



Learnings from the Field



**Central Academy for State Forest Service
Dehradun**



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**Central Academy for State Forest Service
Dehradun**



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सत्यमेव जयते



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निदेशक
Bharat Jyoti
Director

इन्दिरा गाँधी राष्ट्रीय वन अकादमी
INDIRA GANDHI NATIONAL FOREST ACADEMY
पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय,
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FOREWORD

It is heartening to note that 33 Officer Trainees (OTs) of 35th SFS Induction Course (2021-23 Batch) have successfully completed their 2-year professional training program at Central Academy for State Forest Service (CASFOS), Dehradun. The training inputs and delivery involved a judicious blend of theoretical components as well as immersive practical engagements. Some notable highlights of these include field exercises on ecological census techniques, forest biometry and mensuration, tackling forest fires, watershed management, forest engineering, working plan exercise. A number of modules were also included to broaden and deepen the knowledge-skills-attitude trio of training for competence to facilitate the trainees with the best learning outcomes and capacity building at the incubation stage of their professional journey. True to the saying "Experience is knowledge, the rest is information", the 4 months of "On-job Training (OJT)", which is an integral part of the SFS induction training program has prepared the young entrants into the service for their future work assignments. During this period, in addition to learning the functioning of the forest department at the ground level, they have also undertaken short studies on specific issues that they came across during their field work. The CASFOS, Dehradun team deserves appreciation for bringing out a compilation of abstracts of the said studies undertaken by the OTs as part of their OJT. A range of topics covering issues of human wildlife conflict, habitat management, ecotourism, urban forestry, forest land encroachment, new micropropagation techniques, etc., across different states have been dealt with and new perspectives have emerged. The compilation of the abstracts of the reports of these young and fresh minds offered from their individual guided studies make an informative and enriching read for both forest officers and interested citizens. I convey my compliments for this remarkable initiative and enthusiasm of Smt. Meenakshi Joshi, Principal, CASFOS, Dehradun for her efforts in converting the OJT project reports into this meaningful compilation. I also congratulate Shri Ankit Gupta, Scientist-C, CASFOS, Dehradun for the technical guidance and support extended by him to the OTs for this publication. Lastly, I extend all my good wishes to the new officers for a meaningful and satisfying career ahead.



26.07.2023

(Bharat Jyoti)



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Shri Anurag Bhardwaj, IFS
Director

Message

I congratulate all the Officer Trainees (OTs) of the 35th SFS Induction Course (2021-23 Batch) at Central Academy for State Forest Service (CASFOS), Dehradun for successfully completing their induction training programme. The 2-year professional training covers a wide gamut of core technical and related forestry aspects, and contemporary & emerging issues in the sector. Firsthand experiential training during On-job Training (OJT), prepare the OTs for applying concepts to actual field situations. Attachments with different departments lead to knowledge about inter-departmental coordination and inculcate interpersonal relationships with colleagues from other departments. To develop crucial understanding of issues related to diverse aspects of forestry and wildlife in the field, they are assigned topics for detailed study and come up with recommendations and pragmatic approaches for handling real time challenges.



I have noticed that the OTs have worked on diverse issues as part of their OJT and gained tremendous field experience. Capturing the learnings in the form of a report and compiling them into a 'Book of Abstracts', titled "Learnings from the Field", will benefit the future trainees, forestry personnel, and interested citizens alike. The editorial and entire CASFOS, Dehradun team deserves appreciation for their efforts in coming out with this well edited publication. My best wishes to all the OTs of 35th SFS Induction Course for a successful career ahead.

(Anurag Bhardwaj)



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केंद्रीय अकादमी राज्य वन सेवा
Central Academy for State Forest Service
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Smt Meenakshi Joshi, IFS
Principal

Preface

The Book of Abstracts aptly titled "Learnings from the Field" aims to highlight the role of scientific and field studies in communicating research findings, facilitating knowledge dissemination, and aiding researchers and the forest fraternity in the information seeking process. Abstracts serve as concise and brief summaries that capture the essence of the research study, enabling readers to quickly assess the relevance and value of work. The compilation of summaries of the projects undertaken by Officer Trainees (OTs) of SFS Induction Course (2021-23 Batch) at CASFOS Dehradun cover a wide gamut of issues affecting the Forest Departments of Uttar Pradesh, West Bengal, Meghalaya, Nagaland, and Maharashtra. The various topics have been organized into five broad thematic areas covering biodiversity conservation and wildlife management, new avenues in forestry, partnering with the communities, addressing challenges in forest management, and challenges in human wildlife interface. These thematic areas dwell upon people's perception to wildlife re-introduction programmes, conservation success stories, new agroforestry models, ways of creating urban forest, sustainable ecotourism, conservation of sacred groves, legal issues, innovative use of technology, and diverse human-wildlife conflict challenges. Through these studies, the OTs have been able to bring about new perspectives on the said issues. This publication is the first of its kind brought out by the CASFOS, Dehradun that covers the work of OTs during their OJT attachment.



I congratulate all the OTs and their supervising faculties for their efforts in successfully completing the studies. The efforts of Shri Ankit Gupta, Scientist-C, CASFOS, Dehradun, are greatly appreciated for the technical guidance and superb coordination with the batch in bringing out this publication. I am sure the foresters and interested citizens will find the book to be an interesting read. I wish all the OTs a bright and successful career ahead.

Meenakshi Joshi

(Meenakshi Joshi)



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With utmost sincerity, I am grateful for the opportunity given by the Central Academy for State Forest Service (CASFOS), Dehradun, to compile summaries of the project work carried out by Officer Trainees (OTs) of 35th State Forest Service (SFS) Induction Course (2021-23 Batch) during their 4-months On-job Training (OJT), in the form of a **Book of Abstracts** aptly titled "**Learnings from the Field**".

I express deep sense of gratitude to *Shri Bharat Jyoti (IFS)*, Director, Indira Gandhi National Forest Academy, Dehradun, under whose stewardship this compilation of book at CASFOS, Dehradun has become successful.

I place on record the inspiration and support extended by *Shri Anurag Bhardwaj (IFS)*, Director, Directorate of Forest Education, Dehradun, which immensely helped OTs in successful execution of their OJT and publication of this book, respectively.

Special mention of thanks to PCCF & HoFF of Uttar Pradesh, West Bengal, Meghalaya, Nagaland, and Maharashtra for the continuous support provided to the academy in planning and conduction of OJT. All the efforts of the Field supervisors in the state in formulating the OJT activities of OTs and guidance provided during field work is greatly appreciated.

I'm very thankful to *Smt Meenakshi Joshi (IFS)*, Principal, CASFOS, Dehradun for her unstinted support, profound guidance, abundant technical suggestions, and cooperation extended towards execution of this publication.

I also gratefully acknowledge the encouragement and cooperation extended by all colleagues viz., *Shri Pradeepchandra P. Wahule (IFS)*, *Dr T. Beula Ezhil Mathi (IFS)*, and *Shri Amlendu Pathak (IFS)*, of CASFOS, Dehradun for successfully guiding the trainees for the project work and providing valuable inputs in the preparation of this book.

Last but not least, the hard work of all the OTs is greatly appreciated and acknowledged, without which this book would not have become a reality.


(Ankit Gupta)

Table of Contents

BIODIVERSITY CONSERVATION AND WILDLIFE MANAGEMENT..... 1

- 1.1 Assessment of Biodiversity in Dudhwa Tiger Reserve for successful Rhino re-introduction3
- 1.2 People’s perception towards Tiger augmentation at Buxa Tiger Reserve, WB5
- 1.3 Significance of People’s Biodiversity Register in Biodiversity Conservation..... 7
- 1.4 Role of Community Reserves in Wildlife Conservation and Management9
- 1.5 Rhino conservation at Jaldapara National Park, WB: a success story 11
- 1.6 Habitat management, relocation and livelihood concerns in the newly notified Ranipur Tiger Reserve, UP 13
- 1.7 A new perspective on Amur Falcon Conservation in Nagaland 15

NEW AVENUES IN FORESTRY 17

- 2.1 Saubhari city forest: largest urban forest in making 19
- 2.2 Assessment of plantations in Taj Trapezium Zone.....21
- 2.3 Forestry interventions under Namami Gange programme in Pratapgarh, UP23
- 2.4 Prospects of Eco-park development in Kanpur, Uttar Pradesh.....25
- 2.5 Feasibility and impact of creating farmer societies & linking it with production of TOF on agroforestry models of Western UP27
- 2.6 Ravine reclamation through forestry interventions in Etawah.....29
- 2.7 New avenues in Agroforestry sector using application of Micropropagation techniques.....31
- 2.8 Creating city forests in Prayagraj (UP) through Miyawaki plantations33

PARTNERING WITH THE COMMUNITIES..... 35

- 3.1 Potential of ecotourism in creating sustainable livelihood opportunities for forest villagers of the Darjeeling Hills, WB.....37
- 3.2 Involving JFMCs in creating sustainable livelihoods through ecotourism in fringe forest villages of Moraghat Range, Jalpaiguri Forest Division, WB39
- 3.3 Development of ecotourism through community participation and generating alternative livelihood options at Pilibhit TR41
- 3.4 Challenges and opportunities in conservation of sacred groves in Khasi community: a case study in Lyngiong law Lyngdoh.....43

ADDRESSING CHALLENGES IN FOREST MANAGEMENT 45

- 4.1 Tackling issues and challenges of encroachment in Bijnor Forest Division, UP ... 47
- 4.2 Status of implementation of forest laws: a case study from Garo Hills, Meghalaya 49
- 4.3 Role of forest department in implementation of MMDR, 1957 and MMMCR, 2016 in Meghalaya..... 51
- 4.4 Wildlife crime in Baikunthapur Forest Division, West Bengal 53
- 4.5 Use of technology in demarcating encroachments in forest lands: a case study of Kalimpong Forest Division, West Bengal..... 55
- 4.6 Assessment of growing stock and carbon values of teak in different localities in plantations carried out in Maharashtra Forest Corporation, Nagpur 57
- 4.7 Conversion of Van Taungya settlements as revenue villages under FRA: challenges and way forward 59

CHALLENGES IN HUMAN WILDLIFE INTERFACE 61

- 5.1 Assessment of Human-elephant conflict in Wokha, Nagaland..... 63
- 5.2 Using technology for mitigation of Human-elephant conflict in Terai Arc Landscape of Uttar Pradesh 65
- 5.3 A study on Human-wildlife conflict in Katarniaghat Wildlife Division, UP..... 67
- 5.4 Human-wildlife conflict in Terai Arc Land of Balrampur District, UP..... 69
- 5.6 Human-wildlife conflict, a distinct reality in South Kheri Forest Division (UP) and potential mitigation measures 71
- 5.7 Human-elephant conflict at Buxa Tiger Reserve, West Bengal..... 73
- 5.8 Assessing the current scenario of Human-wildlife conflict in Gorumara Wildlife Division, West Bengal..... 75

List of Abbreviations

ADC	Autonomous District Council
ANR	Assisted Natural Regeneration
BDA	Biological Diversity Act, 2002
BMC	Biodiversity Management Committee
BTR	Buxa Tiger Reserve
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CASFOS	Central Academy for State Forest Service
CO₂	Carbon dioxide
CR	Community Reserve
DFE	Directorate of Forest Education, Dehradun
DGPS	Differential Global Positioning Systems
DIF	Darjeeling Improvement Fund
DTR	Dudhwa Tiger Reserve (UP)
EDC	Eco Development Committee
EPT	Elephant Proof Trenches
FCA	Forest Conservation Act, 1980
FD	Forest Department/Division
FDCM	Forest Development Corporation of Maharashtra
FPC	Farmer Producing Company
FPD	Forest Project Division
FPO	Farmer Producer Organization
FRA	Forest Rights Act, 2006
FRI	Forest Research Institute, Dehradun
GHADC	Garo Hills Autonomous District Council
GIS	Geographic Information System
GPS	Global Positioning System
GS	Growing Stock
HEC	Human Elephant Conflict
HEI	Human Elephant Interface
HWC	Human Wildlife Conflict
IA	Interlocutory Application
IGNFA	Indira Gandhi National Forest Academy, Dehradun
JFMC	Joint Forest Management Committee
JNP	Jaldapara National Park
KHADC	Khasi Hills Autonomous District Council
KWLS	Katarniaghat Wildlife Sanctuary
LULC	Land Use and Land Cover
MDF	Moderately Dense Forest
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act, 2005
MH	Maharashtra
ML	Meghalaya

MMDR	Mines and Minerals (Development and Regulation) Act, 1957
MMMCR	Meghalaya Minor Mineral Concession Rule, 2016
MOEFCC	Ministry of Environment, Forest and Climate Change
MP	Madhya Pradesh
MPT	Multipurpose Tree Species
NBA	National Biodiversity Authority
NBM	National Bamboo Mission
NFP	National Forest Policy, 1998
NGO	Non-Government Organisations
NH	National Highway
NKFD	North Kheri Forest Division (UP)
NL	Nagaland
NMCG	National Mission for Clean Ganga
NP	National Park
NTFP	Non-Timber Forest Products
OWR	Over Wood Removal
PBR	People's Biodiversity Register
PF	Protected Forest
PNV	Potential Natural Vegetation
PRA	Participatory Rural Appraisal
PTR	Pilibhit Tiger Reserve (UP)
QEMC	Quality, Evaluation & Monitoring Committee
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RF	Reserve Forest
SFD	Social Forestry Department/Division
SKFD	South Kheri Forest Division (UP)
SWOC	Strengths, Weaknesses, Opportunities, and Challenges
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TAL	Terai Arc Landscape
TD	Territorial Division
TER	Terai Elephant Reserve
TIES	The International Ecotourism Society
TOF	Trees Outside Forest
TR	Tiger Reserve
TTZ	Taj Trapezium Zone
UK	Uttarakhand
UP	Uttar Pradesh
WB	West Bengal
Wbfdcl	West Bengal Forest Development Corporation Limited
WBI	Wood-based industries
WII	Wildlife Institute of India, Dehradun
WLD	Wildlife Division
WLS	Wildlife Sanctuary
WPA	Wildlife Protection Act, 1972

List of Flora and Fauna

S.No.	Common Name	Scientific Name
Flora		
1.	Amaltas	<i>Cassia fistula</i>
2.	Amla	<i>Emblica officinalis</i>
3.	Arjun	<i>Terminalia arjuna</i>
4.	Ashoka tree	<i>Saraca asoca</i>
5.	Awal	<i>Cassia articulata</i>
6.	Babul	<i>Acacia nilotica</i>
7.	Bakain	<i>Melia azedarach</i>
8.	Ber	<i>Ziziphus mauritiana</i>
9.	Bermuda grass	<i>Cynodon dactylon</i>
10.	Cogon grass	<i>Imperata cylindrica</i>
11.	Drumstick tree (sahjan)	<i>Moringa oleifera</i>
12.	Jamun	<i>Syzygium cumini</i>
13.	Karanja	<i>Pongamia pinnata</i>
14.	Kher	<i>Acacia catechu</i>
15.	Lantana	<i>Lantana camara</i>
16.	Mahogani	<i>Swietenia macrophylla</i>
17.	Mahua	<i>Madhuca longifolia</i>
18.	Mauritian grass	<i>Apluda mutica</i>
19.	Neem	<i>Azadirachta indica</i>
20.	Palm rose	<i>Cymbopogon martini</i>
21.	Papdi	<i>Holoptelea integrifolia</i>
22.	Poplar	<i>Populus ciliata</i>
23.	Rohini	<i>Mallotus philippensis</i>
24.	Sal	<i>Shorea robusta</i>
25.	Salt reed grass	<i>Desmostachya bipinnata</i>
26.	Shisham	<i>Dalbergia sissoo</i>
27.	Siris	<i>Albizia lebbeck</i>
28.	Teak	<i>Tectona grandis</i>
29.	Tree of heaven	<i>Ailanthus excelsa</i>
30.	Tulsi	<i>Ocimum sanctum</i>
31.	Vilayati kikar (mesquite)	<i>Prosopis juliflora</i>
32.	White sandalwood	<i>Santalum album</i>
Fauna		
1.	Amur falcon	<i>Falco amurensis</i>
2.	Blue bull (nilgai)	<i>Boselaphus tragocamelus</i>
3.	Gaur	<i>Bos gaurus</i>
4.	Indian elephant	<i>Elephas maximus indicus</i>
5.	Indian rhinoceros	<i>Rhinoceros unicornis</i>
6.	Leopard	<i>Panthera pardus</i>
7.	Tiger	<i>Panthera tigris</i>



CHAPTER – 1

BIODIVERSITY CONSERVATION AND WILDLIFE MANAGEMENT

ASSESSMENT | PEOPLE'S PERCEPTION

SUCCESS STORIES | NEW PERSPECTIVES

Assessment of Biodiversity in Dudhwa Tiger Reserve for successful Rhino re-introduction

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Abstract:

Rhino introduction in Dudhwa Tiger Reserve (DTR) was a landmark effort to restore the ecosystem of Terai arc landscape comprising a blend of grassland, wetland, and woodland. *Rhino* rehabilitation area in Kakraha beat of South Sonaripur Range of DTR is a mosaic of grasses, water, and trees. The study assessed the biodiversity of DTR for a successful rhino re-introduction programme. Determining home range pattern of rhino by taking GPS location during daily patrolling was used to assess the habitat suitability for *rhino* population. Thereafter, based on analysis of data captured pertaining to home range pattern, habitat augmentation works have been suggested. Leaves of *Mallotus philippensis*, new shoots of *Imperata cylindrica*, *Cynodon dactylon*, *Saccharum narenga*, floating cover of *Pistia*, etc., were found to be the most preferred species by Rhino. However, infestation by unpalatable grasses, encroachment of grassland by woodland species over the years like *Bombax* and *Acacia catechu* has degraded the habitat quality for *Rhino*. Measures like replacement of unpalatable grasses like *Cymbopogon martini* and *Desmostachya bipinnata* by palatable grasses suitable for *rhino* population such as *Imperata cylindrica*, *Saccharum narenga*, *Apluda mutica*, *Cynodon dactylon*, etc. Removal of *Lantana*, and tree species like *Bombax* and *Acacia catechu* along with augmentation of wetland through fresh water in summers will be boon for *Rhino* population in DTR. Wildlife corridor between DTR and Katarniaghat Wildlife Sanctuary (KWLS) along with Pilibhit TR will increase the habitat area for *Rhino* by providing ample food, space and water to thrive. Success of *Rhino* rehabilitation is a challenging task for DTR and should be conducted through collaborative approach involving various stakeholders.

Keywords: *Dudhwa Tiger Reserve, Rhino re-introduction, Biodiversity assessment.*

Highlights:

- ✓ The wildlife corridor between DTR and Katarniaghat WLS is needed.
- ✓ Restoration of wetlands, lantana eradication and planting of palatable grasses.

People's perception towards Tiger augmentation at Buxa Tiger Reserve, WB

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Abstract:

Forest dwelling communities are an important stakeholder in any carnivore translocation programme. Acceptance of any translocation programme and continued support by the community is essential to ensure its success and viability. The Buxa Tiger Reserve (BTR), located in Alipurduar district of West Bengal is rich in floral and faunal biodiversity. Protected area authorities in association with the Wildlife Institute of India (WII), Dehradun have undertaken augmentation and long-term monitoring of tiger at BTR. The focus of the programme is on habitat improvement, prey augmentation and availability, relocation of forest villages, and eventual translocation of Tigers in the area. Based on learnings from previous attempts of tiger re-introduction, the FD of WB conducted a questionnaire survey wherein the attitude of the people towards conservation in general and tiger specifically was analysed. A total of twenty households from two forest villages namely Bhutia Basti and Gangutia located in BTR participated in the survey comprising both open and close ended questions in vernacular language. People's perception on multiple variables representing five categories viz., a) socio-economic survey and perception towards tiger conservation and augmentation; b) conflict status; c) willingness for village relocation; d) relationship and attitude towards forest department; e) post relocation prospects, were recorded and analysed. The findings indicate willingness amongst the villagers towards tiger augmentation in the area subject to relocation of villages from the area. A detailed study covering thirty-six villages is presently underway in the area.

Keywords: *Buxa Tiger Reserve, Tiger Augmentation, Village Relocation.*

Highlights:

- ✓ Assessing people's willingness towards tiger re-introduction.
- ✓ Linking village relocation with tiger augmentation.

Significance of People's Biodiversity Register in Biodiversity Conservation

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Abstract:

People's Biodiversity Register (PBR) as prescribed in the Biological Diversity Act (BDA), 2002, is a database that records the variety of living organisms in a particular area. It documents comprehensive information on availability and knowledge of local biological resources, their medicinal and other uses, species present in the area, their distribution and abundance, as well as their interactions with each other and the environment. As a part of study, the preparation of PBR of Atour village, Ghaziabad was undertaken with the help of Biodiversity Management Committee (BMC) and FD. Awareness generation campaign was conducted amongst the BMC members and villagers to sensitize them about the importance of PBR. Participatory Rural Appraisal (PRA) techniques were applied to document the existing biodiversity, change in its pattern, and geotagging of photographs. Thereafter, methodology as prescribed by the National Biodiversity Authority (NBA) was followed. Draft PBR was presented before the PBR Quality, Evaluation & Monitoring Committee (QEMC) for final approval. The findings that emerged during the preparation of the PBR indicate reduction in biodiversity in the area and shift in cultivation practices from consumption-based species to commercial farming. PBR preparation will help the communities in accessing equitable sharing of benefits arising out of commercial utilization of biodiversity resources and knowledge. It is a key legal document that will assist in ascertaining the rights of local people over the biological resources and associated traditional knowledge. It will also promote the cultivation and conservation of valuable floral and faunal diversity.

Keywords: *Biodiversity, PBR, Benefit sharing, Conservation.*

Highlights:

- ✓ Community involvement in documentation of local biological resources and associated knowledge for accessing benefit sharing under BDA.
- ✓ Protection and rehabilitation for threatened species and vulnerable species.

Role of Community Reserves in Wildlife Conservation and Management

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Abstract:

Meghalaya is a part of Indo-Burma biodiversity hot spot and identified as key area for biodiversity conservation due to high species diversity and endemism. About 76% of total geographical area in Meghalaya comprises forest land, but due to prevailing land tenure system only 5.10% of geographical area comes directly under the control of the State FD in the form of reserve forest (RF), protected forest (PF), national park (NP), wildlife sanctuary (WLS), parks, and garden, and remaining forest area belong to communities, clan, private people, and district councils. The Govt. of Meghalaya *vide* Section-36(C) of the Wildlife Protection Act (WPA), 1972 has declared eighty-one private and community lands/forests into Community Reserves (CR) outside NP and WLS. This study attempted to assess the opinion of the FD officials and community members with respect to declaration of CR for wildlife conservation and management in Jirang CR in Ri Bhoi District of Meghalaya. As a part of the study, a questionnaire survey was conducted for department officials and community members. Further records available with the department were also examined. The findings indicate that around 80% of the respondents from the community were satisfied with the notification of the CR. The responses from the FD officials indicates that the interest in wildlife conservation is limited to only few individuals in the entire community. Consensus amongst both groups of respondents was observed with respect to significance of notifying CR for conservation of local flora and fauna, and in providing a refuge and safe passage for animals. Notifying the community forests as CRs especially in Elephant corridors in Garo hills has tremendously helped in conservation and management of elephants. The study also observed that CRs also provides a scope for eco-tourism and eco-development since a management plan is prepared accordingly for each notified reserve. Notifying an area as a CR has resulted in behavioural change in the masses, wherein they felt a sense of responsibility and ownership in conservation of environment. Study also recommends that there is great scope for boosting the conservation efforts by CR notification in the North-eastern India in general where land tenure system is a challenge.

Keywords: *Meghalaya, Community Reserves, Wildlife corridor, Eco-tourism, Conservation.*

Highlights:

- ✓ CRs function as elephant corridors in Garo hills.
- ✓ CRs provide avenues for eco-tourism activities.
- ✓ Enhancing sense of responsibility and ownership within the community towards conservation efforts.

Rhino conservation at Jaldapara National Park, WB: a success story

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Abstract:

Jaldapara National Park is the second largest natural home and in situ conservation site in India for the Greater Indian one-horned rhino (*Rhinoceros unicornis*) after Kaziranga National Park (NP) in Assam. The study is based on the analysis of factors contributing to the success of Rhino conservation in Jaldapara NP (JNP). In 1985, Rhino population was down to just fourteen in JNP due to rampant poaching and habitat degradation over the years. Thereafter multiple interventions like creating camps and watch towers in interior parts of the JNP, increasing captive elephants for intensive patrolling, GPS track patrolling, use of drones, increasing intelligence network and local area domination, increasing legal control, controlling forest fire, generating awareness, use of sniffer dogs, etc. were taken up. Additionally, habitat improvement works like plantation of grass fodder, weed removal, cutback, etc. were carried out for habitat improvement and extension. All these interventions have resulted in steady growth of the Rhino population in the JNP i.e., from 14 Rhinos in 1985 to a healthy population of 292 individuals in 2022.

Keywords: *Rhino conservation and revival, protection measures, habitat improvement.*

Highlights:

- ✓ Forest protection and habitat improvement are the key interventions.
- ✓ Expansion of Rhino habitats into parts of Nilpara & Lankapara Ranges of the NP.

Habitat management, relocation and livelihood concerns in the newly notified Ranipur Tiger Reserve, UP

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Abstract:

While sustained conservation efforts over more than five decades has led to an increase in tiger population in the country, at the same time, concerns for appropriate approaches of habitat management in tiger populus landscapes has also increased. The study examined the possible management approaches which may be followed in the newly notified Ranipur TR in Uttar Pradesh (UP) i.e., Ranipur TR (fourth in UP and 53rd in India), with respect to habitat management, relocation, livelihood, corridor suitability, ecotourism potential and related issues. Findings based on prey base study indicate that there is a potential need for development of a corridor between the Ranipur TR (UP) and Panna TR, Madhya Pradesh (MP). Eradication of *lantana*, which is currently disrupting succession and decreasing biodiversity of the region, in a scientific phased manner and redevelopment of recovered areas into grasslands through plantation of fodder species has emerged as a major management intervention. It has also been observed that a tourist specific zone can be identified in the area for ecotourism purposes, which may be managed jointly with Eco Development Committees (EDCs). Capacity building of existing workforce through trainings, infrastructural improvements and efficient use of technology will go a long way in effective management of TR. The study also recommends further collaboration with scientific organizations to enhance the output with respect to wildlife management and livelihood generations.

Keywords: *Ranipur Tiger Reserve, Wildlife Management, Corridor Suitability, Ecotourism.*

Highlights:

- ✓ Need for a wildlife corridor between Ranipur TR (UP) and Panna TR (MP).
- ✓ Development of new grassland & water sources to be done by eradicating *Lantana*.
- ✓ Tourist specific zone to be developed in the reserve for ecotourism purposes.
- ✓ Participation of local stakeholders should be done via EDCs.

A new perspective on Amur Falcon Conservation in Nagaland

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Abstract:

The Amur falcon (*Falco amurensis*) is a species of bird that has been recognized as a flagship species for conservation in the state of Nagaland. In recent years, there has been growing awareness of the importance of conserving this species and Pangti village has been popularized by the media as one where ‘hunters turned conservationists’ live. The Amur falcon, which breeds in Russia, China, and Mongolia, has long been known to assemble in Nagaland for a brief time between mid-October and mid-November each year, as a stopover location on its annual journey from breeding grounds in those countries to wintering grounds in Southern Africa. Up till early 2000, killing of this species for local consumption was observed, thereafter it drew negative attention, thus sparking a global uproar for conservation in the year 2012. Mostly Nagas constitutes farming communities, but the history of hunting wildlife is long and deeply engrained in their culture. With active interventions of State FD, Non-Government Organisations (NGOs), and participation of communities, the conservation of Amur falcon has become a reality. The study examined the long-term conservation scenario for the Amur falcon with the participation of the communities. It was found that the villagers had lost a significant source of income due to conversion of fertile land into Doyang Hydro dam and had to shift farming to the hill tops. Subsequently, the farmers had to give up farming at the hilltop for conservation of Amur falcon roosting areas. The communities are now currently struggling to make ends meet, for which government and NGO's need to provide financial and handholding support for ensuring sustainability of interventions. The findings indicate that the success story of Amur falcon conservation will be short lived if interest of local communities get diminished over time. Therefore, it is imperative to bear in mind that the government and non-government agencies need to continue encouraging these villagers and build their trust and confidence. These efforts are critical for the long-term survival of the species and will help to ensure that the Amur falcon remains a symbol of hope for future generations.

Keywords: *Amur falcon, Long-term conservation, Livelihoods, Community participation.*

Highlights:

- ✓ Safe passage for Amur falcon during migration.
- ✓ Active involvement of local communities by providing alternative sources of income.
- ✓ Departments & NGO's need to provide constant financial and handholding support.
- ✓ Long term survival of the species.



CHAPTER – 2

NEW AVENUES IN FORESTRY

**CITY FORESTS | FARMER PRODUCER
ORGANISATIONS | NEW AGROFORESTRY MODELS |
MIYAWAKI PLANTATION**

Saubhari city forest: largest urban forest in making

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Abstract:

Creating forests in urban landscapes results in benefits ranging from commercial to ecological. Ecological benefits include reducing the temperature rise in urban heat islands, reducing carbon emissions through photosynthesis, removing other air pollutants, soil erosion prevention, groundwater recharge, soil stabilization, etc. Forest serves as the habitat for many animals and birds, and therefore aid in biodiversity conservation. Several studies have measured the ability of urban forests to reduce air pollution, purify water and provide natural services as well as opportunities for recreation. Saubhari city forest in Mathura, UP has been conceptualized as largest and one of the best city forests in Asia. It is being developed on 153 ha of land which was previously under encroachment. Removal of encroachment was a challenging task and was successfully completed with the mutual coordination of various departments. Project design envisages Saubhari city forest as an oxygen duct for Mathura-Vrindavan area and is also being used as a temporary halting place for pilgrims visiting the area. Successful project completion will lead to development of green patch in this region of approx. five km² and will add tremendous ecological significance to the Braj area. The study examined the proposal of development of the Saubhari city forest and following key recommendations have emerged viz., a) selection of species should be done based on topography; b) grid-based plantation for ease of maintenance and protection; c) wetland development in areas prone to water logging to provide resting and breeding place for migratory birds because of its close vicinity with Keoladeo NP; d) development of city forest in two zones (viz., visitor zone with thematic plantation and zone of dense forest) divided by the drainage of Yamuna river; e) plough-back of revenue generated from entry fee for financial sustainability; f) development of yoga hut/garden, children park, forest hut/kutiya as a resting/halting place for visitors; g) addition of contiguous areas currently under encroachment for developing it into world's longest and largest self-sustaining city forest.

Keywords: *City Forest, Encroachment, Plantation, Biodiversity, Ecotourism, Wetland.*

Highlights:

- ✓ Development of world's largest city forest in Mathura-Vrindavan area.
- ✓ Reclamation of encroached revenue land for developing city forest.
- ✓ Financial sustainability through plough-back of revenue generated from entry fee.
- ✓ Site specific interventions through using appropriate species mix and development of wetlands.

Assessment of plantations in Taj Trapezium Zone

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Abstract:

In 1996, the Hon'ble Supreme Court of India has defined an area of total 10,400 km² around the Taj Mahal as Taj Trapezium Zone (TTZ). The order seeks to protect the Taj Mahal from environmental pollution by relocating industries and imposing various pollution control measures in the TTZ. A blanket ban on felling of trees in TTZ was also imposed, which was later found to be affecting the progress of developmental activities in the region. In response to various interlocutory application (IA) filed by user agencies seeking felling of trees for developmental activities, the apex court has directed for planting ten trees for each felled tree within the TTZ. As part of the study, assessment of nine plantation sites on which compensatory afforestation under CAMPA has been carried out in the last decade was conducted. All plantation sites of 10 ha each and aged between 8-10 years were studied for their canopy density using three diverse ways viz., a) ground survey; b) drone survey; and c) temporal analysis of satellite imageries. Overall findings indicate a 95% survival rate for all sites, with an achievement of 50-80% of canopy density amounting to Moderately Dense Forest (MDF). Shisham, Papdi, Bakain, Kanji, Sahjan, etc., were found to be the most suitable species in the region. It was also found that Shisham was the dominant species due to favourable soil conditions provided by the rivers Yamuna and Chambal in the region. *Prosopis juliflora* was observed to be the major invasive species which interfered with the growth of planted broadleaf species. Based on the findings, the study recommends that the planting of *Prosopis juliflora* should either be phased-out or alternatively removed to improve the quality of forest. Steps like manual digging of roots, mechanical weeding, application of systemic herbicides such as glyphosate need to be adopted. Further several interventions such as site selection in the vicinity of existing forest areas, planting bamboo in degraded lands, permitting felling of *Prosopis juliflora* in TTZ, chain-link fencing, regular monitoring using drones and satellite imagery will go a long way in developing more biodiverse green areas in the TTZ.

Keywords: *Taj Trapezium Zone, Compensatory afforestation, Biodiversity.*

Highlights:

- ✓ Declaration of TTZ has proved to be beneficial for environment conservation.
- ✓ Intensive management resulted in high survival % of plantations with development of MDF in 8-10 years.
- ✓ Appropriate species selection & protection has contributed to success of plantations.
- ✓ Phasing-out or removal of *Prosopis juliflora* for improving forest quality in TTZ.
- ✓ Video of survey conducted may be accessed via <https://youtu.be/WBu7AidhJDw>

Forestry interventions under Namami Gange programme in Pratapgarh, UP

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Abstract:

Recognizing the dynamic inter-linkage between forest ecosystems and river basins National Mission for Clean Ganga (NMCG) has started the Namami Gange Programme wherein a comprehensive approach to rejuvenate and conserve the river Ganga is being adopted. Forestry interventions under Afforestation component of “Aviral Ganga” Pillar of Namami Gange is aimed at conserving and protecting the floral biodiversity along the basin of Ganga through ecosystem approach. This programme is being implemented in Ganga districts, in Pratapgarh FD, it was implemented in Kunda and Kalakankar ranges comprising an area of 110 ha and 20 ha, respectively. As part of the study, the quality and quantity of forestry intervention were analysed through field visits, interaction with farmers, and departmental records. Findings indicate 90% survival rate in plantations of tree species namely *Dalbergia sissoo*, *Tectona grandis*, and *Ailanthus excelsa*. Species of medicinal importance were conspicuous by their absence, despite there being a huge demand in local Ayurvedic pharma industries within and nearby districts. Some of the important recommendations emerging from the study are a) promotion of agroforestry in the area; b) suitable tree species of medicinal (like Triphala, Neem, Amaltas (*Cassia fistula*), Amla, etc.) value should be planted to improve the biodiversity; c) dedicated nursery for raising medicinal plant species; d) medicinal plants based agroforestry model utilizing vacant lands under tree orchards of Mango, Amla, and Mahua based on the edaphic suitability will be an extra enterprise for farmers; e) Bamboo plantation in river degraded areas will act as protection layers for agricultural fields. Suitable implementation strategy based on above recommendations through involvement of progressive farmers in district and FPOs will play a pivotal role in realizing the local ecological and economic goals. It will help in improving the floral biodiversity of the region to create a strong and stable riparian buffer.

Keywords: Pratapgarh, Namami Gange, Agroforestry models, Medicinal plants.

Highlights:

- ✓ Agroforestry models involving utilisation of vacant lands under tree orchards for maximum returns.
- ✓ Promoting progressive farmers and FPOs for increasing rural income.
- ✓ Promoting entrepreneurship through agroforestry is important.
- ✓ Collaboration of FD with forestry research institutions is necessary.
- ✓ Tapping linkages between departments like MGNREGA, 2005 & NBM.

Prospects of Eco-park development in Kanpur, Uttar Pradesh

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Abstract:

Eco-parks in urban areas provide green spaces for citizens to enjoy nature and escape the pollution and noise of the city. The study examines the prospects of setting up eco-parks in the heavily industrialized city of Kanpur, Uttar Pradesh as a model for future development and to attract funding support from the government and private sector for green initiatives. As part of study, a proposal for creation of eco-park on 5 ha area within the existing Sanjay Van in Kanpur city was developed. The soil testing conducted in 2020 using random sampling techniques had confirmed the soil in the area to be sodic. Therefore, suitable plantation techniques that are available for sodic soil treatment were explored. Technology of plantation focuses primarily on diverse tree species, developed by Forest Soil and Land Reclamation Division of Forest Research Institute (FRI), Dehradun was adopted based on the research done in four districts of UP near Kanpur. Based on the above information, it was proposed to design and develop the area in line with existing *Vatika* themes developed by UP State Biodiversity Board like Nakshatra *Vatika*, Navgraha *Vatika*, Ramayan *Vatika*, etc. Plantation of tree species in the area like *Moringa oleifera* and *Albizia lebbek*, and *Saraca asoca* is recommended to reduce air and noise pollution levels respectively in the agglomeration area. Overall, the prospects of the development of eco-parks in Kanpur city is positive in the long run.

Keywords: *Eco-parks, Thematic Park, Urban Forest.*

Highlights:

- ✓ Suitable plantation techniques and appropriate species for sodic soil.
- ✓ Development of thematic parks in urban areas.

Feasibility and impact of creating farmer societies & linking it with production of TOF on agroforestry models of Western UP

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Abstract:

Various models of agroforestry are in practice in U.P., yielding both tangible and intangible benefits. With 68% of the geographical area of the state under agriculture, agroforestry holds tremendous potential to enhance the area under forest cover in TOF of the state as envisaged in the NFP, 1988, while simultaneously enhancing the income of the farmers. Western U.P. has adopted the Eucalyptus and Poplar based agroforestry models to remarkable success. The study examined the potential of enhancing the scope of expanding the area and returns from agroforestry in the state, through diversification of tree-crop combination, formation of Farmer Producer Organizations (FPOs) in accordance with agro-climatic zones, financing support, forest certification, improved varieties, capacity building through trainings in forest nurseries, etc. General discussions on above mentioned issues were conducted with farmers and forest department officials and thereafter a questionnaire survey was carried out comprising of close and open-ended questions with thirty-four farmers from four villages of Muzaffarnagar district viz., Deval, Kakroli, and Dariyabad and Unn village of Shamli district. Some of the challenges identified during the study includes viz., a) permit system; b) dependency on contractor and unavailability of mandi; c) lower returns; d) lack of knowledge about govt. schemes; e) absence of centralized system for rate determination; f) absence of extension services; g) absence of tree insurance scheme. Based on the findings, a working blueprint for the establishment of FPO has been proposed, which would have a positive impact on region's wood-based industries (WBIs) and traditional wood-based micro & small wood-based enterprises.

Keywords: *Agroforestry models, Farmer Producer Organizations, Wood-based industries.*

Highlights:

- ✓ Agroforestry has potential to enhance forest cover in TOF areas of U.P.
- ✓ Preference for fast growing species for quick benefits.
- ✓ Working blueprint for establishment and sustainable functioning of FPOs at village, district, and agroclimatic zone level.
- ✓ FD as nodal department for agroforestry schemes to support establishment and promotion of FPOs.

Ravine reclamation through forestry interventions in Etawah

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Abstract:

The ravine areas are one of the most fragile landscapes with high vulnerability to erosion and subsequent natural resource losses and threats to biodiversity. Ravine rehabilitation through plantation of Multipurpose Trees Species (MPTs) is one of the best interventions to reclaim degraded lands and transform them into an economic resource. As a part of study, an attempt was made to analyse existing plantations in ravine areas of Fisher, Sarangpura toda, Pratapner and Sirsavan van block of Etawah region and suggest strategies for ravine reclamation using a multi treatment approach. Effect of soil properties on the growth of various MPTs like Babul (*Acacia nilotica*), Neem (*Azadirachta indica*), Amla (*Emblica officinalis*), Karanja (*Pongamia glabra*), etc., was also analysed to produce appropriate species mix. Findings of the study indicate that ravine rehabilitation requires an integrated approach of treatment of table and marginal lands contributing runoff to the gullies on watershed basis through appropriate soil moisture conservation structures. Tree species such as Babul, Neem and Karanja, which generate litter fall should be preferred for reclamation of ravine lands. The choice of species for plantation may be expanded to include more of Bamboo (*Dendrocalamus spp.*), *Cassia auriculata*, agroforestry options like Amla, Ber, etc., legume-based species, and grasses. Use of multi-tier plantation through V-Ditch yields better result.

Keywords: Ravine, Agroforestry plantation, Soil moisture conservation, Grasses, V-ditch.

Highlights:

- ✓ Ravine reclamation to be undertaken through plantation of MPTs.
- ✓ Better results using of MPTs V-ditch technique for plantations.

New avenues in Agroforestry sector using application of Micropropagation techniques

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Abstract:

National Forest Policy (NFP), 1988 envisages a goal of 1/3rd Forest and Tree cover over total geographical land area of the country. In the state of Uttar Pradesh with forest cover of 6.09% of the total geographical area and limited land with greater emphasis on agriculture due to high population, the choice left to achieve the goals as envisaged in NFP, 1998 is to increase the area under Trees Outside Forest (TOF). Practice of agroforestry harbours the potential by which increase in forest cover with simultaneous increment in farmers income may be achieved. However, successful agroforestry interventions are dependent on proper supply of true type clones of suitable agroforestry species. The clones developed by traditional method of grafting, budding, and cutting are very susceptible to fungal attacks. Whereas clones developed by tissue culture (i.e., micropropagation) are healthy, disease-free, available in a substantial number in lesser time throughout the year. Micropropagation is a recent development to get true phenotype and genotype clones, which are remarkably like parent material. The study examines new avenues in agroforestry with application of micropropagation techniques. Findings indicate that mixed cultivation of 4 to 5 species can be done to get maximum yield, with maximum utilization of space, and get optimum income. The study also recommends new agroforestry models which includes cultivation of *White sandalwood*, *Mahua*, *Shisham*, medicinal plant cultivation to replace existing *Eucalyptus* and *Poplar* based monoculture agroforestry system. Such practices will result in generating regular income to the farmers and increase the carbon sequestration potential as well. Though initial setup is costly but becomes a cost-effective method to get true type clones in the long run.

Keywords: *Agroforestry model, Carbon sequestration, Micro-propagation, Tissue culture, True type.*

Highlights:

- ✓ New agroforestry models may be adopted to increase forest cover in TOF.
- ✓ Use of micropropagation techniques to developed diseases and drought resistant seeds.
- ✓ Mix of tree and horticultural species may be planted to get short- and long-term profits.

Creating city forests in Prayagraj (UP) through Miyawaki plantations

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Abstract:

Miyawaki method of afforestation was developed by the Japanese botanist Prof Akira Miyawaki and draws inspiration from natural ecosystems to create 100% organic, dense, and diverse pioneer forests in a short duration of 20-30 years. It helps to restore indigenous ecosystems, maintain global environments through carbon dioxide (CO₂) mitigation. Miyawaki forests grow ten times faster and are thirty times denser with high biodiversity. Since they are quick to establish, maintenance-free after the first two to three years and can be raised on sites as small as three m², Miyawaki forests are emerging as viable solutions for developing climate resilient cities. A Miyawaki forest is a compressed layer of four categories of native plantings viz., main tree species, sub-species, shrubs, and ground-covering herbs on a small plot of land, thereby turning them into tiny forest. As a part of study, development of Miyawaki forest was undertaken on an abandoned degraded (usar) land 0.5 ha area in Handia range of Prayagraj FD, UP. The interventions include testing of pH value of soil, soil treatment for improving soil fertility, selection of suitable plant species, planting, and post planting operations. Regular checking for three months through complete enumeration was conducted for assessing mortality of planted species in the area. Findings indicate that local species like Arjun (*Terminalia arjuna*), Teak (*Tectona grandis*), Neem (*Azadirachta indica*), Siris (*Albizia lebbek*), Mahogani (*Swietenia macrophylla*), etc., are resistant to diseases and exhibit proper growth. Tree species like Jamun (*Syzygium cumini*) and Sheesham (*Dalbergia sissoo*) suffered the maximum mortality, along with herbs such as Tulsi (*Ocimum sanctum*), due to high alkalinity of soil.

Keywords: Prayagraj FD, Miyawaki, Urban Forest.



CHAPTER – 3

PARTNERING WITH THE COMMUNITIES

SUSTAINABLE ECOTOURISM

CONSERVATION OF SACRED GROVES

Potential of ecotourism in creating sustainable livelihood opportunities for forest villagers of the Darjeeling Hills, WB

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Abstract:

Ecotourism is defined as ‘responsible travel to natural areas that conserve the environment, sustains the well-being of the local people, and involves interpretation and education’ (TIES). In West Bengal, Darjeeling is a major tourism destination since British times. In recent times, tourists have also started exploring rural areas and visiting local forest villages, which in turn has encouraged the growth of ecotourism in the Darjeeling Hills. However, this development has not translated into increase in incomes to the local forest village households. This study examines the potential of ecotourism for creating sustainable livelihood opportunities for forest villagers in Darjeeling hills. Data from villagers was collected through questionnaire survey on several important parameters viz., demographic, socio-economic details, extent of dependency on forest, monetary benefits due to increase in tourism, openness in sharing culture, and prospects of better livelihood generation. Further interaction and discussion with FD personnel also revealed vital information. Findings indicate that a) due to alternative income sources outside the village, more than 80% of locals did not have direct dependence on forest; b) dependency on forest is primarily for fodder, fuelwood, and construction wood; c) high levels of dissatisfaction amongst locals due to activities conducted by outsiders and non-residents in the area; d) involvement of only few JFMCs in conservation; e) no proper revenue sharing model available presently; f) minimum marketing prospects of local handicrafts, souvenirs, cuisine, and etc. Based on analysis of data, some of the major recommendations include putting in place a uniform mechanism to provide economic benefits to forest villagers of all areas, revenue sharing with JFMC’s, regulation on homestays, women as major beneficiary on account of 70% participation in activities, encouragement to production of local handicrafts, packaged food items, marketing support by FD.

Keywords: *Darjeeling, Ecotourism, Conservation, Homestays, Benefit sharing.*

Highlights:

- ✓ Revenue sharing model to be developed with JFMC.
- ✓ Homestays should be limited to only two storeys and regulated by the FD.
- ✓ Illegal encroachments under FRA should be checked properly.

Involving JFMCs in creating sustainable livelihoods through ecotourism in fringe forest villages of Moraghat Range, Jalpaiguri Forest Division, WB

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Abstract:

Jalpaiguri FD comprises of the RFs of Jalpaiguri district, WB covering approximately 310 km² of forest land. It has eight territorial ranges among which Moraghat range is very crucial range with respect to management perspective. The forests of Moraghat range adjoining the Indo-Bhutan border are rich in wildlife with scenic and picturesque landscapes. However, issues like unemployment, illiteracy, economic and educational backwardness are resulting in huge biotic pressure on forest including illicit felling, poaching of wildlife, etc. Due to proximity to famous tourist destinations and connectivity with major cities by NH31 and railway network, there is tremendous potential for developing nature-based tourism in the area with the involvement of local population of the Rava tribal. Past attempts at kickstarting the ecotourism activities in Moraghat range to wean away the youth from committing forest offences and crimes, have not been successful due to lack of comprehensive strategy and conflict of locals with FD. Current thinking within the FD aims at renewing the efforts in establishing a comprehensive, integrated model of ecotourism in consultation with the resident tribal community after considering the requirements of forest villages and the need for ecological conservation. As part of the study an attempt was made to develop a sustainable model of ecotourism in Moraghat range based on principle of feasibility, nature-based tourism, and community participation. SWOC (nee SWOT) analysis, discussions with locals and FD personnel, socio-economic survey, site visits, and departmental records were some of the tools utilised to develop the proposal. Framing a scheme of rules and regulations which may be followed to bring about a harmonious relationship between nature conservation and economic development of remote forest villages was also attempted. Recommendations include a) setting up of a dedicated Rava tribal museum displaying local cuisine and culture; b) wildlife safari route; c) creation of watch tower which may be used by tourists and FD alike; d) creation of selfie points; e) potential for catch and release angling outside forest area; f) nature trails; g) support from tourism departments for outreach; h) restoration of Gosai ghat ecopark; i) creation of homestays; and j) effective management of pollution due to tourism. The resultant model is scalable and may be expanded to the entire division and even to other states, with site-specific modifications.

Keywords: *Moraghat range, Ecotourism, Homestays, Tribal welfare.*

Development of ecotourism through community participation and generating alternative livelihood options at Pilibhit TR

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Abstract:

Ecotourism is presently perceived as a sustainable intervention for the preservation of forests, biodiversity, wildlife, and scenic landscapes by linking with opportunities of livelihood generation for local communities. Successful ecotourism has a positive impact on employment, incomes of neighbouring villagers, tax revenue by authorities and enhanced tourist footfall. However, for successful ecotourism, integration of conservation, environmental responsibility, and community service is imperative. The study examines the potential of involving Eco Development Committees (EDCs) in conduction of ecotourism activities in Pilibhit Tiger Reserve (PTR) of Uttar Pradesh, which has emerged as an attractive ecotourism destination in India. PTR also has good connectivity with neighbouring protected areas like Shuklaphanta National Park of Nepal, Dudhwa TR through Kishanpur Wildlife Sanctuary (WLS), and Corbett TR of Uttarakhand via Nandhaur WLS. Ecotourism activities are currently being managed by the local EDCs and different strategies that could offer a range of sustainable income-generating activities for the communities residing in the vicinity of PTR have been examined. Findings indicate that difficulties are being faced by the EDCs in terms of successful operation of ecotourism in PTR, which includes low tourist footfall, lack of potential ecotourism spots near the village, and no direct connectivity for certain spots like Sapsarovar. Resolution of these issues will result in enhanced tourist arrivals in the area, which in turn will empower the locals financially and socially. Developing new ecotourism spots, promotional support, better infrastructure, and training of local EDC members, will bring professionalism in the working of the EDC and lead to sustainable livelihoods of community and create stakes in conservation.

Keywords: *Pilibhit Tiger Reserve, Ecotourism, Responsible Travel, Local Community, EDCs.*

Highlights:

- ✓ Creating stakes in conservation through ecotourism activities.
- ✓ Opportunities for involvement of EDCs of PTR in ecotourism activities.
- ✓ New ecotourism destinations with necessary infrastructure will enhance tourist footfall.
- ✓ Capacity building of local EDC members should be done to bring professionalism.

Challenges and opportunities in conservation of sacred groves in Khasi community: a case study in Lyngiong law Lyngdoh

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Abstract:

State of Meghalaya is known for its rich cultural and natural heritage in the form of sacred groves. Sacred groves are deeply intertwined with culture and society in Meghalaya, thanks to the population's religious beliefs and associated myths. Meghalaya FD has taken the initiative to document the sacred groves in the state and so far over four hundred sacred groves covering an area of more than 1,000 ha have been documented with respect to area and status of biodiversity. Some of the sacred groves lie within the notified CR and the majority are under management of Khasi Hills Autonomous District Councils (KHADC). As part of the study, assessment of *Lyngiong law Lyngdoh* (sacred grove in Khasi) in KHADC managed area was carried out. The study attempted to understand the diverse issues related to the conservation of sacred grove and people's perception for developing them into multiple benefit areas. Qualitative techniques namely a) focused group discussions with Lyngdoh (administrator of the area), community members, and FD officials; b) review of literature pertaining to sacred grove of Meghalaya; and c) reports from forest survey division were used for the study. Findings indicate that majority of the sacred groves are experiencing abandonment due to change in the belief system from past tribal culture wherein there was greater connect with nature. It has been observed that *Lyngiong law Lyngdoh* sacred grove is continuing to be in good condition due to the strong connect of the community with its belief system of local deity being the guardian against calamities, disease, good harvest, etc. Lack of dedicated financial support and legal provision for protection and conservation of the area have further aggravated the situation. Recommendation includes a) assigning greater legal protection through declaration as heritage sites under BDA or as CR under WPA; b) scope for developing them as ecotourism sites for financial sustainability; c) scope for research as these are repositories of floral and faunal biodiversity; d) involvement of community through REDD+ projects that incentivize conservation and protection; e) awareness generation amongst the younger generation about their natural and cultural heritage and inculcating attitude towards conservation of the same.

Keywords: Meghalaya, *Lyngiong law Lyngdoh*, Sacred groves, Belief, Conservation.

Highlights:

- ✓ Sacred groves in the belief system of the Khasi Tribes of Meghalaya.
- ✓ *Lyngiong law Lyngdoh* sacred grove as an exemplary example of community contribution in conservation of biodiversity.



CHAPTER – 4

ADDRESSING CHALLENGES IN FOREST MANAGEMENT

LEGAL ISSUES

INNOVATIVE USE OF TECHNOLOGY

Tackling issues and challenges of encroachment in Bijnor Forest Division, UP

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Abstract:

Controlling forest conversion has always been a major challenge for State FDs. Factors like anthropogenic pressures and poverty are the two main factors driving deforestation and encroachment. The study examines socio-economic causes of encroachment and its pattern in Bijnor Forest Division, Najibabad, which is a territorial division located in Shivalik foothills, Terai and Bhabhar belt of Uttar Pradesh. An encroachment case on forest land, which was given on lease prior to enactment of Forest Conservation Act (FCA), 1980 was studied in detail using secondary data acquired from revenue, forest, police records, court orders, working plans, and departmental files. Additionally detailed discussions with forest officials, staff and concerned people were also conducted. The study found unclear demarcation of forest boundaries, and mismatches of records in revenue and forest department as major causes leading to encroachment of forest land. Challenges faced by the department during encroachment removal such as mass gatherings by women, external pressures, false accusations, cases against forest staff, inadequate funds, lack of knowledge of forest laws, etc., have also been highlighted. Developments such as *Anti Bhu Mafia Task Force*, and greater use of GIS and Remote Sensing is easing the situations for the department. The study recommends demarcation of boundary pillars, digitization of forest land records, use of modern DGPS survey, regular patrolling, checking of Section-4 and Section-20 records in the division and mutation in the revenue records, better coordination and communication with other departments as measures which will go a long way towards consolidation of forest lands.

Keywords: *Encroachment, Forest & Revenue Records, Use of Modern Tools and Techniques, Positive Development.*

Highlights:

- ✓ Conversion of forest land due to deforestation and encroachment is a major challenge.
- ✓ Checking of boundary pillars and patrolling of forest land should be done regularly.
- ✓ Digitization of forest land records using modern tools and techniques is necessary.
- ✓ Setting up of *Anti Bhu Mafia Task Force* is a positive development.
- ✓ Regular training of staff in forest laws is needed.

Status of implementation of forest laws: a case study from Garo Hills, Meghalaya

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Abstract:

In the state of Meghalaya, 79.37% of total geographical area comprises of forest land. Approximately 5.10% of forest land is under the control of FD and is being regulated by several state laws namely Meghalaya Forest Regulation (Application & Amendment) Act, 1973 and Meghalaya Tree (Preservation) Act, 1976. Remaining forest land is under management and control of 3 Autonomous District Councils (ADCs), namely Garo Hills, Khasi Hills, and Jaintia Hills. The forest management in Garo Hills is being controlled by the Garo Hills ADC (GHADC) as per provisions of Garo Hills District (Forests) Act, 1958. At ground level, the control of the GHADC on forest land is limited, and all powers are exercised by the 'Nokma' (head of the village) who controls the management of forests in the area. Additionally, Meghalaya Forest-Based Industries (Establishment & Regulation) Rules, 1998 promote establishment of industries in the State while ensuring the sustainable use of forest resources. In view of the current focus on all round development in the State and the importance of community forest in Garo society, relevance of the existing laws enacted in 1950s and 1970s was studied in detail. Methodology involved interaction and focus group discussion with officials of GHADC and local communities, review of forest acts related to management and control of forest by GHADC and literature review of traditional governance system with respect to community forest. Findings indicate that, a) to a substantial extent, the laws enacted by the ADCs have little meaning for the tribals; b) certain provisions of the existing laws have become irrelevant in the present scenario; c) customary laws have taken precedence over all statutory laws enacted by the ADCs and forest areas are managed on the ground by local customs. Based on findings, the study recommends for preparation of working plan in consultation with the ADC for scientific management of forests under the control of ADC. Enhanced engagement with the local communities in projects for sustainable development and conservation of natural resources, and sensitisation of society with respect to laws and regulation to prevent over exploitation of forests and promote sustainable use of forest resources is the way forward.

Keywords: *Meghalaya State Forest Laws, Garo Hills, District Council, Sustainable Development.*

Highlights:

- ✓ Need for awareness generation about forest laws amongst the tribal population and enforcement agencies.
- ✓ Capacity building of FD personnels on legal issues
- ✓ Enhanced engagement with the local communities in projects for sustainable development and conservation of natural resources in the forest reserves.

Role of forest department in implementation of MMDR, 1957 and MMMCR, 2016 in Meghalaya

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Abstract:

New rules for regulation of mining of minor minerals were framed in Meghalaya in 2016 as a step towards eliminating skewed approaches and prolonged confusion on differing views with respect to central acts. The new rules (Meghalaya Minor Mineral Concession Rule (MMMCR), 2016) prohibited operation and sought closure of illegal mines and quarries in Garo Hills. It also provided for grant of No Objection Certificate by the PCCF & HoFF and DFO Territorial Division (TD) for areas more than 5 ha and less than 5 ha outside forest, respectively, in respect of minor minerals for use other than industries. The current study was conducted to understand the role of FD in ground level implementation of MMDR, 1957 and MMMCR, 2016. The methodology involved collection of data such as (i) area permitted for quarry, (ii) grants of permit by TD as per new rules, (iii) potential areas of sand mining under FD as per district survey report, and (iv) GPS survey of mining locations. Observations in the field brought to light that 7.35 ha area is currently under three stone quarries which were permitted legally with requisite clearances under the new rules. Further, a total of 20 coal pits were found to be filled illegally in Rongrengiri Reserve of Simsangre Range, under East & North Garo Hills (T) Division. The study recommends a) granting of permission for 10 potential sites in North Garo Hills (total 81.67 ha) and 7 sites in East Garo Hills (total 5.4 ha) for sand mining for small industries; b) regular monitoring of Simsangre range through patrolling for illegal refilling of coal pits; c) monitoring of mining activities as per approved mining plan; d) regular monitoring of transit permit; e) strict action against agencies in cases of non-compliance of the new rules.

Keywords: *Meghalaya, New mining rules, Illegal mining, Sand mining.*

Highlights:

- ✓ Approval of mining plans to prevent illegal mining in the forest areas.
- ✓ Involvement of FD as per new mining rules is leading to greater consideration for environmental sustainability.

Wildlife crime in Baikunthapur Forest Division, West Bengal

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Abstract:

The intensification of wildlife crime including trafficking, over the past several years poses a substantial threat to ecological stability, national and local economies, public health, security, and the criminal justice system. Recent studies suggest that the illegal trade of wildlife (excluding illegal timber trade and fishing) is worth an estimated US \$20 billion per year. North Bengal, especially the Siliguri corridor, because of its geographical location, near Nepal, Bangladesh, and Bhutan is overly sensitive for wildlife crime and serves as a smuggling route for various wildlife articles which may be acquired throughout India. Baikunthapur FD spreads over Darjeeling and Jalpaiguri districts of WB and lies in the Siliguri Corridor. The present study focused on the nature of wildlife crimes, concentration, distribution throughout the division, and status of prosecution of wildlife offenses cases. The methodologies include a) study of area for its vulnerability to different crimes; b) study of offence registers; and c) judgements delivered by the courts. Findings indicate a) vulnerability of division to wildlife crimes is high due to its geographical location as gateway to international borders; b) lack of legal knowledge amongst forest staff has led to failure in prosecution in majority of the cases; c) community outreach and increased intensity of patrolling shows positive impact on the discovery of poachers, animal carcasses and poaching paraphernalia. Recommendations include a) proper legal training for forest staff; b) development of modules based on model case studies for dealing with forest and wildlife offense cases; c) enhancing patrolling frequency by Range officers in areas with greater sensitivity for wildlife crime; d) proper incentive mechanism for the locals to assist the FD in cases of wildlife crime; e) greater effort in funding and promotion of research on alternate methods of crime prevention.

Keywords: *Baikunthapur Forest Division, Siliguri corridor, wildlife crime.*

Highlights:

1. Wildlife trade poses a threat to ecological stability, economies, and public health.
2. Siliguri corridor is a hub of illegal wildlife trade due to its proximity with international borders.
3. Sound legal training of forest staff for greater conviction in wildlife offense cases.

Use of technology in demarcating encroachments in forest lands: a case study of Kalimpong Forest Division, West Bengal

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Abstract:

The district of Kalimpong (1056.5 km²) was carved out of the erstwhile Darjeeling district in 2017. Subsequently Kalimpong FD (374.33 km²) was created in 2018 by renaming the existing Soil Conservation Division and transferring Kalimpong FD from West Bengal Forest Development Corporation Limited (WBFDC) to the Directorate of Forest. Kalimpong district is witnessing fast growth and development leading to increase in forest diversion cases for developmental activities under FCA and increase in instances of encroachment on forest land. As per 10th Working Plan Code of this division, the total encroached forest land is 416.41 ha. A survey of areas within the division which are extremely prone to encroachment was carried out along with analysis of causal factors and identification of potential mitigation measures. Methodology involved data collection from the working plan, ground truthing to verify available old records, GPS survey of encroached forest lands and preparation of shapefiles. Findings after field data collection and analysis indicates a) total area under encroachment in the division is 630.76 ha i.e., 51.47% more than the reported encroachment; b) primarily the encroachment of forest land in the area has been by victims of natural disasters, forest fringe populations, some locals of DI fund land; and c) expansion of defence establishments for strategic purposes. Based on findings, the study recommends that a) clear demarcation of forest boundary should be made in the division; b) digitization of forest boundaries; c) regular monitoring of boundary pillars should be carried out; and d) strengthening of local JFMC will be helpful for protection and conservation of the forest land in the area.

Keywords: *Kalimpong FD, Working Plan, Encroachment, GPS survey, Ways of mitigation.*

Highlights:

1. Clear demarcation of forest boundary will be helpful.
2. Capacity building of JFMC for protection and conservation of forest land.
3. Use of modern tools and technology should be explored.

Assessment of growing stock and carbon values of teak in different localities in plantations carried out in Maharashtra Forest Corporation, Nagpur

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Abstract:

Growing stock (GS) provides an estimation of volume of wood present inside the forest and is an important quantifiable parameter used for calculating biomass and carbon stock. In case of plantations, growing stock is used for the calculation of the sustainable yield of timber from forest. GS of plantation of different ages and site qualities undergo changes till the tree reaches its rotation age. Additionally silvicultural operations such as tending, thinning, etc., carried out during the growth period also play a significant role in enhancing the GS and associated sequestered carbon. Different methodologies are available for calculation of growing stock and associated carbon content. Changes in both the parameters with respect to age and site quality of plantation, can be measured. As a part of the study, estimation of GS of teak (*Tectona grandis*) and non-teak species, was carried out in Nagpur, Pranhita, and Markhanda Forest Project Division (FPD) under Forest Development Corporation of Maharashtra Ltd. Nagpur (FDCM). Objective of study was to analyse the difference in GS with the changing site qualities and changing age of the plantation. Methodology involved a) selection of sites using random sampling techniques; b) laying of sample plots in areas where felling work for thinning and over wood removal (OWR) has not started; c) different site qualities were also considered. Further, comparative analysis was done between the change in growing stock with corresponding change in carbon stock. Findings indicate that a) increase in GS with increase in the age of the plantation; b) increase in GS also observed in areas which underwent regular thinning as per silvicultural prescriptions; c) plantations of same age experienced high growth in area with improved site quality as compared to plantations in areas of lower site quality; d) general principles of thinning may not be applicable in natural forest with teak and non-teak species. Recommendation includes conversions of woods into furniture or other products for carbon stocking for longer time, following proper tending and thinning regime to achieve healthy and economically valuable growing stock.

Keywords: Site quality, growing stock, girth class population, carbon pool, carbon stock density.

Conversion of Van Taungya settlements as revenue villages under FRA: challenges and way forward

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Abstract:

‘Taungya’ (a system of forest management whereby desirable forest tree species is simultaneously intercropped with agricultural crops involving local cultivators) was introduced by the Britishers over one hundred years ago, to reforest large tracts of forest which were felled for laying railway tracks in Uttar Pradesh. One of the best Sal forests of northern India found in Gorakhpur Forest Division was raised through the Taungya system. For this purpose, between 1920 and 1923, labourers (‘Vantangiya’) from the villages of Gorakhpur district were brought to the forest area for short spells, till the plantations became established. Over the years, the Taungya settlements became permanent and the relationship between the Taungya’s and forest department soured. With the realization that Taungya work is unlikely to become a permanent feature of the forest management, the study has attempted to analyse the diverse issues associated with this system including the claims and rights granted under FRA 2006 for the lands on which plantation work was carried out by them. Discussion with forest staff and interaction with Vantangiya villagers, field visit, official records like working plan, Tangiya register kept in range office, etc., were the methods employed to analyse the issues. Findings indicate a) involvement in encroachment of forest land, engagement in illicit felling, over grazing, illicit liquor brewing, etc.; b) over time, the idea that cultivator should be the proprietor of the soil he cultivates has become embedded in the community; c) grant of forest land titles under FRA; d) conversion of forest village into revenue village as one of the forest rights under Section 3(1)(h) of FRA, 2006; e) low socio economic status in spite of the land rights and conversion into revenue village. The study recommends that since Vantangiya settlements around reserved forest of Gorakhpur division are now the current reality, therefore positive engagement with them in a way that ensures livelihood opportunities and employment generation such as Jungle Prahari, involvement in ANR and other forestry works, ecotourism etc will lead to a harmonious relationship with benefits for all involved.

Keywords: *Vantangiya, Encroachment, FRA, Revenue village, Employment.*

Highlights:

1. Positive engagement with Vantangiya to check illegal activities in forest areas
2. Proper land records and its documentation.
3. Revival of practice on a pilot project basis.



CHAPTER – 5

CHALLENGES IN HUMAN WILDLIFE INTERFACE

NATURE | EXTENT | MITIGATION

Assessment of Human-elephant conflict in Wokha, Nagaland

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Abstract:

Human-elephant conflict (HEC) is emerging as a major challenge to the continued existence of elephants (*Elephas maximus*) in the Wokha Forest Division (FD), Nagaland due to rise in human population and developmental interventions leading to reduction and fragmentation of their habitats. Wokha FD has the second highest density of elephants next to Karnataka state in the country. It is estimated that 180-200 elephants out of 466 (around two-third) in Nagaland are present in Wokha district alone. Degradation of habitats on the traditional routes used by elephants to migrate between Assam and Nagaland (Wokha) started in 1970s and 1980s, resulting fragmentation of habitats in Nagaland. One such disjointed corridor that leads to HEC is in the Wokha district. Though species such as wild boars and other small rodents cause damage to the agricultural crops, but in recent times, elephants have become the focal point for conflict and conservation issues. The study examines the diverse issues related to human-elephant conflicts in the area. Records of the State FDs were examined to assess the presence, distribution, and status of distinct species of wildlife, especially elephants. Further discussions with the community residing in villages falling in the elephant range viz., Baghty valley, Akuk, Mekukla, and Wazukong were held to understand the nature and extent of the conflict. Effort was made to interview the villagers, forest staff, and hunters that had experienced conflicts with elephants. The study found that the loss of traditional corridors between Assam and Nagaland (Wokha) due to habitat fragmentation from large scale plantation of tea, rubber, coffee, etc., around the corridor, is the major reason for HEC in this area. The study findings indicate that the elephant population in fragmented habitats is on the rise and the conflict will eventually escalate if proper steps are not taken in the coming years. The study also suggests that although several steps have been taken by the public and government, rising human population and loss of natural forest must be addressed before any pragmatic solutions to this conflict can be reached.

Keywords: *Human-Elephant Conflict, Loss of Traditional Corridors, Habitat Fragmentation.*

Highlights:

- ✓ Need for reconnecting elephant corridors.
- ✓ Include people's participation in conservation of the elephant corridors.
- ✓ Learning to coexist with elephants.

Using technology for mitigation of Human-elephant conflict in Terai Arc Landscape of Uttar Pradesh

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Abstract:

The Terai Elephant Reserve (TER) is the 2nd Elephant reserve of UP, which comprises of DTR, PTR, and parts of SKFD, with a total area of 3072.36 km². TER has both resident as well as migratory elephants, who use fragmented corridors with dotted human settlements, that link with adjoining protected areas of Nepal. As a result of which, damage of crop land and infrastructure along with threat to life has become frequent feature of Human-Elephant Interface (HEI). An attempt was made to study the nature of HEI in parts of the TER in NKFD, SKFD and DTR of UP. Incidents of both positive and negative interface between the local community and elephant population were examined in detail through field visits, GPS survey, data of present and past compensation cases, discussions with local community in fringe areas, mapping of hotspots of HEI through digitisation of both present and past compensation cases, and pareto analysis for identifying the priority areas of negative interface through partial sampling. Digital plotting of compensation cases helped in assessing the extent of negative interface from the periphery of the DTR. Findings indicate that a) negative interface is clustered and located in traditional routes mainly in Mailani & North Nighashan range of NKFD and Mohammadi range of SKFD; b) pareto analysis shows that around 80% of the crop damages are located within 0.5 km of forest boundary; c) increase of crop damages in recent years is evident from the increase in crop compensation payments from 2016 to 2021. It has also been observed that change in of climate has prolonged the stay of elephants due to availability of water for a longer period in seasonal streams, invariably resulting in more crop damage. Key recommendations include a) harvesting of sugarcane crops in priority areas at the earliest for saving crop damages in fringe areas; b) elephant proof trenches (EPT); c) solar fencing in hotspot areas; d) timely disposal of compensation cases; e) capacity building of staff and infrastructure development; f) habitat improvement and enrichment; and g) awareness and sensitization of people for living with elephant.

Keywords: *Terai Elephant Reserve, Elephant Corridors, Human-Elephant Interface, Habitat Improvement, Pareto analysis.*

A study on Human-wildlife conflict in Katarniaghat Wildlife Division, UP

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Abstract:

Managing Human Wildlife Conflict (HWC) is a major challenge for forest departments and needs to be addressed in a holistic manner to attain conservation goals and facilitate coexistence of human and wildlife in and around protected areas. Katarniaghat Wildlife Sanctuary (KWLS), situated within the Terai Arc Landscape is part of DTR, Uttar Pradesh and a hotspot of HWC involving leopard and tiger population in the region. The fragmentation of the habitat coupled with immense biotic pressure further compounds the problem. The study was conducted to understand the geographical and spatial characteristics of conflict sites, temporal and seasonal trends observed in killing/mauling, causes responsible for HWC, and suggest workable solutions towards mitigation of the conflict. Analysis of last 5 years data on HWC in the KWLS, socio-economic data of the district, field sign survey of leopard presence in the KWLS, GIS mapping of sites of incidences of HWC, pattern analysis of killings, and related information were used for the study. Key findings attribute following factors to high incidence of HWC in the area are a) poor socio-economic strata of the local community and high vulnerability to HWC; b) absence of buffer areas between KWLS and fringe villages resulting in direct interface between humans and wildlife; c) cropping of sugarcane in areas adjoining the KWLS periphery; d) adoption of sugarcane areas by leopards as habitation; e) fragmented habitat due to intermittent road and rail network in the area. Based on the study, following recommendations given are a) formulation of in-situ mitigation plan; b) developing local expertise in dealing with conflict situations; c) crop switch from sugarcane to alternative options; d) prompt release of compensation; e) promotion of alternate livelihood options that aim at reducing competition between human and wildlife for existing natural resources.

Keywords: *Katarniaghat WLS, Drivers of HWC, Mitigation strategies.*

Highlights:

- ✓ Adoption of sugarcane areas by leopards as habitation
- ✓ Formulation of site specific/in-situ mitigation plan, quick response team, crop switch, alternative livelihood strategy.

Human-wildlife conflict in Terai Arc Land of Balrampur District, UP

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Abstract:

Sustainable development requires harmonisation of both environmental and human development goals and resolving human wildlife conflict (HWC) is central to this aim. Retaliatory killing of wildlife and loss of habitats are threats to the survival of many species around the world. HWC has a high impact on rural households especially social, cultural, and economic aspects in hotspots where numbers of leopard attack continue to increase annually. Local governments pay compensation for HWC losses, but it acts like a transient safety valve and not a permanent solution. The study analysed drivers and key issues regarding HWC at the micro (local), meso (range/district) and macro (state/nation) levels w.r.t Balrampur FD in Terai Arc landscape. Interaction with locals and FD officials, analysis of past 10 years data on HWC, field visits were the methods employed for the study. At micro level, it was found that communities were facing several problems regarding employment opportunities, lack of awareness to wildlife, lack of education and co-operation with forest department. A wide range of measures to prevent or reduce HWC (viz trapping in cage, provision of camera traps, haka at evening near settlements) were being tried, but were not successful due to institutional failures resulting in inadequate maintenance and/or upkeep. Implementation of development schemes at local level without adequate consideration of HWC, Forest land conversion and allocation for developmental projects, lack of appropriate assessments of habitat destruction, extensive small-scale commercial farming schemes, horticulture schemes, dairy farming near the reserve forest were found to be major factors leading to increase of HWC at meso level. At macro level, porous international boundary with Nepal was found to be highly vulnerable to illicit felling and poaching. The report suggests that for effective mitigation of HWC, integrated coordination between macro, meso and micro levels is a prerequisite. Such coordination can reduce the costs of HWC by increasing the efficiency of planning and implementation of development projects and ensuring that HWC prevention and mitigation measures are integrated as part of a coordinated and systematic programme.

Keywords: *Sohelwa Wildlife Division, HWC drivers, Integrated coordination.*

Highlights:

- ✓ Policy formulation to integrate HWC concerns.
- ✓ Habitat improvement works and exploring ecotourism potential in partnership with local communities.
- ✓ Greater vigil at international boundaries.
- ✓ Group insurance system, PM Krishi Beema Yojna should be employed.

Human-wildlife conflict, a distinct reality in South Kheri Forest Division (UP) and potential mitigation measures

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Abstract:

The present study discusses HWC in South Kheri Forest Division with special emphasis on management practices by forest division. South Kheri Forest Division is one of the small and oldest divisions of Uttar Pradesh located on the border of Dudhwa National Park. Major conflict exists due to carnivores (tiger, leopard, crocodile and snakes) as well as herbivores (elephants, hare and blue bull). The current study was conducted at three ranges (Gola, Mohammdi and Sharda Nagar) and the HWC incidents during the On-job Training (OJT) of the author were handled, recorded and analysed critically. Further information deduced during interaction with local communities and patrolling in forest areas was also used for analysis. The data of HWC for the last five years was collected, discussed, and analysed thoroughly. Findings indicate that a) collection of fuel, fodder, NTFPs, protection of crops on forest boundary (sugarcane, wheat and rice), movement of wild animals outside the protected areas for food, shelter, water, mate, injury, old age or some behavioural changes are the major causes of conflict in the region; b) highest conflict is due to tiger followed by leopard, elephants and crocodiles; c) within a period of 4 months, five human killings by tiger, leopard and elephant took place; d) practices like habitat management, patrolling, Bagh-Mitra program and local cooperation were found effective in conflict management. Recommendations include use of effective management strategies like faster release of compensation, solar fencing on forest boundary, crop switch, awareness programmes, digging animal proof trench around forest as effective measures for HWC management in the area. The study arrives at the conclusion that while wildlife has adapted to the changed environment due to anthropogenic effect but now it is the turn of humanity to walk the extra mile to adapt to the situation for peaceful coexistence.

Keywords: *Human-wildlife conflict, Crop switch, Coexistence.*

Human-elephant conflict at Buxa Tiger Reserve, West Bengal

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Abstract:

The state of West Bengal is home to only 2% of total elephant population of India but contributes to highest number of human casualties due to human-elephant conflict (HEC). Between 2010 and 2019, a total of 726 human deaths, 51,542 ha areas of crop loss, and 136 unnatural elephant deaths were reported. The current study attempts to assess the extent of HEC and efficacy of mitigation strategies used by Buxa Tiger Reserve (BTR). Methodologies involved a) examination of past records; b) information of vulnerable areas, corridor, nos. of casualties, crop damage, etc.; c) field visit in fringe villages and interaction with locals; d) compensation causes of conflict; and e) assessment of maximum, medium, and least conflict zone. Findings indicate that major land use and land cover (LULC) changes such as establishment of tea gardens, rail network expansion, cropping pattern along migration zone of elephants in and around wildlife habitat, along with inappropriate measures employed by villagers to drive elephants from human habitations is driving HEC. Study recommends that measure such as a) setting up of specialised elephant squad and camps for quick response during crop harvest time; b) solar fencing in high conflict zone; c) awareness generation amongst JFMC; d) speedy compensation disbursement; e) creation of artificial or bio-corridors to reduce conflict will go a long way in reducing HEC in the BTR.

Keywords: *Buxa Tiger Reserve, LULC changes, Bio-corridors.*

Highlights:

- ✓ Changing of LULC in the BTR area is rapid and alarming.
- ✓ Need of speedy compensation in HEC cases.
- ✓ Need for setting up of bio-corridors.

Assessing the current scenario of Human-wildlife conflict in Gorumara Wildlife Division, West Bengal

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Abstract:

Anthropogenic reasons are responsible for increasing human-wildlife conflict (HWC) in North Bengal landscape. The scenario of frequent occurrences of HWC, especially with reference to elephants, gaurs and leopards, is quite common in the Gorumara Wildlife Division, which has in its vicinity 120 Tea Gardens and 448 Revenue villages in the Jalpaiguri district of the state. In the present work, human-animal conflicts in the Gorumara Wildlife landscape, arising due to leopards, elephants and gaurs was extensively studied by analysing the nature of the situation, reasons, impact, present operational measures adopted, future scope for betterment of the situation by tabulating the month-wise (for last five financial years) depredation duty performed by the different wildlife squad ranges. Past 5-year record of seasonal pattern analysis of HWC, annual reports, field attachment with wildlife squad ranges (Binaguri and Mal wildlife squad) were utilised for the analysis. Findings indicate that a) the leopard depredations occur mostly during April-June (during the beginning of the plucking season of tea leaves) followed by January-March (when the leopards are likely to give births and it is the bush-cutting season of the tea gardens); b) Elephant depredations were found to mostly occur during the January-March (potato crop/maize crop season);c) While no annual pattern in the depredation cases by Gaurs could be discerned; d) The Gaurs were observed to be venturing out from the forest areas into the human habitation areas even during monsoon times, when there is no dearth of resources in the forests. Conclusions indicate that the carrying capacity of the gaurs might have exceeded due to absence of predator species in the area and at the same time the grassland cover of the forests have not increased as well. Creating quick response teams for effective handling of HWC situations, aware generation, and earmarking buffer areas as shock absorbers between Tea gardens and human habitations will go a long way in reducing HWC in the area.

Keywords: Human-wildlife conflict, Depredation, Wildlife squad range.

Highlights:

- ✓ Seasonality in HWC due to behaviour patterns and cropping patterns.
- ✓ Absence of predator species resulting in spilling over of herbivore population.



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