Forest Fire Mangement in Guyana [1]

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Abstract

The majority of the world's vegetation fires is caused by man and occurs in the tropics and sub-tropics. These are as a result of increasing human population pressures on those areas where fire is used as a land treatment tool for the conversion of forested lands into agricultural lands, grazing lands and for facilitating the utilization of non-timber forest products of the seasonal forests and savannah (ITTO 1996).

Guyana is no exception to tropical fire. Fires in Guyana occur mainly in the driest period of the year and in dry evergreen forest which are primarily white sand areas. The dry evergreen forest constitutes approximately 2.8 million hectares of exploitable forests. It supports two major forest vegetation types (1) Wallaba and Clump Wallaba (Eperua falcate and Dicymbe spp) (2) Dakama (Dimorphandra conjugata).

The impact of modern fire events and the role of past fires in Neotropical forests have received considerable attention in recent years, but Guyana's rainforest has not been figured prominently. Consequently little work has been done to examine the past and present roles of catastrophic events, such as fire, in Guyana's forest.

Understanding how fire has affected Guyana's forest is important not only in assessing how best to manage and conserve these ecosystems but also in a larger comparative context, Guyana currently has the lowest population density and deforestation rate in the Neotropics

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and should therefore be the least affected by burning if there is a faithful link between human activity and fire.

DESCRIPTION OF FIRE PRONE AREAS IN GUYANA

Introduction

Geographic Zones Characterized by Regular Fires

Fire sensitive areas typically exist under extremely dry conditions where forest sites are cleared for agricultural purposes. Areas along the Essequibo/Berbice watershed are also prone to fires. Fire also occurs in clump Wallaba forest which is found in the southern portion of the Bartica triangle and areas west of this, as well as the dakama forest which occurs mainly east of the Essequibo River. (Fig. 1).

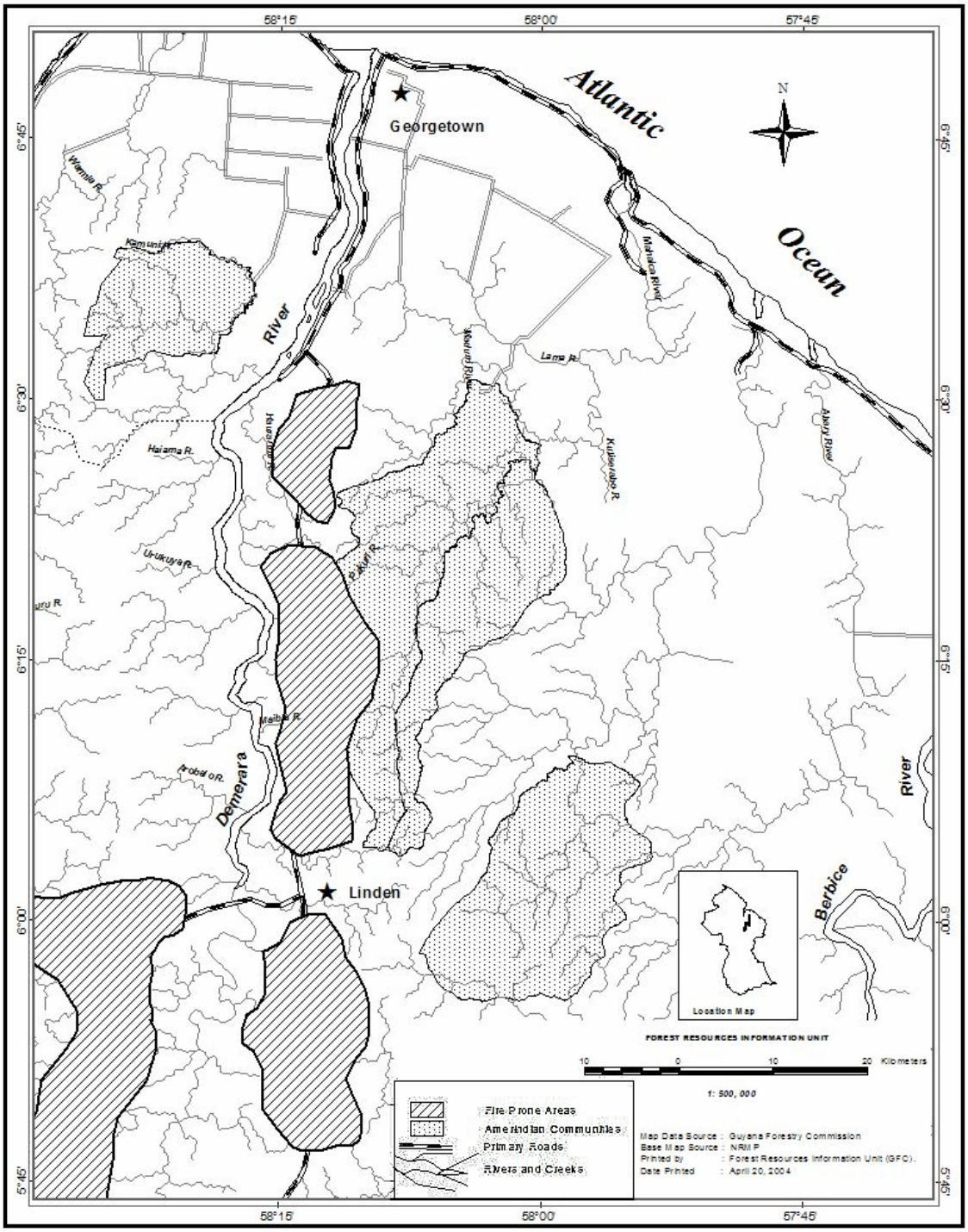

Figure 1 - Vegetation Map of Guyana. Vegetation interpretation by Hans ter Steege for Guyana Forestry Commission (May 2001). Based on Soil Map of Guyana (Gross-Brown 1965), FIDS Vegetation base maps, JERS Radar Satellite Images. Upland Vegetation, DEM (USGS), Hubert et al. 1995. © Guyana Forestry Commission.

Topography

The topography of dry evergreen forest ranges from level to undulating plains. The altitude varies from 20-60 meters above sea level. The plains are dissected by many creeks and rivers running through shallow gullies and valleys. The flat bases of gullies are comprised of narrow strips of swamp or marshlands on either bank of the rivers and creeks.

Vegetation Characteristics

The mixed dry evergreen forest contains most of the fuel wood producing areas to which dakama and Wallaba are the common species. Limited areas around creeks and rivers are covered with mixed tropical rain forest. Dry evergreen forest types are associated with sites having net water deficits during dry periods and are found primarily on white sand soils.

In dry evergreen forest, secondary growth is dominated with Dakama and is regarded as a degraded stage of Wallaba forest. Also in the dry evergreen forest are areas with deep and sterile white sands covered with xeromorphic Muri shrub.

DETERMINANTS OF FIRE

The Guianas' exhibit a consistent El Nino-Southern Oscillation (ENSO) precipitation pattern, which is characterized by a drop in rainfall nine months following the onset of an ENSO (Ropelewski and Halpert 1996). The recent 1997-1998 ENSO event caused widespread drought throughout the Guianas, and rainfall during this period dropped to its lowest in over a century. (Fig. 2).

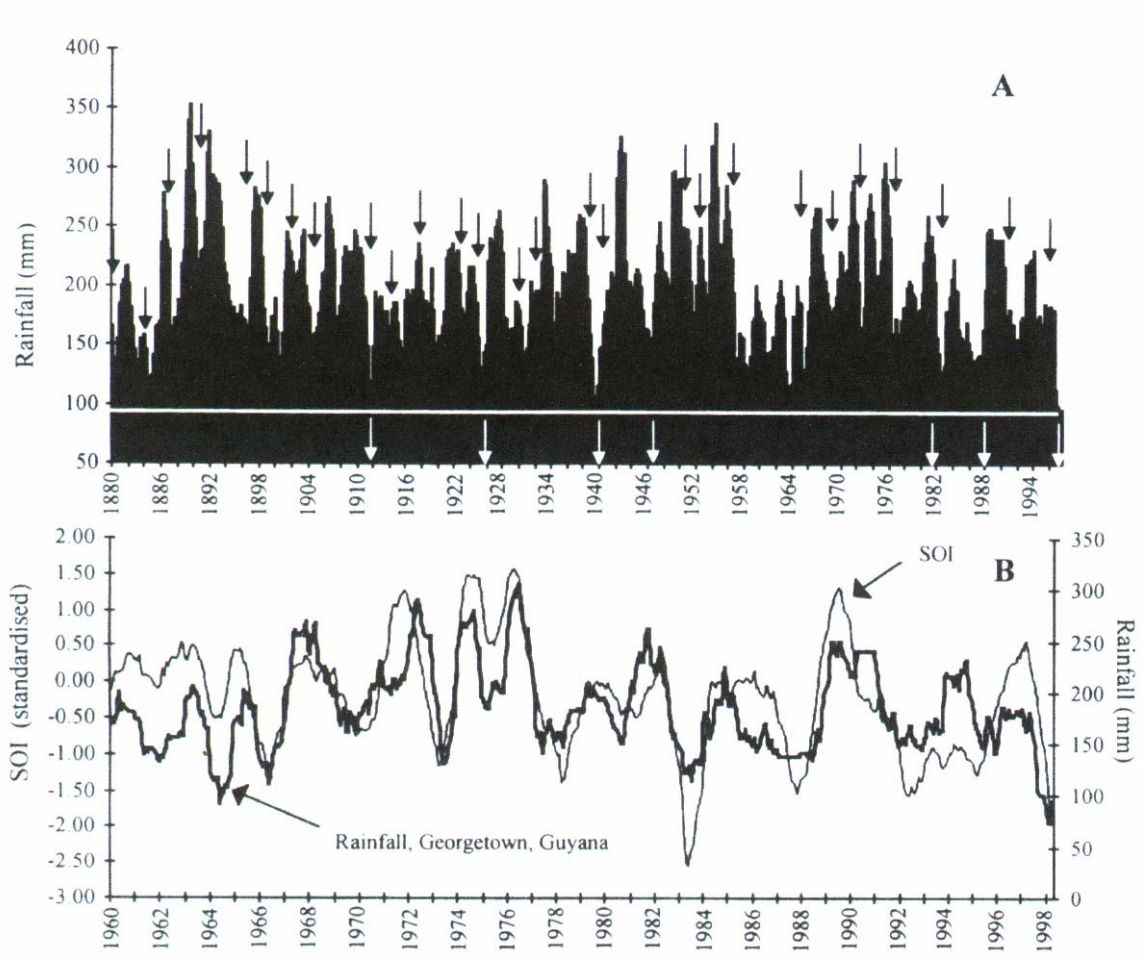

Figure 2 - The impact of El Nino-Southern Oscillation on rainfall failure and fire in Guyana at different temporal scales. The relationship between El Nino, fire records, and rainfall in Guyana at a centennial scale (January 1880-April 1998) (a). Black arrows are known El Nino and forest fire events, respectively. The white line indicates minimum value for a 12-month moving average of rainfall during the most recent 1997-1998 El Nino event. A tele-connection between the 12-month moving average for the Southern Oscillation Index (SOI) and Georgetown rainfall from 1960 to 1998 (b).

Several fires were detected in forested areas in Guyana, particularly near Amerindian lands in the Kamarang-Mazaruni River area and in forests between the Potaro, Essequibo, Demerara, and Berbice Rivers, but individually these rarely consumed more than 0.5 ha, were normally restricted to understory vegetation and litter, and

almost always occurred along logging roads or as a consequence of agriculture activities near settlements. In contrast, no fires were detected during the same period in other areas which lack true savannahs and have fewer roads and communities in the interior, despite experiencing a similar anomalous drop in rainfall.

Most records indicate that forests on well drained sandy soils are the most susceptible to fire. These soils predominate in northeastern Guyana and were often the first to burn during past droughts (Roth 1946, Schultz 1960). Forests in sandy soils are smaller in stature but tend to have a higher ratio of dead to living biomass than those on soils with higher clay content (Whitton 1962). They may also contain up to ten times more standing litter crops (about 72.6 tons/ha) than forests on other soil types because of slower decomposition rates (Cooper 1982). The extreme vertical drainage rapidly depletes soil moisture in the upper strata (Jetten 1994), leaving the main root zone and surface litter devoid of moisture after several rainless weeks, as typically occur during strong ENSO events. The combination of a large standing crop of dead leaf biomass, poor water retention, and poorly formed canopies predisposes these areas to fire. Patches of low-lying scrub vegetation dominated by Muri (Humiria balsamifera) and Dakama (Dimorphandra conjugata)are subject to frequent fire, the latter species dominating after multiple burns through its prodigious coppicing and subterranean sprouting ability, two processes that typify fire-adapted plants in the tropics (Kauffman and Uhl 1990). The fact that higher forests dominated by Wallaba (Eperua spp.) have developed across large tracts of similarly sandy soils on upland plateaus suggests that these areas may be predisposed to fire but less frequently, possibly because their poor water and nutrient retention capacity have in the past made them unsuited for human inhabitation and consequently less subject to ignition events.

From fire surveys conducted by the Guyana Forestry Commission (GFC) in fire prone areas it was found that majority of the fires are man-made (fig. 3). The occurrences of these fires seem centered around areas of human activity. Fires may originate from natural causes also (e.g. lightning strikes, spontaneous combustion of litter), from observation however, it can still be concluded that the majority of forest fires are man-caused. Fire occurrences seemed centered around areas of human activity which is found in Soesdyke- Linden Highway area. Fire caused by man may occur from the following:

1. Careless disposal of cigarette butts, matches, etc.
2. The spread of fire to forest areas from areas where it has been used as a land clearance tool that is, lack of proper precautions and monitoring of an intentional fire.
3. Incendiarism

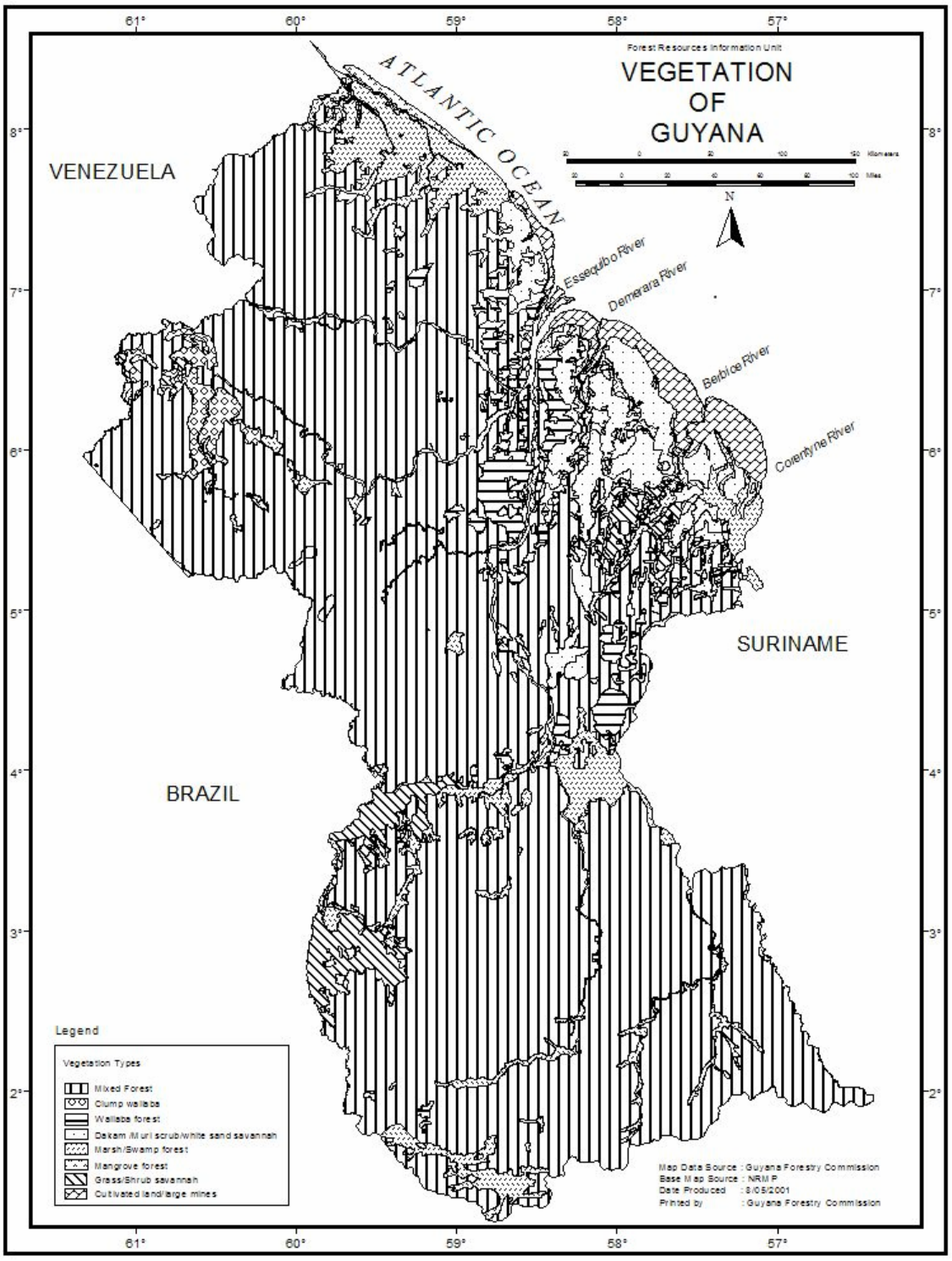

Figure 3 – Map showing areas vulnerable to the element of forest fires in the near interior dry evergreen forest of Guyana.

FIRE EFFECTS ON SPECIES DIVERSITY

Central Guyana is characterized by low-diversity forests composed of tree species with large seeds that are dispersed by rodents, gravity and bats and with strong competitive ability in an environment not prone to frequent catastrophic disturbance (Hammond and Brown 1995). There is no doubt that areas of forest subject to a short fire return decline in diversity as fewer and fewer species are able to recolonize and recruit in sandy areas that have lost most nutrient and moisture conserving capacity. In Guyana this decline leads to nearly pure stands of the legume genera Dimorphandra and Dicymbe (Fanshawe 1952).

FIRE CONTROL

In Guyana, it was found that control measures will be rendered ineffective if public awareness and thinking are not aroused and channeled to produce better protective habits. Massive programs are usually needed to achieve this objective.

Direct control systems are usually devised according to the needs, priorities and available capital, staff, man-power etc. of the regions or countries that are intended to serve. They range from the very simple (e.g. observation towers, crews with hand tools etc.) to the very sophisticated (computerized monitoring of the relevant environmental parameters, spotter plane patrols, water and fire retardant bombers etc.)

Each system derived is also a dynamic organization with constant attempts and innovation aimed at increasing its effectiveness. The more important characteristics of control system include:

1. Speed and efficiency of detection and reporting
2. Speed and efficiency of initial attack component
3. Effectiveness of support communications network
4. Proper modes of access to important key areas
5. Back up logistics and services
6. Clear lines of authority and responsibility, together with proper organization in the field.

In many countries legislation also exists which make it possible to mobilize any or all individuals, private concerns etc. in a given area for fire fighting purposes.

FIRE MANAGEMENT PLAN

In Guyana, a fire management plan is not currently included in the guidelines for forest management planning. A fire management plan is an essential component for the prevention, suppression, and management of fire within forests and adjacent lands. Planning should be on a cooperative basis on national, regional, provincial, and local levels as appropriate.

The current forest legislation has adequately addressed the issue of fire prevention, fire suppression, and fire protection plans. The understanding and enforcement of this legislation are very important in prevention and control of forest fires in Guyana.

CONCLUSION

Fire has been a useful human tool for the millennia but has caused grave economic loss and intolerable harm to the environment. Despite the development of advanced techniques, particularly in fire detection and suppression, the incidence of ecosystem damage from forest fire appears to be increasing.

Recent and historic records suggest several factors that predispose Guyana's forest to fire. Preliminary evidence presented here allows us to reach several tentative conclusions concerning forest fire dynamics in Guyana. (1) The recent 1997-1998 ENSO event was the most severe on record and led to widespread reports of fire. Guyana, however, was unaffected in comparison to adjacent areas in Brazil and Venezuela. Most fires were associated with savannah and human settlements in the north and south of Guyana. (2) There is a casual linkage between ignition source, rainfall failure, and available fuel load. The main ignition sources are savannahs, roads, and river margins. Strong to very strong ENSO events are the main periods when rainfall failure leads to fire in well developed-forest, despite regular, seasonal troughs in rainfall leading to savannah burning. Forests on sandy soils are most susceptible to burning. (3) Available fuel load seems the critical factor limiting the frequency and magnitude of contemporary fire events in Guyana's high forest. Recent roads into uninhabited high forests have led to an increase in ignition incidents, but these have not led to large-scale burning. Undisturbed forests suffer severs physiological drought during strong ENSO events but do not burn if humans are absent. Lightning, another putative ignition source, almost always accompanies heavy rainfall in Guyana. (4) Preliminary evidence suggests that much of Guyana's forest is subject to long fire return times, most likely associated with more significant

decline in regional precipitation patterns. Sandy soils and close proximity to savannah would make these forests particularly prone to fire under more intense and prolonged drought events. (5) Frequent fire on well-drained soils leads to a degraded and species-poor forest over the short term. The long term ecological consequences of fire are less clear. Spatial patterns of canopy trees in Guyana suggest that disturbance promotes diversity. Many species with typical fire-adapted characteristics are most abundant near savannah and human settlements. (6) Guyana's forest appears to be largely fire-proof at present, although charcoal data suggest that they were more fire-prone in the past. Degradation of forests through human activity may alter the current fire-proof status of these forests by introducing higher fuel loads and drier microclimates and by increasing the chance of ignition through human intent or negligence.

Forest management in Guyana needs to account for the increased risk of fire caused by the interaction between ENSO periods and large-scale canopy disruption and to take remedial action to prevent future widespread degradation of Guyana's most precious resource.

RECOMMENDATIONS

Forest fire management strategies should be incorporated in the Guyana Forestry Commission guideline for the preparation of forest management plans.

This fire management strategy should include clear statement of objectives, and should also incorporate information on land tenure, assets threatened, degree of fire risk, fire history, and fire management measures.

Specific guidelines must be incorporated in the GFC's Code of practice to deal with high fire risk during periods of extreme dry weather.

For the successful implementation of any policy to protect tropical forests against fires, it is important that active support is obtained from all sectors of society, particularly NGO's and groups working with government authorities and this must be supported by appropriate legislation.

Stakeholders participation especially concession holders, local communities and Non-governmental organizations should be encouraged by GFC. Appropriate training in fire management and providing equipment and incentives should also be coordinated by GFC.

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