent energy must be invested in using it to prevent its potential hazardous impacts on the human, spiritual or natural worlds. In other words, for fire to have a role as a practical livelihood tool it must also play an active role as a risk prevention tool. Ultimately, it is through fire that fire can be most optimally controlled.

This explains why many of the specific traditional principles for an adequate use of fire refer to its role in damage prevention. According to the findings of this research, traditional uses of fire that must be maintained over time in order to ensure a sustainable management of the land include:

- Ensuring the regular maintenance of a **savannah patch-burning** mosaic and **forest edge burns** in order to prevent savannah fires expanding without control during the dry season through large tracks of the savannah or entering into the forests and/or its areas.
- When carrying out burns it is important take into account natural factors such as: the season of the year, time of the day, wind speed and direction, seasonal and daily variations in the rainfall, soil humidity, the size of the fire and natural barriers such as roads, rivers, creeks, swamps and lakes (see Table 8 for details). Of these factors, attention to the season of the year is of utmost importance. The two primordial fire prevention methods (savannah path-burning and forest edge burning) must be carried out at the end of the rainy season or beginning of the dry season.
- In farming, the use of double firebreaks is deemed necessary in order to ensure effective protection of the land and forests from fire. One firebreak must be burned along and outside the bush islands/forest edges and then a second one inside the bush-islands/ forest edge and around the farming area. Sweeping around the farming areas before setting fire to the internal firebreak is another common fire prevention technique. When subsequently

burning the farms in preparation for sowing, fire must be set around the farm so that it ends in the middle of the farm, and thus avoid it spreading into the forest.

Table 8: Natural factors to take into account for a proper use of fire

Time of the day	Around the homes: evenings. Fire breaks and savannah patch burning: early morning or evenings Farms: midday.
Intensity of the wind	When the place is quiet, quiet, when there is no breeze around. November-December is time of high winds, there should be little burning
Direction of the wind	You burn always burn against the wind. When the wind is blowing from the east, you burn from the west. When the wind is blowing from the west you burn from the east.
Time of the year	September-October: best time for fire prevention methods. Second burn in November, January or March if necessary. See seasonal calendar for more details in different livelihood practices.
Humidity of the soil	When the soil is moist (end of the rainy season), it's the right time to burn. It will burn patch-patch, not completely (patch burning)
Rain	The end of the rainy season is better for fire prevention methods. Before the rain is coming, or after a rainy day, during a sunny spell.
Size	Small patches, not big areas at one burn.
Natural barriers	Creeks, roads, swamps play an important role as natural barriers to fire expansion.
Actions after setting fire	It is important to keeping an eye on fires, and out them if necessary.

- Apart from fire breaks, there may be cases in which it might be necessary to resort to other traditional fire prevention/control methods, such as wetting the land before burning, extinguishing or “outing” fires (particularly in fire places set to cook during fishing and hunting trips) or fighting fire with fire (when a fire has become too big and has gone out of control).
- There are critical fire management areas, such as *shakaru* and swamps where a potentially hazardous natural build up of organic matter normally takes place. Therefore, attention must be paid to regularly burning *shakaru* and swamps in order to avoid fires hitting these areas in the dry season from spreading through the savannah landscape or into the forests. The frequency that was agreed to burn a *shakaru* and individual swampy areas was once a year, not more. While burning of swamps generally take place once they are have dried up, a *shakaru* must be burned at the end of the rainy season, when the grass is still green and it still has water.

In new adaptive approaches to land use such as cattle grazing, where there is an intensive use of fire in the height of the dry season, an adequate use of fire also depends on the continuation of the traditional preventative measures mentioned above, such as the time of the day in which the burns are set, the size of the burn, the direction of the wind, but most importantly, on what happens to the savannah during the rest of the year. If there is an adequate maintenance of the savannah mosaic and of forest edge fire breaks during the end of the rainy season and the beginning of the dry season, there is less chances that the fires set from cattle grazing activities set in the middle of the dry season may turn into uncontrollable and damaging ones. Hence, the importance of maintaining the traditional fire control practices in cattle grazing as well.

7. POSSIBLE NEXT STEPS

The following set of actions, drawn up from discussions at the final validation meeting held in Shurinab on 20-21 January 2011, could help address the fire management problems identified in this study and ensure an adequate use of fire in the area in long term:

1. Identify communities where the traditional fire management methods are is still being used on a regular basis (for example Sawari wa'o) and encourage them to become an example or point of reference to other communities.
2. Carry out community meetings in villages to rekindle the traditional knowledge system of fire management. Include the youth in public meetings, as they are seldom present in public discussions.
3. Revive local knowledge "by doing" not just talking about it. Take younger generations to the farms, hunting and fishing on a more regular basis to learn about the time, areas and seasons to burn. Revive contact between elders and younger generations over traditional practices. The elders that participated in this study expressed their commitment to carry out this task.
4. Use the potential of schools as places for handing down traditional knowledge of fire management through talks and environmental education activities. The information gathered in

this report in section 4.1 could be used as base line for developing educational materials of the Traditional Wapichan and Makushi Way to Use Fire.

5. Develop fire management plans by community: identifying critical and vulnerable areas (including areas that must be burned and those that should not be burned), times and season to burn in order to ensure that fires are set in the right times of the day, year and places. Discussions should be carried out among different fire users (hunters, farmers, cattle grazers, fishermen, craft makers) genders and generations in order to clarify possible differing interests and views about the uses of fire and its and impacts. This report shows that fire management is a contentious issue at the community level, and views about its impacts are not uniform. Thus, the development of fire management plans should be used as an opportunity to clarify differing views across generations, users and genders and enable inclusive collective decision-making. For example, Table 9 shows some areas in which there was some disagreement among the people interviewed in relation to places that should not be burned. Public discussion in the final validation meeting was useful for making these differences visible and collectively agreeing on the topic.

Table 9: Areas mentioned as places that should not be burned

Shizizi	<ul style="list-style-type: none"> • Shizizi Mountain slopes and top • Dokuban Mountain (east of Shizizi) • <u>Tomara Shakaru (AREA OF DISAGREEMENT)</u>Inabaana (baawuzi/ forest) • Buro Wa"o Toon (house materials) • Kazar Tao Toon (house materials)
Sawari wa"o	<ul style="list-style-type: none"> • Cultural Heritage sites • Grandfather spirits areas • <i>Ite</i> bushes (areas for housing materials) • Multiplying animal grounds (areas for housing materials)
Potarinao	<ul style="list-style-type: none"> • In Shizizi, <i>Kinaabana</i> - turtle breeding area <i>Koamada</i> (behind the Shizizi) a place where the armadillo and deer breed. <i>Komiri Orudu</i>, (around Shizizi): house materials and you can find red wood (Saporudai), Tapuzai (freasure), Aturub (water cedar). • <i>Bakawaada Tawaa</i> (mountain forest with house materials and game animals). • All our <i>Ite</i> groves: Kamao Wa"o, Korara Wa"o, Kotu"I Wa"o, Kubai Wa"o (Clay creek), Kibi"o Wa"o.
Parikwarinao	<ul style="list-style-type: none"> • <i>Kanawad Dakuo</i>: this is a multiplying breed ground for animals. It's an area were we find construction material. • <i>Ite</i> groves: Aligator creek, tributary to the Aturu Wa"o • <i>Wurada Toon</i>: There is a cave in a where the are turtles, and were they all breed, and also a big snake.
Shurinab	<ul style="list-style-type: none"> • <u>House Lake (AREA OF DISAGREEMENT)</u> • <u>Mara Creek (AREA OF DISAGREEMENT)</u> • Awara Landing (Public Landing) • <i>Chawuda Toon</i> • <i>Mapuzu Toon</i>

Important points that would need further clarification during the development of the fire management plans include:

- Traditional methods for burning swamps and *shakaru*: do burns of these areas traditionally take place in stages, with protective burns in the borders during the end of the rainy season and beginning of the dry season, in preparation for the dry season? As swamps and *shakaru* were identified as critical fire management areas, greater clarity of the burning methods being used in these areas and the periodicity of the burns would help ascertain with more precision the impact that too much fire, or too little is having in the vegetation and wildlife of South Rupununi.
- Impact of fire during rodeo times: As rodeo times are singled out as the most critical time of the year for wild fires, is important to answer if the current impact of fires during rodeo and shipment times caused by: a) the savannahs being “too brown” when burned (in which case late wet season fires in these areas would be necessary), b) by the savannah patch burning and forest-edge areas adjoining the shipment and rodeo roads not being maintained, or c) by both.

6. Once community fire management plans have been developed, set clear management agreements (rules and regulations) in relation to how to look after critical areas: times, seasons and areas to be burned. It is very important that fire management plans are carried out first to agree on the appropriate uses, and once this is done, rules and regulations for the use of fire can be developed.

7. Appoint fire managers per community to make sure critical burns are set in the right time of the year. Rather than appointing rangers to control fire in the dry season (as done in the past), or monitoring fires in the dry season (as being done by Guyana Forestry Commission), the effort should shift towards monitoring and setting fires in the late rainy season and early dry season. There needs to be careful discussion and consensus as to *who* would be responsible -what persons and how would they be selected and/or rewarded- for looking after certain areas. Some communities like Shizizi and Sawari wa’o have already started doing this. However, greater attention needs to be paid to ensuring shared management responsibility between villages and to arriving to intercommunity fire use agreements in areas that are subject to uses by different

villages, such as the Shizizi Mountain. Particular attention has to be paid to swamps and *shakarus*, due to the potentially hazardous fuel buildup that they generate.

8. Share and discuss fire management plans among different villages and reach some basic intercommunity agreements (rules and regulations) for the use of fire in commonly used lands. Intercommunity discussion needs to be part of drawing up such plans as many lands are shared among communities, satelilites, homesteads and ranches, including within village jurisdictions. The responsibility of looking after critical areas (such as the Shizizi Mountain) should be a common effort among of all villages and not left in the hands of individuals. Even if certain areas are looked after regularly (e.g. doing fires breaks in the right seasons in the edge of mountain slops or in swamps and *shakaru*) fires can still come across the other side. Thus efforts made by one village can be useless unless agreed with other villages and users. Implementation arrangements for fire management also need much more thorough discussions, as pointed out above.

9. Community discussions and long term fire management plans would benefit with further research on the following topics:

- An ecological evaluation of the effectiveness of the traditional savannah patch-burning and forest-edge burning systems in the long-term management of fire, paying particular attention to whether the systems are being optimally applied throughout the study area. Besides establishing (or disproving!) an ecological basis for traditional fire management regimes, this would help to determine exactly which areas require better fire management for the protection of both plant and animal communities.
- Comparison of the current vegetation cover of South Central Rupununi with past vegetation studies, using a geographical information system. This would help to ascertain if the stability in the forest-savannah boundary reported by Eden in 1986 persists, or whether forest cover is changing. Such a study would identify critical areas in which vegetation cover is being lost, as well as places where reforestation may be taking place, and attempt to correlate vegetation change with fire and land use practices.

- Impact caused by forest fires on the forested area of South Central Rupununi during successive periods of extreme drought. This should include an analysis of the rate of recovery of the affected forests and/or of conversion into other types of vegetation.

- Study to determine whether local weather patterns are indeed changing as a result of global climate change, how this might affect trends in vegetation cover, and the implications for fire management policy. For example, is there a tendency for forest to dry out more? Is there an increase in frequency in extreme weather events (including severe drought)? Are natural burns more frequent and severe? Should the traditional fire management regime adapt to changing conditions, and how?

8. REFERENCES:

BirdLife International (2011) IUCN Red List for birds. Downloaded from <http://www.birdlife.org> on 17/05/2011.

But-Colson (2009) Naming, identity and structure: the Pemon. *Antropologica*. 111-112:35-114

Butt-Colson, Audrey & Cesareo Armellada (2001). The Pleiades, Hayades and Orion (Tamökan) in the conceptual and ritual system of Kapon and Pemon Groups in the Guaina Highlands. *Archaeology and anthropology*. 13, 2001. Journal of the Walter Roth Museum of Anthropology, Georgetown, Guyana.

David, Beryl; Isaacs, Percival; Johnny, Angelburt; Johnson, Pugsley, Larry; Maxi; Ramachindo, Claudine; Winter, Gavin & Winter, Yolanda (2006) *Wa Wiizi - Wa Kaduzz. Out territory - our custom. Customary use of biological resources and related traditional practices within Wapichan Territory in Guyana. An indigenous case study.*

Cochrane, M. A., A. Alencar, M. D. Schulze, C. M. Souza, D. C. Nepstad, P. Lefebvre & E. A. Davidson (1999). Positive feedbacks in the fire dynamic of closed canopy tropical forests. *Science* 284: 1834-1836.

Charnley, Susan; Fischer, A. Paige; Jones, Eric T. 2008. *Traditional and local ecological knowledge about forest biodiversity in the Pacific Northwest*. Gen. Tech. Rep. PNW-GTR-751. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 52 p.+

Eden, Michael J (1986) "Monitoring Indigenous Shifting Cultivation in Forest Areas in Southwest Guyana using Aerial Photography and LANDSAT" pp. 255-278 in Eden, M J and Parry J T (Eds)(1986) *Remote Sensing and Tropical Land Management* John Wiley and Sons, London.

Edwards, W & K, Gibons (1979) An ethnohistory of Amerindians in Guyana. *Ethnohistory*, 26(2): 161-175.

Government of Guyana (2008) *Saving the worlds forests today. Creating incentives to avoid deforestation*. Office of the President, Guyana.

Guyana Forestry Commission (2009). *Terms of Reference for Developing Capacities for a national Monitoring, Reporting and Verification System to support REDD+ participation of Guyana Background, Capacity Assessment and Roadmap*. Guyana, November 13, 2009.

Henfrey, Thomas (2002). *Ethnoecology, resource use, conservation and development in a Wapishana community in the South Rupununi, Guyana*. Ph.D Thesis in Environmental Anthropology. Department of Anthropology and Durrell Institute of Conservation and Ecology. University of Kent, UK.

Herold, Martin & Bholanath, Pradeepa (2009). *Preparing Guyana's REDD+ participation: Developing capacities for monitoring, reporting and verification*. Report and summary of a workshop and consultation held 27 -29 October 2009 in Georgetown, Guyana. Wageningen University, Center for Geoinformation and Guyana Forestry Commission.

Hoffmann, A. A., A. Hinrichs & F. Siegert (1999). *Fire damage in East Kalimantan in 1997/98 related to land use and vegetation classes: Satellite radar inventory results and proposal for further actions*. IFFM-SFMP Report No.1a. Samarinda, East Kalimantan, MOFEC, GTZ and KfW.

Huber, Otto, G. Gharbarran & V. Funk (1995) *Vegetation map of Guyana* (preliminary version) 1:100,000- Centre for the Study of Biological Diversity, University of Guyana, Georgetown.

Mistry, Jayalaxshmi, Andrea Berardu, Valeria Andrade, Txicaprô Krakô & Othos Leonardos (2005) Indigenous fire management in the cerrado of Brasil: the case of the Krakô of Tocantís. *Human Ecology* 33(3): 365- 386.

Kingsbury, Nancy (2003). Same forest, Different Countries. *Journal of Sustainable Forestry*, 17(1): 171-188.

Kull, Christian (2002). Empowering pyromaniacs in Madagascar: ideology and legitimacy in community based natural resource management. *Development and Change*, 33(2002): 57-78.

Leal, Alejandra (2010). *Historia Holocena de la vegetación y el fuego en bordes sabana/bosque y turberas de la Gran Sabana, Guayana Venezolana*. Tesis Doctoral en Ciencias Biológicas. Universidad Simón Bolívar, Caracas.

McGregor, Sandra, Violet Lawson, Meter Christophersen, Rod Kenneth, James Boyden, Peter Bayliss, Adam Liedloff, Barbie McKaige & Alan Andersen (2010) Indigenous Wetland Burning: conserving natural and cultural resources in Australia's World Heritage- listed Kakadu National Park. *Human Ecology*, 2010(38): 721-729.

Parker, Theodore A III; Robin Foster, Louise Emmons, Paul Freed, Adrian Forsyth, Bruce Hoffman & Bruce Gill (1993) *A biological Assessment of the Kanuku Mountain Region of Southwestern Guyana*. Conservation International (CI), July 1993.

Read, Jane M.; José M. V. Fragoso & Kirsten M. Silvius (2010) Space, Place, and Hunting Patterns among Indigenous Peoples of the Guyanese Rupununi Region. *Journal of Latin American Geography*, Volume 9, Number 3, 2010, pp. 213-243

Robbins, Mark B, Michael J Braun, & Davis W Finch (2003) Discovery of a population of the endangered Red Siskin (*Carduelis cucullata*) in Guyana. *Auk* 120: 291-298.

Robbins, Mark B, Michael J Braun, & Davis W Finch (2004) Avifauna of the Guyana southern Rupununi, with comparisons to other savannahs of northern South America. *Ornitología Neotropical* 15: 173 - 200.

Rodríguez, Iokiñe & Bjørn Sletto (2009) *Apok* hace feliz a *Pata*: desafíos y sugerencias para una gestión intercultural del fuego en la Gran Sabana. *Antropologica* 52 (111-112).

Rodríguez, Iokiñe (2007) Pemon perspectives of fire management in Canaima National Park, Venezuela. *Human Ecology*. 35(3):331-343. (Published On-line First: 13 December 2006).

Schindele, W., W. Thomas and K. Panzer (1989) *Investigation of the Steps Needed to Rehabilitate the Areas of East Kalimantan Seriously Affected by Fire. The Forest Fire 1982/83 in East Kalimantan*. Part I: The Fire, the Effects, the Damage and the Technical Solutions.

Secretariat of the Convention on Biological Diversity (2001) Impacts of human-caused fires on biodiversity and ecosystem functioning, and their causes in tropical, temperate and boreal forest biomes. Montreal, SCBD, 42p. (CBD Technical Series no. 5).

9. ANNEXES

ANEX 1: People interviewed

Shizizi	<ol style="list-style-type: none"> 1. Tochau Raymond Griffith & Grace Griffith 2. Ronald Joseph 3. Basil Edmund 4. Winston Chapel 5. Hilary Saba 6. Dunston Saba
Potarinao	<ol style="list-style-type: none"> 1. Miguel Bernard, Agnes Bernard & Sainty Bernard 2. Raymond Edwin 3. George Domingo & Nelly Domingo 4. John Joseph & Lucita Joseph 5. Oscar Stevens 6. Touchau Sigfrid Albert
Parikwarinao	<ol style="list-style-type: none"> 1. Ivan Isacs & Helen Isacs 2. Edna Daniel 3. Tochau John Daniel
Shurinab	<ol style="list-style-type: none"> 1. Moris Adolf and Olga Adolf 2. Yede Laurence and Nina Laurence 3. Allan Fredericks 4. Tochau Wilbert Ignase 5. Abraham Ignase 6. Nick Fredericks & Asaph Wilson
Sawariwa'ō	<ol style="list-style-type: none"> 1. Angelbert Johnny



ANEX 2: Participants of Focus Group Discussions

Women focus group discussions

Shizizi	Potarinao	Shurinab
Lucille Marco Maria Joseph Clarita Saba Edwina Saba Jolisia Simon Clari Simon Patricia Jhonny Grace Griffith	Silvia Gomez Carola Perry Versida Anthony Mary Fernanandez Clara Francis Marcelina Daniel Claris Anthony Desliña Stanilos	Winifred Marari Mildred Rodriguez Martilla Malcom Cornilia Ignace Nelly Felix Tesa Felix Rosalia Simon

Men focus group discussions

Sawari wa'fo	Potarinao	Shizizi
Angelbert Johnny Amos Albert Angus Thomas	Paul Francis Sigfrid Albert Joe Lui Anthony Raymond Edwin Lenox David	Raymond Griffith Ronald Joseph Hilary Saba Dunston Saba Tony Joseph

Mixed focus group discussion

Parikwarinao
James Walker Simeon Marcell Virginia Daniels Delfina Ignacio Rose Jacobs Jacqueline Jacobs



ANEX 3: Participants in the final validation meeting.

Shizizi	1.Tochau Raymond Griffith 2. Hilary Saba 3.Clarita Saba
Potarinao	1. Touchau Sigfrid Albert 2. Silvia Gomez 3. Joe Luis
Shurinab	1.Moris Adolf 2.Olga Adolf 3. Yede Laurence 4. Nina Laurence 5. Allan Fredericks 6. Tochau Wilbert Ignase 7. Abraham Ignase 8. Nick Fredericks 9.Tessa Felix 10. Nelly Felix 11. Fred Fredericks
Sawari Wa'o	1. Angelbert Johnny 2. Amos Albert 3. Angus Thomas
Aishalton	1. Kid James

