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A Methodology to Estimate Land Values in the Coastal Zone of Suriname Case Study in the District of Commewijne

by

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A thesis submitted to the Anton de Kom University of Suriname, Faculty of Technology, Suriname, in fulfillment of the requirements for the degree of Master of Science (MSc) in Sustainable Management of Natural Resources

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Paramaribo, Suriname

PREFACE

The master course Sustainable Management of Natural Resources (SMNR) is completed by means of after submitting a graduation graduate research with a corresponding an accompanying thesis. The graduation research enables a student, under supervision, to apply the acquired knowledge in practice. I am thankful to R. Nurmohamed Ph.D. for his supervision during my research. I would also like to thank K. Fung Loy M.Sc., Raoul Hieralal M.Sc. and N. Kalpoe B.Sc. for their support and helpful comments throughout the progress of my research.

A special thanks goes to my family and friends, especially my father for his encouragement, support and guidance throughout my entire study and research. I would also like to express my gratitude to my brothers, also to Radjiv, Shailish, Indira and Peter for their moral support.

This research would also not have been possible without the encouragement of many individuals and therefore I would like to express my sincere thanks to everyone for their motivation and encouragement.

Last but certainly not the least, I want to thank the Almighty for giving me the strength to achieve the goals aimed in my life.

Anuradha Lachman B.Sc.
Paramaribo, May 27, 2020

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LIST OF ABREVIATIONS

AMOG	Associatie van Makelaars in Onroerend Goed in Suriname (Association of Real Estate Agents in Suriname)
CBDs	Central business districts
EBS	N.V. Energie Bedrijven Suriname
FCM	Forest Cover Monitoring Unit
GDP	Gross Domestic Product
GHG	Greenhouse gas emission
GMD	Geologisch Mijnbouwkundige Dienst (Geological Mining Service)
HFLD	high-forest/low-deforestation country
KFC	Kentucky Fried Chicken
LULC	Land Use and Land Cover Map
LVV	Ministerie van Landbouw, Veeteelt en Visserij (Ministry of Agriculture, Livestock and Fisheries)
MIGLIS	Management Institute for Geographic Land Information System
MUMA	Multiple Use Management Areas
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RGD	Regionale Gezondheidsdienst (Regional Health Service Suriname)
SBB	Stichting Bosbeheer en Bostoezicht (Foundation for Forest Management and Production Control)
SWM	N.V. Surinaamse Waterleiding Maatschappij
tC	Ton carbon
TEV	Total Economic Value
TI	Tax Institute
UN	United Nations

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EXECUTIVE SUMMARY

Land Use Land Cover (LULC) have been continuously changing, through human activities towards development. In order to earn a living, people focus more on developed areas, causing an increased demand of land in these areas, and resulting into higher land values. The district of Commewijne is known as the agricultural district of Suriname, and in addition has various land use and land cover types. The demand for a piece of land in this district is lower, because it mainly consists of ecosystems. Residential, industrial and commercial areas represent a lower percentage, which complicates the valuation of land. There is no framework that can lead to a proper value estimation.

As a result of the aforementioned, the objective of this research is to describe historical land use and value behavior, design a methodology based on specified parameters to estimate land values in a demarcated area in the coastal zone of the district of Commewijne. The importance of ecosystems and how they add value to land are also highlighted, for example the trade of carbon credits for carbon sequestration by forests and mangroves within the ecosystem of this area. The various categories known as 'Use Classes' for valuation are: (1) abandoned areas, (2) agricultural area, (3) rural, (4) open swamp, (5) waterways, and (6) roads. Furthermore, the external factors, sea level rise, natural disasters and accessibility to the area cause a sudden change in value of land. This methodology can be used for the coastal zone of Suriname, by using a substitution parameter according to the location. The accessibility of the area can boost the development within the area for income in terms of land trading and usage of ecosystem services.

Keywords: land valuation, ecosystem services, Commewijne, land cover and land use.

1. INTRODUCTION

1.1 Background information

Suriname is one of the smallest countries of South-America, counting 10 districts, bordered by French Guyana to the east, Guyana to the west and Brazil to the south. Suriname is a developing country and its economy is dependent on the supply of natural resources, gold and crude oil (in the past also bauxite) [1]. According to research of reducing emissions from deforestation and forest degradation (REDD+) Suriname is a high forest, low deforestation country (HFLD) and also the greenest country on earth; 93% of Suriname is forest. Forest is an important component on economic, social and cultural level for the country. The forest has value on national and international level, on national level it provides important goods, and services in terms of income and food security; on international level it contributes to reduction of greenhouse gas emissions through carbon storage [2].

Suriname can be divided into two main geographic regions:

- The northern, lowland coastal area has been cultivated and most of the population lives in this area, including Paramaribo the capital of Suriname, situated in the lowland coastal area and containing the largest number of inhabitants, because most facilities are located in Paramaribo and its surroundings [3]. This results in a preference of living in or near Paramaribo. The preference causes an increasing demand of settlement in or around Paramaribo, the urban areas with high land values for residential, commercial or industrial purposes.
- The southern part, consisting of tropical rainforest and sparsely inhabited savanna merging into the amazon rainforest of Brazil. This part of the country is a known for its forest, causing lower demand for living and commercial and therefore being of lower value. Using the ecosystems can be used to derive income.

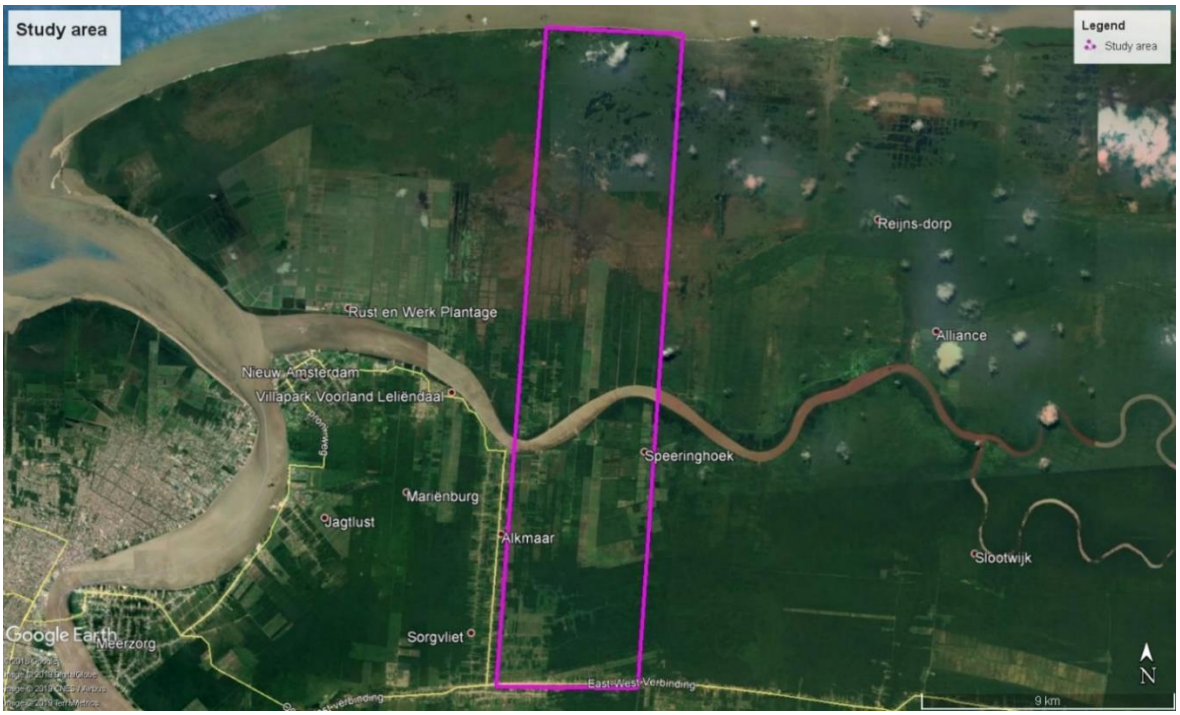
In order to support decision-making and formulating proposed plans, programs and development projects, the Forest Cover Monitoring Unit (FCM) produced, in collaboration with other institutes, a Land Use and Land Cover Map (LULC) of Suriname. This map is produced every 5 years to present an overview of developments in the different land uses [4]. In addition, the Management Institute for Geographic Land Information System (MIGLIS) is the office of the custodian for information on land and land surveys. The MIGLIS has an online land value index with prices of land based on the street where the

plot of land is located. Unfortunately, the index contains only parcels situated in Paramaribo, in parts of Nickerie and in parts of Commewijne; the built-up areas of these districts [5].
The Taxation Institute (TI) is the governmental institution which is engaged in land values exclusively of governmental grounds, determination of annual land rent reimbursement and valuation of land that the government is interested in to buy or exchange [6]. Unfortunately, there are no valuations of ecosystems of Suriname. Furthermore, there are valuators taking their own approach to valuation of land, instead of following a fixed directive. The focus is mostly on the economic value of land, and in addition to forest, wetlands, mangrove and other ecosystems deliver an economic value to the Gross Domestic Product (GDP) of Suriname. These ecosystems provide income.

1.2 Problem description

Land is one of the most precious assets and it is finite in its extent. Offer and demand are decided by the underlying perception of potential benefits that can be derived from a piece of land and that also determines the value. Land value can be defined as the monetary cost of the land, it can be the value of undeveloped land, a built-up property or the services produced by land. Mostly, land is known for the economic benefits, for example the trading of parcels, but land is also a natural resource that produces ecosystem services. In order to regulate land valuation, it is important to understand the history as well as the current situation. Historical data of this area could provide insight in the land use and land cover at that time. The baseline study is meant to analyze and describe the current situation, and changes in land use through time may be linked to an increased or decreased of value of land. A proper methodology for the regulation of land valuation will be achieved during this research based on specified factors. Furthermore, external factors which can cause a land value to rise or drop unexpectedly, are studied. Valuators have interest in urban areas, whereas the districts that are less inhabited and have more forested areas receive less interest for valuation. Commewijne is also one of the districts of Suriname which is less inhabited and more forested, resulting into less interest in the valuation of land in this district. Commewijne is located in the north of Suriname, it is bordered by the Atlantic Ocean in the north, in the west by the districts of Paramaribo, Wanica and Para, in the east by the district of Marowijne, and in the south by the district of Para. Commewijne has a total land surface of 2,353 square kilometers and is subdivided into six resorts Margaretha, Bakki, Nieuw Amsterdam, Alkmaar, Tamanredjo, and Meerzorg. Commewijne consists of mainly rural

areas, while urbanization is also increasing strongly in the district. A delineated area of Commewijne is selected for the research (see Figure 1.1 Study area).



Map 1.1 Study area

1.3 Objective

The objective of this research is to describe historical land use and value behavior, alongside designing a methodology for the valuation of natural resources produced by the ecosystems in the study area.

1.4 Research questions

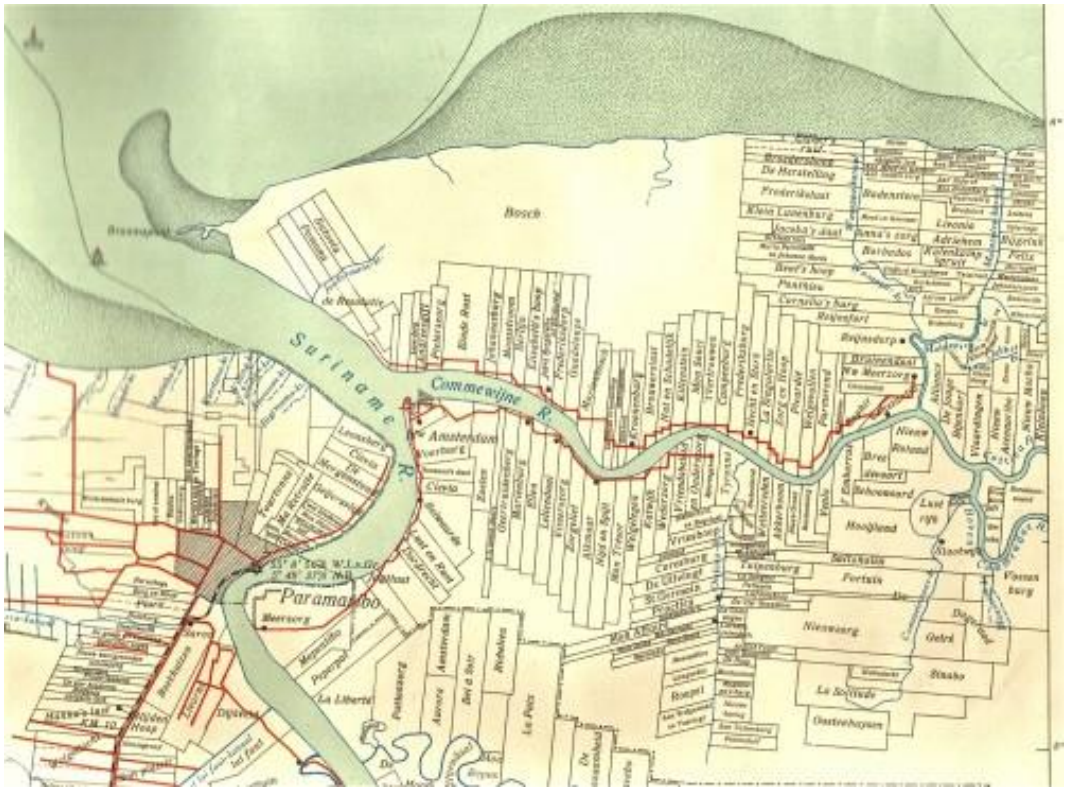
In order to carry out the research in a targeted manner, the following research questions are formulated:

- How was the division of the study area during the colonial period from 1667 till 1975, and what was the reason for that specific division?
- What parameters are currently used to assess land value within the study area, and what factors may cause land value to change in the future?
- Why is a methodology for the valuation of less inhabited areas and ecosystems also important and how can ecosystems be used to generate income?
- How can external factors affect land value?

2. LITERATURE REVIEW

2.1 Historical information

The early history of Suriname dates from 3000 BCE when Native Americans first inhabited Suriname. In 1490, Suriname was discovered by western colonists and became a colony of England until Suriname was conquered by the Netherlands in 1667. Plantations were established and the main agricultural products were coffee cacao, cotton and sugar. Even in the district of Commewijne, plantations were established, where cacao and cotton were planted alongside coffee and sugar cane. Commewijne counted about 300 plantations [7]. The plantation situation was the main structure of the area layout of Commewijne. The plantations were mainly situated alongside the Commewijne River and creeks, because formerly the main transport routes were via water, by means of boats.



Map 2.1 Map plantation layout

The Second World War caused sales markets of plantation products to be lost and plantation workers to return to be drafted for the military service. Many big agricultural companies were forced to close their doors. Furthermore, the plantations located on the northern bank of the Commewijne River were salinized. Neglected dikes allowed seawater and salinized

river water to gain access to the plantations that caused the plantations to become infertile. The result of this salinization was that many plantations were abandoned [7]. This caused the economic value of the plantations to decrease.

2.2 Factors that affect (commercial) land value

The value of land may significantly differ per location due to several factors. Furthermore, a piece is land is more valuable after investing a significant amount of money in it, for example raw rural land is not useable for urban development without spending significant amounts of money on infrastructure or site preparation resulting in an increase of economic value. In some cases, larger parcels have lower prices than smaller parcels due to fewer structural improvements per unit area and poor accessibility [8].

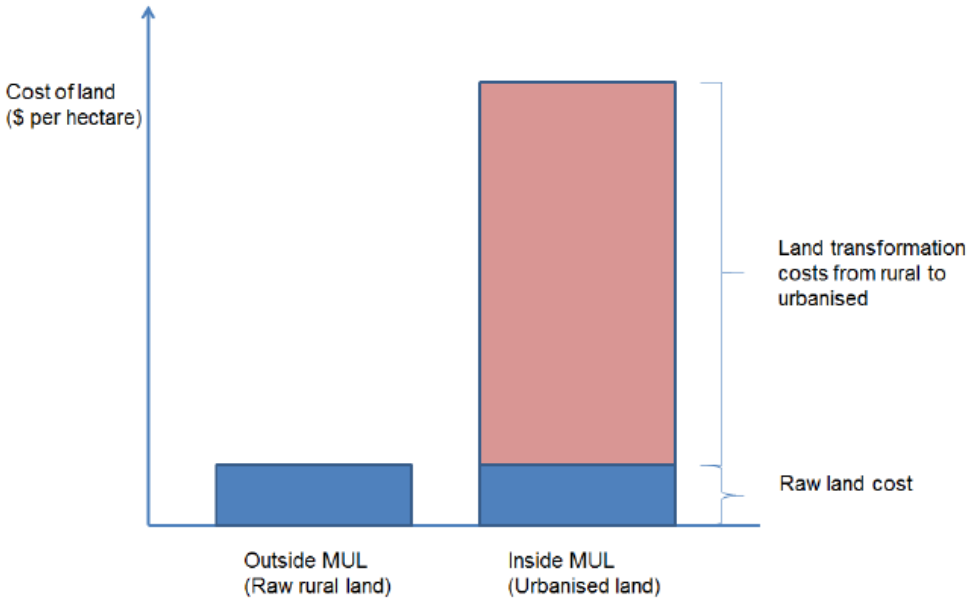


Figure 2.1 Rural vs urban land value [9]

The economic value of urban areas at first depends on the distance from the city center. Due to shifts in the global economy, as well as recent technological and economic developments, city centers have begun to act as central business districts (CBDs) by offering accommodation, education, culture, recreation, and health facilities. Thus, the distance to these new CBDs has begun to affect and determine land values not only in their immediate surroundings, but also for all the plots within the urban area [10].

There are several factors affecting direct economic value of land in built-up areas to be used for building:

1. *Physical attributes*, such as quality of location (topography), availability of water, sewer lines. More and better facilities is attributed to a higher value of land. Topography, the quality of location, has a direct effect on the potential uses. The availability of water is of great importance for most uses and so is the sewer system important for a good drainage of the area [11];

2. *Distance from economic centers*; the more accessible economic activities, the higher the value. People should have easy access to economic activities and work places, neighborhood amenities, the facilities in the area, such as schools, medical health centers, supermarkets, and other basic human needs. This saves time and money for people every day, but at the other hand it causes an increase of land value. The more accessible the social facilities, the higher value of land in a significant area [11];

3. *Land title*, in Suriname consisting of sole ownership, leasehold property, and allodial title and hereditary property. In addition to land title, the present and future land use purpose permitted in the land premises by law, such as residential or agricultural, also impact the value of land [11];

4. *Location and transport linkages,* and the infrastructure of an area also determines the value of the area. The type of linkage, such as paved or unpaved roads are also a factor influencing land values. The value of the land with the land use having a higher rate of return over a period of time is to be valued more highly. This causes a higher willingness to pay for commercial, industrial or institutional land use [11];

5. *Demand and supply function***.** Once an area is being developed, the demand for certain services and needs increases. The increased demand will lead to increasing artificial scarcity of available land, caused by the preference one has to an area where the necessary facilities already exist.

2.3 Factors that affect land value (ecosystems)

The most commonly used ecosystem services are [12]:

- *Supporting ecosystem services;* all processes that affect the functioning of ecosystem services maintenance, such as primary production, nutrient cycle, oxygen production, soil formation, and food and water circulation;
- *Regulatory ecosystem services;* the benefits we obtain from the regulation of ecosystem processes, such as climate regulation, water treatment, pollination, erosion control and pest control;
- *Producing ecosystem services*, these include the products obtained from the ecosystems, such as food, fuel, fiber, wood, freshwater, genetic material and medicines;
- *Cultural ecosystem services*, these are all non-material benefits that people receive from ecosystems, such as aesthetic and spiritual values, ecotourism, education and religion [12].

The economic value of an ecosystem depends on the income that can be generated using the ecosystem services, which the revenue is derived from, while this business determines the value of that ecosystem. The four services mentioned above can be used to derive income, for example from production of food; people can grow crops and sell for gaining income. Furthermore, climate regulation in the form of trading carbon credits can also deliver income and this can increase the GDP.

Mangroves, coral reefs, seagrass and other coastal wetland habitats provide ecological, economic, and social services that support the existence of ecosystems and human communities. Coastal habitats support high floral and faunal biological diversity, and people living in the coastal plain depend on these habitat types for their livelihood, through extraction of resources in a direct or indirect way [13].

Despite the fact that these coastal habitats provide services for human beings, they have undergone serious degradation and loss in the recent past decades due to industrialization, urbanization, increased tourism, and other destructive human activities. A reason for the high percentage of degradation and loss of coastal habitats is the lack of awareness of markets of the economic values of coastal habitats and the undervaluation of environmental goods and services. The role of the ecological functions of coastal habitat in sustaining

coastal economies is not well understood and often coastal habitats are considered low valued or no use lands. The profit gained by these areas may not be in direct terms, but indirect terms and that is why the economic value of coastal areas is not well understood [13].

Caribbean mangroves strongly influence the community structure of fish on neighboring coral reefs. In addition, the biomass of various commercially important species is more than doubled when the adult living environment is connected to mangroves [14].

An example of the impact of deforestation of mangrove in South China is the production of mud crab. Over the period 1990 – 2003, the average mud crab gathered was 638kg/ha/year. In 2004 and 2005, the average mud crab collected in the area dropped to 416.7kg/ha/year due to mangrove deforestation. The price of mud crab in 2005 was US$1.5/kg. So the loss of mangrove forest caused a decrease in annual production of mud crabs, equivalent to about 221.3kgs/hectare or US$331.95/hectare loss of income from mud crab catch.

The conclusion is that the decrease in mangrove forest cover resulted in an economic loss equivalent to US$331.95 per hectare per year for that coastal area [13]. Wetlands resources provide economic benefits in many ways. In the United States of America there are billions earned using the wetland services. Many commercial fish species, furbearers, like muskrat, beaver, otter, and mink, as well as reptiles, such as alligators are found in these wetlands. Wetlands also provide recreational, educational and research opportunities for bird watchers, wildlife photographers or students who study ecological functions of vegetation in these areas. Furthermore, wetlands provide water quality improvement, shoreline erosion protection and flood storage [15]. Figure 2.2 “Economic valuation approach for ecosystems” gives an approach of the economic valuation of ecosystems, including wetlands. The Total Economic Value (TEV) of an ecosystem is subdivided into use values and non-use values with its subdivisions ending up to the functions which they deliver to the community.

According to Florian V. Eppink, losing natural resources, such as wetland ecosystems affects human welfare, because wetlands not only regulate the climate by capturing carbon dioxide, methane and nitrous oxide, but also provide a nursery for fish populations, regulate groundwater recharge, filter nutrients and pollutants from surface water and provide opportunities for recreational and educational purpose. The study of Florian V. Eppink proves that wetlands may not have a direct value as land, but they surely produce economic and social benefits by their ecosystem services, which contain their own value as land per hectare production [16]. One side logging of mangrove produces big amounts of economic value as forest and, on the other hand REDD+, a United Nation (UN) program, compensates

forest conservation. Unfortunately, development goes hand in hand with deforestation, whilst mangrove is a gigantic form of carbon storage and reduces the effects of climate change, forest disappears for the construction of infrastructure or industries.

The conservation of mangrove delivers carbon credits, which can be traded with developed countries. Recent studies indicate that each hectare of mangroves stores several times the amount of carbon found in upland tropical forests [17]. The Kyoto Protocol has set out an article which allows countries that have emission units to spare - emissions permitted them but not "used" - to sell this excess capacity to countries that are over their targets. It is called the “carbon market”, because carbon is being traded [18]. As carbon credits are a certain amount of carbon dioxide or other type of greenhouse gas (GHG) emission which can be traded, it is called “cap-and-trade” [19]. This is a type of polluter pays principle; companies or countries that pollute can trade the balance in the form of credits to other companies or countries up to a certain limit. Emission of 1 ton CO2 equals to 1 carbon credit, for example reduction of 1 ton CO2 by mangrove can provide the trading of 1 carbon credit. One ha mangrove plants store approximately 437-ton carbon (tC) [20].

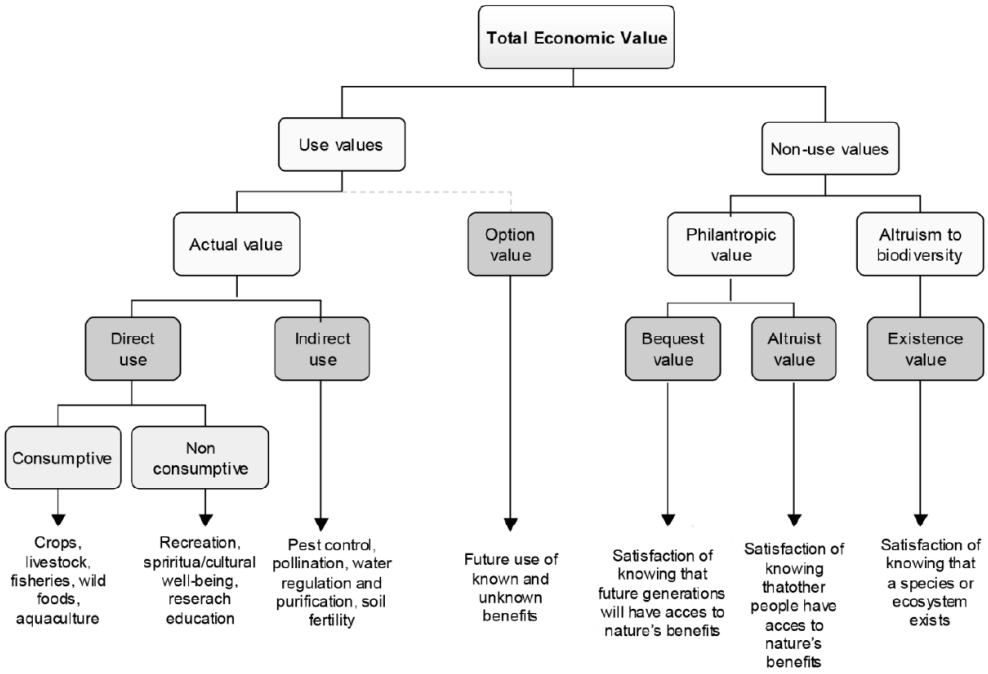


Figure 2.2 Economic valuation approach for ecosystems [16]

About 60% of the coastal plain of Suriname is covered by wetlands, and these contain fresh water during wet seasons from precipitation falling directly on the wetlands and revert to brackish waters during dry season [21]. The conservation of coastal wetlands is important

because they provide nursery function, biodiversity and coastal protection. These ecosystems can be used for deriving income, for example enabling environments with the mangroves, such as fisheries, logging, recreation resorts and tourism to generate income and create job opportunities.

The TEV provides a framework to understand the value of wetlands. Table 2.1 "Use and non-use value of ecosystems" illustrates the use of this framework and the grouping of "Use values" and "Non-use values". Use values involve some human "interaction" with the resource, whereas non-use values do not. Commercial uses may be important for both domestic and international markets. In general, the value of marketed products (and services) of wetlands are easier to measure than the value of non-commercial and subsistence direct uses. Policy makers often fail to consider these non-marketed subsistence and informal uses of wetlands in many development decisions. In contrast to economic values, wetlands provide regulatory ecological functions, for example the storm protection and shoreline stabilization functions of a wetland may have indirect use value through reducing property damages, yet often coastal or riverine wetland systems are drained in order to build still more waterfront property [22].

Bigi Pan not only is one of the most famous wetlands in Suriname, but it also is an example of conservation of a wetland and also of how people can generate income from the natural resources produced by a wetland. Bigi Pan MUMA is identified as potential wetland for tourism activities, including revenue generation [23]. This very productive area houses various products and services that are of interest to not only the local community, but also to the entire Surinamese society. A study carried out in the Bigi Pan area indicates that fishing and tourism are the most important uses, while approximately 1000 families earn their income directly or indirectly from Bigi Pan [24].

REDD+ encourages developing countries to protect their forest, leading to reduction of emissions from deforestation. The REDD+ mechanism is based on financial compensation for encouraging responsible logging, replanting, for example after mining, spreading conservation activities, such as creating nature conserves or protected areas. Suriname is also a developing country and because of the fact that Suriname is the greenest country on earth, it is a REDD+ Country Participant. [25] . Timber delivers revenue, but once trees are cut, it takes years to have those adult trees back, while conservation of forest can generate income in the long run. While conserving the forest, other functions to generate income through the forest, for example creating parks can be implemented.

Protected areas are tools for a special kind of development that respects both people and nature. In this case, development is conceived to meet the needs of today without compromising the potential of tomorrow. Protected areas might be sustainable suppliers of natural products, a store of biodiversity, protectors of vital water suppliers, centers of tourism and cultural assets, for example the Bigi Pan wetland. These areas are to contribute fully to sustainable development where people can meet their needs. The economic valuation of these areas is more or less indirect, and the ecosystem services contribute to the economic and social benefit [26]. Within the non-use value, the willingness to pay is also taken into consideration, whereby people pay an amount to preserve an ecosystem for its produced services, such as a wetland purifying water.

Table 2.1 Use and non-use value of ecosystems [21]

USE VALUES			**NON-USE VALUES**
Direct Use Value	**Indirect Use Value**	**Option and Quasi-Option Value**	**Existence Value**
• fish • agriculture • fuelwood • recreation • transport • wildlife harvesting • peat/energy	• nutrient retention • flood control • storm protection • groundwater recharge • external ecosystem support • micro-climatic stabilisation • shoreline stabilisation, etc.	• potential future uses (as per direct and indirect uses) • future value of information	• biodiversity • culture, heritage • bequest values

2.4 External factors affecting land value

1. Sea level rise

   Climate change causes the sea level to rise, due to warmer atmosphere and sea water. The mean global sea level rose by an average of 3.2 mm/year since 1993 and is projected to increase another 0.18 – 0.82 meters by 2100, while coastal populations have continued to expand [27]. The sea level rise threatens the coastal zones. Yet presently, approximate 40% of the world's population lives in the coastal zones. Reasons for the high concentration of human settlements in the coastal zone are the economic benefits, coast fisheries, tourism and recreation. On the other hand, the high density and increasing economic activities in the coastal zones pressure causes habitat conversion, land cover change, pollutant loads, and introduction of invasive species, causing threat to the coastal zones [28]. Sea level rise also increases the salinity of ground water and pushes salt water further upstream. Higher salinity can make water undrinkable without desalination, and harms many aquatic plants and animals, and impacts agriculture. Furthermore, a rising sea level could erode and inundate coastal ecosystems and eliminate wetlands [29].

   Sea level rise, flooding, can impact land values for residential function. Agricultural areas can also be impacted by salinity, which can cause abandonment. Furthermore, it can impact protected areas which are used by local resident for income generation by fisheries or tourism. Figure 2.3 "Flood at Weg naar Zee" shows an example of flooding in Paramaribo, this flooding caused loss for many local farmers, also land prices dropped instantly because of the damages caused by the flooding.

Figure 2.3 Flood at Weg naar Zee [29]

2. Natural disasters

   A natural disaster is defined as a serious disruption triggered by a natural hazard causing human, material, economic or environmental losses [30]. Natural disasters, such as earthquakes, landslides, flooding, forest fires and hurricanes may result in significant loss of land. An examination to Fourmile Canyon Fire done by Kathy Kiel and Victor Matheson showed that a forest fire causes first of all huge loss of fertile land. After such a fire, acres of land are left burned, causing a decrease of value, even the neighboring grounds face drop of value [31]. These disasters not only destroy land, but also ecosystems, the biodiversity in the area, crops and livestock. Damaged land takes time to recover as to be used again. The percentage of the decreased value is determined by keeping several factors in mind, such as nature of destructions, the number of times the area was affected by a natural disaster and the coverage of the natural disaster [32]. Earth quakes and/or peat fires can cause severe damage to areas which also decreases the value of an area suddenly, for example crops that were burned or got damaged or damage to residential area. The recovery may take time and money.

3. Accessibility to an area and development causes sudden changes in connectivity, neighborhood and other human connecting factors, which mostly results in attractiveness for people to establish in the area. Once an area gets access and connection to main facilities, such as stations, shopping centers and activity areas, the value of land in such an undeveloped or less developed area increases suddenly [10]. Accessibility to nature reserves adds value to the area, while the ecosystem services can be used to generate income. For example, a neglected canal was cleaned up and maintained to be used for transporting tourists for bird and turtle watching tours from resort Frederiksdorp, the people involved in the tours generate their income through use of ecosystem services. Accessibility to wetlands can motivate the fisheries sector and accessibility to agricultural areas can make it easy for farmers to invest in the sector and increase their revenue which will have an impact on the GDP.

3. METHODS AND MATERIALS

3.1 Methods

3.1.1 Literature study

This research was carried out by first reviewing relevant literature and reports about the thesis topic to get insight in land valuation and the factors that determine the value of a piece of land (April 2018-June 2018). Documents based on different countries were studied to understand the difference in valuation according to parameters. Management plans by Teunissen were used to understand the importance of ecosystems in Suriname.

3.1.2 Interviews

To understand the situation in Suriname, I have interviewed the custodian of MIGLIS, valuator of TI, four private valuators and a public notary. The interviews were conducted in the months of June and July.

During these interviews, I understood that every valuator has its own interpretation, insights and approach for the valuation of any piece of ground. The TI consists of 4 valuators among whom Mr. Jateman is the head. According to him, the TI has no specifications or parameters for the valuation of a wetland. He also noted that a valuation is an instantaneous valuation based on personal experiences. The TI has a list with factors being scored by the valuator on the spot (see Appendix 1a, 1b, and 1c "Valuation form"). After giving each factor a score according to its distance from the plot to be valuated, the scores are summarized and multiplied by a value per square meter which delivers the minimum price. The TI is involved with government lands, and has no interference with commercial and/or property land. Private valuators are busy drawing up valuation reports for commercial and/or sole ownership property. The private valuators have no fixed guideline, each valuator uses its own experience and insight. There is an association called Association of Real Estate Agents in Suriname (Associatie van Makelaars in Onroerend Goed in Suriname, AMOG), which provides guidelines and regulations for valuations. Unfortunately, not all valuators are member of this association, although one needs to be confirmed by oath as valuator to draw up a legal valuation report. According to Mr. Robert Elmont M.Sc., a valuator of AMOG, they use the next factors for every valuation as guideline: (1) land title, (2) location, (3) land

use aim permitted for the premises, (4) infrastructure, (5) accessibility. These factors affect the value of trading any piece of land.
Furthermore, a valuation report may have many purposes, such as:

- valuation by valuators of the TI to make an offer in case the government needs to buy a piece of land which is someone's property;
- for an application of a mortgage on the property;
- for trading a property;
- or to have an indication of the value of the property.

During all these interviews the valuation of ecosystems was missing. There is less interest in the valuation of ecosystems, because these are not used for trading; one cannot earn money by selling them. In order to understand the valuation of ecosystems, the services provided by ecosystems, and their importance, literatures were reviewed. Paul Ouboter Ph.D. and Usha Satnarain M.Sc. were also interviewed to get more insight about ecosystems and their use in Suriname.

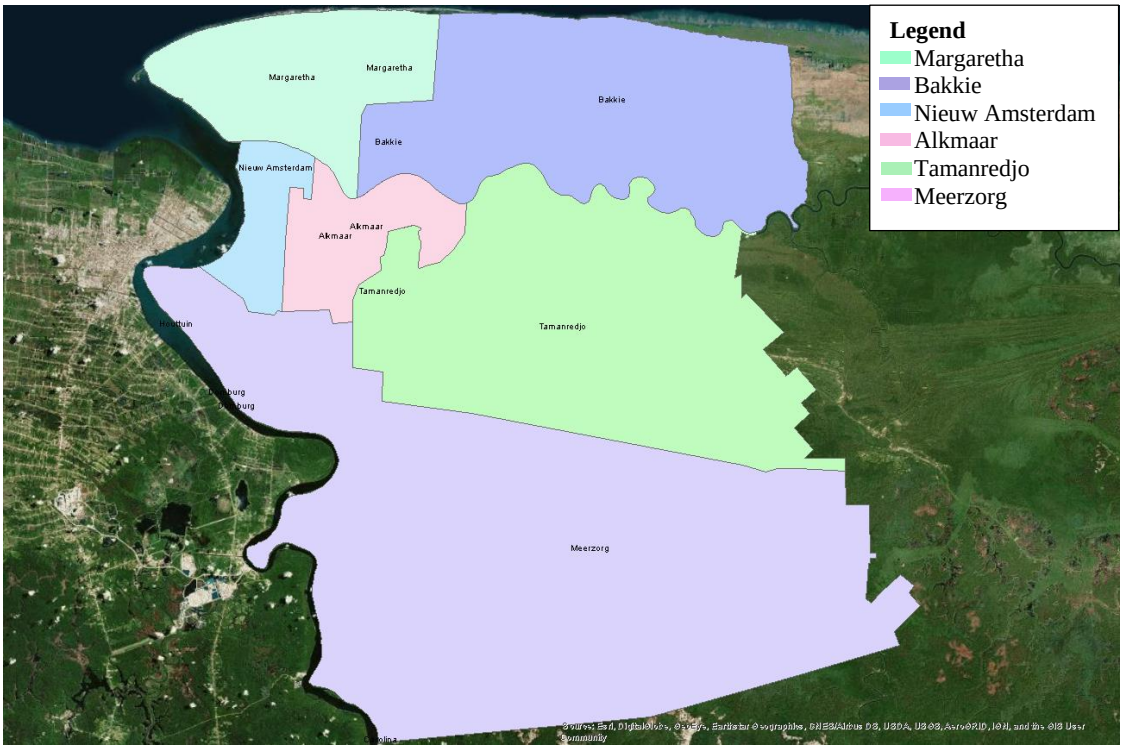
3.1.3 Field observation and surveys

For the baseline, study field visits were carried out based on the accessibility of the area and the certainty of the locations. Subsequently, ten field surveys and field visits were carried out, in order to have insight in land uses, the infrastructure and the biodiversity of the area and to have an indication of the manner in which local residents use their land. The results of the field surveys and observations are described in the next chapter, Results and discussion. The field surveys and observations were carried out in July and August (Map 3.1 Pinpoints of surveys in field). During the surveys, it was necessary to cover at least one survey per land use and land cover type, but it was not possible to cover the whole study area equally, because of impassable and uninhabited areas.

Map 3.1 Pinpoint Land Survey

3.1.4 Study area

Commewijne is one of the ten districts of Suriname. In Chapter 2, section historical review, it is indicated that Commewijne was a plantation district in the colonial period. The district is still known for its agricultural quality.



Map 3.2 Jurisdictions of Commewijne [33]

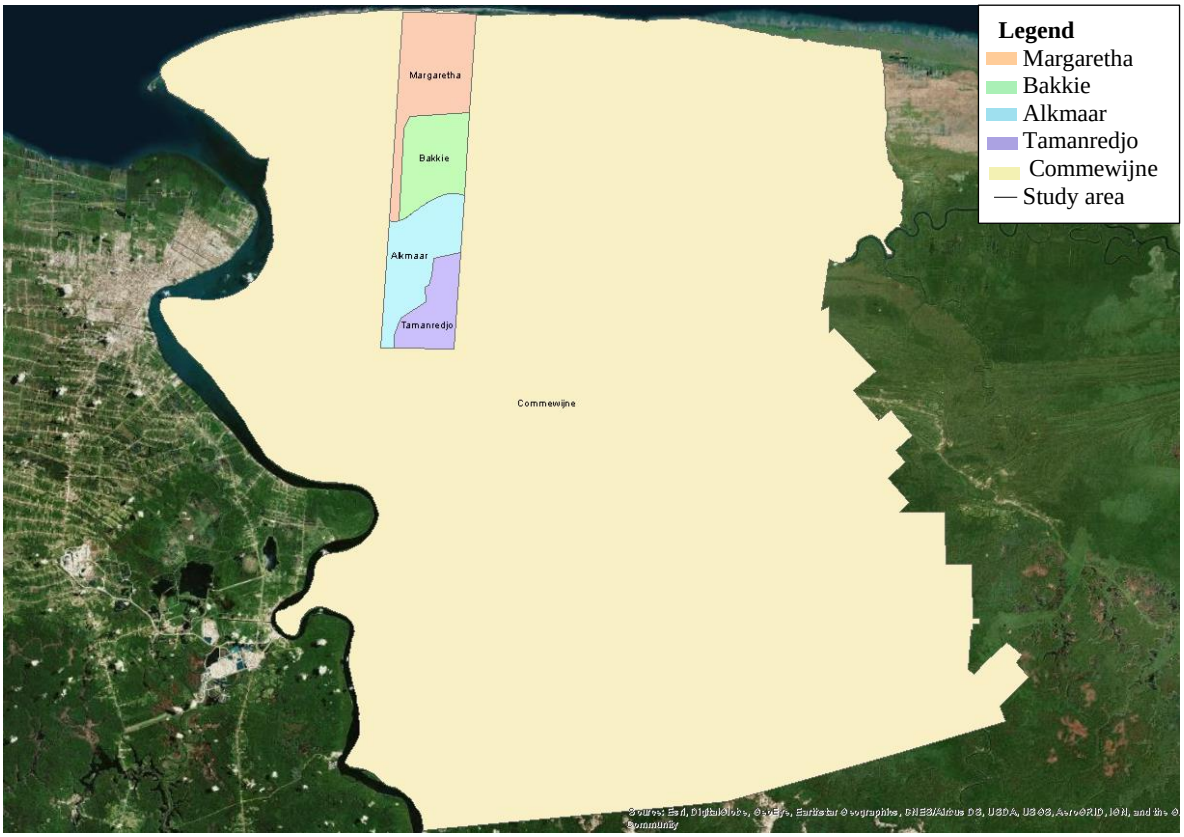
Currently, Commewijne is still popular for its agricultural quality, but not in the form of the former plantations. Commewijne is divided into six jurisdictions (See Map 3.2 Jurisdictions of Commewijne).

Table 3.1 CENSUS 8 (2012 census)

Jurisdiction	Population
Margaretha	756
Bakkie	447
Nieuw Amsterdam	5,650
Alkmaar	5,561
Tamanredjo	6,601
Meerzorg	12,405

The population in Commewijne accounts for 2.25% of Suriname [34].

The research area contains parts of four jurisdictions: Margaretha, Bakkie, Alkmaar and Tamanredjo (see Map 3.3 Jurisdictions in the research area).

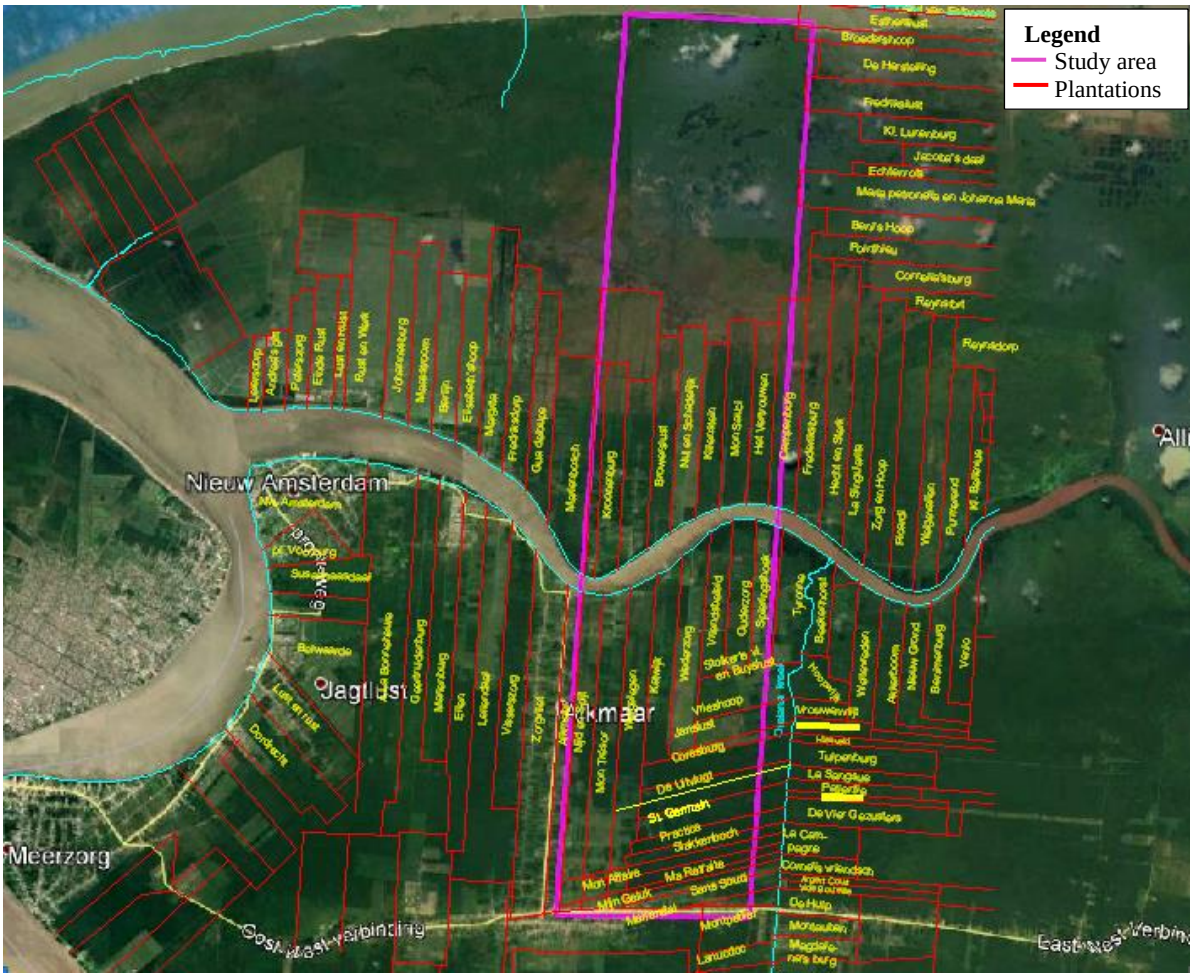


Map 3.3 Jurisdictions within the research area [33]

In the next chapter the physical, biological and human resources are described extensively as baseline study. A delineated area of Commewijne (see Map 3.3 Jurisdictions in the research area [32]) was chosen for the study area. The area covers approximately 11,534 hectares with a variety in land use and land cover types. Map 3.4 “Study area with plantation layout” shows the study area in the color magenta and also the formerly plantation layout. The plantation division is used as a basis for the distribution of land and can still be found in current area planning. The northern part of the study area has no plantations, according to literature those areas were salinized area and unusable as plantations.

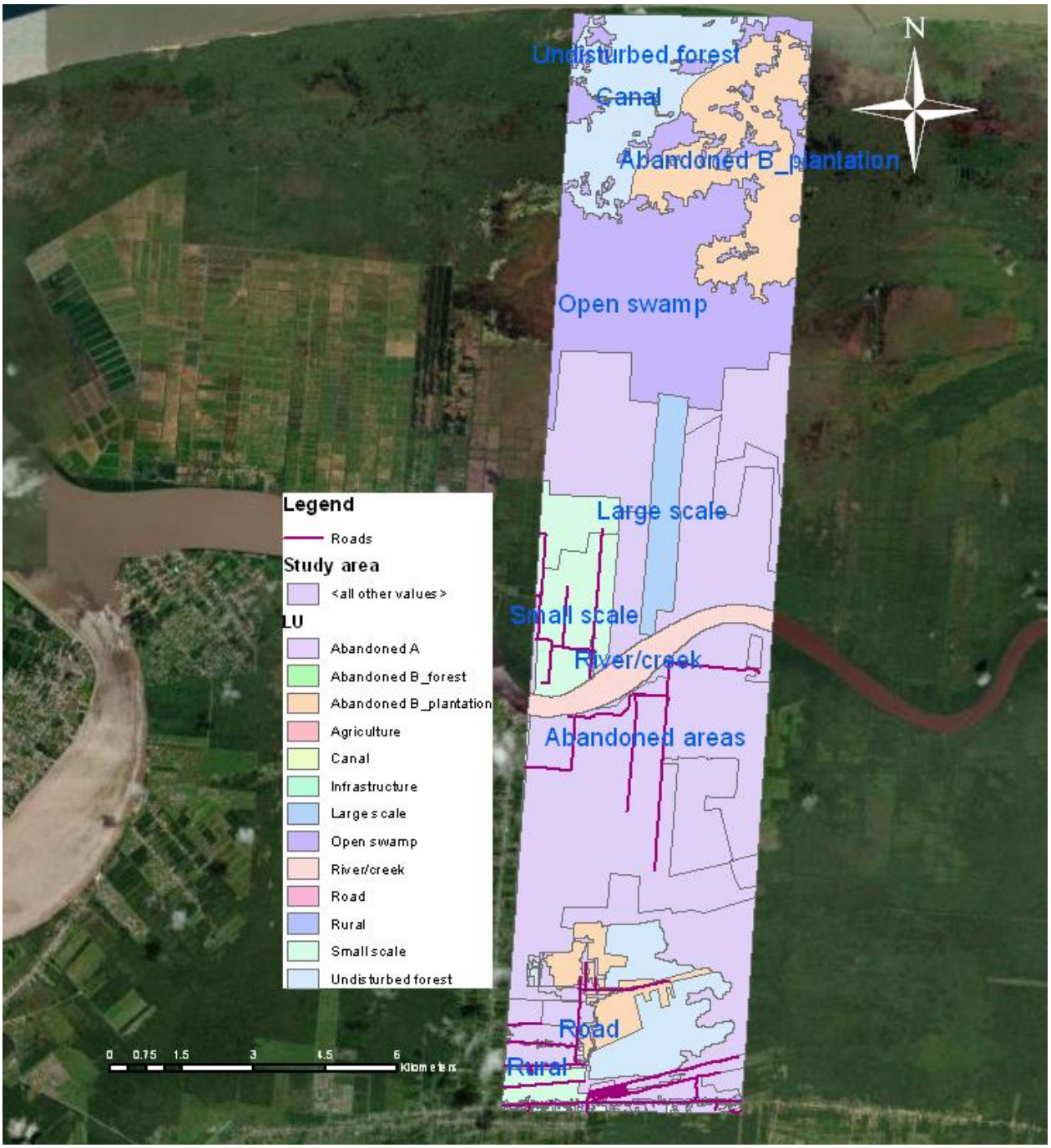
The plantations *on the northern side of Commewijne River* within the study area are: Kronenburg, Browerslust, Nut en Schadelijk, Killenstein, Mon Sauci, Het Vertrouwen, and Campenburg.

The plantations *on the southern side of Commewijne River* within the study area are: Nijd en Spijt, Mon Trésor, Welgelegen, Katwijk, Wederzorg, Vriendsbeleid, Ouderzorg, Spieringshoek, Stolkertsvlijt en Buyslust, Vrieshoop, Janslust, Coresburg, De Uitvlugt, St. Germain, Practica, Slakkenboch, Mon Affaire, Ma Retraite, Mijn Geluk and Sans Sauci.



Map 3.4 Study area with plantation layout

During the field visits, different land use functions and services were observed, and The Foundation for Forest Management and Production Control (*Stichting Bosbeheer en Bostoezicht*, SBB) was also consulted to get a land use map of the area. According to a land use map produced by SBB in 2015, the land use types in the study area are presented in Map 3.5 “Land use and land cover” (see Appendix 2 Land use and land cover map). In total, there are thirteen land use types demonstrated on this map. Each land use type has been described in Table 3.1 “Land use classes and the descriptions”, and these were strategically updated and used as a starting point for estimation of the values. Using information gathered by field visits and google images, the land use classes were modified using the existing map. In the next chapter the modified map is presented and described.



Map 3.5 Land use and land cover [33]

Table 3.2 Land use classes and the descriptions [35]

Land use classes	Description
Abandoned A	Land that was used for human activities, but which has been abandoned and is at an early stage of regeneration and where extensive livestock farming may be done. The structures of agricultural activities may still be visible in these areas.
Abandoned B_forest/ plantation	Land that was once used for human activities, but has been abandoned and was already in an advanced state of regeneration in the year 2000, covered primarily by trees, with a minimum tree crown cover of 30% (or equivalent stocking level), with the potential to reach a minimum canopy height at maturity in situ of 5 meters
Large scale/Agriculture	Large areas with a minimum surface area of at least 5ha that are used for agricultural purposes, where the production of various agricultural crops, such as rice, bananas, vegetables and fruit crops take place on a large scale
Open swamp	Land that is covered or saturated by water for all or part of the year and is not covered by trees that fall under the definition of forest. Lagoons are also included in the class open swamp
River/creek/canal	Unmanaged water bodies, such as natural rivers and creeks.
Rural	Housing along the road, characteristically longitude pattern with family holdings or shifting cultivation in the neighboring area.
Small scale	Small cultivated areas with a maximum area of 5 ha for the production of various agricultural crops on a small scale, also taking place in the form of horticulture. These areas are usually adjacent to rural or suburban areas.
Undisturbed forest	Land covered primarily by trees, but also often containing shrubs, palms, bamboo, herbs, grass and climbers, with a minimum tree crown cover of 30% (or equivalent stocking level), with the potential to reach a minimum canopy height at maturity in situ of 5 meters
Infrastructure/Road	Connection between two areas having a line structure, which can be paved or unpaved.

3.1.5 Data analyses

The valuation of any area is based on what is present in the area and what activities are being developed there. Using Land Use and Land Cover mapping along with Infrastructure mapping and field visits, the area activities could be described and used for the methodology for the valuation of the area. The land use classes of the map produced by the Foundation for Forest Management and Production Control were modified. The modifications were done by taking into account the attributes of the area. The present land use and resource production were also important factors for the merge of land use classes. Furthermore, the soil map, deforestation map and mangrove map were studied, to understand how these factors impact the valuation of that specific area.

3.2 Materials

In this research, the colonial period and current situation were analyzed. Using the plantation layout map, the history of the area was described. The study area was defined using Google Earth Pro. There was no AutoCAD or ArcMap file available of the plantation layout to define the study area. The available PDF files with plantation layouts of the colonial period were used to create files using AutoCAD for the creation of a map showing the plantation layout within the study area. Using Georeferencing, the defined study area was exported from Google Earth Pro to ArcMap to be used for further analysis. As the Land Use and Land Cover mapping from SBB was available, this could be used for the modification of the current situation and further analysis in categorization of land use classes with their attributes for the valuation. The literature study provided different strategies and insights for valuation of areas. It is important to understand what factors are determinative for the value of a specific area. Land trading for residential, industrial or commercial purpose deliver income, but ecosystems of an area can also be used to derive income. Interviews with academics and literature about the use of biodiversity and ecosystems provided insight in the services and how this can be used to derive income. The used data types and adaptations are described in Table 3.2 Used data and adaptations.

Table 3.3 Used data and adaptations

Data	Format	Source	Adaptation
Image of the study area	jpg.	Google Earth Pro (2019)	Indicated the study area using Google Earth Pro, and then used the image as base layer in AutoCAD. Using Georeferencing, the data were exported to ArcMap for further analysis.
Overview map with plantation division of the District of Commewijne	PDF	N.V. GISSAT (1998)	Converted the PDF-files to jpg-files and then imported the files into AutoCAD. The image file of Google Earth Pro was used as base map for creating a combination image of the plantation division.
Overview map of plantations in the District of Commewijne	PDF	Nationaal Archief	
Jurisdictions	Shp.	Gonini	The file was opened with ArcMap and using the tool "clip", the district of Commewijne was extracted and then the study area was clipped out to view which jurisdictions are part of the study area.
Protected areas	Shp.	Gonini	Using the ArcMap Clip tool, the study area was extracted from the file.
Soil map	Shp.	GMD	Again, part of the study area was clipped out from the whole.
Land Use and Land Cover mapping 2015	Shp.	SBB	The study area was clipped out, first all the land use classes where studied. After field observations, the land use classes where modified.

3.3 Assumption

The area has a very low level of accessibility for field observation and there was also lack of data in terms of flora and fauna. The available information of North Commewijne-Marowijne MUMA were used for assumptions of the flora and fauna occurring in the area. Furthermore, the land LULC map was modified using Google images, information obtained from SBB, MIGLIS, the Ministry of Agriculture, Livestock and Fisheries (*Ministerie van Landbouw, Veeteelt en Visserij*, LVV) and field observations within the scope provided by the area.

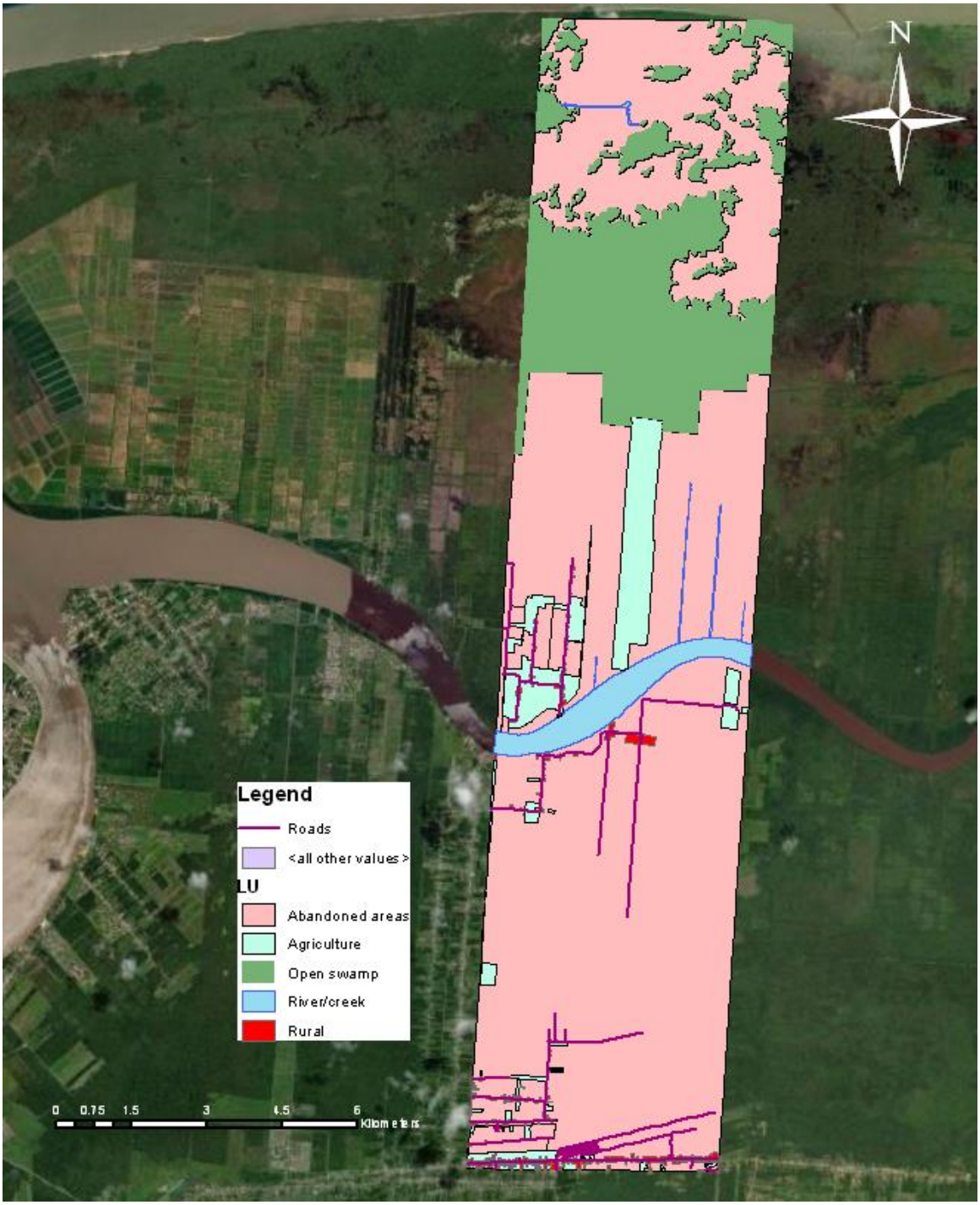
4. RESULTS AND DISCUSSION

In this chapter the baseline of the study area is extensively detailed. Using the gathered information, the area was valuated, and the variety land use and land cover details were used for the valuation. The largest part of the area had a very low level of accessibility, which caused a low demand or productivity of the area. The northern part of the area is forming part of the North Commewijne-Marowijne MUMA. The valuation of this area was, for a larger part, dependent on the ecosystem services. The natural resources in the area add value to it and people can earn income using these resources.

4.1 Baseline analysis

4.1.1 Land use

In the previous chapter, the Land Use and Land Cover map, produced by the Foundation for Forest management and Production Control was presented. For this research, the map provided by the Foundation for Forest management and Production Control was modified based on land observations and Google images. The thirteen land use classes were merged into six land use classes. The grouping of the classes was done on the basis of a description produced by Foundation for Forest Management and Production Control. Map 4.1 “Modified land use and land cover map” presents the modified form of the Land Use and Land Cover map. Figure 4.1 “Merge of the land use classes” shows which classes are merged into which land use class and also the attributes of each land use class were summarized.



Map 4.1 Modified land use and land cover map

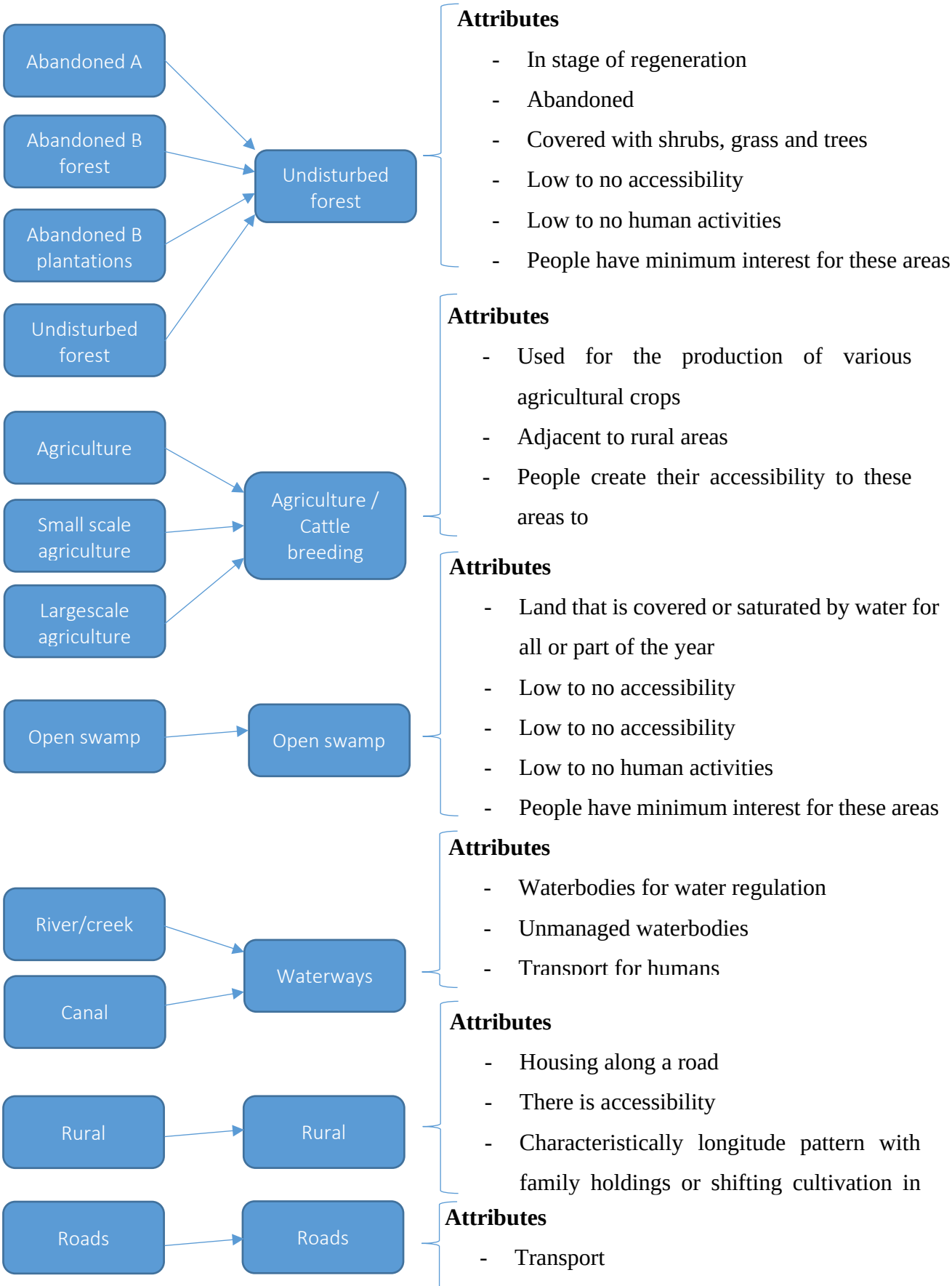


Figure 4.1 Merge of the land use classes

4.1.2 Human environment

Population and residential facilities

As observed, the study area was located in an area with low density of population. A large part of the residents was resident for many years in the area, but also new residents were observed. Most houses were simple residentials from years ago, but there were also newly built homes. The area is popular for its agricultural character, most residents are involved in agriculture, and also horticulture. A research plot of LVV was also spot in the area. During field surveys, a man was interviewed, who lives in another city and has his agricultural plot in the area. According to this interviewer, owners of some agricultural areas nearby are not residing in Commewijne. The fertile ground of the area is the reason that local and non-local people are involved in farming, even local residents who are employed outside of the area cultivate crops and fruits for their own use. The northern part even shows a decrease in population, according to ABS, and local residents also mentioned that people move out of the area because of many reasons, such as lack of health care, infrastructure, schools, employment etc.

Due to a lack of recreation, many young people are involved in drugs. There is one primary school in the northern area, but according to local residents there are almost no pupils for the school. To attend secondary schools, children cross over with boats to reach the school in Alkmaar. In Alkmaar there are primary and secondary schools and at Tamanredjo there is a high school, School Community Tamanredjo, approximate 20 minutes away from the boat dock, to be reached through the Alkmaar and de Oost-Westverbinding. In terms of paying attention to health care, the northern side is in pretty bad shape. There is a clinic for Regional Health Service Suriname (*Regionale Gezondheidsdienst*, RGD). According to the local residents, the doctor visits the clinic once every two weeks, and there is a phone number to call on for emergencies. Most of the people living in that area mentioned to have visited a doctor at the Regional Health Service Suriname of Meerzorg. Furthermore, on the north side there a district commissioner's office was observed (see Figure 4.2 Districts commissary's office). People mentioned that government workers visit regularly for mowing grass, but they also mentioned that there is a lack in visits of specialized people from LVV to provide them with the necessary guidance and agricultural knowledge.

On the southern part of the study area there are no clinics within the defined boundaries, but at Alkmaar, there is doctors' clinic. In this part, residents also mentioned to have visited the Regional Health Service Suriname of Meerzorg, which is recently expanded, as are the

emergency services. This health center is approximately 30 minutes away from the boat boarding place at Tje Tje Weg.

The southern area has its advantages because of the direct road connection with the Oost-Westverbinding thoroughfare. At Alkmaar, there are several facilities, such as ATM, Telesur office, supermarkets, etc. Despite having almost no facilities in the inland roads, there was a special education school observed on Tje Tje Weg (see Figure 4.1 Kronenburg Primary School).

Infrastructure

The study area is accessible through the Oost-Westverbinding and Alkmaar. It is located north of Oost-Westverbinding and east of Alkmaar. Via the Oost-Westverbinding, this area is connected to Paramaribo, with a bridge linkage across the Suriname River. The area is approximately 20 km from central Paramaribo.

The Commewijne River divides the study area into two separate areas and there is no bridge connection between both sides. The only way to reach the northern shore is by boat. Map 4.2 Scaffolding location shows the boat boarding place at Mon Trésor (see Figure 4.3 Scaffold at Mon Trésor). Bus transport from Oost-Westverbinding starts exclusively on on Alkmaarstraat. There is no bus transport on secondary roads or to the boat dock. There are people from the northern side who park their car on the southern side, where the boat dock is located. After crossing the river by boat, they continue by car.

The roads on the north and south banks are unpaved (see Figure 4.4 Secondary road intersection southern part of study area and Figure 4.5 Roads on the northern part of the study area and Map 4.3 Roads in the study area) and poor maintained. Local residents mentioned that the government does not pay any attention to infrastructure maintenance. In the rainy season, the few sandy roads become very difficult to pass. The local residents also have to deal with flooding in rainy seasons, because the sluices are small and not well-maintained, which makes agriculture difficult.

Figure 4.2 Kronenburg Primary School

Figure 4.3 District Commissary's office

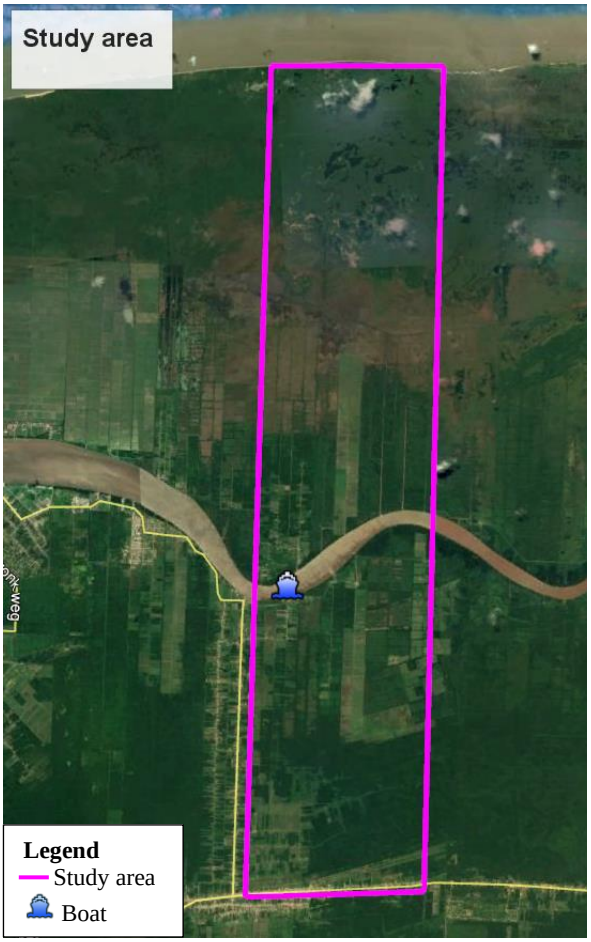
Figure 4.4 Scaffold at Mon Trésor

Figure 4.5 Secondary road intersection, southern part of study area

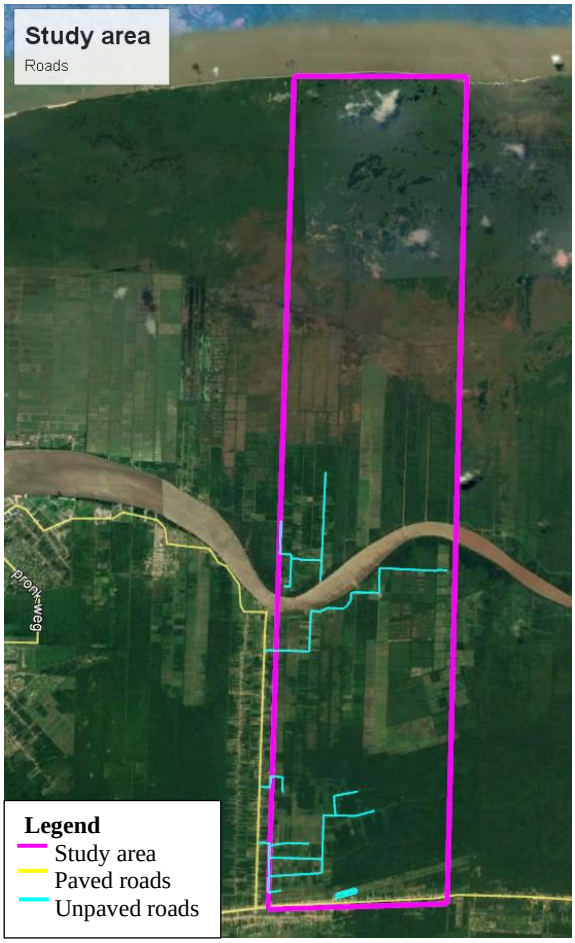
Figure 4.6 Roads on the northern part of the study area

Developing activities in the area is highly dependent on accessibility, which is a disadvantage for the area in terms of valuation. Local residents mentioned that they cannot even go fishing or hunting for personal use due to bad accessibility. On Map 4.3 “Roads in the study area” the roads in question are indicated. It can be perceived that a large part of the area is not accessible, and that the extent of the roads are very limited. On the northern part, no cars were observed, because the inhabited range is too small and accessibility for cars is very difficult, so many residents ride motorbikes.

All over the inhabited area, electricity is supplied by *N.V. Energie Bedrijven Suriname* (EBS) [Electricity Company Suriname]. According to local residents, the powerline on the northern bank was donated by Belgium Development Cooperation. There are no public phones in the area; people use mobile phones. Radio and television connections are fairly good. The entire study area lacks access to clean water supplied by N.V. Surinaamse Waterleiding Maatschappij (SWM); people gather rainwater, groundwater (well water) or even buy water in the dry season (southern part, possibly because of road access).



Map 4.2 Scaffolding location



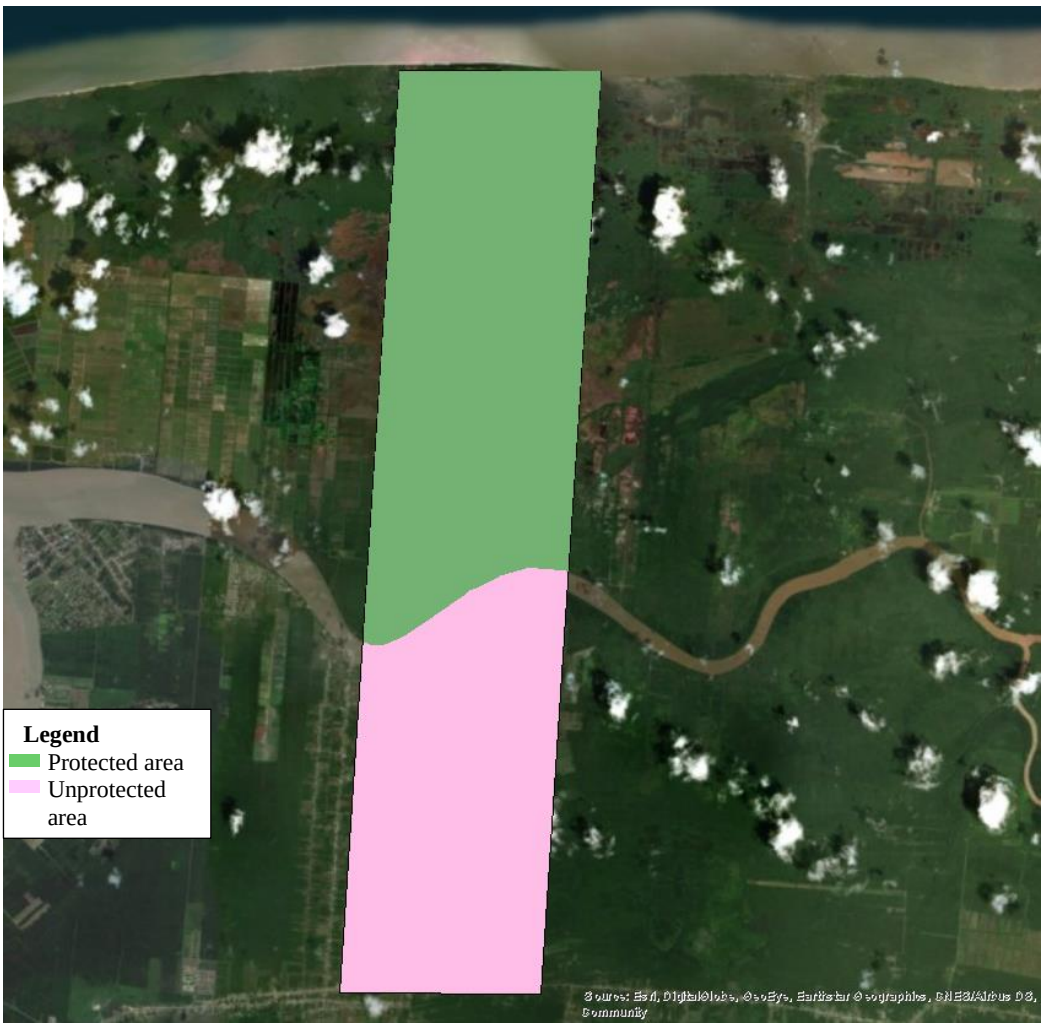
Map 4.3 Roads in the study area

Commercial

On the northern part of the study area itself, two supermarkets and one bar were observed. Near the boat dock, a bar was established, while in the southern part, there were no supermarkets or any other kind of shops established on the secondary roads, because these facilities are located on the Alkmaar thoroughfare. During the field surveys, local residents on the southern part mentioned that most people travel to Tamanredjo or Meerzorg for their shopping. There were no recreational areas spotted; most people are engaged in horticulture and use that as a recreation. One survey respondent even mentioned that they lack any type of fast food restaurants in the area, like Kentucky Fried Chicken (KFC) or Mac Donald's. According to him, it would be great to start a fast food restaurant at least on the Oost-Westverbinding, at Meerzorg, so they will have to travel less.

4.1.3 Biological environment

Commewijne is a district diverse in flora and fauna because of the domination of ecosystems in the district. The coastal plain of the research area is a part of the North Commewijne-Marowijne MUMA, covering a total area of 61,500 hectare (see Appendix 3 Protected areas in Suriname). MUMA in the coastal zone were established in 2002 [35] . MUMA have been established to assure the sustainability of natural productivity and conservation, which considers the demands of the vulnerable natural ecosystems. The MUMA also ensures the prevention or minimization of pesticides in agricultural areas. An area as MUMA means there are special rules and regulations for any kind of actions in that area to prevent damage or disturbance of the ecosystem. Within the study area, 6622 hectares is protected, this is located on the northern bank (see Map 4.4 Protected and unprotected areas).



Map 4.4 Protected and unprotected areas [33]

Flora

The area is partially covered with black-mangroves or “parwa” (Avicennia germinans), parts of the abandoned plantations in the saline area are covered with black-mangrove forest. In addition, the abandoned plantations are covered with wigeon grass (Ruppia maritima), waterlily (Nymphaea ampla), halophytic herb vegetation, dominated by sea purslane (Sesuvium portulacastrum), saltwort (Batis maritima) and Virginia grass (Sporobolus virginicus). Within the study area there are also saline to brackish marshes found, with growth of brackish short "grass", dominated by spike rush or "drikanti" (Eleocharis mutata), "fini-adrun"-sedge (Cyperus articulatus) or salt grass (Paspalum vaginatum) and giant salt fern (Acrostichum aureum).

Farther to the south, there is brackish to freshwater found with short grass swamps, dominated by "fini-adrun" sedge (Cyperus articulatus) or "alesi-grasi" (Leersia hexandra) and tall grass swamps dominated by reed mace or "langa-grasi" (Typha angustifolia). Local swamp scrub may have developed, dominated by "brantimaka" (Machaerium lunatum) and swamp wood, dominated by the immortelle or "kofimama" (Erythrina glauca).

Coastal vegetation mainly consists of mangrove plants, such as red mangrove (Rhizophora mangle), black mangrove (Avicennia germinans) and white mangrove (Laguncularia racemosa).

The wetland part consists of freshwater herbaceous swamps, swamp scrub and swamp wood. The dry land area has natural forests but is almost completely deforested although only part of it is currently cultivated. The vegetation types in the area are rather common all along the Surinamese coast. The mudflats and the mangrove zone are part of the important feeding and nesting grounds of Suriname for residential coastal birds and for migratory birds from the north. The mangrove forests belong to a natural protected zone and function as nursing ground for different species [35]. The wetlands in the coastal plain consist of saline water during the dry season and brackish during the rainy season. Field observations demonstrated that the ecosystem services provided by mangroves are not exploited within the area. The government does not pay enough attention to the value it can bring through carbon sequestration.

Figure 4.7 Mangrove

Figure 4.8 Mangrove on the Commewijne River bank

Fauna

The flora and fauna of MUMA deliver ecosystem services which add value to such environments. The Surinamese coastal plain, including Commewijne, is an important feeding and nesting area for more than 118 species of coastal birds. According to the 1971

Ramsar Convention on Wetlands, more than 70 species of these are defined as waterfowl. For the North Commewijne MUMA, 54 species of mammals: 7 species of marsupials, 13 bats, 4 monkeys, 4 edentates were listed, among which the giant ant-eater (Myrmecophaga tridactyla); 8 carnivores, among which the jaguar (Panthera onca) and the Brazilian giant otter (Pteronura brasiliensis); 4 ungulates, such as the white-tailed deer (Odocoileus virginianus) and 12 rodents. In addition, the American manatee (Trichechus manatus) and the Guiana white dolphin (Sotalia guianensis) are frequently reported. There are also two species of reptiles in this area: the Iguana (Iguana iguana) and the spectacled caiman (Caiman crocodilus). The northern area is also a housing for turtles, shrimp, crabs and fish. The mangrove is a nursery for various shrimp and fish species. [35]. During field observations, dolphins and locally known fish "koetai" were spot in the Commewijne River.

Open swamp

The open swamp areas had a low level of accessibility or were inaccessible. For this reason, there is no development in those parts. There are also less to no activities in order to make use of the ecosystem services. Local residents are not able to make use of ecosystem services derived from the swamps, neither are the natural resources of these area being used in any way. Despite of being part of the north Commewijne-Marowijne MUMA, the ecosystem services are not exploited in the area, for example former plantation Frederiksdorp has been developed into a tourist attractive resort, generating employment for local residents and income for people living in the area. The survey respondents mentioned that inaccessibility is the main reason for not making use of ecosystem services. No hunting is carried out in the area, local residents mentioned that they spot rabbits and deer. People go fishing in the area, but not for selling. Fish species like *tilapia* (Oreochromis mossambica), *pataka* (tiger fish/Hoplias malabaricus), *trapoen* (Atlantic tarpon/Megalops atlanticus), *krobia* (Aequidens spp), and *kwie-kwie* (Callichtydae unidentified) are found in the swamp.

Abandoned plantations and undisturbed forest

As mentioned before, the plantations on the northern bank of the Commewijne River were salinized due to poor maintained dikes. These plantations became useless for agriculture, resulting in abandonment. The undisturbed forests were also plantations in the past, which became abandoned. There are no activities in these areas. In this area, primary trees were observed, but also the secondary layer and newly emerging trees and weeds.

Figure 4.9 Abandoned area on the northern bank

Figure 4.10 Abandoned area grown with grass on the southern bank

Large scale agriculture & cattle breeding

According to the land use and land cover map derived from SBB, there is still a part of the northern bank being used for large scale agriculture and/or cattle breeding. The farmer does not live in the area, according to local residents. The farmer has employed local residents as care taker for the crops grown and/or the cattle breeding. Van Allen is a famous family owning the plantation Nut en Schadelijk, using it for large scale cattle breeding. They also own butcheries. The large-scale farmers own land larger than 5 hectares.

Table 4.1 Large scale used plantations with information about their owner and crops

Plantation	Number of farmers	Crops	Owner
Katwijk	1	Oranges Mandarins Grapefruit Geleking mandarin Rodeking mandarin Coffee	Nouh-Chaia
Spieringshoek	1	Oranges Grapefruit	Jaharia

Table 4.2 Plantations with information on their owner and cattle

Plantation	Number of farmers	Cattle	Owner
Nut en Schadelijk	1	unknown	Van Allen
Spieringshoek	1	310 beef cattle	Jaharia
Wederzorg	1	unknown	Jin A Djie

Small scale agriculture

A few local residents were observed doing small scale agriculture. The fertile ground was the reason that local residents could cultivate fruits and vegetables for the local market. It has also been mentioned that the small-scale agriculture did not produce enough income,

which caused that local people forcedly needed to get a job in other sectors rather than agriculture. Most people are employed in Paramaribo, because of the lack of employment in Commewijne. The table below indicate the number of farmers and growing crops. The farmers engaged in small scale farming own 2-5 hectare of land for agriculture.

Table 4.3 Small-scale plantations with information on their owner and crops

Plantation	Number of farmers	Crops
Kronenburg	38	Pepper Cabbage Soursop Banana Citrus Coconut Cassava Urdi Black Bean African eggplant (antroewa)
Nijt en Spijt	47	Pepper Tomato Banana Citrus Coconut Mango Cassava Urdi Black Bean African eggplant (antroewa)
Mon Trésor	9	

Animal husbandry and horticulture

Animal husbandry, poultry farming and horticulture were also observed as land use types, local residents even mentioned to be engaged in these activities for their personal use. Even on the sidewalk, (see Figure 4.11 Papaya cultivation on the side walk) papaya trees and small gardens with crops were observed (see Figure 4.10 African eggplant (antroewa)

cultivation by local residents). On the north bank, locals were observed cattle breeding of cows (see Figure 4.12 Cattle breeding). For this land use type, the local residents own up to 2 hectares of land, mostly having their house on the same property.

Figure 4.11 African eggplant (antroewa) cultivation by local residents

Figure 4.12 Papaya cultivation on the side walk

Figure 4.13 Cattle breeding

Figure 4.14 Sluice on the northern part of the study area

Flood control and drainage

As mentioned previously, the infrastructure (canals, sluices) are not well maintained, causing flood in the rainy season. This harms the agriculture in the area; agricultural land is flooded and crops get destroyed.

4.2 Valuation

The importance of land has been mentioned in the previous chapter; land is a finite natural resource, so it needs to be used and valued in a proper way. The modified land use map contains six land use classes (roads are polylines causing it to be derelict land), as is shown below including its area coverage:

Table 4.4 Land use classes and area coverage

Land use class	Area coverage (ha)
Abandoned areas	8,055
Agriculture/cattle breeding	1,036
Rural	118
Open swamp	2,006
River/creek	319
Total	**11,534**

The land use classes will be tested on the parameters that impact each. Classification of rural land use will be divided into 4 parts:

1. Rural land use alongside the Oost-Westverbinding;
2. Rural land use in the secondary roads near Oost-Westverbinding;
3. Rural land use in the secondary roads near the Commewijne River;
4. Rural land use of the north bank.

The abandoned and agricultural/cattle breeding areas are both divided into north and south bank parts. As mentioned before, the study area contained plantations dating from the colonial period, so their ground title is mostly allodial and hereditary property, which means that it can be traded without any permission of the state and the land use purpose may be decided by the owner.

Table 4.5 Impact of parameters on land value per land use class

Parameters / **Land use class**	Topography	Distance to economic centers and neighborhood facilities	Transport from and to location	Development chances	Income derived from ecosystem services (TEV)
Rural alongside the Oost-Westverbinding	The importance of topography is higher on built-up areas, for example a good sewer system and/or clean water adds more value to built-up areas.	Shorter distance causing higher value.	The value is highest because of convenient transport and linkage.	Higher chances, causing higher value.	Is used for living, therefore has a low impact on the value.
Rural in the secondary roads near Oost-Westverbinding		Has lower value because of being along the secondary road.	The value drops because of being along the secondary road and lack of public transport.	Because of inaccessibility, development chances are lower resulting in lower land value. The value keeps dropping from the Oost-Westverbinding	Is used for living, therefore has a low impact on the value.
Rural in the secondary roads near the Commewijne River		The bigger distance results into lower value.	The value drops because of the bigger distance from Oost-		Is used for living, therefore has a low impact on the value.

			Westverbinding and lack of public transport.	until the rural area on the north bank.	
Rural on the north bank		The inaccessibility (no bridge connection) causes a very low value.	Lowest value for rural, because transport is difficult, just by boats.		Is used for living, therefore has a low impact on the value.
Abandoned areas north bank	Has currently low to no impact on the value, because this area is not in use. The basic existing drainage is enough for the area, no need for extension.	Has currently low to no impact on the value, because this area is not in use.	Has currently low to no impact on the value, because this area is not in use. It is not accessible so people have no interest in investing in that area.	Developing accessibility will cause increased value. People will be able to use the area for many purposes.	The ecosystem of the abandoned areas add value to it, people can derive income by preserving it, for example for carbon sequestration.
Abandoned areas south bank				Accessibility will cause development therefore increased value.	

Agriculture/cattle breeding north bank	A good sewer system and availability of water can increase the value of agricultural areas.	The farmers have more difficulties reaching facilities, causing lower value of agricultural areas on the north bank.	The farmers have more difficulties transporting their goods, causing lower value of agricultural areas on the north bank.	The agricultural areas on the south bank already are accessible for the owners, although better maintained roads will impact the value positively.	Agriculture is already a form of using ecosystem services of an area, by determining its value, for example, in terms of soil fertility or types of crops grown or cattle bred
Agriculture/cattle breeding south bank		Being agricultural area, the value is lower than that of rural area, despite similar distance, though higher value compared to north bank, because of better accessibility.	Being agricultural area, the value is lower than that of rural area, despite same distance, but higher than the value of area on the north bank, because of better accessibility trough secondary roads.		
Open swamp	Has currently low to no impact on the	Has currently low to no impact on the	Inaccessibility is one of the main reasons for the	Accessibility to the swamp will increase its value,	The ecosystem services that can be derived from the

	value, because this area is not in use.	value, because this area is not in use.	services of the wetland not being used.	people will be able to use the area for deriving income, for example by fishing and trading, or developing the area for tourism.	swamp, are the main factor for a valuation of the swamp. If there are no activities that show the use of the ecosystem services derived from the wetlands, it will not have any value. It does not contribute to the GDP.

Table 4.6 Average value estimation per land use class expressed in hectare

Land use class	Average value per ha ($)
Rural alongside the Oost-Westverbinding	100,000
Rural in the secondary roads near Oost-Westverbinding	50,000
Rural in the secondary roads near the Commewijne River	25,000
Rural on the north bank	7,500
Abandoned areas north bank	500
Abandoned areas south bank	1,000
Agriculture/cattle breeding north bank	1,000
Agriculture/cattle breeding south bank	2,500
Open swamp	0

Graph 1 “Value estimation per land use type” shows the pattern of the value per land use type. The open swamp has no trading or commercial value, because it is not being used for any purpose, nor it is a private property. The government can earn funds by conservation of the wetlands and submitting proper reports which proof the importance of wetland conservation. Accessibility to the areas will add more value to every land use class. Making the area accessible (deforestation for construction of roads) may cost approximately $ 3,500 per hectare.

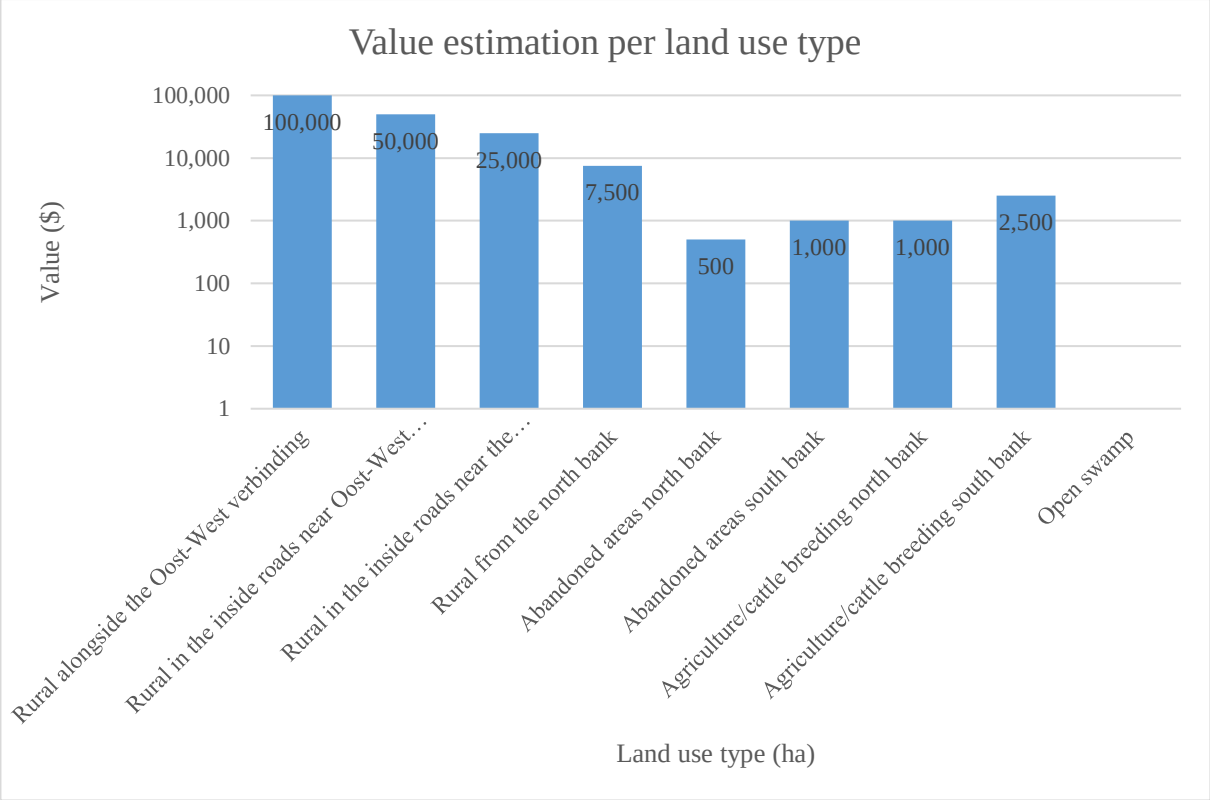


Figure 4.15 Value estimation per land use type

Impact of sea level rise

Sea level rise may cause salinization of the areas in the north bank, which happened in the past, causing areas being abandoned and losing their value. The north bank is more vulnerable to sea level rise.

Impact of natural disasters

Suriname is not likely to face natural disasters, but any kind of natural disaster, such as forest fires (the abandoned areas) will cause an instant drop of the value in the area.

Impact of accessibility

Accessibility to the abandoned areas and the north bank will enable more activities. People will be interested in investments in the area, interest will increase, causing an increasing value of the areas. A good example of accessibility is the wetland being used to derive income by tourism.

5. CONCLUSION

A proper methodology for the valuation of land is missing in Suriname. The main focus is on land that can be traded, that is why the online land value index of MIGLIS is mostly focused on urbanized areas, which are in high demand for land trade for residential, industrial, and commercial purposes. Rural areas and ecosystems are totally neglected, whereas the country and residents could have derived income from the ecosystem services. Conclusions regarding the study area are as follows:

- The area was used for plantations in the past and due to abandonment, this area was not developed. Negligence of dike maintenance caused salinized agricultural areas on the north bank of the Commewijne River which could not be used for agriculture anymore;
- Yet the agricultural and cattle breeding areas contribute to the GDP;
- The lack of interest in the area results into a lack of further development of accessibility. People of the north part move because of lack of facilities and jobs;
- Inaccessibility also limits the usage of ecosystem services in the area, even local people are not able to go fishing in the wetlands or using the MUMA for deriving income;
- The long distance from Paramaribo and inaccessibility within the area result into declining investments by people in the area to increase development.

6. RECOMMENDATIONS

This research results into the following recommendations:

- This methodology can be used for other coastal areas; however, the parameters should be adjusted on the bases of land use classes;
- Such a research can also be carried out for the interior of Suriname to see which parameters should be considered there and how land valuation will take place in that area;
- A further study can be carried out with the aim to have better insight in the flora and fauna of the area, for example in corporation with SBB and LVV;
- The area can be developed and local residents can earn more income if the government pays more attention to the accessibility of the area which will result in a boost to land trading and ecosystem services. (1) The MUMA can be used for ecotourism by creating bird watching tours, and tours which lead to the Matapika beach where tourists can spot turtles. This will add value to the wetlands, because people will be able to derive income from the ecosystem services. (2) Fisheries can also be boosted in the area, using the swamp as a resource for aquaculture. (3) Furthermore, good guidance by the Ministry of Agriculture, Livestock and Fisheries can help local people improving agriculture in the area, and making use of the soil fertility in the area. (4) Part of the protected area is covered by mangrove which delivers carbon credits by carbon sequestration, which is also a way of income generation for the country itself. The government can pay attention to it for trading the carbon credits to GHG emitters.

At last this study can be used as a guideline for further development of land valuation methods, especially for areas which deliver ecosystem services.

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APPENDIX 1A: Valuation Form A

Formulier: A

Blad 2: Behoort bij taxatieformulier no…….

(perceelnummer: op naam van……)

Formulier uitsluitend bestemd voor de taxatie van percelen die ter bebouwing en bewoning zijn uitgegeven.

Aantal punten afhankelijk van de mate en de omstandigheden van de voorzieningen.

Gezichtspunten waarop wordt beoordeeld	Goed 8 - 10	Redelijk 5 - 7	Slecht 2 – 4	Afwezig 1	Totaal
1. Watervoorziening 2. Elektriciteitsvoorziening 3. Openbaar vervoer 4. Afwatering 5. Kwaliteit wegennet (a) 6. Hoog of laag terrein 7. Medische voorzieningen (b) 8. Sociale voorzieningen (c) 9. Sport- en Recreatie-voorzieningen 10. Winkels & assortiment 11. Primaire onderwijsvoorzieningen (d) 12. Secundaire onderwijs-voorzieningen (e) 13. Crèches 14. Kwaliteit van de buurt 15. Ligging van terrein (f) 16. Politiepost 17. Overige publieke voorzieningen (g)					
Totaal					

APPENDIX 1A: Valuation Form B

Formulier: B

Blad 2: Behoort bij taxatieformulier no……..

(perceelnummer: op naam van……)

Formulier uitsluitend bestemd voor de taxatie van percelen bestemd voor agrarische doeleinden.

Aantal punten afhankelijk van de mate en de omstandigheden van de voorzieningen.

Gezichtspunten waarop wordt beoordeeld	Goed 8 - 10	Redelijk 5 - 7	Slecht 2 – 4	Afwezig 1	Totaal
18. Vruchtbaarheid 19. Waterregulering 20. Energievoorziening 21. Transportmogelijkheden 22. Landbouwkantoor 23. Onderzoekcentra 24. Coöperatiecentrum 25. Opslag- en verwerkings-faciliteiten 26. Proeftuinen 27. Veterinaire faciliteiten					
Totaal					

APPENDIX 1A: Valuation Form C

Formulier: C

Blad 2: Behoort bij taxatie-formulier no……..

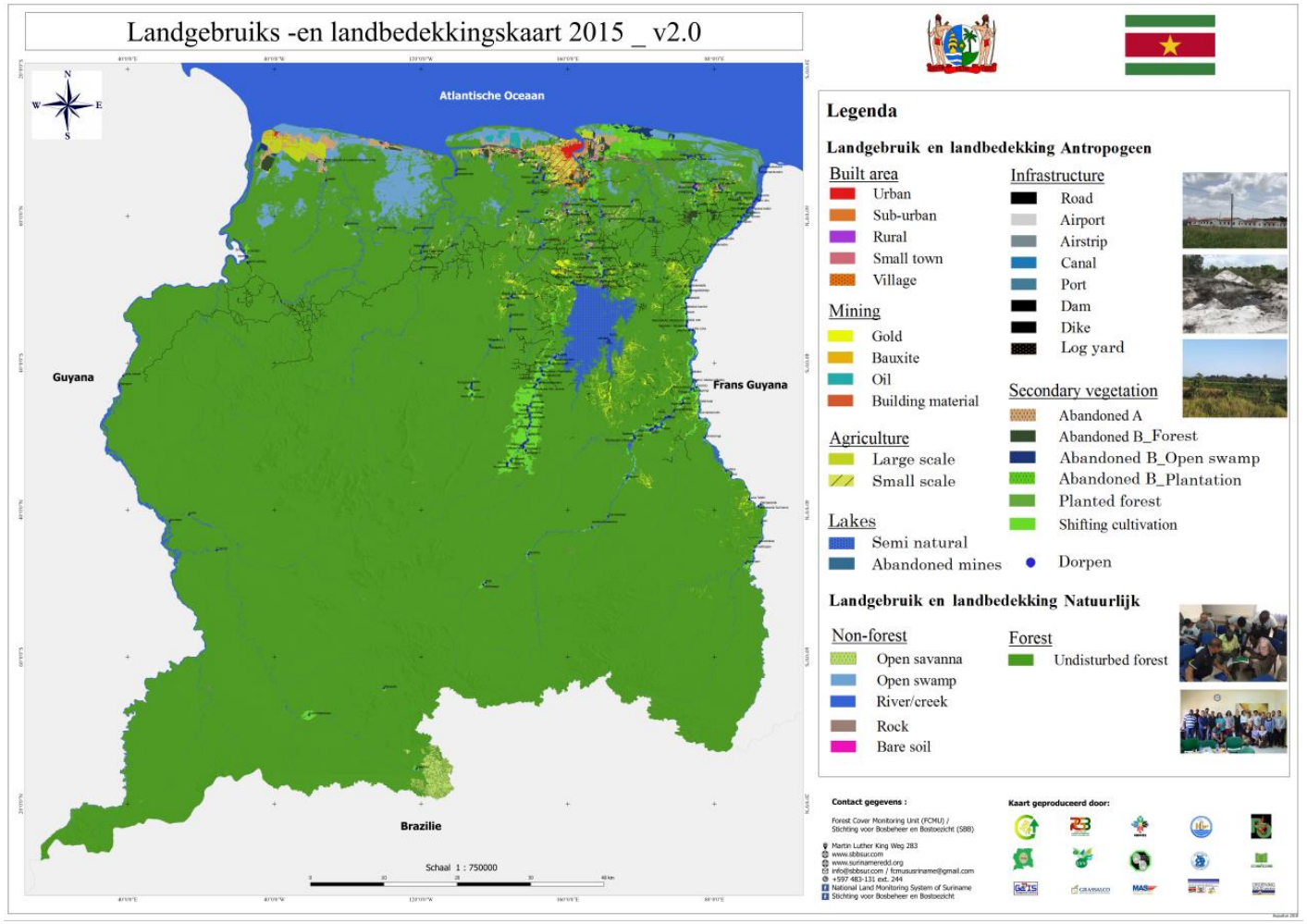
(perceelnummer: op naam van……)

Formulier uitsluitend bestemd voor de taxatie van percelen bestemd voor industriële doeleinden.

Aantal punten afhankelijk van de mate en de omstandigheden van de voorzieningen.

Gezichtspunten waarop wordt beoordeeld	Goed 8 - 10	Redelijk 5 - 7	Slecht 2 – 4	Afwezig 1	Totaal
1. Watervoorziening 2. Energievoorziening 3. Afwatering 4. Transportmogelijkheden 5. Opslag- en verwerkings-faciliteiten 6. Ligging t.o.v. haven, banken, markten 7. Publieke voorzieningen-a 8. Beschikbaarheid arbeidskrachten					
Totaal					

APPENDIX 2: Land use and land cover map



APPENDIX 3: Protected areas in Suriname

Table 6: Protected areas according to type and size

	Name of the protected area	Type of area	Total area (ha)
1	Bigi Pan MUMA	Terrestrial/marine	67,900
2	Hertenrits NR	Terrestrial	100
3	North Coronie MUMA	Terrestrial/marine	27,200
4	North Saramacca MUMA	Terrestrial/marine	88,400
5	Coppename-monding NR	Terrestrial/marine	12,000
6	North Commewijne-Marowijne MUMA	Terrestrial/marine	61,500
7	Wia-Wia NR	Terrestrial/marine	36,000
8	Galibi NR	Terrestrial/marine	4,000
9	Peruvia NR	Terrestrial	31,000
10	Boven-Coesewijne NR	Terrestrial	27,000
11	Copi NR	Terrestrial	28,000
12	Wanekreek NR	Terrestrial	45,000
13	Brinckheuvel NR	Terrestrial	6,000
14	Brownsberg Nature Park	Terrestrial	12,200
15	Central Suriname NR	Terrestrial	1,592,000
16	Sipaliwini NR	Terrestrial	100,000
	Total		**2,138,300**

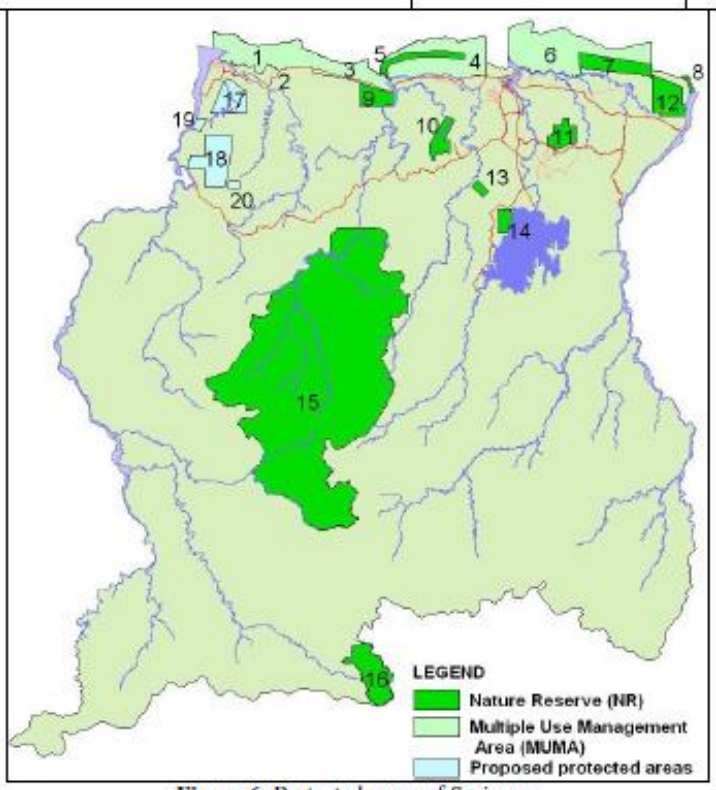


Figure 6: Protected areas of Suriname