COUNTRY REPORT ON THE STATE OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

SURINAME

PLANT GENETIC RESOURCES OF SURINAME

(COUNTRY REPORT)

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Note by FAO

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EXECUTIVE SUMMARY

This report portrays a detailed evaluation on the current situation with regard to conservation, sustainable use and development of plant genetic resources for food and agriculture in Suriname. It reflects the capacity needs and constraints related to the current contribution of plant genetic resources to food and agriculture in Suriname

Currently there is no coherent national policy regarding the management of plant genetic resources in Suriname.

For agronomic and horticultural crops there are no coordinated national programmes in Suriname with focus on well-organized plant genetic resources activities. For these crops elements related to plant genetic resources exist, but linkages between these elements is lacking. Different organizations conduct conservation activities to a certain extent. However, these activities do not occur according to standard protocols and procedures.

With regards to forestry species, however, the Government of Suriname has a long-standing commitment to nature preservation and biodiversity conservation. Forest genetic resources comprise timber species, medicinal plants and other non-timber species. The Suriname Forest Service gives high priority to conservation and sustainable management of natural resources. Suriname's strong tradition of nature conservation with regard to forestry crops, its protection of biodiversity and its preservation of primary tropical forest is indicated by a nature conservation system comprising 13 protected areas, ranging from 100 to 1 600 000 ha, covering about 12% of the total land surface. These protected areas encompass a wide range of ecosystems, from tropical forests to coastal formations, making Suriname's nature conservation system one of the most representative in South America.

Several organizations are either responsible for or managing genetic resources: The Research Department of The Ministry of Agriculture, Animal Husbandry and Fisheries (MAAHF), the Suriname Forestry Service, two national institutions of the Anton de Kom (ADEK) University of Suriname (the National Herbarium Suriname and the National Zoological Collection Suriname), Conservation International - the Amazon Conservation Team and The Anne van Dijk Rice Research Institute (ADRON).

Suriname's knowledge on genetic resources is best known for the coastal plain and savannah belt. Collections are scarce and the situation regarding the conservation of agricultural crops is miserable. Conservation is constrained by the lack of financial means and human capacity.

Except for rice, seed production practices re inadequate, Not well regulated import of new varieties, lack of proper testing by the MAAHF or other research institutes (except for ADRON), bad storage facilities, and no conservation programmes may result in loss of valuable genetic resources.

Regulations regarding management of genetic resources can be found scattered in several laws and other parts of legislation. Suriname has not yet passed specific legislation regulating Farmers' Rights with respect to sharing of benefits deriving from PGR.

There are restrictions to entry of Plant Genetic Resources. The Plant Quarantine Division of the Ministry of Agriculture, Animal Husbandry and Fisheries is the regulatory body that ensures the safety of planting materials coming into Suriname. Prior to the import of plants, plant parts, and seed approval is needed from the Plant Quarantine Division of the MAAHF.

The threat for introduction of alien invasive species is great, especially in the interior, where hardly anything is known about our genetic resources, and the fact that there is poor control at the borders (rivers, south). The quarantine service at airports (Zanderij, Zorg en Hoop) and the harbour is weak. Knowledge on impacts of alien invasive species is inadequate, except for the impact of pests on agricultural crops.

Much information regarding Suriname's biodiversity exists outside the country (Utrecht, USA). Over the past years the situation has improved somewhat, since many expeditions and surveys are now conducted in close cooperation with local institutes (University of Suriname, MNR, MAAHF).

Databases hardly exist for genetic resources. NZCS and NHS have a relatively well organized database. Most of the ministries do not have a database at all, or it is not updated. The Rice Research Station, ADRON, also has a Database system for rice lines and varieties.

Suriname is a signatory to the Convention on Biological Diversity – CBD (1992), and consequently benefits from the international agreement with respect to access of genetic resources and sharing of benefits arising out of their use. The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) is related to access and benefit-sharing regarding plant genetic material for food and agriculture. There is a direct link between the CBD and the ITPGRFA.

Suriname still needs to sign the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR). The Ministry of Agriculture, Animal Husbandry and Fisheries and the Ministry of Environment, Technological Development and Labour are mutually responsible for undertaking actions to sign the agreement on the ITPGRFA.

In brief it may be stated that in Suriname systemic germplasm management is lacking.

Aspects that are important for adequate germplasm management include:

- availability of funds;
- awareness about the importance of germplasm management;
- adequate policy to ensure that PGR becomes an fundamental part of agricultural programmes
- knowledge regarding germplasm management;
- adequate facilities;
- a well coordinated national and regional system.

All the listed aspects for adequate germplasm management are limited in Suriname.

Needs with regard to plant genetic resources management can be summarized as follows:

- A clear policy with regard to genetic resources needs to be developed;
- An inventory needs to be made of the plant genetic resources occurring in the interior. Suriname;
- A national and regional inventory of plant genetic resources is required. Useful results of the inventories and of germplasm research should be communicated to farmers in order to increase sustainable use of biodiversity;
- Capacity to explore the biodiversity (in the less accessible southern part or interior of the country) needs to be strengthened. Training to qualify scientists and researchers in the area of plant genetic resources management is mandatory.
- The situation regarding the conservation of agricultural crops needs improvement;
- Proper conservation programmes should be developed;
- There is need to establish a national committee on PGR management to ensure adequate coordination of the management of genetic resources
- Training courses to qualify scientists in the area of PGR management are essential;
- Improved Seed Production leading to the availability of germplasm with specific, desired characteristics is necessary;
- Adequate storage facilities need to be established;
- Exchange of information related to plant genetic resources between national and regional institutes needs to be improved;
- In order to prevent loss of PGR (in order to prevent genetic erosion) it is necessary to create awareness on the importance, the use and the threats for PGR;
- Measurements should be taken to protect endangered plant species by establishing additional nature reserves or nurseries (*ex situ* conservation). This to reduce the risk of loss of germplasm in case, for some reason, one gene bank gets lost;
- Institutional strengthening of the Plant Quarantine Division of the MAAHF is an essential requirement.

Maintaining or improving access to Plant Genetic Resources is important for contribution to food security and poverty alleviation, and for conservation of biodiversity and environmental stability.

CHAPTER 1

INTRODUCTION TO SURINAME AND THE AGRICULTURAL SECTOR OF SURINAME

1.1 Geography

FIGURE 1
Map of Suriname

Source: Bosatlas

The Republic of Suriname is situated on the northern coast of South America, between 2° and 6° North Latitude and between 54° and 58° West Longitude. In the East it is bordered by French Guyana, in the West by Guyana, in the South by Brazil and in the North by the Atlantic Ocean, The total area is 163 265 square kilometres (63 064 square miles). The country contains many rivers and some mountains (highest point 1 280 meters). The larger part of the country consists of uncultivated rain forest. Suriname is divided into ten districts. The capital of Suriname, Paramaribo, is situated about 20 km south of the coast at the west bank of the Suriname River.

1.2 General information about Suriname

The major part of the inhabitants of Suriname, 492 000 (ABS, 2004), lives within a 30 km wide coastal region. Over 150 000 inhabitants live in Paramaribo. The population of Suriname consists of several ethnic groups such as: Afro-Surinamese 40%, Indians 38 %, Javanese 15%, Amer-Indians 3%, Chinese 2% and others 2%.

The native inhabitants, the Amer-Indians, were driven out of the coastal area during the period of colonisation. They populate the interior part of the country as do the descendants from runaway negro slaves, the Maroons. The major part of the Surinamese population, about 85%, is concentrated in the coastal area (about 40% residing in the capital, Paramaribo). About 15% of the population lives in the interior in villages along the rivers and comprises mainly of Maroons and Amer-Indians.

Large areas of biological diverse, tropical rain forest with some areas of savannah cover Suriname, formerly known as Dutch Guyana. The official language is Dutch, but many other languages are also spoken.

Suriname has a good starting point for a sustainable social-economic development. The availability of several natural resources and the potential of fertile land and fresh water provide a solid foundation for the economic development of the country. Besides this there is a reasonable health care system, adequate educational possibilities, reasonable infrastructure and a relatively well educated population.

For decades the pillars of the Surinamese economy has been the mining of bauxite and the production of aluminium, and the production of the agricultural crops rice, bananas, vegetables and fruits.

About 15% of the labour force is employed in the agricultural sector, 4% in mining and 10% in trade. Of the labour force 38% works for the Government.

The Northern coastal plain is farmed, mined and logged, and the area along most rivers is heavily used for subsistence agriculture in the interior.

The backbone of Suriname's economy is the export of alumina and small amounts of aluminium produced from bauxite mined in the country. In 1999, the aluminium smelter was closed. However, alumina exports accounted for 72% of Suriname's estimated export earnings of $496.6 million in 2001. Suriname's bauxite deposits have been among the worlds richest.

Suriname, a member of CARICOM, has the following natural resources: timber, hydro-electric potential, fish, shrimp, bauxite, gold, iron ore and small amounts of nickel, copper and platinum.

The most important export products are:

- Aluminum, unrefined petroleum and crude oil;
- Rice;
- Bananas, other fruits and vegetables;
- Shrimp, fish and fish products;
- Timber and timber products.

Since 2003 the economy is back on track in terms of development; the inflation rate has declined, the exchanges rates have stabilised and the perspectives for further growth of the economy are promising. Some investments in large-scale projects, that have been in the pipeline for quite a while, commenced in 2003 (expansion of alumna production, gold mining (Cambior), investments in expansion of the petrol industry, bauxite exploration in West Suriname). This inclines a possible growth of the economy.

1.3 Climate and geomorphologic land division

Suriname has a tropical climate. The average temperature is 27 ^{0}C with daily deviations between 23 ^{0}C and 33 ^{0}C. The average annual rainfall in Paramaribo is about 2 200 mm. In the entire country the rainfall varies from less than 1 750 mm to over 3 000 mm. In Suriname four seasons can be distinguished viz.:

- The main rainy season - from April until August
- The main dry season - from September until November
- Small rainy season - from December until January
- Small dry season - from February until March

The rivers of the country flow from the south to the north and two of the biggest rivers form the border; in the west the Corantijn river and in the east the Marowijne river. The ecological diversity of the country is not formed by the climate, but more by the geomorphological differences, for which 4 areas can be distinguished:

1. **The young coastal plain – Demerara formation**
   The distance across the east of this area is 8 km and across the west 50 km and is situated between 0 and 4 degrees above sea level. It consists of swampy soil, deposited by the sea. Suriname has a coastal line with a length of about 350 km that consists of large mud banks with a few small strokes of sand beaches. The coast line is not stable;

this because of the rapid deposit of clay by the sea, forming land and destroying land. The mud derives from the Amazon river and is deposited by the Guyana stream. Sand and shells are deposited from the bottom of the sea. The brackish water area is covered with Mangrove.

2. **The old coastal plain – Coropina formation**
   This area lies between 4 – 11 m above sea level and covers a width of 20 – 70 km. It consists of swampy soil and sand ridges of sea and river origin. This area is covered with different types of swamps and grass; swamp forests, dry land forests and large areas with swampy turf swamps
3. **The savanna belt – Zanderij formation**
   This area covers a acreage of about 12 000 square km and lies about 10 m above sea level. The coarse bleached and unbleached sandy soils vary with regard to clay content and are of poor structure and quality. The area is covered with xerofytic and mesofytic dry land, swamp forest vegetation, dry till swampy grass and brush savannas.
4. **The Interior**
   The interior comprises 80 – 85% of the total land area of Suriname. It consists of hills, mountains and rock formations. The area is covered with primary, tropical rain forest. Suriname is part of the Amazon Province. The Amazon Province is sub-divided in 15 districts; one of them is the Guyana district of which the Suriname forest represents a part.

1.4 Brief description of the agricultural sector of Suriname

Suriname constitutes an area of 16.4 million ha of land. Of the 16.4 million ha of land in Suriname, 1.5 million ha is considered suitable for agricultural purposes. Of the acreage of 1.5 million ha approximately 120 000 ha (8%) is currently being utilised. The agricultural potential of the interior is about 400 000 ha. Agricultural activities are concentrated in the coastal plain.

Agriculture is an important sector of the economy of Suriname. Within the agricultural sector rice and bananas are the main commodities, followed by vegetables and fruits. The contribution of the agricultural sector over the period 1990 - 1995 to the GDP was about 9%, to employment 12%, and to foreign exchange earnings 17.5%.

The contribution of the agricultural sector to the GNP over the last five (5) years was about 7%. In spite of the fact that large-scale agriculture has declined the contribution of agriculture to foreign exchange earnings is still about 15%. During the past decennium there has been a downward trend in both contribution to the in GNP and foreign currency income. In the Agricultural Sector Plan of Suriname (March 2004) it is stressed that the agricultural sector is the only renewable sector in the economy and that the current raw materials like bauxite, that are currently important foreign exchange earners, will be exhausted some day.

The agricultural sector consists of about 10 000 – 12 000 smallholders, of which 85% live in the coastal area, where - for rice and bananas - modern and market oriented production technologies are practised. The remaining 15% farmers (Amerindians and Maroons) live in the interior, where subsistence farming is carried out.

Rice is the most important staple food. Rice constitutes the basic component in the diets of the Surinamese people. This commodity is an important export crop and foreign exchange earner. Rice production is an activity of medium and large scale farmers using modern and market oriented production techniques.

The current situation in the rice sector of Suriname can be summarized as follows:

- High soil tillage cost (25%)
- Inadequate seed supply system
- Improper I&D conservation
- Inadequate pesticide use
- Inefficiencies in processing
- Inefficiencies in export facilities
- Poor/inadequate organization
- Inadequate marketing

Rice producing areas (two crop seasons) include:

- Nickerie (15 areas planting average 11 000 ha)
- Saramacca (3 areas planting average 1 200 ha)
- Coronie (planted 750 ha)

Rice farms can roughly be divided into:

- Small farms: 1 – 24 ha
- Mid-level farms: 25 – 250 ha
- Large-scale farms: > 250 ha

The most important **Banana** producer is the State owned company "Stichting Behoud Bananen Sector" (SBBS). This enterprise comprises two estates, located in the Saramacca and Nickerie district, and covers a total area of about 2 000 ha. At the SBBS 1 900 persons are employed. Bananas are mainly being exported to the European market.

In Suriname **vegetable crops** are mainly grown by some 3 000 - 4 000 full-time and part-time, small-scale farmers. Women play a crucial role in vegetable production in our country. The main vegetable producing areas are: the Kwatta area (Weg naar Zee), the Wayombo area in the Central Region, The Saramacca district, The Lelydorp area in the Wanica district and Alkmaar, Tamanredjo and Sinabo in the Commewijne district. Over the past 10 years an average of about 1 000 ha was destined for vegetable production. This comprises less then 0.1% of the total acreage. Farm sizes vary between 0.08 and 2.0 ha. Vegetable Farms consist most of the time of a small variety of crop kinds. The production technology is predominantly labour intensive. The Importance of the Vegetables sub-sector of Suriname encompasses:

- Income generation for many rural families
- They complement the staple food rice to contribute to the nutritional needs of the local population
- This commodity is a foreign exchange earne

Remarkable characteristics of the vegetable crop sub-sector of Suriname are:

- Small sizes of the individual plantings
- The production technology is predominantly labour intensive
- Large consumption of artificial fertiliser and pesticides
- Great risk of harvest failure due to seasonal effects. This mainly caused by lack of suitable irrigation and drainage facilities in times of drought or heavy rainfall

The quantity of locally produced vegetables does not always meet the demands. The supply of demanded vegetables is not always guaranteed or sufficient because of seasonal effects.

The main vegetable crops produced include:

- Tomatoes (*Lycopersicum esculentum*)
- Cabbage (*Brassica oleracea*)
- Common bean (*Phaseolus vulgaris*)
- Yard long beans (*Vigna unguiculata* vr. *Sesquipedalis*)
- Tanya leaves (*Xanthosoma* sp.)
- Chinese cabbage (*Brassica* sp.)
- Egg-plant (*Solanum melongena*)
- Cucumber (*Cucumis sativus)*
- Hot pepper (*Capsicum frutescens*)
- Pumpkin (*Cucurbita pepo*)
- Bitter gourd (*Momordica charantia*)
- Okra (*Abelmoschus esculentus*)
- African egg-plant (*Solanum macrocarpon*)

Vegetable crops produced in smaller quantities include:

- Bitter greens (*Cestrum latifolium*)
- Celery (*Apium gravéolens*)
- Amaranthus (*Amaranthus* sp.)
- Lettuce (*Lactuca sativa*)
- Broccoli, cauliflower (*Brassica olerácea* var. *botrytis*)
- Sweet peppers (*Capsicum annuum*)
- Spinach (*Basela alba*)

Approximately 10% of the amount of vegetables produced over the past years has been exported. Vegetable crops exported include: bitter gourd (*Momordica Charantia*), eggplant (*Solanum melongena*), yard long beans (*Vigna sesquipedalis*), leaf vegetables [Bitter greens (*Cestrum latifolium*); spinach (*Basella alba*)] hot pepper (*Capsicum frutescens*), pumpkins (*Cucurbita pepo*). The export market for these commodities is mainly the Dutch market.

To sustain the diversification efforts of the Government of Suriname (GOS) increasing vegetable crop production and improving productivity of this commodity group is considered to be an important activity as a means of reducing the reliance on rice and bananas as sources of foreign currency and for improving nutrition of the population. Improving vegetable production technology is therefore incorporated into the diversification efforts of the GOS.

For data on production and export of agricultural commodities refer to Annexes 1 – 5.

Policy

The Government recognises that development and diversification of the agricultural sector is important in ensuring adequacy in food and nutrition, in improving rural incomes and standard of living, and in elevating the economic well-being of the population. Diversification in the agricultural sector is also of importance for risk spreading and for achieving the possibility to generate more incomes from other agricultural commodities.

The current agricultural policy of the GOS is therefore aimed at "diversification and at providing consumers with a wholesome and safe diet at reasonable prices, and having an environment within which an efficient and dynamic agriculture can provide for domestic food needs and larger foreign exchange earnings".

GOS currently identifies three goals with regard to the agricultural sector:

- Self-sufficiency: to guarantee the availability of sufficient healthy and safe food for all residents;
- Income: the achievement of a successful agro-sector that generates employment and adequate income to those active in the sector and contributes to poverty alleviation;
- Foreign exchange: to encourage and facilitate the orientation of the exports of the sector and through this the growth of the export value.

Agricultural development is guided by the Multi Annual Development Plan. The current plan is prepared for the period 2006 – 2011.

1.5 Food security

As defined by the 1996 World Food Summit (WFS), food security "…exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". This definition integrates access to food, availability of food and the biological utilization of food and the stability of these. These factors are interrelated.

Over the past years the following activities related to Food Security took place in Suriname:

- Establishing the Seed Inspectorate at the MAAHF in 1999 (Seed Quality Control, seed training, seed research);
- Approval of the Seed law in April 2005 in Parliament (Encompassing regulations for the production, quality and sale of seed);
- Collaboration between the Research Department of the MAAHF and the Dutch Research Institute PPO ("Praktijk Onderzoek Plant en Omgeving") in the area of quality standards for vegetable crops exported to The Netherlands;
- Sub-project "Improved Vegetable Production" (part of Regional Project GTFS/RLA/141/ITA - "Promoting CARICOM/CARIFORUM Food Security). The components comprised:
  - Setting up 5 greenhouses with hydroponic system in the coastal area;
  - Training in greenhouse and hydroponic operation
  - A two-week training course on Integrated Pest Management (IPM) for vegetables (May, 2006).
- Sub-project "Improved Rice Production" (part of Regional Project GTFS/RLA/141/ITA - "Promoting CARICOM/CARIFORUM Food Security). The components comprised:
  - 8 Minimum tillage production demos
  - 8 Hydro-tillage production demos
  - 3 IPM/FFS production demos (FFS = Farmer Field School)
  - A one-week IPM training for Rice (December 2006)

- 3-days training on "Food Security and Vulnerability Analysis" (November 2006), under Project GTFS/RLA/141/ITA - "Promoting CARICOM/CARIFORUM Food Security
- Participation in project IICA/MAAHF/Educons project on production of agricultural instruction CD's. Target group: pupils from the 4th and 5th grade of Elementary Schools.

Under the Regional Food Security Programme three projects were executed in Suriname over the past years:

- Introduction of Aquaculture and Other Integrated Production Management Practices to Rice Farmers
- "Food Security in CARIFORUM – Market information and Institutional Development Strengthening"
- Components of Regional Project GTFS/RLA/141/ITA - "Promoting CARICOM/ CARIFORUM Food Security".

As part of Regional Project "Promoting CARICOM/ CARIFORUM Food Security" a food security assessment was carried out in Suriname in 2006. From the Food Security assessment the following information was obtained:

Key factors in vulnerability to food security in Suriname include:

- Limited quantity and quality of livelihood assets
  - Weak access to, and the poor quality of, privately-owned and publicly-held physical capital;
  - Vulnerable farmers tend to have inadequate privately-owned physical capital (including agricultural land, livestock, kitchen gardens) to support their main occupation;
  - Limited access to diversified fishing gear and adequate boats;
  - Households that are most vulnerable to becoming food insecure have few if any other physical assets (such as home gardens or livestock) with which to supplement their income or food supply in case of adverse unexpected shocks;
  - Access to water and electricity services;
  - Inadequate sanitation services contribute to high rates of diseases;
  - Vulnerable households have very limited financial capital (cash, savings, jewelry and access to credit)
- Low education level (Limited knowledge and skills, and poor education are core contributing causes to vulnerability)
- Adverse trends erode the risk management capacities of vulnerable livelihoods (Population growth and unsustainable production practices lead to increased pressure on available land, forest and fishery resources)
- Sudden shocks drive vulnerable households into food insecurity (e.g. death or serious illness of the household head, floods).

Floods in 2006 and in 2008 in large parts of the interior, due to unexpected excessive rains, turned out to be catastrophic. While no lives were lost the social and material damage was relatively huge. The Government and local and international NGO's provided substantial aid in terms of food, medical supplies and basic hygiene articles during the periods of flooding.

CHAPTER 2

THE STATE OF DIVERSITY

2.1 Agricultural plant genetic resources

At the MAAHF, the Agricultural Experiment Station is one of the institutes responsible for agricultural research. Conservation activities are principally located at several experimental gardens. The most important of these experimental gardens are La Poule and Dirkshoop. A number of relevant agricultural species, such as citrus, mango, coffee, cacao and coconut, are being grown and used in field trials or are kept for future research activities. Species that are currently present at Dirkshoop and La Poule are presented in Annex 7.

2.2 Indigenous plant genetic resources

Forestry genetic resources

About 90% of the country is covered with forest. The major part is covered with rain forest (78%). Other types also occur such as Mangrove forest and swamp vegetation (10%) and savanna vegetation (about 1%). The major part of the forest is not accessible. This because of the mountainous country side and the bad navigability of the rivers. For this reason timber production is mostly carried out in the northern part of the Surinamese rain forest, the so called forestry belt. This belt is an economic zone of high forest trees and varies in distance across from 10 to 40 km. This area constitutes 1.5 million ha of forest trees, of which about 60 000 ha is suitable for sustainable timber production. In this area about 10 000 ha comprises man made forest. This forestry belt is accessible through about 2 000 km of good roads. The rain forest consists of more than 300 botanical species, of which less than 10% is suitable for timber harvest. In Suriname the emphasis has been on commercial timber production for a long time. The other functions and products of the forest are still under-valued, such as the genetic potential, medical plants, ornamentals and fauna in all their diversity.

Under the Timber Act of 1947 the following tree species are listed as protected and are not permitted to be harvested:

- Bolletrie (*Manilkara bidentata*);
- Tonka (*Dioteryx odorata*);
- Hoepelhout (*Copaifera guianensis*);
- Rosenhout (*Aniba* sp.);
- Kwasibita (*Quassia amara*);
- Maho (*Hibiscus tiliaceus*).

A list of commercial forestry wood species was compiled according to an FAO report of 1974 (FO. DP/SUR/71/506 – Technical Report 6 – Forestry Development Suriname). See Annex 8.

Palmae

Palms of economic or potential economic importance include:

- *Elaeis guineensis* (African oilpalm)
- *Elaeis oleifera* ("Sabana obe")
- *Astrocaryum vulgare* ("awarra")
- *Maximilliana* sp. ("maripa")

Astrocaryum vulgare and *Maximilliana* sp. are used by inland tribes for the production of edible oil. The pulp of *Astrocaryum vulgare* is also used fresh. The pulp of this crop is rich in vitamine A, vitamine C and Carotene. The pulp can also be used to give flavour to ice-cream.

- *Euterpe oleracea* ("palmito")
- *Bactris gasipaes* ("paripoe" or peach palm). The "paripoe" is not indigenous.
- *Attalea* spp. This palm type is suitable for the production of strips for parquet floors.

Medicinal plants

About 600 indigenous plants are used for medicinal purposes. A famous medicinal plant used over a great part of the world concerns *Quassia amara* ("Kwasibita").
Other medicinal plants include:

- *Bixa orellana* ("koeswe"); is used against inflammation of mouth and throat.
- *Cecropia surinamensis* ("Oema boesi papaja"); is used for treatment of kidney disorders, nervous diseases and heart conditions.
- *Ruellia tuberosa* ("Watra kanoe"); is used for kidney ailments and for diabetics.
- *Hura crepitans* ("Possentrie"); is used against skin problems.
- *Phyllantus amarus* ("fini bita"); is used against venereal diseases, colds, influenza, and as a diuretic.
- *Lippia geninata* ("Blakka tiki minti"); is used against stomach problems.
- *Piper marginatum* ("Anesi wiwiri"); is used against stomach disorders and nervous conditions.

Ornamentals

Many plants that are present in the forest of Suriname can be used as ornamentals and could become of economic importance for local growers of ornamentals. These plants include: Orchid species, fern species, and varieties of the *Bromeliaceae*, *Araceae* and *Musaceae* family.

Other species of economic importance

Other species of economic importance, that are grown by local producers and of which relatives are present in the forest, include:

- *Ananas comosus* (pine apple);
- *Manihot esculenta* (cassava);
- *Dioscorea alata* ("yams");
- *Dioscorea trifada* ("napi");
- *Ipomoea batatas* (sweet potato);
- *Xanthosama* spp. ("tanya");
- *Theobroma cocao* (cocao);
- *Passiflora edulis* (passion fruit);
- *Passiflora laurifolia* (Para markoesa);
- *Oenocarpes bacaba* ("koemboe");
- *Anacardium occidentale* (cashew);
- *Bertholletia excélsa* (Para noto);
- *Caryocar nuciferum* (Ingi noto);

Indigenous species that could become important with regard to agricultural production include:

- *Spondias mombin* ("mope"); for the processing industry;
- *Ananas soides* and *Ananas nanus* (Wild pine apple); could be used in breeding programmes;
- *Manihot* spp. (Wild cassava);

The vegetables:

- *Talinum triangulare* (postelein);
- *Amaranthus lividus* and *Amaranthus dubius* (klaroen);
- *Solanum oleraceum* (agoema wiwiri);
- *Caladium bicolor* (jaba foetoe).

CHAPTER 3

POLICY AND REGULATORY FRAMEWORK FOR MANAGEMENT OF GENETIC RESOURCES

At present Suriname does not have a coordinated genetic resources program, nor a coherent national policy regarding genetic resources. This results in an unmanaged system where different organizations conduct conservation activities to a certain extent. However, these activities do not occur according to standard protocols and procedures.

In Suriname activities regarding management of genetic resources falls under the responsibility of a number of ministries, namely The Ministry of Natural Resources, the Ministry of Agriculture, Animal Husbandry and Fisheries (MAAHF), and the Ministry of Trade and Industry.

Several institutes of the University of Suriname are also involved in the areas of plant and animal genetic resources namely The National Zoological Collection of Suriname (NZCS), the Center for Environmental Research (CMO), the National Herbarium Suriname (NHS), and CELOS (Center for Agricultural Research).

The Anne van Dijk Rice Research Institute (ADRON) is responsible for rice research (breeding, testing of new lines, conservation etc). In the past LON (Agricultural Research Nickerie) of the "Stichting ter bevordering van de Machinale Landbouw" (Foundation for Mechanized Agriculture - SML) was responsible for these activities.

The Ministry of Agriculture, Animal Husbandry and Fisheries is responsible for the management of plant, animal and fish resources. Several units of this Ministry (Seed Unit, the Quarantine Office of the Plant Protection Division, The Plant Protection Divisions, the Weed Division, Fruit Crops, Vegetable Crops and Ornamental Crops Division) are involved with plant genetic resources.

The MAAHF conducts all agricultural activities in terms of production and the necessary research in this field. The management of plant (especially agriculture and horticulture), animal (except wildlife), and fish resources is also the responsibility of this ministry.

The main institute responsible for cultivar introduction and evaluation is the Sub-directorate Agricultural Research, Marketing and Processing. Several units are involved with plant genetic resources namely the Seed Unit, the Quarantine Office, The Plant Protection Divisions (insects, fungi, bacteria, and nematodes), the Weed Division (Grasses, weeds, medicinal plants), and the Divisions Fruit Crops, Vegetable Crops and Ornamental Crops. Two foundations that also fall under the MAAHF, namely STINAPA (Foundation Nature Parks) and STIPRIS (Foundation Experimental Stations in Suriname), have a number of *ex situ* collections of exotic trees and agricultural crops. The botanical garden, which is situated in Paramaribo, falls under the responsibility of STINAPA.

With regard to introduction of farm, pet, and other type of animals the Sub-directorate of Animal Husbandry is the responsible authority, namely the Veterinary Inspection Division.

The Sub-directorate of Fisheries is responsible for the management of fish resources. They gather data on fishery activities on board of ships and on fish landings in the harbor of Paramaribo. This department enforces the Fish Protection Act and the Sea Fisheries Decree and is responsible for the management of fisheries including aquarium fish. The department is not involved in CITES permitting, only in the licensing of the catching of aquarium fish and issuing health certificates for the export of aquarium fish.

The Ministry of Natural Resources (MNR) controls the exploitation and management of all energy and natural resources, except fish. The Suriname Forest Service (LBB) is responsible for the implementation of the laws regarding the country's natural resources. It places a high priority on conservation and sustainable development (Dupaix, 2001). The Nature Conservation Division of the Suriname Forest Service is in charge of nature conservation including the management of wild flora and fauna, management of protected areas and control of the trade in wild life. The management of protected areas is conducted in close cooperation with the Foundation for Nature Preservation. The Foundation for Forest Management (SBB) is in charge of forest management, including management of non-wood forest products (NWFP's) of plant origin. The Ministry of Trade and Industry, namely the Division of Import, Export and Foreign Currency Control (IUD) is responsible for the issuance of licenses to for import and export of plants, animals and microorganisms and develops the general import and export policy in the country. Customs not only controls the movement of plants and animals at the airports and borders but is also present at the moment when shipments of animals, plants and micro-organisms are being packed.

CHAPTER 4

THE STATE OF *IN SITU* MANAGEMENT

Germplasm is living tissue from which new organisms can be generated. Through germplasm the genetic information of an organism is transferred from generation to generation. A distinction can be made between animal and crop germplasm. In this document the focus will be predominantly on germplasm of crop species.Germplasm management is an important aspect for obtaining improved planting material.

Germplasm management comprises: collecting, characterizing, evaluating, describing and conservation of germplasm.

A place where germplasm is conserved is called a gene bank. Gene banks for crops can be *in situ* or *ex situ*. *In situ* conservation of germplasm involves conservation of germplasm in its original region. *Ex situ* conservation involves conservation of germplasm outside the natural environment.

4.1 Forest genetic resources

Forest genetic resources comprise timber species, medicinal plants and other non-timber species. The Suriname Forest Service gives high priority to conservation and sustainable management of natural resources. Other tasks include: forest inventory, forest management, nature conservation, forest research, forest control, timber control, accessibility to the forest and training of forest guards.

Suriname is committed to the conservation of natural resources, while promoting better living conditions for the population of the small villages of the Interior and the people living in the coastal areas. The country does have some programmes or projects for *in situ* conservation of Forest Resources. It is necessary to involve more intensively the inland tribes to assist in the management *in situ* conservation sites.

4.2 Conservation in protected areas

There are 13 protected areas, ranging from 100 to 1 600 000 ha, covering about 12% of the total land surface. They include forest eco-systems, sea turtle nesting beaches and estuarine areas, hosting North American migratory birds and other locally breeding coastal birds.

The country's protected areas are listed below:

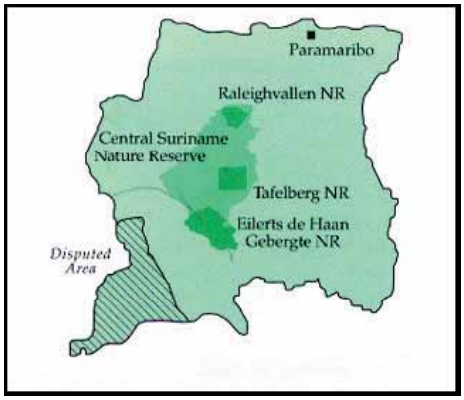
	Name	Nature	Area (ha)	Established/ Expanded
1	Wia Wia	Nature reserve	36 000	1961/1966
2	*Voltzberg-Raleighvallen	"	77 000	1961/1986
3	Coppename River Mondingw	"	12 000	1966
4	Brinck Heuvel	"	6 000	1961
5	*Tafelberg	"	140 000	1966
6	*Eilerts de Haan Gebergte	"	220 000	1966
7	Galibi	"	4 000	1969
8	Hertenrits	"	100	1972
9	Sipaliwini	"	100 000	1972
10	Copie	"	28 200	1986
11	Boven Coesewijne	"	27 430	1986
12	Peruvia	"	35 150	1986
13	Wane Kreek	"	43 860	1986

	Name	Nature	Area (ha)	Established/ Expanded
14	Brownsberg Nature Park	Nature reserve	8 400	1969
15	**Centraal Suriname Natuur Reservaat – CSNR (The Central Suriname Nature Reserve)	"	1 600 000	Inscribed on the World Heritage List in 2000

*Voltzberg-Raleighvallen, Tafelberg and Eilerts de Haan Gebergte are now part of the CSNR
**The Central Suriname Nature Reserve (CSNR)

The Central Suriname Nature Reserve (CSNR), established by Government Decree SB 1998 no. 65, comprises 1.6 million ha. of primary tropical forest of West-Central Suriname. The CSNR covers over 10% of the total land area of Suriname. The Reserve forms a corridor connecting three important former protected areas in Central Suriname: the Raleighvallen Nature Reserve in the north, and the Tafelberg and Eilerts de Haangebergte Nature Reserves in the central and southern portion of the corridor, resulting in the fact that there are now 13 protected areas. The Nature Reserve also protects the watershed of one of Suriname's most important river systems, the Coppename River. The Reserve covers a range of topography and ecosystems of significant conservation value due to their unspoiled state.

FIGURE 2
The Central Suriname Nature Reserve (CSNR)



(Source: http://www.2docstock.com/Suriname/Stinasu/centralreserve.html)

Its mountainous and lowland forests contain a high diversity of plant life with almost 6 000 vascular plant species collected to date. There are viable populations of animals typical of the region including jaguar, giant armadillo, giant river otter, tapir, sloths ("luiaard") and eight species of primates, as well as 400 bird species. The site encompasses significant vertical relief, topography and soil conditions that have resulted in a variety of ecosystems. The CSNR contains a high diversity of plant and animal species, many of which are endemic to the Guyana Shield and are globally threatened.

With the inscription of the Central Suriname Nature Reserve on the World Heritage List, Suriname has established itself as a nation with exceptional universal heritage assets. The recognition that Suriname has tropical forest of worldwide value will certainly contribute to the general view of Suriname's nature.

Suriname's strong tradition of nature conservation with regard to forestry crops, its protection of biodiversity and its preservation of primary tropical forest is indicated by a nature conservation system comprising the protected areas listed on page 17. These protected areas encompass a wide range of ecosystems, from tropical forests to coastal formations, making Suriname's nature conservation system one of the most representative in South America.

The Ministry of Natural Resources (MNR), in particular her institute The Suriname Forestry Service, is responsible for management of the country's protected areas.

Wildlife outside the reserve is protected by law and is managed by the Nature Conservation Division of The Forest Service. All forest and other domain land is property of the Government of Suriname. Timber concessions and cutting permits limit the exploitation of forest land of those forests that remain full property of the Government. Tribal communities, living in the interior, are also entitled to a part of the forest in the vicinity of their village. The total forest held under these privileges amounts to approximately 400 000 ha.

Proposed protected reserves include:

	Name	Area (ha)
1	Nanni nature reserve	53 920
2	Kaboeri Kreek nature reserve	67 720
3	Mac Clemen forest reserve	5 970
4	Snake Creek forest reserve	4 125
5	Lelydorp forest reserve	500
6	Cassipora forest reserve	4 420

4.3 Inventories

Most inventories on plant species took place in the Coastal Plain of Suriname and well accessible airstrips in the Interior. Large areas of the interior, especially the mountain ranges, remain completely unknown for their flora, fauna, ecosystems and ecological relations. The two national institutions responsible for general inventories of flora and fauna are the National Herbarium Suriname (NHS) and the National Zoological Collection Suriname (NZCS), both part of the University of Suriname.

CHAPTER 5

THE STATE OF *EX SITU* MANAGEMENT

5.1 General information on *ex situ* management in Suriname

Ex situ conservation involves conservation of germplasm outside the natural environment.

Ex situ conservation includes:
a. Conservation in the field
b. Conservation in Seed Banks
c. "Cryopreservation"
d. *In vitro* conservation

a. Conservation of germplasm in the field

Seeds of several fruit crops and nuts deteriorate quickly in case they are conserved in the form of seed (recalcitrant seed). Germplasm of these species is conserved in the form of living plants. The Research Department of the MAAHF manages different *ex situ* collections at several experimental gardens where conservation related activities are conducted. At the experimental fields of the Research Department of the MAAHF, La Poule and Dirkshoop, and of the Foundation Experimental Gardens in Suriname (STIPRIS), Tijgerkreek West, there are collections of:

- Several fruit crops and varieties of agronomic crops
- Several palm species and varieties of these species
- A few ornamentals.

The Centre for Agricultural and Forestry Research (CELOS) has a collection of 74 cassava accessions in the Hinterland.

b. Conservation of germplasm in seed banks

Orthodox seeds can be dried to a moisture content of 4 – 8% MC and stored.

Currently there is only a true seed bank for rice lines and varieties. This seed bank is located at the Anne van Dijk Rice Research Centre Nickerie (ADRON) of the Foundation National Rice Research Institute (SNRI). The Anne van Dijk Research Institute (ADRON) is responsible for rice research (breeding, testing of new lines, conservation). ADRON has a rice germplasm collection and a plant breeding program to develop new rice varieties. ADRON conserves and uses two types of germplasm, a working collection and a gene bank. The working collection is a strategic collection. In this collection rice cultivars and lines from all over the world are stored, and used for breeding purposes to produce cultivars suited for Suriname. Genetic material is obtained from several institutes like IRRI (International Rice Research Institute), and CIAT.

The gene bank is a conservation collection. Rice cultivars and lines of Suriname, and sometimes Guyana, are preserved in this collection. Every cultivar in the collection is preserved for an indefinite period of time. Rice seed conservation at ADRON occurs in deep freezers, a refrigerator or in the Seed Storage Room, where a temperature of about 25 °C is maintained. It is not exactly known how many accessions are being conserved at ADRON.

Until a few years ago the Agricultural Experiment Station of the Ministry of Agriculture, Animal Husbandry and Fisheries (MAAHF) and the Centre for Agricultural and Forestry Research in Suriname (CELOS) had seed storage rooms with collections of local and exotic varieties of grain crops, pulses, vegetables and weeds. Due to lack of funds for proper conservation of the seed storage rooms it was not possible to keep these facilities functioning. This caused decline of the facilities, resulting in loss of germplasm at these facilities. Around 1997 the Seed Storage room at the Agricultural Experiment Station was partially renovated. However, the storage conditions do not comply with internationally recommended standards. Temperature and humidity cannot be controlled adequately. Both institutes have plans to again collect and conserve germplasm.

At present CELOS is doing variety testing on crops such as maize, soybean, cashew and cassava. Seed is obtained from research institutes. No conservation programs are yet being conducted.

c. Conservation of germplasm through "cryopreservation"
Seed samples of crops or embryo's are conserved in or on top of liquid Nitrogen at a temperature of –196 °C. In Suriname there are no conservation activities by means of cryopreservation.

d. *In vitro* conservation
Tissue culture techniques are applied for conserving germplasm. This conservation method is suitable for species that can not be conserved in the form of seed. At the Faculty of Technology of the ADEK University of Suriname there is an *in vitro* laboratory for research and teaching purposes. The capacity of this laboratory is limited. In this *in vitro* laboratory there is an *in vitro* collection of *Musa acuminata* en *Anananas comosus*.

Collecting, describing and characterizing germplasm
There are no systemic procedures for collecting germplasm. For describing germplasm descriptors from IPGRI are available and the software PC Grin. For describing germplasm ADRON uses the Standard Evaluation System for Rice from IRRI.

Collections at the NHS and NZCS
The two national institutions responsible for general inventories of flora and fauna are the National Herbarium Suriname (NHS) and the National Zoological Collection Suriname (NZCS). The NHS and the NZCS are very active and well managed, but lack the financial means and human capacity to conduct their tasks properly.
The National *Herbarium* of Suriname has approximately 1 500 boxes with specimens, with 80-90% of all existing plant species of Suriname, including the following collections (Anon., 2002):

- A plant collection of around 35 000 specimens
- A xylotheek: wood species collections of around 8 000 specimens
- An alcohol collection of 900 specimens, mainly orchids
- A collection Fungi (mushrooms) and Musci (mosses)
- A library of around 3 500 books, journals, magazines, reports and reprints.

5.2 Rice germplasm management at the Rice Research Station, ADRON

SIn the past the Foundation for the Furtherance of Mechanized Agriculture (SLM = "Stichting ter Bevordering van de Machinale Landbouw") was responsible for rice research, rice germplasm management and rice breeding programmes. Since 1994 ADRON is the recognized institute for research on rice, the major crop in Suriname. Since rice is the major crop in the country and ADRON is the only institute with a true seed bank for rice lines and varieties information on germplasm management for rice will be elaborated in this chapter.

5.2.1 Collection, introduction and exchange of germplasm

Collecting genetic material encompasses collection of varieties of a crop species in several regions where this crop is present or where it is cultivated. In the case of ADRON this activity regards collecting rice varieties and lines from all over the world; introduced for breeding purposes to obtain rice lines with characteristics, suitable for Suriname's agro-ecological conditions. Material is introduced from South East Asia, obtained through IRRI, lines from CIAT, from the Latin American Region and from other regions. The composition of the collection may change periodically, as sometimes it is decided to remove lines that will not be used anymore in breeding programmes from the collection.

5.2.2 Characterization

In characterization, at ADRON attention is paid to: plant height, spikelet fertility, panicle threshability, fenotype, growth period and other characters.

Measurements: At ADRON this includes experimental data to be determined, that characterize every accession genetically. The numerous, fully or partially genetically determined, characters of rice varieties can be divided into two extreme types:

- Constant characters, sometimes also called "qualitative" characters;
- Variable characters, sometimes called "quantitative" characters.

Fore example: smooth or rough leaves can only be measured during one growing season; the appearance will not change. Grain length is also not very variable, but two observations are necessary. Plant height varies much more, depending on soil fertility, water availability and day length.

5.2.3 Evaluation

At evaluation observations are done with regard to (among other things):

- Yield;
- Pest and disease resistance;
- Resistance against biotic and a-biotic stress situations.

Yield depends on the season, the geographic location and other growth factors. Yield comprises variable data. It is extremely important that germplasm is free of pests, diseases and weed seed.
At ADRON attention is paid to:

- Diseases: Blast
- Pests: several storage insects
- Weed seeds: *Oryza sativa* (weed rice), *Cyperus* spp., *Ischaemum rugosum*.

5.2.4 Description

For the description of germplasm specially designed computer database programmes can be used. For description, characterization and evaluation of germplasm internationally recognized descriptors are used. ADRON uses the Standard Evaluation System for Rice from IRRI.

During the growing cycle of the rice crop three growth phases can be distinguished:

- The vegetative phase;
- The reproductive phase;
- The ripening phase.

For the different growth phases the characteristics that are important for the particular phase are described.

5.2.5 Conservation

ADRON holds and uses two types of genetic resources:

- A work collection and
- A gene bank.

Both collections are stored and catalogued together. However there are fundamental differences between the two collections.

There are about 500 Surinamese lines and about 1 000 lines and varieties from abroad in the collection.

Work collection

The work collection comprises a strategic collection. It concerns rice varieties and rice lines, obtained from all over the world, for breeding purposes aimed at combining agronomic characteristics that are desirable for Suriname in one genotype. The material obtained represents material from South East Asia, obtained through IRRI, lines from CIAT, lines from the Latin American Region and lines from other regions. The composition of the collection might change: a line that will not be used anymore in breeding programmes is removed.

This collection is stored in plastic bottles (1 and 2 litres) in a cold storage room (20 °C). The moisture content of this material is not higher than 13%.

Gene bank

A conservation collection. Rice varieties and lines from Suriname and sometimes from Guyana are kept in this collection. This collection comprises for example SML lines, dry land rice from the Hinterland, outstanding ADRON lines that were not selected to be released as a variety, but could be requested for use as a breeding parent. Ones a new variety is released, this variety is conserved for an indefinite period of time. The material is renewed periodically. It is namely

ADRON's task, as partner in international exchange programmes, to conserve and have available the Surinamese lines and varieties. It is recommended for material in the conservation collection to submit seed of the first multiplication to gene banks with which exchange programmes exist. In case the ADRON seed bank will be destroyed, for whatever reason, this material can be obtained again from a partner in the exchange program.
ADRON recognizes two types of storage:

- Mid term storage: storage for a period of 3 – 4 years in plastic containers that are kept in a cool cell at a temperature of 4 - 5 °C. The moisture content of this material is about 10%;
- Long term storage: storage for a period of more than 4 years in aluminium bags in a deep freezer at a temperature of -18 °C. The moisture content of this material is about 6%.

5.2.6 Organisation of ADRON's genetic resources

In the past rice research was carried out by the Foundation for the Furtherance of Mechanized Agriculture (SML). Since 1994 the institute ADRON (Anne van Dijk Rijst Onderzoeks Centrum Nickerie), that falls under the responsibility of the Foundation National Rice Research Institute (SNRI), is responsible for rice research in Suriname.

Moisture content determination

At ADRON moisture content determination is done by using a Brabender moisture measuring device. This method is based on the oven dry method.

5.2.7 Management

Management comprises:

- Collecting/introducing new lines and determining criteria for doing this;
- Storage of the accessions;
- Plant the accessions periodically in the field and collect data on germination of the collection in storage;
- Selective removal of material that will not be utilized anymore (strategic collection);
- Organize field measurements of collections of varieties, storage, and making data available;
- As part of exchange programmes submit Surinamese germplasm to regional and international institutes, among other things, for risk spreading.

5.2.8 Accessibility of data

A collection is only useful in case it is accessible. The accessibility can be observed physically, for instance displaying the material systematic in a storage facility. Accessibility by means of a catalogue is also very important. Accessibility has to do with everything that makes it possible for plant breeders and others to utilize the collection of rice lines and varieties and indicates that there are data on:

1. What is present in the collection;
2. Where a line or variety is located;
3. What the different lines or varieties are useful for.

Nowadays storage of and accessibility of data through a computer programme is an absolute necessity for making information on gene banks and collections of lines and varieties available.

For the data that one is interested in one can differentiate between passport data and measurements or experimental data (field observations).

Information

This is related to data on identity and origin (passport data). These data are used to make searching on name, origin, and reputation possible.

- Accession. At ADRON the method Diary of Materials Received (DMR) is used. This comprises continuing numbers that are assigned immediately after receiving the material. In experiments carried out later on this number could be used as an ID number;
- Name of the variety or line;
- Aliases of the variety. The same variety can occur under different names;

- Line number. A variety often has, apart from the name allocated at release, a line number that provides information on the history in the breeding programme;
- Origin of the seed. The name and location of the experimental station where the seed was derived from is provided or the place where it was collected;
- Taxonomic group (*japonica, indica, mixed form, wild rice, weed rice*);
- Reputation of the variety. This regards characters that are denoted to the variety by the persons that make the material available.

5.3 On-farm conservation

Horticultural activities are mainly carried out by small farmers. These farmers often save part of their commercial production for collecting seed (e.g. for eggplant, African eggplant, yard long beans, and common beans). However, the quality of the seed may not be satisfactory due to improper practices during harvest, conditioning and/or storage. For several crops they also use imported seeds (e.g. cabbage, Chinese cabbage, lettuce, cucumber, gherkin, sweet pepper, tomato, celery).

5.4 Botanical garden

In Paramaribo there is a botanical garden. The botanical garden falls under the responsibility of STINAPA (= Stichting Natuur Parken – Foundation Nature Parks). Information on the collection in the Botanical Garden can be obtained from the publication "Inventarisatie en Kartering van de Nuttige Planten en Sierplanten in de Cultuurtuin te Paramaribo" by P.A. Teunissen (February 1982)).

5.5 Germplasm management in the CARICOM region

In the Caribbean region there is a wide variety and quantity of germplasm present. However; until now in the Region insufficient attention was given to collecting and conservation of germplasm, partly due to lack of knowledge on the importance of germplasm. Also in Suriname there are no systemic procedures for collecting and conserving germplasm (except for rice). There is also no clear policy with regard to germplasm.

Over the past years several organizations that had attention for germplasm collection and conservation were set up. Unfortunately they soon terminated this activity. These organizations focused on ornamentals, horticultural and agronomic crops. There has also been some attention for trees and marine ecological systems.

Germplasm management in the Region is carried out by Ministries of Agriculture. Universities and/or other Government bodies or organizations. Germplasm conservation in the Region occurs in parks, botanical gardens, protected areas, experimental gardens or seed banks. Some ministries and universities obtain collections of local and introduced crops. Collections are known of sugarcane, cocoa, coffee, bananas and citrus. Organizations in the Region involved in germplasm collection and conservation are: The University of the West Indies (UWI), CARDI, The Inter-American Institute for Cooperation on Agriculture (IICA), French and Chinese missions. In the course of time farmers maintained numeral crop kinds and varieties. They constitute an important group in the area of germplasm conservation.

In brief it may be stated that in the Region systemic germplasm management is lacking.

Aspects that are important for adequate germplasm management include:

- Availability of funds;
- Awareness about the importance of germplasm management;
- Knowledge regarding germplasm management;
- Adequate facilities;
- A well coordinated national and regional system.

All the listed aspects for adequate germplasm management are limited in the Region, including Suriname.

Over the past 30 years several international organizations pointed out that genetic material gets lost and that it is necessary that attention is given to conservation of genetic diversity. The Inter-American Institute for Cooperation on Agriculture (IICA) is one of the institutes that stressed that in the America's progressively genetic material gets lost. It is estimated that within the next 20 – 25 years about 25% of plant species may be lost in case no adequate measures are taken before long.

CHAPTER 6

THE STATE OF USE

The plant genetic resources of Suriname are used for various purposes.

6.1 Use of genetic material in the horticultural and agricultural sector

Horticultural activities are mainly carried out by small farmers. Sources for vegetable seed are farmers and imports. For the commercial cultivation of several vegetable crops farmer-saved seed plays a very important role (e.g. eggplant, African eggplant, yard long beans, and common beans). For several crops farmers also use imported seeds (e.g. cabbage, Chinese cabbage, lettuce, cucumber, gherkin, sweet pepper, tomato, celery).

Fruit tree crops species are multiplied vegetatively (e.g. bananas, pine apple) or are reproduced from seed (e.g. rambutan).

In rice improvement programmes local and introduced germplasm are used.

Numerous agricultural and horticultural products are utilized in the Agro-processing sector. This is a sector with great potential and importance in the development of agriculture and agro industry in Suriname. This sector is mainly comprised of small and medium-sized enterprises that produce goods for the local and export market.

Plant genetic resources are also a source of animal feed and forage.

Every year students from the Technical College and from the Faculty of Technology of the ADEK University of Suriname visit the germplasm collections at the Experimental Gardens La Poule and Dirkshoop for educational purposes.

6.2 Use of genetic material for medicinal purposes

About 600 indigenous plants are used for medicinal purposes. A famous medicinal plant used over a great part of the world concerns *Quassia amara* ("Kwasibita").

Other medicinal plants include:

- *Bixa orellana* ("koeswe"); is used against inflammation of mouth and throat.
- *Cecropia surinamensis* ("Oema boesi papaja"); is used for treatment of kidney disorders, nervous diseases and heart conditions.
- *Ruellia tuberosa* ("Watra kanoe"); is used for kidney ailments and for diabetics.
- *Hura crepitans* ("Possentrie"); is used against skin problems.
- *Phyllantus amarus* ("fini bita"); is used against venereal diseases, colds, influenza, and as a diuretic.
- *Lippia geninata* ("Blakka tiki minti"); is used against stomach problems.
- *Piper marginatum* ("Anesi wiwiri"); is used against stomach disorders and nervous conditions.

6.3 Use of crop species as ornamentals

Many plants that are present in the forest of Suriname can be used as ornamentals and could become of economic importance for local growers of ornamentals. These plants include: Orchid species, fern species, and varieties of the *Bromeliaceae*, *Araceae* and *Musaceae* family.

6.4 Conservation as integral part of sustainable development in Suriname

- Nature tourism
- "Non-timber forest products"
- Community artisanry
- Bioprospecting

The establishment of the Central Suriname Nature Reserve is expected to be a cornerstone of Suriname's commitment to conservation-based development and gives the country a new leadership role in global biodiversity conservation. Conservation International and the Government of Suriname are seeking new partnerships with the corporate sector to generate environmentally friendly alternatives for development and to create a specific policy to promote investments in this. The encouragement of new investments in the private sector is one of our biggest challenges in the years to come. The following is a non-exhaustive list of possibilities that exist for sustainable development in and around the Central Suriname Nature Reserve.

Nature tourism

Suriname has tremendous nature tourism potential, and, in fact, was one of the first countries to carry out successful rain forest tourism in the 1970s. The new Reserve should help the country re-establish this sector and tap into the rapidly growing international nature tourism market, which is currently estimated at $ 200 billion. Several countries in the Caribbean have already been successful in developing nature-based tourism, notably Costa Rica and Belize. Suriname has major nature tourism attractions, including large tracts of rain forest wilderness, outstanding coastal ecosystems, and cultural attractions.

Non-timber forest products

The potential of non-timber forest products has only recently been tapped in Suriname. These include latexes, resins, tannins, fibers, and oils of various kinds for personal care products.

Community artisanary

Small-scale timber utilization for local use and for high quality value-added products such as furniture or indigenous art has considerable appeal in Suriname. The woodcarving skills of the Bush Negroes (Maroons, have enabled them to produce some of the finest wood products in the Americas. At this time, there is very little marketing of these products from Suriname, but there is definite potential for both high- and low-value tourist souvenirs, as well as for export. The Amerindian communities of Suriname's coast and the far interior are also skilled artisans who work mainly with cloth, beads, seeds and other forest products, and their handicrafts could readily be marketed to tourists as well. As with non-timber forest products, community artisanry is unlikely to generate major foreign exchange, but could be quite significant to local communities.

Bioprospecting

Bioprospecting is the exploration of biodiversity for commercially valuable genetic and biochemical resources. Conservation International has been working on a bioprospecting program with the Saamaka and Tareno peoples of Suriname for over ten years. Bioprospecting offers opportunities for working with large companies, in this case the pharmaceutical company Bristol Myers-Squibb, while at the same time providing employment, an increase in local technological capacity and funding for community development. Another benefit of bioprospecting is a more profound knowledge of phyto-medicine, local cures used in perhaps just one or two villages that have potential relevance to the entire country. Such cures are likely to be important for tropical diseases such as malaria and *Leishmaniasis* that are of direct concern to tropical countries like Suriname, but of less interest to major international pharmaceutical companies with their largely northern markets. Bioprospecting projects could help Suriname tap into the growing international market for herbals.

6.5 Trade in wild flora and fauna

A low level of trade in wild flora and fauna existed in Suriname for many years. This has never been considered a serious threat to the flora and fauna of the country. An export quota system for all wild life species was established in 1987, which requires wild life dealers to have a license. All exports of wild flora and fauna have to be accompanied by an export permit. In addition, as a member of the Convention on International Trade in Endangered Species (CITES), Suriname required for all species of wild fauna and flora exports a CITES permit.

CHAPTER 7

TTHE STATE OF NATIONAL PROGRAMMES, TRAINING AND LEGISLATIONN

7.1 National Programmes

For agronomic and horticultural crops at the moment there are no structured national programmes in Suriname with focus on well-organized plant genetic resources activities. For these crops elements related to plant genetic resources exist, but linkages between these elements is lacking. With regards to forestry species, however, the Government of Suriname has a long-standing commitment to nature preservation and biodiversity conservation.

National Biodiversity Steering Committee

In 2005 a National Biodiversity Steering Committee (NBSC) was installed by the Minister of Environment, Technological Development and Labour. In October 2008 this Committee was re-installed for a period of one year.

The considerations for installing the Inter-Departmental National Biodiversity Steering Committee were: In the framework of effectively and efficiently coordinating the execution of the National Biodiversity Strategy, that indicates the outline for the national implementation of the UN Treaty, for preparing the National Biodiversity Action Plan and for drafting national reports on the implementation of the UN Treaty a National Biodiversity Steering Committee was essential.

In this committee the following ministries/institutes/organisations are represented:

- The Ministry of Environment, Technological Development and Labour (2 members)
- The Ministry of Planning and Development Cooperation (1 member)
- The Ministry of Agriculture, Animal Husbandry and Fisheries (1 member)
- The Ministry of Town and Country Planning, Land and Forest Management (1 member)
- The Anton de Kom (Adek) University of Suriname (1 member)
- The National Institute for Environment and Development in Suriname (NIMOS) (1 member)
- The Association of Amer Indian Village Captains (1 member)
- The Association for Community Development and Autonomy (1 member).

There are two observers:

- One representative from Suriname Conservation Foundation (SCF) and
- One representative from The United Nations Development Programme (UNDP).

The duties of this committee are:

- Monitoring and evaluating activities in the framework of implementing the National Biodiversity Strategy;
- Monitoring and evaluating activities in the framework of preparing The National Biodiversity Action Plan;
- Monitor and evaluate activities in the framework of preparing The National Report;
- Assist in incorporating The National Biodiversity Strategy and The Action Plan in national development programmes and plans;
- Exchange information and experience between relevant institutes regarding project proposals on research regarding biodiversity, data collection on fauna species, flora species, ecosystems and other. Also collecting and documenting all research/survey reports regarding projects concerned, including the (financial) support.

The NBSC has developed a strategic plan for Biodiversity and an action plan.

Conservation Projects

The organization, Conservation International Suriname (CI), which has been active in Suriname since 1991, coordinates several conservation projects. Conservation International Suriname uses an integrated approach that draws on both knowledge and expertise of trained Surinamese conservationists as well as on CI's on-the-ground experience in more than thirty countries. CI-Suriname's initiatives include:

- **Geographic Information Systems (GIS) projects** that document and map natural resource use by both the Saamake communities north of the Brokopondo lake and the Tareno community (known in scientific literature under the name of Trio) of Kwamalasamutu in southwestern Suriname.
- **Protected areas management projects** that contribute towards the rehabilitation of the former Raleighvallen Nature Reserve and Brownsberg Nature Park.
- **Ethnobotanical projects** that include the International Cooperative Biodiversity Group's (ICBG) Bioprospecting Program, an initiative with the Saamaka and Tareno peoples that identifies and screens tropical plants for potential medicinal uses on an international scale. Other partners in this project include Virginia Polytechnic Institute and State University, Missouri Botanical Garden, Bristol Myers-Squibb and BGVS ("Bureau Geneesmiddelen Voorziening Suriname" - Suriname's national pharmaceutical company). CI's ethnobotanical work also includes the Shaman's Apprentice Program, a scientific education program that works to preserve indigenous knowledge of plants for the benefit of local people.
- **Economic development projects** that seek to promote economic alternatives. An important component of this work is the promotion of nature tourism development. CI has given technical assistance to community-owned nature tourism projects, provided input in national nature tourism strategies and legislation, and initiated in-country nature tourism campaigns. CI is also promoting the development of non-timber forest products as an economic development alternative for Suriname. CI's tourism development activities in Suriname include the design of a tourism development plan for three key areas, the CSNR, The Upper Suriname River, and the cultural tourism of Paramaribo.
- **Environmental Policy development projects**, as well as **active involvement in the development of the National Biodiversity Strategy**, the National Strategy for Rural Sustainable Development, the National Strategy for Environmental Education and Awareness, the Amazon Cooperation Treaty (ACT), the development of the petroglyph site Werehpai, GEF small-grants program, the Sipaliwini Nature reserve, identification of and assistance for community-based projects.

7.2 Training

A few professionals from the Research Department of the MAAHF and from the Faculty of Technology of the ADEK University of Suriname attended short basic training courses abroad in the area of plant genetic resources management. Nationally there are no experts in the area of plant genetic resources management. Training to qualify scientists and researchers in the area of plant genetic resources management is essential.

A few professionals and technicians attended short training courses in different aspects of seed technology (nationally, regionally and internationally). There is one professional with a graduate degree in Seed Technology.

7.3 Legislation

Legislation on import and export of animals (wildlife, pets, farm animals, and poultry), plants and micro-organisms can be found in the legislation listed below (Hoefnagel, 2001):

- Game Act of 1954, amended in 1980, 1982, 1986 and 1994
- Law on Forest Management of 1992
- Game Resolution of 1970, amended in 1973
- Annual Ministerial Game Decrees
- Law on Regulation for Import and Export of 1954
- Nature Protection Act of 1954
- Fish Stock Protection Act of 1961, amended in 1963
- The Fish Stock Protection Resolution of 1961
- Sea Fisheries Decree of 1980

- Aquaculture Act
- State Resolution Negative List of 1999, amended in 2000
- Regulation on the Prevention and Control of Animal Diseases, 1954
- Plant Protection Act of l965 no. 102
- Seed Act of 2005
- Draft Plant Breeder's Right Act

Existing legislation on Plant Quarantine and Plant Propagation

Plant Protection Act of 1965
(Plantbeschermingsverordening, G.B. 1965 no. 102 as amended by S.B. 1980 no 116)

Suriname is party to the International Plant Protection Convention (IPPC), which aims at maintaining and increasing international cooperation in controlling pests and diseases of plants and plant products, and the prevention of their introduction and spread across national boundaries. The current Plant Protection Act is based on the 1951 text of the IPPC. The act is outdated and does not reflect either modern phytosanitary concepts or international norms agreed-upon. For example the act does not contain provisions related to biosafety. The Plant Protection and Quality Control Division (Plant Quarantine Division) of the Ministry of Agriculture is the responsible authority.

For the import of plants, plant parts, and seed approval is needed from the Plant Quarantine Division of the MAAHF. (State Resolution Negative List, 2000). Article 11(1) of the Seed Act (2005) indicates that a permit is needed for the import of seed (including vegetatively propagated planting material) into Suriname. Before ordering plants, plant parts, and seed, the importer needs approval to import this material from the Ministry of Agriculture, Animal Husbandry and Fisheries (MAAHF). The Ministry of Trade and Industry issues permit to import. The Plant Quarantine Division is the responsible authority for granting the approval. At present seed and vegetative propagation material is imported and when needed tested on the presence of pests (weed seed, fungi, bacteria, nematodes). The Plant Quarantine Division does not execute the screening but several Plant Protection Divisions of the Research Department of the MAAHF. Quarantine plays an important factor to be able to move genetic material through the borders. Plant genetic resources accessions should meet the requirements stated in the Plant Protection Act of l965 no. 102.

Draft Plant Protection Act (Ontwerp Plantenbeschermingswet)

Currently there is a draft plant protection act at the Ministry of Agriculture, Animal Husbandry and Fisheries. This model was prepared based on the model that was prepared by the FAO especially for CARICOM countries and is in line with IPPC 1997 text. The objective of this act is to prevent the introduction and spread of pests of plants and to protect the vegetable resources by facilitating the trade in plants and plant products and the regulation of relevant issues. With regard to LMOs, it can be stated that this draft provides the opportunity to prohibit or restrict the entry of certain plants, plant products and other regulated goods into the country. Both exotic plants and LMOs can be prohibited when they can be harmful to the local flora. The newly drafted Plant Protection act was reviewed by and discussed with the relevant stakeholders. It is expected that this draft will soon be submitted to the Legal Department of the Ministry of Justice and Police for screening.

The Seed Act of 2005

The Seed Act was formalized in 2005. The Seed Act encompasses regulations for the production, quality and sale of seed. The objective is to sustain increase the production of seed and guarantee improvement of quality. ISTA (International Seed Testing Association) norms will be applied. Also seed quality control and certification will be done according to the ISTA rules. The Seed Act is a framework. All implementation regulations with regard to technical aspects will be by means of Government Decrees.

Draft Plant Breeder's Right Act

A Draft Plant Breeders' Right Act has been developed which aims at the protection of improved plant varieties and the increase of the productivity in both agriculture and horticulture and the protection of the grower. Breeder's right is also regulated as an Intellectual property right in this draft. The Draft Plant Breeder's Right Act has recently been screened by the Legal Department of the Ministry of Justice and Police and was returned to the MAAHF for adjustment.

Legislation on the Introduction of Species

Plant Protection Act of 1965
(Plantbeschermingsverordening, G.B. 1965 no. 102 as amended by S.B. 1980 no 116)
(Refer to information listed under the heading "Existing legislation on Plant Quarantine and Plant Propagation")

1954 Act to Control Animal Diseases
(Landsverordening bestrijding dierziekten, G.B. 1954 amended by S.B. 1986 no. 70)
The objective of this Act is to prevent and combat animal diseases, and to control animals and animal products on harmful substances.

The 1954 Act to Control Animal Diseases is relevant to animal quarantine when other animals are in danger. The Minister of Agriculture, Animal Husbandry and Fisheries, in particular the Director of the Department of Animal Husbandry, is the responsible authority under the Act. Enforcement is entrusted to the Head of the Animal Husbandry Service and the inspectors reporting under him. According to reports, however, in practice the Head of the Veterinary department and the veterinary inspectors are carrying out these tasks. The act is applicable to all living animals, including poultry, birds, reptiles and insects. The Act contains several provisions aimed at preventing and controlling animal diseases, some of which may be dangerous to human health. The animal diseases are listed in a Government Decree. Paragraph 3 of the Act specifically deals with the import of animals. It is prohibited to import animals without a permit. The permit contains specific requirements. It is stated in the permit that in case of an outbreak of a contagious animal disease in the country of origin/sending, while a permit is pending, the permit will be withdrawn. This regards agricultural animals like cows, sheep and domestic animals like dogs and cats.

When it regards the import of Wildlife (including CITES species), the Nature Conservation division, section permits and licenses, permits a license.

As was mentioned before The Veterinary Inspection Division (VID) of the MAAHF is in charge of the implementation and enforcement of the regulation on the Prevention and Control of Animal Diseases as well as import and export control of animals. For import of animals (for use as farm animals and other uses), the importer has to submit relevant information to the MAAHF, such as the purpose for import (e.g. research, production), expectations etc. On the basis of the information a permit is granted, after an official health certificate from the country of origin (issued by an authorized institute) is submitted. In case of animals on the CITES list, a permit from the MNR is required. On the import certificate it is mentioned that the importer is obligated to inform the VID 48 hours ahead about the date of arrival. A quarantine period of 30 days is set, at the place of confinement. (a farm, a home). If imported animals show signs of a harmful pest, they are killed, even if the health certificate states otherwise. Inspectors of VID or veterinarians will come at regular times to monitor the animals. If necessary the period of quarantine can be extended (is also stated in the license). The VID works in close collaboration with the Customs Office.

There are initiatives to draft a new Animal Health Act based on the CARICOM Model Animal Health Act of 2001.

Legislation on Conservation and Protection of Species

The Nature Protection Act of 1954
The Nature Protection Act of 1954 is the legislative cornerstone for conservation in Suriname. The act recognizes that establishing protected areas is important to scientific knowledge, recreation and education, as well as for ethical and economic reasons. To qualify as a nature reserve, an area must be noteworthy because of its biodiversity or varied landscape, or as a result of fauna, flora or geological features of scientific or cultural value.

The Forest Management Act of 1992
In this law is included some legislation relating to nature conservation and the trade of wood products. Presently new legislation is under preparation.

Although there is no specific wildlife trade legislation enacted in Suriname, Article 15 paragraph 2 of the Game Act and Article 49 paragraph 4 of the Law on Forest Management are used to apply the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) in Suriname for animals and plants respectively. The Head of the Nature Conservation Division (NCD) of the Suriname Forest Service, which is part of the MNR, acts as the CITES Management Authority on behalf of the head of the Forest Service. The Scientific Authority in Suriname is the Nature Conservation Commission. However this commission has not been active for several years. Some funds were set aside to reactivate the commission but no substantive progress was made so far. Some "CITES appendix II-species" are not protected by

the Game Law. However all specimens of wild game and flora require a permit for export or import, based on the State Resolution Negative List.

The Fish Protection Act and The Sea Fisheries Decree

The Fish Protection Act and The Sea Fisheries Decree cover fish, although the marine turtles are covered by the Game Resolution as Game Species. The Fish Protection Act and Fish Protection Resolution provide for very limited protection of fresh water fish. Eight fish species are protected by setting limits on the size to be captured and non-fishing seasons are determined for certain species. The Sea Fisheries Decree provides for the enactment of the regulations on the fishing of certain species, the establishment of minimum harvest sizes, open and closed seasons, maximum allowable catches the use of certain methods or fishing gear (art 25). In 2001, a provision was included to prohibit fishing from April to July north of the Galibi beach to protect the sea turtles. The current law is not applicable in the territorial sea; so marine turtles are currently not protected while at sea.

The Draft Aquaculture Act

The Draft Aquaculture Act states that a license from the Fisheries Department of the MAAHF is needed to fish aquarium fish. It also specifies certain quarantine periods but does not mention permits for import and export. These are required on the basis of the State negative list (Hoefnagel, 2001).

Legislation on Intellectual Property Rights

National legislation with regard to Intellectual Property Rights is outdated and not adjusted to recent developments. This implies that the law in Suriname cannot satisfactorily protect Intellectual Property Rights. If it is the Governments intention to actively take part in international trade, it is highly recommended that the intellectual property rights law and – institutions are adapted.

A few existing laws that are applicable to Intellectual Property Rights are listed below:

Patent Act, 1910 (Octrooiwet 1910, G.B. 1969 no. 43)

The Suriname patent right is based on a Patent Act of 1910. The patent right is an exclusive right granted to the inventor of a novel product, method or an improvement of an industrial product. A patent, once granted gives the patent holder the exclusive right:

The application for obtaining a patent should be forwarded to the Office for Industrial Property.

In case of a biotechnology product the Patent Act could be an opportunity for registration. For genetically engineered products the system existing in Suriname has no possibilities for registration. The possibilities to protect traditional knowledge from indigenous communities could possibly be included in the Patent Act. With this, indigenous knowledge can be handled as a trade secret, only when commercialized properly. The outdated Surinamese laws can protect traditional knowledge to a certain extent, but provide no full protection for the intellectual contribution.

The Civil Code (Burgelijk Wetboek, G.B. 1968 no. 14 as last amended by S.B. 1995 no. 101)

This regards the provisions on product liability and misleading advertisement. It is stated in Article 1401j that misleading can concern the nature, composition, the amount, the quality, characteristics and options for use of products or services. This can be applicable if it regards information dissemination or misleading advertisement with regards to LMOs

Draft legislation on International Property Rights

Draft Act on Intellectual property rights

The Intellectual Property Office has been working on a Draft Intellectual Property Rights Act. This draft provides provisions regarding trade names, patent, geographical origin. According to the information on this draft, the issue of LMOs is not taken into consideration while drafting the bill.

Draft Plant Breeder's Right Act

A Draft Plant Breeder's Right Act has been developed which aims at the protection of improved plant varieties and the increase of the productivity in both agriculture and horticulture and the protection of the grower. Breeder's right is also regulated as an Intellectual property right in this draft. The Draft Plant Breeder's Right Act has recently been screened by the Legal Department of the Ministry of Justice and Police and was returned to the MAAHF for adjustment.

Intellectual Property Rights

For several years there have been discussions, internationally on the legal protection of germplasm. An answer to the question whether or not patent should be requested for germplasm was not yet agreed upon. In fact, for material that could be of commercial value, the rights and obligations of collectors should have been decided. For developing countries, like Suriname, protection of plant genetic resources would be useful. This could ensure that when germplasm is exploited the benefits will be shared between private investors and national governments. In brief it may be stated that "Intellectual Property Protection" will lead to regulations on access to germplasm and on collecting, improvement, exchange and use of germplasm.

Suriname is party to several international treaties/conventions, both global and regional, which focus to varying extents on management of wildlife, animals and plants that recognize the vital need for environmental protection. These treaties include:

- the Convention on Wetlands of International Importance (1971);
- the Convention for the Protection of the World Cultural and Natural Heritage (1972);
- the Convention on International Trade in Endangered Species (CITES) (1973);
- the Treaty for Amazonian Cooperation (1978);
- the Convention on Biological Diversity (1992);
- The UN Convention on the Law of the Sea;
- the International Plant Protection Convention; and
- the Conservation projects and Framework Convention on Climate Change (1992).

CHAPTER 8

THE STATE OF REGIONAL AND INTERNATIONAL COLLABORATION

With regard to plant genetic resources Suriname collaborates/used to collaborate with several international organizations:

- The Food and Agricultural Organisation of the United Nation (the FAO)
- The Inter American Institute for Collaboration on Agriculture (the IICA). Via IICA Suriname could have access to the following fruit germplasm gene banks:
  - USDA/TARS Puerto Rico Germplasm Inventory
  - Fairchild Tropical Garden, Miami Florida
  - Phyto Genetic Resources, CATIE, Turrialba, Costa Rica
  - Fruit Germplasm Collection, TREC, University of Florida, U.S.A.
  - Tropical Fruit Germplasm, CIRAD/FLHOR, Guadeloupe
  - Mango Germplasm, CIRAD/FLHOR, Guadeloupe
  - Citrus Germplasm, CIRAD/FLHOR, Martinique
  - Pineapple Germplasm, CIRAD/FLHOR, Martinique
  - Mango Germplasm/CEVACU/Aguaruto, INIFAP, Mexico
- CIMMYT (The International Maize and Wheat Improvement Centre) Until about 10 years ago there was a programme with CIMMYT for evaluating new maize varieties under Suriname's agro-ecological conditions.
- IRRI (International Rice Research Institute) and CIAT (Centro International de Agricultura Tropical). From IRRI, in the Phillippines, and CIAT, in Columbia, rice germplasm is received. This germplasm is being utilised by ADRON/SNRI for plant breeding activities.
- AVRDC (Asian Vegetable Research and Development Centre). In the past The Vegetables Division of the Experiment Station of the MAAHF received vegetable Seed from the AVRDC, located in Taiwan, for evaluation under Surinamese conditions.
- ICRISAT (International Crop Research Institute for the Semi-Arid Tropics) - India. In the past Sorghum and peanut seed was obtained from ICRISAT for evaluation.
- EMBRAPA ("Empresa Brasileira de pesquisa Agropecuaria" - The Brazilian Agricultural Research Corporation). From Brazil over the past years CELOS obtained cassava and soybean germplasm for evaluation. The Research Department of the MAAHF over the past three years carried out a project in collaboration with EMBRAPA "Training Program for Technicians and Farmers in Techniques of Cashew Industry in Suriname". It is agreed that one of the activities of this project will be the introduction of cashew, *Anacardium* occidentale, varieties from EMBRAPA in Suriname for evaluation and possible use.

In October 1998 a mission from the MAAHF visited EMBRAPA (The Brazilian Agricultural Research Corporation) and PROCITROPICOS ("Programa Cooperativo de Investigación y Transferencia de Tecnología para los Trópicos Suramericanos"), Brasilia, Brasil, to explore the potential for exchange of Plant Genetic Material. Unfortunately a structured exchange programme was not materialized as a follow-up of this mission. A few years ago our country signed a technical cooperation agreement with Brazil. As a result of this agreement the project "Training Program for Technicians and Farmers in Techniques of Cashew Industry in Suriname" was executed. As was mentioned above it is expected that as a result of the mentioned project cashew, *Anacardium* occidentale, germplasm from EMBRAPA will be introduced in Suriname for evaluation and possible use.

The Centre for Agricultural Research in Suriname (*Celos*) participates in PROCITROPICS ("Programa Cooperativo de Investigación y Transferencia de Tecnología para los Trópicos Suramericanos") - the Cooperative Program on Research and Technology Transfer for the South American Tropics.

In 1978 The Amazon Cooperation Treaty was signed by Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela with the goal to promote combined actions aiming at the harmonious development of the Amazon.

The Suriname State Forest Service has some form of collaboration with United Nations organizations, such as FAO, UNDP and UNEP. Because of lack of funds to pay the annual contribution the State Forest Service cannot benefit from collaboration with the Internationa Timber Organization (ITTO) in Malaysia, Tropenbos in the Netherlands, ICRAF in Kenya and CIFOR in Indonesia. Suriname, i.e. the State Forest Service, could benefit tremendously if she could manage to pay the annual contributions and become of a member of the above-mentioned organizations.

Rice germplasm exchange and international collaboration

Rice germplasm from Suriname was send to several institutes on a non-commercial basis. Material was sent to Columbia, Venezuela, Guyana, Trinidad and Tobago, The United States of America, The Philippines, Thailand, Indonesia, Japan and the Ivory Coast.

There is intensive collaboration with CIAT in Columbia and IRRI in The Philippines. ADRON is part of the "International Network for the Genetic Evaluation of Rice" (INGER). The plant breeder at ADRON is the national coordinator for Suriname. Through this network annually many lines and varieties are obtained for evaluation and for breeding purposes.

CHAPTER 9

ACCESS TO PLANT GENETIC RESOURCES AND SHARING OF BENEFITS ARISING OUT OF THEIR USE, AND FARMERS' RIGHTS

Suriname has not yet passed specific legislation regulating Farmers' Rights with respect to sharing of benefits deriving from PGR.

Suriname is a signatory (1992) to the Convention on Biological Diversity (CBD), and consequently benefits from the international agreement with respect to access of genetic resources and sharing of benefits arising out of their use.

The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) is related to access and benefit-sharing regarding plant genetic material for food and agriculture. The Treaty has as objectives conservation and sustainable use of plant genetic resources for food and agriculture, as well as fair and equitable sharing of benefits derived from their utilization. These objectives are expected to help augment crops genetic base and increase the number of species utilized to ensure food security. Suriname still needs to sign the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR). There is a direct link between the CBD and the ITPGRFA. The Ministry of Agriculture, Animal Husbandry and Fisheries and the Ministry of Environment, Technological Development and Labour are mutually responsible for undertaking actions to sign the agreement on the ITPGRFA.

There are restrictions to entry of Plant Genetic Resources. The Plant Quarantine Division of the Ministry of Agriculture, Animal Husbandry and Fisheries is the regulatory body that ensures the safety of planting materials coming into Suriname. Prior to the import of plants, plant parts, and seed approval is needed from the Plant Quarantine Division of the MAAHF.

Some farmers meet their planting needs by utilizing planting materials from their own farms. An example is the use of Banana suckers from previously established plantings to plant elsewhere on the same or other farms.

Maintaining or improving access to Plant Genetic Resources is important for contribution to food security and poverty alleviation, and for conservation of biodiversity and environmental stability.

CHAPTER 10

THE CONTRIBUTION OF PGRFA MANAGEMENT TO FOOD SECURITY AND SUSTAINABLE DEVELOPMENT

Research on genetic resources and plant breeding should be one of the most significant activities of the country, as it is expected to bring about results that will have considerable contribution to the further development of Suriname's agriculture. The MAAHF and Celos have initiated a number of initiatives that should lead towards sustainable conservation of Plant Genetic Resources.

An intensive selection programme for food production should be targeted to the promotion of food security and health.

Growing interest in agriculture's diversification and added value – in the forms of new food, fibres, flavours and feedstock for various (industrial) areas – will, without doubt, lead to improving the area of biodiversity, in the search for species, systems and processes in a diversification programme.

In order to ensure adequate supply of planting material, to intensify plant propagation operations, and to promote private initiative the MAAHF initiated in 1993 training courses in the field of plant propagation, in the first instance for the reproduction of fruit crops. Over the past years also courses for the production of true seed were conducted. The MAAHF still also has a programme to distribute planting materials to farmers in different regions to ensure sustainable production of agricultural produce.

It is important that strategies and procedures are implemented in the future with the goal to access, organize and make knowledge and information available that can benefit traditional and indigenous communities, especially with on-farm management as an agro-biodiversity promoting strategy.

CHAPTER 11

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

- There is no clear policy with regard to genetic resources.
  In the "Country Position Paper and Agricultural Policy of Suriname" from May 1998 it is mentioned that a national and regional inventory of plant genetic resources is recommended. In this document it is also mentioned that the international community could assist us with training in the area of germplasm and management of PGR. Also is mentioned that useful results of the inventories and germplasm research should be communicated to farmers in order to increase sustainable use of biodiversity.
- For many crops there is lack of quality seed. Seed production practices for several crops are inadequate. Improved Seed Production leading to the availability of germplasm with specific, desired characteristics is necessary. Germplasm is important in crop propagation. Seed is one form of germplasm. The availability of good quality seed is a requirement for successful crop production. For Suriname this is an important aspect, since within the National Development Programme the agricultural sector is expected to play a crucial role in improving the national economy. For crop production farmers will need germplasm with specific features.
- Except for rice, introduced new crop varieties are not tested properly by research institutes;
- Storage facilities are inadequate;
- Proper conservation programmes are lacking;
- Activities on the management of genetic resources are not coordinated;
- There is lack of awareness on the importance of germplasm;
- Regulations regarding management of genetic resources are found scattered in several laws and other pieces of legislation;
- Collections are scarce and their conservation is constrained by lack of financial means and human capacity.

Recommendations

- Serious actions need to be undertaken for conservation and use of germplasm.
  A national system is needed for coordinating activities and information on germplasm to prevent unnecessary duplication of efforts and for ensuring proper use of funds. (A national committee could be installed to deal with (conservation of) (plant) genetic resources) or the tasks of the existing National Biodiversity Committee could be increased.
- Several conservation sites for germplasm should be established nationally. This to reduce the risk of loss of germplasm in case, for some reason, one gene bank gets lost.
- Institutional strengthening of the Plant Quarantine Division of the MAAHF.
  Currently, when germplasm is imported, this material is often not kept in quarantine for a certain period of time, during which period the imported material could be screened for pests and diseases. This occurs because of lack of an adequate infrastructure, adequate transportation, and manpower at the Plant Quarantine Division.
- Exchange of information related to plant genetic resources between national and regional institutes needs to be improved.
- In order to prevent loss of PGR (in order to prevent genetic erosion) it is necessary to create awareness on the importance, the use and the threats for PGR.
- Training to qualify scientists and researchers in the area of plant genetic resources management is mandatory.
- An inventory should be made of the plant genetic resources occurring in the interior
- Measurements should be taken to protect endangered plant species (by establishing additional nature reserves or nurseries (*ex situ* conservation).
- To safeguard plant genetic resources for future utilization a work plan should be developed. The activities of the work plan should aim at:
  - Recovery of land races;
  - Characterization and purification of species that are already present in Suriname;

- Selection of elite lines for breeding purposes;
- Exchange of Germplasm with Regional and International Institutes;
- Capacity building in the area of Germplasm management;

• Suriname should invest in plant genetic resources and should approach international organizations that have adequate capacity and knowledge in this area, in order to be able to exploit her plant genetic resources optimally in the future.

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APPENDIX 1

AREA AND PRODUCTION OF PADDY

Area and production of paddy (14% moisture)

DESCRIPTION	UNIT	2004	2005	2006	2007
PADDY AREA:					
Cultivated area	HA	50 790	50 790	50 790	50 790
Grown: Spring harvest	„	21 583	23 022	21 769	21 521
Fall harvest	„	27 437	22 541	22 463	20 566
AREA PLANTED	"	**49 020**	**45 563**	**44 232**	**42 087**
Small Farmers	„	23 950	23 027	23 589	23 135
Large-scale farmers	„	25 070	22 536	20 643	18 952
Nickerie District	„	45 695	42 984	41 766	40 311
Other Districts	„	3 325	2 579	2 466	1 776
PADDY PRODUCTION:					
Spring harvest	ton	67 710	79 149	89 579	90 322
Fall harvest	"	106 780	84 806	93 080	88 690
TOTAL PRODUCTION	**"**	**174 490**	**163 955**	**182 659**	**179 012**
Small Farmers	„	89 515	89 970	101 960	101 627
Large-scale farmers	„	84 975	73 985	80 699	77 391
Nickerie District	„	163 466	155 300	174 212	173 485
Other Districts	„	11 024	8 655	8 447	5 527
AVERAGE YIELD/HA					
Spring harvest	Kg.	3 128	3 438	4 115	4 197
Fall harvest	„	3 884	3 762	4 144	4 312
Country	„	3 551	3 598	4 130	4 253
Small Farmers	„	3 738	3 907	4 322	4 393
Large-scale farmers	„	3 373	3 283	3 909	4 084
Nickerie District	„	3 577	3 613	4 171	4 304
Other Districts	„	3 194	3 356	3 425	3 112

(Source: MAAHF – Statistics Division)

APPENDIX 2

RICE EXPORT DATA OVER THE PERIOD 2004–2007

Rice export 2004 – 2007

DESCRIPTION	UNIT	2004	2005	2006	2007
AMOUNT:	Ton				
White rice	„	34 348	13 974	30 138	31 732
Broken rice	„	49	911	385	4 200
Cargo	„	17 883	20 992	10 941	16 567
TOTAL	„	**52 280**	**35 877**	**41 464**	**52 499**
VALUE:	SRD1000				
White rice	„	23 895	10 461	23 945	28 912
Broken rice	„	70	905	536	2 123
Cargo	„	9 295	13 376	7 536	11 818
TOTAL	„	**33 260**	**24 742**	**32 017**	**42 853**
AVERAGE EXPORT VALUE/TON	SRD				
White rice	„	696	749	795	911
Broken	„	1 429	993	1 392	505
Cargo	„	520	637	689	713
COUNTRY OF DESTINATION REGION AND COUNTRY:					
Caribbean Region	Ton				
Aruba	„	837	94	1 072	2 241
Dominican Republic	„	2 000	225	50	-
Guadeloupe	„	92	253	276	923
Haiti	„	5 300	500	10 152	12 128
Jamaica	„	7 279	3 188	5 450	7 412
Martinique	„	1 388	1 056	748	792
Netherlands Antilles	„	735	3 506	25	1 549
Trinidad	„	24	52	313	138
Other	„	25	1 625	200	-
TOTAL	„	**17 680**	**1 499**	**18 286**	**25 183**
South America					
Brazil	„	8 371	105	25	245
Fr. Guyana	„	887	442	387	622
Guyana	„	5 698	1 503	11 740	8 006
Other	„	-	-	-	-
TOTAL	„	**14 956**	**2 050**	**12 152**	**8 873**
North and Mid America					
Belize	„	-	-	50	-
VS	„	-	-	-	-
Other	„	-	2 230	-	20
TOTAL	„	**-**	**2 230**	**50**	**20**
Europe					

DESCRIPTION	UNIT	2004	2005	2006	2007
Belgium	„	140	303	50	-
Germany	„	1 850	-	-	626
France	„	552	1 260	1 986	1 402
The Netherlands	„	16 343	10 317	7 406	13 570
Portugal	„	92	8 092	1 457	69
Switzerland	„	-	253	-	-
Other	„	-	125	75	653
TOTAL	**„**	**18 977**	**20 350**	**10 974**	**16 320**
Other Regions	„	667	749	0	2 102
GRAND TOTAL	**„**	**52 280**	**35 878**	**41 462**	**52 498**

Source : Customs Office (ASYCUDA System)

APPENDIX 3

AREA PLANTED AND YIELD OF VEGETABLES

Area planted and yield of vegetables

DESCRIPTION	UNIT	2004	2005	2006	2007
Tomato	Ha	58	48	54	62
	Ton	674	574	670	779
Cabbage	Ha	39	30	34	34
	Ton	891	718	821	823
Common beans	Ha	36	32	31	25
	Ton	517	458	460	367
Yard long beans	Ha	221	160	167	124
	ton	3 116	2 249	2 388	1 957
Tanya leaves	ha	45	47	66	35
	ton	1 070	837	1 205	877
Chinese Cabbage (Amsoi, Kaisoi and Paksoi)	ha	38	27	24	21
	ton	362	267	265	256
Eggplant	ha	83	76	81	45
	ton	2 193	2 043	2 215	1 245
Cucumber	ha	76	56	56	32
	ton	1 784	1 111	1 225	712
Pepper	ha	96	103	114	98
	ton	1 820	1 729	2 305	2 077
Pumpkin	ha	123	66	66	57
	ton	1 694	870	985	855
Bitter Gourd	ha	75	96	86	79
	ton	1 124	1 396	1 188	1 239
Okra	ha	49	40	66	59
	ton	334	326	929	756
African Eggplant	ha	67	60	70	49
	ton	1 260	1 101	1 363	936
Other vegetables	ha	105	106	126	95
	ton	1 697	1 444	1 781	1 488
TOTAL AREA PLANTED	**ha**	**1 111**	**947**	**1 041**	**815**
TOTAL PRODUCTION	**ton**	**18 536**	**15 123**	**17 800**	**14 367**

APPENDIX 4

AMOUNT AND VALUE OF VEGETABLES EXPORTED

EXPORT OF VEGETABLES (Root crops included):	UNIT	2004	2005	2006	2007
Amount	ton	2 732	2 873	2 390	2 783
Value	SRD (X 1000)	2 925	3 724	3 587	4 408

Source: Export data : Customs Office (ASYCUDA System)

APPENDIX 5

AMOUNT EXPORTED AND EXPORT VALUE OF AGRICULTURAL COMMODITIES

Amount exported and export value of agricultural commodities

DESCRIPTION	EENH.	2004	2005	2006	2007
AMOUNT:					
Rice	Ton	52 280	35 877	41 464	52 499
Bananas*	„	20 121	38 388	47 005	57 135
Fish and Fish products	„	9 563	11 926	13 935	15 307
Crustacean	„	6 378	5 412	5 620	5 211
Vegetables and root crops	„	2 732	2 873	2 390	2 783
Fruit (Bananas not included)	„	621	522	297	282
Flowers	„	339	204	256	206
Ber. of vegetables, fruits en plant parts	„	39	96	34	169
TOTAL AGRICULTURAL COMMODITIES	**ton**	**92 073**	**95 298**	**111 001**	**133 592**
VALUE:					
Rice	SRD1000	33 260	24 742	32 017	42 853
Bananas*	„	14 759	28 664	35 196	46 219
Fish and Fish products	„	21 375	25 812	30 820	30 535
Crustacean	„	78 479	69 603	61 648	64 502
Vegetables and root crops	„	2 925	3 724	3 587	4 408
Fruit (Bananas not included)	„	593	491	330	305
Flowers	„	671	457	391	859
Ber. of vegetables, fruits en plant parts	„	88	390	114	374
TOTAL EXPORT VALUE	**SRD1000**	**152 150**	**153 883**	**164 103**	**190 055**

Note: * = Banana export commenced again in March 2004
Total Value = Total Agricultural Export

Source: Customs Office (ASYCUDA)

APPENDIX 6

LIST OF PLANT SPECIES COLLECTIONS (WEEDS, MEDICINAL PLANTS) AT THE WEED SCIENCE DIVISION OF THE MAAHF (MULLER, 2004)

Survey on genetic resources

Hyptis brevipes
Hyptis pectinata
Imperata contracta
Indigofera sp.
Ipomoea setifera
Iribachia alata
Lantana camara
Leersia hexandra
Leptilon pusillum
Ludwigia affinis
Ludwigia erecta
Lugwigia leptocarpa
Melothria pendula
Mimosa pudica
Momordica charantia
Montrichardia arborescens
Oldenlandia corymbosa
Panicum dichotomiflorum
Panicum maximum
Paspalum conjugatum
Paspalum melanopermum
Paspalum virgatum
Passiflora foetida
Phyllanthus amarus
Phyllanthus niruri
Physalis angulata
Piper aduncum
Polygonum hydropiperoides
Pueraria phaseoloides
Rena bellata
Ruellia tuberosa
Scleria bracteata
Sida rhombifolia
Smilax cumanensis
Solanum stramoniifolium
Sorghum arundinaceum
Spigelia anthelmia
Sporobolus indicus
Sporobolus tenuissimus
Stachytarpheta cayennensis
Stenotaphrium secundatum
Stigmaphyllon puberum
Synedrella nodiflora
Tricholeana repens
Tridax procumbens
Vernonia cineria
Vetiveria zizanoides
Vigna luteola
Wedelia trilobata
Wulffia baccata

Onkruiden/Medicinale kruiden herbarium.

Acalypha sp.
Allamanda cathartica
Alysicarpus vaginalis
Andropogon bicornis
Asclepias curassavica
Borreria laevis
Brachiaria erucaeformis
Caladium bicolor
Cassia fruticosa
Cassia tora
Cecropia surinamensis
Cenchrus echinatus
Chloris barbata
Cissus erosa
Cissus sicyoides
Cleome aculeata
Clidemia hirta
Clidemia sp.
Coix lachryma - jobi
Commelina nudiflora
Convolvulaceae en Apocynaceae (mixed collection)
Cordia graveolens
Crotalaria retusa
Crotalaria saltiana
Crotalaria sp.
Cuscuta americana
Cyathula prostrata
Cynodon dactylon
Cyperus articulatus
Cyperus brevifolius
Cyperus cf. flavescens
Cyperus luzulae
Cyperus rotundus
Cyperus surinamensis
Dactyloctenium aegyptium
Desmodium canum
Desmodium tortuosum
Digitaria bicornis
Diodia sp.
Diodia teres
Dolicholus minimus
Eclipta alba
Eleucine indica
Emilia javanica
Eragrostis amabilis
Eragrostis unioloides
Euphorbia hypericifolia
Fimbristylis dichotoma
Hymenachne amplexicaulus
Hyptis atrorubens

APPENDIX 7

OVERVIEW OF COLLECTIONS AT THE EXPERIMENTAL GARDENS, DIRKSHOOP (DH) AND LA POULE (PO) (SARAMACCA DISTRICT) PER JANUARY 2009 (RAMAUTAR, 2009)

Family	Genus	Species	Variety	Traditional name	English	Location
Rutaceae	*Citrus*	*Sinensis*	Kwatta 16- 22 Alidjan Valencia Pera Lamb summer Jaffa Natal Westin Pine apple Parson brown Navel Kwatta 202 Kwatta 71	Sinaasappel	Orange	PO PO, DH PO, DH PO, DH PO, DH PO, DH PO PO PO, DH PO, DH PO, DH DH DH
Rutaceae	*Citrus*	*amblicarpa*		djeroek lima sambal		PO
Rutaceae	*Citrus*	*aurantifolia*	Tahiti lime Spine less of key lime West Indische Lemmetje LS Florida Lime	Lemmetje		DH DH DH DH
Rutaceae	*Citrus*	*aurantium*		zure oranjes		PO, DH
Rutaceae	*Citrus*	*Jambhiri*		rough lemon		PO
Rutaceae	*Citrus*	*Limon*	Eureka Citroen Sukade		Citroen	DH DH
Rutaceae	*Citrus*	*Maxima*		Pompelmoes		PO, DH
Rutaceae	*Citrus*	*Medica*		Sucade		PO
Rutaceae	*Citrus*	*microcarpa*				PO
Rutaceae	*Citrus*	*Paradise*	Star Ruby Thompson Marsh Hooghart	Grapefruit		PO, DH PO DH DH
Rutaceae	*Citrus*	*Reticulate*	Ortanique Rode king Gele king Empress Clementine Dancy Ponkan Cur. Oranje Mexirica de Rio Copy manderijn	Cur.oranje/ponkan (Mandarijn rassen)		PO, DH PO, DH PO, DH PO, DH PO, DH PO, DH PO, DH PO, DH PO, DH DH
Rutaceae	*Citrus*	*reticulata x paradise*	Minneola Orlando	Tangelo's		PO, DH PO, DH
Rutaceae	*Citrus*	*reticulata. Sinensis*		Tangors		PO
Rutaceae	*Citrus*	*Sinensis*		Sinaasappel		PO
Rutaceae	*Fortunella*	*margarita*	Margarita Meiwa	Kumquat		PO, DH DH
Musaceae	*Musa*	*acuminata*	Suiker bacove	Bacove	Banana	PO
Theobromaceae	*Theobroma*	*Cacao*		Cacao	Cacao	PO

Family	*Genus*	**Species**	**Variety**	**Traditional name**	**English**	**Location**
Rubiaceae	*Coffea*	*Arabica*		Koffie		PO
Leguminosae	*Crotalaria*	Spp.			Sunn hemp, Indian hemp	PO
Anacaedeaccae	*Anacardium*	*occidentale*		Kasjoe	Cashew	DH
Anacaedeaccae	*Mangifera*	*Indica*	Golet Golet Aromanis Cayenne Ruby red Roodbortsje Aromanis Titee Tommy atkins Terpentine Lippens Lorvin Singh	Manja	Mango	DH DH DH DH DH DH DH DH DH DH DH DH DH
Guttiferae	*Garcinia*	*mangostana*		Mangistan	Mangosteen	DH
Guttiferae	*Garcinia*	*Dulcis*		Moendoe		DH
Myrtaceae	*Pimenta*	*racemosa*		Bayrun blad	Bay	DH
Annonaceae	*Annona*	*Muricata*		Zuurzak	Soursop	DH
Averrhoaceae	*Averhoa*	*carambola*		Fransman birambi	Carambola	DH
Averrhoaceae	*Averhoa*	*Bilimbi*		Lange birambi	Bilimbi	DH
Moraceae	*Artocarpus*	*heterophylia*		Nangka		DH
Sapindaceae	*Blighia*	*Sapida*		Akie	Akee	DH
Sapindaceae				Ramboetan		DH
Lauraceae	*Persea*	*Americana*	Garcia	Advokaat	Avocado	DH
Malpigihiaceae	*Malphigia*	*punicifolia*		West Indische kers	W.I. Cherry	DH
Palmae	*Cocos*	*Nucifera*	Surinaamse dwerg Ceylonese dwerg	Kokosnoot	Coconut	DH
Palmae				Awarra		DH
Palmae	*Bactris*	*Gasipaes*		Paripoe	Peach palm	DH
Palmae				Amana		DH
Palmae	*Euterpe*	*oleraceae*		Podosiri		PO
Piperaceae	*Piper*	*Nigrum*		Zwarte peper		DH
Bromeliaceae	*Ananas*	*Comosus*		Ananas		DH
Meliaceae	*Azadirachta*	*Indica*		Neem		DH

APPENDIX 8

LIST OF COMMERCIAL FORESTRY WOOD SPECIES (Goedhar, 1996)

Laagland baboen	*Virola surinamensis*	*Myristicaceae*
Hoogland baboen	*Virola melinonii*	*Myristicaceae*
Pintri baboen	*Virola sebifera*	*Myristicaceae*
Basralokus	*Dicorynia guianensis*	*Papilionaceae*
Bolleti	*Manilkara bidentata*	*Sapotaceae*
Bruinhart	*Vouacapoua Americana*	*Papilionaceae*
Kopi	*Goupia glabra*	*Celastraceae*
Kras pisi	*Ocotea glomerata*	*Lauraceae*
Witte pisi	*Ocotea petalanthera*	*Lauraceae*
Kleinbladige zwarte pisi	*Nectandra cf, Ocotea wachenheimii*	*Lauraceae*
Grootbladige zwarte pisi	*Nectandra cf grandis, Ocotea glomerata*	*Lauraceae*
Zwarte pisi	*Ocotea glomerata*	*Lauraceae*
Kaneel pisi	*Licaria guianensie*	*Lauraceae*
Pedrekoe pisi	*Xylopia aromatica, Xylopia nitida*	*Lauraceae*
Wana pisi	*Ocotea puberula*	*Lauraceae*
Waikara pisi	*Aniba hostmanniana*	*Lauraceae*
Rode kabbes	*Andira coriacea, A. inermis, A. surinamensis*	*Papilionaceae*
Kleinbladige rode kabbes	*Andira* sp.	*Papilionaceae*
Grootbladige rode kabbes	*Andira* sp.	*Papilionaceae*
Sali	*Tetragastris* sp.	*Burseraceae*
Rode Sali	*Tetragastris altissima*	*Burseraceae*
Soemaroeba	*Simarouba amara*	*Sterculiaceae*
Gele pisi	*Ocotea* sp.	*Lauraceae*
Zilve pisi	*Ocotea guianensis*	*Lauraceae*
Harde bast pisi	*Ocotea schomburgkiana*	*Lauraceae*
Savanne pisi	*Ocotea schomburgkiana*	*Lauraceae*
Ceder	*Cedrela odorata*	*Meliaceae*
Groenhart	*Tabebuia serratifolia*	*Bignoniaceae*
Man groenhart	*Tabebuia* sp.	*Bignoniaceae*
Kromanti kopi	*Aspidosperma sandwithianum*	*Apocynaceae*
Kleinbladige Kromanti kopi	*Agonandra silvatica*	*Opiliaceae*
Pakoeli	*Platonia insignis*	*Guttiferae*
Hoogland pakoeli	*Rheedia* sp.	*Guttiferae*
Manpurperhart	*Peltogyne pubescens*	*Papilionaceae*
Purperhart	*Peltogyne venosa*	*Papilionaceae*
Rode lokus	*Hymenaea courbaril*	*Papilionaceae*
Slangenhout	*Loxopterygium sagotii*	*Anacardiaceae*
Zwarte kabbes	*Diplotropics purpurea*	*Papilionaceae*
Gevlamde bostamarinde	*Marmaroxylon racemosum*	*Papilionaceae*
Kaneelart	*Licaria canella,* L. *cayennensis*	*Lauraceae*
Koenatepi	*Platymiscium trinita, Platymiscium ulei*	*Papilionaceae*
Manletter	*Perebea laurifolia*	*Moraceae*
Letterhout	*Piratinera scabridula*	*Moraceae*

Berg manletter	*Helicostylis tomentosa*	*Moraceae*
Pritijari	*Fagara pentandra*	*Rutaceae*
Satijnhot	*Brosimum pararense*	*Moraceae*
Wana	*Ocotea rubra*	*Lauraceae*

APPENDIX 9

OVERVIEW OF THE BIOLOGICAL COLLECTIONS IN SURINAME (Muller, 2004)

Type	Institute	Specimens	Collection types
Fauna			
Invertebrates	NCZS	72.000 terrestrial invertebrates	Alcohol preserved collection
		40.000 miscellaneous insects	Dry-pinned insect collection
		25.000 land arthropods	Dry shell collection
		3.450 aquatic invertebrates	Artifact collection of bees and wasps
			Agricultural pest collection
			Van Regtenen Altena Mollusk collection
Vertebrates		7000 fishes	Alcohol and dry formalin collection
		1000 amphibians	Dried skins and stuffed animals
		600 reptiles	Skulls and skeleton collection
		530 birds	Artifact collection
		240 mammals	Haversmidt bird collection
		100 skeletons and skulls	Vari Corantijn river fish collection
			Carnegie bat collection
Flora	NHS*	35.000 plants	
		8.000 wood	
		900 orchids	
	MAAHF	Several Fruit crop and Palm species	Living collections at Experimental Gardens
	CELOS	Seed of pulse and grain species	Seed storage facility
		Cassava	Living collection at Experimental Garden
	ADRON	Rice	Dry storage collection
Microorganism	NHS	Mushroom and mosses	

NHS = National Herbarium Suriname

APPENDIX 10

PRELIMINARY LIST OF THE NUMBER OF PLANT SPECIES ORDERED BY PRODUCTS AND USES (Werkhoven, 1995)

Use	Number of indigenous species	No of introduced species	Total number of species
Grains	--	3	3
Beans	--	10	10
Root crops	1	8	9
Sugar	--	1	1
Oils and fats	12	6	18
Stimulants	16	11	27
Snacks	3	3	6
Spices	2	5	7
Vegetables and herbs	23	67	90
Fruits	45	75	120
Animal fodder	12	34	46
Shade trees	3	7	10
Green manure	8	3	11
Tie and plaiting material	27	14	41
Construction material	14	3	17
Rubber	8	7	15
Resins, aromatic substances	11	8	19
Tannins	1	1	2
Body care products	17	7	24
Rituals	7	3	10
Utensils	14	6	20
Hunting, fisheries	14	2	16
Toxins	17	3	20
Timber	97	1	98
Medicinal	613	159	772
Ornamentals	70	500	570
Total	**1 035**	**947**	**1 982**