

Development of the Gum Arabic and Aloe Sub Sectors in Karamoja Region of Uganda



**For The Government of Uganda, through the Office of the President,
AGOA Office**

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**The Republic of
Uganda**



**The Network of Natural Gums and Resins
in Africa**



**Regional Centre for Mapping of
Resources for Development**



**Kenya Forestry
Research Institute**

Development of the Gum Arabic and Aloe Sub Sectors in Karamoja Region of Uganda

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Inaugural Mission Team with the President of the Republic of Uganda,
H.E Yoweri Museveni, at State Lodge in Soroti, September 2006

List of Acroynms

GPS	Global Positioning System
KEFRI	Kenya Forestry Research Institute
LC	Local Council
MT	Metric Tonnes
NGARA	The Network for Natural Gums and Resins in Africa (NGARA)
RCMRD	Regional Centre for Mapping of Resources for Development
sph	Stems per hectare
UGAC	Uganda Gum Arabic Cooperative

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1.0 Background Information

The Uganda government, through an initiative by H.E. the President, seeks to empower the Karamoja people harness the potential of their natural resources. This initiative hopes to promote sustainable utilization of gum arabic and allied products in Karamoja Region for improved livelihood and biodiversity conservation. The Uganda government, specifically His Excellency, the President, believes that, engaging the local communities in harvesting and marketing of gum arabic and allied products will not only reduce poverty, but also reduce idleness, change attitude of over reliance on livestock as a means of living and therefore indirectly limit cases of cattle rustling and insecurity in Karamoja Region.

A task force was therefore appointed and tasked with implementing the presidential initiative on the development of gum arabic and allied products in the Karamoja Region as alternative sources of income for the communities. The communities have already been mobilized to form a cooperative, the Uganda Gum Arabic Cooperative (UGAC). Gum arabic is seen as an entry point for economic development of other potential dryland resources in Karamoja Region.

The Network for Natural Gums and Resins in Africa (NGARA), a regional network with its secretariat hosted by the Kenya Forestry Research Institute (KEFRI) in Nairobi, Kenya was identified as a potential collaborator in this initiative. A mission was organized for an official delegation of the Ugandan Government to visit the NGARA Secretariat in Nairobi in June 2006 to discuss collaboration, and in particular, prepare terms of reference (ToRs) related to the Development of Gum Arabic and related dryland commodities in Karamoja Region of Uganda. During the mission, the Regional Centre for Mapping of Resources (RCMRD) was identified as a key partner with NGARA to coordinate activities of resource mapping.

Consequently, an inaugural mission was planned to Uganda in September 2006 to initiate the activities for the development of the Uganda Programme on Gum Arabic and Related Dryland Resources. During the mission, a reconnaissance survey of the gum arabic producing species and other dryland resources was undertaken to verify the species and their spatial distribution as well as a rapid stakeholder analysis to establish the existing capacity in the country and Karamoja Region. It was during this mission that aloe was identified as a commercially important commodity in Karamoja Region and was included in the programme for subsequent resource mapping and assessment. The RCMRD was able to undertake a preliminary assessment of the resources and initiated acquisition of relevant data as well as identified local stakeholders who were to be involved in the mapping activity.

A field mission was subsequently organized in November/December 2006 by the RCMRD and KEFRI/NGARA from Kenya and accompanied by a taxonomist from Makerere University as well as staff of the Uganda Gum Arabic Company (UGAC) to carry out resource identification and mapping. A second mission was carried out in February/March 2007 to present results on resource identification, preliminary results on resource mapping and initiate resource inventory activities.

The current report provides information on resource identification, mapping and inventory of the gum arabic and aloe resources.

2.0 Identification, Mapping and Inventory of Gum Arabic, Aloe and Allied Dry land Resources

2.1 Approach used

2.1.1 Resource Identification

Plant taxonomists undertook taxonomic identification within the selected areas by species, sub species and varieties that produce gum arabic (including potential adulterants), Aloe species and other dryland resources in Karamoja Region.

2.1.2 Resource Mapping

Experts from the Regional Centre for Mapping of Resources for Development (RCMRD) spearheaded the activity of resource mapping. The process involved the following;

- i. Landsat images were acquired, processed and used to generate land cover classes. Following further interpretation a total of 7 land cover classes were found to support the growth of *Acacia senegal*, *Acacia seyal* and Aloe species.
- ii. The seven classes were subjected to further interpretation, carefully mapping areas covered by *A. senegal*, *A. seyal* and Aloe.
- iii. A two-week fieldwork was conducted in November/December 2006 to verify the preliminary interpretation. A total of 109 sample points were pre-selected for field visit. About 60% of these were visited with the remaining 40% being inaccessible due to poor roads and insecurity.
- iv. The preliminary interpretation was adjusted based on the findings of the fieldwork. In addition, based on the field measurements of densities of each of the resources, polygons of *A. senegal*, *A. seyal* and Aloe were delineated and further classified as Low, Medium and High densities. Provisional maps were produced showing the location, distribution and densities of the resources. These maps were then used as a basis for further field verification and resource inventory.
- v. The provisional maps were finally updated based on data from the resource inventory exercise and harmonized to establish the areas covered by each resource in each density class (low, medium and high density) at LC3 and district levels.

2.1.3 Rapid Resource Assessment

Experts in the management and use of gum arabic and Aloe assisted in generating information on resource inventory and viability of the gum arabic and Aloe for commercial production. In carrying out this activity provisional resource maps generated by experts from RCMRD were used. The following procedure was followed:

- i. The RCMRD provided information on geographic coordinates of the centroids of the polygons containing *Acacia senegal*, *A. seyal* and Aloe. The points were marked on the provisional resource maps and also entered into a GPS. The polygons were examined in terms of accessibility (roads) and security and those that were accessible and secure were marked for field verification.
- ii. Prior to field verification, local informants were consulted on availability of the target resource. The verification exercise was then undertaken in the field to verify if mapped units have the resources as indicated in the provisional map.
- iii. Areas that were relatively accessible by car were selected as transect routes. Along each transect route and guided by a local informant, square sample plots of 20x20 m (0.04 ha) were established in vegetation resources bearing gum arabic and circular plots of 6.5m radius (0.01 ha) for aloe resources.
- iv. Within each sampling plot, data was collected on;
 - Density of young and mature gum arabic and aloe producing species
 - Density of associated species including local and botanical names
 - Terrain conditions
 - Soil conditions
 - Evidence of exploitation through tapping or harvesting
- v. The collected data was cleaned and synchronized to ensure that data from the mapping and inventory exercises correspond to the correct mapping units, LC3 and Districts.
- vi. Densities per hectare were calculated for each resource. Density classes were then assigned based on the following criteria;
 - For *Acacia senegal* and *A. seyal*, it was based on the optimal stocking for a plantation of 625 stems per hectare and a spacing of 4m x 4m. Based on this criterion;

Density Classification for *Acacia senegal* and *A. seyal* (stems/ha)

< 500	- Low
500 – 800	- Medium
> 800	- High

- For Aloe it was based on pre-sampling activities in Karamoja to determine low, medium and high classification. In Lorengedwat for example the density was 8900 stems/ha, which was considered high, and in Nadunget it was 3600stems/ha, which was considered medium. This formed criteria upon which the following density classification was adopted;

Density Classification for Aloe (stems/ha)

< 1000	- Low
1000 – 3600	- Medium
> 3600	- High

- The densities of each resource were then classified into low, medium and high-density classes and the mean, standard deviation and coefficient of variation calculated at LC3 and District level.
- A correction factor was applied to account for the existence of other land uses such as farmlands, settlements or glades because the mapping units were not homogenous. The following correction factors were adopted for all the resources.

High Density	75%
Medium Density	50%
Low Density	25%

vii. Assessment of area under gum arabic/aloe resources and yield of gum arabic and aloe sap were derived as follows;

- ✓ Estimated density of gum Arabic resource for a given density class;

$$\text{Estimated Density} = \text{Mean Density} \times \text{Area} \times \text{correction factor (1)}$$

- ✓ The yield of gum arabic was based on the formula;

$$\text{Estimated Yield (MT)} = (\text{Number of Stems} \times \text{Crown Cover} \times \text{Yield}) / 1000000 \text{ (2)}$$

Where; Crown Cover *Acacia seyal* = 18.2% Yield=500gm
Crown Cover *Acacia senegal* = 10%

- ✓ In the case of aloe, to estimate sap yields;

Leaves of *Aloe tweediae* were harvested for sap and collected in plastic basins, in some selected sites in the field. After 30 minutes, the volume of sap released was measured using a calibrated measuring cylinder.

- ✓ The yield of aloe gum was based on the formula;

$$\text{Estimated Yield (MT)} = (\text{Number of Stems} \times 150) / 3000000 \text{ (3)}$$

Where; 1 stem produces 150 mls of sap
3 liters of sap produces 1 kg of gum

2.2 Gum Arabic Resources

2.2.1 Resource Identification

Gum arabic from Uganda is produced by two main species *A. senegal* var. *senegal* and *A. seyal*.

(a) *Acacia senegal* (L.) Willd var. *senegal* Mimosaceae

The *Acacia senegal* var. *senegal* locally known as *Ekodokodoi* is a shrub or tree that reaches 2-12 m high. It is generally recognized by its three hooked prickles at the nodes, the two lateral

ones pointing upwards or forward in the direction of growth and central one pointing downwards or backwards or else solitary, the two laterals being absent. The bark varies from greenish yellow to grey-brown, branches appearing whitewashed. Leaves are bipinnate: pinnae 2-6 pairs, leaflets 8-18 pairs per pinna. Flowers are white or cream, up to 12 cm long in spikes. Pods are yellowish brown, 2-19 x 1.2-3.4 cm, rounded or blunt at the tip, papery with distinct lateral veins, dehiscent. The seeds are sub-circular, 8-12 mm in diameter with visible central U-shape.

Acacia senegal var. *senegal* is common almost throughout Karamoja, on well-drained reddish sandy alluvial loamy soils in plains or at the foot of hills, sometimes forming almost pure stands. It is particularly locally dominant in Nakapelimoru and Panyangara sub-counties in Kotido. Also in Kapedo, Kathile and Loletaa sub-counties in Kaabong. Large quantities of gum arabic were reported to come from Kawalapol area. It is usually associated with *A. mellifera*, *A. tortilis*, *Lannea* sp. and *Aloe tweediae*. Average density counts for 8 samples, enumerated in almost pure stands were 2500 stems per hectare while in scattered stands 625 stems per hectare were recorded.



Acacia senegal stand at Kapedo



Gum arabic from *A. senegal* at Kotido

(b) *Acacia seyal* Del.

Mimosaceae

Acacia seyal locally known as *Ekaramoi* is a tree with irregularly flattened, spreading crown that grows to about 10m in height. It is easily recognized by its smooth or sparsely flaking bark, which is covered with whitish, greenish yellow or orange-red powdery layer. It has white, stout, sharp thorns about 8 cm long, arranged in diverging pairs. In some trees, some pairs of thorns are fused and inflated at base forming bi-lobed whitish "ant-galls" (var. *fistula*) while in others there are no ant galls (var. *seyal*). Leaves are bipinnate: pinnae 3-8 pairs; leaflets 11-20 pairs per pinna, 3-8 x 0.7-1.5 mm. Flowers are bright yellow, in round heads. Pods are shiny red-brown, curved, 7-20 x 0.5-9 cm, longitudinally veined, slightly constricted between the seeds, splitting open on the tree. Seeds wrinkled, compressed, 7-9 x 4.5 mm.

The *Acacia seyal* is common throughout Karamoja, usually found in colonies in wooded grassland, especially on seasonally flooded or wet flats of black cotton soils, along watercourses, depressions and on stony ground at the base of hills. Very good, almost pure stands occur around Bokora, Iriri, Kapedo, Loro and Lope along Lokichar river system and also foothills of Lokatapar hills. Density counts for 8 samples enumerated were 1750 stems per hectare.



A.seyal var. seyal stand at Iriri



Gum from A.seyal var. seyal

c) Potential Adulterants

It is important to know how to differentiate the two species; *Acacia senegal* and *A. seyal* that produce gum arabic since each type must always be collected and marketed separately. In addition to these two species there are other trees that also produce gum that may accidentally or deliberately be mixed with gum arabic. This was evident at Kotido where gums from various species were found mixed together in one bag as gum arabic. Mixing gums from different species at collection time or at post-harvest handling stage results in variability and is the prime reason for poor quality. *Acacia polyacantha*, *A. sieberiana* and also *Balanites aegyptiaca* are among the potential adulterants of gum arabic in Karamoja.

(i) *Acacia polyacantha* Willd. subsp. *campylacantha* (A. Rich.) Brenan
Common name: Falcon's claw acacia

Tree 3.5–20 m high with flattened, spreading crown. Bark yellow-brown to ash-grey, scaly or papery, often with persistent prickles. Prickles in pairs, well developed and strongly recurved, well spaced with one each side of stem, sometimes absent from branchlets. Leaves with 6-40 (sometimes up to 60) pairs of pinnae; leaflets 16-64 pairs per pinna. Flowers cream-white, in spikes 12 cm long, 2 to 3 together. Pods brown, 6-18 cm long, pointed at both ends, splitting open when mature and dry.

Acacia polyacantha is common in Karamoja growing in wooded grassland, often in poorly drained soils, riverine and also on stony hillsides. It was recorded in two *A. seyal* sample plots at Iriri. It produces a pale yellow to red-brown gum that can be easily confused with gum arabic especially from *A. senegal*.

(ii) *Acacia sieberiana* DC. Common name: Umbrella thorn

Tree 4-15 m high with rounded umbrella-shaped or flattened crown. Bark greyish brown or yellowish and flaking especially on branches. Thorns in pairs, straight, greyish white with dark tips, up to 12 cm long. Leaves usually with 6-23 pairs of pinnae, but can reach up to 35, leaflets 13-45, up to 52 pairs per pinna. Flowers white or pale yellow, in heads. Pods straight or slightly curved, 9-21 x 1.5-3.5 cm, yellowish or reddish brown, thick and almost woody in texture when dry, indehiscent.

Acacia sieberiana is common in Karamoja, often in wooded grassland, in areas with impeded drainage, also riverine. It was recorded in one *A. seyal* sample plot at Abim. It produces reddish brown gum similar to gum arabic from *A. seyal*.

(iii) *Balanites aegyptiaca*(L.)Del. Local name:Thoo, Common name: Desert date

Evergreen tree up to 10 m high with rounded crown of tangled mass of thorny branches. Bark smooth, green or dark brown, cracked, young branchlets green and smooth with thorns up to 8 cm long. Leaves in pairs of grey-green leaflets. Flowers yellow green, in clusters. Fruit oblong, up to 5 cm, both ends round, yellow when ripe, with a hard pointed seed. *Balanites aegyptiaca* is a very common tree in Karamoja, occurring in wooded grassland with black cotton, sandy, alluvial and stony soils. Though hardly confused with any *Acacia*, *B. aegyptiaca* produces a reddish brown gum that can be deliberately mixed with gum arabic by ignorant or fraudulent collectors.

2.2.2 Resource Maps and Inventory

The area covered by gum Arabic resources (both *Acacia senegal* and *A. seyal*) in Karamoja Region is shown in Figure 1. Results of the resource mapping and inventory show that the estimated area of gum Arabic resources in Karamoja Region is 648,147 ha with a production potential of 7,484 MT. Between the two species, *A. senegal* is more abundant and widespread. It was estimated to cover 373,542 ha with an estimated production potential of 4700 MT. *A. seyal* covers an estimated area of 274,605 ha with a potential production of 1784.06 MT per year (Tables 1 and 2).

In terms of districts, Kotido (including Kaabong and Abim) contains the highest amount of the gum Arabic resources (376, 823 ha) with a potential production of 5,269 MT. *A. senegal* resources are more abundant (247, 683 ha) accounting for 3942 MT per year than *A. seyal*, which covers approximately 129,140 ha with a production potential of 1,327 MT. Within the district highest concentrations of *A. senegal* were found in LCs of Panyangara, Kotido and Nakapeilimoru (present Kotido District) and Kaabong and Karenga (the present Kaabong District) as indicated in Figure 3. Mean densities varied between 1100 – 2000 sph influenced mostly by soils but also anthropogenic factors. The disparity as measured by the coefficient of variation was within acceptable limits (below 35%). Dominant soils were red to brown sands and occasional stony red soils. *A. seyal* was found in medium concentrations in Lopei (border with Moroto) and Kathile. Mean densities vary between 450 – 650 sph.

Moroto District is second in production potential. Total area was 241, 438 ha with a potential production of 1,914 MT. *A. seyal* resources are more abundant (131, 030 ha) with a potential production of 1304 MT compared with *A. senegal*, which covered an area of 110, 408 ha with potential of 610 MT. *A. seyal* is found in high densities in Lopei and Rupa LCs with mean densities of 1350 sph on black cotton and grey stone soils. Some areas in Lopei have medium density resources with means of 550 sph. Lokopo has also resources of *A. seyal* but densities are classified as low.

Nakapiripirit District has the lowest amount of resource covering 29,886 ha with a potential production of 301 MT. In this district *A. senegal* is more abundant (15, 451 ha) but with a potential production of 148 MT compared to *A. seyal*, resource, which covers approximately 14,434 ha but with a potential production of about 153 MT per year because of the relatively higher concentrations of the resource under high density class. High concentrations of the *A. seyal* are found in Namalu and Loro areas, (mean densities of 1308 sph) with low densities in Kirita (about 100 sph). *A. senegal* is found in medium densities in Loro (600 sph) and low in Amudat and Lorengedwat (250 sph).

GUM ARABIC MAP OF KARAMOJA REGION- UGANDA

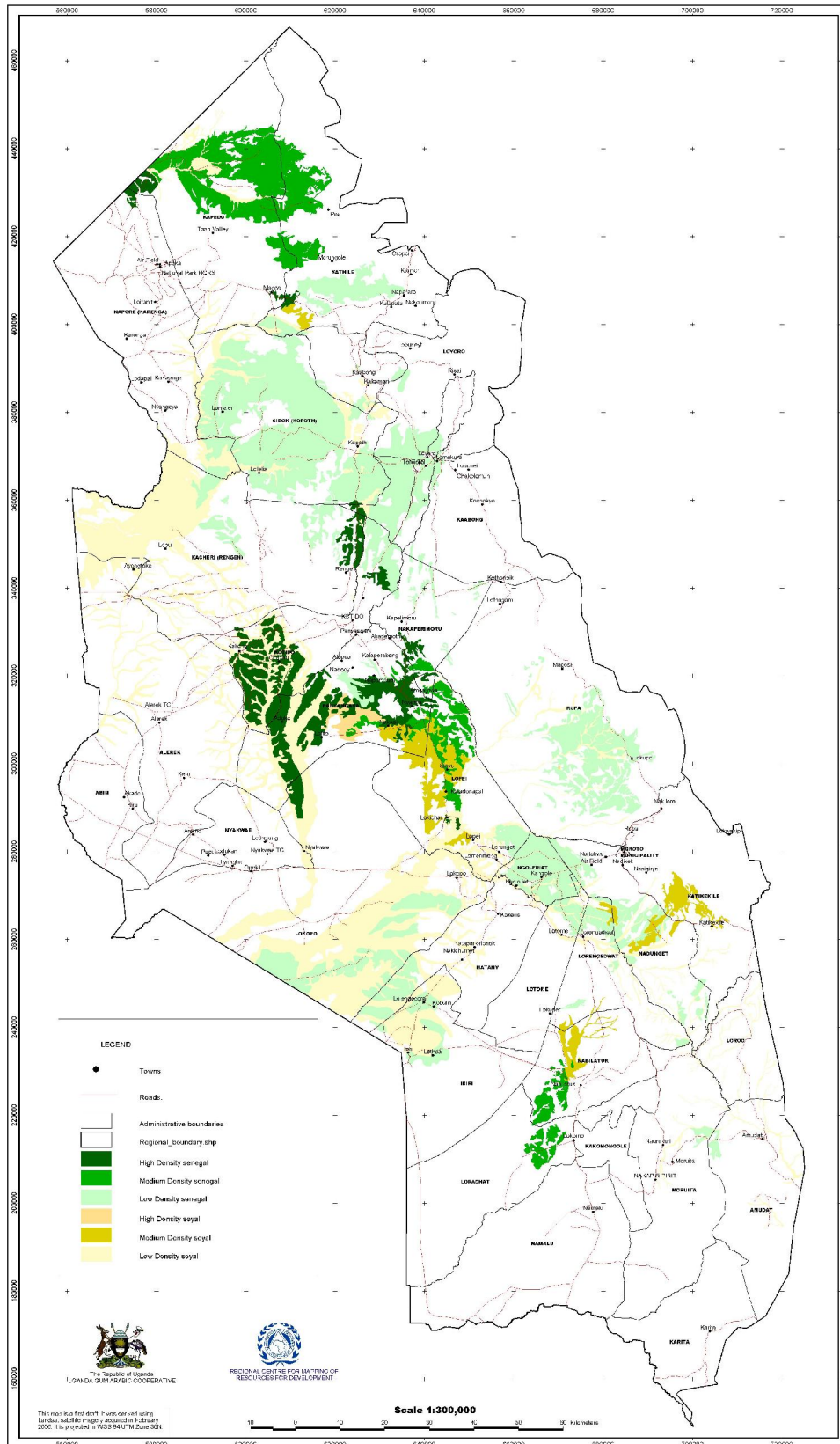


Figure 1: Gum Arabic map of Karamoja Region - Uganda

Table 1: *Acacia senegal*

DISTRICT	Density Class	Mean Density (ha)	Area (ha)	Population (stems)	Estimated Yield (MT)
Kotido	Low	200.00	142,711.28	7,135,564	356.78
	Medium	658.00	53,804.68	17,701,740	885.09
	High	1,406.00	51,167.10	53,995,707	2,699.79
Subtotal			247,683.07	78,833,011	3,941.66
Moroto	Low	258.00	97,945.57	6,317,489	315.87
	Medium	725.00	9,734.06	3,528,596	176.43
	High	1,150.00	2,728.02	2,352,917	117.65
Subtotal			110,407.65	12,199,002	609.95
Nakapiripirit	Low	244.00	7,013.74	427,838	21.39
	Medium	600.00	8,437.29	2,531,187	126.56
	High	0.00	0.00	0.00	0.00
Subtotal			15,451.03	2,959,025	147.95
TOTAL			373,541.75	93,991,038	4,699.56

Table 2: *Acacia seyal*

DISTRICT	Density Class	Mean Density (ha)	Area (ha)	Population (stems)	Estimated Yield (MT)
Kotido	Low	305.00	118,645.96	9,046,754	823.25
	Medium	538.00	5,776.44	1,553,862	141.40
	High	1,125.00	4,717.52	3,980,408	362.22
Subtotal			129,139.91	14,581,023	1,326.87
Moroto	Low	321.00	111,615.42	8,957,138	815.10
	Medium	550.00	19,370.61	5,326,918	484.75
	High	1,350.00	44.21	44,763	4.07
Subtotal			131,030.24	14,328,818	1,303.92
Nakapiripirit	Low	117.00	9,376.96	274,276	24.96
	Medium	544.00	5,057.93	1,375,757	125.19
	High	1,308.00	35.00	34,335	3.12
Subtotal			14,469.89	1,684,368	153.27
Total			274,605.04	30,594,209	2,784.06

2.3 Aloe Resources

2.3.1 Resource Identification

Aloes are fleshy-leaved (succulent) perennial herbs or shrubs with leaves arranged in a rosette, usually triangular, the margins usually armed with sharp teeth, usually with a bitter-tasting yellowish or brown juice when broken and lateral simple or branching inflorescences with racemes of red or yellow tubular flowers. The bitter juice and gel from various aloes are the major products with international market in pharmaceutical industries. They are largely used to make laxatives and lotions.

Carter, (1994) in the Flora of Tropical East Africa (FTEA) family Aloaceae records sixteen species of Aloes in Uganda. Eight of these species occur in Karamoja region: *A. amudatensis*, *A. labworana*, *A. wilsonii*, *A. wrefordii*, *A. tweediae*, *A. turkanensis*, *A. canarina* and *A. cheranganiensis*. Of the eight species, *A. tweediae* is by far the most abundant, occurring almost throughout Karamoja. It is this species that holds potential for exploitation.

(i) *Aloe tweediae* Christian

Aloaceae

Aloe tweediae locally known as *Echuchuka* is a fleshy-leaved perennial herb, usually solitary or in small groups but not suckering, stemless but older plants developing a short thick stem up to 50 cm high with dried leaves persistent. Leaves in a compact rosette, erect to spreading and recurved in upper quarter, ovate-lanceolate, to 50 cm long and 15 cm wide towards the base, about 15 mm thick, glossy dull green, with scattered elongated whitish spots usually present on both surfaces but sometimes absent; margin armed with reddish-brown teeth joined by a horny rim, the teeth usually pointing forward. Sap dries deep purple. Inflorescence erect, 1-2 m high with 10-20 widely spaced branches curving upwards, the lower ones re-branching, sometimes 2-3 simultaneously. Racemes ascending, up to 20 cm long, the terminal erect with flowers evenly distributed. Bracts scarious, 2 mm long. Flowers coral red merging into pale yellowish pink at the mouth, cylindrical, 20-24 mm long, 8-9 mm diameter across the ovary. Fruit a capsule with many brown seeds with narrow membranous wings. *A. tweediae* is endemic to Karamoja and adjacent areas.

Aloe tweediae is common throughout Karamoja from Amudat, northwards to Moroto, Kongole, Kotido, Loyoro; also abundant SW of Kotido to the Labwor hills and from the Moroto turn-off to Napua Pass. Dense stands occur in Loroo, Amudat, Lorengedwat, Nadunget, Nakicumet, Kautakuu, Katikakire and Rupa areas. Other dense stands occur around Kotido particularly on the way to Abim. It occurs on well-drained dry sandy soils with grass in very open woodland; altitude between 1340-1670 m. Associated species include *Acacia mellifera*, *A. senegal*, *A. tortilis* and *Balanites aegyptiaca*.



Aloe tweediae at Lorengedwat



Natural "plantation" at Lorengedwat

2.3.2 Resource Maps and Inventory

The area covered by aloe resources in Karamoja Region is shown in Figure 2. Aloe resources cover an estimated area of 379,136 ha with a production potential of 35,915 MT. Kotido District has the highest amount of the resource (190,826 ha) and production potential (10,862 MT). Highest concentrations are found in limited areas around Kathile (4600 sph). However, most of the resource occurs in medium concentrations (182, 530 ha) in Kaabong, Kathile and Kacheri LCs. Densities varied between 1100 – 3300 sph with a mean of 2365 sph. Disparity was within the accepted limits (i.e. < 35%).

Moroto District has the second highest amount of resource (185, 957 ha) and production potential (18,958 MT) per year. Most of the resource is found in medium densities in Rupa, Lopei and Katikekile LCs. Mean density was 2367 sph but varied between 1600 – 3000 sph. Total area under Medium density was 140,623 ha with a production potential of 8,321 MT. Moroto and Ngoleriat LCs have high densities (6300 sph) covering a total area of 45,009 ha and potential production of 11,342 MT.

Nakapiripirit District has the lowest amount of resource. Total area was 133,759 ha with a potential production of 6096 MT. Most of the resource is concentrated in Amudat, Loroo, and Nabilatuk LCs within medium density class. Mean density was 1863 sph but varied between 1000 sph – 3200 sph. Total area for medium density class was 116, 691 ha with production potential of 5435 MT per year. High densities were observed around Lorengedwat (1263 ha) with a production potential of 305 MT per year.

COMMERCIAL ALOE RESOURCE MAP OF KARAMOJA REGION - UGANDA

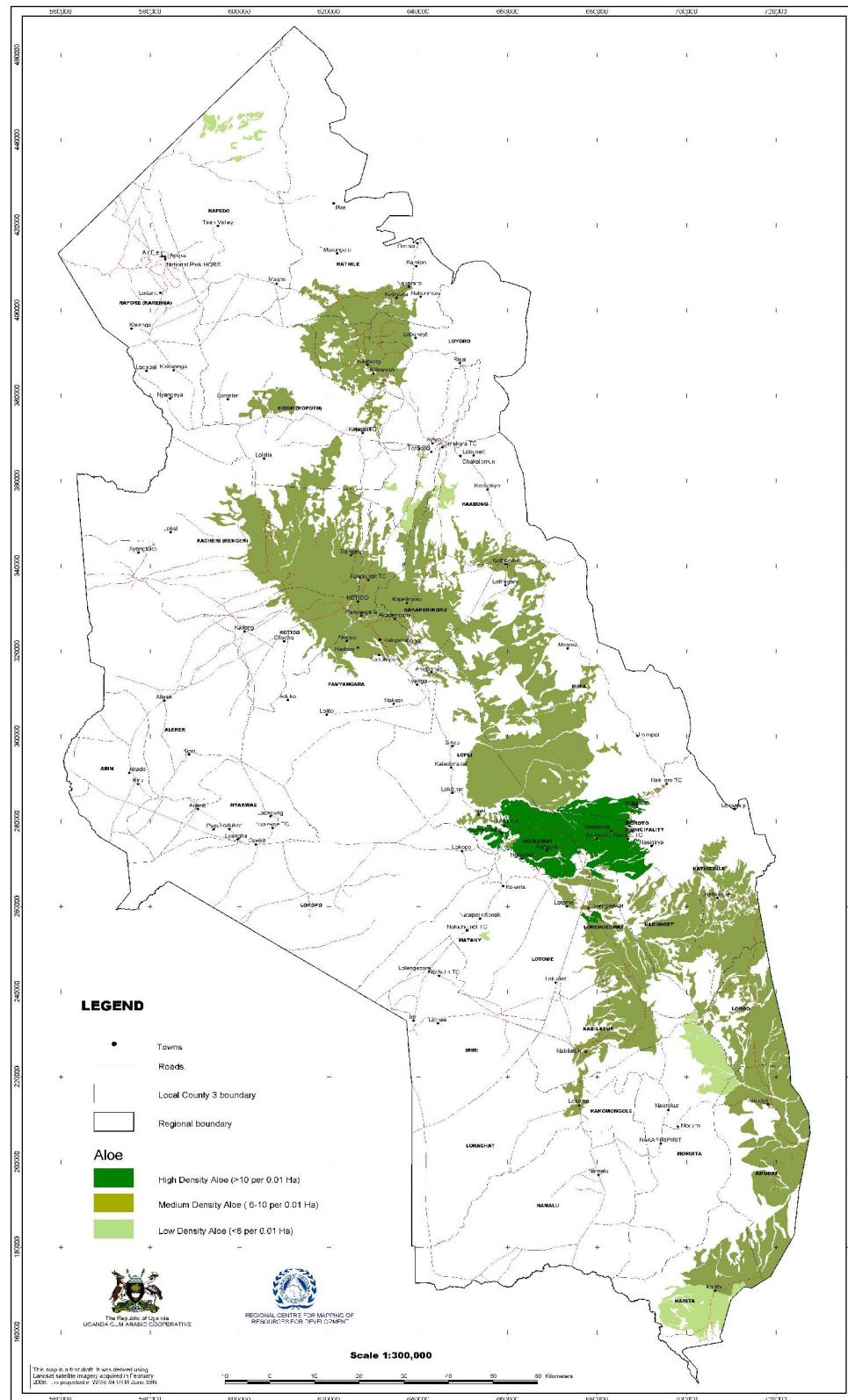


Figure 2: Commercial Aloe Resource Map of Karamoja Region - Uganda

Table c: Aloe

DISTRICT	Density Class	Mean Density (ha)	Area (ha)	Population (stems)	Estimated Yield (MT)
Kotido	Low	700.00	8,295.98	1,451,797	72.59
	Medium	2,363.00	182,529.69	215,658,829	10,782.94
	High	4,600.00	35.00	120,750	6.04
Subtotal			190,825.67	217,231,376	10,861.57
Moroto	Low	700.00	324.52	56,791	2.84
	Medium	2,367.00	140,622.87	166,427,167	8,321.36
	High	6,300.00	45,009.33	212,669,084	10,633.65
Subtotal			185,956.71	379,153,042	18,957.65
Nakapiripirit	Low	700.00	14715.08	2,575,140	128.76
	Medium	1,863.00	116690.95	108,697,620	5,434.88
	High	6,033.00	2352.80	10,645,832	532.29
Subtotal			133,758.83	121,918,592	5,868.45
TOTAL			510,541.21	718,303,010	35,915.15

3.0 Way Forward

A total of 291 Polygons were marked as potentially bearing gum arabic resources (both *A. senegal* and *A. seyal* species). Similarly 267 polygons were marked as bearing aloe resources. However, during the mapping and field inventory, 65 polygons for gum Arabic and 26 for aloe were visited and verified during the reporting phase, which was carried out under the “Fast tracking of the mapping and assessment of gum arabic and aloe resources” arrangement. The areas visited represent 22% for gum arabic and 10% for aloe respectively, of the total area identified as containing the resources and is likely to impact on the level of accuracy. It is recommended that more areas be visited during the medium and long-term development of gum arabic and aloe and the data generated used in updating the maps and inventory statistics. The data used during the mapping and inventory have been posted in the relevant NGARA and RCMRD databases.