

AGRO-ECOLOGICAL ZONING SURINAME



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ABBREVIATIONS AND ACRONYMS

ABS	: General Bureau of Statistics
MUMAs	: Multiple –Use Management Areas
MSL	: Metris above Sea Level
AEZ	: Agro –Ecological Zoning
ITCZ	: Inter Tropical Convergence Zone
NPO	: National Planning Office
mm/yr	: millimeters per year
SWS	: Small Wet Season
SDS	: Small Dry Season
LWS	: Long Wet Season
LDS	: Long Dry Season
IUCN	: International Union for Conservation of Nature

1 INTRODUCTION

The "Agro-Ecological Zoning in Suriname" project was carried out within the framework of the "Basic Agreement for Scientific and Technical Cooperation between the Government of the Federative Republic of Brazil and the Government of the Republic of Suriname, signed on June 22, 1976 and promulgated on November 23, 1976" and the "Complementary

Agreement to the Basic Agreement for Scientific and Technical Cooperation between the Federative Republic of Brazil and the Republic of Suriname", signed on May 5, 2012.

Agricultural suitability assessments seek to determine favorable economic and environmental cost-benefit ratios, which should not be used as recommendations for direct use by farmers, but rather to underpin agricultural planning, since they deliver multiple usage possibilities.

Several factors, such as socio-economic and environmental conditions, legislation, producers' interests, public policies, etc., should be taken into account for making an informed decision. Agricultural suitability assessments must therefore be considered an indispensable step in a given region's agricultural zoning.

This mission's goal encompassed both preparing this report and establishing some guidelines for future zoning evaluations in Surinam.

The AEZ Project in Surinam centered on capacity building for Surinamese experts, who after five technical missions in both Brazil and Surinam are qualified to perform agro-ecological land assessments, geo-information procedures and environmental planning in the interest of territorial intelligence. The project's final output is a technical report about AEZ in Suriname.



2 TEAM

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3 ADOPTED DATABASE

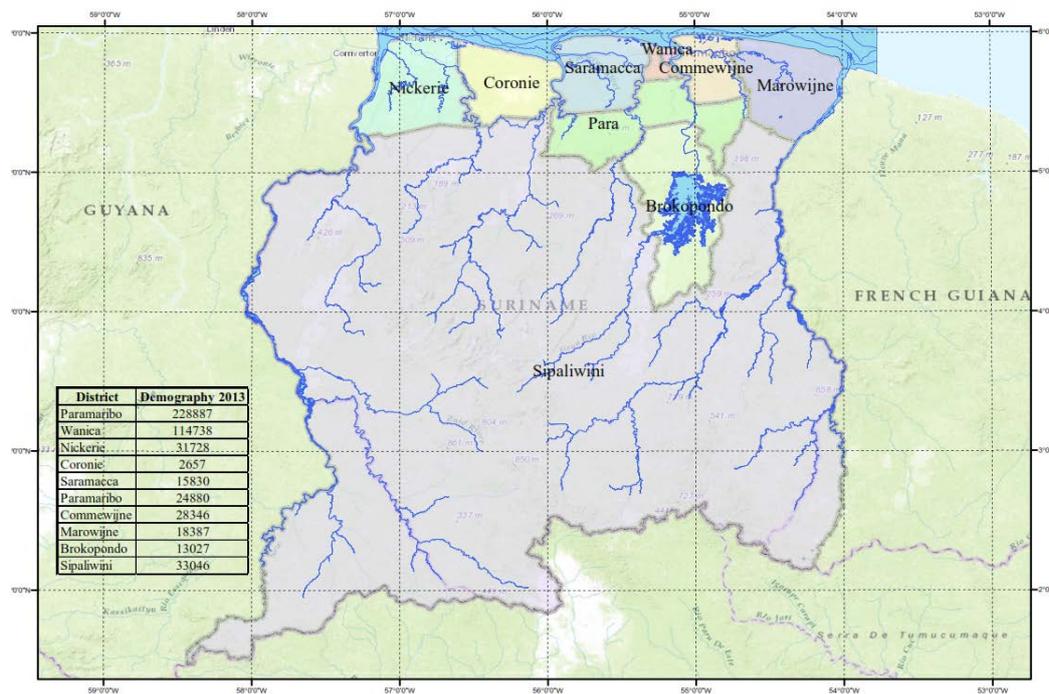
The information presented in the following maps was collected throughout the past decennia by different institutions, such as the National Planning Office, the Soil Survey Office, the Meteorological Office, the Hydrological Office, the Ministry of Agriculture and the Office of Civil Affairs, Centre for Agriculture Research in Suriname, to name a few. The resulting dataset was then analyzed and adapted by the National Planning Office for the present project's purposes.

3.1 Demography³

As of 2015, Suriname had a total population of 558.773, according to the Surinamese General Bureau of Statistics (ABS). The population is largely concentrated in Paramaribo, the capital of the country. Suriname's colonial history has played a major role in the multi-ethnic composition of its population. Until the abolition of slavery in 1863, Western Europeans imported slaves from the west coast of Africa. Later, laborers were attracted from India, Indonesia and China to work on plantations. Suriname's population consists of the following ethnic groups: Amerindians (the indigenous people), Maroons (descendants of runaway slaves) and Creoles (of African or mixed descent), Hindustanis (from the Indian sub-continent), Javanese (from Indonesia), Chinese, Lebanese, Brazilians, descendants of European settlers and mixes among these ethnic groups. The official language is Dutch. *Sranang Tongo*, the *lingua franca*, and English are widely spoken as well. Most of the ethnic groups also use their own languages. All major religions such as Christianity, Hinduism and Islam are practiced, along with traditional religions. About 67% of Suriname's total population is concentrated in the capital and 20% in the other coastal districts. The remaining 13% was concentrated in small, mainly tribal communities along rivers of the interior. The overall population density was 3.0 people per km², which makes Suriname a very lowly populated country. The most densely populated districts are Paramaribo and Wanica.

³ Text Second National Communication to the United Nations Framework Convention/ Map by National Planning Office (NPO)

Figure 1 – Demography and District Borders in Suriname



3.2 Ecosystems⁴

The terrestrial ecosystems in Suriname can be characterized as follows:

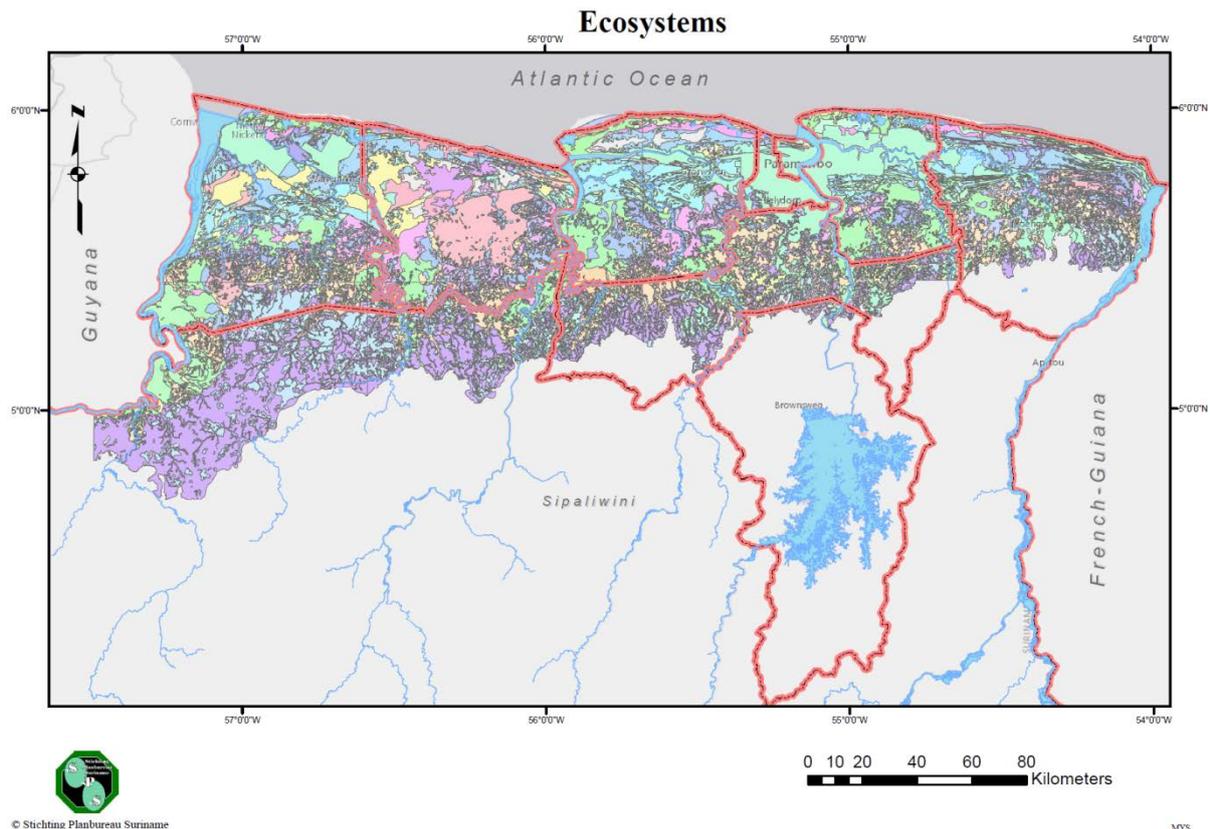
- Brackish water Ecosystems are influenced by coastal changes and tidal action. This type of area (an estuarine zone) consists of mangrove forests, locally interrupted by salty to brackish lagoons, low succulent salt-plant cover and brackish herbaceous swamps. Mangrove forests protect the coastline and riverbanks from erosion and stimulate accretion. They are breeding grounds for many species of marine fish and shrimp and contain a high degree of biodiversity. The estuarine zone of Suriname is a wetland of international importance, containing the feeding and nesting sites for Caribbean coastal birds and feeding grounds for migratory birds from North America.
- Along the coastline, mainly in the eastern part of the country, are found shell and sand beaches. These beaches are nesting places for four species of sea turtles.
- Slightly inland, freshwater wetlands dominate the young coastal plain and part of the old coastal plain. These wetlands play an important role in supplying freshwater to the estuarine Zone, thus contributing to the maintenance of the

⁴ Text Second National Communication to the United Nations Framework Convention.

brackish condition of these waters. The swampy areas are inundated throughout most of the year, allowing a peat layer to accumulate on top of the mineral soil.

- Low swamp forest, also known as swamp wood, includes palm swamp forest, low swamp forests cover about 3% of Suriname.
- High swamp forests and creek forests are found in the shallow freshwater swamps of the coastal plain, where strong fluctuations in surface water levels occur.

Figure 2 Ecosystems in Suriname



3.3 Primary roads Infrastructure ⁵

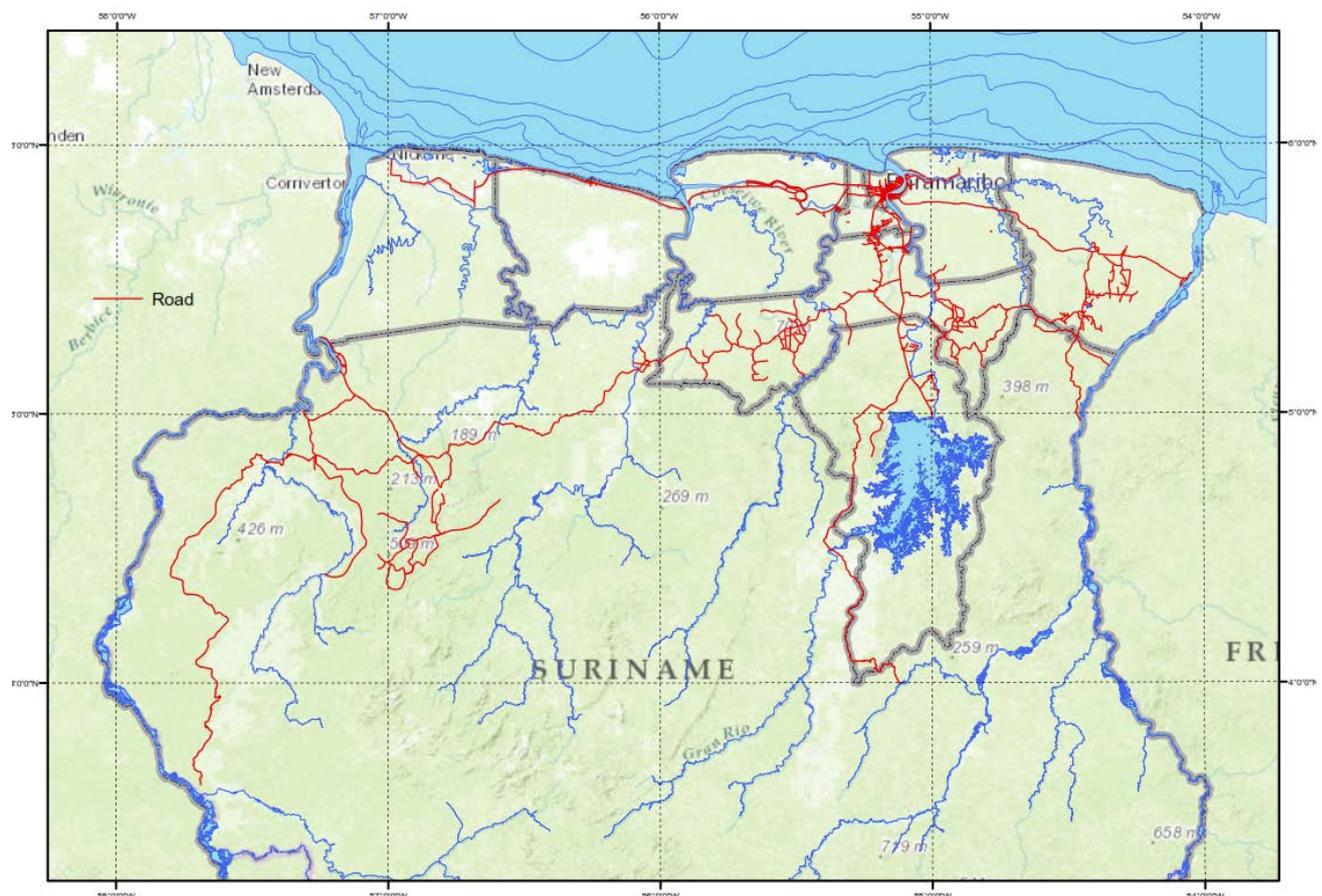
The physical infrastructure in both the eastern and the western part of Suriname is characterized by the developments within the agricultural sector. To utilize the fertile agricultural land both the wet and dry infrastructure were established. Need for the construction of infrastructure facilities further inland, was marginal. As a result of World War II, the important North-South connection of Paramaribo to Zanderij was build. After the World War II the need establish mechanized sustainable forest management appeared and the

⁵ Text and map by NPO

road known as the second East-West connection was built along the old the cover landscape and through parts of the interior. The northern and the southern East-West link is an important part of our road network system and therefore included as part of the Pan-American State Highway System. The road network system can be divided in three categories, namely:

- a) Paved portion;
- b) Part that laid out but still not paved;
- c) Part which is incomplete

Figure 3 – Primary roads Infrastructure



3.4 Protected areas⁶

There are three types of protected area in Suriname:

1) Multiple-Use Management Areas

(MUMAs), in which economic activities are allowed as long as specific protection Goals are not threatened;

2) Nature Parks, in which light forms of exploitation

(Mainly recreational) are allowed; and

3) Nature Reserves, in which specific species or ecosystems are protected and human activities are limited. MUMAs throughout almost the entire coastal area of Suriname protect species such as endangered shore birds and sea turtles. Representative terrestrial and aquatic (freshwater) ecosystems, and endangered species that live in them are further protected in Nature Reserves and Nature Parks across the country. With the establishment of the Central Suriname Nature Reserve, a complete rainforest and freshwater river system with a large population of species (including endangered species) has been preserved. The protected areas cover approximately 13% of the land area of Suriname.

Figure 4- Protected Areas



⁶ Text and maps from Second National Communication to the United Nations Framework Convention

3.5 Geography ⁷

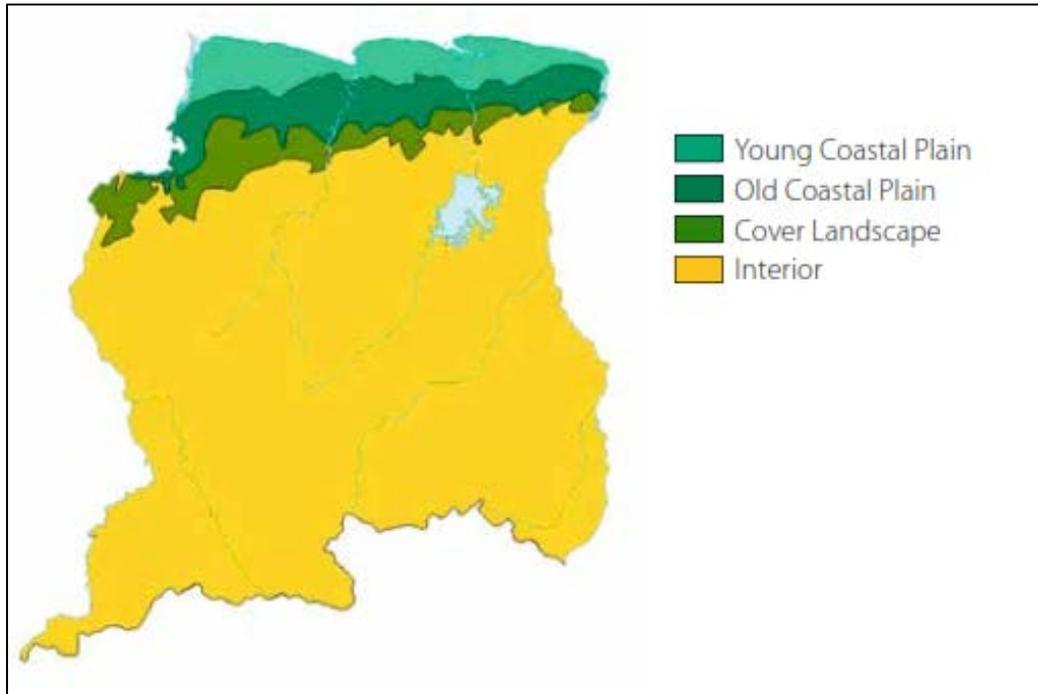
Geologically, over 80% of Suriname consists of the Precambrian Guiana Shield, the deeply weathered, rainforest-covered hill and mountain lands that stretch east and south to the Amazon River in Brazil and west to the Orinoco River in Venezuela. Eroded material from the Guiana Shield was deposited in the subsiding areas to the north.

The oldest outcropping sediments in this coastal area were deposited during three distinct periods, resulting in three different formations:

- The Zanderij Formation, consisting of medium to coarse sands to sandy clays, which have been deposited by braided rivers at the foot of the Guiana Shield in the form of alluvial fans;
- The Coropina Formation, consisting of fine sandy to clayey marine sediments, which have been deposited north of (and on top of) the sediments of the Zanderij Formation. The marine clays were deposited as extensive clay flats and the marine sands as ridges, which were later severely eroded. The remaining surface deposits of this formation are found as “islands” surrounded by the sediments of the Mara Formation; and
- The Mara and Coronie Formations. The Mara Formation consists of marine clays and peat that were deposited in the eroded areas between the remnants of the Coropina Formation, and in gullies that had been cut into the former Old Coastal Plain. The Coronie Formation on the coastal plain is predominantly of marine origin, but along the main rivers, sediments have been deposited in fluvial and estuarine environments. The deposits consist of mudflats of marine clays and ridges of sands and shells. The finer sediments (clay, silt and fine sand) originate from the Amazon basin, while coarser sands come from the hinterland. The above formations divide Suriname into five main geographic regions which can be identified from north to south as:
 - the Near-coastal zone and the Coastline, formed by extensive mud flats and sandy shell beaches;
 - the Young Coastal Plain, ranging in breadth from about 20 km in the east to about 100 km in the west, with height variations of 0-4 m above mean sea level (MSL);
 - the Old Coastal Plain, formed on remnants of ridges, gullies and mud flats, with height variations of 4-10 m above MSL;
 - the Cover Landscape (also known as the Savannah Belt), consisting of coarse bleached white sand and yellowish brown sands to clay loams, ranging from 10 – 100 m above MSL;
 - the Interior Uplands, which form the Guiana highland region, with highly weathered Precambrian formations and heights of more than 100 m above MSL.

Figure 5 - Geographic zones of Suriname

⁷ Text and maps from Second National Communication to the United Nations Framework Convention

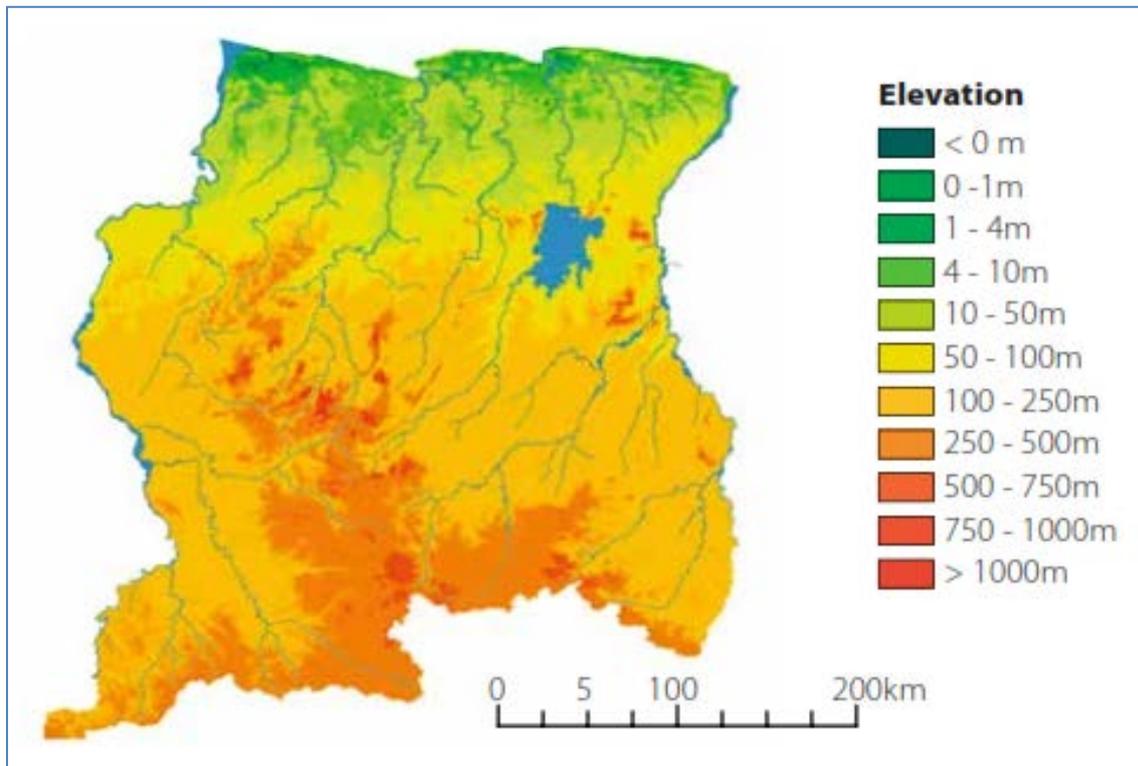


The highest mountain of Suriname has an elevation of about 1,200 meters. The remainder of the country consists of a monotonous landscape type, with heights of 50-500 meters above MSL. The coastal zone is a low-lying flat area with many swamps, some of which contain open waters. All local rivers flow in a general south-to-north direction, ultimately discharging their water into the sea.

The coast of Suriname is part of a coastal system that extends from the mouth of the Amazon River in Brazil to the mouth of the Orinoco River in Venezuela.

It is a muddy coastline, where mud, including fine sands, from the Amazon Basin is deposited. The coast is subjected to active geomorphological development, determined by a system of cyclic accretion and erosion. Both are linked to the presence of shore face-attached mudflats and mud banks, which migrate continuously to the west. Essentially, this migration is the result of deposition of fluid mud on the west side and the simultaneous erosion of the east side. The mudflats are separated by intermediate troughs. Generally speaking, accretion occurs at locations sheltered by the mud banks, whereas coastal retreat occurs between mud banks, when the coast is unprotected from waves. Along the coast, there are large differences in accretion/erosion rates, with considerable accretion, for instance, along the Saramacca coast since 1947 (at least) and on-going retreat around Coronie and North of Paramaribo.

Figure 6 Topographic map Suriname



3.6 Hydrology⁸

All four major rivers and their near-coastal subsidiaries have *estuarine characteristics*. Large volumes of tidal water and strong tidal currents give these river estuaries more or less funnel shapes and wide mouths. They are characterized by a mix of fresh and muddy saline water and by relatively large tidal variations.

In the river estuaries, considerable quantities of marine mud are moved upriver with the intruding tide. Sedimentation of this mud occurs on the riverbed and as flats on the insides of river bends. The opposite outer bends may be eroded by the undercutting of the riverbank. Very locally, small sand beaches are found along estuaries, especially of the Marowijne and the Suriname River. The large amount of sand supplied by a large “moving” beach from east Suriname has recently formed, and is still forming, a recurred spit that bends from the east into the Suriname River near Braamspunt.

The many rivers originating in the hinterland, groundwater aquifers and swamps found in the coastal area are all fed by rainfall, with annual averages varying from 1,750 mm/yr. in the north to about 3,000 mm/yr. in the center of the country. With the exception of the Suriname

⁸ Text /Second National Communication to the United Nations Framework Convention.

River, the five main rivers and their numerous tributaries discharge excessive rainfall from the main land directly into the Atlantic Ocean. The discharge of the Suriname River is regulated by the Afobaka Hydropower dam. Variations in freshwater discharge are encountered due to variations in rainfall and the resulting decrease in availability of freshwater. During the rainy seasons, fresh water is abundant, while during the dry seasons, it may become temporarily limited. Freshwater reserves may experience further pressure when drought coincides with a strong El Niño. During a strong La Niña, abundant rainfall is expected. If accompanied by other conditions, such as high soil moisture content, limited water storage capacity and relatively steady rainfall, inundation may result.

Figure 7 Hydrology of Suriname

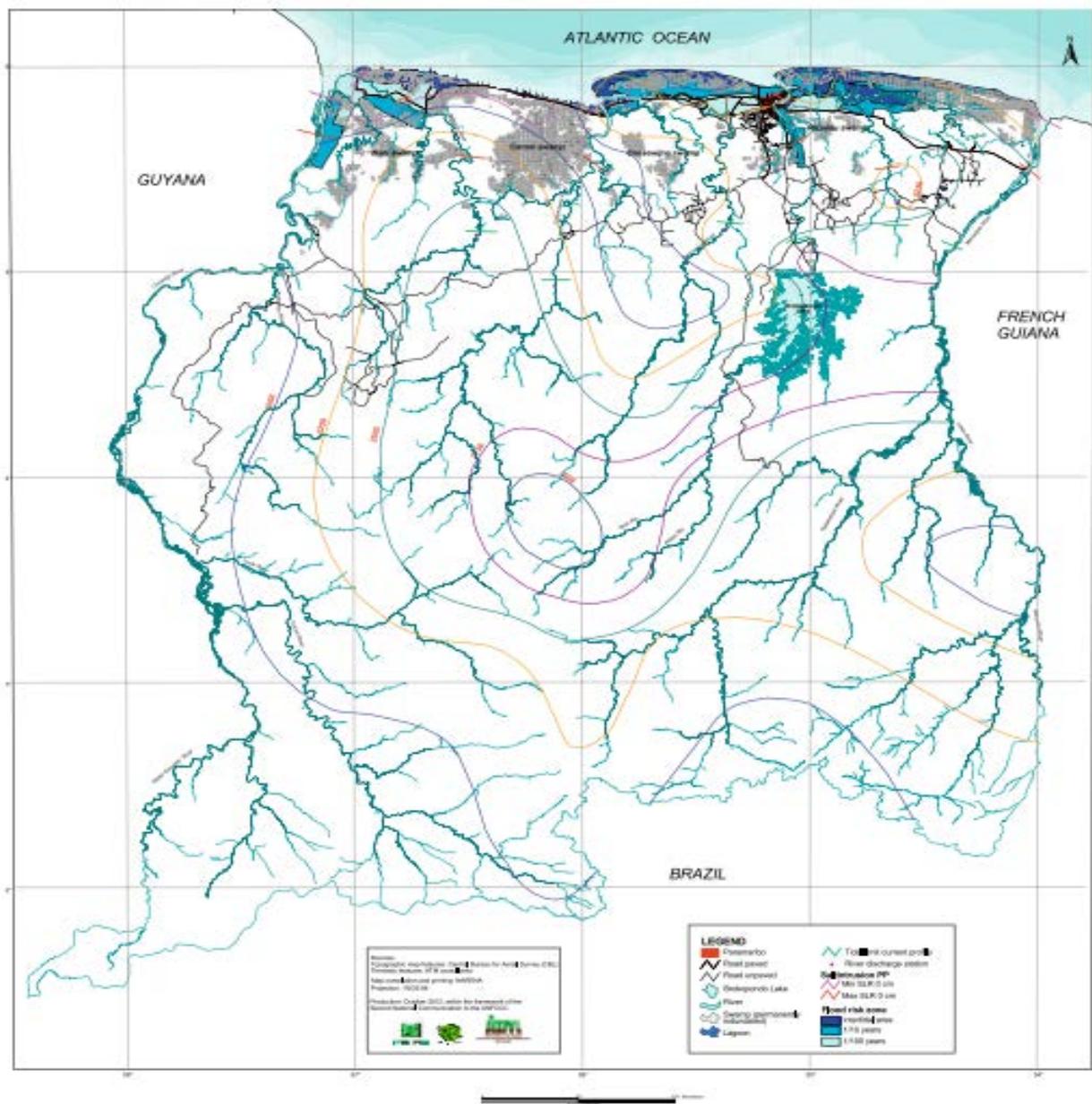


Table 1 **Rivers**

No.	Rivers	Area of the basin in km ²	Discharge in m ³ /s	Specific discharge (l/s/km ²)
1	Marowijne	68,700	1,780	25.9
2	Commewijne	6,600	120	18.2
3	Suriname	16,500	426	25.8
4	Saramacca	9,000	225	25.0
5	Coppename	21,700	500	23.0
6	Nickerie	10,100	178	16.7
7	Corantijn	67,600	1,570	23.2

Table NPO

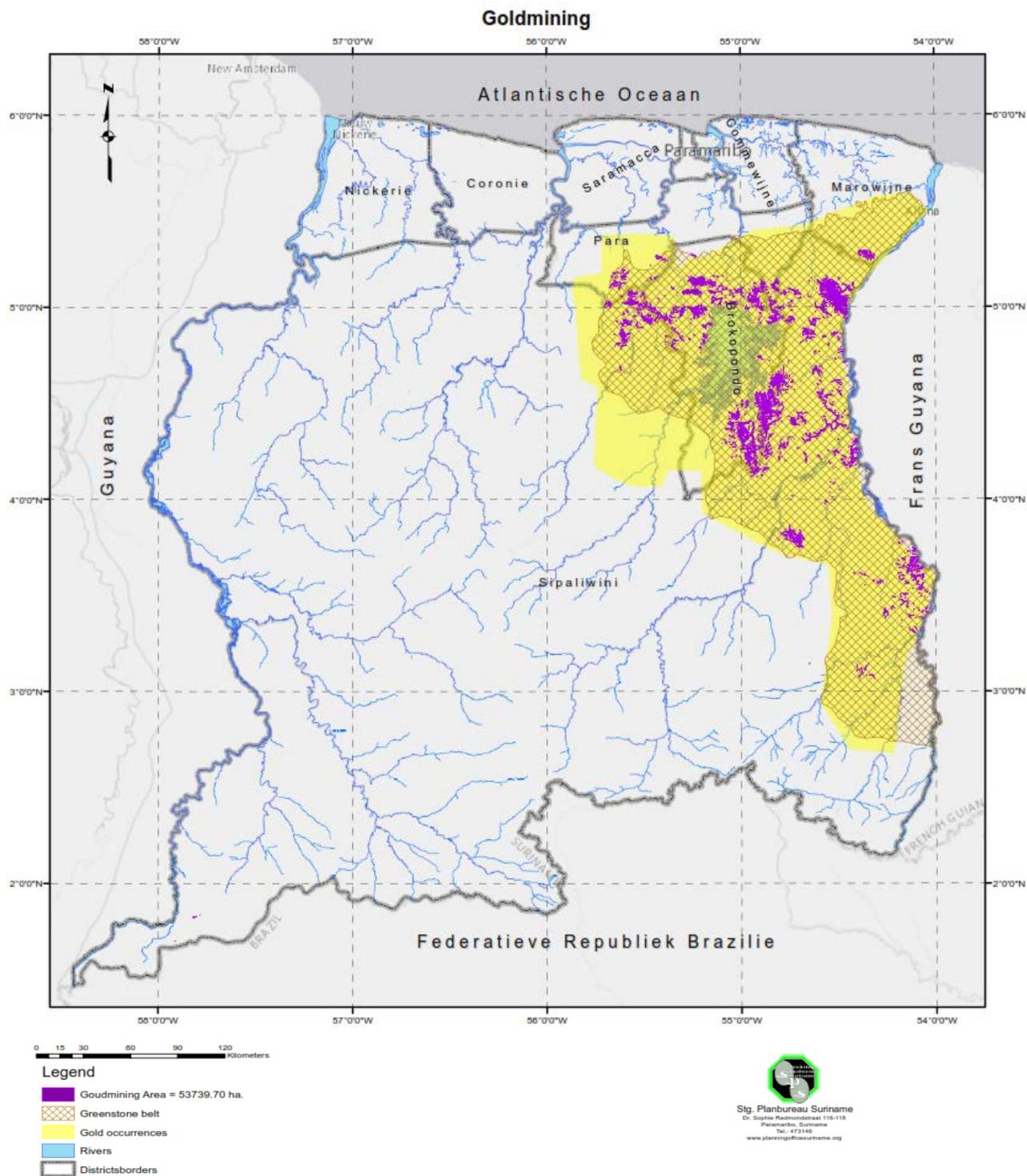
Changes in rainfall in the upper basins of the Surinamese rivers are followed by saltwater intrusion in their lower courses, since these lower river courses are controlled by the hydrological influence of the Atlantic Ocean. A decrease of the upstream flow promotes saltwater intrusion, while an increase in river discharge pushes the salt limit back to near the estuarine zone of the river.

3.7 Gold mining operations⁹

Gold mining activities take place throughout the district Sipaliwini, Brokopondo, Para and Marowijne. Among other things can be called locations like the either side of the Saramacca River and the Suriname River, around the Brokopondo reservoir, West of the road to Langatabiki, the basins of the Lawa and the tapanahony River, along the road to Pokigron and West of the Marowijne River and North of the Paramaccakreek. In the period up to 2014 in total 6,638,886 hectares has been released in concessions for the exploitation of gold. The gold mines are located mostly in the immediate area of the villages. These activities are part of an important economic activity of the local communities who mainly in tribal life.

⁹ Text and maps from Second National Communication to the United Nations Framework Convention

Figure 8 Overview goldmines in Suriname



3.8 Small villages

The small villages are mostly situated along the river banks as the tribal communities depend on the river for transport, fishing, recreation and water supply. Population in the villages can vary up to the 500 people.

Figure 9 Overview Small Villages

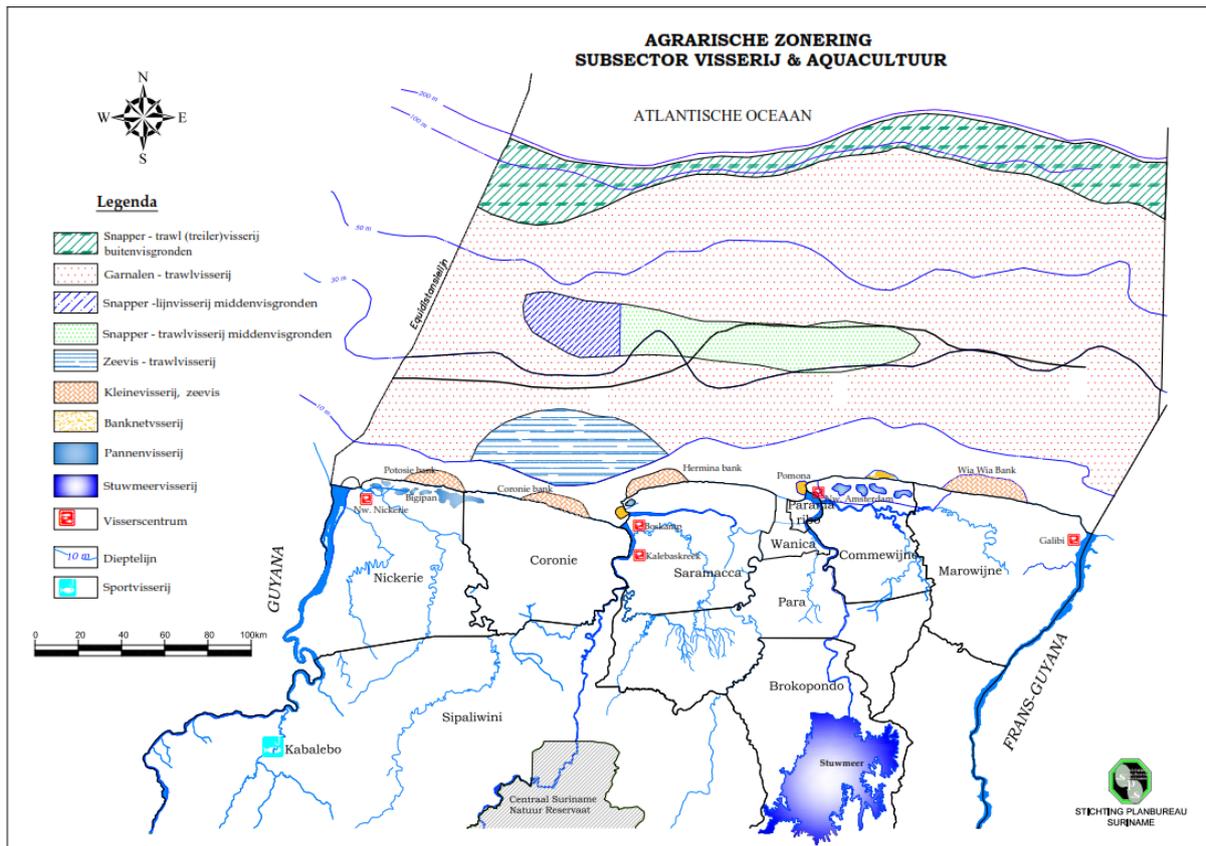


3.9 Fishing zones¹⁰

Suriname has a flat continental plateau, which is rich in nutrients and therefore a comprehensive stock. The coastal waters contain many fish species with a high market value. These fish species are highly sought after in the Caribbean, the United States of America, Europe and Japan. The rivers, creeks and swamps also contain various species of fish. A characteristic of the fishing industry is that the use of this resource is renewable. The map in figure 10 shows the several zones where different economic fishing activities take place.

¹⁰ Map NPO

Figure 10 Fishing zones



3.10 Climate conditions¹¹

Suriname lies in the tropical climate zone and divided into Aw, Am and Af (according to the Köppen classification system). Respectively a Savannah climate, a monsoon climate and a tropical rainforest climate. The difference between these three climates is located in the precipitation and distribution. Even though the temperature of the coldest month on average above 18 ° Celsius, if there is a long dry season prevails would no tropical rain forests grow. It is not so much the total amount of rain falls per year, as well as their distribution over the year. A "guaranteed" monthly minimum of 60-65 mm for a vegetation is valuable.

The seasons

In Suriname there are about four seasons per year, broadly divided into the following periods:

- Short wet season (SWS), first half of December to second half of January
- Small dry season (SDS), second half of January to second half of March

¹¹Text Gruitenberg Suriname

- Long wet season (LWS), second half of March to first half August
- Long dry season (LDS), first half August to first half December

There is a certain variation in time, as sometimes a season starts earlier or much later and the short rainy season or the short dry season may not occur, but both the long rainy and long dry seasons are always encountered. The seasons are affected by the movements of the so-called Inter Tropical Convergence Zone (ITCZ). It is this zone where the winds of the northern hemisphere and the South Atlantic gyre circulates counterclockwise in the southern hemisphere meet. In this zone is widely convergence village and there are vast areas with clouds and showers. The zone around the whole earth and is visible on satellite photos as a long band showery overcast.

The ITCZ moves with the Sun to the North in the Northern summer, up to a maximum of 12 degrees north latitude. As Suriname lies around 5 degrees north latitude, it is gradually passes by the ITCZ from the South and one speaks then of the long rainy season. Once the zone is in the North of the country the long dry season occurs, with more southerly winds. Suriname is now on the meteorological southern hemisphere, whereby drier air is supplied. By the warmth of the Caribbean Sea, the ITCZ is kept very long North of Suriname, hence the name long dry season.

This situation changes quickly at the end of November and the ITCZ draws relatively fast to the South and passes the country again, usually with somewhat lighter showers and this is called the small rainy season. If this zone is South of Suriname it is shortly dry, the short dry season, before the ITCZ again moves to the north and the cycle repeats itself. The ITCZ provides a clear pattern in the precipitation for one year.

Apart from the ITCZ, the precipitation is also affected by local and regional disturbances (easterly waves). Mountainous areas receive more rain (storm) by stowing effects and local showers can also cause increased precipitation. From year to year, there are rather large differences and by the irregularly scattered monitoring stations a good rainfall pattern is difficult to make. Per day, there is a clear pattern of rainfall. Especially in the afternoon is the chance of rain great, by the heating of the air and the showers. The chance of rain in the coast during the morning hours is greater than in the interior, while in the evening, the showers are likely to occur in the interior.

Temperature

In Suriname the temperature is fairly constant. The coldest month is always warmer than 18 °C. Between the warmest and coldest month there is a very slight difference of about 2 degrees. In the evenings it gets cooler gradually, but only occasionally the temperature drops below 20 °C. The months of the long dry season, are the warmest when the sun can heat the drier air long. In the rain operation the temperature lower. The average annual temperature to Zanderij is 25.7 degrees Celsius.

Sunshine

The Sun is rarely entirely absent and one has a lot of sunny hours per year. The months in the long dry season are certainly the sunniest. The percentage of sunshine amounts to 58% for Paramaribo. The sun provides a global radiation from an average of 450 watt/m².

Wind

Due to the presence of the trade winds, the wind is also fairly constant, from Eastern directions and most weak. Suriname is located entirely outside the hurricane zone and is thus free from these destructive systems. However, fierce rain and heavy wind gusts can occur. Around 22 m/s has been measured and even wind velocities up to 30 m/sec are possible. Sea and land wind are often emergent phenomena, caused by the low pressure differences and 'large' temperature differences. Also local circulations in hills and mountains occur.

Precipitation

Suriname has a tropical climate with abundant rainfall, uniform temperature, and high humidity. Precipitation amounts vary across the country. On average, Paramaribo receives 2,210 mm of rainfall annually; Coronie and Nieuw Nickerie (north-western coast) receive 1,561 mm/year and 1,808 mm/year respectively; Kwamalasamutu (south Suriname) 2,109 mm/year and Stoelmanseiland (central east Suriname) 2,445 mm/year.

4. MATERIAL AND METHODOLOGY

4.1 Materials

The initial procedure in AEZ is to define the area for which the evaluation is done. This is closely related to the legal information from Surinam, composed by the material available and the existing spatial data base.

Figure 11 The country and the study area.

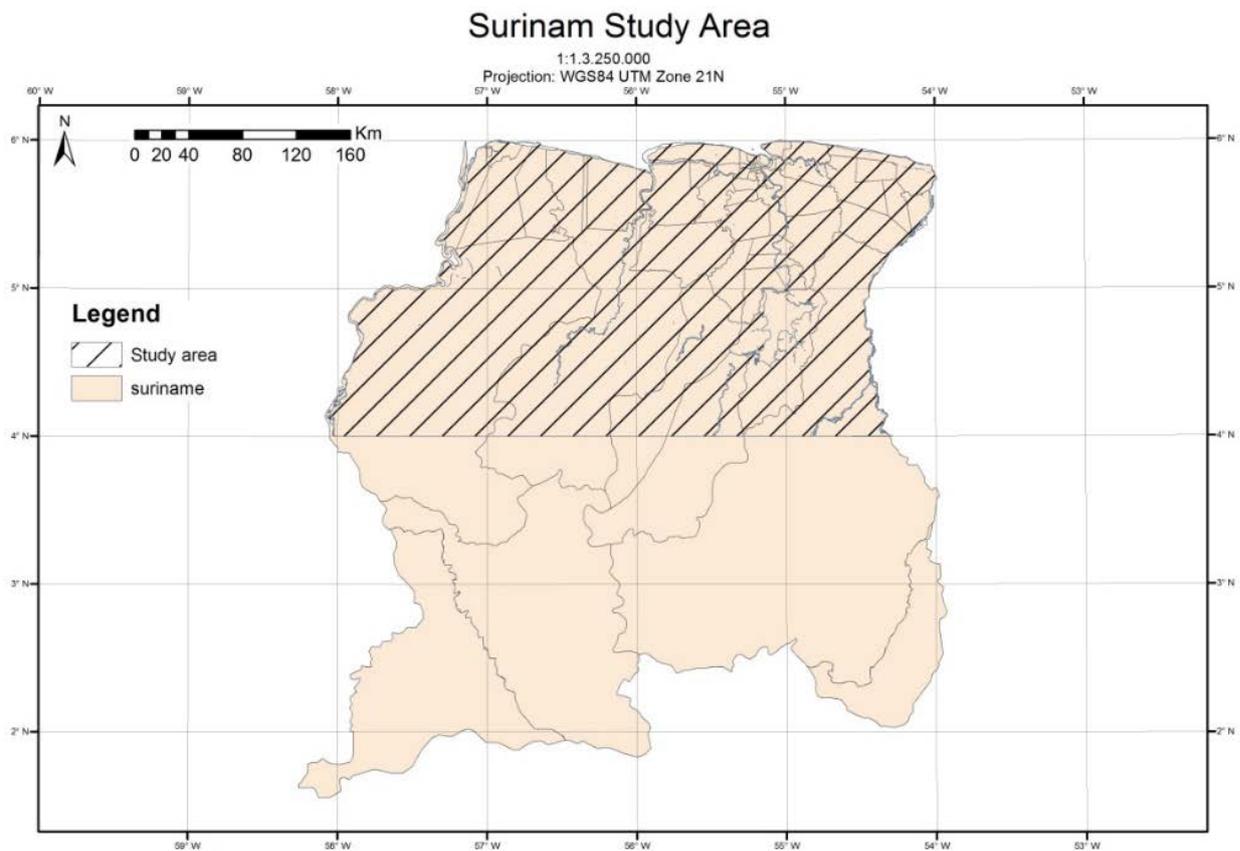


Figure 12 Protected area (green)

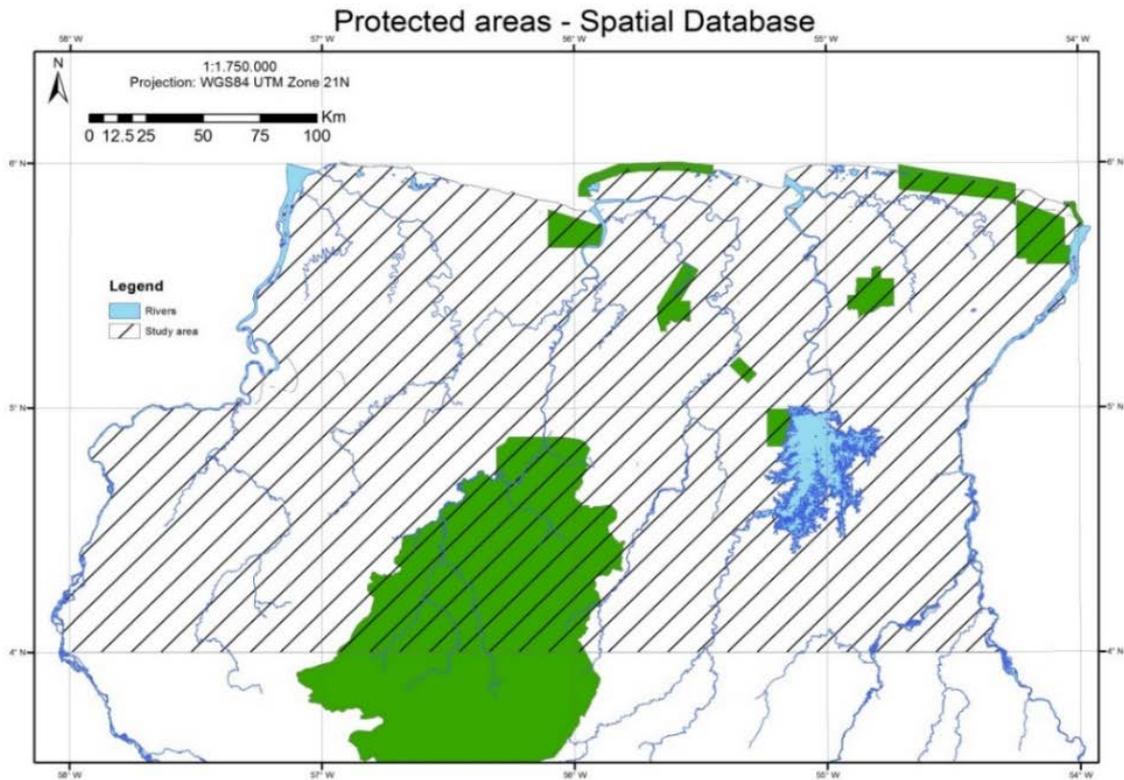


Figure 13 Water Bodies in the area

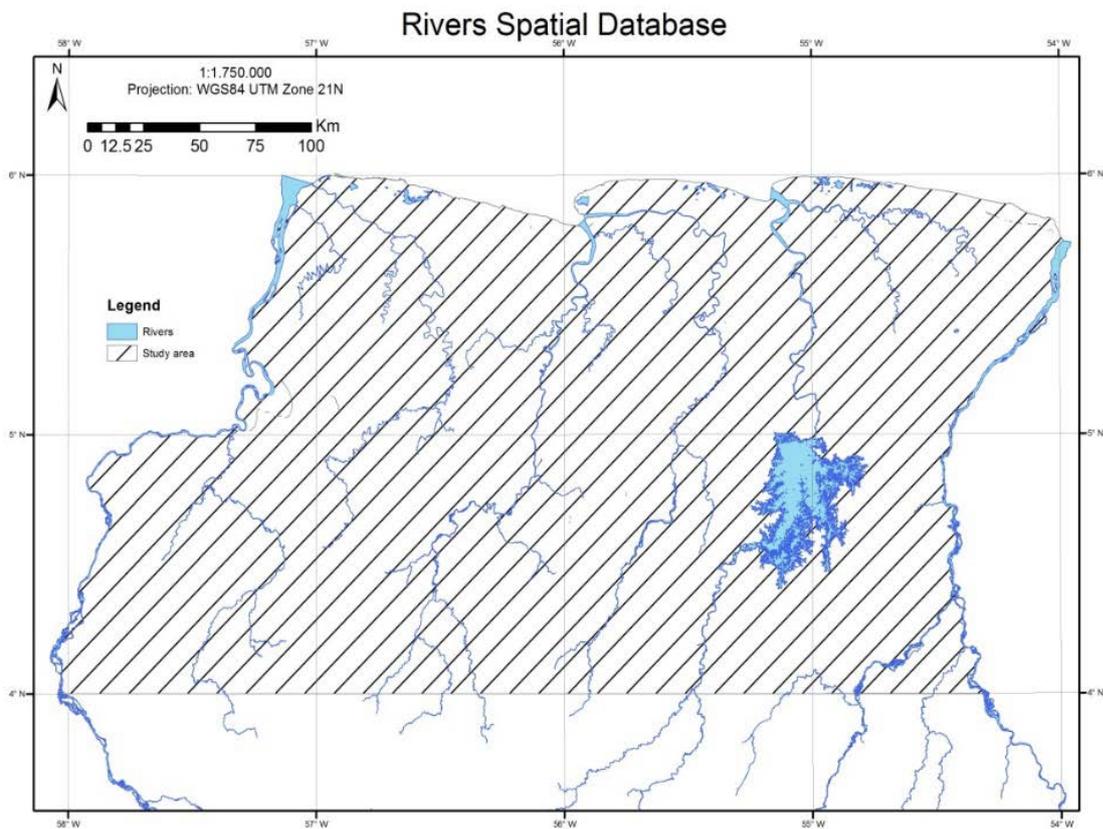


Figure 14 Land Use Spatial Database

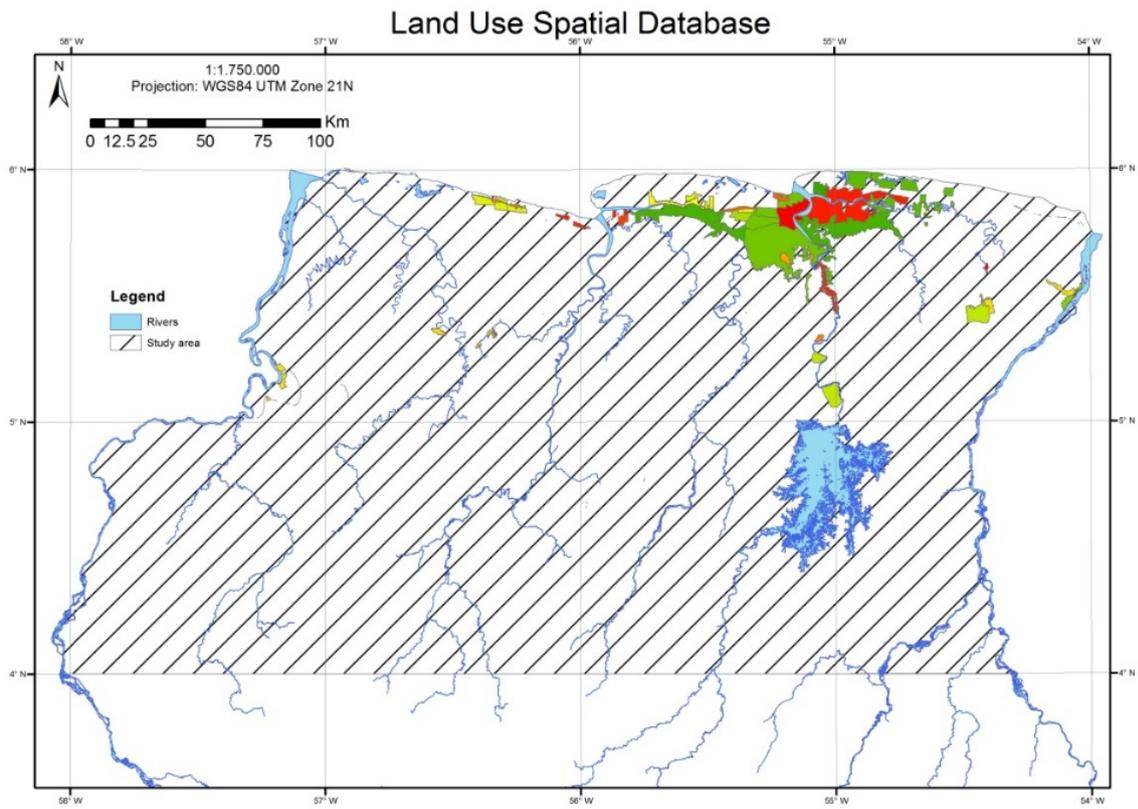


Figure 15 Soil Spatial Database

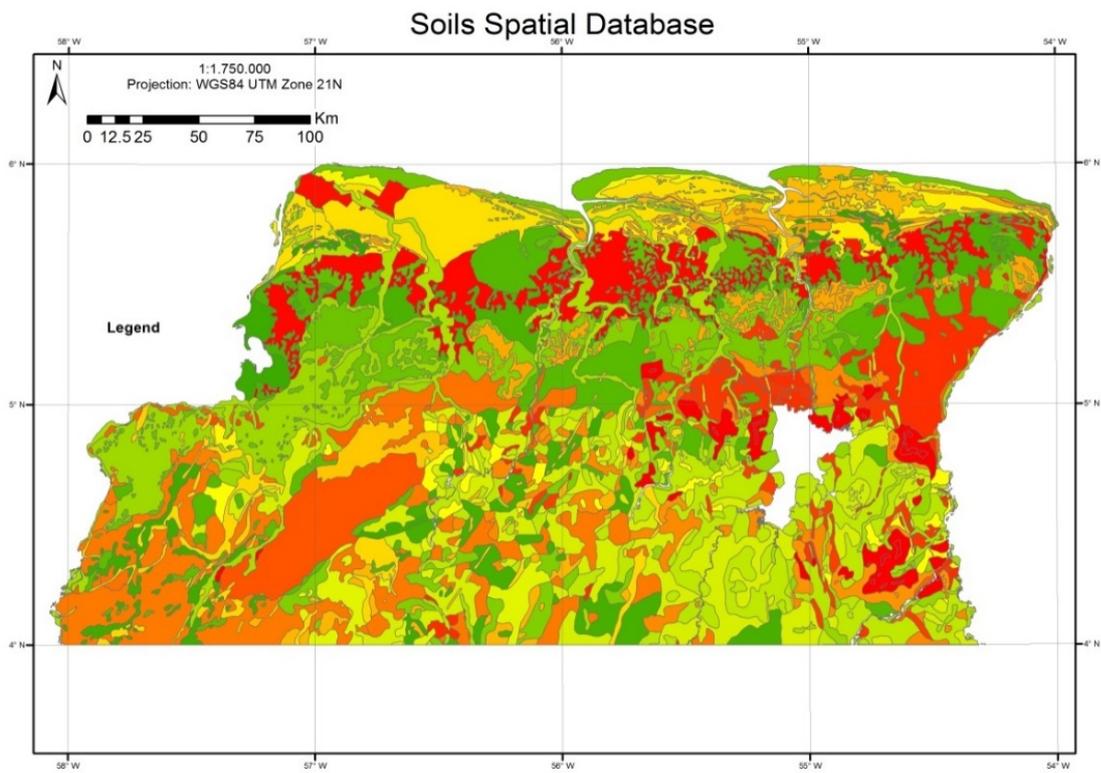


Table 2 Description of the legend of the soil map

	DESCRIPTION	Area (Ha.)
1	Ridge soils with (very)fine sand, sometimes medium or loamy sand to sandy loam, sand with shell grit, or shells	6,342.70
2	Unripe and practically unripe saline swamp clay soils	2,341.16
3	Practically unripe and half-ripe brackish swamp clay soils	0.29
4	Half-ripe and nearly ripe swamp clay soils, mostly desalinized to a depth of more than 1 meter	148,160.37
5	Ridge soils with (loamy very) fine sand, and sometimes sandy loam	55,845.85
6	Ripe swamp clay soils, mostly desalinized to more than 2 meter depth	26,587.08
7	Nearly ripe swamp clay soils, mostly desalinized to more than 2 m depth sometimes with loamy topsoil	53,192.49
8	Fresh water swamp and marsh with ombrogenous thick peat cover	62,786.96
9	River & estuarine soils with silt & loam	30,812.84
10	Half-ripe to ripe river & estuarine clay soils	126,356.52
11	Ripe polder clay (sometimes loam) soils (predominantly plantations)	41,298.40
12	Half-ripe polder clay soils (rice fields)	6,428.57
13	Unripe and practically unripe mostly pyritic swamp clay soils	338,541.74
14	Ridge and plateau soils with (very) fine (bleached) sand, and sometimes clay	8,852.59
15	Ridge and plateau soils with (very fine sandy) loam and very fine sand over clay	79,747.54
16	Plateau soils with silt loam and silt clay loam over stiff (silt) clay	202,303.17
17	(Sandy) loam and clay levee and basin soils	161,508.10
18	Sand, sandy loam, sandy clay loam and clay soils; locally heavier textured denudation terrace soils	60,803.86
19	Bleached medium and coarse sandy plateau and slope soils	89,865.55
20	Unbleached medium and coarse (loamy) sand, sandy (clay) loam to sandy clay plateau & slope soils	176,364.05
21	Plateau and slope soils with sandy (clay) loam and clay, locally with gravelly topsoil	270,541.98
22	Plateau and slope soils with probably gravelly sandy(clay) loam and clay	97,546.43
23	Plateau and slope soils with (loamy) sand, sandy (clay) loam and sandy clay	30,669.74
24	Ridge, plateau, slope and depression soils with sand, sandy(clay) loam and sandy clay, often gravelly	107,743.79
25	Hill-top, plateau and slope soils with mostly gravelly clay	82,508.80
26	Bleached medium and coarse sandy plateau an slope soils	103,744.00
27	Unbleached medium and coarse (loamy) sand, sandy (clay) loam to sandy clay plateau and slope soils, locally gravelly	313,709.90
28	Hill-top and slope soils with gravelly	115,078.55
29	Hill-top, plateau and slope soils with sandy clay loam and sandy clay, sometimes gravelly	386,977.72
30	Hill-top and slope soils with clay loam and clay often gravelly; ironstones occurs on hill-tops	4,677.99
31	Hill-top, plateau and slope soils with (sandy) clay loam and (sandy) clay; locally a few stones on the soil	356,060.04
32	Hill-top and slope soils with gravelly clay over clay	221,564.53
33	Hill-top and slope soils with gravelly clay	135,343.28
34	Hill-top plateau and slope soils with silt clay loams and clays; on the plateaus presumably iron-stone	66,787.99

35	Hill-top and slope soils with clay loam, silt clay loam and silt clay; often gravelly and locally many stones on the soil	14,333.44
36	Hill-top and slope soils varying in texture from sand to sandy to silt and clay; moderate amount of stones on the soil	7,467.45
37	Ridge and slope soils with gravelly clay; locally iron-stone and many iron-stones on the soil	48,567.89
38	Ridge and slope soils with mostly stony and gravelly clay loam (silt)clay; a moderate amount of stones on the soil	13,475.62
39	ridge and slopes soils with probably gravelly clay loam and (silt) clay; locally continuous iron-stone and many stones on the soil	36,931.75
40	Hill-top, plateau and slop soils with sandy clay loam and sandy clay; often gravelly, with many stones on the soil	395,974.11
41	Hill-top and slope soils with probably (sandy) clay loam and sandy clay	25,843.40
42	Hill-top and slope soils, with probably mostly gravelly sandy clay	92,918.16
43	Hill-top and slope soils, with probably gravelly clay loam and clay; presumably a moderate amount of stones on the soil	42,841.83
44	Hill-top, plateau and slope soils with gravelly clay and many stones on the soil	74,595.79
45	Hill-top, plateau and slope soils with gravelly clay, and locally iron-stone and bauxite at the surface	74,026.38
46	Hill-top, plateau and slope soils with probably stony and gravelly sandy clay loam and sandy clay; many stones and locally bedrock on and at the surface	18,225.23
47	Hill-top, plateau and slope soils with probably gravelly clay loam and clay	72,567.24
48	Plateau, hill-top and slope soils with probably gravelly and stony clay loam and clay; locally stony; on the plateaus many stones to continuous iron-stone or an	64,714.73
49	Mountain-top and slope soils with probably gravelly and stony sandy clay loam and sandy clay; many stones and locally bedrocks on and at the surface	29,958.43
50	Plateau, mountain-top and slope soils with probably gravelly and stony clay; many stones to continuous iron-stone and bauxite on and at the surface	239,296.07
51	Mountain-top, plateau and slope soils with gravelly and stony silt clay and clay; very stony to continuous ion-stone at the surface	95,035.85
52	Plateau, mountain-top and slope soils with gravelly and stony clay loam and silt clay; on the plateaus iron-stone and bauxite at the surface	154,916.68
200	City	1,535.50
500	Old mine	2,675.45
1000	Water	4,829,762.25
1001	Protected	2,249,982.72
1005	buffer zone	1,119,407.39

Table 3. Legend of the land use map and area

	DESCRIPTION	Area m²	area HA
1	Unknown	21,490,281	2,149
2	Abandoned plantation	253,725,986	25,373
3	Banana	30,159,199	3,016
4	Drainage works	15,216,385	1,522
5	Mixed agriculture	609,506,658	60,951
6	Mixed Permanent Subsistence Ag	271,227	27
7	Mixed: subsistence agriculture and shifting cultivation	83,715,519	8,372
8	Old plantation (abandoned land/marginal agricultural activities)	405,779,463	40,578
9	Old plantation: predominantly grassland	28,247,032	2,825
10	Predominantly horticulture	31,912,773	3,191
11	Predominantly subsistence agriculture	42,501,579	4,250
12	Rice	111,836,774	11,184
13	Semi abandoned agricultural land	539,285,695	53,929
14	Shifting cultivation	33,884,667	3,388
15	State Farm	152,334,744	15,233
16	Urban area	104,549,393	10,455
	Total	2,464,417,375	246,443

Table 4 Protected area

Protected area (IUCN definition)	Area (ha)
Boven Coesewijne (IV)	27,000
Brinckheuvel (IV)	6,000
Central Suriname (IV)	1,592,000
Copi (IV)	28,000
Coppename Monding (IV)	12,000
Galibi (IV)	4,000
Hertenrits (III)	100
Peruvia (IV)	31,000

Sipaliwini (IV)	100,000
Wanekreek (IV)	45,000
Wia Wia (IV)	36,000
Brownsberg (II)	12,200
Bigi Pan (IV)	67,900
Noord Coronie (IV)	27,200
Noord Saramacca (IV)	88,400
Noord Commewijne-Marowijne (IV)	61,500
Total	2,138,300

Proposed protected areas	Area (ha)
Nani Natuurreservaat	54,000
Kaburi Natuurreservaat	68,000
Mac Clemen SPF	6,000
Snake Creek SPF	4,000
Total	132,000

4.2. METHODOLOGY

The assessment of agricultural suitability is an interpretation process that relies essentially on information about the conditions of the environment, physical and chemical properties of different soil classes and the feasibility of improving the basic qualities of the land: natural fertility, water deficiency, deficiency of oxygen (or excess water), susceptibility to erosion and impediments to the use of agricultural inputs. Some necessary modifications have been made for the specific case of Suriname.

4.2.1 Summary of the Assessment System for Agricultural Land Suitability

Considering the context of the country, especially concerning easier credit and environmental sustainability, in this work we will use only management level 1, indicated for family farming and management level 2, suitable for more intensive agriculture.

4.2.2. Management Levels

In order to determine the potential of the lands under different levels of agricultural technology and financial investments, the suitability of the land is being evaluated for two types of management, briefly described in Table 5.

Table 5 - Brief definition of the management levels used in agricultural land suitability classification.

Management Level	Agricultural Practices	Financial investments and agricultural technology used in the improvement and conservation of soil and crops	Type of work used
1	Average technology level	Moderate use.	Basically animal traction or small agricultural inputs.
2	High technology level	Intensive use.	Mechanization in almost all agricultural operations.

4.2.3 Suitability Classes.

The agricultural land suitability classes were defined as Good, Regular, Limited and Unsuitable. These categories represent the suitability of land for annual crops, perennial crops, planted pasture, forestry and aquaculture, in relation to the two levels of management. They exemplify to which extent the limitations impact the land.

Good - Lands without significant limitations for sustained production of a particular type of use, with respect to the management conditions taken into account. There are few restrictions that do not reduce productivity or benefits, and do not increase input levels above an acceptable level.

Regular - Lands which have moderate limitations for sustained production of a particular type of use, with respect to the management conditions taken into account. The limitations reduce productivity or benefits, increasing the demand for inputs in order to increase the

overall benefits obtained from land use. Although attractive, these advantages are significantly lower than those observed in lands classified as Good.

Limited - Lands that present strong limitations for sustained production of a particular type of use, with respect to the management conditions taken into account. These limitations reduce productivity or benefits, or increase the inputs needed in such a way that the costs can only be justified if there are specific interests.

Unsuitable - Lands which are not suitable for sustained production of a certain type of use.

The soil classes are represented by the letters G (Good), R (Regular), L (Limited) and U (Unsuitable), exemplifying land suitability for pasture, annual and perennial crops.

5 RESULTS

5.1 Crop Evaluation

In the proces five crops were evaluated using the ArcView GIS 10.4.1 software. The crops are;

- **Coconut**
- **Maize**
- **Papaja**
- **Oilpalm**
- **Livestock**

0The evaluation took place on the basis of the discription of the several crops in Tropical Crops *monocotyledons and dicotyledons* by J.W.Purseglove combined with publications and studies done by the National Planning Office in Paramaribo.

Table 6 Suitability table

CODE	Coconut	Maize	Papaya	Oil palm	Livestock
1	G	G	G	U	G
2	U	U	U	U	U
3	U	U	U	U	L
4	L	L	L	U	R
5	G	G	G	L	G
6	R	G	G	L	G
7	R	R	G	U	G
8	U	U	U	U	U
9	U	U	U	U	U
10	U	U	U	U	U
11	R	G	G	U	G
12	R	L	L	U	R
13	U	U	U	U	U
14	G	R	G	R	G
15	G	R	G	R	G
16	G	R	G	R	G
17	G	R	G	R	G
18	G	R	G	R	G
19	U	U	U	U	U
20	G	G	G	G	G
21	G	G	G	G	G
22	G	G	G	G	G
23	G	G	G	G	G
24	G	G	G	R	G

25	G	G	G	R	G
26	U	U	U	U	L
27	R	L	R	L	R
28	R	L	R	L	R
29	R	L	R	L	R
30	R	L	R	L	R
31	R	L	R	L	R
32	R	L	R	L	R
33	R	L	R	L	R
34	R	L	R	L	R
35	R	L	R	L	R
36	R	L	R	L	R
37	R	L	R	L	R
38	R	L	R	L	R
39	R	L	R	L	R
40	R	L	R	L	R
41	R	L	R	L	R
42	R	L	R	L	R
43	R	L	R	L	R
44	R	L	R	L	R
45	R	L	R	L	R
46	R	L	R	L	R
47	R	L	R	L	R
48	R	L	R	L	R
49	R	L	R	L	R
50	R	L	R	L	R
51	R	L	R	L	R
52	R	L	R	L	R
200	City	City	City	City	City
500	U	U	U	U	U
1000	water	water	water	water	water
1001	protected	protected	protected	protected	protected
1005	buffer	buffer	buffer	buffer	buffer

Figure 16 Soil suitability map for coconut

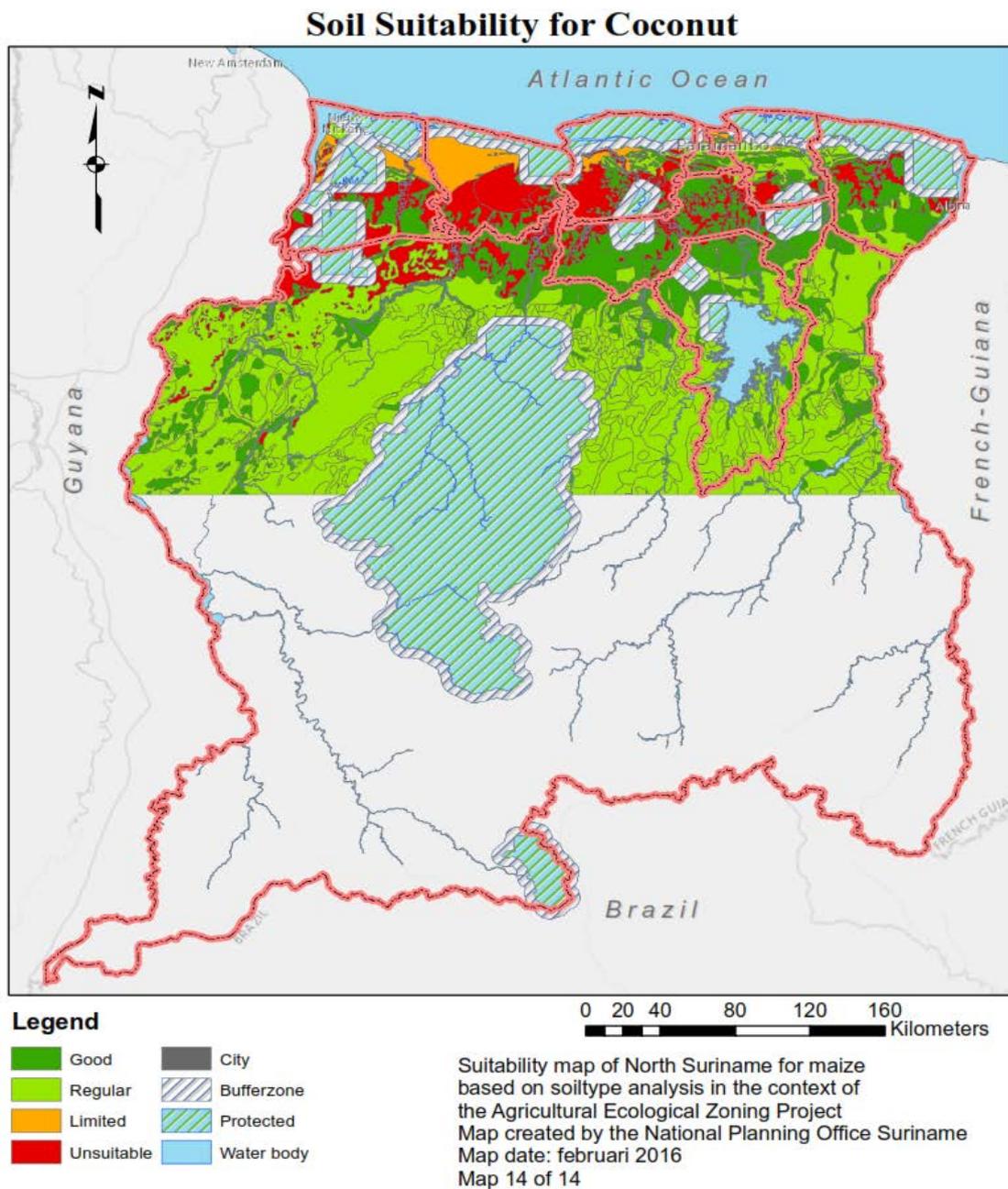


Table 7 Suitable areas for coconut

	Coconut	km²
1	Good	13,407.79
2	Regular	32,293.97
3	Limited	1,481.60
4	Unsuitable	7,571.25
5	City	15.36
6	Buffer zone	11,194.07
7	Protected Area	22,499.83
8	Water body	48,297.62

Figure 17 Soil suitability map for Maize

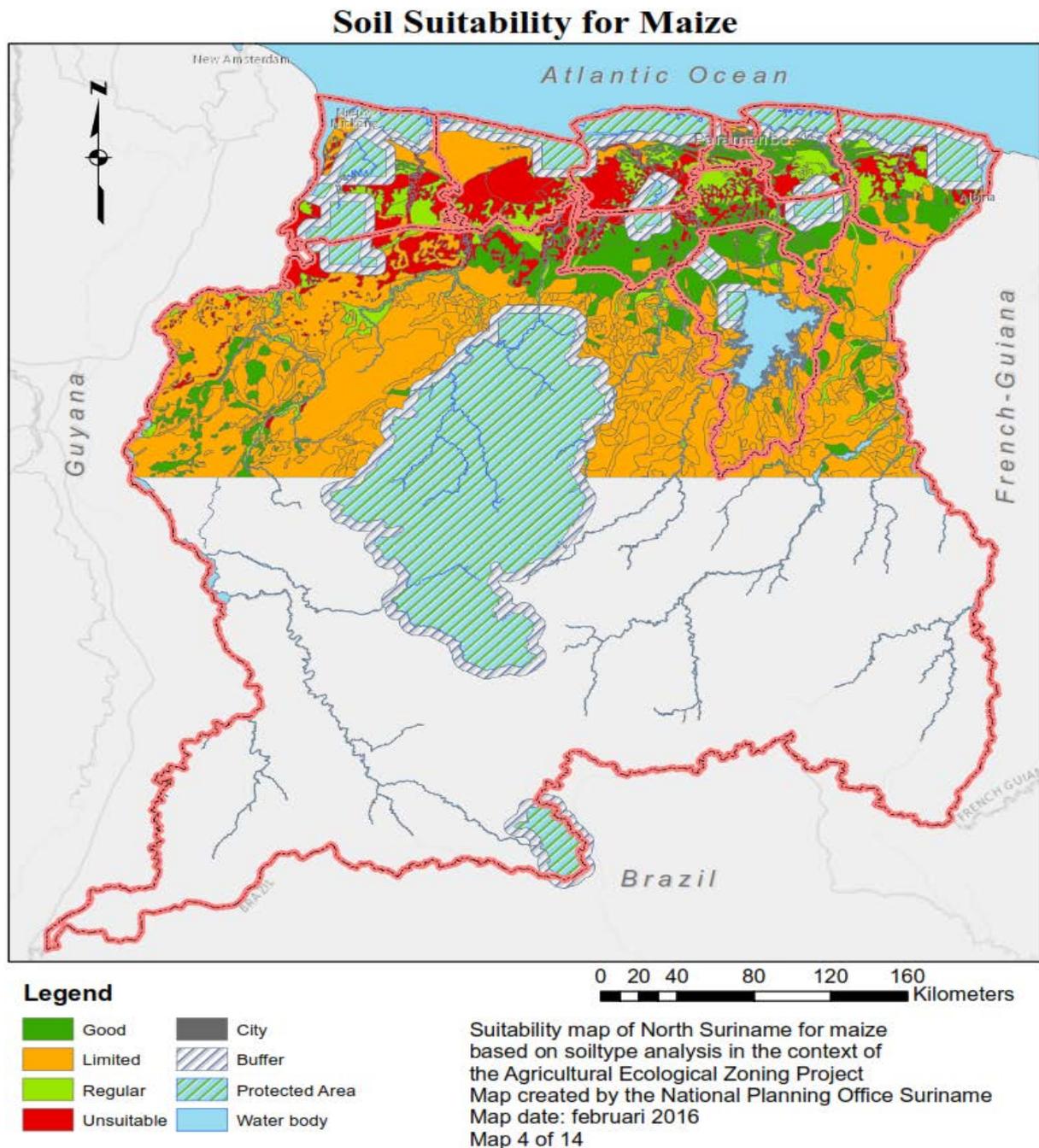
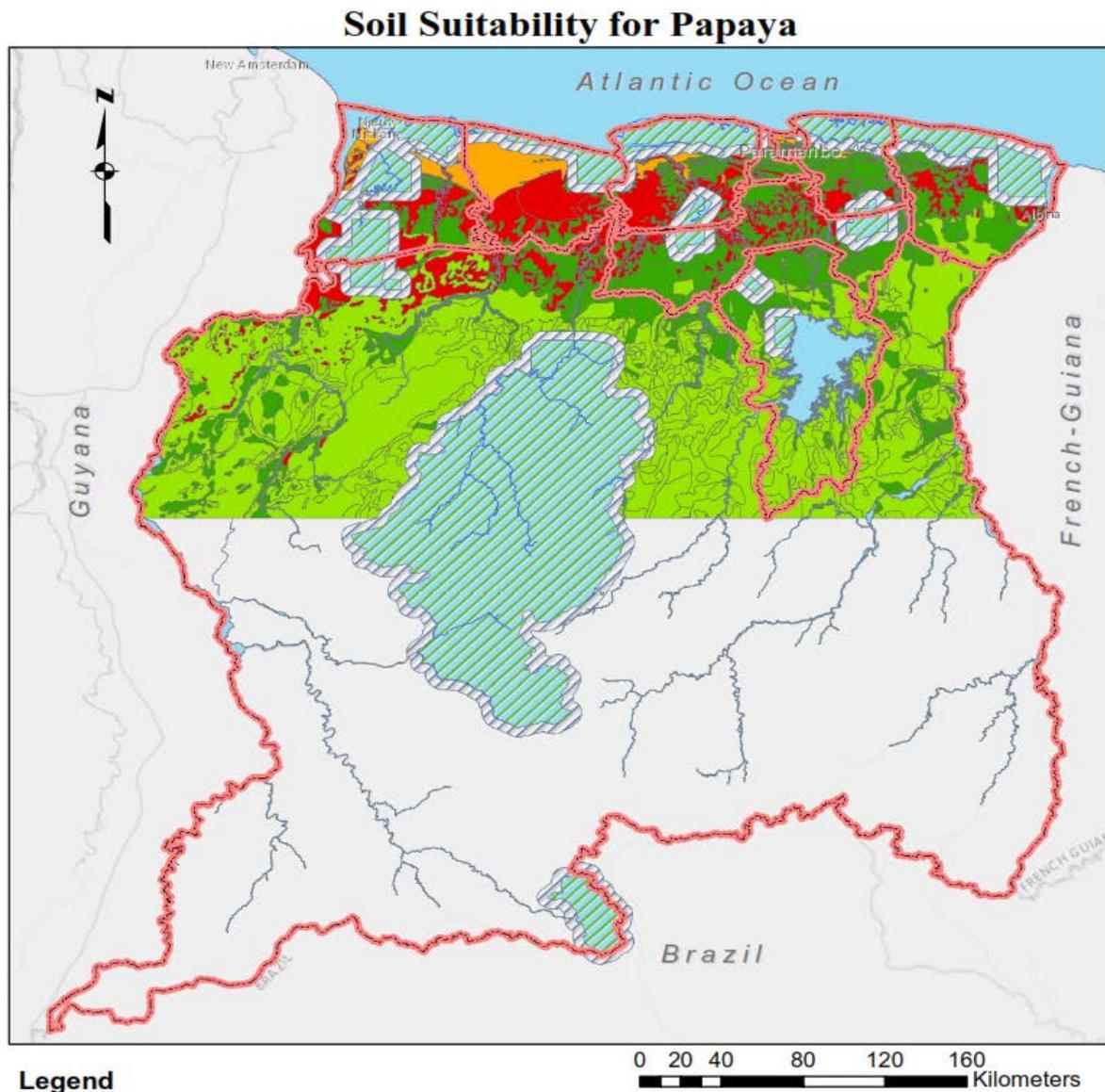


Table 8 Suitable areas for maize

	Maize	km ²
1	Good	8,954.49
2	Regular	5,664.08
3	Limited	32,564.79
4	Unsuitable	7,571.25
5	City	15.36
6	Buffer zone	11,194.07
7	Protected Area	22,499.83
8	Water body	48,297.62

Figure 18 Soil suitability map for Papaya



Legend

- Good
- Limited
- Regular
- Unsuitable
- City
- Buffer Zone
- Protected Area
- Water body

Suitability map of North Suriname for maize based on soiltype analysis in the context of the Agricultural Ecological Zoning Project
 Map created by the National Planning Office Suriname
 Map date: februari 2016
 Map 5 of 14

Table 9 Suitable areas for papaja

	Papaya	km ²
1	Good	14,618.57
2	Regular	31,018.90
3	Limited	1,545.89
4	Unsuitable	7,571.25
5	City	15.36
6	Buffer zone	11,194.07
7	Protected Area	22,499.83
8	Water body	48,297.62

Figure 19 Soil suitability map for Oil palm

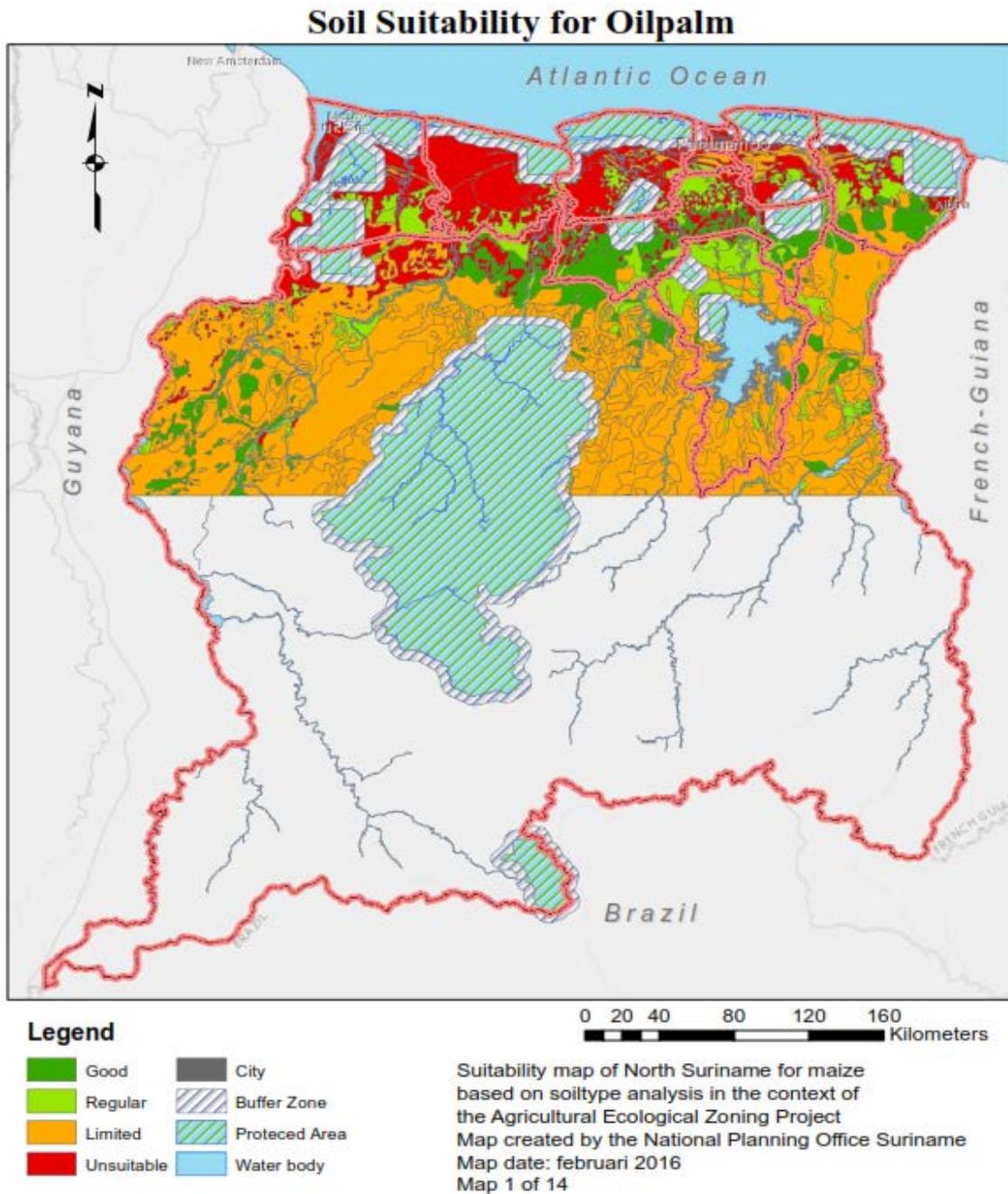
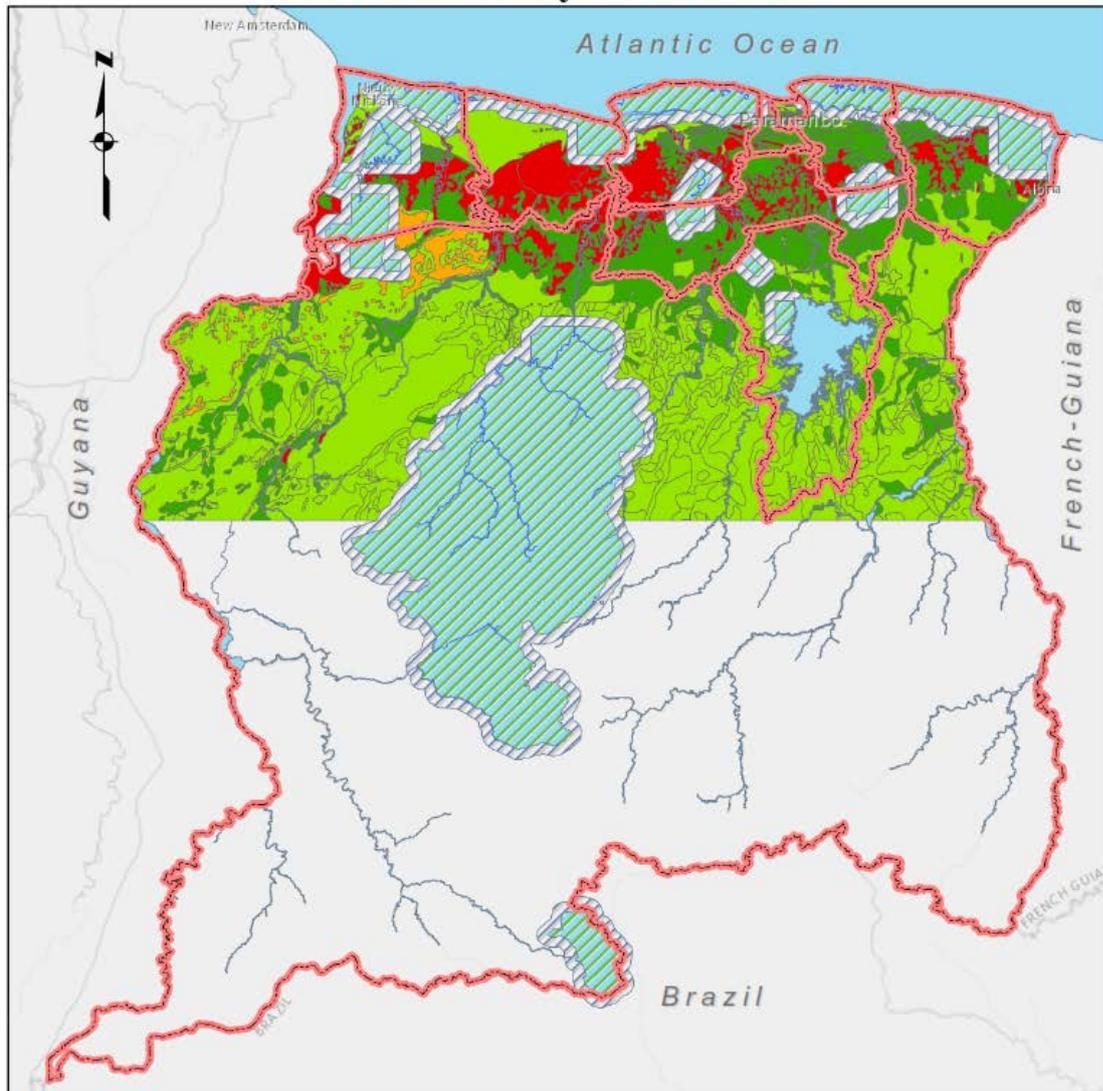


Table 10 Suitable areas for oilpalm

	Oil palm	km ²
1	Good	5,751.22
2	Regular	7,034.68
3	Limited	31,843.23
4	Unsuitable	10,125.47
5	City	15.36
6	Buffer zone	11,194.07
7	Protected Area	22,499.83
8	Water body	48,297.62

Figure 20 Soil suitability map for Livestock

Soil Suitability for Livestock



Legend

- Good
- Regular
- Limited
- Unsuitable
- City
- Buffer Zone
- Protected Area
- Water body

0 20 40 80 120 160 Kilometers

Suitability map of North Suriname for maize based on soiltype analysis in the context of the Agricultural Ecological Zoning Project
 Map created by the National Planning Office Suriname
 Map date: februari 2016
 Map 6 of 14

Table 11 Suitable areas for livestock

	Livestock	km²
1	Good	14,618.57
2	Regular	32,564.79
3	Limited	1,037.44
4	Unsuitable	6,533.80
5	City	15.36
6	Buffer zone	11,194.07
7	Protected Area	22,499.83
8	Water body	48,297.62

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