STUDIES ON LITTER PRODUCTION IN ELIMINEDU AND MRUGAVANI NATIONAL PARK URBAN FOREST BLOCKS, RANGA REDDY DISTRICT, TELANGANA STATE.

Dissertation
submitted to Palamuru University in partial fulfilment
of the requirement for the award of

Student Study Project

IN

BOTANY

by

K. PAVANI

D. INDU

K. MANASA

B. ANUSHA

Research Supervisor

Dr. B. SADASIVAIAH

Assistant Professor of Botany

Submitted to

DEPARTMENT OF BOTANY

DR. BRR GOVERNMENT DEGREE COLLEGE

JADCHERLA – 509 301

MAY- 2023

DECLARATION

We hereby declare that the Research work presented in this Dissertation entitled "**Studies on Litter Production in Eliminedu and Mrugavani National Park (MNP) Urban Forest Blocks, Ranga Reddy District, Telangana State"** is original work carried out by us under the supervision of **Dr. B. Sadasivaiah**, Department of Botany, Dr. BRR Government Degree College, Jadcherla during the period 2022-2023 for the award of the degree of Student Study Project in Botany. The research work is original and no part of the work has been submitted for the award of any degree or diploma of this College or any other College/University.

Place: Jadcherla

Date: 15-5-2023

Name of the Student	Hall Ticket Number	Class	Signature
D.Indu	20033006445022	BZC III year, E/M	D. Indu
K.Pavani	20033006445042	BZC III year, E/M	
K.Manasa	20033006445032	BZC III year, E/M	Manasa
B.Anusha	20033006445011	BZC III year, E/M	B. Anusha

Dr. B. Sadasivaiah
Assistant Professor
Coordinator-
Biodiversity Research & Education Centre

Department of Botany
Dr. BRR Government Degree College
Jadcherla
Cell No: +91 9963536233
Email: sadasivaiahbyalla@gmail.com

CERTIFICATE

Certified that the thesis entitled **"Studies on Litter Production in Eliminedu and Mrugavani National Park (MNP) Urban Forest Blocks, Ranga Reddy District, Telangana State"** is a bonofide research work done by **K. Pavani, D. Indu, K. Manasa, B. Anusha** under my supervision in Biodiversity Research & Education Centre, Department of Botany, Dr. BRR Government Degree College, Jadcherla.

Date : 15-05-2023
Place : Jadcherla

(Dr. B. SADASIVAIAH)
Research Supervisor

Dr. B. SADASIVAIAH
Assistant Professor of Botany
Dr. B.R.R. Government College
JADCHERLA.

External Examiner

Head

HEAD
DEPARTMENT OF BOTANY
Dr.B.R.R. DEGREE COLLEGE
Jadcherla-509 301
Dist.Mahabubnagar (T.S.)

ACKNOWLEDGEMENTS

Our deep heartfelt thanks to my research supervisor ***Dr. B. Sadasivaiah,*** *Department of Botany, Dr. BRR Government Degree College, Jadcherla for his guidance and planning of the dissertation work. We will always be grateful for his immeasurable patience and support throughout the period of work, without which it would not have been possible to complete our work. His recommendations on both research as well as on our career has been priceless. We genuinely thank him from bottom of our heart and will be truly grateful to him throughout our life.*

We avail this opportunity to express our gratitude and thanks to ***Dr. Ch. Appiya Chinnamma****, Principal, Dr. BRR Government Degree College, Jadcherla for her healthy guidance, encouragement, support and permission for the project work.*

We would like to express our sincere thanks to ***P. Srinivasulu****, Assistant Professor & Head, Department of Botany, Dr. BRR Government Degree College, Jadcherla for his valuable guidance, encouragement, timely suggestions. Our heartfelt thanks also due to* ***Mrs. K. Latha,*** *Assistant Professor of Botany, Dr. BRR Government Degree College, Jadcherla for her continuous support during the project work. We convey our gratitude and special thanks to* ***Mr. Lakshmi Reddy****, Herbarium Keeper, Department of Botany for his suggestions.*

Our heartfelt thanks also due to ***Dr. M. Sridhar Reddy****, Associate Professor and Head, Department of Environmental Sciences, Yogi Vemana Univeristy, Kadapa for his continuous support during the project work.*

We are extremely thankful to ***Dr. A. Ramakrishna,*** *Junior Research Fellow;* ***Ms. G. Ramadevi,*** *Project Assistant and Mr.* ***P. Rahul, Mr. S. Veeranjaneyulu*** *for their valuable and timely support in the quantification studies, identification of plants and calculations of the Carbon sequestration methodology.*

We are grateful to our parents who encourages a lot during tenure of project work. We are also thankful to ***Mr. Pavan*** *for his help in the preparation of manuscript.*

……. Pavani, Indu, Manasa, Anusha

CONTENTS

Chapter-I

INTRODUCTION

Litter fall, transferring organic matter and energy from the vegetation to the soil,is one of the major global carbon fluxes, in forest ecosystem, bark and reproductive organs, and usually, foliage litter fall occupies a major fraction of total litter fall. At a continental or global scale, the synthesis of litter fall data is important for estimating and explaining quantitative litter fall, as well as it's pattern.

The Eurasian continent comprises a variety of climatic condition and forest vegetation(Ahti et al.1968; Hou 1982; FAO 2001).Eurasian forest currently cover around 1.5 billion hm square,or 41%of the total global forest area (FAO 2001) and thus play an important role in global carbon cycle. In the context of forestry management as a strategy to sequestrating carbon in forest ecosystem,it is necessary to quantity the litter fall to obtain a better understanding of carbon dynamics in Eurasian forest.

Litter fall on the stand level has been long observed in European forest (see Rodin and Bazilevich 1967).During the period of the international Biological program (IBP),litter fall data were collected also at some sites of Japanese and Asian tropical forest(Deangelis et al.1981, Cannell 1982). Since the beginning of the 1980s, a lot of litter fall investigations have been conducted in Chinese(Zhou1995) and Indian forest (Dadhwal et al. 1997). Most of these litter fall data have not yet been synthesized at a continental scale.

The importance of litter production in the forest ecosystem has long been recognized;therefore this is one of the aspects that has received much attention (BRAY&GORHAM, 1964;JENSEN, 1974;JORDEN&MURPHY, 1978.) While most of the studies on litter production have been done on temperature forests, tropical and sub tropical forest ecosystems have also received some attention. However, the data available on tropical and sub tropical belt are those of JENNY, 1949 in colombia.

The present study on litter production pattern of a sub tropical Montana forest at an Evelation of 1900 m near shillong concerns that of a mixed evergreen scared forest grove. This scared grove has been maintained by the local Khasi tribe with least disturbance as they believe that their sylvan

deities live here and therefore this represents a relict climax community of this area which otherwise is highly disturbance due to slash and burn agriculture (Ramakrishnan &Toky, 1978) which is a prevalent from of agricultural practice of the region.

The importance of litter production in the forest ecosystem has long been recognised because the majority of organic matter produced by plants through photosynthesis is returned to the soil as litter. Litter fall may be a seasonal or a continuous process, and represents one of the most important pathways for the transfer of energy and material. The ways in which these two processes are accomplished , determine to a large extent the structural and functional features of the ecosystem.Litter decomposition plays a crucial role in regulating the nutrient budget of forest ecosystem where vegetation depends mainly on the recycling of nutrients contained in the plant detritus. During this process plant nutrients became available for recycling within the ecosystem. Decomposition of plant residues and the resulting release of nutrient elements are key functions of soil microorganisms.(Rottmann et al. 2010).(Singh et al.(1990) have have stated that abundance of decomposing microbes depends partly on the native litter through its influence on soil properties. Decomposition process plays an important role in maintaining soil fertility in terms of nutrients cycling and the formation of soil organic matter (Bargali et al. 1993; Guendehou et al., 2014; Gupta & Singh 1977; Pandey & Singh 1982; Singh et al., 2007; Upadhyay & Singh 1989; Usman et al.2000). Decomposition is regulated by soil organisms, environmental conditions and chemical nature of the litter. Decomposition and a nutrient release or two key processes in tropical forests, where the vegetation is generally sustained on soil with low fertility (Lavelle et al. 1993). Therefore, forest productivity depends on efficient nutrient cycling mechanisms that ensure rapid turnover of litter nutrients(Vendrami et al. 2012).Foliar litter occupies a major fraction of the litter in forest ecosystems and may be totally decomposed within a year in subtropical and tropical areas(Meentemeyer 1984). It is thus of importance to investigate the pattern of forest leaf litter decomposition and its influence on the ecosystem functioning.

Much literature has accumulated in recent years on litter decomposition of plants of various forest ecosystems of the tropical and the temperate regions. In the present region a few studies on leaf litter decomposition of planted multipurpose species are available (Bargali et al.2006; Pandey et al.2006; Singh et al. 2007). However, no quantitative study on leaf litter decomposition in natural dry deciduous forests is known from this part of India.

The importance of litter production in the forest ecosystem has long been recognized;therefore this is one of the aspects that has received much attention (Bray&Gorham, 1964; Jensen, 1974; Jorden&Murphy, 1978.) While most of the studies on litter production have been done on temperature forests, tropical and sub-tropical forest ecosystems have also received some attention. However, the data available on tropical and sub-tropical belt are those of Jenny, (1949) in colombia.

The present study on litter production pattern of a sub-tropical Montana forest at an Evelation of 1900 m near shillong concerns that of a mixed evergreen scared forest grove. This scared grove has been maintained by the local Khasi tribe with least disturbance as they believe that their sylvan deities live here and therefore this represents a relict climax community of this area which otherwise is highly disturbance due to slash and burn agriculture (Ramakrishnan &Toky, 1978) which is a prevalent from of agricultural practice of the region.

Litter production is an important pathway for transfer of organic matter and chemical elements from vegetation to soil. It is also an important component of primary production and there have been several studies of litter production in tropical forests including on the Indian subcontinent (Singh and Ramakrishnan, 1982; Proctor et al., 1983; Prasad and Sharat Chandra 1984; Whitmore 1984; Rai and Proctor, 1986) The present communication reports for the first time on the levels of litter fall in the moist tropical forests of the Western Ghats district of Uttara Kannada as a part of an ongoing comprehensive study of the forest ecology of this region. The main objective of the study are mentioned below.

Objectives

- To quantify the fine litter production and standing crop of litter
- To determine the contribution of various plant species to total leaf litter production in Eliminedu and Mrugavani National Park Urban forest blocks

Chapter-II
REVIEW OF LITERATURE

Arul pragasan and parthasarathy (2005) studied on litter production in tropical evergreen forests of south india in relation to season, plant life forms and physiorganic groups and stated that litter production peaked during summer and the majority litter is coming from leaves.

- Linasanework, N. and Michelsen, A., (1994). Litterfall and nutrient release by decomposition in three in the ethiopian highland.
- Deangelis et al. 1981;cannell 1982 during the period of the international biological program litterfall data were collected also at some sites of Japanese and Asian tropical forests
- Ramakrishnan & Toky, 1978 sacred grove has been maintained by the local khasi tribe with least disturbance as they believe that their sylvan deitier live here and therefore this represents a relict climax community of this area which otherwise is highly disturbed due to slash and burn agriculture which is a prevalent form of agriculture practice of the region.
- Bray& Gorham, 1964;Jensen, 1974;Jordan&Hurphy, 1978. The importance of litter production in the forest ecosystem has long been recognized therefore this is one of the aspects that has received much attention.
- Jenny etal, 1949 while most of the studies on litter production have been done on temperate forests, tropical and sub-tropical forest ecosystem have also received some attention.
- Ramakrishian &Toky, 1978 The present study on litter production pattern of a sub-tropical montane forest at an elevation of 1900 m near shil long concerns that of a mixed evergreen. Sacred forest groove. This sacred Grove has been maintained by the local knasi tribe with least disturbance as they believe that their sylvan deities live here and therefore this represent a relict climax community of this area which other wise is highly disturbed due to slash and burn agriculture.
- singh and Ramakrishnan. 1982 proctor at al 1983; prasad and sharatchandra 1984; whitmore 1984; Rai and proctor 1986 litter production is a important pathway for transfer organic matter and chemical elements from vegetation to soil. It is also an important component of primary production and there have been several studies of litter production in tropical forests including on the indian subcontinent.

- Rottmann et al. (2010) litter decomposition plays a crucial role in regulating the nutrient budget mainly on the recycling of nutrients contained in the plant detritus. During this process plant nutrient become available for recycling within the ecosystem. Decomposition of plant residues and the resulting release of nutrient elements are key functions of soil microorganisms.
- singh et al. (1990) have stated that abundance of decomposing microbes depends partly on the native litter through its influence on soil properties.
- Meentemeyer (1984) folias litter occupies a major fraction of the litter in forest ecosystem and may be totally decomposed within a year in subtropical and tropical areas. It is thus of importance to investigate the pattern of forest leaf litter decomposition and its Influence on the ecosystem functioning.
- Lavelle et al. (1993) Decomposition is regulated by soil organisms, environmental conditions and chemical nature of the litter. Decomposition and nutrient release are two key processes in tropical forests. Where the vegetation is generally substained on soils with low fertility.
- Bargali et al. (2006) ; pandey et al (2006) ;Singh et al (2007) on litter decomposition of plants of various forest ecosystem of the tropical and the temperate regions. On the present region a few studies on leaf litter decomposition of planted multipurpose species are available.

Chapter-III
STUDY AREA

The Eliminedu Reserve Forest (RF) Block, Ibrahimpatnam Mandal and Mrugavani National Park Reserve Forest Block Moinabad Mandal of Ranga Reddy District, Telangana was notified as perthe Government vide GORT No. 73 EFS&T (For.I) Department, dated 25.05.2018.

Eliminedu Reserve Forest (RF) is covering an area of 1649 ha and Mrugavani National Park RF covering an area of 401.36 ha with natural forest land was developed as an urban park and it is with hillocks and plans areas with few water holes. Both Reserve forest is basically Tropical Dry Deciduous Forest and Open Scrub Forest as per Champion and Seth Classification's revised forest types of India (1968). The study area is shown in **Fig.1, 2** and the land use pattern presented in **Table 1, 2**.

Table 1: NDVI Change analysis for Eliminedu Cluster Urban Forest Block						
S. No.	**NDVI Category**	**Areas in Ha Year 2015**	**% of Category**	**Areas in Ha Year 2020**	**% of Category**	**Changes inthe study areaover year 2015 in Ha**
1	No vegetation	4.81	0.29	2.54	0.15	2.27 (Reduced)
2	Low vegetation	591.33	35.86	19.78	1.20	571.55 (Reduced)
3	Sparse vegetation	1027.60	62.32	156.81	9.51	870.79 (Reduced)
4	Moderate vegetation	24.48	1.48	910.64	55.23	886.16 (Increased)
5	Dense vegetation	0.59	0.04	559.04	33.91	558.45 (Increased)

Fig. 1: Study area of Eliminedu

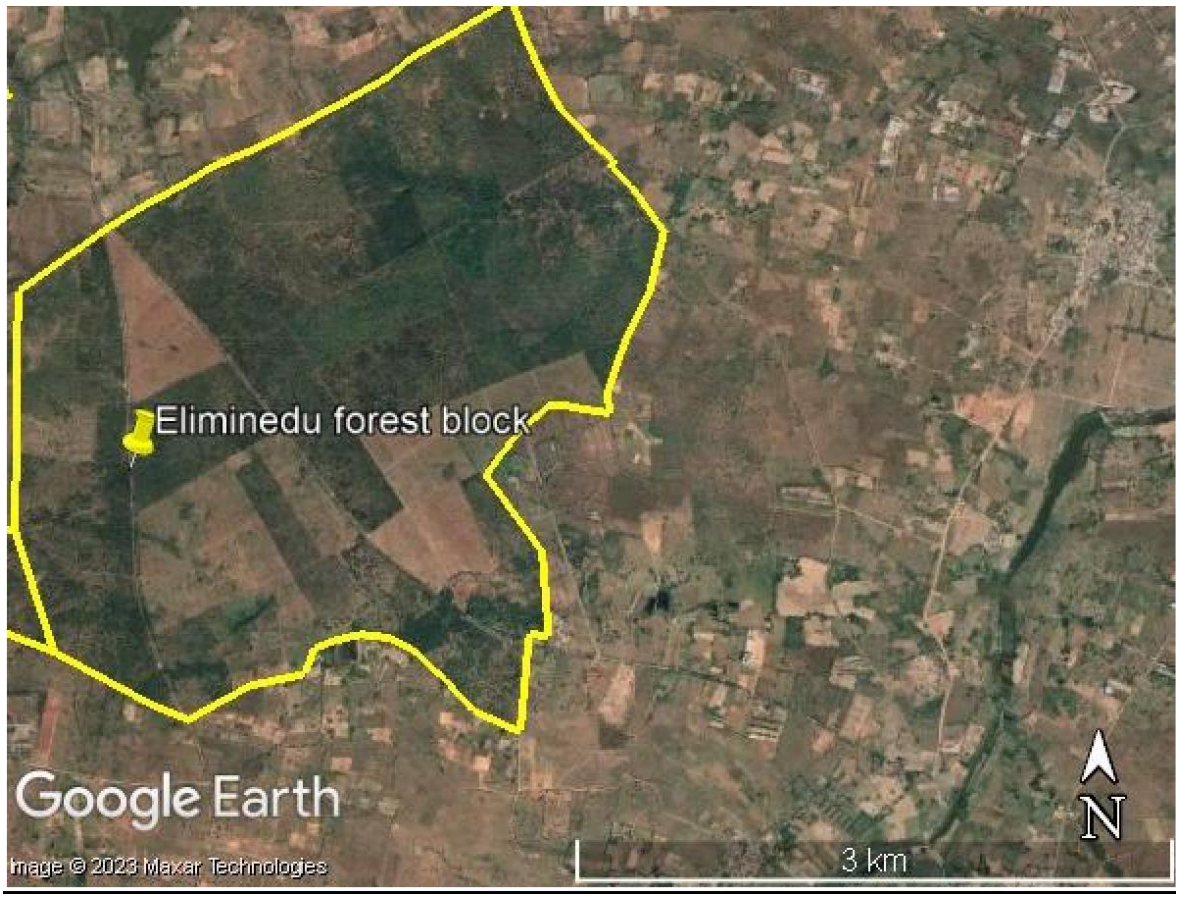
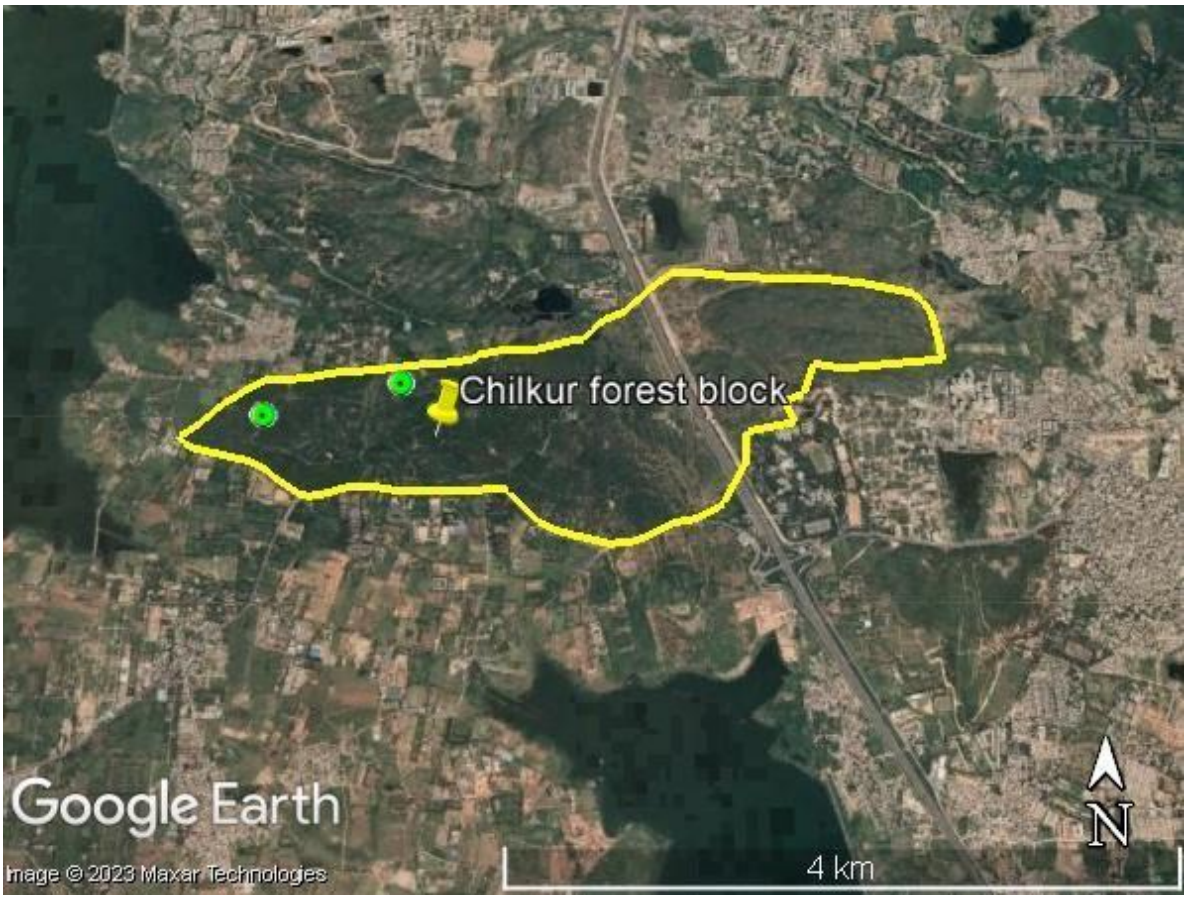


Table 2: NDVI Change analysis for MNP Urban Forest Block						
S. No.	**NDVI Category**	**Areas in Ha Year 2015**	**% of Category**	**Areas in Ha Year 2020**	**% of Category**	**Changes in the study area over year 2015 in Ha**
1	No vegetation	10.51	2.21	13.56	2.85	3.05 (Increased)
2	Low vegetation	175.23	36.86	9.62	2.02	165.61 (Reduced)
3	Sparse vegetation	136.99	28.82	82.72	17.40	54.27 (Reduced)
4	Moderate vegetation	152.43	32.06	296.81	62.44	144.38 (Increased)
5	Dense vegetation	0.21	0.04	72.65	15.28	72.44 (Increased)

Fig. 2: Study area of Mrugavani National Park (Chilukur RF)



Chapter-IV

METHODOLOGY

Leaves, twigs and pieces of bark that have fallen to the ground makeup leaf litter. Leaf litter is an important component of healthy soil. Decomposing leaf litter releases nutrients into the soil and also keeps it moist. It also serves as great nesting material, hiding places and protected spots for animals. The forest leaf litter is the dead plant material that has fallen from trees, shrubs and other plants. There are many different names for leaf litter or duff, but it's all the same thing.

In the data compilation, some criteria were followed. We used the data of forested areas to estimating litter fall data was obtained in this study meet the definition of forest of FAO: stands, which had been fertilized or disturbed by forestry practice. To determine fine litter production and standing crop of litter, a permanent plot of 1 ha was established at each site. Litter fall was quantified by stone-block lined denuded quadrat technique in 25 replicates of 1m×1m area, placed regularly at 20m inter-distance with in the 1 ha plot in each site.

All forest floor material with in the 1m×1m area were removed in December and these denuded quadrates were bordered with locally available large pebbles and stones, as to facilitate subsequent monthly collection for one year from the forest areas Hayathnagar and Mudimyal. Also, possible methodical errors by this method are avoided. Litter fall quantification by stone block lined denuded quadrat technique is being reliably adopted because there are no medium and large wild animals in these forests and hence trampling by them is ruled out.

Leaf litter was collected in traps set up at 15cm above ground level during the peak fall period of each species was kept in 15cm×15cm nylon bags. All bags of each species were randomly placed in direct contact with soil in each plot within 2 weeks after litter collection. We collected 29 bags from Eliminedu and 17 bags from Mudimyal. One bag of each species from each plot was recovered at monthly intervals over a period of 1 year litter was removed from each sampled bag, including flowers, seeds, fruits, leaves, bark and stem, brushed gently to remove soil. There were weighed separately using electronic top pan balance.

The annual decomposition quotient (Kl) was calculated as Kl=l/x, where l is the annual litter input to the forest floor and x is the mean standing crop of litter. A test was performed to

check for significant difference in total litter production, standing crop of litter and litter fall components between the two sites, and between tree and liana leaf litter production. One way ANOVA was used to check for difference in leaf litter contribution among plant species categorized into deciduous, brevi-deciduous and evergreen types. Also a spearman rank correlation was performed between temperature and total litter fall.

Chapter-V

RESULTS

I. Mrugavani National Park

The litter production of mrugavani national park is 394.93gr for 8 sampling points with 1x1m size. A total of 17 species of plant produce litter was collected from the study area and mentioned in **Table 3** and point wise litter production mentioned in **Table 4**.

Table 3: List of species produced litter

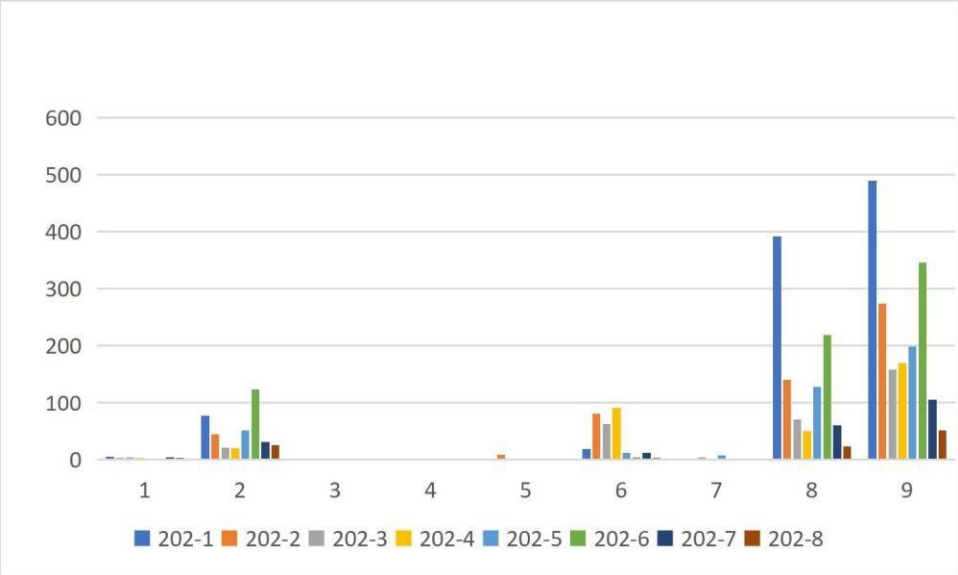
S. No.	Name of the plant	Leaves	St	Total
1	*Albizia Amara*	0.37	0	0.37
2	*Azadirechta indica*	15.40	0	15.40
3	*ABauhinia recemosa*	12.82	0	12.82
4	*Diospyros chloroxylon*	38.5	0	38.5
5	*Grewia tilifolia*	59.55	0	59.55
6	*Maytenus emarginata*	46.05	0	46.05
7	*Dalbergia lanceolaria*	0.65	0	0.65
8	*Ixora arborea*	131.86	0	131.86
9	*leucaena leucocephala*	0.64	0	0.64
10	*combretum aibidum*	10.9	0	10.9
11	*Butea monosperms*	50.86	0	50.86
12	*Wrightia tinctoria*	0.10	0	0.10
13	*Dalbergia latifolia*	0.08	0	0.08
14	*ziziphus xylopyrus*	0.25	0	0.25
15	*Grewia damine*	17.58	0	17.58
16	*Dalbergia paniculata*	6.90	0	6.90
17	*Annona squamosa.*	0	2.42	2.42
		392.51	2.42	394.93

Table 4: Point wise litter production of Mudimyal RF

Point No.	No. of species	Leaves	Fr	Stem	Bark	Misc.	Total
202-1	5	77.07	0	1.74	19.09	0	392
202-2	3	44.9	0	8.23	80.15	0	140.5
202-3	4	20.85	0.51	0	62.5	3.85	70.1
202-4	3	19.54	0	0	90.15	0	50.5
202-5	2	50.96	0	0	12.48	8.06	127.62
202-6	1	122.75	0	0	4.65	0	218.94
202-7	4	31.2	1.11	0	12.2	0	60.42
202-8	3	25.24	0	0	3.33	0	22.7
	25	**392.51**	**1.62**	**9.97**	**284.55**	**11.91**	**1082.78**

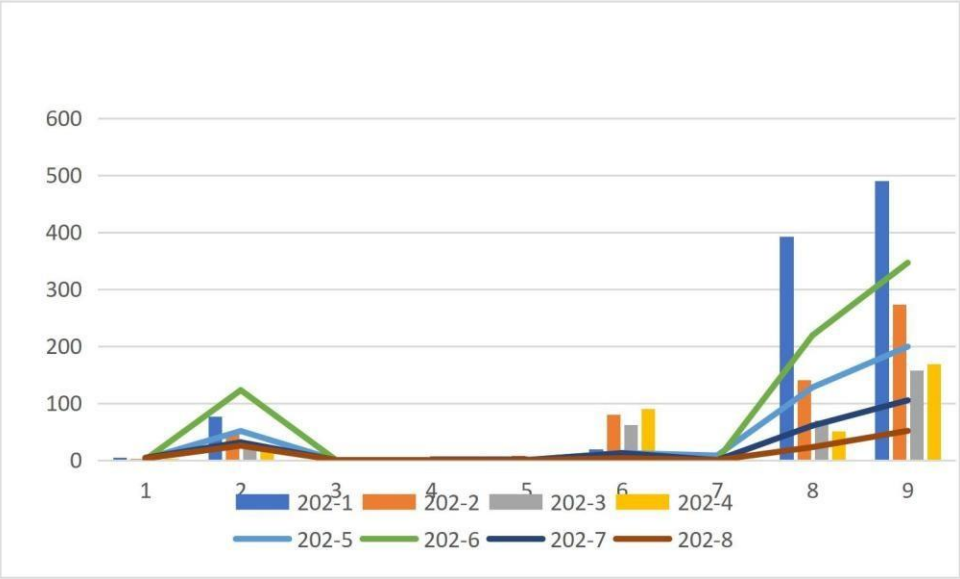
Out of total 1082.78 gr, Leaf litter (17 species) occupies major portion with 392.51gr followed by dead stems284.55gr, Miscellaneous parts with 11.91gr, bark with 9.97gr (2 species) and 1.60gr of fruits. There are no flowers and seeds were recorded in the litter. The parts of litter was graphically represented in **Fig. 3**

Fig. 3: Parts of litter vs sampling points



Among the 17 species, *Ixora arborea* produced 131.86 litter including Leaves followed by *Grewia tilifolia* (59.55gr) including leaves; *Butea monosperma* (50.86gr) only leaves; *Maytenus emarginata* (46.05 gr) including leaves The sampling point wise species diversity and leaf litter production presented in **Fig. 4.**

Fig. 4: Species diversity and Leaf litter production



II. Eliminedu Reserve Forests

The litter production of eliminedu Reserve Forest is 1505.537 gr for 29 sampling points with 1x1m size. A total of 28 species of plant produce litter was collected from the study area and mentioned in **Table 5** and point wise litter production mentioned in **Table 6.**

Table 5: List of species produced litter

S. No.	Name of the plant	Leaves	st	Total
1	*Acacia auriculiformis*	119.6	0	119.6
2	*Acacia chundra*	32.01	0	32.01
3	*Albizia Amara*	0.32	0	0.32
4	*Annona squamosa*	37.8	3.22	41.02
5	*Ananas comosus*	10.76	2.66	13.42
6	*Brachiaria ramosa*	0.24	36.03	36.27
7	*Bauhinia recemosa*	23.96	0	23.96

8	*Bridelia Montana*	2.127	0	2.127
9	*Crocus sativus*	0.23	0	0.23
10	*Cassia fistula*	12.5	0	12.5
11	*Cassine glauca*	0.95	0	0.95
12	*Diospyros chloroxylon*	9.78	0	9.78
13	*Dadonaea*	0.4	0	0.4
14	*Eucalyptus*	341.14	4.50	345.64
15	*Flacourtia indica*	1.4	0	1.4
16	*Grewia damine*	94.18	0	94.18
17	*Grewia flavescens*	2.83	0	2.83
18	*Ixora arboreal*	37.18	0	37.18
19	*Lantana camara*	150.25	0	150.25
20	*Maytenus Emarginatus*	3.18	0	3.18
21	*Mundulea serecia*	0.16	0	0.16
22	*Mimosa shrub*	22.2	0	22.2
23	*Pletophorumpterocarpou*	22.41	0	22.41
24	*Parmelia tinctorial*	1.82	0	1.82
25	*Pongamia pinnata*	326.28	188.52	514.8
26	*Plantana camarous*	11.24	0	11.24
27	*Tlytophora*	3.7	0	3.7
28	*Cocculus hirsutus*	1.96	0	1.96
		1270.607	**234.93**	**1505.537**

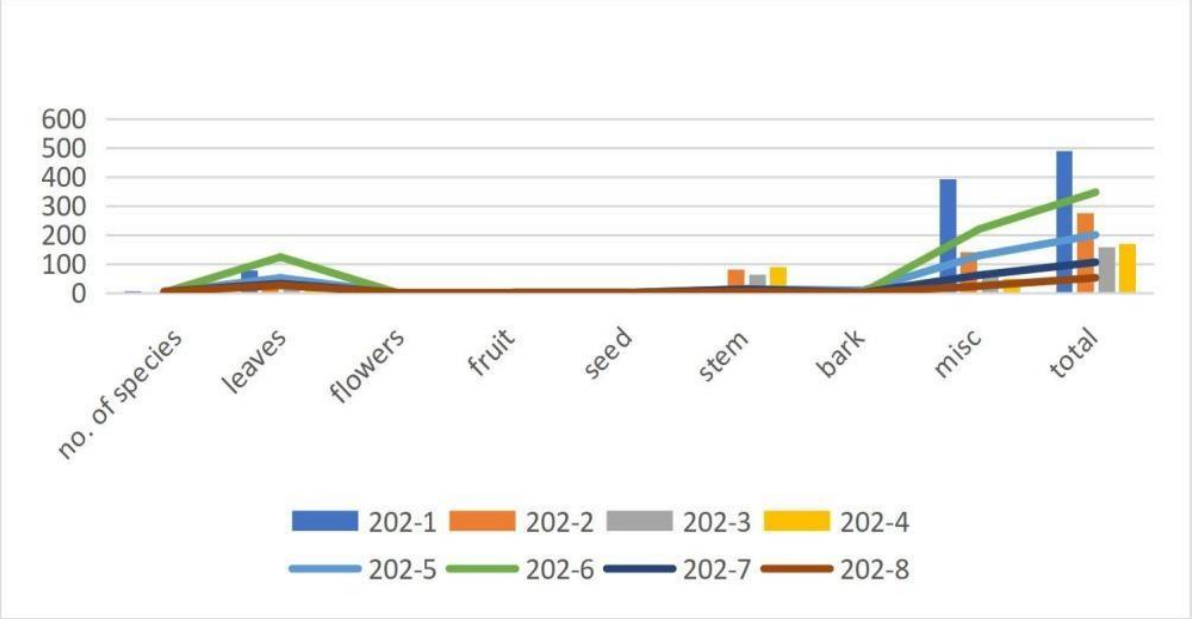
Table 6: Point wise litter production of Hayathnagar RF

Point No.	No. of species	Leaves	Fl.	Fr	Bark	Stem	Misc.	Total
287-1	1	19.2	3.25	2.05	0	48.1	0	0
287-2	3	25.21	0	0	0	42.5	0	0
287-3	3	54.08	0	0	0	13.1	0	0
287-5	6	46.8	0	0	1.39	22.43	0	0
288-4	4	38.55	0	0	0	21.5	0	0
288-6	4	23.36	0	0	0	13.2	0	0
288-7	3	39.07	0	0	1.83	13.8	17.4	30.6
288-9	4	19.08	0	0	0	52.5	0	0.04
289-10	2	0.69	0	0.62	0	33.42	0	0
289-11	4	36.65	0	0	0	21.75	0	0
290-12	1	93.3	0	3.13	0	45.14	1.25	22.7
290-13	4	61.33	0	3.77	0	34.3	0	4
290-14	3	101	0	1.09	0	12	0	0.75

290-15	2	53.64	0	0	4.5	35.43	2.2	19.4
290-16	4	28.12	0	3.3	0	39.6	0	28.41
290-17	5	41.66	0	0	0	13	0	0
290-18	3	60.45	0	0.45	0	73.2	0	0
290-19	4	21.38	0	0	2.66	74.18	0	41.1
290-20	4	68.81	0	0	0	21.5	0	0.13
290-21	2	38.4	0	0	0	56.4	0	0
290-22	3	204.04	0	0	119.8	36.03	0	79.6
290-22	1	42.48	0	0	68.72	45.31	0	125.32
290-24	2	38.78	0	0	0	31.5	2.13	22.37
334-25	5	58.14	0	0	0	3.21	0	0
334-26	4	25	0	0	0.45	0	0	0.27
334-27	4	28.07	0	0	0	68.3	0	1.24
334-28	3	34.93	0	0	0	2.04	0	0.15
334-29	4	41.66	0	0	0	13	0	0
334-30	1	27.29	0	0	0	0.23	0	0
	93	1371.17	3.25	14.41	199.35	886.67	22.98	376.08

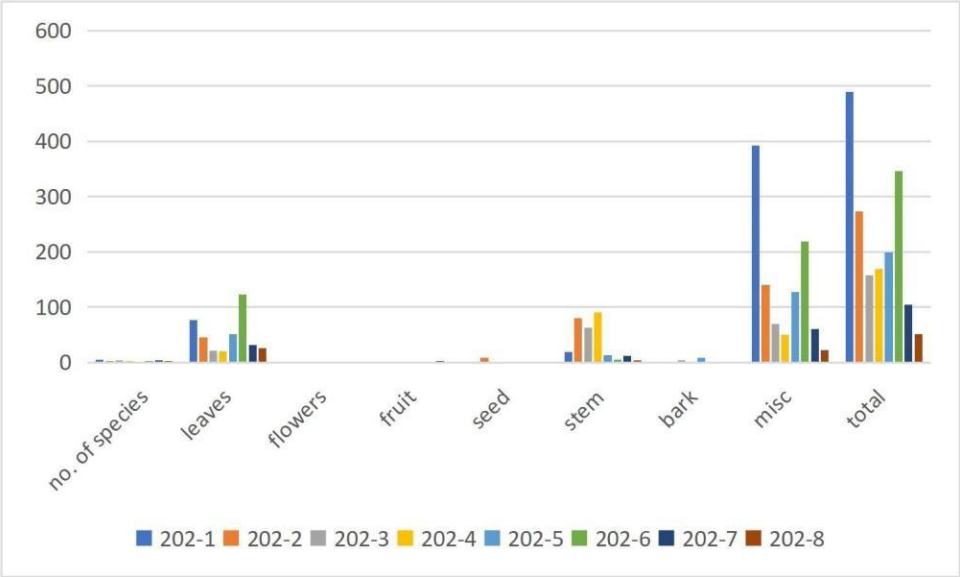
Out of total 376.08 gr, Leaf litter (72 species) occupies major portion with 1371.17 gr followed by dead stem 886.67gr, miscellaneous parts with 22.98gr, bark with 199.35 gr (7species) and 14.41gr of fruits. There are no flowers and seeds were recorded in the litter. The parts of litter was graphically represented in **Fig. 5.**

Fig. 5: Parts of litter vs sampling points



Among the 28 species,Pongamia pinnata produced 514.28 litter including Leaves and stems followed by Eucalyptus (345.64gr) including leaves and stems ; lantana camara (150.25gr) only leaves; The sampling point wise species diversity and leaf litter production presented in **Fig. 6.**

Fig. 6: Species diversity and Leaf litter production



CHAPTER – VI

SUMMARY & CONCLUSION

The litter production of Mrugavani National Park (MNP) Reserve Forest is 394.93 gr for 10 sampling points with 1x1m size. A total of 17 species of plant produce litter was collected from the study area. Out of total 1082.78 gr, Leaf litter (17 species) occupies major portion with 392.51 gr followed by dead stems 284.55 gr, Miscellaneous parts with 11.91gr, bark with 9.97gr (2 species) and 1.60 gr of fruits. There are no flowers and seeds were recorded in the litter.

The litter production of Eliminedu Reserve Forest is 1505.537 gr for 29 sampling points with 1x1m size. A total of 28 species of plant produce litter was collected from the study area. Out of total 376.08 gr, Leaf litter (72 species) occupies major portion with 1371.17 gr followed by dead stem 886.67gr, miscellaneous parts with 22.98gr, bark with 199.35 gr (7species) and 14.41gr of fruits.

Chapter-VII
REFERENCES

- Allen, S. E., H. M. Grimshew, J. A. Perkinson & C. Quarmby. 1974. Chemical Analysis of Ecological Materials.John Wiley & Sons, New York.
- Arslan, H., G. Gurcan & S. Kirmizi. 2010. Nitrogen mineralisation in the soil of indigenous oak and pine plantation forests in a Mediterranean environment. European Journal of soil biology 46: 11 -17.
- Bargali, S. S. 1995. Litter fall, nutrient return and leaf decomposition in an age series of eucalypt plantations in Central Himalaya.Oecologia Montana4:31-38.
- Bargali, S. S. 1996. Weight loss and N release in decomposing wood litter in a eucalypt plantation age series. Soil Biology & Biochemistry 28: 699-702.
- Bargali, S. S., C. B. Pandey & D. K. Sharma. 2006. Weight loss and nitrogen release pattern in leaf and wood litter of Gliricidia sepium(Jacq.)Walp.Bulle-tin of the National Institute of Ecology 17: 25-29.
- Bargali, S. S., S. P. Singh & R. P. Singh. 1993. Pattern of weight loss and nutrients release from decomposing leaf litter in age series of eucalypt plantations. Soil biology and Biochemistry 25:1731-1738.
- Bargali, S. S., V. P. Pandey & Kiran Bargali. 2014. Floral composition and diversity pattern in open and closed canopy tropical dry deciduous forest. Vegetos 27 (2): In Press.
- Odiwe, A.I and Muoghalu,J.I,Litterfall dynamics and forest floor litter as influenced by fire in a secondary lowland rainforest in Nigeria.Trop.Ecol.,2003
- Rajendra prasad,M.,krishnan.P.N.and pushpangadan,P.,vegetational characterization and litter dynamics of the sacred groves of kerala ,Southwest India .j.Trop.for.sci.,2000.
- Sundarapandian,S.M.and swamy,P.S Litter production and leaf-litter decomposition of selected tree species in tropical forests at kodayar in the westen ghats ,india .For.ecol.manage.,1999
- Proctor,j., nutrient cycling in primary and old secondary rainforests.Appl.Geor.,1987.
- Vitousek, P.M.and Sanford,R.I., Nutrient cycling in moist tropical forest .annu Rev. ecol.syst 1986

- Burghouts, T. B. A., straalen, N. M. V. and bruijinezeel, l. A., spitial hererogenity of element and litter turnover in a bornean rainforest j. Trop. Ecol. 1998
- Vishlakshi, N., litterfall standing crop of litter and their nutrients in two tropical dry evergreen forests in India int. J. Ecol. Environ. Sci., 1993
- BOOJH, R. & RAMAKRISHNAN, B.3., 1981, Phonology of trees in a subtropi- cal evergreen montane forest in North-East India. Ceo-Eco-Trop 5 (3) 189-209.
- BRASELI, H.M., UNWIN, G.L. & STOCKERG, C., 1980. The quantity, temporal distribution and mineral element content of litterfall in two forest types at two sites in tropical Australia. J. Ecol., 68, 123-139. BRAY, J.R. & GORHAM, E., 1964. Litter production in forests of the world In J.B. CRAGG (Ed). Advances in Ecological Research, Academic Press, New York, 2, 101-157.CORONER, 13, 1970. Lear fall in a tropical rain forest. J. Appl.Ecol., 7, 603-608.
- EDWARDS, P.J., 1977. Studies of mineral cycling in a Montane Rain forest in New Guinea. II. The production and disappearance of litter. J. Ecol., 65, 971-992. HAINES, 8. & FOSTER, R.B., 1977. Energy flow through litter in a Panama- nian forest. J. Ecol., 65, 147-155.
- JENSEN, B., 1974. Decomposition of angiosperm tree leaf litter. In: G.H. DICKINSON & G.J.F. PUGH (Eds). Biology of Plant Litter Decomposition, Academic Press, New York, 69-104.
- JENNY, H. GESSEL, S.P. & BINGHAM, E.T., 1949. Comparative study of de- composition rates of organic matter in temperate and tropical regions. Soil Science, 68, 419-432.
- JORDAN, C.F. & MURPHY, P.G., 1978. A latitudinal gradient of wood and litter production, and its implication regarding competition and species diversity in trees. The American Midland Natura-list, 99, 415-434.
- JORGENSEN, J.R., WELLS, G. & METZ, L.J., 1975. The nutrient cycle; key to continuous forest production. Journal of Forestry, 73, 400-403.
- KLINGE, H., 1977. Fine litter production and nutrient return to the soil in three natural forest stands of Eastern Amazonia, Geo-Eco- Trop, 1 (2) 159-167.

- Gilmour DA, King GC, Applegate GB, Molins B. Silviculture of plantation forests in central Nepal to maximize community benefits. Forest Ecology and Management 1990; 32:173-86.
- Rao KS, Maikhuri RK, Saxena KG. Participatory approach to rehabilitation of degraded forest land: a case study in high altitude village of Indian Himalaya, International Tree Crops Journal 1999;10:1-17.
- Maikhuri RK, Semwal RL, Rao KS, Singh K, Saxena KG. Growth and ecological impacts of traditional agroforestry tree species in central Himalaya, India. Agroforestry Systems 2000; 48:257-72.
- Okeke Al, Omaliko CPE Leaf litter decomposition and carbon dioxide evolution of some agroforestry fallow species in southern Nigeria. Forest Ecology and Management 1992:50:103-16.
- Montagnini F, Ramstad K, Sancho F. Litter fall, litter decomposition and the use of mulch of four indigenous tree species in the Atlantic lowlands of Costa Rica. Agroforestry Systems 1993;23:39-61.
- Lehmann J, Schroth G, Zech W. Decomposition and nutrient release from leaves, twigs and roots of three alley-crop tree legumes in central Togo.Agroforestry Systems 1995;29: 21-36.
- Palm CA. Contribution of agroforestry trees to nutrient requirements of intercropped plants. Agroforestry Systems 1995;30:105-24.
- Vanlauwe B, Vanlangenhove G, Merckx R, Vlassak K. Impact of rainfall regime on the decomposition of leaf litter with contrasting quality under subhumid tropical conditions. Biology and Fertility of Soils 1995;20:8-16.
- KLINGE, H. & RODRIGUES, W.A., 1968. Litter production in an area of Ama- zonian Terra Firme forest. I. Litterfalls, organic carbon and nitrogen contents of litter. Amazonia, 1, 287-310.
- KUNKEL-WESTPHAL, K. & KUNKEL, P., 1979. Litterfall in a Guatemalan pri-mary forest, with details of leaf-shedding by some common tree species. J. Ecol., 67, 665-686.
- LAUDELOT, H. & MEYER, J., 1954. Mineral element and organic material cycles in the equatorial forest of the Congo. Oecologia planta- rum, 7, 1-21.

- MALAISSE, F., FRESON, R., GOFFINET, G. & MALAISSE-MOUSSET, M., 1975. Litterfall and litter breakdown in Miombo. In: F. GOLLEY & E. MEDINA (Eds): Tropical ecological systems, Springer Verlag, New York- Berlin, Ecological Studies, 11, 137-152.
- NYE, P.H., 1961. Organic matter and nutrient cycles under moist tropical forest. Plant soil, 13, 333-346.
- RAMAKRISHNAN, P.S. & TOKY, 0.P., 1978. Preliminary observations on the impact of jhum (shifting agriculture) on forested ecosystem. In: Proc. National Seminar on Resources Development and En- vironment in the Himalayan region, Department of Science & Technology, New Delhi, 343-354.
- Akai,T and furuno,T. 1970. Amount of litter fall and grazing in young loblolly pine forest [J]. Bulletin of the Kyoto Univ. Forest No 42 83-93.
- Aksornkoae, S. and Khemnark. C. 1980. Nutrient cycling in mangrove forest of Thailand [C] In Asian Symposium on Mangrove Environment and Management Kuala Lumpur University of Malaya p 1-14
- Andersson, F. 1981. Biomass data in Reichle. D. E. (Ed) Dynamic properties of forest ecosystems. [c] Cambridge Cambridge University press p 620.
- Ando, T.,Takeuchi,I., Saito.A and watande. H 1969 Some observation of dry-matter production on the artificial two-storied stand[J] J Jap For Soc. 51. 102-107
- Balasubramanyam Y 1964 Litter fall data cited in Litter Production in Forest of the world(p 132) (Bray J R and Gorham E 1964)
- Bandhu, D 1973 Chakia project Tropical deciduous forest ecosystem (C).In kern L (Ed) Modering forest ecosystems Tennessee Oak Ridge National Laboratory p39-61
- Bao C S 1991 Nutrient cycling in a birch forest In Zhou Xiaofeng(Ed) LocatedResearch on the Forest Ecosystem.Harbin Northeastern Forestry University Press,p217-228(inChinese)
- Bazilevich NI 1967 Litterfall data cited in production and mineral cycling in terrestrial vegetation(Table 9 Table32) (Rodin L,E and Bazilevich N.I 1967)Berg B Berg MP. Cortina J Flower-Ellis. J Gallardo A, Johansson M-B
- Lundmark J-E and Madeira M 1993 Amount of Litterfall in some European coniferous forest (C) In Breymeyet A (Ed) Geography of Organic Matter Production and Decay

Warsaw Institute of Geography and Spatial Organization Polish Academy of Sciences ,p81-110.

- Bladco F and Tassy B. 1975 Elude d un ecosystem forestier montagnard du sub de I Inde[J] Bulletin d Ecologie ,6 525-539.
- Bonnevie-Svendsen. C. and Gjems. O 1957. Amount and chemical composition of the litter from larch. Beech. Norway spurce and Scots pine stands and its effect of the soil [J]. Norske Skogstorsoksv,48. 111-174.
- Bray JR and Gorham E. 1964. Litter Production in forest of the world[J] Advances in Ecological Research, 2: 201-157
- Breymeyet,AI. 1991 .Comparative analysis of organic matter transformation in coniferous forest ecology fromr an international perspective The Hague SPB Academic Publishing BV,p161-177.
- Bruijnzeel LA 1982 Hydrological and bioeochemical aspects of man-made forests in sounth-cental Java. Indonesia [M] Amsterdam.Vrije Universitite Amsterdam
- Bruijnzeel LA 1985 Nutrient content of Litterfall in coniferous forest plantations in central Java Indonesia[J] Journal of Tropical Ecology 1(14): 354-372.
- Bunyavejchewin. S. 1989 primary production of plots of five young closed-spaced fast-growing tree species three dry matter and nutrient content of Litterfall [J] Nat.Hist Siam Soc. 37(1): 65-73
- Burghouts T Ernsting G, korthals G and de Vris T. 1992. Littetall leaf litter decomposition and litter invertebrates I primary and selectively logged depterocap forest in Sabah,Malaysia [J] Philtrans R Soc Lon B 335 407-416.
- Cannell M.G.R 1973 World Forest Biomass and primary production Data [M] Landon.Academic press,p 1-150.
- Chaturvedi O P and Singh J.S 1987.The structure and function of pine forest in central Himalaya I Dry Matter dynamics [J] Annals of Botany,61 236-252.
- Chaturvedi, O.P and Singh, J.S. 1987 The structure and functions of pine forest in central Himalaya second Nutrient dynamics[J].Annala of Botany.62.253-267.
- Chen Z-H 1992.Biomass and productivity of a South subtropical evergreen brodleaved forest in Heishiding Nature Conserve Area seventh Litter fall, standing crop and decomposition rate[J] Botanical Journal of South China. 1: 107-113