

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

CONVENCIÓN SOBRE EL COMERCIO INTERNACIONAL DE ESPECIES
AMENAZADAS DE FAUNA Y FLORA SILVESTRES

CONVENTION SUR LE COMMERCE INTERNATIONAL DES ESPECES
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A CITES ACTION PLAN FOR *CEDRELA ODORATA*

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A CITES Action Plan for Cedrela odorata

An assessment of the status of Cedrela odorata in Suriname

Draft

Final report



Centre for Agricultural Research in Suriname

19 February 2010

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1. Introduction

On request of the Nature Conservation Division of the Suriname Forest Service the Center for Agricultural Research in Suriname has made an assessment of the status of the timber species *Cedrela odorata* in Suriname. This activity is part of the CITES Project no. S-337 and is executed from September, 15 2009 till February, 15 2010.

One of the objectives of the consultancy is to study the occurrence of the timber species *Cedrela odorata*, *Dalbergia retusa*, *Dalbergia granadillo* and *Dalbergia stevensonii* in Suriname. However, in the literature review on the aforementioned species no indication of the occurrence of the latter three species in Suriname is found. From the species *D. stevensonii* it is reported that it grows only in the swamp forests of southern Belize and nearby regions of Guatemala and Mexico. *Dalbergia retusa*, natural range is the Pacific side of Central America and Mexico *Dalbergia granadillo* occurs in Central Mexico.

After consultation with the Nature Conservation Division the decision is taken to limit the assessment to the species *Cedrela odorata* (ceder). In its natural area of distribution ceder is found in the tropical and sub-tropical forests and more specific on areas with well-drained soils and some disturbance. The preliminary study indicates that the species *Cedrela odorata* occurred scattered in the high dryland forests in Suriname (Lindeman, 1954). The tree appears especially along the slopes of the hills and is mentioned to become scarce on the ridges of the coastal plain (Ostendorf, 1962). Ceder is reported not to grow well on waterlogged or heavy soils. The species prefers fertile, free draining, weakly acidic soils. The study area in Suriname for this assessment is therefore the forests on the dryland areas, which are the forest on the ridges of the coastal landscape and the high dryland forest of the interior. The area of the savannah landscape is because of the excessive drainage of the soils excluded.

The activities which are conducted as part of this consultancy are:

- A literature review for the identification of the potential ecosystems which contains ceder trees in Suriname;
- the collecting of data on the presence of *ceder* in the high dryland forest;
- an inventory in the ridge forests of the Coastal plain (young and old coastal plain);
- an assessment of the extend of lost of ceder habitats;
- the collecting of data on the production and export of ceder;
- the preparation of a map showing the potential locations with stands containing ceder trees;
- the preparation of a map indicating the area converted to other use;
- an analyses of the population dynamics;
- an evaluation of the inclusion of the species ceder in appendix III of CITES.

Information on the presence of cedar in the high dryland forest of the interior is obtained from the results of past forest inventories and vegetation studies executed by respectively the Suriname Forest Service, logging companies and by research institutions. Information on its occurrence in the ridge forests is derived from the inventory executed by CELOS at different locations in the coastal plain. The inventory is carried out on both the young and old coastal plain and entails a systematic inventory in the ridge forest complex using a sampling design of transects of 10 m wide.

The fieldwork is executed by the Forestry research division of CELOS and is coordinated by the biodiversity specialist of CELOS, Ms V. Wortel. Personnel of the National Herbarium of Suriname joined the crew in the latter two expeditions, while support was furthermore given by the regional offices of the Nature Conservation Division.

Data on production and export of cedar was provided by the economic section of the Foundation for Forest Management and Production Control, (SBB). The production planning section of the SBB provided CELOS with data on the detailed forest inventory conducted by the logging industry in the production forest belt. The Geographic Land Information System (GLIS) department of the Ministry of Spatial Planning Land and Forest Management made available digital aerial survey data of selected areas in the coastal region. In addition Google Earth Pro 2005 information and data derived from aerial surveys in the early 70's; (CBL toposheets 1: 100000) processed by the GIS and RS department of CELOS ; NARENA are used.

The report contains:

- Information on the occurrence of *Cedrela odorata* in the high dryland forest and in the forests of the ridge landscape with a map indicating the localities of the forest stands containing *Cedrela odorata*
- Insight in the population dynamics of the species
- An overview of the situation with regard to the production and export of *Cedrela odorata*
- An overview of the changes in land use over the years and the extend of lost of *Cedrela odorata* habitats
- Recommendations on the inclusion of the above-mentioned species in appendix III

M. Playfair

February 2010

2. Background

Suriname has a total land area of 16.4 million hectare land. The area covered with natural vegetation is approximately 14.6 million hectare (almost 90 % of the total land area). The country is scarcely inhabited, with a population of about 493,000 inhabitants; most of them (70%) concentrated in the capital Paramaribo or in a number of smaller settlements in the coastal plain. Approximately 15 % of the population lives in and around the forest areas in the interior.

No reliable statistics on deforestation rates are available, but in general conversion of forest to other land use in Suriname is very low. There is also not a real trend in deforestation. Conversions of forests have been the case in very distinct periods and are for the greatest part in the coastal plain. The total area of the forest land converted to other uses in the coastal plain is estimated on approximately 405,000 ha. The area under a swidden agricultural system (shifting cultivation) by the people living in the interior is estimated on 250,000 ha and is the largest cause of the deforestation. However shifting cultivation in Suriname is considered at present a relatively stable activity; only on some parts along the access roads in the interior people have established new agricultural plots and settlements.

Current forest clearings are in the case of bauxite mining, and in gold mining of both large-scale companies and small individual miners. Evidence of forest lost through fires in the marsh forest were visible during the El Nino year of 1998, but no figures on the extent of these fires and the consequent forest lost are available.

In geological sense Suriname consist of a coastal plain and the shield area (approximately 80%) belonging to the Guyana Shield. The four major geomorphologic zones are: the young coastal area, the old coastal area, the savanna belt and the basal complex of the interior (the Guyana Shield area) See figure 1: Geomorphologic map of Suriname.

SURINAME Geomorphology

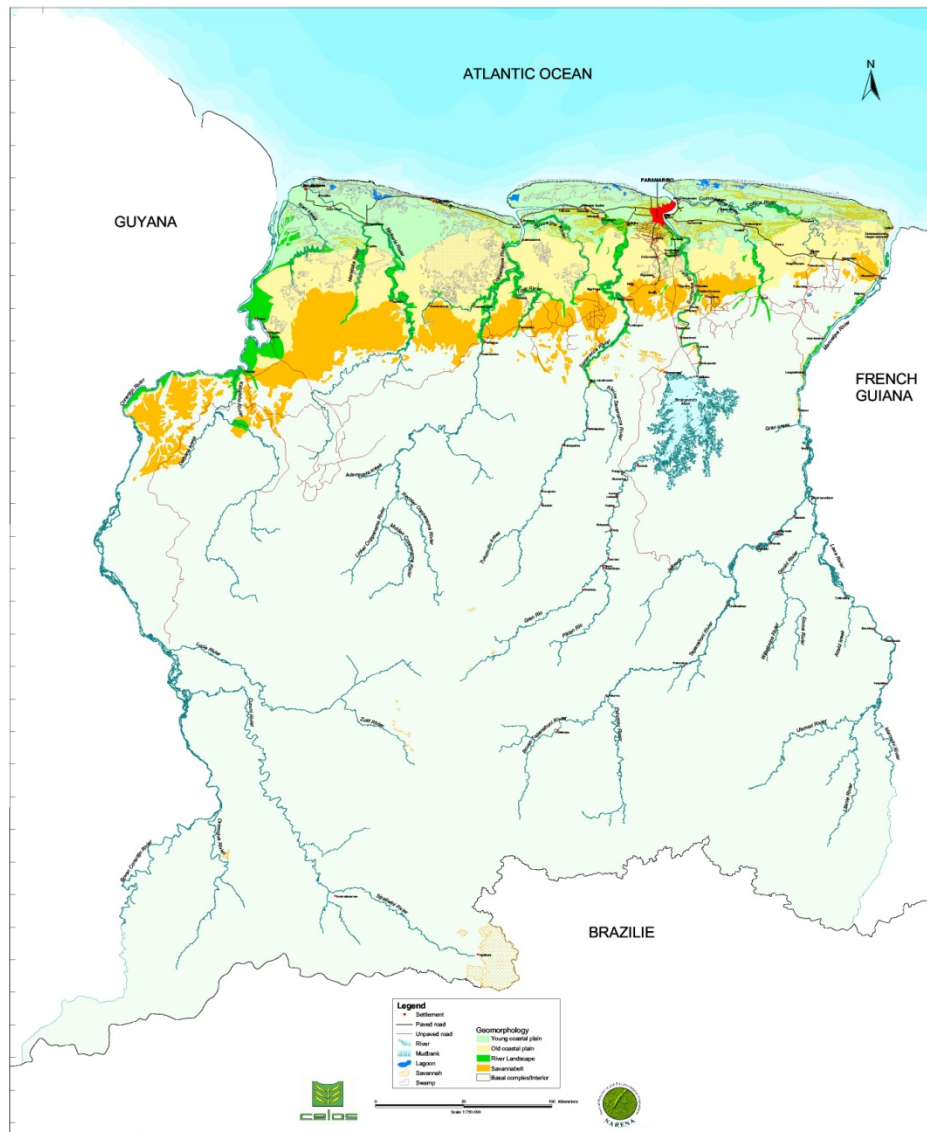
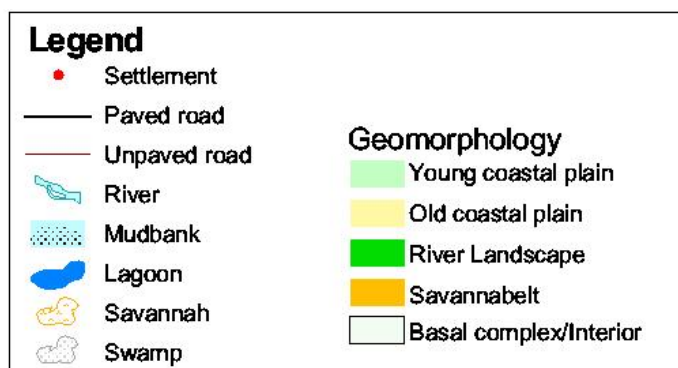


Figure 2 Geomorphologic map of Suriname



Important vegetation types in Suriname are:

- In the coastal plain various types of hydrophytic vegetation like mangroves along the coasts, swamp forest, ridge forest and marsh forest.
- The high and low savanna forests from the cover landscape in the savannah belt, together with open, grass and shrub savannas.
- The high dryland forest in the interior, which differs in the species, height, density and diversity.

A small area of in total about 12,600 ha natural forest is converted to plantation forests. Plantation forest started in the period 1913 - 1923 and a total area experimental plantings of 40 ha of indigenous tree species were established. The Forest Service started in 1951 with the establishment of plantations to create plantations of fast growing timber species at accessible locations, as a timber resource to meet expected future demands. The majority of the plantations were pine plantations (7000 ha) which until recent years produced sawlogs and poles. The plantation area under broadleaf species was approx. 5,000 ha in total, of which almost 2,200 ha was from an early stage in a very poor condition. The most important species are: *Virola surinamensis*, *Cordia alliodora* and *Simaruba amara* and as an exotic species *Eucalyptus deglupta*. In addition a small area had been used for experimental plantings among which trials with *Cedrela odorata*. None of these plantations however, came into a full production, while some nowadays are converted to other uses.

The timber production sector in Suriname consists, with the exception of the activities by a few (foreign) investors for the majority of small producers. Total production in 2008 amounts to approximately 200,000 m³, while the export amounts to a bit over 35,000 m³ (18% of the production), with a value of 5.5 million US dollars. A number of 50 species have commercial value, but their occurrence in the forest and consequently in the production- and export volume are low. Production and export concentrated largely on ten (10) traditional species.

Production of cedar has been traditionally low. On the domestic market cedar wood has because of its resistance to insect attacks always been used for special purposes. The species is valued in Suriname as the raw material for the typical woodcarvings made by maroon people and for the production of small furniture e.g. clothes chests. Export volumes are small and export is at present mostly in the form of souvenirs.

3. The occurrence of *Cedrela odorata* in Suriname

3.1 Introduction

Cedrela odorata, in this report further to be mentioned by its vernacular name; cedar is a deciduous tree up to 40 m tall, sometimes with small buttresses. In its native range cedar is appearing in forests of moist and seasonally dry Subtropical or Tropical life zones. Cedar is always found naturally on well-drained soils, often but not exclusively on limestone; it tolerates a long dry season but does not flourish in areas of rainfall greater than about 3000 mm (120 in) or on sites with heavy or waterlogged soils. Individual trees are generally scattered in mixed semi-evergreen or semi-deciduous forests dominated by other species.

In Suriname the tree is expected to be found in the high dryland forest of the interior and in the forests of the ridge landscape in the coastal zone.

Information about the occurrence of cedar is obtained through a review of vegetation inventory reports, analysis of the results of the existing forest inventory data and a field inventory executed in the ridge landscape. The reports reviewed in this study are on the first systematic surveys of the vegetation in the coastal plain of Suriname (edited by J.C. Lindeman), the reports of the inventories in the timber production forest area in the lowland of the interior and on the more recent studies of the vegetation on the bauxite plateaus.

The most important conclusion from this review is that the density of the species *Cedrela odorata* is compared to other major commercial species in Suriname very low. In none of the landscapes investigated cedar occurred as a dominant species and neither special mention is made of its presence.

3.2. Cedar in the forests of the coastal area

At the scientific expedition in several vegetation types of the coastal plain, which was conducted from September 1948 to May 1949 it became apparent that the majority of the clay soils in the coastal zone were permanently inundated and covered by extensive swamp

vegetations. Well drained soils are the soils raised in the form of ridges. They consist of sand (locally mixed with or replaced by shells). These ridges appear according to Vink (1967) either singly or in groups and may reach a considerable length. The number of ridges is the highest in the eastern part and decreases to the west. In the most western district Nickerie, the ridges are reduced to small isolated patches. The eastern ridges are completely sandy, while the western part has more shells. Another distinction which can be made are in the older type of ridges, which are south of the younger type of ridges.

The ridges of the old coastal plain are covered with marsh forest or mesophytic forest. Lindeman classified the forest found everywhere on the ridges where the soil is well drained (never flooded in the wet season and not cut off from the ground water) as evergreen seasonal forest (Beard's classification). The characteristics of this forest are:

- a stratum of emergent trees of 30 m high;
- an understory everywhere of 12 m and,
- frequent appearance of lianas and epiphytes

The net area of the ridge forest is estimated on 28,000 hectare (Vink; 1967).

The inventory of the ridges carried out by CELOS is conducted on nine locations of which three comprise the older ridges and six the younger type of ridges. Ridges which still bare natural vegetation were selected for this study. The soil structure varies here from fine sand to sandy loamy sand and at one location shells with fine sand. The terrain type is flat land (except for at one inventory line at the location of Perica where the terrain goes from flat to undulating). Almost at all the locations visited the vegetation on the ridge is in a vigorous state. At the ridges in the district Coronie (the Welgelegen ridge) and in the district Commewijne (the Perica ridge) there were clear signs of lasting human activities. At the location Wakay (line 2) the vegetation is dying after the construction of an irrigation canal which intersected the ridge. Appendix I; figure 2 contains a map showing the ridge landscape where cedar trees were found in the inventory.

The data on the CELOS inventory in the ridge forest is processed for each location separately. It appears that the tree species composition differs with the type of ridge. The forests of the old ridges seem to have a slightly higher number of species than the younger ridges. The highest number of species is found in the old ridge forest of Santigron. Rode krappa (*Carapa guianensis*) is the most common tree species in both types of ridges.

Cedar is found in more than 50% of the inventory strips. However, the number of cedar trees per ha is small and there is no prevalence of clustering of this species. Stem number of cedar in the sample locations vary from 0.9 to 5.7 (dbh >15 cm). In one case a group of seedlings is

found underneath the mother tree. In nine of the 24 sampled lines cedar can be considered a dominant species with a total stem number of more than 1 tree per hectare (trees with dbh >25cm). Table 1. provides information on the total number of trees, the number of species and the total number of cedar trees per hectare for each location.

Table 1. Total number of trees and total number of cedar trees per hectare per sample location

Inventory line	Location	Ridge type	Total number of species	Total number of trees per ha dbh>25cm	Number of Cedar trees per ha dbh>25cm	Regeneration of Cedar trees per ha 10 - 25cm dbh	Total number of Cedar trees per ha
1	Wakay	Young ridge	20	84.3	4.3	1.4	5.7
2	Wakay	Young ridge	31	85.3	0.0	0.6	0.6
3	Marataka	Young ridge	27	131.3	2.7	1.3	4.0
4	Marataka	Young ridge	17	93.6	0.9	0.0	0.9
5	Marataka	Young ridge	14	43.8	0.0	0.0	0.0
6	Tamanredjo	Young ridge	46	96.3	0.0	0.0	0.0
7	Tamanredjo	Young ridge	55	115.3	0.0	0.0	0.0
8	Tamanredjo	Young ridge	28	101.3	0.0	0.0	0.0
9	Peruvia north	Young ridge	44	107.0	1.0	0.3	1.3
10	Peruvia north	Young ridge	48	137.0	0.6	0.0	0.6
11	Peruvia north	Young ridge	12	130.0	0.0	0.0	0.0
12	Peruvia south	Old ridge	26	78.3	3.3	0.0	3.3
13	Welgelegen	Young ridge	7	128.6	0.0	0.0	0.0
14	Perica	Young ridge	44	88.0	1.5	1.0	2.5
15	Perica	Young ridge	30	116.0	1.0	1.0	2.0
16	Perica	Young ridge	60	96.8	0.0	0.0	0.0
17	Santigron	Old ridge	70	98.7	0.3	0.0	0.3
18	Santigron	Old ridge	59	126.5	0.0	0.5	0.5
19	Coesewijne	Old ridge	10	42.5	0.0	2.5	2.5
20	Coesewijne	Old ridge	33	114.2	1.7	0.8	2.5
21	Coesewijne	Old ridge	26	99.0	0.0	0.0	0.0
22	Coesewijne	Old ridge	48	279	1.0	1.0	2.0
23	Coesewijne	Old ridge	41	229	0.0	0.0	0.0
24	Tijgerkreek	Young ridge	20	294	4	0	4

The species in the undergrowth and ground layer vary from location to location. Palm species are common in the undergrowth and in the ground layer the most common species were heliconia (*Fam. Musaceae*) and warimbo (*Ischnosiphon spp*).

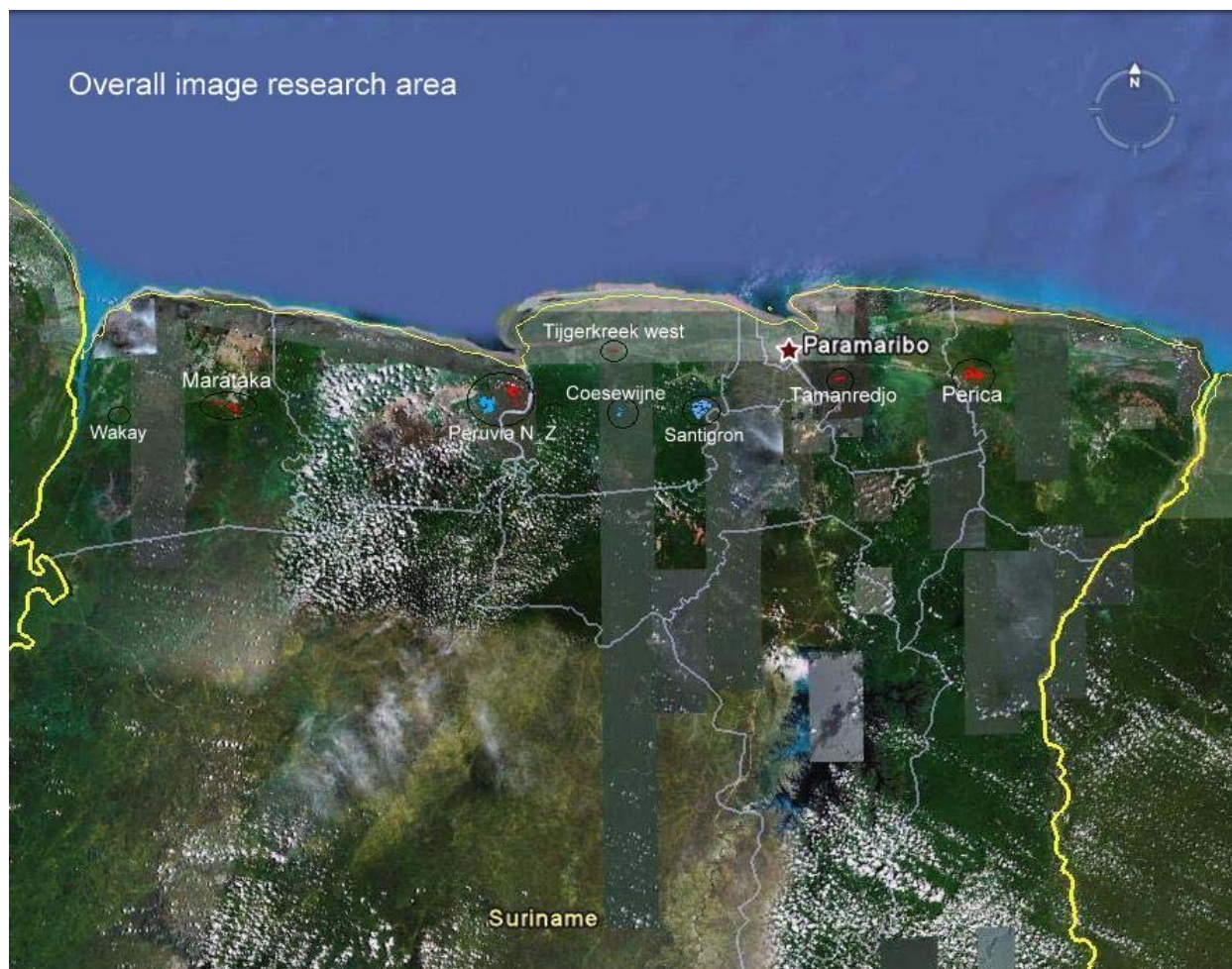


Figure 3 Overview of the location of the sampled areas

Red = young ridge

Blue = old ridge

3.3. The occurrence of *Cedrela odorata* in the high dryland forest

Data from the national inventories are used to analyze the species composition and the position of cedar in the high dryland forest, while also available data of the 100% forest inventory of a number of cutting compartment in the forest production area and furthermore information from the study on Plant diversity on the bauxite plateaus provide insight in the occurrence of cedar in the landscapes of the interior of Suriname.

3.3.1. Data from the national forest inventories

Analysis of the results of the available forest inventory data was done to obtain more information on the distribution of cedar in the interior. Data from the national inventories are used, as well as data of the 100% forest inventory of a number of cutting compartment in the forest production area.

In the period 1948-1958 a systematic forest inventory was executed by the Suriname Forest Service in the forestry belt located in the accessible forest area of Suriname (the near interior). For this assessment the occurrence of cedar studied in a number of the sample blocks. The most important results are that cedar occurs in most cases with a density of not more than 0.1 trees per hectare in the high dryland forest type (dbh \geq 35 cm). In some blocks and likely in some regions cedar is absent. In some blocks cedar can reach considerable densities. A density of 0.6 trees per hectare is recorded for block 867 b+d. Occasionally cedar is also found in the lower forest vegetation type.

The overview on the next page provides information on the total number of trees per hectare, the total number of cedar trees, the diameter distribution of all trees and where available the diameter distribution of cedar in the high dryland forests for the forest inventory areas Fallawatra, Nassau, Kabalebo and Pokigron. These areas were inventoried in the second period of national inventory and are situated south of the production forest belt; two in West Suriname (Kabalebo and Falawatra) and one in East Suriname (Nassau), with a total area of 334,000 hectare. The results of the inventory from the period 1970 -1974 showed that the dominant forest types are dryland forests of which high dryland forests (70% of the total area), savannah forests (6.4%) and other less important types. Wetland forest types namely the creek forest is approximately 14% and liana forest 4%.The second inventory period was expanded to include the inventory of the Pokigron area, where the inventory was executed in the period 1979-1980 by the Suriname Forest service. The total inventory area in Pokigron amounts to approximately 80,000 hectare. The inventory method was a three stage stratified sampling.

Table 2. Overview of the results of the inventory in the high dryland forests for the forest inventory areas Fallawatra, Nassau, Kabalebo and Pokigron.

Number of trees per hectare per diameter class

Fallawatra

Diameter class	25-34	35-44	45-54	55-64	65-74	75-84	85-94	95-104	≥105	total
All species	53.8	35.2	20.5	9.4	4.6	2.1	0.9	0.4	0.3	127.2
ceder										0.04

Nassau

Diameter class	25-34	35-44	45-54	55-64	65-74	75-84	85-94	95-104	≥105	total
All species	54.4	34.1	19.9	8.7	4.4	2.2	1.1	0.7	0.6	126.1
ceder	0.017	0	0.008	0.017	0	0	0	0.008	0	0.05

Kabalebo

Diameter class	25-34	35-44	45-54	55-64	65-74	75-84	85-94	95-104	≥105	total
All species	41.6	30.6	17.9	9.5	4.9	2.3	1.4	0.6	0.4	109.2
ceder										0.01

Pokigron

Diameter class	25-34	35-44	45-54	55-64	65-74	75-84	85-94	95-104	≥105	total
All commercial species*	8.7	6.4	4.1	2.7	1.4	0.6	0.3	0.1	0.1	0.0
ceder	0.00	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.04

* In Pokigron only the data of the commercial species are processed.

3.3.2. Data from the inventories in the timber cutting compartments

Data on the results of the inventory in cutting compartments are providing further information on the presence of cedar in the high dryland forests. (Average size of a cutting compartment is 100 hectare). The species cedar was encountered in total in 98 different terrains (some in one concession area). However, cedar is only in less than 2 % of the terrains found with a density of more than 0.1 per hectare (diameter on breast height of ≤ 35 cm). From the information on the compartments without cedar it is not clear if cedar does not belong to the species taken into account at the inventory or that cedar does not occur in the particular compartments. Table 3. provides the results of the analysis of the inventory for compartments with cedar.

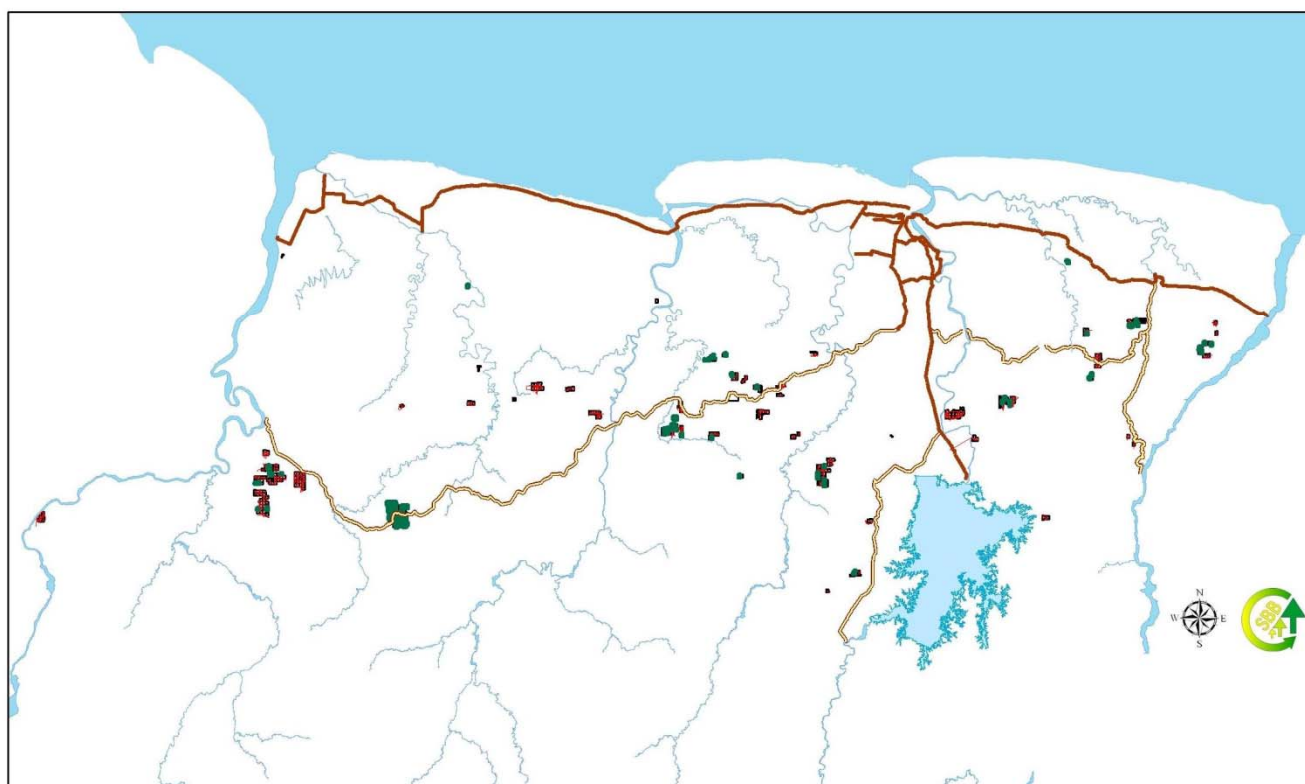
Table 3. Cedar in the compartments with a 100% inventory for timber production

Terrain No.	Compartment No.	Total No. of trees	Total No. of cedar	Volume of cedar in m3	N/hectare of cedar
1	1	1409	1	3.71	0.01
1	2	959	1	2.37	0.01
1	3	1709	3	12.69	0.03
1	4	2237	1	0.82	0.01
2	1	583	6	8.52	0.06
3	1	1394	1	0.53	0.01
3	2	547	2	3.57	0.02
4	1	675	2	3.89	0.02
5	1	430	1	2.57	0.01
6	1	826	1	1.93	0.01
7	1	354	1	1.50	0.01
7	2	905	2	7.90	0.02
7	3	1021	1	1.11	0.01
7	4	1163	5	16.86	0.05
7	5	1058	3	12.59	0.03
7	6	1256	2	5.96	0.02
7	7	878	2	10.44	0.02
7	8	1024	3	6.61	0.03
7	9	1124	2	3.26	0.02
7	10	1067	3	17.23	0.03
7	11	1192	3	20.66	0.03
7	12	1336	5	13.72	0.05
7	13	1320	2	4.31	0.02

Terrain No.	Compartment No.	Total No. of trees	Total No. of cedar	Volume of cedar in m3	N/hectare of cedar
7	14	1032	6	24.70	0.06
8	1	1200	17	28.71	0.17
9	1	603	1	2.47	0.01
9	2	565	3	19.45	0.03
9	3	797	3	16.50	0.03
9	4		2	8.53	0.02
9	5		1	2.75	0.01
9	6	551	4	19.41	0.04
9	7	762	3	21.12	0.03
10	1	1816	2	6.54	0.02
11	1		2	6.37	0.02
12	1	1327	15	34.43	0.15
12	2	1528	4	16.63	0.04
12	3	1249	2	7.40	0.02
12	4	1233	3	7.86	0.03
12	5	1270	1	1.06	0.01
12	6	1046		7.82	0
12	7	1488	5	9.23	0.05
12	12	1267	2	4.79	0.02
12	14	1358	1	1.65	0.01
12	15	989	2	5.34	0.02
12	17	1050	3	11.07	0.03
12	18	1167	1	3.56	0.01
12	19	1125	1	2.34	0.01
12	20	1060	1	0.88	0.01
12	21	867	1	1.06	0.01
12	22	1244	1	2.33	0.01
12	23	787	5	8.74	0.05
12	24	1185	4	11.46	0.04
12	25	820	3	8.30	0.03
12	26	850	2	28.95	0.02
12	27	842	3	7.32	0.03
12	28	1800	3	12.93	0.03
12	29	1290	6	17.21	0.06
12	30	1219	1	1.65	0.01
12	31	1245	5	14.76	0.05
12	32	1394	1	1.32	0.01

Terrain No.	Compartment No.	Total No. of trees	Total No. of cedar	Volume of cedar in m3	N/hectare of cedar
12	33	1138	3	18.92	0.03
12	34	1280	5	12.11	0.05
12	35	804	2	7.70	0.02
12	36	840	6	12.76	0.06
12	37	997	3	8.90	0.03
12	38	808	2	8.59	0.02
12	39	800	1	2.97	0.01
12	40	745	2	2.70	0.02
12	41	595	1	2.20	0.01
12	42	928	5	17.26	0.05
12	43	1203	3	8.16	0.03
12	44	440	3	10.76	0.03
12	45	689	2	8.44	0.02
12	46	1239	9	35.40	0.09
12	47	1259	7	24.60	0.07
12	48	780	7	23.53	0.07
13	1	758	1	1.34	0.01
13	2	1290	4	5.33	0.04
13	3	954	4	3.96	0.04
13	4	1064	1	1.34	0.01
13	5	1212	2	3.66	0.02
14	1	1210	1	1.72	0.01
15	1	466	1	2.20	0.01
15	2	421	1	3.17	0.01
15	3	554	1	1.99	0.01
15	4	422	1	2.16	0.01
16	1	1375	1	1.34	0.01
16	2	1590	1	0.79	0.01
16	3	707	1	1.34	0.01
16	4	715	3	5.13	0.03
17	1	676	7	21.27	0.07
18	1	539	2	3.85	0.02
19	1	554	1	3.35	0.01
20	1	846	1	1.92	0.01
20	2	694	4	15.14	0.04
21	1	532	1	2.49	0.01
21	2	583	1	2.97	0.01

Figure 3 Overview of timber inventory compartments containing *Cedrela odorata*



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- Primary roads (paved)
- Primary roads (unpaved)
- Compartment with cedar
- Compartment without cedar

3.3.3. Ceder on the bauxite plateaus

The study on Plant diversity on the bauxite plateaus is conducted on the Nassau Mountain, the Lely Montain and the Brownsberg Mountain by the National Herbarium of Utrecht (NHN-U) and the National Herbarium of Suriname (BBS) with technical support from CELOS. Numerical data on tree diversity was obtained by establishing a number of 1-ha plots. Table. 4 illustrates the occurrence of the species ceder in the plots for the 3 inventory areas.

Brownsberg Mountain

A total of 4487 trees with diameter at breast height of at least 10 cm DBH were found in the eight 1-ha plots (in total 8 ha). Preliminary species count based on certain identifications and morpho-species resulted in 383 species in these plots. Only 6 species are represented with over 100 individuals. Most species found (269) were represented by less than ten individuals in the plots. In only one plot ceder has been recorded.

The Lely Mountains

A total of 4682 trees of at least 10 cm DBH were found in the eight 1- ha plots (in total 8 ha). Preliminary species count resulted in 376 species in these plots. Most species found (280) were represented by less than ten individuals in the plots. The number of species represented by only one individual (98) and species with two individuals or less (48) is also high. Ceder is recorded in only one plot.

The Nassau Mountains

A total of 3448 trees ≥10 cm DBH were found in the six 1-ha plots (in total 6 ha). Preliminary species count resulted in 336 species in the six plots. Four species are represented with over 100 individuals. Most species found (244) were represented by less than ten individuals in the plots. The number of species represented by only one individual and species with individuals below five individuals is also high. Ceder is recorded in only one plot.

Table 4. Total number of trees, total number of cedar trees and total number of species in the inventory areas Brownsberg Mountain, Lely Mountain and Nassau Mountain

Brownsberg Mountain

plot	BB1	BB2	BB3	BB4	BB5	BB6	BB7	BB8	Total
Total No. of trees	639	571	635	466	540	548	526	562	4487
Total cedar trees		2							2
Total No. of species	167	144	141	128	126	137	124	117	383

Lely Mountain

plot	L1	L2	L3	L4	L5	L6	L7	L8	Total
Total No. of trees	639	494	602	523	981	478	476	489	4682
Total cedar trees						1			1
Total No. of species	147	134	171	143	31	112	106	113	376

Nassau Mountain

plot	N1	N2	N3	N4	N5	N6	Total
Total No. of trees	477	257	500	775	831	608	3448
Total cedar trees						1	1
Total No. of species	114	92	136	149	144	137	335

3.3.4. The population dynamics of *Cedrela odorata*

Literature review of the dynamics of cedar indicates that the species is considered to be a “gap opportunist”. These species have a lower and temporary shade tolerance, a short juvenile phase and a more rapid growth. “Gap opportunists” can under adequate light conditions reach dominant or codominant positions. The species is considered to be able to regenerate and permanently position themselves in the primary forest, although with lower abundances than in secondary stands. The number of cedar trees found in the inventory of the ridge forest is too small to produce a valid diameter frequency distribution table for cedar in this study. The tree appears in all the diameter classes up to 94 cm dbh with the highest number found in the lower diameter classes (up to 45 cm). Young trees of cedar (10 - 25 cm dbh) are found in 10 of the 24 inventory lines. From the data available on diameter frequency distribution of cedar in the high dryland forest it appears that cedar has an irregular distribution. Regeneration in the form of seedlings is found at one location in the neighbourhood of a mature tree.

3.3.5. Conclusion

The conclusion to be made is that the species cedar with a density of less than 0.1 per hectare (dbh > 25cm) in the lowlands and on the bauxite plateaus with a density which varies from 0.13 to 0.25 (dbh > 10 cm) is a tree which is sporadically found in the high dryland forest. In the ridge forest cedar occurs in relatively higher numbers of trees per hectare (on average 2.2 trees per ha for trees with dbh > 10 cm) , although it is not encountered at all of the sampled ridges. From the 24 sample lines the tree occurs on 15. Most of these sample lines without cedar are at locations with frequent human activities for instance the ridges at Welgelegen (Coronie), Perica and Tamanredjo in the district Commewijne with upcoming occupation where cedar might be lost through excessive harvesting and Maratakka and Peruvia north where the vegetation is recovering from past human activities (shell/sand mining). Annex 1. gives an indication of the areas which contains a relatively high frequency of cedar trees.

4. The production and export of *Cedrela odorata* in Suriname

4.1. Production of cedar

Data on forest production is collected by the SBB. Timber production is recorded per concession area and where possible per cutting compartment. Data is available for the period 2000 to 2009. An analysis is made from the production statistics of the SBB.

The species *Cedrela odorata* is recorded to be produced in this ten year period on 73 different timber production terrains spread over the entire timber production area. The total harvest recorded in this period amounts to approximately 644 m³ round wood of cedar. The volume per producer is in most cases small. Table 5 gives an indication of the level of production.

Table 5. Production level of cedar in the period 2000- 2009 for the round wood producers

Quantity of the production of cedar round wood	No of producers
≤ 5 m ³	42
5.1 – 10.0 m ³	13
10.1 – 15.0 m ³	8
15.1 – 20.0 m ³	4
> 20.0 m ³	6

4.2. The export of cedar

The export statistics are also produced by the SBB. Export statistics for the period 2005 – 2009 (up to the month September) are made available by the economic section. The data shows that export of cedar from Suriname is mostly in the form of souvenirs brought back to their home country by tourists from the Netherlands. The total export volume of the souvenirs is unknown since from this assortment only export value is recorded. Commercial exports were in the form of round wood (unprocessed or roughly processed), sawn timber, commercial souvenirs and final products. Round wood exports were to China and sawn wood to Belgium and Germany. The table below (table 6) gives the number of exports of cedar and the number of times that a certain assortment is exported, while for round wood and sawn wood the export volume is given.

Table 6. Export of cedar per assortments for the period 2005- 2009 (up to September) and total export value

Year	Total No of cedar exports	Total volume of round wood in m3	Total volume of Sawn wood in m3	No of cases Export of Final products	No of cases Export of Souvenirs Commer- cial export	No of cases Export of Souvenirs (gifts)	Export value of cedar in USD	Total export value in million dollars
2005	21	-	-	-	6	15	2,355	2.9
2006	42	1.84	2.56	5	-	31	5,200	4.6
2007	24	-	10.71	-	3	22	3,745	5.0
2008	59	16.57	1.39	2	-	40	6,728	5.5
2009*	41	-	10.35	-	9	30	-	

*Up to September

5. The changes in land use and the extend of lost of *Cedrela odorata* habitats

Deforestation rate in Suriname is low. In the coastal plain an estimated area of 0.4 million hectare is converted, mainly for agriculture and establishment of (urban) settlements. An assessment was made to estimate changes in area of *C. odorata* habitats on the sand and shell ridges in Northern Suriname. The assessment focused on alterations of ridge vegetation induced by anthropogenic influences, whereby a distinction was made between affected ridges and unaffected ridges.

Affected ridges are defined as ridge vegetation that has been altered or converted to other land uses such as agriculture, settlements, infrastructure, mined out areas, inundated areas and areas where selective timber harvesting (possibly *C. odorata* amongst other species) has taken place. These affected ridges were mainly located to the north where the so called East-West connection (Oost-West verbinding), a paved road leading from Albina in the East to Nw. Nickerie to the West of Suriname's coast was constructed and where concentrations of people have settled, agricultural plantations were established and other economical activities have and are taking place.

Unaffected ridges are ridges where the ridge vegetation is still in its natural state.

It is estimated that the total ridge landscape area in the coastal plain which is affected is approximately 60,210 ha against 62,820 ha of unaffected land. This figure is the gross area and includes the land in between the elevated ridges. Except for clearance for agricultural purposes the area in the ridge landscape is affected by sand and/or shell mining and logging. See ANNEX. Map with the location of the affected ridge forests.

From the nine ridge complexes investigated in the field study each of them was more or less visibly affected by human activities. The encountered activities range from construction of irrigation canals, sand mining, agriculture either small scale or market oriented, logging, hunting, gathering of non timber forest products and fishing. However, almost at all the locations visited the vegetation on the ridge is still in a vigorous state. The ridge forest at the location Wakay in the district Nickerie is dying after the construction of an irrigation canal which leads to an increase in the water table. Threatened ridges encountered during the fieldwork are in the case of the ridges in the district Coronie and in the district Commewijne where land is being occupied for agriculture and inhabitation.

In conclusion the total change in sand and shell ridge *C odorata* habitats in the coastal area of Suriname is at present almost 50 % which can increase in the districts where human occupation is growing.

The forest area in the interior converted to other use in the interior is estimated on 250,000 hectare. This is a more or less stable figure. Further lost of forests can only be expected in the case of conversion of land for large scale agriculture and in the case of (gold) mining. The low intensive selective logging system which is currently practiced in Suriname does not give room to expect lost of forests through logging.

6. Conclusion

The main objective from this assessment of the status of the timber species *Cedrela odorata* in Suriname is to provide a basis for the advise on the inclusion of above-mentioned species in appendix III.

The main conclusions to be made are:

1. The species cedar has no specific location in Suriname and might occur everywhere on areas with well-drained soils. In Suriname these are in the coastal area the ridge forests and in the interior the high dryland forest
2. Cedar plantations in Suriname are only established as small experimental plantings in the past and had never come into production.
3. In the ridge forest cedar seems to occur in relatively higher numbers of trees per hectare (on average 2.2 trees per ha; dbh > 10 cm) than in the high dryland forest where the density is less than 0.1 per hectare (dbh > 25cm).
4. In the inventory in the ridge forest in the coastal plain cedar is not found at the sample locations with frequent human activities.
5. The total area of ridge landscapes changed in the coastal area of Suriname is at present almost 50 % which can increase in the districts where human occupation is growing.
6. The low intensive selective logging system which is currently practiced in Suriname does not give room to expect lost of forests through logging.
7. Further lost of forests in the interior can only be expected in the case of conversion of land for (large scale) agriculture and in the case of (gold) mining.
8. The total production of cedar recorded in the period 2000- 2009 amounts to approximately 644 m³ round wood. The volume per producer is in most cases small; only 6 producers had a production of more than 20m³ round wood in this period.
9. The export of cedar from Suriname is mostly in the form of souvenirs by tourists from the Netherlands; in 2008 there were 40 cases of export of souvenirs registered with an unknown export volume.
10. Commercial exports are incidental and very small; total round wood export in 2008 was 16.57 m³, sawn timber was 1.39 m³ and the total value of the commercial exports was USD 6,700.

Recommendation

It is on the basis of the above mentioned figures recommended for Suriname **not** to include the species *Cedrela Odorata* in CITES appendix III.

The production and export of cedar are small. Although there is a tendency set in for export of round wood and sawn wood, export quantities are still a minor part of the total production. CITES administrative regulations will have consequences for the export of souvenirs and can

consider a too big burden for the upcoming tourism sector and the small producers engaged in the craft production.

The habitats where cedar has a relatively high density; the ridge forest is under threat as a result of ongoing human occupation and the consequent human activities in the form of sand/shell mining and conversion of land to other uses (agriculture and inhabitation). Regulation of the export trade of cedar will not prevent this.

Export regulations in Suriname prescribed that all exported wood comes from legal origin, which means that the bulk of the exported wood will have as source the regular logging sector which is mainly in the high dryland forests or comes from approved conversion forests in the coastal area.

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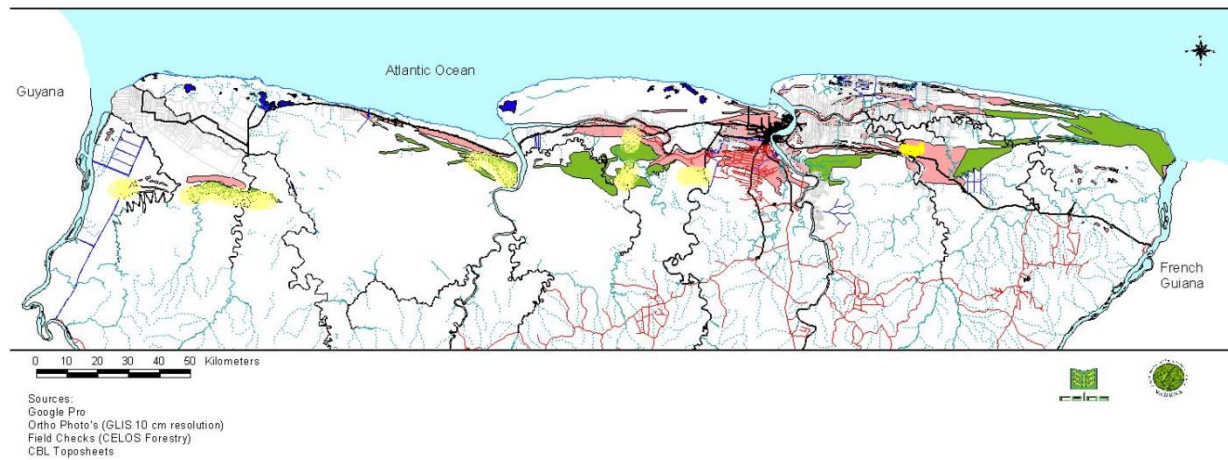
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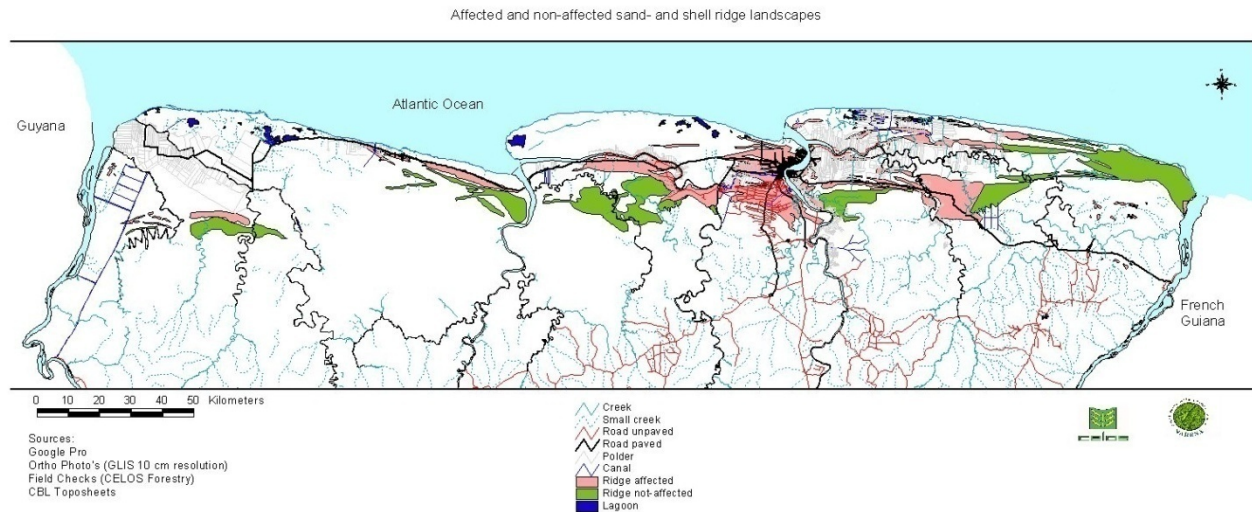
ANNEX 1. Locations with proven occurrence of cedar trees



Locations with proven occurrence of cedar trees

- Creek
- Small creek
- Road unpaved
- Road paved
- Polder
- Canal
- Ridge affected
- Ridge not-affected
- Lagoon

ANNEX 2. Map with the location of the affected ridge forests.



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