Guyana National Land Use Plan

Government of Guyana

Ministry of Natural Resources and Environment

Guyana Lands and Surveys Commission

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PREFACE

A National Land Use Policy and Plan for Guyana have been long overdue. Although several baselines and regional and municipal plans have been prepared, there still remained a national overarching policy and plan that can serve to guide land use decisions. This National Land Use Policy and Plan comprises both the process by which it was developed, and the policy and plan itself, including full explanations of the plan content

It is accompanied by a separate map folder, which contains larger format maps, where the larger format helps in viewing and use. A separate Summary document is also available.

This National Land Use Plan was developed by the Guyana Lands and Surveys Commission (GL&SC) with support from the Development of Land Use Planning Project (DLUPP).

As described in this document, the Plan, as presented, is not a prescriptive document. Rather, it is intended to provide the overarching policy framework for land use decision-making co-ordination for the other land-based sector agencies such as the Forestry Commission, the Geology and Mines Commission and the Central Housing and Planning Authority.

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TABLE OF CONTENTS

Table of Figures

Table of Tables

LIST OF ACRONYMS & ABBREVIATIONS

ADP	Agriculture Diversification Programme
AU	Animal Unit
B	Boron
BoS	Bureau of Statistics
BP	Before Present
CCSI	Climate Change Solutions International
CDC	Community Democratic Council
CH&PA	Central Housing & Planning Authority
CJIA	Cheddi Jagan International Airport
CTO	Caribbean Tourism Organisation
D&I	Drainage & Irrigation
DBH	Diameter Breast Height
DEM	Digital Elevation Model
DfID	Department for International Development (UK)
DLUPP	Development of Land Use Planning Project
DTL	Demerara Timber Ltd
EBD	East Bank Demerara
ECD	East Coast Demerara
EDMI	Enumeration District Marginality Index
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
ETM	Enhanced Thematic Mapper
FDI	Foreign Direct Investment
FAO	UN Food & Agriculture Organisation
GDP	Gross Domestic Product
GEA	Guyana Energy Agency
GEF	Global Environment Fund
GFC	Guyana Forestry Commission
GGDMA	Guyana Gold and Diamond Miners Association
GGMC	Guyana Geology & Mines Commission
GINRIS	Guyana Integrated Natural Resources Information System
GIS	Geographic Information System
GLASP	Guyana Land Administration Support Programme

GLCN	Global Land Cover Network
GLDA	Guyana Livestock Development Authority
GL&SC	Guyana Lands and Surveys Commission
GMTIC	Guyana Ministry of Tourism, Industry & Commerce
GoG	Government of Guyana
GPL	Guyana Power & Light
GW(h)	Gigawatt (hour)
ha	Hectare (2.47 acres)
HEP	Hydro-electric Power
IADB	Inter American Development Bank
IIRSA	Initiative for Regional Integration of Infrastructure in South America
K	Potassium
kW	Kilowatt
LCC	Land Capability Classification
LCCS	Land Cover Classification System
LCDS	Low Carbon Development Strategy
LCI	Living Conditions Index
LTR	Land Tenure Regularisation
LUP	Land Use Plan/Planning
Mg	Magnesium
MMA	Mahaica, Mahaicony & Abary
MoA	Ministry of Agriculture
MoAA	Ministry of Amerindian Affairs
MoEd	Ministry of Education
MoLG	Ministry of Local Government
MoNRE	Ministry of Natural Resources & Environment
MoPW	Ministry of Public Works
MW	Megawatt
MRVS	Monitoring, Reporting and Verification System
NAREI	National Agricultural Research & Extension Institute
NCS	National Competitiveness Strategy
NDC	Neighbourhood Democratic Councils
NDIA	National Drainage & Irrigation Authority
NDS	National Development Strategy

NGO	Non-Governmental Organisation
NLUP	National Land Use Plan
NRDDB	Northern Rupununi District Development Board
NRMP	Natural Resources Management Programme
NTFP	Non Timber Forest Product
OP	Office of the President
ODA	Official Development Assistance
P	Phosphorus
PA	Protected Area
PAMS	Protected Area Management System
PGGS	Permission for Geophysical & Geological Survey
PIT	Project Implementation Team
PPL	Petroleum Prospecting License
PRS	Poverty Reduction Strategy
R&E	Research and Extension
RCO	Regional Chairman Officer
RDC	Regional Democratic Council
REDD+	Reducing Emissions from Deforestation and Forest Degradation
REO	Regional Executive Officer
SC	Steering Committee
SFE	State Forest Estate
SFEP	State Forest Exploratory Permission
SFP	State Forest Permission
SLM	Sustainable Land Management
SRTM	Shuttle Radar Topographic Mission
T&CP	Town & Country Planning Act (1946)
TM	Thematic Mapper
ToRs	Terms of Reference
TSA	Timber Sales Agreement
UAEP	Unserved Areas Electrification Programme
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation

USGS	United States Geological Survey
WCL	Wood Cutting Lease
WSG	Work Services Group
WWF	World Wildlife Fund
Zn	Zinc

1 INTRODUCTION

This document is the full version of the Guyana National Land Use Policy and Plan. It comprises six (6) Chapters (1 Introduction, 2 Current Situation, 3 Opportunities and Constraints, 4. National Land Use Policy, 5 Development Options and 6 Conclusions and Recommendations) a bibliography, two annexes and an associated map album. A summary of this document is also available, synthesising background data and information and highlighting the findings.

1.1 Objectives

The primary objective of the National Land Use Plan (NLUP) is to provide a strategic framework to guide land development in Guyana. As such the NLUP is built upon a number of national policies and strategies that have a direct relevance for land use and land management.

A main objective of the NLUP is to enable financial resources to be targeted at optimal land uses at the regional level. To this regard the NLUP has been compiled from a policy of active promotion of multiple land use.

The NLUP is not prescriptive in that it does not aim to zone areas of the country for particular land uses, rather it aims to suggest a number of options for particular areas that can then guide decision-makers and attract inward investment.

In conjunction with the above, a further aim of the NLUP is to provide a spatial element to development planning, to show on one map, or a series of maps, what the current situation is, where resources are located, where potential exists and what linkages may be necessary to develop those resources.

1.2 Rationale

The rationale behind the development of the NLUP is multi-faceted and includes:

- **Climate change, adaptation, mitigation and a need to develop land away from the coastal plain**

  90% of Guyana's population is concentrated on the coastal plain, much of which lies at 0.5 to 1m below sea level necessitating a high level of infrastructure (sea defence, dykes, canals, drains etc) the maintenance of which is a constant drain on the country's economic resources. The LCDS estimates that 39% of the population producing 43% of GDP live in regions exposed to significant flooding risk.

  By 2030 flooding has been estimated to cost US$150m annually and extreme events such as the flooding of 2005 (that resulted in losses equivalent to 60% of GDP) could result in US$0.8bn in losses and affect 320,000 people.

  The need to identify and develop land away from the coastal plain has been included in the LCDS as Hinterland Adaptation Measures to be undertaken in 2012-2015.

- **Land pressure on the coastal plain**

  The PRS (2000 & 2004) pointed out that the increased pressure on land resources in the coastal plain made the development of a land use policy and plan crucial. The absence of a policy and plan was seen to create land use conflicts which then had serious implications for the sustainable use of natural resources, and that the absence

of clear policies and guidelines for integrated environmental management (especially of the coastal zone) was a major constraint.

- **The need for rational land use development as spelled out in many policies and strategies**

  It is now fifteen (15) years since the NDS (1996) called for the 'formulation of a national land use plan to define sustainable land use practices…..' and the Land Use Baseline Report called for 'land use plans … to be …based on empirically derived data …. of physical, social, economic and demographic characteristics', and that 'policy must provide for the co-existence of multiple land uses…'

  In addition the PRS has called for both policy and plan formulation, and more recently the LCDS and the NCS have identified specific areas for development highlighting the need for a plan.

- **Need for more effective management of competing land use claims**

  Economic expansion in the 1990s and 2000s has led to a number of problems due to agricultural expansion and increased resource use:

    - Illegal resource extraction
    - Inadequate regulation
    - Multiple-use conflicts both inland (mainly mining and forestry) and on the coastal plain (cropping, livestock, housing and industry)
    - Environmental degradation and pollution

  These symptoms betray a more fundamental problem; the absence of a comprehensive land use policy and of a formal land use planning mechanism.

- **The need for linkage between regional development plans and national development**

  At present Regional Planning is almost wholly economic without a spatial element. The NLUP aims to provide that spatial element and to highlight potential areas and options for development within which future Regional Plans can fit.

- **The desire for infrastructure linkages within the wider northern South America**

  An IIRSA (Initiative for Regional Integration of Infrastructure in South America) study in 2007 looked at the potential for greater regional integration through infrastructure development and proposed a number of potential projects on three axes involving Guyana: Brazil-Guyana, Venezuela-Guyana and Guyana-Surinam-French Guiana.

1.3 Policy and Strategic Guidance

The preparation of the national land use plan has taken place within the context of a number of policy and strategic documents that have guided plan formulation. These include the National Development Strategy (NDS 1996), the Poverty Reduction Strategy (PRS 2000, 2004, 2011), the Land Use Baseline Document (1996) which led to the Draft Land Use Policy (2004, 2007), the National Competitiveness Strategy (NCS 2006) and the Low Carbon Development Strategy (LCDS 2010).

Annex B looks at a number of policy and strategy documents and how they may affect land use policy and planning. The main points that have influenced and guided the development of the NLUP are indicated below.

1.3.1 National Development Strategy (1996)

The National Development Strategy (NDS) provides a framework for the long term (25 years) development of Guyana. It took four (4) years to compile through a participatory process. The main points include:

- **Macroeconomic** growth should be sustainable in terms of fiscal, environmental and institutional terms
- Access to **agricultural land** should be made easier (lease conditions, selection criteria, improved decision making etc) and a rural land tax should be introduced to discourage under-use of land
- The potential for non-traditional crops should be studied in certain geographical zones based on suitability and markets
- **Aquaculture** should be promoted
- **Forestry** should be developed to increase economic benefits and improve sustainability
- A national **mineral** inventory should be undertaken
- Export Processing Zones (**Manufacturing**) should be set up to coincide with a deep-water port and a Georgetown-Lethem road link
- **Transport** links should be developed including all-weather roads to resource rich areas (mining, forestry, soils), complete the Georgetown-Lethem road link, construct bridges across major rivers, develop a water port, upgrade airport facilities and develop the hinterland
- Water Resources and **Flood Control**. Protection of mangroves, encouragement of participation in D&I maintenance, climatic zoning for land use planning
- Develop Export Processing Zones, Industrial areas and green belts around **urban** areas
- **Environment**. Protection of mangroves, develop Codes of Practice for mining and forestry, introduce EIA legislation, set up Protected Areas system
- Land reform to secure **Amerindian** land rights

Many of the proposals in the NDS have been acted upon or are currently ongoing. Areas that have not been acted on include a rural land use tax to maximise land use, a mineral inventory to guide mining development and some of the infrastructure developments.

1.3.2 Land Use Baseline Report (1996)

The Baseline Document on Land Use in Guyana formed part of the Natural Resource Management Project and sets out land use issues, constraints and recommendations following country-wide stakeholder consultations. This led to the preparation of a draft land use policy. The main points of the Policy in relation to land use planning include:

- Policy must provide for the co-existence of **multiple land uses** and also provide clear, implementable guidelines for making decisions on multiple land uses and mutually exclusive, competing land uses.
- Policy must provide for the use of zoning, particularly **multiple-use zoning**.
- Land use plans and policies must be based on **empirically derived data** as far as this is available.
- Land policy should support the principle of allocation based on **beneficial occupation**, and that lands not productively used should be re-allocated to more productive uses or users.

1.3.3 Land Use Policy (2004, 2007, 2012)

The draft land use policy used existing, approved policies and strategies and was first develop in 1998. It went through three drafts.

However, the introduction of the Poverty Reduction Strategy (PRS) in 2000 (*q.v.*), and updated in 2004, reawakened interest in land use policy since many of the recommendations of the NDS in 1996 (updated in 2001) were reaffirmed in the PRS and concerned natural resource management, land and land use planning, agriculture and environmental policy. Salient points were:

- The absence of clear policies and guidelines for integrated environmental management (especially of the coastal zone) was a major constraint
- The lack of a general land use plan was seen to create land use conflicts which then had serious implications for the sustainable use of natural resources
- As pressure on land resources increased, the need for a national land use policy and plan would become crucial, especially since such a national policy could be a strategy for attaining optimal land use towards national development

In 2004 a further draft of a national land use policy was produced. This was set within existing broad-based policy documents such as the NDS, the PRS and the Area Development Strategy for Amerindian Communities and took all existing sector policies and strategies into account. The policy identified the need for a National Physical Plan to provide a spatial element to the NDS.

In addition, the draft policy identified criteria for the allocation of agricultural land and specifically allowed and promoted multiple land use. It also proposed the establishment of a co-ordinating National Land Resource and Land Use Working Group to co-ordinate land issues and to address and resolve land use conflicts.

The draft policy was circulated in Government and associated Agencies but again was not ratified. However, an inter-agency land use co-operation committee was established to address issues of land use conflict. The policy was reconsidered in 2007 and re-issued as a shorter document comprising the policy statements only, without any appendices, setting the policy environment and context. This 4th draft was also not adopted.

In 2012 GL&SC, through UNDP, produced a document integrating Sustainable Land Management (SLM) principles into the draft Land Use Policy. This concluded that Guyana would benefit greatly from a National Sustainable Land Management Policy document that would integrate land administration, land use planning and land management across all sectors incorporating social, economic and environmental concerns. A possible policy outline was produced.

1.3.4 National Competitiveness Strategy (2006)

The National Competitiveness Strategy (NCS) was prepared in 2006 as a response to NDS goals and to the fact that many of Guyana's preferential export markets (sugar, gold, bauxite) were eroding due to globalisation. The strategy targeted exports and a supply chain approach and highlighted potential for aquaculture and non-traditional agriculture products.

Of particular interest to land use planning is a **pilot programme** for allocating relatively large land plots of land to attract larger investors such as the Canje Basin, Intermediate Savannas and Rupununi Savannas.

The NCS has led to the **Grow More Food** campaign that ran from 2008-2011 with plans for expansion in 2012 to include medium and large-scale farmers. The main pillars of the campaign were:

- the **Agricultural Export Diversification Programme** that aims to increase income derived from the export of non-traditional agricultural exports in the aquaculture, fruits and vegetables and livestock sub-sectors. This increase in income can be achieved partly by improving agricultural support services but also by bringing new or abandoned land into development.
- the **Rural Enterprise & Agricultural Development Programme**
- increased **investments in D&I** by restoring drainage to areas abandoned by farmers and training farmers to manage the maintenance of rehabilitated structures
- improved **extension services** through the creation of the Guyana Livestock Development Authority (GLDA) and augmenting the National Agricultural Research and Extension Institute (NAREI)
- improved **input provision**; seeds, planting materials and improved breeds

Of particular interest to the NLUP are:

- The **rehabilitation of abandoned land** through improved D&I
- The policy that **livestock** development will only be on **non-forested land**
- GL&SC policy of providing five priority areas for agricultural development
    - Bartica-Potaro road
    - Moblissa Watoka
    - Intermediate Savannas
    - Rupununi Savannas
    - Mara-Canje Backlands

1.3.5 Low Carbon Development Strategy (2010)

The Low Carbon Development Strategy was influenced by the effects of climate change, in particular the floods of 2005. In 2006 Guyana first proposed the idea that it could be paid for placing its 15 million hectares of pristine forests under protection and the subsequent REDD+ (Reduced Emissions from Deforestation and Degradation) mechanism has provided a means whereby this may be achieved.

The LCDS is a different development strategy based on the environmental services that Guyana's forests provide to the world, such as bio-diversity, water regulation and carbon

sequestration. It sets out the means to transform Guyana's economy while combating climate change by forging a low-carbon economy over the coming decade.

Essentially, the strategy proposes integrating forest land use policies with the LCDS through integrated land use planning for forestry and mining and other forest-based land uses. The LCDS is likely to guide both national and regional land use decisions, and will need to be reflected in the land use planning.

In this context, the LCDS consists of a vision and strategic plan to attract resources for Guyana to grow and develop without jeopardizing the significant forest resources that exist within the country.

The three main components of the LCDS are:

- Investment in low carbon economic infrastructure
- Investment and employment in low carbon economic sectors
- Investment in communities and human capital

The LCDS has several implications for land use planning in Guyana

- Currently, the LCDS only pertains to the State Forest Estate (which covers about 85% of Guyana); it does not include titled Amerindian lands (although communities can decide whether they wish to opt in to the strategy) or existing Protected Areas.
- While the LCDS does not require mining and forestry activities to stop, such activities are required to comply with rigorous standards; monitoring and enforcement have become more stringent.
- Included in the component of investment in low carbon economic infrastructure is the development of Amaila Falls HEP on the Potaro River and infrastructure improvement to target the development of unused non-forested land such as on the coastal plain (e.g. Canje Basin) and the intermediate and Rupununi savannas. Infrastructure improvements include roads, D&I and off-grid power.
- The high-potential low-carbon sectors build on those identified in the NCS and include:
    - fruits and vegetables
    - aquaculture
    - eco-tourism
    - Forestry and wood processing
    - Bio-ethanol
- As part of the adaptation measure to combat flooding the LCDS commits to upgrading D&I infrastructure on the coastal plain
- The demarcation and titling programme of Amerindian lands is integral to both LCDS and REDD+ and is due to be completed by 2015, although doubts have been raised whether this is an attainable goal
- The Amerindian Development Fund has highlighted particular land uses as suitable for development in particular areas. These are:
    - aquaculture in Regions 1,2,7,8,9
    - eco-tourism - all regions

- cattle rearing and processing in Regions 8 and 9

1.3.6 Poverty Reduction Strategy (2000, 2004, 2011)

The Poverty Reduction Strategy (PRS) dates from 2000 with public consultations in 2001. It was formulated largely in response to the 1992 Living Standards Survey which had shown that 43% of the population lived below the poverty line. The PRS was considered a medium-term strategy to run in tandem with the NDS, which has a 25 year timeframe.

The PRS noted that

- The lack of a general land use plan was seen to create land use conflicts which then had serious implications for the sustainable use of natural resources.
- As pressure on land resources increased, the need for a national land use policy and plan would become crucial, especially since such a national policy could be a strategy for attaining optimal land use towards national development.
- The absence of demarcation between crop and livestock pastures on the coastal plain was a constraint to agricultural production and productivity. A policy should be developed to demarcate the different land uses.

The strategy was reviewed in 2004 and noted that substantial progress had been made in land development and allocation including Land Tenure Regularization (LTR), improvement of land administration systems and services and organisational development of GL&SC.

The PRS was again reviewed in 2011 and realigned the strategy in recognition of progress between 2001 and 2010 and taking into account the global economic slowdown that started in 2008. The report noted that Guyana had met or exceeded 16 of the 28 core poverty indicators.

The poverty reduction agenda for 2011-15 shows the GoG vision for medium term development with the following pillars very much in line with the NCS and the LCDS:

- broad-based, low-carbon led job creation economic growth
- stronger governance, institutional and regulatory structures
- accelerated investment in human capital and primary health
- accelerated investment in physical infrastructure in support of growth strategy
- special intervention programmes to address regional and demographic pockets of poverty

These will be augmented by cross-cutting measures including disaster risk management and environmental sustainability.

In terms of land use planning it is recognized that much of Guyana's non-forested land available for high-value agricultural development requires costly drainage and irrigation and significant road investments. There is a large 'infrastructure gap' given the need for D&I and sea defence works on the coastal plain and the development of a transport network (including roads and bridges) for accessing the rest of the country that will require significant resource outlay.

It is also noted that Guyana's oil dependent electricity supply is more expensive to end users making Guyana less attractive to industrial investors. Potential investments in manufacturing, agricultural processing, and mining all require reliable and cheaper sources of energy and that economic transformation will require resolving the energy issue.

The report also notes that climate change and natural disasters (particularly flooding) present a recurring challenge to growth and that with 90% of the population living on the coastal plain the continued maintenance of the D&I system is a significant cost, and that the possibility of further flooding is a key challenge to economic development.

Policies for national development in 2011-2015 with particular relevance to land use planning include:

- Continued Modernisation of the Traditional Sectors
- Agricultural Diversification
- Growth supporting Infrastructure

Continued Modernisation of the Traditional Sectors

(sugar, rice, forestry, mining (particularly gold and bauxite) including:

- **Reforming the Agricultural Sector**

  Aggressively expanding sugar cultivation

  Expand drainage and irrigation of arable land suited for rice cultivation

- **Sustainable forestry and wood processing;**

  Pilot forest plantations establishment;

  Conducting a detailed National Forestry Inventory;

  Establishment of additional Community Forestry Organizations and providing them with accessible forested lands

  Promote the use of forestry resources in Amerindian Lands

Agriculture diversification and Expanding production and exports of fruits and vegetables

Diversification of the agricultural sector is a major strategic priority for the Government. Elements of the agriculture diversification will include:

- Fresh Produce and Aquaculture
- Production of Soya Beans and Cashew Nuts

In the medium-term, the Government aims to expand the area of land cultivated for export crops and to allow farmers to use otherwise fallow land (i.e. abandoned/unused land) to supply both local and export markets.

Aquaculture is promoted through the ADP. The production of soya beans and cashew nuts for stock feed and export will be concentrated in Region 9.

In addition, the strategy aims at the emergence and growth of new sectors including tourism and business process outsourcing. Of interest for land use planning is that a Protected Area Management system (PAMS) will be put in place with detailed planning developed to:

- distinguish between zones suitable for different types of eco-tourism
- determine general carrying capacities
- identify sensitivities and limits of acceptable change

- outline guidelines for development within the different zones
- specify indicators to monitor activities and change

Building Infrastructure to Support Growth

This includes construction, rehabilitation and ongoing maintenance of:

- drainage and irrigation systems
- roads and bridges
- sea defences
- air and marine transport infrastructure
- power generation, transmission and distribution

The main points of interest for land use planning are:

Drainage and Irrigation

Includes the following measures

- Routinely de-silt the mouths of rivers that provide outlets for the D&I system
- Construct a new outlet for the East Demerara Water Conservancy and permanent structures for the main conservancies
- Install more pumps along the coastal regions to speed up drainage during periods of high tides
- Rehabilitate sluices and kokers and make them functional all-year round
- Undertake regular routine maintenance of the D&I system.

Sea Defences

The medium term strategy will focus on:

- Maintenance, monitoring and surveillance with some amount of reconstruction.
- Protecting and enhancing the mangrove forests which provide protection to large length of sea defences

Sustaining and Expanding the Road and Bridge Network

Rehabilitation of farm-to-market roads and bridges and key road projects including:

- a four lane road from Providence to Diamond,
- four lane expansion from Sherriff Street to Houston
- access road from Turkeyen to Diamond and then to Timehri.

Air and Marine Transportation

This will concentrate on upgrading the Essequibo River transport infrastructure with two roll on-roll off ferries and rehabilitation of wharves and stellings. On the Demerara River, the emphasis will be on maintaining the Demerara Harbour Bridge to extend its operational life time. In the area of air transport, the expansion of CJIA including the extension of the runway are planned for the medium term.

Developing Core System of Infrastructure for Growth and Competitiveness

The report notes that the investment programmes mentioned above may help to sustain the existing structure of growth, but will not provide the paradigm shift critical to change the dynamics of the economy, make best use of the country's vast natural resources or take advantage of Guyana's strategic geographical location between Brazil and the Caribbean. To this end the Government aims to develop the core infrastructure system consisting of:

- Development of a deep-water harbour at New Amsterdam
- Construction of a highway from Linden to Lethem

Feasibility studies have been undertaken to analyze the construction of an all weather road and improvements to the four hundred and twenty eight (428) km roadway from Linden to Lethem. Feasibility studies for the development of a deep harbour have also been completed. The Government in the medium term will seek private funding including public private partnership arrangements for the construction of the deep-water harbour.

Expanding and Diversifying Power Supplies

In the short-term, the development of up to 165MW of power from the Amaila Falls Hydroelectric Project is now projected to achieve commercial operation by 2015. This aims to replace the oil fired units currently operating in Demerara and Berbice.

The report notes that renewable energy will also be pursued with 10MW from the bagasse-fired co-generation unit at Skeldon, the potential for wind power from a 13.5MW wind farm at Hope Beach (since shelved) and solar power for remote hinterland communities. In addition, the aim is to reduce power losses within the current distribution system where losses account for 40% of power generated.

In addition, and with particular relevance to land use planning, under **'Improving The Legal And Regulatory Framework'** key actions that are being considered include:

- Abolition of the Land Selection Committee
- Passage of an omnibus law on land use
- Revision of the Town and Country Planning Act to empower CHPA, and enforce land use and zoning regulations
- Strengthening enforcement mechanisms and penalties

1.4 Synthesis

A synthesis of the policies and strategies above reveals a number of statements that have guided the development of the National Land Use Plan:

Broad Policy. In terms of the broad policy context, Guyana calls for economic development thus prioritising economic use of land but at the same time calls for sustainable development with the mainstreaming of environmental considerations into all land use planning decisions. Sectoral policies and strategies indicate how this may be done.

Invest in the Coastal Plain. Despite the potential increased flood risk due to climate change (sea level rise and storm surge) it is apparent that Guyana intends to invest in the coastal plain through:

- Improved maintenance of D&I and bring lands back into production
- Continued investment in sea defences (mangrove and structural)

- Target livestock, aquaculture new crops (fruit and vegetable) development
- Expand sugar and rice production
- Convert abandoned and unused land to productive use (agriculture, livestock, aquaculture, housing, export processing, energy)
- Improve monitoring and assessment of land use to apply beneficial occupation requirements (possibility of rural land tax to optimise land use)
- Specifically target Mara-Canje backlands for biofuels
- Assess potential for conversion of currently unused backlands to productive use (but need to be aware of hazard of draining acid-sulphate soils)

Agriculture. Guyana intends to develop its agricultural base through:

- Investment in the Coastal Plain (see above)
- Targeting non forested areas such as the Intermediate and Rupununi savannas as well as the Coastal Plain

Forestry. Forestry will be allowed to continue but has to follow guidelines and codes of practice developed by GFC to ensure sustainability. Sustainability will be ensured through:

- Improved monitoring of forest operations following a forest inventory with guidelines for timber harvesting stipulating a harvestable amount in m^3/area/y of trees of a certain age, height and diameter
- The use of Codes of Practice for forest management that include the sub-division of concessions into blocks to be managed on 25-65 year cycles with an annual allowable cut based on a 60 year cutting cycle at $20m^3$/ha and an annual audit
- A requirement that large-scale concessions (TSAs) leave 4.5% of any concession as a biodiversity reserve
- The understanding that future forestry will concentrate on current concessions since these areas have been assessed as being able to sustainably produce $1.5m^3$ of timber a year but historic and current production rates are only $0.5m^3$/y
- That the only new developments will be those SFEPs south-east of Iwokrama that will be logged at a very low rate of 2-3 trees/ha
- That the production of forest products moves up the value chain requiring better access and energy supplies
- That Community Forestry, pilot plantations and forestry in Amerindian Areas will be developed

Mining. Mining will be allowed to continue but has to follow guidelines and codes of practice developed by the Guyana Geology and Mines Commission (GGMC) to mitigate against deforestation, forest, land and water degradation and pollution. Sustainability in mining cannot be ensured but there is a presumption that the right to extract minerals is paramount in terms of land use although mining rights cannot be exercised with total disregard for other rights and uses. Policy within the mining sector includes:

- A proposed change from a land-based to a mine-based licensing system to promote multiple land use and ensure that smaller areas of land are leased for mining
- A proposed national mineral inventory to outline potential

- The need for prospectors and miners to follow codes of practice and guidelines (Mining Amendment Regulations & Mining Act) for mining and reclamation dependent on mine type and size

Infrastructure. Coupled to developments in the sectors above, Guyana recognises the need to develop infrastructure to promote and sustain development. These include:

- The Georgetown to Lethem road and other potential new roads
- Other roads and bridges to non-forested agricultural development areas such as the Intermediate Savannas
- To make use of roads and bridges developed for mining and logging to drive development in other areas with suitable soils
- The development of a deep-water harbour at New Amsterdam
- The development of improved access on the Essequibo river to Regions 2, 7 and 8
- The development of new D&I areas (particularly for rice) and rehabilitation and maintenance of existing areas
- Better management of conservancies to reduce flooding including the construction of a canal from the East Demerara conservancy (ongoing)
- The development of Export Processing Zones to link up with agricultural development, new road alignments and the deep-water harbour

Energy. Coupled to the promotion of agricultural, forestry and mining development and particularly in promoting processing and manufacturing in Guyana is the development of 'clean' energy. This includes:

- The development of Hydroelectric Power. Initially Amaila Falls but there are many other potential sites
- The development of co-generation (e.g. Skeldon) in rice and sugar mills using biomass
- The potential for alternative energy sources such as wind, solar, biomass and biofuels particularly in non-forested areas but also in conversion forests
- The promotion of small-scale solar and HEP in Amerindian and other hinterland areas

Protected Areas. In keeping with the LCDS and the REDD+ is the maintenance of biodiversity and the ecological function of Guyana's forests. Part of a way to ensure this is the establishment of a Protected Areas Commission and a Protected Area Management system that will:

- Set out a range of eight (8) protected area types involving different management, goals and strategies for resource conservation
- distinguish between zones suitable for different types of eco-tourism
- identify sensitivities and limits of acceptable change
- outline guidelines for development within the different zones
- specify indicators to monitor activities and change

Housing and Commerce. There are several policies setting out the government's thoughts on housing including increasing supply, faster disbursement of public land for housing and

the development of land and housing markets. In this regard, the Central Housing and Planning Authority is in the process of finalising the draft National Housing Policy. However, while the degree to which the National Land Use Plan can take housing developments into account is limited due to the scale of the plan and the relatively small areas of land proposed for housing, the Plan can offer guidance as to the future spatial direction of housing and urban settlement.

Amerindian Land is owned and administered by the community who also have all rights over that land with the exception of large-scale mining. The management of Amerindian Land is set out in the Amerindian Act of 2006 where it is recognised that Amerindian Land is owned communally and that village councils plan, manage and regulate their land.

At present, Amerindian Lands are excluded from the REDD+ process (although GoG is promoting their 'opt-in' to the process) and it is LCDS policy to address all Amerindian areas' titling, demarcation and extension issues by 2015, although the process is very slow.

Under the LCDS it is policy to create opportunities for Amerindian communities through provision of social-services (health, education), low carbon energy (solar power), water supply and income-generating opportunities. Similarly under the PRS (2011) it is policy to address regional poverty through the provision of business development, infrastructure, social services and power supply.

1.5 Method of Compilation

1.5.1 Planning Team

The planning team consisted of consultants and GL&SC Staff. A steering committee, composed of representatives of institutions with various roles and responsibilities in land use planning, was established at the start of the project and met quarterly. In addition, regular presentations and workshops were held throughout the duration of the Project to present findings.

1.5.2 Data Collection

Data and information relevant for land use planning was collected during the inception stage and was added to as it became available during the course of the Project. An analysis of available data was made during the inception phase but it was not until the arrival of the GIS specialist in May 2011 that the limitations of this data became apparent.

Data had been collected by GL&SC and the Project that, when printed, looked suitable. However when all the different data were laid over an image base, it was clear that the data had been collected, collated and kept in a myriad of formats, topologies and projections and would have to be 'cleaned' before being analysed for land use planning. This 'cleaning' meant reshaping and redigitising much of the data to an image base, a process that took about nine (9) months, much of the time being taken up in sourcing, downloading and processing suitable imagery.

As indicated, some data was available at GL&SC at the start of the Project and more data was collected during the Inception Phase (Feb-May 2011). From about June-August the data was analysed and found wanting, and the process of obtaining imagery and cleaning the data took from about October 2011 to May 2012. During this time some data collected earlier was updated (by GGMC and GFC) and this was made available.

The data and maps presented in the NLUP relate to this new mapping to an image base and therefore there may be differences between old data and mapping and the new mapping. This

is noticeable visually on-screen and also in tables where the national and regional area calculations may differ.

1.5.3 Consultation

Consultations for land use planning can be divided into two types; institutional and community stakeholder consultations. The institutional consultations were undertaken mainly in Georgetown and followed the pattern of an initial consultation to introduce the aims of the Project followed by a longer consultation to gather information, discuss issues and obtain any available data. Other institutional consultations were also conducted in easily accessible Regions and during the course of a country-wide field trip in September 2011. The majority of institutional consultations were undertaken between February and September 2011 although follow-up consultations continued until the end of the Project if the need arose.

Community stakeholder consultations were undertaken in each Region of the country between February and May 2012. The method of consultation preparation and format was as set out below.

The DLUPP liaised closely with MoLG who contacted the RDC and arranged a date for an initial meeting between DLUPP and the REO and RCO at the RDC office. The aim of this meeting was to introduce the Project, the concept of a national land use plan and to outline what the stakeholder consultation would aim to achieve. Logistics such as the date, venue, catering and costs were agreed upon, usually being firmed up at a later date.

At this stage an outline list of participants was drawn up. This varied between Regions but usually included representatives of NDCs (or CDCs in Region 10), Water User Associations, Co-ops and land users such as rice, cash crop and livestock farmers, aquaculture operators and the like. In regions with Amerindian Areas, Toshaus and other Amerindian representatives were invited. In Regions containing municipalities then the relevant representatives were invited. Regional representatives of major land use agencies such as GFC, GGMC and GL&SC were also invited.

The aim of the regional stakeholder consultation was to gain an insight as to what the regional land use and planning issues were so that these could then guide the strategic level of the national land use plan.

The stakeholder consultations followed the following format:

Materials

- Handouts (Explanation of DLUPP, Land Use Planning)
- Poster (Example of LUP in Guyana, Region 6)
- Regional Map and Satellite Image
- Questionnaire (Aimed to gather information from land users concerning the main land use issues and land management status etc)

Session

- Introduction
- Presentation
- Discussion

The introduction by the facilitator welcomed participants, outlined the aims of the consultation and its format. The presentation by the consultant started by asking 'why are we here today?', introduced the DLUPP, highlighting its role in producing a strategic NLUP and in looking at the legal and institutional aspects of land use planning.

It also:

- Explained what land use planning is, why it is important and how it differs from development plans in that it is spatial
- Explained the need for land use planning, showing how it is undertaken and gave an example from Region 6
- Outlined the objectives of the National Land Use Plan and the rationale behind it
- Introduced some maps concerning the current situation and potential, identified land use problems and different development options for different parts of the country
- Explained how land use planning is undertaken, the importance of stakeholder consultation and therefore ….
- ….what we would like from the discussion
    - What are the main regional land developments and issues?
    - How do they affect national development?
    - What are main opportunities, constraints and conflicts in region?
    - What are the legal and institutional issues concerning land use planning
    - How could the region be more fully integrated into national development?

The consultations lasted for about 3 hours and the main points arising from these are outlined in Chapter 3 'Analysis of Opportunities and Constraints' with more detail reported in Annex A.

1.5.4 Analysis, Report and Map Production

The analysis of information and data gathered was undertaken in the knowledge that the output of the NLUP would be a series of development options both nationally and for different areas of the country. The evaluation of development options was undertaken following the assessment of the current situation, the identification of problems and an evaluation of options guided by an analysis of sectoral opportunities and constraints while keeping in mind the issues raised by local land users in the stakeholder discussions within a framework of government policies and strategies.

The NLUP report is presented as a short document with maps of land availability and regional development options along with potential infrastructure links and potential development 'hotspots'. The synthesis report is backed up by more detailed annexes, maps and digital data.

1.5.5 Scale and Zoning

The issue of scale is very important in planning and particularly in relation to the NLUP. Output scales are set according to the objectives and requirements of a land use plan but are also highly influenced by the scale of data that can be input to a plan.

In Guyana the vast majority of data that can be mapped and used in a plan is at the national level i.e. small scale, of 1:1 million or smaller. The output maps for the NLUP will be at 1:2.5m and 1:1m scales. At these scales the level of detail that can be shown is limited but it is already limited by the amount of detail available. At 1:2.5m scale a square centimetre equals 62,500ha while at a scale of 1:1m 1cm^2 equates to 10,000ha.

This point is important for those who are hoping that the NLUP can 'solve' their local issue. It cannot. It is intended as a framework for development planning not as a zoning tool. In many stakeholder discussions, particularly on the coastal plain, the need for zoning was highlighted as an issue. This may well be the case but this would require land use mapping and planning at scales far larger than those envisaged for the NLUP.

NLUP and Amerindian Lands

Amerindian Land is owned and administered by the community who also have all rights over that land except for mineral rights although they do have veto rights over medium and small-scale mining.

The NLUP is a strategic document setting out development options for Guyana. It has been compiled by assessing current land use, potential, constraints and stakeholders' concerns. It has taken the location, resources and issues of titled Amerindian areas into consideration but does not attempt to plan for land use within those areas rather to offer land use options for the wider region within which those Amerindian areas are located.

2 CURRENT SITUATION

2.1 Climate

Guyana has a tropical climate characterised by a high but variable rainfall, high humidity and a relatively small temperature range with two wet and two dry seasons. Most of the country is covered by dense tropical forest with savannas on the coast and in the southwest. The majority of the population lives in the coastal lowlands where the northeast trade winds moderate the climate.

Along the coastal plain rain falls an average of 200 days a year, with 50% of the average rainfall occurring from mid-April to mid-August (USACE 1998). The second wet season is in December and January. The wet seasons begin in the west of the country and move to the east, ending with their retreat back to the west giving longer wet seasons in the west of the country.

Annual rainfall is shown in Figure 2-1 and varies from about 2,200mm on the coast to 2,800mm inland, although it rises to over 4,000mm in the Upper Mazaruni/Pakaraima Mountains area. In the drier savannas, where there is only one wet season from April to August the annual rainfall average ranges from about 1,400mm to 1,800mm and most rainfall occurs from April to May.

Mean air temperature ranges between 25 to 27.5°C throughout the year in most regions except the upland regions in the interior/west of the country, where mean temperatures are cooler and range between 20 to 23°C.

Figure 2-1 shows the Climatic Regimes of Guyana as defined by the Hydromet Department of the Ministry of Agriculture. Data are available from the 1920s and 1940s to the present day, with data gaps in the '80s. Collated data was published from 1972-1974 but not since. There are currently 8 synoptic stations in the country, in all regions except Regions 2 and 3 on the coast.

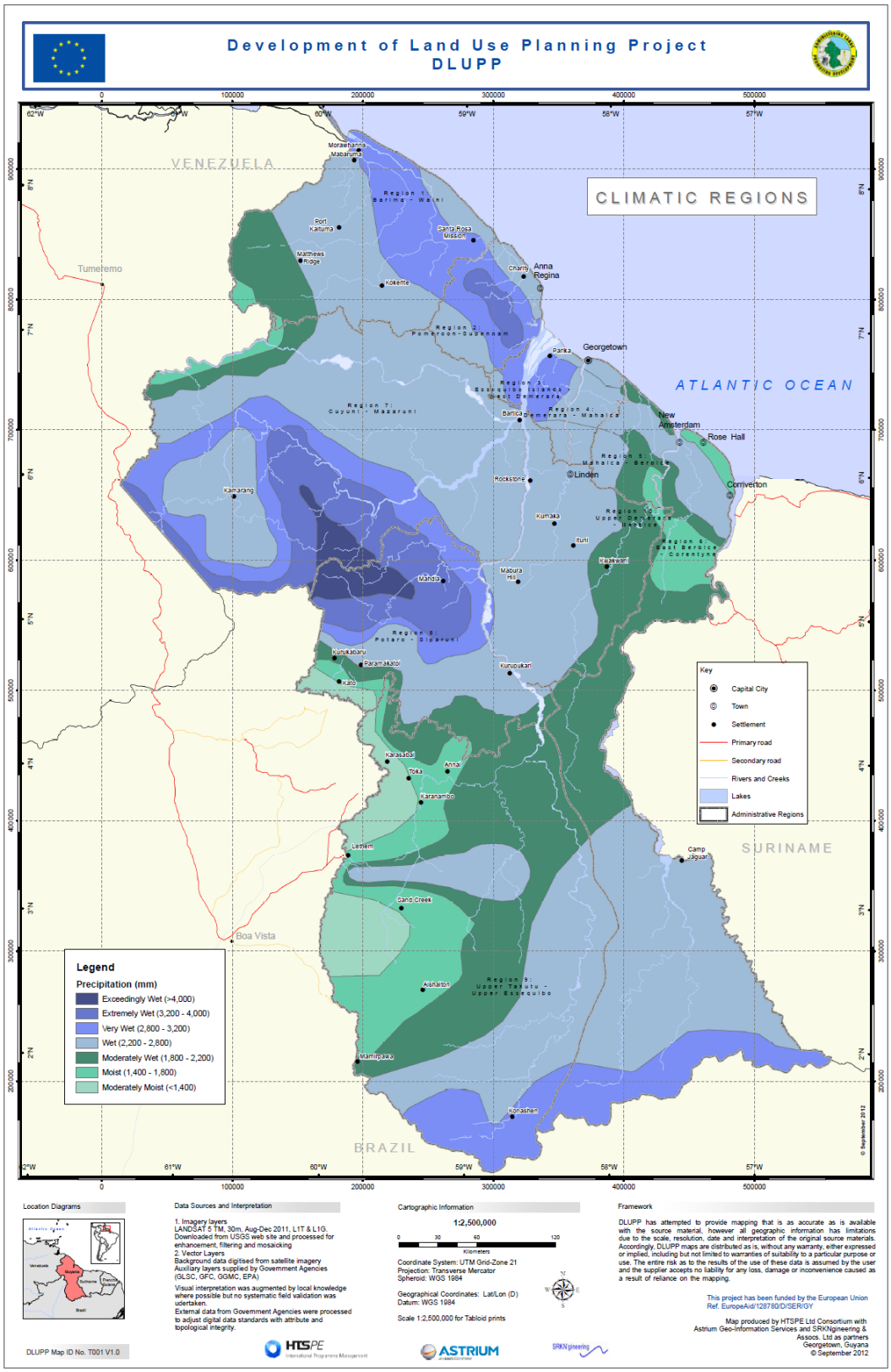
In terms of climate trends, anecdotal evidence points to one of increased rainfall in the south of the country at the expense of coastal rainfall although there are not enough data to confirm this as yet (see Climate Change below).

2.1.1 Climate Change and Sea Level Rise

Guyana's Second National Communication prepared by **Climate Change Solutions International** (CCSI, 2009) noted that the mean annual air temperature of Guyana, overall, has increased by 0.3°C since 1960, which translates into an average rate of c.0.07°C per decade. This rate of warming is less rapid than the global average of c.0.08°C per decade. Mean annual rainfall over Guyana has increased at an average rate of 4.8mm per month or 2.7% per decade since 1960. Trends in both annual and seasonal rainfall are minimal and not statistically significant and there seems to be no evidence of any significant trends in maximum 1 day or 5 day extreme rainfall events.

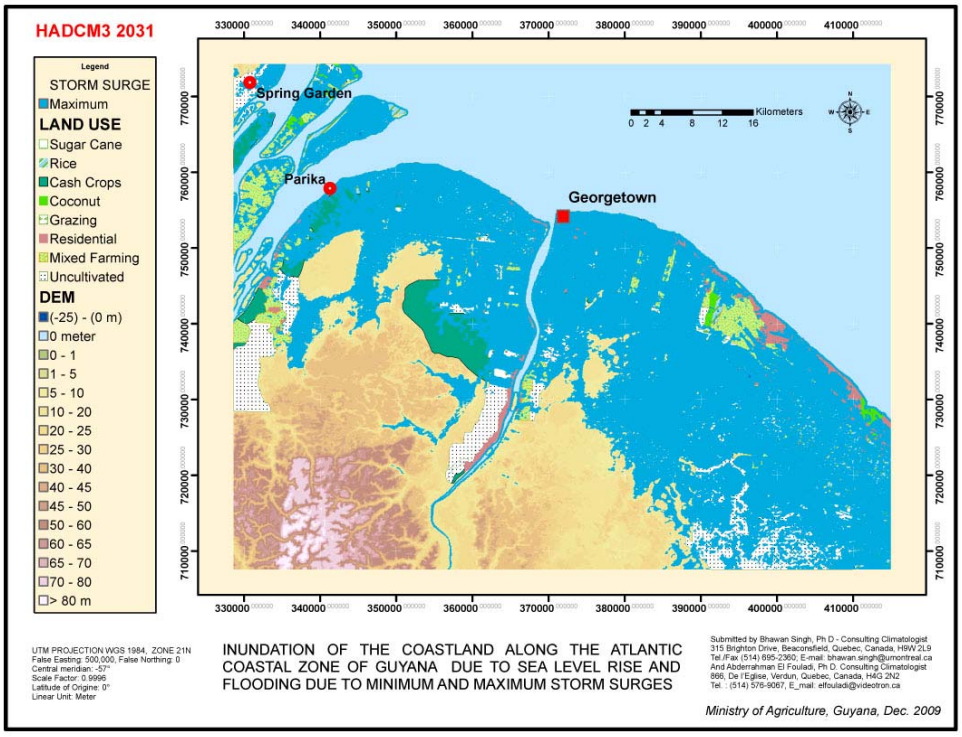
Future predictions for temperature and rainfall for the 2030s, 2060s and 2090s show a warming of around 1°C by the 2030s, 2°C by the 2060s and 3°C by the 2090s but more rapid in the southern, interior regions of the country than in the northern, coastal regions. Precipitation is predicted to fall by about 10% by the 2090s, mainly in the northern coastal zone.

Figure 2-1 Climatic Regions



The Second National Communication also analysed sea level rise and predicted a rise in sea level of 0.2-0.5m by the 2090s with a resultant loss of land ranging from 2-3,000ha due to inundation up to 80,000-140,000ha due to storm surges (CCSI 2009) as shown in Figure 2-2.

Figure 2-2 Inundation due to Sea Level Rise and Storm Surge 2031



Source: CCSI (2009)

2.2 Physiography and Geomorphology

Guyana is usually considered to consist of four (4) main natural regions; Coastal Plain, Hilly Sand and Clay Region, Interior Savannas and Forested Highlands although the Food and Agriculture Organisation of United Nations (FAO 1966) mapped five (5) separate Physiographic Regions:

- The Coastal Plain
- Interior Alluvial Plains and Low-lying Lands
- The 'White Sand' Plateau and Older Pediplains
- Crystalline Shield Uplands
- Highlands, Mountains and Plateaux

The Natural Regions are shown on Figure 2-3 and their extent in Table 2-1 with the Physiographic Regions in Figure 2-44 and Table 2-2.

Figure 2-3 Natural Regions

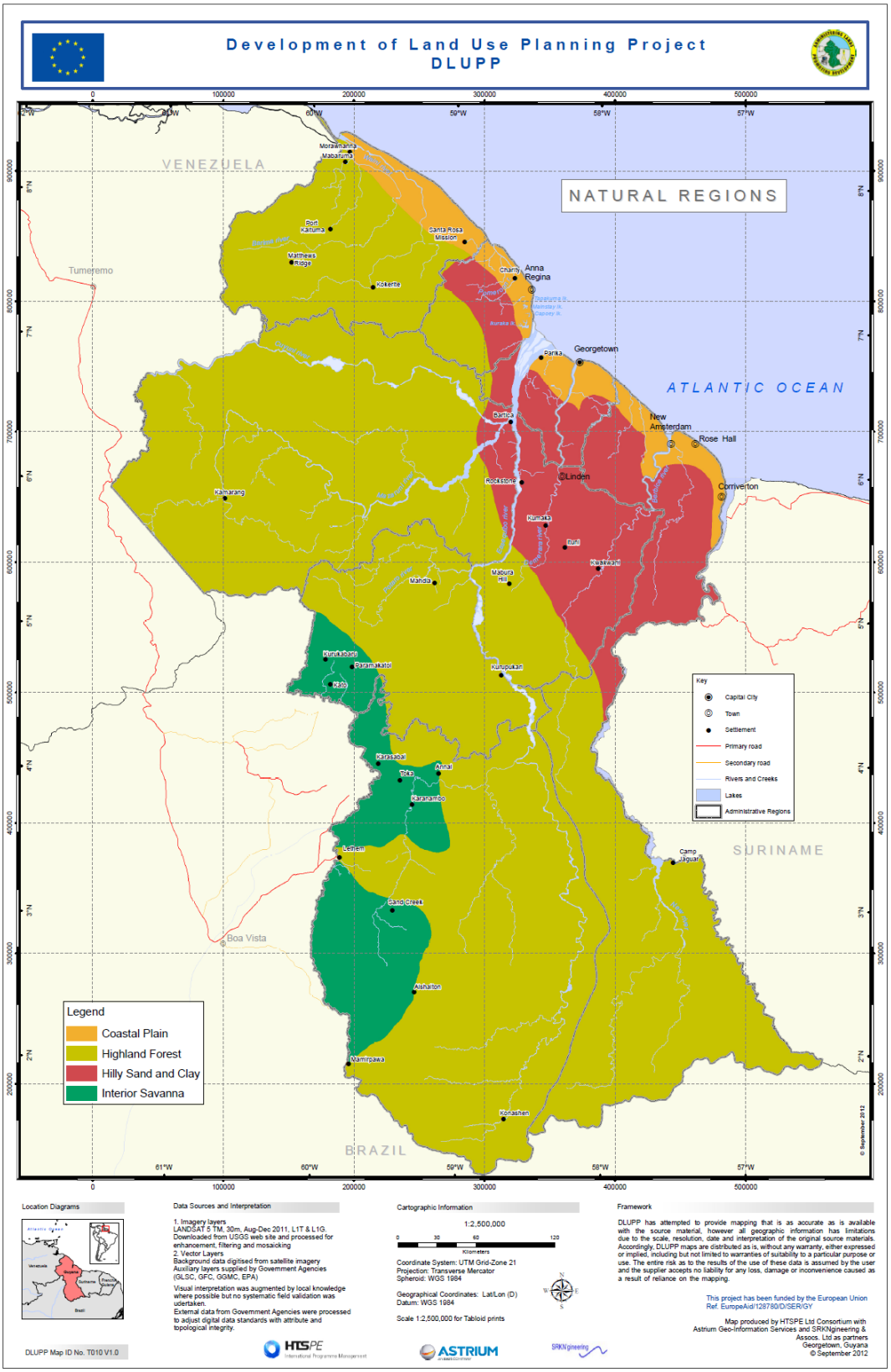


Figure 2-4 Physiographic Regions

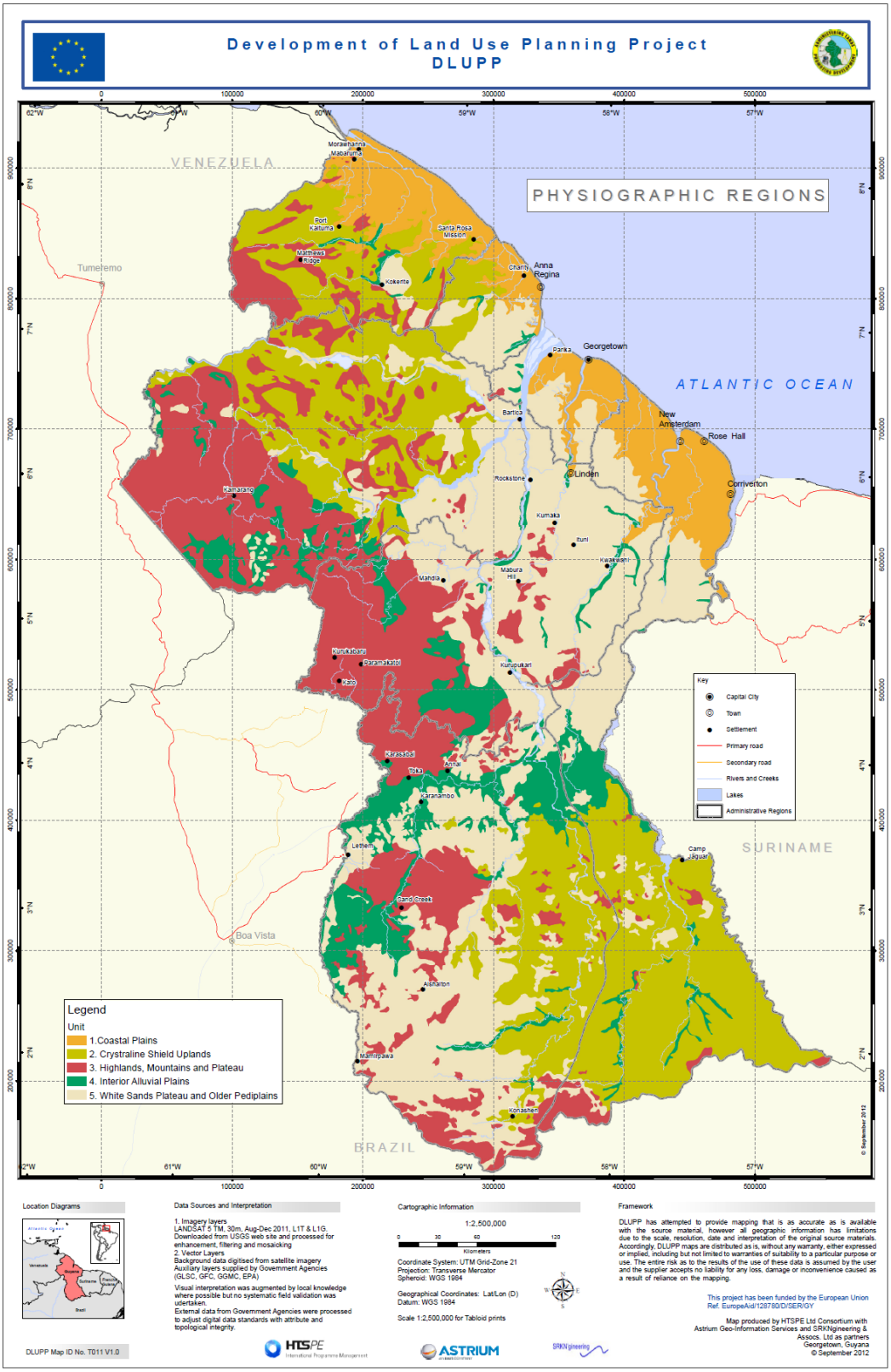


Table 2-1 Extent of Natural Regions

Natural Region	Area (km^2)	%
Coastal Plain	9,128	4.3
Hilly Sand and Clay	28,995	13.7
Forested Highlands	156,747	74.0
Interior Savannas	16,986	8.0
Total	**211,856**	**100.0**

Source: GL&SC GIS database

Table 2-2 Extent of Physiographic Regions

Natural Region	Area (km^2)	%
The Coastal Plain	18,033	8.5
Interior Alluvial Plains and Low-lying Lands	19,669	9.3
The 'White Sand' Plateau and Older Pediplains	65,255	30.9
Crystalline Shield Uplands	58,610	27.8
Highlands, Mountains and Plateaux	49,457	23.4
Total	**211,025**	**100.0**

Source: FAO Reconnaissance Soil Survey of British Guiana, DLUPP

The **Coastal Plain** is a narrow belt (ranging between 8 and 65km in width with a length of 440km) stretching from the Corentyne River in the east to Waini Point in the west, providing most of the agricultural production in the country. East of the Essequibo River the plain consists of recent and old sediments with recent deltaic and fluvio-marine clays and silts occurring on the coast with silty clays and sands inland. The recent plain occurs at elevations of 2m below to 3m above sea level with sandy old beach ridges forming higher ground. The older coastal plain lies at an altitude of about 3-9 m above sea level. The normal tidal range is about 3m with resultant flooding (particularly sea invasion) especially during the wet seasons from April to August and November to January and during high tides.

Many areas of the coastal plain are below sea level while other areas are man-made and built-up to raise them above the surrounding land level. An elaborate system of sea defences, along with irrigation and drainage canals, is required to protect the area from flooding.

West of the Essequibo River the coastal plain narrows with extensive organic wetland 'pegasse' deposits inland. While these are most extensive in the west of the country, (Regions 1 & 2) they also occur scattered between the Essequibo, Demerara and Berbice Rivers. East of the Berbice River the pegasse area is small and the coastal 'frontland' and 'riverain' clays relatively wide.

The **Hilly Sand and Clay Region** is found just inland of the coastal zone, although not in the north-west. This region is also known as the **'White Sand Plateau'** in the north-east and centre of Guyana, although the FAO mapping extends the unit to include older pediplains in the south of the country. The unit is gently undulating with altitudes varying from about 15m

above sea level close to the coast to 150m in the south. The White Sands overlie brown sands and the unit also contains deltaic sands and clays, laterite gravels and bauxite, and is deeply dissected in the centre north of the area. In the north-east, and corresponding to the greatest extent of white sand, the plain has a distinctive vegetation of Wallaba and Dakama forest, Muri scrub and savannah grasslands. The white, sandy soil is permeable and low in nutrients, and forms the most vulnerable ecosystem in Guyana (WS Atkins 2005).

The **Forested Highlands** make up the bulk of the country and are often divided into the Western Highlands and Southern Uplands. The FAO mapping divides the country into **Crystalline Shield Uplands** and **Highlands, Mountains and Plateaus**.

The Western Highlands comprise the border of Venezuela and Brazil, and are rugged igneous and metamorphic mountains that are densely forested and virtually inaccessible. Topographically, it is a dissected upland with steep tabular hills and mountains cut by deep gorges. Rivers are fast flowing within deeply dissected terrain, creating deep gorges and waterfalls. The Southern Uplands region is bordered by Brazil and Suriname and consists of four mountain ranges with elevations of 300-1,200m. Access to these forested ranges is very limited.

The Crystalline Shield Uplands occur in the north-west and south-east of Guyana and is part of the larger Guiana Peneplain. The unit is described as a monotonous continually rolling to hilly land, dominantly forested. The Highlands, Mountains and Plateaus unit corresponds primarily to the Pakaraima Mountains but also includes many isolated mountainous areas (inselbergs) within the Crystalline Uplands in the north-west, centre and south of Guyana as well as including the Kanuku and Açarai Mountains.

The **Interior Savannas** account for about 8% of the country's area and are vegetated by grasses, scrub and low trees. The Rupununi savanna is divided into the northern and southern savannas by the Kanuku Mountains. The FAO maps the northern Rupununi savannas as Interior Alluvial Plains and the southern savannas as part of the White Sand Plateau and Older Pediplains.

The savanna itself is generally flat but in places is more dissected with an undulating topography, particularly to the north and east of the Kanuku range. The northern savannas are characterised by large areas of wetlands caused by the backflow of the Takutu and Ireng Rivers during the Amazonian wet season while the southern savannas are composed of pre-cambrian aged rocks.

The northern savannah plain lies at an altitude of about 100-110m and the Pakaraima Mountains rise abruptly from the plain to altitudes of 610m and reach heights of 990m at their highest. The Kanuku Mountains rise to 760-840m. The southern savannahs are characterised by a relatively flat plain at a height of 100-120m with granitic inselbergs rising abruptly from the plain to heights of 760m.

2.3 Water Resources

Guyana, meaning ‘land of many waters,’ is rich in water resources. The most recent study of national water resources was undertaken by The United States Army Corps of Engineers in 1998. The study produced maps of water resources, a combination of surface water (Figure 2-5) and groundwater resources (Figure 2-6).

The maps show that the majority of the country has perennially plentifully available fresh water with enormous (defined as >400,000 litres/min) quantities available for 8 months of the year (wet seasons) and large (4,000-40,000 l/min) to very large (40,000-400,000 l/min)

quantities available for 4 months of the year. Exceptions include the coastal plain backlands, Rupununi Savannas and Pakaraima Mountains and the far south of the country where water is seasonally plentiful. Only in the coastal frontlands is water scarce or lacking with large to enormous quantities of brackish to saline water available.

The assessment of groundwater resources showed that fresh groundwater was generally plentiful on the coastal plain, white sands plateau and in the Takutu basin, with other inland areas having only pockets of fresh groundwater in largely unexplored aquifers.

A measure of the relative water 'richness' of a country or region is annual per capita water resource availability. This is a simple indicator of whether an area is in a state of water scarcity or water surplus, based on the total runoff of the area in question. Generally, annual per capita water availability above 2,000m^3 is considered relatively safe. Once it drops below 1,700m^3 a state of water stress exists, with a high level of risk in dry or drought years. As it drops towards 1,000m^3 and below, it becomes a state of water scarcity, in which the consequences are more severe and the risk much greater. Problems with access to safe domestic water supplies and water for food production become chronic.

Guyana has an annual per capita water availability of 314,963 m^3 (water availability of 241km^3 and a population of 765,169) indicating an enormous water surplus. Another way of indicating this is to note that the population of Guyana would have to grow to 142 million before a state of water stress existed.

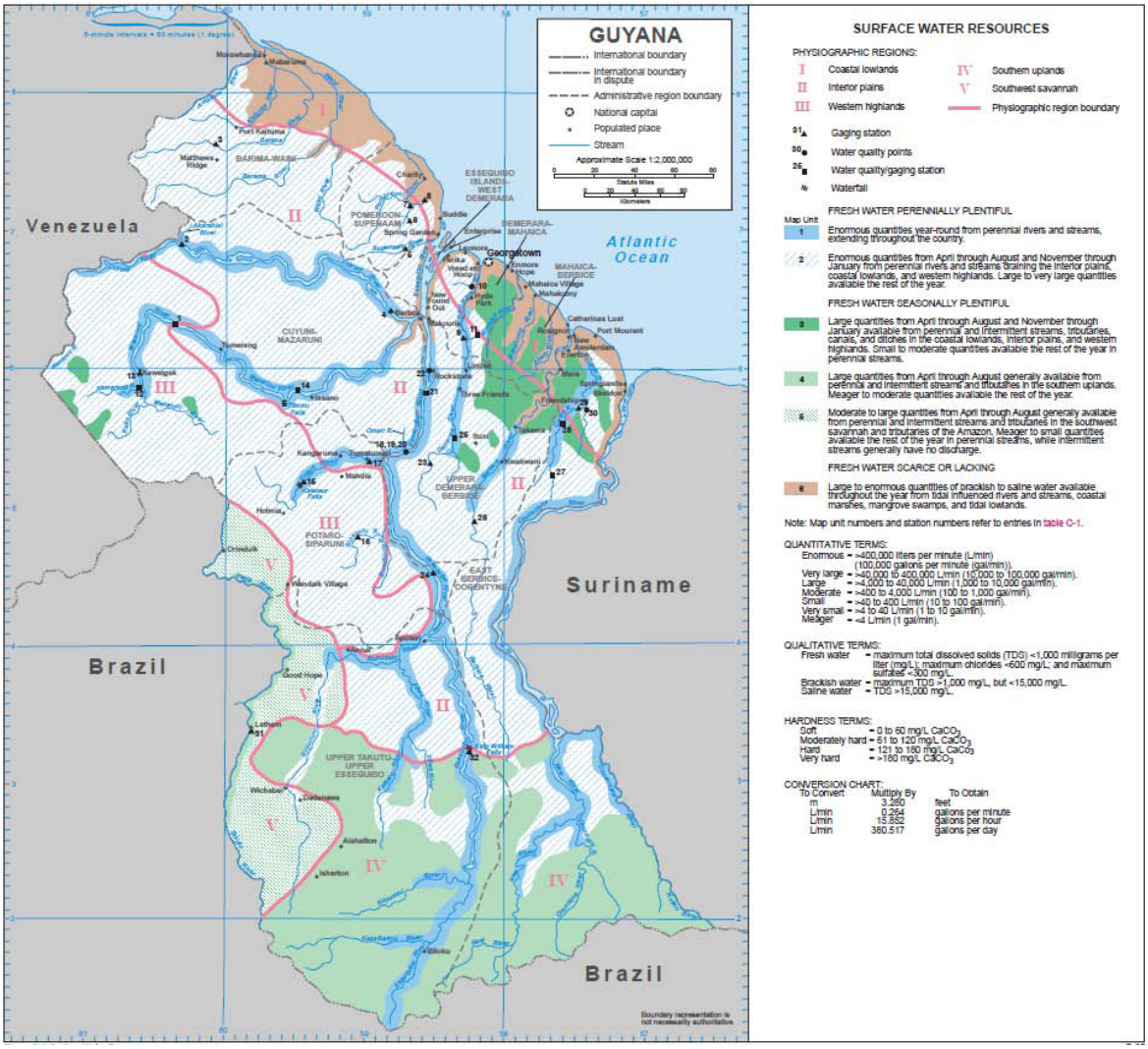
The USACE report stated that high maintenance costs of the coastal sea defence system and the system of drainage and irrigation canals that feed shallow reservoirs, known as conservancies, had led to a state of disrepair with subsequent sea water flooding and a lack of sufficient water for irrigation and other water needs. It further indicated that the lack of storage capacity had hindered agricultural production, one of the most important sectors of the economy.

This has been borne out by the LCDS which has costed the upgrading of existing coastal D&I infrastructure at US$225m, upgrading conservancies at US$410m, upgrading the seawall outside of priority regions at US$15-60m and expanding D&I at US$119m; a total of US$814m. Against this though must be put the cost of flooding which is estimated to be US$150m per year by 2030 with extreme events such as the 2005 floods costing US$800m.

As a result of surface water supply shortages, groundwater has been used to supplement domestic water requirements. Groundwater from the coastal aquifer system, which consists of three distinct aquifers, provides about 90% of the domestic water for the country. Presently, these aquifers, particularly the 'A Sand' aquifer, provide ample water for the country's coastal population. However from approximately 1913 to 1993, dewatering of the "A Sand" aquifer has caused the head to fall almost 20m.

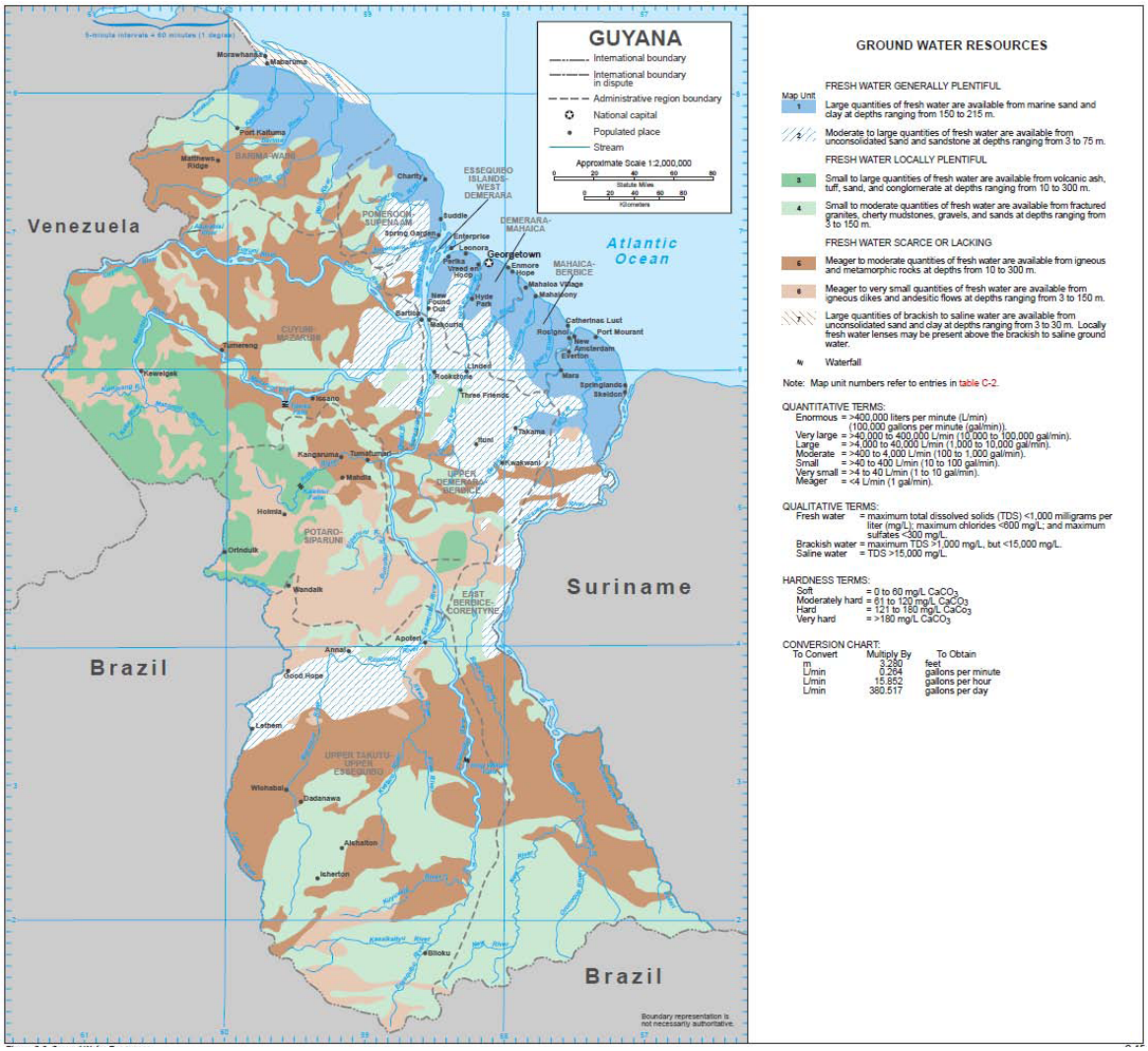
The report pointed out that hydrologic data are lacking throughout the country, particularly since the late 1960's when data collection decreased dramatically, and that Guyana has significant hydropower potential but that development is prohibited by difficult access due to lack of roads. Wastewater treatment is minimal nationwide. As a result, surface water is laden with sewage, particularly in the heavily populated coastal areas.

Figure 2-5 Surface Water Resources



Source: USACE 1998

Figure 2-6 Groundwater Resources



Source: USACE 1998

2.4 Geology and Mineral Resources

2.4.1 Regional Geology

The geology of Guyana forms part of the Guiana Shield which shows striking similarities with that of the West African Shield and covers the area from Venezuela in the west to French Guiana in the east incorporating parts of Northern Brazil. Guyana is sub-divided geologically into three provinces; the Northern and Southern with the Takutu Graben between them (GGMC 2011) as shown in Figure 2-7.

The Northern Province is subdivided into three main geological units; the Greenstone Belts, the Roraima Group and the Tertiary/Quaternary Deposits. The Greenstone Belts are collectively named the Barama-Mazaruni Super Group, are predominantly metamorphic and occur in the centre north of the country running from Region 1 in the north-west to the Takutu Graben in the centre. They are bounded by the Roraima Group of the Pakaraima Mountains to the west and the Quaternary Deposits to the east and contain much of the country's mineral wealth.

The Roraima Group comprises sedimentary rocks with associated Avanavero Suite Gabbro sills and dykes, and forms the high plateaux and hills of the Pakaraima Mountains, bounded by Brazil and Venezuela to the west and the Greenstone Belt to the east. The Tertiary/Quaternary Deposits occur in the north-east of the country and comprise Fluvial and Marine Sands, known as the White Sand Formation and the Mackenzie Formation containing Bauxite, inland of recent coastal marine clays.

The Takutu Graben comprises the Rewa Group composed of the Takutu Formation (mudstone, shale, siltstone and sandstone with potential petroleum and natural gas) and the Apoteri Formation (Andesite lava) and occurs in the Northern Rupununi between the Pakaraima and Kanuku Mountains.

The Southern Province occurs south of the Takutu Graben but is at the centre of the Guiana Shield where it forms part of the old Pre-Cambrian crystalline basement and Proto-Kanuku Complex (Gneiss and Granulite) dating from 3.1-3.4 billion years BP. The majority of rocks in the Southern Complex are known as Younger Granites dating from the Trans-Amazonian Event of 1.8-2.4 billion years BP.

2.4.2 Mineral Resources

The Mineral Resources of Guyana are shown in Figure 2-8 and in Table 2-3. The main economic minerals currently mined or with potential for extraction are gold, diamonds and bauxite.

Gold occurs mainly in the Greenstone Belts in the north-west and centre of the country with alluvial gold occurring in rivers draining this area but also occurs in quartz veins in the south of the country. From 1993 to 2005 the majority of gold was produced by Omai Gold Mine in Region 7 but since 2006 all gold has been produced by small-scale mining largely working alluvial deposits. The recent increase in the price of gold has seen an expansion in the amount of gold mining.

Figure 2-7 Geology of Guyana

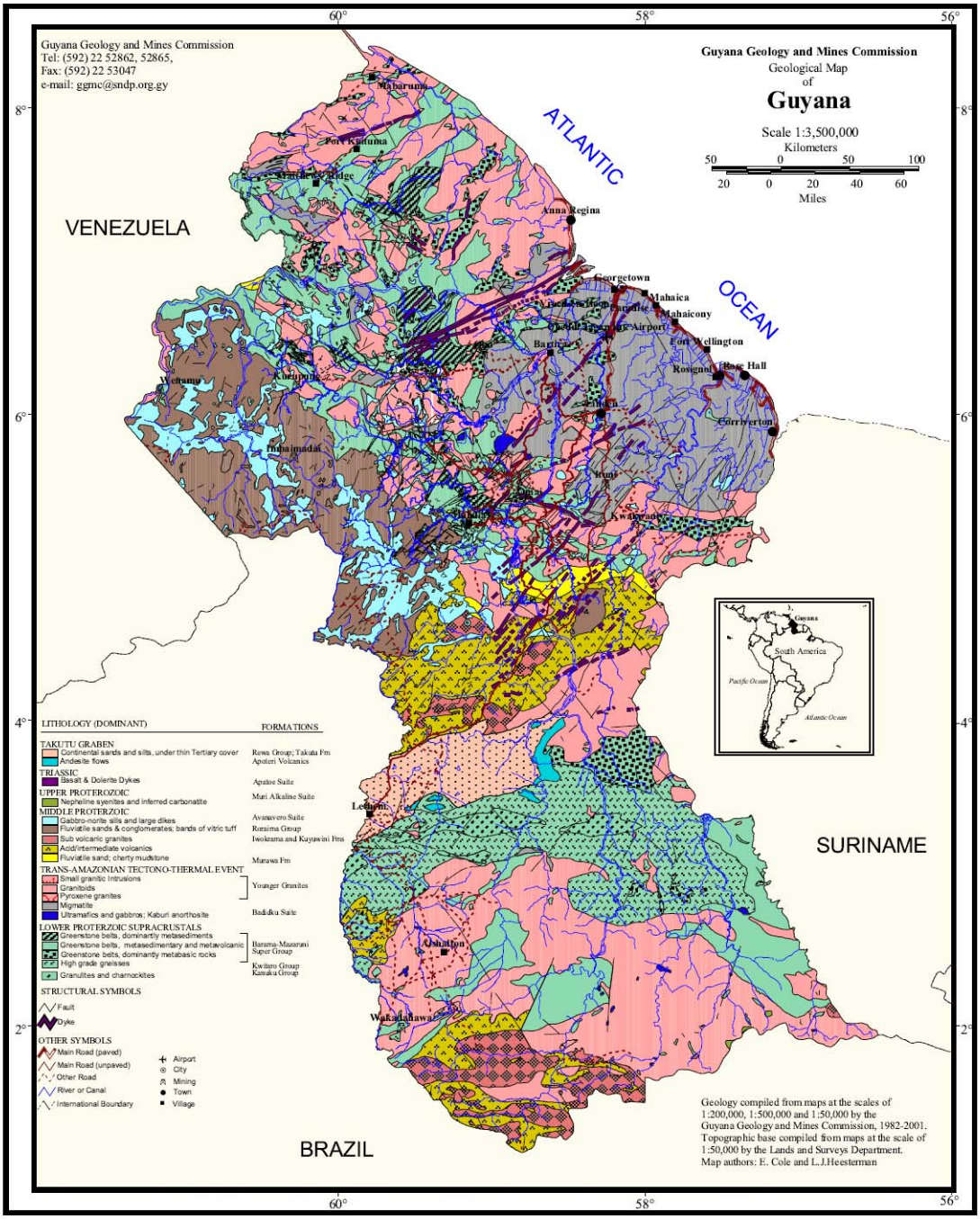
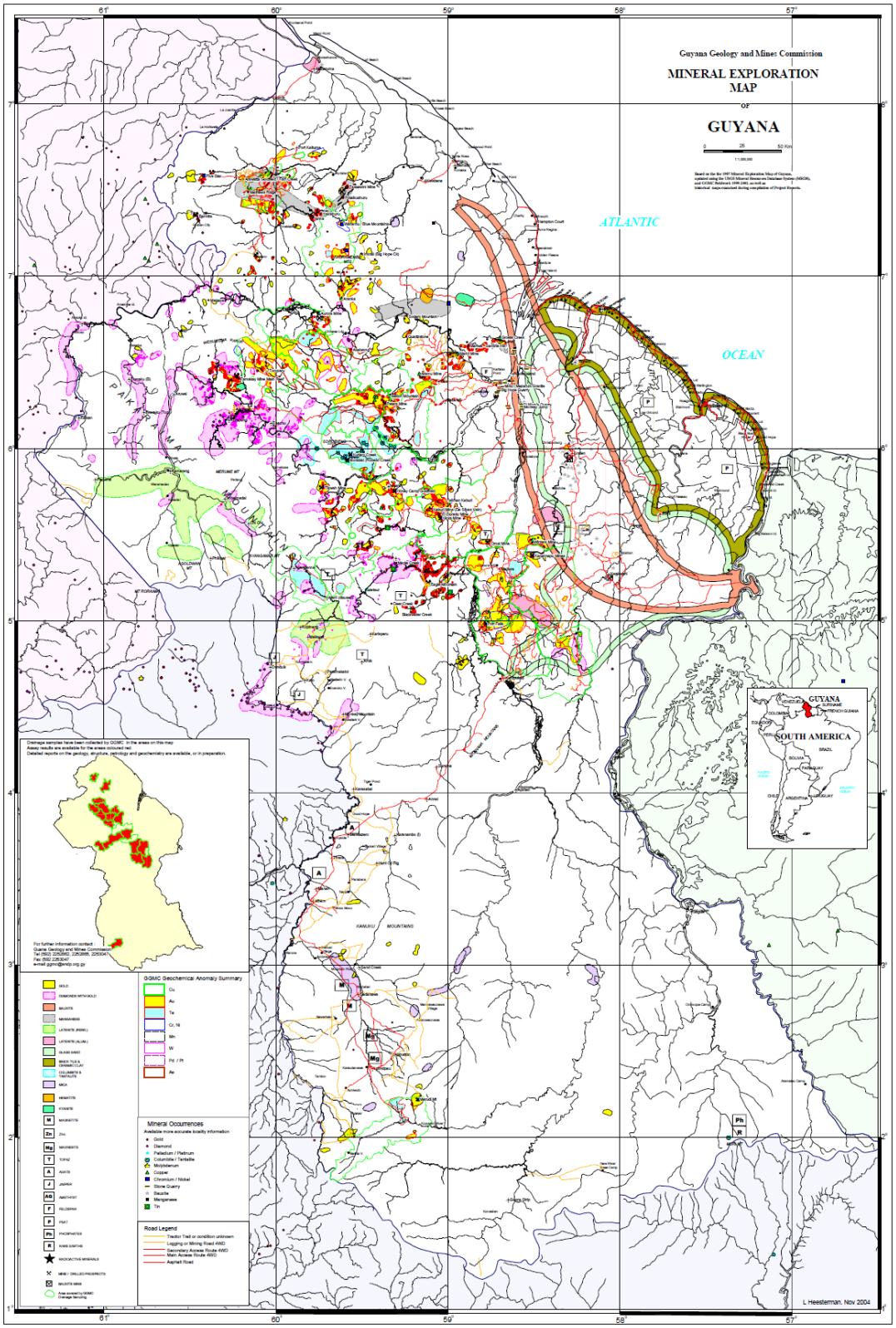


Figure 2-8 Mineral Resources



Diamonds occur in alluvial deposits in many of the main rivers of north-west Guyana and are thought to be derived from the Pakaraima Mountains, but the primary source remains unclear.

Table 2-3 Mineral Resources by Geologic Formation

Period	Formation	Lithology	Minerals and Commodities
Quaternary & Tertiary		Marine Clays	**Brick Clays**
	White Sand	Fluvial & Marine Sands	**White Sand/Silica Sand**
	Mackenzie Formation	Bauxite & Kaolin	**Bauxite**, Kaolin
Mesozoic – Takutu Graben	Takutu Formation	Continental Sands & Silts	**Petroleum & Natural Gas, Agate**
	Apoteri Volcanics	Andesite Flows	Potash
Middle Proterozoic	Avanavero Suite	Gabbro Sills & Dykes	**Diamonds, Gold**, Copper, Tantalite, PGE (Platinum Group Elements), Potarite (Palladium Mercury), Jasper
	Roraima Group	Fluvial Sands & Conglomerates	
Trans-Amazonian Tecono-thermal event	Younger Granites	Granites, Granitoids and Dolerite	Columbite/Tantalite, Feldspar, Uraninite, Monazite, Rutile, **Building Stone, Aggregates**
	Bartica Assemblage		
	Badidku Suite	Ultra-mafics	Magnesite
Lower Proterozoic Supracrustals	Barama-Mazaruni Super Group	Greenstone	**Gold**, Zinc, Copper, Molybdenum, Nickel, Manganese
	Kanuku Group	Gneiss	Banded Iron, Copper
			Bold = Main Economic Minerals

Source GGMC 2011

Bauxite is mined at Linden and Aroiama near Kwakwani and was also mined at Ituni in the past. The cost of production of bauxite in Guyana is relatively high. Both residual and alluvial bauxite occur on the coastal plain in deposits of 8-10m thick and residual bauxite also occurs inland, capping hills with a 5m thick deposit comprised of 50% aluminium and 4% silica. Most of the bauxite mined and exported is Calcined Bauxite rather than Metallurgical Grade bauxite. Further bauxite deposits are known to occur north and east of Linden and south and east of Ituni.

Gravel and Aggregate quarries are mainly located in the Bartica Assemblage where gneisses and schists are extracted and crushed and used for road and building foundations, and sea defences. Gravel is extracted from alluvial deposits and is used in road construction.

Silica sand is abundant in the White Sand Plateau and is homogeneous with very few impurities, <0.1% heavy minerals and no clay. It is extracted in open quarries and can be used in the manufacture of glass, ceramics and abrasives.

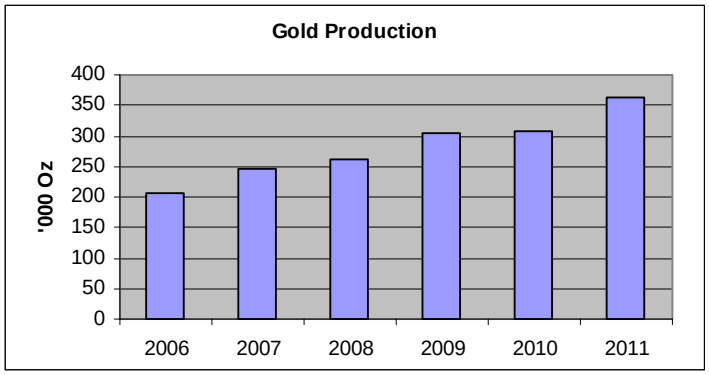
Manganese was mined at Mathews Ridge in Region 1 up to 1968 and a recent (March 2011) development has been the possible resumption of manganese mining in this area with the issue of a prospecting licence to Reunion Manganese of Canada.

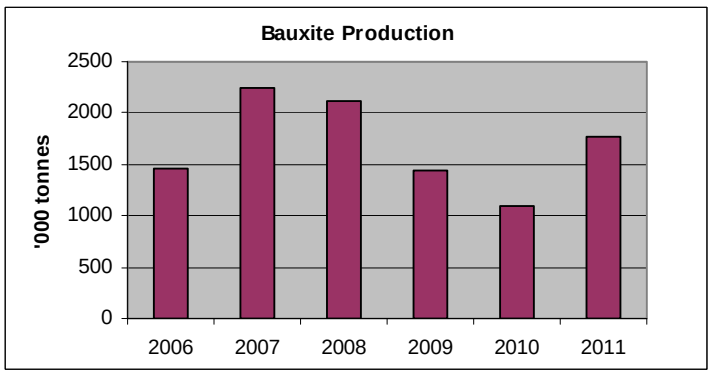
2.4.3 Current Production

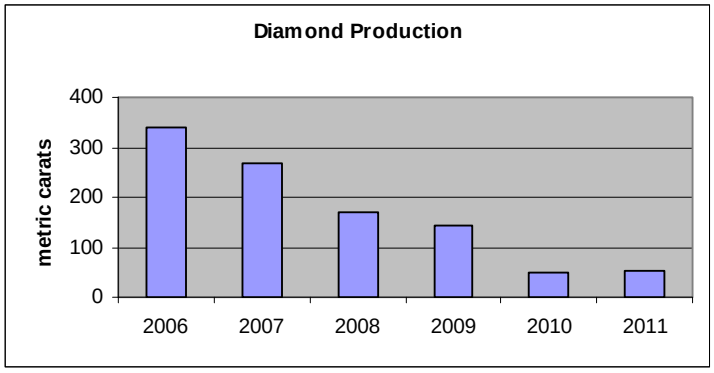
The 2012 Mineral Industry Review (GGMC 2012) gives details of production, leases, exports and employment.

In terms of production of major minerals data concerning Gold, Bauxite and Diamonds is given in Table 2-4 and Figure 2-9. This shows that while gold production is rising steadily, bauxite has fluctuated from highs in 2007-08 and diamonds has decreased from 2006 as small-scale miners moved into gold production, but picked up slightly in 2011. Quarry stone production was 505,865 t in 2010 (an increase of 33% on 2009) and 488,030 t in 2011 but sand production fell 38% from 569,151 t in 2010 to 354,828 t in 2011.

Figure 2-9 Mineral Production 2006-2011







Source: GGMC 2011 & 2012

Table 2-4 Mineral Production 2006-2011

Mineral	Units	2006	2007	2008	2009	2010	2011
Gold	Thousand oz	205.9	246.2	260.4	305.2	308.4	363.1
Bauxite	Thousand tonnes	1,453	2,239	2,109	1,448	1,100	1,771
Diamonds	Thousand Metric carats	340	269	169	144	50	52

Source: GGMC 2011 & 2012

In terms of exports, the value of exports from mining and quarrying increased from US$375m in 2009 to US$447m in 2010 comprising 50.2% of total exports. Gold comprises most of the export value at US$346m followed by Bauxite at US$94m and Diamonds at US$7m. Quarry stone and sand are negligible amounts. The increase in the overall value of mineral production and exports is due to the high gold and bauxite prices (gold exports by volume actually fell 3% and bauxite by 20%) and increased production of quarry stone and sand.

GGMC estimates that the mineral industry contributed 9% to GDP in 2010, slightly down from 2009 due to increased diversification of the economy as a whole. Gold alone contributed 7% to the GDP. In terms of employment just under 11,200 people were employed in mining in 2010, an increase of 4% on 2009.

2.4.4 GGMC Leases

GGMC is charged with the promotion of mineral exploration and mining in Guyana as well as lease issuance and the enforcement of conditions attached to licences, permits and concessions. GGMC issues a suite of different forms of leases dependent on the scale of the mining operation and whether the operation is prospecting for minerals or actually mining. In addition quarry leases and petroleum licences are issued.

Table 2-5 shows the number of different leases issued by GGMC existent in 2010 and 2011 and Figure 2-11 shows the spatial extent of the medium and large-scale leases.

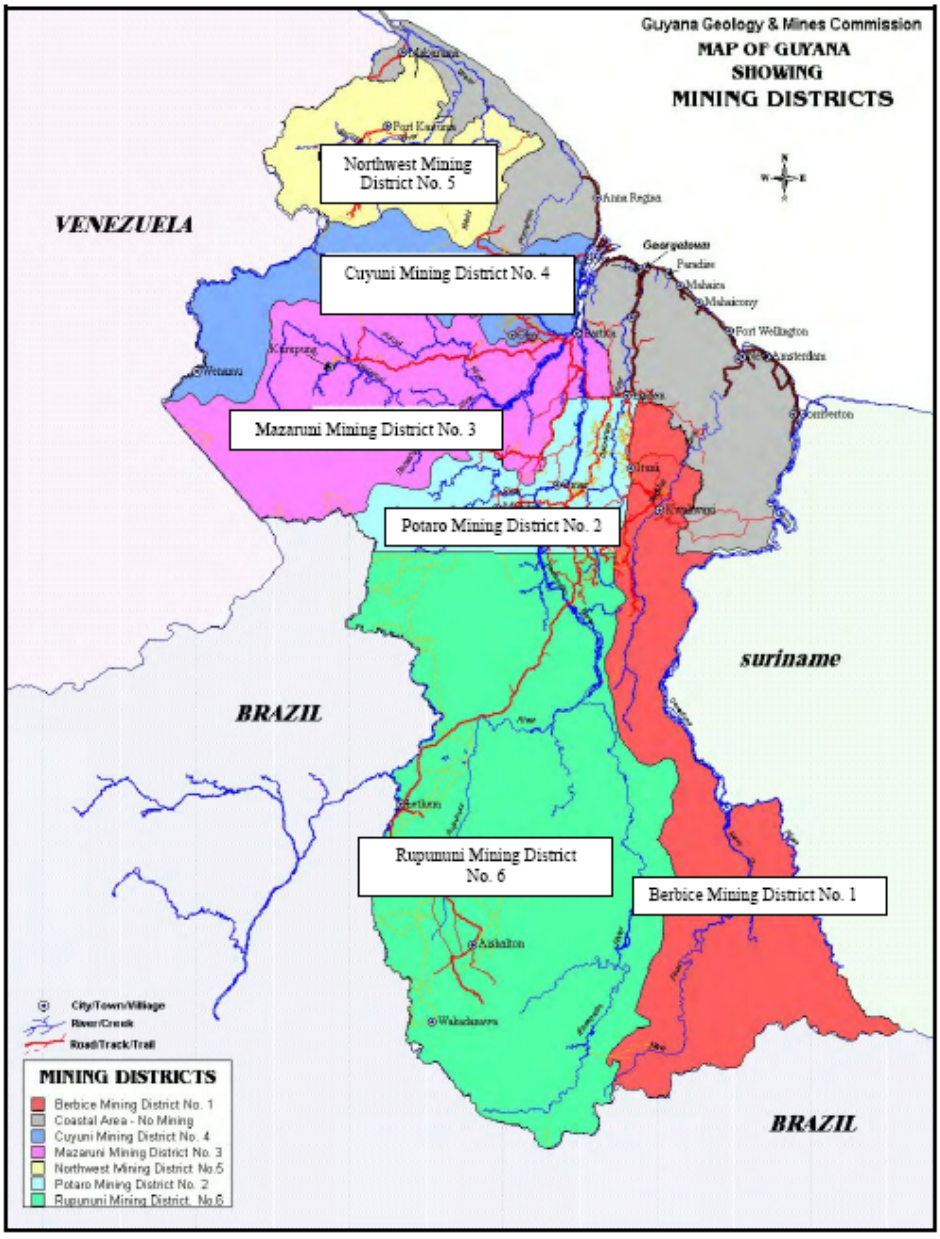
Lease types are:

Small-scale	**Land Claim** (1,500 x 800 ft (457.5 x 244m) i.e. 27.58 acres (11.16ha)) or 1 mile (1.61km) of river. (About 70% of claims are land claims)
Medium-scale	**Prospecting Permit** (150-1,200 acres (61-486ha)) renewable yearly that can be converted into a **Mining Permit** (up to 20 years or life of deposit, renewable)
Large-scale	**Prospecting License** (500-12,800 acres (202-5,180ha) renewable yearly that can be converted into a **Mining License** (up to 20 years or life of deposit, renewable)

In addition a Reconnaissance Survey Permission is permission for a Geophysical and Geological Survey (PGGS) of a large area.

GGMC has divided the country into 6 Mining Districts as shown in Figure 2-10.

Figure 2-10 Mining Districts



Source: GGMC (2007)

The mining of more than one mineral (e.g. gold and bauxite) is allowed on one area of land. Prospecting and mining leases can be issued on State Land that has agricultural and forestry leases and can also be issued on Amerindian Land, although the Amerindian Communities have veto rights. No large scale mining leases have yet been issued on Amerindian Land.

Table 2-5 GGMC Issued Leases 2010 and 2011

Lease Type	Number (2010)	Number (2011)	Area (ha) 2010	Area (ha) 2011
Claims (small-scale)	14,335	15,043	159,979	167,880
Prospecting Permits (small-scale)		991		
Prospecting Permits (medium-scale)	4,879	5,149		
Mining Permits (medium-scale)	742	1,161	288,703	
Prospecting Licenses (large-scale)	136	191	803,553	
Mining Licenses (large-scale)	7	12	17,886	
Reconnaissance Permissions (large-scale)	3	8	8,121,425	
Quarry Licenses	1	4	1,412	
Petroleum Licenses	7	7		

Source: GGMC Mining Sector Reports 2011 & 2012

When a mining lessee wishes to exercise their rights to mine land that also has a forestry lease, then the miner has to give GFC lessee six (6) months notice to allow them to harvest valuable timber from the area. Any timber remaining after that time can be clear felled although the timber cannot be sold but can be used on-site. This is a source of conflict between the two land users since the foresters consider six (6) months to be insufficient time to harvest timber but the miners would like to see the time reduced to three (3) months to enable rapid mobilisation.

Figure 2-11 GGMC Prospecting and Mining Leases

See associated Map Album

Figure 2-11 shows GGMC issued prospecting and mining leases. These date from May 2012 and are updated continually. Small-scale claims are a challenge to map since they only have a fifteen (15) month time-frame of a one (1) year lease and three (3) months to renew within which time an area can have a claim staked, be prospected, worked and abandoned. The map shows that the vast majority of mineral exploration and mining occurs in the Greenstone Belt stretching from Matthews Ridge and Port Kaituma in Region 1 in the north-west of the country through Region 7, along the Cuyuni and Mazaruni Rivers to north-eastern Region 8 and the Potaro River and through Region 10 to the Berbice River. Much smaller areas occur in Region 6 and Region 9 in the south of the country.

A recent development (March 2012) has been the issue of special mining permits by lottery. A total of three hundred and sixty (360) parcels were offered comprising sixty (60) parcels in each of the six (6) Mining Districts.

2.4.5 Petroleum and Natural Gas

The Petroleum section of GGMC has divided the whole of Guyana (including offshore) into blocks of approximately 9 x 9km although Petroleum Prospecting Licenses have only been

issued for offshore (Guyana Maritime Zone), coastal onshore and the Takutu Basin in the south of the country as shown on Figure 2-12.

Figure 2-12 Prospecting Leases including Petroleum Exploration Permits

See associated Map Album

The Petroleum Prospecting Licenses (PPLs) are valid for four (4) years with two (2) optional renewal periods of three (3) years. Most of the areas covered by PPLs are offshore with ongoing exploration activities by Repsol, CGX and Tullow hoping to replicate the oil finds in Venezuela and Trinidad to the west and Surinam and French Guiana to the east.

In the near onshore section CGX undertook 10,000 geochemical auger samples and some seismic work in Region 6 in 2005-06 with results such that more exploratory work is expected to be undertaken in the area in the future. Further west towards the Pomeroon River in Region 2 there are known gas deposits but little oil is expected to be found.

In the Takutu Basin, Home Oil held an exploration license between 1979-83 for the western half of the graben and undertook 1,100 line km of seismic studies and drilled two (2) wells finding oil in non-commercial amounts at Karanambo. Hunt Oil also held an exploration license for the whole basin between 1989-93 and undertook 1,300 line kms of seismic studies, undertook geochemical work and drilled one (1) well, Turundsink No. 1, which struck oil at an estimated yield rate of 400 barrels per day before depletion and being abandoned.

Hunt Oil indicated a need to find 250 million barrels to make the field viable but estimated mean recoverable prospective resources at only 128 million barrels of oil.

More recently in 2011, Groundstar Resources of Canada drilled a well 600m from the Hunt Oil well at Apoteri but drilling was abandoned in April at a depth of 2,992 metres due to the reservoir being penetrated by water below the oil. Groundstar have indicated a desire for more drilling but encountered resistance from local communities concerning the creation of an access road in the wet season.

2.5 Soil Resources

2.5.1 Data Availability

Information on the soil resources of Guyana has been obtained from FAO mapping in the mid-1960s which produced a soil map for the whole of Guyana (FAO 1966) at a scale of 1:1million. This mapping was derived from reconnaissance scale mapping at a scale of 1:500,000 and is a compilation of these maps with some additional aerial photography interpretation.

The soil units used in the FAO mapping were recently reclassified by NAREI into current USDA classification soil units. The original map units and the reclassified soil units are shown in Table 2-6 and the soil map of Guyana is shown in Figure 2-13 in the original FAO map units and

Figure **2-14** with the USDA soil classification.

Figure 2-13 Soils (Original FAO Classification)

See associated Map Album

Figure 2-14 Soils (USDA Classification)

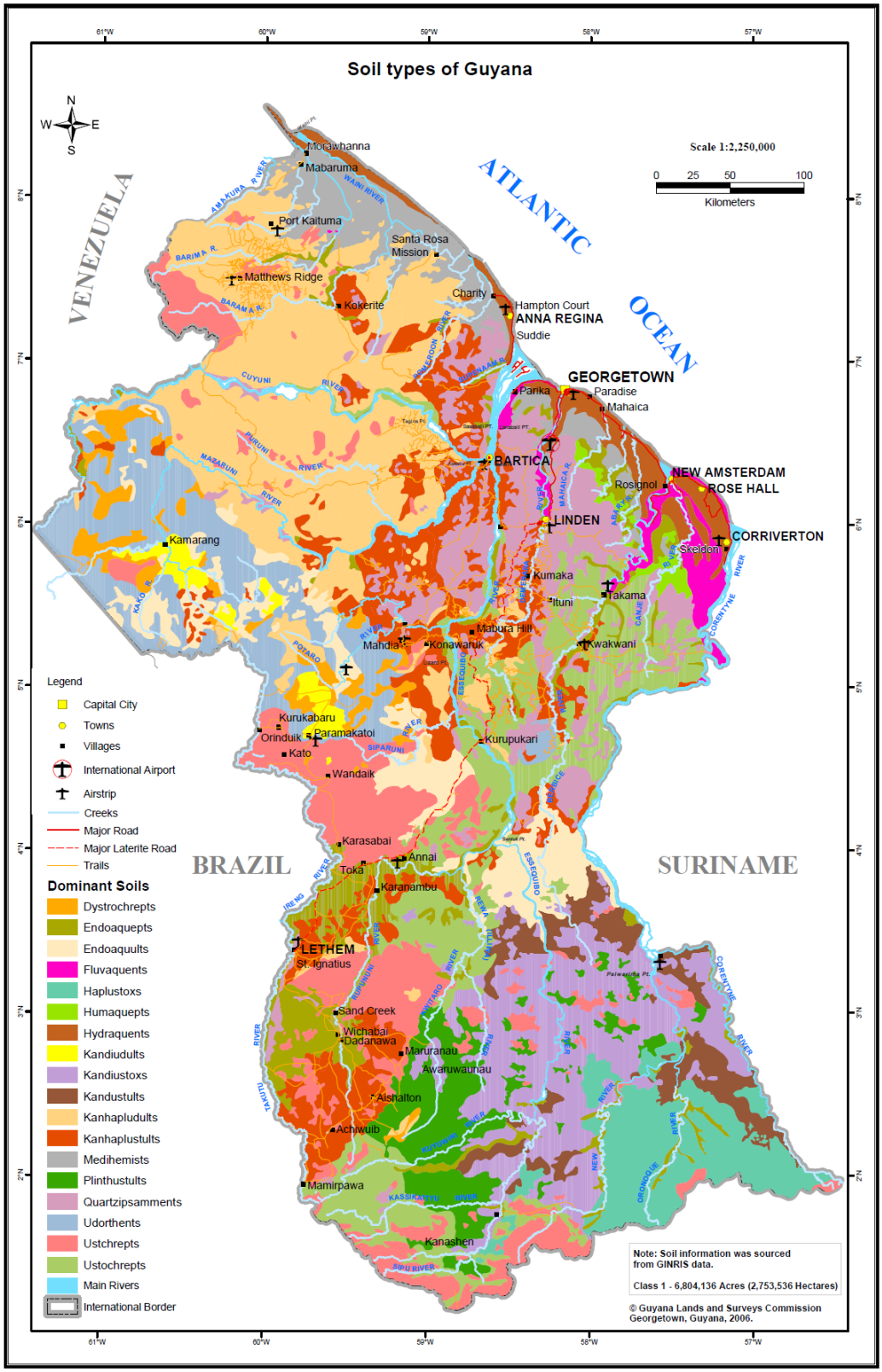


Table 2-6 Soil Mapping Units FAO & USDA

FAO Geomorphic Unit (Soil Description)	FAO Mapping Unit	Dominant USDA Soil Class	Associated USDA Soil Class	Land Capability Classification	Area (ha)	%
Coastal Plain (Hydromorphic soils of recent deltaic deposits)				**Total**	**1,803,312**	**8.5**
Low humic gleys of high base status, marine phase "frontland clay"	1a	Hydraquents	Sulfaquents, Fluvaquents	I&II	440,121	2.1
Low humic gleys of high and medium base status, fluvio marine phase, riverain soils	2a	Fluvaquents	Endoaquents, Medhemists	I&II	327,594	1.6
Bog soils, peat and muck phases, deep pegasse	3a	Medihemists	Sulfohemists, Medisaprists	III	813,403	3.9
Low humic gleys of low base status, including groundwater laterites and planosols	4a	Endoaquepts	Fluavaquents, Sulfaquepts	III	128,394	0.6
Groundwater laterites	5a	Humaquepts	Endoaquepts, Fluvaquents, Psammaquents	I&II	93,800	0.4
Interior alluvial plains and low-lying lands (Hydromorphic and some well drained soils of recent alluvial and pedimentary materials)				**Total**	**1,966,928**	**9.3**
Low humic gleys of low base status, groundwater laterites including alluvial soils	1b	Endoaquepts	Endoaquods, Udorthents	I&II&IIIf	773,482	3.7
Low humic gleys, including alluvial soils, regosols and groundwater podzols	2b	Endoaquults	Kanhaplaquults, Endoaquepts	IV	972,703	4.6
Red yellow latosols and hydromorphic soils, low humic gleys and groundwater laterites	3b	Endoaquepts	Psammaquents, Endoaquults	III	220,742	1.0
White sand plateau and older pediplanes (Well drained soils of old deposits)				**Total**	**6,525,506**	**30.9**
Regosols, white quartz phase	1c	Quartzipsamments	Psammaquents, endoaquepts	IV	1,671,910	7.9
Red yellow latosols, light textured phase	2c	Ustochrepts	Quartzipsamments, Kanhaplustults	I&II&IIIf	2,009,793	9.5
Red yellow latosols, steep phase including red yellow podzolic intergrades to red yellow latosols	3c	Kanhaplustults	Dystrochrepts, Kandiudults	III	1,022,998	4.8
Regosols, laterite gravel phase, including red yellow latosols, forest and savannah phases	4c	Kanhaplustults	Kandiudults, Eutrochrepts	III	652,476	3.1
Red yellow latosols, groundwater laterites and lithosols	5c	Kanhaplustults	Plinthudults, Kandiudults	III	345,668	1.6
Groundwater laterites, truncated phase and red yellow latosols	6c	Plinthustults	Plinthaquults, Kanhaplustults	IIIf	822,661	3.9
Crystalline Shield Uplands (Well drained soils derived in situ)				**Total**	**5,860,999**	**27.8**
Red yellow podzolic soils	1d	Kanhapludults	Dystrochrepts, Endoaquults	III	1,398,578	6.6
Red yellow podzolic soils and red latosols, heavy textured phase	2d	Kanhapludults	Hapludoxs, Dystrochrepts	I&II	1,198,472	5.7
Red yellow latosols, heavy textured phase	3d	Kandustults	Kanhaplustults, Kandiustoxs	IIIf	604,572	2.9
Red yellow latosols, steep phase and lithosols	4d	Kandiustoxs	Kanhaplustults, Ustochrepts	III	1,692,371	8.0
Red yellow latosols, shallow and concretionary phase	5d	Haplustoxs	Kandustults, Kandiustoxs	III	967,004	4.6
Highlands, Mountains and Plateaus				**Total**	**4,945,717**	**23.4**
(Well drained colluvial soils)				Sub-total	1,023,346	4.8
Reddish brown lateritic of low base status	1e	Kanhapludults	Dystrochrepts, Kanhaplustults	III	690,223	3.3
Reddish brown lateritic of high base status, pedimentary phase	2e	Kanhapludults	Rhodudults, Kandiudox	I&II	37,734	0.2
Brown latosols, laterite gravel phase	3e	Kandiudults	Kandiudox, Kanhapludults	III	206,886	1.0
Brown latosols, laterite gravel phase and lithosols	4e	Kanhapludults	Dystrochrepts, Kandiudults	III	88,503	0.4
Shallow soils and Rock Outcrops (Shallow, excessively drained soils)				Sub-total	3,922,371	18.6
Lithosols basic rock phase	1f	Dystrochrepts	Udothents, Kanhapludults	IV	418,807	2.0
Lithosols acidic rock phase	2f	Ustchrepts	Ustorthents, Kanhaplustults	IV	2,089,236	9.9
Lithosols siliceous rock phase	3f	Udorthents	Dystrochrepts, Rock Outcrops	IV	1,414,329	6.7
				Total	**21,102,462**	**100.0**

Source: FAO 1966 and GL&SC/NARI GIS data

Table 2-7 Soil Map Unit Characteristics

Map Unit	Texture	Depth	Drainage	Fertility	Erosion Hazard	LCC	Limitations
1a	C-ZC (S-SL)	Deep	Poor	Med-High	None	I-II	Drainage, (Salinity, Toxicity (AcS))
2a	ZL-C	Deep	Poor	Med-High	None	I-II	Drainage
3a	Organic	Deep	V Poor	Ex. Low	None	III	Drainage, (Toxicity (AcS), Fertility)
4a	C-ZC	Deep	Poor	V Low	None	III	Drainage, Toxicity (AcS), Fertility
5a	ZL-C	Deep	Poor-Mod. well	Low	None	I-II	Fertility, (Drainage)
1b	ZL-C (S)	Deep	V Poor-Poor	Low	None	I-II & IIIf	Drainage, Fertility, Flooding
2b	S-SL	Deep	Poor	Ex Low	None	IV	Fertility, Drainage, water-holding capacity
3b	L-SCL (S-C)	Deep	Poor-Mod. well	Low-V low	None-slight	III	Fertility, Drainage, Flooding
1c	S	Deep	Excessive	Ex. Low	Slight	IV	Fertility,
2c	S-SC	V deep	Well	Low	Slight	I-II & IIIf	Fertility, water-holding capacity
3c	S-C	Deep	Well	Low	Slight-High	III	Erosion potential, fertility
4c	gC-L	V shallow	Well	V Low	Slight-Mod	III	Fertility, gravels
5c	SCL-C	Deep (shallow)	Well (Poor)	V Low	High	III	Fertility, erosion, shallow depth

6c	SL-SCL	Shallow-Deep	Well-excessive	Low	Slight	IIIf	Fertility, (shallow depth)
1d	SC-C	Shallow-Deep	Well	Low	Slight-High	III	Severe erosion potential, fertility
2d	SC-C	Deep-V Deep	Well	Low	None-slight	I-II	Fertility (slight erosion)
3d	SC-C	Deep-V Deep	Well	Low	Slight	IIIf	Fertility
4d	C	Shallow-Deep	Well	Low-V low	Slight-High	III	Severe erosion potential, fertility
5d	gL-C	Shallow	Well	Low	Slight-High	III	Fertility, Severe erosion potential, shallow depth
1e	CL-C	V deep	Well	Low-Med	None-High	III	Fertility, erosion potential
2e	CL-C	Deep	Well	High	None-slight	I-II	None
3e	gCL-C	Deep	Well	Low	Slight-High	III	Fertility, gravelly
4e	gCL-C	Shallow-Deep	Well	Low	Slight-High	III	Fertility, gravelly, shallow depth
1f	gL-ZC	V shallow	Well-excessive	V Low	High	IV	Fertility, shallow depth, steep slopes
2f	gL-ZC	V shallow	Well-excessive	V Low	High	IV	Fertility, shallow depth, steep slopes
3f	gL-ZC	V shallow	Well-excessive	V Low	High	IV	Fertility, shallow depth, steep slopes

Source: Derived from FAO 1966

The 1:500,000 reconnaissance scale mapping covered the whole country but was reported on by area: **Northeast** Guyana covered an area east of a line between the Mazaruni River-Kaieteur-Kurupukari to the coast and Corentyne River, **Northwest** Guyana essentially north of the Mazaruni River to the coast, **Pakaraima Mountains** West-Central Guyana from the Venezuelan border to the Rupununi, **Southwest** Guyana from the Brazilian border to the Essequibo River and **Southeast** Guyana between the Essequibo and Corentyne Rivers.

Complementing the reconnaissance scale mapping three areas with development potential were mapped in greater detail at 1:60,000 scale. These were the Mahaica-Mahaicony-Abary area, the Intermediate Savannas mapped as the Ebini-Ituni-Kwakwani area and the Canje area corresponding to the coastal part of Region 6. In addition the Soils and Land Use Surveys Section of NARI (now NAREI) produced about 85 soil and land use survey reports (most with associated maps at varying scales) the majority of which were produced in the 1960s and 1970s. However the soil map of Guyana at 1:1m scale remains the only data and mapping that covers the whole country and as such it has been used for the NLUP.

2.5.2 Soils of the Coastal Plain

The coastal plain is part of the flat, low-lying coastal lands that extend along the coast of South America from the Amazon to the Orinoco. The plain is composed of a great variety of soils developed from a variety of parent materials such as marine and fluvio-marine deposits with back-swamp organic soils. In general, the soils closer to the shore and along rivers are more fertile than the soils behind which can have very low fertility and toxicity in some instances.

The soils have been mapped as:

1a Low humic gleys of high base status, marine phase "frontland clay" (Hydraquents with Sulfaquents, Fluvaquents)

2a Low humic gleys of high and medium base status, fluvio marine phase, riverain soils (Fluvaquents with Endoaquents, Medhemists)

3a Bog soils, peat and muck phases, deep pegasse (Medihemists with Sulfohemists, Medisaprists)

4a Low humic gleys of low base status, including groundwater laterites and planosols (Endoaquepts with Fluavaquents, Sulfaquepts)

5a Groundwater laterites (Humaquepts with Endoaquepts, Fluvaquents, Psammaquents)

1a Low humic gleys of high base status, marine phase "frontland clay" (Hydraquents with Sulfaquents, Fluvaquents)

This mapping unit occurs mainly on the coastal plain of eastern Guyana from the Essequibo to the Corentyne river stretching some 32km inland in places. It contains relatively fertile, poorly drained clay soils developed on unconsolidated sediments with associated sandy ‘reefs’ that are old beach ridges. Some saline soils and organic ‘pegasse’ soils also occur in patches.

The soils need drainage prior to agricultural production but are relatively fertile. The main limitations for agriculture are the need for drainage and occasional areas of salinity and acid sulphate and aluminium toxicity. In much of the coastal plain these soils have a land use of rice and sugar with coconuts on the sandy reefs. Where not developed for agriculture the vegetation is one of mangrove and swamp forest and marshy grassland.

2a Low humic gleys of high and medium base status, fluvio-marine phase, riverain soils (Fluvaquents with Endoaquents, Medhemists)

This mapping unit describes poorly drained, deep, silty loam to silty clay over clay textured soils that have developed over alluvial deposits. They occur mainly between the Berbice and Corentyne rivers, along the Demerara river as far south as Linden and 100km up the Berbice river and at the Essequibo river mouth. The soils have moderate to high fertility which decreases away from the coast. The need for drainage is the main limitation. The soils are extensively cultivated with rice and sugar the main crops but with a natural vegetation similar to 1a where not cultivated.

3a Bog soils, peat and muck phases, deep pegasse (Medihemists with Sulfohemists, Medisaprists)

These organic bog soils known as 'pegasse' occur as coastal back-swamps and are most extensive in north-western Guyana, west of the Pomeroon river where they can extend 65km inland, although they also occur in patches behind the rest of the coastal plain.

The soils are organic accumulations of peat and other organic matter occasionally interlayered with clay and can be as deep as 9m. They are very acid and have extremely low fertility. Drainage, fertility and acid sulphate toxicity are the main limitations to agriculture. The land cover is mainly natural vegetation of grassland and swamp forest with characteristic ite palms.

4a Low humic gleys of low base status, including groundwater laterites and planosols (Endoaquepts with Fluavaquents, Sulfaquepts)

This unit represents a complex of different soils in which Low Humic Gleys (Endoaquepts) are predominant. The unit occurs primarily in the backlands of the Mahaica-Berbice area, between the Berbice river and Canje Creek and in small patches between the Essequibo and Demerara rivers.

The soils are very poorly drained clays often with a peat topsoil with better drained laterite 'islands' and planosols that show an abrupt silt pan. The soils are very poorly drained, have extremely low fertility and often exhibit acid sulphate and aluminium toxicity. Drainage, fertility and acid sulphate toxicity are the main limitations to agriculture. The land cover is mainly natural vegetation of scrub, waterlogged grassland/marsh and swamp forest.

5a Groundwater laterites (Humaquepts with Endoaquepts, Fluvaquents, Psammaquents)

This mapping unit occurs at the boundary of the coastal plain and the White Sand Plateau and is most extensive between the Berbice and Demerara rivers and south of the Torani Canal in Region 6. The soils are poor to moderately well drained, deep silty clays to clays of low fertility. Drainage is the main limitation in some areas but the low fertility can be enhanced through appropriate land management. The land cover is largely forest with some areas of savanna.

2.5.3 Soils of the Interior Alluvial Plains

Alluvial plains and other low-lying lands dominate extensive parts of the interior and are most extensive in the Rupununi savannas both south and north of the Kanuku Mountains. In addition these mapping units also occur in the Pakaraima plateau and along most major rivers. A variety of soils are represented, all derived from alluvium, generally hydromorphic with poor drainage (apart from the latosols) and are generally of low fertility.

The soils have been mapped as:

1b Low humic gleys to groundwater laterites including alluvial soils (Endoaquepts with Endoaquods, Udorthents)

2b Low humic gleys, including alluvial soils, regosols and groundwater podzols (Endoaquults with Kanhaplaquults, Endoaquepts)

3b Red yellow latosols and hydromorphic soils, low humic gleys and groundwater laterites (Endoaquepts with Psammaquents, Endoaquults)

1b Low humic gleys to groundwater laterites including alluvial soils (Endoaquepts with Endoaquods, Udorthents)

This mapping unit is centred on the Northern Rupununi savannas and extends as far east as the Corentyne river south and east of Apoteri. The soils are very poorly to poorly drained silty loams to clays (occasionally sands) and are mainly low humic gleys (Endoaquepts) except in the Marakanata Basin in the Rupununi savannas where groundwater laterites (Endaquods) predominate.

The soils have low fertility and can be flooded for appreciable amounts of time, often 3-4 months but rising to 6-8 months in the Marakanata depression. Drainage and low fertility is a limitation for the whole unit with flooding an additional limitation in parts of the savannas. The land cover is a mixture of forest and savanna.

2b Low humic gleys, including alluvial soils, regosols and groundwater podzols (Endoaquults with Kanhaplaquults, Endoaquepts)

This unit represents an association of primarily hydromorphic soils at the foot of the Pakaraima Mountains, most extensive to the south and west of Iwokrama but also extensive in patches in the Upper Mazaruni area. The soils are poorly drained silty clays and clays overlying white sands to sands. They are very infertile with poor drainage and are also subject to flooding. The land cover is mainly forest.

3b Red yellow latosols and hydromorphic soils (low humic gleys and groundwater laterites) (Endoaquepts with Psammaquents, Endoaquults)

This small unit occurs in undulating terrain in the southern Rupununi savannas to the south and west of the Kanuku Mountains and is characterised by moderately well to well drained latosols in upland positions with poorly drained gleys in 'baixas, low lying areas. The upland soils are clay to clay loams with sandy loams in depressions.

The soils have limitations of fertility with flooding and waterlogging an additional constraint in low lying areas. The land cover is mainly savanna grassland used for grazing.

2.5.4 The White Sand Plateau and Older Pedeplains

The White Sand Plateau and Older Pedeplains unit extends from inland of the coastal plain through much of central and eastern Guyana to the southern Rupununi savannas and forested areas of the Upper Essequibo to the Sierra Acarai on the southern border with Brazil.

The soils have been developed on old deltaic and continental deposits with some inclusions developed on crystalline rocks. The majority are red-yellow latosols and sandy regosols with steep, gravelly and truncated phases.

The soils have been mapped as:

1c Regosols, white quartz phase (Quartzipsamments with Psammaquents, Endoaquepts)

2c Red yellow latosols, light textured phase (Ustochrepts with Quartzipsamments, Kanhaplustults)

3c Red yellow latosols, steep phase including red yellow podzolic intergrades to red yellow latosols (Kanhaplustults with Dystrochrepts, Kandiudults)

4c Regosols, laterite gravel phase, including red yellow latosols, forest and savannah phases (Kanhaplustults with Kandiudults, Eutrochrepts)

5c Red yellow latosols, groundwater laterites and lithosols (Kanhaplustults Plinthudults, Kandiudults)

6c Groundwater laterites, truncated phase and red yellow latosols (Plinthustults Plinthaquults, Kanhaplustults)

1c Regosols, white quartz phase (Quartzipsamments with Psammaquents, Endoaquepts)

This large unit is extensive on the interfluves between the Mazaruni, Essequibo, Demerara, Berbice and Corentyne rivers in the north centre of Guyana with patches west of the lower Essequibo in Region 2 and between the Berbice and Corentyne rivers in central Guyana and consists almost entirely of soils developed from quartz sand.

The soils are excessively well drained sands of extremely low fertility with fertility and water-holding capacity limitations. The land cover is largely forest, often wallaba and dakama and muri scrub.

2c Red yellow latosols, light textured phase (Ustochrepts with Quartzipsamments, Kanhaplustults)

This large unit is extensive inland of unit 1c between the Demerara and Berbice and Corentyne rivers and extends to the eastern Rupununi savannas and east to the Essequibo river and the Kanuku Mountains. It is also extensive in the southern savannas to the Sierra Acarai.

The soils are largely very deep, well drained sands over sandy clays of low fertility with limitations of fertility and low water holding capacity but which have favourable physical properties that could be ameliorated by land management and irrigation. The land cover is forest.

3c Red yellow latosols, steep phase including red yellow podzolic intergrades to red yellow latosols (Kanhaplustults with Dystrochrepts, Kandiudults)

This association occurs in north-central Guyana around the lower Cuyuni, Mazaruni and Essequibo rivers and between the Cuyuni and Barama rivers. The unit is characterised by the hilly terrain and steep slopes with deep, well drained sandy loams to sandy clays of low fertility. The main limitation is the terrain with a high erosion potential if the forest cover were to be removed.

4c Regosols, laterite gravel phase, including red yellow latosols, forest and savannah phases (Kanhaplustults with Kandiudults, Eutrochrepts)

This unit describes soils containing large amounts of laterite gravels. They occur east of the Pakaraima Mountains, north of the Siparuni river and in the Ebini hills between the Mazaruni and Potaro rivers. They are also extensive in the northern Rupununi

savannas forming the higher ground between the alluvial plain and the Kanuku Mountains.

The soils are generally very shallow (though occasionally deep), very gravelly (>70% gravels) and vary from darker coloured gravelly sandy clay loam under forest to lighter coloured gravelly clay loams on the savannas, both of very low fertility. The main limitations are the high gravel content resulting in low water holding capacity and low fertility.

5c Red yellow latosols, groundwater laterites and lithosols (Kanhaplustults Plinthudults, Kandiudults)

This mapping unit describes soils formed from crystalline rocks in the southern Rupununi savannas between Dadanawa and Sawariwau in the north to Achiwuib, Aishalton and Shea in the south and east. The landform is an undulating plain with shallow lithosols and rock outcrops at the highest elevations, latosols on higher ground and laterites and gleys in depressions similar to unit 3b.

The majority of soils are the latosols which are deep, well drained sandy loams to sandy clays with shallow lithosols on crests and deep, poorly drained gleys in depressions. The soils are all have very low fertility and are prone to erosion which are the main limitations.

6c Groundwater laterites, truncated phase and red yellow latosols (Plinthustults Plinthaquults, Kanhaplustults)

This unit also occurs in the southern Rupununi savannas, south east of the Kanuku Mountains and extends eastwards towards the upper Essequibo river. The dominant soils are gravelly over plinthic clays with highly variable depths from shallow to very deep, often topography dependent when the gravelly layer may be absent. The soils have low fertility and can be shallow and gravelly in places which are the main limitations. The land cover is savanna in the west, forest in the east.

2.5.5 Soils of the Crystalline Shield uplands

The old Crystalline Shield Uplands occur in two main areas in Guyana; in the north-west of the country largely to the north and west of the Mazaruni river although the unit does occur between the Mazaruni and the Pakaraima Mountains and in the south-east of Guyana, south and east of the alluvial plains around Apoteri. The uplands are characterised by a rolling to hilly relief that has been densely dissected by erosion.

The soils have developed from igneous and metamorphic rocks and are generally well drained, of variable depth and are largely of low fertility with a high erosion hazard if the forest cover were to be removed.

The soils have been mapped as:

1d Red yellow podzolic soils (Kanhapludults with Dystrochrepts, Endoaquults)

2d Red yellow podzolic soils and red latosols, heavy textured phase (Kanhapludults with Hapludoxs, Dystrochrepts)

3d Red yellow latosols, heavy textured phase (Kandustults with Kanhaplustults, Kandiustoxs)

4d Red yellow latosols, steep phase and lithosols (Kandiustoxs with Kanhaplustults, Ustochrepts)

5d Red yellow latosols, shallow and concretionary phase (Haplustoxs with Kandustults, Kandiustoxs)

Units 1d and 2d occur in the north-west with units 3d, 4d and 5d in the south-east.

1d **Red yellow podzolic soils (Kanhapludults with Dystrochrepts, Endoaquults)**

These soils occur extensively in the north-west of Guyana in relatively large blocks, particularly between the Mazaruni and Cuyuni rivers and north of the Cuyuni river. The soils are shallow to deep, well drained loams over often gravelly clays with low fertility. Due both to the nature of the soils and to the often dissected nature of the terrain the soils have a high erosion hazard which, with the low fertility is the main limitation. The main land cover is forest.

2d **Red yellow podzolic soils and red latosols, heavy textured phase (Kanhapludults with Hapludoxs, Dystrochrepts)**

This mapping unit is an association of two soils which occur at lower elevations than those of unit 1d with a rolling to gently undulating topography. They occur extensively in north-west Guyana, particularly in Region 1 along the Barama, Barima and Waini rivers as well as in the Puruni river basin.

The soils are deep to very deep, well drained, friable sandy loams to clays that have low fertility but have favourable physical properties that could be ameliorated by appropriate land management that would have to include soil conservation in areas with rolling topography. The land cover is forest.

3d **Red yellow latosols, heavy textured phase (Kandustults with Kanhaplustults, Kandiustoxs)**

This mapping unit occurs in the south-east of the country in two main areas between the Kwitaro, Essequibo and Corentyne rivers east of the northern Rupununi savannas and in the far south-east between the New river and Corentyne river. The topography is rolling to gently undulating. The soils are deep to very deep, well drained clay loams to clays of low fertility that could be ameliorated by appropriate land management that would have to include soil conservation in areas with rolling topography. The land cover is forest.

4d **Red yellow latosols, steep phase and lithosols (Kandiustoxs with Kanhaplustults, Ustochrepts)**

This large unit is characterised by strongly dissected topography with steep slopes, shallow soils on crests and deep colluvial soils on mid-slopes. The unit occurs in south-eastern Guyana mainly between the Rewa and Corentyne rivers.

The soils are shallow to very deep, well drained clays but with low to very low fertility and with a high erosion hazard due to the dissected topography should the forest cover be removed.

5d **Red yellow latosols, shallow and concretionary phase (Haplustoxs with Kandustults, Kandiustoxs)**

This unit occurs in the far south and east of Guyana between the New and Corentyne rivers. The soils are shallow with laterite gravels over indurated laterite gravels in a dissected topography with rounded hills. The soils are shallow, well drained gravelly

clays that have limitations of shallow depth, low water holding capacity due to gravels, high erosion hazard and low fertility. The land cover is forest.

2.5.6 Soils of the Highlands, Mountains and Plateaus

The Highlands, Mountains and Plateaus of Guyana include the Pakaraima Mountains in the west-centre bordering Venezuela and Brazil, the Kanuku Mountains in the south-west and the Sierra Acarai in the far south bordering Brazil. The soils are highly variable and have been subdivided into deeper soils (1-4e) and shallow soils and rock outcrops (1-3f). The deeper soils have developed from basic igneous rocks or colluvium and are generally deep, well drained and of variable fertility with a high erosion hazard if the forest cover were to be removed.

The soils have been mapped as:

1e Reddish brown lateritic soils of low base status (Kanhapludults with Dystrochrepts, Kanhaplustults)

2e Reddish brown lateritic soils of high base status, pedimentary phase (Kanhapludults with Rhodudults, Kandiudox)

3e Brown latosols, laterite gravel phase (Kandiudults with Kandiudox, Kanhapludults)

4e Brown latosols, laterite gravel phase and lithosols (Kanhapludults with Dystrochrepts, Kandiudults

The shallow soils and rock outcrops have been mapped as:

1f Lithosols basic rock phase (Dystrochrepts with Udothents, Kanhapludults)

2f Lithosols acidic rock phase (Ustchrepts with Ustorthents, Kanhaplustults)

3f Lithosols siliceous rock phase (Udorthents with Dystrochrepts and Rock Outcrops)

1e Reddish brown lateritic soils of low base status (Kanhapludults with Dystrochrepts, Kanhaplustults)

This unit describes soils derived from basic rocks occurring on ridges and isolated mountains that occur scattered in an arc from the upper Demerara, through the lower Potaro and Mazaruni rivers, across the central Cuyuni river to the upper Waini river in Region 1. The soils are very deep, well drained clay loams to clays with some gravels and patches of very gravelly and shallow soils. They have a low to medium fertility but on steeper slopes are often very gravelly with a high erosion hazard if the present forest cover were to be removed. The low fertility and erosion potential are the main limitations.

2e Reddish brown lateritic soils of high base status, pedimentary phase (Kanhapludults with Rhodudults, Kandiudox)

This mapping unit describes some of the most fertile soils in Guyana but unfortunately it is of very limited extent. It occurs on the northern flanks of the Kanuku Mountains between Moco Moco and Nappi, a small area within the mountains and on the flanks of Marudi Mountain in the far south. The soils are deep, well drained loams to clays with high fertility and no limitations to development except for the forest cover (if present) and the need for appropriate land management.

3e Brown latosols, laterite gravel phase (Kandiudults with Kandiudox, Kanhapludults) and

4e Brown latosols, laterite gravel phase and lithosols (Kanhapludults with Dystrochrepts, Kandiudults

These two units describe soils that occur at relatively high altitudes related to old laterite caps. They occur in two large areas in the Pakaraima Mountains, in the Kamarang and upper Mazaruni valleys and along the upper Potaro and Kopinang rivers in areas of rolling to hilly topography. Where not shallow the soils are deep and well drained clays with a high gravel content (30-65%) that reduces their water holding capacity. Their low fertility, high gravel content and erosion hazard are the main limitations.

The lithosols are all very shallow, well to excessively drained with variable textures, often with a high gravel content and are prone to erosion often occurring on steep slopes.

1f Lithosols basic rock phase (Dystrochrepts with Udothents, Kanhapludults)

These soils occur at high altitudes in the Pakaraima Mountains and also at Marudi Mountain in the south.

2f Lithosols acidic rock phase (Ustchrepts with Ustorthents, Kanhaplustults)

This is one of the most extensive soil mapping units occurring in large areas of south-west Guyana including the southern Pakaraima Mountains, the Kanuku Mountains and the Sierra Acarai at the southern border with Brazil. The unit also occurs scattered in the interfluves of the Rewa, Essequibo, New and Corentyne rivers as well as in the upper Barama and Barima rivers in north-west Guyana.

3f Lithosols siliceous rock phase (Udorthents with Dystrochrepts and Rock Outcrops)

These soils are associated with the Roraima Formation in the Pakaraima Mountains and also at Makari Mountain at the head of the Demerara river.

2.6 Land Capability

Land Capability Classification (LCC) is a method of grouping soils together to show their relative agricultural suitability and is based on each soil unit's limitations for crop production.

The LCC used by FAO in the reconnaissance soil survey of Guyana is based on that used by the United States Bureau of Reclamation (USBR) but modified for local conditions in that it assumes the provision of adequate drainage for coastal soils and splits Class III (Poor Agricultural Land) in the interior into III and IIIf based on the cost of transport of fertiliser.

The classification therefore differs from the USBR in that Class I and II soils on the coast possess limitations that greatly limit the range of crops that can be grown, due mainly to the soils' poor to very poor internal drainage. The Class I and Class II soils in the Coastal Plain would correspond to Class III (Poor Agricultural Land) with poor drainage as the primary limitation under the USBR classification.

For inland Guyana it was assumed that the cost of transporting fertiliser into the Pakaraima Mountains or south of the $4^{o}30'$N parallel was prohibitive, given their remoteness and distance from market. As such, some soils which have been classified as I-II in the north of the country were classified as IIIf in the south. This classification has been retained since it is

considered that the costs of transportation of fertiliser are still prohibitive and will remain so at least until the Linden-Lethem road is asphalted

Table 2-8 Areas of Land Capability Classes

LCC	Description	ha	%
I-II	Good to Moderate Agricultural Land	3,327,395	15.8
III	Poor Agricultural Land	8,227,247	39.0
IIIf	Poor Agricultural Land with fertilization potential	2,980,836	14.1
IV	Non-Agricultural Land	6,566,984	31.1
	Total	**21,102,462**	**100.0**

Source: FAO 1966, DLUPP

Table 2-8 and Figure 2-15 Land Capabilityshow the extent of the different land capability classes in Guyana. Their characteristics, location and limitations are discussed in the assessment of opportunities and constraints concerning the assessment of potential for agriculture.

Figure 2-15 Land Capability

See associated Map Album

Current promotion of agricultural development is being undertaken by GL&SC through their 'Capital Projects' programme where land is earmarked for development to attract investors. There are 5 areas as shown in Table 2-9 below ranging from 1,500ha of land along a 12km stretch of the Bartica-Potaro road to the Intermediate Savannas and Mara Canje backlands at 300,000 and 200,000ha respectively. The total area is 536,500ha.

Table 2-9 GL&SC Capital Projects

Location	Area (ha)
Bartica-Potaro Road	1,510
Intermediate Savannas	
A	92,937
B	83,176
C	61,629
D	66,763
Sub-Total	**304,505**
Mara Canje Backlands	201,558
Moblissa Watoka	12,141
Region 9	16,754
Total	**536,468**

Source: GL&SC

2.7 Forestry Resources

2.7.1 Introduction

As stated by GFC (GFC 2007) the forest resources of Guyana have multiple land uses the main ones being timber production and in providing ecosystem services. Forests cover some 88% of Guyana at 185,700km^2 containing over 5 gigatonnes of CO_2 in above ground biomass (MoNR&E 2012). Other land uses include non-timber harvesting, agriculture, eco-tourism, research, conservation and as biodiversity reserves. These uses occur on both State and Amerindian Land with those on State Land being administered by GFC while those on Amerindian Land are administered by local communities often with the help of GFC.

2.7.2 Natural Vegetation Mapping

A map of the natural vegetation of Guyana is shown in Figure 2-16 and the extent of the different classes in Table 2-10. This mapping and data was compiled by The Guyana Forestry Commission (GFC) in 2001 (ter Steege 2001) and was based on the FAO soil survey mapping from the 1960s but correlated with other regional forest mapping and updated imagery. The resultant map legend is shown in Table and each mapping unit contains a list of characteristic species which are not detailed here.

Figure 2-16 Natural Vegetation (2001 data)

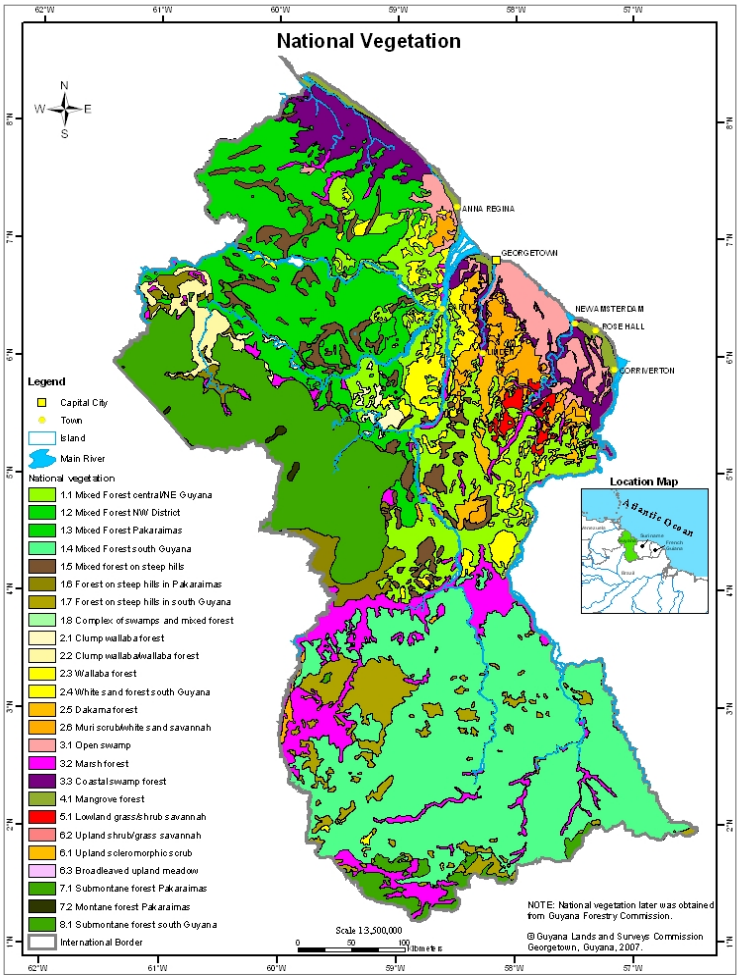


Table 2-10 Natural Vegetation (2001 data)

Mapping Unit	Vegetation Type
1. Mixed Forest	
1.1	Mixed Forest Central to NW Guyana
1.2	Mixed Forest NW District
1.3	Mixed Forest Pakaraimas
1.4	Mixed Forest South Guyana
1.5	Mixed Forest on Steep Hills
1.6	Forest on Steep Hills in Pakaraimas
1.7	Forest on Steep Hills in South Guyana
1.8	Mixed Forest and Swamp Forest S Guyana
2. Wallaba, Dakama and Muri Forest and Scrub	
2.1	Clump Wallaba Forest
2.2	Clump Wallaba / Wallaba Forest
2.3	Wallaba Forest
2.4	White Sand Forest, South Guyana
2.5	Dakama Forest
2.6	Muri Scrub / White Sand Savanna
3. Marsh and Swamps	
3.1	Open Swamp
3.2	Marsh Forest
3.3	Coastal Swamp Forest
4. Mangrove	
4.1	Mangrove Forest
5. Lowland Savanna	
5.1	Lowland Grass / Shrub Savanna
6. Upland Savanna and Grassland	
6.1	Upland Shrub / Grass Savanna
6.2	Upland Scleromorphic (Tepui) Scrub
6.3	Broadleaved Upland Meadow
7. Pakaraima Mountains Forest	
7.1	Sub-montane Forest Pakaraimas
7.2	Montane Forest Pakaraimas
8. South Guyana Forest	
8.1	Sub-montane Forest South Guyana

As part of the REDD+ process the Monitoring, Reporting and Verification System (MRVS) exercise aims to identify and map forest and non-forest land covers so that the changes between the two can be monitored. The MRVS baseline study therefore reassessed the 2001 vegetation mapping and produced a 'Simplified National Vegetation Map at 1:1m as shown in Figure 2-17 and Table 2-11.

Figure 2-17 Simplified Natural Vegetation Map

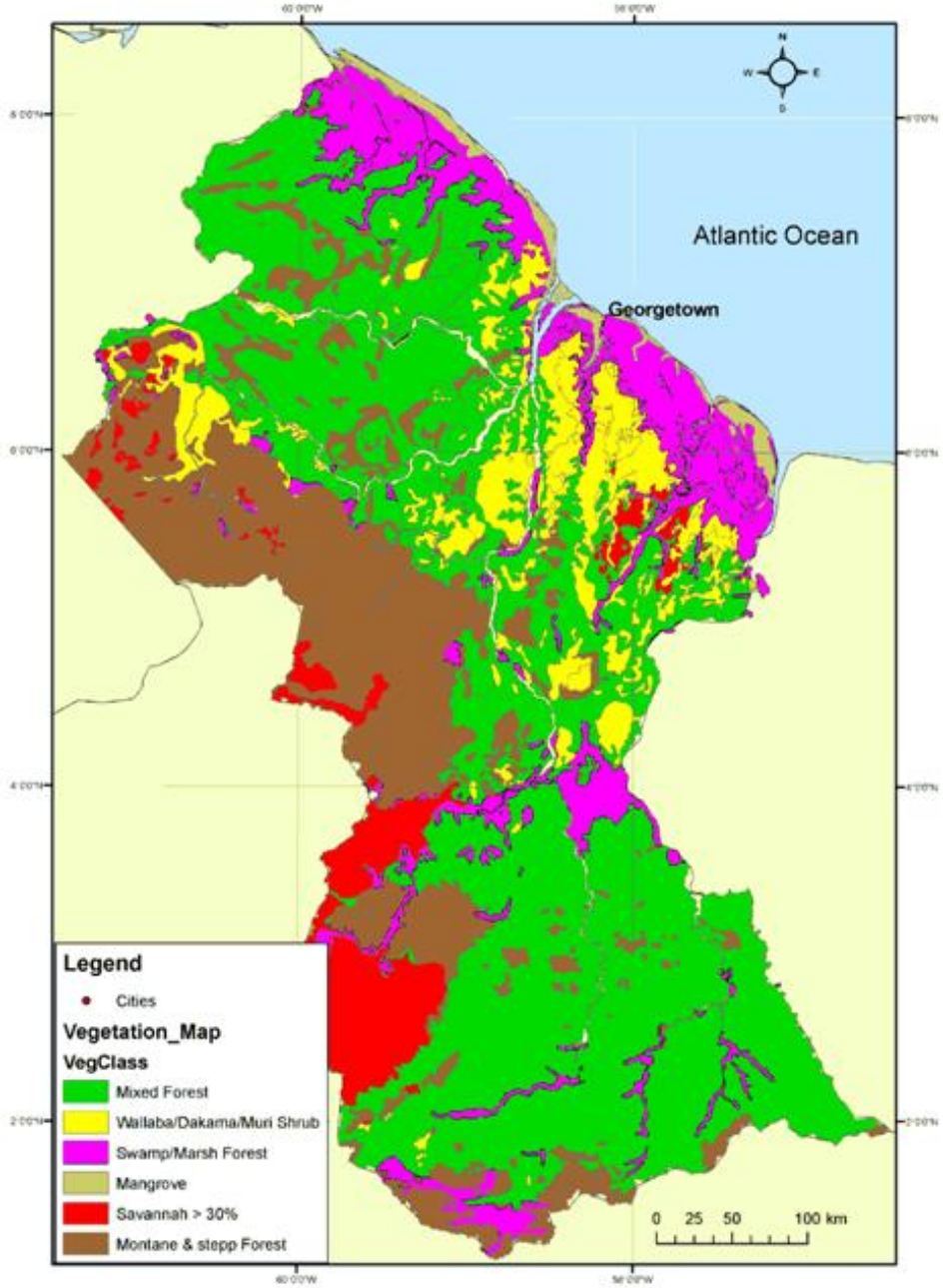


Table 2-11 Simplified Natural Vegetation Areas

2001 Classes	Vegetation Type	Area (ha)	%
1.1-1.4, 1.8	Mixed Forest	10,232,522	48.4
2.1 – 2.6	Wallaba/Dakama/Muri Shrub	1,725,002	8.2
1.5-1.7, 7.1, 7.2, 8.1	Montane and Steep Forest	4,369,646	20.7
4.1	Mangrove Forest	103,707	0.5
3.1-3.3	Swamp/Marsh Forest	1,905,788	9.0
5,6	Savanna >30% cover	137,569	0.7
	Non-Forest	2,400,003	11.4
	Water-bodies	268,650	1.3
	Total	**21,142,888**	**100.0**

The current project has used these maps and datasets, as well as other regional maps and datasets, and has included non-forest land uses such as agriculture to produce a map of Land Cover/Land Use as discussed below.

2.7.3 The State Forest Estate and Forest Classification

The maps above show vegetation for the whole country. However, forests cover only some of Guyana, and the area that is administered by GFC is known as the State Forest Estate. Areas that are not part of the Forest Estate are either Amerindian Areas, Public (State and Government) Lands or Private Lands.

According to the recent GFC Forestry Policy Statement (GFC 2011a) about 87% or 18.3 million ha of the country is forested (DLUPP mapping (q.v.) indicates 88% or 18.57m ha) of which 12.8 million ha (74%) is State Forest, administered by GFC.

GFC commenced a process of forest zonation in 2001 which focused on the delineation of forests into Production, Conversion and Protection forest which were subdivided, as shown on Table 2-12, below.

Table 2-12 Forest Classification

Zonation	Forest Management Class	Description
PRODUCTION	Permanent Production Forests	Sustainable commercial timber extraction
	Extractive Forests	Sustainable commercial Non-Timber Forest Products (NTFPs) extraction
	Multiple Use Forests	Sustainable commercial timber and non-timber forests products extraction
CONVERSION	Conversion Forests	For non-forest land uses
PROTECTION	Permanent Protection Forests	For protection of natural and

	and Biodiversity Reserves	cultural heritage
	Reserve Forests	No commercial forestry allowed
	Permanent Research Forests	Scientific research only

Source: GFC 2007

However not all the forest resources were classified and the new 2011 Forest Policy Statement proposes the classification of forests into four classes:

- **Multiple Use Forests.** These are forests that are to be used both for the production of goods (timber and non-timber) and for the provision of ecosystem services with a minimum of 4.5% of any concession area to be set aside as a biodiversity reserve. These forests are leased by GFC and managed according to GFC Guidelines. They occur mainly in the north of the country covering a broad swathe from Region 1 and 7 in the north-west, through Regions 8 and 10 and extending into Region 6. The backlands of coastal Regions 2 to 6 are also included.
- **Permanent Protection Forests and Biodiversity Reserves**. These are forests set aside for protection where no tree felling or NTFP production will be allowed. These include the forests in Iwokrama and Kaieteur National Park (although Iwokrama does allow some sustainable production) and the newly created Kanuku Mountains and Shell Beach Protected Areas as well as other smaller reserves such as the Moraballi Reserve on the east bank of the Essequibo River in Region 10 and within the Demerara Timber Limited (DTL) concession at Mabura in Region 10. In addition the Conservation International Concession in the upper Essequibo in Regions 9 and 6 could fall into this category since, despite being leased under a Timber Sales Agreement, the intention is of conservation rather than production.
- **Reserve Forests.** These are forests that are yet to be classified but in which no extraction is currently allowed and any extraction will need ministerial approval to proceed. These forests occur at the fringes of the currently leased area in the north, particularly between the State Forest Area and the Pakaraima Mountains to the west and all the forests in the south of Guyana even though exploratory permits do exist for some areas just south of the 4^{o}N parallel in Regions 9 and 6.
- **Conversion Forests**. These are forested areas that can be cleared for other land uses. They are small in number and occur around Orealla in Region 6 and further south between the Berbice and Corentyne rivers in Region 6.

Figure 2-18 shows the allocation of forest resources within the State Forest Estate.

2.7.4 Forest Management and GFC Leases

Forestry in Guyana has moved on since a DfID country report in the late 1990s noted that the reason that Guyana had a plethora of forest resources was more to do with benign neglect rather than judicious management of its forest resource. At the same time, international thinking has moved away from considering forest resources solely in terms of logging and timber production, and has embraced the economic benefits for the whole world to be derived from the ecosystem functions that forests perform.

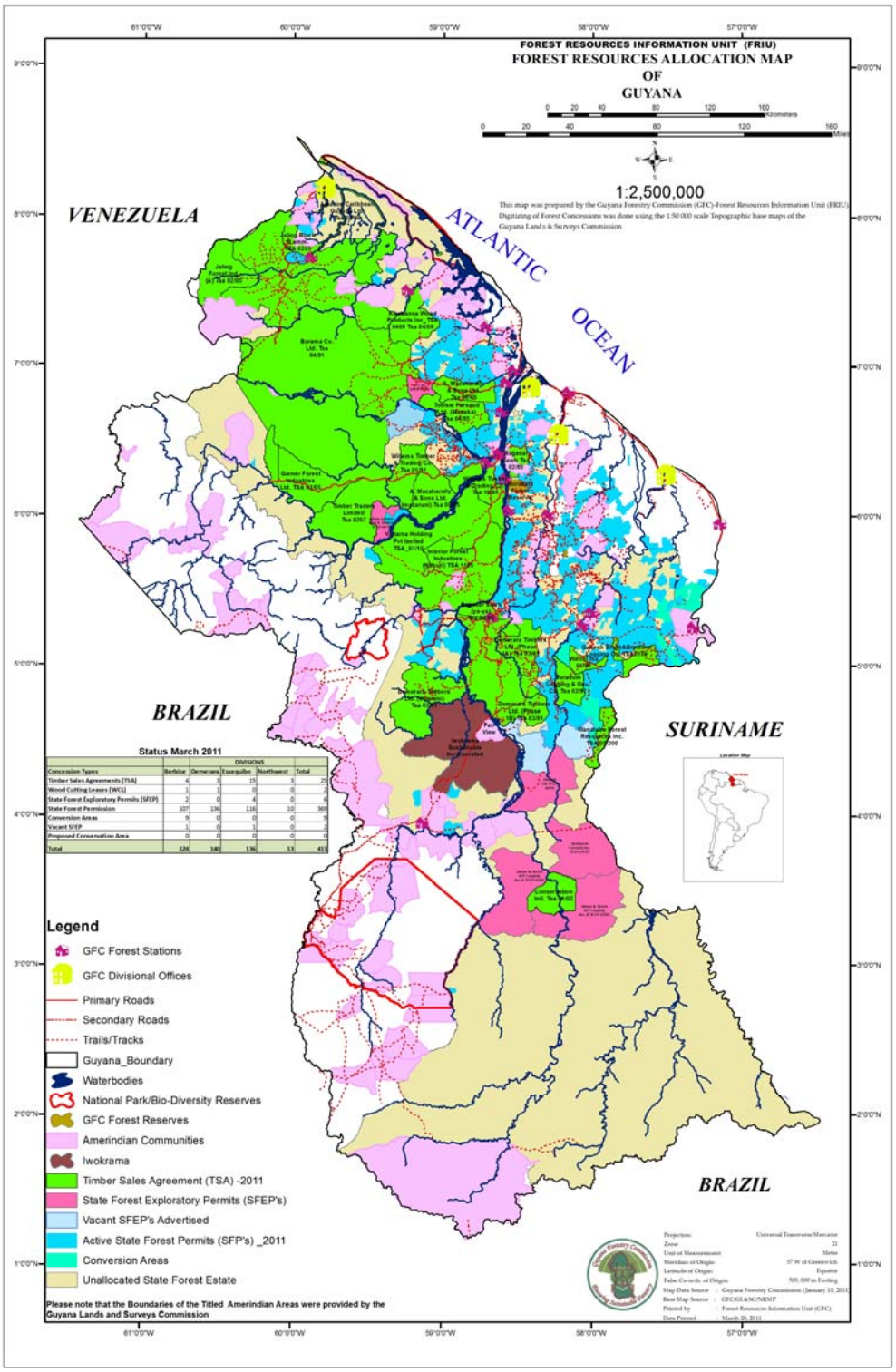
To these ends, GFC has instituted measures to ensure the sustainable management of its forest resources including guidelines for timber harvesting, and a Codes of Practice for the

operation and management of forest concessions that includes stipulations on proximity limits, a minimum tree diameter for harvesting, tree selection and fall direction planning, skid trail layouts, and the sub-division of concessions into blocks to be managed on 25-65 year cycles and a variety of other prescriptions aimed at ensuring good forestry practice.

Selective logging has been the traditional approach to timber harvesting, where an identified number of commercial species above a specific Diameter-at-Breast-Height (DBH) are extracted per hectare with little effect on the forest canopy. The Annual Allowable cut is based on a 60 year cutting cycle at $20m^3$/ha. This is outlined in detail in the Codes of Practice for Harvesting Operations which is one of three harvesting guidelines in place together with Forest Management Plan Guidelines and guidelines for Reduced Impact Logging Techniques.

In addition to the Guidelines and a Codes of Practice, GFC has been working to broaden the range of tree species harvested through the promotion of Lesser Utilised Wood Species, and this has been coupled with a Log Export Policy that aims to dissuade the export of primary products by providing incentives for processing in Guyana which in turn is aimed at increasing employment opportunities.

Figure 2-18 Forest Resource Allocation Map



Coupled to enhanced sustainable forestry management is intensive monitoring that has increased in efficiency of late and the implementation of an enhanced log tracking system that enables checks and verification of the legality and provenance of timber. These initiatives are aimed at increased transparency largely driven by the export market.

There are three types of State Forest Leases dependent on area and duration of operation:

Timber Sales Agreements (TSAs). These are leases granted for 10-25 years for areas greater than 24,000ha. A total of 25 TSAs were in existence in June 2011 (see Table 2-13) covering over 4.1 million ha and extending between the north-west and centre of the country as shown in Figure 2-18.

Wood Cutting Leases (WCLs). These are leases granted for up to 10 years for areas of 8,000-24,000ha. Only 2 WCLs were in existence in June 2011.

State Forest Permits (SFPs). These are leases granted for 2 years for areas up to 8,000ha. A total of 448 SFPs were in existence in June 2011 largely concentrated on the White Sand Plateau running from Region 2 in the north-west to Region 6 in the north-east and covering a total area of just over 1.6 million ha.

In addition, **State Forest Exploratory Permits (SFEPs)** are leases issued to allow an assessment of the potential of an area of interest and are a necessary precursor to an extended TSA for 25-50 years duration. There are currently five (5) SFEPs in operation and two (2) more are advertised.

Table 2-13 Status of GFC Leases June 2011

Forest and Lease Type	No.	Area (ha)	% Zoned area	% Allocated Forest	% State Forest
Production Forests					
SFP	448	1,610,965	24.6	21.2	12.5
WCL	2	30,459	0.5	0.4	0.2
TSA	25	4,167,139	63.5	54.8	32.4
SFEP	5	750,063	11.4	9.9	5.8
Total	**480**	**6,558,626**	**100.0**	**86.2**	**51.0**
Research & Reserved Forests					0.0
GFC Forest Reserves	11	17,796	1.7	0.2	0.1
Other Research & Reserve Sites	2	1,032,903	98.3	13.6	8.0
Total	**13**	**1,050,699**	**100.0**	**13.8**	**8.2**
Total Allocated Forests	**493**	**7,609,325**		**100.0**	**59.2**
Unallocated Forest Areas		5,245,482			40.8
Total State Forest		**12,854,807**			**100.0**

Source: Forest Sector Information Report Jan-June 2011 (GFC)

Figure 2-19 GFC Issued Forestry Leases

See associated Map Album

Figure 2-19 and Table 2-13 show the situation regarding forestry leases in 2011. There is some discrepancy between the map and the table due to a three (3) month gap in compilation; the map dates from March and the table from June 2011. However they do show important information.

It is notable that only 59% of the State Forest area is allocated and if the SFEPs are excluded then the allocated area percentage drops to under 57%. Production forests occupy 51% of the State Forest area, falling to 48% if SFEPs are excluded.

It is also notable that the vast majority of Production Forests are located in a broad swathe running from the north-west to north-east of the country largely north of Iwokrama. The majority of this area is under long-term TSAs with a mean area of 167,000ha. South of Iwokrama, there is very little forestry (with the exception of small-scale community forestry in and around Amerindian Areas) largely due to a moratorium on forestry south of the 4°N parallel.

There are large SFEPs south of the Production Forests and the Conservation International TSA Concession, and it is reported that there are plans to convert the SFEPs to TSAs for the production of timber for furniture. The proposal comes from an Indian company that plans to establish a timber factory at Annai and a processing plant at Linden. The rate of timber harvest proposed is very low at 2-3 trees/ha and consultations are ongoing with local Amerindian communities who are reported to be in favour of the proposal.

2.7.5 Forestry in the Economy

The Forestry sector contributed between 3-4% (mean 3.43%) of the national economy in the 2000-2010 decade as shown in Table 2-14. According to the 2007 GFC fact-sheet, export earnings grew steadily from 2002 and almost doubled between 2000 and 2006 with timber production increasing. However, plywood production and exports declined during this period. The National Forestry Policy Statement pointed out that for the period 2006-10, forestry earned Guyana US$270m (mean US$54m/y) on a total production of 2.2million m^3.

Table 2-14 Forestry's contribution to GDP

Year	GDP (G$m)[1]	Forestry Sector (G$m)	% contribution
2000	5,352	189	3.53
2001	5,474	195	3.56
2002	5,536	180	3.25
2003	5,500	183	3.33
2004	5,587	184	3.29
2005	5,478	199	3.63
2006	262,880	10,958	4.17

2007	281,335	10,331	3.67
2008	286,896	8,927	3.11
2009	296,417	9,161	3.09
2010	309,329	9,619	3.11

[1] (2000-2005 based on 1988 prices, 2006-2010 on 2006 prices) Source: GFC 2007 and GFC 2011c

The latest data from the Forestry Sector Information Report (GFC 2011c) indicated that production in almost all wood categories was down on similar 2010 figures, largely attributed poor weather conditions in early 2011.

The total value of timber exports for the first half of 2011 was US$19.3m a slight reduction on first-half 2010 at US$23.9m. The main markets for Guyana timber and wood products are Asia/Pacific, particularly China, India, and Barbados, Trinidad and Tobago in the Latin America/Caribbean market.

The total number of people employed in the Forestry sector (excluding furniture making, charcoal & firewood production etc) in mid 2011 was 19,181, a drop of 13% from the mid-2010 figure largely attributed to the temporary closure of the Barama plywood processing plant. Over the past five (5) years the Forestry sector has provided employment for twenty thousand (20,000) people on average.

The half-yearly reports produced by GFC contain a plethora of information concerning timber and timber products production, prices, total exports and exports by volume, value and export destinations by forest product type, as well as labour and lease information.

2.7.6 Community Forestry

Community forestry refers to the issuance of SFPs to (largely) Amerindian communities that are dependent on the forest for their livelihood, to provide employment, greater access to forest resources and income for the community. Through the Community Forest Initiative, village councils, communities or groups of individuals can apply for a SFP to be operated on a commercial basis.

GFC noted (GFC 2011c) that as of June 2011, a total of sixty-one (61) Community Forestry Organizations are in operation of which fifty-six (56) have been granted State Forest Permissions with five (5) Associations in various stages of preparation for the application of SFPs. There are to date 448 State Forest Permissions (SFPs) in operation of which 95 are operated by Forest Based Communities totalling 375,717 ha located both within and outside of the boundaries of titled Amerindian Areas.

Within Amerindian Areas, communities are encouraged to apply for a SFP, and GFC provides assistance to communities in the preparation of forest management plans for commercial forestry operation but it is currently optional rather than mandatory.

The National Forest Plan (GFC 2011b) indicated that GFC would like to see all commercial forest operations (including on private and Amerindian lands) brought under GFC lease umbrella with management plans thus prepared in accordance with guidelines and operated under the standard Codes of Practice.

2.7.7 REDD+, MRVS and the LCDS

The Low Carbon Development Strategy (LCDS) was formalised in May 2010 (GoG 2010). This was influenced by the effects of climate change, in particular the floods of 2005. In 2006, Guyana first proposed the idea to be paid for placing its forests under protection and the subsequent REDD+ (Reduced Emissions from Deforestation and Degradation) mechanism has provided a means whereby this may be achieved.

The LCDS is a development strategy based on the environmental services that Guyana's forests provide to the world, such as bio-diversity, water regulation and carbon sequestration. It establishes how Guyana can maintain its forest cover and be paid by developed nations for the ecosystem services that these forests provide to the world. It sets out the means to transform Guyana's economy while combating climate change by forging a low-carbon economy over the coming decade.

The GoG signed a Memorandum of Understanding with Norway in 2009 that, among other things, adopted REDD+ as a key component. REDD+ means a reduction in emissions from deforestation and degradation plus enhancing the role of conservation through the sustainable management of forest resources and the enhancement of forest carbon stocks. Financial support to Guyana from Norway is therefore linked to the reduction of deforestation and degradation plus establishing institutions and practices that will help this reduction.

It is important to note that the adoption of REDD+ does not halt all forestry operations in Guyana (it remains an important income) but aims to ensure that forestry is sustainable and carried out under the Sustainable Forest Management (SFM) procedures established by GFC.

A key component in REDD+ is the Monitoring, Reporting and Verification System (MRVS) that will provide a framework for monitoring progress. A key part of the MRVS is establishing a baseline against which progress can be measured. The baseline against which future deforestation can be measured was set at 30 September 2009 (GFC/Pőyry 2011) with the first monitoring year set as 1 October 2009 to 30 September 2010 and the second from 1 October 2010 to 31 December 2011 (GFC/Indufor 2012).

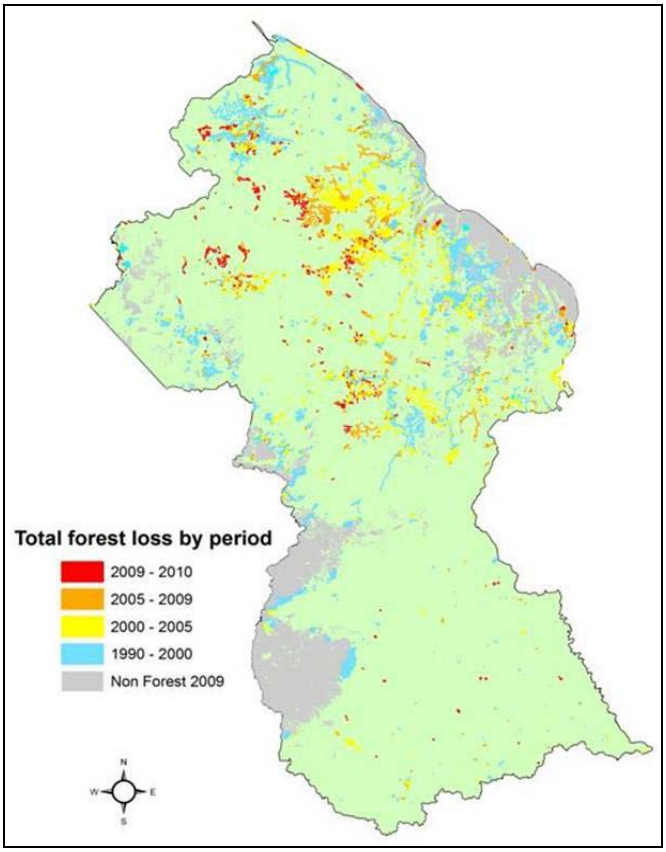
In addition, satellite imagery was used to assess the level of historical deforestation by assessing forest losses since 1990. This found that the total loss (deforestation) from 1990-2009 was 74,900ha a total loss of 0.41% equating to an annual loss of 3,800ha/y or 0.02% each year. At 30 September 2009, the total forest area was estimated at 18.39 m ha.

Areas of deforestation from 1990 to 2011 are shown in Figure 2-20. The map shows that most of the change is clustered and that new areas tend to be developed in close proximity to existing activities. It should be noted that deforested areas have been buffered to make them more visible. The majority of deforestation has occurred and still occurs in Region 7 with some scattered areas in Regions 1 and 8. Older deforestation is noted in Region 1 (particularly 1990-2000) and around Mabura Hill and scattered throughout the White Sand Plateau (particularly Regions 10, 6 and 4) in 2000-2005.

The main driver of deforestation was found to be mining accounting for 60% of the change (particularly between 2000-2005) followed by forestry itself (26%) then agriculture at 9% with infrastructure development and fire accounting for under 3% each as shown in Table 2-15.

The conversion of forests to agriculture is relatively stable at 200-500ha a year and the introduction of SFM has reduced the impact of forestry related developments to those of forest roads and log landings. Harvesting in concessions is selective and does not cause discernable deforestation but is a factor in degradation.

Figure 2-20 Areas of Deforestation 1990-2011



Source: GFC/Indufor 2012

Table 2-15 Deforestation drivers 1990-2010

Drivers	Area of deforestation (ha)						
	1990-2000	2001-2005	2006-2009	1990-2009	%	1990-2010	%
Forestry	6,094	8,420	4,784	19,298	25.8	19,592	23.0
Agriculture	2,030	2,852	1,797	6,679	8.9	7,192	8.4
Mining	10,843	21,438	12,624	44,905	59.9	54,253	63.7
Infrastructure	590	1,304	195	2,089	2.8	2,153	2.5
Fire	1,708	235		1,943	2.6	1,975	2.3
Total Area Deforested	**21,265**	**34,249**	**19,400**	**74,914**	**100.0**	**85,165**	**100.0**

Source: GFC/Pőyry, MRVS Final Report 2011

Table 2-16 shows the deforested areas and drivers for years 1 and 2 of the MRVS. Forest loss (deforestation) for Year 1 (2009-10) was 10,251ha and for Year 2 (2010-11) 9,796ha corresponding to percentage losses of 0.056% and 0.053% respectively.

Table 2-16 Deforestation Drivers 2009-2011

Drivers	Area of deforestation (ha)			
	Year 1 2009-10	%	Year 2 2010-11	%
Forestry	294	2.9	234	2.4
Agriculture	513	5.0	72	0.7
Mining	9,348	91.2	9,205	94.0
Infrastructure	64	0.6	149	1.5
Fire	32	0.3	136	1.4
Total Area Deforested	**10,251**	**100.0**	**9,796**	**100.0**

Source: GFC/Pőyry 2011 & GFC/Indufor 2012

Mining is the main driver of current deforestation accounting 91% in Year 1 and 94% in Year 2 with the majority in the State Forest area (85% Year 1, 96% Year 2) with analysis showing that most change occurs around existing roads and navigable rivers. Deforestation due to forestry accounts for under 3% of the deforestation while deforestation due to agriculture fell from 5% in Year 1 to less than 1% in Year 2, while that due to infrastructure and fire increased from Year 1 to Year 2.

An assessment of forest degradation (as opposed to deforestation) was also undertaken. This showed a sharp drop in area from 92,413ha in Year 1 to 5,467ha in year 2 attributed to the much greater accuracy achievable by using GeoEye imagery with 5m resolution as opposed to Landsat with 30m resolution. Again mining accounted for the vast majority (97%) of forest degradation.

As part of the MRVS, mapping was undertaken to ascertain the area of Intact Forest Landscape i.e. areas where the forest is pristine. This is shown in Figure 2-21 and covered an area of 10.16m ha at the time of the baseline study. The Year 2 MRVS report indicated a change in the area to 7.60m ha in Year 1 though this change was largely due to definition and a further reduction to 5.59m ha in Year 2 due to the exclusion of mining reconnaissance areas as shown in Figure 2-22.

Figure 2-21 Intact Forest Baseline (2009)

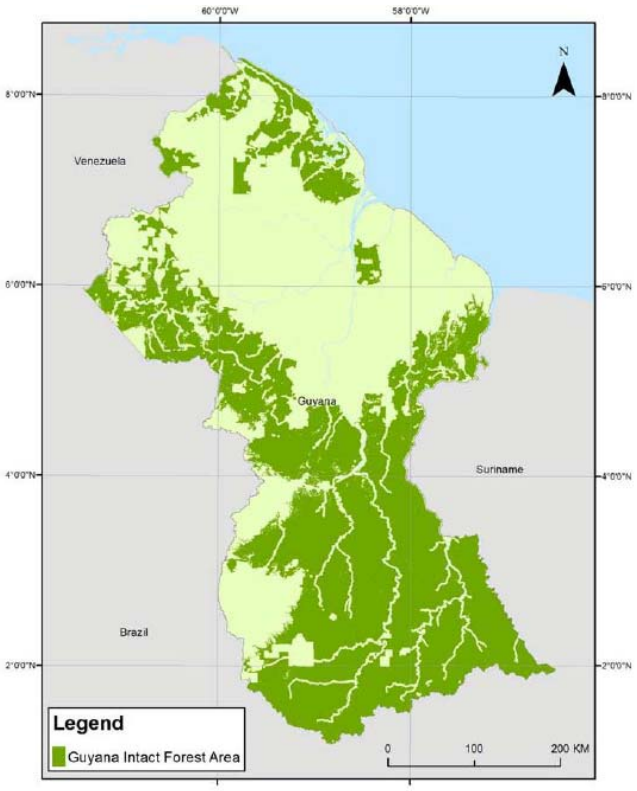
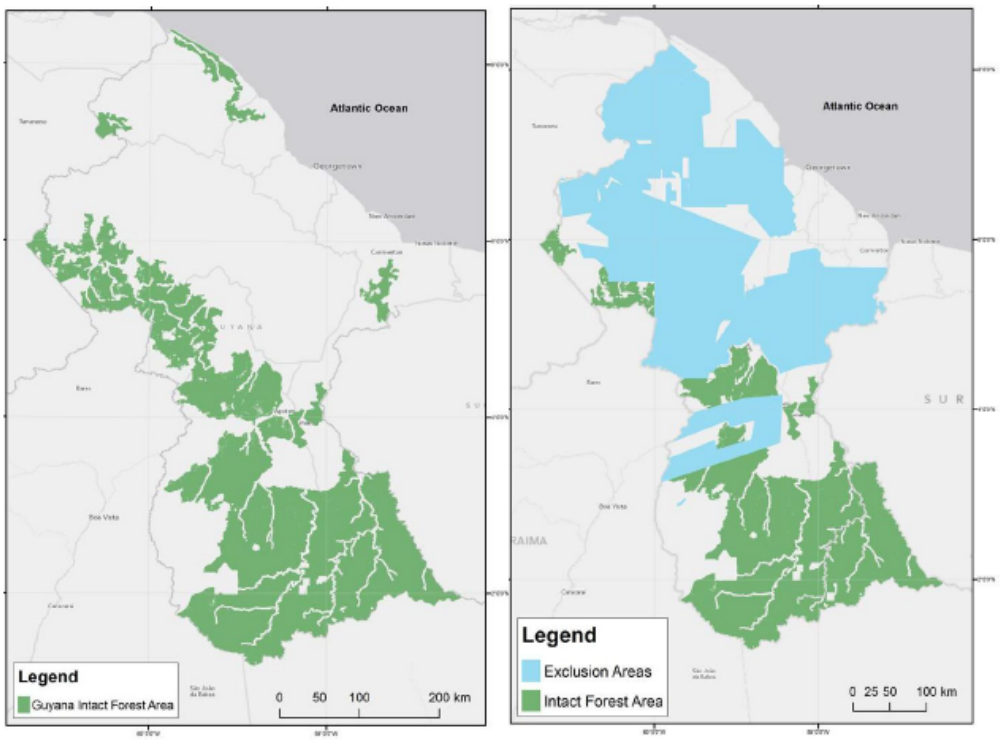


Figure 2-22 Intact Forest Area Year 1 and 2 (2010 & 2011)



Source: GFC/Indufor 2012

2.8 Land Cover & land use

2.8.1 Definitions

Land Cover and Land Use are often used interchangeably. However, they are actually quite different and their definition is given here.

The Global Land Cover Network (GLCN 2006) defines Land Cover as the observed (bio)physical cover, as seen from the ground or through remote sensing, including vegetation (natural or planted) and human construction (buildings, roads, etc.) which cover the earth's surface. Water, ice, bare rock or sand surfaces also count as land cover.

Land Use is based upon function, the purpose for which the land is being used. The definition of land use establishes a direct link between land cover and the actions of people in their environment.

Thus, a land use can be defined as a series of activities undertaken to produce one or more goods or services. A given land use may take place on one, or more than one, piece of land and several land uses may occur on the same piece of land. Definition of land use in this way provides a basis for precise and quantitative economic and environmental impact analysis and permits precise distinctions between land uses, if required.

Land cover types are divisions and sub-divisions of land covers used to describe an area. There are a number of global land cover classification systems of which the best known have been developed from the USGS Land Use/Land Cover Classification System and the FAO's Land Cover Classification System (LCCS) as used in AFRICOVER and promoted by the GLCN. A land cover type may be defined as a land surface area in which a cover type shows a relative degree of homogeneity in terms of type, distribution characteristics, and relations to human practices and other environmental parameters. This homogeneity of a cover type is dependent on the working scale of the imagery and/or derived mapping.

2.8.2 Mapping

For the purposes of mapping land cover and land use, the Project decided to combine the two into one map, a common procedure at the mapping scale proposed and one which enabled correlation with previous land cover/land use mapping in Guyana as derived by GFC during the development of the MRVS. While GFC MRVS mapping was aimed primarily at forest mapping it did include non-forest categories although these were not mapped as separate units.

A comprehensive land use mapping exercise was undertaken for the coastal area from 2001-2002 resulting in a land audit, data from which was used in the Region 6 Land Use Plan. The DLUPP has undertaken a land use mapping exercise to prepare land cover/land use mapping data based on an assessment of (mainly) 2011 Landsat TM imagery augmented by Landsat 7 ETM imagery in areas of high cloud cover. This allowed a visual assessment of vegetation types that were then correlated with Huber's Vegetation Map of Guyana (Huber et al 1985), GFC's MRVS mapping (See Figure 2-17) and the coastal land audit mapping created under GLASP in 2001.

The coastal land use mapping was updated using both Landsat and high-resolution imagery while a SRTM (Shuttle Radar Topographic Mission) DEM (Digital Elevation Model) was used in particular for forest strata mapping to discriminate between different altitudinal belts. GFC MRVS mapping was used as a base and combined with the Huber map to create an output land cover/land use map based on natural vegetation according to altitude, vegetation height, phenology and physiognomy.

2.8.3 Classification

A total of 15 classes of main vegetation types were able to be identified on the satellite imagery:

1. Medium / Tall Evergreen Riparian Forest
2. Medium / Tall Evergreen Montane Forest
3. Low / Medium Evergreen Montane Forest
4. Tall Evergreen Sclerophyllous Forest
5. Tall Evergreen Mixed Forest
6. Low Semi-deciduous Mixed Forest
7. Tall Evergreen Estuarine Forest
8. Low Evergreen Swamp Forest
9. Low Evergreen Tepui Forest
10. Scleromorphic Scrub
11. Thorn Semi-deciduous Scrub
12. Shrub Savanna
13. Open Savanna
14. Broadleaf Meadow
15. Flooded Meadow

Forests

Forests were initially sub-divided by flooding conditions with Estuarine, Swamp and Riparian forests separated from Sclerophyllous, Mixed and Montane Forest. They were then classified by height into three groups:

Low:	5-10m
Medium:	10-20m
Tall:	>25m

and were finally classified by leaf condition (phenology) into Evergreen (trees retain some or all their foliage during the year) and Deciduous (trees lose all of their leaves and are bare for a part of the year and the leaves are often broad).

Riparian Forest

This group includes the forested areas along rivers (gallery forest) in the lowlands (0-400m) on alluvium up to the Rupununi savannas and in some uplands in the Pakaraima and the Southern regions associated with Mora forest. The dominant element in the landscape associated with open savannas is the palm *Mauritia flexuosa (known as Ite Palm, http://ecocrop.fao.org/ecocrop/srv/en/cropView?id=7639)(buriti palm, mauriti palm, aguaje palm, babinda, palmier bâche, carandai-guazú (Bolivia), ideuí, canaguche, canangucho (Colombia, Ecuador), chomiya, buritί, moriche (Colombia, Venezuela), morete (Ecuador), palma real (Bolivia), coqueiro anajá, inajazeiro, miritί, muritί, palmeira dos brejos, ite palm (Guyana), aguaje (Colombia, Perú), morichal (Colombia), buriti-do-brejo, coqueiro-buriti, buritizeiro)*.

Montane Forest

Montane forest units in Guyana are associated with high rainfall tolerant species (ombrophilous) and slopes in the uplands (500-1,500m). They occur mainly in the southern regions, the Kanuku Mountains, the Pakaraima Mountains and the upper Mazaruni valley. This is the least known forest type in terms of floristic composition and their latitudinal extension in South America (Huber, 2006).

Sclerophyllous Forest

This type of forest is better known as Wallaba forest and is mainly found on excessively drained white sands in the lowlands (10-400m).

Mixed Forest

This unit is the most common type of forest occurring in Guyana. It occurs in lowlands (10-400m) with high rainfall. The evergreen units occur in the north-west areas of Regions 1 and 7 commonly known as 'Rainforest' as well in the Pakaraimas (on the border with Venezuela) and the uplands on the border with Brazil. In the southern areas of Region 9 they are mainly deciduous and occur at the border of the Rupunini savannas.

Estuarine Forest

These are Mangrove forests that occur in a narrow zone along the coast from Regions 1 to 6. They are partly sheltered areas found near river mouths where freshwater mixes with seawater.

Swamp Forest

These are areas flooded most of the year located in flat coastal backlands (0-50m).

Tepui Forest

This type of forest can be grouped with Tepui scrub. These units are located in the highlands (>1,500m) and are very extensive in the Guiana Shield but, in Guyana, occur only at Roraima and Ayanganna mountains. It is a particular community formed by saxicolous vegetation with small trees adapted to grow on upper walls and cliffs and on the flat-topped summit plateaus.

Shrubland

In the lowlands, this type of Scleromorphic scrub is known also as Muri scrub and is located on white sands and savannas. It also occurs in the Pakaraima mountains and the Kanuku foothills up to 1,500m.

Grassland

This type of unit is formed of herbaceous plants located in the bi-seasonal lowlands. Savannas dominated by grasses are found at all altitudinal levels, from the lowlands to the uplands. In the white sand plateau area in the north, shrub savannas form an interrupted chain stretching from Guyana into Suriname heavily degraded by human activities. In the Rupunini savannas there is a mixed of shrub savannas with woody elements (*Curatella americana* and *Byrsomima crassifolia*) mixed with open areas dominated by grass (*Trachypogon sp*.). They form large alluvial plains crossed by rivers and riparian forests and are exposed to annual dry season fires. The only upland savanna known in the Guiana Shield is located in the Pakaraima Mountains of north-west Guyana (Huber, 2006). It occurs on some plateaus between 600-1,200m in the upper Mazaruni.

Other herbaceous systems called meadows are characterised by non-grass species in the herbaceous layer. They are associated with highly acidic substrates (Huber, 2006) such as sandy soils on white sands (Broadleaf meadows) and also occur in flooded conditions in the Rupununi savannas.

2.8.4 Extent of land cover types

The classes used in the land cover/land use classification are shown in Table 2-17, the areas of the different classes in Table 2-18 and their extent in Figure 2-23. As can be seen the vast majority of Guyana has been mapped as Forest covering nearly 88% of the country largely composed of Mixed Forest (57%) and Montane Forest (17%) with smaller areas of Riparian Forest (5%), Sclerophyllous Wallaba Forest (5%), Swamp Forest (4%) and Mangrove (0.2%).

Table 2-17 Land Cover/Land Use Classification Classes

Class	Description
Built-up area	Residential, commercial and industrial development
Bare land	Includes bare soils and bare previously cultivated land
Cropland	Agricultural land (rice, sugar, cash crops etc) including fallow land
Inland water-body	Freshwater lakes, rivers and streams
Plantation	Tree crops e.g. coconut
Grassland	Herbaceous ecosystems formed by grasses and non-grass plants less than 5m tall. Woody elements may be present either singly or clumped but do not form a continuous canopy
Shrubland	Vegetation types where the dominant plants are woody perennials, generally more than 0.5m and less than 5m in height on maturity and without a definite crown
Forest	A woody vegetation type with trees taller than 5m and a canopy cover of more than 10%

Table 2-18 Land Cover/Land Use Categories

Land Cover/Land Use	Area (km^2)		%
Bare Land		**122**	**0.06**
Water Bodies		**3,052**	**1.44**
Built-up Area		**348**	**0.16**
Arable Land and Tree Crops		**3,261**	**1.54**
Cropland	3,180		1.50

Tree Crop Plantations	81		0.04
Meadow		**1,763**	**0.83**
Flooded Meadow	1,690		0.80
Broadleaf Meadow	73		0.03
Savanna		**15,597**	**7.37**
Open Savanna	1,269		0.60
Shrub Savanna	14,328		6.77
Scrubland		**1,676**	**0.79**
Thorn Scrub	119		0.06
Scleromorphic Scrub- Muri	1,557		0.74
Forest		**185,716**	**87.79**
Lower Evergreen Tepui Forest	48		0.02
Low Evergreen Swamp Forest	8,758		4.14
Tall Evergreen Estuarine Forest - Mangrove	432		0.20
Low Semi-deciduous Mixed Forest	3,234		1.53
Tall Evergreen Mixed Forest - Rainforest	116,902		55.26
Tall Evergreen Sclerophyllous Forest - Wallaba/Dakama	11,068		5.23
Low/Med Evergreen Montane Forest	278		0.13
Med/Tall Evergreen Montane Forest	35,259		16.67
Med/Tall Evergreen Riparian Forest	9,736		4.60
	Total	**211,534**	**100.00**

Source: DLUPP GIS Data.

Figure 2-23 Land Cover/Land Use 2012

See associated Map Album

The forests extend from the north-west to the south-east of the country with Mixed Forest comprising lower land areas and Montane Forest confined to the Pakaraima and Kanuku Mountains in the west and Aracai Mountains in the south. The Wallaba/Dakama scleromorphic Mixed Forests occur mainly on the white sand plateau. The Swamp Forests occur mainly in the coastal plain backlands with Mangroves confined to the coast. Riparian Forests have been mapped along the mid and upper Essequibo, Demerara and Berbice Rivers as well as the Kaituma and Barima Rivers in the north-west and are most extensive on the Oronoque, New and Upper Essequibo Rivers in the south east.

Savanna lands have been mapped as Open and Shrub Savanna with Shrub Savanna more extensive occurring in the Rupununi, Pakaraimas and Intermediate savannas, and Open Savanna mainly in the southern Rupununi savannas. Wetland savannas have been mapped as

Flooded Meadow, extensive in the northern Rupununi and also in the Berbice backlands. Only a very small area of Broadleaf Meadow has been mapped in the Pakaraima Mountains.

Scrubland is not extensive, comprising Thorn Scrub in the southern Kanukus, Tepui Scrub in the Pakaraimas and Muri Scrub in the lower Berbice River and north-western extent of the Pakaraimas. Bare Land is confined to mining spoil around Linden and individual rocky outcrops in the south eastern forests. Water Bodies comprise wider stretches of rivers and small lakes, particularly in Region 2.

Human influenced land uses cover only 1.7% of Guyana with Built-up Areas comprising 0.16% and Cropland 1.54% (348 and 3,261km^2) confined to the coastal strip. This figure corresponds well with GL&SC estimate of 380,583ha of leased land. Tree crops cover only 81km^2 (0.04%) as coconut plantations in Regions 2 and 4.

2.9 Agriculture and Livestock

Despite Cropland only covering 1.54% of Guyana, agriculture is an important sector of the Guyanese economy, accounting for around 13% of the national GDP in 2010 (BoS 2011). The vast majority of agriculture occurs on the coastal plain with rice and sugar the main crops.

Rice is the most productive crop in Guyana with an export value in 2010 of US$155m (BoS 2011), double what it was in 2007 and well above the US$57m a year between 2000 and 2008 (MoA/Scott Wilson 2011).

As the PRS (2011) notes 'the rice sector continues to show resilience both on the production and export fronts, despite the effects of climate change and uncertainties of market conditions'. The growing international demand for rice and the recent export agreement with Venezuela indicate that rice production could well drive expansion of the agricultural sector. This is borne out by MoA statistics (MoA 2011) showing that rice production for the first half of 2011 was up 23% compared to 2010 (attributed to better D&I, new high yielding strains and increased planting area) and that a further increase to 421,000t is expected in 2012.

At present the Guyana Rice Board indicates that some 60,000ha is planted to rice annually mainly in Cane Grove in Region 4, Region 2 and Villages 52-74 in Region 6 although this could expand again to the high of 72,000ha, particularly with the development of Pomona and Aurora in Region 2. Rice yields are about 2.5-3.0t/ha.

Since 2000, the highest yields tend to have been associated with the least land under production suggesting that extreme weather events (severe flooding and drought) and other factors (e.g. varieties used) have a significant bearing on productivity. The Rice Board and NAREI are in the process of trialling new varieties that offer better flood resistance and can be planted later in the season when the flood risk had decreased.

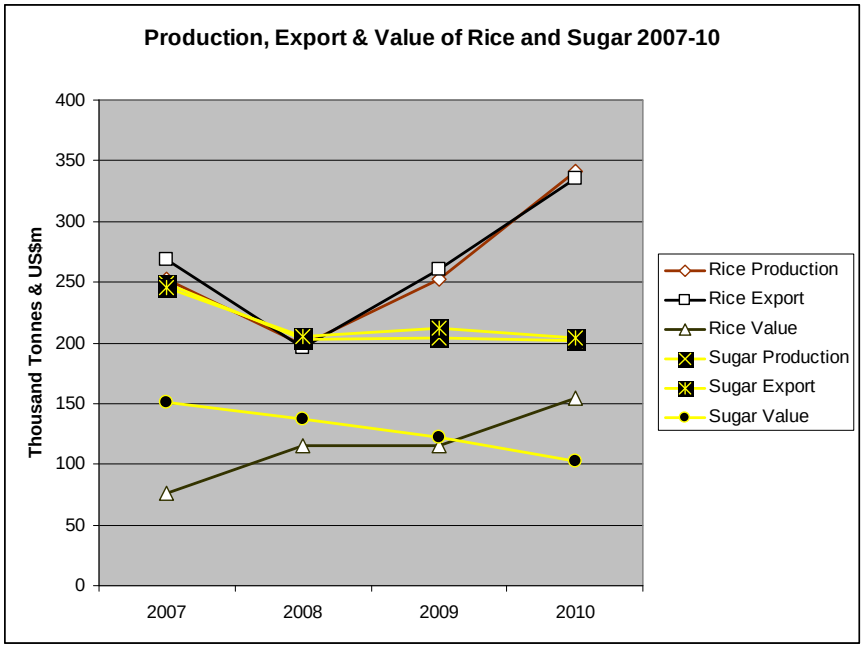
Table 2-19 and Figure 2-24 show the amount of production and export (in thousands of tonnes) and export value (US$m) for rice and sugar. It is notable that the vast majority of both are exported and that rice production and export value has increased sharply since 2008 whereas sugar has fallen.

Table 2-19 Production, Export and Export Value of Rice & Sugar 2007-10

Production Trends 2007-2010 ('000 tonnes)						
	Production		Exports		Export Value (US$m)	
	Rice	Sugar	Rice	Sugar	Rice	Sugar
2007	253	249	269	246	76.0	151.5
2008	198	203	196	205	115.6	136.8
2009	252	204	261	212	114.8	121.9
2010	341	202	336	204	154.9	103.0

Source: Bureau of Statistics 2011

Figure 2-24 Production, Export and Value of Rice and Sugar 2007-10



Source: Bureau of Statistics 2011

Sugar has been inextricably linked with the development of Guyana over the past few hundred years and is expected to continue to be one of the important engines of growth for the economy in the future. There are sugar estates and factories on the coastal plain in Regions 3, 4, 5 and 6 covering about 44,500ha, with recent expansion in Region 6 due to the modernisation of the Skeldon plant (which became operational in 2008) and an increase in area and production coupled with increased power production from burning bagasse as part of the co-generation process.

As Figure 2-24 shows, sugar production and export have been steady since 2008 at just over 200,000 tonnes but the value of sugar exports has fallen slightly to around US$100M. MoA (2011) statistics show that sugar production for the first half of 2011 was up 30% on the same period in 2010 at 106,871 tonnes.

Other crops include ground provisions, coconut, fruit and vegetables which are grown in different locations on the coastal plain. Production of these non-traditional agricultural

products were 3.25mkg of Copra, 2.7mkg of Dried Coconut, 111,000kg of coconut water, 529,000kg of pumpkin and 365,000kg of watermelon for 2009 (MoA 2009). A small increase of 3% was seen in the first half of 2011 compared to 2010. There is a potential for development of this sector as set out in the LCDS and the PRS.

Livestock production in Guyana takes place mainly in the coastal plain and in the Intermediate and Rupununi savannas in the south. Livestock numbers are scarce; the National Dairy Development Programme estimated a total cattle population of 238,000, the NDS in 1996 estimated a total cattle population for Guyana of 270,000 head and also quoted figures of 300,000 sheep and 150,000 goats. A more recent census for Regions 5 and 6 in 2006 gave a population of 280-300,000 head and based on these figures estimates were made of other regions.

MoA/Scott Wilson (2011) reported that livestock numbers had grown significantly over the period 2000-06 and that the principal contributors to this growth were poultry and equine. Over the same period, significant increases were also experienced in cattle and pig production (increases of 44% and 35% respectively). They also noted that livestock husbandry tends to be undertaken on small farms and at household level rather than on a large, commercial scale.

In the Rupununi savannas, the Region 9 (I) Land Use Plan (GL&SC 2005) quoted anecdotal evidence, supported by Colchester (1997), indicating that the cattle population was only one-tenth (10%) of what it was in 1969 before the Rupununi uprising and varied between a low of 9,000, an often stated figure of 12,000 and a high of 15,000.

The development of the livestock sector has been given high priority by both the ADP and the LCDS with the result that a semi-autonomous agency, the Guyana Livestock Development Authority (GLDA) was established in 2010. This Agency has the aim of developing the livestock sector for export, mainly for beef but also small-scale dairy, poultry and pork. GLDA have plans to conduct a livestock baseline survey in 2011-12 and plan to develop the whole commodity value chain including abattoirs, laboratories and trained vets.

The Authority pointed out that the current livestock regime of poorly managed open grazing will need to change to satisfy export markets with changes of breed, improved pasture and water supply and drainage and that conflict between livestock and competing land uses will need to be resolved.

2.10 Fisheries and Aquaculture

Fisheries in Guyana can be divided into three primary components (FAO 2005):

Marine fishery, including:

- industrial trawl fishery
- deep slope fishery (semi-industrial red snapper fishery)
- small-scale artisanal fishery

Inland fishery, including:

- subsistence fishery
- ornamental fish fishery

Aquaculture, including:

- brackish-water culture

- freshwater culture

The marine fishery, composed mainly of prawns and shrimp (seabob) is an important contributor to the national economy comprising just under 6% of GDP with an export value of US$30m in 2010, down from a high of US$42m in 2006. The total marine fish catch is 22,000 tonnes a year (MoA 2011). The inland fishery is mainly subsistence but ornamental fish for aquariums is a small but growing niche market. In addition, the Arapaima Management Plan allows a catch of 100 fish a year.

Of most concern to the NLUP though is aquaculture being highlighted in both the NDS and the LCDS. According to FAO, aquaculture started in Guyana in the 1950s but development was slow. At present, according to the Fisheries Department of MOA, there are forty-two (42) registered aquaculture farms occupying 391ha (968 acres) producing 483t of mainly tilapia and shrimp. This equates to a mean farm area of 9ha and a yield of 1.2t/ha. The farms are located mainly in Regions 2, 3 and 6.

The MoA Fisheries Department reports that for 2011 (data to end November) out of a total 400,000kg, the amount of tilapia produced was 217,000kg (120 tonnes), tambaqui (Black Pacu) 110,000kg (110t) and black shrimp 28,000kg (28t). Other species reared include mullet, querriman, bashaw, hassar and crab.

Most aquaculture farms rear tilapia, and most farms utilise fresh water with some brackish water aquaculture for shrimp in Region 6. In the past, most aquaculture was small-scale on private land or on sea defence reserves but there is now a trend for large investors to lease large areas of land.

2.11 Biodiversity and Protected Areas

As the National Biodiversity Action Plan II (EPA 2007) pointed out, the forests of Guyana are valuable reservoirs of biodiversity. Their value is enhanced by the fact that a high proportion is pristine (the forests of the Guiana Shield have been recognised as one of the last remaining 'frontier forests' of the world), they contain many animal and plant endemics (it is estimated that 5% of all flora species in Guyana are endemic), they provide numerous habitats for wildlife, and they are an integral part of the country's freshwater ecosystems.

Even Production Forests are characterised by high species diversity but the main commercial species have a low standing volume per unit area. This results in low volume extraction per unit area estimated at less than $0.1m^3$/ha overall and still only $0.5m^3$/ha in the most heavily deforested areas.

The NBAP cited the reasons for low productivity as the relatively poor forest soils; the highly selective nature of logging (targeting less than 5% of the tree species occurring) and the relatively high occurrence of defective trees (estimated at more than 20% overall).

The NBAP also indicated that the coastal fringe and inland waters also have relatively high biodiversity and that 'the rivers and wetlands of the Guianas hold some of the greatest concentrations of freshwater biodiversity in the world'. It pointed out that the freshwater ecosystems are currently in relatively good condition as their watersheds are still protected by large areas of pristine forests and their natural watercourses are mostly unaltered by dams and other water infrastructure.

Part of the management of this biodiversity is a system of Protected Areas, defined by Conservation International to be important for its landscape, beauty or biodiversity and which has been protected by national law.

The Protected Areas Bill of June 2011 sets out a range of protected areas and proposes how they should be managed. The different protected areas are:

Strict Nature Reserve

Wilderness Resource

National Park

Natural Monument

Management Area for Habitat or Species

Protected Landscape/Seascape

Managed Resource Protected Area

Amerindian Protected Area

These involve different management, goals and strategies for resource conservation. Nature Reserves are created strictly for the protection of wildlife and for the maintenance of undisturbed ecosystems while National Parks may be created for the protection of areas with important national resources where educational visits and tourism may occur. Other areas, such as Amerindian PAs exist specifically for the protection of cultural and biological resources, and are managed by the indigenous Amerindian population.

The Bill proposes the establishment of a Protected Areas Commission and this has recently (March 2011) been established.

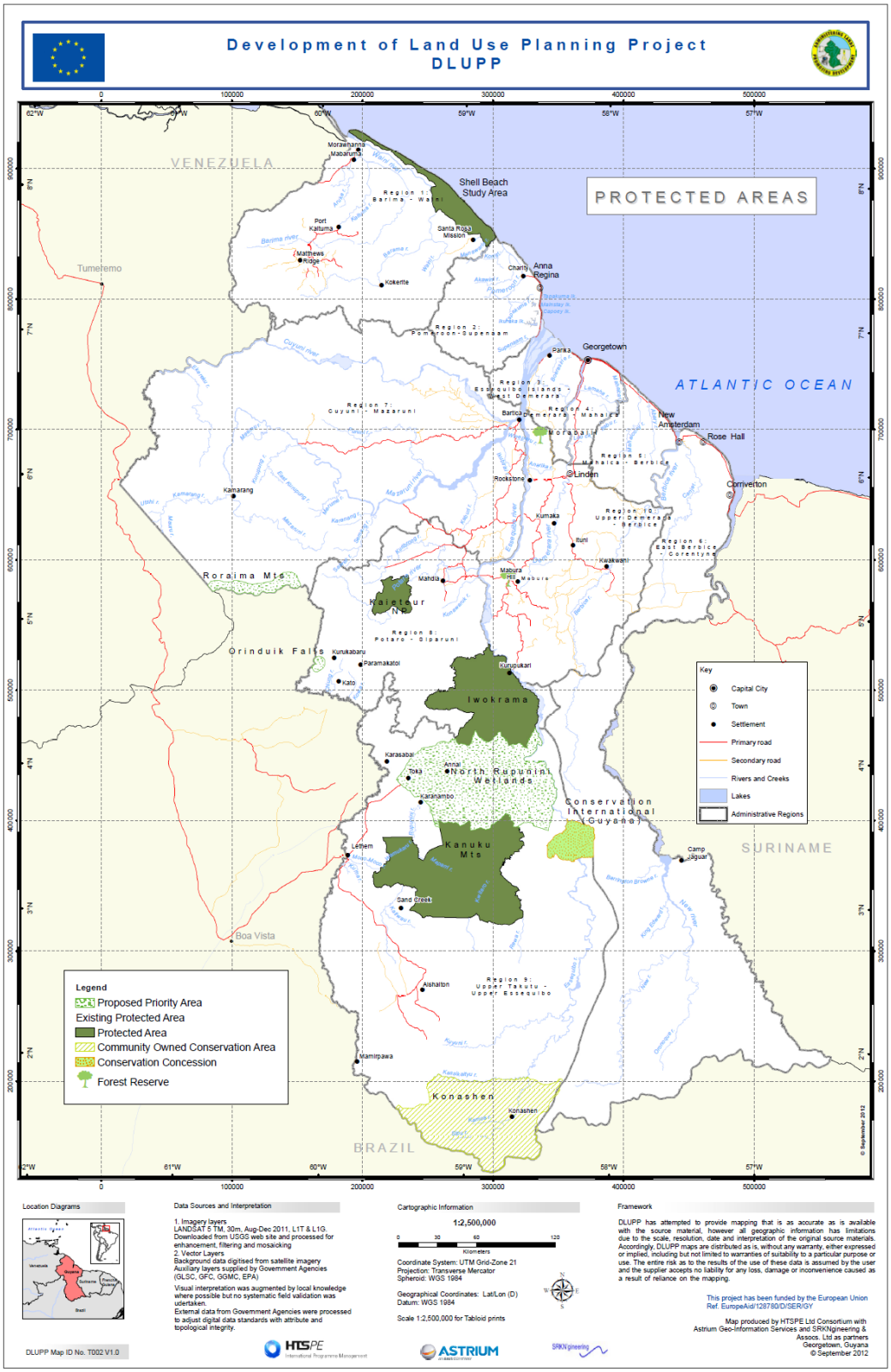
Table 2-20 and Figure 2-25 show the 5 legally recognised Protected Areas in Guyana (Kaieteur, Iwokrama, Shell Beach, Kanuku Mountains and Konashen) with a combined area of 17,262km^2 comprising 8.2% of the country. Other areas have some form of protection but they are not yet legal entities. Proposals for a tri-state (Guyana/Brazil/Venezuela) Mt Roraima National Park have apparently been shelved but the area in Guyana is still proposed for protection.

Table 2-20 Protected Areas Status

Name	Status	Area (ha)
Kaieteur National Park	National Park. Established in 1929, increased in 1999.	61,392
Iwokrama International Centre for Rainforest Conservation and Development	Established by Act of Parliament 1996	372,190
Shell Beach	Established by Act of Parliament 2011	119,459
Kanuku Mountains	Established by Act of Parliament 2011	609,152
Konashen District Community Owned Conservation Area	Titled Amerindian Area. Partnership with Conservation International	564,639
	Sub-Total	**1,726,832**
Upper Essequibo Conservation	TSA lease managed by Conservation	82,102

Concession	International	
Moraballi Reserve	GFC Forest Reserve	5,200
Mabura Reserve	GFC Forest Reserve	900
Mt Roraima	Potential Protected Area	57,220
Orinduik Falls National Monument	Potential Protected Area	8,546
	Sub-Total	**153,96**

Figure 2-25 Protected Areas Location



In addition to those above, the World Database of Protected Areas lists a further eight (8) locations (Ayanganna Mountain, Berbice Savanna, Essequibo Islands Wildlife Sanctuary, Kurupukari Wildlife Reserve, Kuyuwini-Kassikaityu Bird Reserve, New River Triangle Resource Reserve, Wakadanawa and Wokomung Mt. Scientific Reserve) as having some protected status but their location, area and status is not clear.

Other areas with some degree of protection or proposed for protection include the areas of TSAs that have to be left as biodiversity reserves under GFC guidelines where there is some discussion about bringing them under National Protected Areas status and the Northern Rupununi Wetlands Management Plan that outlines the potential for a RAMSAR site in the Northern Rupununi savannas.

2.12 Energy Resources

The energy resources of Guyana are mainly renewable and are, as yet, largely undeveloped. Energy supply in Guyana is primarily from petroleum products with other energy sources including bagasse, rice husk and fuel-wood as shown in Table 2-21. (MoA/Scott Wilson 2011). Guyana currently imports all of the petroleum products used in the energy sector but there are potential oil resources as discussed in 2.4.5 above.

Table 2-21 Energy Supply 2008

Fuel Type	Barrels (BBLs)	Litres	Energy Value (BOE)	%
Avgas	9,988	1,587,962	8,332	0.2
Kerosene	171,826	27,318,100	159,748	3.1
Gasoline	842,471	133,941,937	726,233	14.2
Fuel oil	1,006,600	160,036,314	972,313	19.0
Diesel	1,675,189	266,333,274	1,591,416	31.1
LPG	133,400	21,208,866	93,898	1.8
Bagasse			1,311,687	25.7
Charcoal			2,803	0.1
Fuel Wood			20,417	0.4
Rice Husk			222,172	4.3
Solar PV			28	-
Total	**3,839,474**	**610,426,453**	**5,109,047**	

Source: MoA/Scott Wilson 2011

According to the Bureau of Statistics Guyana imported US$384.8m worth of fuel and lubricants in 2010 (27% of total imports), this had risen to US$303.6m for the first six (6) months of 2012 (32% of all imports) according to BoS. MoA/Scott Wilson estimate that 20%

of all fossil fuels imported into Guyana are used for transport indicating that the rest is used for power generation at an annual cost of some US$307m.

In terms of electricity generation, in 2008 Guyana's installed capacity was 314MW of which 83% was thermoelectric and 17% was from bagasse-based co-generation. In 2008, Guyana generated approximately 819 GWh of electricity (MoA/Scott Wilson). The completion of the co-generation plant at Skeldon will increase the proportion of bagasse used for electricity generation, Rice husk is used for drying rice in twenty-two (22) rice mills.

Energy demand per capita in Guyana has been fairly stable from 1994 to 2008 at around 5 barrels of oil (795 litres) per capita a year although it can reasonably be expected to increase as a result of economic development and climate change. The GEA indicated that electricity demand is increasing at about 3-5MW/y, an amount that is considered low.

According to the PRS (2011) the 2002 census showed that about 69% of households nationwide had access to electricity. GPL is currently expanding its generating and distribution capacities with two projects targeting rural and un-served areas of the country reaching an additional 17,000 rural and poor households in the past few years (PRS 2011).

The renewable energy resources of Guyana can be divided into hydropower, wind, solar, biomass and biofuels. As of November 2011, only one hydropower facility (Moco-Moco) has been constructed but has not operated since 2002 and another (Amaila Falls) is under construction. There are no wind farms but solar is widespread although only generating 88kw of power. Biomass (the burning of waste crop products to generate energy) already contributes 30% of energy supply but Biofuels (the growing of crops specifically for conversion into fuel) are confined to a biodiesel plant from oil palm in Region 1.

2.12.1 Hydropower

The Amaila Falls site at the confluence of the Amaila and Kuribrong rivers is in the process of being developed. As of mid 2012 the road to the site is 80% complete and construction can begin once the road is completed. This site has a potential yield of 165MW (AFH 2012) that will satisfy Guyana's power demand on completion in 2015/16 so that the country should be able to move away from its dependence on fossil fuels for power generation.

The access road is a total of about 170km in length with 67km of new road from Kaburi village to the dam site and 18km from the Mabura Hill road to a ferry crossing on the Essequibo river at Butukari. The proposed dam will produce a reservoir of 23km^2 and will require a new 270km long high-voltage (230kV) power line that will transfer power to two 230kV substations at Linden and Sophia, east of Georgetown.

The only site of any size that has been constructed and was operational is Moco Moco in the Kanuku Mountains that operated between 1999-02 supplying Lethem with 0.25MW of electricity until the gravity feed was damaged by a landslide. Current estimates indicate that it will cost about US$430,000 to re-commission.

2.12.2 Wind

There is no wind power currently generated in Guyana. The potential for wind power is discussed in Section 3.4.10.

2.12.3 Solar

The high average daily solar radiation with an average of about 5 peak sun hours per day means that Guyana is suitable for solar power. Small-scale solar photovoltaic (PV) systems are already used in health centres, schools, communities and homes for lighting, small appliance loads, water pumping and productive cottage industries. Solar water heating is also beginning to be used for domestic water. Guyana has around 88kW of solar power installed primarily in the hinterland regions where there is no access to the grid which generates approximately 160kWh of annual electricity (MoA/Scott Wilson 2011).

GEA has identified a potential site at Eccles for a 1MW solar photo voltaic cell array but there has been no progress towards development.

2.12.4 Biomass

Energy from biomass is an important source of energy with around 26% of the electricity supply in Guyana from bagasse co-generation in 2008 with the Skeldon expansion due to supply a further 10MW. Bagasse is used in the sugar industry and rice husk in the rice industry for the co-generation of heat and electricity, while wood (firewood and charcoal) is used in the residential sector for cooking purposes.

Biogas generators using methane to generate electricity are in their infancy but it is reported that there are seven digesters using various feed-stocks located throughout Guyana.

The only biofuel plant currently in operation is at Wauna in Region 1. This unit is capable of producing 300 to 600 barrels of bio-diesel per month from palm oil. In 2008 1,076 barrels of biodiesel were produced and sold to the Region 1 Administration for power generation at Mabaruma. However by 2012 it was more profitable to transport the palm oil to Georgetown to be used as animal feed but the plant itself is powered by dried oil palm biomass.

2.13 Population

The 2002 census calculated Guyana's population at 751,223, as shown in Table 2-22. The regional distribution shows that 88% of the population is concentrated in the coastal regions 1-6 and, of that, 89% (78% of the country) is in Regions 3, 4, 5, and 6.

Table 2-22 Regional Population Data

Region	Area (km^2)	Population (2002)	%	Density/ km^2	% Change 1980-2002	Yearly change ('80-'02)
1	20,339	24,275	3.2	1.19	32.7	1.56
2	6,195	49,253	6.6	7.95	16.5	0.79
3	3,755	103,061	13.7	27.45	-1.4	-0.07
4	2,232	310,320	41.3	139.03	-2.1	-0.10
5	4,190	52,428	7.0	12.51	-2.6	-0.12
6	36,234	123,695	16.5	3.41	-18.7	-0.89
7	47,213	17,597	2.3	0.37	22.5	1.07
8	20,051	10,095	1.3	0.50	125.5	5.98

9	57,750	19,387	2.6	0.34	50.9	2.42
10	17,040	41,112	5.5	2.41	6.6	0.31
Guyana	**214,999**	**751,223**	**100.0**	**3.49**	**-0.9**	**-0.04**

Source: 2002 Census, Bureau of Statistics.

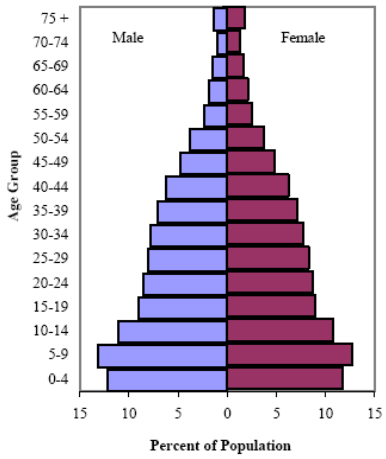
The overall population density is very low at 3.5 people per km^2 although this varies from a high of 139 in Region 4 to a low of 0.34 in Region 9, as shown in Figure 2-27, with all inland regions having extremely low densities at fewer than 2.5 people/km^2 and Regions 7, 8 and 9 having less than 1 person per km^2. 29% of the population is considered to be urban dwelling with 71% rural.

In terms of population change, between 1980 and 2002 Guyana overall saw a slight decrease in population largely due to out migration in the 1980s since when the population has shown a small natural increase of 0.33%. The regions with the greatest increases in population were Regions 8 and 9 inland, followed by Regions 1 and 2. The coastal regions of 3, 4, 5 and 6 showed a population decrease that is particularly marked in Region 6 with nearly a 19% reduction in population between 1980 and 2002.

The Bureau of Statistics has estimated the 2010 population of Guyana at between 777,873 and 787,517 depending on the population growth model used; the medium variant gives a 2010 population of 784,894.

Figure 2-26 shows the distribution of the population of Guyana by sex and age in the form of a population pyramid. Flat bottomed pyramids are indicative of an expanding population with the largest number of people in the youngest age groups. The fact that there are fewer people in the 0-4 age group than the 5-9 age group is possibly an indication of the improved economic outlook in the late 1990s.

Figure 2-26 Guyana Population Pyramid (2002)



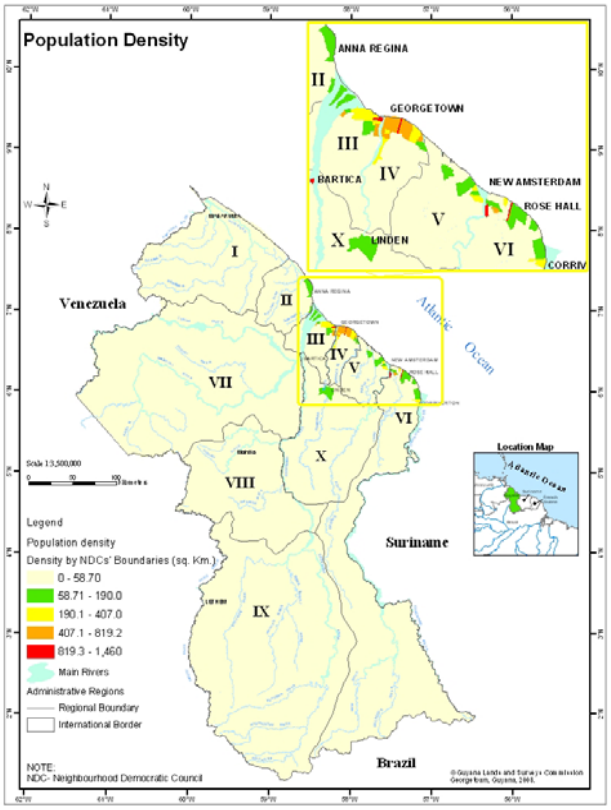
2.14 Economic Data

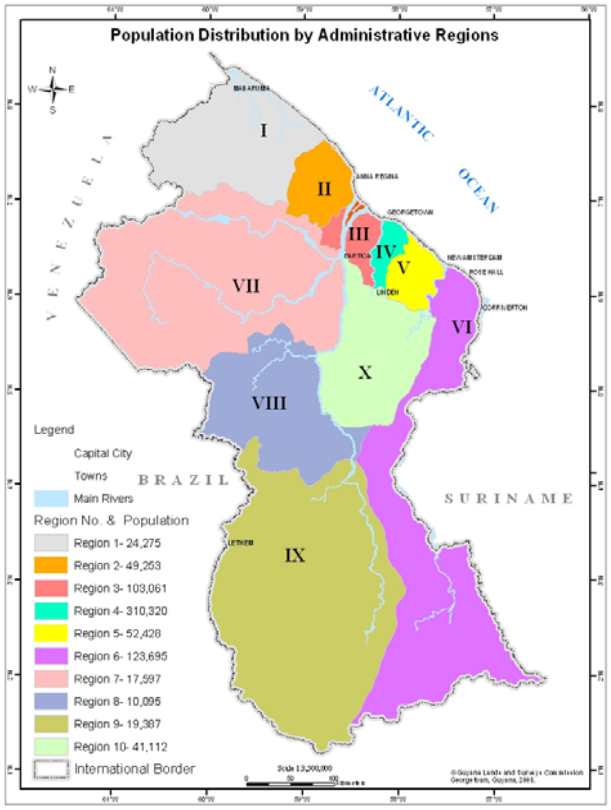
Economic data are only available at the national level. Table 2-23 shows key macro-economic indicators for Guyana. Agriculture and mining are Guyana's most important

economic activities accounting for 35% of GDP, with sugar, bauxite, rice, and gold accounting for 70-75% of export earnings.

2.14.1 Macro-economic data

The PRS (2011) notes that GDP growth averaged only 1.3% between 2001 and 2006 but recorded an average annual rate of 4.4% in the second half of the decade. Inflation was estimated to have risen to 4.4% in 2010, up from 3.7% in 2009, mostly due to rising food prices.





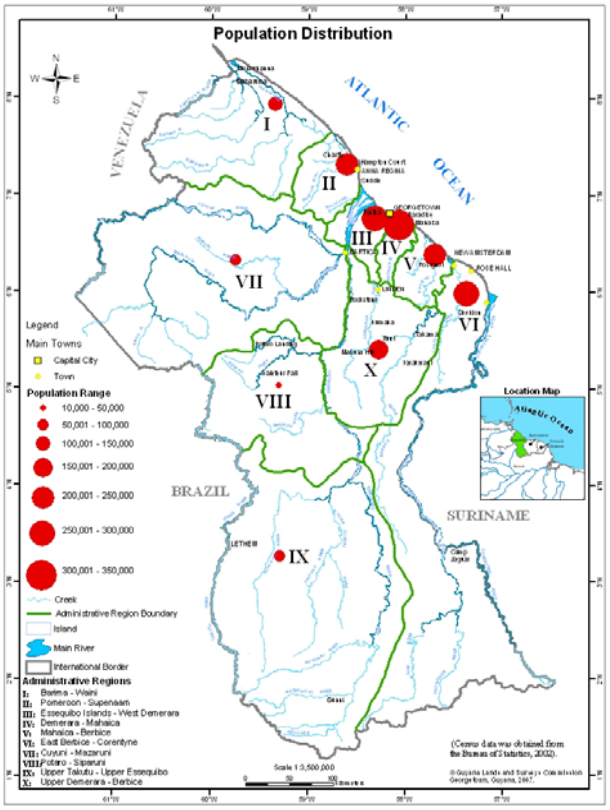


Figure 2-27 Population Distribution and Density

Source: GL&SC, BoS 2002 Census

Despite higher exports (bauxite, gold), the current account deficit is estimated to have widened to 11.4% of GDP in 2011, up from 8.8% in 2009. Since Guyana relies exclusively on imports for oil consumption, the country's fiscal accounts are highly exposed to oil price fluctuations.

Table 2-23 Key Macroeconomic Indicators, Guyana

	Indicator	Amount
1	Gross National Income (2009)	US$ 1.1 billion
2	GDP per capita (2006)	US$ 1,147 (2007 dollars)
3	GDP per capita (2010)*	US$ 2,502
4	Real GDP growth rate (2006-2009)	1% per annum (on average)
5	Real GDP growth rate (2009)	3.3%
6	Real GDP growth rate (2010)	3.4%
7	Real GDP growth rate (2011 proj.)	4.7%
8	Non-financial public sector deficit (2010)	4.3% of GDP
9	External current account balance (2011 proj.)	-8.8%
10	Inflation rate (2010)	4.4%

Sources: 1 World Bank (2011), 2, 4 USAID (2007), 3, BoS 2011, 5-10 IMF (2011), * Increase due mainly to rebasing of GDP.

2.14.2 Migration & Remittances

Guyana has a significant level of emigration and, as such, it is a recipient country for remittances. The stock of emigrants living outside Guyana is estimated to amount to more than half of the domestic population (see Table 2-24). Net emigration is estimated at 14.32/1,000 people (Index Mundi 2011) or -1.43%, the highest in the world outside of the Pacific Islands of Tonga, Micronesia and Nauru. The emigrants are almost wholly in the younger (0-45) age groups (BoS). For the tertiary-educated population the out-migration rate is much higher at 89%. The most popular destination countries for emigrants from Guyana are the United States, Canada, and the United Kingdom.

The World Bank has estimated that for 2010, inward remittance flows amounted to US$280 m. For comparison, net Official Development Assistance (ODA) to Guyana was estimated at US$200m for 2008. Foreign Direct Investment (FDI) inflow for 2008 was also estimated to be US$200m. Guyana's remittances as a percentage of GDP were the highest among the countries of the Latin America & Caribbean region (IADB 2007) but fell from 17.1% of GDP in 2008 to 14.2% in 2010.

Table 2-24 Key Migration and Remittance Indicators

	Indicator	Amount
1	Stock of emigrants (2010 est.)	432,900
2	Stock of emigrants as % of domestic population	56.8%
3	Emigration rate of tertiary-educated population (2000 est.)	89.0%

4	Inward remittance flows (2010)	US$ 280 million
5	Remittances as % of GDP (2010)	14.2%

Source: 1-4 World Bank (2011), 5 PRS (2011)

2.15 Settlements, Housing, Commerce and Industry

Guyana is divided into ten regions as shown in Figure 2-28. Local government comprises Regional Democratic Councils at the regional level and Neighbourhood Democratic Councils and Municipal or Town Councils at the local level. There are 10 RDCs, 65 NDCs (mainly on the coastal plain) and at least 95 Amerindian Village Councils. In areas with a scattered population there may be Community Development Councils; for instance in Region 10 there is only one NDC but many CDCs.

Settlements can be divided into towns and villages. The Bureau of Statistics recognises twelve towns in Guyana of which six have municipality status (four additional municipalities are proposed) as shown in Table 2-25. The pattern of settlements on the coastal plain is a linear one with housing concentrated along the main road.

Inland the settlement pattern is more nodal with scattered Amerindian villages.

Housing and commerce occurs in and around settlements but is heavily concentrated in the coastal plain and particularly within the sphere of influence of the city of Georgetown. New housing areas are delineated by CH&PA and are made available through a process of transfer and land use conversion, based upon decisions at Cabinet level. This is particularly applicable to the case of abandoned sugar estate lands formerly held by GuySuCo and parcels of State and Government Land.

CH&PA has the responsibility for the planning and implementation of Government of Guyana housing schemes as well as undertaking squatter regularisation. In this regard, a five year strategic plan housing is in place. It must be noted however that specific housing sector planning is based primarily on demand and is dependent on GoG making land available.

Housing demand is high on the coastal plain close to transport routes, and the desire to own rather than lease housing land is driven by the higher value of private housing land and the collateral that can then be obtained. There is not a strong demand for housing land inland due to the factor of remoteness. There is however growing interest in housing lands in selected areas along the Soesdyke-Linden highway.

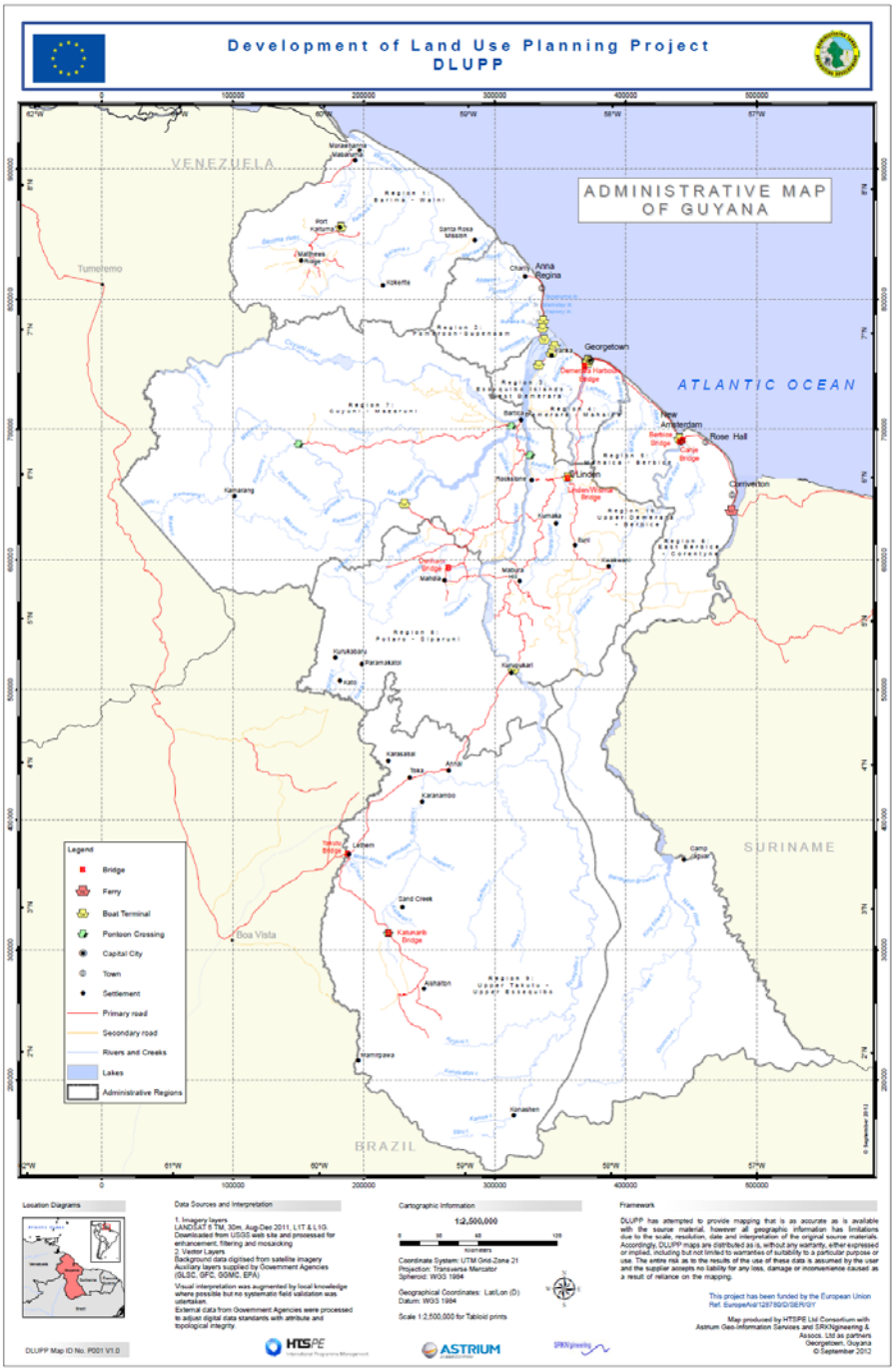
Table 2-25 Urban Areas

Name	Region	Status	Population (2002)
Anna Regina	2	Municipality	12,391
Charity	2	Town (Proposed Municipality)	1,295
Parika	3	Town (Proposed Municipality)	4,081
Georgetown	4	Municipality	134,497
Rosignol	5	Town	3,071
New Amsterdam	6	Municipality	17,033

Rose Hall	6	Municipality	3,583
Corriverton	6	Municipality	11,494
Bartica	7	Town (Proposed Municipality)	7,423
Mahdia	8	Town	1,617
Lethem	9	Town (Proposed Municipality)	1,158
Linden	10	Municipality	29,298

Source: Bureau of Statistics 2002 Census.

Figure 2-28 Administrative Regions and Settlements



The only commercial estate in Guyana is in Lethem driven by the completion of the Takutu Bridge in 2009. Since then a number of large commercial units have been erected and there are reportedly some 500-600 Brazilian cars a day crossing into Guyana for shopping every weekend. There is a perceived need for a similar area around Georgetown but as yet no land has been made available.

There are four industrial parks located at Eccles and Ruimveldt, (East Bank Demerara), south of Georgetown, Coldingen (East Coast Demerara), east of Georgetown, all in Region 4 and Belvidere between New Amsterdam and Rose Hall in Region 6. Another is planned for

Lethem in Region 9. The industrial estates are located away from population as far as possible and are planned to take air and noise pollution and waste into account.

2.16 Poverty

The household poverty status was determined by Thomas (2000) in 1999 according to the following definitions:

Absolute poverty was defined as "being unable to meet both essential food and non-food needs" In monetary terms the absolute poverty line was set at G$7,639 per month (US$1.40/day).

Critical poverty was defined as "unable to purchase/consume food essential for survival" and the critical poverty line was set at G$5,463 per month (US$1/day). The data showed that 27% of households in Guyana were in absolute poverty with 13% in critical poverty. For the rural coastal zone the figures were 31% and 12% while for the rural interior zone the figures were 68% and 56% respectively ranging from 100% in critical poverty in Region 8 and 82% in Region 9 with Regions 8, 1 and 9 also having a high incidence of absolute poverty.

Since that time the assessment of poverty in Guyana has been undertaken using two methodologies, the Consumption Approach, using the Household Income and Expenditure Survey (HIES), and the Basic Needs Approach (BNA). As the PRS (2011) noted though, a major shortcoming has been the inability to measure changes in absolute and critical poverty due to the different methodologies used.

Table 2-26 Poverty Indices by Region

Poverty Index LCI		Poverty Index EDMI		Poverty Rating
Region	Score	Score	Region	
8	162	2.125	1	Poorest
9	184	2.049	9	
1	207	1.982	8	
7	259	1.023	7	
2	278	0.583	2	
3	352	0.303	5	
5	355	0.234	3	
10	364	0.188	6	
6	373	-0.137	4	
4	375	-0.299	10	Least Poor

Source: Skoufias E 2005 at http://www.statisticsguyana.gov.gy/pubs/Marginality_Index_brief_notes(Region).pdf

Table 2-26 shows poverty indices calculated from 2002 census data. The LCI is the Living Conditions Index and is based on a number of criteria such as access to and quality of water, toilet facilities, lighting, garbage disposal and household crowding. The index was compiled

by a simple sum for the six variables for all 182,609 households in Guyana with low scores equating to poverty.

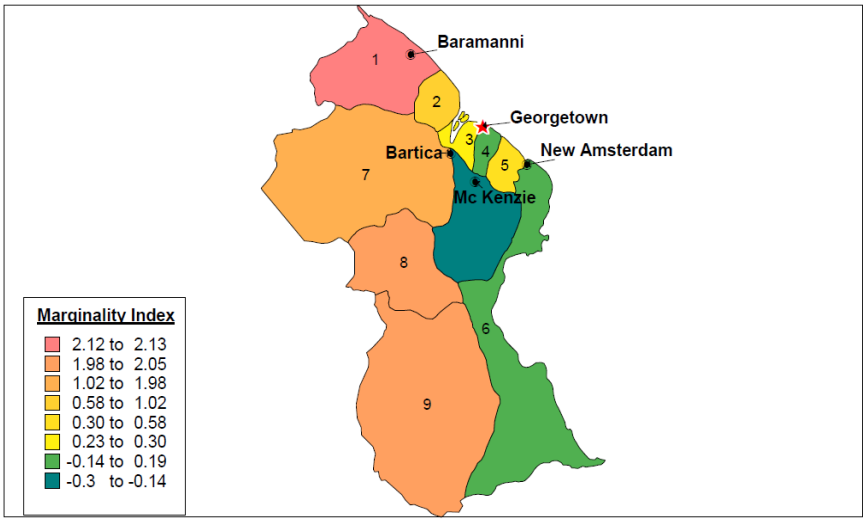
Data from the PRS 2011 show that 36 percent of the population lived in moderate poverty while 19 percent lived in extreme poverty in 2006. The 2006 survey also suggests that Guyana has made steady progress in reducing poverty since 1992. Specifically, moderate poverty fell from 43.2 percent in 1992 to 36.1 percent in 2006 while extreme poverty declined from 28.7 percent in 1992 to 18.6 percent in 2006

The Enumeration District Marginality Index (EDMI) is based on a set of eight variables including education attainment, employment, school attendance and other variables similar to those used in the LCI. These are then subjected to principal components analysis with weights attached to individual variables. The higher the score, the poorer the region.

Table 2-26 shows that Regions 1, 8 and 9 could be classed as Very Poor; Regions 2 and 7 as Poor; Regions 3 and 5 as Moderately Poor and Regions 4, 6 and 10 as Least Poor. This is also shown in Figure 2-29 below.

Figure 2-29 Marginality (Poverty Status) by Region

BUREAU OF STATISTICS
REPUBLIC OF GUYANA
POPULATION AND HOUSING CENSUS - 2002
MARGINALITY (POVERTY STATUS) BY REGION



Key:
1 - BARIMA/WAINI
2 - POMEROON/SUPERNAM
3 - ESSEQUIBO ISLANDS/WEST DEMERARA
4 - DEMERARA/MAHAICA
5 - MAHAICA/BERBICE
6 - EAST BERBICE/CORENTYNE
7 - CUYUNI/MAZARUNI
8 - POTARO/SIPARUNI
9 - UPPER TAKATU/UPPER ESSEQUIBO
10 - UPPER DEMERARA/BERBICE

Notes:
The index is weighted by the number of households in the enumeration area.
High marginality index value indicates high level of poverty.
The indices were computed using selected variables from the 2002 population census.

Variables used:
1. Proportion of adults - who are illiterate.
2. Proportion of adults - working in the primary sector.
3. Proportion of children not attending school full-time.
4. Proportion of dwellings not having piped water.
5. Proportion of dwellings that do not have a W.C. linked to sewer.
6. Proportion of dwellings that do not have electricity.
7. Proportion of dwellings that do not have garbage collection service, or do not use compost, or burying.
8. Overcrowding.

In terms of targeting the national land use plan towards the poorest areas, the PRS (2011) notes that the population living in urban areas (28%) has a poverty rate of 18.7% which is

about half the national average and significantly lower than the Millennium Development target of 21.6%.

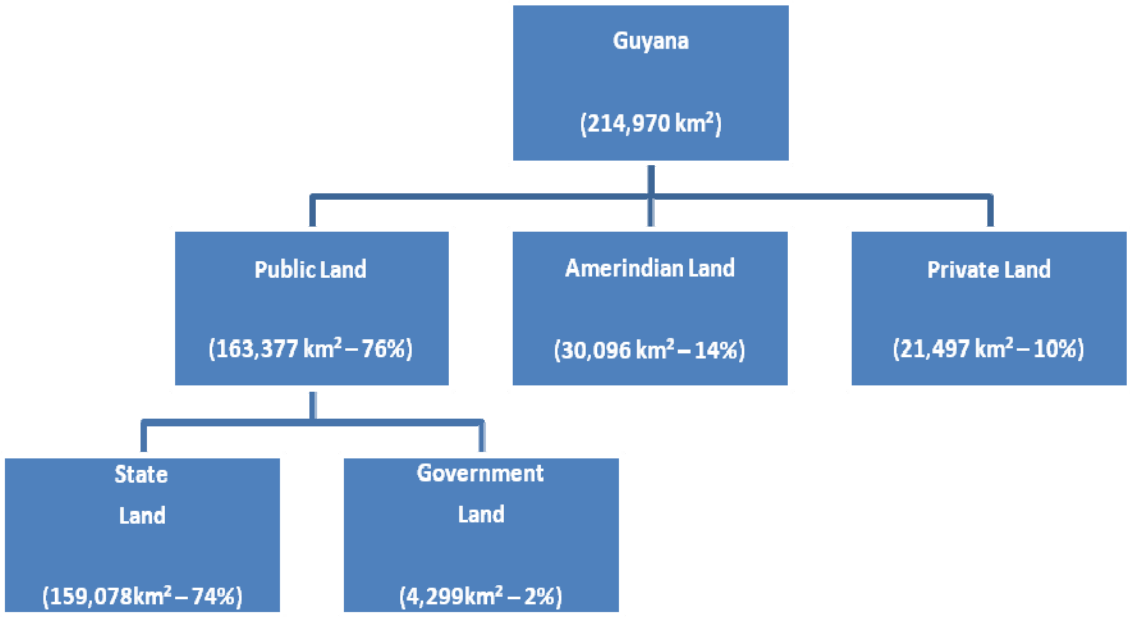
Rural coastal areas, which comprise 60% of the total population, register a poverty rate slightly above the national average, at 37% but the rate rises to 75% in the rural interior region where Amerindians are concentrated comprising about 12% of the population

As the PRS states, poverty severity is deepest in the rural interior regions and most shallow in the urban coastal regions of the country implying that targeted policies and possible economic opportunities in the agriculture sector may have contributed to reducing the depth of poverty for the very poor.

2.17 Land Tenure

According to GL&SC, land in Guyana can be divided into Public Land, Private Land and Amerindian Land as shown in Figure 2-30.

Figure 2-30 Land Tenure Diagram



Source: GL&SC

It should be noted that the information above is an indication only. The actual area of Private Land is not known although with only about 3,600km^2 of human influenced land use it would appear that 10% is an overestimate and that 1% or less may be nearer the mark. The current study indicates an area of 32,265km^2 or 15% for Amerindian Land with additional areas in dispute or awaiting demarcation.

Figure 2 31 shows the outline of land tenure of Guyana with Amerindian Lands, the State Forest Estate and Protected Areas. All land outside of this is State Land but there is no spatial information concerning Private Land.

Figure 2-31 Land Tenure Map

See associated Map Album

Public Land is all land that is not owned privately or by Amerindian communities. It can be sub-divided into State Land and Government Land. GL&SC has jurisdiction over State Lands with the exception of Municipalities, which are controlled by a Municipal Council, and Protected Areas which are mandated to the recently established Protected Areas Commission.

GL&SC administers state land that is used for agriculture. Data from January 2013 shows that there are 18,537 parcels with unexpired leases comprising 195,760ha (483,734acres) or 0.92% of the country in existence. GL&SC estimates that the total area of leased land, including expired leases, is 380,583ha (940,441acres) comprising 24,682 parcels or 1.8% of the country, and that the area of land including leases under consideration rises to 1,383,526ha (3,418,766acres) comprising 40,300 parcels and 6.5% of Guyana.

GGMC and GFC administer leases for resources on and under the land, for mining and forestry, respectively. Each of these agencies may issue titles for different purposes over the same land space as discussed above.

Government Lands are those purchased by, or granted to, the Government, to be developed for general revenues, such as hospitals, schools, government administrative buildings, and land development schemes. Municipalities can contain state, government and private land.

Private Land is land that has been alienated from the State and which is held by private or corporate interests. The administration of Private Land is carried out by the Land Registry under the Office of the Attorney General. There are two systems of land law and property recordings governing the private market, namely, the 'Transport Index' based on Roman Dutch Law and the "Index of land transfer of title," based on the Torrens System derived from English Law.

The main difference between the two systems is that a transport of land from one entity to another must pass through a court whereas a transfer of title does not. Much of the land in municipalities such as Georgetown and New Amsterdam are transport land as is some of the agricultural land in the 'frontlands'.

Amerindian Land is owned and administered by the community who also have all rights over that land with the exception of mineral rights. Communities have veto rights over medium and small-scale mining but not over large-scale mining. Communities have surface rights over their land, however, communities that wish to exploit their forest resources commercially could also apply for a SFP lease from GFC outside their Village. Communities could seek the assistance of GFC for preparation of a forest management plan for non-villagers. This stipulation is currently optional rather than mandatory but many communities choose to go down this route.

As of November 2012 there are 112 Amerindian Communities recognised by MoAA composed of 98 Amerindian Villages with Grant of Title of which 62 (63%) are titled villages all of which have been demarcated in the field. A further 25 villages are to obtain title from the State and a further 11 are in preparation, and all of these are to be demarcated.

Of these 98 villages with grant of title, 12 have applied for extensions to their community land. Three have been issued and demarcated, the rest are in progress. Figure 2-32 show the location of Amerindian Land in Guyana and highlight that they are concentrated in the west and south of the country. A further 14 Amerindian Communities (without a grant of title) are recognised of which 4 have titles in preparation and the status of 9 are to be confirmed by MOAA.

The status of some communities is in dispute, however, with 6 Villages in the Upper Mazaruni in Region 7 challenging their titled area in a court action that has been ongoing for 11 years.

As part of the REDD+ process it is proposed to address all Amerindian areas titling, demarcation and extension issues by 2015 although the process, particularly field demarcation, is very slow.

Figure 2-32 Amerindian Areas

See associated Map Album

2.18 Tourism

Tourism in Guyana is a small but growing industry based on eco-tourism.

The number of tourist arrivals is shown in Table 2- but there are obviously discrepancies between what the Guyana Ministry of Tourism Industry and Commerce (GMTIC) classes as a tourist and what the Caribbean Tourism Organisation (CTO) and Guyana Tourism Authority (GTA) calls a tourist. Data from Cheddi Jagan International Airport shows a rise in arrivals from 186,673 in 2003 to 236,344 in 2011, a rise of 27% or just under 3% a year.

Recent indicators in late 2012 show a near 20% rise in tourist entries over 2011 that can be attributed to the introduction (and subsequent demise) of low-cost airlines serving Guyana, as well as the success of the GTA's 'Rediscover Home' campaign aimed specifically at the Guyanese diaspora in North America.

Table 2-27 Tourist Arrivals 2007-10

Year	Tourist Arrivals		
	CTO	GMTIC	GTA
2007	134,057	186,800	
2008	129,595	223,050	
2009	141,281	224,200	
2010 (Jan-Sep)	113,538	283,500	
2010			152,000
2011 (Jan-Oct)			126,313
2012 (Jan-Oct)			148,628

Source: CTO website, Kaiteur News, GTA

The CTO data also offers a breakdown of travellers' reasons for travelling, their accommodation in Guyana and the amount of money spent. For 2009, of the 141,281 tourists to Guyana, 64% cited 'Holiday' as their reason for travelling, 11% as 'Business' and 25% as 'Other'. As for accommodation, 85% (120,088) of visitors stated that they were staying in a private house indicating that the vast majority of tourists are probably returning Guyanese visiting family. This leaves only 21,193 'tourists' of whom an appreciable number can be assumed to be short-stay business visitors, leaving only a few thousand (5,000 is an often quoted number although this cannot be verified) true tourists.

The average length of stay is 19 nights and the total tourism revenue is given at US$86.6m, an average spend of US$ 613 per person or US$32/day. Recent GTA data indicates that 57% of entrants are from USA, 21% Caribbean, 14% Canada, 5% Europe, 2% South and Central America and 1% from other parts of the world. This data does not include entries from Brazil to Lethem where a reported 500-600 cars a day at weekends are reported equating to some 100,000 to 180,000 people a year.

The tourist attractions of Guyana are its pristine rainforests with their huge biodiversity, rivers and waterfalls, Amerindian culture and heritage, Georgetown's colonial architecture and the southern savannas, and the difference between these and most other Caribbean nations. The tourist hotspots of Guyana can be grouped into a few different types offering different experiences to different target audiences.

Georgetown. This comprises wooden colonial buildings and architectural heritage and acts as the gateway to Guyana attracting tourists from overseas.

Resorts on the **Essequibo and Demerara** rivers and the Soesdyke-Linden highway. This group comprises largely weekend retreats for domestic tourism although some are also sold to short-to medium stay business visitors.

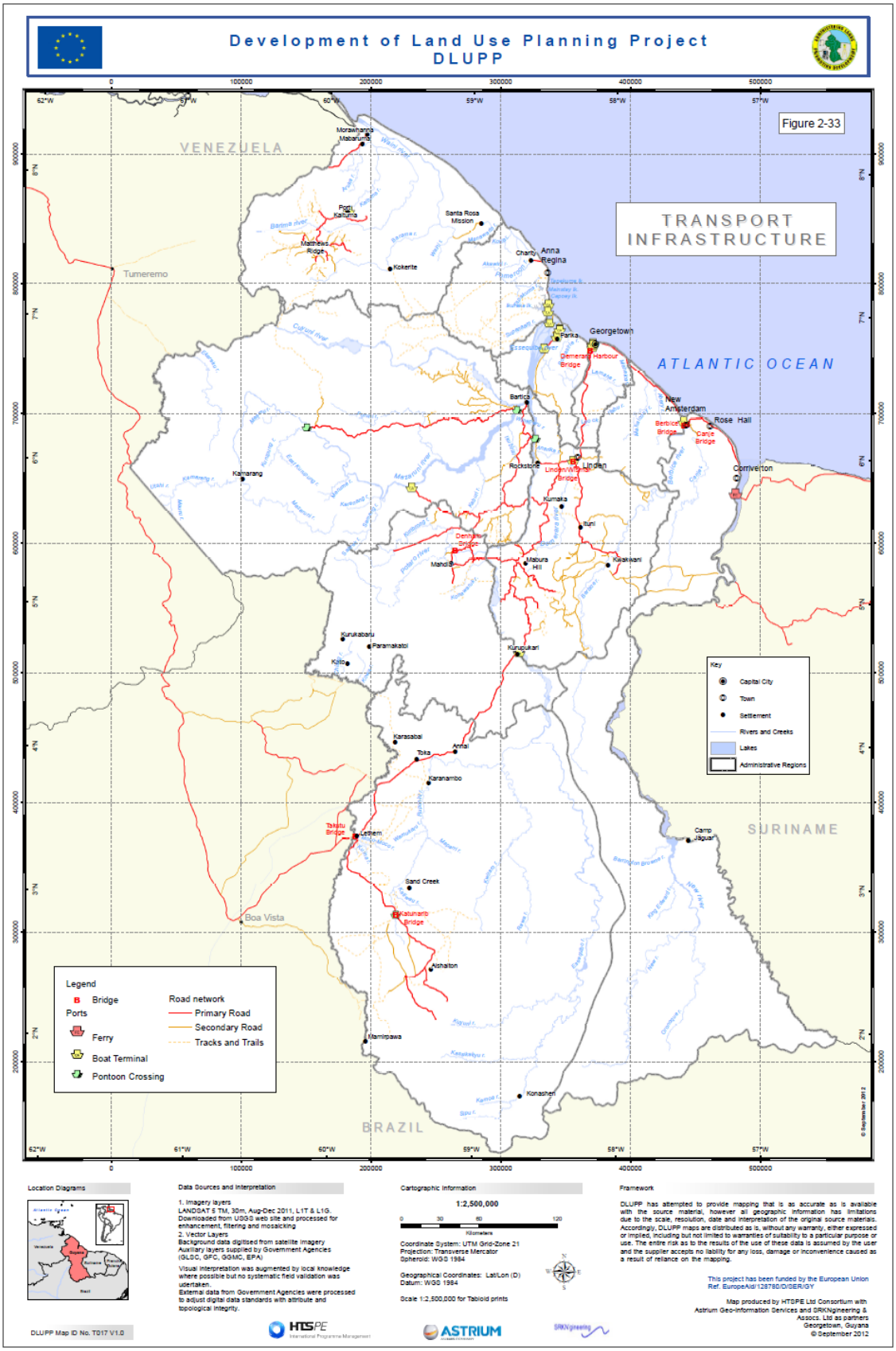
Inland eco-tourism. This comprises places such as Iwokrama, Kaieteur, Shell Beach and Orinduik falls, which are mainly only accessible by air (with the exception of Iwokrama) and mainly attract overseas visitors although there would be some domestic tourism.

Rupununi Savannas, Pakaraima Mountians and Amerindian heritage. This includes places such as Surama, Annai, Karanmbo and, to a lesser extent, the Kanuku Mountains, Southern Savannas and Konashen. These attractions are accessible by air and road and attract mainly overseas tourists and, following the opening of the Takutu bridge, Brazilian tourists from Boa Vista and Roraima province. At present the Pakaraima Mountains are largely inaccessible by land.

2.19 Infrastructure

The transport infrastructure comprises roads and tracks, navigable rivers, ports and airports and airstrips as shown in Figure 2-33.

Figure 2-33 Infrastructure



The **road infrastructure** comprises asphalt roads, maintained gravel roads and tracks. Asphalt roads occur only in the coastal plain in the north of the country, from Charity in Region 2 in the west to Moleson Creek in Region 6 in the east and extending south to Linden in Region 10.

The main maintained gravel roads include the main arterial road from Linden in the south to Lethem on the Brazilian border, a distance of 432km, passing through Mabura Hill, crossing the Essequibo River at Kurupukari close to Iwokrama and passing through Anai and the Rupununi savannas to Lethem. This road is maintained by two separate companies but has recently been in a poor state of repair with no maintenance having been undertaken for a year between 2010 and 2011.

Other roads include the Kwakwani road south of Linden in Region 10, through Ituni to Kwakwani on the Berbice river, the Bartica-Siparuni road extending west some 180km from Bartica into Region 7 through Peters Mine to Kurupung at the north bank of the Mazaruni river, the Bartica-Potaro road that links Bartica and Mahdia, the Issano road that branches off this terminating at Issano on the south bank of the Mazaruni river, the road from Mabura Hill to Mahdia in Region 8 and the Barama-Buckhall road that links Buckhall on the Essequibo river to Aurora on the Cuyuni and the Barama foresty concession. None of these roads are all-weather and can be impassable for appreciable amounts of time after heavy rain. An all-weather road is being constructed to Amaila Falls from the Linden-Mabura Hill road.

Radiating from these roads are a series of tracks created by mining and logging activities. Tracks also occur in Region 1 radiating from centres such as Matthews Ridge, Port Kaituma and Mabaruma and in Region 9 extending into the southern savannas.

Rivers provide an important means of transport in inland Guyana though not all are navigable by ocean going vessels. The Essequibo river is navigable to Bartica but rapids upstream on the Essequibo, Mazaruni and Cuyuni preclude transport further inland. The Demerara River is navigable to Linden for ocean-going vessels and both the Berbice and Corentyne Rivers are navigable for 100km upstream. The main ports are Morawhanna on the Baraima river in Region 1, Parika on the Essequibo river in Region 3, Georgetown and Linden on the Demerara River in Regions 4 and 10 and New Amsterdam on the Berbice river in Region 6.

There are two international **airports** in Guyana, at Timehri some 40km south of Georgetown and Ogle at the east of the city. With the exception of flights to Suriname, all international flights are through Timehri.

Ogle is due to complete a runway extension to 1,280m in November 2011 with the aim of attracting Caribbean traffic away from Timehri. Timehri has also recently (Nov 2011) signed a contract to increase it's runway by 1,066 meters to reach a total of 3,336 meters as well as build a new terminal.

Trans Guyana Airways, Roraima Airways and Air Services operate a mix of scheduled and charter flights to a number of airports and airstrips in Regions 1, 7, 8 and 9 including Mabarruma, Lethem, Imbaimaidai, Mahdia and Bartica.

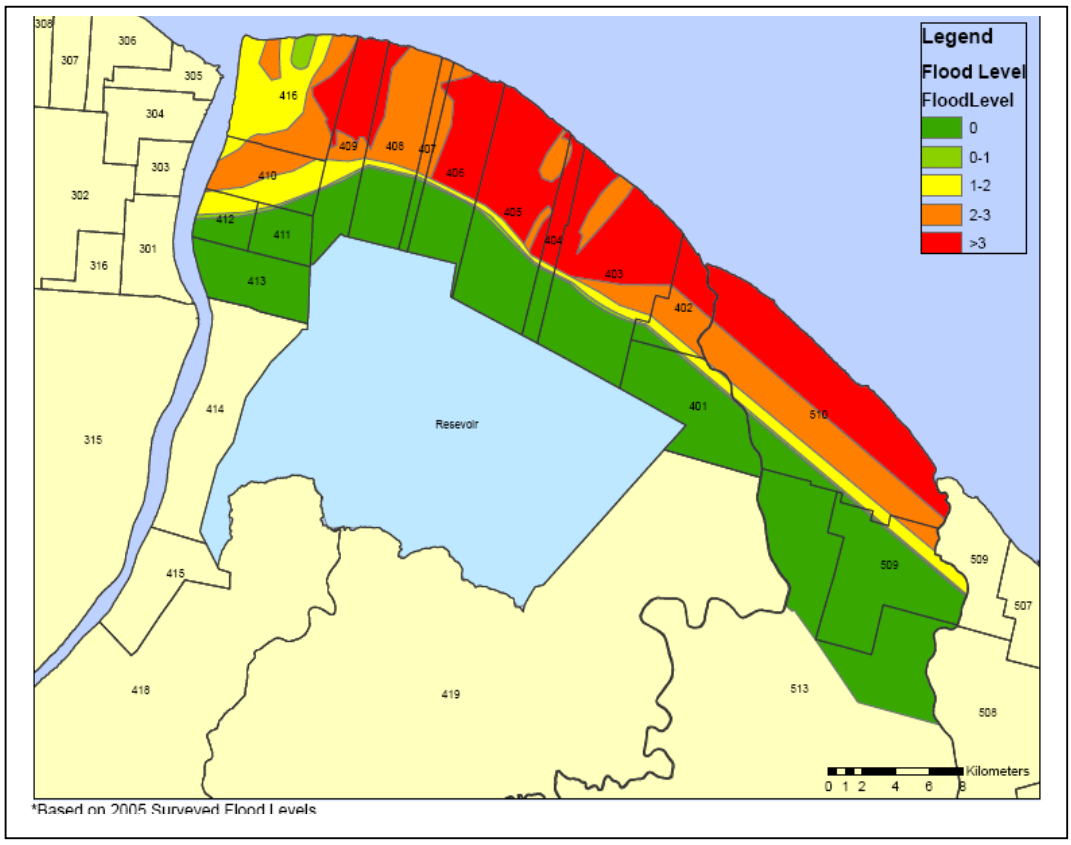
The **water infrastructure** relates to conservancies and areas where drainage and irrigation has been provided through engineering works (D&I Areas). These areas are located along the coastal plain and are a development of the original Dutch works from the 1700s. Figure 2-35 shows the location of the inland water conservancies and the D&I infrastructure.

New land areas, called landdevelopment schemes, were empoldered in the 1980s at Black Bush Polder in Region 6, MMA in Region 5, Boerasirie in Region 3 and Tapakuma in Region 2.

The LCDS estimates that 39% of the population producing 43% of GDP live in regions exposed to significant flooding risk and estimates that, by 2030, flooding will cost US$150m annually and extreme events such as the flooding of 2005 (that resulted in losses equivalent to 60% of GDP) could result in US$0.8bn in losses and affect 320,000 people.

The poor maintenance of the D&I infrastructure from the 1970s to the present day has been a major constraint to the development of agriculture in some parts of the coastal plain and there are indications that flooding could become more prevalent due to climate change, poor D&I maintenance and increased runoff from housing. The National Drainage and Irrigation Authority (NDIA) point out that runoff from agricultural land is 38mm in 24 hours rising to 127mm/24h from housing land. The extent and depth (in metres) of flooding around Georgetown in 2005 is shown in Figure 2-34.

Figure 2-34 Flood Levels in Coastal Region 4



The creation of a National Drainage and Irrigation Authority in 2006 has meant that D&I rehabilitation work has increased (e.g. at Crabwood Creek in Region 6 in association with the Skeldon sugar estate expansion) and that some new areas such as Aurora in Region 2 have been created. There are plans to rehabilitate the D&I in Canals Polder in Region 3 and Black Bush Polder and Yakusari in Region 6.

The PRS (2011) notes that about 1,500 miles of canals/drains, 300 structures and 120 miles of earthen embankment have been rehabilitated between 2006 and 2010 and that dredges,

mobile drainage pumps and excavators have been procured. Further, the social and institutional organisation of the D&I system has been reformed through the creation of the National Drainage and Irrigation Authority and the establishment of Water Users Associations

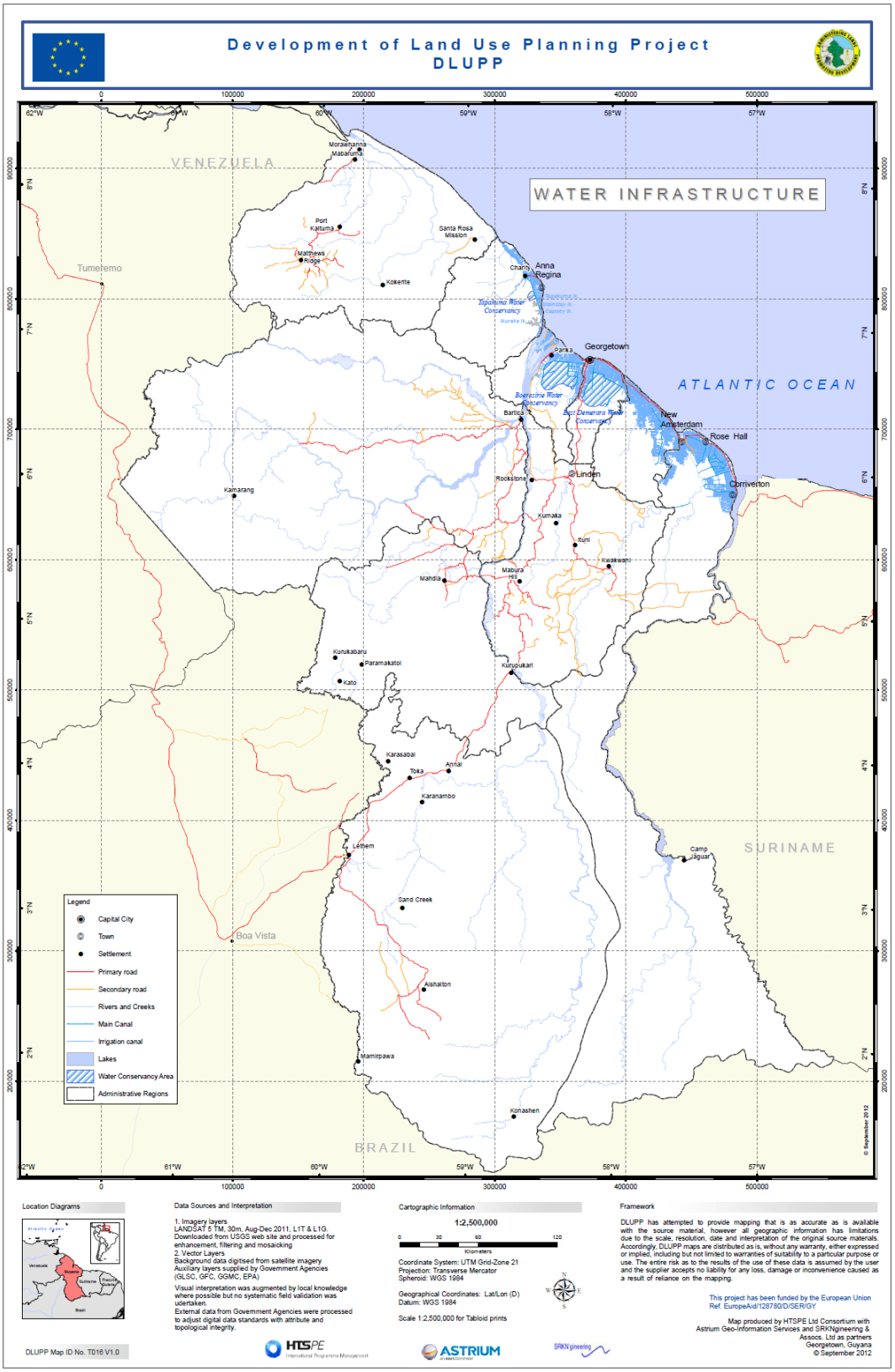
In terms of drinking water provision, the PRS notes that about 89% of the non-poor population has access to safe water with significant progress made (especially in hinterland and rural coastal communities) resulting in about 63% of the poor having access to potable water. The distribution of access is also found to be equitable. According to the 2002 census report, with the exception of Regions 1, 8 and 9, about 88% of the population in the seven remaining regions had access to safe water.

2.20 Waste

The only official landfill site for solid waste is the Haags Bosch site at Eccles, EBD, south of Georgetown. There are also two temporary dump areas at Lusignan and Grove in Region 4. The Haags Bosch site was opened in February 2011 and is an international standard sanitary landfill covering 40ha with a design life of around 20 years. It receives between 250-400t of waste a day. Georgetown has a solid waste collection system serving approximately 92% of the city's population.

The now decommissioned Le Repentir landfill site covered about 8ha and operated from 1993 to 2011. It has been capped and gas vents installed. The Ministry of Local Government has indicated that the aim is to establish a landfill site in each region.

Figure 2-35 Conservancies and D&I Infrastructure



3 ANALYSIS OF OPPORTUNITIES AND CONSTRAINTS

3.1 Introduction

The analysis of opportunities and constraints has come from two main sources. Firstly, from stakeholder consultations, both at the national institutional level in Georgetown and the public meetings at regional level, where participants were asked to identify land use issues, opportunities and constraints. Secondly, opportunities and constraints were obtained from an assessment of alternative land uses for a particular area. This was undertaken both as an objective exercise, particularly in an assessment of potential, and also on a subjective basis where data were not available.

3.2 Regional Consultation Outcomes

The outcomes of the regional consultations are also from two main sources; answers given to a questionnaire handed out during each meeting and issues raised during the discussions.

3.2.1 Questionnaire Answers

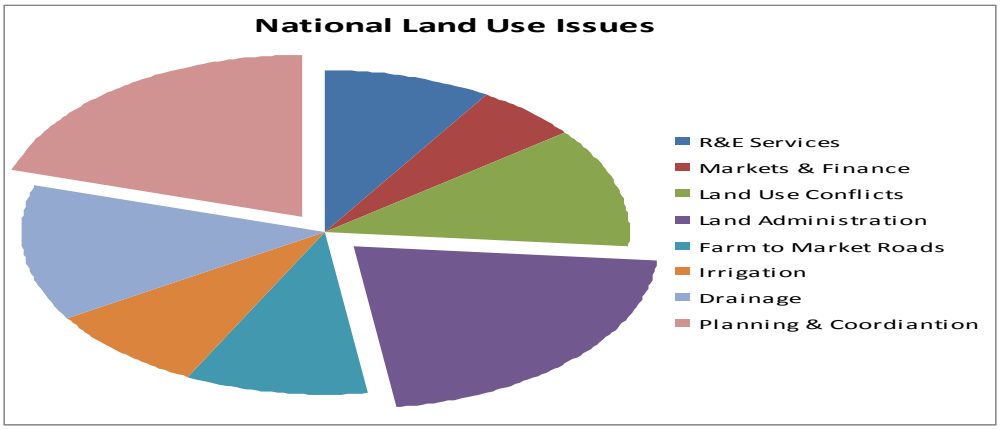
Answers to Question 1 concerning the main land use issues in the region are shown in Table 3-1 and aggregated in Figure 3-1

Table 3-1 Main Land Issues by Region

	Region										
Stakeholder Issues	**1**	**2**	**3**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**	**%**
Research & Extension Services	9	6	5	5	2	0	4	2	11	44	8.9
Markets & Finance	4	5	3	3	2	1	4	1	5	28	5.6
Land Use Conflicts	5	6	3	7	11	13	4	2	8	59	11.9
Land Administration	17	14	13	7	13	9	10	7	17	107	21.5
Farm to Market Roads	1	10	10	3	10	6	8	0	0	48	9.7
Irrigation	0	9	8	4	15	0	1	1	4	42	8.5
Drainage	2	10	14	11	19	3	2	1	6	68	13.7
Planning & Co-ordination	8	7	6	10	11	17	12	10	20	101	20.3
Total	46	67	62	50	83	49	45	24	71	497	

Source: Responses to Regional Consultation Questionnaire (NB the question was only included after the Region 4 meeting)

Figure 3-1 National Land Issues



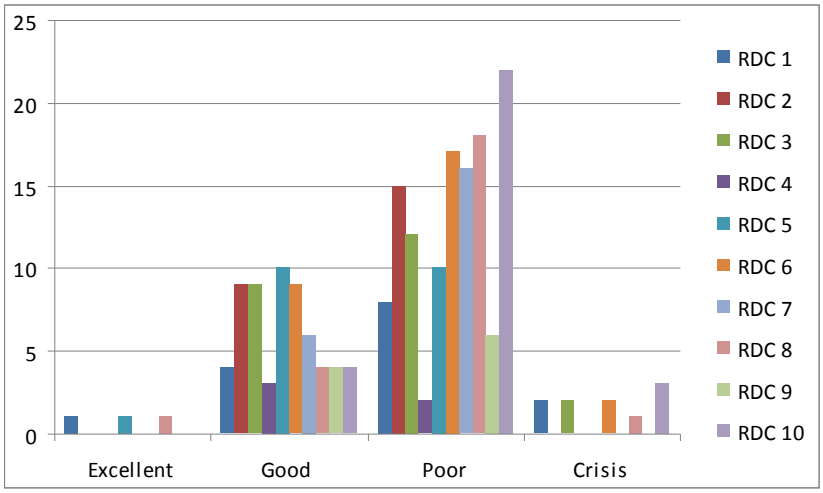
This shows that the main land issues noted on the questionnaire were Land Administration closely followed by Planning and Co-ordination. Poor Land Administration was cited as a constraint across the country whereas poor planning and co-ordination was more prevalent in inland areas than on the coast. Land Use Conflicts (a result of the lack of planning and/or poor co-ordination) are also a constraint throughout the country and access in terms of farm to market roads were also an issue in most regions.

Issues of drainage and irrigation were much more prevalent in coastal regions than inland but access to markets and finance and issues of research and extension were ranked relatively low but were prevalent nationwide. Other issues raised during the discussion sessions will be commented on at a later date.

Other responses to the questionnaire included an assessment of the performance of land management, what the main land administration problems were and whether this was a national problem, what a reasonable land rental rate should be and who should have priority in access to lands for investment.

The response to a question concerning the performance of land management by region is shown in Figure 3-2 with the majority of respondents in all regions except Regions 4 and 5 indicating 'Poor' over 'Good' (63% v 31%) and 'In Crisis' over 'Excellent' (5% v 1%). Coupled with the results from the land issues survey it is apparent that land management in Guyana needs to be improved.

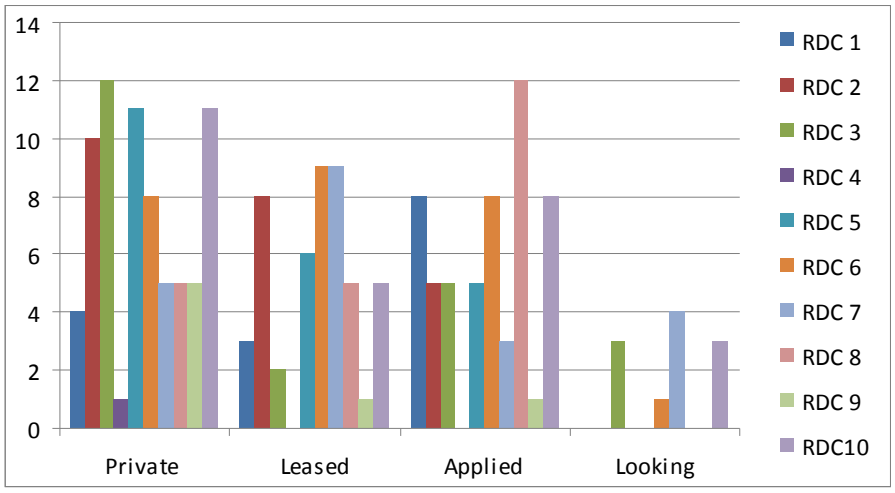
Figure 3-2 Land Management Performance



Source: Responses to Regional Consultation Questionnaire

In order to gain an appreciation of who was attending the stakeholder consultations a question was asked concerning their land tenure status. The results are shown in Figure 3-3 and show that most (39%) were private owners, followed by those applying for land (30%), those leasing land (26%), with only 6% in the process of looking for land to buy.

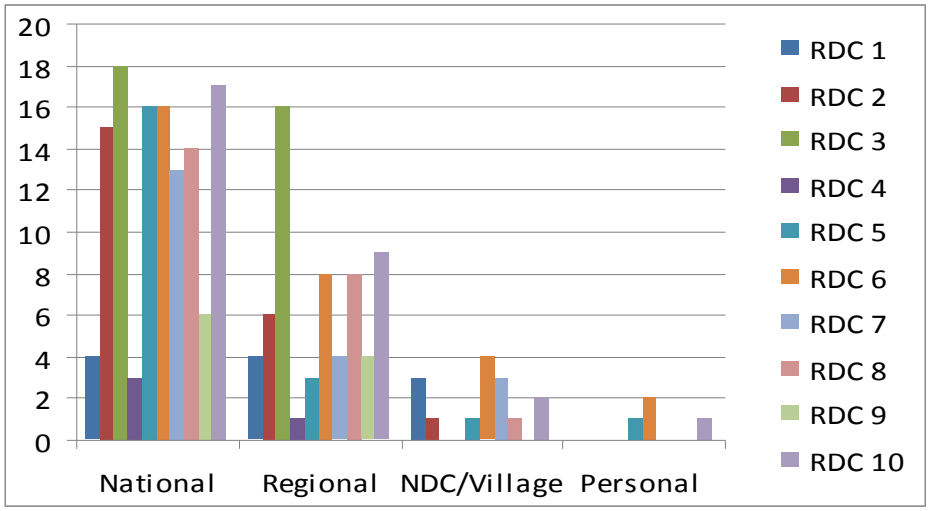
Figure 3-3 Land Tenure Status of Attendees



Source: Responses to Regional Consultation Questionnaire

Question 5 asked that, if a respondent had a problem with the land administration system, whether they thought that problem was a national, regional, local or personal issue. The results are shown in Figure 3-4 and indicate that the majority of people (60%) that have a land administration problem believe it is a national issue, followed by regional (31%), local (7%) and personal (2%).

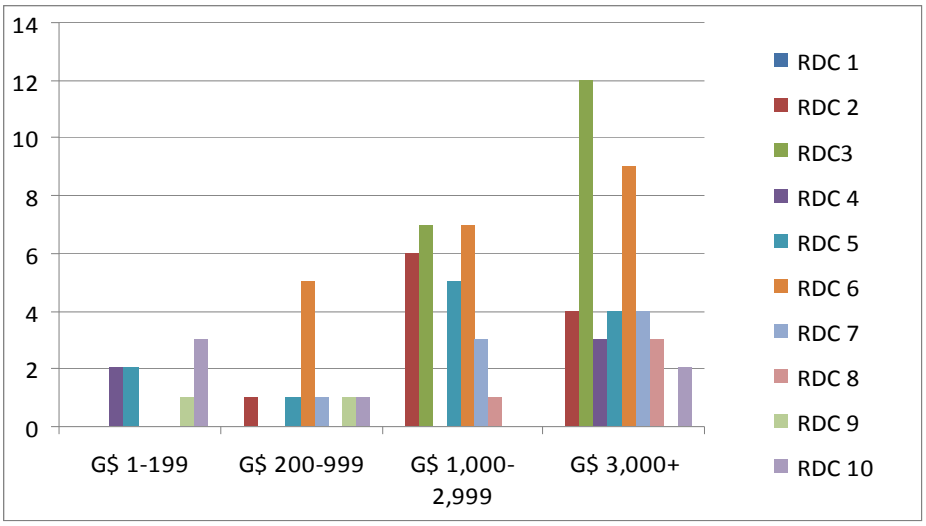
Figure 3-4 Perceived Extent of Land Administration Issues



Source: Responses to Regional Consultation Questionnaire

Question 7 asked what people would be willing to pay for renting state land including the provision of drainage and irrigation, road access and support services. The current rate for land rental alone is G$1,000/acre/year although in Region 4 it is much lower at G$100. The results are shown in Figure 3-5 below.

Figure 3-5 Acceptable Land Rental Rates



Source: Responses to Regional Consultation Questionnaire

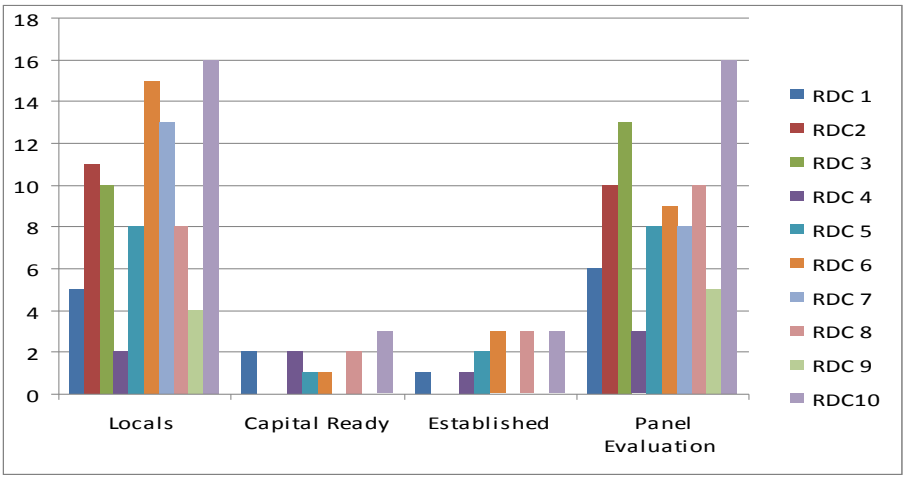
The results show that just under half of all respondents (47%) consider a rate of G$3,000/ac/y and above as reasonable with 33% favouring a rate between G$1,000 to 2,000, 11% G$200-999 and 9% less than G$200. The rate of G$3,000/ac/y is higher than the current agricultural land rental rate of G$1,000/ac/y but lower than the commercial rates paid for rice land which is known to be about G$8,000/ac/y in Region 3 and G$15,000/ac/y in Region 6.

The fact that 80% of respondents felt that a rate greater than that currently being charged is reasonable indicates that GL&SC could increase rates to increase its revenue with little opposition, although it should be noted that the sample may not be representative of the wider population. It is also noticeable that, in general, coastal regions favoured higher rates more than inland regions.

Question 11 asked attendees to indicate who should have priority in access to land for investment; local people, investors with finance in place, people already in business or open to all applicants with evaluation by a panel. The results are shown in Figure 3-6.

The results indicate that respondents overwhelmingly favoured either locals (45%) or any investor but, with a panel evaluation (43%) over established businessmen and capital ready investors at 6% and 5% respectively with results similar throughout the country. This indicates a preference for a more open and transparent system than currently operates.

Figure 3-6 Priority for Land Access



Source: Responses to Regional Consultation Questionnaire

3.2.2 Issues Raised during Discussion

The following are the main issues raised in the course of discussion during the regional stakeholder meetings.

Poor Planning and co-ordination

The essential lack of a planning system has led to poor planning decisions being taken leading to conflicting land uses. Examples include housing on good agricultural land and drainage reserves in the coastal plain, housing on sand resources in Region 2 and competing mining and forestry land use inland. Stakeholders would like to see a better planning system, optimal land use and enforcement of planning regulations.

Use of Reserved Land

The lack of a planning system and poor enforcement of regulations has meant that many reserves have land uses of housing (squatting), agriculture, grazing and the removal of soil from reserves to farmland. Stakeholders would like to see enforcement of regulations precluding use of reserved land.

Beneficial Occupation and unused land

This refers to the fact that there are appreciable areas of both private and state land that are unused. Some land has been abandoned due to natural conditions such as salinity but other areas are unused due to the deterioration of the D&I system and access roads (dams) and absentee owners or lessees. Stakeholders have indicated that land pressure is increasing, particularly on the coastal plain and would like to see a means whereby those who wish to use this land can do so.

Extension

The need for improved extension services to drive agricultural development was a feature of the stakeholder discussions. Soils are poor in much of Guyana and stakeholders feel that they

need help from NAREI to increase agricultural production, both on the coastal plain and in the interior.

Improvement of land administration

The improvement of land administration services provided by GL&SC was cited in discussions as well as in the questionnaires. The main complaints centred around the length of time for leases to be granted, the difficulty in changing leases and the cost of surveys. The fact that most respondents to the questionnaire indicated that they would be willing to pay appreciably more than the current land rent indicates that costs incurred in improving the system should be able to be recouped.

Rehabilitation of drainage and irrigation (D&I)

The rehabilitation of D&I and access dams was cited in all stakeholder consultations on the coastal plain as an issue holding back agricultural development. Stakeholders felt that if government could rehabilitate the D&I system and access dams then they would be in a position to take advantage of this and increase production. In some inland areas such as Region 10 and Region 1 the provision of D&I was discussed. It would appear that NAREI needs to initiate a training programme promoting rainfed farming in inland areas since the provision of D&I is not a prerequisite for agricultural development on the well drained soils of inland Guyana.

Amerindian land

The demarcation of Amerindian land and the extension of current Amerindian land titles was an issue mainly in inland areas where there are appreciable Amerindian communities. Amerindians would like to proceed as quickly as possible on these issues.

Need for zoning

The need for zoning of land for land use planning and land management was an issue, particularly in the coastal plain in relation to the point concerning poor planning and co-ordination. In many NDCs land is zoned for a purpose (rice, cash-crops, housing, reserve) but decisions have often been taken above the NDC or RDC level with a resultant sub-optimal land use. Stakeholders felt that zoning should be reintroduced and adhered to. The point made in Region 8 concerning zoning related to a question of which land use out of mining, forestry and agriculture has priority at the policy level.

Other issues

Other issues tended to relate to the local area and included the land tenure status of former freed slave villages in Regions 2 and 4, cattle rustling in Region 6 and 9, the use of mined out land in Regions 8 and 10, the need for identification of potential agricultural land in Region 1, the need for town planning in Regions 1 and 9, access roads in Region 7 and 8, illegal logging on unused logging concessions in Region 2, legal issues in Regions 3 and 4, the control of sand mining in Region 10, the mining lottery in Region 7 and fact that lease conditions make it impossible to raise capital in Region 5.

3.3 Assessment of Problems

As may be expected, many of the problems are interrelated and deal with issues of institutional co-ordination, overlapping mandates and policy as much as physical issues of actual land use. They are summarised below:

3.3.1 Institutional Problems

- **Poor planning and co-ordination**. Development planning is sectoral, piecemeal and ad hoc. Examples include D&I and MoPW not being informed of housing developments and conflict between GFC, GGMC and GL&SC over land leases
- **Centralised decision-making.** Planned developments have to be passed at Cabinet level in many cases. GL&SC leases have to be approved at OP level. CH&PA are allocated land by Cabinet. NDCs and RDCs feel they have little role in planning and decision-making.
- **Institutions are reactive rather than proactive**. CH&PA react to housing applications, the MoTCI react to tourism, commerce and industrial applications, GL&SC react to applications for land as opposed to planning and guiding development

3.3.2 Policy and Legal Problems

- **Overlapping mandates**. Both CH&PA and GL&SC have mandates to undertake regional planning. GFC, GGMC and GL&SC can issue leases on same land overseen by EPA.
- **Obsolete law governing planning.** The Town & Country Planning Act dates from 1946 but is based on 1932 UK law (repealed in 1947 in UK). The law is 65 years old and has hardly ever been used.
- **No Land Use Policy**. There is no comprehensive land use policy approved by the Government. There is a Forests policy, Mining policy, and guidance emanating from the Select Land Use Committee. However, an approved national policy is needed to answer key questions such as: What land use(s) have primacy? Should forestry be cleared on good agricultural land? Should housing be developed on good agricultural land? What are the preferred options for abandoned coastal land and underdeveloped savannas? Can areas with low forestry potential be converted to plantations?
- **Policy and Strategy Conflict**. In formulating and approving policies and strategies, care must be taken to ensure that there is no conflict between the two, particularly the already approved LCDS.

3.3.3 Land Tenure Problems

- **Unclear Tenure Arrangements**. Historically low land pressure, high emigration and traditional land tenure arrangements have led to an unclear pattern of land tenure. This was substantially addressed by the GLSC land tenure regularization programme in major land development schemes across the coast., where clearer land tenure arrangements were established. However much still remains to be done, including the high proportion of abandoned (some due to salinity) and underused land and squatting on reserves. Improved land administration required.
- **Beneficial Occupation**. Lack of effective monitoring and enforcement has led to a high degree of abandoned land and land not beneficially occupied.

- **Coastal Land Pressure.** Increasing population and economic opportunities is leading to land pressure on coastal plain. Abandoned and underused land is a hindrance to development. Zoning called for by stakeholders.
- **Demarcation of Amerindian Land.** The resolution and demarcation of Amerindian Lands is a pre-requisite for the REDD+ process. Some overlap between Ameridian Land and leased land, need to identify actual and proposed Amerindian Areas.

3.3.4 Physical Problems

- **Soils**. Most soils are poor. Coastal soils require drainage to become productive. Almost all soils require lime and fertiliser to attain high yields. Soils under forest cover are quickly depleted if cover is removed. Soils in hilly areas have high erosion potential if forest cover removed. Improved extension services required.
- **Access**. Much of Guyana is inaccessible. Need to improve access to export goods. Monitoring of land use is hampered by poor access. High number of cloud cover days and cost reduces ability of satellite monitoring.
- **Climate Change and Sea Level Rise**. Estimates show that up to 140,000ha of coastal plain could be flooded by worst scenario storm surge by 2090. There is a need to develop lands, infrastructure and urban areas in the interior, and to engage in adaptation actions on the vulnerable coast.
- **Historically poor D&I maintenance.** Land in coastal plain needs functioning D&I or may become saline and be abandoned. Historically, poor D&I maintenance has led to abandonment in some places but recently investments have improved the situation, though much still remains to be done.

3.3.5 Socio-Economic Problems

- **Small Market**, Need to Export. Low population means small internal market and therefore agricultural and other investments are export driven. Poor access hampers investment.
- **Poverty, Low Skills Base and Emigration.** High poverty incidence, particularly inland. Reduces peoples' ability to cope with shocks and make optimal land use decisions. Increases non sustainable land use practices. High degree of emigration by educated Guyanese lowers skill base.

Many of the problems above are the root cause of unsustainable land use but it is not the objective of the NLUP to change them. Therefore the strategic aim of the NLUP is to be mindful of the need to develop land away from the coast and to suggest a range of land use options that could be developed in different areas.

3.4 Opportunities and Potential by Sector

3.4.1 Agriculture

The potential for agriculture has been identified using the following criteria:

- Land Capability (a function of land and soil parameters such as topography, drainage, texture, salinity, toxicity, fertility and erosion hazard)
- Land Cover and Land Use
- Land Tenure

- Government Policy

The opportunities for the development of agriculture are largely determined by soil and land capability and government policy although other factors such as access to an area and to markets and water availability will also be important. Government policy indicates that agricultural development is to be focused on non-forested land in the short term but opportunities for development of agriculture on currently forested land also exist in the long term.

At the reconnaissance level the Land Capability Classification is split into four classes as set out below and shown in Table 3-2 and Table 2-8 and Figure 2-15. These show the extent of the different land capability classes in Guyana. Their characteristics, location and limitations are discussed in the assessment of opportunities and constraints concerning the assessment of potential for agriculture.

Land Capability Classification

Land Capability Classification (LCC) is a method of grouping soils together to show their relative agricultural suitability and is based on each soil unit's limitations for crop production.

Table 3-2 Areas of Land Capability Classes

LCC	Description	Ha	%
I-II	Good to Moderate Agricultural Land	3,327,395	15.8
III	Poor Agricultural Land	8,227,247	39.0
IIIf	Poor Agricultural Land with fertilization potential	2,980,836	14.1
IV	Non-Agricultural Land	6,566,984	31.1
	Total	**21,102,462**	**100.0**

Source: FAO 1966, DLUPP

Class I-II Good to Moderate Agricultural Land.

Coastal

These soils are poorly drained and therefore require drainage prior to agricultural development. They are clays and silts on a flat plain but with relatively high fertility. Patches of saline soils occur and toxic acid sulphate soils occur close to swamps. Drainage, lime and fertiliser will be needed for sustainable agricultural production.

Inland

These are soils with only slight to moderate limitations for general agricultural use. These soils are deep well drained, loams to clays, occasionally gravelly, generally of low fertility but easily cultivable on gently sloping land. With the addition of lime and fertiliser and good husbandry, the soils could be cultivated intensively to give moderate to high yields for suitable crops.

Class III Poor Agricultural Land

These are marginal soils for agriculture with severe limitations of fertility, toxicity, water holding capacity, flooding and topography. They can be cultivated with difficulty but generally should be left in their natural condition.

Coastal

These are soils that are very poorly drained and are either organic peats and mucks of swampy areas or are mineral soils with low to extremely low fertility. These include potential acid sulphate soils which can release sulphuric acid if drained. Even if developed, the range of crops that may be grown will be small and will require a high level of management to be sustainable.

Inland

These soils are generally deep, well drained sandy loams to clays (often very gravelly) that have low fertility that occur in hilly areas with steep slopes. Some soils occur on flatter terrain but here a fluctuating water table is the main constraint.

In the hilly areas, a high degree of land management and inputs including soil conservation measures, will be required following the removal of the forest cover for development. Only the development of suitable tree crops would be recommended. On flatter land the poorly drained soils should be left as natural vegetation with the development of improved pasture the only suitable option.

Class IIIf Poor Agricultural Land with fertilization potential

Inland

This class describes soils which are presently rarely cultivated, due primarily to severe fertility constraints, but which have the potential for agricultural development with improved access and inputs. These soils are largely deep, poor to well drained, sands, loams and clays that, in places (particularly in the Rupununi savannas), have additional limitations of flooding. With improved management, soil amelioration and, in some places minor drainage and irrigation works, these areas could become productive either for arable crops or as improved pasture lands.

The development of these areas as agricultural land or improved pasture land however, will be dependent on competing land uses of biodiversity reserves particularly in the savanna wetlands as well as in forested areas. Policy decisions will need to be made whether these areas should be developed for agriculture (including livestock) or retained as natural vegetation performing an ecological function.

Class IV Non-Agricultural Land.

Inland

These are soils that cannot be cultivated due to their very severe limitations which include shallow depth, steep slopes or deep sterile sands. Lands in this class are unsuitable for agriculture and should remain under their natural vegetation.

Location of Land Classes

Class I&II land is largely confined to the north of Guyana with only very few small patches flanking the Kanuku Mountains in Region 9 in the south of the country.

The main areas of Class I-II land occur along the coastal plain (assuming that drainage has been developed) from Region 2 in the west to Region 6 in the east. Much of Region 6 inland has Class I&II land and it is also extensive in Region 10, particularly in the east and south.

Other areas include alluvial soils along the Essequibo and Berbice rivers and relatively large areas between the Demerara, Berbice and Corentyne rivers. Other large areas occur in Regions 1 and 2 in north-western Guyana and there are many scattered areas in Region 7 particularly along the Cuyuni and middle Mazaruni rivers.

The main areas of IIIf land occurs in the northern Rupununi savannas and extends eastwards to the Corentyne river. Another large area occurs in the southern savannas and also extends east towards the Essequibo river, with smaller areas in the south-east of the country in the upper Essequibo, New and Corentyne rivers.

Class III land occurs throughout the country but is concentrated in the coastal backlands, associated with the inland soils of the White Sand plateau, in much of the Cuyuni, Mazaruni and Potaro basins in Regions 7 and 8 and most of the south-east of Guyana.

Class IV land is associated with the Pakaraima and Kanuku Mountains and their flanks and the white sands of the White Sand plateau.

Limitations

The reconnaissance soil survey of Guyana used only one level of land capability classification as shown above; Classes I to IV where Class I land has the least limitations and the widest range of agricultural use whilst Class IV land is not fit for agricultural use. However the semi-detailed mapping that was undertaken took this one step further and introduced a second level, the sub-class to denote the type of limitation.

As part of the National Land Use Plan therefore, and in order to clarify what are the soil and land limitations to agricultural development, a similar exercise has been undertaken. In keeping with the FAO semi-detailed mapping a two level approach has been adopted with the I-IV level followed by a suffix denoting the limitations to agricultural development as set out below and as shown in Table 3-3:

w	poor drainage
s	salinity
t	soil toxicity
l	flooding
f	low fertility
x	low water holding capacity
d	shallow depth
e	erosion hazard

In addition Table 3-3 also shows mapping units that have hilly and/or dissected topography and whether the unit has a forest cover or not. This is to aid the delineation of land suitable for agricultural development and for policy formulation regarding any potential change from forest cover to agriculture.

Most soil mapping units have a number of limitations, some of which may be interrelated (shallow depth, low water-holding capacity and erosion hazard for instance) so an assessment has been made as to the main limitation and this has been mapped.

Table 3-3 Limitations to Agriculture by Soil Unit

Soil Mapping Units		Soil and Land Limitation											
Symbol	**Description**	**LCC Unit**	**LCC sub-unit**	**Poor drainage (w)**	**Salinity (s)**	**Potential Toxicity (t)**	**Flooding (l)**	**Fertility (f)**	**Water Holding Capacity (x)**	**Shallow Depth (d)**	**Erosion Hazard (e)**	**Hilly Topography**	**Forest Cover**
1a	Frontland clays	I-II	w(sx)	**X**	x	x							
2a	Riverain soils	I-II	w	**X**									**(X)**
3a	Bog soils	III	wt(f)	**X**		**X**		**X**					**(X)**
4a	Gleys, groundwater laterites and planosols	III	w(tf)	**X**		**X**		**X**					**X**
5a	Groundwater laterites	I-II	f(w)	x				**X**					**X**
1b	Gleys, groundwater laterites and alluvial soils	I-II&IIIf	wl	**X**			**X**	x					**(X)**
2b	Gleys, alluvials, regosols and podzols	IV	fwl	**X**			**X**	**X**					**X**
3b	Latosols, gleys and groundwater laterites	III	lf	x			**X**	**X**					
1c	White sand regosols	IV	fx					**X**	**X**				**X**
2c	Sandy latosols	I-II&IIIf	f					**X**	x				**X**
3c	Latosols in dissected terrain	III	e(f)					**X**			**X**	**X**	**X**
4c	Gravelly regosols	III	xf					**X**	**X**				**X**
5c	Latosols, groundwater laterites and lithosols	III	fe	x				**X**		x	**X**		**X**
6c	Groundwater laterites and latosols	IIIf	f					**X**		x			**(X)**
1d	Podzols	III	e(f)					x			**X**	**X**	**X**
2d	Podzols and latosols	I-II	f(e)					x			x		**X**
3d	Clay latosols	IIIf	f(e)					**X**			x	x	**X**
4d	Latosols, hilly terrain and lithosols	III	e(f)					x			**X**	**X**	**X**
5d	Gravelly and shallow latosols	III	de					x	x	**X**	**X**	**X**	**X**
1e	Laterites, gravelly and steep terrain	III	e(f)					x			**X**	**X**	
2e	Fertile laterites	I-II											x
3e	Gravelly laterites	III	xde					x	**X**	**X**	**X**	**X**	**X**
4e	Gravelly laterites and lithosols	III	xde					x	**X**	**X**	**X**	**X**	**X**
1f	Shallow soils with rock outcrops	IV	xde					x	**X**	**X**	**X**	**X**	**X**
2f	Shallow soils with rock outcrops	IV	xde					x	**X**	**X**	**X**	**X**	**X**
3f	Shallow soils with rock outcrops	IV	xde					x	**X**	**X**	**X**	**X**	**X**

Explanation

X	major limitation for whole unit
x	limitation in part of unit
(X)	part of unit forested

Source: Derived from FAO 1966

Table 3-4 Soil Unit and Main Limitation

Soil Unit	LCC (Main Limitation)
1a	I-IIw
2a	I-IIw
3a	IIIw
4a	IIIw
5a	I-IIf
1b	I-IIw (IIIf-w)
2b	IVf
3b	IIIw
1c	IVx
2c	I-IIf (IIIf-f)
3c	IIIe
4c	IIIx
5c	IIIf
6c	IIIf-f
1d	IIIe
2d	I-IIf
3d	IIIf-f
4d	IIIe
5d	IIId
1e	IIIe
2e	I-II
3e	IIIx
4e	IIIx
1f	IVd
2f	IVd
3f	IVd

Figure 3-7 Land Capability and Limitation

See associated Map Album

Figure 3-7 shows the soils of Guyana by Land Capability Class and limitation. It shows that coastal soils have a drainage limitation. Inland the Class I&II soils in the northwest have a fertility limitation but the poorer soils are limited by potential erosion problems if the forest cover were to be cleared. Soils of the white sand plateau are non-agricultural and have a limitation of low water holding capacity but other soils of central Guyana have limitations of fertility or drainage depending on their slope position. The soils of the Pakaraima Mountains are generally poor and shallow with a depth limitation while the soils of the Rupununi savannas have limitations of drainage, low water holding capacity or fertility. The soils of the south eastern forests are generally poor with either depth or erosion hazard limitations.

Class I&II Land by Land Cover

An analysis has been undertaken of the current land cover/land use on Class I&II land. This indicates the area of good quality land that could be developed without the need to clear the forest cover and the area of good quality land that is currently under forest. The data are shown in Table 3-5 and Figure 3-8 and indicate that the vast majority (79%) of Class I&II land is under forest with only 7% on savanna or grassland and that 9% is currently cropped. The nearly 4% that occurs on 'inland water' refers to flooded backlands, mainly in Region 6.

Table 3-5 Land Cover of Class I&II Land

Land Cover	Area (ha)	%	%
Bare Land	7,112	0.2	0.2
Built-up Area	30,743	0.9	0.9
Cropland	297,333	9.0	9.2
Forest Plantation	7,025	0.2	
Inland Water	124,615	3.8	3.8
Flooded Meadow	29,116	0.9	7.3
Scleromorphic Scrub	56,213	1.7	
Open Savanna	9,297	0.3	
Shrub Savanna	149,140	4.5	
Low Evergreen Swamp Forest	219,858	6.6	78.6
Low Semidecidous Mixed Forest	19,213	0.6	
Med/Tall Evergreen Montane Forest	179,966	5.4	
Med/Tall Evergreen Riparian Forest	203,395	6.1	
Tall Evergreen Estuarine Forest	36,380	1.1	
Tall Evergreen Mixed Forest	1,806,325	54.4	
Tall Evergreen Sclerophyllous Forest	143,004	4.3	
Grand Total	**3,318,734**	**100.0**	

Source: DLUPP

Class I&II Land by Region

To aid future development plans an assessment has been made of the occurrence of good agricultural land by region as shown in Table 3-6 below and Figure 3-8.

Table 3-6 Class I&II Land by Region

Region	Area (ha) of Class I&II Land	Total Area (ha)	%
1	479,896	1,956,891	24.5
2	150,212	597,384	25.1
3	89,504	370,291	24.2
4	84,641	218,154	38.8
5	152,845	397,227	38.5
6	690,569	3,648,961	18.9
7	834,320	4,751,539	17.6
8	110,283	1,938,925	5.7
9	37,826	5,603,101	0.7
10	696,192	1,670,963	41.7
Guyana	**3,326,288**	**21,153,436**	**15.7**

Source: DLUPP

Figure 3-8 Class I&II Land by Land Cover and Region

See associated Map Album

As expected the regions with the greatest proportion of Class I and II land are coastal although somewhat surprisingly the region with the highest proportion is Region 10 with relatively large areas of good land in the east. Further assessments as to the land cover and land tenure of this land on a regional basis will be available with the dataset held at GL&SC.

3.4.2 Livestock

The potential for livestock development is to be concentrated on non-forested land according to the GLDA.

Figure 3-9 and Table 3-7 show the location and areas of non-forested land. The majority of this land (70%) occurs in savanna areas with the majority of land occurring in the intermediate savannas and Canje Basin area and the Rupununi and southern Pakaraimas. Cropland has been included in the assessment since some parts of the area mapped as cropland at the scale of mapping (1:1m) will be abandoned land or grassland. A more detailed assessment of the coastal plain will be required to delineate areas suitable for livestock development.

Figure 3-9 Non-forested Land

See associated Map Album

Table 3-7 Non-forested Land

Land Cover	Area (ha)	%
Bare Land	12,181	0.5
Cropland	317,994	14.2
Broadleaf Meadow	7,336	0.3
Flooded Meadow	168,987	7.6
Open Savanna	126,892	5.7
Shrub Savanna	1,432,769	64.1
Scleromorphic Scrub	155,701	7.0
Thorn Scrub	11,872	0.5
Grand Total	**2,233,732**	**100.0**

Source: DLUPP

As noted in the Region 9 Land Use Plan, the area has huge potential for the development of livestock given that the present stocking rates are in the order of 1animal unit (AU=400kg of animal=1 cow or 8 sheep/goats) per 61ha for the whole savannah or 1/35ha for grazing lease areas (Ranches), whereas, with improved pasture, stocking rates of 0.8-1.1 AU/ha are attainable.

NAREI has undertaken research into potentially suitable forage crops and grasses and has been studying what has been achieved in Brazil and in the Colombian savannahs as a model for the development of the Rupununi savannas.

Both in Brazil and in Colombia (and to a lesser extent in Venezuela) the development of the savanna lands farming system has followed a pattern of planting cereal crops initially (often rice in Brazil) in order to improve the topsoil structure, and then forage crops/grasses after two to three years as cereal yields decline. The conversion to livestock for a number of years then builds up the soil organic matter content after which the land can revert to cereal production if required. Evidence also shows that indicators such as calving rate and calving percentage increase over time.

In Brazil, savanna lands produce 180-200kg/ha/yr from cattle and 2 million litres milk/ha/yr.

The main forage crops/grasses tested by NAREI and which are recommended by EMBRAPA in Brazil are:

- VF717 (*Brachiaria humidicula*) yielding 200kg/ha/yr
- Palisade Grass (*Brachiaria brizantha*) yielding 400kg/ha/yr
- Gamba Grass (*Andropogon gayanus*) yielding 350kg/ha/yr

In addition GLDA indicate that antelope grass (*Echinocloa pyramidalis*) has shown good results. Trials in Ituni in the intermediate savannahs showed the following results:

Table 3-8 Potential Stocking Rates on Trial Grasses

Grass	Stocking Rate AU/ha	Weight gain rate kg/d
VF717 *Brachiaria humidicula*	1.2	0.35
Palisade Grass *Brachiaria brizantha*	1.2	0.5
Gamba grass *Andropogon gayanus*	1.2	0.4

If this potential stocking rate were applied over the whole Intermediate savannas (241,278ha) then they could support nearly 290,000 head of cattle and the Rupununi savannas could see a rise in the cattle population to 1.36 million, or to 780,000 on land with grazing leases. This is, of course, an unlikely scenario but serves to indicate the huge potential for improved pasture and livestock development.

However the development of livestock will require water resources. According to the GLDA it takes 1,600-1,700 litres of water to produce 1kg beef and daily water requirements range from 16-56 l/d for cattle to 5 l/d for sheep and goats. In the past the development of livestock was constrained by the lack of D&I; the potential for development of livestock must take availability of water into account.

3.4.3 Aquaculture

The potential for aquaculture, which is being actively promoted by the government through both the NDS and the LCDS, has already being realised in several places along the coast, primarily in Regions 2, 3 and 6. The potential can be assessed using a combination of soil and land use data.

The MoA Fisheries Department do not currently have guidelines as to land suitable for aquaculture but indicate that most soil types on the coastal plain are suitable with the possible exception of the peaty, pegasse 3a soils of the backlands and sandy reefs. Ragbirsingh and De Souza (2005) have provided criteria for the development of aquaculture in the Caroni basin in Trinidad. They show criteria of distances from Highways (50m), roads (15m) and rivers (10m) as well as land use and infrastructure criteria as set out in The most **suitable areas for aquaculture are therefore coastal plain soils 1a, 2a, and 5a with a land cover/land use of abandoned land. Soils mapped as 3a are not suitable due to their peaty nature and 4a soils are marginal to unsuitable due to a peaty topsoil and toxicity. Similar soils but with a land cover/use of natural vegetation or cropped land are also suitable but abandoned land is preferred. Aquaculture ponds should not be situated closer than 25m to habitation.**

Table 3-9 below.

In Guyana these criteria could be modified so that a land use of Abandoned Land would be optimal, Agriculture suitable and Natural Vegetation marginal. Slope is not an issue on the coastal plain and most of the soils have surface clay percentages greater than 30%. Water quality is not known but is likely to be good throughout but the flooding status is unknown.

Areas with a high potential for fish farming/aquaculture are often those which have been long abandoned by rice farmers due to salinity. These areas often also have soils that would make

amelioration back to arable land difficult so the promotion of conversion to aquaculture is to be encouraged, provided that there is no conflict with the environment. For instance, at Fyrish in Region 6, cases of environmentally damaging fish farming have been reported with sea defences breached, flooding and an increase in mosquitoes.

The most suitable areas for aquaculture are therefore coastal plain soils 1a, 2a, and 5a with a land cover/land use of abandoned land. Soils mapped as 3a are not suitable due to their peaty nature and 4a soils are marginal to unsuitable due to a peaty topsoil and toxicity. Similar soils but with a land cover/use of natural vegetation or cropped land are also suitable but abandoned land is preferred. Aquaculture ponds should not be situated closer than 25m to habitation.

Table 3-9 Criteria for Development of Aquaculture

Data Layer	Critical Factor	Optimal	Suitable	Marginal	Unsuitable
Land Cover/Use		Agriculture, Mixed Forest			Forest Reserve, Industry, Quarry, Residential, Swamp
Slope %		0-3	3-6	6-9	>9
Soil Surface Texture	Clay %	>30	20-30	20	<20
Water Quality	Water Quality of Rivers	Good			Poor
Flooding	Flood Zones	Unlikely	Slight	Rare	High

Source: Ragbirsingh & De Souza (2005), Caroni basin, Trinidad.

There is also potential inland for the conversion of old mine workings to aquaculture although local conditions of soil quality, drainage and flooding will have to be assessed. The potential for this land conversion was commented on at Stakeholder Consultations in Regions 1 (Mabaruma) and 8 (Mahdia) where access was considered to be the major constraint.

The promotion of the conversion to fish farming/aquaculture must also ensure that there is no damage to the existing areas of mangrove. In fact a case could be made for some of the profits from aquaculture to go towards the rehabilitation of mangrove in degraded areas since the mangrove provides excellent sea defence that protects the fish ponds from erosion.

3.4.4 Forestry

The potential for forestry is dependent on a number of factors:

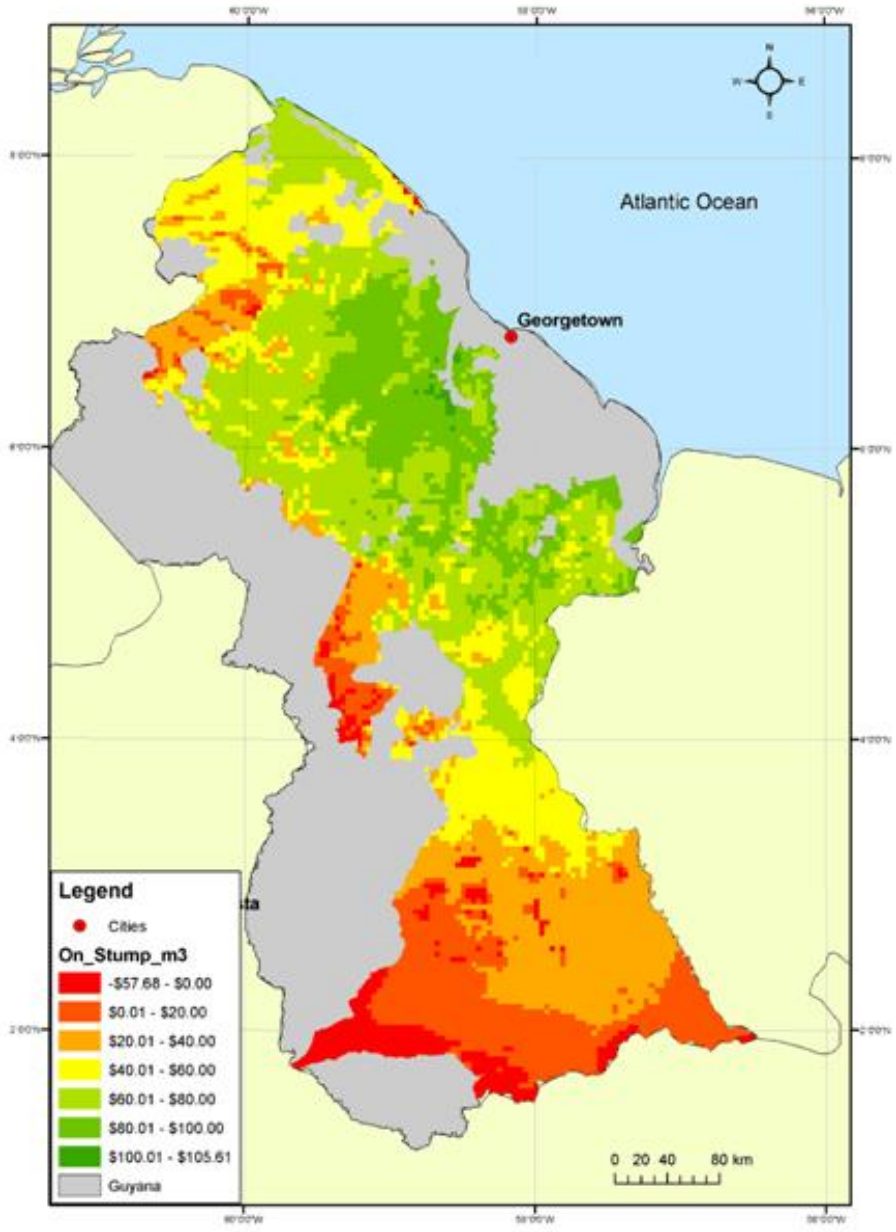
- Forest species composition
- GFC lease type, time and degree of exploitation

- Topography
- Forest Management class
- Access/location

Data on forest species composition (ter Steege 2001) has been combined with topography to give an indication of the value of timber in Guyana's forests as shown in Figure 3-10.

This shows the on stump value of timber calculated in US$ and has been calculated taking, forest composition and density into account. The data can be aggregated into Low to High values as shown in Table 3-10 below.

Figure 3-10 Standing Timber Value of State Forests



Source: GFC 2011

The map is confined to the State Forest Estate but shows that areas of highest value, and therefore with the greatest potential, are located in the lower Cuyuni, Mazaruni and Essequibo river area and between the Essequibo and Berbice rivers. These areas have on-stump values of US$80-105/$m^3$ and are relatively easily accessible being at their furthest 135-170km from Georgetown and close to major rivers. The majority of the country's forest resources are of high medium value and potential at US$60-80/$m^3$ stretching from Region 1 in the northwest to east of Iwokrama. The far north-west and middle Essequibo river areas have a medium value and potential at US$40-60/$m^3$.

Table 3-10 Forest Potential by Value

Forest Potential		Value (US$/$m^3$)
Low	Very Low	-57-0
	Low	0-20
Medium	Low Medium	20-40
	Medium	40-60
	High Medium	60-80
High	High	80-100
	Very High	100-105

Source: GFC

Areas of lower value include the upper Cuyuni river on the border with Venezuela (south of Baramita Amerindian Area), an area fringing the Pakaraima Mountains to the west of Iwokrama and the forests of the far south east of Guyana that have a different species composition, are regularly flooded in an undulating terrain and are inaccessible.

Not surprisingly the areas of greatest value and therefore potential show a high correlation with the areas of current and historical forest leases, although there are still some unallocated areas shown on the forest resources allocation map.

The potential for plantation forestry is different from that for forestry since it is largely concentrated on lands that are not currently forested, although there is also potential for using areas classified as Conversion Forests and also for converting some currently forested areas to plantations.

There is a growing interest in plantation forestry i.e. in growing trees as a crop, either for biofuels, for wood pulp or for other uses such as building poles. Areas suitable for plantations include any land not currently forested such as the coastal plain and savannas with plantation forest being particularly useful in making beneficial use of the most infertile savanna lands.

GFC reported that there has been no plantation forestry undertaken to date but that there is an interest in a *Paulownia spp* plantation at Ibini in the Intermediate Savannas as well as an exploration of the potential for bamboo both at Ibini and in the Canje basin. Paulownia is a fast growing tree that is suitable for plywood and which sequesters 60% carbon. Like Eucaluptus, it can be coppiced and 3-4 harvests can be obtained from a single planting. Clenergen (http://www.clenergen.com/biomass/bamboo) indicate that *Bambusa balcooa* can

produce 49t/ha in year 2, 86t/ha in year 3 rising to a maximum of 161t/ha in year 5 and that the plant can be mechanically harvested and has a lifespan of up to 50 years.

The Region 9 land use plan reported in 2004 that GFC had been asked by local Amerindian communities to investigate the potential for plantation forestry with particular emphasis on using the savanna lands. However no species trials were undertaken but potential species could include Eucalyptus, Teak, Oil palm (although this prefers a year-round humid climate) and several species of Acacia for wood pulp. There are plantations of Acacia mangium around Boa Vista in Brazil where they were planted in anticipation of a pulp plant and paper industry.

The relatively small areas of Conversion Forests centred around Orealla on the Corentyne river would be suitable for plantations as would worked out SFPs on the White Sand Plateau between the Demerara and Berbice rivers. However, as Evans (1992) points out, it is the efficient recycling of nutrients in an ecosystem that is important in a tropical forest with the effect that the conversion of natural forests to plantations can be difficult if the soils are as poor as those on the white sand plateau. He cites evidence from Guyana and NE Brazil where wallaba forests on white sands were cut down and only scattered bush has been able to regrow even many years after.

Plantations would also be suitable for the reclamation of old bauxite workings around Linden where initial results using *A.mangium* have been encouraging according to NAREI.

3.4.5 Mining

The potential for the development of mining is wholly dependent on mineral occurrence. As outlined in 2.4.2 and Figure 2-8 the known mineral occurrences are located in a broad swath running from the northwest of Guyana (Region 1) in a south east direction comprising much of Region 7, northern Region 8 and Region 10 west of the Berbice river with scattered occurrences in Region 9.

Gold occurs mainly in the Greenstone Belts in the north-west and centre of the country with alluvial gold occurring in rivers draining this area but also occurs in quartz veins in the south of the country. Since 2006 all gold has been produced by small-scale mines with a rapid expansion in the number of gold mines driven by the high gold price. Data from GGMC shows an increase of 5% in the number of small-scale claims and medium-scale prospecting permits between 2010 and 2011 and increases of 57% in medium-scale mining permits (742 to 1,161) and 71% in large-scale mining licenses (7 to 12).

Recent developments include the expansion of small-scale mining in Regions 1, 7 and 10 as well as potential larger-scale operations such as Guyana Goldfields at Aurora Creek on the Cuyuni river that is due to begin production in 2013-14 with a proposed life of 22 years producing an average 256,800oz gold/y for the first 10 years. This operation will be the first large-scale mine in Guyana since Omai closed in 2006 and will be open-pit mining initially followed by underground mining.

Other potential gold mining operations include Sandspring Resources at Toroparu in the Upper Puruni River area in Region 7 a gold and copper deposit with a current potential start date for mining operations of 2015, Marudi mine in the far south of Guyana in Region 9 and Stronghold at Eagle Mountain, south east of Mahdia in Region 8. The current recovery rate of gold in Guyana is around 40% but it is intended to increase this to 90% with new techniques such as centrifugal systems and different sluices.

Diamonds occur in alluvial deposits in many of the main rivers of north-west Guyana and are thought to be derived from the Pakaraima Mountains but the primary source remains unclear.

Diamond mining and production has declined recently and the potential for future expansion is unclear although road development into alluvial deposits in the upper Mazaruni area could drive more diamond mining. Platinum Group Elements are also believed to occur in the Pakaraima Mountains.

Bauxite is mined at Linden by Bosai a Chinese company and at Aroaima near Kwakwani by Rusal and was also mined at Ituni in the past. The cost of production of bauxite in Guyana is relatively high. Both residual and alluvial bauxite occur on the coastal plain in deposits of 8-10m thick and residual bauxite also occurs inland, capping hills with a 5m thick deposit comprised of 50% aluminium and 4% silica. None of the bauxite in Guyana is metallurgical grade bauxite; at Linden it is refractory grade while the deposit at Aroaima is classified as abrasive and chemical grade. The bauxite exported from Linden is Calcined Bauxite meaning that the ore has been heated to remove water and iron.

The potential for the development of bauxite mining in the 'bauxite belt', that stretches from the Pomeroon river in Region 2 in the north and runs south and east through Regions 3 and 10, culminating at the Corentyne river in Region 6, is high though dependent on world market prices. FBCs Bankable Feasibility Study (see below) is based on, among other factors, a premise that the global demand for bauxite is likely to grow steadily over the next 10 to 15 years with nominal and real refractory grade bauxite prices rising over the next ten years.

Recent developments highlight the potential for bauxite mining in that a Canadian company, First Bauxite Corporation (FBC), has been granted a permit for the establishment of a bauxite mine at Bonsika, on the Essequibo River some 16 km upriver from Parika in Region 3. The resource to be developed by FBC has risen from an initial 1.6 million tonnes to over 12 million tonnes with a potential project life of 44 years on a production of 100,000 tonnes per year (Guyana Chronicle 25 Nov 2011). The bauxite between Bonasika and Kwakwani is at a very shallow depth of 0.3-0.6m to 6m and would be mined by strip mining on very low quality forest creating an opportunity for higher quality forestry plantation or other land use on completion.

FBC intended to start construction of the bauxite mine at Bonasika and related infrastructure, such as a roll-on roll-off wharf at Soesdyke, roads and camps in 2012 with a proposed start date in 2013 and to be in full production in 2014 although this timescale has since slipped.

In addition to the FBC development, both BOSAI at Linden and RUSAL at Aroaima/Kwakwani have been granted an additional block of land for mining development. Rusal has recently (late 2012) begun working two new mining areas on the east bank of the Berbice River. It is envisaged that the expansion of RUSAL at Kwakwani will increase its production from the current rate of 1.2 million tonnes of bauxite per year to five million tonnes per year by 2015 and ten million tonnes per year by 2018. This will have a knock-on effect downstream in that it will require the development of a turning basin at the mouth of the Berbice River close to the proposed deep water port.

Manganese was mined at Mathews Ridge in Region 1 up to 1968 and a recent development has been the possible resumption of manganese mining in this area with the issue of a prospecting licence to Reunion Manganese of Canada. Manganese deposits are concentrated in two areas, at Matthews Ridge in Region 1 where the deposit stretches east to the Barama River and just north of the Cuyuni River at the junction of Regions 1, 7 and 2.

Information from April 2012 (bis.gy 2012) indicates the feasibility of manganese mining with production due to commence at the end of 2014. Large-scale production of manganese could see Guyana being ranked among the top five producers of manganese in the world,

generating approximately 2 million metric tonnes of concentrate per year, just over Brazil's current capacity. Brazil is ranked as the number 3 world producer.

The Matthews Ridge development could also see the rehabilitation of 50km of railway between Matthews Ridge and Port Kaituma as well as 30km of road between the two centres.

Uranium/Rare Earths have been identified at scattered locations in Guyana; at Port Kaituma in Region 1, in the Upper/Middle Mazaruni, near Mahdia in Region 8 and in the Rupununi savannas in Region 9. Only prospecting licences and reconnaissance permissions have been issued and only Argus Metals at Port Kaituma are planning a drill programme in 2012. A recent (late 2012) development has been the awarding of a PGGS to Muri Brazil Ventures Inc. for rare earth elements in the extreme south of Guyana as well as applications for medium-scale prospecting licences in the New River Triangle.

Columbite/Tantalite deposits are concentrated in the Middle Mazaruni in region 7 and west of Marudi Mountain in the southern Rupununi but to date only prospecting licenses have been issued for the Mazaruni area.

Other minerals include copper and nickel, often associated with gold in the Cuyuni, tin (Cassiterite), Potarite (palladium-mercury), tungsten and molybdenite, also associated with gold around Mahdia, magnesite (magnesium carbonate) in the southern Rupununi, kaolin within the bauxite belt at Ituni and Kwakwani, kyanite on the Potaro river close to Mahdia and mica at scattered locations throughout Guyana but concentrated in the southern Rupununi. Iron ore is reported between Mabura Hill and Kurupukari and there are large deposits of aluminous laterite in the Pakaraima Mountains.

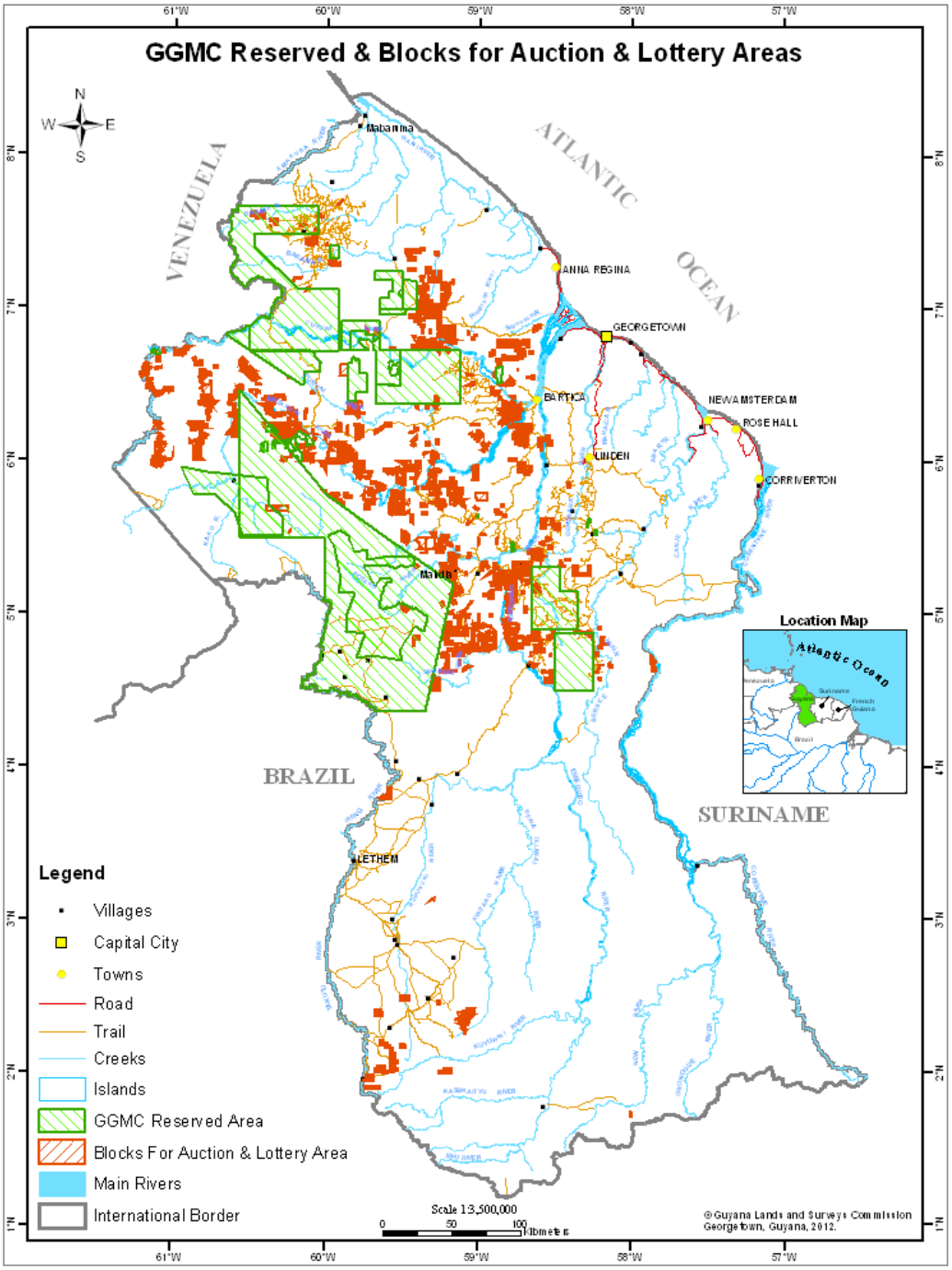
Gravel and Aggregate quarries are mainly located in the Bartica Assemblage where gneisses and schists are extracted and crushed and used for road and building foundations and sea defences. Gravel is extracted from alluvial deposits and is used in road construction.

Silica sand is abundant in the White Sand Plateau and is homogeneous with very few impurities, <0.1% heavy minerals and no clay. It is extracted in open quarries and can be used in the manufacture of glass, ceramics and abrasives.

The potential for **petroleum** occurs offshore and in the Takutu basin corresponding to the northern savannas although the amount of oil and/or gas deposits has yet to be proven. The last oil exploration company to explore the deposit found oil at a yield rate of 400 barrels per day (12,000/m, 146,000/y) which is an appreciable amount since Guyana currently imports less than 1,500 barrels per month. However the total amount of extractable oil was not proven and the company needed proven reserves of 250 million barrels to justify development. If the reserve were 250 million barrels then, at present-day consumption, this would supply Guyana for 13,889 years.

The areas with the highest potential for future mining development therefore essentially correspond to areas of current mining operations as shown in Figure 3-11 where areas proposed for auction and lottery are shown as well as Reserved Areas (areas reserved by GGMC for study).

Figure 3-11 GGMC Proposed Blocks for Lottery and Auction



Source: GGMC

3.4.6 Protected Areas, Ecological Function and Biodiversity

The potential for conservation to preserve biodiversity and ecological function is well understood in Guyana and underpins the Low Carbon Development Strategy. The land cover/land use map showed only about 1.7% of the country as having a human influenced land use, although it is known that both forestry and mining activities are causing land degradation in areas mapped as natural vegetation.

The national assessment of land degradation in Guyana (GL&SC/UNDP/GEF (2008)) estimated current land degradation at 150-160,000ha and predicted a rise to 200-250,000ha by 2018. This corresponds to 0.7 to 1.2% of the country being subjected to land degradation indicating that the vast majority of Guyana still provides ecosystem services and harbours huge biodiversity. The MRVS study has shown that around 10,000ha or 0.05% of forest is lost each year and that millions of hectares of forest can still be classified as intact.

A system of Protected Areas has been established with 5 legally protected areas covering a total of 17,262km^2 comprising 8.2% of the country as shown in Table 3-11.

However, as a signatory to the UN Convention on Biological Diversity Guyana has an obligation to protect at least 17% of its terrestrial area by 2020 (MoNRE 2012). This could be achieved in part by including GFC Forest Reserves, the Conservation International TSA and the biodiversity reserves required for Multiple Use Forests by GFC, as well as two proposed areas of Roraima and Orinduik, but this would still leave a shortfall of 1.52m ha.

Table 3-11 Protected Areas Status

Protected Area	Area (ha)	%
Currently Legally Protected (Iwokrama, Kaieteur, Shell Beach, Kanuku Mountains, Konashen)	**1,726,180**	**8.2**
Proposed and Other Protected Areas		
GFC Forest Reserves (Moraballi, Mabura)	6,100	<0.1
CI Essequibo TSA	82,102	0.4
Roraima	57,220	0.3
Orinduik	8,546	<0.1
Biodiversity Reserves in TSAs (4.5% of 4,16m ha)	187,521	0.9
Proposed and Other Sub-total	**341,489**	**1.6**
Current, Proposed and Other	2,067,669	9.8
17% of Guyana	3,587,419	17.0
Current shortfall	1,861,239	8.8
Shortfall including proposed and other	1,519,750	7.2

Source: GL&SC, GFC, DLUPP

With the vast majority of the southern half of the country still classed as 'intact forest' (GFC 2012) there is huge potential for the development of protected areas. The forests of southern Guyana (basically south of Iwokrama) are not as valuable in terms of timber as those of central Guyana, have hilly terrain and have not been developed due to their inaccessibility.

However they do have huge ecological value as the headwaters of the Essequibo, Corentyne and Berbice rivers and as such should be considered for conservation rather than development.

It is not only forests that have high biodiversity and perform ecological function, other land covers such as savannas, wetlands and shrublands do the same. As such, a case can be made for conserving these landscapes, particularly in the Pakaraima Mountains and Rupununi Savannas. A proposed protected area for the northern Rupununi wetlands has been demarcated as shown in Figure 3-12 but the area is much larger than the actual wetland area and an additional problem is that Guyana is not a signatory to RAMSAR, the wetland conservation treaty.

Figure 3-12 Current and Proposed Protected Areas

See associated Map Album

Much of the Pakaraima Mountains are Amerindian lands that could be declared protected areas as the Konashen area in the southern Rupununi has been.

3.4.7 Amerindian Areas

The potential for Amerindian Areas relates to the expansion of existing areas through extensions, the titling of existing communities and the potential for 'Other Settlements' (established before 2003) to apply for title in the future.

The latest information from GL&SC indicates that there are currently 12 extensions applied for (of which 3 have been demarcated, digitised and issued with the other 9 awaiting demarcation), a further 3 titles are at the Land Registry awaiting preparation, 2 surveys are in progress, one survey has been stopped by the community and other known Amerindian communities such as Orealla in Region 6 have not been demarcated and do not have title.

It is difficult to provide an indication as to how much land and where may become Amerindian land since, until an extension is formally applied for and demarcated, it is not mappable. The southern Rupununi outline plan (SCSRDTC 2012) for instance indicates that all 12 existing communities intend to apply for extensions and one new community title is proposed (Parobaz) resulting in the disappearance of all state land in the southern Rupununi.

3.4.8 Housing and Commerce

The potential for housing and commerce is largely demand-driven and at present occurs mainly on the coastal plain. According to CH&PA the main demand in 2012 is at East Coast Demerara but available land is at a premium. CH&PA have been concentrating on East Bank Demerara developing 3,600 plots at Eccles, Herstelling, Farm and Providence. Along with 500 plots at Uitvlugt in Region 3 and 1,000 plots on former GuySsuCo land at ECD, the agency intends to have 6,500 plots available by the end of 2012.

As data from the Bureau of Statistics show (BoS 2011), the population of the coastal plain regions increased by an average of 6% between 1991 and 2002 but varied greatly between an increase of 12% in Region 2 and a decrease of 14% in Region 6. (Region 1 increased by 25% but most of this increase was away from the coastal plain). A similar or greater increase in population can be expected in the 2012 census with stakeholder consultations indicating increased land pressure. Assuming population increases similar to those between 1991 and

2002 then the population of the coastal regions 2-5 will have increased by 31,244 by 2012 requiring around 7,811 new houses assuming 4 people per household. At 500 lots per 100acre block (a standard development block in the coastal plain e.g. Uitvlugt in Region 3) this equates to a total area required of 1,562acres or 632ha (or 63ha/y) a figure that should be easily attainable given that the coastal plain covers a total area of 1.8m ha.

However squatter regularisation and lower family size has meant that demand for housing has increased. This has been corroborated by information from the stakeholder consultations that indicated that demand for land was particularly high in Regions 2, 3 and 4.

Inland the population has risen by an average of 16.2% ranging from 0.3% for Region 10 to 39.2% for Region 8, followed by 21.9% for Region 7. These increases are largely driven by mining development and there is potential for turning the transitory mining camps into settlements by the provision of services with former mining areas being changed to a number of land uses including plantation forestry, agriculture (particularly tree crops), livestock pasture or aquaculture. However better access and services will need to be provided to ensure people stay in these areas rather than return to the coast or move on to new mining areas.

3.4.9 Industry

The potential for industrial development is dependent on the development of other sectors of the economy such as agriculture, mining and forestry as well as developments in infrastructure and power generation.

In the forestry sector it is policy to move away from the export of raw materials and to move up the value chain, producing materials on site. For example the proposed development of forestry south of Iwokrama in the current SFEPs proposes the development of a saw mill at Annai and a factory at Linden to export partly finished furniture products.

Similarly it is also policy to move up the value chain in livestock (particularly beef) products and non-traditional crops. The Region 9 land use plan stated (assuming that access would still be a constraint) there would be a need to add value close to areas of raw material production so that small to medium scale agri-processing industries, such as peanut and peanut butter, cashew, brazil nut, fruit canning and drying could be established in and around Lethem.

Similarly, an increase in livestock rearing would require at least an upgraded abattoir at Lethem if not further abattoirs in the northern and southern savannas and possibly a canning factory. Other areas with livestock potential such as the intermediate savannas as the coastal backlands will also need either improved access to abattoirs or the establishment of on-site abattoirs.

In the mineral sector power availability is the primary determining factor (particularly for bauxite and aluminium) and the potential for industry seems limited.

Coupled with the potential for plantation forestry there is also potential for a paper and packaging industry using plantation forestry in the future.

3.4.10 Energy (Hydropower, Wind, Solar, Biofuels)

Hydropower

Guyana has a large hydropower potential of approximately 4.5-7GW. The Guyana Energy Agency (GEA) has compiled an inventory of the hydropower potential in Guyana and has

identified 67 potential hydropower sites (GEA 2011) across four major river basins; the Cuyuni, Mazaruni, Potaro and Essequibo basins, as shown in Figure 3-13.

MoA/Scott Wilson (2011) assessed the most promising sites that either had been constructed, were under construction or had been studied at least at pre-feasibility level and these 19 sites are shown in Table 3-12.

Table 3-12 Most Promising Potential HEP Sites

Sites	Status	Ave. Cont. Power (MW)	Observations
Hosororo	Feasibility Study	0.015	
Eclipse Falls	Feasibility Study	4	
Tiboku	Feasibility Study	40	
Ikuribisi	Feasibility Study	0.7	
Teperu	Tender Documents & Final Design	0.1	
Turtruba	Pre-feasibility Study Completed in 2005	320 – 800 MW	MOU was signed by GoG and ENMAN Services Ltd to conduct studies on the feasibility until July 2010. Based on preliminary investigations, the Turtruba Rapids Hydro Project is feasible and can provide a maximum peak power of 1,100 MW and confirmed reliable power of 650 MW. A preliminary optimization also indicated that an installation of about 800 MW is possible
Kamaria	Pre-Feasibility Level	103	
Oko-Blue	Pre-Feasibility Level	162	
Chi-Chi Diversion to Merune R.	Pre-Feasibility Level	96	
Sand Landing	Pre-Feasibility Level	650	
Kaieteur	Pre-Feasibility Level	216	

Sites	Status	Ave. Cont. Power (MW)	Observations
Amaila Falls HEP	Pre-Construction Level	100 -154	Presently the most advanced project with a proposed capacity of about 165MW. It is envisaged that this hydroelectric station will be commissioned by 2016.
Tumatumari	Feasibility Study completed but dormant for a period of time	34	It is envisaged that this project will seek to provide stable and reliable power for the Guyana economy and the excess will be exported.
Moco-Moco	Existing 0,5MW Station (Under Repair)	0.1 – 0.5	The Government of Guyana and INCOMEX are negotiating the rehabilitation of this hydropower station and have estimated the cost of repair to be approximately USD 430,000. A full assessment of the site has to be completed to determine the precise sum for the completion of the project.
Wamakaru	Feasibility Level	First Phase: 2.75MW Second Phase: 3.5MW	The feasibility study presented two main alternatives for the development of the site using a phased approach: Alternative I: Serving the Rupununi area only with up to 2.75 MW (1985 to 1993), US$12.5 million Alternative II: Serving the Rupununi area and Bomfim, (Brazil) with up to 3.5 MW (1985 to 1996), US$ 14.6 million. Located within Kanuku Mts. PA.
Tiger Hill	Feasibility Level	15	
Kato	Feasibility level	0.3	Under the Unserved Areas Electrification Programme, the Hinterland Electrification component, Government of Guyana is currently seeking funding to conduct a feasibility study for the Kato site on the Chiung River
Devil's Hole	Feasibility Study Completed (October 2008).	16	Three alternatives were studied and it was recommended that alternative 3 might be the best option which has a proposed installed capacity of 16 MW

Sites	Status	Ave. Cont. Power (MW)	Observations
	On-hold for future considerations		with an estimated cost of investment of USD 65.24 million.
Upper Mazaruni	RUSAL Feasibility Study. Reduced world bauxite demand has downgraded development potential	1500-3000 First 1000MW: Supply to Brazil and Guyana Second 1000MW: Supply to smelting plant Third 1000MW: Supply to Brazil	RUSAL approached the GoG expressing an interest in the development of this project. RUSAL was granted exclusive rights for an initial three (3) years to conduct a feasibility study of the site, in 2007. It is estimated that the cost of construction will be approximately US$2.7-2.9 billion (2007 estimates).
All other sites	Inventory Level		

Source: MoA/Scott Wilson 2011 from GEA data

Figure 3-13 Potential HEP Sites

See associated Map Album

The Amaila Falls site at the confluence of the Amaila and Kuribrong rivers is in the process of development. This site has a potential yield of 165MW that will satisfy Guyana's power demand on completion in 2015/16 so that the country should be able to move away from its dependence on fossil fuels for power generation. The site requires an access road that is currently under construction and will also require a 270km power line and two 230kV sub-stations at Linden and Sophia.

The only site of any size that has been constructed and was operational is Moco-Moco in the Kanuku Mountains that operated between 1999-02 supplying Lethem with 0.25MW of electricity until the gravity feed was damaged by a landslide. Current estimates indicate that it will cost about US$430,000 to re-commission.

Other sites of particular interest include Turtruba on the Mazaruni west of Bartica and Sand Landing on the Upper Mazaruni River which have a combined potential yield of 1,450MW with Turtruba showing an optimal yield of 800MW and Sand Landing 650MW. The main driver for these developments are from Brazil since its main power supply, the Guri Dam in Venezuela, is showing siltation problems and operating at 75% of capacity and only 50% at low water levels.

A more comprehensive study of potential hydropower sites is needed in order to be able to gauge their relative feasibility, cost of development, energy capability and environmental impact (run of river *v* storage requirement etc) to be able to prioritise investments in the sector.

Wind

The potential for wind power was studied by Delta Caribbean N.V. in 2008-9 who indicated a high potential with mean windspeeds of 7-8m/s at a height of 40m with a potential peak production of 100MW. A proposal to construct a 13.5 MW Wind Farm at Hope Beach, ECD was launched in 2007 but has since been abandoned. GEA indicate that there is potential along the whole coastal plain, onshore rather than offshore.

The Un-served Areas Electrification Programme (UAEP) recorded wind speeds at Orealla, Jawalla, Campbelltown and Yupukari but the data collected suggests that the wind speeds are not sufficiently attractive for development.

Solar

The high average daily solar radiation with an average of about 5 peak sun hours per day means that Guyana is suitable for solar power. Small-scale solar photovoltaic (PV) systems are already used in health centres, schools, communities and homes for lighting, small appliance loads, water pumping and productive cottage industries. Solar water heating is also beginning to be used for domestic water. Guyana has around 88kW of solar power installed primarily in the hinterland regions where there is no access to the grid which generates approximately 160kWh of annual electricity (MoA/Scott Wilson 2011).

GEA has identified a potential site at Eccles for a 1MW solar photo voltaic cell array but there has been no progress towards development.

Biomass

Energy from biomass is an important source of energy in Guyana with around 26% of the electricity supply in Guyana from bagasse co-generation in 2008 with the Skeldon expansion due to supply a further 10MW. Bagasse is used in the sugar industry and rice husk in the rice industry for the co-generation of heat and electricity, while wood (firewood and charcoal) is used in the residential sector for cooking purposes.

Biogas generators using methane to generate electricity are in their infancy but it is reported that there are seven (7) digesters using various feed-stocks located throughout Guyana.

Biofuels

The only biofuel plant currently in operation is at Wauna in Region 1. This unit is capable of producing 300 to 600 barrels of bio-diesel per month from palm oil although it is now more profitable to sell the palm oil for use in animal feeds than as fuel although the plant still uses waste biomass as fuel. The oil palm plantation covers 1,000 acres (405ha) but an application

has been made to extend this to 25,000 acres (10,100ha). This application was made in 2008 but as of early 2013, no decision had been made.

The potential for biofuel development is highlighted in the LCDS which outlines the Canje Basin as a potential site. However Ansa McAl, a Trinidad based company looking to develop 40,000ha for an ethanol project has indicated that soil and drainage conditions are not suitable in the Canje Basin and have turned their attentions to the Intermediate savannas. The GEA indicate that the potential sites for biofuels should not be in food producing areas, highlighting the potential of the savannas and sandy soils along the Soesdyke-Linden highway. They also indicate that sugar rather than a crop such as jatropha would be preferred. This provides potential for an ethanol distillery from sugar that would require a co-generation facility.

There is also potential for energy farming using fast-growing trees; however, as yet there are no strategies or policies for guidance. There have been a number of investors reportedly interested in developing biofuel plantations in the Intermediate Savannas but none have begun operation reportedly largely due to poor infrastructure. Clenergen are currently interested in developing a 4,000ha bamboo plantation on land near Ebini to produce oil by pyrolysis for export but have not yet been given the go-ahead by GoG.

3.4.11 Infrastructure

The potential for infrastructure development is enormous, and it is GoG policy to develop infrastructure both in the LCDS and the PRS. This initial development will concentrate on the Linden-Lethem road, for which both pre-feasibility and feasibility studies have been completed, and the Amaila Falls Hydropower development that is nearing construction. An alternative East Bank Demerara road, to the east of the present road, has also been recently proposed.

In the longer term, the development of a deep-water port at New Amsterdam could affect the alignment of the Linden-Lethem road, particularly if coupled with development of the Intermediate Savannas meaning that a road directly to New Amsterdam from Kurupukari via Kwakwani may well be feasible. The MoPW reported that they have recently (late 2012) been asked to study the potential for a road link from Manaus in Brazil to a potential deep-water port at New Amsterdam.

Another longer-term proposal is the development of a road linkage with Venezuela through to Suriname, which could facilitate the development of other hydropower sites. These developments could well drive other road developments linking Region 1 to the Venezuela road through Aurora, linking Parika to Barica, developing a road through the Pakaraima Mountains with a link to Kurupung and the development of the intermediate savannas. These links indicate that the Matthews Ridge area in Region 1, Bartica and Kurupung in Region 7, Linden and surrounding areas in Region 10 and New Amsterdam and surrounding areas in Region 6 could become ‘growth points’ or ‘hotspots’ with Mabura Hill, Mahdia, Annai and Lethem also experiencing growth.

Potential infrastructure developments are shown on Figure 4-3 in association with development options.

3.4.12 Tourism

The potential for tourism is largely unmet with only a few thousand tourists visiting a year. With over 98% of the country covered in natural vegetation, 87% forested, with savannas and mountains, and Amerindian heritage in the south and west and only an hour’s flight away

from the Caribbean (with its 23.8 million tourists in 2011), Guyana has huge potential to attract greater numbers of tourists and is increasingly promoting itself as a destination for eco-tourism.

In contrast to the Caribbean where Island States are universally known as holiday destinations having been developed over decades with hotels and services catering to the needs of tourists, Guyana's niche eco-tourism is a developing sector although the presence of small cruise ships docking in Georgetown is welcome development. Improvements in marketing, transport services and accommodation could see the realisation of the potential.

The opening of the Takutu bridge at Lethem has resulted in a huge increase in Brazilian visitors and the road infrastructure developments mentioned above could help to drive tourism in central Guyana, particularly with the opening of a route through the Pakaraima Mountains linking to a road to Venezuela.

The main thrust of future tourism is likely to be as at present in the eco-tourism market drawing on ecological value and biodiversity and incorporating elements of landscape, uniqueness and Amerindian heritage.

3.5 Constraints by Sector

3.5.1 Agriculture

There are many constraints to the development of agriculture in Guyana. The main ones are: water supply and D&I, soil resources, land cover, land tenure and administration, policy, road access and access to markets.

Water Supply and D&I

The supply of water, drainage and irrigation are a prerequisite for agriculture on the coastal plain. Inland soils tend to be better drained and do not require drainage although supplementary irrigation may be required for some rainfed cropping. The maintenance of D&I systems was a common issue raised in stakeholder consultations on the coastal plain.

Soil resources

The soil resources of Guyana are a constraint to agricultural development since those Class I&II soils on the coastal plain need drainage before they are suitable and the vast majority of inland soils are not suitable due to limitations of fertility, topography, low water holding capacity and erosion hazard.

Land Cover

Land cover is a constraint since the vast majority of suitable soils (particularly inland of the coastal plain) have a forest land cover that will require clearing before they can be used for agriculture.

Land Tenure and Administration

The situation regarding land tenure and administration was a frequently cited issue in stakeholder consultations. As well as the inordinate length of time it takes to obtain a lease for land is the issue of abandoned or unused land. As the Region 6 East Berbice Corentyne Land Use Plan noted there was almost as much unused land as cultivated land and the issue of unused land when there is land pressure is a major constraint to agricultural intensification on the coastal plain.

Policy

Policy and particularly the LCDS is a constraint to agricultural development since it does not allow the clearing of forest cover for agriculture. As shown there are 2.6 million ha of forested Class I & II land within the State Forest boundary that could otherwise be developed.

Road access

The poor state of farm to market roads was a frequently cited issue at stakeholder meetings on the coast while poor access roads such as the road from Linden to the intermediate savannas are a constraint to agricultural development in the interior.

Access to markets

Guyana's small population means that agricultural developments need to target export markets but poor infrastructure means that investments may not be made.

3.5.2 Livestock

The main constraints to the development of livestock in Guyana relate to land availability, access and access to water, security, and access to markets.

Livestock farming is currently largely confined to the coastal plain and Rupununi savannas although chicken rearing is more widespread serving local markets. The main thrust of development of the livestock sector will be confined to the non-forested areas thus expanding in currently not cropped/ cultivated or abandoned coastal plain land as well as both the intermediate and Rupununi savannas.

Given the current conflict between arable and livestock farming on the coastal plain, that is largely due to issues of access (both to the backlands and to water) and security (rustling was cited as a major concern in some coastal regions), there is a need to develop secure livestock pasture in the backlands. Similarly, the main constraints to livestock development in the savannas are road access, access to water and security.

Coupled to these constraints are the lack of improved breeds and pasture, extension services, veterinary laboratories and abattoirs that are being dealt with by the GLDA. The lack of these things has hindered access to export markets in the past but, if addressed, could open up new markets.

3.5.3 Aquaculture

The main constraints for aquaculture are the availability of land, drainage of excess water in the wet season and theft from ponds. The same constraints in terms of infrastructure and marketing for agriculture also apply.

3.5.4 Forestry

The main constraints for forestry are access, conflict with competing land uses, the nature of Guyana's forests, forest policy and power availability.

Access is a constraint in that the majority of Guyana's commercially exploited forests are a long way from a main road and also the port of Georgetown. This is compounded by the fact that the GoG has historically not invested in road access leaving it up to logging and mining companies to do so with the result that roads are not built to a high standard. Poor road access was a frequently cited issue in hinterland regional stakeholder meetings.

Conflict with competing land uses, usually mining but also agriculture and housing development, was also often cited as a land issue. The main constraint is seen as a land management issue as much as anything else, with no clear procedural guidelines as to the management of a piece of land with competing leases.

Guyana's forests are a constraint in that they are characterised by high species diversity but with a low standing volume per unit area for the main commercial species, resulting in a low volume extraction per unit area. This, coupled with an estimated 20% defective trees, highly selective logging (targeting less than 5% of the tree species occurring) and poor forest soils result in low productivity per unit area. While this pushes costs up and is a constraint to logging, it is obviously a benefit to biodiversity and ecological function.

The Forest policy is only a constraint in that GFC guidelines and Codes of Practice ensure that logging per unit area is low and clear-felling does not take place. Again while this pushes up the costs of logging, it enhances biodiversity and enables Guyana to earn money from good forest management.

It is GoG policy to move up the value chain in timber products with the export of logs stopped completely in the next few years. This envisages the establishment of forest product industries but these are constrained by poor access and power availability. The development of HEP could help these industries to flourish.

3.5.5 Mining

The main constraints for mining are access, conflict with competing land uses, the lack of a comprehensive mineral resources survey, cost, and power availability.

Similar to forestry, access is a constraint to mining in that the majority of Guyana's mining areas are a long way from a main road, compounded by low GoG investment with resultant poor and often impassable roads.

Again, as with forestry, conflict with competing land uses is a land management issue with no clear procedural guidelines as to the management of a piece of land with competing leases. In mining this is compounded by the fact that small-scale claims only last for twelve (12) months and monitoring several thousand claims is extremely difficult.

Mining as a cause of environmental degradation is seen as a constraint to mining development, with environmental bonds having to be placed/ lodged at GGMC before mining can commence. Miners, as represented by the Guyana Gold and Diamond Miners Association (GGDMA), see mining as a 'temporary use of land' with mined out land able either to revert to forest or be converted to a number of other uses. This again is a land management issue and will need to be developed further.

The lack of a comprehensive mineral resources survey is a constraint in that many prospecting leases are taken out, covering large swathes of the country, but are not developed or cause forest destruction. A better minerals map would help to concentrate prospecting in certain areas and could reduce the conflict between competing land uses. A case in point is the recent (late 2012) decision to open up the south-eastern forests for reconnaissance survey and small and medium-scale prospecting and mining.

The constraint of access and the need to prospect over large areas raises costs which is then a constraint to the development of a mine or an oil resource. Some resources, such as oil in the Takutu basin, are seen as too small for a large oil exploration company to want to develop but too expensive for a smaller oil exploration company to take the risk.

The fact that almost all mining operations have to provide their own power is a constraint that could be overcome with the development of HEP although transmission costs will still be high and a national grid will still not reach the most remote locations.

3.5.6 Protected Areas, Ecological Function and Biodiversity

The constraints to Protected Areas and to the conservation of biodiversity, and the protection of areas with ecological value and function, relate more to environmental threats. These threats to the environment come from unsustainable development, particularly forestry, mining and land pressure in general.

To a large extent, forestry in Guyana is sustainable provided GFC guidelines and Codes of Practice are adhered to, so the main threat is from mining although miners argue that mining is a temporary use of land and that environmental damage is reversible.

As the MRVS has shown, the area of pristine forest in Guyana has shrunk from over 10m ha in 2009 to 5.6m ha in 2011. It could certainly be argued that this is misleading since much of the area was only excluded due to the existence of reconnaissance prospecting permits that may well have very little impact on the environment. The issue of a reconnaissance survey permit for the south-eastern forests will reduce this area further.

However, it can be argued that much of the forested area with long-standing TSAs and with extensive mineral prospecting and mining leases (Regions 1, 7, 8 and 10) retain much of their biodiversity and ecological function despite the amount of logging and mining that has been undertaken in these areas.

The conservation of biodiversity and ecological function is not confined to forested areas but is also apparent in mountainous areas and the savannas. Much of the Pakaraima Mountains are Amerindian Land as are the Rupununi Savannas, while the Kanuku Mountains are a protected area and the Aracai Mountains in the south are part of the Konashen Community Protected Area. The intermediate savannas are not protected and have been earmarked for development in the LCDS and Agricultural Diversification Programme, Ministry of Agriculture (ADP).

The threat of land pressure on biodiversity is most apparent on the coastal plain and its backlands but is also present in populated areas inland. Other threats that are attributed to land pressure may actually be poor land use practices. As the Region 9, Sub-Region 1 Land Use Plan stated, a 'decline in wildlife and fish populations are more a result of poor management (fishing with toxins for instance) than land pressure. Land pressure is currently not thought to be so severe as to present an immediate threat and with guidance, better management and planning, the area can be used sustainably.'

3.5.7 Amerindian Areas

The constraints for Amerindian lands comprise the slow progress in titling existing lands and extensions, land management and conflict with other land users. As indicated above, there are approximately eighteen (18) applications for titling and extensions ongoing although it is also known that there are communities intending to apply for title (e.g. Orealla) and many other extensions pending (e.g. Southern Rupununi). The constraint is that the delay in issuing titles and extensions prolongs uncertainty which can have a knock on effect such as for REDD+ payments.

Other constraints relate to the management of Amerindian lands in that they may not fit in with Government or regional objectives, and there is also actual and potential conflict with other land users regarding mining, logging and agricultural developments.

3.5.8 Housing and Commerce

The main constraints to the development of housing and commerce are the availability of designated land and conflict with other land uses.

The current potential for housing and commerce is largely demand-driven and, at present, occurs mainly on the coastal plain. Future demand and planning of urban areas can be expected to move inland due to climate change and government policy.

According to the CH&PA, the main demand in 2012 is at East Coast Demerara but available land is at a premium. The CH&PA has been concentrating on East Bank Demerara, developing 3,600 plots at Eccles, Herstelling, Farm and Providence. Along with 500 plots at Uitvlugt in Region 3 and 1,000 plots on former Guysuco land at ECD. The agency planned to have 6,500 plots available by the end of 2012.

As data from the Bureau of Statistics show (BoS 2011), the population of the coastal plain regions increased by an average of 6% between 1991 and 2002 but varied greatly between an increase of 12% in Region 2 and a decrease of 14% in Region 6. (Region 1 increased by 25% but most of this increase was away from the coastal plain). A similar or greater increase in population can be expected in the 2012 census, with stakeholder consultations indicating increased land pressure. Assuming population increases similar to those between 1991 and 2002, the population of the coastal regions 2-5 will have increased by 31,244 by 2012, requiring around 7,811 new houses (assuming ahousehold size of 4 persons). At 500 lots per 100 acre block (a standard development block in the coastal plain e.g. Uitvlugt in Region 3) this equates to a total area required of 1,562acres or 632ha (or 63ha/y); a figure that should be easily attainable given that the coastal plain covers a total area of 1.8m ha.

However, squatter regularisation and lower family size has meant that demand for housing has increased. This has been corroborated by information from the stakeholder consultations that indicated that demand for land was particularly high in Regions 2, 3 and 4.

Inland, the population has risen by an average of 16.2%, ranging from 0.3% for Region 10 to 39.2% for Region 8, followed by 21.9% for Region 7. These increases are largely driven by mining development. There is potential for turning the transitory mining camps into settlements by the provision of services, with former mining areas being changed to a number of land uses including plantation forestry, agriculture (particularly tree crops), livestock pasture or aquaculture. However, better access and services will need to be provided to ensure people stay in these areas rather than return to the coast or move on to new mining areas.

There are a number of options for the future direction of urban development and housing provision in Guyana. While the NLUP, looking at the national perspective, has concentrated on developments away from the coastal plain, it is highly likely that there will continue to be a high demand for housing land on the coastal plain meaning competition between housing, agriculture, livestock and aquaculture for highly valuable land.

Past urban development in Guyana has been linear or ‘ribbon development’ along transport routes i.e. rivers or roads. If there is to be a policy of further urban expansion on the coastal plain then it should be one of ‘nuclearisation’ of settlements. To an extent this is already happening with the developments at Aurora in Region 2, Tuschen in Region 3 and Diamond in Region 4. Any further planned nuclear settlements, however, must be linked to the

development of road access and/or an increase in capacity of current roads. Similarly, drainage from these urbanised areas will need to be improved.

A further policy option for the development of the coastal plain could be linked to the development of a deep-water port at the Berbice river mouth, and the commercial and industrial opportunities this may afford At present, the majority of the population of the coastal plain is concentrated in and around Georgetown as well as in Regions 3 and 4, but the deep-water port development could drive a movement of population to Regions 5 and 6. Region 5 is relatively sparsely populated while coastal Region 6 saw the highest population fall between 1980 and 2002. Both areas have high potential for agricultural development (including livestock and aquaculture) and the proposed transport links in the NLUP could open up large areas of backlands for development. Again, any urban or housing policy should be one of promoting nuclear settlements, although ribbon development may be inevitable in areas such as New Amsterdam to Mara on the right bank of the Berbice river. Any major urban development on the coastal plain will require a detailed land capability and current land use study to ensure that housing is located on appropriate land and does not occupy the best agricultural land or land that is liable to flood. An assessment of housing design to accommodate any future flooding should be incorporated into policy.

A further policy issue relating to the development of urban areas and housing on the coastal plain centres on balancing the cost of defending the plain from seawater incursions, and drainage of the land, against the provision of infrastructure which would allow the development of urban areas on the White Sand Plateau immediately inland of the coastal plain. Land on the White Sand Plateau is of low quality for most land uses, apart from quarrying and urban or industrial development, so it could be promoted for urban expansion. However, past experience has shown that people are not keen to settle, for instance along the highway, due to the high transport costs and long time it takes to reach Georgetown and the coast. The provision of a relief road from Soesdyke to Georgetown (as proposed by WSG) would relieve the problem and could well encourage more settlement inland of the coastal plain.

The provision of housing in inland areas can be expected to follow any planned urbanisation of inland areas in the future. While it is not stated GoG policy to move people away from the coastal plain (indeed the investment in coastal plain infrastructure points to the continuing development of the coastal plain), the future development of Guyana needs to consider increased and planned urbanisation inland.

Government policy should promote the development of nucleated urban settlements to facilitate provision of services such as water, power and waste treatment to these settlements, as well as making it easier to supply security, health and education services and employment. Nuclear settlements also have an advantage in being able to attract commerce and employment generating activities that are not attracted to linear settlements. This concentration of people, housing, commerce and industry in particular areas is in line with the LCDS in that less land is then used for urban activities, with less competition with other land uses and minimal deforestation.

The specific location of any future urban development in inland Guyana will depend on a number of factors, but it can reasonably be expected that they will correspond both to the expansion of already established urban centres as well as the accelerated development of

'hotspots' outlined in the NLUP. These hotspots are discussed in section 4.3 and potential urban expansion areas include Port Kaituma and Matthews Ridge in Region 1, and Linden, Bartica, Ituni and Kwakwani in Regions 10 and 7. In addition, the expansion of current transport nodes such as Mabura Hill and Anai can be expected, as can mining centres such as Port Kaituma and Mahdia.

In the longer term, the development of transport routes is likely to lead to urbanisation at junctions that could also be promoted (e.g. Olive Creek, Aurora) or dissuaded (e.g. Kurupukari) by government policy, depending on the location.

As noted above, urban development and housing could be promoted on former mining land, thus reducing the impact of the development and the conflict with other land uses.

3.5.9 Industry

The main constraints to the development of industry are the availability of designated land, poor infrastructure especially in terms of a deep water harbour for export and the high cost and unreliability of power.

Some of these constraints are in the process of being sorted out with the aim of developing export processing zones, improving infrastructure (particularly roads) and the development of hydropower.

It is likely that the development of industry will use local raw materials from the agriculture, mining and forestry sectors and that the location of these industries will reflect this and access to export points whether they be ports or by road to Brazil and Venezuela.

3.5.10 Energy (Hydropower, Wind, Solar, Biofuels)

The main constraint to the development of energy is the cost of development, particularly in the case of HEP although this can be offset by the reduction in the need to import fuel. The development of sources of alternative energy, such as wind turbines and solar arrays, will also be greatly influenced by the cost of development and the amount of power that can be produced. The main constraint to the development of biofuels is land availability although initial costs will also be high but the use of biomass as a fuel has fewer constraints since the use of a by-product is inherently more economic.

3.5.11 Infrastructure

The main constraints to infrastructure development (roads, harbours, bridges, power, water supply) are financial, access and the low number of beneficiaries. All infrastructure developments are costly and are made more so by access constraints and physical conditions with soft boggy soils on the coastal plain and hilly forested areas in the interior making road building costly. The low population means that the number of beneficiaries is low affecting project viability but developments enhancing export potential such as HEP sites with exported electricity and a deep water port should prove more economically viable.

3.5.12 Tourism

The main constraints to tourism are marketing and perception, access, infrastructure and cost. Guyana is a little known tourism destination and its image in the Caribbean, where it could be marketed to high-value foreign visitors as an alternative eco-tourism destination within a beach holiday, is not attractive.

Access both to and within Guyana is difficult and costly, with three carriers that used to fly to Guyana withdrawing or about to withdraw services in the year to May 2013 (RedJet, EZJet and Delta) with commensurate flight cost increases. Within Guyana flights are relatively frequent but costly while the reliance on small singe-engined planes may well dissuade some potential tourists. Flights are made necessary due to poor road access while safety standards on river boats are questionable.

4 DEVELOPMENT OPTIONS

The evaluation of development options has been undertaken following the assessment of the current situation and of opportunities and constraints, while keeping in mind government policy and the issues raised by local land users in the stakeholder discussions.

The assessment of development options is presented below by natural region being relatively homogeneous areas in terms of their physical conditions, socio-economic status and linkages both within Guyana and within the context of wider northern South America.

While the assessment of these options was undertaken in six (6) natural regions, they were also amalgamated into a national picture through an assessment of potential for different sectoral development, an assessment of land available for development and, following the presentation of regional development options, the highlighting of potential hotpot areas and linkages between them.

The national picture is presented first, followed by the regional options.

4.1 Potential

Figure 4-1 shows an assessment of the potential for four different sectoral developments. The map in the top left shows areas with a high potential for biodiversity protection i.e. the intact forests, Protected Areas and Amerindian Areas. These are areas with high biodiversity and a high degree of provision of ecological services.

To this layer the area with high potential for forestry development is added as shown on the map in the top right. This corresponds to areas of mainly high to high-medium value and covers currently leased land which GFC indicates will form the bulk of forest development in the foreseeable future.

To this map is added a layer of high mineral resource potential. This layer corresponds to the current area of prospecting and mining leases held at GGMC plus the bauxite belt although it does not include petroleum exploration leases. As can be see this layer overlaps the area of high forestry potential to a large degree in north-western and central Guyana.

To this map a layer of high agricultural development potential has been added. This corresponds to areas of Class I&II land and is located primarily on the coastal plain and eastern Guyana but also as scattered blocks overlapping areas with high mineral, forest and protection potential. The map is shown below and is also in the associated map album.

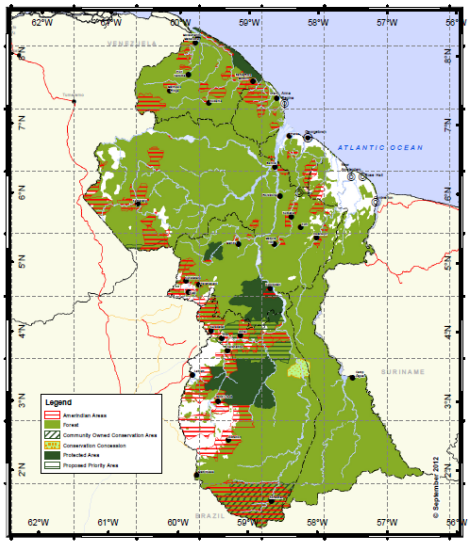
This exercise has helped to target different development options at different parts of the country but also serves to illustrate that a broad swathe of north-western and central Guyana has high potential for the development of a number of options and is particularly suitable for multi-use development; the challenge being how to manage that development.

4.2 Land Availability

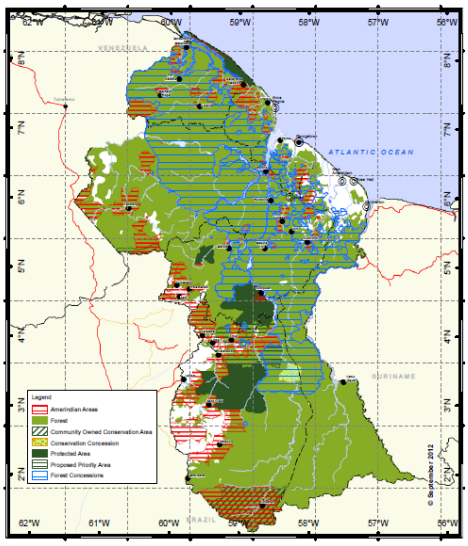
An assessment of land availability has also been undertaken. This was to show where land without any claim on it is available for development and was undertaken using data concerning: Amerindian Areas, Protected Areas, Built-up areas, Agricultural land, Forestry Concessions, Mining Concessions, Petroleum Exploration leases and Mineral prospecting leases. Due to the fact that small and medium-scale mineral prospecting leases are only valid for a year at a time, two assessments of available land were made, one including mineral prospecting leases and one without.

Figure 4-1 Assessment of Development Potential

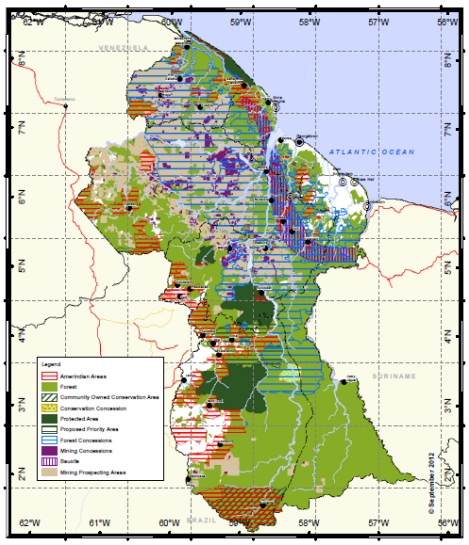
DEVELOPMENT POTENTIAL MAPS



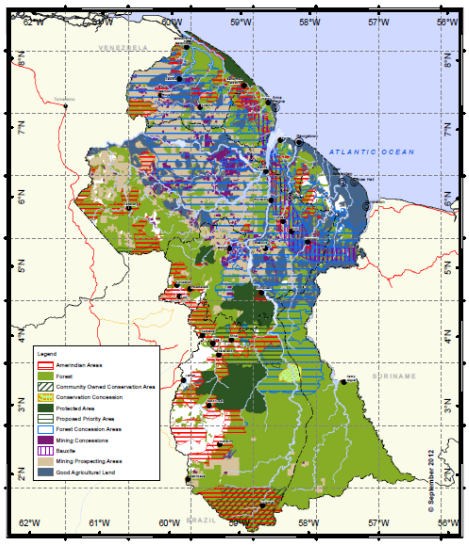
MAP No.1 - POTENTIAL FOR BIODIVERSITY PROTECTION



MAP No.2 - MAP No.1 + FORESTRY POTENTIAL



MAP No.3 - MAP No.2 + MINERAL RESOURCE POTENTIAL



MAP No.4 - MAP No.3 + AGRICULTURE POTENTIAL

The results are shown in Table 4-1 and Figure 4-2 (shown below and in the associated map album) and indicate that where land is available it is largely concentrated in the coastal plain backlands, the Pakaraima Mountains (where the difference between including or excluding mineral prospecting leases is most obvious), parts of the Rupununi Savannas and the South Eastern Forests.

Figure 4-2 Available Land

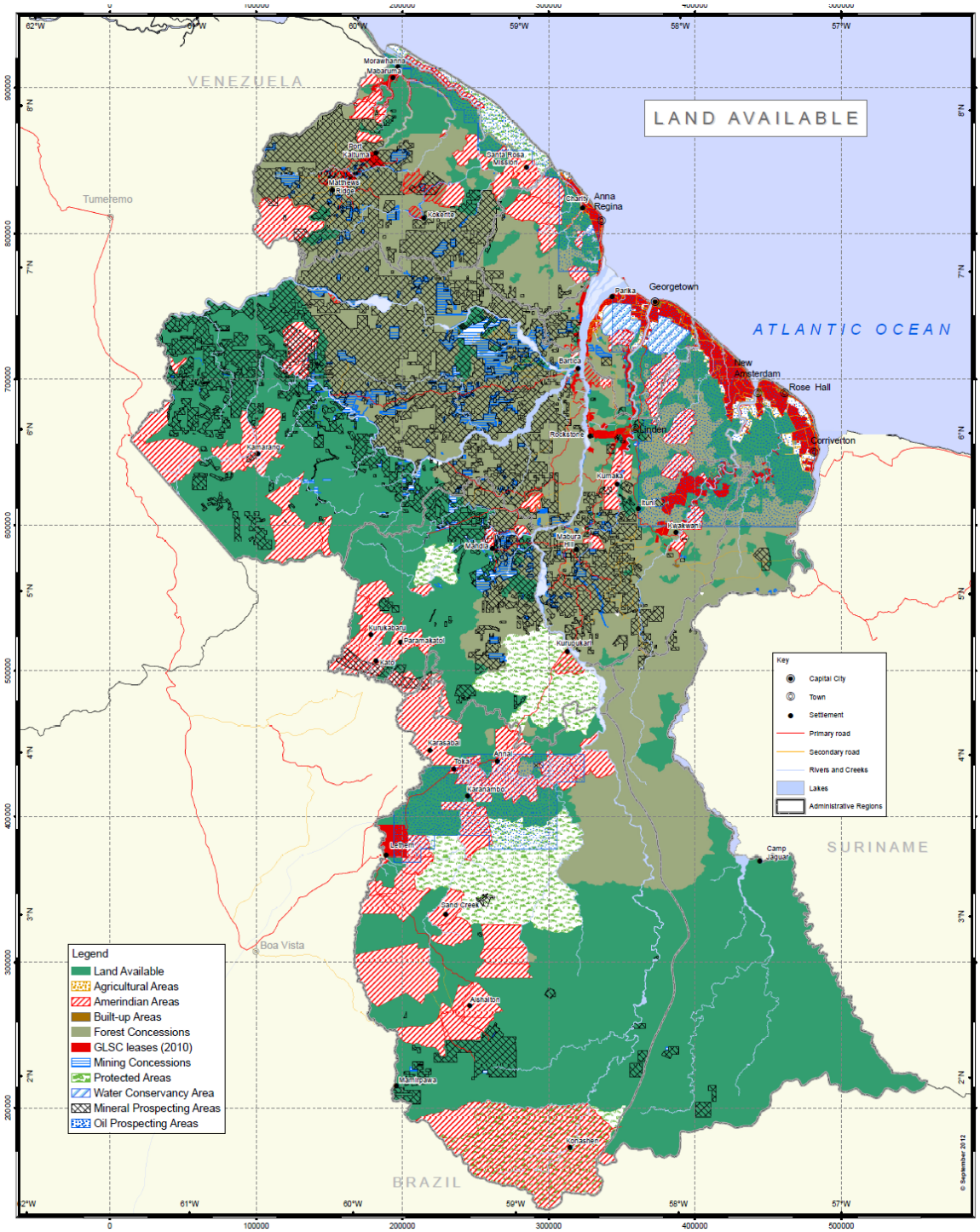


Table 4-1 Available Land

Land Use Type	Area (ha)	%
Total Land Area	21,153,431	100.0
Protected Areas[1]	1,726,120	8.2
Amerindian Areas[2]	2,661,853	12.6
GFC Forestry Leases	6,951,451	32.9
GGMC Prospecting Leases	3,955,643	18.7
GGMC Mining Leases	458,251	2.2
Petroleum Exploration Leases (Onshore)[3]	2,603,008	12.3
GL&SC Leased Land	534,519	2.5
Available Land (excluding Prospecting Leases)	8,917,803	42.2
Available Land (including Prospecting Leases)	7,832,701	37.0

Source: DLUPP GIS. 1 – including Konashen, 2 – excluding Konashen PA

3 – excluded from Prospecting Leases

Excluding mineral prospecting leases 8.9m ha (42% of the country) of land is still available for development. This falls to 7.8m ha or 37% of the country if mineral prospecting leases are included. Petroleum exploration leases reconnaissance leases have not been included in the calculation since they are only exploratory in nature and do not affect land availability for other uses. In terms of land cover the vast majority of available land (88%) is forested with 8% savanna, 2% meadow and 1% shrubland.

An assessment was then undertaken on the available land by its land capability and land cover/land use. This showed that the area of Class I&II available land was 714,734ha excluding prospecting leases, falling to 485,307ha when prospecting leases are included. This land occurs in two main areas; in a swathe to the west of the State Forest boundary in Region 7 (primarily forested) and associated with the intermediate savannas and Canje basin in Regions 10 and 6. Other smaller areas occur in the lower Cuyuni in Region 7 and scattered in Regions 1 and 2 the majority of which have a forest vegetation cover.

4.2.1 Multiple Land Use

The assessment of available land has enabled the study to highlight where two or multiple land uses occur. The most obvious is the overlap between GFC issued forestry leases and GGMC issued prospecting and mining leases.

Table 4-2 Prospecting, Mining and Forestry Overlaps

GFC and GGMC Overlaps	Area (ha)	% of GGMC issued leases
Mining and Forestry	437,310	95.4
Prospecting and Forestry	2,723,825	68.9

As shown in Table 4-2 the vast majority of all mining leases issued (95%) are within the state forest boundary and on GFC leased land. The ratio for prospecting leases is lower at 69% but the area is much greater at 2.7m ha.

Other instances of multiple land use occur, for instance in Region 1, where around Port Kaituma mining claims, prospecting leases, GL&SC issued agricultural leases and forestry leases all overlap. Also in Region 1 there are instances of overlap between Amerindian land and GL&SC issued leases in White Water and Arukamai Amerindian areas. Instances of forestry leases and prospecting leases on Amerindian land are relatively common but this is not a conflict of land uses, rather a single land use in an area of specific land tenure. There is an instance of a prospecting lease in a Protected Area in the Kanuku Mountains east of Sand Creek.

The issue of multiple land use was often raised as an issue in the stakeholder discussions and the NLUP has been directed to promote areas of multiple land use. The question is one of land management and how to attain an optimal use of resources without hindering other uses.

4.3 Hotspots and Linkages

The assessment of development options by region below has taken into account national infrastructure developments that have then led to the identification of 'hotspots' i.e. areas with high development potential. These hotspots typically have potential for a number of land uses and can be linked to each other and already existing developed areas by improving infrastructure linkages.

Figure 4-3 Development Options, Hotspots and Linkages

See associated Map Album

Figure 4-3 shows the hotspots and linkages as well as the development options which are discussed in detail below. The hotspot areas are:

- Matthews Ridge/Port Kaituma, Region 1
- Bartica-Linden
- Intermediate Savannas-Canje Basin
- Northern Rupununi

The Matthews Ridge/Port Kaituma area is a hotspot due to its high potential for forestry, mining and agriculture. At present it is constrained by access and power. Access could be remedied with a spur off the main yet to be developed Venezuela-Surinam road and power by the development of Eclipse Falls hydropower (4MW). Access could initially be from Aurora through Kokerite to Matthews Ridge. The area is currently being developed mainly for forestry and mining, but is known as a historically important area for agriculture and there are large areas of suitable land. Mining activities lead to land clearance and there is a need and desire to use these lands efficiently for other purposes after mining has finished. These other land uses could be agriculture (tree crops due to the lack of topsoil), livestock, aquaculture, plantation forestry or for urban development. The area is relatively high and could be earmarked as an urban centre if people are forced to move away from the coastal plain. However, the current lack of access, power and the cost of developing access to the area is likely to remain a major constraint for some time to come.

The **Bartica-Linden** area is a hotspot due largely to its position as a centre linking areas of production to transport links and, particularly, to coastal port(s). At present, production is concentrated on mining and forestry to the west and south but there is potential for the development of agriculture and mining to the south and east as well. The area is also at the cross roads of potential road developments, west-east from Venezuela to Surinam and north-south from the coast inland. In addition, there are a number of potential HEP sites (Turtuba [320MW] on the Mazaruni and Oko Blue [162MW] and Kamaria [103MW] on the Cuyuni) and there is a proposed electricity sub-station at Linden from Amaila Falls and GoG policy of moving up the value chain and establishing Export Processing Zones, coupled with a pool of labour point to an increase in industrial development. There is a large area of mined out land around Linden that could be used as an export processing zone.

At present, the main port in Guyana is at Georgetown but there is the potential for a deep-water port at New Amsterdam. This will require new linkages to Linden, particularly if coupled with increased agricultural, livestock and bauxite mining developments to the east of Linden. A number of routes are possible; direct from Linden to Rosignol crossing to the new port via the Berbice bridge, a link from Kwakwani down the east bank of the Berbice River or improving the existing road through Ituni and extended past Orealla into Surinam. The Work Services Group of MoPW indicate that they have been requested to look at the potential of a Manaus-New Amsterdam or Georgetown route with a possible road routing from Kurupukari to Kwakwani and down to New Amsterdam.

The development of a port at New Amsterdam and linkages to Linden or through Kwakwani will reduce the load at Georgetown ports. With less traffic, the possibility of moving the port area upstream, away from Georgetown centre, could be explored. This would result in less container traffic in Georgetown itself and the potential to redevelop the port area.

The development of the **Intermediate Savannas/Canje Basin** area is due to its potential for agriculture, livestock and plantation forestry or biofuels coupled with an expansion of bauxite mining. The development of the area as a whole will require linkages with processing centres such as Linden and export ports such as New Amsterdam. The fact that the area lies on the proposed IIRSA Venezuela-Surinam route is in its favour. There is also the potential for developing the Tiger Hill (15MW) hydropower site on the Demerara to power agroprocessing industries. Of the three southern hotspots, the development of this area is the most likely in the short-term coupled with the development of Bartica-Linden for manufacturing and housing.

The **Northern Rupununi** Savannas area is a hotspot due to the number of potentially competing land uses. The area does not have particularly good agricultural land and is therefore only suitable for large-scale farming due to the high capital costs involved. Potential also exists for livestock and plantation forestry development with easy market access to northern Brazil. The area also has potential oil deposits. However, the area is also an important wetland with parts waterlogged for appreciable periods, and there is a proposal by the Northern Rupununi District Development Board (NRDDB) for the whole area to be declared a protected area.

Other areas of lesser importance, but which could become development hotspots depending on other developments, could include the **Olive Creek-Toraparu-Kurupung** area which could develop into a major gold mining area and which could link and provide access to Kamarang; and the north-western Pakaraima Mountains, particularly if hydropower sites on the upper Mazaruni such as Sand Landing (650MW) are developed. Similarly **the Mahdia-Amaila-Kaieteur** area could become a multi-use area with mining, forestry and tourism important.

The development of access and linkages between these hotspot areas is vital to their development and the development of the country as a whole. Some access developments such as the Lethem-Linden road and a deep-water port are already included in GoG policy. Other linkages within northern South America such as the Venezuela-Surinam road would bring great benefits to Guyana as would the development of large hydropower sites allowing the export of power. In addition, the maintenance and upgrading of roads developed for forestry and mining and their linkage to existing and potential roads can also foster development.

4.4 Regional Development Options

Table 4-3 below shows the primary and secondary development options by natural region. The sectors used in the assessment are those used in the evaluation of opportunities and constraints with the exception of Amerindian Areas which have been excluded since they are not a sectoral development option.

Table 4-3 Primary (X) and Secondary (a) Development Options by Natural Region

Sectors	Coastal Plain	White Sand Plateau & C. Guyana	NW Guyana	Pakaraima Mountains	Rupununi Savannas	SE Forests
Agriculture	**X**	**X**	**X**	a	**X**	
Livestock	**X**	**X**	a	a	**X**	
Aquaculture	**X**		a			
Forestry	a	**X**	**X**		a	
Mining	a	**X**	**X**	a	a	
Protection	a	a	a	**X**	**X**	**X**
Housing	**X**	a	a		a	
Industry	**X**	**X**	a		a	
Energy	**X**	**X**		**X**	a	
Infrastructure	**X**	**X**	**X**	**X**	a	
Tourism		a	a	**X**	**X**	a

4.4.1 Coastal Plain Development Options

The development options for the coastal plain are shown in Table 4-4. The coastal plain comprises about 9% of Guyana but includes about 88% of the population. The main land uses are agriculture (mainly sugar and rice), livestock rearing, aquaculture and built-up areas comprising housing, commerce and industry. There are appreciable areas of abandoned or unused agricultural land (45% of all agricultural land according to the Region 6 land use plan) and large areas of undeveloped land in the backlands.

The main issues concerning land use in the coastal plain centre around the need for improved land administration, improved planning and co-ordination, the issue of unused land with increasing land pressure, rehabilitation of the D&I system, improved access to markets and

the use of reserved land. Government policy regarding the coastal plain addresses many of these issues through: improved maintenance of D&I, continued investment in sea defences, the targeting of livestock, aquaculture and new crop (fruit and vegetable) development, the expansion of sugar and rice production, the conversion of abandoned and unused land to productive use and improvements in the monitoring and assessment of land use to apply beneficial occupation requirements.

Table 4-4 Coastal Plain Development Options

Coastal Plain Development Options	Requirements and Comments
Primary	
Agriculture Suitable land except NW plain Expansion of rice and cash crops Expansion of sugar - outgrowers? Rehabilitation of coconut plantations Diversification (fruits, vegetables, inland fisheries)	Rehabilitation of D&I system and dams Provision of new D&I for new areas but beware of draining acid sulphate soils Improve access to markets Improve planning procedures so that 'best' land is not converted to housing Ensure unused land is used productively
Livestock Expansion and improvement of breeds Conversion of abandoned frontlands to cattle pasture, mindful of cattle conflicts in populated areas Establishment of cattle pastures in backlands	Improve access to markets Rehabilitation of D&I system and dams Provision of new D&I for new backland areas but beware of draining acid sulphate soils Improve security
Aquaculture Prioritise abandoned (saline) frontlands	Improve access to markets Improve security
Housing Identify land for housing expansion Squatter regularisation Priority land not prime agricultural land	Improve planning – no development on prime agric. land or areas liable to flood Prioritise use of abandoned land Improve drainage from housing developments
Industry Establish export processing zones Target abandoned land	Establish links to harbour and airport for export Power available from Amaila Falls HEP
Energy	

Potential for wind farms Potential for solar arrays on abandoned land and/or unused backlands Potential for biofuels in backlands (unsuitable for agriculture)	
Infrastructure Development of deep-water harbour in the Berbice River estuary Potential access roads from Linden and Kwakwani Access road from Port Kaituma to Mabaruma	
Secondary	
Forestry High-medium potential in Region 1 Potential for plantations on abandoned land	
Mining Potential for clay mining for ceramics Potential on-shore oil exploration	
Protection Mangrove protection as part of sea defences Shell Beach PA in NW	

Taking all this into account, the development option for the coastal plain, as shown in Table 4-4, include the development of agriculture, livestock and aquaculture as primary options. The development of these sectors, particularly agriculture, will be dependent on ongoing rehabilitation of the D&I systems, while the development of pasture for livestock and aquaculture could benefit from the conversion of abandoned land to these other uses, particularly frontlands abandoned due to salinity. It was not possible to undertake a detailed land audit during the course of the Project but anecdotal evidence from stakeholders indicates that there are appreciable areas of abandoned or unused Class I & II land that could be brought back into production.

The development of backlands will require the provision of D&I but care will need to be taken in parts of 3a and 4a soils where there are toxic acid-sulphate soils that should not be drained. More detailed soil surveys will be required before developing these areas. Additionally, the backlands of the north-west (Regions 1 and 2) are mainly peat and pegasse and should be left as wetland biodiversity reserves rather than developed.

In all cases improved access to markets, including farm to market roads, will be required.

The development of housing, industry and energy is also a primary option on the coastal plain. There is the potential for developing housing on abandoned agricultural land but housing developments need to be better planned in relation to both their location and to other land uses. According to CH&PA there will be a total of 6,500 plots available for development by the end of 2012, the vast majority of which will be in Region 4 on East Bank Demerara and East Coast Demerara.

The development of industry on the coastal plain is currently confined to four (4) industrial sites (three in Region 4, one in Region 6) but can be expected to expand in line with Government policy of moving away from the export of raw materials and adding value in Guyana. Coupled with improved access, a deep-water port and the development of HEP an expansion of industrial sites can be envisaged. These should be located either on poor quality, abandoned frontlands or could even be located in backland areas providing access and power are provided. The development of a deep-water port at New Amsterdam with new linkages to the intermediate savannas and Linden could see the development of industrial sites at strategic locations along these routes.

The development of the energy sector on the coastal plain relates to alternative energy rather than HEP which should form the bulk of Guyana's energy generation in the near future. The coastal plain is suitable for wind, solar and biofuel development with wind and solar potential users of abandoned land and biofuels in as yet undeveloped backlands. As with agricultural development, care will need to be taken not to drain areas of acid-sulphate soils in the backlands. Assuming that HEP from Amaila Falls comes on line in the near future, then it can be expected that the demand for alternative energy will decrease.

The development of infrastructure on the coastal plain will comprise a deep-water port at New Amsterdam and new road links between it and the Lethem-Linden road. With the development of this road and the potential of the intermediate savannas, a number of options are available; a new road from Linden directly to Rosignol using the current Berbice River bridge, a road to Kwakwani including a river crossing and a link north to New Amsterdam to the east of the Berbice river or an upgraded road through Ituni to Orealla with a link north to New Amsterdam.

Other infrastructure developments include the upgrading of the Georgetown to Linden road, a new link road from Parika to Makouria near Bartica, improvement of ferry services on the Essequibo River and improvements in the road between Port Kaituma and Mabaruma in Region 1.

Development options of secondary importance on the coastal plain include forestry where there is some potential for the development of plantations on abandoned land and for community forestry in Region 2, for mining with the potential for clays for ceramics and onshore oil exploration, and for protection with Shell beach Protected Area in Region 1, mangroves at many places along the coast and pegasse backlands in Region 1.

4.4.2 White Sand Plateau & Central Guyana Development Options

The development options for the White Sand Plateau & Central Guyana are shown in Table 4-5. This area comprises the white sand plateau itself, just inland of the coastal plain but also includes more clayey soils to the south and east. The land cover is almost exclusively forest with the exception of the area of shrub savanna, the Intermediate Savannas, in the north-east of the area. The area contains Bartica, Linden and Mahdia as the main centres of population.

In terms of land capability, the area is mainly poor and non-agricultural land (Classes III & IV) but there are appreciable areas of Class I & II land in the east. The majority of this

suitable land is forested but there are also areas of shrub savanna. The area is underlain by the bauxite belt in the north and by gold and other mineral bearing rocks in the south. The main area for mineral prospecting is in the west and south although there is renewed interest in the bauxite belt in the north. In terms of forest resources and concessions, the area has scattered smaller WCL and SFP leases in the north and east, corresponding to the Wallaba/Dakama forest of the white sand plateau, with larger TSAs corresponding to the mixed rainforest in the south and west. The majority of the area has high to moderately high value timber resources.

The area has a number of potential HEP sites including Tiger Hill (15MW) on the Demerara, Tumatumari (34MW) on the Potaro and Turtuba (320MW) on the Mazaruni, all of which have been studied to at least feasibility level. Iwokrama Protected Area is located within the area and there are also a number of Amerindian areas mostly located along the Demerara and Berbice rivers.

The main land issues revolve around access and the planning and management of forestry and mining and which has precedence. Other issues include the use of mined out land, the need for extension services for agriculture and the titling of Amerindian land. Government policy regarding the area focuses agricultural and livestock development on the Intermediate Savannas, and indicates that forestry will continue in currently leased areas with further developments in community forestry, plantations and in Amerindian areas; mining will move to a mine-based rather than land-based licensing system (ensuring smaller areas leased for mining) to promote multiple land use. Furthermore, infrastructure will be concentrated on the Linden-Lethem road, possibly a Kurupukari-Kwakwani link, as well as access to the intermediate savannas and make use of mining and forestry roads with export processing zones linked to these areas.

Table 4-5 White Sand Plateau & Central Guyana Development Options

White Sand Plateau & Central Guyana Development Options	Requirements and Comments
Primary	
Agriculture Suitable land mainly in E and Intermediate Savannas Potential large-scale farming in savannas	Policy decision regarding converting forests to agriculture Improve road access to Intermediate Savannas and to port
Livestock Potential in Intermediate Savannas	Improve access to markets (see roads above) Improved pasture and water supply
Forestry TSAs in west, SFPs in east – mainly high to high-medium potential Conversion forests in east Potential for plantations on low quality land and around Linden	Policy decision regarding converting forests to plantations Land Management decisions regarding forestry and mining

Potential for forest industry (eg around Linden) with improved access to ports	
Mining Bauxite in north and east, gold etc in south-west – expansion of both	Land Management decisions regarding forestry and mining
Industry Establish export processing zone at Linden – use old mined out land	Establish road links to deep-water harbour for export Power available from Amaila Falls HEP
Energy Amaila Falls established – sub-station at Linden Potential for HEP at Turtuba Potential for biofuels on abandoned mining land	
Infrastructure Linden as hub on Lethem-Georgetown and Venezuela-Surinam routes Potential new roads to deep-water port – direct and/or through savannas and Canje basin Potential route from Kurupukari to Kwakwani to link in with new port Mazaruni & Essequibo crossings close to Bartica	
Secondary	
Protection Iwokrama PA Biodiversity reserves in TSAs	
Housing Bartica and Linden become hubs – housing demand	Improve planning – no development on prime agricultural land or areas liable to flood Ensure drainage from housing developments
Tourism Eco-tourism in PAs Increased numbers with improved access	

Taking all this into account, the development options for the White Sand Plateau and Central Guyana area, as shown in Table 4-5, include the development of agriculture, livestock, forestry, mining, energy, industry and infrastructure as primary options. The development of agriculture and livestock is centred on the intermediate savannas but there are relatively large areas of Class I & II land to the south and west of the savannas that are forested and could be earmarked for future development. A detailed survey of the intermediate savannas undertaken by FAO in the 1960s indicated that there were 135,000ha of Class I & II land and 81,000ha of Class III land available. The development of the intermediate savannas will have to be accompanied by infrastructure developments to link them to Linden and to the deep-water port at New Amsterdam.

The development potential for forestry will concentrate on currently leased areas with the potential for the conversion of some areas of low quality forest to plantation forests and the development of community forestry in Amerindian areas. There is also potential for the development of plantations on mined out land that could lead to the development of forest product based industries at hubs such as Linden, Bartica and Mabura Hill with linkages to ports for export.

Mining as a development option is likely to concentrate on bauxite in the south, from Bonasika up to Linden and east to Ituni and Kwakwani with gold and associated minerals concentrated in the west, centred at Mahdia. GoG is keen to promote multiple land use but the management of the competing land uses of forestry and mining is a major issue in the area that needs to be addressed.

Energy is another development option for the area with a number of potential HEP sites as well as the potential of alternative energy (wind, solar arrays, biofuels) being located on old mining land. The potential of cheap, reliable energy could lead to the development of Export Processing Zones at centres such as Linden (with its abundance of mined out land) using forest, mine and agricultural products to add value before export.

This should be integrated with the development of infrastructure with Linden and Bartica as important crossing points between an east-west route between Surinam and Venezuela and the Brazil-Georgetown route. The development of the intermediate savannas means that links between Linden and a port at New Amsterdam can be developed either directly from Linden to Rosignol or through Ituni and Kwakwani, and north to New Amsterdam on the east bank of the Berbice river. Other infrastructure developments include the upgrading of the Bartica-Potaro road and on to Mahdia and the completion of the Amaila Falls road.

Development options of secondary importance include protection, focusing on the Iwokrama Forest Reserve and the biodiversity reserves in TSAs; housing, particularly around Linden and Bartica, and tourism concentrated on Iwokrama with an increase in tourism numbers due to improved access.

4.4.3 **North Western Guyana Development Options**

The development options for North-western Guyana are shown in Table 4-6. This area comprises Region 1 away from the coastal plain and most of Region 7, and is very sparsely populated. The area is rolling to hilly with the more suitable soils at lower elevations. Most of the area is classed as poor agricultural land but there are appreciable area of Class I & II land, particularly in Region 1 surrounding Mathews Ridge and Port Kaituma, and in the Cuyuni, Puruni and middle Mazaruni valleys.

The land cover is almost exclusively mixed rainforest of high to medium high potential except for the far north west of the area where it is lower. The forests are mainly leased

under TSAs except in the east where smaller SFPs exist. The area is underlain by the greenstone formation with gold and associated minerals, diamonds and manganese deposits. As such, the area is a major prospecting and mining area with almost the whole area covered by prospecting leases, with mining leases concentrated around Matthews Ridge/Port Kaituma in Region 1, Olive Creek and Kurupung, and the lower Cuyuni and Mazaruni area in Region 7. In addition the Aurora gold mine on the Cuyuni is in the process of beginning operations.

The area does not have as great a potential for HEP development as other parts of Guyana but does include Eclipse Falls (4MW) on the Barima and Tibiku (40MW) on the Mazaruni as sites that have been studied to feasibility level. The area has relatively few Amerindian areas compared to the Pakaraima and Rupununi areas, and they are largely concentrated in Regions 1 and 2 at the border of the coastal plain. There are no Protected Areas apart from the biodiversity reserves within TSAs.

Table 4-6 North Western Guyana Development Options

North Western Guyana Development Options	Requirements and Comments
Primary	
Agriculture Scattered Class I&II land but mostly forested Historically an agricultural area, coffee, cocoa and citrus feasible	Rehabilitate previously used land before opening new land Policy decision regarding converting forests to agriculture Improve road access and access to markets Improve ports for export
Forestry Primarily TSAs in west, SFPs in east – mainly high medium to medium potential Potential for plantations on mined out land Potential for forest industry (eg around Matthews Ridge/Port Kaituma) with improved access to ports	Policy decision regarding converting forests to plantations Land Management decisions regarding forestry and mining
Mining Mainly gold etc and Manganese Aurora gold mine on Cuyuni	Land Management decisions regarding forestry and mining
Infrastructure New road from Bartica to Venezuela Road from Essequibo to Aurora Link to Matthews Ridge & Port Kaituma Spur to Venezuela Road to Olive Creek and Kurupung – link to Kamarang	
Secondary	
Livestock Potential on former mined out areas	Improve access to markets, roads and ports
Aquaculture Potential on former mined out areas	Improve access to markets, roads and ports
Protection Biodiversity reserves in TSAs	

Housing Port Kaituma/Matthews Ridge area becomes a hub – housing demand	Improve planning – no development on prime agricultural land or areas liable to flood Ensure drainage from housing developments
Industry Establish export processing zone at Port Kaituma/Matthews Ridge but limited by power constraint	Establish Eclipse Falls HEP
Tourism Increased numbers with improved access Develop eco-resorts close to roads and on rivers	

The main land issues revolve around access, the planning and management of forestry and mining, and which has precedence, the titling of Amerindian land and the identification of agricultural land for development. Other issues include the use of mined out land, the need for extension services for agriculture and of under-used land. Government policy regarding the area focuses agricultural development in Region 1, indicates that forestry will continue in currently leased areas with further developments in community forestry, plantations and in Amerindian areas, and that mining will move to a mine-based rather than land-based licensing system (ensuring smaller areas leased for mining) to promote multiple land use. Furthermore, infrastructure developments will be concentrated on ensuring that access roads developed by private-sector mining and forestry companies will be maintained to ensure access for all and that river access along the Essequibo will be upgraded.

Taking all this into account, the development options for the North-West Guyana area, as shown in Table 4-6, include the development of agriculture, forestry, mining and infrastructure as primary options, with livestock, aquaculture, protection, housing, industry and tourism as secondary options.

The development of agriculture should be centred on the large areas of Class I & II land around Matthews Ridge and Port Kaituma in Region 1, due to the area being a population centre as well as the fact that the area was an agricultural centre in the past. However, practically all of the suitable land is currently forested so a policy decision will have to be taken regarding the conversion of forestry to agriculture. In addition, access will have to be improved for export with the possible upgrading of ports in Region 1 and/or the improvement and maintenance of road access to the Essequibo River and beyond.

The development potential for forestry will concentrate on currently leased areas with the potential for the development of plantations on mined out areas and the development of community forestry in Amerindian areas. There is also potential for the development of forest product based industries at hubs such as Matthews Ridge/Port Kaituma, Aurora and Kurupung with linkages to ports for export.

Mining as a development option is likely to concentrate on manganese in Region 1, gold and associated minerals such as copper elsewhere, and diamonds to the west flanking the

Pakaraima Mountains. GoG is keen to promote multiple land use but the management of the competing land uses of forestry and mining is a major issue in the area that needs to be addressed.

The developments in forestry and mining should be integrated with the development of infrastructure centred on an east-west route between Surinam and Venezuela between Bartica in the east and Eteringbang in the west and on to San Martin in Venezuela. A spur could run north from this route to Aurora, Kokerite and Matthews Ridge extending to Mabaruma. Other roads will include the road to Aurora from the Essequibo River and from Bartica to Olive Creek and Kurupung that could extend to Kamarang and a trans-Pakaraima link. Other infrastructure developments could include the rehabilitation of port facilities at Port Kaituma, Mabaruma and Morawhanna to enable export directly.

Development options of secondary importance include livestock and aquaculture focusing on using mined out land, particularly in Region 1 which could be coupled to the development of housing and industry in an Export Processing Zone in the same area. This would need to be linked to a reliable energy supply that could come from local HEP development. Protection is largely confined to biodiversity reserves in TSA areas but ecotourism could be developed, particularly on rivers with good access. An increase in tourism numbers can be expected with improved access.

4.4.4 Pakaraima Mountains Development Options

The development options for the Pakaraima Mountains are shown in Table 4-7. This area is hilly and mountainous and forms Guyana's western boundary with Venezuela and Brazil and comprises parts of Regions 7, 8 and 9. It is sparsely populated with many Amerindian areas. Most of the area is classed as non-agricultural land due to its topography but there are some areas of Class III poor agricultural land as well as very small non-mappable pockets of suitable soils.

The land cover is mainly montane forest with some areas of shrub savanna in the south. The forest is largely outside the State Forest Estate with the exception of a small area just north of Iwokrama. The area is renowned for diamonds, with gold and associated minerals on the lower slopes in the east. Mineral prospecting leases are largely confined to the north and eastern boundary of the area with scattered claims in the south. Mining leases are fewer and are concentrated south-east of Kamarang and west of Mahdia on the footslopes.

The area has huge potential for HEP development with around thirty (30) potential sites of which Amaila Falls (165MW) and Kato (0.3MW) are nearing being built and Sand Landing (650MW) on the Mazaruni has been studied to feasibility stage. The area has many Amerindian areas and one Protected Area in Kaieteur Falls National Park.

Table 4-7 Pakaraima Mountains Development Options

Pakaraima Mountains Development Options	Requirements and Comments
Primary	
Protection Unique landscape High percentage of Amerindian land Kaieteur PA	Available land for development will need protection Possible conflict with mining, road and HEP development
Energy Amaila Falls (165MW) nearing construction Kato (0.3MW) designed Potential for large HEP (650MW) at Sand Landing Many other potential sites	Securing funding and political will for development Access to sites
Infrastructure Upgrade road in south from Karasabai to Kopineng Link road in north from Kopineng to Venezuela border at Eteringbang Link from Kamarang to Kurupung	
Tourism Promote low impact ecotourism (walking etc) staying at Amerindian villages	Develop road infrastructure
Secondary	
Agriculture Mainly Poor or Non-agricultural land but pockets of good soil Potential for different crops due to cooler climate	Improve road access and access to markets Extension advice from NAREI
Livestock Potential for free-range grazing in cooler climate	Improve access to markets and roads Extension advice from NAREI
Mining Mainly small-scale gold and diamond mining	

The main land issues revolve around access, the titling and protection of Amerindian land and land management issues concerning Amerindian land and mining. Other issues include the need for extension services for agriculture and the lottery system for mineral prospecting rights. Government policy regarding the area focuses on securing Amerindian land rights, developing community forestry and that mining will move to a mine-based rather than land-based licensing system (ensuring smaller areas leased for mining) to promote multiple land use. Furthermore, infrastructure developments will be concentrated on ensuring that access roads developed by private-sector mining and forestry companies will be maintained to ensure access for all.

Taking all this into account, the development options for the North-west Guyana area, as shown in Table 4-7, include the development of protection, energy, infrastructure and tourism as primary options with agriculture, livestock and mining as secondary options.

Protection of the area should concentrate on the area's unique landscape and role in protecting the headwaters of several rivers that flow into the Mazaruni. The relatively high percentage of Amerindian areas should ensure this but there is the potential for conflict with other development options such as HEP and further prospecting and mining that may occur following infrastructure development.

The area has huge potential for the development of hydropower with both the nationally important Amaila Falls scheme and the locally important micro-hydro scheme at Kato nearing construction. In addition, an internationally important scheme such as Sand Landing and others on the Mazaruni River could transform Guyana's energy sector and economic base. These developments will have to be sensitive to their environment and will require extensive impact assessments before commissioning.

In the shorter term, the development of infrastructure to link Pakaraima communities to the rest of Guyana and its neighbours should be promoted. The development of the Linden-Lethem road will encourage travel into the southern Pakaraimas where the road has recently been rehabilitated. In the longer term, the development of a road north through the area to join with the Venezuela-Surinam road can be envisaged. This could link with the road to Kurupung from Kamarang giving easier access to Bartica and coastal Guyana.

Coupled to improved access, low-impact eco-tourism can be promoted with activities such as walking between Amerindian communities in hilly and mountainous areas.

Development options of secondary importance include agriculture, livestock and mining. Agriculture could be focussed on high-value 'different' crops such as potatoes and carrots that would be suitable in the cooler climate. The development of reliable access routes will be paramount to the success of this option. Similarly, livestock could be promoted in a cooler environment. The development option of mining is likely to focus on diamonds and gold, and it is thought that these minerals could be abundant in placer deposits in the foothills. Access improvements will encourage the exploitation of these deposits

4.4.5 Rupununi Savannas and SW Guyana Development Options

The development options for the Rupununi Savannas and SW Guyana are shown in Table 4-8. This area, the western part of Region 9, includes the Rupununi savannas, the Kanuku Mountains in the centre and the Açarai Mountains in the south, and forms the western and southern border with Brazil. It is sparsely populated with many Amerindian areas. Most of the area is classed as poor agricultural land (Class III) or non-agricultural land (Class IV), although there are a few pockets of good agricultural land (Class I&II) on the footslopes of the Kanuku Mountains.

The land cover is shrub savanna and flooded grassland on the savannas with montane and mixed forest to the east and south. The forest is largely outside the State Forest Estate with the exception of forests south of the southern savannas but north of Konashen Amerindian Community Owned Conservation Area. The forests are classed as very low to low monetary value although their ecological value is high. There are only very few small forestry leases east of Annai in the north.

The mineral resources of the area comprise oil in the Kanuku Basin in the north, gold at Marudi Mountain and other locations in the south and scattered other minerals, mainly in the southern savannas. Prospecting is confined to a large petroleum exploration lease in the north and smaller mineral leases in the south centred on Marudi Mountain. The only mining permits are also located around Marudi in the south.

Table 4-8 Rupununi Savannas and SW Guyana Development Options

Rupununi Savannas and SW Guyana Development Options	Requirements and Comments
Primary	
Agriculture Mainly poor agricultural land (some fertilisation possibility) Potential for large-scale agriculture	Land will require lime, fertiliser and organic matter to become economically productive Need NAREI extension services Improve road access and access to markets Potential conflict with Amerindian areas and other land uses
Livestock Intensification of current extensive grazing regime could increase head and yield	Clarify land tenure situation Improve access to markets and roads Extension advice from NAREI Potential conflict with Amerindian areas and other land uses
Protection Unique landscape, high biodiversity, wetlands Kanuku Mts. & Konashen PA High percentage of Amerindian land	Amerindian land extensions will reduce state land to practically zero Proposed RAMSAR wetland PA in N Rupununi No State Forests Potential conflict with Amerindian areas and other land uses (particularly oil)
Tourism Promote low impact ecotourism staying	Develop road infrastructure

at Ranches and Amerindian villages	Dependent on protection over development
Secondary	
Forestry Community forestry development Potential for plantation forestry Link to forest industries	Develop forest industry centre at Annai Improve access to markets
Mining Oil reserves in N Rupununi Gold mining in S Rupununi Sand and laterite for road building	Oil - potential conflict with Amerindian and protection land uses
Housing Rapid development of Lethem as commercial centre increased housing demand	Identify potential housing land away from flooding Power requirement
Industry Lethem is commercial centre Establish industrial zone, agro-industries from livestock and agriculture development Forest industry centre at Annai	Need to rehabilitate Moco-Moco HEP and/or develop others (Wamakaru now in PA) or receive power on grid from Amaila Falls
Energy Moco-Moco HEP defunct since 2002 Other potential small-scale HEPs (Cozier, Kumu, Maparri) Wamakarru HEP in Kanuku Mts. PA	Need to rehabilitate Moco-Moco HEP and/or develop others (Wamakaru now in PA) or receive power on grid from Amaila Falls
Infrastructure Completion of Lethem-Linden road Improved access to southern savannas	Ensure road design allows flow of water to and from northern savannas

The area has a little potential for HEP development with five sites identified on the northern flanks of the Kanuku Mountains including the rehabilitation of Moco-Moco. The sites are all small scale ranging from 0.1 to 4MW. There are two Protected Area in the area; Kanuku Mountains and Konashen Amerindian Community Owned Conservation Area.

The main land issues revolve around the titling and protection of Amerindian land and land management issues concerning Amerindian land agriculture, livestock, forestry and mining. Other issues include the need for extension services for agriculture development, the beneficial occupation of ranchland and cattle rustling. Government policy regarding the area

focuses on securing Amerindian land rights, developing the savanna (as non-forested land) for agriculture, livestock and other uses, developing community forestry, and that mining will move to a mine-based rather than land-based licensing system (ensuring smaller areas leased for mining) to promote multiple land use.

Taking all this into account, the development options for the Rupununi Savannas and South - West Guyana, as shown in Table 4-8, include the development of agriculture, livestock, protection and tourism as primary options with forestry, mining, housing, industry, infrastructure and energy as secondary options.

The development of agriculture can only realistically be in large-scale, mechanised agriculture given the huge investments in lime, fertilizer, land preparation and management that would be necessary. There are examples given in the Region 9, Sub-Region 1 Land Use Plan of similar agricultural developments in the savanna areas of Colombia, Venezuela and Brazil that have been developed using cereal crops initially (often rice in Brazil) in order to improve the topsoil structure, and then forage crops/grasses after two (2) to three (3) years as cereal yields decline. The conversion to livestock for a number of years then builds up the soil organic matter content after which the land can revert to cereal production if required.

EMBRAPA (the Brazilian Extension service) recommends liming at 2t/ha and the addition of Mg and P and possibly K, Zn and B depending on soil conditions. They also recommend a permanent soil cover, minimum tillage and crop rotations with legumes and forage crops. The Region 9, Sub-Region 1 Land Use Plan showed that there were 6,365ha of Class I&II non-forested State Land available with a further 8,500ha of non-forested land in Amerindian areas. The plan also showed that there were larger areas of non-forested Class IIIf land available (60,000ha in Amerindian areas, 121,000ha on State Land) but that limitations of flooding, topography and shallow soils precluded arable cropping which was only recommended where fertility was the main limitation.

The development of large-scale mechanised agriculture will be dependent on huge investments, not only on-farm but also in access roads and access to markets. The potential conflict with other land users such as livestock and Amerindian lands will need careful management.

The development of livestock has huge potential with the Region 9, Sub-Region 1 Land Use Plan indicating that stocking rates could rise from the current rate of 1 animal unit (400kg of animal = 1 cow or 8 sheep/goats) per 61ha to 0.8-1.1 AU/ha with improved pasture that could see a rise in the cattle population to 1.36 million, or to 780,000 on land with grazing leases. Improved pasture can be developed on most Class IIIf land (as well as Class I&II land) and even some Class III land although the flooding limitation in the northern Rupununi will be a major limitation. As with agricultural development, the development of livestock will require improved road access, access to markets and the establishment of an abattoir at Lethem.

Protection of the area should concentrate on the savanna's unique landscape, particularly the wetlands of the northern Rupununi, the Kanuku Mountains and the Açarai Mountains in the south comprising the Konashen Amerindian Community Owned Conservation Area. There are plans to declare the whole of the northern Rupununi a wetland protected area but obtaining RAMSAR certification will not be possible until Guyana ratifies the RAMSAR convention. The development of the Lethem-Linden road should take the particular situation of the northern Rupununi into consideration and not act as a barrier to the flow of water into and out of the area. Protection of the savannas competes directly with the potential for agriculture or livestock development and, to a lesser extent, with the development of the oil resource meaning that decisions will have to be taken on the preferred option(s).

The development of tourism is likely to be, as at present, in the eco-tourism market drawing on the region's ecological value and incorporating elements of landscape, uniqueness, difference from the rest of Guyana and its Amerindian heritage. The development of tourism is somewhat dependent on protection over development although it would be possible to have both. The completion of the Takutu bridge has already increased tourism numbers from Brazil and the completion of the Lethem-Linden road, particularly if coupled with improved access to the Pakaraima Mountains, can be expected to drive an increase in tourist numbers. With improved road access tourism is still likely to be concentrated in the northern Savannas there being very few facilities in the Kanuku Mountains or southern savannas.

Development options of secondary importance include forestry, mining, housing, industry and energy. Forestry relates to plantation forestry with a reported growing interest in growing trees as a crop, particularly in making beneficial use of infertile savannah lands. The Region 9 , Sub-Region 1 Land Use Plan reported that GFC had been asked by Amerindian communities to investigate the potential for plantation forestry with particular emphasis on using the savannah lands with potential species of Eucalyptus, Teak and several species of Acacia for wood pulp. There are plantations of Acacia mangium around Boa Vista in Brazil where they were planted in anticipation of a pulp plant and paper industry. In addition, Amerindian communities are looking to replant local wetland trees such as Kimbe, Ite, and Toro to get Non-Timber Forest Products (NTFPs) from areas now depleted.

Mining as a secondary activity relates more to gold mining around Marudi and Vanessa Mine in the south rather than the development of oil in the Kanuku basin. This would be a development of national importance but the field may be too small to develop with an estimated mean recoverable prospective resource of 128 million barrels of oil but requiring 250 million barrels to make the field viable.

The developments of housing and industry centre on Lethem and, to a lesser extent, Annai. Any developments in agriculture or livestock will lead to the development of agro-industries in Lethem. The town is already growing with new housing and commercial developments and more can be expected with improved access. There is a growing need for Lethem to be declared a municipality to be responsible for planning its own future.

As the Region 9, Sub-Region 1 Land Use Plan pointed out the need to add value close to raw material production could lead to the development of small-scale agri-processing industries such as peanut and peanut butter, cashew, brazil nut, fruit canning and drying and an increase in livestock rearing will require at least an upgraded abattoir at Lethem if not further abattoirs in the northern and southern savannas and possibly a canning factory. There is also potential for a paper and packaging industry using plantation forestry in the future.

Coupled with these industrial developments will need to be the provision of secure energy, either through the development of local small-scale hydropower or by linking Lethem and southwest Guyana to the national grid with power from Amaila Falls and others that may be developed in the future. Infrastructure developments are primarily the completion

4.4.6 South Eastern Forests Development Options

The development options for the South Eastern Forests are shown in Table 4-9. This area is characterised by its totally untouched forest cover, a dissected topography and extreme remoteness with practically no access. It forms Guyana's southern boundary with Brazil and eastern boundary with Surinam and comprises the headwaters of the Corentyne, Berbice and Essequibo rivers.

The area is barely populated, with a single Amerindian area, Apoteri, in the north-west although the Wai Wai people are said to migrate through the south from the southern Rupununi at certain times of the year. Most of the area is classed as Class III poor agricultural land due to topography and low fertility.

The land cover is exclusively forest, mainly hilly with montane forest in the south and seasonal forest in the north. The forest is flooded in the south and is of very low to low value rising to medium value in the north where there are four (4) SFEPs due to be converted to TSAs for low impact timber production (2-3 trees/ha) with a processing plant at Annai. The Conservation International TSA on the Essequibo River in the north of the area is maintained for research and conservation rather than production and as such can be considered a protected area rather than a forest resource.

The area has practically no known mineral resources largely due to the lack of a mineral resource survey. The situation should become clearer in the future with a geophysical and geological survey due to take place in 2013 with a particular emphasis on rare earth elements. There are only a few scattered prospecting claims in the south of the area but applications have been made for medium-scale prospecting leases in the New River Triangle. The potential for HEP development is limited with a few sites identified on the Essequibo, Corentyne and New rivers but none have been studied even to pre-feasibility level.

Table 4-9 SE Forests Development Options

SE Forests Development Options	Requirements and Comments
Primary	
Protection Pristine forest Headwaters of many major rivers Low value forest and hilly terrain Conservation International TSA is for conservation rather than production	Potential for declaration of Protected Area to attain target of 17% of country
Secondary	
Forestry Mainly low to low-medium potential Low impact forestry proposed in current SFEPs in north	
Tourism Promote low impact ecotourism from Apoteri and Konashen Amerindian villages	

The main land issues are largely unknown since there is no population in the area and there are no policies specific to the area. The development options for the SE Forests are as shown in Table 4-9 with protection as the primary option and forestry and tourism as secondary options.

Protection is seen as the main option since the area is one of pristine forest cover of low monetary value but high ecological value in a dissected topography and is the headwaters of several major rivers. In order to ensure protection the GoG could classify some of the area as a PA which would also enable it to reach its target of 17% of Guyana under some form of protection.

Secondary development options include low impact forestry in the north and low impact eco-tourism throughout.

5 NATIONAL LAND USE POLICY

6 CONCLUSIONS AND RECOMMENDATIONS

The NLUP has been compiled from a number of sources. These have included the collection of relevant data and information at the national level, the collection of relevant policy and strategy documents and an assessment of issues concerning land use both by institutions at national level and stakeholders (land users) at regional level. Following data and information collection, an assessment of opportunities and constraints by sector was undertaken followed by the mapping of potential and available land, and the delineation of development options for different parts of the country while highlighting hotspots and linkages.

The NLUP is presented as a full report with many printed maps. A shorter synthesis report supported by maps of potential, development options, hotspots and linkages has also been produced. The original digital data and derived maps used in planning are held at GL&SC and could be used to derive supplemental data in the future.

The NLUP output is a framework for the development of Guyana. As such, it presents a series of development options for different parts of the country. It also highlights 'hotspot' areas where development could be concentrated and the linkages that will be needed to drive development in the country as a whole.

Since the main output of the NLUP is a series of suitable options, it raises questions that GoG will have to consider rather than provide answers. This section of the report presents the main findings followed by recommendations and policy questions to be considered.

6.1 Main Findings

- **Land Use -** Natural vegetation accounts for 98% of Guyana. Human influenced land use covers only 1.7%. Forests cover 88% with deforestation at 0.02 to 0.06% a year (3,800-10,000ha/y), main driver is mining (60-90%). Forest degradation is 5,500ha/y. Only 200-500ha/y converted to agriculture.
- **Land Tenure** - Amerindian Areas 15%, Protected Areas 8%, GFC Forestry leases 33%, GGMC Prospecting leases 19% (67% in GFC area), Mining leases 2% (95% in GFC area), GL&SC leases 1.8%. Overlap of GFC and GGMC leases in NW and centre of country.
- **Available Land** - 37-42% of country still 'available' (excluding or including Prospecting leases) mainly in coastal backlands, intermediate savannas, Pakaraima Mountains, Rupununi savannas and SE Guyana. Of available land, 88% is forested, 12% non-forested but only 6-8% good agricultural land (Class I&II).
- **Population & Poverty** - Population concentrated on coastal plain (88%), slight decrease 1980-2002 but large increase inland. Very low population density (mean 3.5/km2, range 0.3 (Region 9) to 139 (Region 4)). Poverty greatest in Regions 1, 8 & 9; lowest in Regions 4, 6 & 10. Increase in land pressure on coastal plain.
- **GDP Contribution** – In terms of GDP/ha both mining (G$132,550) and arable agriculture (G$ 127,140) are a far more profitable use of land than forestry (G$2,233) although this does not take REDD+ payments or forests' ecological value into account
- **Potential**
  - **Agriculture** - Class I&II land (good agricultural land) 3.3m ha located on coast but also large areas inland in Regions 1, 6, 7 and 10. Most (79%) forested but 21% non-forested land.

- **Livestock** - Non-forested areas 2.2m ha only in coastal plain, intermediate and Rupununi savannas. Potential for improved pasture could increase stocking rates up to 60 times.

- **Aquaculture -** Mainly on coastal plain, conversion of abandoned land to aquaculture but also in old mine workings inland.

- **Forestry -** High potential, concentrated in areas with current GFC leases (6.9m ha) (area has high standing value) NW & central Guyana. Current areas assessed as being able to produce 1.5m^3 of timber a year sustainably but historic and current production rates only 0.5m^3/y therefore potential to increase production in these areas. Conversion of SFEPs to TSAs but low impact. Potential for plantation forestry largely unexplored.

- **Mining -** High potential, overlap with forestry potential area plus Pakaraima Mountains. High price of gold driving expansion with renewed interest in Magnesium, Bauxite, Uranium and Copper. Current Prospecting area 3.9m ha, Mining 0.4m ha and onshore oil prospecting 2.6m ha.

- **Energy -** High potential for hydropower and biomass, moderate for wind, solar and biofuels. Many (67) potential HEP sites with 17 studied to feasibility level, Total potential 4.49GW, 'most promising' 3.18GW. Amaila Falls (starting construction) will satisfy current demand (165MW). High potential for power export.

- **Protection -** High potential due to large area of forest cover (18.6m ha) of which 5.5m ha intact and 10.1m ha largely intact. Deforestation rate very low at 0.02% of SFE/y. Legally protected areas 1.7m ha, potential for declaring SE forests as protected area.

- **Infrastructure -** High potential to provide linkages between other sectoral developments (e.g. Linden-Lethem road, Venezuela-Surinam road, deep-water port) and to intensify existing developments (e.g. improving D&I on coastal plain). Also potential to improve and maintain existing infrastructure to open up new areas e.g. roads to Aurora, Amaila Falls, Kurupung.

- **Industry, Housing, Commerce** - High potential but depend on developments in other sectors.

- **Constraints -** Similar across sectors: primarily access, land availability, conflict with competing land uses, access to markets (coupled with low number of beneficiaries making unit costs high, necessity of exporting), power, cost of development, policy (e.g. LCDS reduces agriculture potential), natural resources (soil resources, nature of forests), security (livestock & aquaculture) and low infrastructure investment (e.g. D&I on coastal plain).

- **Land Use Issues** (from Regional Stakeholder Consultations) - poor planning and co-ordination, use of reserved land, beneficial occupation and unused land, need for extension, improvement of land administration, Amerindian land, need for zoning, rehabilitation of D&I.

6.2 Recommendations and Policy Considerations

The main recommendations and policy questions that GoG will have to consider are set out below:

Protection and Development

Most of Guyana's land is forested, providing ecosystem services and high biodiversity and the LCDS aims to keep it that way. Plans for the development of agriculture, livestock and biofuels target non-forested land such as the coastal backlands and intermediate savannas.

However, there are large areas of available, forested, good agricultural land that, due to the LCDS, cannot currently be developed. While this may not be an issue at present, it may well become an issue in the future and GoG should be aware that this resource exists and could form the basis for development in some inland areas.

Table 6-1 below shows the relative contributions of the three main sectors of Guyana's economy to GDP in terms of area covered and production. Forestry has been included as production forests and the whole forestry area including REDD+ payments.

Table 6-1 Sector contributions to GDP (2010)

Contribution to GDP (2010)	Area (ha)	%	GDP (mG$)	%	GDP(G $) /ha
Forestry (TSA,WCL,SFP)	5,808,563	27.5	12,973	3.3	2,233
Forests (including REDD)	15,504,000	73.3	27,973	7.1	1,804
Forestry (including value added)	5,808,563	27.5	67,002	17.0	11,535
Mining (Mining Leases)	466,568	2.2	61,842	15.7	132,547
Agriculture (crops) (Land Use Mapping)	318,000	1.5	40,430	10.3	127,138
Guyana	**21,153,400**		**394,130**		

Source: BoS, GFC, GGMC, DLUPP

It can be seen that forestry (in terms of productive forest leases) covers a large area in comparison to both mining and arable agriculture. However, the contribution of mining and agriculture to GDP is some 4 to 5 times greater but 50 to 60 times greater per hectare. When REDD+ payments of US$75m/y (G$15,000m/y) are included for the whole forest area included under the REDD+ agreement then the contribution of forests to the GDP doubles but drops slightly per unit area.

This figures used in Table 6-1 are crude (not all GFC leases produce lumber, the area of actual mining is much less than the mining lease area, not all land mapped as agricultural land is used and a REDD+ payment was not included in GDP 2010). However, they do illustrate an important point; mining and agriculture are currently a far more profitable use of land than forestry or conservation.

However the profitable use of land is not the only measure that guides land use. As GFC have pointed out, the amount of value added by the manufacturing of forest products (i.e.

timber) raises the contribution of forests to about 17% of GDP thus giving a GDP/ha figure of G$11,500 as well as providing employment to thousands.

Also, as noted in the LCDS, the future value of Guyana's forest is possibly even more important than the present value. McKinsey, in Appendices II and III of the LCDS, valued Guyana's forests at US$40b/y against a valuation of US$4.3b to US$23.4b (most likely value US$580m/y) for 'rational deforestation', a figure that includes the value of timber and the exploitation of mineral resources and agricultural development of suitable land. The value of US$40b/ha/y values Guyana's State Forest Estate at US$2,580/ha or G$516,000/ha essentially making the ecological services of the forests four times more valuable than mining or agriculture and 286 times more valuable than they are currently valued.

However, the current valuations of mining and agriculture against forests do not mean that large areas of Guyana's forests need to be turned over to mining or agriculture. In fact, since mining and agriculture are so much more productive it means that only small areas of land need to be used for mining or agriculture and that GoG can promote and manage any future developments by providing access to targeted high potential areas.

At present, it appears to be perfectly feasible that Guyana can develop while protecting large areas of the country through intensifying agriculture on the coastal plain and non-forested lands inland, developing a deep-water port and a road to Brazil thus acting as an entrepot for northern Brazil, and developing hydropower sites with the aim of exporting power. Unemployment could be checked by the development of Export Processing Zones using raw materials from agriculture, mining and forestry and power from new hydropower sites. New roads could then link these zones to export points.

Intensification on Coastal Plain or Move Inland

The threat of climate change and sea level rise, coupled with the high cost of sea defences and coastal plain D&I infrastructure has heightened attention to alternatives to development on the coastal plain. The NLUP has highlighted a number of 'hotspot' areas inland that have high potential for development and has proposed linkages between them and other developments. Government policy is to direct new developments inland while safeguarding and optimizing developments on the coast. The NLUP will play an important role in such decisions.

Infrastructure Investments

As outlined above, GoG can pursue its goals of both protection and development by investing in infrastructure to promote different sectoral developments in different areas. The development of roads, a deep-water port and hydropower sites will enhance development options and provide linkages to hotspot areas.

Institutional Co-ordination

The need for better co-ordination and planning has been borne out by the number of comments regarding this issue at both institutional and regional stakeholder consultations. The establishment of the Ministry of Natural Resources & the Environment (MNRE) may address the issue but it is imperative that better co-ordination between mining, forestry, agriculture and infrastructure is achieved. This needs to be coupled with improved land resources management as set out below.

Management of Multiple Resources

It is a policy to promote multiple land use but the conflict between competing land uses remains problematic. The majority of mineral resources (particularly gold) and areas of high forestry potential occupy the same area of land stretching from Region 1 in the NW through Region 7 to parts of Regions 10, 8 and 6. Two thirds (67%) of prospecting leases and nearly all (95%) mining leases overlap forestry leases. There are also appreciable areas of forested Class I&II agricultural land in these areas.

The recommendations of the Special Land Use Committee, particularly in the sequencing of mining and forestry, and modalities for the joint use of roads, should be formalized and be implemented.

With improved communications and GIS it should be possible for GFC and GGMC at least (GL&SC does not have all lease data digitally mapped) to share data frequently.

A national land use policy can potentially provide guidance as to which land use has priority and how development should be managed.

A MNRE's cross-sectoral strategy can clarify land use priorities, and multiple land use modalities.

One option that may be considered for the forestry/mining issue is to divide the country by grid and issuing both prospecting/mining and forestry leases on a rotating block basis such that forestry could remove suitable trees from a block before mining can commence. Once mining has finished then forestry could return to the block to harvest trees that have grown in the intervening period.

A means by which prospecting (and follow-up mining) could be concentrated in particular areas would be a more comprehensive mineral resources survey. Prospecting and mining could then be concentrated in smaller blocks with highest potential leaving forestry to concentrate on areas of lower mineral potential.

Another means by which mining and forestry could be better managed is through higher recovery rates, particularly of gold.

If coupled with the block approach then small and medium-scale gold mining could be concentrated in smaller areas for a longer period of time but quite possibly produce more gold and reduce the areas of environmental degradation. Following completion of an area, it could be either rehabilitated or converted to another land use.

Forestry and Agriculture

The NLUP has shown that there are large areas of Class I&II land, suitable for agriculture currently under forest. A policy decision is needed as to whether some of this land should be converted to agriculture. An assessment of forest value (both economic and ecological) should be made to aid decision-makers.

Some forests, particularly on the white sand plateau are of low value and potential, and could be converted to plantation forest, biofuel plantations or livestock feed farms although a high level of management will be vital. A decision will need to be made whether to classify more forest as conversion forest to promote these kinds of development.

Agriculture and Mining

To date there has been little conflict between agriculture and mining with agriculture concentrated on the coastal plain and mining inland; the only conflict area has been between sand quarries and agriculture on the Soesdyke-Linden Highway.

The bauxite belt is an area where planned land management will be needed. East and south of Ituni the bauxite belt also has highly suitable soils for agriculture. Assuming that good soils on savannah lands will be used for agriculture and bauxite areas with poor soils to the east of the Essequibo River to Linden can be earmarked for bauxite development, a decision will need to be taken regarding the use of lands east of Kwakwani to the Corentyne River that are in the bauxite belt, are Class I&II agricultural land and are forested.

Future planning though should be mindful that highly suitable agricultural land occurs in areas with a high mineral potential, and that most agriculture is not possible after mining since the topsoil is stripped. Measures such as restoration plans and restoration bonds need to be formalized and be implemented.

Land Use Planning, Beneficial Occupation and Available Land

Although Guyana is relatively advanced in land use planning within the Caricom region, it still has much to do in terms of completing its regional and municipal plans, a national policy and implementation. The issue of beneficial occupation of leased land needs to be addressed as does the issue of non-or under-use of private land. The issue of abandoned and otherwise idle land needs to be recognized, identified and addressed to ensure optimal land utilization and benefits.A map and database of occupied/available land needs to be developed to facilitate efficient and transparent application processing and to attract investors. In the regard, the rehabilitation of D&I in affected areas can be a useful approach.

The recent acquisition of high resolution satellite imagery covering the coastal plain presents an opportunity to map land use on the coastal plain, identify which areas have a high proportion of abandoned or unused land, assess the reasons for abandonment and suggest means to bring it back into production or highlight areas for conversion to other land uses. It will also enable GL&SC to identify areas of under-used leased land enabling repossession and reallocation to people who will use the land productively.

Coupled to the identification of abandoned and un-used land is the use of reserved land that was a priority issue raised in many regional stakeholder discussions. If suitable unused land can be found, the land could be allocated.

Land Rent to Market Rates

State Land agricultural rents are currently 8 to 13 times less than what prevails in the market, judging from actual subleasing rates. Most stakeholders have indicated that if adequate D&I is provided, they would be willing to pay a higher rent that the current rate. Considering the current and persistent revenue shortfall at the GLSC and its dependency on Government subvention, a review of the current rent rate can be considered. Such a move can also have the effect of encouraging more efficient and more beneficial use of agricultural land.

Decentralisation of Decision-making

Another major issue raised in stakeholder discussions is that land use decisions are often taken at a higher level rather than at a local level and that subsequently inappropriate land uses are located at inappropriate locations. Examples include housing on good agricultural land or in areas that flood regularly.

Decisions concerning land use should conform to a process that includes local inputs. Large scale and strategic decisions must be decided at a central level since the State is the owner, controller and final arbiter of the land.

Use of Mined Out Land

The past few years have seen an explosion in mining in inland Guyana, the vast majority by small and medium scale miners. This has led to some 2,300ha of deforestation annually (GFC MRVS data), a lot of which is concentrated in a few areas in Regions 1, 7, 8 and 10. With a relatively high influx of population, there is an opportunity to develop these areas by promoting land use change of mined out land to other suitable land uses such as agriculture, concentrating on tree crops (since topsoil may be at a premium), livestock and aquaculture. This will require investments by GoG in infrastructure and housing but would help to promote hinterland development while reducing pressure on the coastal plain.As suggested above, mined out land could also be used as gold recovery centres in gold mining areas.

Land Administration and Extension Services

The need to improve land administration services and to increase the reach of extension services was highlighted as an issue in almost all regional stakeholder discussions. DLUPP is in the process of overseeing institutional reform at GL&SC with the aim of improving land administration services. If coupled with improved land information, then the identification of available land and the lease transfer process could be speeded up to improve the situation.

The need for greater agricultural extension reach was highlighted almost everywhere and points to a need for NAREI to assess what is required and plan a public information campaign accordingly.

Development of Hydropower

Guyana has huge hydropower potential and could supply demand for power from Brazil and Venezuela. A total of sixty-seven (67) sites have been identified and nineteen (19) sites with a combined capacity of 3.1GW (about 20 times Guyana's current demand) have been studied to at least pre-feasibility level. A strategic assessment of these sites should be undertaken to prioritise them for development taking cost and environmental impact into account.

Integrated Land Use Planning and a National Land Use Policy

There is a critical need for a national land use policy. Baseline work was initiated since 1996 and drafts were produced subsequently. The NLUP can be the catalyst to speed up the finalization of such a policy, which can be coupled with this NLUP. A NLUP and national land use policy can then provide the framework for integrated land use planning in Guyana.

Next Steps, Actions and Decisions

Table 6-3 below sets out the next steps that will be needed to implement the NLUP. This includes policy development, additional data collection, decisions to be made and procedures to be strengthened. The table indicates which agencies should lead each step, the links to other steps, the means by which the steps may be achieved and, if possible, an outline timeframe for achievement.

Table 6-3 National Land Use Plan - Next Steps/Actions/Decisions

Category	Description	Main Agency(ies)
POLICY		
Energy	Need for energy policy to set out future direction for energy development in Guyana. Of particular importance is the potential for hydropower development and the potential for Guyana to earn revenue from exporting power.	GEA
Land	Need for land use and/or land policy including land administration and land management..	MoNRE, GLSC
DATA NEEDS		
Mineral survey	Need for systematic, nationwide mineral resources survey(s) to enable targeting of prospecting and mining to most suitable areas. This will enable policy decisions regarding land use priorities and management to be undertaken.	GGMC MONRE
Biodiversity assessment	An assessment of biodiversity and/or of ecological function will enable areas of particularly high biodiversity or critical ecological function to be identified. This will also enable policy decisions regarding land use priorities and management to be undertaken.	PAC, GFC
Soil survey	More detailed soil survey may be needed in areas of high agricultural potential (Class I&II land) due to the small-scale mapping (1:500,000) available and inherent soil variability.	NAREI
DECISIONS		
Land Use Priorities	GoG needs to decide land use priorities between resource utilization and protection in some areas; and between agricultural and non-agricultural uses in areas of Class I&II soils.	GoG, MoNRE
Multiple Resource Management	GoG needs to address issue of competing and conflicting land uses and propose and implement	GoG, MoNRE

	land management solutions..	
PROCEDURE		
Institutional Co-ordination	Need for better institutional co-ordination particularly in relation to land use planning and management	GoG, MoNRE
Land Use Planning	Need to develop land use planning procedures in the long term, including forward planning and development controls.	GoG, MoNRE, GLSC, CH&PA, MoLG
Land Administration	Need to improve land administration procedures to speed up process, increase transparency and improve access to land. Link to use of high-resolution imagery to improve land use monitoring, map actual land use and improve enforcement of lease conditions.	GLSC
Beneficial Occupation	Coupled with above, the need to enforce lease conditions to make more beneficially occupied. The level of land rents should be reviewed.	GLSC, MoNRE
OTHER		
Use of Land Use Planning in GLSC data	GLSC has collated and mapped a large amount of data. GLSC could make the thematic base maps available to all regions to inform their planning.	GLSC
Use High-resolution Imagery	DLUPP has acquired high-resolution satellite imagery for much of the north of Guyana. This imagery could form the basis for improving the land administration system by improved land use mapping and monitoring leading to improved enforcement of lease conditions. The imagery could also be used in urban planning and image maps could be made available to relevant authorities such as municipalities and regional councils.	MoNRE, GLSC, CH&PA
Agricultural Extension	Regional consultations have indicated a need for greateragricultural extension, particularly related to the development of rainfed farming as opposed to irrigated agriculture.	MoA, NAREI

Note on Implementation and Monitoring of the National Land Use Plan

Planning normally involves four essential considerations – an assessment of the current situation (A), a decision on a desired future state (B), the means of getting from A to B (Implementation), and monitoring and evaluation of progress). The current version of the NLUP of Guyana fully describes the current situation, to the degree possible with available data.

However, there is a lack of clarity over the desired future state, which is normally defined by published government policies; the Next Steps identify key areas of policy development which would assist in defining the desired future state.

Given this uncertainty, the NLUP avoids any attempt at prescription. Land use recommendations are not made; rather the Plan provides land use options for different parts of the country. In this way, the Plan makes a major contribution to the decision process of a desired future state, which is intimately linked to the development directions adopted. However, in the absence of a defined desired future state, it is neither possible to address implementation to reach that state, nor undertake monitoring and evaluation of the implementation.

Despite the above, some future objectives are known or can be surmised, and can be considered here in terms of implementation and/or use of the NLUP.

1. Responsibility for Land Use Planning

A first and immediate task in Plan implementation and monitoring is to clarify responsibility for land use planning, including implementation and monitoring. Currently, there is a lack of clarity at legislative and institutional levels. However, from a practical perspective, responsibility rests with the Land Use Policy and Planning section at the GL&SC, except for urban planning which rests with the CH&PA.

If the GL&SC is to effectively deliver on this responsibility, then the Land Use Section needs to be properly staffed and supported (resourced), and a planning system established. The Institutional work being undertaken by the DLUPP will propose staffing levels for the Land Use Section, which can be acted on within the next few months. Development of a proper planning system will take longer; however, as discussed below, this is a requirement of REDD+.

2. Maintaining and improving the NLUP

The NLUP has used existing data to describe the current situation and analyse options; there was little primary data collection beyond stakeholder consultations. Much of the existing data is limited by scale and age; key areas for primary data collection are identified above under **N**ext Steps.

It would be reasonable to revisit the NLUP in five years. Therefore a programme should be developed to achieve the Next Steps (especially Policy, Data Needs, and Decisions) over the next five years. This is an achievable target. Once the timetable is set, it can be easily monitored.

3. Publicising the NLUP

Value from the NLUP will come from its use; this can only happen if people know about it, and it is accessible. Therefore, The Plan needs to besimplified and publicized, targeting all stakeholder groups and preparing. While the DLUPP project prepared somepreliminary materials, more targeted communications need to be developed. Use of the media should also be considered. All of these recommended actions have the underlying objective of ensuring a good level of public knowledge and understanding of the NLUP.

Accessibility: Developing appropriate outreach materials, and making them widely available, will improve accessibility. Posters and other materials can be placed in other agencies, be available at all GL&SC offices, and the full Plan made available on the GL&SC website or on CD from GL&SC offices. Currently, the GL&SC website requires a responsible person/section, restructuring, and regular updating.

4. Use of the NLUP by the GL&SC

The National Land Use Plan needs to be integrated into the lease granting process. In assessing a lease application, the GL&SC must look at two key aspects:

- Is the requested land available and developed?
- Is the requested land use appropriate?

The computerization of the land information system at GL&SC, the digitalization of lease data and expected development in the area of remote sensing supported by field sampling are critical capacity-building interventions targeting at improving efficiency in relation to the above aspects.

5. Use of the NLUP by other agencies

From an inter-sectoral co-ordination perspective, the NLUP therefore offers an initial spatial and analytic framework to address land use issues across sector agencies in a more co-ordinated manner.

The NLUP offers an initial spatial and analytical framework to address this issue. From the NLUP, along with information from GFC and GGMC, it would be relatively easy for example to identify and to map the following (Area Priority Map):

• Priority agricultural areas (essentially current agricultural areas)
• Option agricultural areas (areas indicated as Class 1 and 2 lands for agriculture, subject to confirmation by more detailed surveys)
• Priority forestry areas (need GFC input)
• Priority mining areas (need GGMC input, subject to confirmation after a minerals survey)
• Areas of potential urban expansion and/or development (around existing towns, along potential road corridors, within the identified 'hotspot' areas), subject to clarification on the desired development direction

Agencies may then be required to consult the NLUP and the above map (Area Priority Map) before issuing permits or making land use decisions on new urban development areas. The

most important element should be to maintain options for the future, until such time that there is a clear development agenda. For example, mining in potentially valuable agricultural areas will tend to render such areas non-agricultural, thereby compromising options for the future.

A Land Use Coordinating Committee (LUCC) should be reconstituted and re-focused. Previously, it worked more in reaction to conflicts; in future it should have a proactive mandate, supporting planning and coordination among agencies in implementing the NLUP.

BIBILOGRAPHY

Amaila Halls Hydro (AFH) Inc (2012) Amaila Hydropower Project.Powering Guyana's Future – About the Amaila Falls Hydropower Project.

Bureau of Statistics Guyana (2011). Statistical Bulletin.http://www.statisticsguyana.gov.gy/nataccts.html#statsbull

Bureau of Statistics Guyana (2006). Population Projections 2005-2025.Beaie Sonkarley T, Demographer.http://www.statisticsguyana.gov.gy/pubs/Guyana_Population_Projections_2005-2025.pdf

Bureau of Statistics Guyana (2006) Populationand Housing Census - 2002. Population by Age by Town and Major Areas

Childress M D (2010) Land Tenure and Land Management Issues for REDD Preparation in Guyana: Framing the Agenda for Policy Discussion. Paper at World Bank Conference on Land Policy and Administration, April 26-27 2010.

CTO (2011) Caribbean Tourism Association. Individual Country Statistics. Guyana 2009.http://www.onecaribbean.org/content/files/Strep3.pdf

CCSI - Climate Change Solutions International (2009) Vulnerability and Adaptation (V&A) Assessment of Guyana.Second National Communication of Guyana. Dr Bhawan Singh.

Colchester M (1997). Guyana.Fragile Frontier.Loggers, Miners and Forest Peoples.

Latin America Bureau.World Rainforest Movement.Ian Rankle Publishers

EPA (2007) National Biodiversity Action Plan II (2007-2011).A Continued Programme for Action by Stakeholders towards the Conservation and Sustainable Use of Biodiversity.

Evans J (1992) Plantation Forestry in the Tropics. 2nd edition OUP

FAO (1966) Report on the Soil Survey Project. British Guiana. Vol I General Report. Vol II Soil Chemitry and Land Management. Vol III Parts 1 & 2 Reconnaissance Soil Survey of British Guyana. Vol VII A Report to accompany a General Soil Map of British Guiana.

Guyana Chronicle. 25 Nov 2011. Thousands of new jobs coming in mining sector

Guyana Energy Agency (2011) Energy Development, Hydropower. http://www.gea.gov.gy/energyDev/Potential%20hydropower%20sites.pdf

GLCN-LCTS (2006), Land Cover and Land Use Definitions. http://www.glcn-lccs.org/index.php

Government of Guyana (2010).A Low Carbon Development Strategy.Transforming Guyana's Economy While Combating Climate Change.Office of the President. May 2010.

Government of Guyana/ World Bank (2001) Guyana Poverty Reduction Strategy Paper.

Government of Guyana/ World Bank (2011) Guyana Poverty Reduction Strategy Paper 2011-2015. July 2011.

GFC (2007) Forestry in Guyana Factsheet.http://www.forestry.gov.gy/Downloads/Fact%20Sheet%202007.pdf

GFC (2010) Readiness Preparation Proposal (RPP) Guyana, Forest Carbon Partnership Facility (FCPF), April

2010.http://www.forestry.gov.gy/Downloads/Readiness_Preparation_Proposal_April_2010_Revised.pdf

GFC (2011a) National Forest Policy statement.http://www.forestry.gov.gy/Downloads/Guyana's_National_Forest_Policy_Statement_2011.pdf

GFC (2011b) National Forest Plan.http://www.forestry.gov.gy/Downloads/Guyana's_National_Forest_Plan_2011.pdf

GFC (2011c) Forest Sector Information Report Jan-June 2011.http://www.forestry.gov.gy/Downloads/Forest_Sector_Information_Report_January_to_June_2011.pdf

GFC/Indufor (2012). Guyana REDD+ Monitoring Reporting & Verification System (MRVS) Interim Measures Report 01 October 2010 – 31 December 2011 Version 1 15 June 2012.

GFC/Pőyry Consulting (2011). Guyana MRVS Interim Measures Report. Final January 7 2011.

GGMC (2011& 2012) The Mining Sector in Guyana 2011& 2012. Including: The Mining (Amendment) Regulations 2005 in Brief. Land Management Section – Expanding Investment in a Sustainable Environment. List of Prospecting Licences, Mining Licences, Quarry Licenses & Reconnaissance Permissions.

GLDA (2010) Facts on Guyana Livestock Development Authority.

GLSC (2004) Region 6 Land Use Plan.

GLSC (2005) Region 9, Sub-Region I (Rupununi) Land Use Plan.(Unpublished)

GLSC/UNDP/GEF (2008) National Assessment of Land Degradation in Guyana Diagnostic Report.

IIRSA (Iniciativo para la Integracion de la Infraestructura Regional Suramericana) (2007) Vision de Negocios del Eje Del Escudo Guayanes. Brasil, Guyana, Surinam y Venezuela. Actualizacion 2007.

IMF (2011). Guyana: 2010 Article IV Consultation.

Inter-American Development Bank. (2007). Remittances in 2007.

MoA (2010). Diversification & Modernisation of the Agriculture Sector 2009 Highlightshttp://www.agriculture.gov.gy/Bulletins/January%202010/Diversification%20&%20Modernisation%20of%20the%20Agriculture%20Sector%202009%20Highlights.html

MoA (2011) 2011 Half Year Report for the Guyana Economy: Agricultural Componenthttp://www.agriculture.gov.gy/2011%20Half%20Year%20Report%20for%20the%20Guyana%20Economy%20-%20Agricultural%20Component.pdf

MoA/Scott Wilson (2011). Mitigation and Abatement Analysis.Enabling Activity for the Preparation of Guyana's Second National Communication to the UNFCCC.Final Report. February 2011

Ministry of Finance, Co-operative Republic of Guyana (1996)

National Development Strategy for Guyana. MoF, Georgetown, Guyana

MoNR&E (2012) Continuing the Sustainability of Guyana's Forest

MoNR&E (2012) Mining Opportunities in Guyana

MoNR&E (2012) Policy Statement by the Minister of Natural Resources and Environment. The Guyana Protected Areas System. http://www.nre.gov.gy/TheGuyanaNationalProtectedAreasSystem.20June2012.html

PRS (2011). Guyana Poverty Reduction Strategy Paper 2011-2015.July 2011.

Ragbirsingh and De Souza (2005) Site Suitability for Aquaculture Development on the Caroni River Basin, Trinidad, West Indies using GIS. 56th Caribbean and Gulf Fisheries Institute pp 661-673 http://procs.gcfi.org/pdf/gcfi_56-61.pdf

Skoufias E (2005) A Poverty Map for Guyana. Based on the 2002 population and housing census. LCSPP.World Bank. September 2005.

South Central and South Rupununi Districts Toshaos Council (SCSRDTC) (2012). Thinking together for those coming behind us.An outline plan for the care of Waichipan territory in Guyana.

Technical Publishing & Advisory Services (TPAS) 2003

Area Development Strategy Project. Report prepared for Ministry of Amerindian Affairs & UNDP. Final Report.Vol.1. Georgetown. Guyana. 2003.

ter Steege H. (2001) Mapping Forest and Vegetation of Guyana at Regional and National Level. Consultancy Report for GFC. May 2001.

Thomas C. Y. (2000) Poverty and the 1999 Guyana survey of living conditions. Report prepared for UNDP. IDS, Georgetown, Guyana. July 2000.

USACE (1998)Water Resources Assessment of Guyana.United States Army Corps of Engineers Mobile District & Topographic Engineering Center.

USAID (2007). Guyana Economic Performance Assessment.

World Bank.(2011). Migration and Remittances Factbook 2011. "Guyana".

WS Atkins (2005)Guyana.Country Environmental Profile. Draft Final Report. March 2005http://www.eoearth.org/article/World_Database_on_Protected_Areas

http://www.indexmundi.com/guyana/net_migration_rate.html