



Puntland Date Palm Mapping Study Report



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LIST OF ACRONYMS

FAO	Food and Agriculture Organization of the United Nations
GAP	Good Agricultural Practices
GIS	Geographic Information System
GPS	Global Positioning System
HH	Household
ha	Hectare
ICRC	International Committee of Red Cross
IMC	Information Management Center for Water and Land resources
MoAI	Ministry of Agriculture and Irrigation
NBS	Nature Based Solutions
RS	Remote sensing
SWALIM	Somali Water and Land Information Management
VHR	Very High Resolution

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EXECUTIVE SUMMARY

This mapping in Puntland presents detailed analysis of date palm (*Phoenix dactylifera* L.) cultivation in Puntland covering four main regions of Puntland namely Raascasayr , Bari , Nugal , Sanaag and Karkaar. Using very high drone imagery , Field data collection from 966 farmers interviewed , the study mapped date palm areas under cultivation , Total number of trees grown , and assessed major challenges facing by the farmers for possible solutions.

The study findings show that Puntland has a total area of 2,409 ha under date palm cultivation supporting 347,033 trees . Despite that date palm has been practiced in Puntland for over centuries production remains low . Mos of the farmers continue to rely on indigenous or traditional verities and flooding irrigation which adversely limit productivity. Using both field and spatial data the average yield across Puntland is 12,146 tons per year.

The key challenges identified in the study included limited technical know-how , in adequate farm inputs , pests and diseases infestation (Red palm weevil) , poor post-harvest handling and poor market access due to inaccessible roads.

The study emphasis the need for improved extension services , adoption of modern technologies such as drip irrigation and tissue culture varieties and infrastructure development and strengthen farmers' technical capacities and addressing these barriers will significantly improve productivity , enhance household income and build the resilience of the date palm farmers across Puntland.

1. INTRODUCTION

1.1. Background

Puntland is semi-autonomous state that suites in northeastern of Somalia , with the major date palm production and potentiality in the country owing to its favorable climate and ecological conditions. The region’s favorable temperature and low humidity is an ideal environment for dating palm growth and that has been practiced for centuries by the local inhabitants.

The date palm (*Phoenix dactylifera* L.) is considered a symbol of life in the desert, because it tolerates high temperatures, drought and salinity more than many other fruits crop plant species. It is one of the oldest trees from which man has derived benefit, and it has been cultivated since ancient times(Lunde, P. (1978).

It the only indigenous wild desert plant domesticated in its native harsh environments appears to be the date palm (Zohary and Hopf, 2000). In Islam the date holds important value of serving vital source of dietary and as symbol of strength and endurance. In Arabic, it is known as al-nakhl, which etymologically means “good, nourishing and nice smelling.

The Arecaceae family comprises over 2,500 species and 200 genera, contributing significantly to global nutrition, health, and economies. Date palms can reach heights of 21–23 m, with leaves extending 4–6 m and consisting of up to 150 leaflets (Jaradat, 2016).

The exact origin of the date palm (*Phoenix dactylifera* L.) is lost in antiquity. However, it is certain that the date palm was cultivated as early as 4000 B.C. since it was used for the construction of the temple of the moon god near Ur in Southern Iraq - Mesopotamia (Popenoe, 1913; 1973).

More proof of the great antiquity of the date palm is in Egypt's Nile Valley where it was used as the symbol for a year in Egyptian hieroglyphics and its frond as a symbol for a month (Dowson, 1982). However, the culture of date palm did not become important in Egypt until somewhat later than that of Iraq (Danthine, 1937), about 3000 - 2000 B.C.

The date palm is a major agricultural crop in the Near East and North Africa, and it has historically related to sustaining human life in many of the hot and barren parts of the old world and has become an integral part of the culture and tradition of the people of these regions (Sawaya, 2000).

Date palm production is facing serious problems, such as low yields due to the lack of research, the spread of pests, as well as marketing constraints. Over the last decade, productivity has declined in the traditional growing areas Pests and diseases have caused significant effects upon date production in the Arab countries. *Rhynchophorus ferrugineus* Olivier known as Red Palm

Weevil is the most important pest of the date palm in the world. It is native and has been detected in many countries of southern Asia. Since the 1980s it has rapidly expanded its geographical range westwards and reached many countries in the Middle East and Europe. It is present in Egypt, Jordan, Iraq, Palestinian Authority Territories, Kuwait, Bahrain, Oman, Qatar, Saudi Arabia, United Arab Emirates, Spain France, Italy, Greece and Turkey (Malumphy and Moran, 2009).

Usually solitary palm, never thicket-forming, with trunk up to 20 m tall. in Somalia much shorter and up to 40–50 cm in diameter, leaves up to 3 m long, glaucous, with stiff rachis and scarcely curved , leaflets numerous up to 30cm length and 2 cm width. Inflorescences up to 60 cm or more long, pedunculate. Male flowers with inner tepals obtuse , Female flowers globose inner tepals rounded. Fruits 40–70 mm in length and 20–30 mm in width and their colors varies from yellow to orange-brown or almost black and the Seeds are about 24mm long and 6–8 mm wide (Thulin,1995).

As the Somalia faces rising food insecurity and unfavorable weather conditions, date palms offer a stable, long-term solution to sustain livelihoods, and generate income for families. The success of this date palm programme offers a blueprint for sustainable, resilient farming practices that can withstand even the harshest of conditions (ICRC,2024).

Although Somalia especially Puntland has a long history of date palm cultivation and had been key exporter of many Arab countries and beyond the records are limited and not well documented.

However, the due to the limited government attention in Puntland , the lack of studies in date palm production , poor road infrastructure , in adequate farming technologies and continued reliance of traditional farming practices inherited from parents and forefathers are usually practiced for date palm cultivation in Puntland regions , and no or limited training for date palm cultivation and production which is important for successful productivity of high yield production as indicated by (A. Zaid and P.F. de Wet) and (Glasner et al).

Furthermore, the date palm plays a very profound role in stabling land degradation by means of land reclamation , particular the coastal areas of Puntland which is affected by sand dunes .

Puntland Information Management center for water and land resources (IMC) in collaboration with Puntland Ministry of Agriculture and Irrigation(**MoAI**) carried out 2 months field date palm Mapping exercise . The study aims to explore and document the status of date palm cultivation in Puntland regions , number of trees per region , actual area Hecter under cultivation , identify challenges faced by farmers and propose appropriate solutions and recommendations.

2. OBJECTIVES OF THE ASSESSMENT

2.1. General Objectives

The general objective of the study was to assess the status of date palm production in Puntland , the actual area coverage , identify key challenges and suggest possible ways to improve date palm productivity in all the regions of Puntland.

2.2. Specific Objectives

- To assess the current status , area under cultivation , number of farms and trees grown in Puntland regions.
- To identify the major challenges face date palm production in Puntland regions.
- To propose possible strategies and sustainable solutions in date palm production regions in Puntland.

2.3. Soil Resources

Soil resources play a profound role in agricultural productivity across Puntland . The regions contain different soils which are identified as Regosols , leptosols , Cambisols , Arenosols and Gypsisols which together shape the agricultural in Puntland (FAO-SWALIM , 2020). These soil categories support date palm growth as they align soils requirements of date palm growth.

3. MATERIALS AND METHODS

3.1. Description of the Study Area

The study was conducted in Four regions in Puntland especially the Nugal, Bari , Sanaag and Raascasayr. These regions have long history in date palm cultivation which dates to centuries , although enough documentation is not made available these areas has been exporting the date fruits in the neighboring countries including Yemen. These regions characterized an average elevation ranging from 262 to 2,116 meters above sea level(a.s.l)

According to its climatic condition the Puntland region is considered as arid and semi-arid climatic zone with mean average rainfall less than 76 mm, per annum as recorded by 7 rainfall stations in Puntland, The area experiences a bimodal rainfall pattern , with the *GU'* season occurring from March to June followed by hot and dry period of *Hagaa* from June to September and *Deyr* season from October to December after which the region experiences cool long dry *Jilaal* period between November to February. The annual temperatures range between 27°C to 30°C and the community primarily depends on shallow wells, boreholes and natural springs as their main water sources. **(TS MERRA-2 Earth Skin Temperature (C)).**

The date Palm is harvested in one season by Puntland farmers which is autumn from August to September is after the soil begins to warm up.

3.2. Community Entry and Engagement

As community engagement plays profound role in local support and participation, IMC and Ministry of Agriculture conducted joint community engagement before data collection process began. These engagement sessions are intended to enhance the understanding of the different community segments for drone operations and planned field activities to ensure all community stakeholders including date palm farmers are well informed and support the Mapping study exercise.

3.3. Data Acquisition

The data acquisition for date palm production study was acquired using very high resolution (VHR) drone imagery to capture detailed spatial information on the distribution , density , area coverage , number of trees grown and extent of the date palm plantation in the selected regions in Puntland. The drone images provided precise and up to date information , enabling accurate mapping of date palm covered sites and detection of farm level variations. These high-resolution data sets serve as the primary source of information for analyzing the actual status of the date palm in those regions.

3.4. Sampling Procedure and Field Data Collection

The four regions of Puntland have experience for date palm cultivation and production, and the regions were purposely selected based on their long history in date palm cultivation, consumption and the fact of existing data gaps for date palm cultivation and its associated challenges.

In the study a total of 966 date palm farmers were interviewed across the target regions of Puntland and data collected through structured questionnaires were used to collect the primary data with focus on the knowledgeable people for date palm cultivation. In addition, direct observation was employed to generate primary data on the physical condition of the date palm production in the study area. A literature review was also conducted drawing available documents specific to the study area as well as other relevant documents available.

3.5. Date Palm Tree detection and Counting Using Machine Learning

Tree detection and counting were carried out using the acquired very high-resolution drone imagery of 2 to 5cm which allowed for precise identification of individual date palm crown.

The tree counts are intended to estimate the total number of tree species per farm and its densities. Validation is ultimately made by comparing the drone imagery derived counts and ground survey data and the results show reliable estimates of date palm trees distribution, density and areas under cultivation forming solid bases for the current date palm status in Puntland regions.

3.6. Geographic Information System (GIS)

Geographic Information System, which is a powerful tool of collecting, analyzing and displaying remote sensing data was employed in the study. This tool enabled the assessment team to digitize the actual area under cultivation, conduct trees count, identify the actual number of farms and produce statistical displays.

3.7. Data analysis

The analysis used combination of descriptive statistics and spatial analysis using Microsoft excel, and GIS tools.

The results were further processed to produce statistical summaries, tables, and chart representations. Microsoft excel was used to descriptive analysis including frequencies, percentages, and averages while the very high-resolution drone images was used to analyses date palm cultivation areas, detect and count the individual date palm trees and calculate the average Hectors per farm (ha) in Puntland regions.

4. RESULTS AND DISCUSSION

4.1. GENERAL DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

4.1.1. Gender of the respondents in the study area

Gender distribution of the respondents is presented in **Table (1)**. the data indicates, sex composition is largely influenced by the involvement of the date palm farmers in the date palm production . according to the field results (80.2%) of the respondents was male while only (19.8%) are female . This imbalance is the fact that date palm farming is physically demanding job, and this limits female involvement, and it additionally states that majority of the date palm farms are owned by male farmers.

Gender	Frequency of Respondents	Percentage%
Male	775	80.2%
Female	191	19.8%
Grand Total	966	100%

Table 1: Gender of the Respondents

4.1.2. Age group of Respondents

The age group distribution of the respondents is presented in **Table (2)**. The results show that the majority of respondents in middle aged and adults with (32.2%) aged 55 and above , (27.6%) between 45-54 , while (24.4%) 35-44 years , only (11.8%) aged 25-34 in the working age group and only (4%) were below 25 years. This is probably associated with the fact that the date palm cultivation is physically demanding job which requires both physical and mental matured personnel.

Age group	Frequency of Respondents	Percentage(%)
55 and above	311	32.2%
45-54	267	27.6%
35-44	236	24.4%
25-34	113	11.8%
below 25	39	4%
Grand Total	966	100%

Table 2: Age group of the Respondents

4.1.3. Education of Respondents in the study area

The results in **Table (3)** show that the majority of respondents 64.8% had no formal education , 13.7% attained Primary education level , while 12.2% was in secondary education level , about 8.5% reached college/University level and only 0.8% had vocational skills and technical training indicated mainly in general seminars. according to Ekwe et al.(2009) education is the most

important tool for attitude and personal change implementing that recommendation is very crucial.

Education	Frequency of Respondents	Percentage(%)
Non-Formal Education	627	64.8%
Primary Education Level	132	13.7%
Secondary Education Level	118	12.2%
College/University Level	81	8.5%
Vocational/Technical Training	8	0.8%
Grand Total	966	100%

Table 3: Education of the Respondents

4.2. Training received Date palm Farmer's

Majority of the date palm respondents noted that they lack Formal training on date palm cultivation with the majority (91.3%) lack specialized knowledge in date palm cultivation and expressed the need for targeted training particularly date palm harvesting, maintaining and fruit handling while 8.7% noted that they received general training on Good agricultural practices (GAP). Continuous extension services are crucial for improving production and productivity of date palms in Puntland regions.

Formal Training	Frequency of Respondents	Percentage(%)
No	882	91.3%
Yes	84	8.7%
Grand Total	966	100%

Table 4: Training of the Respondents Received

4.3. Average Yield Per Tree for the Last Harvest

According to the results in Table (5) indicate that most respondents (34.7%) indicated that 21-30kg is produced per tree in the last harvest, (31%) reported Less than 10 kg, 12.2% responded 10-20 kg, more than 70 kg, (9.1%), 31-40 kg, (8.2%) and only 4.9% 41-70 kg.

The results indicate that date palm production per tree varies widely among farmers, but most trees yield relatively low amounts. The largest proportion of respondents (90.9%) reported low yield per tree, showing that low productivity is common. Only a small proportion of farmers achieved Moderate yields (9.1%) (More than 70 kg per tree). Overall, the data suggests that date palm production is limited, likely due to traditional farming practices, limited access to improved varieties, and poor farm management techniques. This finding agrees with the Al-Marshudi (2002) and Al-Yahyai (2007), the yield of the date palm is considered to be low (40-80 kg/tree) compared to the yields in neighboring countries (i.e. Saudi Arabia and UAE). The yield is mainly caused by traditional farm management, high pest infestations and fully dependence on ground water extractions.

Category	Average Yield Per Tree	Frequency of Respondents	Percentage(%)
Low	<10-60 kg	878	91%
Moderate	70-100 kg	88	9%
High	>100 kg	-	0%
Total		966	100

Table 5: Average Yield Per Tree in the Last Harvest

The average yield for Puntland farms is 12.5 tons per year making the highest production in Somalia.

4.4. Types of Date Palm Cultivated in Puntland Regions

According to the survey findings of **Table (6)**, the date palm farmers in Puntland practice different cultivation methods with majority of the farmers (48%) practices Indigenous Traditional/Local varieties due to their long standing knowledge , adaptability to the local climate and cultural preferences inherited from their forefathers , (32%) Tissue culture/derived lab propagated belief of resistant to certain pests and only (20%) practice both varieties demonstrating how local farmers committed to improve their productivity amid of associated challenges.

Date Palm Types	Frequency of Respondents	Percentage(%)
Indigenous traditional local varieties	468	48%
Tissue culture derived lab propagated	305	32%
Both	193	20%
Grand Total	966	100%

Table 6: Date Palms Cultivated

4.5. Farm Management observed in Puntland Date Palm Farms

As shown in **Table (7)** of the results the most of date palm farmers in Puntland lack farm fences with (96%) of the respondents noted that their farms lack proper fences which makes them unsave for animal's intrusion meanwhile (4%) of the respondents indicated some form of farm protection , however these measures are not enough to protect as they rely on weak nets , Thony tree cover , and loosely built stone walls. To enhance farm Management and protection, a provision of durable fencing technologies must be supported by the farmers such as wire mesh , chain-link or concrete walls.

Farm Management	Frequency of Respondents	Percentage(%)
No	927	96%
Yes	39	4%
Grand Total	966	100%

Table 7: Farm Protections

4.6. Challenges of Date Palm production in Puntland regions

Many extreme weather events over the past 25 years had a negative impact on the agricultural sector of Somalia, the most important for the regional economy. (Sharmake et al., 2022).

The nature of the challenges and problems encountered by farmers vary depends on the variety of cultivated used, prevailing weather conditions, and cultural practices applied (Carpenter & Elmer, 1978).

Although various challenges affect by the date palm farmers

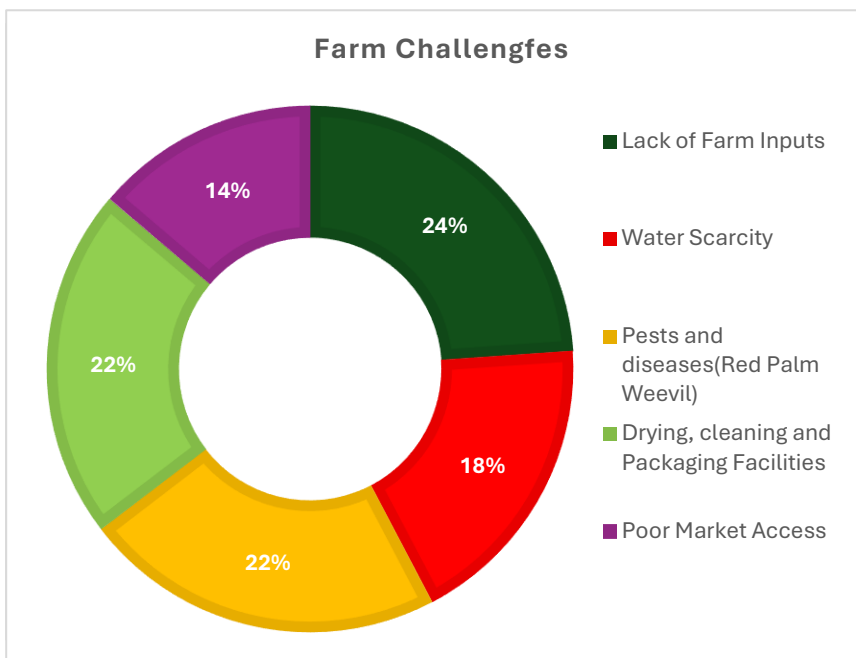


Figure 1: Farm challenges in Puntland regions

According to the respondents 24% of problems are due to lack of farm inputs such as quality seeds , and farm machinery , about 22 % are associated with pests and diseases, especially the Red Palm Weevil. Additionally, 22% of issues are linked to inadequate drying , cleaning , packaging and branding facilities . in addition, 18% is due to water scarcity and finally 14% of the challenges stem from a poor market access due to poor and inaccessible roads and this finding agrees with observation with Al-Yahyai R. and Manickavasagan A. (2012). According to the Spatial analysis there are poor agricultural practices in date palm farmers in Puntland as result of inconsistent tree spacing.

4.7. Irrigation methods used by Palm Farmers in Puntland

Irrigation Method	Respondents	Percentage(%)
Flooding Irrigation	896	93%
Drip Irrigation	70	7%
Grand Total	966	100%

Table 8: Irrigation Methods Used

Irrigation plays an important role in agricultural productivity, an especially important for date palm as it mainly grows sand soil with low water holding capacity. According to the survey results the majority of respondents (93%) indicated that they rely on flooding irrigation, 7% use drip irrigation this findings aligns with Liebenberg and Zaid (2002), who note that flood irrigation is

the oldest method known and widely practiced all over the world since its low labor cost , and easy to apply and however flooding irrigation is not suitable irrigation for date palm as it's hard to achieve high level production efficiency , labor intensive , irrigates no palm planted areas and not well suited in sand soil.

The study encourages the adoption of modern irrigation techniques, especially the drip irrigation for Puntland date palm farmers is essential . Drip irrigation provides more efficient use of water , low running cost , easy to schedule and manage , topography is not limited, and it applies water needed directly to the palm, it's not influenced by wind, easily automated and not labor intensive (Liebenberg and Zaid, 2002).

4.8. Economic Significance of Date Palm to Household Income in Puntland

The results in the above **Table (9)** revealed that the majority of the respondents (57.7%) of the date palm contributes less than 25% of their family income , while (22.7%) indicated that 25-50% and (15.4%) reported contribution of More than 75% and only (4.2%) indicated 51-75% this shows that the date palm income plays minor role in family income in Puntland regions to enhance the economic contribution of date palm to the households income , there is need to be improved the value chain of the date palm including post harvesting handling , storage and packaging and enhancing market access while encouraging private and external investments sector participation in to expand commercial opportunities.

Income Contribution	Frequency of Respondents	Percentage(%)
Less than 25%	557	57.7%
25-50%	219	22.7%
More than 75%	149	15.4%
51-75%	41	4.2%
Grand Total	966	100%

Table 9::HH Income Contribution

4.9. Date Palm Farms Storage Facilities in Puntland

The survey results show in **Table(10)** that the majority of date palm farmers (94%) do not have storage facilities for their date palm productions while only (6%) have some access to storage facilities. This indicates that there is significant gap for post harvesting capacity for the farmers, highlighting the need for improved storage infrastructure facilities including grading and sorting units , cold rooms , ventilated dry warehouses, freezing and cold chain transportation system.

Storage	Frequency of Respondents	Percentage(%)
No	908	94%
Yes	58	6%
Grand Total	966	100%

Table 10: Farm Storage Facilities

5. The Main Water Sources for Date Palm in Puntland

The study revealed that the primary sources of water for date palm farms in the study area are shallow wells which account for more than half of the water supply (62.4%) , followed by Natural springs of (25.4%), Boreholes of (8.8%) , Berkads of (2.5%) , rainwater harvesting of (0.7%) and only (0.2%) rely on Dams.

This indicates that a high dependence of groundwater for shallow wells , natural springs and boreholes together make an over 84% of the total of date palm irrigation in Puntland regions. As these sources play key role in water demand protecting them through sustainable water harvesting is essential to ensure long term sustainability of underground water resources and date palm production. The study provides that the farmers require support to inform them of solarization and renewable energy alternatives as substitute for diesel powered motor generators , efficient irrigation systems , water solutions and this will enhance the date palm productivity and increase water use efficiency for date palm farmers in Puntland.

Water Sources	Frequency of Respondents	Percentage(%)
Shallow Wells	603	62.4%
Natural Spring	245	25.4%
Borehole	85	8.8%
Berkad	24	2.5%
Rainwater	7	0.7%
Dam	2	0.2%
Grand Total	966	100%

Table 11: Water Sources

5.1. Major Date Palm Varieties

According to the field data collected Puntland date palm cultivators use to grow the following as main date Palm varieties :

- **Majhool**
- **Ajwa**
- **Khalas**
- **Sukkari**
- **Barhi**
- **Sultana**

These varieties are not native, and their cultivation is driven by their superior productivity and good market value. Despite the preference of those exotic species native varieties of Miro-cad, Miro-guduud and Naaso lo'aad remain important for being adaptive to the climate of Puntland and contribution to resilience.

6. SPATIAL DATA ANALYSIS

6.1. Regional distribution of Date Palm Farms in Puntland

Region Name	Total Area in ha	Number of Trees
Raascasayr	2,067ha	297,627
Nugal	29.6 ha	4,262
Karkar	3.8 ha	548
Bari	285 ha	41,073
Sanaag	24.5 ha	3,523
Total	2,409 ha	347,033 Trees

Table 12: Regional Date palm Farm distribution

Date Palm farms in Puntland are differently distributed in Nugal , Karkar , Raascasayr , Bari and Sanaag regions of Puntland with Raascasayr region has the largest area (2,067 ha) and Total number of trees (297,627) making the dominant date palm grown zone in Puntland . Bari follows with (285 ha) and 41,073 Trees showing substantial production footprint in date palm production

Nugal and Sanaag have moderate Date Palm farms with Nugal region farm covering of (29.6 ha) and Total tree of (4262.1) while Sanaag region comprises of (24.5 ha) with a total of trees (3,523). Karkaar represents the least and smallest producing region for date palm with only (3.8 ha) and total trees of (548).

Puntland has an overall of 2,409 ha under date palm cultivation and supporting 347,033 date palm trees with most of its farms distributed near water sources.

7. CONCLUSION AND RECOMMENDATION

7.1. Conclusion

The date palm production in Puntland regions has a long history dating back to centuries which is practiced by pastoral , agropastoral , frankincense collectors and fishing communities in Puntland.

The date palm contributes to minor household income and most farmers practice date palm at subsistence level with limited adoption for improved production techniques , the farmers use traditional varieties for date palm which is low income contribution , challenges such as limited technical knowledge , inadequate extension services , lack of farm inputs such as quality seeds , and farm machinery including inadequate drying , cleaning , branding and packaging facilities , associated with pests and diseases especially the Red Palm Weevil and Termites , poor market access due to inaccessible roads , and water scarcity are affected the region.

7.2. Recommendations

To address these challenges collaborative and comprehensive approach is required for improvement in all aspects of the date palm value chain including :

- Enhanced extension services through regular farmer training specialized for date palm on modern date production , pests and disease control and post-harvest handling.
- Initiation of Tissue Culture Laboratory in Puntland
- Improving the Puntland region's road infrastructure and accessibility can also improve and support farmers market accessibility and income opportunities.
- Encourage private sector participation in processing , packaging , branding and marketing for value addition.
- Promote Water harvesting techniques through solarization and integrated water resources management.
- Strengthening disease and pest surveillance department for targeting termites and red palm weevil for date farmers.
- Promote modern irrigation techniques of irrigation to improve water efficiency and reduce costs.
- Support research and documentation to fill existing knowledge gaps for proper decision making.

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Annex 1: Date Palm Field Photos in Puntland



Annex 2 : Selected Date Palm Map's

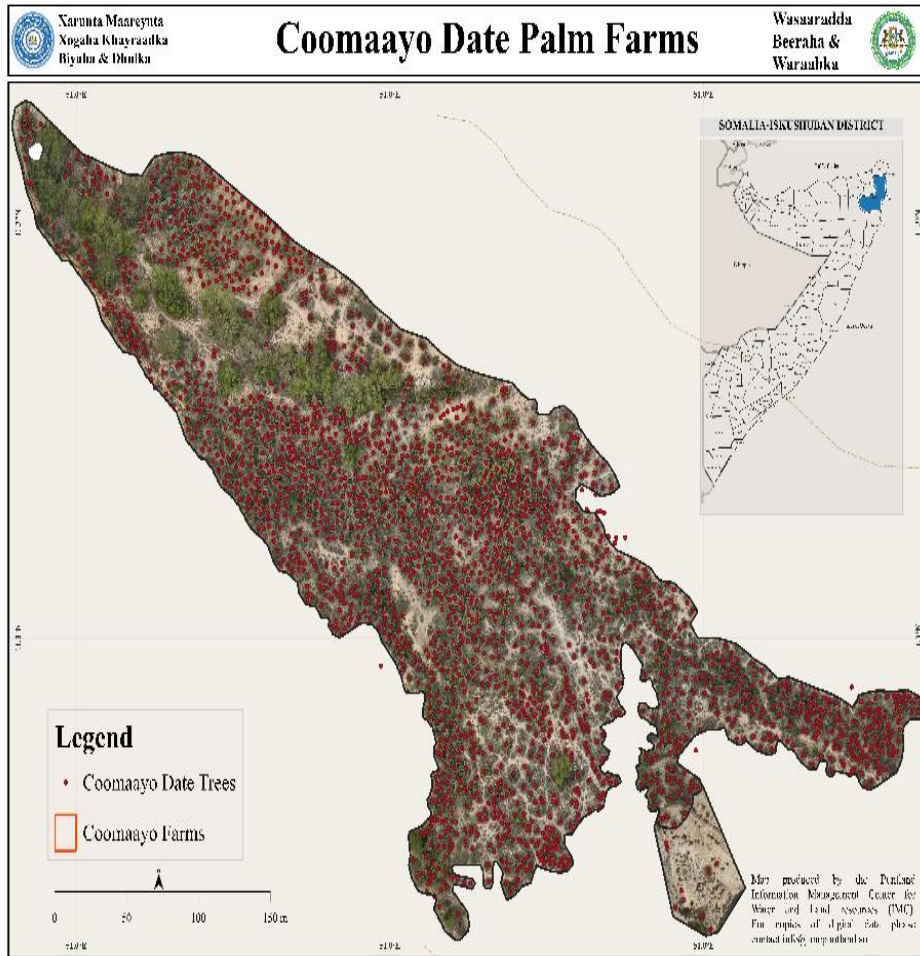


Figure 1: Coomaayo in Raasacayr Region

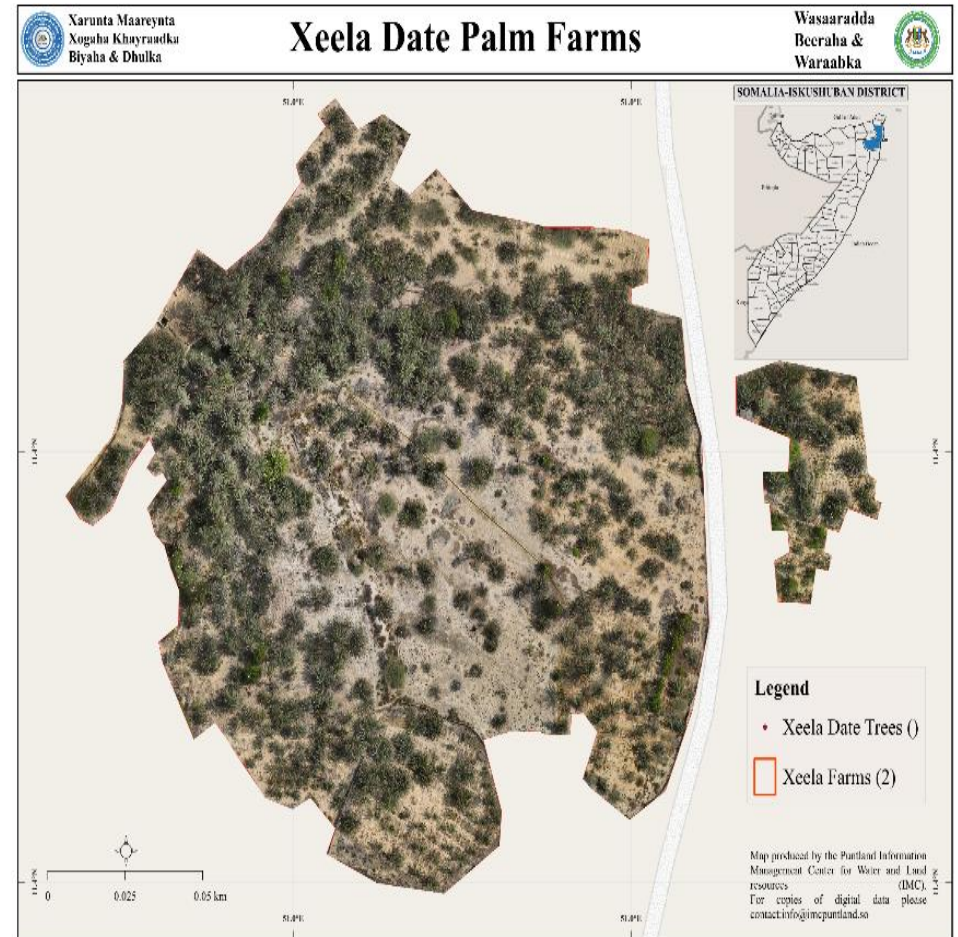


Figure 2: Xeela in Raasacayr Region

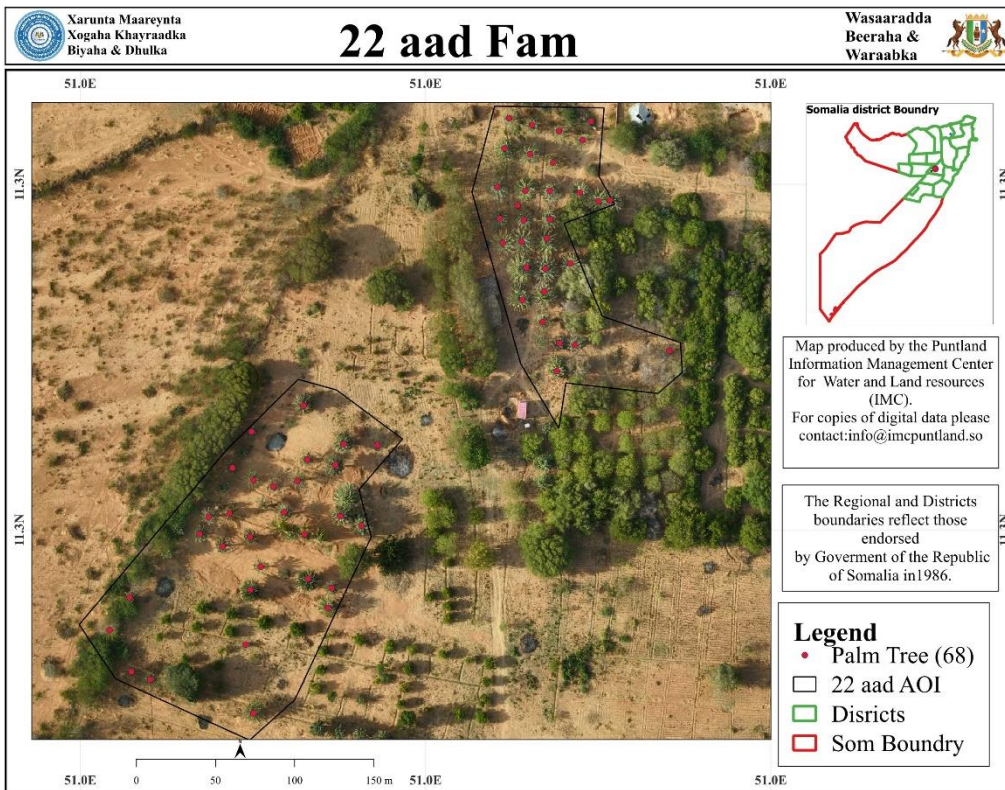


Figure 4: 22aad in Nugal region

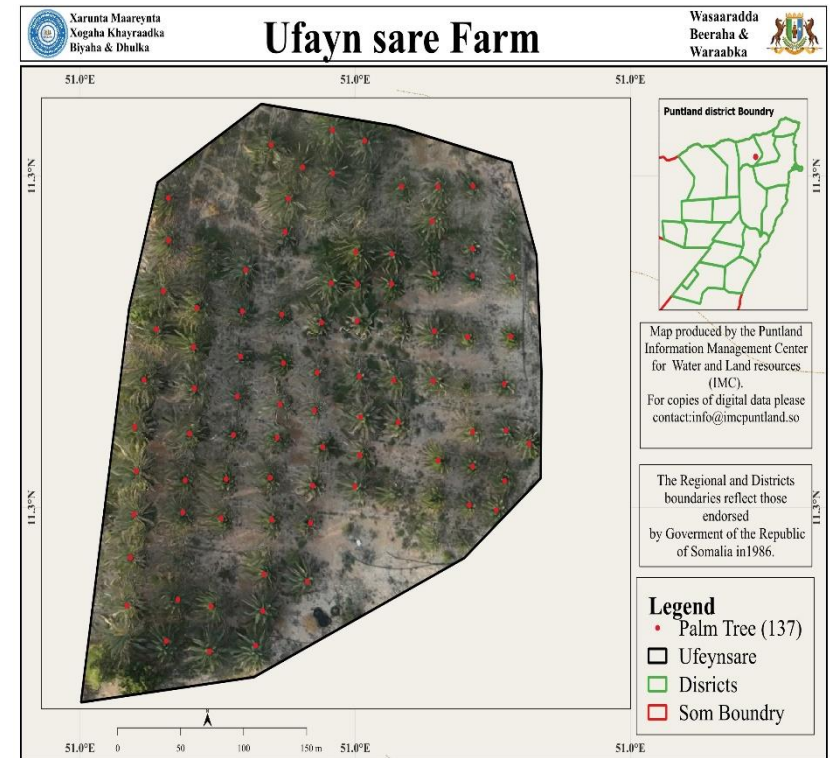


Figure 3: Ufeyn sare in Bari region



Figure 5: Geesalay in Raasacasayr Region



Figure 6: Xalwad in Raasacasayr region



Puntland Date Palm Sites

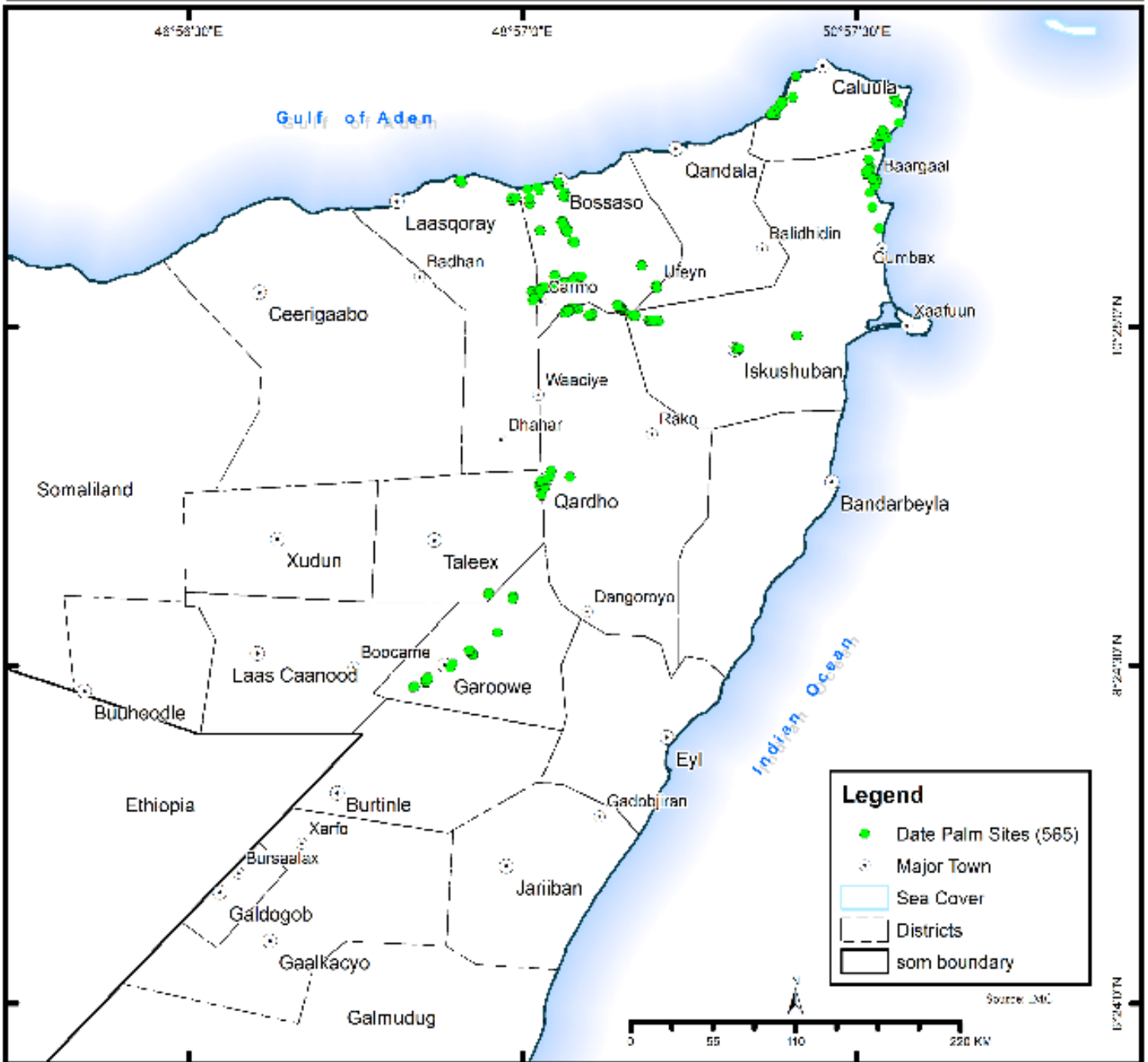


Figure 7: Puntland Date Palm Sites