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Examining the effectiveness of ecotourism as a funding source for protected area management in Guyana

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EXAMINING THE EFFECTIVENESS OF ECOTOURISM AS A FUNDING SOURCE FOR PROTECTED AREA MANAGEMENT IN GUYANA

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LIST OF ABBREVIATIONS

IIC – Iwokrama International Center for Rainforest Conservation and Development

IRL – Iwokrama River Lodge and Research Center

PA – Protected area

PPM – Parts per million

IUCN – International Union for the Conservation of Nature

UNEP – United Nations Environmental Programme

WPA – Wilderness Preserve Area

SUA – Sustainable Utilization Area

FAO – United Nations Food and Agriculture Organization

CBET – Community-based ecotourism

CBA - Cost-benefit analysis

EF – Ecological footprint

GHA – Global hectares

ABSTRACT

Protected areas in tropical rainforests serve many important ecosystem services, including carbon sequestration. These areas are often in need of donor or grant funding to operate as governments in tropical forested countries are not always able to provide adequate funds for protection. This paper focuses on the Iwokrama International Center for Rainforest Conservation and Development in the South American country of Guyana, which has had funding issues since the global economic crisis of 2008 and an accompanying shift in donor country financial priorities. Increasing the amount of sustainable ecotourism in the Iwokrama reserve was identified as a potential source for earning enough revenue to offset external funding losses. Current Iwokrama tourism capacity was evaluated and a formula was created to determine the highest possible amount of ecotourism revenue based on sustaining maximum capacity over the course of a calendar year. Findings indicated that sustainable tourism has the potential to contribute US$853,940 in funding if 1,464 guests could be sustained for an entire year (25% of full capacity). This would be an increase of US$598,250 from the 2013 tourism revenue of US$255,690 brought in by 605 tourists (10.33% of full capacity). The increased revenue would be very useful in making up for the 40% drop in grants and donor funding between 2012 and 2013 which caused severe austerity measures to be implemented and nearly resulted in termination of operations. Recommendations for attaining this level of ecotourism were made pertaining to marketing and partnerships with international organizations.

1. INTRODUCTION

1.1 Overview

Figure 1: Tropical rainforests of the world (Source: Amazon Ecology, 2014)

The majority of tropical rainforests across the world are located within countries that would benefit a great deal economically from logging or mining in these areas. However, countries outside of this region that are recognizing the adverse effects of carbon dioxide accumulation in the atmosphere want to keep rainforests intact as a means of carbon sequestration. This presents a serious challenge, where developing countries need to use their forest resources while the world in general would benefit from keeping these forests undisturbed. One tested solution is for more developed countries to pay for areas of rainforest to be protected from development. In theory, developing countries would earn money from the forests that reside within their boundaries without logging or mining, and countries that have become wealthy from development based on fossil fuel emissions would be reducing their carbon footprint by enabling sequestration. One such case where this has occurred is in the Iwokrama reserve in the country of Guyana. The Iwokrama International Center for Rainforest Conservation and Development (IIC)

lies in the heart of the reserve and oversees all conservation work within the protected area. Countries such as Norway have contributed funding for the entire country of Guyana to benefit from scaling back on rainforest development (Lang, 2010; Guiana Shield Facility, 2009), but the IIC is a protected area within the country that requires a certain amount of funding simply to operate. External funding is the major source of operational revenue for the IIC, and with the economic crisis of 2008 and a shift in donor priorities the IIC has faced a declining budget and a serious threat of ceasing operations due to a lack of funding since this occurred.

1.2 Importance of protected areas in tropical rainforests

The reason it is important for the IIC to remain operational is that protected areas in tropical forests are of great value to the entire world. Tropical rainforests cover approximately 2% of the earth's land surface and yet they contain the most biodiversity on the planet with an estimated half of all wildlife and two-thirds of all plant species living in tropical rainforests, many of which have yet to be discovered (Prance, 2013). However, the most important ecosystem service that tropical rainforests provide may be in the form of carbon sequestration. Sequestration is the act of removing carbon dioxide from the atmosphere and storing it in organic material, and tropical rainforests in particular act as great terrestrial carbon sinks to absorb atmospheric carbon dioxide due to forest density and year-round photosynthesis. It is estimated that the Amazon Rainforest alone absorbs roughly 2 billion tons of carbon per year (Dombro, 2010).

Atmospheric CO_2 is most commonly measured in parts per million (ppm), and the current net rate of CO_2 emissions is estimated to be increasing by roughly 2 ppm per year (Wennersten, 2014). The actual rate of emissions is higher than the net rate which takes into consideration

terrestrial and aquatic sequestration amount of carbon sequestration, including the rough equivalent of 1.7ppm per year of carbon sequestration within the greater Amazon Rainforest (Dombro, 2010). The current atmospheric CO_2 concentration is nearing 400 ppm (Wennersten, 2014; Riahi, 2013), and climate scientists are divided between what the acceptable levels should be to avoid serious and potentially irreversible climatic effects. These acceptable levels generally range from 350ppm to 450ppm (Wennersten, 2014; Riahi, 2013; Syri, 2008). The temperature increase that is considered to be acceptable before irreversible effects are felt is thought to be between 1.5 – 4.5 degrees Celsius, depending on varying models (van der Zwaan, 2006). Recognizing the urgency needed to prevent a 1.5 degree increase in global temperatures is paramount because even if stagnation occurred for burning rates of fossil fuels roughly 2 ppm would still be added annually to the atmospheric level, climbing closer to 450 ppm. That is why drastic measures have been called for to reduce CO_2 emissions rather than simply stop increasing the rate of emissions. The importance of keeping rainforests intact is evident considering that deforestation had been occurring at an alarming rate but has improved slightly in recent years. 29,059 km^2 of forests were cleared in Brazil alone during 1995, although rates have dropped significantly since 2004 with only 4,571 km^2 of forests being cleared during 2012 (Eugenio, 2014). Deforestation emits CO_2 while also removing organic material that was being used to take in and store carbon. Protected areas within tropical rainforests are extremely important in the aim of reducing overall annual CO_2 emissions, especially since intact rainforests sequester more carbon than newly planted trees. It is also important to have protected areas in tropical rainforests to maintain a proper water cycle, prevent soil erosion, and protect species biodiversity.

1.3 Research statement

The purpose of this paper is to address the feasibility of sustainable tourism as a major source of funding for the Iwokrama International Center for Rainforest Conservation and Development. This is being addressed because the IIC needs funding to operate and depending on donor and grant funding creates vulnerability problems. It is important that the IIC meets its funding needs every year because over 350,000 hectares of intact rainforest are found within the protected area. A loss of funding would threaten the protection of this area and an increase in tourism has been identified as a potential strategy to reduce dependence on donor funding and make the IIC more self-sufficient. The main research objective of this study is to assess the funding potential that sustainable tourism could generate for the IIC based on current tourism infrastructure and capacity, along with an assessment of actual funding and expenditure over the previous two years.

2. LITERATURE REVIEW

2.1 Protected areas and conservation

2.1.1 History of protected areas

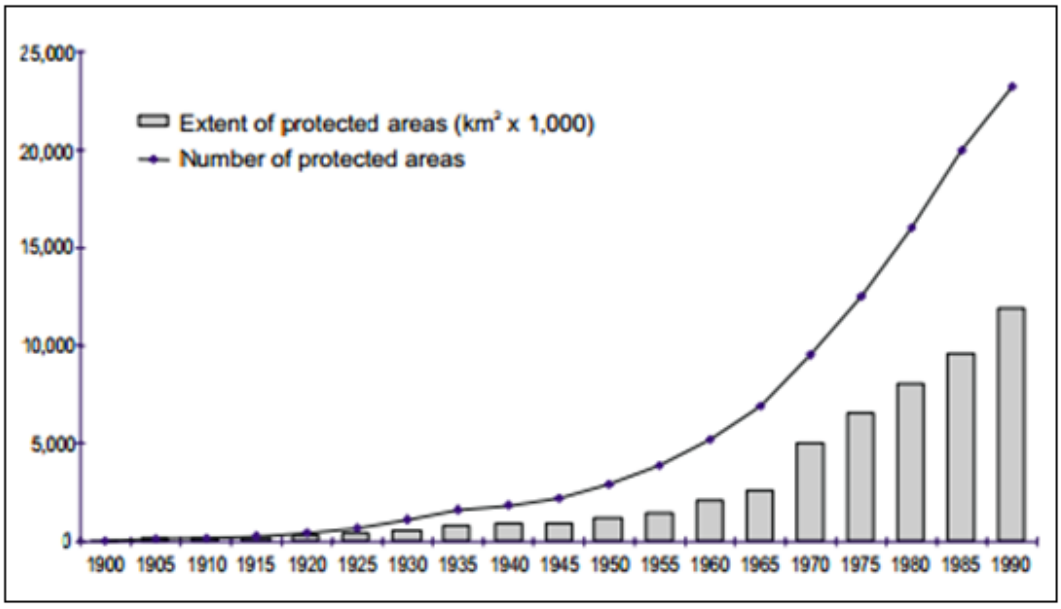
The history of protected areas dates back at least two thousand years, and possibly longer (Eagles, 2002). Areas of land were set aside for the protection of nature and natural resources in India before the start of the common era, and areas were protected as hunting grounds for the European elite class over one thousand years ago (Holdgate, 1999). Protected areas in modern times have developed in large part from the Renaissance era land that was set aside for kings and other national rulers, mainly as royal hunting reserves (Eagles, 2002). These areas slowly became open for public use and eventually provided a basis for community involvement and tourism. By the 1800's protected areas were becoming more officially recognized in national law in several countries. A portion of present day Yosemite National Park was granted protected status in 1864, but the first official national park in the world was created in 1872 with the creation of Yellowstone National Park in the Midwest region of the United States (Curry, 2009). The first national park outside of the United States was created in 1885 in the Canadian Rocky Mountains with the official protection of the hot springs in the Bow Valley region (McNamee, 1993). This area, later named Banff National Park, was effectively "reserved and set aside as a public park and pleasure ground for the benefit, advantage, and enjoyment of the people of Canada" according to legislation of the Canada National Parks Act (2000). The creation of Banff National Park coincided with the completion of the Canadian Pacific Railway, and the park was seen as an excellent opportunity to stimulate passenger growth through tourism. This is an important fact because it shows the strong link between tourism and protected areas since their

modern day inception, and it is interesting to note that Banff remains one of Canada's most visited tourist destinations with over 3 million visitors each year (Ellis, 2012).

Eagles (2002) identifies three common features that all of the aforementioned national parks share. First, they were all created by government action. Second, the areas that were set aside were generally large and contained relatively natural environments. Third, the parks were made available to all people. This again shows an important link between tourism and protected areas from the onset of the modern national parks. Protected areas, community development, and tourism are thought to each benefit from proper management of the others (Scheyvens, 1999; Wunder, 2001).

While the 19th century saw the birth of modern protected areas and accompanying management framework in the relatively new nations of Canada, Australia, New Zealand, South Africa, and the United States, the 20th century saw these ideas spread around the world. Between 1900 and 1999 nearly every country passed protected area legislation and designated sites for protection (Chape, 2003). By the beginning of the 21st century, 44,000 sites met the International Union for Conservation of Nature (IUCN) definition of a protected area (see *Section 2.1.2*) and the total area of these sites combined covered nearly 10% of the total land surface of the planet with additional sites being designated every year (Chape, 2003).

Figure 2: Amount of protected areas from 1900 – 1990 (Source: IUCN, 1994)



During the 20th century the thinking behind protected area management developed alongside the rapidly increasing number of protected areas. Advances in ecology in the 1960's led to a broader understanding of the need for a systematic approach to resource planning and management, seen in the creation of the IUCN protected management classification system which sets biodiversity conservation as the starting point, while systematically recognizing other areas of importance such as recreation, tourism, and natural resource management (IUCN, 1994). Economic importance of protected areas has also become more pronounced, with the impact of tourism contributing to community, regional, and national economic gain depending on the area (Wunder, 2000). There is also an increasing emphasis on the economic importance that protected areas provide through ecosystem services such as water supply, flood control, and mitigation of climate change, although the focus of this paper is concentrated on the value of tourism as a means to financially support a specific protected area in the South American rainforest.

2.1.2 IUCN categories for protected areas

An internationally defined set of management categories for protected areas was developed in 1994 with the IUCN 'Guidelines for applying protected area management categories' document. There are six categories, with the first category split into two. The categories are listed in the table below along with the accompanying definition and primary objective of each category.

Table 1: IUCN protected area categories (Source: IUCN, 1994)

Category	Title	Definition	Primary Objective
Ia	Strict nature reserve	"Strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring."	"To conserve regionally, nationally or globally outstanding ecosystems, species (occurrences or aggregations) and/or geodiversity features: these attributes will have been formed mostly or entirely by non-human forces and will be degraded or destroyed when subjected to all but very light human impact."
Ib	Wilderness area	"Protected areas are usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition."	"To protect the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate, so that current and future generations have the opportunity to experience such areas."
II	National park	"Protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities."	"To protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation."

III	Natural monument or feature	"Protected areas are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, or geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value."	"To protect specific outstanding natural features and their associated biodiversity and habitats."
IV	Habitat/species management area	"Protected areas aim to protect particular species or habitats and management reflects this priority. Many category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category."	"To maintain, conserve and restore species and habitats."
V	Protected landscape/ seascape	"A protected area where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values."	"To protect and sustain important landscapes/seascapes and the associated nature conservation and other values created by interactions with humans through traditional management practices."
VI	Protected area with sustainable use of natural resources	"Protected areas are generally large, with much of the area in a more-or-less natural condition and where a proportion is under sustainable natural resource management and where low-level use of natural resources compatible with nature conservation is seen as one of the main aims of the area."	"To protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial."

The Iwokrama reserve is designated as a category IV *habitat/species management area* according to the World Database on Protected Areas (WDPA). This is not an easily apparent classification as the Iwokrama reserve is split into a Wilderness Preserve (WP) and Sustainable Utilization Area (SUA), both of which seem to fit better within category Ia and VI, respectively. Furthermore, tourism and recreation as a management objective of a category IV protected area is listed as a "potentially applicable objective" rather than a primary or even secondary objective according to the IUCN management objectives framework (IUCN, 1994). Tourism is a major focus area for the Iwokrama International Center but it should be no surprise that the IIC does

not fit the exact mold of a category IV protected area because it combines wilderness preservation and sustainable resource use to form a habitat management area "to maintain, conserve, and restore species and habitat" (IUCN, 1994). This may seem somewhat confusing because the ultimate objective of the Iwokrama International Center is to mitigate climate change through preservation of carbon storing trees, but there is no category designated for ecosystem services, and considering Iwokrama cannot be classified as a split between categories, a category IV classification does indeed make the most sense. In comparison, the Galapagos Islands are also a category IV protected area (Chape, 2003).

2.2 Development in tropical rainforests

It has been established that tropical rainforests are valuable on a global scale if left intact, but extraction of natural resources within these forests results in opportunities for significant economic advancement. This is the essence of why protected areas are needed. Industries that benefit from harvesting rainforest resources have the potential to destroy or degrade forests even with laws preventing excess degradation, such as clear-cutting, in some areas that are not even protected (Ros-Tonen, 2008). Even with the continued emergence of protected areas and laws regulating development of forested areas, over one-fifth of all tropical forests have been cleared since 1960 (Arcand, 2008). Listed below are the immediate and underlying causes of deforestation and forest degradation during this time period that continue through the present.

2.2.1 Proximate causes of deforestation

Logging

Cutting down trees for lumber is a very apparent form of rainforest destruction and it the most basic use of natural resources in a forested area. There is always a demand for wood and wood products, and the removal of timber results in profits for companies that exploit this. There are two main types of large-scale logging: clear cutting and selective cutting. In clear cutting entire tracts of forested land are cut down leaving empty gaps in forests of varying sizes. This method of logging was common in the Amazon in previous years, and is still prevalent in the vast Canadian hinterland (Sist, 2007; Roberts, 2004). Selective logging is a process where mature trees are selected for their timber and only these trees are taken, allowing the surrounding trees to continue growing and leaving the forest relatively gap-free. This method requires more meticulous surveying to identify timber candidates and there is less yield. In some cases this method is sustainable and the surrounding forest is allowed to regrow, but in many cases the heavy machinery used to enter the forest and bring out the selected trees results in other trees being felled as a by-product and leads to more compact and less fertile soil (Roberts, 2004). A study was conducted within the Iwokrama Forest on the impact of the IIC sustainable timber harvesting program by quantifying vertebrate species in areas subjected to reduced impact logging (RIL) and in nearby areas that were undisturbed. Line-transect censuses for vertebrate identification were set up at three forest sites where RIL had taken place and also at three adjacent sites that were not subjected to RIL. The study found that there was in fact a minimal difference in the amount and diversity of birds, bats, and mammals in the timber harvested areas when compared to the undisturbed areas (Bicknell, 2010).

Mining

Mining is a particularly destructive practice as well as a very lucrative industry in Guyana and the surrounding forests of northeastern South America. Direct forest loss is attributable to large scale mining, and, unlike with logging and agriculture, the forest impacted by mining is incapable of proper regeneration. This is because intense machine use compacts soil, making it less fertile, and mining practices cause severe air, land, and water pollution (Miserendino, 2013; Dunker, 1995). Mining also affects the physical properties of soil, including texture and bulk density which has been shown to increase by up to 54% compared to undisturbed soils in the same area (Shrestha, 2011). The impact of mining is much more pronounced than logging or any other industry that capitalizes on natural resources within rainforests for these reasons.

There are also many social and economic issues surrounding the mining sector in tropical rainforests, including Guyana (Thomas-Caesar, 2013). An uneducated person in this country is capable of making a very generous living by going into the field and working with gold mining companies. There are few, if any, other industries in Guyana that afford someone lacking education or experience the opportunity to earn a comparable salary to that of mining. There are also social aspects that may lead to a desire to enter the mining profession. Social status associated with a high salary and an urban disconnect from nature are two possible contributors for individuals to overlook the environmental damages caused by mining and join the industry, although without solid data to support these claims it is only speculation. The most serious issue facing the mining sector in Guyana is malaria as the majority of cases within the country are concentrated in mining camps in the hinterland (Jagessar, 2014).

Agriculture

There are three forms of agriculture that impact tropical rainforests: shifting cultivation, cash crops, and cattle ranching (Rudel, 2002; Hecht, 1988). Shifting cultivation refers to using plots of land temporarily and then moving on to another plot while the former regenerates. The plots of land used for this type of agriculture are often cleared from forested areas and are abandoned after soil loses fertility. Lucrative cash crops are responsible for clear cutting of forested areas to provide land for production of internationally valuable crops grown for export, which usually results in quick profits (Colchester, 1993). However, due to the makeup of rainforest soil, the productivity of cash crops declines rapidly after a few years, especially if plantations are unsustainable monoculture crops. This leads to a compounding problem of clearing land for agriculture which eventually becomes infertile; cash crop farmers must then move on and seek different land to use, continuing a cycle of deforestation. Finally, cattle ranching is responsible for clearing vast amounts of forested land for increased beef demand, especially in Brazil where the cattle herd grew from 147 million in 1990 to over 200 million in 2007 (Bowman, 2012). Ranching not only clears trees, but the soil underfoot of the cattle becomes compacted and some areas of high usage become bare of any vegetation due to trampling. This affects future fertility as well due to less soil organic carbon (SOC) levels and lower levels of soil microbes (Hiltbrunner, 2012). There is promising evidence in Brazil that increasing beef demand is not driving deforestation at the same rate as the expansion of the beef industry (Dávalos, 2014; Martha Jr., 2012). Current pastureland productivity in Brazil is at 32 – 34% of potential and increasing, with a target productivity rate of 49 – 52% that would meet rising demand without clearing any more land (Strassburg, 2014). At this target up to 18 million hectares could be

spared for forest restoration and up to 14.3 Gt of CO_2 equivalent could be mitigated against deforestation projections at the 32 – 34% pastureland productivity level (Strassburg, 2014).

Fuelwood

Between 1.5 and 2 billion people rely on fuelwood for cooking and heating, according to the United Nations Food and Agriculture Organization (FAO, 2002). Small-scale timber harvesting for this type of fuel results in long term overcutting of forests, particularly in drier regions of the tropics (FAO, 2002). A clear example of visible destruction due to fuelwood can be seen in Haiti, where the FAO reports only 4% of land cover remains forested. 85% of the population relies on fuelwood and 3.3 million cubic meters of fuelwood was harvested per year through the turn of the century (CFET, 1997). However, a recent study published in the International Journal of Applied Earth Observation and Geoinformation utilizes multiple layers of Landsat imagery and land cover datasets to challenge the FAO figure of 4% forest cover in Haiti by suggesting the true figure is closer to 32% (Churches, 2014). The study details patchy forest cover due to small scale fuel wood deforestation as having an impact on previous forest cover estimates. The implications of a 28% discrepancy between high and low forest land cover values are intriguing. If the forest cover percentage of Haiti is indeed higher than previously thought then perhaps there may be other areas with more forest cover than currently stated, although it may be wise to apply the precautionary principle in this instance.

Dams

Hydro-electric dams are responsible for deforestation as a point source during construction, and entire ecosystems are affected by the presence of functioning dams after construction has been completed. Aside from the thousands of hectares of trees that were cleared to build large-scale dams in Brazil, Paraguay, and elsewhere in tropical rainforests, many groups of people have been uprooted due to these dams. Waterborne disease rates can increase rapidly under certain conditions created by damming some of these rivers (Sow, 2002), and ecosystems are affected at the micro and macro levels. Dams trap silt, which holds back valuable nutrients, and reduced silt is a component of coastal erosion (Myers, 1992). Irrigation from dams also has the potential to lead to further environmental degradation.

The main reason dams are so important, especially in river abundant countries such as Brazil, is that a single large dam can provide a great deal of electricity with no emissions. The Itaipu Dam located on the Parana River near the Brazil-Paraguay border is the world's largest hydropower plant with an installed power of 12,600 MW (de Souza, 2008). Brazil is a country with nearly 200 million people and meeting electricity needs for this population is accomplished with hydropower providing 81.7% of the country's electricity supply (de Souza, 2008). Given the economic and energy security advantages of obtaining this form of energy, environmental and ecosystem impacts caused by large dams are often overlooked due to the opportunity cost.

Trans-migration schemes

Encouragement for relocation and colonisation of rainforest areas has been employed by several governments as a means to alleviate poverty in developing countries while also exploiting forests

for resources (Wunder, 2001). However, according to Colchester and Lohmann, these schemes have failed and have only led to deforestation and damage to indigenous peoples' culture and way of life (1993). The Transmigrasi Program in Indonesia that began in 1974 is "believed to be the greatest cause of forest loss in Indonesia, directly causing an average annual loss of 200,000 hectares" between 1974 and 1992 (Colchester, 1993). No such schemes have been implemented in Guyana, with nearly 90% of the population living along the coastline and very little non-indigenous habitation in the forested interior (Thomas-Caesar, 2013).

Tourism

The creation of national parks and protected areas was intended to protect natural areas while allowing people to visit, and for the most part this goal has been achieved. However, due to the fact that tourism is allowed and usually promoted in these areas, it can be damaging and lead directly to deforestation if not properly managed. Proper management of protected areas is crucial in order to utilize tourism as a positive activity rather than a destructive one. Tourism may be utilized as a revenue source to fund protected areas if there is inadequate funding allocated for preservation of forests, but these areas are often open to the public without adequately developed and implemented management plans which can result in environmental degradation (Gössling, 2002). Ecotourism, or sustainable tourism, involves education of public visitors and results in far less ecological damage if managed properly (Scheyvens, 1999). However, some authors claim sustainable tourism is not really attainable, and ecotourism still has negative environmental consequences (Kiss, 2004; Orams, 1995). If sustainable tourism is possible it would still be extremely difficult to achieve without properly organized and well developed management plans. There are many environmental benefits from tourism if it is

managed properly, but degradation of forests may occur in the absence of proper management, or, according to some authors, even if it is present. *Sections 2.3, 2.4,* and *2.5* describe the benefits and risks of protected area tourism in greater detail.

2.2.2 Driving forces of deforestation

Overconsumption

There are several underlying causes that lead to the act of deforestation, one of which is overconsumption. The World Rainforest Movement stated that "deforestation is the inevitable result of the current social and economic policies being carried out in the name of development" (1990). Demand for lumber drives commercial logging, increasing demand of certain foods drives cash crops, increasing demand for beef and dairy drives cattle ranching, the need for electricity keeps dams operational, and increasing tourism leads to degradation if not properly managed.

The complicated nature of overconsumption can also be seen by looking at where the problem originates. It is rare that consumption levels are extremely high in developing countries where most of the tropical forested land exists (WRM, 1990). Harrison Ngau, winner of the Goldman Environment Award in 1990, claims "the roots of the problem of deforestation and waste of resources are located in the industrialised countries, where most of our resources, such as tropical timber, end up. The rich nations with one quarter of the world's population consume four-fifths of the world's resources. It is the throw away culture of the industrialised countries now advertised in and forced on to the Third World countries that is leading to the throwing away of the world. Such so-called progress leads to destruction and despair" (1990). Guyana provides an

excellent exemplification of this problem with most timber being exported to more developed countries, especially China which owns and operates major timber operations in the Guyanese forest (Thomas-Caesar, 2013).

Population growth

Increasing population is another major driver of deforestation due to the amount of resources necessitated by more people. Population growth is highest in less developed countries, which have far less total primary energy consumption rates per capita than more developed countries (EIA, 2014). However, this still leads to degradation from activities such as small-scale fuelwood logging and increased land clearance for cash crops. Furthermore, although population growth is slower in more industrialized countries, the fact that an average individual from any of these nations consumes up to sixty times as much of the world's resources than an average individual in a less industrialized country (EIA, 2014) shows that even modest increases in population will have an effect on resource depletion and ultimately deforestation. Pahari and Murai (1999) suggest that population is the most significant factor contributing to global deforestation over other factors such as GNP, government policy, and land ownership, among others. This suggestion is the result of several correlation analyses between deforestation and the aforementioned factors where the "correlation between the logarithm of population density and the cumulative forest loss computed from potential natural land cover and actual land cover was most significant" (Pahari, 1999). Research has also shown a clear relationship between human population size and biodiversity threats (McKee, 2004).

Industrial exploitation

Industrial exploitation is tied in with overconsumption. Wealthier nations that over-consume and cannot meet demand based on their own resources turn to less developed countries to satisfy their commodity needs. Emphasis is placed on maximising exports and revenue for short term gain (Wunder, 1999; Rudel, 2002; Roberts, 2004). The problem is then compounded by the low price of most goods coming out of tropical forested regions in comparison to goods that come from more industrialized areas. Low commodity prices coupled with financial prosperity of consumer nations drives a cycle which initiates overconsumption and degradation of tropical rainforests (WRM. 1990).

Debt burden

Tropical rainforests are located almost entirely within developing countries, with very few exceptions such as parts of Australia and dependant territories such as French Guiana. Governments of forested nations located within the tropics often face large international debt, some of which is the result of development agency loans given out in the 1970's and 1980's that most countries are still struggling to repay due to nearly insurmountable interest accumulation (Orams, 1995). A solution seen by many government leaders has been to exploit resource rich rainforests for much needed revenue. Increasing debt then leads to increasing exploitation of resources, and deforestation and degradation intensifies. This should theoretically decrease the debt burden even if it is at the expense of losing tracts of forest, but in reality many outside logging and mining companies profit from the exploitation and host countries do not get to reap the full value of benefits from the forests they are losing. This underscores the notion that there

are still unbalanced relationships between developed countries with power and developing countries that have been at a disadvantage for decades or even centuries.

Poverty

Poverty is responsible for much of the damage to tropical rainforests, but poverty in developing countries is also fostered due to exploitation from developed economies (WRM, 1990). Development is often spoken of as the solution to poverty (Wunder, 2001), but in reality it does not always help those that need to benefit from it most (Zwane, 2007). Increased development leads to increased environmental degradation while those responsible benefit financially more than the impoverished (Wunder, 2001). If this logic is followed more development will occur to attempt to alleviate poverty while not actually addressing the problem, thus causing a cycle of perpetually increasing degradation.

2.2.3 Addressing the causes that are driving deforestation

Both the proximate and ultimate driving forces behind deforestation and forest degradation go far beyond simple economic advancement opportunities. There is a complex colonial legacy in many tropical forested regions and socio-economic factors that combine to make a solution to the problem very difficult to achieve. Some authors choose to focus on the immediate causes and effects of deforestation and tropical forest degradation while others choose to focus on the underlying reasons for these issues. There is an abundance of literature written about the environmental impacts of RIL, mining and ranching impacts on soil, agriculture and land clearing, tourism costs, and other forms of development. There is also much informative

literature written about the driving forces of development and their relationship to environmental degradation, such as Zwane (2007) suggesting that a small increase in household income for the lowest earners in the country is unlikely to reduce deforestation. It is of the utmost importance to address the ultimate driving forces because a failure to address the underlying causes will result in allowing the proximate causes to endure. The Iwokrama International Center for Rainforest Conservation and Development attempts to address both the immediate and underlying causes of degradation by bringing together forest research on the impacts of RIL, eliminating mining, and making tourism as ecologically friendly as possible, while at the same time promoting less consumption, attempting to reduce poverty through community building, and helping relieve Guyana's debt burden by bringing in international aid for the IIC.

2.3 Benefits of Sustainable tourism in protected areas

Tourism in protected areas has benefits and drawbacks, and the more sustainable tourism activities are within these areas, the more benefits can be realized. Protected areas are set up to preserve one or more aspects of the environment, including, but limited to, natural landscapes, biodiversity, and cultural heritage. Tourists visit these areas to understand and appreciate the values for which they were established and for the personal benefits these areas offer. The better managed a protected area is, the more tourism can fall in line with the values and goals of the area and produce benefits. The United Nations Environment Programme (UNEP) describes three main benefits that tourism can bring to protected areas and the countries they are located within: enhancing economic opportunity, protecting natural and cultural heritage, and advancing the quality of life for all concerned (2002).

2.3.1 Enhancing economic opportunity

Tourism in protected areas has the potential to increase economic and financial well-being for several stakeholders involved. Tourism funding enhances economic opportunity for locals, but also enhances economic opportunity for protected area management, and in some cases for the country where the protected area is located. On a local level, tourism in protected areas helps create jobs for residents while increasing income and improving living standards (Wunder, 2000). Local governments also benefit from tax revenues brought in by visitors. Increased funding for protected areas brought in by tourists is a benefit for a wide range of people, from national governments that typically provide a large portion of funding, to residents in faraway countries that benefit from the existence value of areas set aside to preserve forested land.

Tourism has the potential to be a major funding source for preservation and conservation, especially with inconsistent donor funding threatening many operational budgets of protected areas, including the Iwokrama reserve. A rapidly growing sustainable ecotourism industry in developing countries has proved to be an increasingly important source of foreign exchange inflows. Nature tourism is an important tool for generating employment and income in underdeveloped, biodiversity-rich regions because it requires comparatively small investments (Wunder, 2000).

2.3.2 Protecting natural and cultural heritage

A very important benefit of tourism in protected areas is the protection of natural and cultural heritage that results from visitors using these areas in a sustainable manner. Tourism helps fund protection of designated natural areas, or at least helps to fund projects within them, and this

leads to better protected ecological processes and watersheds, increased biodiversity conservation, and protected resources which otherwise have no perceived value to residents or represent a cost rather than a benefit (Eagles, 2002).

Tourism also directly helps preserve cultural heritage while transmitting conservation values through education and interpretation which helps communicate values of natural heritage and cultural inheritance to visitors and residents, theoretically resulting in future generations of responsible consumers. Conservationists look to nature tourism as a potential 'win-win' strategy of sustainable development, where tourist spending constitutes a much-needed instrument for capitalizing on biodiversity and natural site preservation (Wunder, 2000). Tourism also ensures increased research and development of proper environmental practices and management systems that influence the operation of travel and tourism businesses, as well as visitor behaviour at destinations (Eagles, 2002). The result is a protected cultural heritage for locals that can be shared with visitors, and protection of natural heritage for all.

2.3.3 Enhancing quality of life

Tourism in protected areas can have a positive impact on local living standards due to increased economic opportunities, but tourism also has the potential to enhance the quality of life for locals and visitors alike without a direct link to financial gain. Tourism helps promote aesthetic, spiritual, and other values related to well-being in areas where nature is at the forefront. Tourism also supports environmental education for visitors as well as for locals, and an increased overall education for locals often results as a positive by-product (Eagles, 2002). If visitors and locals make an effort to interact with one another an improved intercultural understanding is usually a

result. Interaction also encourages locals to learn foreign languages of tourists and encourages visitors to learn the local language. Empowerment of local communities and betterment of the quality of life for all are possible positive results from tourism in protected areas.

2.4 Potential risks of tourism in protected areas

Along with all the benefits that tourism provides in protected areas, negative consequences do occur as well. It is up to management in these areas to (1) provide effective regulations and planning to minimise the impact of visitors on the environment, (2) provide effective measures to ensure visitors are using the areas in the most sustainable manner, and (3) weigh the impact of the negative effects against the positive benefits and determine what level is acceptable; stakeholder involvement is important in determining this level as well. Negative effects of tourism in protected areas can be broken down into three types of costs: financial/economic, socio-cultural, and environmental.

While tourism brings in revenue for protected areas, in some cases it can have a negative effect as visitor numbers increase. With increasing visitor numbers comes increasing demands for services such as policing, fire, safety, and healthcare. Tourism expansion may lead to increases in foreign ownership of properties and businesses either within or surrounding protected areas, which can be an economic problem for local residents if ownership leaves the community. More visitors also means more costs for the protected area agency as additional personnel and facilities will be in demand. Couple that financial stress with the possibility of a decline in tourism after investing the money to support more tourists and it becomes a serious risk.

Social costs are also prevalent in some cases as increasing numbers of tourists may disturb community activities and take up space for recreational or service purposes that would have previously been available for local residents. Eagles (2002) adds that "poorly planned tourism development can lead to increased congestion, littering, vandalism, and crime. Governments may exacerbate these problems if they put short-term economic considerations before all else, for example by building inappropriate infrastructure or failing to establish the needs of local communities. When this happens, the local support for the protected area may be put at risk" (2002).

Lastly, environmental costs may be the most detrimental and counterproductive negative effects of tourism in protected areas. Tourism, like most other forms of development, will always produce some form of impact on the environment, even at low intensity levels and even if proper management planning is in place. However, it is extremely important to consider what environmental impacts would have occurred in the area in place of tourism if another form of development were to take place in the region, or even if the area was left unprotected and visitors had little or no regulations regarding environmental use. In this case, impacts due to tourism are likely less prevalent and less intense compared to another form of development, or if they were left unprotected. Thus, proper management and meticulous planning to ensure minimal environmental costs due to tourism in protected areas is essential.

Table 2: Summary of costs associated with tourism in protected areas (Adapted from: Brown, 2001)

Costs	Description
Direct costs	Facilities construction, maintenance, administration, etc.
Environmental degradation	Soil erosion, water pollution, disturbance of wildlife, etc. due to use of site
Congestion	Additional user imposes cost on all other users by reducing solitude
Reduced welfare of locals	Negative impact on locals due to congestion

2.5 Weighing costs and benefits of ecotourism

The effectiveness of ecotourism as a means to achieve biodiversity and forest conservation must be addressed on a case by case basis. A case study of several community-based ecotourism (CBET) initiatives revealed that many CBET projects listed success stories that in actuality involve very little change in existing land-use practices, provide only a slight supplement to local livelihoods, and remain dependant on external funding to operate (Kiss, 2004). However, there are identifiable conditions where CBET or larger forms of ecotourism are likely to be effective, efficient, and sustainable.

Some CBET projects have claimed success in motivating community members to reduce the exploitation of wild plants and animals, limiting poaching, and setting aside parts of farmland for conservation; but CBET projects typically fall short when it comes to protecting a wide range of ecosystems, maintaining natural habitats, and maintaining large conservation areas (Kiss, 2004). Larger ecotourism ventures may be able to protect and maintain these areas, but the larger the venture the greater the risk for environmental costs related to tourism. Kiss (2004) claims that there is an abundance of literature linking CBET projects with poverty reduction and economic

development that is “full of claims but short on data and quantitative analysis,” but Wunder (2001) claims that protected areas have the potential for providing noticeable poverty alleviation and biodiversity conservation. Another line of thinking was proposed by Gössling (1999) who argues that ecotourism contributes to safeguarding biodiversity and ecosystem functions in developing countries regardless if strict ecotourism requirements are met because a cost-benefit analysis of tropical rainforests concludes that non-use values outweigh conventional use values. In this view tourism is seen as more desirable than clear-cutting forests even after taking into account the environmental damage costs that were integrated into Gössling’s CBA calculations (1999).

One well documented method of weighing the costs and benefits of ecotourism against the ultimate goal of conservation is an ecological footprint analysis (Hunter, 2007; Gössling, 2002). The ecological footprint (EF) provides an estimate of demands on the biophysical productivity and waste assimilation capacity of nature imposed by human lifestyle on the environment measured in global hectares (gha) per year (Hunter, 2007). The EF measurement is a very useful and applicable measure because it takes into account the impact of the act of travelling itself, of which more than 90% is a contribution to climate change (Gössling, 2000). Prior to the suggestion of using ecological footprint analysis to measure comprehensive impacts of tourism, environmental impact assessments had also been suggested, along with conducting research in the carrying capacity concept and the limits of acceptable change (Gössling, 2002). These concepts do not take into consideration the global impact of transportation and the physical act of travel, however, and are therefore less effective than using EF measurements for a full ecotourism assessment.

Gross tourism EF is calculated by determining the ecological footprint per tourist in the transit zone, which is during the transportation phase of the tourist visit, and combining it with the ecological footprint per tourist in the destination area, which is during the leisure portion of the tourist visit. Calculating the gross tourism EF per tourist requires several measurements that must be obtained, including total roundtrip flight distance (km), energy use (MJ) per tourist, and equivalent forest land area (ha) used per tourist (Hunter, 2007). Energy use is found by multiplying flight distance by an energy intensity factor of 1.75-2.75 MJ/km, depending on airplane model and whether it is a long-haul or short-haul flight. The result must be multiplied by a factor of 2.7 (Gössling, 2002) to account for emissions other than CO_2 emitted at altitude (IPCC, 1999; Schumann, 1994) and then multiplied by the appropriate 'equivalence factor' to arrive at a final estimate of the transit zone EF per tourist in gha/year. The destination area EF can be calculated using host country average per capita EF with a reduced annualized value according to length of stay (Hunter, 2007). Net EF per tourist is calculated by subtracting the average per capita EF from the home country of the tourist from the gross EF for the length of the trip. Management in protected areas can calculate average EF values for tourists from target demographic areas and weigh the environmental costs of tourism against the economic benefits to determine the effectiveness of tourism in assisting in preservation.

2.6 Creating a more apposite form of ecotourism in protected areas

Ecotourism or sustainable tourism in protected areas is largely thought of as being more beneficial than tourism in unprotected areas, but is sustainable tourism in the strict sense possible? It is clear that the effects of tourism need to be held below critical threshold levels in order to be sustainable and in order to stay below these levels they must be quantified (Gössling,

2005). Quantifying and measuring impacts of tourism against environmental thresholds has been a major goal of tourism studies. The result has been conflicting views on whether the current understanding and implementation of ecotourism practices are effective. Orams (1995) suggests that the success of ecotourism depends on the definition of ecotourism; if viewed from a low human responsibility standpoint all tourism can be considered ecotourism whereas from a high human responsibility standpoint ecotourism is impossible. These are extreme opposite viewpoints on the term, but both are very important to keep in mind when assessing the suitability of ecotourism in protected areas for the future. It would appear that, despite the notion of impossibility, it would be more beneficial to move towards a high human responsibility role in future tourism planning. It may be impossible to reach truly sustainable tourism by this definition, but the active contribution to protect natural environments from the effects of tourism is much more effective than the passive minimization of damage from a low human responsibility role. Quantifying the eco-efficiency of tourism, as proposed by Gössling (2005), would also help minimize environmental impacts of tourism by focusing on less efficient areas and making improvements for the future, most notably in the form of energy use efficiency for travel. Tourism is one of the largest industries in the world, and ecotourism has become more than a buzzword in recent years. It will be interesting to witness the extent of sustainable tourism in the future based on present changes in the field taking place.

3. OVERVIEW OF STUDY AREA: IWOKRAMA RESERVE IN GUYANA

3.1 Location and description of study area

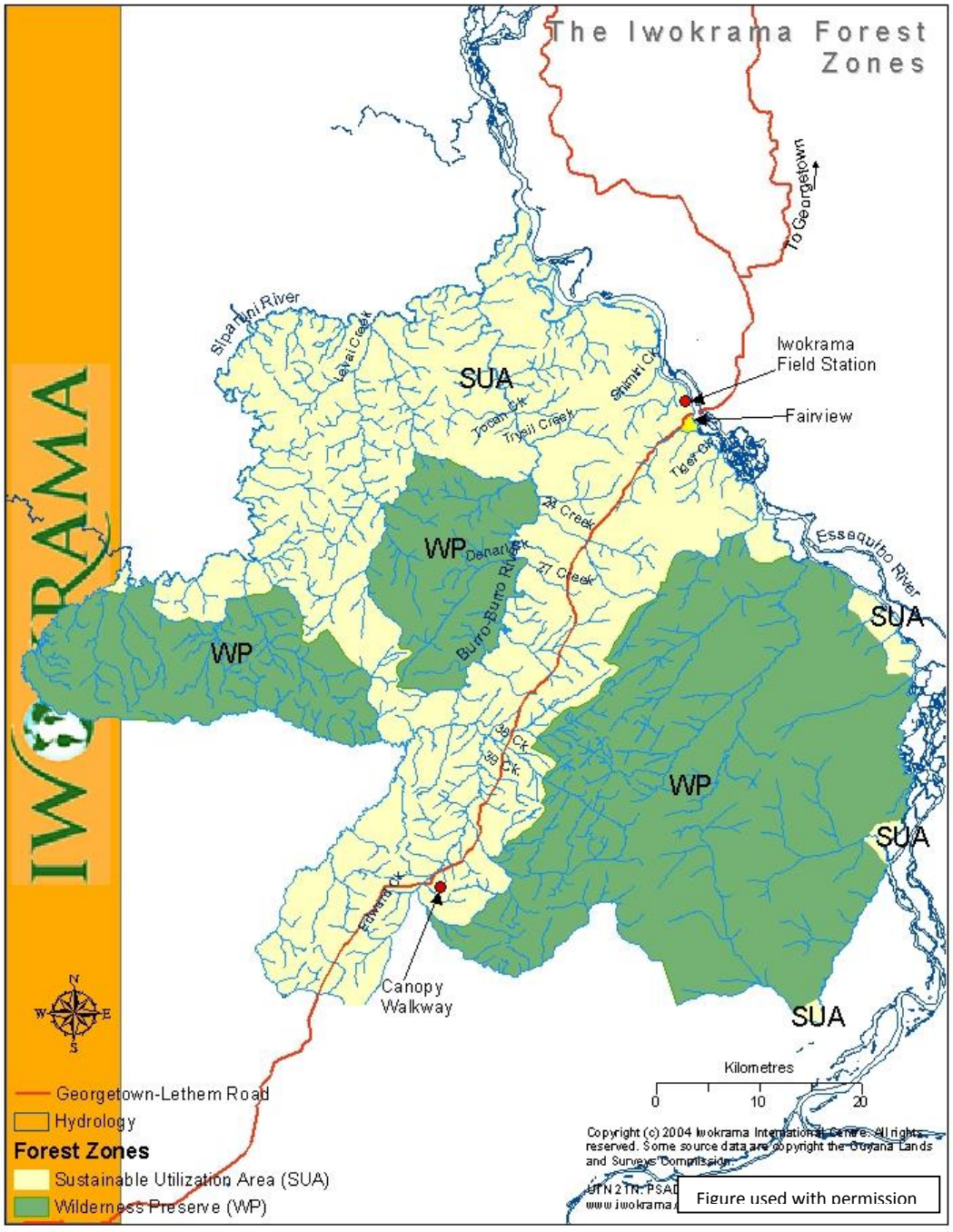
Figure 3: Map of Guyana in relation to world (Adapted from: Natural History, 2014)

Figure 4: Location of Iwokrama Forest within Guyana (Adapted from: Natural History, 2014)

The Iwokrama rainforest reserve is located near the geographical center of Guyana, a relatively small country on the north-central coast of South America (*Figure 3*). The Iwokrama International Center for Rainforest Conservation and Development is split between the administrative office located in the Guyanese capital city of Georgetown and the field station near the northern border of the Iwokrama reserve (*Figure 4*) which houses the Iwokrama River Lodge and Research Center. The reserve comprises 371,000 hectares, or close to 1 million acres, of protected intact forest. Of the 371,000 hectares of protected land, 184,000 ha are designated as SUA and 187,000 are designated as WP (Gobin, 2014). The Iwokrama reserve is bordered on 3 sides by rivers: the Buro Buro River serves as a partial southwestern border, the Siparuni River serves as a northwestern border, and the Essequibo River (the largest in Guyana) serves as the northeastern and eastern border. Guyana's only cross-country highway, which runs from Georgetown to the town of Lethem on the Brazilian border, cuts across the Iwokrama Forest from north to south near the middle of the reserve (*Figure 5*). Over 50 km of the Georgetown-Lethem road runs through the Iwokrama reserve.

The Iwokrama Forest is a part of the Guiana Shield which has been listed as one of the four last remaining intact major rainforests on Earth along with the Amazon, the Congo, and Papua New Guinea (Gobin, 2014). Within this 371,000 ha protected area over an immense amount of biodiversity resides: 474 species of birds, 130 species of mammals, 132 species of reptiles, 420 species of fish, and 1250 species of plants (Thomas-Caesar, 2013). That accounts for over half of the total biodiversity in all of Guyana in each respective group, an important statistic given that over 85% of Guyana is covered in tropical rainforest (Janki, 2010; Sizer, 1996). Within the forests of the Guiana Shield a complex social, economic, and cultural environment exists with some inhabitants that are among the poorest people in the world (Gobin, 2014).

Figure 5: Zoning of Iwokrama Forest (Source: IIC, 2014)



The broader area features weak national and local community institutions, along with dispersed small scale gold mining, chainsaw logging, and wildlife trading.

In order to accomplish effective management plans, Iwokrama brings together local communities, scientists, and a sustainably managed business operation. The IIC has created a unique alliance involving sixteen local communities who are participants in IIC operations and share benefits, scientists carrying out climate change and ecosystem services research, and a sustainably managed business operation that earns income from the forest and its natural assets (Gobin, 2014).

The following is the official designation and statistics of the IIC as found in the World Database on Protected Areas (WDPA):

WDPA Record (source: WCPA, 2014)
WDPA ID: 116298
Country / territory: GUY
Sub-location: GY-PT
Name: Iwokrama
Original name: Iwokrama
Designation: Wilderness Reserve/Managed Resource Use Area
Designation type: National
IUCN category: IV
Reported area: 3716.808 km^2
Status: Designated
Status year: 1996

3.2 Purpose of Iwokrama Center and Reserve

The Iwokrama Rainforest Programme was conceived during the prelude to the Rio Summit of 1992. The key environmental programme of one of the last remaining intact tropical rainforests

was dedicated by the government of Guyana to the world in 1989 (IIC, 2014). The Iwokrama International Centre for Rainforest Conservation and Development was established in 1996 under a joint mandate from the Government of Guyana and the Commonwealth Secretariat through the IIC Act, Act No. 7 (IIC, 2014). Since inception the distinctive tropical rainforest reserve has sought to advance best practice in the sustainable management of the world's remaining rainforests "in a manner that will lead to lasting ecological, economic and social benefits to the people of Guyana and to the world in general" (IIC, 2014).

Iwokrama provides a dedicated site in which to test the concept of a truly sustainable forest, where conservation, environmental balance, and economic use can be mutually reinforcing. The IIC, in close collaboration with the Government of Guyana, the Commonwealth, and other international partners such as the UK company Canopy Capital, is currently developing a new approach to enable countries with rainforests to earn significant income from ecosystem services and creative conservation practice (IIC, 2014). Iwokrama is also contributing to the ongoing study and development of further conservation measures as part of the international transition to low carbon economies based on its clear vision and unique partnership with local communities, science, and business, as well as its innovative work on the impacts of climate change on tropical forests and the contribution of ecosystem services for financial value (IIC, 2014).

The mission statement of the IIC, which can be found on the organization's website as well as in many publications, is to "promote the conservation and the sustainable and equitable use of tropical rainforests in a manner that will lead to lasing ecological, economic and social benefits to the people of Guyana and to the world in general, by undertaking research, training, and the development and dissemination of technologies (1996)."

The basic aim of the IIC and the Iwokrama reserve is to show that forests have an economic value in remaining intact and alive. Essentially, Iwokrama strives to demonstrate that a forest can be used without losing it and that forests can potentially be worth more alive than dead. The sectors that are responsible for reaching this goal are business development, community development, science and research, and conservation and monitoring. Business development includes sustainable timber harvesting, sustainable tourism, training, and ecosystem services. The research done for this paper focuses almost entirely on sustainable tourism operations and its role in providing funding for the IIC, with some data taken on timber, community development, and monitoring to show the extent to which they are a funding source in comparison to tourism.

4. METHODOLOGY OF STUDY

The research conducted for this paper was collected on-site at the Iwokrama field station within the Iwokrama reserve. After a detailed literature review on the subject of protected areas and ecotourism, data was gathered on all financial and tourism aspects of the IIC. Tourism capacity measures, such as the extent of accommodations, types of tours, and availability of staff, were recorded from on-site observations. Tourism patronage statistics, such as the number of tourists per month, nationality of visitors, and number of tours visitors took part in, were recorded from statistics kept by the tourism department at the IIC. Findings were recorded and recommendations were made after applying a formula to determine full visitor capacity and how much tourism revenue could be earned by the IIC in its current state.

4.1 Developing assessment and evaluation framework

The assessment framework was done in two parts: an assessment of IIC revenue and expenditure from 2012 and 2013, and an assessment of tourism statistics from 2013.The evaluation framework was developed using data from the assessment framework and comparing it with the current state of infrastructure and available staff to determine the maximum capacity of the Iwokrama reserve.

The revenue and expenditure assessment was done by accessing the 2013 IIC annual report, the first annual report to be accessible online. This document contains detailed statistics on all sectors within the Iwokrama reserve, including a breakdown of revenue and expenditure by sector for 2013 and comparisons to the same statistics in 2012. The assessment of tourism statistics was done by accessing monthly reports found at the Iwokrama River Lodge and

Research Center (IRL) main building on site, the Fred Allicock building. Tourism reports and records are kept on file in the tourism department main office. Access was granted for monthly statistical reports on number of visitors, visitor nationality, main purpose of visit, mode of transportation, source of business (tour operator or direct), number of visitors partaking in each tour, and accommodation type for all visitors. Information was also available from individuals from comment cards, waiver forms, and receipts, but this information was not used because of the risk of infringing on privacy and because information on individuals is of little value for this research. After collection of all relevant tourism and financial data the current state of Iwokrama tourism and the current state of funding and funding needs was assessed.

The evaluation framework was developed after the assessments had been completed. A formula was developed for determining the maximum tourism capacity for the IIC as capacity measurement was critical for discovering the funding potential of tourism. This formula is an integral research component since funding potential is essential for assessing the effectiveness of ecotourism as a viable funding source. A set of systems thinking diagrams were used, albeit in a somewhat limited way, to assess potential benefits and costs of increased tourism in an ecosystem such as Iwokrama.

4.2 Analysis techniques used

The analysis techniques used to assess tourism data and evaluate tourism capacity were comprised of data analysis from Iwokrama tourism documents and on-site observations of tourism facilities. Analyzing tourism revenue and usage required only basic statistical analysis carried out in spreadsheet format. Some documents had already been put into spreadsheet format

and the data was available without any need to do any further statistical analysis. On-site observations for accommodation, boat, vehicle, and tour capacity were recorded in a logbook, and other on-site observations, such as manual labour load for staff, were taken into consideration when developing the capacity model. Full capacity for IIC was developed by taking into account the highest possible number of guests and tours that could be accommodated by current infrastructure and staff availability regardless of probability. The capacity formula was developed to determine the absolute most tourism revenue that can possibly be attained under optimal conditions. This formula uses a 4-day cycle of tourists staying in accommodations, partaking in tours, and making use of Iwokrama transportation which is then multiplied by 91 to find a 364-day total. Adding the first day of the cycle to this total results in the 365-day total. The formula was developed after much trial and error and was selected over all other cycles because it maximized tourism revenue. A 1-day cycle would not allow tourists to use Iwokrama transportation because vehicles need a full day to return to Georgetown, missing out on US$1200 per trip, and would not maximize tour usage. 2-day and 3-day cycles would also not maximize tour usage or fulfill accommodation turnover rates, resulting in some empty rooms. Anything more than a 4-day cycle would be less efficient and result in less overall funding.

Vensim diagrams were also used as a systems thinking technique to view increased tourism levels from different perspectives and analyze potential costs that might outweigh or affect benefits. Findings were then recorded along with recommendations.

5. ASSESSMENT OF OPERATIONAL FUNDING FOR IWOKRAMA CENTER AND RESERVE

5.1 Analysis of the annual operations budget for Iwokrama Center and Reserve

At present time of writing, the audited accounts of the IIC's financial reports have been completed up to and including the calendar year of 2013. Changes in revenue and expenditure from 2012 to 2013 have been identified for all sectors, with emphasis on the sustainable tourism operations. All figures in this section come from these official reports which can be accessed via Iwokrama's publication archives in hard copy (all reports) or online (2012 - 2013 report only). Although two years of data is not enough to determine definite trends, these are the only numbers publicly available. However, since they pertain to the two most recent years it still allows for an accurate depiction of the current state of IIC funding and expenditure.

Total revenue for the IIC was US$1,220,325 in 2013, a 38% decrease from US$1,961,133 in 2012. The sharp drop in funding was largely a result of a substantial decline in grant income, which was nearly cut in half at a 40% decrease from 2012 to 2013. The government of Guyana was the largest financial contributor in both years.

Table 3: IIC revenue breakdown 2013

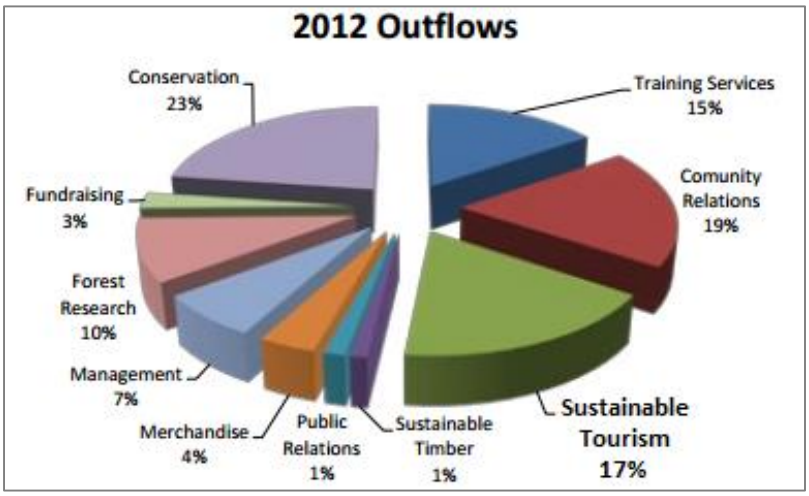
Sector	Amount (US$)
Grant/Donor funding	836,537
Tourism	255,690
Training	40,615
Timber	0
Other	87,483
Total	1,220,325

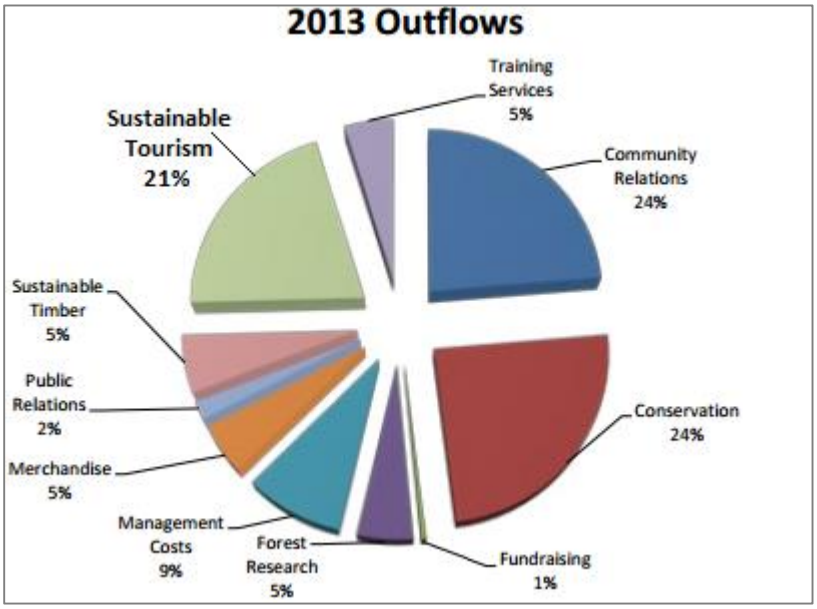
Table 4: IIC expenditure breakdown 2013	
Sector	Amount (US$)
Fundraising	4,941
Tourism	251,430
Training	51,584
Monitoring	267,511
Forest research	55,683
Community development	259,469
Management	97,051
Other	209,621
Total	1,197,290

Expenditure for the IIC was US$1,197,290 (including depreciation of US$100,822) in 2013, a 44% decrease from an expenditure of US$2,151,122 (including depreciation of US$196,720 and a one-time paper loss of US$500,276 from timber related fees) in 2012. A loss of donor and grant funding is the main reason for the extreme austerity measures and resulting drop in spending. Compounding the problem was an inability to undertake fundraising campaigns due to an 87% spending cut on these efforts. The US$4,941 spent on fundraising in 2013 was not nearly enough to generate any serious donor funding or grants, which were already decreasing significantly (Thomas-Caesar, 2013). Training services at the IIC were cut by 77% from 2012 to 2013, with US$51,584 spent on this program that received significantly more the previous year. Forest research was also down 61% in 2013, with only US$55,683 used for the program. This is somewhat concerning as forest research is an integral part of Iwokrama's mandate and ultimate objective of protecting and studying all areas of the tropical rainforest reserve. The conservation and monitoring program, which is responsible for keeping the Iwokrama reserve protected, had 19% less funding in 2013 compared to 2012 expenditures. US$267,511 was still spent on this

program even with the drop of nearly one-fifth. The IIC stayed strong with a commitment to its community development program, however. US$259,469 was spent on this program in 2013, a drop of only 6%. This is evidence of the importance of community development in Iwokrama's mission.

Figure 6: IIC expenditure 2012 – 2013





The austerity measures that were put in place in 2013 due to the severe decrease in donor and grant funding from the previous year resulted in serious staff changes for the IIC. A loss of a number of key staff, including the Tourism Manager position, were lost as a part of the austerity plan. Specific increases in emoluments were also put in place to retain certain key staff, and many management positions accepted salary cuts as part of the plan. Despite emolument, transport, and other operational costs, the IIC's management costs decreased from US$99,038 in 2012 to US$97,051 in 2013 because of key staff losses. This small drop illustrates the challenges of attempting to decrease management costs as staff losses and salary cuts resulted in only US$1987 less expenditure in this area. Furthermore, with the large drop in overall expenditure, the 2013 management costs were in fact higher as a percentage of total expenditure at 9% as compared to 7% in 2012.

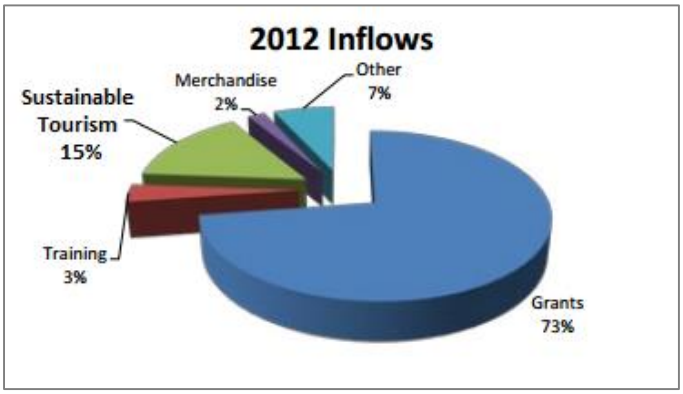
The overall financial performance of the IIC was a marked improvement from 2012 to 2013 due in large part to the austerity measures put in effect. The IIC improved from a deficit of US$189,989 in 2012 to a small surplus of US$23,035. It is encouraging that Iwokrama was able to end 2013 with this small surplus, however, financial increases are needed for the reserve to function properly. Increases in revenue are needed to ensure: (1) key staff remain in critical positions, (2) key staff lost can be reintroduced, and (3) monitoring, research, conservation, training, and fundraising programs can operate at a higher capacity. With the ability to attract more donor and grant funding limited by worldwide economic struggles and an 87% reduction on IIC fundraising activities, the two most viable solutions for increased funding are sustainable timber harvesting and sustainable tourism. Sustainable timber harvesting is Forest Stewardship Council (FSC) certified and has very strict rules: a 60-year cutting cycle, harvesting a maximum of $20m^3$/ha from a minimum of 20 species and 1,800 ha per year, which is less than 0.5% of the

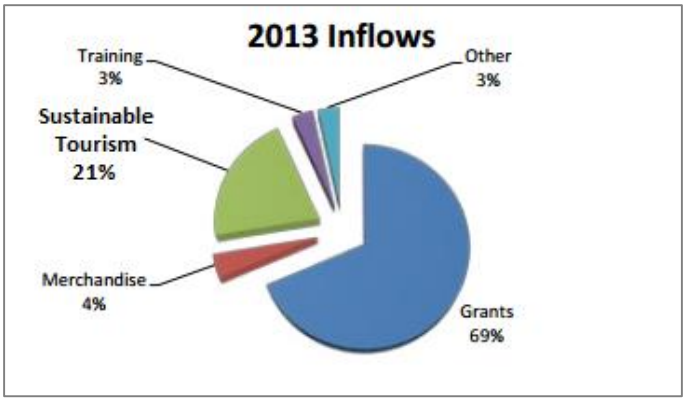
Iwokrama Forest and "will result in the removal of only a few stems per ha, causing no noticeable gaps in the forest canopy" (Gobin, 2014). However, even with these rules in place and compliance ensured by the FSC, and with assurances only one half of one percent of the Iwokrama Forest will be removed per year with no noticeable effect on the forest canopy, public perception may be a concern. People often disapprove of any type of logging in a protected area regardless of the impact on the environment (Thomas-Caesar, 2013). It is for this reason that sustainable tourism has been identified by the author and by Iwokrama management as the best available option for increased funding, and why it is the focus of this paper.

5.2 Analysis of tourism revenue

Tourism in the Iwokrama Forest during 2013 resulted in US$255,690 of revenue for the IIC. This number is a 13% decrease from the previous year. The IIC was lacking a tourism manager in 2013 as opposed to 2012 when this position was occupied. However, because of the large decrease in overall funding, sustainable tourism revenue percentage actually increased from 15% of total inflows in 2012 to 21% in 2013.

Figure 7: IIC funding inflows 2012 - 2013





Iwokrama has addressed the importance of tourism for funding purposes and has begun implementing changes for 2015 – 2020. An independent consultant was hired in 2013 to create a new tourism business plan aimed at improving tourism in the area and to ultimately raise revenue for the IIC. This plan focused on key areas such as marketing, training, staffing, and infrastructure maintenance. Iwokrama has also hired a tourism manager for 2014 onwards to implement this plan.

Tourism revenue comes from a variety of sources directly and indirectly linked with the available tours and accommodations at the research center and river lodge. A US$15 forest user fee is a one-time fee per trip, per person while staying within the Iwokrama reserve. This money is mainly used to help fund IIC's community development program aimed at nearby villages, including Fairview which is the only village located within the reserve.

Tours range in price and duration. The most expensive tour is the Turtle Mountain hike and accompanying boat ride through Stanley Lake. The least expensive tour is a guided trail walk along one of the paths adjacent to the research center.

Transportation to, from, and within the reserve is also a major source of revenue without being directly associated with tours. An Iwokrama vehicle will take between 1 and 4 passengers from Georgetown on a return trip to the river lodge for US$500, with the cost remaining constant regardless of the number of passengers. A minibus service will also take passengers from Guyana's capital to the entry of the Iwokrama reserve. Domestic commercial single engine airplane flights can be taken to Annai airstrip, approximately 100 km from the river lodge and research center. Charter flights can be taken to Fairview village airstrip within the reserve. With the exception of flights to Annai, which require passengers to be picked up by Iwokrama vehicles, flights and minibus transportation do not contribute to funding of the Iwokrama Forest reserve, though these modes of transportation are still divulged on Iwokrama's updated website, a product of the 2014 tourism business plan implementation.

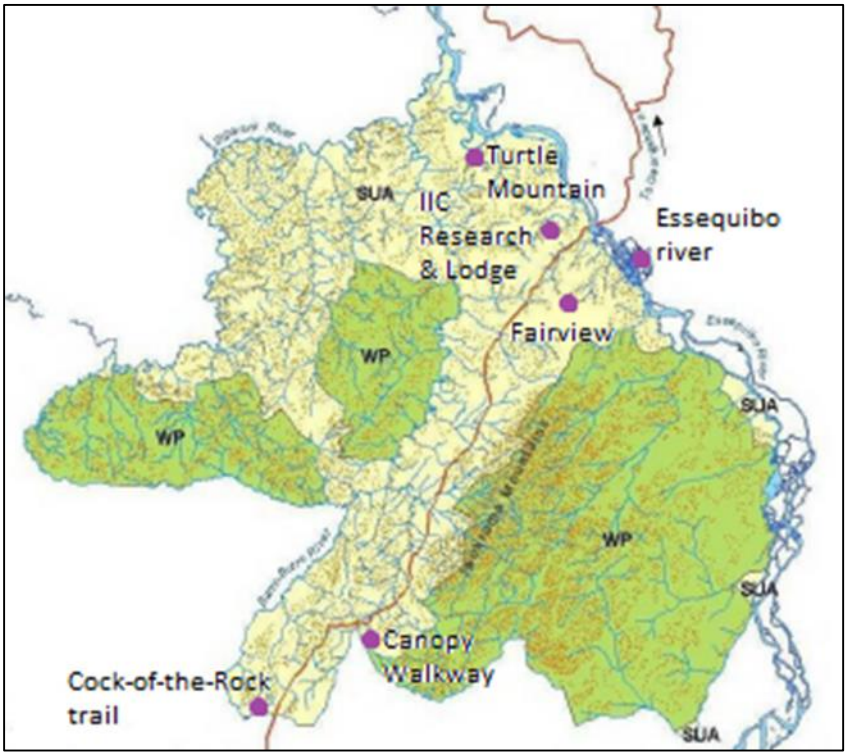
Accommodations bring in between US$25 and US$180 of revenue per night based on number of guests and type of room. Meals bring in between US$8 and US$20. A full breakdown of rates, which have been increased as per the 2014 tourism business plan, are listed in *Section 6*.

6. EVALUATION OF IWOKRAMA ECOTOURISM

6.1 Current Iwokrama tours and attractions

As of 2014 there are 11 available tours within the Iwokrama reserve, with two former tours being either temporarily or permanently disbanded. These 11 tours can be grouped into six main tourism sub-regions mentioned in *Figure 8*. All tours take place within these areas labeled below.

Figure 8: Iwokrama tour locations (Adapted from IIC, 2014)



Sub-region	Tours available
IIC RC & IRL	Nature trail walks Mori Scrub trail Nocturnal wildlife/jaguar spotting by road
Essequibo River	Caiman night spotting Rapids/petroglyphs Indian Island Michelle's Island Canoe trip
Turtle Mountain	Turtle Mountain/Stanley Lake
Canopy Walkway	Canopy Walkway
Cock-of-the-Rock	Cock-of-the-Rock
Fairview	None (previous tours disbanded as of 2014)

Lodging is a main source of revenue for the IIC with a riverfront cabin bringing in US$120 – US$180 per night depending on occupancy. Food service brings in US$40 per person per day, and often the combination of lodging and food brings in more revenue per guest than tours during an average stay. The US$15 per person forest user fee is mandatory for any visitor spending the night or partaking in any tours within the Iwokrama Forest.

Table 5: Comprehensive Iwokrama rates (Source: IIC, 2014)

Tours	Price (US$)
Turtle Mountain/Stanley Lake	$150
Canopy Walkway	$50
Caiman night spotting	$35
Nocturnal wildlife/jaguar spotting by road	$100
Rapids/petroglyphs	$35
Indian Island	$35
Michelle's Island	$25
Nature trails walk	$25
Mori scrub trail	$25
Canoe trip	$10
Cock-of-the-rock trail	$66

Transportation – Georgetown to Iwokrama	**Price (US$)**
Overland by Iwokrama vehicle (return)	
Standard vehicle (1-4 persons)	$500
Larger vehicle (1-6 persons)	$700
Overland by public minivan (return)	
Per passenger fare	$125
Air/ground combo (one-way)	
Ogle (Georgetown) to Annai (Scheduled flight, per person)	$280
Annai to Iwokrama (Ground transfer, 1-4 persons)	$220
Charter flight to Fair View airstrip (return)	
Cessna 206 (1-5 persons)	$2,225
Norman Islander BN1 twin prop (1-9 persons)	$3,375
Cessna C208 Caravan (1-13 persons)	$4,650
Accommodation	**Price (US$)**
Cabin Accommodation	
Single Occupancy	$120/cabin
Double Occupancy	$150/cabin
Triple Occupancy	$180/cabin
Research Building	
Single Occupancy	$45/room
Training Rooms	
Single Occupancy	$25/room
Meals	
Breakfast	$12
Lunch	$18
Dinner	$20
Extra fees	
Forest User Fee (per person, per visit)	$15

6.2 Current state of Iwokrama tourism

In order to evaluate the current state of the Iwokrama tourism area for effectiveness and funding potential, two main points must be assessed: current tourism statistics and maximum visitor capacity. A comparison can then be made with patronage statistics to see how efficient the IIC is at bringing in tourism revenue from the current amount of visitors and how much more tourism can be sustained using the pre-existing infrastructure.

6.2.1 Tourism statistics for 2013

Table 6: Iwokrama visitor statistics 2013

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
VISITOR TYPE													
Overnight Visitors	**63**	**94**	**118**	**108**	**38**	24	63	75	47	111	86	51	**878**
Day Trippers											16		**16**
Total	**63**	**94**	**118**	**108**	**38**	**24**	**63**	**75**	**47**	**111**	**102**	**51**	**894**
MODE OF ARRIVAL													
Land	63	94	118	108	38	21	53	37	35	71	63	17	**718**
Air (Arrive at Fair View Airstrip)						3		8		28	12	22	**73**
Air and Land							10	30	12	12	27	12	**103**
Total	**63**	**94**	**118**	**108**	**38**	**24**	**63**	**75**	**47**	**111**	**102**	**51**	**894**
COUNTRY OF RESIDENCE													
United Kingdom	11	16	27	19	8		18	14	24	14	39	14	**204**
USA	13	24	15	10	7	9	6	18	7	31	3	12	**155**
Guyana	19	38	36	34	6	7	18	22	9	48	25	7	**269**
Canada	7	8	18	8	5	2	4	2			2	2	**58**
Rest of Europe	9	7	20	26	8	4	4	3		4	15	10	**110**
Other Caribbean	4	1		1	4	2	8	13	1	8	2	3	**47**
Rest of the World			2	10			5	3	6	6	16	3	**51**
Total	**63**	**94**	**118**	**108**	**38**	**24**	**63**	**75**	**47**	**111**	**102**	**51**	**894**
MAIN PURPOSE OF VISIT													
Tourists (Leisure)	47	**68**	73	73	24	19	15	45	35	67	88	51	**605**
Staff & Community Members	15	14	8	18				6	8	41	2		**112**
Business				1	1	1	16	3	4		3		**29**
Research & Education		3	28	15			32	20		3	6		**107**
Fam Trip for Tour Operator/Press		8			12								**20**
Volunteers & Interns	1	1	5	1	1			**1**					**10**
Other			4			4					3		**11**
Total	**63**	**94**	**118**	**108**	**38**	**24**	**63**	**75**	**47**	**111**	**102**	**51**	**894**
SOURCE OF BUSINESS													
Wilderness Explorers		**8**				3	4	11	23	25	38	25	**137**
Dagron Tours							2	3	4	1	2		**12**
Wonderland Tours											2		**2**
Adventure Guianas								3		2	1		**6**
Other Tour Operator	28	29	64	68	21	2				22	12	7	**253**
Walk In or Direct to GT Office	11	1	10	19	11	14	9	20	20	14	28	9	**166**
Walk In to River Lodge	24	46	33	21	6	1		7		47	19	8	**212**
Other		10	11			4	48	31				2	**106**
Total	**63**	**94**	**118**	**108**	**38**	**24**	**63**	**75**	**47**	**111**	**102**	**51**	**894**

A total of 894 people visited the Iwokrama Center in 2013, with 605 visiting for the sole purpose of tourism. The majority of visitors arrived at the IIC field station by land, and nearly all spent at least one night on the grounds. The highest number of visitors were Guyanese citizens because staff, community members, and educational visitors are mostly from within the country; few tourists are from Guyana but non-tourist visitors are most commonly Guyanese. The most

tourists came from the United Kingdom, United States, and continental Europe, with direct bookings at either the Georgetown Iwokrama office or the IRL field station being the most common source of business for tourism. March, April, and October had the highest overnight visitor volume with over 100 people staying at least one night during each of these months.

Figure 9: Monthly Iwokrama visitors 2013

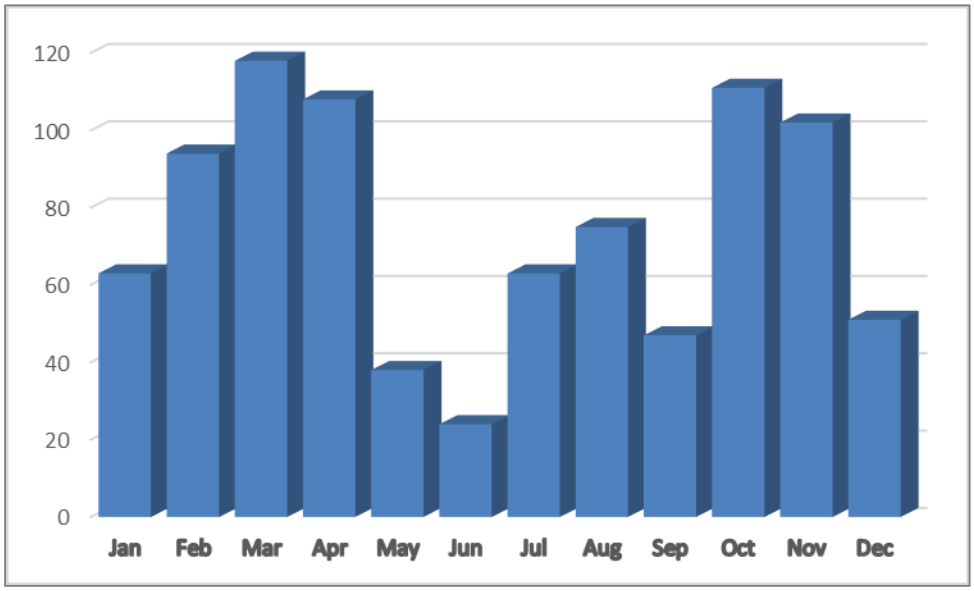
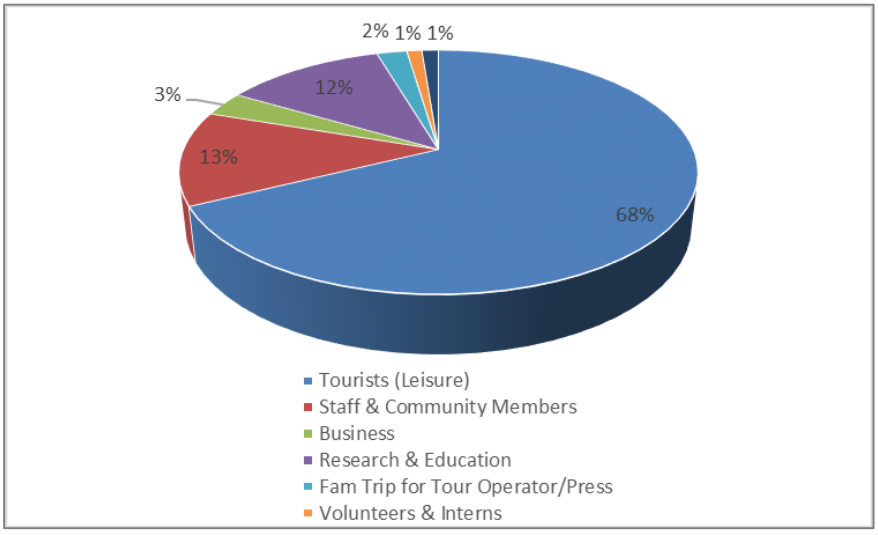


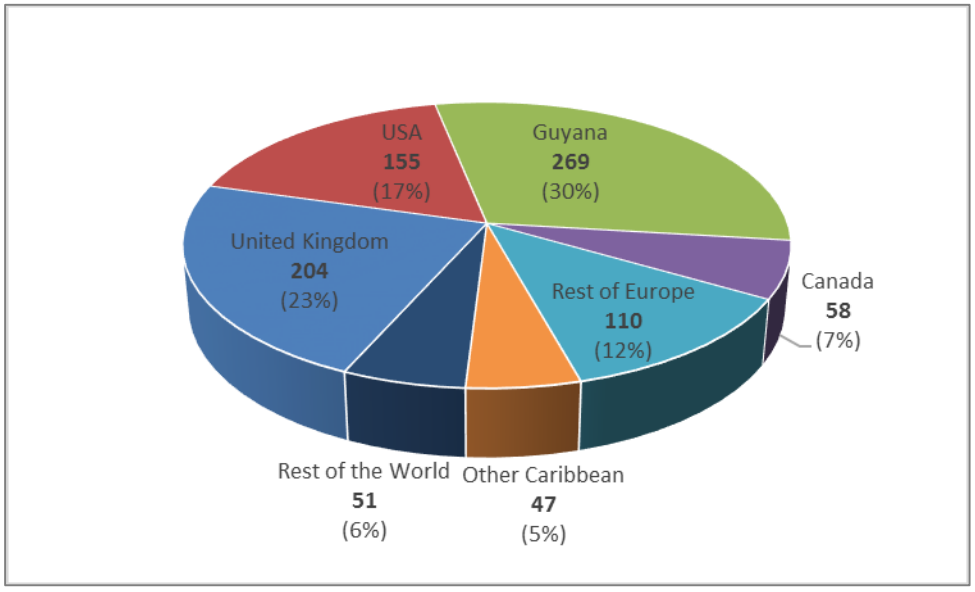
Figure 10: Main purpose of Iwokrama visitors by percentage 2013



6.2.2 Target visitor demographics

One of Iwokrama's core value statements is to offer a low volume, high value product and service. This is consistent with the desire to keep tourist volume relatively low while still bringing in significant revenue. A three night stay in a riverfront cabin with double occupancy and participation in the five most common tours will cost US$686 per person, not including transportation which ranges from US$120 to US$2,325 per person depending on mode of transport. Tour operators such as Wilderness Explorers, which operates in Georgetown, will bundle together tour packages including the IRL among visits to other parts of interior Guyana south of the Iwokrama reserve. Retired or middle age nationals from Europe and North America are the main target demographic for several key reasons: (1) available time to tour this area, (2) disposable income to afford to tour this area, and (3) high probability of having visited other countries prior to Guyana since it is an unlikely destination for non-seasoned tourists.

Figure 11: IIC Visitor Demographics 2013



Apart from the main target demographics, one change in IIC tourism prompted by the new business management plan is increased awareness for independent overland travelers, especially those coming through either Venezuela or Brazil from the south. There was previously no visible attempt at accommodating these travelers with no pricing for training or research cabins online, and no rates for individual tours. However, these are now easily accessible on the Iwokrama website and staff is now trained to expect these visitors when they were previously not properly accommodated.

6.2.3 Current infrastructure capacity

Iwokrama River Lodge & Research Center capacity: 32 guests per night

The IRL is equipped with 8 riverfront cabins that are the main accommodation type for target demographics. Each cabin has a double bed and a smaller side bed, effectively making maximum occupancy 3 people. Although it is more common to house 2 guests in each cabin, the capacity of each is still 3 persons. There are also 6 rooms in the more recently built FORENET research building and 2 of the training building rooms are available for tourists. Each room in these buildings has a double bed or two single beds and can potentially house 2 guests, but based on the pricing scheme they are designed and only available for single occupancy. The largest training building room has 8 beds and is used for large groups of visiting student groups or wildlife clubs rather than for tourists.

Given the above accommodation parameters, it can be determined that there is space to house 32 guests for any one given night: 24 people in the 8 cabins, 6 people in the 6 research building rooms, 2 people in the 2 regular training building rooms available for tourists, and 0 people in

the large training building room. This is the full accommodation capacity for the IRL based on pricing and subjectivity of single occupancy for rooms in the research and training buildings. Despite the incredibly unlikely occurrence of full capacity being reached this is the most possible number of tourists that can be accommodated nonetheless.

The most guests ever present at Iwokrama at one time, according to former Operations Manager Vibert Welch, was over 50 people. However, this large group was predominantly made up of training groups and school groups rather than 50 independent tourists all convening on the IIC at the same time. Unused staff rooms were used to house some people in this case. This number of guests, which is beyond the measure of capacity, is important to show that the IIC is able to be resourceful and come up with solutions to accommodation issues, indicating an ability to handle the number of guests at full capacity without a need to drop the capacity number lower than the infrastructure dictates due to staffing or management issues.

Air/Land travel capacity – 10 persons per day

The Georgetown-Lethem road that vertically dissects the entire country of Guyana from the Atlantic shore to the Brazil border runs directly through the Iwokrama Forest. The fact that the main, and virtually only, road through the interior of the country passes right by the IRL and field station is crucial for bringing visitors in via land, especially with minibus and private car travel. The downside to travelling by land is the condition of the road. At best the clay-dirt road is rutted and top travel speed rarely exceeds 80 km/h. At worst the road can be nearly impassable with mud “pools” that trap vehicles and make the use of winches a necessity. During the dry season the road tends to be better, with the heavy rains of the rainy season responsible for the

worst road conditions. With good road conditions it takes between 5 – 6 hours to traverse the roughly 230 km from Georgetown to the IRL. With difficult road conditions it can take over 12 hours to reach the IRL, and breakdowns and flat tires are common as well.

The IIC has 4 vehicles available for transporting visitors and all are better equipped to handle the stresses of the road than minibuses. 2 vehicles can carry 4 passengers and 2 vehicles can carry 6 passengers, bringing the absolute land travel capacity for Iwokrama to 20 persons. Again, similar to the accommodations capacity, it is rare that groups can fill this capacity on a regular basis given the nature of group structures, odd numbered groups, and, unlike with lodgings, availability of vehicles. It is common to have a vehicle in use transporting passengers away from the IRL towards eco-lodges south of the Iwokrama Forest, and sometimes vehicles are unavailable due to maintenance work. Air travel is arranged through private companies and private charters, but Iwokrama vehicles are still needed to collect passengers from either the Fairview airstrip or Annai airstrip. Fairview airstrip is less than 5 km from the IRL and no fee is charged for pickup. Annai airstrip is over 100 km from the IRL and the journey between the airstrip and the IRL can take between 2 – 6 hours based on road conditions. Given these figures, the true capacity for land travel is 10 persons with 2 available vehicles taking passengers from either Georgetown or Annai to the IRL, and back to Georgetown. The 2 remaining vehicles are used for transporting passengers to certain tours and south to destinations outside of the Iwokrama Forest, or unavailable due to maintenance.

Tour capacity: 96 tour slots per day

Capacity for guests partaking in tours is slightly different than for the previous two categories. Some tours require vehicle usage, some require boat usage, some require neither vehicle nor boat, and all require at least 1 tour guide. Vehicles also require a designated Iwokrama driver.

Tours that require vehicle use include: Canopy Walkway, Mori Scrub trail, Cock-of-the-Rock trail, and nocturnal wildlife/jaguar spotting. Since 2 out of the 4 Iwokrama vehicles are designated for transportation to and from the IRL, 2 vehicles are available for tours on a daily basis, with a capacity for 10 guests. However, three of these tours may depart either after breakfast or after lunch as there is enough time to facilitate two trips per day, and nocturnal wildlife/jaguar spotting takes place after sunset. This brings the effective capacity for vehicle tours to 30 persons: 10 person capacity for morning tours, 10 person capacity for afternoon tours, and 10 person capacity for night tours.

Tours that require a boat include: Turtle Mountain/Stanley Lake, caiman night spotting, rapids/petroglyphs, Michelle's Island, and Indian Island. Iwokrama's policy is to have at least one guide and a boat driver accompany all boat related tours. There are 4 boats at the IIC Research Center and River Lodge, each with space for up to 10 guests, not including guide and boat driver. 1 boat is in use the majority of the time for monitoring and research purposes, so the effective capacity is decreased to 3 boats for tourists. Similar to the vehicle tours, boat trips occur multiple times per day. Turtle Mountain/Stanley Lake and both island tours are offered immediately after breakfast and after lunch, with a daytime capacity of 60 guests. Caiman night spotting occurs after dark as the title suggests, and visits to Michelle's Island are also available after sunset, resulting in a nighttime capacity of 30 guests.. In total the capacity for boat tours is 90 guests, which is more than double the amount of guests that are able to stay on the premises. However, It is important to note that the capacity is this high because it is very common for the

same guest to partake in both a day and night boat tour, effectively making a higher number of guests partaking in tours than number of guests staying at the IRL.

The only tours that do not require a vehicle or a boat are the trail walks adjacent to the IIC field station compound where the IRL is located. The limiting factor for participation in these tours is the number of available guides. Iwokrama policy dictates no more than 10 people per guide, and this number is rarely reached. It is common for each individual group of tourists to request their own guide. Capacity for these tours is a maximum of 40 persons due to the number of guides available, although this number will rarely, if ever, be reached. Capacity for these tours is also dependant on number of visitors partaking in other tours due to the availability of guides.

Calculating maximum capacity for all tours combined is not as straightforward or simple as calculating capacity for accommodations or travel. The number of visitors able to partake in tours is dependent on the number of guides available so it is impossible to reach full capacity in vehicle, boat, and walking tours simultaneously. The full capacity regardless of probability is: 10 persons in 2 vehicles twice daily, 10 persons in 2 vehicles once daily (night tour), 20 persons in 2 boats twice daily, 30 persons in 3 boats once daily (night tour), and 10 persons with 1 guide walking twice daily, bringing the number of available tour slots per day to 120. Even with this many tour slots available, it cannot be possibly reached because the full capacity of 32 guests partaking in 3 tours per day would only be able to fill 96 tour slots. Therefore 96 is the maximum capacity of tour usage on any given day for the IIC.

7. ASSESSMENT OF IWOKRAMA TOURISM POTENTIAL

7.1 Funding potential based on absolute full capacity

Achieving absolute full capacity is extremely unlikely for several reasons. Reaching this level requires: triple occupancy of all cabins, when couples are most common; participation in three tours per day, when two tours is more common; and maximum usage of Iwokrama transport vehicles. Calculating absolute full capacity is necessary though, regardless of probability, as it shows the maximum statistical amount of revenue that tourism can possibly provide. The most funding Iwokrama can receive from tourism in a single day is US$12,910 using the equation:

(8*180)+(6*45)+(2*25)+(32*40)+(700)+(500)+(32*150)+(20*66)+(12*25)+(10*100)+(22*35)+(32*15)= 12,910.

In this equation the second number in each bracket is price (US$) and the first number respectively pertains to: number of cabins (8), number of research building rooms (6), number of training building rooms (2), number of guests/food (32), price of 6-person vehicle transport (700), price of 4-person vehicle transport (500), number of guests/tour (32, 20, 12, 10, 22), and number of guests/forest user fee (32). However, this total cannot be expanded to calculate funding potential over the course of a calendar year because of transportation logistics and repeat tours. Using a 4-day cycle provides the most comprehensive maximum yearly funding potential for the Iwokrama reserve. A 4-day cycle was chosen because it provides the most possible revenue based on the most number of guests filling room capacity, taking part in the most expensive tours, and using the most Iwokrama transportation as compared to any other cycle.

The calculation for a 4-day cycle begins by assuming there are no present visitors at the IRL. This is the base starting point from which an entire calendar year of funding potential can be determined. *Table 5* lists all parameters for capacity measurement, but there are some important

things to note when looking at this matrix. IIC vehicles leave Georgetown in the early morning and arrive at the IRL in time for dinner, which is why there is no lunch included on Day 1. Breakfast for the 20 FV and IICV guests on Day 1 will not be included on the initial day as the base starting point assumes zero visitors at the lodge, but breakfast is included for subsequent groups. Tours are structured the way they are because of vehicle limitations as only a maximum of 10 guests can partake in any vehicle dependent tour during each time period.

Table 7: Absolute full capacity scenario at IRL

Day	Guests & Mode Of Transport	Meals	IICV Cost	Lodging	Turnover	Morning Tour & # Guests	Afternoon Tour & # Guests	Night Tour & # Guests
1	12 - MB 10 - FV 10 - IICV	BLD BLD BD	NO NO YES	2C+4RR+2TR 3C+1RR 3C+1RR	-12MB, +12MB -10FV, +10FV -10MB, +10IICV	12TM - -	10CR+2RP 10TM -	10NJ+2CS 10CS 10CS
2	12 - MB 10 - FV 10 - IICV	BLD BLD BLD	NO NO NO	2C+4RR+2TR 3C+1RR 3C+1RR	NONE NONE NONE	12II 10CR 10TM	12TW 10II CR10CR	10CS 10NJ -
3	12 - MB 10 - FV 10 - IICV	BLD BLD BLD	NO NO NO	2C+4RR+2TR 3C+1RR 3C+1RR	-12MB, +12MB -10FV, +10FV NONE	12TM 10TW 10II	10CR 10TM 10RP	12CS 10CS 10NJ
4	12 - MB 10 - FV 10 - IICV	BLD BLD BLD	NO NO NO	2C+4RR+2TR 3C+1RR 3C+1RR	NONE NONE -10IICV, +10MB	12II 10CR 10TM	10CW+2RP 10RP 10RP	10NJ - 10CS

Variable	Meaning
MB	Minibus
FV	Fairview charter flight
IICV	IIC vehicle
BLD	Breakfast, lunch, dinner
C	Cabins
RR	Research rooms
TR	Training rooms
TM	Turtle Mountain
CR	Cock-of-the-Rock trail
II	Indian Island
RP	Rapids/petroglyphs
CW	Canopy Walkway
NJ	Nocturnal jaguar spotting
CS	Caiman spotting

The likelihood of this scenario happening repeatedly every four days for an entire year is extremely miniscule; it is even extremely unlikely that it would happen for a short period, but it represents the absolute most revenue the IIC could possibly bring in from tourism. This matrix assumes that a new group will come and replace the previous group with precision, including assuming guests in a minibus would replace guests leaving in the two IIC vehicles and only stay one night as a new group would be arriving with the Iwokrama vehicles the following evening. Nonetheless, the full funding potential of the IIC can be calculated by assigning the corresponding US$ value to all parameters in Table 5.

Table 8: Full capacity scenario values

Variable	Value (US$)
BLD	40 (B=8, L=12, D=20)
IICV Cost = YES	1200
ICV Cost = NO	0
C	180
RR	45
TR	25
+TurnoverMB/FV/IICV → Forest User Fee (FF)	15
-TurnoverMB/FV/IICV	0
TurnoverNONE	0
TM	150
CR	66
II	35
RP	35
TW	25
CW	50
NJ	100
CS	35

Substituting the corresponding values for the constants makes Table 4 an equation and the result is the maximum capacity for tourism revenue for a 4-day cycle shown below:

Table 9: Maximum revenue equation

Day	Group	Equation Variables and Values	Totals (US$)
1	12MB	(12BLD)+(2C+4RR+2TR)+(12FF)+(12TM)+(10CR)+(2RP)+(10NJ)+(2CS) = 480+590+180+1800+660+70+1000+70 =4,850	
	10FV	(10BLD)+(3C+1RR)+(10FF)+(10TM)+(10CS) = 400+585+150+1500+350 =2,985	10,400
	10IICV	(10BD)+(IICVcost)+(3C+1RR)+(10FF)+(10CS) = 280+1200+585+150+350 =2,565	
2	12MB	(12BLD)+(2C+4RR+2TR)+(12II)+(12TW)+(10CS) = 480+590+420+300+350 = 2,140	
	10FV	(10BLD)+(3C+1RR)+910CR)+(10II)+(10NJ) = 400+585+660+350+1000 = 2,995	8,280
	10IICV	(10BLD)+(3C+1RR)+(10TM)+(10CR) = 400+585+1500+660 = 3,145	
3	12MB	(12BLD)+(2C+4RR+2TR)+(12FF)+(12TM)+(10CR)+(CS12) = 480+590+180+1800+660+420 = 4,130	
	10FV	(10BLD)+(3C+1RR)+(10FF)+(10TW)+(10TM)+(10CS) = 400+585+150+250+1500+350 = 3,235	10,050
	10IICV	(10BLD)+(3C+1RR)+(10II)+(10RP)+(10NJ) = 400+585+350+350+1000 = 2,685	
4	12MB	(12BLD)+(2C+4RR+2TR)+(12II)+(10CW)+(2RP)+(10NJ) = 480+590+420+500+70+1000 = 3,060	
	10FV	(10BLD)+(3D+1RR)+(CR10)+(RP10) = 400+585+660+350 = 1,995	8,390
	10IICV	(10BLD)+(3C+1RR)+(10FF)+(10TM)+(10RP)+(10CS) = 400+585+150+1500+350+350 = 3,335	
			37,120

The total from this 4 day cycle is 37,120. If this figure is multiplied by 91 it will give a 364-day total of 3,377,920. Subtracting 160 for the missing breakfasts on the initial day and adding the Day 1 value of 10,400 makes for a 365-day total of US$3,388,160. This amount, which is nearly triple the total revenue in 2013, is the absolute most tourism revenue the IIC could possibly earn from tourism during one calendar year.

7.2 Funding potential based on half capacity

While maintaining full capacity for an entire year would solely provide the IIC with enough funding to operate fully with no restrictions, it is not feasible nor is it necessary. The IIC will always receive at least some form of donor or grant funding, and other programs such as training bring in funding as well. Tourism, though a desirable source of funding improvement, is not needed to carry all funding needs by itself. It is also virtually impossible to sustain the full capacity of tourism for even a brief period of time, let alone an entire year, due to the extremely unlikely logistical situation of filling all cabins with groups of three and replacing the exact number of guests as they leave with new guests. The full capacity measure is designed to show the absolute limit of tourism funding and a basis to work off to develop goals.

Using the full capacity as a benchmark, half capacity can be determined as a measure of potential tourism funding. Half capacity tourism revenue would bring in US$1,707,880 in funding. This would be enough for the IIC to increase expenditures to pre-austerity levels even if donor funding continues to decline. However, operating at this capacity is not likely to occur in the near future as tourism funding in 2013 accounted for a little more than 1/8 of this figure and an 8 fold increase in tourism without a major marketing campaign is not a likely occurrence. It would be

beneficial to operate at half capacity, but it is not a realistic goal at present time. Funding potential based on half capacity would provide enough revenue for the Iwokrama Center to function with little or no need for outside donor funding, but based on 2013 tourism statistics it is still an unrealistic number.

7.3 Funding potential based on quarter capacity

605 tourists visited the Iwokrama reserve out of 894 total visitors in 2013. 605 tourists is 10.33% of the total yearly capacity of 5,856 (based on the 4-day cycle). Quarter capacity would run at 1,464 tourists (0.25*5,856) in a calendar year, a significant yet manageable increase of 859 guests compared to 2013 statistics. This would bring in US$853,940, a more desirable figure for the IIC compared to the 2013 total of US$255,690. A US$598,250 rise in tourism funding would be very useful for key expenditures to keep the IIC operating at a more optimal level. Furthermore, the environmental costs associated with tourism will also theoretically be 75% less if quarter capacity is attained rather than full. Staff will be able to accommodate 25% capacity much easier as well, which is especially important for the guides as guiding multiple tours every day is physically exhausting in a hot climate. Reaching and maintaining quarter capacity may not be attained either, but it is a feasible goal, and has a desirable cost-benefit relationship with the environmental impact of tourism versus potential funding.

7.4 Analysis of ecotourism from a systems thinking perspective

When discussing tourism potential, it is important to acknowledge the potential costs associated with an increase in tourism as mentioned in *Section 2.4.* Along with the promise of increased revenue and increased funding for the IIC, ecotourism also has the potential to cause environmental degradation if not managed properly or if usage exceeds capacity. This could lead to a detrimental situation where the ultimate goal of conservation is threatened by the source of funding that is supposed to help the area to function well enough to protect against degradation. Systems thinking is a valuable method of analyzing positive and negative effects of both an increase and decrease in IIC tourism. This method allows for a more comprehensive view of the ramifications of introducing more people into a protected area that could potentially help or harm the environment.

Figure 12: Vensim diagram of Iwokrama tourism and conservation

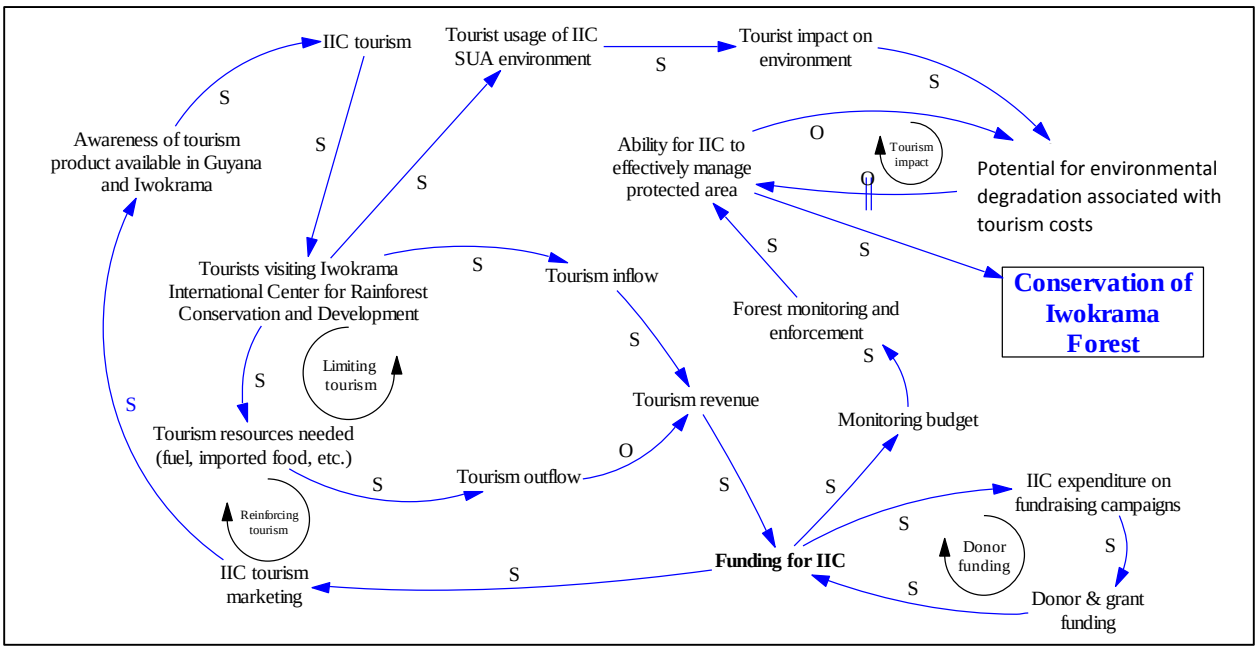


Figure 12 depicts a Vensim diagram showing various aspects of tourism and funding dynamics within the IIC. The ultimate goal of conservation is highlighted in blue. Arrows connect dependent variables and indicate whether an increase or decrease in each variable will result in the same (s) or opposite (o) effect for the connected variable. In this diagram the Conservation of Iwokrama Forest variable is not a part of the system, but rather the end result of all other factors. There are four feedback loops within the system, with three being reinforcing loops and one being a balancing loop.

Figure 13: Tourism funding and conservation of Iwokrama Forest

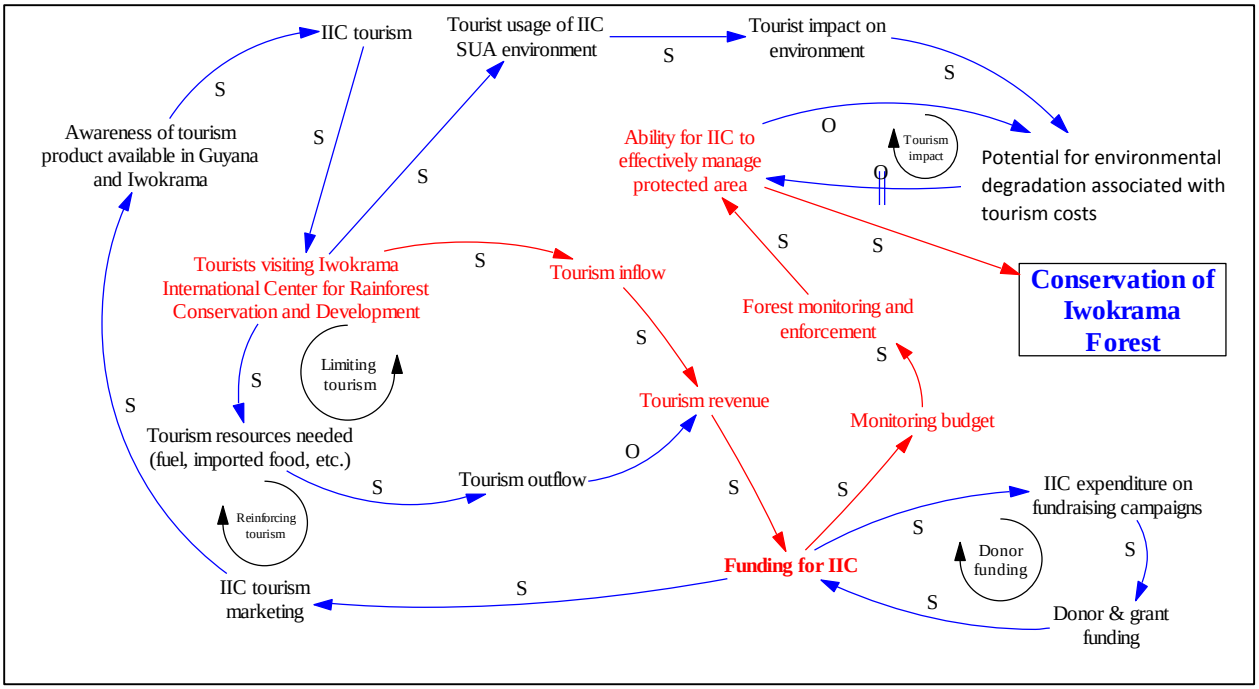


Figure 13 depicts a causal flow from the number of tourists visiting the Iwokrama Forest to the overall conservation of the forest itself. Beginning with the variable "Tourists visiting IIC," an increase in this variable will lead to an increase in tourism inflow, tourism revenue, and funding for the IIC. With an increase in funding the IIC can increase its monitoring budget, which will

increase forest monitoring and enforcement and increase the ability for the IIC to effectively manage the protected area, ultimately leading to better conservation of the Iwokrama Forest. With a decrease in the original "Tourists visiting IIC" variable the reverse is true. Decreasing numbers of tourists will lead to a decrease in tourism inflow, revenue, and funding, which will not allow for an increased monitoring budget and an effective decrease in forest monitoring. A decrease in monitoring and enforcement will lead to a decrease in the ability to manage conservation of the forest and ultimately leads to decreased conservation on the Iwokrama Forest.

Figure 14: Tourism impact and conservation of Iwokrama Forest

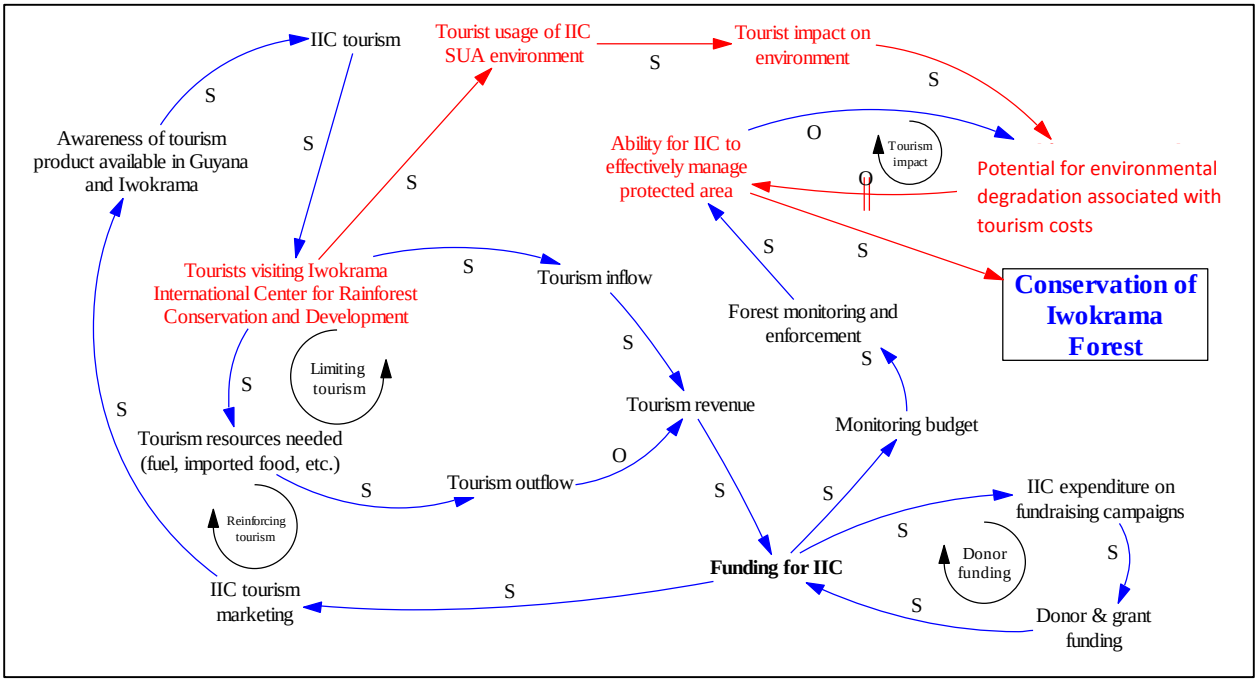


Figure 14 details the line of thinking of environmental impacts associated with tourism and Iwokrama Forest conservation. Again beginning with the "Tourists visiting IIC" variable, an increase in the number of tourists will increase usage and impact on the environment, which will

lead to increased potential for environmental degradation and a decreased ability to effectively manage conservation due to degradation; ultimately this would lead to a decrease in overall conservation. With a decrease in the original variable the reverse is true, with less tourists using and having an impact on the environment the potential for degradation decreases and the ability to effectively manage the forest increases; in this instance the level of conservation would ultimately increase. It would be beneficial for Iwokrama management to incorporate the eco-footprint analysis discussed in *Section 2.5* into this line of thinking, keeping in mind that tourists travelling from farther distances have a higher environmental impact and adjust the target visitor demographics as needed.

Figure 15: Iwokrama management ability and potential environmental degradation reinforcing loop

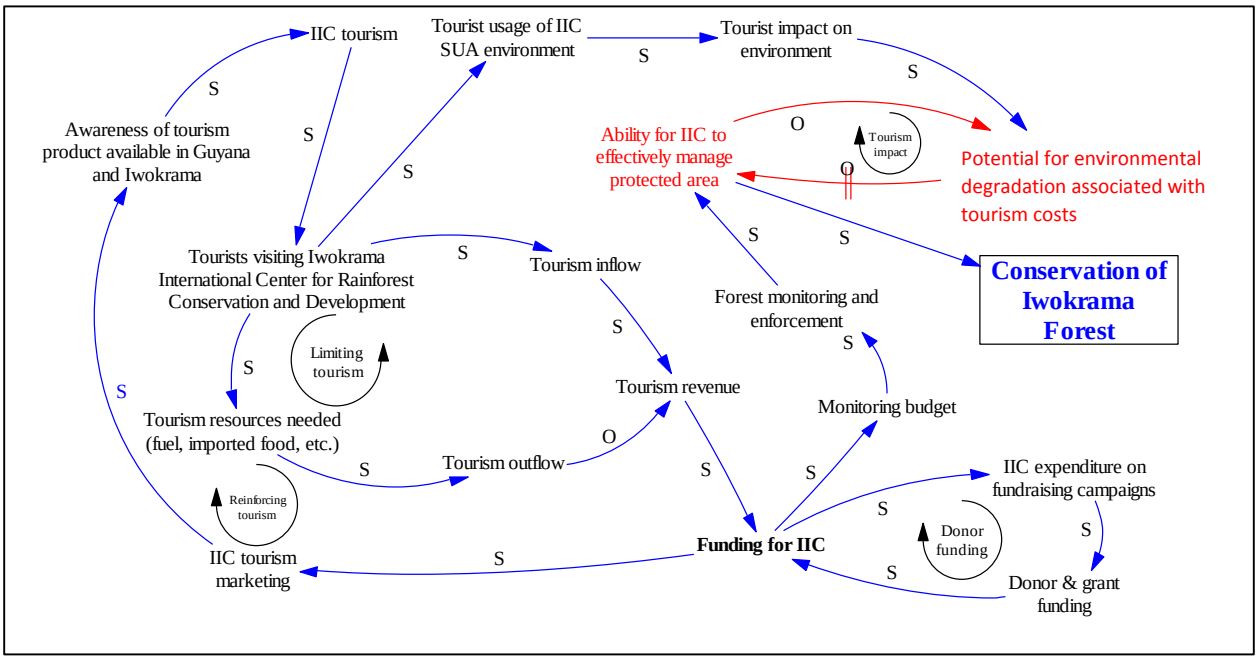


Figure 15 depicts the reinforcing feedback loop pertaining to potential environmental degradation and the ability for the IIC to effectively manage the protected area. This loop is a

double limiting loop, with an opposite effect occurring in each variable based on an increase or decrease in the other. If the ability to manage effectively increases then the potential for degradation decreases and in turn further increases management effectiveness; and vice versa.

Figure 16: Iwokrama funding causal loops

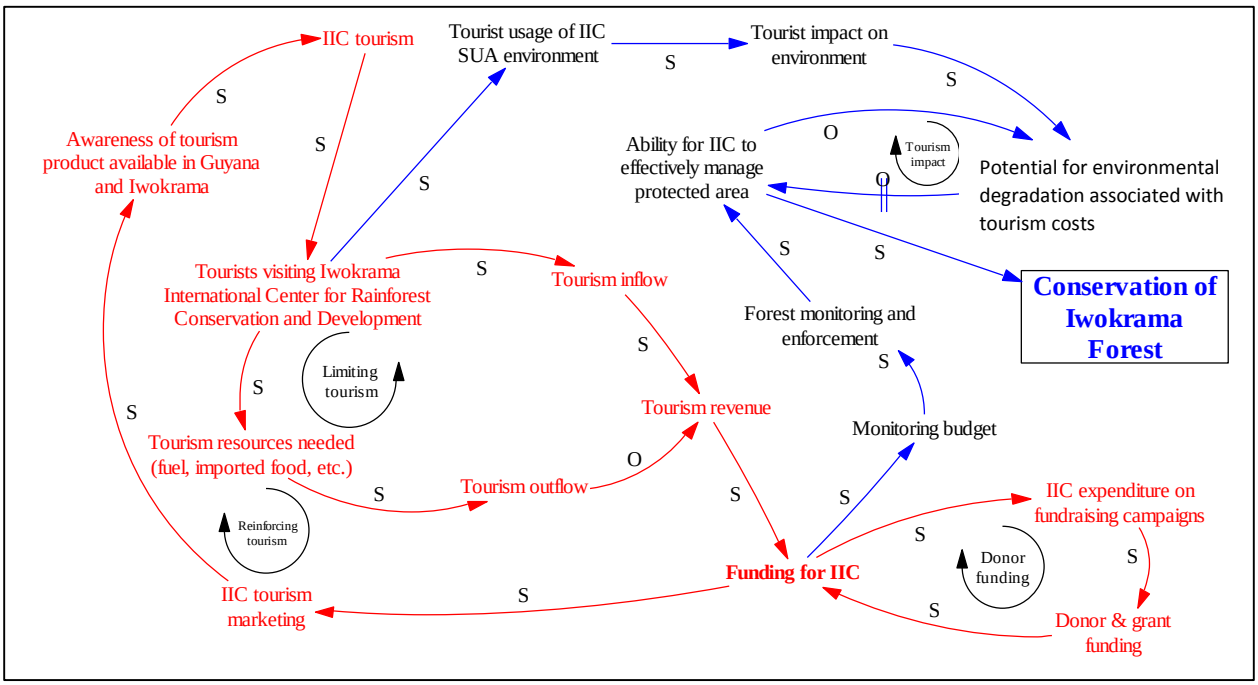


Figure 16 depicts the three causal loops associated with funding for the IIC. The "Donor funding" loop is reinforcing and implies that an increase in funding will lead to an increase in fundraising and in turn more donor funding, which will lead to a further increase in funding, and vice versa. The "Reinforcing tourism" loop implies that increased funding will lead to increased marketing and ultimately an increased number of tourists which will bring in more revenue and lead to increased funding, while an initial decrease in funding will have the reverse effect. The "Limiting tourism" loop implies that an increase in the number of tourists visiting the IIC will lead to a limiting negative feedback cycle of decreasing funding based on the associated increase

in tourism resources needed to sustain more tourists and the necessary increase in tourism outflow that will decrease overall funding. This negative feedback loop is not as strong as the positive reinforcing loop and will not affect funding near as much due to the slight increase of tourism resource use leading to a slight increase in tourism outflow and only a small decrease in overall funding. This is compared to the potential for large increases or decreases in funding associated with the amount of tourists that visit the Iwokrama Forest. It is also important to note that the IRL uses captured rainwater for drinking water, stored river water for washing and bathing purposes, and solar panel electricity combined with a diesel generator that runs for only 6 hours per day. The result is a very small environmental impact for tourists using accommodations and a main reason why the "Limiting tourism" feedback loop is much weaker than the positive "Reinforcing tourism" loop. The ecological footprint analysis discussed in *Section 2.5* is not considered in this line of thinking. Management may or may not choose to include EF measurements when determining the environmental impact of tourism within the Iwokrama Forest.

8. FINDINGS AND RECOMMENDATIONS

8.1 Findings

Based on IIC funding, expenditure, and tourism statistics, it can be concluded with certainty that tourism is an effective funding source for protected area management in Guyana using the Iwokrama International Center for Rainforest Conservation and Development as a baseline study. Tourism is already a significant source of funding with US$255,690, or 21% of total revenue, coming from tourism in 2013, but there is the capacity to increase this further as the 605 tourists that visited in 2013 accounted for only 10.33% of the full visitor accommodation capacity. If tourism could increase to 25% of full capacity over the course of a year it would bring in US$853,940 worth of funding while most likely having significantly less of an impact on the environment than if the remaining 75% of capacity was filled.

An increase of funding from US$255,999 to US$853,940 would give the IIC a 334% increase in tourism revenue and would account for 70% of total revenue if it remained at the 2013 level. The US$598,250 increase from 10.33% capacity to 25% capacity would almost make up for the US$740,808 decrease in total revenue between 2012 and 2103. The IIC could use this extra funding to return expenditure levels to that of 2012, before fundraising decreased by 87%, training decreased by 77%, forest research decreased by 61%, and monitoring decreased by 19%. The increased expenditure could be used to undertake fundraising efforts that would in turn lead to more potential funding from outside sources and an increase in training services would also help in multiple aspects. Increasing monitoring expenditure and bringing back key staff that was lost would be very important in contributing to management effectiveness of the Iwokrama reserve and the ultimate goal of keeping the area properly protected.

If the IIC can remain operational at an optimal level and the Iwokrama Forest can be protected in the manner that was intended the result would be beneficial for the entire planet. 2013 had the highest single year jump in carbon emissions with a 2.9 ppm increase, beating the previous record of 2.7 ppm in 1998 (WMO, 2014). Emission increases are not solely caused by actually emitting more carbon as several measures have been put in place to try and slow emissions. Increases in atmospheric concentrations of CO_2 are also due to decreases in carbon sinks, such as dense forests. Iwokrama offers not only a carbon storage area of over 350,000 hectares, but also a model for a combination of conservation, community development, and limited sustainable use of forest products to benefit the people living in tropical forested regions without having to give up these forests to mining or logging for financial gain. Sustainable ecotourism is an effective way of bringing in revenue for forests if managed properly, essentially conserving carbon storing and biodiversity rich ecosystems without a reliance on donor or grant funding. Iwokrama is a working example of using tourism in a financially rewarding manner, and with a small increase in tourism numbers some very positive results could be seen within the organization and reserve as a whole.

8.2 Recommendations

Tourism increases will help the IIC increase funding, but in order to achieve this certain measures must be put in place to bring more tourists to central Guyana. The following are a set of small recommendations aimed at bringing more awareness to tourism in this region:

- Iwokrama and the government of Guyana partner to increase awareness of the Guyanese hinterland in North America, Europe, and Georgetown

- Iwokrama develops a cost effective marketing and advertising campaign aimed at North American and European travel agencies. Based on current funding troubles this would need to be a very small endeavor, but if a small increase in marketing leads to a small increase in funding, then the small increase in funding can be used for further marketing and start a reinforcing cycle of increased tourism
- The IIC aims at developing partnerships with organizations such as National Geographic that send teams and film crews to areas like Iwokrama. Benefits from such partnerships would include direct revenue from teams using the reserve, as well as indirect revenue from increasing amounts of tourists that would want to visit the area shown on film
- Updated brochures and promotional materials in Georgetown through the main office
- Road improvements (government issue; IIC could appeal for changes)

Some previous recommendations from the 2013 tourism management plan have been implemented for 2014 including: an updated and more user friendly website, easier booking through direct contact with IIC rather than only through tour operators, marketing of the availability of research building and training building accommodation on website, breakdown of all costs on website, small tour maintenance improvements, and small IRL maintenance improvements. There are no major recommendations for improvements to the IRL or the IIC tourism area at present time because of the recent implementations. All recommendations for increased tourism and associated funding increases are centered on marketing and developing partnerships with organizations that would partake in high revenue excursions. If more tourists make the trip to the Iwokrama Forest then tourism revenue will increase and increased overall funding will follow. This should be the main focus of the Iwokrama International Center for Rainforest Conservation and Development. Sustainable ecotourism is an effective means of

increasing much needed funding, but funding from tourism cannot increase without an increase in tourism patronage.

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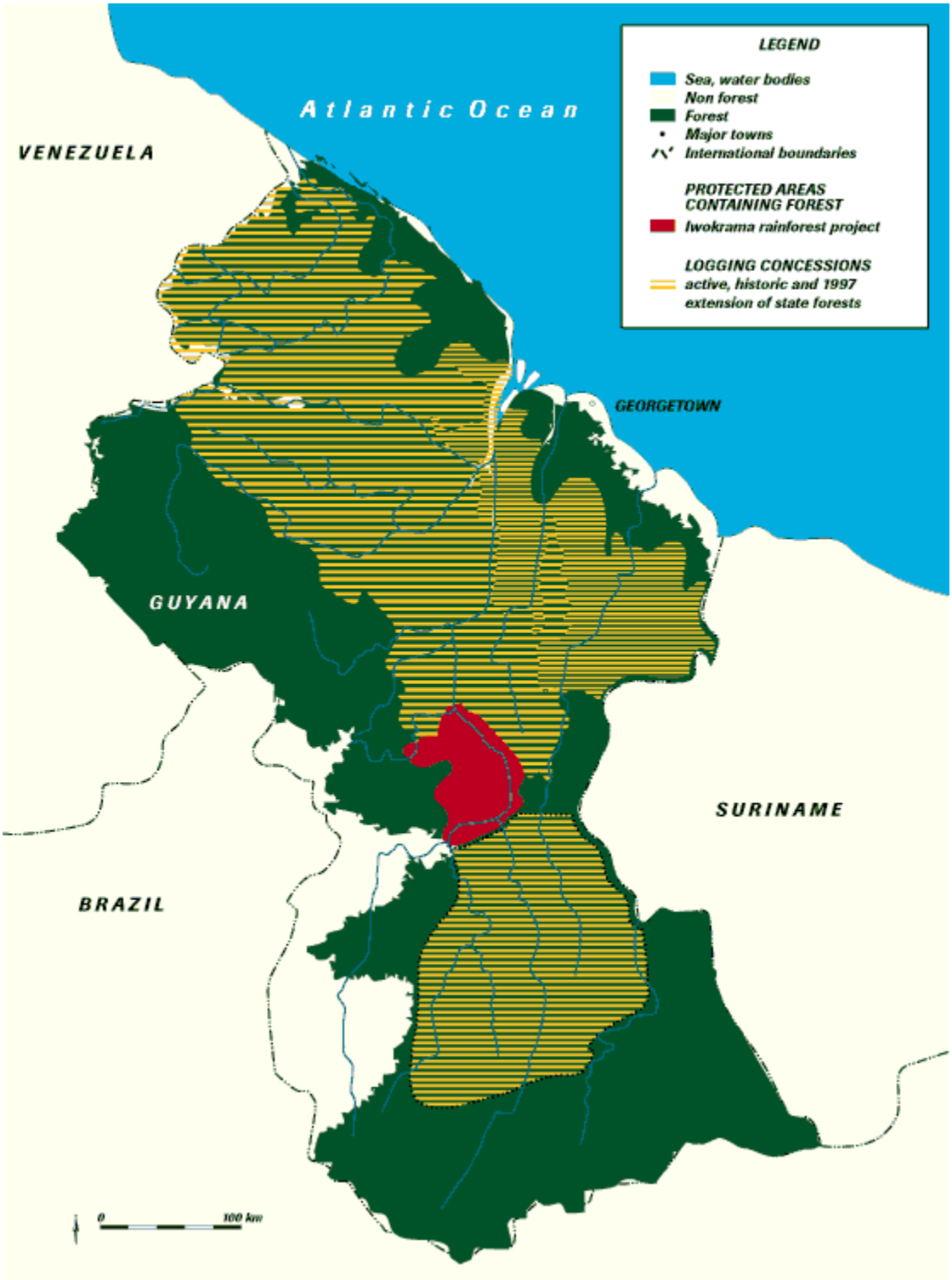
APPENDIX I

LOGGING CLAIMS SURROUNDING IWOKRAMA FOREST



(Source: Forest Monitor, 2014)

APPENDIX II

MINING CLAIMS SURROUNDING IWOKRAMA FOREST

Mining Claims in DTL Concession (Source: Thomas-Caesar, 2013)