

## Changing Pattern of Arecanut Plantations in Gondi Irrigation Command area

### Background

Arecanut (*Areca catechu* L.) is one of the major plantation crop in the world and is predominantly grown in India by small and medium farm holders. Generally, the arecanut plantations used to be cultivated along the small valleys in the Western Ghats regions of Karnataka, Kerala and in the north eastern states where water availability has been adequate for the plantation. In the recent decades arecanut cultivation has extended beyond hilly regions to plain lands of Karnataka where most of the irrigation requirement is met through groundwater. Expansion of arecanut plantations in canal irrigated command area is of importance as the cultivation of normal cereals and other field crops is replaced with perennial plantation. Arecanut plantations in an irrigated command like Gondi Irrigation Project is of such cases where plantations are seen in plain terrain.

The Gondi Anicut is built (1923) across river Bhadra, near Gondi village located at 11.56 Km from Bhadravati town, Bhadravati taluk Shivamogga district (Lat:13 0 46' N, Long:75 0 41' E) two canals and irrigation, as per the available information; was commissioned during 1926-27. The Gondi Irrigation Project has a cultural command area is 4,600 ha. Paddy, sugarcane and other field crops used to be grown with the help of canal water. Arecanut is the major horticultural crop cultivated in the command.

### Objectives

- To estimate the current extent of Arecanut plantation in Gondi command area and to understand the pattern of incremental expansion of arecanut over a decade
- To explore the feasibility of open source platform GIS tools for both image processing and map composition
- To study the feasibility of archived IRS data for land use change studies

### Methodology adopted

#### 1. Image Selection

Arecanut being a perennial plantation, can be easily distinguished during the period from December to January as other irrigated field crops are normally absent. In Gondi Project, the first crop season starts from July and the canal closes by November. The second season start of canal flow is from end of January and closes by March – April. Main crops irrigated are paddy, sugarcane and other field crops besides arecanut. As the command area would not have field crops between December to January, arecanut can be distinguished. Details

of the toposheet coverage of the Gondri Irrigation Command area and the date of image acquisition are listed in Table below:

<b>Details of LISS III Images Used for the Study</b>					
<b>Sl. No</b>	<b>Toposheet No.</b>	<b>Bounding Box</b>	<b>Toposheet No.</b>	<b>Bounding Box</b>	<b>Date of Pass</b>
1	D43J12	75.5E14.0N-75.75E14.25N	D43P09	75.5E13.75N-75.75E14N	17-Dec-11
2	D43J12	75.5E14.0N-75.75E14.25N	D43P09	75.5E13.75N-75.75E14N	27-Feb-12
3	D43J12	75.5E14.0N-75.75E14.25N	D43P09	75.5E13.75N-75.75E14N	04-Jan-13
4	D43J12	75.5E14.0N-75.75E14.25N	D43P09	75.5E13.75N-75.75E14N	23-Jan-14
5	D43J12	75.5E14.0N-75.75E14.25N	D43P09	75.5E13.75N-75.75E14N	20-Dec-15
6	D43J12	75.5E14.0N-75.75E14.25N	D43P09	75.5E13.75N-75.75E14N	13-Jan-16
7	D43J12	75.5E14.0N-75.75E14.25N	D43P09	75.5E13.75N-75.75E14N	19-Jan-17
8	D43J12	75.5E14.0N-75.75E14.25N	D43P09	75.5E13.75N-75.75E14N	14-Jan-18

## 2. Base layer preparation

Base layers are prepared using Bhuvan web site (<https://bhuvan.nrsc.gov.in/>). Using the menu for high resolution satellite image and Draw tools, the Command area boundary, extent of Built-up area and water bodies were digitized. The base map was kept as reference for other processes.

## 3. Downloading of LISS III data (Resourcesat-1/ Resourcesat-2)

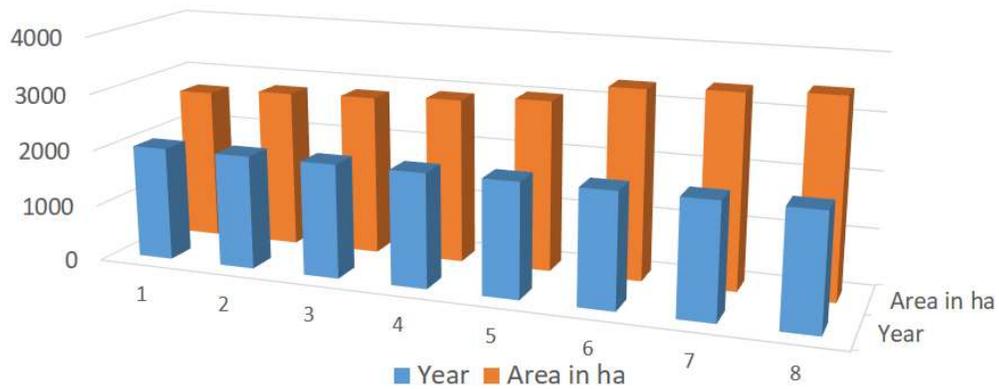
The satellite data are downloaded using the Bhuvan website (<https://bhuvan.nrsc.gov.in/>). With the help of Open Data Archives, LISS III images from Resourcesat-1/Resourcesat-2 were identified and using the Bounding Box and / or Map sheet/Tiles/Interactive drawing tools the selected image tiles were downloaded.

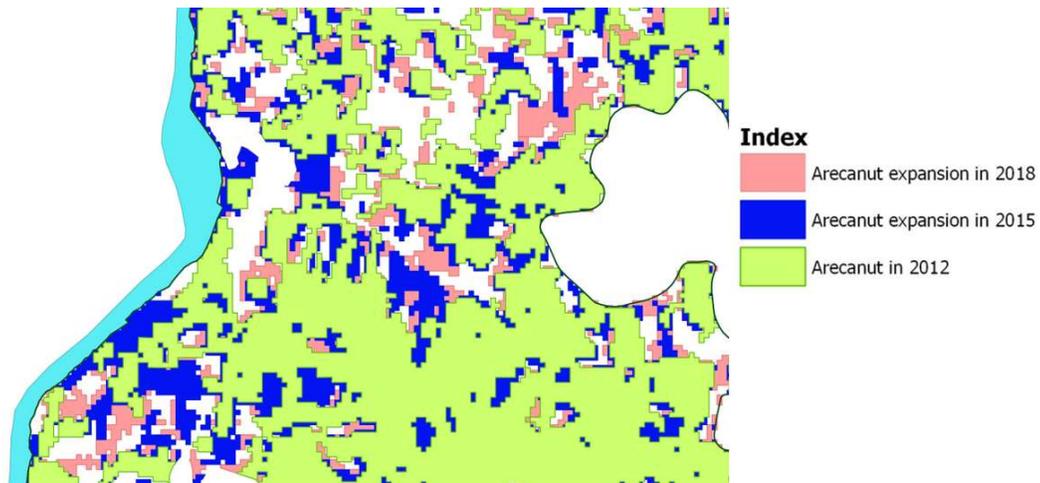
## 4. Supervised Classification for extracting the Arecanut Plantation using QGIS

QGIS 3.4 GIS was used for processing of the LISS III images. Standard FCC were generated for all the years using appropriate image enhancement techniques. Later all the FCCs were subjected to supervised classification using the Semi-Automatic Classification Plugin (SCP) for the QGIS. Limited ground validation of the arecanut plantation was made and the training sets were refined and the process was adopted for the images of all the years. The classified data was directly converted in vector format and area estimates were tabulated. The area statistics are provided only for arecanut plantation for different years.

Extent of Arecanut Plantation in Gondri Irrigation Command Area			
Cultivable Command Area of Gondri Irrigation Project: 4,600 ha.			
Sl. No.	Year	Area in ha	Incremental expansion in % w.r.t base year (2011)
1	2011	2691	Base year - 100
2	2012	2791	104
3	2013	2829	105
4	2014	2907	108
5	2015	3012	112
6	2016	3333	124
7	2017	3394	126
8	2018	3458	129

Incremental expansion of Arecanut in Gondri Irrigation Command





Expansion pattern of Arecanut Plantation in Gondi Irrigation Command Area

## Conclusion

1. The image characteristics of arecanut plantation like zonality, structure and tone that are normal in the hilly terrain are not observed in the Gondi Irrigation Command which is almost a plain terrain.
2. Supervised classification has been able to differentiate area under arecanut plantation. There are few locations where coconut is grown as mixed crop and further, young plantation that have not developed good canopy could not be delineated. More training sets and high resolution (providing more insights on canopy/ crown density) may provide better results.
3. The LISS III data archives was helpful in getting the images of desired cropping season for all the years and facility provided in the Bhuvan could be conveniently used for the study. The open source platform of QGI along with plugin have been helpful to derive the results efficiently.
4. Historical data indicate that since the region covered by Gondi Irrigation Project, cropping pattern shifted from dry cultivation to paddy cultivation and later more towards sugarcane. Though it is difficult to interpret (in the absence of reliable spatial data like images) the extent of arecanut prior to 2011, subsequent increments are indication of shift towards commercial (horticultural) crops.
5. Recent report related to modernization of canals in the Gondi Project with the assistance of Asian Development Bank indicates that area under arecanut is 3368 Ha. and coconut is 103 Ha. The results of image processing indicated that the total extent of arecanut is 3458 Ha. As it was not possible to distinguish arecanut and coconut separately (many a times grown as mixed), the results are comparable.
6. Since arecanut requires more water than paddy, area and pattern of distribution are important for water management.