



# Mangrove Mapping of Uttara Kannada District

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**Abstract**– This study has mapped mangrove habitat and assessed the mangrove potential area with the use of Remote sensing imageries of MODIS, IRS & Google maps of different years and integrated with geographic information system (GIS) in the entire Uttara Kannada District Karnataka State, India. The results are important to planning and sustainable management of natural resources. Mapping reveals mangrove area of 1119.73 hectares and potential area of 1786.75 hectares.

**Keywords**– Coastal ecosystems, Mangroves, Uttara Kannada District,, Estuaries, Creeks, RS-GIS,

## INTRODUCTION

Mangrove vegetation (*Kandla* in Kannada) is a characteristic plant community growing in the coastal zones of tropics and sub-tropics. Mangroves consist of a group of mostly woody plants which grow in the zone between high tide and low tide in estuaries and other backwaters, and cannot grow anywhere else. Mangroves form the foundation of a highly productive and biologically rich ecosystem which provides a home and feeding ground for a wide range of species, many of which are endangered. They are highly valuable ecosystems, providing an array of essential goods and services which contribute significantly to the livelihoods, well-being and security of coastal communities. Mangroves deliver a range of economic, social and environmental benefits to people, collectively referred to as their ecosystem goods and services. Many of the services provided by healthy intact mangroves are not marketable goods and this means that they are often undervalued in market based cost benefit analyses. The accelerating destruction of natural habitats and consumption of natural resources by rapidly expanding human populations has caused huge impacts to ecosystems across the globe (Defeo *et al.* 2009). Many of these impacts are focused on world's coastlines that include a mosaic of mangrove ecosystems. Thus, there is a demand to assess the mangrove ecosystems at national levels to satisfy a great number of needs, including scientific ones as well as planning and environmental managements in conservation efforts.

**Importance in Indian context:** Realizing the importance of mangroves the Government of India, vide CRZ Notification of 1991, has proclaimed mangroves as vegetation to be protected as CRZ-I. The Ministry of Environment and Forests initiated a

series of measures to enrich estuaries and other suitable coastal backwaters with mangrove vegetation. The CRZ-2011 has also considered mangrove areas as inviolable. The Government, both Centre and State are working together for mapping mangrove areas, countrywide, to declare them as 'ecologically sensitive areas' under the CRZ-I category.

**Importance of Mangrove Mapping:** Mapping of natural resources is a key component of many planning applications. When the public views an application, they may not fully understand what the application entails. Therefore, plans and drawings are a valuable communicative tool within the realm of the planning process. The west coast estuaries, despite their high productivity and biodiversity, faced neglect regarding mangrove conservation and development programmes, probably on account of lack of data. These estuarine regions, densely populated due to high productivity, are prone to rising human pressures causing greater mangrove fragmentation and losses. The lack of spatial quantitative maps on mangroves for the west coast has often crippled restoration programmes. In the Uttara Kannada district of Karnataka State, mangrove planting works in the small estuaries attempted during the recent years have raised high hopes of better ecology and higher biological production. Yet the local forest departments, which manage most mangrove areas, are to be equipped with spatial, quantified data on mangroves and potential area for mangrove planting. The district has three agro-climatic regions - coastal, Ghats and Plains region. Kali, Gangavali, Aghanashini, Sharavathi and Venkatapur Rivers are the important rivers of the district having their estuaries with most of the mangrove areas. In addition are some minor rivers/rivulets/creeks such as Belikeri river, Kumta creek, Sankandhole (Ankola creek) and Belamber creek are other coastal water bodies where mangroves are situated. The notable earlier works on mangroves in the district were by Ananda Rao (2001) and Andrade (2003). M.D.Subhash Chandran(2012). The Forest Survey of India estimated just 2 sq.km of mangroves in the State of Karnataka, during 2001,

### OBJECTIVES

The overall objective of the present study was to map mangrove habitat areas with the use of satellite images integrated with geographic information system (GIS). Using open source GIS software (QGIS) and remote sensing software (GRASS) and IRS imageries and Google satellite images mangrove areas and potential areas available for planting in river estuaries and creeks in the Uttara Kannada district of Karnataka State were mapped.

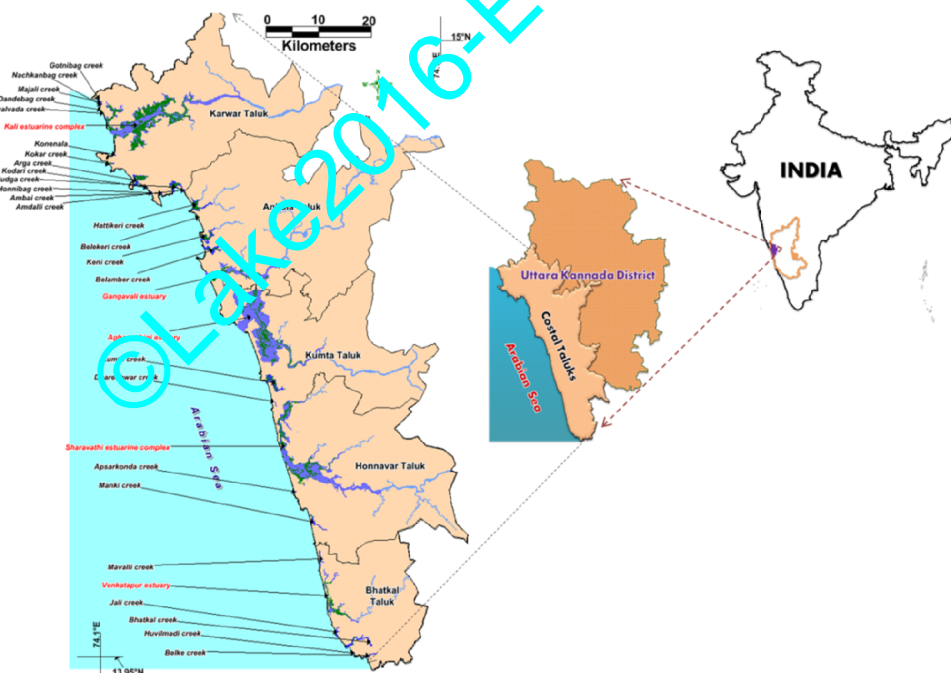
The study of this nature, using GIS and remote sensing are handy tools for scientific planning and management of mangroves even at a micro-level. The applicability of such modern techniques to micro-level mapping of mangroves, for depicting potential mangrove areas, assessing threats to mangroves through diversion of mangrove areas etc., for the relatively smaller west coast estuaries and creeks, is expected to pave way for increase in area under mangroves and improve the efficiency of mangrove management even at the village level.

- To study estuaries and creeks of Uttara kannada district for mangroves and estimate and map potential area available for planting with mangroves, estuary-wise.
- To document mangrove species diversity and distribution of mangroves, species-wise, in estuaries in relation to salinity and sediment conditions.
- To recommend suitable species for planting in demarcated potential areas.

### MATERIALS AND METHODS

**Study area:** Uttara Kannada District is the northernmost district located on the west coast of Karnataka. The district has 11 Taluka out of which Karwar, Ankola, Kumta, Honnavar and Bhatkal are coastal taluks. District is situated within Northern latitude 13° 55' 28" to 15° 31' 26" and Eastern longitude of 74° 5' 9.8" to 75° 6' 12.7". (Fig. 1) The total notified forest area in the District is 813,595 Hectares.

**Fig. 1; Map showing location of estuaries and creeks of Uttara kannada district**



**Materials used:** GPS, Water analyzing Kit, Sediment grabber, Survey of India Topo-sheets (1:50,000 scale), Census Village maps, Remote sensing imageries of MODIS, IRS & Google maps of different years.

### METHODS:

#### Area calculation using GIS:

*Step 1:* Mangrove areas (areas under canopies of mangrove crowns) and Potential areas (exposed areas during low tides, without mangrove crowns, excluding seasonal sand bars and bivalve beds) have

been digitized as separate vector polygon layers using Google Earth, Bing map & Geo-referenced IRS images.

*Step2:* These polygons (regions) are overlaid on Revenue Taluk ADM vector (based on Census 2001) and split using polygon split into Taluka as a units

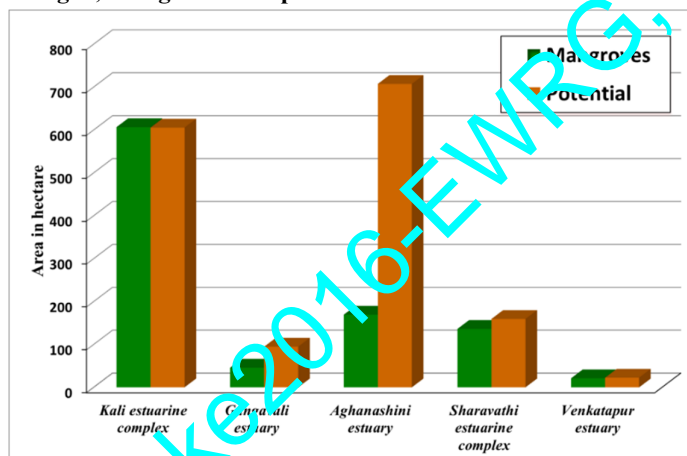
*Step3:* Each region's spatial tables are updated with coordinate extractor, region area (in ha) and perimeter. Data is converted in to GPX format and uploaded into GPS.

*Step4:* Using GPS, sample regions are surveyed for species distribution & some decisive hydro-biological parameters, especially salinity and associated mangroves, incorporated in the region. Using this data Isolines are created for possible distribution of such parameters in the estuaries and creeks studied.

**RESULTS & DISCUSSION**

**Estuary and creek wise mangrove situation in Uttara Kannada District:** Among the estuaries Kali estuarine complex topped the list with 606.47 ha of mangroves and 605.48 ha of potential area for planting followed by Aghanashini estuary (169.38 ha and 707.3 ha respectively) and Sharavathi-Badgani estuarine complex (136 ha and 136.24 ha respectively) (Table 1 & Figure 2) apart from this Gangavali estuary (45.81 ha and 94.78 ha respectively) and Venkatapur estuary (21.12 ha and 22.51 ha) to a lesser extent. Among the creeks more than ten hectare mangrove area found in Mudga, Arga, Hattikeri, Keni and Kumta creeks. (Table 1 & Figure 2-3)

**Fig. 2; Mangroves and potential in estuaries of Uttara Kannada district**

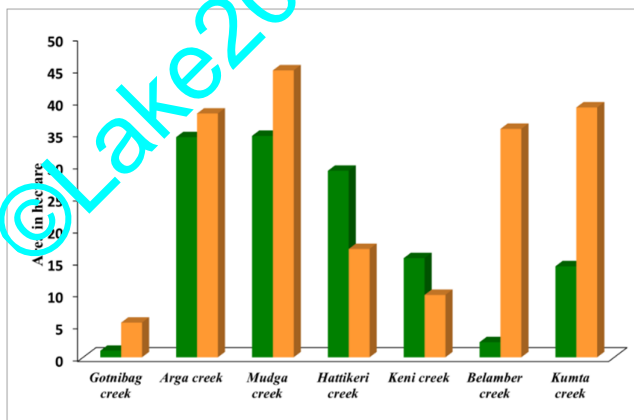


**Table 1: Estuary creek wise Mangroves and potential area of Uttara Kannada District**

Sl.No	Estuary/Creek	Estuarine water spread Area in hectare	Mangroves Area in hectare	Potential Area in hectare	Longitude	Latitude	Taluka
1	Gotnibag creek	9.87	1.03	5.41	74.0967	14.9007	Karwar
2	Majali creek	5.53	0.03	1.51	74.1009	14.894	Karwar
3	Nachkanbag creek	2.42	0.09	0.71	74.1016	14.8905	Karwar
4	Dandebag creek	0.96	0.10	-	74.1009	14.881	Karwar
5	Uyalvada creek	0.77	0.06	-	74.1051	14.8762	Karwar
6	<b>Kali estuarine complex</b>	<b>4452.94</b>	<b>606.47</b>	<b>605.48</b>	<b>74.2314</b>	<b>14.8654</b>	<b>Karwar</b>
7	Konenala	3.44	0.03	0.06	74.1252	14.8046	Karwar
8	Kokar creek	9.26	0.43	0.24	74.115	14.7895	Karwar
9	Arga creek	179.96	34.37	38.05	74.1644	14.7609	Karwar
10	Kodari creek	7.02	0.55	1.13	74.1815	14.749	Karwar
11	Honnibag creek	2.56	-	-	74.1914	14.7397	Karwar

12	Ambai creek	3.09	-	2.36	74.2078	14.7388	Karwar
13	Mudga creek	162.33	34.56	44.79	74.2334	14.7502	Karwar
14	Amdalli creek	5.36	-	-	74.2474	14.7442	Karwar
15	Hattikeri creek	175.33	29.12	16.91	74.2688	14.7197	Ankola
16	Belekeri creek	2.66	1.14	-	74.2739	14.6985	Ankola
17	Keni creek	151.00	15.48	9.74	74.2853	14.6663	Ankola
18	Belamber creek	155.57	2.36	35.65	74.2982	14.6422	Ankola
19	Gangavali estuary	769.65	45.81	94.78	74.3931	14.603	Ankola, Kumta
20	Aghanashini estuary	5235.76	169.38	707.3	74.3856	14.5083	Kumta
21	Kumta creek	238.15	14.21	39	74.408	14.4154	Kumta
22	Dhadeshwar creek	4.02	1.39	1.19	74.4056	14.3843	Kumta
23	Sharavathi estuarine complex	3229.17	136.24	159.47	74.4254	14.3087	Honavar, Kumta
24	Apsarkonda creek	1.30	0.14	-	74.438	14.2301	Honavar
25	Manki creek	21.63	0.62	0.46	74.4766	14.1784	Honavar
26	Mavalli creek	17.80	3.06	-	74.4915	14.1168	Bhatkal
27	Venkatapur estuary	219.17	21.12	22.51	74.5011	14.0536	Bhatkal
28	Jali creek	5.40	0.02	-	74.517	13.9918	Bhatkal
29	Bhatkal creek	53.22	1.69	-	74.5759	13.9753	Bhatkal
30	Huvilmadi creek	1.37	0.10	-	74.5474	13.9561	Bhatkal
31	Belke creek	5.97	0.12	-	74.5736	13.952	Bhatkal
<b>Total</b>		<b>15132.66</b>	<b>1119.73</b>	<b>1786.75</b>			

Fig. 3; Mangroves and potential in major creeks of Uttara Kannada district



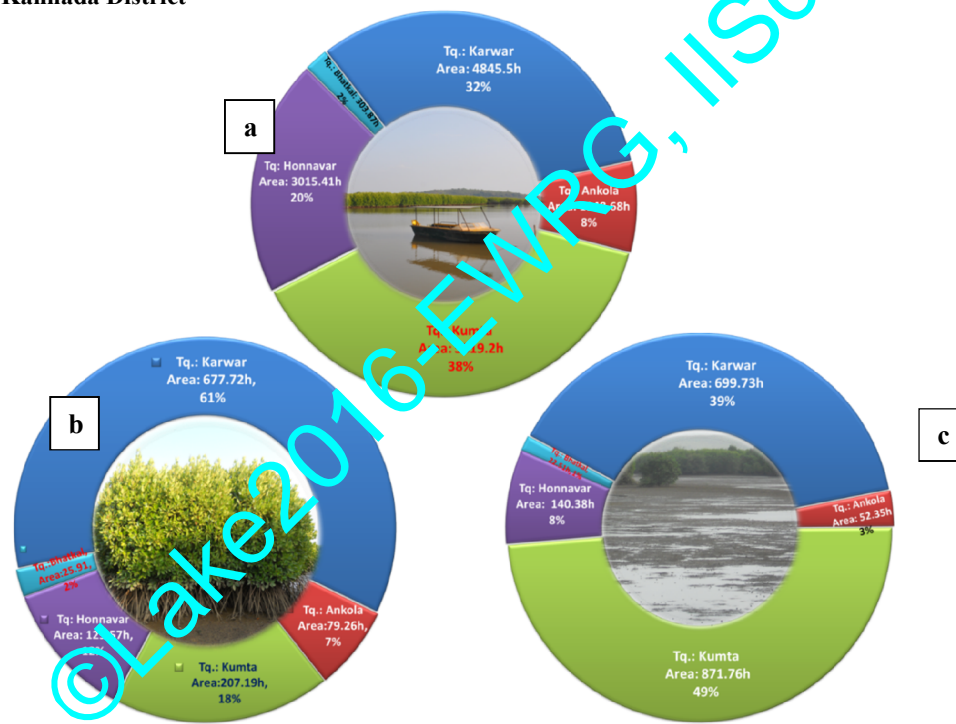
**Mangrove area estimates:** Of the 15132.66 ha of Uttara Kannada district estuarine water spread area of 5819.2 ha (38%) fall in Kumta taluk, Karwar taluk contributed 4845.5 ha (32%) and 3015.41 ha (20%), 1148.68 ha (8%), 303.87 ha (2%) in Honnavar, Ankola and Bhatkal taluka respectively. (Table 2 & Figure 4). Mangrove occurs in all five coastal taluks of the district. By far most area under mangroves in creeks of Uttara Kannada District is under Karwar taluk. This taluka has 13 creeks namely Gotnibag

creek (9.87 ha), Majali creek (5.53ha), Nachkanbag creek (2.42ha), Dandebag creek (0.96ha), Uyalvada creek (0.77ha) of northern part of Kali river and in south Konekala (3.44ha), Kokar creek (9.26ha), Arga creek (179.96ha), Kodari creek (7.02ha), Honnibag creek (2.56ha), Ambai creek (3.09ha), Mudga creek (162.33ha), Amadalli creek (5.36ha). Mangroves are found mainly in Kali estuarine complex, Arga creek and Mudga creek and very little mangrove found in Majali creek, Nachkanbad creek and Konekala creek

**Table 2; Taluka-wise Mangrove and potential area in Uttara Kannada District**

SL.No.	Taluk	Water Spared area in ha	Mangrove area ha	Potential area in ha
1	Karwar	4845.5	677.72	699.73
2	Ankola	1148.68	79.26	52.35
3	Kumta	5819.2	207.19	871.76
4	Honnavar	3015.41	129.57	140.38
5	Bhatkal	303.87	25.91	22.51
<b>UK District Total</b>		<b>15132.66</b>	<b>1119.65</b>	<b>1786.73</b>

**Fig.4; Taluka-wise percentage Water Spared (a), Mangrove (b) and Potential (c) area in ha in Uttara Kannada District**



**Table 3; Mangrove distribution in Uttara Kannada District**

Sl.No.	Mangroves sp.	Kali estuarine complex	Gangavali estuary	Aghanashini estuary	Sharavathi estuarine complex	Venktapur estuary
1	<i>Acanthus ilicifolius</i>	✓	✓	✓	✓	✓
2	<i>Acrostichum aureum</i>	✓	✓	✓	✓	✓
3	<i>Aegiceras corniculatum</i>	✓	✓	✓	✓	✓
4	<i>Avicennia alba</i>					
5	<i>Avicennia marina</i>	✓	✓	✓	✓	✓
6	<i>Avicennia officinalis</i>	✓	✓	✓	✓	✓
7	<i>Bruguiera cylindrica</i>	✓				
8	<i>Bruguiera gymnorrhiza</i>	✓				✓





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9	<i>Excoecaria agallocha</i>	✓	✓	✓	✓	✓
10	<i>Kandelia candel</i>	✓	✓	✓	✓	✓
11	<i>Rhizophora apiculata</i>	✓	✓	✓		✓
12	<i>Rhizophora mucronata</i>	✓	✓	✓	✓	✓
13	<i>Sonneratia alba</i>	✓	✓	✓	✓	✓
14	<i>Sonneratia caseolaris</i>	✓	✓	✓	✓	✓

## CONCLUSION

Latest estimate reveal that Uttara Kannada district has **1119.73** (11.19 sq.km) ha of mangrove vegetation. This is considered a commendable achievement by the MoEF, and is understandably, the reason for selecting this district for special attention.

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