

**Impact Assessment on Land Use/ Land Cover  
Change, Tree Diversity and Anthropogenic  
pressure at Khondra Forest, Chhattisgarh  
through remote Sensing & GIS**

**(Dissertation)**

*Submitted for the Partial fulfillment of degree of*

**MASTER OF SCIENCE**

In

**Forestry & Environmental Sciences**



**Session – 2023-25**

*Submitted By:*

**ABIR GHOSH**

Enrollment no.: GGV/23/06701

*Under the Supervision of:*

**Dr. Ajay Kumar Singh**

*Assistant Professor*  
Department of Forestry, Wildlife  
& Environmental Sciences  
GGV, Bilaspur

*Submitted to:*

**DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES**  
(ICFRE A++)

**GURU GHASIDAS VISHWAVIDYALAYA (NAAC A++)**

(A Central University Establishment Under Central University Act 2009, No. 25 of 2009)

**BILASPUR - 495009, CHHATTISGARH**

**2025**

डॉ. अजय कुमार सिंह

सहायक प्राध्यापक  
प्राकृतिक संसाधन अध्ययन कक्षा  
वनिकी, वन्यजीव एवं पर्यावरण विज्ञान विभाग  
गुरु गणेशदास विश्वविद्यालय, बिलासपुर, छत्तीसगढ़  
+91- 7879721224, 7800591141  
ajk.ggu@gmail.com, ajayksingh.02@ggu.ac.in



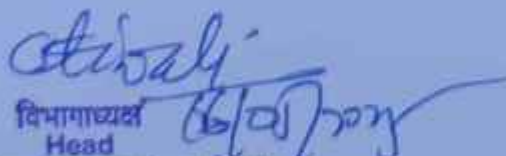
Dr. Ajay Kumar Singh

Assistant Professor  
School of Natural Resources  
Department of Forestry, Wildlife & Environmental Sciences  
Guru Ghasidas Vishwavidyalaya, Bilaspur Chhattisgarh  
+91- 7879721224, 7800591141  
ajk.ggu@gmail.com, ajayksingh.02@ggu.ac.in

## CERTIFICATE

I have great pleasure in certifying that **Mr. ABIR GHOSH** s/o **Mr. ASHIS KUMAR GHOSH** is a regular student of M.Sc. Forestry & Environmental Sciences, 4<sup>th</sup> Semester, Guru Ghasidas Vishwavidyalaya, Bilaspur (CG). He has completed his Dissertation entitled "**Impact Assessment on Land Use/ Land Cover Change, Tree Diversity and Anthropogenic pressure at Khondra Forest, Chhattisgarh through remote Sensing & GIS**" during the session 2023-2025 under my supervision.

I wish him all the success in his academics.

  
विभागाध्यक्ष  
Head

वनिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु गणेशदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)



Dr. Ajay Kumar Singh  
Supervisor & Assistant Professor

## DECLARATION

I hereby declare that the present research entitled "**Impact Assessment on Land Use/ Land Cover Change, Tree Diversity and Anthropogenic pressure at Khondra Forest, Chhattisgarh through remote Sensing & GIS**" interpretation or part has not been submitted for any degree or diploma from any university. The source of the material and all assistance received during the course of the investigation has been duly acknowledged. All the records and data given in the report are correct to my knowledge.

*Abir Ghosh*

**Abir Ghosh**

M.Sc. Forestry & Environmental  
Sciences 4<sup>th</sup> Semester  
Enrollment No. GGV/23/06701

## Acknowledgement

First of all, I would like to thank 'God' who bestowed me with patience and favourable conditions and circumstances to achieve this feat.

I express my profound indebtedness to Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing me all the necessary facility to complete my project work.

I pay my deep regards to **Prof. S.C. Tiwari, Dean, School of Natural Sciences and Head of Department of forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh** for his constant help and academic encouragement.

I express my deep sense of gratitude and thanks to **Dr. Ajay Kumar Singh, Supervisor & Assistant Professor, Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh** for guidance and support.

I pay my thanks to **Prof. S.S. Dhuria, Dr. K.K. Chandra, Dr. Garima Tiwari, Dr. Gunjan Patil, Dr. Bhavana Dixit, Dr. B.P. Singh, Dr. A.K. Bhardwaj, Dr. C.K. Singh, Dr. C. Manpoong**, faculties of the, Department of Forestry, Wildlife & Environmental Science, GGV for much needed critical comments during entire study period.

I would also like to thanks **Divisional Forest officer** and other Staff member of Bilaspur Forest Division, Bilaspur for sparing their valuable time for us and give more information and co-operate with us.

I pay my thanks to **Sohini Bhaumik, Rahul Kumar Dhruw and Bhupendra Devdas** for their constant encouragement, guidance and support for completion of this work.

I am highly obliged to my worthy Parents **Mrs. Shyamali Ghosh and Mr. Ashis Kumar Ghosh** and my sister **Mrs. Soumi Ghosh** without their blessings and support this work would not have seen the light of the day.

I pay my gratitude to my Senior **Sudhir Ranjan Chudhary, Ashutosh Anand, V. Baswanth, Subham Tandan** and my junior **Bhagirathi jaiswal** for their help during the study.

*Abir Ghosh*  
**Abir Ghosh**

## Table Of Content

Chapter No		Title	Page no
Chapter- 01	1.1	Introduction	1- 5
Chapter- 02	2.1	Review of Literature	6- 9
Chapter- 03		Material and Methods	
	3.1	Study Area	10- 11
	3.2	Methods	12- 23
Chapter- 04		Result & discussion	
	4.1	Land Use /Land Cover	24- 44
	4.2	Tree Diversity Assessment	45- 62
	4.3	Anthropogenic Pressure on Khondra Forest	63- 70
Chapter- 05		Conclusion	71- 73
	5.1	Recommendations	73- 75
		Tables	
		Graphs	
		Photos	
		Reference	76- 79
		Appendix -I	80
		Appendix -II	81

**गुरु घासीदास विश्वविद्यालय**  
(केंद्रीय विश्वविद्यालय अधिनियम 2009 अ. 25 के अंतर्गत स्थापित केंद्रीय विश्वविद्यालय)  
कोनी, बिलासपुर - 495009 (छ.ग.)



**Guru Ghasidas Vishwavidyalaya**  
(A Central University Established by the Central Universities Act, 2009 No. 25 of 2009)  
Koni, Bilaspur - 495009 (C.G.)

**STATUS AND COMPOSITION OF FAUNAL DIVERSITY OF MARWAHI  
FOREST DIVISION CHHATTISGARH.**



**A DISSERTATION SUBMITTED**

**FOR**

**PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE  
DEGREE OF MASTER OF SCIENCE IN FORESTRY AND ENVIRONMENTAL SCIENCES**

**BY**

**AYUSHMAN SINGH RAJPUT**

**Enrollment No: GGV/19/ 6026**

**Batch: 2023-25**

**UNDER THE SUPERVISION OF  
Dr. ATUL KUMAR BHARADWAJ  
Assistant Professor**

**DEPARTMENT OF FORESTRY WILDLIFE AND ENVIRONMENTAL SCIENCES,  
SCHOOL OF NATURAL RESOURCES**

**GURU GHASIDAS VISHWAVIDYALAYA**

**(A Central University established by the Central Universities Act 2009, No. 25 of 2009)**

**KONI, BILASPUR (C.G) 495009**

**2025**

**16.05.25**  
**(SATYADEO SHARMA)**  
**(IES)**




**Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)**  
(A Central University established under Central University Act 2009, No.25 of 2009)  
**Department of Forestry, Wildlife and Environmental Sciences**

**CERTIFICATE**

I have great pleasure in certifying that **Mr. Ayushman Singh Rajput S/o Mr. Dilshwar Singh Rajput** is a regular student of M.Sc. Forestry & Environmental Sciences IV Semester during the session of 2023-25 Department of Forestry, Wildlife & Environmental Sciences, GGU, Bilaspur. He has completed his Dissertation entitled "STATUS AND COMPOSITION OF FAUNAL DIVERSITY OF MARWAHI FOREST DIVISION CHHATTISGARH" during this semester under my supervision and guidance.

I wish him all the success in his academics.

*Atul Kumar Bharadwaj*  
16/5/2025

  
**Dr. Atul Kumar Bharadwaj**  
(Supervisor)  
Assistant Professor of  
Department of Forestry, Wildlife &  
Environmental Sciences, GGU, Bilaspur



## DECLARATION

I hereby declare that the dissertation entitled "STATUS AND COMPOSITION OF FAUNAL DIVERSITY OF MARWAHI FOREST DIVISION CHHATTISGARH" submitted to Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, C. G is a record of an original work done by me under the guidance of **Dr. Atul kumar Bharadwaj** and this work has been formed for the award of Degree of Master of Science in Forestry & Environment Sciences. This work has not been submitted for any other degree in any Universities/Institutes.

Date:

Place: Bilaspur

**Ayushman Singh Rajput**

M.Sc. Forestry 4<sup>th</sup> Sem.

Roll No. 23078103

Enroll.No. GGV/19/6026





## ACKNOWLEDGEMENT

First of all, I would like to thank 'God' who bestowed me with patience and favourable conditions and circumstances to achieve this feat.

I express my profound indebtedness to Department of Forestry, Wildlife & Environmental Science, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing me all the necessary facilities to complete my project work. I pay my deep regards to **Prof. S.C. Tiwari**, Dean, School of Studies of Natural Resources, for his academic encouragement.

I express my deep regards to **Prof. S.C. Tiwari**, Head, Department of Forestry, Wildlife and Environmental Science, for his valuable motivation and comments.

I express my deep sense of gratitude and thanks to my supervisor **Dr. Atul Kumar Bharadwaj**, Assistant Professor, Department of Forestry, Wildlife and Environmental Science for his inspiring guidance, support and much needed critical comments during this entire study period.

I express my deep regards to Coordinator **Dr. Ajay Kumar Singh**, Assistant Professor, Department of Forestry, Wildlife and Environmental Science for his guidance and Support and managing activities.

I pay my thanks to **all my teachers, staff members, seniors and batch mates** of the department for their constant encouragement, guidance and support for completion of this work.

I am highly obliged to my worthy parents, without their blessings and support this work would not have seen the light of the day.

  
**Ayushman Singh Rajput**



## CONTENTS

Sl. No.	Items	Page No.
	<i>Certificate</i>	ii
	<i>Declaration</i>	iii
	<i>Acknowledgement</i>	iv
	<i>Contents</i>	v
	<i>Abstract</i>	1
1.	Introduction	2-11
2.	Review Literature	12-15
3.	Materials and methods	16-19
4.	Results	20-27
5.	Discussion	28-29
6.	Conclusion	30
	Reference	31-33

**ASSESSING THE ECOTOURISM POTENTIAL OF KOTMI SONAR  
CROCODILE PARK: STRATEGIES FOR SUSTAINABLE  
DEVELOPMENT**

**Dissertation**

*Submitted for the Partial fulfillment of*  
**DEGREE OF MASTER OF SCIENCE**

In

**Forestry & Environmental Sciences**



**Session-2023-25**

*Under the Supervision of:*

**Dr. Garima Tiwari**

*Assistant Professor*  
Department of Forestry, Wildlife  
& Environmental Sciences, GGV

*Submitted By:*

**Bharti Sahu**

Enrollment no.:  
GGV/19/6029

Roll No.: 23078104

*Submitted to:*

**DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES**

(ICFRE A++)

**GURU GHASIDAS VISHWAVIDYALAYA (NAAC A++)**

(A Central University Establishment Under Central University Act 2009, No. 25 of 2009)

**BILASPUR-495009, CHHATTISGARH**

गुरु घासीदास विश्वविद्यालय  
(गुरु घासीदास स्मृतिगत १९७३ अ. २१ में स्थापित राष्ट्रीय केंद्र विश्वविद्यालय)  
कोनी, बिलासपुर - 495009 (छ.ग.)

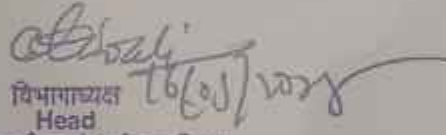


Guru Ghasidas Vishwavidyalaya  
(Central University Established by the Central Government Act 209 of 2009)  
Koni, Bilaspur - 495009 (C.G.)

## CERTIFICATE

This is to certify that the Dissertation entitled "ASSESSING THE ECOTOURISM POTENTIAL OF KOTMI SONAR CROCODILE PARK: STRATEGIES FOR SUSTAINABLE DEVELOPMENT." Submitted in partial fulfilment of the requirements for the degree of Master of science in forestry and environmental Sciences in Department of Forestry, wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur (Chhattisgarh) is the work carried out by Miss. Bharti Sahu D/O R.P.Sahu under my supervision and guidance.

I wish all the Success in her future academics endeavors.

  
विभागाध्यक्ष  
Head

प्राणिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

Dr.S.C. Tiwari

(Professor)

Dept.of Forestry,Wildlife

& Environmental Science,

GGV.Bilspur (C.G.)



DR. GARIMA TIWARI

Assistant Professor

Dept. of Forestry

Guru Ghasidas Vishwavidyalaya

Bilaspur (Chhattisgarh)

Dr. Garima Tiwari

Supervisor

## *DECLARATION*

---

I hereby declare that the dissertation entitled "Assessing the Ecotourism Potential of Kotmi Sonar Crocodile Park: Strategies for Sustainable Development" Submitted to Department of forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, C.G is a record of an original work done by me under my guidance of **Dr. Garima Tiwari** and his work has been formed for the award of degree of Master of Science in Forestry & Environment Sciences. This work has not been submitted for any other degree in any universities/Institutes.

Place :

Date :

*Bharti*

**Bharti Sahu**

M.Sc. Forestry

IV<sup>th</sup> Semester

Roll No. -23078104

Enrollment No. - GGV/19/6029

## ACKNOWLEDGEMENT

First of all, I would like to thank 'God' Who bestowed me with patience and favourable conditions and circumstances to achieve this feat.

I express my profound indebtedness to Department of Forestry, Wildlife & Environmental Science, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing me all the necessary facilities to complete my Dissertation work, I pay my deep regards to **Prof. S.C. Tiwari**, Dean, School of Studies of Natural Resources and & Head, Department of Forestry, Wildlife and Environmental Sciences or his academic encouragement.

I wish to acknowledge my sincere gratitude to my supervisor **Dr. Garima Tiwari** Department of Forestry, for helping me at every step in guiding me in every way possible. This project would not have been successful without his help and continuance guidance throughout.

I express my deep regards to all my professors **Dr. S.S. Dhuria, Dr. K.K. Chandra, Dr. Gunjan Patil, Dr. Bhawana Dixit, Dr. Brijendra Pratap Singh, Dr. Ajay Kumar Singh, Dr. Atul Kumar Bhardwaj, Dr. Chandresh Kumar Singh, Dr. Chowhani Manpoong**, Department of Forestry, Wildlife and Environmental Science, for their insightful suggestions and encouragement over the years. Your support and encouragement helped me to overcome challenges I faced.

I want to express my gratitude towards **My Parent** for their encouragement which helps me in completion of this project. And also sincerely acknowledge the efforts of all those who have directly or indirectly helped me in completing my project work.

It is the kindness of these acknowledge person that this project work sees the light of the day. I submit this Project Work of mine with great humility and utmost regard.

Date:

Place: Bilaspur.

**Bharti Sahu**  
M.Sc. Forestry IV Semester  
Roll. No. - 23078104  
Enrollment No. - GGV/19/6029

## TABLE OF CONTENT

Sr. No.	Title	Page No.
1.	<b>1. INTRODUCTION</b> 1.1 Ecotourism 1.2 Principle of Ecotourism 1.3 Importance of Ecotourism 1.4 Potential of Ecotourism 1.5 Sustainable Development 1.6 Ecotourism in India 1.7 Ecotourism in C. G. 1.8 Objective	1-5
2.	<b>2. LITRATURE REVIEW</b>	6-11
3.	<b>3.1 Material &amp; Methodology</b> 3.1.1 Study Site 3.1.2 Parameter <b>3.2 Data Collection</b> 3.2.1 Primary Data 3.2.2 Secondary Data	12-18
4.	<b>4. RESULT</b> 4.1 Site overview and Ecological Significance 4.2 Crocodile Conservation Park 4.3 Revenue through Ecotourism 4.4 Visitor Entry Fees Structure & Revenue Insight 4.5 Livelihood opportunities 4.6 Impact of Ecotourism on the Biodiversity of Study area 4.7 Visitor Preference & Infrastructure area 4.8 SDG Goal 4.9 Environmental Zoning & Tourism zone 4.10 Community Feedback and willingness to Participate 4.11 Summary of key Result	19-30
5.	<b>DISCUSION</b>	31-33
6.	<b>PICTURES PLATE</b>	34-36
7.	<b>CONCLUION</b>	37
8.	<b>REFERENCE</b>	38-40

**A DISSERTATION ON  
TO ASSESS THE SURVIVAL PERCENTAGE AND GROWTH  
PERFORMANCE OF THE CAMPA PLANTATION GROWN IN  
KAWARDHA FOREST DIVISION (WEST PANDARIYA RANGE)**

**SUBMITTED FOR THE PARTIAL FULFILLMENT OF  
THE DEGREE OF MASTER'S OF SCIENCE IN**



**FORESTRY & ENVIRONMENTAL SCIENCES**

**SESSION- 2023 - 2025**

***Under the Supervision of:***

***Dr. ATUL KUMAR BHARDWAJ***  
Assistant Professor Dept. of  
Forestry, Wildlife &  
Environmental Sciences,  
GGV, Bilaspur

***Submitted By:***

**BHUMIKA DANSENA**  
M.Sc. Forestry 4<sup>th</sup> Semester  
Roll No.: 23078105  
Enroll. No.: GGV/19/6030

**DEPARTMENT OF FORESTRY, WILDLIFE  
& ENVIRONMENTAL SCIENCES (ICFRE A++)**

---

**GURU GHASIDAS VISHWAVIDYALAYA,  
BILASPUR, CHHATTISGARH 495009 (A Central University established under  
Central Universities Act 2009, No. 25 of 2009) (NAAC A++)**

---



DEPARTMENT OF FORESTRY, WILDLIFE AND ENVIRONMENT SCIENCES  
(ICFRE A++)  
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)  
(A central university established under Central Universities Act 2009, No. 25 of 2009)  
(NAAC A++)



**CERTIFICATE**

I have great pleasure in certifying that Miss BHUMIKA DANSENA D/o Mr. Shyam Lal Dansena is a regular student of M.Sc. Forestry and Environmental Sciences VI Semester during the session of 2023-25 of Department of Forestry, Wildlife and Environmental Sciences, GGU, Bilaspur. She has completed this dissertation entitled "To assess the survival percentage and growth of the CAMPA plantation grown in Kawardha Forest Division (West Pandariya Range)" during this semester under my guidance.

I wish her all the success in her academics.

**Dr. ATUL KUMAR BHARDWAJ**

Assistant Professor

Supervisor

Dept. of Forestry,

Wildlife and Environmental Sciences

GGU, Bilaspur (C.G.)

विभागाध्यक्ष  
Head  
16/05/2025  
वनिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु ग्हासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)



## DECLARATION

I hereby declare that the dissertation entitled "To assess the survival percentage and growth of the CAMPA plantation grown in Kawardha Forest Division (West Pandariya Range)" submitted to Department of Forestry, Wildlife and Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur is a record of an academic work done by me under the guidance of **Dr. Atul Kumar Bhardwaj** and this dissertation work has been performed for the award of Master's degree in Forestry and Environment Science.

Date - 15/05/25

*Bhumika*

**Bhumika Dansena**

*M.Sc. Forestry & Environmental  
Sciences*

*IV Semester*

*Roll no: 23078105*

*Enrolment no: GGV/19/6030*



## ACKNOWLEDGMENT

*First of all, I would like to thank 'God' who bestowed me with patience and favourable conditions and circumstances to achieve this feat.*

*I express my profound indebtedness to Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing me all the necessary facility to complete my dissertation work.*

*I pay my deep regards to Prof. S.C. Tiwari, Dean, School of Natural Sciences and Head of Department of forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for his constant help and academic encouragement..*

*I express my deep sense of gratitude and thanks to Dr. Atul Kumar Bhardwaj, Supervisor & Assistant Professor, Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for guidance and support.*

*I pay my thanks to Dr. K.K. Chandra, Dr. Gunjan Patil, Dr. Garima Tiwari, Dr. Bhavana Dixit, Dr. Ajay Kumar Singh, Dr. B.P. Singh, Dr. A.K. Bhardwaj, Dr. C.K. Singh, Dr. C. Manpoong, faculties and staff members of the, Department of Forestry, Wildlife & Environmental Science, GGV for much needed critical comments during entire study period.*

*I would also like to thank for your guidance and support Divisional forest officer Shashi Kumar (IFS) for sparing their valuable time for me.*

*I would also like to thank Ranger Mrs. Pallavi Gangber, Beat Forest Officer Jaishree Kausal and Staff Officials for sparing their valuable time for me and give more information and co-operate with me.*

*I pay my thanks to my seniors Chanchal Kumari, Animesh Shukla , Poonam Xess, Ashutosh Anand and my friends for their constant encouragement, guidance and support for completion of this work.*

*I am highly obliged to my worthy parents, without their blessings and support this work would not have seen the light of the day.*

**Bhumika Dansena**

M.Sc. Forestry 4<sup>th</sup> Semester

Dept. of Forestry, Wildlife &  
Environmental Sciences, GGV, Bilaspur

Roll No.: 23078105

Enroll. No.: GGV/19/6030

## CONTENT

			Page no.
CHAPTER-1	1	INTRODUCTION	1
	1.1	Forest	1
	1.2	Plantation forestry	2
	1.3	Soil	3-4
	1.4	CAMPA plantation	5
		OBJECTIVE	6
CHAPTER-2	2	REVIEW OF LITERATURE	7-14
CHAPTER-3	3	MATERIALS AND METHODS	15
	3.1	Site description	15
	3.2	Methodology	16
	3.2.1	Plantation details	16
	3.3	Biomass and carbon storage	17
	3.4	Soil sampling	18
	3.5	Laboratory analysis	19
	3.5.1	Soil pH	19
	3.5.2	Soil organic carbon	19
	3.5.3	Cation exchange capacity	20
	3.5.4	Nitrogen	21
	3.5.5	Phosphorus	22
	3.5.6	Potassium	23
	3.5.7	Micronutrient	24
CHAPTER-4	4	RESULTS	26
	4.1	Biomass and carbon storage	26
	4.2	Soil pH, SOC , Cation exchange capacity	27
	4.3	Nitrogen, phosphorus ,potassium	28
	4.4	Micronutrient	29-34
CHAPTER-5	5	CONCLUSION	35-36
		REFERENCES	37-40

## LIST OF TABLE

S.No	TABLE	Page no.
1	Biomass and carbon storage of three site	27
2	pH, SOC and CEC value of sample	28
3	Nitrogen, phosphorus, and potassium value	29
4	Micronutrient value of the soil sample	31
5	Correlation table	31

### LIST OF PLATES

S.No	Plates	Page no.
1	Plantation site of Pandariya	3
2	CAMPA Plantation in Kabirdham	6
3	Measuring diameter & height of the plant in plantation site	18
4	Estimation of soil pH	19
5	Titration of soil sample for SOC	20
6	Titration of soil sample for Nitrogen	22
7	Phosphorus Analyzer	23
8	Estimation of potassium	24

### LIST OF FIGURES

S. No	Figure	Page no.
1	Map of the study area west Pandariya range of Kawardha Forest Division	16
2	Graph of Height	32
3	Graph of Diameter	32
4	Graph of ABG	32
5	Graph of BGB	32
6	Graph of Total Biomass	32
7	Graph of Total Carbon	32
8	Graph of pH	33
9	Graph of SOC	33
10	Graph of CEC	33
11	Graph of Nitrogen	33
12	Graph of Phosphorus	33
13	Graph of Potassium	33
14	Graph of Zinc	34
15	Graph of Iron	34
16	Graph of Copper	34
17	Graph of manganese	34
18	Graph of Boron	34
19	Graph of Sulphur	34

**Carbon Sequestration and Avifaunal Diversity Influenced by the  
Plantation of Various Tree Species at NTPC Sipat Bilaspur (C.G)**

**DISSERTATION**

**ON**

**SUBMITTED FOR THE PARTIAL FULFILLMENT OF**

**THE DEGREE OF MASTER OF SCIENCE**

**IN**

**FORESTRY & ENVIRONMENTAL SCIENCES**



**(Session: 2024-2025)**

***Under the Supervision of:***

**Dr. Gunjan Patil**

(Assistant Professor)

Dept. of Forestry, Wildlife &  
Environmental Sciences, GGV,  
Bilaspur (C.G.)

***Submitted By:***

**Bhupendra Devdas**

M.Sc. Forestry IV Semester

Roll No.: 23078106

Enroll. No.: GGV/23/06703

**DEPARTMENT OF FORESTRY, WILDLIFE &  
ENVIRONMENTAL SCIENCES (ICFRE A++)**

**GURU GHASIDAS VISHWAVIDYALAYA,  
BILASPUR, CHHATTISGARH 495009**

**(A Central University established under Central Universities Act 2009, No. 25 of 2009)**

**(NAAC A++)**



**GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR,  
CHHATTISGARH**


(A Central University established under Central Universities Act 2009, No. 25 of 2009)



**CERTIFICATE**

I Have great pleasure in certifying that **Mr. Bhupendra Devdas S/O Mr. Manee Ram Devdas** is a regular student of M.Sc. Forestry & Environmental Sciences IV Semester during the session of 2024-25 of Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh. He has completed his dissertation entitled **“Carbon sequestration and avifaunal diversity influenced by the plantation of various tree species at NTPC Sipat Bilaspur (C.G)”** during this semester under my guidance.

I wish him all the success in his future academic endeavors.

  
**Head**  
**Dr. S. C. Tiwari**  
(Professor)  
Dept. of Forestry, Wildlife  
& Environmental Sciences,  
GGV, Bilaspur, (C.G)

*15/05/2025*

  
**SUPERVISOR**  
**Dr. GUNJAN PATIL**  
(Assistant Professor)  
Dept. of Forestry, Wildlife &  
Environmental Sciences,  
GGV, Bilaspur, (C.G)

*13/05/25*

## DECLARATION

I hereby declare that the dissertation entitled "Carbon sequestration and avifaunal diversity influenced by the plantation of various tree species at NTPC Sipat Bilaspur (C.G)" A Dissertation report submitted to the Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh is a record of an original work done by me under the guidance of Dr. Gunjan Patil, Assistant Professor. The work been formed for the award of Master of Science in Forestry & Environmental Science and not been submitted elsewhere for the award of any other degree. The facilities, cooperation and the assistance received during the dissertation are duly acknowledged.



**BHUPENDRA DEVDAS**  
M.Sc. Forestry IV Semester  
Dept. of Forestry, GGV  
Roll No.: 23078106  
Enroll. No.: GGV/23/06703



## ACKNOWLEDGEMENTS

*First of all, I would like to thank 'God' who bestowed me with patience and favourable conditions and circumstances to achieve this feat.*

*I express my profound indebtedness to Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing me all the necessary facility to complete my project work.*

*I pay my deep regards to **Prof. S. C. Tiwari, Dean, School of Natural Sciences and Head of Department of forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh** for his constant help and academic encouragement.*

*I express my deep sense of gratitude and thanks to **(Dr. Gunjan Patil Assistant Professor)** Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for as supervisor.*

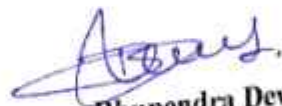
*I pay my thanks to **Prof. Dr S. S. Dhuria Dr. K. K. Chandra , Dr. Garima Tiwari, Dr. Bhavana Dixit, Dr. Ajay Kumar Singh, Dr. B. P. Singh, Dr. A. K. Bhardwaj, Dr. C. K. Singh, Dr. C. Manpoong,** faculties of the ,( Department of Forestry, Wildlife & Environmental Science) GGV for much needed critical comments during entire study period.*

*I would also like to thank for your guidance and support **Dr. Alok Tripathi sir General Manager & Head Regional learning Institute & Business Excellence** and Staff Officials for sparing their valuable time for us and give more information and co-operate with us.*

*I want to sincerely thanks to my senior sir **Dr. Ramesh Kumar Sahu** & frinds for his important advice, encouragement, and sharing of his vast field experience, all of which were crucial in helping me finish my dissertation.*

*I pay my thanks to staff members and my friends **Abir Ghosh Srijan Vaishnav Rahul Kumar Dhruw and Sudipa** of the department for their constant encouragement, guidance and support for completion of this work.*

*I am highly obliged to my worthy parents, without their blessings and support this work would not have seen the light of the day.*



**Bhupendra Devdas**  
M.Sc. Forestry IV Semester  
Forestry, Wildlife & Environmental  
Sciences, GGV, Bilaspur  
Roll No.: 23078106  
Enroll. No.: GGV/23/067103

**A DISSERTATION  
ON  
SOIL QUALITY STATUS OF DIFFERENT VILLAGES IN  
LALPUR BLOCK MUNGELI DISTRICT OF  
CHHATTISGARH**

**SUBMITTED FOR THE PARTIAL FULFILMENT OF THE  
REQUIREMENT FOR THE DEGREE OF MASTERS OF SCIENCE IN  
FORESTRY AND ENVIRONMENTAL SCIENCE**



Submitted by

**CHANDRA PRAKASH**

M.Sc. Forestry & Environmental Sciences

Roll No. - 23078107

Under the supervision of

**Dr. S.C. TIWARI**

Professor

---

**Department of Forestry, Wildlife and Environmental Sciences**

**Guru Ghasidas Vishwavidyalaya (A Central University),**

**BILASPUR – 495001 (C.G.)**

**(NAAC ACCREDITED A++)**

**SESSION – 2024-25**

# Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

(A central university established under Central University Act 2009, No. 25 of 2009)

Department of Forestry, Wildlife and Environmental Sciences



## CERTIFICATE

This is to certify that the dissertation entitled, "Soil quality status of different villages in Lalpur block Mungeli district of Chhattisgarh" submitted in partial fulfillment of the requirement for the degree of Masters in Forestry & Environmental Sciences of the Guru Ghasidas Vishwavidyalaya, Bilaspur, is record of the bonafide research work carried out by **Chandra Prakash** under my guidance and supervision. No part of the dissertation has been submitted for any other degree or diploma elsewhere has been published/published part has been fully acknowledged. All the assistance and help received during the course of the investigations have been duly acknowledged by him.

I wish all the success in his Academics.

Chairman

Dr. S.C. Tiwari

Professor & Supervisor

Date: 14/05/2025

Place: Bilaspur

विभागाध्यक्ष  
Head

16/05/2025  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

## DECLARATION

I hereby declare that the dissertation entitled "**Soil quality status of different villages in Lalpur block Mungeli district of Chhattisgarh**" Submitted to Department of Forestry, Wildlife and Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.) is a record of an original work done by me under the guidance of **Dr. S.C. Tiwari** and this work has been formed for the award of Degree of Master of Science in Forestry & Environment Sciences. This work has not been submitted for any other degree in other Universities/Institutes.

Date: 14/05/2015

Place: Bilaspur

चन्द्रप्रकाश खाते

**Chandra prakash**

**M.Sc. Forestry & Environmental Sciences**

**Roll No. - 23078107**

## ACKNOWLEDGEMENT

*First of all, I would like to thank "God" who bestowed me with patience and favourable conditions and circumstances to achieve this feat*

*It is my privilege to study and conduct my research under Dr. S.C. Tiwari, Professor and HOD, Department of Forestry & Environmental Sciences, Chairman of my Advisory Committee, who provided me the research insight, illuminating and meticulous guidance, calm endurance, continuous and unfailing encouragement, scholarly suggestions, unique supervision, constructive criticisms, sympathetic attitude, plausible appreciation and sustained support during the entire course of investigation and preparation of manuscript. I am highly indebted to him for his invaluable painstaking efforts taken towards my study while devoting his precious time. I owe a profound debt to him for providing me his intellectual resources, reading materials and other all necessary facilities during my study period.*

*I express my deep regards to all my professors, Dr. Ajay Kumar Singh, Dr. Krishna Kumar Chandra, Dr. Atul Bharadwaj and Dr. S.S. Dhariya, Department of Forestry wildlife and Environmental Sciences, for their Support, Vision and Encouragement over the years.*

*I am sincerely grateful to all research scholars specially Mr. Shivakant, Miss priyanka Soren, Miss Sikha Singh Tanwar, Miss Chanchal.....Mrs. Gunja.... whose generous support technical guidance and patience assistant wear instrumental in completing this work their expertise and friendly cooperation make the entire process smooth and enriching.*

*I would also like to thanks staff members, seniors and batchmates of the Department for their constant encouragement, guidance and support for completion of this work.*

*I am highly obliged to my worthy parents, without their blessing and support this work would not have been seen the light of the day. I also express my thanks to all my friends which have helped me during my field observation.*

*Finally, I am thankful to the Almighty God for his heavenly blessings which has enabled me to achieve this seemingly invincible. So my Lord, please feel my feelings and accept my gratitude.*

*Department of Forestry & Environmental Sciences,*

*Date. 14/05/25*

*चन्द्रा प्रकाश खांडे*  
**Chandra Prakash**

गुरु घासीदास विश्वविद्यालय  
(केंद्रीय विश्वविद्यालय अधिनियम 2009 अ. 25 के अंतर्गत स्थापित केंद्रीय विश्वविद्यालय)  
कोनी, बिलासपुर - 495009 (छ.ग.)



Guru Ghasidas Vishwavidyalaya  
(A Central University Established by the Central Universities Act, 2009 No. 25 of 2009)  
Koni, Bilaspur - 495009 (C.G.)

## Forest Diversity Study at Pakri Barwadih Coal Mining area in Jharkhand through Remote Sensing & GIS

### Dissertation

*submitted for the partial fulfillment for the degree of*

**MASTER OF SCIENCE**

In

**Forestry & Environmental Sciences**



**Session: 2023-25**

*Submitted By:*

**CHITYENDRA DEWANGAN**

Enrollment no: GGV/19/6157  
Roll. No. 23078108

*Under the Supervision of:*

**Dr. AJAY KUMAR SINGH**

Assistant Professor  
Department of Forestry, Wildlife  
& Environmental Sciences, GGV  
Bilaspur, C.G.

*Submitted to:*

**DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES**  
(ICFRE A++)

**GURU GHASIDAS VISHWAVIDYALAYA (NAAC A++)**  
(A Central University Establishment Under Central University Act 2009, No. 25 of 2009)  
**BILASPUR - 495009, CHHATTISGARH**

गुरु घासीदास विश्वविद्यालय  
(केंद्रीय विश्वविद्यालय अधिनियम 2009 अ. 25 के अंतर्गत स्थापित केंद्रीय विश्वविद्यालय)  
कोनी, बिलासपुर - 495009 (छ.ग.)



Guru Ghasidas Vishwavidyalaya  
(A Central University Established by the Central Universities Act, 2009 No. 25 of 2009)  
Koni, Bilaspur - 495009 (C.G.)

डॉ. अजय कुमार सिंह

अहात्मक प्राध्यापक  
सामुदायिक संरक्षण, अजयकम श्वाभ  
कारिकी, कालाजीव एवं पर्यावरण विज्ञान विभाग  
गुरु घासीदास विश्वविद्यालय, बिलासपुर, छत्तीसगढ़  
+91- 7879721224 7000591141  
ghs.ggu@gmail.com, ajayksingh.02@ggv.ac.in



Dr. Ajay Kumar Singh

Assistant Professor  
School of Natural Resources  
Department of Forestry, Wildlife & Environmental Sciences  
Guru Ghasidas Vishwavidyalaya, Bilaspur Chhattisgarh  
+91- 7879721224, 7000591141  
ghs.ggu@gmail.com, ajayksingh.02@ggv.ac.in

### CERTIFICATE

I have great pleasure in certifying that **CHITYENDRA DEWANGAN** s/o Mr. **RAMESH DEWANGAN**, is a regular student of M.Sc. Forestry & Environmental Science, 4<sup>th</sup> Semester, (Roll. no. 23078108), Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.). He has completed his Dissertation entitled "Forest Diversity Study at Pakri Barwadih Coal Mining area in Jharkhand through Remote Sensing & GIS" during the session 2023-2025 under my supervision.

I wish him all the success in his academics.

*Dr. Ramesh Dewangan*  
16/05/2025

*Dr. Ajay Kumar Singh*  
17/05/2025  
Dr. Ajay Kumar Singh  
(Assistant Professor)



## DECLARATION

I hereby declare that I, Mr. Chityendra Dewangan, Roll no. 23078108, M.Sc. Forestry & Environmental Science, 4<sup>th</sup> Semester, Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.) present my dissertation entitled: "Forest Diversity Study at Pakri Barwadih Coal Mining area in Jharkhand through Remote Sensing & GIS" interpretation or part has not been submitted for any degree or diploma from any university. The source of the material and all assistance received during the course of the investigation have been duly acknowledged. All the records and data given in the report are correct to my knowledge.

*Chityendra*  
CHITYENDRA DEWANGAN

M.Sc. Forestry & Environmental Science  
4<sup>th</sup> Semester  
Enrollment No. GGV/19/6157  
Roll no. 23078108





## ACKNOWLEDGEMENT

The expression of giving thanks is just a part of those feelings, which are too large for words, but shall remain as memories of wonderful people with whom I have had the pleasure of working during the completion of the survey. At first, I am deeply thankful to my family for their unconditional support, patience, and motivation, which helped me stay focused and complete this assignment with dedication.

Universities train technical students, yet they also influence how we see the world and our lives. I appreciate **Prof. Alok Kumar Chakrawal**, the **Honorable Vice-Chancellor** of the **Guru Ghasidas Vishwavidyalaya Bilaspur, Chhattisgarh**, who inspired us to complete the assignment.

I am also grateful to **Prof. S. C. Tiwari**, Dean, School of Natural Resources & Head, Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh, for academic help and motivation.

A special word of thanks goes to my supervisor, **Dr. Ajay Kumar Singh**, Assistant Professor, Dept. of Forestry, Wildlife & Environmental Sciences, GGV, Bilaspur, whose patient mentoring, constructive suggestions, and continuous encouragement helped me navigate the attachment period meaningfully. His insights and feedback were instrumental in shaping this report.

I would also like to sincerely thank all the professors of the department **Prof. S.S. Dhuria, Prof. K.K. Chandra, Dr. G. Tiwari, Dr. G. Patil, Dr. B. Dixit, Dr. B.P. Singh, Dr. A.K. Bhardwaj, Dr. C.K. Singh, and Dr. C. Manpoong** for their continues encouragement and support during my study.

I also thank **Dr. Aman Kumar**, Assistant Professor, Department of Forestry, Central University of Orissa, Sonabeda, Orissa, for his expert advice, field knowledge, and constructive feedback.

I am deeply grateful to **Mr. S.K. Khator**, CEO-Coal, Thriveni Sainik Mining Pvt. Ltd., and **Mr. Ravish Kumar**, Senior Manager, Thriveni Sainik Mining Pvt. Ltd., at Pakri Barwadih Coal mining Project, Hazaribagh, Jharkhand, for providing me with an opportunity for such fieldwork and academic motivation for the successful completion of this Research Work.

A special note of thanks to all the officials of the Thriveni Sainik Mining Pvt. Ltd., Jharkhand, especially **Mr. Navneet Kumar** (Deputy Manager), **Mr. Vivek Shrivastava**, **Mr.**



Abhijeet Kumar, and Mr. Deepak Prabhat (Environment Officer), Mr. Arvind Yadav and Mr. Lallan Kumar at Pakri Barwadih Coal Mining Project (M/s NTPC Mining Limited).

My heartfelt gratitude also goes to Mr. Sudhir Ranjan Choudhary, and Mr. Ashutosh Anand, Research Scholars at Guru Ghasidas Vishwavidyalaya (GGV), for their intellectual support, thoughtful discussions, and motivating presence during this journey.

I also extend my heartfelt thanks to my father, Mr. Ramesh Dewangan, my mother, Shushama Dewangan, and my elder brother, Mr. Rajendra Dewangan, sister-in-law Ms. Kavita Dewangan, and niece, Tavishi, for their motivation, inspiration and for always being there with a kind word or a helping hand. This accomplishment is as much theirs as it is mine.

A special note of thanks to Mr. Y. Baswanth, Mr. Shubham Tandan, Mr. Abhishek Maitry, Mr. Animesh Shukla, Mr. Shishir Chandrakar, Mr. Ajay Kumar Patel, Mr. Ayushman Singh Rajput, and Mr. Roshan Khamari for their intellectual support, thoughtful discussions, and motivating presence during this journey.

Special appreciation is extended to my classmates, friends, seniors, juniors, and hostel mates for their constant encouragement and thoughtful insights. Their support and shared perspectives significantly enriched the quality and depth of this research work.

Lastly, I express my deep gratitude to all who directly or indirectly contributed to the learning experience.

*Chityendra*  
CHITYENDRA DEWANGAN



### Table of Content

Chapter	Title	Page no
I	Front Page	
II	Certificate	
III	Declaration	
IV	Acknowledgment	
V	Table of Content	
VI	List of Tables	
VII	List of Figures	
VIII	List of Plates	
IX	Abbreviations	
1	Introduction	01-04
	1.1 Background	1
	1.2 Importance of the Study	4
	1.3 Objectives	4
2	Literature Review	05-07
3	Materials and Methods	8-22
	3.1 Study Area	8
	3.2 Research Design	12
4	Result & Discussion	23-62
	4.1 Spatio-temporal Land Use and Land Cover Change Analysis	23
	4.2 Floral and Faunal Diversity Assessment	28
	4.3 Effect on Vegetation	59
5	Conclusion	63-64
	Suggestion & Recommendation	65
	Photo Plate	66-68
	References	69-73

ASSESSMENT OF HEAVY METAL CONTAMINATION IN SOIL FROM  
FLY ASH AFFECTED AREAS, SIPAT, BILASPUR

*Dissertation*

Submitted for the Partial fulfillment of  
**DEGREE OF MASTER OF SCIENCE**  
In  
**Forestry & Environmental Sciences**



Session – 2023-25

*Under the Supervision of:*

*Dr. Brijendra Pratap Singh*

Assistant Professor

Department of Forestry, Wildlife &  
Environmental Sciences, GGV

*Submitted By:*

*Juhi Kumari*

Enrollment no.: GGV/23/06705

Roll No.: 23078109

*Submitted to:*

**DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES**  
(ICFRE A++)

**GURU GHASIDAS VISHWAVIDYALAYA, (NAAC A++)**

(A Central University Establishment Under Central University Act 2009, No. 25 of 2009)

**BILASPUR - 495009, CHHATTISGARH**

**2025**



CERTIFICATE

*This is to certify that the Dissertation entitled "Assessment of Heavy Metal Contamination in Soil from Fly Ash Affected Area of Sipat, Bilaspur, Chhattisgarh" Submitted for partial fulfilment of the requirements for the degree of Master of science in forestry and environmental Sciences in Department of Forestry, wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur (Chhattisgarh) is the work carried out by Juhi Kumari D/O Mr. Bansidhar Tiwari under my supervision and guidance.*

*I wish all the Success in her academics.*

Place: GGV, Bilaspur, C.G.

Date: 14/05/2025

  
विभागाध्यक्ष  
Head

पानिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

(Supervisor)

  
Dr. Brijendra Pratap Singh  
Dept. of Forestry, Wildlife & Environment & Sciences  
Guru Ghasidas Vishwavidyalaya (Central University)  
Bilaspur-495009, Chhattisgarh, India  
Assistant Professor

Department of Forestry, Wildlife  
& Environmental Sciences, GGV

## DECLARATION

*I hereby declare that the dissertation entitled " Assessment of Heavy Metal Contamination in Soil from Fly Ash Affected Area of Sipat, Bilaspur, Chhattisgarh" Submitted to Department of forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, C.G is a record of an original work done by me under the guidance of Dr. Brijendra Pratap Singh and this work has been formed for the award of degree of Master of Science in Forestry & Environment Sciences. This work has not been submitted for any other degree in any universities/Institutes.*

*Place: GGV, Bilaspur, C.G*

*Date:14/May/2025.*

*Juhi*

**Juhi Kumari**

*M.Sc. Forestry, Wildlife &  
Environmental Sciences 4th Sem.*

*Roll No: 23078109*

*Enrollment no.: GGV/23/06705*

## ACKNOWLEDGEMENT

First of all, I would like to thank 'God' Who bestowed me with patience and favourable conditions and circumstances to achieve this feat.

I extend my heartfelt thanks to my university and our esteemed Vice Chancellor, **Prof. Alok Kumar Chakrawal**, for providing the academic framework and institutional encouragement that made this Dissertation possible.

I express my profound indebtedness to Department of Forestry, Wildlife & Environmental Science, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing me all the necessary facilities to complete my Dissertation work, I pay my deep regards to **Prof. S.C. Tiwari**, Dean, School of Studies of Natural Resources and & Head, Department of Forestry, Wildlife and Environmental Sciences, GGV, Bilaspur, for his generous support and encouragement.

I express my deep sense of gratitude and thanks to my Supervisor **Dr. Brijendra Pratap Singh**, Assistant professor, Department of Forestry, Wildlife and Environmental Sciences GGV, Bilaspur, for his inspiring guidance, support and much needed critical comments during this entire study period.

A special word of thanks goes to our Coordinator **Dr. Ajay Kumar Singh**, Assistant Professor, Department of Forestry, Wildlife and Environmental Sciences, GGV, Bilaspur, for his never-ending support and motivation and also his helping nature towards the students.

I am grateful to **Dr. Atul Kumar Bhardwaj**, **Dr. Gunjan Patil**, Assistant Professor, Department of Forestry, Wildlife and Environmental Sciences, GGV, Bilaspur, for their assistance with the statistical analysis, which was essential to the successful completion of this study.

I express my deep regards to all my **Professor S.S. Dhuria**, **Professor K.K. Chandra**, **Dr. Garima Tiwari**, **Dr. Bhawana Dixit**, **Dr. Chandresh Kumar Singh**, **Dr. Chowlani Manpoong**, Department of Forestry, Wildlife and Environmental Science, GGV, Bilaspur, for their insightful suggestions and encouragement over the years. Your support and encouragement helped me to overcome challenges I faced.

I am deeply grateful to the **Mr. R. A. Khan**, General Manager of Environment Department, of the Central Mine Planning & Design

Institute Limited (CMPDI Ltd.) Sipat Road, Bilaspur, for providing me with the opportunity and necessary permissions to utilize the laboratory facilities for my Dissertation work. My gratitude extends to **Mr. Praveen Shrivastav**, Deputy Manager of Environment Department at CMPDI Ltd., for their help in granting permission to work in the laboratory and my heartfelt gratitude to **Mr. Santosh kr. Singh (Scientific Assistant)**, **Mrs. Deepanvita Bin (Scientific Assistant)**, **Mr. Manoj Baghel (Junior Scientific Assistant)**, of the CMPDI Ltd., for their hands-on support and assistance during the analysis phase of my Dissertation work.

I express my deep regards to **Dr. Kamesh**, **Dr. Ramesh** and **Miss Sikha Singh Tanwar**, **Mr. Samyak Singh** (research scholar) Department of Forestry, Wildlife and Environmental Science, GGV, Bilaspur, for guiding me through this entire journey.

I would also like to sincerely thank to the office staffs of our Department of Forestry, Wildlife and Environmental Science, GGV, Bilaspur, for their assistance throughout the course of my academic journey. Their behind-the-scenes efforts have played a significant role in facilitating my work.

I pay my thanks to all my friends **Abhishek**, **Sreya**, **Bharti**, **Nandita**, **Khushboo**, **Shristi**, **Chityendra**, **Saurav** and other batchmates of the department who stood with me throughout my journey. Their support either in the form of motivation or emotion helped me a lot into the completion of my work on time.

I am highly obliged to my worthy parents, **Mr. Bansidhar Tiwari** & **Mrs. Meena Tiwari**, without their blessings and support this work would not have seen the light of the day. I also express thanks to my brother, **Deepak**, **Gaurav** and my sister **Garima**, for their unwavering support and encouragement throughout this journey.

Lastly, I express my deep gratitude to all who directly or indirectly contributed to the learning experience.

Place: GGV, Bilaspur, C.G.

Date: 14/May/2025.

**Juhi Kumari**

M.Sc. Forestry 4<sup>th</sup> Sem.



## **CONTENTS**

<b>S. No.</b>	<b>Items</b>	<b>Page No.</b>
1	List of Tables	1
2	List of Images	2
3	List of Abbreviations	3
4	Introduction	5-10
5	Objective	11
6	Review Literature	12-25
7	Materials and Methods	26-35
8	Results	36-44
9	Discussion	45-47
10	Conclusion	48
11	Photo plates	49-51
12	References	52-59

**A DISSERTATION ON**  
**EXPLORING THE ECONOMIC ROLE OF NON-TIMBER FOREST**  
**PRODUCTS AND MEDICINAL PLANT PRACTICES IN BAIGA TRIBE**  
**OF KAWARDHA FOREST DIVISION (WEST PANDARIYA RANGE)**

**SUBMITTED FOR THE PARTIAL FULFILLMENT OF**  
**THE DEGREE OF MASTER'S OF SCIENCE IN**



**FORESTRY & ENVIRONMENTAL SCIENCES**

**SESSION- 2023 - 2025**

*Under the Supervision of:*

**Dr. GARIMA TIWARI**

Assistant Professor Dept. of  
Forestry, Wildlife &  
Environmental Sciences,  
GGV, Bilaspur

*Submitted By:*

**KALPNA DUBEY**

M.Sc. Forestry 4<sup>th</sup> Semester

Roll No.: 23078110

Enroll. No.: GGV/19/6061

**DEPARTMENT OF FORESTRY, WILDLIFE**  
**& ENVIRONMENTAL SCIENCES (ICFRE A++)**

---

**GURU GHASIDAS VISHWAVIDYALAYA,**  
**BILASPUR, CHHATTISGARH 495009** (A Central University established under  
Central Universities Act 2009, No. 25 of 2009) (NAAC A++)

---

DEPARTMENT OF FORESTRY, WILDLIFE AND ENVIRONMENT SCIENCES  
(ICFRE A++)  
**GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)**  
(A central university established under Central Universities Act 2009, No. 25 of 2009)  
(NAAC A++)



## CERTIFICATE

I have great pleasure in certifying that **Miss Kalpna Dubey** D/o Mr. Mukesh Kumar Dubey is a regular student of M.Sc. Forestry and Environmental Sciences VI Semester during the session of 2023-25 of Department of Forestry, Wildlife and Environmental Sciences, GGU, Bilaspur. She has completed this dissertation entitled “Exploring the Economic Role of Non-Timber Forest Products and Medicinal Plant Practices in Baiga Tribe of Kawardha Forest Division (West Pandariya Range)” during this semester under my guidance.

I wish her all the success in her academics.

विभागाध्यक्ष  
Head

16/05/2025  
वनिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

**Dr. Garima Tiwari**

Assistant Professor  
Supervisor  
Dept. of Forestry,  
Wildlife and Environmental Sciences  
GGU, Bilaspur (C.G.)



## DECLARATION

I hereby declare that the dissertation entitled “**Exploring the Economic Role of Non-Timber Forest Products and Medicinal Plant Practices in Baiga Tribe of Kawardha Forest Division (West Pandariya Range)**” submitted to Department of Forestry, Wildlife and Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur is a record of an academic work done by me under the guidance of **Dr. Garima Tiwari** and this dissertation work has been performed for the award of Master’s degree in Forestry and Environment Science.

Date- 13/05/2025

*Kalpna*

**Kalpna Dubey**

*M.Sc. Forestry & Environmental  
Sciences*

*IV Semester*

*Roll no: 23078110*

*Enrolment no: GGV/19/6061*



## AKNOWLEDGMENT

*First of all, I would like to thank 'God' who bestowed me with patience and favourable conditions and circumstances to achieve this feat.*

*I express my profound indebtedness to Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing me all the necessary facility to complete my dissertation work.*

*I pay my deep regards to Prof. S.C. Tiwari, Dean, School of Natural Sciences and Head of Department of forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for his constant help and academic encouragement..*

*I express my deep sense of gratitude and thanks to Dr. Garima Tiwari, Supervisor & Assistant Professor, Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for guidance and support.*

*I pay my thanks to Dr. K.K. Chandra, Dr. Gunjan Patil, Dr. Garima Tiwari, Dr. Bhavana Dixit, Dr. Ajay Kumar Singh, Dr. B.P. Singh, Dr. A.K. Bhardwaj, Dr. C.K. Singh, Dr. C. Manpoong, faculties and staff members of the, Department of Forestry, Wildlife & Environmental Science, GGV for much needed critical comments during entire study period.*

*I would also like to thank for your guidance and support Divisional forest officer Shashi Kumar (IFS) for sparing their valuable time for me.*

*I would also like to thank Ranger Mrs. Pallavi Gangber, Beat Forest Officer Jaishree Kausal and Staff Officials for sparing their valuable time for me and give more information and co-operate with me.*

*I pay my thanks to my seniors Animesh Shukla and Poonam Xess and my friends for their constant encouragement, guidance and support for completion of this work.*

*I am highly obliged to my worthy parents, without their blessings and support this work would not have seen the light of the day.*

**Kalpna Dubey**

M.Sc. Forestry 4<sup>th</sup> Semester

Dept. of Forestry, Wildlife &  
Environmental Sciences, GGV, Bilaspur

Roll No.: 23078110

Enroll. No.: GGV/19/6061

## CONTENT

			Page No.	
<b>Chapter 1</b>	1.	<b>INTRODUCTION</b>	1	
	1.1	NTFPs and Tribals	2	
	1.2	Importance of NTFPs	2	
	1.3	Baiga: The Traditional healers	4	
	1.4	Baiga culture	5	
	1.5	State of income from NTFPs	6	
		<b>OBJECTIVE</b>	7	
<b>Chapter 2</b>	2.	<b>LITERATURE REVIEW</b>	8-12	
<b>Chapter 3</b>	3.	<b>RESEARCH METHODOLOGY</b>	13	
	3.1	Purpose and significance	13	
	3.2	Material and methods	14	
	3.3	Delineation of Study Area	14	
	3.4	Availability of Medicinal plants in forest area	17	
	3.5	Forest types	19	
	3.6	Data collection	21	
		I Primary data	21	
		II Secondary data	22	
		III Sampling intensity	22	
		IV Observation and unstructured interview	22	
		V Statistical tool used- Descriptive statistics	23	
	<b>Chapter 4</b>	4.	<b>RESULT AND DISCUSSION</b>	25
		4.1	The salient findings of each objective are presented in sequence	25
		4.2	Analysis of NTFPs Collected: Species, Family Abundance, and Collection Seasons	27
		4.3	Current status of NTFPs	30
		4.4	Marketing of NTFPs	30
		4.5	Socio-economic characteristics of NTFP collectors	33
		4.6	Horticulture and agroforestry	37
	4.7	Dependency of tribes on NTFPs	37	
	4.8	Contribution of income from different sources to ave. household income	38	
	4.9	Income distribution (Agriculture + NTFP)	38	
	4.10	Preferential Sale of NTFPs to Middlemen	42	
	4.11	Involvement in Self Help Groups (SHGs)	43	
	4.12	Government schemes for PVTGs, especially the Baiga tribe in C.G.	43	
	4.13	Diversity of medicinal plants	48	
	4.14	Plant part used	48	
	4.15	Therapeutic uses	49	
	4.16	Preparation and procedure	49	
	4.17	Interpretation	51	
	4.18	Key findings	51	
<b>Chapter 5</b>	5	<b>CONCLUSION</b>	56	

	5.1	Key findings	57
		Suggestion	58

#### LIST OF TABLES

S.No.	TABLE	Page no.
1.	Description of forest types present in the study area as per champion and seth classification	19
2.	Number of NTFPs species and collection season	26
3.	Village wise mean and SE for education, age, and gender	32
4.	Basic information about the NTFPs collectors	33
5.	Income distribution of respondents	38
6.	Minor forest produce collection rate year 2023-24 (MSP) minimum support price, rate fixed by Central Government	40
7.	List of medicinal plants and traditional practices by Baiga(traditional healers)	45
8.	Percentage of plant part use	51

#### LIST OF PLATES

S.No.	Plate	Page no.
1.	Baiga tribe image	7
2.	Images during data collection	24
3.	Char (Buchanania lenzan)	29
4.	NTFPs sell in local market	31
5.	NTFPs and Millets	31
6.	Data collection from traditional healer	44
7.	Observed meditional plants parts from traditional healers	55

#### LIST OF FIGURE

S.No.	Figure	Page no.
1.	Map of the study area west pandariya rang of Kawardha forest division	14
2.	Vegetation map of Kawardha forest division	20
3.	Flow chart of survey of villages during the study	23
4.	Bar chart showing family wise abundance NTFP species	29
5.	Pie chart showing gender distribution of respondent percentage	34
6.	Pie chart showing education level of respondents	35
7.	Chart Showing Occupation distribution of respondents	36
8.	Pie chart showing land holding of respondents	36
9.	Pie chart showing income distribution of respondents	39
10.	Pie chart and Bar diagram shows the distribution of plant part used	50

A DISSERTATION  
ON  
COMPARATIVE STUDIES OF RHIZOSPHERE SOIL AND BULK SOIL  
OF *BUTEA MONOSPERMA* & *ACACIA NILOTICA* OCCURRING  
UNDER AGROFORESTRY PRACTICES IN BILASPUR,  
CHHATTISGARH.

SUBMITTED FOR THE PARTIAL FULFILMENT OF THE  
REQUIREMENT FOR THE DEGREE OF MASTERS OF SCIENCE IN  
FORESTRY AND ENVIRONMENTAL SCIENCE



**Submitted by**  
Kaushal Sahu  
M.Sc. Forestry 4<sup>th</sup> Semester  
Roll No. 23078111

**Under the supervision of**  
**Dr. Chowhani Manpoong**  
Assistant Professor

**Department of Forestry, Wildlife and environmental science**  
Guru Ghasidas Vishwavidyalaya (A Central University)  
Bilaspur-495009, Chhattisgarh  
(NAAC ACCREDITED A++)  
**SESSION- 2024-25**



# Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

(A central university established under Central University Act 2009, No. 25 of 2009)

Department of Forestry, Wildlife and Environmental Sciences



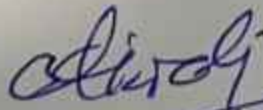
## CERTIFICATE

This is to certify that the dissertation entitled **Comparative studies of Rhizosphere soil and Bulk soil of *Butea monosperma* & *Acacia nilotica* occurring under agroforestry practices in Bilaspur, Chhattisgarh** Submitted in partial fulfilment of the requirements for the degree of **Master of Science in Forestry and Environmental Sciences** in Department of Forestry Wildlife and Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur (Chhattisgarh) is the work carried out by **Mr. Kaushal Sahu S/o Lt. Rajkumar Sahu** Under my Supervision and Guidance.

I wish all the Success in his Academics.

Place: Bilaspur

Date: ...06 /May/2025.

  
विभागाध्यक्ष  
Head

वानिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)



**Dr. Chowlani Manpoong**

Assistant Professor

(Supervisor)

**DR. CHOWLANI MANPOONG**

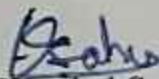
Assistant Professor  
Department of Forestry Wildlife & Environmental Sciences  
Guru Ghasidas Vishwavidyalaya  
Kori, Bilaspur (C.G.), 495009

## DECLARATION

I hereby declare that the dissertation entitled '**Comparative studies of Rhizosphere soil and Bulk soil of *Butea monosperma* & *Acacia nilotica* occurring under agroforestry practices in Bilaspur, Chhattisgarh**' Submitted to Department of Forestry, Wildlife and Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur C.G. is a record of an original work done by me under the guidance of **Dr. Chowhani Manpoong** and this work has been formed for the award of Degree of master of Science in Forestry & Environmental sciences. This work has not been submitted for any other degree in any Universities/Institutes.

Place: Bilaspur, C.G.

Date: 06/05/25



Kaushal Sahu

M.Sc. Forestry 4<sup>th</sup> Sem

Roll No. 23078111

Enroll. No. GGV/23/06706

## ACKNOWLEDGEMENT

First of all, I would like to thank 'God' who bestowed me with patience and favourable conditions and circumstances to achieve this feat.

I express my profound indebtedness to Department of forestry wildlife and environmental science, Guru Ghasidas Vishwavidyalaya, Bilaspur C.G. For providing me all the necessary facilities to complete my project work. I pay my deep regards to professor **S.C. Tiwari, Dean,** school of studies and natural resources and **HOD,** Department of Forestry Wildlife and environmental science for his academic encouragement.

I extend my heartfelt gratitude to my **Supervisor Dr. Chowlani Manpoong, Assistant Professor** Department of Forestry Wildlife and environmental sciences, whose unwavering guidance, insightful corrections, and thoughtful remarks have shaped every step of this dissertation. His humility, vast knowledge, and genuine kindness truly make him a mentor par excellence.

I would like to extend my special thanks to **Dr. Brijendra Pratap Singh, Assistant Professor** Department of Forestry wildlife and environmental sciences, for his valuable contribution, his support added great depth and Clarity to my work, for which I remain truly grateful.

I express my deep regards to **all my professors, Dr. SS Dhuria, Dr. K.K. Chandra, Dr. Gunjan Patil, Dr. Garima Tiwari, Dr. Bhawana Dixit, Dr. Ajay Kumar Singh, Dr. Atul Kumar Bhardwaj, Dr. Chandresh Kumar Singh** Department of Forestry wildlife and environmental sciences, for their Support, Vision and Encouragement over the years.

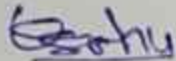
I'm sincerely grateful to all research scholars specially **Miss Priyanka Soren, Miss Shikha Singh Tanwar, Miss Chanchal Kumari, Dr. Gunja Baretha** whose generous support technical guidance and patience assistant wear instrumental in completing this work their expertise and friendly cooperation made the entire process smooth and enriching.

I would also like to thanks **staff members, seniors and batchmates** of the department for their constant encouragement, guidance and support for completion of this work.

I am highly obliged to my worthy parents, without their blessings and support this work would not have been seen the light of the day. I Also express my thanks to all my friends which have helped me during my field observation.

Date: 06/05/25

Place: Bilaspur C.G.

  
Kaushal Sahu

**DISSERTATION  
ON  
ASSESSMENT OF THE IMPACT OF DIFFERENT TREE  
SPECIES ON THE MICROCLIMATE OF GURU GHASIDAS  
VISWAVIDYALAYA, BILASPUR (C.G)**

submitted to  
**GURU GHASIDAS VISHWAVIDYALAYA**  
for the degree of  
**MASTERS IN  
FORESTRY & ENVIRONMENTAL SCIENCES**  
(School of Natural Resources)



**2024-2025**

*Submitted by*

**KESHAV PRASAD**

**M. Sc. Forestry & Environmental Sciences**

**Roll no: 23078112**

**Enrollment no: GGV/23/06707**

*Under the supervision of*

**Dr. GUNJAN PATIL**

**Assistant Professor**

---

**Department of Forestry, Wildlife and Environmental Sciences**  
**Guru Ghasidas Vishwavidyalaya, (NAAC A++) Bilaspur- 495009 (C.G.)**  
(A central university established under Central Universities Act 2009, No. 25 of 2009)

*S*  
16.05.25  
(SATYADEO SHARMA)  
IFS

Department of Forestry, Wildlife and Environmental Sciences  
Guru Ghasidas Vishwavidyalaya, (NAAC A++) Bilaspur- 495009 (C.G.)  
(A central university established under Central Universities Act 2009, No. 25 of 2009)



### CERTIFICATE

I have great pleasure in certifying that **Mr. KESHAV PRASAD** s/o **Mr. JAI PRAKASH** is a regular student of M.Sc. Forestry & Environmental Sciences, 4<sup>th</sup> Semester, Guru Ghasidas Vishwavidyalaya, Bilaspur (CG). He has completed his Dissertation entitled "ASSESSMENT OF THE IMPACT OF DIFFERENT TREE SPECIES ON THE MICROCLIMATE OF GURU GHASIDAS VISWAVIDYALAYA, BILASPUR (C.G.)" during the session 2023-2025 under my supervision. I wish him all the success in his academics.

*Gunjan Patil*  
15/05/2025

**Dr. Gunjan Patil**  
Assistant Professor  
Department of Forestry wildlife &  
Environmental Sciences

*S.C. Tiwari*

**Professor S.C. Tiwari** 16/5/2025  
Head of Department  
Department of Forestry wildlife  
& Environmental Sciences

विभागाध्यक्ष  
Head

पशुचिकित्सा, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

Department of Forestry, Wildlife and Environmental Sciences  
Guru Ghasidas Vishwavidyalaya, (NAAC A<sup>++</sup>) Bilaspur- 495009 (C.G.)  
(A central university established under Central Universities Act 2009, No. 25 of 2009)



### DECLARATION

I hereby declare that the present research entitled "ASSESSMENT OF THE IMPACT OF DIFFERENT TREE SPECIES ON THE MICROCLIMATE OF GURU GHASIDAS VISWAVIDYALAYA, BILASPUR (C.G.)" interpretation or part has not been submitted for any degree or diploma from any university. The source of the material and all assistance received during the investigation have been duly acknowledged. All the records and data given in the report are correct to my knowledge.

Date: 15/05/25

A handwritten signature in black ink, appearing to read "Keshav Prasad", is written over a red horizontal line.

**KESHAV PRASAD**

M.Sc. Forestry & Environmental  
Sciences 4<sup>th</sup> Semester  
Enrollment No. GGV/23/06707  
Roll No.: - 23078112

## ACKNOWLEDGEMENTS



*First of all, I would like to thank 'God' who bestowed me with patience and favourable conditions and circumstances to achieve this feat.*

*I express my profound indebtedness to Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing me all the necessary facility to complete my project work.*

*I pay my deep regards to Prof. S.C. Tiwari sir, HOD/Dean, School of Natural Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for his constant help and academic encouragement.*

*I express my deep sense of gratitude and thanks to my supervisor Prof. Dr. Gunjan Patil I pay my thanks to Dr. K.K. Chandra Sir, Prof. S.S. Dhuria Sir, Dr. Ajay Kumar Singh, Dr. B.P. Singh, Dr. A.K. Bhardwaj, , Dr. Garima Tiwari, Dr. C.K. Singh, Dr. C. Manpoong, Assistant Professor, Department of Forestry, Wildlife & Environmental Science, GGV for much needed critical comments during entire study period.*

*I would also like to thank for your guidance and support Mr. Ramesh Sahu and Mr. Abhishek Maitry I am highly obliged to my worthy parents, and my elder brother without their blessings and support this work would not have seen the light of the day.*

*I pay my thanks to staff members and my friends of the department for their constant encouragement, guidance and support for completion of this work.*

Keshav Prasad  
M.Sc. Forestry 4th Semester  
Forestry, Wildlife & Environmental  
Sciences, GGV, Bilaspur  
Roll No.: 23078112

**“EFFECT OF NITROGEN FERTILIZER DOSES ON THE  
CHARACTERISTICS OF *Terminalia arjuna*”**

**DISSERTATION**

**SUBMITTED TO THE**



**GURU GHASIDAS UNIVERSITY  
BILASPUR (CHHATTISGARH)**

*(A Central University Established by the Central University Act 2009 No. 25 Of 2009)*

*In partial fulfillment of the requirements for the degree of*

**MASTERS OF SCIENCE IN FORESTRY**

**(SESSION: 2023-25)**

**BY**

**KHUSHBOO BARA**

**Under the supervision**

**of**

**DR. ATUL KUAMR BHARDWAJ**

**Assistant Professor Department of Forestry, Wildlife & Environmental  
Sciences**

**Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G), 495009**

**(A Central University)**





## CERTIFICATE

This is to certify that the dissertation entitled “Effect of Nitrogen Fertilizer Doses on the Characteristics of *Terminalia arjuna*” submitted by Khushboo Bara daughter of Chunilal Bara Enrolment Number GGV/23/06708 to the Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, in partial fulfillment of the requirements for the award of the degree of Master of Science in Forestry, is a Bonafide and original work carried out by her under my supervision and guidance.

The work embodied in this dissertation has not been submitted, either in part or full, for the award of any other degree or diploma of this or any other university/institute.

Place: Bilaspur

Date: 16/05/25

विभागाध्यक्ष  
Head

यानिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

(Signature)

Dr. ATUL KUMAR BHARDWAJ

Assistant Professor

Forestry, Wildlife and Environment Sciences

Guru Ghasidas Vishwavidyalaya



## CANDIDATE'S DECLARATION

I Hereby declare that the dissertation entitled "Effect of Nitrogen fertilizer doses on the Characteristics of *Terminalia arjuna*" Submitted to the Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, (C.G) is a record of an original work done by me under the guidance of Dr. Atul Kumar Bhardwaj and this work has been formed for the award of the degree of Master of Science in Forestry, Wildlife & Environmental sciences. This work has not been submitted for any other degree in any Universities/Institutes.

Date: 15/05/25

Place: Bilaspur

*Khushboo Bara*

(Signature of the candidate)

**KHUSHBOO BARA**

M.Sc. Forestry 4<sup>th</sup> Sem

Roll no. 23078113

Enroll No.: GGV/23/06708

## ACKNOWLEDGEMENT

First of all, I would like to express my deepest gratitude to the almighty for bestowing his blessing and being benevolent in me to accomplish my dissertation.

I am highly indebted to my supervisor and my mentor **Dr. Atul Kumar Bhardwaj** whose able support and guidance have been a constant source of encouragement in shaping this dissertation. The time which I have spent in his association and shadow will remain with me as a superb memory.

I owe my gratitude and sincere thanks to **Prof. Dr. S.C. Tiwari**, Dean, School of Natural Resources, and Head, Department of Forestry, Wildlife and Environmental Sciences, GGV, Bilaspur for his inspiring guidance, support, and much-needed critical comments during this entire study period.

I express my deep regards to all my professors **Dr S.S. Dhuria, Dr. K.K Chandra, Dr. Gunjan Patil, Dr Garima Tiwari, Bhawana Dixit, Dr. Ajay Kumar Singh, Dr. Brijendra Pratap Singh, Dr. Chandresh Kumar Singh, Dr. Chowlani Manpoong**, Department of Forestry, Wildlife and Environmental Sciences, for their insightful suggestions and encouragement over the years. Your support and encouragement helped me to overcome the challenges I faced.

I pay sincere gratitude to **Prof Alok Kumar Chakrawal**, Vice Chancellor, Guru Ghasidas Vishwavidyalaya, Bilaspur Chhattisgarh whose constant encouragement and guidance helped us in the smooth sailing of the dissertation work, providing the academic framework and institutional encouragement that made this work possible.

I deeply appreciate the help extended by **Miss. Chanchal Kumari** (research scholar) Department of Forestry, Wildlife and Environmental Sciences, during the experimentation work.

I am also thankful to the **Vrindesh Kumar Rahi** technical staff, and **Santuram** nursery staff of the Department for their help and support during my research work.

I express my heartiest regard to my Father **Mr. Chunilal Bara** and my mother **Smt. Meena Devi**, my Brother **Durgesh Oraon**, and my sisters **Rohini Bara**, **Priti Bara**, and **Priyanka Bara** for their blessing, support, and encouragement at every step and the patience they showed during this work.

I express my heartfelt thanks to my friends, **Sreya Biswas**, **Bharti Sahu**, **Shristi Singh**, **Juhi Tripathi**, **Nitesh Kumar Oraon**, and other batchmates of the Department Forestry, Wildlife and Environmental Sciences for their constant support that has helped in accomplishing this dissertation. Finally, it gives me the utmost pleasure to acknowledge the constant encouragement support, and love of all my family members in the completion of my dissertation work.

Lastly, I express my deep gratitude to all who directly or indirectly contributed to the learning experience.

Date: 15/05/25

Place: GGU, Bilaspur

*Khushboo  
Bara*

**KHUSHBOO BARA**

M.Sc. Forestry 4<sup>th</sup> Sem

## TABLE OF CONTENTS

S.No.	Titles	Page No.
1.	INTRODUCTION	1-6
2.	REVIEW OF LITERATURE	7-12
3.	MATERIALS AND METHODS	12-25
4.	RESULTS AND DISCUSSION	26-35
5.	CONCLUSION	36
	PICTURE PLATE	37-41
	REFERENCES	42-44

## LIST OF TABLES

<b>S.No.</b>	<b>Table No.</b>	<b>Particulars</b>	<b>Page No.</b>
1.	3.1	Meteorological parameters for the experimental period	13
2.	3.2	General characteristics of the soil of the nursery site	14
3.	4.1	Effects of various Nitrogen fertilizer treatments on height, diameter, and number of leaves of <i>T. arjuna</i>	19
4.	4.2	Effect of Different Nitrogen Fertilization on Biomass Production	24
5.	4.3	Correlation coefficients for different parameters	27

**Utilization of NTFPs by Gond Tribe in Korba district of Chhattisgarh**

*Dissertation*

Submitted for partial fulfilment of the requirement for the  
Degree of Masters of Science

In

Forestry and Environmental Science



(Session: 2024-25)

Under the Supervision of

*Dr. Chowhani Manpoong*

Assistant Professor

Department of forestry, wildlife

& Environmental sciences, GGV Bilaspur

Submitted by

*Kunal Rajeev Dewangan*

M.Sc. Forestry 4<sup>th</sup> sem

Enrl No. GGV/19/6069

Roll No. 23078114

**DEPARTMENT OF FORESTRY, WILDLIFE**

**& ENVIRONMENTAL SCIENCES**

**GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G.)**

(A central university Established under central university Act 2009, No.25 of 2009)

16.05.25  
(SATYADEO SHARMA)  
IS

DEPARTMENT OF FORESTRY, WILDLIFE  
& ENVIRONMENTAL SCIENCES  
GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G.)  
(A central university Established under central university Act 2009, No.25 of 2009)



CERTIFICATE

I hereby certify that Mr. Kunal Rajeev Dewangan S/O Mr. Laxmi Prasad Dewangan is a regular student of M.Sc. Forestry 4<sup>th</sup> semester during the session of 2024-25 of department of Forestry, wildlife & Environmental Sciences, GGV, Bilaspur, Chhattishgarh. He has completed the dissertation entitled “**Utilization of NTFPs by Gond Tribe in Korba district of Chhattisgarh**” I wish him all the success in his future academics.

Date: 06/05/2025

*[Handwritten Signature]*

16/05/2025

विभागाध्यक्ष  
Head

यार्निकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

*[Handwritten Signature]*

Under the guidance of

Dr. Chowhani Manpoong

Assistant Professor & supervisor



## DECLARATION

I hereby declare that the dissertation entitled "**Utilization of NTFPs by Gond Tribe in Korba district of Chhattisgarh**" Dissertation report submitted to the Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya Bilaspur, C.G. is record of work done by me under the guidance of **Dr. Chowlani Manpoong**, Assistant Professor. The work has been formed for the award of Master of Sciences in Forestry, Wildlife & Environmental Sciences and not submitted for any other degree. The sources of material and all assistance received during the course of the investigation have been duly acknowledged. All the records and the data given in the report are correct to my knowledge.

Date -

Place - Bilaspur (C.G.)

  
**Kunal Rajeev Dewangan**

M.Sc. Forestry

Enrl No: GGV/19/6069

Roll No. 23078114

## Acknowledgement

*I would like to begin by sincerely thanking God for giving me the strength, health, and determination to complete this dissertation. I'm deeply grateful to my mentor and advisor **Dr. Chowlani Manpoong**, for their constant support, valuable guidance, and insightful suggestions throughout this journey their help truly shaped this research into what it is today. I would also like to thank the faculty and staff of the Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.) for providing the necessary lab facilities, technical support, and a motivating research environment. A heartfelt thanks goes to my friends, classmates, and seniors for being there through both the smooth and rough parts of this work your support meant a lot. I'm especially thankful to my family for standing by me always, cheering me on with their love, blessings, and silent strength, even during the toughest times. Lastly, I truly appreciate everyone whether directly or indirectly who helped me complete this dissertation.*

A handwritten signature in black ink, appearing to be 'Manpoong', located at the end of the acknowledgement text.

**A DISSERTATION ON**  
**“ETHNOMEDICINAL SURVEY OF SHRUB SPECIES  
IN KONDAGAON DISTRICT ”**



**Submitted in partial fulfillment of the requirement for the award of degree of  
MASTERS OF SCIENCE**

*Submitted By:*  
**MANISH KUMAR BAGHEL**  
M.Sc. Forestry 4<sup>th</sup> semester  
Roll no.: 23078116  
GGV/20/03634

*Under the supervision of :*  
**PROFESSOR DR. S.C. TIWARI**

Department of Forestry, Wildlife & Environmental Sciences

**GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G.)**

(A Central University Established Under Central University Act 2009, No. 25 of 2009)

16.05.25  
(SATYADEO SHARMA)  
IES

## CERTIFICATE

I have great pleasure in certifying that Mr. Manish Kumar Baghel S/o Suresh Kumar Baghel is a regular student of M.Sc. Forestry 4<sup>th</sup> semester during the session 2024-25 of Department of Forestry, Wildlife & Environment Sciences, GGV Bilaspur Chhattisgarh. He has complete the Dissertation entitled "Ethnomedicinal survey of shrub species in Kondagaon District (C.G.)" I wish him all the success in his future academics.

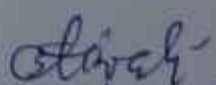
Date-13/05/2025  
Place- Bilaspur C.G.

  
(Dr. S.C. Tiwari)  
Professor &  
Supervisor

---

This is submitted to Head of Department of Forestry, Guru Ghasidas Vishwavidyalaya Bilaspur C.G. in partial fulfillment of degree of Masters of Science in Forestry.

Date-  
Place- Bilaspur C.G.

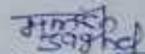
  
(Dr. S.C. Tiwari) 16/05/2025  
Head of Department, Forestry  
विभागाध्यक्ष  
Head  
यानिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु गहासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

## DECLARATION

I hereby declare that the dissertation entitled " Ethnomedicinal Survey of Shrub Species in Kondagaon District of Chhattisgarh" Dissertation report submitted to the Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.) is record of an original work done by me under the guidance Dr. S.C.Tiwari, Assistant Professor. The work has been formed for the award of Masters of Science in Forestry & Environmental Sciences and not submitted for any other degree. The source of material and all assistance received during the course of the investigation have been duly acknowledge. All the record and data given in the report are correct to my knowledge.

Date- 13/05/2025

Place- Bilaspur C.G.



**Manish Kumar Baghel**

M.Sc. Forestry 4<sup>th</sup> semester

Roll no.: 23078116

Enrt. No.:GGV/20/03634

**A Comprehensive Study on Avian Ecology & Migration Dynamics  
at Bhaiasajhar Dam, Bilaspur, Chhattisgarh**

*Dissertation*

**Submitted for partial fulfilment of the requirement**

**For The Degree Masters of Science**

**In**

**Forestry & Environmental Science**



Session-2024-25

**Under the Supervision of:**

*Dr. GARJMA TIWARI*

Assistant Professor

Department of Forestry Wildlife &  
Environmental Science

GGV, Bilaspur (C.G)

**Submitted by**

*MANSI SINGH*

M.Sc. forestry 4<sup>th</sup> Semester

Roll No. 23078117

Enroll No. GGV/19/6075

**DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES**

**GURU GHASHIDAS VISHWAVIDYALAYA BILASPUR (C.G)**

(A Central University established by the Central Universities Act 2009)



## CERTIFICATE

I have great pleasure in certifying that Miss Mansi Singh D/o Mahendra Singh is a regular student of M.Sc. Forestry 4<sup>th</sup> Semester during the session of 2024-25 of Department of Forestry, Wildlife & Environmental Sciences, GGV, Bilaspur, Chhattisgarh. She has completed entitled **“A Comprehensive Study on Avian Ecology & Migration Dynamics at Bhisajhar Dam, Bilaspur, Chhattisgarh”**

I wish all the success in her future academics.

*Divya*

विभागाध्यक्ष  
Head

द्वानिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

*Garima*

**Dr. Garima Tiwari**

**Assistant Professor**

## DECLARATION

I hereby declare that the dissertation entitled: "**A Comprehensive Study on Avian Ecology & Migration Dynamics at Bhisajhar Dam, Bilaspur, Chhattisgarh**" Dissertation report submitted to the Department of Forestry, Wildlife & Environmental Sciences, GGV, Bilaspur, Chhattisgarh is record of an original work done by me under the guidance of **Dr. Garima Tiwari**, Assistant Professor. The work has been formed for the award of Master of Science in Forestry & Environmental Sciences and not submitted for the any other degree. The source of material and all assistance received during the course of the investigation have been duly acknowledged. All the records and data given in the report are correct to my knowledge.

  
*Mansi Singh*

M.Sc. forestry 4<sup>th</sup> Semester

Roll No. 23078117

Enroll No. GGV/19/6075



## ACKNOWLEDGEMENT

First and foremost, I would like to express my deepest gratitude to my supervisor, Dr. Garima Tiwari, Assistant Professor, Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for their invaluable guidance, constant support, and constructive feedback throughout this research journey. Their encouragement and insightful suggestions have been instrumental in the completion of this dissertation.

I am also thankful to Dr. Brijendra Pratap Singh, Assistant Professor, Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing some necessary guidance for my research.

I pay my thanks to my all teachers and staff members of the department for their constant encouragement, guidance and support for completion of this work.

To my seniors, thank you for the stimulating discussions, collaboration, motivation and identification of birds. Special thanks to Abhijeet Sharma and Animesh Shukla for your help and companionship during this process.

To my friend Shivangi Rai thank you for your collaboration, feedback, and moral support. Your camaraderie made the research process much more enjoyable.

I am deeply grateful to my family for their unwavering support, patience, and love. To my parents, who have always believed in me and provided constant encouragement, thank you for being my source of strength.

*Mansi Singh*

M.Sc. forestry 4<sup>th</sup> Semester

Roll No. 23078117

Enroll No. GGV/19/6075

Forest resource utilization patterns in different villages of Maundergarh, Chirang,  
Bharatpur, Chhattisgarh

Dissertation

Submitted for partial fulfillment of the requirements for the  
Degree of Masters of Science

in

Forestry and Environmental Science



Delhi (2024-25)

Under the Supervision of  
*Dr. Chaitan Mahapatra*  
Assistant Professor  
Department of forestry, wildlife  
& Environmental sciences, GGV, Bilaspur

Submitted by  
*M. Anshu Singh*  
M.Sc. Forestry 4<sup>th</sup> sem  
Enr No. GGV/19/0679  
Roll No. 23078118

DEPARTMENT OF FORESTRY, WILDLIFE  
& ENVIRONMENTAL SCIENCES  
GURU GHANSHYAM VISHWAKIYAYA BHILASPURE (G.G.)

14.05.25

( Smt. Arpita Sharma )  
18

(A Central institution established under special provision Act 2000, No. 27 of 2000)

DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES

GURU GHANSHYAM VISHWAKULAVA BHASKRUPUR (G.G.V.B.)

(A Central university established under special provision Act 2000, No. 27 of 2000)



CERTIFICATE

I hereby certify that Mr. Mohan Singh S/O Mrs. Pooja Singh is a regular student of M.Sc. Forestry 4<sup>th</sup> semester during the session of 2024-25 of Department of Forestry, Wildlife & Environmental Sciences, G.G.V.B. Bilaspur, Chhattisgarh. He has completed the dissertation on "Forest resource utilization pattern in different villages of Mandragarh-Chandigarh-Chandigarh" I wish him all the success in his future academics.

Date: 06/5/2025

Col. Arora

*(Signature)*

Head, Institute of Forestry, Wildlife & Environmental Sciences, G.G.V.B. Bilaspur, Chhattisgarh

*(Signature)*

Under the guidance of

Dr. Chandra Mohan Singh

Assistant Professor & supervisor

## DECLARATION

I hereby declare that the dissertation entitled "Forest resource utilization patterns in different villages of Mairandagarh-Chimnari-Bharatpur, Chhatisgarh" Dissertation report submitted in my Department of Forestry, Wildlife & Environmental Sciences, Gann College, Maharashtra, Raipur, C.G. is a record of work done by me under the guidance of Dr. Chandrajit Manjhiwar, Assistant Professor. The work has been done for the award of Master of Science in Forestry, Wildlife & Environmental Sciences and not submitted for any other degree. The contents of material and all assistance received during the course of the investigation have been duly acknowledged. All the records and the data given in the report are correct to my knowledge.

Date:-

Place:- Raipur (C.G.)



Mahesh Singh

M.Sc. Forestry

Roll No. 45001190079

Roll No. 23078118

### Acknowledgments

I would like to begin by sincerely thanking God for giving me the strength, health, and determination to complete this dissertation. I'm deeply grateful to my mentor and advisor Dr. **Christian Murrell** for their constant support, valuable guidance, and helpful suggestions throughout this journey. Their helpful input has been instrumental in making this a reality. I would also like to thank the faculty and staff of the Department of Physics, **WZLAP**, & **Department of Science**, **Georgia Christian College**, for providing the necessary facilities, technical support, and a motivating research environment. A heartfelt thanks goes to my friends, **Jonathan**, and **Sammy** for being there through all the sweat and tears. Parts of this work were supported in part by the **family** and **church**. I am especially thankful to my family for reading the manuscript. **Family**, I truly appreciate everyone who has directly or indirectly helped me complete this dissertation.



A DISSERTATION ON  
STUDY ON NON-TIMBER FOREST PRODUCTS FOR SUSTAINED  
LIVELIHOOD OF FOREST DEPENDENT LOCAL RESIDENTS OF  
GAURELA-PENDRA-MARWAHI DISTRICT(C.G.)



Submitted For the Partial Fulfillment of The Requirement for The Degree of Master of  
Science in Forestry and Environmental Sciences

**(FOREST MANAGEMENT)**

**BY**

**NANDITA TAMRAKAR**

Enrollment No: GGV/23/06710

Batch: 2023-25

· UNDER THE SUPERVISION OF

**Dr. K. K. CHANDRA**

Professor

**DEPARTMENT OF FORESTRY WILDLIFE AND ENVIRONMENTAL SCIENCES  
SCHOOL OF NATURAL RESOURCES**

**GURU GHASIDAS VISHWAVIDYALAYA**

**(A Central University accredited with A<sup>++</sup> grade by NAAC)**

**BILASPUR (C.G.) 495009**

**2025**

Dr. K.K. CHANDRA  
Professor  
Department of Forestry, Wildlife &  
Environmental Sciences,  
kkckvk@gmail.com



Guru Ghasidas  
Vishwavidyalaya  
(A Central University, NAAC A++)  
Bilaspur, Chhattisgarh,  
India

## CERTIFICATE

This is to certify that the Dissertation entitled "Study on Non-Timber Forest Products for Sustained Livelihood of Forest Dependent Local Residents of Gaurela-Pendra-Marwahi district, Chhattisgarh" Submitted in partial fulfilment of the requirement for the degree of Master of science in Forestry and Environmental Sciences in Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur (Chhattisgarh) is the work carried out by Nandita Tamrakar, D/O Mr. Nand Kishor Tamrakar under my supervision and guidance.

I wish her success in academics.

Place: Bilaspur

Date: 13/5/2025

Supervisor

Dr. K.K. CHANDRA

विभागाध्यक्ष  
Head

पानिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

## DECLARATION

I hereby declare that the Dissertation work entitled “**Study on Non-Timber Forest Products for Sustained Livelihood of forest Dependent Local Residents of Gaurela-Pendra-Marwahi district (C.G.)**” Submitted to the Department of Forestry, Wildlife and Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, C.G. is a record of an original work done by me under the guidance of **Dr. K.K. CHANDRA** Department of Forestry, Wildlife and Environmental Sciences. This work has not been submitted for any other degree in any university/Institutes.

Place: Bilaspur

Date: 13-5-25



Nandita Tamrakar

M.Sc. Forestry 4<sup>th</sup> sem.

Roll No. 23078119

(Enroll. No. GGV/23/06710)



## ACKNOWLEDGEMENT

It has been an immense pleasure and Satisfaction to be able to complete my dissertation. First, I thank "God" for the opportunity I was given ,for showering his blessings on me, and for giving me the strength to complete my dissertation on time.

I Express my profound indebtedness to Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya. Bilaspur, Chhattisgarh provides me with all the necessary facilities to complete my project work. I pay my deepest regards to **PROF. S. C. TIWARI**, Dean, School of Studies of Natural Resources and Head, Department of Forestry, Wildlife and Environmental Sciences for his constant help and academic encouragement.

I express my deep sense of gratitude and thanks to my supervisor **Dr. K.K. CHANDRA**, Professor, Department of Forestry, Wildlife & Environmental Sciences, for his inspiring guidance, analytical Powers, and much needed critical comments during the entire study period.

I also express my deep regards to all my Professors Dr. S.S. Dhuria, Dr. Gunjan Patil, Dr. Garima Tiwari, Dr. Bhavana Dixit, Dr. Ajay Kumar Singh, Dr. Brijendra Pratap Singh, Dr. Atul Kumar Bhardwaj, Dr. Chandresh Kumar Singh, Dr. Chowlani Manpoong, Department of Forestry, Wildlife & Environmental Sciences, for his valuable guidance and comments.

I want to express my gratitude to my Mousi Mrs. Kanchan Tamrakar and my beloved parents Mr. Nandkishor Tamrakar, Mrs. Mamta Tamrakar for their encouragement, which helped me in completing this project.

Most importantly I am grateful to my friends Sandeep Rajak, Komal Ekka, Anupam Rai and my batchmate Juhi Tripathi for giving me their valuable advice and knowledge whenever I was stuck without which I never would have been able to complete my study. I give thanks to all people who have directly or indirectly helped me to do this work.

**NANDITA TAMRAKAR**

M.Sc. Forestry, 4<sup>th</sup> Sem

## CONTENTS

<b>Chapters</b>	<b>Items</b>	<b>Page no.</b>
1.	Introduction	1-5
2.	Review of Literature	6-9
3.	Materials & Methods	10-14
4.	Results and Discussion	15-26
5.	Conclusion	27
6.	Summary	28
7.	Reference	29-33

**ASSESSMENT OF GROWTH AND DEVELOPMENT**  
**PATTEN & DIFFERENT SEEDLING IN FOREST**  
**NURSERY OF CHHATTISGARH.**

DISSERTATION

Submitted for partial fulfillment of the requirement for the DEGREE  
OF MASTER SCIENCE

In

Forestry and environmental sciences



(Session :- 2024-25)

Under the supervision of :-  
DR. KRISHNA KUMAR CHANDRA

PROFESSOR  
Department of forestry, wildlife  
& environmental science ,GGU, Bilaspur .

submitted by :-  
PRIYANKA SAHU

Enr no. – GGV/23/06712  
Roll no. 23078121

**DEPARTMENT OF FORESTRY , WILDLIFE**  
**& ENVIRONMENTAL SCIENCES**  
**GURUGHASIDAS VISHWAVIDYALAYA**  
**,BILASPUR (C.G)**  
( A CENTRAL UNIVERSITY ESTABLISHED UNDER CENTRAL  
UNIVERSITY ACT 2009, NO.25 OF 2009)



**DR. KRISHNA KUMAR CHANDRA**

PROFESSOR  
DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCE  
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR CHHATTISGARH  
NO.9893750299  
GMAIL -kkckvk@gmail.com

## CERTIFICATE

I have great pleasure in certifying that Ms.PRIYANKA SAHU S/O RAJENDRA SAHU is a regular student of M.sc forestry 4<sup>th</sup> semester forest management during the session of 2024-25 of department of forestry, wildlife & environmental sciences, GGU ,bilaspur, Chhattisgarh . he has completed the dissertation entitled "**ASSESSMENT OF GROWTH AND DEVELOPMENT PATTEN & DIFFERENT SEEDLING IN FOREST NURSERY OF CHHATTISGARH.**"

*Dr. Krishna*  
विभागाध्यक्ष  
Head  
16/05/2025  
सानिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

*Dr. Krishna*  
(DR. KRISHNA KUMAR CHANDRA)  
PROFESSOR

## DECLARATION

I hereby declare that the dissertation entitled. "**ASSESSMENT OF GROWTH AND DEVELOPMENT PATTEN & DIFFERENT SEEDLING IN FOREST NURSERY OF CHHATTISGARH.**" Dissertation report submitted to the department of forestry, wildlife & environmental science guru ghasidas vishwavidyalaya, bilaspur, C.G. is record of an original work done by me under DR. KRISHNA KUMAR CHANDRA ,Professor . the work has been formed for the award of master of science in forestry & environmental science and not submitted for any other degree . the source of material and all assistance received during the course of the investigation have been duly acknowledged . all the records and data given in the report are correct to my knowledge.

TE - 14/05/2025

CE - BILASPUR (C.G.)

Priyanka sahu

**PRIYANKA SAHU**

M.Sc Forestry 4<sup>th</sup> semester

Enrl no. - GGV/23/06712



CamScanner



CamScanner

A DISSERTATION ON

**Human-Elephant Conflict: Financial Modelling Damage  
and Settlement by Elephants in Udanti Sitanadi Tiger  
Reserve, Gariyaband (C.G)**

SUBMITTED FOR THE PARTIAL FULFILLMENT OF  
THE DEGREE OF MASTER OF SCIENCE

IN

FORESTRY & ENVIRONMENTAL SCIENCES



(SESSION: 2023-2025)

*Under the Supervision of:*

**Dr. S.S. DHURIA**

Professor

Dept. of Forestry, Wildlife &  
Environmental Sciences, GGV, Bilaspur

*Submitted By:*

**RAHUL KUMAR DHRUW**

M.Sc. Forestry 4<sup>th</sup> Semester

Roll No.: 23078122

Enroll. No.: GGV/23/06713

**DEPARTMENT OF FORESTRY, WILDLIFE  
& ENVIRONMENTAL SCIENCES (ICFRE A++)**

---

**GURU GHASIDAS VISHWAVIDYALAYA,  
BILASPUR, CHHATTISGARH 495009**

(A Central University established under Central Universities Act 2009, No. 25 of 2009)

**(NAAC A++)**

---

**DEPARTMENT OF FORESTRY, WILDLIFE &  
ENVIRONMENTAL SCIENCES (ICFRE A++)**

**GURU GHASIDAS VISHWAVIDYALAYA,**  
(A Central University established under Central Universities Act 2009, No. 25 of 2009)  
**BILASPUR, CHHATTISGARH**




**CERTIFICATE**

I have great pleasure in certifying that **Mr. Rahul Kumar Dhruw S/O Mr. Chandrabali Dhruw** is a regular student of M.Sc. Forestry & Environmental Sciences 4<sup>th</sup> Semester Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh. He has completed his dissertation entitled **"Human-Elephant Conflict: Financial Modeling Damage and Settlement by Elephants in Udanti Sitanadi Tiger Reserve, Gariyaband (C.G)"** during the Session 2024-25 under my Supervision.

I wish him all the success in his future academic endeavors.

**DATE :**

  
विभागाध्यक्ष  
Head  
76/05/2024

वनिकी, प्रत्यक्ष एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु गहरीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

  
**Supervisor**

**Dr. S.S. DHURIA**

**Professor**

Dept. of Forestry, Wildlife &  
Environmental Sciences,  
GGV, Bilaspur

## DECLARATION

I hereby declare that the dissertation entitled "**Human-Elephant Conflict: Financial Modeling Damage and Settlement by Elephants in Udanti Sitanadi Tiger Reserve, Gariyaband (C.G)**" Dissertation submitted to the Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh is a record of an original work done by me under the guidance of Dr. S.S. Dhuria, Professor. The work has been formed for the award of Master of Science in Forestry & Environmental Science and not been submitted elsewhere for any other degree. The facilities, cooperation and assistance received during the dissertation are duly acknowledged.



**RAHUL KUMAR DHRUW**

M.Sc. Forestry 4<sup>th</sup> Semester

Dept. of Forestry, Wildlife &  
Environmental Sciences,

GGV, Bilaspur

Roll No.: 23078122

Enroll. No.: GGV/23/06713



## ACKNOWLEDGEMENTS

*First of all, I would like to thank 'God' who bestowed me with patience and favourable conditions and circumstances to achieve this feat.*

*I express my profound indebtedness to Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing me all the necessary facility to complete my project work.*

*I pay my deep regards to **Prof. S.C. Tiwari, Dean, School of Natural Sciences and Head of Department of forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh** for his constant help and academic encouragement..*

*I express my deep sense of gratitude and thanks to **Prof. S.S. Dhuria, Supervisor & Professor, Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh** for guidance and support.*

*I pay my thanks to **Dr. K.K. Chandra, Dr. Garima Tiwari, Dr. Gunjan Patil, Dr. Bhavana Dixit, Dr. Ajay Kumar Singh, Dr. B.P. Singh, Dr. A.K. Bhardwaj, Dr. C.K. Singh, Dr. C. Manpoong,** faculties of the, Department of Forestry, Wildlife & Environmental Science, GGV for much needed critical comments during entire study period.*

*I would also like to thank for your guidance and support **Deputy Director of USTR Mr. Varun Jain (IFS)** and Staff Officials for sparing their valuable time for us and give more information and co-operate with us.*

*I want to sincerely thank my father, **Mr. C.B. Dhruw, USTR Ranger,** for his important advice, encouragement, and sharing of his vast field experience. all of which were crucial in helping me finish my dissertation.*

*I pay my thanks to staff members and my friends **Abir Ghosh and Bhupendra Devdas** of the department for their constant encouragement, guidance and support for completion of this work.*

*I am highly obliged to my worthy mother **Mrs. Savita Dhruw** and Uncle **Mr. Baldev Dhruw,** without their blessings and support this work would not have seen the light of the day.*

*Rahul*

**RAHUL KUMAR DHRUW**  
M.Sc. Forestry 4<sup>th</sup> Semester Dept. of  
Forestry, Wildlife & Environmental  
Sciences, GGV, Bilaspur  
Roll No.: 23078122  
Enroll. No.: GGV/23/06713

**Office of Deputy Director, Udanti Sitanadi Tiger Reserve  
Gariaband, Dist. Gariaband (C.G.)**



Email ID:- ddustr@gmail.com

ddustr.gbd-cg@gov.in

Ph.No. 07706-296229

**TO WHOM SO EVER IT MAY CONCERN**

This is to certify that "Mr. Rahul Kumar Dhruw" student of "MSc Forestry & Environmental Science IV Semester Dept. of Forestry, Wildlife & Environmental Sciences Guru Ghasidas University, Bilaspur Chhattisgarh, has successfully completed his Dissertation work in Topic "**Human-Elephant conflict : Financial Modeling Damage and Settlement by Elephants**" under the guidance of Deputy Director Udanti Sitanadi Tiger Reserve Gariaband. During his tenure he worked in The Office of Deputy Director Udanti Sitanadi Tiger Reserve Gariaband.

We found him sincere & hardworking during his Dissertation work. He worked well as part of a team during his tenure. We wish him all the best for future.

  
**Deputy Director**

Udanti Sitanadi Tiger Reserve  
Gariaband

Gariaband, Date 21/10/2025

No./Steno/G/ 1715  
Copy To :-

01. Principal Chief Conservator of Forest (Wildlife), Chhattisgarh Atal Nagar Raipur.
02. Chief Forest Conservator (Wildlife) and Field Director Udanti Sitanadi Tiger Reserve Raipur.
03. Mr. Rahul Kumar Dhruw student of "MSc Forestry & Environmental Science IV Semester Dept. of Forestry, Wildlife & Environmental Sciences Guru Ghasidas University, Bilaspur Chhattisgarh.

  
**Deputy Director**

Udanti Sitanadi Tiger Reserve  
Gariaband

## CONTENT

Chapter	TITLE	PAGE NO.
1.	<b>INTRODUCTION</b>	1
	1.1 HEC In INDIA	2
	1.2 Previous distribution	3
	1.3 HEC IN CHHATTISGARH	4
	<b>Objectives</b>	8
2.	<b>Review Of Literature</b>	9
3.	<b>Material &amp; Methodology</b>	12
	3.1 Study Area	12
	3.1.1 Geographic Overview	13
	3.1.2 Hydrology and Water Source	14
	3.1.3 Vegetation Cover	14
	3.1.4 Wild Fauna, Habitats and Tropic Niches	16
	3.1.5 Human Settlements and Livelihood Trends	17
	3.2 Research Methodology	17
4	<b>Result and Discussion</b>	23
	4.1 Objective 1	23
	4.1.1 Year-wise Number of Conflict Cases and Compensation	23
	4.1.2 Type of Damage (Crop, House, Property etc.)	24
	4.1.3 Month-wise Incident Table (Based on your survey)	25
	4.1.4 Compensation Details	26
	4.2 Objective 2	29
	4.2.1 Government Notified Compensation Amounts for Human-Elephant Conflict	29
	4.2.2 Types of Damages	29
	4.2.3 Process of Compensation	37
	4.3 Objective 3	40
	4.3.1 Head 6991: Supporting Elephant Conservation	49
5	<b>Conclusion</b>	53
6	<b>References</b>	55
	<i>Appendices</i>	60

**BIOMARKER RESPONSE IN *Channa punctatus* AFTER THE EXPOSURE OF  
CADMIUM (Cd) SOLUTION**

*Dissertation*

Submitted for partial fulfilment of the requirement for the  
Degree of Masters of Science

In

Forestry and Environmental Science



(Session: 2024-25)

Under the Supervision of

*Dr. Brijendra Pratap Singh*

Assistant professor

Department of forestry, wildlife

& Environmental sciences, GGV Bilaspur

submitted by

*Reshma Chouhan*

M.Sc. Forestry 4<sup>th</sup> sem

Enrl No. GGV/23/06714

Rol No. 23078123

**DEPARTMENT OF FORESTRY, WILDLIFE**

**& ENVIRONMENTAL SCIENCES**

**GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G.)**

(A central university Established under central university Act 2009, No.25 of 2009)

16.05.21  
SATYADEO SHARMA  
IES

DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES

GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G.)

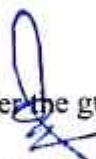
(A central university Established under central university Act 2009, No.25 of 2009)



CERTIFICATE

I have great preference in certifying that Ms. Reshma Chouhan D/o Ganjoo Ram Chouhan is a regular student of M.Sc. Forestry 4<sup>th</sup> semester (forest management) during the session of 2024-25 of department of Forestry, wildlife & Environmental Sciences, GGV, Bilaspur, chhatishgarh. She has completed the dissertation entitled “**Biomarker responses in *Channa punctatus* after the exposur of cadmium (Cd) solution**” I wish her all the success in her future academics.

  
विभागाध्यक्ष  
Head  
वनिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

  
Under the guidance of  
Dr. Brijendra pratap singh  
Assistant professor & supervisor

## DECLARATION

I hereby declare that the dissertation entitled "**Biomarker responses in *Channa punctatus* after the exposur of cadmium (Cd) solution**" Dissertation report submitted to the Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya Bilaspur, C.G. is record of an original work done by me under the guidance of Dr. Brijendra Pratap singh, Assistant professor. The work has been formed for the award of Master of Sciences in Forestry, Wildlife & Environmental Sciences and not submitted for any other degree. The sources of material and all assistance received during the course of the investigation have been duly acknowledged. All the records and the data given in the report are correct to my knowledge.

Date - 14/5/25

Place - Bilaspur (C.G.)



Reshma chouhan

M.Sc. Forestry

Enr No: GGV/23/06714

Roll No. 23078123

## Acknowledgement

*I extend my heartfelt gratitude to all those who have supported and guided me throughout the course of this dissertation.*

*First and foremost, I express my sincere thanks to Prof. S.C. Tiwari Dean, School of Studies of Natural Resources and Head of the Department of Forestry wildlife and environmental sciences for their invaluable support, encouragement, and for providing all necessary resources for the successful completion of my research work.*

*I am deeply grateful to my esteemed supervisor, Dr. Brijendra Pratap Singh Assistant Professor Department of Forestry wildlife and environmental sciences for their continuous guidance, patience, and insightful suggestions throughout the dissertation. Their expertise and mentorship have been instrumental in shaping this work.*

*I would also like to thank coordinators, Dr. Ajay Kumar Singh, and all other faculty members, Prof. S.S. Dhuria, Prof. K.K. Chandra, Dr. Garima Tiwari, Dr. Bhawana Dixit, Dr. Gunjan Patil, Dr. Chandresh Kumar Singh, Dr. Atul Kumar Bhardwaj, Dr. Chowlani Manpoong of the Department of Forestry wildlife and environmental sciences for their academic support, constructive feedback, and encouragement during various stages of this study.*

*I am also thankful to my senior research scholars Dr. Kamesh Sahu, Dr. Ramesh Sahu and batchmates Vandana Mishra, Yukta Yadav for their cooperation, encouragement, and the stimulating discussions that enriched my academic experience.*

*Lastly, I express my gratitude to my family and friends for their unwavering emotional support, which kept me motivated throughout this journey.*

*This dissertation is a result of collective guidance, inspiration, and blessings from all of you.  
Thank you*

Date - 14/5/25

Place - Bilaspur (C.G.)

**Reshma Chouhan**

M.Sc. Forestry

Enrl No: GGV/23/06714

Roll No. 2307812

**Assessment of Urban Noise Pollution Using Smart Noise Meters: A Case  
Study of [ BILASPUR CITY]**

**Dissertation**

Submitted for partial fulfilment of the requirement for the  
Degree of Masters of Science

In

Forestry and Environmental Science



(Session: 2024-25)

Under the Supervision of

*Dr. Chandresh Kumar Singh*

Assistant professor

Department of forestry, wildlife

& Environmental sciences

submitted by

*Ritik Gahire*

M.Sc. Forestry 4<sup>th</sup> Sem

Enrol No. GGV/19/6113

Rol No. 23078124

**DEPARTMENT OF FORESTRY, WILDLIFE &**

**ENVIRONMENTAL SCIENCES**

**GURU GHASIDAS VISHWAVIDYALAYA BILASPUR**

(A central university Established under central university Act 2009, No.25 of 2009)



## DECLARATION

I hereby declare that the dissertation entitled "Assessment of Urban Noise Pollution Using Smart Noise Meters: A Case Study of [Bilaspur City]" Dissertation report submitted to the Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya Bilaspur, C.G. is record of an original work done by me. The work has been formed for the award of Master of Sciences in Forestry, Wildlife & Environmental Sciences and not submitted for any other degree. The sources of material and all assistance received during the course of the investigation have been duly acknowledged. All the records and the data given in the report are correct to my knowledge.

Date - 15/05/25

Place - Bilaspur (C.G.)



Ritik Gahire

M.Sc. Forestry

Enrol No: GGV/19/6113

Roll No. 23078124

## AKNOWLEDGEMENT

I extend my heartfelt gratitude to all those who have supported and guided me throughout the course of this dissertation. First and foremost, I express my sincere thanks to Prof. S.C. Tiwari, Dean, School of Studies of Natural Resources and Head of the Department of Forestry wildlife and environmental sciences for their invaluable support, encouragement, and for providing all necessary resources for the successful completion of my research work. `

I am deeply grateful to my esteemed supervisor, Dr. Chandresh Kumar Singh, Assistant professor Department of Forestry wildlife and environmental sciences for their continuous guidance, patience, and insightful suggestions throughout the dissertation. Their expertise and mentorship have been instrumental in shaping this work.

I would also like to thank coordinators, Dr. Ajay Kumar Singh, Dr. Gunjan Patil, and all other faculty members, Prof. S.S Dhuria, Prof. K.K. Chandra, Dr. Chandresh Kumar Singh, Dr. Garima Tiwari, Dr. Bhavna Dixit, Dr. Atul Kumar Bharadwaj, Dr. Chowlani Manpoong of the Department of Forestry wildlife and environmental sciences for their academic support, constructive feedback, and encouragement during various stages of this study.

Lastly, I express my gratitude to my family and friends for their unwavering emotional support, which kept me motivated throughout this journey.

  
Ritik Gahire

डॉ. चंद्रेश कुमार सिंह  
(सहायक प्राध्यापक)

वन्यजीव एवं पर्यावरणीय विज्ञान विभाग  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छत्तीसगढ़)  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छत्तीसगढ़)  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छत्तीसगढ़)  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छत्तीसगढ़)  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छत्तीसगढ़)  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छत्तीसगढ़)  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छत्तीसगढ़)  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छत्तीसगढ़)  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छत्तीसगढ़)

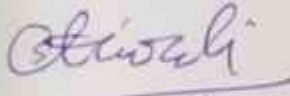


Dr. Chandresh Kumar Singh  
(Assistant Professor)

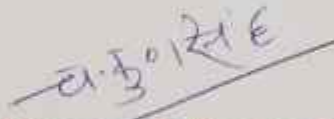
DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES  
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR, (CHHATTISGARH)  
(Accredited by ICFRE - A<sup>++</sup> - 2023)  
(A Central University established by the Central University Act 2009 No. 25 of  
2009) (Accredited by SIAC - A<sup>++</sup> - 2024)  
Contact No: +91-989393948, 9871022267  
Email: dr.chandreshsingh@gmail.com  
dr.chandreshsingh@ggu.ac.in

## CERTIFICATE

I have great pleasure in certifying that Mr. Ritik Gahire S/o Mr. Ashwani Gahire is a regular student of M.Sc. Forestry 4<sup>th</sup> semester (forest management) during the session of 2024-25 of department of Forestry, wildlife & Environmental Sciences, GGV, Bilaspur, Chhattisgarh. He has completed the dissertation entitled "Assessment of Urban Noise Pollution Using Smart Noise Meters: A Case Study of [Bilaspur City]" I wish him all the success in his future academics.

  
16/05/2024  
विभागाध्यक्ष  
Head

वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

  
(Dr. Chandresh Kumar Singh)

Assistant professor & supervisor

गुरु घासीदास विश्वविद्यालय  
(केंद्रीय विश्वविद्यालय अधिनियम 2009 अ. 25 के अंतर्गत स्थापित केंद्रीय विश्वविद्यालय)  
कोनी, बिलासपुर - 495009 (छ.ग.)



Guru Ghasidas Vishwavidyalaya  
(A Central University Established by the Central Universities Act, 2009 No. 25 of 2009)  
Koni, Bilaspur - 495009 (C.G.)

**Human-Wildlife Interactions in a Changing Landscape: A Case Study of  
Gariyaband District, Chhattisgarh**

*Dissertation*

Submitted to

**Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh**  
(A Central University)

*for partial fulfilment to award degree of*

**MASTER OF SCIENCE**

in

**FORESTRY AND ENVIRONMENTAL SCIENCE**



By

**Roshan Khamari**  
M.Sc. Forestry IV Semester  
Roll No: 23078125  
Enroll No: GGV/19/6116

**Under the Supervision of**

**Dr. Ajay Kumar Singh**  
Assistant Professor  
Department of Forestry  
GGV, Bilaspur

**Department of Forestry, Wildlife & Environmental Sciences**  
(ICFRE A++)  
**Guru Ghasidas Vishwavidyalaya**  
(NAAC A++)

(A Central University established by the Central University act 2009)

गुरु घासीदास विश्वविद्यालय  
(केंद्रीय विश्वविद्यालय अधिनियम 2009 अ. 25 के अंतर्गत स्थापित केंद्रीय विश्वविद्यालय)  
कोनी, बिलासपुर - 495009 (छ.ग.)



Guru Ghasidas Vishwavidyalaya  
(A Central University Established by the Central Universities Act, 2009 No. 25 of 2009)  
Koni, Bilaspur - 495009 (C.G.)

डॉ. अजय कुमार सिंह

अध्यापक प्राध्यापक  
प्राकृतिक संसाधन अनुसंधान विभाग  
सहविधि, प्राकृतिक एवं पर्यावरण विज्ञान विभाग  
गुरु घासीदास विश्वविद्यालय, बिलासपुर, छत्तीसगढ़  
☎ +91- 7879721224 📠 7000591141  
✉️ gks.ggu@gmail.com, ajayksingh.02@ggu.ac.in



Dr. Ajay Kumar Singh

Assistant Professor  
School of Natural Resources  
Department of Forestry, Wildlife & Environmental Sciences  
Guru Ghasidas Vishwavidyalaya, Bilaspur Chhattisgarh  
☎ +91- 7879721224 📠 7000591141  
✉️ gks.ggu@gmail.com,  
ajayksingh.02@ggu.ac.in

### CERTIFICATE

I have great pleasure in certifying that Roshan Khamari s/o Mr. Tankadhar Khamari is a regular student of M.Sc. Forestry & Environmental Sciences, 4<sup>th</sup> Semester, (Enrollment No: GGV/19/6116), Department of Forestry, Wildlife and Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur (CG). He has completed his Dissertation entitled "Human-Wildlife Interactions in a Changing Landscape: A Case Study of Gariyaband District, Chhattisgarh" during the session 2024-2025 under my supervision.  
I wish him all the success in his academics.

*Signature*  
16/05/2025

*Signature*  
15/05/2025  
Dr. Ajay Kumar Singh  
Supervisor




### CANDIDATE'S DECLARATION

I, **Roshan Khamari**, certify that the work embodied in this M.Sc. dissertation is my own Bonafide work carried out by me under the supervision of Dr. Ajay Kumar Singh at Department of Forestry, wildlife and Environmental Sciences, Guru Ghasidas Vishwavidyalaya. The Matter embodied in this M.Sc. Dissertation has not been submitted for the award of any degree/diploma.

I declare that I have faithfully acknowledged, given credit to and referred to the research workers wherever their works have been cited in the text and the body of the thesis. I further certify that I have not willfully lifted up some other's work, para, text, data, results, etc. reported in the journals, books, magazines, reports, dissertations, thesis, etc. or available at websites and included them in this Ph.D. thesis and cited as my own work.

Date: 15/05/2025

Place: Bilaspur

  
Signature of the candidate



## ACKNOWLEDGEMENT

The expression of giving thanks is just a part of those feelings, which are too large for words, but shall remain as memories of wonderful people with whom I have had the pleasure of working during the completion of the survey. At first, I am deeply thankful to my family for their unconditional support, patience, and motivation, which helped me stay focused and complete this assignment with dedication.

Universities train technical students, yet they also influence how we see the world and our lives. I appreciate **Prof. Alok Kumar Chakrawal**, the **Honorable Vice-Chancellor** of the **Guru Ghasidas Vishwavidyalaya Bilaspur, Chhattisgarh**, who inspired us to complete the assignment.

I am also grateful to **Prof. S. C. Tiwari**, Dean, School of Natural Resources & Head, Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh, for academic help and motivation.

A special word of thanks goes to my supervisor, **Dr. Ajay Kumar Singh**, Assistant Professor, Dept. of Forestry, Wildlife & Environmental Sciences, GGV, Bilaspur, whose patient mentoring, constructive suggestions, and continuous encouragement helped me navigate the attachment period meaningfully. His insights and feedback were instrumental in shaping this report.

I would also like to sincerely thank all the professors of the department **Prof. S.S. Dhuria**, **Prof. K.K. Chandra**, **Dr. G. Tiwari**, **Dr. G. Patil**, **Dr. B. Dixit**, **Dr. B.P. Singh**, **Dr. A.K. Bhardwaj**, **Dr. C.K. Singh**, and **Dr. C. Manpoong** for their continues encouragement and support during my study.

A special note of thanks to all the Forest officials of the Gariyaband Forest Division. especially **Mr. Laxman Singh**, Divisional Forest Officer of Gariyaband Forest Division.

My heartfelt gratitude also goes to **Dr. Aman Kumar**, Assistant Professor, Department of Forestry at Central University of Odisha (CUO), Koraput, **Mr. Ashutosh Anand** and **Mr. Sudhir Ranjan Choudhary**, Research Scholars at Guru Ghasidas Vishwavidyalaya (GGV), for their intellectual support, thoughtful discussions, and motivating presence during this journey.

गुरु घासीदास विश्वविद्यालय  
(केंद्रीय विश्वविद्यालय अधिनियम 2009 अ. 25 के अंतर्गत स्थापित केंद्रीय विश्वविद्यालय)  
कोनी, बिलासपुर - 495009 (छ.ग.)



Guru Ghasidas Vishwavidyalaya  
(A Central University Established by the Central Universities Act, 2009 No. 25 of 2009)  
Koni, Bilaspur - 495009 (C.G.)

I also extend my heartfelt thanks to my father, **Mr. Tankadhar Khamari**, my mother, **Mrs. Ketaki Khamari**, and my aunty **Miss Pramita Khamari**, for their motivation, inspiration and for always being there with a kind word or a helping hand. This accomplishment is as much theirs as it is mine.

A special note of thanks to Mr. Shubham Tandan, Mr. Rahul Dhruv, Mr. Ayushman Singh Rajput, Mr. Chityendra Dewangan and to my classmates, friends, seniors, juniors for their constant encouragement and thoughtful insights. Their support and shared perspectives significantly enriched the quality and depth of this research work.

Lastly, I express my deep gratitude to all who directly or indirectly contributed to the learning experience.

**Roshan Khamari**

M.Sc. Forestry IV Semester  
Roll No: 23078125  
Enroll No: GGV/19/6116





Table of Content

Chapter No.	Title	Page No.
<b>Chapter-1</b>	<b>Introduction</b>	<b>1</b>
1.1	Background	1
<b>Chapter-2</b>	<b>Literature Review</b>	<b>4</b>
<b>Chapter-3</b>	<b>Study Area</b>	<b>9</b>
3.1	Background	9
3.2	Climate	10
3.3	Forest Types and Vegetation	10
3.4	Faunal Diversity	10
3.5	Human Settlement and Habitation	11
3.6	Farming and Agriculture	12
<b>Chapter-4</b>	<b>Materials and Method</b>	<b>13</b>
<b>Chapter-5</b>	<b>Results and Discussions</b>	<b>15</b>
5.1	Overview of Human-Wildlife Conflict in Gariyaband District	15
5.2	Seasonal Trends in Human-Wildlife Conflict (2021–2024)	15
5.3	Livestock Depredation by Wild Animals (2021–2024)	17
5.4	Crop Damage Patterns	18
5.5	Human Casualties Due to Wildlife Attacks	19
5.6	Monthly Conflict Peaks and Agricultural Correlation	20
5.7	Village-wise Distribution of Conflict Incidents	21
5.8	Key Drivers and Spatial Distribution of Conflict	22
5.9	Mitigation Measures	23
<b>Chapter-6</b>	<b>Conclusion</b>	<b>25</b>
	<b>References</b>	<b>27</b>

**Influence of Fly Ash on Surface Water Quality and Heavy Metal  
Concentration in Water Bodies Near NTPC Sipat, Bilaspur,  
Chhattisgarh**

***Dissertation***

Submitted for the Partial fulfillment of

**DEGREE OF MASTER OF SCIENCE**

In

**Forestry & Environmental Sciences**



**Session – 2023-25**

**Under the supervision of**  
Professor S.C Tiwari  
Dean, School of Natural Resources  
Head of Department  
Forestry Wildlife & Environmental Science

**Submitted by**  
Saurav Rajwade  
M.Sc Forestry 4<sup>th</sup> Semester  
Roll No- 23078126

***Submitted to:***


**DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES  
(ICFRE A++)**

**GURU GHASIDAS VISHWAVIDYALAYA, (NAAC A++)**  
(A Central University Establishment Under Central University Act 2009, No. 25 of 2009)

**BILASPUR - 495009, CHHATTISGARH**

**2025**

**1**

  
16.05.25  
SATYADEO SHARMA  
IFS



## CERTIFICATE

*This is to certify that the Dissertation entitled " Influence of Fly Ash on Surface Water Quality and Heavy Metal Concentration in Water Bodies Near NTPC Sipat, Bilaspur, Chhattisgarh" Submitted in partial fulfilment of the requirements for the degree of Master of science in forestry and environmental sciences in Department of Forestry, wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur (Chhattisgarh) is the work carried out by Saurav Rajwade S/O Ramchandra Rajwade under my supervision and guidance.*

*I wish all the Success in his academics.*

Place: GGV, Bilaspur, C.G.

Date: /05/2025

  
(Supervisor)

Prof. S.C. Tiwari

16/05/2025

Department of Forestry, Wildlife &  
Environmental Sciences

## DECLARATION

*I hereby declare that the dissertation entitled " **Influence of Fly Ash on Surface Water Quality and Heavy Metal Concentration in Water Bodies Near NTPC Sipat, Bilaspur, Chhattisgarh**" Submitted to Department of forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, C.G is a record of an original work done by me under the guidance of Prof. S.C. Tiwari and this work has been formed for the award of degree of Master of Science in Forestry & Environment Sciences. This work has not been submitted for any other degree in any universities/Institutes.*

*Place : GV, Bilaspur, C.G.*

*Date: 05/2025*



*Saurav Rajwade*

*M.Sc. Forestry 4th Semester*

*Roll No- 23078126*

## ACKNOWLEDGEMENT

*First of all, I would like to thank 'God' Who bestowed me with patience and favourable conditions and circumstances to achieve this feat.*

*I express my profound indebtedness to Department of Forestry, Wildlife & Environmental Science, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing me all the necessary facilities to complete my Dissertation work, I pay my deep regards to Prof. S.C. Tiwari, Dean, School of Studies of Natural Resources and & Head, Department of Forestry, Wildlife and Environmental Sciences for his academic encouragement.*

*I express my deep sense of gratitude and thanks to my Supervisor Prof. S.C. Tiwari, Department of Forestry, Wildlife and Environmental Sciences for his inspiring guidance, support and much needed critical comments during this entire study period.*

*I express my deep regards to all my teachers Professor S.S. Dhuria, Professor K.K. Chandra, Dr. Gunjan Patil, Dr. Garima Tiwari, Dr. Bhawana Dixit, Dr. Ajay Kumar Singh, Dr. Brijendra Pratap Singh, Dr. Atul Kumar Bhardwaj, Dr. Chandresh Kumar Singh, Dr. Chowlani Manpoong, Department of Forestry, Wildlife and Environmental Science, for their insightful suggestions and encouragement over the years. Your support and encouragement helped me to overcome challenges I faced.*

*I express my deep regards to Dr. Kamesh, Dr. Chandrashekhhar Koushik and Dr. Ramesh (research scholar) Department of Forestry, Wildlife and Environmental Science, for their guidance and support.*

*I pay my thanks to all my friends Juhi Tripathi, Sudhanshu Tiwari, Srijan Vaishnav, Kaushal Sahu, Abir Ghosh, and other batchmates of the department for their constant encouragement, guidance and support for completion of this work.*

*Place: GGV, Bilaspur, C.G.*

*Date: /05/2025*



**Saurav Rajwade**  
**M.Sc. Forestry 4<sup>th</sup> Sem.**

**DISSERTATION**  
**ON**  
**ESTIMATION OF CARBON SEQUESTRATION POTENTIAL OF**  
**CANDIDATE PLUS TREES PRESENT IN BHAINSAJHAR**  
**FOREST RANGE, RATANPUR BILASPUR**

**Submitted in partial fulfilment of requirement for the award of**  
**degree of**

**Masters of science**

**In**

**Forestry & Environmental Sciences**



**SHIVANGI RAI**

(Enrl no.: GGV/23/06716)

M.Sc. Forestry IV<sup>th</sup> Semester

**DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES**  
**(ICFRE A++)**

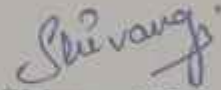
**GURU GHASIDAS VISHWAVIDYALAYA (NAAC A++)**

(A Central University Establishment Under Central University Act 2009, No. 25 of 2009)

**BILASPUR - 495009, CHHATTISGARH**

## DECLARATION

I hereby declare that the present research entitled “**Estimation of Carbon Sequestration Potential of Candidate Plus Trees Present in Bhainsajhar Forest Range, Ratanpur Bilaspur**” interpretation or part has not been submitted for any degree or diploma from any university. The source of the material and all assistance received during the course of the investigation have been duly acknowledged. All the records and data given in the report are correct to my knowledge.



**Shivangi Rai**

Enrollment no. GGV/23/06716

डॉ. चंद्रेश कुमार सिंह  
(सहायक प्राध्यापक)

पानिकी, वन्यजीव एवं पर्यावरणीय विज्ञान विभाग  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छत्तीसगढ़)  
(आई. ए. ए. से मान्यता प्राप्त A\*\* - 2023)  
केन्द्रीय विश्वविद्यालय अधिनियम 2009 संख्या 25, 2009 द्वारा  
स्थापित केन्द्रीय विश्वविद्यालय  
(NAAC द्वारा मान्यता प्राप्त A\*\* - 2024)  
मो. ++91-9839393948, 8871022267  
ईमेल: dr.chandreshsingh@gmail.com,  
dr.chandreshsingh@ogu.ac.in



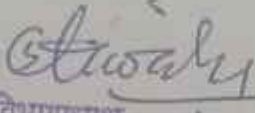
Dr. Chandresh Kumar Singh  
(Assistant Professor)

DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES  
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR, (CHHATTISGARH)  
(Accredited by ICFRE - A\*\* - 2023)  
(A Central University established by the Central University Act 2009 No. 25 of  
2009) (Accredited By NAAC - A\*\* - 2024)  
Contact No: +91-9839393948, 8871022267  
Email: dr.chandreshsingh@gmail.com,  
dr.chandreshsingh@ogu.ac.in

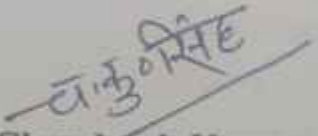
## CERTIFICATE

I have great pleasure in certifying that Ms. SHIVANGI RAI d/o Mr. AMIT KUMAR RAI is a regular student of M.Sc. Forestry & Environmental Sciences, 4<sup>th</sup> Semester, Guru Ghasidas Vishwavidyalaya, Bilaspur (CG). She has completed her Dissertation entitled "Estimation of Carbon Sequestration Potential of Candidate Plus Trees Present in Bhainsajhar Forest Range, Ratanpur Bilaspur" during the session 2023-2025 under my supervision.

I wish her all the success in her academics.

  
विभागाध्यक्ष  
Head 16/05/2025

पानिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

  
Dr. Chandresh Kumar Singh  
Assistant Professor  
Department of Forestry, Wildlife and  
Environmental Sciences



## ACKNOWLEDGEMENT

---

*I bow my head to goddess Durga for providing me with the inconstant energy, spirit, untiring determination and fruitful wisdom to successfully complete my work.*

*With endless pleasure, I wish to express my indebtedness and deep sense of gratitude to my dissertation supervisor, Dr. Chandresh Kumar Singh, Assistant Professor, Department of Forestry, Wildlife and Environmental Sciences for his expert guidance, untiring attention, sustained help and keen interest evinced throughout the course of this investigation and preparation of the report.*

*I am equally thankful to Prof. S. C. Tiwari, Dean, School of Natural Resources, Head, Department of Forestry, Wildlife and Environmental Sciences, Guru Ghasidas Vishwavidyalaya. I would like to express my sincere gratitude and deep sense for honors to Prof. S.S. Dhuria, Prof. K. K. Chandra, and all the respected faculty members of Department Dr. Garima Tiwari, Dr. Bhavna Dixit, Dr. Gunjan Patil, Dr. Ajay Kumar Singh, Dr. Brijendra Pratap Singh, Dr. Atul Kumar Bhardwaj, and Dr. Chowhani Manpoong, and other adhoc faculties for their outstanding motivation throughout my research work. With enormous pleasure, I wish to convey my sincere thanks and credit of completion of the task to my seniors Mr. Ankit Pandey and Gaddam Vinay, PhD. Scholars, who guided me through this entire journey. I also extend my sincere thanks to my friend Ms. Mansi Singh, my classmates, and juniors who kept me motivated and kept me going into completion of my work on time.*

*I cannot express in words my feelings and deepest of gratitude to my beloved parents, father, Mr. Amit Kumar Rai, mother Mrs. Priyanka Rai, and my sisters Ms. Devanshi Rai and Ms. Janhvi Rai who were my anchors and constant motivators during the entire journey of my dissertation and research work.*

*Thanks each and every person for their good wishes for my future.*

Date: 6/05/25

Place: GGU

Shivangi  
Shivangi Rai

A DISSERTATION ON  
GROWTH PERFORMANCE AND CO<sub>2</sub> SEQUESTRATION OF  
BAMBOO

SUBMITTED FOR THE PARTIAL FULFILLMENT OF  
THE DEGREE OF MASTER'S OF SCIENCE IN



FORESTRY & ENVIRONMENTAL SCIENCES

SESSION- 2023 - 2025

*Under the Supervision of:*

**Dr. KRISHNA KUMAR CHANDRA**

Professor Dept. of Forestry, Wildlife &  
Environmental Sciences,  
GGV, Bilaspur

*Submitted By:*

**SHREYA TIWARI**

M.Sc. Forestry 4<sup>th</sup> Semester  
Roll No.: 23078128  
Enroll. No.: GGV/19/6127

**DEPARTMENT OF FORESTRY, WILDLIFE  
& ENVIRONMENTAL SCIENCES (ICFRE A++)**

---

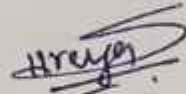
**GURU GHASIDAS VISHWAVIDYALAYA,  
BILASPUR, CHHATTISGARH 495009** (A Central University established under  
Central Universities Act 2009, No. 25 of 2009) (NAAC A++)

---

## DECLARATION

I hereby declare that the dissertation entitled “(Growth performance and CO<sub>2</sub> sequestration of bamboo)” submitted to Department of Forestry, Wildlife and Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur is a record of an academic work done by me under the guidance of **Dr. Krishna Kumar Chandra** and this dissertation work has been performed for the award of Master's degree in Forestry and Environment Science.

Date- 15-05-25



**Shreya Tiwari**

*M.Sc. Forestry & Environmental  
Sciences*

*IV Semester*

*Roll no: 23078128*

*Enrolment no: GGV/19/6127*

## AKNOWLEDGMENT

*First of all, I would like to thank 'God' who bestowed me with patience and favourable conditions and circumstances to achieve this feat.*

*I express my profound indebtedness to Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing me all the necessary facility to complete my dissertation work.*

*I pay my deep regards to **Prof. S.C. Tiwari, Dean**, School of Natural Sciences and **Head of Department** of forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for his constant help and academic encouragement.*

*I express my deep sense of gratitude and thanks to **Dr. Garima Tiwari**, Supervisor & Assistant Professor, Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for guidance and support.*

*I pay my thanks to **Dr. K.K. Chandra, Dr. Gunjan Patil, Dr. Garima Tiwari, Dr. Bhavana Dixit, Dr. Ajay Kumar Singh, Dr. B.P. Singh, Dr. A.K. Bhardwaj, Dr. C.K. Singh, Dr. C. Manpoong**, faculties and staff members of the, Department of Forestry, Wildlife & Environmental Science, GGV for much needed critical comments during entire study period.*

*I pay my thanks to my seniors **Mr. Shishir Chandrakar** and my friends for their constant encouragement, guidance and support for completion of this work.*

*I am highly obliged to my worthy parents, without their blessings and support this work would not have seen the light of the day.*



**Shreya Tiwari**  
M.Sc. Forestry 4<sup>th</sup> Semester  
Dept. of Forestry, Wildlife &  
Environmental Sciences, GGV, Bilaspur  
Roll No.: 23078128  
Enroll. No.: GGV/19/6127

DEPARTMENT OF FORESTRY, WILDLIFE AND ENVIRONMENT SCIENCES  
(ICFRE A++)

**GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)**

(A central university established under Central Universities Act 2009, No. 25 of 2009)

(NAAC A++)



## CERTIFICATE

I have great pleasure in certifying that **Miss Shreya Tiwari** D/o **Mr. Rajesh Tiwari** is a regular student of M.Sc. Forestry and Environmental Sciences IV Semester during the session of 2023-25 of Department of Forestry, Wildlife and Environmental Sciences, GGU, Bilaspur. She has completed this dissertation entitled “(Growth performance and CO<sub>2</sub> sequestration of bamboo)” during this semester under my guidance.

I wish her all the success in her academics.

*Shreya*  
विभागाध्यक्ष  
Head

यानिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Sciences  
गुरु गहासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

*15/1/2025*  
**Dr. K.K. Chandra**  
Professor & Supervisor  
Dept. of Forestry,  
Wildlife and Environmental Sciences  
GGU, Bilaspur (C.G.)

**COMPARATIVE STUDY ON SOIL PROPERTIES OF COAL MINING AFFECTED  
AND UNAFFECTED NATURAL FOREST IN KORBA DISTRICT, CHHATTISGARH**



**A DISSERTATION SUBMITTED FOR  
PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF  
SCIENCE IN FORESTRY AND ENVIRONMENTAL SCIENCES**

2023-2025

by

**SHRISTI SINGH KANWAR**  
**M.Sc. Forestry 4<sup>th</sup> Semester**  
Enrollment no.: GGV/23/06717

**UNDER THE SUPERVISION OF**  
**Dr. CHOWLANI MANPOONG**  
Assistant Professor

**DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES**  
(SCHOOL OF NATURAL RESOURCES)  
**GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.) 495009**  
(A central University established under Central Universities Act 2009, No. 25 of 2009)

#### DECLARATION

I hereby declare that the dissertation entitled "COMPARATIVE STUDY ON SOIL PROPERTIES OF COAL MINING AFFECTED AND UNAFFECTED NATURAL FOREST IN KORBA DISTRICT, CHHATTISGARH" submitted to Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, C.G is a record of an original work done by me under the guidance of Dr. Chawlani Manpoong, Assistant Professor. The work has been formed for the award of degree of Master of Science in Forestry & Environmental Sciences and has not been submitted for any other degree elsewhere. The source of material and all assistance received during the course of the investigation have been duly acknowledged. All the records and data given in my report are correct to my knowledge.

Place: Bilaspur

Date: 6/May/2025



Shristi Singh Kanwar

M. Sc. Forestry 4<sup>th</sup> semester

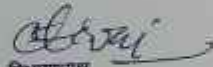
Enrollment no.: GGV/23/06717

Department of Forestry Wildlife and Environmental Sciences  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)  
(A Central University established under Central Universities Act 2009, No 25 of 2009)

**CERTIFICATE**

This is to certify that the Dissertation entitled "COMPARATIVE STUDY ON SOIL PROPERTIES OF COAL MINING AFFECTED AND UNAFFECTED NATURAL FOREST IN KORBA DISTRICT, CHHATTISGARH" submitted by Ms. Shristi Singh Kanwar, D/O Mr. Vishal Singh Kanwar bearing enrolment number GGV/23/06717 for the partial fulfillment of the requirements for the degree of Master of Science in Forestry and Environmental Sciences in Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur (Chhattisgarh) has been carried out under my supervision and guidance.

I wish her all success in her future endeavor

  
विभागाध्यक्ष  
Head

प्राध्यापिका, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु गणेशदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)



Dr. Chowhani Manpoong  
(Supervisor)

DR. CHOWLANI MANPOONG  
Assistant Professor  
Department of Forestry Wildlife & Environmental Sciences  
Guru Ghasidas Vishwavidyalaya  
Korba, Bilaspur (C.G.), 495009



### ACKNOWLEDGEMENT

First of all, I would like to thank 'God' Who bestowed me with patience and favourable conditions and circumstances to achieve this feat.

I express my profound indebtedness to Department of Forestry, Wildlife & Environmental Science, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing me all the necessary facilities to complete my Dissertation work, I pay my deep regards to **Prof. S.C. Tiwari**, Dean, School of Studies of Natural Resources and & Head, Department of Forestry, Wildlife and Environmental Sciences or his academic encouragement.

I express my deep sense of gratitude and thanks to my Supervisor **Dr. Chowhan Manpoong** Assistant Professor, Department of Forestry, Wildlife and Environmental Sciences for his inspiring guidance, support and much needed critical comments during this entire study period.

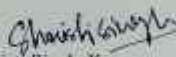
I express my deep regards to all my professors **Dr. S.S. Dhuria, Dr. K.K. Chandra, Dr. Gunjan Patil, Dr. Garima Tiwari, Bhawana Dixit, Dr. Ajay Kumar Singh, Dr. Atul Kumar Bhardwaj, Dr. Chandresh Kumar Singh, Dr. Brijendra Singh** and Department of Forestry, Wildlife and Environmental Science, for their insightful suggestions and encouragement over the years. Your support and encouragement helped me to overcome challenges I faced.

I express my deep regards to **Miss Sikha Singh Tanwar, Miss Priyanka Soren, Dr. Kamesh, Dr. Ramesh**, Department of Forestry, Wildlife and Environmental Science, for their guidance and support.

I pay my thanks to all my friends **Juhi, Sreya, Bharti, Nandita, Khushboo**, and other batchmates of the department for their constant encouragement, guidance and support for completion of this work.

Place: Bilaspur, Chhattisgarh.

Date: 6/May/25

  
Shristi Singh Kanwar  
M.Sc. Forestry 4<sup>th</sup> Sem

### Abstract

This study investigates the impact of coal mining activities on soil properties in the Korba district of Chhattisgarh, India, by comparing soil samples from coal mining-affected forests and unaffected natural forests. The research focuses on five essential soil parameters: soil pH, soil moisture content, soil temperature, soil aggregation, and associated organic carbon. A total of six sampling sites were selected—three each from coal mine-affected forests and natural forests—with 18 replications, and soil samples were collected from a depth of 0–15 cm. Results indicated significant differences between the two forest types. Soils from mining-affected natural forest were found to be more acidic (lower pH), exhibited higher temperatures, and showed a notable decline in soil aggregation and organic carbon content compared to unaffected natural forests. Although soil moisture content showed minor variation, its retention capacity was slightly reduced in disturbed soils. The findings highlight the degradation of soil quality due to coal mining and underline the importance of restoration and conservation practices to rehabilitate these ecologically sensitive areas. This comparative analysis provides critical insight for sustainable land use management and environmental planning in mining regions.

## CONTENTS

*Certificate*

*Acknowledgement*

*Abstract*

*List of Tables*

*List of Figures*

*List of Abbreviations*

<b>Chapter No.</b>	<b>Particulars</b>	<b>Pages</b>
Chapter-I	INTRODUCTION	
Chapter-II	REVIEW OF LITERATURE	
Chapter-III	MATERIALS AND METHODS	
Chapter-IV	RESULTS	
Chapter-V	DISCUSSION	
	<i>Conclusion</i>	
	<i>Photo plates</i>	
	<i>References</i>	

**ASSESSMENT OF DIVERSITY OF ARBUSCULAR  
MYCORRHIZAL FUNGI PRESENT IN DIFFERENT  
REGION OF CHHATTISGARH**

**Dissertation**

*Submitted for the Partial fulfillment of*  
**DEGREE OF MASTER OF SCIENCE**

In  
**Forestry & Environmental Sciences**



**Session – 2023-25**

*Under the Supervision of:*

**Dr. Atul Kumar Bhardwaj**

*Assistant Professor*

Department of Forestry, Wildlife  
& Environmental Sciences, GGV

*Submitted By:*

**SREYA BISWAS**

Enrollment no.:  
GGV/23/06718

Roll No.: 23078130

*Submitted to:*

**DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES**  
(ICFRE A++)

**GURU GHASIDAS VISHWAVIDYALAYA (NAAC A++)**  
(A Central University Establishment Under Central University Act 2009, No. 25 of 2009)  
**BILASPUR - 495009, CHHATTISGARH**

गुरु घासीदास विश्वविद्यालय  
(संघीय विश्वविद्यालय अधिनियम 2009 अ. 23 से स्थापित राष्ट्रीय केंद्रीय विश्वविद्यालय)  
कोनी, बिलासपुर - 495009 (छ.ग.)




Guru Ghasidas Vishwavidyalaya  
(A Central University Established by the Central Universities Act 2009 No. 25 of 2009)  
Koni, Bilaspur - 495009 (C.G.)

## CERTIFICATE

I have great pleasure in certifying that Ms. SREYA BISWAS d/o Mr. PARITOSH BISWAS is a regular student of M.Sc. Forestry & Environmental Sciences, 4<sup>th</sup> Semester, Guru Ghasidas Vishwavidyalaya, Bilaspur (CG). She has completed his Dissertation entitled "Assessment of Diversity of Arbuscular Mycorrhizal Fungi Present in Different Region of Chhattisgarh" during the session 2023-2025 under my supervision. I wish her all the success in her academics.

Place: Bilaspur

Date: 15/May/2025.

  
16/05/2025

विभागाध्यक्ष  
Head

यानिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)



(Supervisor)

Dr. Atul Kumar Bhardwaj

Assistant Professor

## **DECLARATION**

---

*I hereby declare that the present research entitled "Assessment of Diversity of Arbuscular Mycorrhizal Fungi Present in Different Region of Chhattisgarh" interpretation or part has not been submitted for any degree or diploma from any university. The source of the material and all assistance received during the course of the investigation has been duly acknowledged. All the records and data given in the report are correct to my knowledge.*

*Place: Bilaspur, C.G*

*Date: 4/May/2025.*

*Sreya Biswas*

**SREYA BISWAS**

*M.Sc. Forestry & Environmental  
Sciences 4<sup>th</sup> Semester*

*Enrollment No. GGV/23/06718*

*Roll No.: 23078130*

## ACKNOWLEDGEMENT

---

*First and foremost, I express my deepest gratitude to the Almighty for giving me the strength, determination, and clarity of thought to successfully complete this dissertation.*

*I am sincerely thankful to the Hon'ble Vice Chancellor of Guru Ghasidas Vishwavidyalaya, Prof. Alok Kumar Chakrawal for providing the academic environment and infrastructure necessary to carry out this study.*

*I also express my gratitude to the Prof. S.C. Tiwari, Dean, School of Natural Resources, and Head, Department of Forestry, Wildlife and Environmental Science, GGV, Bilaspur for fostering a culture of academic excellence and research enthusiasm.*

*I would like to extend my indebtedness and deep sense of gratitude to my supervisor, Dr. Atul Kumar Bhardwaj, Assistant Professor, Department of Forestry, wildlife and Environmental Science, Guru Ghasidas Vishwavidyalaya, Bilaspur, for his invaluable guidance, continuous encouragement, and unwavering support throughout the course of my research. His mentorship has been instrumental in shaping this dissertation and enhancing my understanding of scientific research.*

*I would like to express my sincere gratitude to Prof. S.S. Dhuria, Prof. K.K. Chandra, and all the respectful faculty members of the Department Dr. Garima Tiwari, Dr. Gunjan Patil, Dr. Bhavna Dixit, Dr. Ajay Kumar Singh, Dr. Brijendra Pratap Singh, Dr. Chowlani Manpoong, Dr. Chandresh Kumar Singh, and other adhoc faculties for their insightful lectures and discussions which helped me build a strong academic foundation. Their dedication to teaching and passion for research has been a great source of inspiration. Your support and encouragement helped me to overcome challenges I faced.*

*A special thanks to my senior Ms. Chanchal Kumari, Research Scholars, Department of Forestry, Wildlife and Environmental Science, who were always ready to assist, discuss, and share knowledge, making the research process collaborative and enlightening.*

*I owe immense appreciation to my parents, father Mr. Paritosh Biswas, mother Mrs. Runa Biswas and my sister Ms. Sneha Biswas for their unconditional love, patience, and sacrifices that allowed me to pursue my academic goals. Your constant motivation has been my pillar of strength.*

*Lastly, I am grateful to my friends Nirbhay, Khushboo, Juhi, Bharti, Shristi, Chityendra, Bhumika, Keshav and classmates, whose companionship and moral support added positivity and balance to this journey.*

*To everyone who has directly or indirectly contributed to the completion of this dissertation thank you from the bottom of my heart.*

*Place: Bilaspur, Chhattisgarh*

*Date: 4/May/2025.*

*Sreya Biswas.*

*Sreya Biswas*

*M.Sc. Forestry 4<sup>th</sup> Sem.*



## CONTENTS

Sr. No.	Title	Page No.
1.	Abstract	01
2.	Introduction	02-05
3.	Literature Review	06-11
4.	Material and Methods	12-23
	Site description	12
	Collection of Soil to characterize colonization expression of AMF Spores in <i>Shorea robusta</i>	13
	Nutrient Determination	13
	Determination of pH in soil samples	14-15
	Determination of Soil Organic Carbon	15-17
	Analysis of available Nitrogen in soil	17-19
	Analysis of Phosphorous in soil	19-21
	Analysis of Potassium in soil	21-22
	Estimation of population of AMF	22-23
	Statistical Analysis	23
5.	Result and Discussion	24-35
	Spore population/ density in rhizosphere soil	24
	Soil pH	25
	Soil Cation Exchange Capacity	25
	Soil Organic Carbon%	25-26
	Available Nitrogen, Phosphorus and Potassium in soil	26-27
	Micronutrient of Soil	27-28
	Graph	30-32
	Photo plate	33-35
		36
6.	Conclusion	37-41
7.	Reference	37-41

### LIST OF TABLE

Sr. No.	Table	Page No.
1.	Estimated chemical properties of soil from different site of Chhattisgarh.	24
2.	Estimated NPK and Spore population of soil from different sites of Chhattisgarh	26
3.	Estimated micronutrients of soil.	27
4.	Correlation between physico-chemical properties and AM spore population	29-30

### LIST OF FIGURES

Sr. No.	Title	Page No.
1.	Site	17
2.	Graph of pH	31
3.	Graph of CEC	31
4.	Graph of SOC%, OOM%, & TOM%	31
5.	Graph of Nitrogen	31
6.	Graph of Phosphorus	31
7.	Graph of Potassium	32
8.	Graph of Zinc	32
9.	Graph of Iron	32
10.	Graph of Copper	32
11.	Graph of Manganese	32
12.	Graph of Boron	32
13.	Graph of Sulphur	33
14.	Graph of Spores	33
15.	Collected soil sample	34
16.	<i>Shorea robusta</i>	34
17.	Collecting soil sample	34
18.	Wet-Sieving and decanting techniques	34
19.	SOC; Soil solution after titration	34
20.	Slide of AMF Spore	34
21.	Performing SOC	34

22.	Soil sample	34
23.	Compound microscope	35
24.	Mycorrhizal spores	35
25.	Soil sample digested in $H_2SO_4$	35
26.	Soil solution mixed with distilled water	35
27.	Soil solution after titration	35
28.	Soil solution before and after titration	35
29.	Spectrophotometer instrument estimate P	35
30.	Flame photometer estimate K	35
31.	Performing N analysis	36
32.	Performing titration for N analysis	36
33.	Mixed indicator solution for N analysis	36
34.	Performing P estimation	36



















**DISSERTATION  
ON  
HIGHER RELEVANCE OF TURTLE AND BUSHMEAT  
CONSUMPTION AROUND BILASPUR DISTRICT  
(GHONGHA RIVER PANCHAYAT SANCTUARY) – RESULT  
NORM OF NUTRITIONAL SURVEY**

**SUBMITTED FOR THE PARTIAL FULFILLMENT OF THE  
REQUIREMENT FOR THE DEGREE OF MASTER OF  
SCIENCE  
IN FORESTRY AND ENVIRONMENTAL SCIENCES**



**Under the supervision of  
Dr. S.S Dhuria  
Professor**

**Submitted by- Sudhanshu Tiwari  
M.Sc. Forestry 4<sup>th</sup> Semester  
Roll No.- 23078132**

**Department Of Forestry, Wildlife & Environmental Sciences  
(ICFRE-A<sup>++</sup>)**

**Guru Ghasidas Vishwavidyalaya (A Central University)  
(NACC-A<sup>++</sup>)**

**Bilaspur- 495009, Chhattisgarh  
SESSION 2024-2025**

# Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

(NACC-A\*\*)

(A central university established under Central University Act 2009, No. 25 of 2009)

Department of Forestry, Wildlife and Environmental Sciences

(ICFRE-A\*\*)



## CERTIFICATE

This is to certify that the dissertation entitled "Higher relevance of turtle and bushmeat consumption around Bilaspur district (Ghongha river panchayat sanctuary) – Result norm of nutritional survey" Submitted for the partial fulfillment of the requirement for the degree of Master of Science in Forestry and Environmental Sciences from Department of Forestry Wildlife and Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur (Chhattisgarh) is the work carried out by Mr. Sudhanshu Tiwari S/o Mr. Brijesh Kumar Tiwari, under my supervision and guidance.

I wish all the success in his academics.

Place: Bilaspur

Date: 16/05/2025

**Dr. S.S Dhiria**  
**Professor**  
**(Supervisor)**

विभागाध्यक्ष  
Head


वनिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

## DECLARATION

I hereby declare that the dissertation entitled "Higher relevance of turtle and bushmeat consumption around Bilaspur district (Ghongha river panchayat sanctuary) - Result norm of nutritional survey" Submitted to Department of Forestry, Wildlife and Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur C.G. is a record of an original work done by me under the guidance of Dr. S.S Dhuria and this work has been formed for the award of Degree of master of Science in Forestry & Environmental sciences. This work has not been submitted for any other degree in any Universities/Institutes.

Place- Bilaspur

Date- 16/May/2025

  
Sudhanshu Tiwari  
M.Sc. Forestry 4<sup>th</sup> Semester  
Roll No.- 23078132  
Enrollment No.- GGV/18/2018

## ACKNOWLEDGEMENT

I express my profound indebtedness to Department of Forestry Wildlife and Environmental Science, Guru Ghasidas Vishwavidyalaya, Bilaspur C.G. for providing me all the necessary facilities to complete my project work. I pay my deep regards to Professor S.C. Tiwari, Dean, School of Studies and Natural resources and HOD, Department of Forestry Wildlife and Environmental science for his academic encouragement. I express my deep regards and sense of gratitude to my Supervisor Dr. S.S Dhuria, Professor, Department of Forestry Wildlife and environmental science for his inspiring guidance, support and much needed critical comments during this entire study period. I pay my thanks to all the guiding teachers, Dr. Gunjan Patil, Dr. Ajay K Singh, Dr. Atul Bharadwaj, Dr. Brijendra Pratap Singh, Dr. Chowlani Manpoong, Dr. Chandresh, Dr. K.K Chandra and all the staff members. I am great full to Shreyansh Budhia Sir and Chandan Pandey Sir for their support and guidance. I also extend my heartfelt gratitude towards my seniors and batch-mates of the department for their constant encouragement, guidance and support for completion of this work. I am highly obliged to my worthy parents, without their blessings and support this work would not have been seen the light of the day. I also express my regards to my friends, Arpita Singh, Saurav Rajwade, Kaushal Sahu & Srijan Vaishnav for their constant support which have helped me during my data analysis & collection. Without anyone of you, it would have not been possible.

Thank-you.

Place- Bilaspur

Date- 16/05/2025

  
Sudhanshu Tiwari

**EVALUATION OF DIFFERENT ECOSYSTEM SERVICES  
THROUGH MULTIVARIATE ANALYSIS IN ECOLOGICALLY  
SIGNIFICANT WETLANDS OF CHHATTISGARH**

**DISSERTATION**

submitted to

**GURU GHASIDAS VISHWAVIDYALAYA**

for the degree of

**MASTER OF SCIENCE**

**IN FORESTRY & ENVIRONMENTAL SCIENCES**

**(School of Natural Resources)**



*Session 2023-25*

*Submitted by*

**Sudipa Priyadarshini**

**M.Sc. Forestry and Environmental Sciences**

Roll No.: 23078133

Enrollment No.: GGV/23/06720

*Under the supervision of*

**Dr. Gunjan Patil**

**Assistant Professor**



**EVALUATION OF DIFFERENT ECOSYSTEM SERVICES  
THROUGH MULTIVARIATE ANALYSIS IN ECOLOGICALLY  
SIGNIFICANT WETLANDS OF CHHATTISGARH**

**DISSERTATION**

submitted to

**GURU GHASIDAS VISHWAVIDYALAYA**

for the degree of

**MASTER OF SCIENCE  
IN FORESTRY & ENVIRONMENTAL SCIENCES  
(School of Natural Resources)**



*Session 2023-25*

*Submitted by*

**Sudipa Priyadarshini**

**M.Sc. Forestry and Environmental Sciences**

Roll No.: 23078133

Enrollment No.: GGV/23/06720

*Under the supervision of*

**Dr. Gunjan Patil**

**Assistant Professor**



**Department of Forestry, Wildlife & Environmental Sciences**  
**Guru Ghasidas Vishwavidyalaya, Bilaspur – 495009 (C.G.)**  
(A NAAC A++ accredited Central University established under Central University Act  
2009, No. 25 of 2009)

## CERTIFICATE

This is to certify that **Miss Sudipa Priyadarshini d/o Mr. Dipak Kumar Dash Sharma** and **Mrs. Sarita Acharya** bearing Enrollment Number GGV/23/06720 of M.Sc. Forestry and Environmental Sciences 4<sup>th</sup> Semester, Department of Forestry, Wildlife and Environmental Sciences has completed her dissertation entitled "*Evaluation of Different Ecosystem Services through Multivariate Analysis in Ecologically Significant Wetlands of Chhattisgarh*" under my guidance. I wish her all the success in her academics.

*Gunjan Patil*  
15/05/2025

**Dr. Gunjan Patil**  
Supervisor  
Department of Forestry,  
Wildlife and Environmental Sciences  
GGU, Bilaspur

*S. C. Tiwari*

**Prof. S. C. Tiwari**  
Head of the Department  
Department of Forestry,  
Wildlife and Environmental Sciences  
GGU, Bilaspur

## CERTIFICATE

This is to certify that **Miss Sudipa Priyadarshini** d/o **Mr. Dipak Kumar Dash Sharma** and **Mrs. Sarita Acharya** bearing Enrollment Number GGV/23/06720 of M.Sc. Forestry and Environmental Sciences 4<sup>th</sup> Semester, Department of Forestry, Wildlife and Environmental Sciences has completed her dissertation entitled "*Evaluation of Different Ecosystem Services through Multivariate Analysis in Ecologically Significant Wetlands of Chhattisgarh*" under my guidance. I wish her all the success in her academics.

*aejij*  
*15/05/2025*

**Dr. Gunjan Patil**  
Supervisor  
Department of Forestry,  
Wildlife and Environmental Sciences  
GGU, Bilaspur

*S. C. Tiwari*

**Prof. S. C. Tiwari**  
Head of the Department  
Department of Forestry,  
Wildlife and Environmental Sciences  
GGU, Bilaspur



**Department of Forestry, Wildlife & Environmental Sciences**  
**Guru Ghasidas Vishwavidyalaya, Bilaspur – 495009 (C.G.)**  
(A NAAC A++ accredited Central University established under Central University Act  
2009, No. 25 of 2009)

## DECLARATION

I **Sudipa Priyadarshini** student of M.Sc. Forestry & Environmental Sciences hereby declare that the dissertation entitled "*Evaluation of Different Ecosystem Services through Multivariate Analysis in Ecologically Significant Wetlands of Chhattisgarh*" submitted to the Department of Forestry, Wildlife & Environmental Science in partial fulfilment of requirement for the award of the degree of Master of Science in Forestry & Environmental Science is my own bonafide work carried out by me under the supervision of Dr. Gunjan Patil and has not been previously formed the basis for the award of any degree, diploma or other similar title or recognition.

Date: 15/05/2025

Place: Bilaspur

  
**Sudipa Priyadarshini**

M.Sc. Forestry and Environmental Sciences,  
Department of Forestry, Wildlife and  
Environmental Sciences,  
GGU, Bilaspur  
Roll No.: 23078133  
Enrollment No.: GGV/23/06720

**IMPACT OF LEAF MORPHOLOGY AND VISIBLE DAMAGE ACROSS  
POLLUTION GRADIENT ZONES IN BILASPUR, CHHATTISGARH**

*Dissertation*

Submitted for partial fulfilment of the requirement for the

Degree of Masters of Science

In

Forestry and Environmental Sciences



(Session: 2024-25)

Under the Supervision of

*Dr. Brijendra Pratap Singh*

Assistant professor

Department of forestry, wildlife

& Environmental sciences, GGV Bilaspur

Submitted by

*Vandana Mishra*

M.Sc. Forestry 4<sup>th</sup> sem

Enrl No. GGV/23/06721

Rol No. 23078134

**DEPARTMENT OF FORESTRY, WILDLIFE**

**& ENVIRONMENTAL SCIENCES**

**GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G.)**

(A central university Established under central university Act 2009, No.25 of 2009)

DEPARTMENT OF FORESTRY, WILDLIFE

& ENVIRONMENTAL SCIENCES

GURU GHASIDAS VISHWAVIDYALAYA BILASPUR (C.G.)

(A central university Established under central university Act 2009, No.25 of 2009)



CERTIFICATE

I have great preference in certifying that Ms. Vandana Mishra D/o Satyanarayan Mishra is a regular student of M.Sc. Forestry 4<sup>th</sup> semester (forest management) during the session of 2024-25 of department of Forestry, wildlife & Environmental Sciences, GGV, Bilaspur, Chhattisgarh. She has completed the dissertation entitled **“Impact of Air Pollution on Leaf Morphology and Visible Damage Across Pollution Gradient Zones in Bilaspur, Chhattisgarh”** I wish her all the success in her future academics.

*Shweta*  
विभागाध्यक्ष  
Head

यानिकी, वन्यजीव एवं पर्यावरण विभाग  
Department of Forestry, Wildlife and Environmental Science  
गुरु घासीदास विश्वविद्यालय, बिलासपुर (छ.ग.)  
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

Under the guidance of

*(Dr. Brijendra Pratap Singh)*

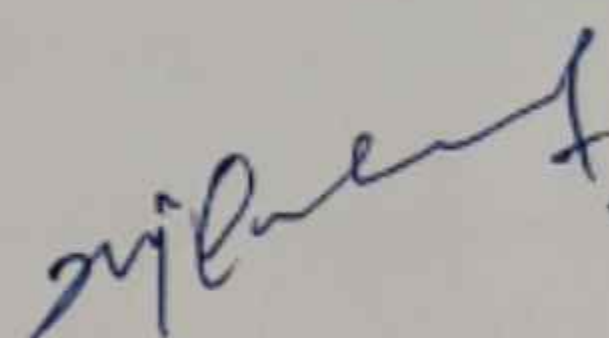
Assistant professor & supervisor

## DECLARATION

I hereby declare that the dissertation entitled "**Impact of Air Pollution on Leaf Morphology and Visible Damage Across Pollution Gradient Zones in Bilaspur, Chhattisgarh**" Dissertation report submitted to the Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya Bilaspur, C.G. is record of an original work done by me under the guidance of Dr. Brijendra Pratap Singh, Assistant professor. The work has been formed for the award of Master of Sciences in Forestry, Wildlife & Environmental Sciences and not submitted for any other degree. The sources of material and all assistance received during the course of the investigation have been duly acknowledged. All the records and the data given in the report are correct to my knowledge.

Date - 14.5.25

Place - Bilaspur (C.G.)



Vandana Mishra

M.Sc. Forestry

Enrl No: GGV/23/06721

Roll No. 2307813

## Acknowledgement

*I extend my heartfelt gratitude to all those who have supported and guided me throughout the course of this dissertation.*

*First and foremost, I express my sincere thanks to Prof. S.C. Tiwari Dean, School of Studies of Natural Resources and Head of the Department of Forestry wildlife and environmental sciences for their invaluable support, encouragement, and for providing all necessary resources for the successful completion of my research work.*

*I am deeply grateful to my esteemed supervisor, Dr. Brijendra Pratap Singh Assistant Professor Department of Forestry wildlife and environmental sciences for their continuous guidance, patience, and insightful suggestions throughout the dissertation. Their expertise and mentorship have been instrumental in shaping this work.*

*I would also like to thank coordinators, Dr. Ajay Kumar Singh, and all other faculty members, Prof. S.S. Dhuria, Prof. K.K. Chandra, Dr. Garima Tiwari, Dr. Bhawana Dixit, Dr. Gunjan Patil, Dr. Chandresh Kumar Singh, Dr. Atul Kumar Bhardwaj, Dr. Chowlani Manpoong of the Department of Forestry wildlife and environmental sciences for their academic support, constructive feedback, and encouragement during various stages of this study.*

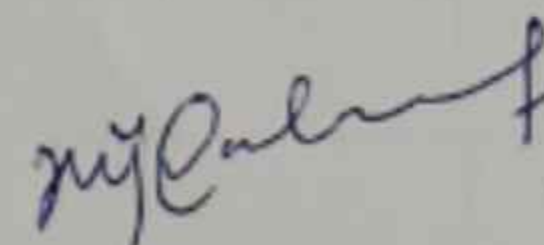
*I am also thankful to my senior research scholars Dr. Kamesh Sahu, Dr. Ramesh Sahu, Samyak Singh and batchmates Reshma Chauhan, Yukta Yadav for their cooperation, encouragement, and the stimulating discussions that enriched my academic experience.*

*Lastly, I express my gratitude to my family and friends for their unwavering emotional support, which kept me motivated throughout this journey.*

*This dissertation is a result of collective guidance, inspiration, and blessings from all of you.  
Thank you*

*Date - 14.5.25*

*Place - Bilaspur (C.G.)*



*Vandana mishra*

*M.Sc. Forestry*

*Enrl No: GGV/23/06721*

*Roll No. 23078134*



# IDENTIFYING BIO INDICATOR OF SOIL HEALTH FOR ASSESSING THE ECOLOGICAL WELL-BEING OF SOIL ECOSYSTEM

A dissertation submitted to  
**GURU GHASIDAS VISHWAVIDYALAYA**  
for the degree of  
**MASTERS IN FORESTRY & ENVIRONMENTAL SCIENCES**  
(School of Natural Resources)



2024-2025

*Submitted by*

**VILAXAN GAREWAL**  
MSc. Forestry & Environmental Sciences

*Under the supervision of*

**Dr. GUNJAN PATIL**  
Assistant Professor

---

**Department of Forestry, Wildlife and Environmental Sciences**  
**Guru Ghasidas Vishwavidyalaya, Bilaspur – 495001 (C.G.)**  
(A central university established under Central Universities Act 2009, No. 25 of 2009)  
(A NAACA++ accredited Central University established under Central Universities act 2009,  
No. 25 of 2009)

गुरु घासीदास विश्वविद्यालय  
(केंद्रीय विश्वविद्यालय अधिनियम 2009 अ. 25 से संरक्षित राष्ट्रीय केंद्रीय विश्वविद्यालय)  
कोनी, बिलासपुर - 495009 (छ.ग.)



Guru Ghasidas Vishwavidyalaya  
(A Central University Established by the Central Universities Act 2009 No. 25 of 2009)  
Koni, Bilaspur - 495009 (C.G.)



## CERTIFICATE

This is to that Mr. Vilaxan Garewal S/O Mr. Dinanath Garewal bearing enrolment number GGV/19/6144 of M.Sc. Forestry, 4<sup>th</sup> semester, Department of Forestry, Wildlife and Environmental Science has completed his project entitled **“Identifying Bio Indicator of Soil Health for Assessing the Ecological Well-Being of Soil Ecosystem”** under my guidance. I wish him all the success in his academics.

Supervisor

Dr. Gunjan Patil

(Assistant professor)

(Dept. of forestry, wildlife,

and environmental science)

Head of Department

Professor S. C. Tiwari

(Dept. of forestry, wildlife, and  
environmental science)

गुरु घासीदास विश्वविद्यालय  
(केंद्रीय विश्वविद्यालय अधिनियम 2009 अ. 25 से संरक्षित राष्ट्रीय केंद्रीय विश्वविद्यालय)  
कोनी, बिलासपुर - 495009 (छ.ग.)



Guru Ghasidas Vishwavidyalaya  
(A Central University Established by the Central Universities Act 2009 No. 25 of 2009)  
Koni, Bilaspur - 495009 (C.G.)



## DECLARATION

I hereby declare that the project work entitled "*Identifying Bio Indicator of Soil Health for Assessing the Ecological Well-Being of Soil Ecosystem*" submitted to Guru Ghasidas Vishwavidyalaya is record of an original work done by me under the guidance of Dr. Gunjan Patil and this project work has been formed for the award of Masters of Science Degree in Forestry. This work has not been submitted in any other University/Institution or elsewhere for any kind of degree/diploma.

Date:

**Vilaxan Garewal**

M.Sc. Forestry 4<sup>th</sup> semester

Roll No. 23078135

Enrolment No. GGV/19/6144



## ACKNOWLEDGEMENT

*First, I would like to thank 'God' who bestowed me with patience and favorable conditions and circumstances to achieve this feat.*

*I express my profound indebtedness to Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for providing me all the necessary facility to complete my dissertation work.*

*I pay my deep regards to Prof. S.C. Tiwari, Dean, School of Natural Sciences and Head of Department of forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for his constant help and academic encouragement.*

*I express my deep sense of gratitude and thanks to Dr. Gunjan Patil, Supervisor & Assistant Professor, Department of Forestry, Wildlife & Environmental Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh for guidance and support.*

*I pay my thanks to Dr. K.K. Chandra, Dr. Garima Tiwari, Dr. Bhavana Dixit, Dr. Ajay Kumar Singh, Dr. Brijendra Pratap Singh, Dr. Atul Kumar Bhardwaj, Dr. Chandresh Kumar Singh, Dr. Chowlani Manpoong, faculties and staff members of the, Department of Forestry, Wildlife & Environmental Science, GGV for much needed critical comments during entire study period.*

*I pay my thanks to my seniors Mr. Ramesh Sahu and Mrs. Gunja Baretha and my friends for their constant encouragement, guidance, and support for completion of this work.*

*A hearty embrace goes to my awesome friends Mohnish Singh, Kunal Rajeev Dewangan, Keshav Tiwari, and Ritik Gahire, whose unwavering camaraderie, intellectual camaraderie, and moral sustenance were my sanctuary. Their laughter, late – night brainstorming session, and shared resilience transformed this arduous journey into a collective triumph.*

*I am highly obliged to my worthy parents, without their blessings and support this work would not have seen the light of the day.*

Vilaxan Garewal

M.Sc. Forestry 4<sup>th</sup> Sem

Dept. of Forestry, Wildlife, and  
Environmental Sciences

Roll No. 23078135

Enrolment No. GGV/19/6144