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[Rao* *et al.*, 6(8): August, 2017]
IC™ Value: 3.00

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

DIVERSITY VARIATIONS OF MANGROVE FLORA AMONG CREEKS AND MUDFLATS OF MACHILIPATNAM MANDAL IN KRISHNA DISTRICT

Prabhakar Rao. V. V[*1] & Brahmaji Rao. P[2]

[*1]Department of Sciences & Humanities, Andhra Loyola Institute of Engineering and Technology, Vijayawada,A.P, India.

[2]Department of Environmental Science, Acharya Nagarjuna University, Guntur, A.P, India

DOI: 10.5281/zenodo.839172

ABSTRACT

Mangrove flora is unique vegetation that survives at high salinity; tidal regimes, strong wind velocity, high temperature and muddy anaerobic soil with the development of some adaptive morphological characteristics.The present study was carried in creeks and mudflats mangrove patches, to find ecological status of the mangrove vegetation and to analyze significant changes. Results shows, highest Important Value Index (IVI) in Kanuru 33.33and Achyyavaripalem is31.82 for Avicennia marina. Highest Maturity index values (MIV) is 71.00 of Kanuru and 31.82 of and 71.00 of Achyyavaripalem .Similarity indices (SI) is 80.00 highest, medium 76.92 to 72.72, least 66.64 to 50.00, majority of sites showed medium resemblance.50.00 is highest coefficient difference (CD) and least is 20.00.In the present study mudflats regions showed densest mangrove vegetation than creek region and most dominating species in both regions are Avicennia marina and Avicennia officinalis.

KEYWORDS: Mangrove Vegetation, creeks, mudflats, Important Value Index (IVI), Maturity Index Values (MIV), Similarity Index (SI), Coefficient Difference (CD).

I. INTRODUCTION

Mangroves comprise salt tolerant plant species that occur along inter-tidal zones of rivers and seas in the form of narrow strips or as extensive patches in estuarine habitats and river deltas of tropical and sub-tropical regions. These plants have special adaptations such as stilt roots, viviparous germination, salt-excreting leaves, breathing roots, knee roots by which these plants survive in water-logged, anaerobic saline soils of coastal environments. Rahaman (1990), Swaminathan (1991) and Moorthy & Kathiresan (1996) observed that the mangrove plants have a great potential to adapt to the changes in climate, rise in sea levels and to solar ultraviolet–B radiation

Mangrove vegetation comprises approximately 59 species 41 genera, of which 34 species 29 genera are present in India. This includes 25 species along the east coast and 25 species on the west coast as cited by Banerjee et al., (1989); Singh (1990)**;** Deshmukh (1994). East coast mangroves represent 51 species, 41 genera belonging to 29 families. [Venkateswarlu (1944), Mathauda (1957), Rao (1959), Sidhu (1963)]**.** Recent estimates by Mandal & Naskar (2008) reveal that 82 species of mangroves are distributed in 52 genera and 36 families in all the 12 habitats in India.

The Indian subcontinent anecdotal studies are studied by Chatarjee (1958), Sidhu (1963), Ahmed (1964), Chapman (1976), Lakshman (1984), Untawale (1984) and Dagar (1988), Rao and Rao (1992). All these scientists recognized that the mangrove ecosystems had been an important source of livelihood, subsistence economy and were the most exploitable for the traditional use of aquaculture and agriculture practices.

II. STUDY AREA

The present study is carried out to identify the mangrove vegetation distributed in and around creeks and mudflats of Machilipatnam.Study areas are selected on the northward region of riverine systems to identify the mangrove diversity at which the river joins the sea and mudflat based sea coast, which is receiving tidal inundation. The study was carried out from June 2016 to June 2017. The first region (Region – I) consists of the creek based villages around Machilipatnam viz., Pallethummalapalem, Kona at which mangrove vegetation is

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

present. The second region (Region – II) consists of mudflat based villages Kanuru, Achayyavaripalem at which mangrove vegetation is present.

A. Palletummalapalem is a small- sized village located at a distance of 15.1 km from Machilipatnam.Palletummalapalem is from 16°5'38"N latitudes and from 81°7'3"E longitudes. Its boundaries are Bay of Bengal on east and south side, a tributary of river Krishna on west and Kona village on north side. Coastal side is with mangrove vegetation.

B.Kona is a mid- sized village located at a distance of 16.8 km from Machilipatnam. Kona is from16°5'5"N latitudes and from 81°6'45"E longitudes.Its boundaries are Bay of Bengal on east and south side, a tributary of river Krishna on west and Kona village on north side. Coastal side is with mangrove vegetation.

C.Kanuru is a medium size village located at a distance of 19.7 km from Machilipatnam.Kanuru is from 16°17'3"N latitudes and from 81°15'30"E longitudes. Its boundaries are Bay of Bengal on east and south side. Coastal side is with mangrove vegetation.

D.Achyyavaripalem is a large village located at a distance of 25.1 km from Machilipatnam.Achyyavaripalem is from16°17'54"N latitudes and from 81°14'51"E longitudes.Its boundaries are Bay of Bengal on east and south side. Coastal side is with mangrove vegetation.

Figure-1: Satellite map showing the mangrove vegetation in region-1&2

III. MATERIALS & METHODS

The mangrove vegetation ecological status was determined by making several field visits. Line transects of varying widths and quadrates from 4 m x 4 m to 10 m x 10 m are laid on either side of the creeks and data from each one are recorded from ten such transects / quadrats. Plant materials collected during sampling are identified with the help of the standard herbaria of the Botanical Survey of India and Gamble Volumes of the Department of Botany, Nagarjuna University, Guntur. Brahmaji Rao, P (1998)

Various parameters like Frequency, Relative Frequency etc. are calculated by the using formulae (1) and (2),

$$\text{Frequency} = \frac{No\ of\ occurrences\ of\ a\ species}{Total\ no\ of\ site\ samples\ taken} \text{ X } 100 \quad (1)$$

$$\text{Relative Frequency} = \frac{No\ of\ occurrences\ of\ particular\ species}{Total\ no\ of\ occurrences\ of\ all\ the\ species} \text{ X } 100 \quad (2)$$

The values of relative frequency are calibrated on a 10-point scale to assign a status to the species in each region. Four distinct groups are derived from this 10-point scale and each group in each region is designated as follows:

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7 – 10 Very Frequent; 5 – 7 Frequent; 3 – 5 Less Frequent; < 3 Rare

The abundance and density represent the numerical strength of species in the community (Mishra, 1968). Abundance is described as the number of individuals occurring per sampling unit and density as the number of individuals per sampling unit. Abundance and density were calculated using the formulae (3) (4) (5) and (6),

$$\text{Abundance (A)} = \frac{Total\ number\ of\ individuals}{Number\ of\ Sampling\ units\ of\ occrance} \text{ X } 100 \quad (3)$$

$$\text{Relative Abundance} = \frac{Abundance\ of\ a\ particular\ species}{Sum\ of\ the\ abundances\ of\ all\ species} \text{ X } 100 \quad (4)$$

$$\text{Density} = \frac{Total\ no\ of\ individuals\ of\ a\ species\ in\ all\ quadrats}{Total\ no\ of\ quadrats\ sampled} \text{ X } 100 \quad (5)$$

$$\text{Relative density} = \frac{Density\ of\ a\ particular\ species}{Sum\ of\ the\ densities\ of\ all\ species} \text{ X } 100 \quad (6)$$

Importance Value Index (IVI)

The concept of 'Important Value Index (IVI)' has been developed for expressing the dominance and ecological success of any species, with a single value, (Mishra, 1968). This index utilizes three characteristics, viz. relative frequency, relative density and relative abundance. The three characteristics are computed using frequency, density and abundance for all the species falling in all the transects using formula (7),

IVI = Relative *frequency* + *Relative abundance* + *Relative density* (7)

Maturity Index Value (MIV), Similarity Index (SI), Coefficient Difference (CD) are used to assess the maturity, similarity, diversity of mangrove vegetation among various field stations (Philips 1959).

Maturity Index Value (MIV)

The degree of maturity of a plant community is established based on the percent frequency of all species in the sites of study regions and divided by the number of species occurrence this is Maturity Index Value (MIV). Sampling is done by selecting 10 quadrats at each site and the frequency of each species is calculated, before calculating the percentage frequency. The Maturity Index Values are compared among different sites and it is inferred that the one nearer to 100 is highly matured in the community over others as suggested by Pichi-Sermolli (1948). The formulae for MIV is given in (8),

$$\text{MIV} = \frac{Frequency\ of\ all\ species}{No\ of\ species\ studied} \text{ x } 100 \quad (8)$$

Similarity Index (SI) and Coefficient Difference (CD)

Expression of similarity of species and community coefficients indicate the degree of homogeneity of vegetation which reflects habitat status. The Similarity Index (SI) is calculated by using the formula (9) given by Oosting (1956).

$$S = \frac{2W}{(a+b)} \text{ x } 100 \quad (9)$$

where S = Similarity index between the sites being compared
W = Sum of the species
a = Total number of species in site number one
b = Total number of species in site number two

The degree of similarity is determined among the sites as percentage of resemblance and categorised into highest, medium, lowest and no similarity. The corresponding Coefficient Difference (CD) values are obtained by subtracting the percentage similarity from 100. The formulae for CD is given in (10),

$$C.D = 100 - S \quad (10)$$

IV. RESULTS & DISCUSSION

V. Mangrove vegetation

The mangrove vegetation in the region-1&2 areas has been broadly classified into three main categories, based on the composition of species and distribution pattern. (Sasidhar.K and Brahmaji rao P. (2015).

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The mangrove vegetation in region -1, the interior area consists of species of Avicenniaceae Euphorbiaceae and Rhizophoraceae, central area consists of species of Acanthaceae, Combretaceae. Myrsinaceae and Sonneratiaceae and peripheral area consists of species of Chenopodiaceae, Convolvulaceae, Fabeceae and Plumbaginaceae.

The mangrove vegetation in region-2, the interior area consists of species of Avicenniaceae and Rhizophoraceae, central area consists of species of Euphorbiaceae and Acanthaceae,and peripheral area consists of species of Chenopodiaceae.

Floral Composition

Mangrove vegetation in region-1 consisting of 12 genera and 18 species of 11 families has been recorded as 13 trees, 2 shrubs and 3 herbs. Habitat-wise distribution of mangrove vegetation Palletummalapalem is observed as trees 72%, herbs 17 % and shrubs 11% and Kona is observed as trees 72%, herbs 17 % and shrubs 11%. The two field stations of region-1 are shown in the (Figure – 2(a) and (b)).

Mangrove vegetation in region-2 consisting of 9 genera and 9 species of 5 families has been recorded as 6 trees, 1 shrub and 2 herbs. Habitat-wise distribution of mangrove vegetation in Kanuru is observed as trees 57%, herbs 29 % and shrubs 14% and in Achyyavaripalem is observed as trees 67%, herbs 22 % and shrubs 11%. The two field stations of region-2 are shown in the (Figure – 2(c) and (d)).

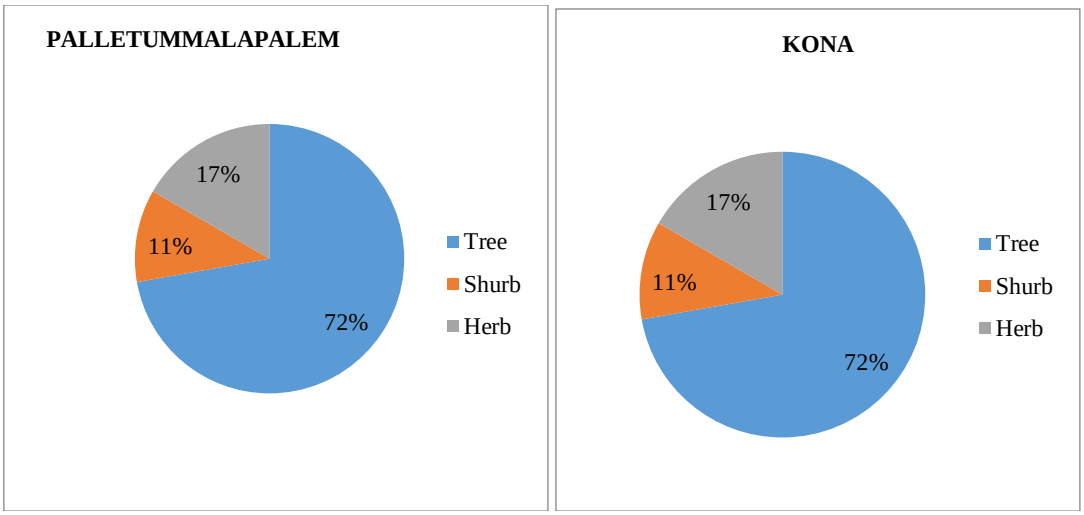
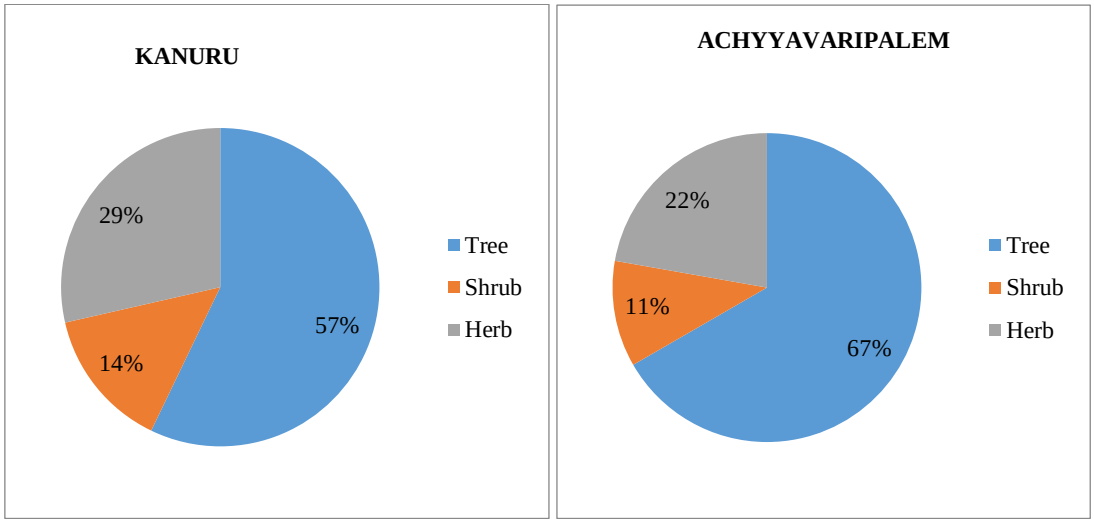


Figure - 2(a, b, c and d): Habitat-Wise Distribution of Mangroves in Region-1&2



4.3 Distribution Pattern of mangrove vegetation in region-1&2

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The mangrove habitat-wise distribution is calculated in the four areas i.e.Palletummalapalem.Kona.Kanuru and Achyyavaripalem and species-wise distribution in region-1&2 (Figure – 3) is discussed below, Nabi A. and Brahmaji Rao P. (2012).

In Palletummalapalem land areas towards sea influenced by river water, tidal inundation is moderate and hence the vegetation composition is high having 4 species like *Avicennia officinalis, Avicennia marina, Bruguiera gymnorrihiza, Excoecaria agallocha* are recorded in all the three areas. *Aegiceras corniculatum, Avicennia alba, Bruguiera cylindrica,, Rhizophora apiculata, Rhizophora mucronata, Sonneratia apetala, Sueda maritime* Species are widely distributed only in two areas out of interior, central and peripheral areas. *Ceriops decandra, Acanthus ilicifolius, Cuscuta Reflexa Roxb, Lumnitzera recemosa, Aegialitis rotundifolia, Dalbergia Spinosa Roxb, Suaeda monoica* have occasional occurrence in the interior and central zone and are more abundant in marginal area.Status of abundance of species is enumerated based on Relative Frequency values. 4 species *with a* Relative Frequency value of 6.8 are "frequent" followed by 7 species with a Relative Frequency value 4.5 and fall in the category of "less frequent" species. 7 species with a Relative Frequency value 2.3 and fall in the category of "rare" status in this field station. It is worth noting that there are no species with "very frequent" status.

In Kona land areas towards sea influenced by river water, tidal inundation is moderate and hence the vegetation composition is moderate having 3 species like *Avicennia officinalis, Avicennia marina, Excoecaria agallocha* are recorded in all the three areas. *Avicennia alba, Bruguiera cylindrica,, Rhizophora apiculata, Rhizophora mucronata, Ceriops decandra, and Acanthus ilicifolius* Species are widely distributed only in two areas out of interior, central and peripheral areas. *Aegiceras corniculatum, Bruguiera gymnorrihiza, Sonneratia apetala, Cuscuta Reflexa Roxb, Lumnitzera recemosa, Aegialitis rotundifolia, Dalbergia Spinosa Roxb, Sueda maritime and Suaeda monoica* have occasional occurrence in the interior and central zone and are more abundant in marginal area.Status of abundance of species is enumerated based on Relative Frequency values. 3 species *with a* Relative Frequency value of 7.7 are "very frequent" 6 species *with a* Relative Frequency value of 5.1 are "frequent" followed by 9 species with a Relative Frequency value 2.6 and fall in the category of "rare" status in this field station. It is worth noting that there are no species with "less frequent" status.

In Kanaru, water is influenced by agricultural drains and low tidal inundation and hence there are 9 moderate species namely *Avicennia marina, Avicennia officinalis, Bruguiera gymnorrihiza, Ceriops decandra, Excoecaria agallocha, Rhizophora apiculata, Acanthus ilicifolius, Sueda maritime and Sueda manoica*. *Suaeda maritima* and *Suaeda manoica* are common in the degraded areas. *Bruguiera gymnorrihiza, Ceriops decandra, Excoecaria agallocha, Rhizophora apiculata, Acanthus ilicifolius* occurs in stunt form. *Avicennia marina, Avicennia officinalis,* and *Excoecaria agallocha* are the dominant species in this area. Dense vagetation of Prosopis juliflora is seen in the uplands.Status of abundance of species is computed with Relative Frequency value. The species *Avicennia officinali, Bruguiera gymnorrihiza, Rhizophora apiculata, Suaeda maritima* and *Suaeda manoica* are " very frequent" species, with a maximum Relative Frequency value ranging from of 14.3 - 9.52 followed by 2 "less frequent" species *with a* Relative Frequency value 4.76. The minumum value of 0 is observed in 2 species, which fall in "rare" category. It is worth noting that there are no species with "frequent" status.

In Achyavaripalem dense vegetation is seen, with 3 species like *Avicennia officinalis, Avicennia marina and Bruguiera gymnorrihiza.* The species Prosopis is conspicuous in some places along with mixed vegetation of *Rhizophora apiculata, Excoecaria agallocha.* Large areas of degraded mangroves occur with stunted growth of *Acanthus ilicifolius, Suaeda maritima, Ceriops decandra and Rhizophora apiculata.*Status of abundance of species is computed with Relative Frequency value. 5 species with a Relative Frequency value ranging between 13.62 - 9.09 are "very frequent" species. 4 species having Relative Frequency value of 4.55 are "less frequent". In this field station also there are no species with "very frequent" and "rare" status. **(Table-1).**

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Table – 1: Status of Mangrove Species based on Relativ Frequency in region -1&2

S. NO	Name of Plant species	Creek						Mudflat					
		Palletummalapalem			Kona			Kanuru			Achyyavaripalem		
		Frequency %	Relative frequency	status	Frequency %	Relative frequency	status	Frequency %	Relative frequency	status	Frequency %	Relative frequency	status
1	*Aegiceras corniculatum*	*66.7*	*4.5*	III	*33.3*	*2.6*	IV	Plant species not present					
2	*Avicennia alba*	*66.7*	*4.5*	III	*66.7*	*5.1*	II	Plant species not present					
3	*Avicennia marina*	*100*	*6.8*	II	*100*	*7.7*	I	*100.0*	*14.3*	I	*100*	*13.6*	I
4	*Avicennia officinalis*	*100*	*6.8*	II	*100*	*7.7*	I	*100.0*	*14.3*	I	*100*	*13.6*	I
5	*Bruguiera cylindrical*	*66.7*	*4.5*	III	*66.7*	*5.1*	II	Plant species not present					
6	*Bruguiera gymnorrihiza*	*100*	*6.8*	II	*33.3*	*2.6*	IV	*0.0*	*0.0*	IV	*100*	*13.6*	I
7	*Ceriops decandra*	*33.3*	*2.3*	IV	*66.7*	*5.1*	II	*0.0*	*0.0*	IV	*33.33*	*4.55*	III
8	*Excoecaria agallocha*	*100*	*6.8*	II	*100*	*7.7*	I	*100.0*	*14.3*	I	*66.67*	*9.09*	I
9	*Lumnitzera racemosa*	*33.3*	*2.3*	IV	*33.3*	*2.6*	IV	Plant species not present					
10	*Rhizophora apiculata*	*66.7*	*4.5*	III	*66.7*	*5.1*	II	*33.3*	*4.76*	III	*33.33*	*4.55*	III
11	*Rhizophora mucronata*	*66.7*	*4.5*	III	*66.7*	*5.1*	II	Plant species not present					
12	*Sonneratia apetala*	*66.7*	*4.5*	III	*33.3*	*2.6*	IV	Plant species not present					
13	*Acanthus Ilicifolius*	*33.3*	*2.3*	IV	*66.7*	*5.1*	II	*66.7*	*9.52*	I	*33.33*	*4.55*	III
14	*Aegialitis rotundifolia*	*33.3*	*2.3*	IV	*33.3*	*2.6*	IV	Plant species not present					
15	*Cuscuta reflexa Roxb*	*33.3*	*2.3*	IV	*33.3*	*2.6*	IV	Plant species not present					
16	*Dalbergia spinosa Roxb.*	*33.3*	*2.3*	IV	*33.3*	*2.6*	IV	Plant species not present					
17	*Suaeda maritima*	*66.7*	*4.5*	III	*33.3*	*2.6*	IV	*66.7*	*9.52*	I	*33.33*	*4.55*	III
18	*Suaeda monoica*	*33.3*	*2.3*	IV	*33.3*	*2.6*	IV	*33.3*	*4.76*	III	*66.67*	*9.09*	I

ISSN: 2277-9655
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> 7= Very Frequent – I, 5 –7 = Frequent – II, 3 – 5 = Less Frequent - III, < 3 = rare – IV

Species dominance is calculated based on the Important Value Index (IVI). In Pallethummalapalem the highest IVI value is 17.42 for *Avicennia marina* and followed by 15.91 for *Avicennia officinalis* and by *Bruguiera gymnorrhiza* with an IVI value of 14.39. The dominant species in this village is *Avicennia marina*.In Kona the highest IVI value is 19.66 for *Avicennia officinalis* and followed by 14.53 for *Avicennia marina* and *Excoecaria agallocha* by *Bruguiera cylindrica, Ceriops decandra* with an IVI value of 11.54**.** The dominant species in this village is *Avicennia officinalis.* In Kanuru the highest IVI value is 33.33 for *Avicennia marina* and *Avicennia officinalis* followed by 23.81 for *Excoecaria agallocha and for Acanthus ilicifolius* and *Suaeda maritima* with a value of 17.46. In Kanuru also the dominant species are *Avicennia marina* and *Avicennia officinalis.*In Achayavaripalem the highest IVI value is 31.82 for *Avicennia marina followed by 28.79 for and Avicennia officinalis* which is further followed by *Bruguiera gymnorrihiza with 22.73.* In this village also the dominant species are *Avicennia marina* and *Avicennia officinalis****.(Table-2)***

Table –2: Species dominance based on the Important Value Index (IVI) Values in region-1&2

S.No	Name of Plant species	IVI Values			
		Creek		Mudflat	
		Palletummapalem	Kona	Kanuru	Achyyavaripalem
1	*Aegiceras corniculatum*	8.33	9.40	Plant species not present	
2	*Avicennia alba*	8.33	9.40	Plant species not present	
3	*Avicennia marina*	17.42	14.53	33.33	31.82
4	*Avicennia officinalis*	15.91	19.66	33.33	28.79
5	*Bruguiera cylindrical*	10.23	11.54	Plant species not present	
6	*Bruguiera gymnorrihiza*	14.39	5.98	0.00	22.73
7	*Ceriops decandra*	5.30	11.54	0.00	10.61
8	*Excoecaria agallocha*	11.36	14.53	23.81	16.67
9	*Lumnitzera racemosa*	5.30	5.98	Plant species not present	
10	*Rhizophora apiculata*	10.23	9.40	11.11	10.61
11	*Rhizophora mucronata*	8.33	9.40	Plant species not present	
12	*Sonneratia apetala*	8.33	5.98	Plant species not present	
13	*Acanthus Ilicifolius*	5.30	9.40	17.46	10.61
14	*Aegialitis rotundifolia*	5.30	5.98	Plant species not present	
15	*Cuscuta reflexa Roxb*	5.30	5.98	Plant species not present	
16	*Dalbergia spinosa Roxb.*	5.30	5.98	Plant species not present	
17	*Suaeda maritima*	8.33	5.98	17.46	10.61
18	*Suaeda monoica*	5.30	5.98	11.11	16.67
	Total	**158.33**	**166.67**	**147.62**	**159.09**

Maturity Index:

Maturity index values of the field stations in Region – I i.e. 61.00 of Pallethummala Palem, 56.00 of Kona and in Region – II i.e. 71.00 of Kanuru, 63.00 of Achayyavaripalem shows that there is the densest mangrove vegetation at a place (Kanuru in the present case), where there is a maximum frequency of inundation. Further, it can be inferred that places where there is less frequency of inundation, have less dense mangrove vegetation **(Table-3).**

Table –3: Maturity Index Values (MIV) of Mangrove in Region-1&2

S.No	Name of Plant species	Frequency %			
		Creek		Mudflat	
		Palletummapalem	Kona	Kanuru	Achyyavaripalem
1	*Aegiceras corniculatum*	66.67	33.33	Plant species not present	
2	*Avicennia alba*	66.67	66.67	Plant species not present	
3	*Avicennia marina*	100.00	100.00	100.0	100.0
4	*Avicennia officinalis*	100.00	100.00	100.0	100.0
5	*Bruguiera cylindrical*	66.67	66.67	Plant species not present	
6	*Bruguiera gymnorrihiza*	100.00	33.33	0.0	100.0
7	*Ceriops decandra*	33.33	66.67	0.0	33.3

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

8	*Excoecaria agallocha*	100.00	100.00	100.0	66.7
9	*Lumnitzera racemosa*	33.33	33.33	Plant species not present	
10	*Rhizophora apiculata*	66.67	66.67	33.3	33.3
11	*Rhizophora mucronata*	66.67	66.67	Plant species not present	
12	*Sonneratia apetala*	66.67	33.33	Plant species not present	
13	*Acanthus Ilicifolius*	33.33	66.67	66.7	33.3
14	*Aegialitis rotundifolia*	33.33	33.33	Plant species not present	
15	*Cuscuta reflexa Roxb*	33.33	33.33	Plant species not present	
16	*Dalbergia spinosa Roxb.*	33.33	33.33	Plant species not present	
17	*Suaeda maritima*	66.67	33.33	66.7	33.3
18	*Suaeda monoica*	33.33	33.33	33.3	66.7
	Total	**1100.00**	**1000.00**	500.0	566.7
		61	**56**	**71**	**63**

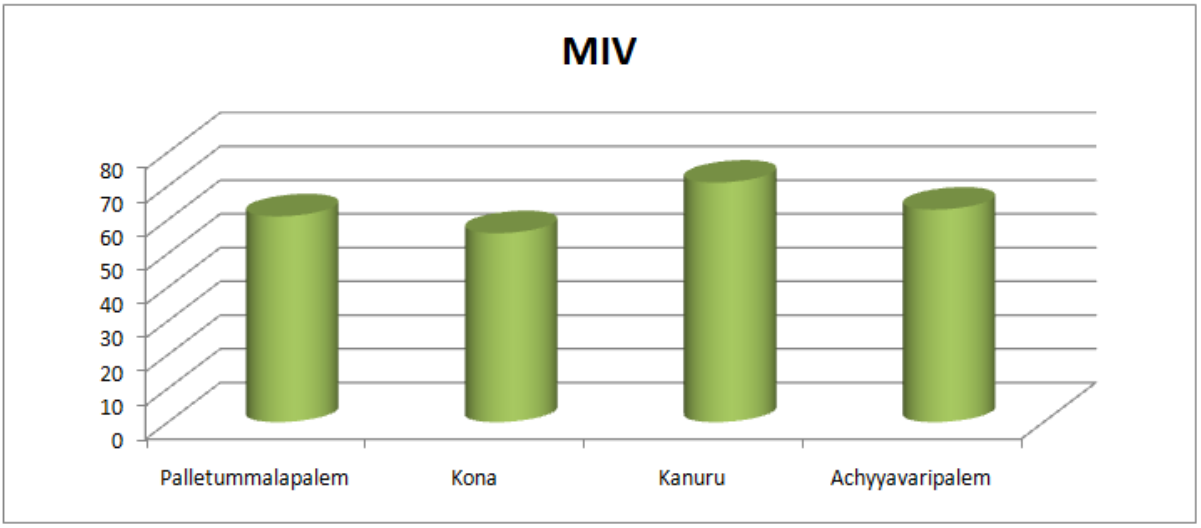

Figure – 3: A comparison of MIV values of Mangrove Vegetation in Region-1&2

Similarity Index:
Similarity Index for each station is calculated to know the extent of homogeneity of vegetation. Depending on the extent of homogeneity, the regions are categorized as given below: **(Table-4).**80 to 100% --highest resemblance, 60 to 80% --medium resemblance, 40 to 60% --least resemblance, 0 to 40% --no resemblance

Table –4: Species-wise distribution pattern of Mangrove vegetation in region-1&2

S.No.	Name of the Plant Species	Sites											
		Creek						Mudflat					
		1	2	3	4	5	6	1	2	3	4	5	6
1	*Aegiceras corniculatum*	+	+	-	-	+	-	Plant species not present					
2	*Avicennia alba*	-	+	+	+	+	-	Plant species not present					
3	*Avicennia marina*	+	+	+	+	+	+	+	+	+	+	+	+
4	*Avicennia officinalis*	+	+	+	+	+	+	+	+	+	+	+	+
5	*Bruguiera cylindrica*	-	+	+	-	+	+	Plant species not present					
6	*Bruguiera gymnorrihiza*	+	+	+	+	+	+	-	-	-	+	+	+
7	*Ceriops decandra*	-	+	-	+	-	+	-	-	-	-	+	-

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8	*Excoecaria agallocha*	+	+	+	+	+	+	+	+	+	+	+	+
9	*Lumnitzera racemosa*	-	+	-	-	+	-	Plant species not present					
10	*Rhizophora apiculata*	+	+	-	-	+	+	+	-	-	-	-	+
11	*Rhizophora mucronata*	+	-	+	-	+	+	Plant species not present					
12	*Sonneratia apetala*	+	-	+	-	+	-	Plant species not present					
13	*Acanthus Ilicifolius*	-	+	-	+	+	-	-	+	+	-	-	+
14	*Aegialitis rotundifolia*	+	-	-	-	-	+	Plant species not present					
15	*Cuscuta reflexa Roxb.*	+	-	-	+	-	-	Plant species not present					
16	*Dalbergia spinosa Roxb.*	-	+	-	-	-	+	Plant species not present					
17	*Suaeda maritima*	+	-	+	+	-	-	+	+	-	+	-	-
18	*Suaeda monoica*	-	+	-	+	-	-	-	+	-	-	+	+
Total no. of species in each station		**11**	**13**	**9**	**10**	**12**	**10**	**5**	**6**	**4**	**5**	**6**	**7**

In region-1 majority of sampling sites showed medium resemblances with regard to species diversity with similarity indices ranging from 63.63 between sites 1&6,2&6,3&6,4&6 and 5&6 to 63.15 between sites1&4,2&4and3&4.Similarly, the least resemblance ranging from 54.54 between the sites 1&3,1&5,2&32&5,3&5and4&6 to50.00 between the sites1&2.**(Table-5)**

Table –5: Similarity Index (SI) of Mangroves at region-1

Site No	1	2	3	4	5	6
1		50.00	54.54	63.15	54.54	63.63
2			54.54	63.15	54.54	63.63
3				63.15	54.54	63.63
4					54.54	63.63
5						63.63

In region-2 majority of sampling sites showed medium resemblances with regard to species diversity with similarity indices ranging from 76.92 between sites 1&5,2&5,3&5 and 4&5 to 66.66 between sites1&4,2&4and3&4.and highest least resemblance 80.00 between the sites 1&3and 2&3**.(Table-6)**. Prabhakar rao.V.V,Brahmaji rao.P(2017)

Table –6: Similarity Index (SI) of Mangroves at region-2

Site No	1	2	3	4	5	6
1		72.72	80.00	66.66	72.72	76.92
2			80.00	66.66	72.72	76.92
3				66.66	72.72	76.92
4					72.72	76.92
5						76.92

Coefficient Difference:
In region-1 highest coefficient difference of 50.00 is recorded between sub field stations 1&2 while the least coefficient difference value of 36.37 is obtained between the sub field stations 1&6,1&2,1&3,1&4and1&5 **(Table -7)**.

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Table –7: Coefficient difference of Mangrove at region-1

Site No	1	2	3	4	5
1					
2	50.00				
3	45.46	45.46			
4	36.85	36.85	36.85		
5	45.46	45.46	45.46	45.46	
6	36.37	36.37	36.37	36.37	36.37

In the region-2 highest coefficient difference of 33.34 is recorded between sub field stations 1&4,2&4 and 3&4 while the least coefficient difference value of 20.00 is obtained between the sub field stations 1&2and2&2 **(Table -8)**.

Table –8: Coefficient difference of Mangrove at region-2

Site No	1	2	3	4	5
1					
2	27.28				
3	20.00	20.00			
4	33.34	33.34	33.34		
5	27.28	27.28	27.28	27.28	
6	23.08	23.08	23.08	23.08	23.08

VI. CONCLUSIONS

The mangrove vegetation present in both creeks and mudflat areas shows divergent distribution of mangroves. In creeks there are 18 species and in mudflats 9 species are present, 9 species are less comparative to creek region reason is because of tidal inundation, more salt accumulation and difference in soil nutrition in mudflats. In both the region's most dominating species are *Avicennia marina* and *Avicennia officinalis.* In the present study mudflats regions showed densest mangrove vegetation than mudflats region and reforestation activities need to be taken to increase species diversity.

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CITE AN ARTICLE

VV, Prabhakar Rao, and Brahmaji Rao P. "DIVERSITY VARIATIONS OF MANGROVE FLORA AMONG CREEKS ANDMUDFLATS OF MACHILIPATNAM MANDAL IN KRISHNA DISTRICT." ***INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY*** **6.8 (2017): 209-19. Web. 5 Aug. 2017**