Template/Pro forma for Submission

NMHS-Himalayan Institutional Project Grant

# NMHS-FINAL TECHNICAL REPORT (FTR)

Demand-Driven Action Research and Demonstrations

| NMHS Reference No.: | GBPNI/NMHS-2018-19/SG 10/172 |
|---|---|

| Date of Submission: | 1 | 9 | 1 | 1 | 2 | 0 | 2 | 2 |
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| | d | d | m | m | y | y | y | y |

## PROJECT TITLE
## CULTIVATION OF PACKING LEAVES PLANT FOR LIVELIHOOD ENHANCEMENT OF ST COMMUNITIES AND PROMOTION OF PACKING LEAVES AS SUBSTITUTE OF PLASTICS IN MEGHALAYA

**Project Duration:** *from* (10.01.2019) *to* (10.01.2022).

***Submitted to*:**

Er. Kireet Kumar
Scientist 'G' and Nodal Officer, NMHS-PMU
National Mission on Himalayan Studies, GBP NIHE HQs
Ministry of Environment, Forest & Climate Change (MoEF&CC), New Delhi
E-mail: nmhspmu2016@gmail.com; kireet@gbpihed.nic.in; kodali.rk@gov.in

***Submitted by*:**

[*Name of Principal Investigator: Dr. Ashish Kar*]
[*Name and Address of Institution: The Energy and Resources Institute, Northeastern Regional Centre, Chachal, Guwahati-36, Assam*]
[*Contact No.: 9954690697*]
[*E-mail: ashish.kar@teri.res.in*]

**NMHS-Final Technical Report (FTR)** *template*

Demand-Driven Action Research Project

*DSL: Date of Sanction Letter*

| 2 | 1 | 1 | 2 | 2 | 0 | 1 | 8 |
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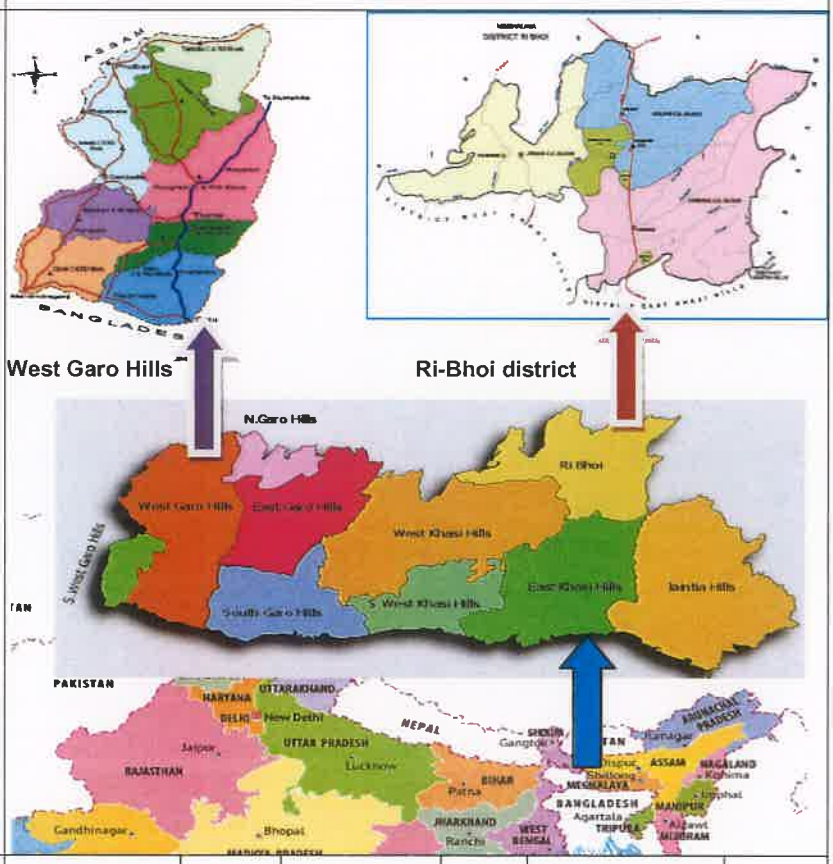
*DPC: Date of Project Completion*

| 1 | 0 | 0 | 1 | 2 | 0 | 2 | 2 |
|---|---|---|---|---|---|---|---|
| d | d | m | m | y | y | y | y |

## Part A: Project Summary Report

### 1. Project Description

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| i. | Project Reference No. | GBPNI/NMHS-2018-19/SG 10/172 | | | | | | | | |
| ii. | Type of Project | Small Grant | √ | Medium Grant | | Large Grant | | | | |
| iii. | Project Title | Cultivation of Packing Leaves Plant for Livelihood Enhancement of ST Communities and Promotion of Packing Leaves as Substitute of Plastics in Meghalaya | | | | | | | | |
| iv. | State under which Project is Sanctioned | Meghalaya | | | | | | | | |
| v. | Project Sites (IHR States covered)<br>(Maps to be attached) |  | | | | | | | | |
| vi. | Scale of project operation | Local | | Regional | √ | Pan-Himalayan | | | | |
| vii. | Total Budget/ Outlay of the Project | Rs. 0.3795 (in Cr) | | | | | | | | |
| viii. | Lead Agency | The Energy and Resources Institute (TERI), Northeastern Regional Centre | | | | | | | | |
| | Principal Investigator (PI) | Dr. Ashish Kar | | | | | | | | |
| | Co-Principal Investigator (Co-PI) | Dr. Naba Kr. Goswami | | | | | | | | |

| | | |
|---|---|---|
| ix. | Project Implementing Partners | North-Eastern Hill University, Tura Campus |
| | Key Persons/Point of Contacts with Contact Details, Ph. No, E-mail | Dr. Arindam Barman, Department of Horticulture, North-Eastern Hill University, Tura Campus, Tura, Meghalaya, Phone number:7980071660<br>E-mail: arindamnehu@gmail.com |

## 2. Project Outcomes

### 2.1. Abstract


**Background**: The leaves of *Phrynium pubinerve* are used as wrapping and packing material. The leaves are collected mostly from wild sources and sold in the market in bundle form. With the background initiative was taken for large scale cultivation of *Phrynium pubinerve* to enhance income among low-income ST group in Meghalaya and also to reduce environment pollution.

**Objectives:** Specific objectives of the project are 1. Awareness programme to promote packing leaf as substitute of plastics 2: Capacity building on package and practice of cultivation and processing 3: To increase cultivation area of *Phrynium pubinerve* plants

**Methodologies**: Capacity building programmes were organized for the project beneficiaries on plantation management, primary processing and grading and marketing. Beneficiaries were selected based on the baseline survey and FGD data. Available lands were earmarked for developing the plantations of *Phrynium pubinerve* as intercrop. Awareness programmes were organized in the project villages to promote cultivation and its uses as substitute of plastic.

***Approach:*** Training on cultivation and management, primary processing and grading and marketing were imparted to the selected beneficiaries. Fifteen awareness programmes were conducted in the project villages to aware the community on packing leaf plantation and its benefit. Healthy and disease-free seedlings were selected and plantations were developed on the selected lands following the package of practices.

***Results***: Established 72 ha plantations, five demonstration plots and developed four nurseries. Six (6) training programmes and eighteen (18) awareness programmes were conducted. Developed five new products from the plant parts. One research paper, one article, two brochure and four leaflets were published.

**Conclusion**: Plantation activities under this project have minimized the pressure on natural population of packing leaf plants to some extent. Uses of packing leaves as substitute of plastics has increased and value-added products has opened up a new venture of income for the ST people

**Recommendations:** As packing leaf plant is partial shade loving plant, therefore, farmers should use unutilized space of orchard for plantation of packing leaf plant. Farmers should remove unhealthy and diseased leaves (if any) and burn the same especially during June-August to get good crop. The base of the petiole should be cut down while harvesting the leaf otherwise cut portion may get infected by the

pathogen. Moreover, This unwanted petiole may be utilized for developing value added products which will give them an additional income.

### 2.2. Objective-wise Major Achievements

| S. No. | Objectives | Major achievements (in bullets points) |
|---|---|---|
| 1 | Awareness programme to promote packing leaf as substitute of plastics | • Organized eighteen awareness programmes |
| 2 | Capacity building on package and practice of cultivation and processing | • Organized five capacity building programmes in the project areas |
| 3 | To increase cultivation area of *Phrynium pubinerve* plants | • Developed 72 ha new plantations under this project.<br>• Developed four (04) nurseries to produce quality planting material of packing leaf plant.<br>• Covered 132 ST beneficiaries in Ri-Bhoi and West Garo Hills districts of Meghalaya.<br>• Productive utilization of wasteland, marginal land through *Phrynium pubinerve* cultivation.<br>• Carried out plantation of *Phrynium pubinerve* plant by the beneficiaries in the available inter space of Ginger, Broom, Dalchini, Areca nut, Orange, Banana, Pineapple and Rosella plantations.<br>• One hundred twenty-one (121) beneficiaries started getting income by selling the leaves and seedlings. Remaining 11 beneficiaries who have started plantation activities lately will get income very soon.<br>• Developed five new products from the plant parts. |

### 2.3. Outputs in terms of Quantifiable Deliverables*

| S. No. | Quantifiable Deliverables* | Monitoring Indicators* | Quantified Output/ Outcome achieved | Deviations made, if any, & reason thereof: |
|---|---|---|---|---|
| 1 | Creation of self-employment of vulnerable groups of tribal communities in 2 districts | Income enhancement of tribal farmers (Nos) | Total 132 farmers started getting income from the project activities | |
| 2 | 72 ha new area will be under packing leaf cultivation with income enhancement of 132 tribal farmers | The cultivation of *Phrynium pubinerve* species (number/ha) | Plantation of *Phrynium pubinerve* plants developed in 72 ha area | |
| 3 | Productive utilization of wasteland, marginal land, and intercropping in areca nut, khasi mandarin, cashew nut | Organized the training and capacity building programmes | Organised eighteen awareness and five capacity building programmes. | |

| S. No. | Quantifiable Deliverables* | Monitoring Indicators* | Quantified Output/ Outcome achieved | Deviations made, if any, & reason thereof: |
|---|---|---|---|---|
| | plantations. | (Nos.) | | |
| 4 | Promoting use of packing leaf material as substitute of plastics | Number of beneficiaries/ village/ST community/local people (Nos) | • Covered five villages under Ri-Bhoi and eight villages in West Garo hills district.<br>• Khasi and Garo ST community were covered under this project<br>• Out of 132 ST beneficiary 59 were female beneficiaries and 73 were male beneficiaries. | |
| 5 | Two research paper, one article, two brochure and | No. of reports/ Research articles Policy documents prepared and published (Nos.) | • Published one article in the local newspaper.<br>• Published one research paper.<br>• Developed two brochures and four leaflets under this project | |

(*) As stated in the Sanction Letter issued by the NMHS-PMU.

### 2.4. Strategic Steps with respect to Outcomes (in bullets)

| S. No. | Particulars | Number/ Brief Details | Remarks/ Attachment |
|---|---|---|---|
| 1. | New Methodology developed | Nursery and plantation management technology developed | |
| 2. | New Models/Process/Strategy developed | Five products developed from the non-used plant parts | |
| 3. | New Species identified | Not applicable | |
| 4. | New Database established | Not applicable | |
| 5. | New Patent if any | Not applicable | |
| 6. | Others (if any) | Not applicable | |

## 3. Technological Intervention

| S. No. | Type of Intervention | Brief Narration on the interventions | Unit Details (No. of villagers benefited / Area developed) |
|---|---|---|---|
| 1. | Development and deployment of indigenous technology | a. Established nursery for production of quality planting material of packing leaf plant.<br>b. Established packing leaf plantation as intercrops in different orchards | a. Established four (04) units and benefitted thirteen villages.<br><br>b. Developed 72 ha plantations in 17 villages |
| 2. | Diffusion of High-end Technology in the region | | |
| 3. | Induction of New Technology in the region | Developed value-added products from the plant petiole which was not in use to the farmer | Developed five eco-friendly products viz., mat, pencil box, visiting card bag, hand fan and bowel as substitute of plastic. |
| 4. | Publication of Technological/Process Manuals | Developed brochure in local language | Developed one brochure in Khasi and Garo language and another brochure in English. |
| | Others (if any) | | |

## 4. New Data Generated over the Baseline Data

| S. No. | New Data Details | Status of Existing Baseline | Additionally and Utilisation New data |
|---|---|---|---|
| | **Nursery for seedling production** | There was no nursery in the villages for production of packing leaf seedlings as observed during the baseline survey | Developed four (4) new nurseries and one (01) with request of beneficiary under the project and farmers have been generating income from these new nurseries. |
| | **Systematic cultivation of packing leaves** | There was no systematic packing leaf cultivation observed during the baseline survey. People used to collect packing leaf from forest area for self-consumption as well as for marketing as observed during the baseline survey | Developed seventy-two (72) ha new plantations. Earlier they used to harvest packing leaves from wild population and produces were mostly used for self-consumption.. Plantation initiative done under the project has minimized the pressure on natural population. |
| | **Innovative Value-added products from the plant parts as substitute of plastics** | There was no product developed in the villages from packing leaf plant and people used plastic product as expressed by the people during the baseline survey. | Developed five products from the plant parts viz., hand fan, mat, bowel, Pencil box, money parts/ visiting card. The petiole which was used to prepare item earlier, it was of no use for the farmers. Earlier people used item made from plastic, now they have started to use item developed from plant parts. Beneficiaries are also getting additional income by selling the items. |

| S. No. | New Data Details | Status of Existing Baseline | Additionally and Utilisation New data |
|---|---|---|---|
| | **New venture of income from seedlings** | There was no nursery observed for seedling production in the villages during the baseline survey | Packing leaf nursery is a new source of income in the village The nursery holders are getting income ranging from Rs.2500/- to Rs.3500/- within a time span of two months. |

## 5. Demonstrative Skill Development and Capacity Building/ Manpower Trained

| S. No. | Type of Activities | Details with number | Activity Intended for | Participants/Trained | | | |
|---|---|---|---|---|---|---|---|
| | | | | SC | ST | Woman | Total |
| 1. | Workshops | 1 | To discuss and disseminate the findings among the experts and concerned beneficiaries / stakeholders | | 20 | 17 | 37 |
| 2. | On Field Trainings | 6 | To build up capacity for nursery establishment, plantation & management | | 146 | 120 | 266 |
| 3. | Skill Development | 2 | To equipped beneficiary on development of value-added products from packing leaf plants. | | 5 | 10 | 15 |
| 4 | Others (if any) Awareness programme | 15 | To aware community about the uses of packing leaves as substitute plastics in different locations of Meghalaya | | 133 | 313 | 446 |

## 6. Linkages with Regional & National Priorities (SDGs, INDC, etc)/ Collaborations

| S. No. | Linkages /collaborations | Details | No. of publications/ Events Held | Beneficiaries |
|---|---|---|---|---|
| 1. | Sustainable Development Goal (SDG) | Emphasized more on women beneficiary in the project and organized training exclusively for women beneficiary (Gender equity-SDG5) | 1 | 10 |
| | | Enhance green coverage through plantation activities. (Climate Action-SDG-13 & Life on Land-SDG-15) | 5 | 132 |
| 2. | Climate Change/INDC targets | Plantation drive | 5 | 132 |
| 3. | International Commitments | World Environment Day observed by initiating packing leaf plantation drive | 1 | 15 |
| 4. | Bilateral engagements | Project completion Workshop. Resource person from Directorate of Soil and Water Conservation, (Research and Training), Conservation Training Institute, Ri-Bhoi district, Meghalaya; | 1 | 42 |
| 5. | National Policies | Azadi Ka Amrit Mahotsav | 1 | 30 |
| 6. | Other collaborations | | | |

## 7. Project Stakeholders/ Beneficiaries and Impacts

| S. No. | Stakeholders | Support Activities | Impacts |
|---|---|---|---|
| 1. | Gram Panchayats | | |
| 2. | Govt. Departments (Agriculture/ Forest) | Stakeholder workshop to aware people on use packing leaves and their benefits | People started to grow packing leaf plant in their villages to get and use more packing leaves as substitute of plastics. |
| 3. | Villagers | Strict rules imposed on disposal of plastics | Increase in use of packing leaves in household activities. |
| 4. | SC Community | | |
| 5. | ST Community | Initiated livelihood activities | Carried out packing leaf plantation activities in 72 ha areas<br>Developed value-added products from the left-out parts of the plant. |
| 6. | Women Group | | |
| | Others (if any) | | |

## 8. Financial Summary (Cumulative)

| S. No. | Financial position/Budget Head | Funds received | Expenditure/ Utilized | % of Total cost |
|---|---|---|---|---|
| I. | Salaries/Manpower cost | 452400.00 | 468000.00 | 103.44 |
| II. | Travel | 365000.00 | 375519.00 | 102.88 |
| III. | Expendables & Consumables | 0.00 | 0.00 | N/A |
| IV. | Contingencies | 145000.00 | 150000.00 | 103.44 |
| V. | Activities & Other Project cost | 2032112.00 | 2058000.00 | 101.27 |
| VI. | Institutional Charges | 321400.00 | 344000.00 | 107.03 |
| VII. | Equipments | 400000.00 | 399999.00 | 99.99 |
| | **Total** | **3715912.00** | | |
| | Interest earned | 9548.00 | | |
| | Grand Total | 3725460.00 | | |

* Please attach the consolidated and audited Utilization Certificate (UC) and Year wise Statement of Expenditure (SE) separately, *ref.* **Annexure I.**

## 9. Major Equipment/ Peripherals Procured under the Project** (if any)

| S. No. | Name of Equipments | Cost (INR) | Utilisation of the equipment after project |
|---|---|---|---|
| 1. | Trolly cart | 22900.00 | All the equipment's are at farmers field and after project period equipment's will be utilized by the project beneficiary for the nursery management and plantation activities. |
| 2. | Plastic Tray | 12801.00 | |
| 3. | Khurpi | 4800.00 | |
| 4. | Shovel | 1820.00 | |
| 5. | Hoe | 1900.00 | |
| 6 | Crowbar | 2780.00 | |
| 7 | Sprayer | 10600.00 | |
| 8 | Water can | 1700.00 | |
| 9 | Plastic pipe | 1500.00 | |
| 10 | Construction and erection of shade house | 339198.00 | |
| | Total Rs. | 399999.00 | |

**Details should be provided in detail (*ref* **Annexure III &IV).**

## 10. Quantification of Overall Project Progress

| S. No. | Parameters | Total (Numeric) | Remarks/Attachments/ Soft copies of documents |
|---|---|---|---|
| 1. | IHR States Covered | 01 | *Appendix* |
| 2. | Project Site/ Field Stations developed | 05 project sites | *Appendix-1a* |
| 3. | New Methods/ Modeling Developed | 03 (Nursery, plantation, and value-added products) | |
| 4. | No. of Trainings arranged | 6 | *Appendix-3b* |
| 5. | No of beneficiaries attended trainings | 266 | |
| 6. | Scientific Manpower Developed (Ph.D. /M.Sc./JRF/SRF/ RA): | N/A | |
| 7. | SC stakeholders benefited | N/A | |
| 8. | ST stakeholders benefited | 132 | |
| 9. | Women Empowered | 59 | |
| 10. | No of workshops arranged along with level of participation | 01 | *Appendix-3c* |
| 11. | On field Demonstration Models initiated | 05 | (Aattached maps about location & photos) |
| 12. | Livelihood options promoted | 3 (Packing leaf nursery, plantation, and value-added products | *Appendix-1h* |
| 13. | Technical/ Training Manuals prepared | 02 | *Appendix-2a (Brochure)* |
| 14. | Processing units established | N/A | |
| 15. | No of species collected | N/A | |
| 16. | New Species identified | N/A | |
| 17. | New Database generated (Types): | N/A | |
| 18. | Others (if any) | | |

## 11. Knowledge Products and Publications:

| S. No. | Publication/ Knowledge Products | *Number* | | *Total Impact Factor* | *Remarks/* Enclosures |
|---|---|---|---|---|---|
| | | National | International | | |
| 1. | Journal Research Articles/ Special Issue: | 1 | | | |
| 2. | Book Chapter(s)/ Books: | | | | |
| 3. | Technical Reports | | | | |
| 4. | Training Manual (Skill Development/ Capacity Building) | 1 | | | |
| 5. | Papers presented in Conferences/ Seminars | | | | |
| 6. | Policy Drafts/Papers | | | | |
| 7. | Others: | 2 | | | |

* Please append the list of KPs/ publications (with impact factor and further details) with due Acknowledgement to NMHS.

## 12. Recommendation on Utility of Project Findings, Replicability and Exit Strategy

| Particulars | Recommendations |
|---|---|
| Utility of the Project Findings | Project findings will help different stakeholders to build up confidence in taking up packing leaf plantation as livelihood venture. Under the project three types of activities carried out viz., development of nursery, establishment of plantations and development of value-added products from the petiole. Moreover, value added products are eco-friendly and can be utilized as substitute of plastics. |
| | |
| Replicability of the project | Beneficiaries of the project village formed groups and are working with common interest of livelihood enhancement through packing leaf plant cultivation. These groups are spreading the message in nearby villages. Other villages are also taking interest in developing plantation by seeing the project activities and benefits that the project has been able to give to the beneficiaries. Several villages expressed their interest in front of us and they are working on it. Specially with the aim of cultivation of packing leaf in unutilized land to earn additional income. |
| | |
| Exit Strategy<br>(Please describe the Exit Strategy of the project, self-sustaining and benefitting the stakeholders and local community) | The message was disseminated among the beneficiaries at the time of beneficiary selection and in project meetings that the project period is for three years, and financial support will be available during the project period only and after the completion of project period they have to maintain their activities themselves.<br>Emphasis was also given during the project period to motivate the people to accumulate a part of their income from packing leaves in their account. The deposited amount to be utilized for maintenance of existing packing leaf plantation activities and further extension of the activities.<br>Project has helped to reduce stress on natural population of packing leaf plant. The village communities are getting leaves from the plantation sites for their self-consumption as well as for selling purposes. |

Dr. Ashish Kar

**(PROJECT PROPONENT/ COORDINATOR)**

**(Signed and Stamped)**

Authorised signatory: Dr. Dipankar Saharia
Senior Director-Regional Centres and Administrative Services, TERI
North Eastern Regional Centre, MM Path, Chachal, Hengrabari,
Guwahati-781036

Place: Guwahati

**Date:** 19/11/2022

**(HEAD OF THE INSTITUTION)**

**(Signed and Stamped)**

## PART B: PROJECT DETAILED REPORT

### 1 EXECUTIVE SUMMARY

Considering the adverse environmental impacts of plastics and polythene bags, it is desirable to promote alternative packing material. *Phrynium pubinerve* is a plant which leaves are being used in different states of northeast India as wrapping and packing material as alternative of plastic. The leaves of *Phrynium pubinerve* are mostly collected from wild sources sold in the market in bundle form and can be used as alternative to plastic in many areas. With the background initiative was taken for large scale cultivation of *Phrynium pubinerve* to enhance income among ST communities of low-income group and also to reduce environment pollution in northeast India. To promote packing leaves seventeen (17) villages were selected for implementation of the project activities in two districts viz., Ri-Bhoi and West Garo district of Meghalaya. The baseline survey of the project villages reflected that there are 1827 households with 10305 populations out of which 5208 are male and 5097 are female 5097. Average literacy rate is 74%. The castes of the villages belong to ST (94.20%), SC (0.88%) and OBC (4.91%). About 35.48% populations of the villages are worker. Among 3657 workers about 42.13% are cultivators and 10.44% are agriculture labour. Project villages are located at a distance of 10-20 km from the district headquarters.

There were three objectives approved by the NMHS under this project and these are 1. Awareness programme to promote packing leaf as substitute of plastics 2: Capacity building on package and practice of cultivation and processing 3: To increase cultivation area of *Phrynium pubinerve* plants .

Awareness programmes were organized in the project villages to promote cultivation of *Phrynium pubinerve* plants and its uses as substitute of plastic. Awareness programmes were organized through various methods such as speech, door to door visit, group meeting, and distribution of leaflets.

Capacity building programmes were organized for the project beneficiaries on plantation management, primary processing and grading and marketing. Training programmes were organized in the project villages by delivering talk by the subject matter specialist on the subject specific to cultivation, management of plantation and disease and pest management. Hands on training and on field practical demonstration were also carried out for capacity building programme.

Beneficiaries were selected based on baseline survey and FGD data. Available suitable lands were earmarked for developing the plantations of *Phrynium pubinerve* as intercrop.
Established 72 ha plantation sites, five demonstration plots and four nurseries were developed. Six (6) training programmes and eighteen (18) awareness programmes were conducted during the project period. Five products viz., mat, hand fan, pencil box, bowl, visiting card/money parts have been developed from the plant parts. Two brochures and four leaflets have been developed and one research paper and one article have also been published.
Project activities have brought out impact on environment and livelihood of the farming communities. Plantation activities under this project have minimized the pressure on natural population of packing leaf plants to some extent as people are getting leaves from their established plantation plots in their vicinity. Uses of packing leaves as substitute of plastics have decreased the uses of plastics and

minimized the pressure on environment. Plantation of 72 ha packing leaf plant has increased green coverage in the project villages. Three livelihood opportunities have been developed under this project. People are generating income by selling seedling from the nurseries establishment under the project, by selling mature leaves and value added products developed from the left out portion, mainly from petiole. All the beneficiaries under this project were ST communities.

## 2 INTRODUCTION

### 2.1 Background of the Project

2.2 Global production and consumption of plastics are increasing gradually day by day. Non-recyclable plastic is creating problems as it remains uncollected and scattered, causing damage to the environment. Plastic waste is considered to be one of the biggest contributors to pollution in the country. More than 34 lakh tonnes of plastic waste was generated in 2019-20 and 30.59 lakh tonnes in 2018-19 in India (Anonymous, 2022), Assam generates 2.99 lakh kilogram of plastic waste every day. Guwahat (major city of northeastern region) generates 3700kg of plastic every day about 12.37 percent of the entire state (Sengupta, 2018). World Environment Day is the United Nations' (UN) most important day for encouraging worldwide awareness and action for the protection of our environment and is organized around a theme that focuses attention on a particularly pressing environmental concern. The theme for the World Environment Day 2018 was "Beat Plastic Pollution" and India was the host country for 2018, it seems importance of plastic pollutant issue to the United Nation's and India as particular. In Ri-Bhoi district, Meghalaya commodities like plastic flags, polystyrene (thermocol) for decoration, plates, cups glasses, trays, wrapping or packing films around sweet boxes, plastic or PVC banners less than 100 micron have been prohibited (Rashir, 2022). Considering the adverse environmental impacts of plastics and polythene bags, it is desirable to promote alternative packing material. *Phrynium pubinerve* is a plant which leaves are being used in different states of northeast India as wrapping and packing material as alternative of plastic. Phrynium pubinerve is a shrub belonging to the family Marantaceae and almost all year-round availability of the leaves makes it a suitable packing material for meat, vegetables, and fruits In Meghalaya. The leaves are mostly collected from wild sources and sold in the market in bundle form (Tynsong & Tiwari, 2011). With the background initiative for large scale cultivation of *Phrynium pubinerve* was taken to enhance income among low-income group ST communities and also to reduce environment pollution in northeast India.

### 2.3 Overview of the Major Issues to be Addressed

Plastic is a hazardous substance for our environment as well as human being. To minimize uses of plastic is always a welcome step to protect environment. Packing leaves is an alternative source of plastic. To aware community on the uses of packing leaves and harmful effects of plastics awareness programmes were organized. Major issues with regard to packing leaf was that there were no systematic cultivation of packing leaf plants and people used to collect the leaves of packing leaf plant from natural population sites of the forest area. Therefore, to promote plantation, capacity building programmes were organized so as to build up confidence among the farmers to take up plantation.

There was an issue as the income from per ha plantation was less compared to other crops in the initial 3-4 years and community was not interested to take up cultivation of packing leaf plant. The issue was addressed by selecting the existing plantation sites of other horticultural and plantation crops to cultivate packing leaf as an intercrop. People accepted the concept and started cultivation of packing leaf plants on available vacant spaces in their banana, pine apple, orange, taro, dalchini, broom plantation sites. To enhance income from packing leaf cultivation peoples were encouraged to develop nurseries for raising seedling for meeting the seedling requirement of their own and also to sell the planting material to generate income. Mature leaves are harvested by cutting at the tip of petiole leaving the rest of the petiole in the live plants which after decaying cause insect infestation and disease problem in the plant and hence petioles were of no use for the farmers. This issue was addressed by proper utilization of resources for developing value-added products from the petiole and opening up of an avenue for generating additional income from left out portion of packing leaf plant. Initially it was thought that marketing would be a challenge for packing leaf and put up the issues in different project meetings by the farmers, but when the plants attained harvestable stage farmers started harvesting and found no problem at all for marketing as because the farmers have their own demand to fulfill household activities like wrapping of pan and would not like to sell outside. Moreover, villagers who don't have packing leaf cultivation has also procured packing leaves from the farmers who have plantations.

## 2.4 Baseline Data and Project Scope

The baseline survey of the project villages reflected that there are 1827 households with 10305 populations out of which 5208 are male and 5097 are female. Average literacy rate is 74%. The castes of the villages belong to ST (94.20%), SC (0.88%), and OBC (4.91%). About 35.48% populations of the villages are worker. Among 3657 workers about 42.13% are cultivators and 10.44% are agriculture labour. Project villages are located at a distance of 10-20 km from the district headquarters. From the baseline survey it was found that the primary occupation of most of the people is agriculture, and few people have secondary income source like agriculture labour, small shop. During survey it was also found that major livestock population of the villages are Hen (5681), Pig (1328 nos), Goat (357 nos) and Cow (288 nos). Most of the household have assets like mobile and TV. Farmers crop field are in hilly area. Ninety five percent populations have their savings bank account. Sixteen SHGs were found at the time of baseline survey in the villages.

Almost 95% population of the proposed project sites belong to schedule tribe (ST) and are most disadvantaged section of Indian society in terms of poverty, poor nutritional and health status, and lack of access to social and technical services. In addition, tribal households face inter-related problems of low levels of agricultural productivity and the absence of economic alternatives undermined livelihood security. Average incomes of BPL families were found at Rs.3950/-.The urgent need for these tribes were to adopt development models which are ecologically and economically viable.

## 2.5 Project Objectives and Target Deliverables (as per the NMHS Sanction Order)

| Project Objectives | Quantifiable Deliverables | Monitoring Indicators |
|---|---|---|
| • Awareness programme to promote packing leaf as substitute of plastic<br>• Capacity building on package and practice of cultivation and processing<br>• To increase cultivation area of *Phrynium pubinerve* plants | • Creation of self-employment of vulnerable groups of tribal communities in 2 districts.<br>• 72 ha new area will be under packing leaf cultivation with income enhancement of 132 tribal farmers.<br>• Productive utilization of wasteland, marginal lands and intercropping in areca nut, khasi mandarin, cashew nut plantation sites.<br>• Promoting use of packing leaf material as substitute of plastic. | • Income enhancement of tribal farmers (Nos.)<br>• The cultivation of *Phrynium pubinerve* species *(*number/ha*)*<br>• Organized the training and Capacity building programmes (Nos.)<br>• Number of beneficiaries village/ ST community/ local people (Nos.)<br>• No. of Reports/Research articles/Policy documents prepared and published (Nos.) |

# 3 METHODOLOGIES, STARTEGY AND APPROACH

## 3.1 Methodologies used for the study

Major components of the project were awareness programme, capacity building and plantation of packing leaves. Following methodology, strategy and approach were adopted to accomplish the objectives

**Awareness programme**: Eighteen (18) awareness programmes were organized during the project period. The basic objectives of the programmes were to make aware community about the benefits of packing leaves, to promote cultivation of packing leaf plant and its uses as substitute of plastic, its benefit on environmental and financial aspects. Awareness programmes were organized in different villages covering wide sections of people by distributing leaflets, speech, and involving village head and key persons of the respective villages. There was hardship to gather people due to COVID-19 restrictions during 2020 and 2021 and same were organized with small gathering.

**Selection of beneficiary**: Base line surveys were carried out in the selected village to get basic information of the villages and people of the villages. To select beneficiary semi structured questioner were developed and filled up by visiting door to door and in small gathering. Beneficiary were selected based on financial status (BPL), ST community, willing to work in group, those who have minimum land for plantation and those who are interested on taking up cultivation of packing leaf plant.

**Capacity building**: Six (06) capacity building programmes were organized for the beneficiaries at different project sites in small gathering due to COVID-19 restrictions. Nursery / plantation management, primary processing and grading and marketing were discussed in the training programmes. Training programmes were organized in the project villages by delivering talk by the subject matter specialist on the specific subject related to packing leaf plant cultivation, plantation management, harvesting, grading,

marketing etc. Hands on training and on field practical demonstration were also carried out for capacity building of the stakeholders. Two brochures were also developed in local Khasi and Garo languages and distributed during the training programmes.

**Establishment of Nurseries**: Four (04) nurseries were established in Ri-Bhoi and West Garo Hills districts of Meghalaya with net house, irrigation facilities and other minor equipment's for production of planting materials. Three nurseries have 3000 seedling producing capacity each and one nursery has 4000 seedling producing capacity with a total production capacity of 13000.

**Management of Nurseries**: To produce quality planting materials managements of nursery are very important. To maintain healthy growth of the seedlings regular weeding, watering, removal of unwanted plant parts and application of manure were followed in all the four nurseries.

**Plantation of packing leaf plant**: For plantation purposes beneficiaries were selected based on baseline survey and FGD data. Available lands were earmarked for developing the plantations of *Phrynium pubinerve* as intercrop. It was emphasized to utilize unused land of farmers for packing leaf plantation. Existing orchard of the beneficiaries were selected for packing leaf plantation, with an aim to utilize the unutilized land between plants and providing partial shade to the packing leaf plants for their proper growth and development.

**Management of plantation plot**: Total 72 ha new plantations were developed in Ri-Bhoi and West Garo Hills districts of Meghalaya. Out of this 54 ha in Ri-Bhoi district and 18 ha in West Garo Hills district. Management and maintenance of the plantations were done through gap filling, soil mounting, application of manure and weeding for proper growth and development of the plants in the plantations.

**Value added product**: Although value-added product development objective was not in the project, but efforts were made to develop value added products from different plant parts. Five value-added products were developed from harvested petiole and stem of plants. Leaves were used to develop plate, dish, and bowl. These are used as substitute of plastic and created a positive impact on environment as the items are biodegradable in nature.

### 3.2 Preparatory Actions and Agencies Involved

As preparatory action preliminary discussions were carried out with different village heads, person dealing with packing leaf business, forest dependent people and with packing leaf users to chalk out the plan and selection of target group and area. Discussions were also carried out with Different institute like North Eastern Hill University, Tura Campus, Meghalaya; Bio Resources Development Centre, Shillong, Meghalaya; Forest Department, Meghalaya; Directorate of Soil and Water Conservation, (Research and Training), Conservation Training Institute, Byrnihat, Ri-Bhoi district, Meghalaya, and local NGOs during project implementation period to know their views on cultivation packing leaf plants and utilization of leaves for various purposes and incorporation of the feedback in the project implementation.

### 3.3 Details of Scientific data collected and Equipments Used

Scientific data were collected at various level of the project activities viz., a. nursery data- quality planting material to raise seedlings, potting mixture for nursery bed, planting of propagules in the nursery bed, watering in the bed, weeding, time required to attain suitable size, suitable height to transplant seedling in the polybag, suitable height to transplant seedling in the plantation plot. B. plantation plot- suitable land for packing leaf plantation, plant to plant and row to row distance, size of the planting pit, manure applied in the pit, watering, weeding, mortality, gap filling, pest and disease and their peak time, management of pest & disease, soil mounting, application of manure, maturity period, harvesting season etc.

**Equipment used:** Net house used to raise seedlings, measuring tape, vernier caliper, GPS machine, balance, simple microscope; minor agricultural implements (trolly cart, plastic tray, khurpi, shovel, hoe, crawbar, sprayer, water can, and plastic pipe) were used to manage nursery and plantation.

### 3.4 Primary Data Collected

Primary data were collected related to the project implemented village, beneficiary profile, socio economic status of the beneficiary, nursery data, nursery management data, plantation site data, plant growth, plant mortality, plantation management data, intercropping, pest & disease occurrence and management data, packing leaf harvest data, packing leaf self-consumption, , best performance data of packing leaf, income from packing leaf, value added product etc.

### 3.5 Details of Field Survey arranged

Field surveys were arranged at different stages of the project period to gather information on village physiography, caste composition, occupation, facilities available to access. To select project beneficiary door to door field survey were carried out. To select best planting material for healthy seedlings production field survey were carried out at different pockets of packing leaf growing areas of the state. To record nursery data, plantation data, farmer's income from packing leaf field survey were carried out at regular intervals at the plantation sites.

### 3.6 Strategic Planning for each Activities

Project was implemented in Meghalaya and one local partner was involved to implement the project activities smoothly

**(a) Identification of Project Partners:** The project partner North East Hill University (NEHU), Tura Campus, West Garo Hills district, Meghalaya was the local partner for the project. Project villages located in West Garo Hills district and NEHU, Tura Campus coordinated with the beneficiary for cultivation and management of *Phrynium pubinerve* in 18 ha area.

**(b) Selection of project beneficiary:** Project beneficiary were identified by adopting the following criteria through baseline survey, FGD and key person interview- Farmers with low income status and ST category, farmers who have wasteland or have areca nut, banana, orange or other orchard for cultivating packing plants as intercrop, person who are involved in wild collection of *Phrynium pubinerve*, person who are involved in trade of packing leaves, willingness to work together with other families in groups.

(c) **Organize Awareness programme at the field**: Awareness programmes were organized at different places by inviting people from project villages and surrounding villages. The main objectives of the awareness programme were to make the people aware about the utility of packing leaf, positive impact on environment, income from packing leaf, possibility of use of packing leaves as a substitute of plastic and aim and objective of the project. Awareness programmes were organized in a center place of the village where all the people from different villages can gather, venues such as community center, School, Church, village head house, open field etc. were identified in consultation with the village head and other stakeholders of the project. Awareness programmes were carried out by explaining the project aim and objectives, distribution of leaflets, information sharing by renowned person of the local community. The key messages of awareness programmes were communicated to the participants in Khasi, Garo, Hindi, and English languages.

(d) **Selection of plantation site:** To establish new plantations of packing leaf following criteria were followed- i. availability of unutilized land in the existing orchard; ii. Land devoid of large stone and big trees iii. Lands having water source in nearby area, iv. Topography of land , i.e., land not in stiff hilly area, v. Land having partial shade, vi. Good quality soil for plantation, vii. Lands free from movement of stray/wild animal, viii Land without any dispute with other farmers.

(e) **Organize capacity building**: Organized four capacity building programmes in the project areas. Training programmes were carried out by delivering talk by subject matter specialist and distributing of brochure. Capacity building programmes were organized for the project beneficiaries on nursery raising and management, plantation and plantation management, primary processing, grading, and marketing. Brochures were developed in Khasi and Garo languages for ease of understanding by the beneficiaries. Training programmes were conducted by explaining the key components of the project in Khasi, Garo, Hindi, and English languages.

(f) **Identification of quality planting material and collection of propagules:** To raise healthy seedlings selection of superior propagules are very important. To collect planting material from mother stock following parameters were considered- i. Plants with healthy growth and free from insect-pest infestation, and disease infection, ii. Plant with quality leaves, iii. Leaves which have user preference.

To raise seedling, rhizomes and seeds were used, but seed take long time compared to rhizome to attain desirable size of the seedling. Therefore, rhizomes were planted as preferred planting material to raise seedlings. Planting materials were collected just before monsoon to get good growth. Winter season was avoided as growth was very poor.

(g) **Establishment of nursery for raising seedlings**: Nurseries were established in different pockets of the project villages. Following parameters were considered to select the sites of a nursery- i. More or less flat land, ii. Land with partial shade, iii. Availability of water facilities in nearby areas, iv. Lands with sufficient space for nursery activities like mixing of soil, sorting of propagules, transplanting of seedlings from bed to polybag, v.. sites having sufficient area for net house construction.

Sites were selected when the beneficiary expressed her/his willingness to provide services from established nursery in his/her land to the fellow beneficiaries during the project period or beyond that. Soils of the nursery bed were mixed properly by adding vermicomposting and making the soil suitable for raising seedling. Propagules planted in the nursery bed with a plant to plant and row to row spacing of 20 cm.

(h) **Management of seedlings in the nursery**: After sprouting of propagules watering were done at regular interval. Weeding was carried out twice in a week and infected or damage seedling observed in the nursery were uprooted and burnt.

(i) **Transfer of seedlings to the polybags**: Seedling were transferred to polybag when the seedling attained a height of 10-15 cm. Potting mixtures consisted of sandy soil, farm yard manure, vermicompost, humas soil (60:20:10:10). Several pores were made on the bottom of the polybags to allow excess water to drain out. Black colour polybag of size 6" x 8" were used for healthy growth of the root of the seedlings.

(j) **Plantation of *Phrynium pubinerve* plants in the plot**: Seedlings grown in polybags were transferred to field when the plant attained a height 20 cm to 25 cm in 20 x 20 x 30 cm pits. Per pit 250 gm vermicompost/ FYM were added and mixed well before planting. Seedlings were planted in the pit by removing from polybag without damaging the roots and plant parts at a plant to plant and row to row distance of 3 m x 3 m.

(k) **Management of plantation in the field**: Just after plantation watering was done to stabilize the root system of the plant in the new environment. Dead plants were removed from field and gap fillings were done. Weeding was done once in a week. After one month of plantation mounting of soil were done to boost the growth of the plant. After six months of plantation 200 gm FYM were applied in each plant and again after six months 200 gm vermicompost were applied for healthy growth of the plant. Survivability percentage of the plant in the field was recorded at 80-90%. Plant attained harvestable height within one and half months to two years.

(l) **Monitoring of project activity in the field**: Each beneficiary plot was visited once in a week for physical verification and to record field data of the plantation sites. Project team members were in contact with the beneficiary and met them once in a month to discuss the problem, remedial measures and progress of each activity.

(m) **Documentation of project activity**: Project activities were documented through photographic evidence. Field data were documented in field note book.

**3.7** Activity wise Time frame followed

| **Activities** | **1st year** | | | | **2nd year** | | | | **3rd year** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3M | 6M | 9M | 12M | 15M | 18M | 21M | 24M | 27M | 30M | 33M | 36M |
| Capacity building | *** | | | | *** | | | *** | | | *** | |
| Group formation | *** | *** | | | | | | | | | | |

| Activities | 1st year | | | | 2nd year | | | | 3rd year | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3M | 6M | 9M | 12M | 15M | 18M | 21M | 24M | 27M | 30M | 33M | 36M |
| Establishment of nursery | *** | | | | | | | | | | | |
| Development of planting material | *** | *** | | | | | | | | | | |
| Raising of seedlings and maintenance of nursery | | *** | *** | *** | *** | *** | *** | *** | *** | *** | | |
| Selection of suitable sites for plantation | *** | *** | | | | | | | | | | |
| Site clearing and land development | | | *** | *** | | | | | | | | |
| Establishment of plantation | | | *** | *** | *** | *** | *** | *** | *** | *** | *** | |
| Vacancy filling | | | | | | *** | *** | | | | | |
| Intercultural operation | | | | | | *** | *** | *** | *** | *** | *** | |
| Awareness programme | | *** | *** | *** | *** | *** | *** | *** | *** | *** | | |
| Monitoring and data collection | | *** | *** | *** | *** | *** | *** | *** | *** | *** | *** | *** |
| Report submission | | | | *** | | | | *** | | | | *** |

**(M=Months)**

## 4 KEY FINDINGS AND RESULTS

### 4.1 Major Research Findings

Following research findings were recorded during project implementation period

**Nursery findings**- Seedling survivability in the nursery was recorded up to 80% in all the four nurseries established under the project and pest and disease incidences were not found in the nursery. Seedlings grown from rhizome were healthy and developed faster and attained mature within one month whereas seedling grown from seed took 2-3 months to attain transplantable stage to poly bags and growth was also not good compared to rhizomatous seedlings.

**Plantation findings**- Plant survivability in the plantation plot was recorded at 80-90 percent in favourable condition. Distance 2 m x 2 m plant to plant and row to row gave good result as every year 3-4 new plants come out from single plant. Healthy growth recorded in partial shade plots, growth of plants in open sunny place was not good, moist soil was found good for the growth of the plants. Proper maintenance of the plantation plot helped to attain harvestable stage of plant in 1.5 years in new plantation sites, whereas in wild population it takes two years to attain harvestable stage.

**Pest and disease**: One pest attack and one fungal disease of packing leaf were recorded in the plantation plot. These are mentioned below

a. **Leaf roll**: *Phrynium* leaf roller is caused *by Calpodes ethlius*. The symptoms of the pest infestation observed were silk thread spined by the caterpillar and rolling of the youngest leaf by stitching leaf edges together. Damaged packing leaves became notched and ragged and when leaf become mature and open, several pores in a single straight line were seen. The leaf became white in colour due to sucking of chlorophyll of the leaf by the pest. The peak time of this pest infestation was noticed from June to August.

**Control:** No chemicals were applied application because larvae were protected from direct chemical exposure within the leaf roll and secondly leaf was used to pack food items and chemical residues might

have negative impact on health. Mechanical control measures were applied during these three months as and when pest occurrence observed by removing and burying/burning the infected leaf parts to reduce the population of the *Phrynium* leaf roller before causing large amount of defoliation.

**b. Rust of *Phrynium***: The leaves were affected by the fungus *Puccinia thaliae,* the causal organism of rust in Phrynium . The rusty circular spot observed on the lower surface of the leaves and protuberances merged into large rusty patches. The leaf surface was begun to show blotches of dead or necrotic brown tissue. In the packing leaf plantation sites disease was not so severe and only five plots spotted with rust disease and each plot with average four infected plants were observed. The disease was observed during December-February.

**Control:** No chemical application was done and mechanical methods were applied to manage the fungal disease. A large pit was dig out outside the plot and infected leaves removed from the plant parts and in severe cases the whole plants were uprooted with rhizome and placed inside the pit and leaves were burnt.

**Best harvest of leaves**: Harvest of good leaf size of 70 cm in length and 35 cm in breadth was recorded in most of the plantation plots and this size leaf has demand in the market for packing purposes. After 1.5 years single plant yielded 5-6 mature leaves and after completion of second year adding 3-4 new plants increased the harvestable leaves up to 30 from a single groove containing 5 plants. Similarly in the third-year harvestable leaf number recorded up to 60-62 numbers.

**Leaf shelf life:** Mature harvested leaves can be kept for 20-30 days in unusable condition. If leaves are properly dried and wrap crop seeds and keep on burner it remains in good condition even up to one year.

**Value added products**: During pre-project survey it was observed that people used to cut leaf at the tip of the petiole by leaving 70-80 cm petiole and later cut end get infected by insect and as a result disease spread to the other parts of the plant or other young leaves. It was suggested to harvest the petiole along with leaf at the base of the petiole which was used for developing value added products. It was observed from the study and experience of the artesian that petiole with 60 cm length is suitable for value added products development. Handmade dish, plate and bowl were prepared from leaf, but machine will give the fine product for edged of the products. Under the project efforts were given to develop items like mat, hand fan, pencil box, visiting card and bowl first time from petiole and packing leaf plant with the help of skilled artesian.

### 4.2 Key Results (max 1000 words in bullets covering all activities)

- Total five villages under Ri-Bhoi district and eight villages from West Garo hills district were covered under the project activities.
- Total 132 ST Khasi and Garo ST beneficiaries were covered under the project, out of which 59 were female beneficiaries and 73 were male beneficiaries in Ri-Bhoi and West Garo Hills districts of Meghalaya
- Organized eighteen awareness programmes and four capacity building programmes in the project areas

- Total 72 ha new plantations developed under this project.
- Four (04) nurseries were developed to produce quality planting material of packing leaf plant.
- Productive utilization of wasteland, marginal land through *Phrynium pubinerve* cultivation.
- Intercropping of *Phrynium pubinerve* were carried out by the beneficiaries in Ginger, Broom, Dalchini, Areca nut, Orange, Banana, Pineapple and Rosella plantations.
- Five value-added products developed from the plant parts
- One article published in the local newspaper and one research paper also published
- Two brochures and four leaflets published in English, Khasi, and Garo language under this project
- Total 132 farmers have started generating income from the project activities by selling the leaves, seedlings, and value-added products developed from packing leaf plants

### 4.3 Conclusion of the study

- Awareness programmes under the project helped the village people and community to start cultivation of packing leaf plant and use of leaf and petiole as substitute of plastics. Community realized the positive impact of packing leaves and negative impact of plastics on environment and as a result of that uses of packing leaves have increased in the project villages and surroundings areas.
- Capacity building programmes helped the beneficiaries to upgrade their skill for establishing and managing nursery, cultivation, management, marketing, and value addition of packing leaves.
- Plantation activities under this project have minimized the pressure on natural population of packing leaves to some extent. Uses of packing leaves have increased as substitute of plastics and value-added products has opened up a new avenue for generating additional income for the ST people.
- Farmers are getting additional income from same plot by cultivating packing leaf plant in available vacant place of the existing horticultural and plantation crop plantations.
- As per beneficiary feedback moisture level of their plantation has increased after plantation of packing leaf plant.
- The project has benefited ST communities and has scope to extend the same in nearby areas as surrounding villages are showing interest to take up plantation of packing leaf plant and development of value-added products.

## 5 OVERALL ACHIEVEMENTS

5.1 Achievement on Project Objectives

- Baseline data of 213 household were collected from 17 villages
- Carried out twenty-eight village level and key person meetings.
- Total 132 beneficiaries were selected through baseline survey
- Eighteen (18) awareness programmes and four (04) capacity building programmes were organized in the state of Meghalaya
- Areas under plantations/orchards like dalchini, banana, orange, pineapple, taro, broom, areca nut, ginger were effectively used for planting of packing leaf plant.
- Four net houses were constructed in the project area and five nurseries were established to produce quality seedlings and farmers are getting income by selling seedlings from those nurseries.

- One (01) Azadi Ka Amrit Mahotshav was organized, and 30 participants attended the programme
- Total 72 ha new plantations of packing leaf were developed under the project
- Total 72 ha waste lands were brought under plantation of packing leaf plant.
- Nursery and plantation management practices were established.
- Insect-pest infestation and diseases were recorded from the packing leaf plantation
- Per plant 5-6 and per groove up to 30 mature leaves were harvested from the plantation plots.
- All the 132 beneficiaries are getting income from the packing leaf plantations.
- Second year onwards total 2,88,000 mature leaves were harvested from 57600 plants and number is increasing gradually.
- Five (05) value added product has been developed from the plant parts
- Published one article in local newspaper and one research paper in journal.
- Two brochures and four leaflets developed under this project in Khasi and Garo languages
- One workshop was organized at the end of the project period as information and experience sharing exercises.

## 5.2 Establishing New Database/Appending new data over the Baseline Data

**Establishing of Nursery**: There was no any nursery operation in the villages to produce quality planting material for new plantation site; evidenced from the baseline survey and interaction made with the beneficiary. Therefore, efforts were given on that line and five nurseries (4 in Ri-Bhoi district and 1 in West Garo Hills district) with net house were developed to produce quality seedlings. Farmers are getting income by selling seedlings from those nurseries.

- **Establishing of new systematic plantation sites**: During base line survey it was found that there was no systematic cultivation of packing leaf plant in the surveyed villages and only eight household were involved in such activities and that too also only t one or two grove of packing leaf in their homestead garden to fulfill their own leaf requirement. Most of the farmers used to collect packing leaves from wild population and few people were purchased packing leaf from market to fulfill the requirement. Under the project beneficiaries were mobilized and 72 ha new plantations were developed in the villages. Beneficiaries are getting income by selling packing leaves from their plantations. Few beneficiaries have been able to fulfill their own requirement and stopped purchasing packing leaf from the market.

- **Increase production of packing leaves**: During baseline survey it was found that people either used to collect packing leaf from wild population or purchase from market due to scarcity of packing leaves. Under this project 57600 seedlings were planted covering 72 ha new plantation area and from second year onwards on an average 2, 88,000 mature leaves were harvested from 57600 plants. In third year harvested leaves has increased up to 4,50,000 numbers. Therefore, production of number of usable leaves is increasing every year with increase in new plant every year generated from the plantations.

- **Value added products**: There was no value added product found from the packing leaves in the project villages. Under this project five (05) value added products, viz., hand fan, mat, pencil box, bowel, and money bag/ parts developed from the unwanted plant parts.

### 5.3 Generating Model Predictions for different variables (if any)

Under the project packing leaf were planted as intercrop in different orchard and some of the model was best in terms of plant growth and income and are as below

a. **Packing leaf - Banana plantation model**: Packing leaf was planted in banana orchard and it was observed in the demonstration plot that packing leaf plant growth was very good as they get partial shade and moisture in the banana orchard. It is a good model as farmers getting income from packing leaf, banana plants from the same plot.
b. **Packing leaf - Areca nut - Betel vine plantation model**: Packing leaf was planted in areca nut plantation sites and betel vine was grown near areca nut plants as support plants to climb on it. It was observed in the demonstration plot that packing leaf growth was very good as they get partial shade both from betel leaf and areca nut plant. Farmers getting income from three crops from same land viz., packing leaf, pan leaf and areca nut plant. This model was one of the best models.
c. **Packing leaf - Dalchini plantation model:** Packing leaf was planted in dalchini plantation sites and it was observed in the demonstration that packing leaf growth was very good as they get partial shade from dalchini plants. This model was also one of the best model as farmers gets good amount from same plot viz., dalchini bark (spice) and packing leaf

### 5.4 Technological Intervention

There was no field manual or plantation technology available on nursery development and systematic plantation on packing leaf plant prior to the initiation of the project activities. During the project period nursery techniques were developed for the packing leaf covering the aspects viz., best planting material, soil, manure, watering schedule, weeding, transplantation, and management of the seedlings at nursery. New plantation sites were selected in the well-established orchard to get partial shade and also proper utilization of vacant space in between the plants of the existing plantation/orchards. Plantation management technique were also developed and applied in the field.

### 5.5 On field Demonstration and Value-addition of Products

Five demonstration plots of packing leaves were developed viz., in Areca nut plantation, banana plantation, dalchini plantation, seasonal vegetables and medicinal herbs plantation, and pineapple plantation sites. Five value-added products, viz., mat, pencil box, visiting card bag, hand fan and bowel were developed from the petiole of packing leaf plant.

### 5.6 Promoting Entrepreneurship in IHR

Two beneficiaries showed interest to develop value added products as new venture for entrepreneurship after capacity building programme under this project and encouraged them to adopt that.

### 5.7 Developing Green Skills in IHR

Created 72 ha new plantation area of packing leaf in Meghalaya under IHR. In the plantation sites FYM and vermicompost manure were applied as organic fertilizer. The green coverage is increasing gradually as new plants sprouting from the planted plants every season and forming a grove. Plantation management will be carried out by the community from the income they have accumulated during the

project periods. Biodegradable products were developed from the plant parts as substitute of plastic to reduce negative impact on environment.

### 5.8 Addressing Cross-cutting Issues

- Six (6) training programmes was organized
- Eighteen (18) awareness programmes were conducted
- Under the "Aazadi Ka Amrit Mahotsav" awareness programme carried out on packing leaves and their economic and environment importance
- Special plantation drive on packing leave were carried out on 5$^{th}$ June 2021
- One completion workshop was organized with different stakeholders

## 6 PROJECT'S IMPACTS IN IHR

### 6.1 Socio-Economic Development

**Social development**

- Six (6) capacity building programmes were organized for the project beneficiaries
- Eighteen (18) awareness programmes were conducted for the communities
- Four (04) nurseries were developed to produce quality planting material of packing leaf plant for the community
- Created 72 ha new plantation area of packing leaf which helping community available of packing leaf within their village periphery (saving time from wild collection and less impact on wild population due to cultivation area)
- One project completion workshop was organized with different stakeholders and shared experienced of packing leaf venture by the communities under this project
- Productive utilization of wasteland, marginal land through *Phrynium pubinerve* cultivation.
- Intercropping of *Phrynium pubinerve* were carried out by the beneficiaries in Ginger, Broom, Dalchini, Areca nut, Orange, Banana, Pineapple and Rosella plantations.
- Five value-added products were developed from the plant parts which have market value
- Total 132 ST beneficiary were benefitted directly under this project

**Economic development**

- Beneficiary of packing leaf nursery holders has earned Rs.24,000/- by selling packing leaf seedlings during project period
- Earned Rs.216000/- by selling packing leaf from second year onwards (on an average 2, 88,000 mature leaves were harvested from 57600 plants).
- Earned Rs.3, 37,500/- by selling packing leaf in the third year (in third year harvested leaves has increased up to 4, 50,000 numbers).
- Beneficiary has earned Rs.43000/- by selling value added product like mat, hand fan, bowel, pencil box (Rs.15000/- by selling hand fan; Rs.18000/- by selling mat; Rs.11000/- by selling pencil box, bowel, money bag etc.)

6.2 Scientific Management of Natural Resources In IHR

- To minimize pressure on wild population of packing leaf it was one of the goal under this project and to address the same 72 ha new plantation area were created with scientific inputs
- Soil erosion of orchards were reduced by the plantation of packing leaves as root are rhizomatous with fibrous which are binding loose soils. Moreover, leaf of packing leaves slow down the rain water force on top soil
- Top soil manure was retain due to packing leaf plantation where the space was unused and rain water were washed out the top soil nutrient
- One beneficiary has experienced that after plantation of packing leaf water remain for seven months in his crop field natural stream before packing leaf plantation it was remains for four months only in the stream
- Vermicompost and FYM was applied in the plantation sites of packing leaves to retain soil fertility and to remain active soil micro flora

6.3 Conservation of Biodiversity in IHR

- Stopped, direct interference of communities on natural population sites of packing leaves. Therefore, natural pockets are getting chance to regenerate and soil micro flora also remain undisturbed

6.4 Protection of Environment

- Community has started to minimize the use of plastics in the project districts particularly in the project implementation villages and they are using packing leaf as wrapping material to pack their commodities, goods and food items. These leaves are biodegradable and have positive sign for environment.
- Value added products like mat, hand fan, bowel, pencil box, bowel, money bag etc. were developed from the petiole fibre of plant which are biodegradable earlier those items were used from plastic made which are hazardous for our environment. People has started to use biodegradable items (hand fan, mat, pencil box, bowl etc.) to reduce negative impact on environment
- It was also tried to develop dish and plate from packing leaves it is possible to develop but, for finish product machine is required. This product will help to reduce use of thermocol and plastic coated paper plates.

6.5 Developing Mountain Infrastructures

- Four (04) net houses (nursery) were constructed under the project and these net house has capacity to accommodate total 13000 seedlings
- All necessary farm equipment's have been procured for the nursery
- Total 132 ST beneficiary were involved in nursery, plantation and development of value added products and from the income from this venture beneficiary were utilized money for education, health treatment, purchase of livestock, renovation of houses, purchase of household items and expansion of agriculture activities

6.6 Strengthening Networking in IHR

- Once in a quarter meeting were held among the project beneficiary and project team members to exchange their views under this intervention and established network among the project villages.
- During project period network was established with the local SHG, NGO, Forest Department, Govt. of Meghalaya, Directorate of Soil and Water Conservation, (Research and Training), Conservation Training Institute, Ri-Bhoi district, Meghalaya; Assam Down Town University, Assam

## 7 EXIT STRATEGY AND SUSTAINABILITY

7.1 How effectively the project findings could be utilized for the sustainable development of IHR (max. 1000 words)

At the time of capacity building programmes under the project it was elaborately discussed with the beneficiary about the prospect, benefit of packing leaf to build up their self-confidence and active participation in the project activities. These self-confidence and ownership has helped the project to sustain beyond project period. Packing leaf venture has opened up new income through four roads for the beneficiary viz., selling of packing leaf seedlings from nursery, selling of leaves from plantation plot, selling of petiole from plantation plot, selling of value added product from packing leaf plants. Beneficiary Income has reached up to Rs.6,20,500/- altogether in the second and third year and income will increase from fourth year onwards with the increase of new leaves in the plantation sites. Nearby villages of the project site also started to utilize waste land of the orchard through packing leaf plantation by learning from the project villages and this indicates that the project goal is not only sustainable but also scalable

7.2 Efficient ways to replicate the outcomes of the project in other parts of IHR (Max 1000 words)

At the initial stage project activities was planned to replicate beyond project period in other parts. People of outside project villages has attracted and started the plantation activities in their areas. Following are the ways to replicate outcome (this experienced was gathered during project period)

a. Planting material should be raised from rhizome instead of seed to get healthy and quick growth of seedlings
b. Plantation activities should be carried out in waste land of the orchard to get shade and additional income from same plot
c. The leaf has good shelf life and vegetables, betel vine leaf remain fresh if wrapped with this leaf

7.3 Identify other important areas not covered under this study needs further attention

The main objectives of the project was awareness programme, capacity building and creation of new plantation plot for packing leaves covering 72 ha area. Development of value added product from the packing leaf was not in the project objectives and it was tried to develop product from the petiole and developed six items which can be used as substitute of plastic product.

Leaf is important part of the packing leaf plant and it was tried to develop plate, dish and bowel through dry leaves but finish was not good. Therefore, to develop plate, dish and bowel from packing leaves plants machine may be installed for finish products. It has huge market and can be used as substitute of plastic/thermocol dish and plate.

7.4 Major recommendations for sustaining the outcome of the projects in future

a. It is recommended to provide small machinery for value added products from the leaves as handmade was not perfect and product through machine like dish, plate and bowel from leaf will give attractive look and will get good market
b. Pest and disease is a problem in isolated pockets it was suggested the farmers to uproot the infected plants and to burn the infected parts during August and September to restrict the spread.
c. To get outcome near future farmers should select unutilized land of orchard for plantation. Open, barren land and direct sunlight is not suitable for the packing leaf plant

## 8 REFERENCES/BIBLIOGRAPHY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## 9 ACKNOWLEDGEMENT


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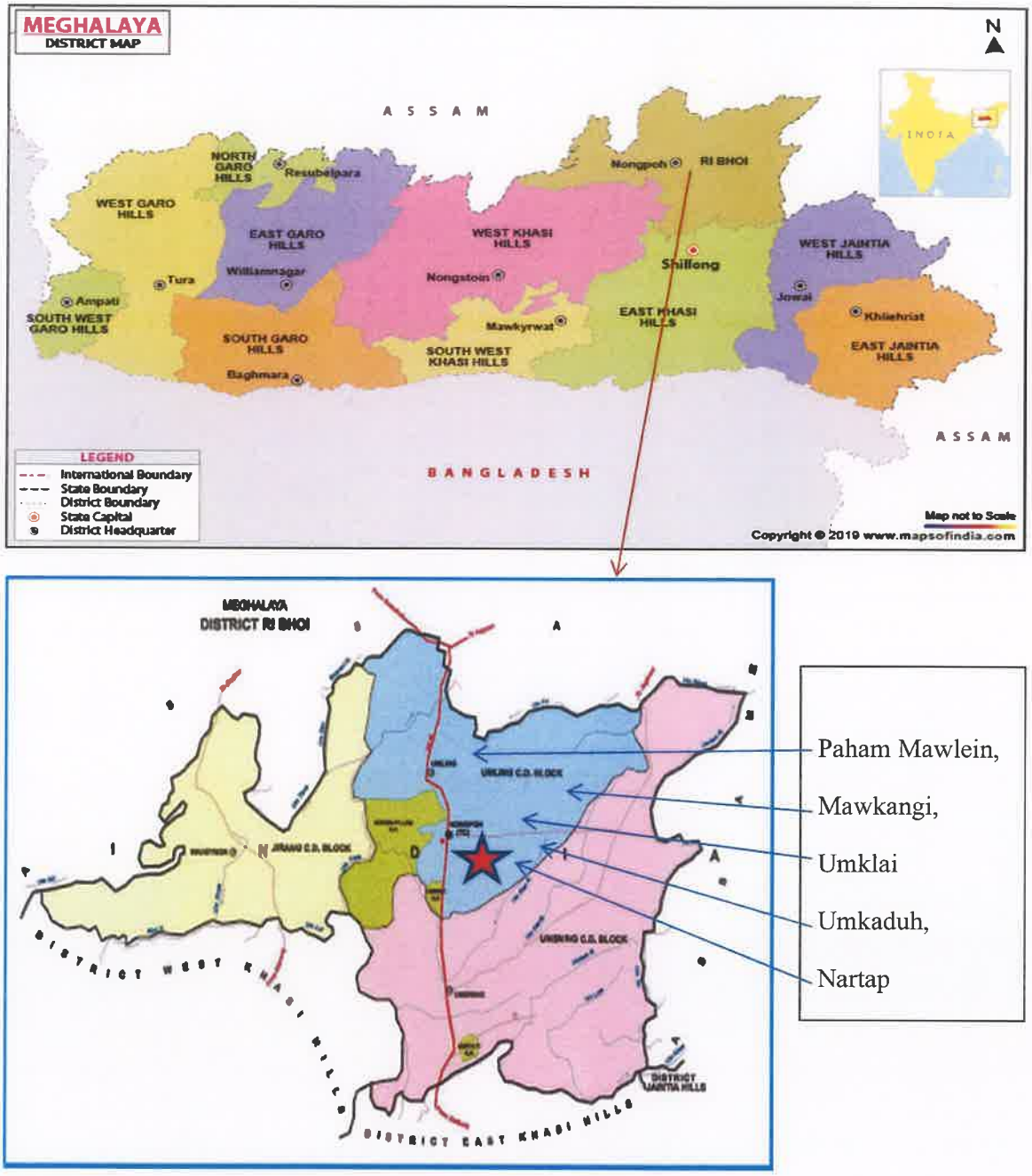
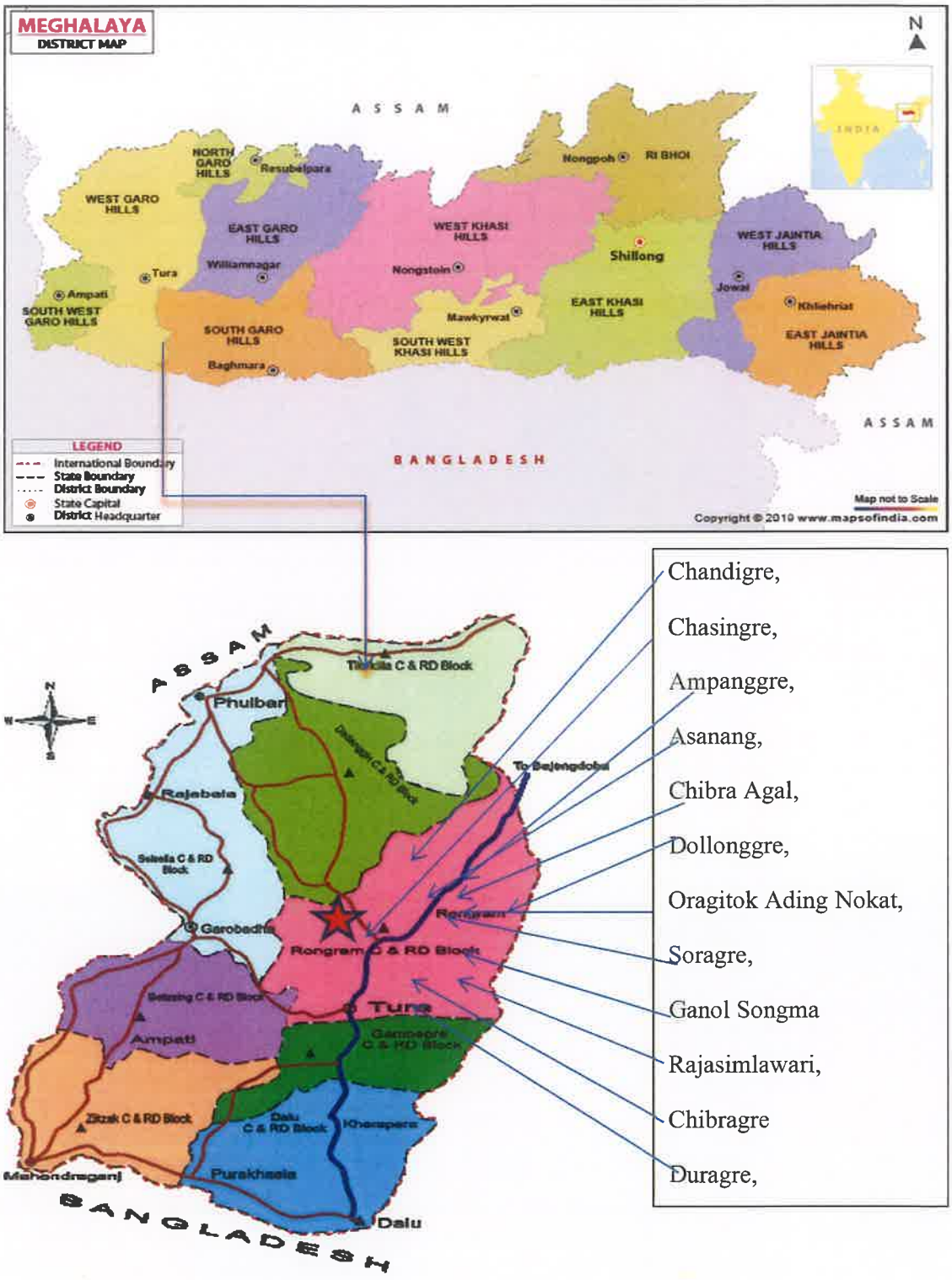



**Appendix 1a: Site Map 1, Site Location map of Ri-Bhoi District, Meghalaya (Village Site marked with arrow and Umling Block with star)**




**Site Map 2: Site Location map of West Garo Hills District, Meghalaya (Village Site marked with arrow and Rongram Block with star)**

**Project site**

| | |
|---|---|
| Project Site: | Ri-Bhoi district and West Garo Hills district |
| IHR States Covered: | Meghalaya |
| Long. & Lat.: | Ri-Bhoi district lies between 90°55'15 to 91°16' Latitude and 25°40' to 26°20'N Longitude. West Garo Hills is situated between the latitudes 90°13' and 90°30' E and longitudes of 25°20' N and 25° 56' N |

**Appendix- 1b: Baseline survey**

To collect primary data and to select beneficiary field survey were carried out in different villages of Ri-Bhoi district and West Garo Hills district of Meghalaya. Baseline data were collected through Focus Group Discussion (FGD), meeting with key personnel and sometimes through door to door visit

**Collection of baseline data**

Baseline data collection in Ri-Bhoi district

Baseline data collection in Ri-Bhoi district

Baseline data collection in Ri-Bhoi district

Baseline data collection in Ri-Bhoi district

Baseline data collection in West Garo Gills district

Baseline data collection in West Garo Gills district

**Appendix-1c: Project beneficiary list**

Total seventeen (17) beneficiaries villages viz., Nartap, Paham Mawlein, Mawkangi, Umkaduh and Umklai in Ri-Bhoi district and Rajasimlawari, Chandigre, Chasingre, Ampanggre, Asanang, Duragre, Chibra Agal, Dollonggre, Oragitok Ading Nokat, Soragre, Ganol Songma and Chibragre in West Garo Hills district (table-1) are in. All the beneficiaries are belonging to Khasi and Garo ST community. Total 132 numbers of local people were involved in the cultivation of packing leaves.

**Table1: Project Beneficiary list**

| Sl no | District | Village | Beneficiary name | Sex | Caste |
|---|---|---|---|---|---|
| 1. | Ri-Bhoi | Nartap | Mr. Alfred Makri | M | ST |
| 2. | Ri-Bhoi | Nartap | Ms. Kwerina Syngkli | F | ST |
| 3. | Ri-Bhoi | Nartap | Mr. Sambor Khongngaj | M | ST |
| 4. | Ri-Bhoi | Nartap | Ms. Veronica Maring | F | ST |
| 5. | Ri-Bhoi | Nartap | Ms. Phulkeria Makri | F | ST |
| 6. | Ri-Bhoi | Nartap | Ms. Biancy Syngkli | F | ST |
| 7. | Ri-Bhoi | Nartap | Ms. Batriti Maring | F | ST |
| 8. | Ri-Bhoi | Nartap | Mr. Banjop Maring | M | ST |
| 9. | Ri-Bhoi | Nartap | Mr. Surest Syngkli | M | ST |
| 10. | Ri-Bhoi | Nartap | Mr. Skimphrang Syngkli | M | ST |
| 11. | Ri-Bhoi | Nartap | Mr. Bidon Syngkli | M | ST |
| 12. | Ri-Bhoi | Nartap | Mr. Harle Syngkli | M | ST |
| 13. | Ri-Bhoi | Paham Mawlein | Mr. Phar Dkhar | M | ST |
| 14. | Ri-Bhoi | Paham Mawlein | Mr. Ialambha Pyngrope | M | ST |
| 15. | Ri-Bhoi | Paham Mawlein | Ms. Pynhun Kshiar | F | ST |
| 16. | Ri-Bhoi | Paham Mawlein | Mr. Wiet Suting | M | ST |
| 17. | Ri-Bhoi | Paham Mawlein | Mr. Jardon Kshiar | M | ST |
| 18. | Ri-Bhoi | Paham Mawlein | Mr. Peter Nongram | M | ST |
| 19. | Ri-Bhoi | Paham Mawlein | Mr. Nishon Majai | M | ST |
| 20. | Ri-Bhoi | Paham Mawlein | Mr. Shaining Star Suting | M | ST |
| 21. | Ri-Bhoi | Paham Mawlein | Mr. Jrain Mannar | M | ST |
| 22. | Ri-Bhoi | Paham Mawlein | Mr. Amin Maring | M | ST |
| 23. | Ri-Bhoi | Paham Mawlein | Mr. Koming Lyngdoh | M | ST |
| 24. | Ri-Bhoi | Paham Mawlein | Mrs. Silian Pyngrope | F | ST |
| 25. | West Garo Hills | Rajasimlawari | Mr.Rosendro R Marak | M | ST |
| 26. | West Garo Hills | Duragre | Mr. Praidison Momin | M | ST |

| | | | | | |
|---|---|---|---|---|---|
| 27. | West Garo Hilsl | Chandigre | Mr. Najong D Sangma | M | ST |
| 28. | West Garo Hills | Chasingre | Mr. Disen Ch. Marak | M | ST |
| 29. | West Garo Hills | Ampanggre | Mr. Laiden B. Marak | M | ST |
| 30. | Ri-Bhoi | Mawkangi | Ms. Stalyna Lapang | F | ST |
| 31. | Ri-Bhoi | Mawkangi | Ms. Billding Khymdeit | F | ST |
| 32. | Ri-Bhoi | Mawkangi | Ms. Sweedin Lyngdoh | F | ST |
| 33. | Ri-Bhoi | Mawkangi | Mr. Kyntiew nam Lyngdoh | M | ST |
| 34. | Ri-Bhoi | Mawkangi | Mr. Robas Khymdeit | M | ST |
| 35. | Ri-Bhoi | Mawkangi | Mr. Kitshanbor Lamarai | M | ST |
| 36. | Ri-Bhoi | Mawkangi | Mr. Casper Syngkli | M | ST |
| 37. | Ri-Bhoi | Mawkangi | Mr. Shepting Khymdeit | M | ST |
| 38. | Ri-Bhoi | Mawkangi | Ms. Rosemary Syngklei | F | ST |
| 39. | Ri-Bhoi | Mawkangi | Ms. Brillian Lyngdoh | F | ST |
| 40. | Ri-Bhoi | Mawkangi | Mr. Kian Khymdeit | M | ST |
| 41. | Ri-Bhoi | Mawkangi | Mr. Rana Lapang | M | ST |
| 42. | Ri-Bhoi | Mawkangi | Mr. Jerly Lapang | M | ST |
| 43. | Ri-Bhoi | Mawkangi | Mr. Followel Maiong | M | ST |
| 44. | Ri-Bhoi | Mawkangi | Mr. Useful Lymphuid | M | ST |
| 45. | Ri-Bhoi | Umkaduh | Mr. Phaintis Syngkli | M | ST |
| 46. | Ri-Bhoi | Umkaduh | Mr. Plester Syngkli | M | ST |
| 47. | Ri-Bhoi | Umkaduh | Mr. Darwel Ranee | M | ST |
| 48. | Ri-Bhoi | Umkaduh | Mr. Displin Kylla | M | ST |
| 49. | Ri-Bhoi | Umkaduh | Mr. Rishat Kylla | M | ST |
| 50. | Ri-Bhoi | Umkaduh | Ms. Useme Sylling | F | ST |
| 51. | Ri-Bhoi | Umkaduh | Mr. Loster Jynthem | M | ST |
| 52. | Ri-Bhoi | Umkaduh | Mr. Serington Syngkli | M | ST |
| 53. | Ri-Bhoi | Umkaduh | Mr. Akaslin Synthem | M | ST |
| 54. | Ri-Bhoi | Umklai | Ms. Mol Narlong | M | ST |
| 55. | Ri-Bhoi | Umklai | Ms. Jesenta Syngkli | F | ST |
| 56. | Ri-Bhoi | Umklai | Ms. Nesty Syngkli | F | ST |
| 57. | Ri-Bhoi | Umklai | Mr. Ian Sungkli | M | ST |
| 58. | Ri-Bhoi | Umklai | Ms. Selita Rongpei | F | ST |
| 59. | Ri-Bhoi | Umklai | Ms. Miri Syngkli | F | ST |
| 60. | Ri-Bhoi | Umklai | Ms. Piltis Syngkli | F | ST |
| 61. | Ri-Bhoi | Umklai | Ms. Lonely Pamshong | F | ST |
| 62. | Ri-Bhoi | Umklai | Mr. Bishnu Syngkli | M | ST |
| 63. | Ri-Bhoi | Umklai | Ms. Nita Syngkli | F | ST |

| 64. | Ri-Bhoi | Umklai | Mr. Sishon Makri | M | ST |
|---|---|---|---|---|---|
| 65. | Ri-Bhoi | Umklai | Ms. Gineries Makri | F | ST |
| 66. | Ri-Bhoi | Umklai | Ms. Anita Narlong | F | ST |
| 67. | Ri-Bhoi | Umklai | Ms. Rosemary Syngkli | F | ST |
| 68. | Ri-Bhoi | Umklai | Ms. Bina Syngkli | F | ST |
| 69. | Ri-Bhoi | Umklai | Ms. Theodora Narlong | F | ST |
| 70. | Ri-Bhoi | Umklai | Mr. Jubalris Khymdeit | M | ST |
| 71. | Ri-Bhoi | Umklai | Mr. Bidisi Pamshong | M | ST |
| 72. | Ri-Bhoi | Umklai | Ms. Therina Syngkli | F | ST |
| 73. | Ri-Bhoi | Umklai | Ms. Balarihun Syngkli | F | ST |
| 74. | Ri-Bhoi | Umklai | Ms. Kresengsia Makri | F | ST |
| 75. | Ri-Bhoi | Umklai | Ms.Simamary Makri | F | ST |
| 76. | Ri-Bhoi | Umklai | Ms.Lusina Syngkli | F | ST |
| 77. | Ri-Bhoi | Umklai | Mr.Elias Jyrwa | M | ST |
| 78. | Ri-Bhoi | Umklai | Mr. Kroswel Syngkli | M | ST |
| 79. | Ri-Bhoi | Umklai | Ms. Swi Narlong | F | ST |
| 80. | Ri-Bhoi | Umklai | Mr. Keribon | M | ST |
| 81. | West Garo Hills | Asanang | Ms. Gremojini A Sangma | F | ST |
| 82. | West Garo Hills | Asanang | Mr. Fleming A Marak | M | ST |
| 83. | West Garo Hills | Asanang | Ms. Ronilla Ch Marak | F | ST |
| 84. | West Garo Hills | Asanang | Ms. Saroni Ch. Marak | F | ST |
| 85. | West Garo Hills | Asanang | Ms. Sunemy B Marak | F | ST |
| 86. | West Garo Hills | Asanang | Ms. Nelmen Marak | F | ST |
| 87. | West Garo Hills | Asanang | Ms. Rita Marak | F | ST |
| 88. | West Garo Hills | Asanang | Mr. Peter Lawford Marak | M | ST |
| 89. | West Garo Hills | Asanang | Ms. Mala S Marak | F | ST |
| 90. | West Garo Hills | Asanang | Mr. Johin Marak | M | ST |
| 91. | West Garo Hills | Asanang | Mr. Kerol A Sangma | M | ST |
| 92. | West Garo Hills | Asanang | Ms. Sobali Marak | F | ST |
| 93. | West Garo Hills | Asanang | Mr. Chesangra Ch Marak | M | ST |
| 94. | West Garo Hills | Duragre | Ms. Prenilla A Sangma | F | ST |
| 95. | West Garo Hills | Duragre | Ms. Benni A Marak | F | ST |
| 96. | West Garo Hills | Duragre | Ms. Mensilla A Sangma | F | ST |
| 97. | West Garo Hills | Duragre | Ms. Jellena R Marak | F | ST |
| 98. | West Garo Hills | Duragre | Ms. Peborina R Marak | F | ST |
| 99. | West Garo Hills | Duragre | Ms. Nonilla A Sangma | F | ST |
| 100. | West Garo Hills | Duragre | Ms. Noreni R Marak | F | ST |

| | | | | | |
|---|---|---|---|---|---|
| 101. | West Garo Hills | Duragre | Ms. Jemina R Marak | F | ST |
| 102. | West Garo Hills | Ganol Songma | Ms. Jimritha Marak | F | ST |
| 103. | West Garo Hills | Ganol Songma | Mr. Hayland Marak | M | ST |
| 104. | West Garo Hills | Ganol Songma | Mr. Mingjeng A Sangma | M | ST |
| 105. | West Garo Hills | Ganol Songma | Mr. Silnang Sangma | M | ST |
| 106. | West Garo Hills | Ganol Songma | Mr. Gobeng Sangma | M | ST |
| 107. | West Garo Hills | Ganol Songma | Mr. Prish Marak | M | ST |
| 108. | West Garo Hills | Ganol Songma | Mr. Edwian Sangma | M | ST |
| 109. | West Garo Hills | Ganol Songma | Ms. Sunitha Marak | F | ST |
| 110. | West Garo Hills | Ganol Songma | Mr.Remju Marak | M | ST |
| 111. | West Garo Hills | Ganol Songma | Mr. Silment A Sangma | M | ST |
| 112. | West Garo Hills | Ganol Songma | Mr. Tiran Marak | M | ST |
| 113. | West Garo Hills | Ganol Songma | Mr. Mikjang. Marak | M | ST |
| 114. | West Garo Hills | Ganol Songma | Mr. Granpeard Sangma | M | ST |
| 115. | West Garo Hills | Ganol Songma | Mr. Jiwen Sangma | M | ST |
| 116. | West Garo Hills | Ganol Songma | Mr. Polwil Marak | M | ST |
| 117. | West Garo Hills | Ganol Songma | Mr. Brinalson Marak | M | ST |
| 118. | West Garo Hills | Chibra- Agal | Mr. Romalish Sangma | M | ST |
| 119. | West Garo Hills | Dollonggre | Ms. Henitha B Sangma | F | ST |
| 120. | West Garo Hills | Oragitok/A·ding Nokat | Mr. Browmick Marak | M | ST |
| 121. | West Garo Hills | Soragre | Ms. Marsitha CH Marak | F | ST |
| 122. | West Garo Hills | Soragre | Ms. Newrine B Marak | F | ST |
| 123. | West Garo Hills | Soragre | Ms Slenni B Marak | F | ST |
| 124. | West Garo Hills | Chibragre | Mr. Killan Sangma | M | ST |
| 125. | West Garo Hills | Chibragre | Mr. Allen Sangma | M | ST |
| 126. | West Garo Hills | Chibragre | Ms. Rusibell Marak | F | ST |
| 127. | West Garo Hills | Chibragre | Ms. Nosilla Marak | F | ST |
| 128. | West Garo Hills | Chibragre | Ms. Rasita Marak | F | ST |
| 129. | West Garo Hills | Chibragre | Ms. Minita A Sangma | F | ST |
| 130. | West Garo Hills | Chibragre | Ms. Tobila B Sangma | F | ST |
| 131. | West Garo Hills | Chibragre | Ms. Inchilla Sangma | F | ST |
| 132. | West Garo Hills | Chibragre | Mr. Tangseng Sangma | M | ST |

## Appendix-1d: Establishment of Nurseries

Total four (04) nurseries were established in Ri-Bhoi and West Garo Hills districts of Meghalaya for plant propagation purpose. Three nurseries have 3000 seedling producing capacity each and one nursery has 4000 seedling producing capacity. The four nurseries have total 13000 seedling producing capacity. Additional one low cost nursery has developed on the request of beneficiary for seedling productions

**Photographs of new nursery establishment sites**

Land preparation for nursery

Preparation of nursery beds

Sowing of rhizome with stem at nursery bed

View of new nursery

Rhizome with stem planted inside net house for seedling raising

Rhizome with stem in the nursery

## Appendix-1e: Management of Nurseries

To provide quality planting materials managements of nursery are very important. To maintain healthy growth of the seedlings regular weeding, watering, removal of unwanted plant parts and application of additional soil and manure if required were taken care in the four nursery

**Photographs of nursery management**

Weeding in nursery

Watering in the nursery

Applying manure mixed soil

Seedling are ready to transplant in the plantation sites

## Appendix-1f: Plantation sites photographs

Total 72 ha new cultivation plots were created in Ri-Bhoi and West Garo Hills districts of Meghalaya in the previous year. Out of this 54 ha in Ri-Bhoi district and 18 ha in West Garo Hills district. Gap filling and weeding being carried out at regular basis for good harvest in the second year. Wasteland, marginal lands were utilized for packing leaf cultivation. Intercropping of *Phrynium pubinerve* have been carried out by the beneficiaries in Dalchini, Areca nut, Orange, Banana, Taro, Ginger and Pineapple orchard for proper utilization of land.

**Packing leaves plantation sites**

Cultivation plot at Pahamawlein

Cultivation plot at Nartap village

Cultivation plot at Mawkangi

Cultivation plot at Umklai village

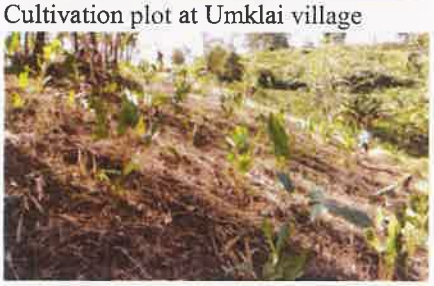
Cultivation plot at Pahamawlein

Cultivation plot at Pahamawlein

Cultivation plot at Umklai village

Healthy plants in farmers field

Cultivation plot at Ganol Songam



Plantation plot at Chasingre

Plantation plot at Chibragre

Plantation plot at Nartap village

**Appendix-1g: Management of plantation plot**

Total 72 ha new cultivation plots were created in Ri-Bhoi and West Garo Hills districts of Meghalaya in the previous year. Out of this 54 ha in Ri-Bhoi district and 18 ha in West Garo Hills district. Management and maintenance were made through gap filling, soil mounting, application of manure and weeding being carried out at regular basis for good harvest in the second year.

**Packing leaves plantation sites**

Cleaned plantation plot at Pahamawlein

Beneficiary weeding his plantation at Pahamawlein village

Manure applied in cultivation plot at Umklai village

After weeding cleaned cultivation plot at Pahamawlein village

**Appendi-1h: Harvesting of packing leaves**

Income generations were targeted for total 132 local ST beneficiaries. The income generation from the project is based on selling of seedlings from nursery, selling of packing leaves from cultivation plot and from value added products. All one hundred and thirty two (132) beneficiaries have started harvesting of leaves. Beneficiary using leaves for wrapping betel vine (pan), local leafy vegetables for marketing and other household uses. During second year onwards beneficiary earned Rs.216000/- by selling packing leaf (on an average 2, 88,000 mature leaves were harvested from 57600 plants). During third year earned Rs.3, 37,500/- by selling packing leaf in the third year (in third year harvested leaves has increased up to 4, 50,000 numbers). Income will be increase every year as number of new leaves will be increase in every season. It is expected that individual income will increase when beneficiary will go for value added products from the plant parts.

**Table 1: Income generated from project activities**

| Sl no | Item sold | Amount earned (Rs.) |
|---|---|---|
| 1 | By selling packing leaf seedlings during project period | 24000.00 |
| 2 | By selling packing leaf from second year onwards (on an average 2, 88,000 mature leaves were harvested from 57600 plants | 216000.00 |
| 3 | By selling packing leaf in the third year (in third year harvested leaves has increased up to 4, 50,000 numbers | 337500.00 |
| 4 | By selling value added product like mat, hand fan, bowel, pencil box (Rs.15000/- by selling hand fan; Rs.18000/- by selling mat; Rs.11000/- by selling pencil box, bowel, money bag | 43000.00 |
| | **Total income generated during project period Rs.** | **620500.00** |

**Photographs of harvested plants from beneficiary plantation sites and their uses**

Women Beneficiary has harvested packing leaves from her plantation plot for self consumption

Beneficiary harvested mature leaves from cultivation plot for household uses

Beneficiary using harvested leaves to pack betel leaf

Packing leaves using in village resturant collected from project village

Beneficiary using harvested leaves to pack local vegetables

Beneficiary using harvested leaves to pack local snacks

Harvested leaves from beneficiary cultivation plot

Beneficiary using mature leaves to wrap inside of container to carry betel leaf from the crop field (backside showing his cultivation plot under NMHS project)

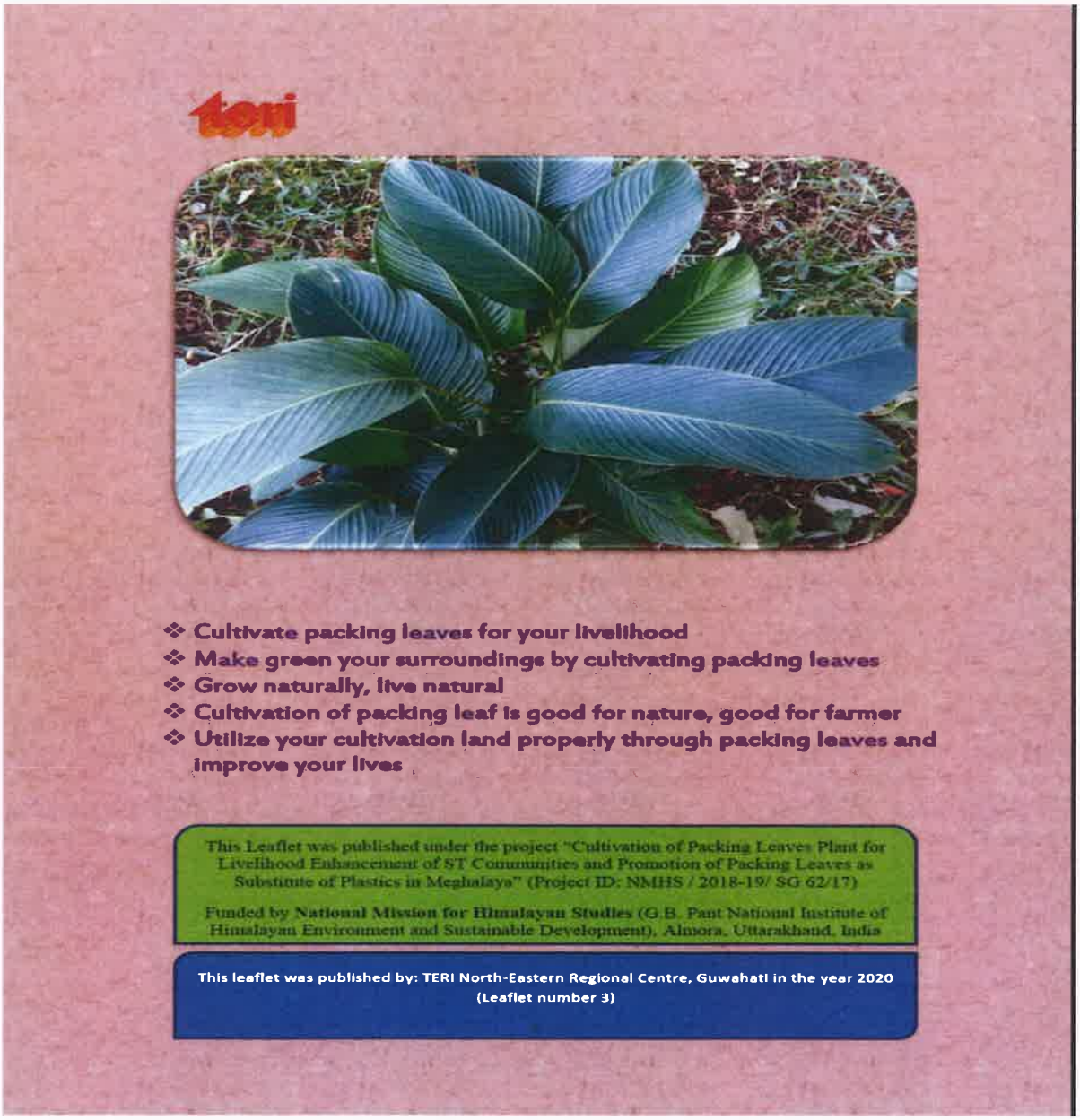
Beneficiary is taking breakfast in packing leaf harvested from his plantation plot developed under NMHS project

## Appendix-2: Publication

To disseminate project activities and knowledge among different stakeholders eight publication were made. Two (02) brochures, four (04) leaflets, one (01) research paper and one (01) article were published in the newspaper for wider awareness among masses.

### Publication to disseminate knowledge

**Leaflet: 01**



Leaflet: 02

- **PACKING LEAF (SLA LAMET/RERU) CAN BE USED AS INSIDE LAYERING OF BAMBOO BASKET TO KEEP HARVESTED BETELVINE WHICH HELPS IN EASY TRANSPORTATION**

- **PACKING LEAF (SLA LAMET/RERU) CAN BE USED TO PROCESS**

This Leaflet was published under the project "Cultivation of Packing Leaves Plant for Livelihood Enhancement of ST Communities and Promotion of Packing Leaves as Substitute of Plastics in Meghalaya" (Project ID: NMHS / 2018-19/ SG52/ 52)

Funded by National Mission for Himalayan Studies (G.B. Pant National Institute of Himalayan Environment and Sustainable Development, Almora, Uttarakhand, India

*This Leaflet was published by: TERI Northeast Regional Centre, Guwahati in the year 2020*

**Leaflet No:4**

- CULTIVATE PACKING LEAF (SLA LAMET/RERU) IN UNUTILIZED LAND
- PACKING LEAF (SLA LAMET/RERU)HAS MANIFOLD USES

This Leaflet was published under the project "Cultivation of Packing Leaves Plant for Livelihood Enhancement of ST Communities and Promotion of Packing Leaves as Substitute of Plastics in Meghalaya" (Project ID: NMHS / 2018-19/ SG52/ 52)

Funded by **National Mission for Himalayan Studies** (G.B. Pant National Institute of Himalayan Environment and Sustainable Development, Almora, Uttarakhand, India

***This Leaflet was published by: TERI Northeast Regional Centre, Guwahati in the year 2019 (Leaflet-4)***

**Leaflet No:3**

- *STOP USE OF PLASTIC*
- *USE PACKING LEAF (SLA LAMET/RERU)*
- *GROW PACKING LEAF (SLA LAMET/RERU)*
- *ENHANCE INCOME*

This Leaflet was published under the project "Cultivation of Packing Leaves Plant for Livelihood Enhancement of ST Communities and Promotion of Packing Leaves as Substitute of Plastics in Meghalaya" (Project ID: NMHS / 2018-19/ SG52/ 52)

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# INDIGENOUS USES OF PACKING LEAVES (*PHRYNIUM PUBINERVE*) AND THEIR COMMERCIAL CULTIVATION FOR LIVELIHOOD PROMOTION IN NORTHEAST INDIA

**ARINDAM BARMAN, ASHISH KAR AND SHEENA HAORONGBAM**

## ABSTRACT

*Survey of packing leaf plant was conducted in different locations of Northeast India with an objective to document the commercial cultivation aspects and indigenous uses of packing leaf of different communities of Northeast India on. Data on different uses were collected using a guided methodology, semi-structured interviews, and field observations. Present study documented that the packing leaves are used under 13 broad categories by the communities of northeast India. During survey it was also found that the different parts of packing leaf plant are also used to treat a total of five different ailments. The leaves of packing leaves are sold in the market in bundle form and are collected mostly from wild sources. Natural population of packing leaves is gradually decreasing due to overexploitation of wild population. Unsustainable harvest from wild is also causing threat and damage of the wild population. The petiole of packing leaf is 30 cm to 50 cm and that can be also be used as binding material instead of plastic. Cultivation of packing leaf will also reduce the pollution in the environment and will also help to enhance income of the local population. A farmer can earn Rs.2400 to Rs.3600 (if selling price 25 paise) and if the selling price is 50 paise then income will go up to Rs. 4800 to Rs.7200 from one ha area. These can be an additional income from packing leaf cultivation of one ha area if farmers do cultivation in arecanut, orange, banana, bay leaf, cashew nut, dalchini plantation area. Moreover, farmers can earn extra income by producing seedling and selling them in the market.*

*Keywords: Phrynium pubinerve, Packing leaf, Indigenous uses, Livelihood,Northeast India*

## INTRODUCTION

According to the Central Pollution Control Board, India produces close to 26,000 tonnes of plastic waste every day and nearly 9.4 million tonnes a year. Of that, only 5.6 million tonnes is recycled in a year, while the remaining 3.8 million tonnes is left unattended. Plastic bags are low resistant to high temperature. Due to leaching of toxic dyes from plastic bags, it can easily contaminate food products. Agriculture, land and environment are also affected due to the pollution caused by plastic bags (Arvind 2019). Toxic chemicals leach out of plastic and are found in the blood and tissue of nearly all of us. Exposure to them is linked to cancers, birth defects, impaired immunity, endocrine disruption and other ailments. Plastic pollution has the potential to poison animals, which can then adversely affect human food supplies. Some of the chemicals used in plastic production can cause dermatitis upon contact with human skin. Plastic bags produce toxic fumes when it is burnt. It takes many years to decompose (Richard, 2009). In different corner of India people use banana leaf as a substitute of plastic plate. In some pockets of Assam plate are made from areca nut leaf sheath. There are some problems in banana leaf and areca nut plate and these are- short shelf life of banana leaf, i.e., 1-2 days and damage in any part of the leaf due to its parallel venation and irregular supply of leaf. Plates made from areca nut leaf sheath are costly and are not commercially viable at the moment and shortage of raw material. *Phrynium pubinerve* leaf (Packing leaf) can be an alternative as the leaves are stronger than banana leaf, eco-friendly, better shelf life, and has capacity in retaining moisture and keeping the packed edibles fresh and long lasting. *Phrynium pubinerve* (packing leaf) is an herb with creeping root stock. Leaves oblong, acuminate, base rounded or obtuse, leaves up to 52cm long and 35 cm broad at mature stage; petiole up to 60 cm long.

Time to time different research works have been carried out on different aspects of packing leaf. Tynsong & BK Tiwari (2011) on contribution of *Phrynium* as non timber forest product to the livelihood ; Li et al. (2015) highlighted the essential oils chemical composition and antioxidant and antimicrobial potentials of the leaves of *Phrynium pubinerve*; Hajja & Bahlouli, 2018 pointed out *Phrynium sp* on prevention and treatment of rheumatoid arthritis; Hyenniewta and Kumar, 2008 highlighted uses of *Phrynium pubinerve* during preparation of Leprosy herbal medicine in Meghalaya. After literature survey it was observed that uses of packing leaves were not documented by earlier researchers. Moreover, such documentation of traditional uses is very important because this knowledge is at the risk of extinction due to people's intension to migrate in urban areas where there is little chance to apply such knowledge. Loss of biodiversity and natural habitats along with adaptation to modern lifestyle are also equally responsible. Therefore, the present study aims to document the traditional knowledge relating to uses of packing leaf plant by the people of northeast India

## MATERIALS AND METHODS

**Study area:** Study were carried out in Tura, Byrnihat, Nongpoh, Ladrymbhai, Khelarihat, Shillong, Borapani (Meghalaya) ; Dharmanagar, Bisramganj, Maharani (Tripura), Jiribam (Manipur); Champhai, Lunglei, Kolasib (Mizoram); Jamiri, Dirang, Pasighat (Arunachal Pradesh), Mokokchung (Nagaland); Diphu, Jagiroad, Tinsukia, Matmara, Jatinga, Chandubi (Assam) to gather information on packing leaves used by different communities of northeast India.

**Survey:** Before start of the work mandatory PIC was taken from the local healers particularly for medicinal uses of packing leaf. The field survey was conducted extensively in isolated pockets of Northeast India during January 2019 to March 2020. The information on traditional uses of packing leaf plants were gathered using a structured questionnaires and conversations with different age group of ethnic people (Figures 1, 2 & 3). During the interviews, informant's knowledge on local name, parts used, method of preparation, and dosages were documented. Taking assistance of the informants necessary voucher specimens was collected. All the collected plants were recorded in the Field Note Book along with the locality and geographical coordinates using a GPS. The collected plant specimen was tagged with the number as per the Field Note Book. Voucher specimen was, later on, processed in to mounted herbarium sheets following Jain and Rao (1977). Plants were identified using local flora including Materials for the Flora of Arunachal Pradesh (Hajra *et al.*, 1996, Mao *et al.*, 2016); Flora of Assam(Kanjilal et al. 1934-1940)and The Flora of British India (Hooker 1872-1897). For updated nomenclature www.plants of the world online.org and www. the plantlist.org were extensively consulted. The specimen has been deposited at TERI-Guwahati. Some photographs of field-survey has been provided in Plate-I.

## RESULTS AND DISCUSSION

### Indigenous uses of packing leaves

During the present study, a total of 13 broad categories of uses of packing leaf by the different community were documented (Table -1). Out of these packing leaf are very commonly used for Packing of fresh vegetables and other food items; packing of cooked and fresh edible items. Packing leaf has great demand in village restaurant. Vendors believe that their fresh commodities remain fresh when wrapped with packing leaves. Packing leaf has shelf life 25-30 days which makes the packing leaf more advantage over banana leaf which has 1-2 days shelf life. During survey it was also found that the different parts of packing leaf plant are also used to treat a total of five different ailments.

**Cultivation technique:** Packing leaf can be grown 100 m to 800 m above mean sea level. It is a shade loving plant. It grows well along natural stand and shady areas. One hectare area can accommodate 800 plants with a spacing of 3.5 m x 3.5 m. It grows well in humus rich soil and in temperature ranging 12°C to 35°C. Seedlings may be raise through seed and rhizome. Healthy seedling may be transplanted to field at the height of 50-60 cm. The seedlings can be planted in the field through pit digging. After plantation watering is required to pick up the growth of seedlings. After plantation it takes 1-2 years to attain harvestable stage.

**Management:** Three weeding (April, July, and October) is required in every year to keep the plantation weed free. Unhealthy leaves should be plucked from the base and burnt. FYM may be applied after one month of plantation for proper growth of the plant. Shade is required for good growth of the plant.

**Intercropping:** Packing leaf can be planted in the vacant place of Arecanut, Khasi mandarin, Banana, Dalchini, Bay leaf, Cashew nut, timber plantation site. as intercropping and orchard space can be utilized properly for additional income from same plot. The orchards plants will also provide shade for packing leaf plant.

**Harvesting:** A mature plant usually have 6-8 leaves, and 4-6 older leaves are can be harvested by cutting from the base, leaving two younger leaves for regeneration per season. In three months' time, the plant produces again the same number of leaves which become ready for harvesting. In one year, farmers could harvest three times from the same plant. From systematic cultivation and well maintained plot farmers may expect 9600 to 14400 leaves from one ha area.

**Marketing:** Packing leaf has got a very good market in Meghalaya. A small inter-state marketing with Assam and a small quantity is traded to Bangladesh via Dawki market. The growers bring the product to the local market where they sell it to the traders, who in turn directly sell it to the consumer at different local and regional markets. May to December is the peak season of packing leaf in the market. Shelf life of packing leaf is 25- 35 days. It can be used after 2-3 months if dried properly on kitchen chulla heat.

**Income:** Existing selling price of packing leaves vary from 25 paise to 50 paise depending on demand, season, leaf quality and place. A farmer can earn Rs.2400 to Rs.3600 (if selling price 25 paise) and if the selling price is 50 paise then income will go up to Rs. 4800 to Rs.7200 from one ha area. These can be an additional income

from packing leaf cultivation of one ha area if farmers do cultivation in arecanut, orange, banana, bay leaf, cashew nut, dalchini plantation area. Moreover, farmers can earn extra income by producing seedling and selling them in the market. The petiole of packing leaf is 30 cm to 50 cm and that can be also be used as binding material instead of plastic.

## CONCLUSION

This study has, established that the community of northeast India bear rich traditional knowledge on the wide ranges uses of packing leaf. There is need of awareness generation among the younger generation about the importance of packing leaf and its conservation and entrepreneurship development. The most serious threat to wild packing leaf population is the habitat destruction, expansion of agricultural land, over grazing, and over exploitation. As in most of the cases to prepare traditional dishes packing leaves are collected from wild sources and now-a-days it is difficult to get the packing leaves from its natural stand because of its declining population due to different anthropogenic pressures. Packing leaf can be grown in unutilized land of Areca nut, Banana, Dalchini plantation, Orange orchard. The packing leaf has few scopes and are summarize below (a).In one hectare natural forest 200 to 225 plants are found whereas in systematic plantation 800 plants / ha can be grown (b) Farmers can properly utilize their unutilized land in the orchard by planting Packing leaf as intercrop and can earn additional income from the same farm land (c) Packing leaf has very good market for whole Meghalaya, Assam and also international demand in Bangladesh (d) It is available throughout the year in the plantation plot (e) very less input is required for plantation and management (f) easy to carry from farm field to market (g) Pan, green Vegetables remain fresh if wrap with packing leaves (h) Packing leaf has good shelf life (i) The plant has cultural significance among some tribes of Northeast India (j) The leaf is used for fermentation of soya bean; to store water in a bamboo basket lined with packing leaf. Leaf used to wrap the steam rice balls retains some of its heat besides making it convenient for the farmer to carry it to the agricultural fields. To trap market potential of packing leaf, it can be made available in the city and town markets from the cultivation plots.

## ACKNOWLEDGEMENTS

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## CONFLICT OF INTERESTS

The authors declare that they have no competing interests for the work.

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**WEBSITES**

www.plantsoftheworldonline.org

www.theplantlist.org


**Table 1:** Packing leaf used for different purposes in northeast India

| Utility head | State | Community used | Specific uses |
|---|---|---|---|
| Packing of fresh vegetables and other food items by the vendor | Tripura | Jamatia, Chakma, Halam | In Tripura packing leaf is used to pack dry fish, fermented fish and salted Hilsa fish |
| | Manipur Mizoram, Nagaland, Assam Meghalaya | Mizo, Naga, Assamese, Karbi, Tiwa,Garo, Khasi, Jaintia, Kuki, Chiru Kom | In all the north-eastern states packing leaf is used to pack *Diplazium esculentum* popular sag of northeast India (Jhur Tyrkhang), *Centella asiatica* (Kynbat Moina, Brahmi), *Eryngium foetidum* (Etucha bellock), *Cucurbita moschata,* shoot & flower (Pathaw), *Colocasia esculenta* (Shriew, Matchitangong), *Portulaca oleracea* (Stilchi, Jiahusia), *Houttuynia cordata* (Jamyrdoh), *Rhynchotechum ellipticum* (Regong) etc. by the vegetable vendors as it remain fresh. |
| | Meghalaya | | Packing leaf is extensively used to pack betel leaf and sliced areca nut |
| | Assam | Deuri,Karbi, Mishing, Rabha,Dimasa, Tai Ahom | It is used to wrap eri and muga silk worms, ant egg (edible) and also local mushroom to sell in the market |
| Packing of cooked and fresh edible items by the vendor | Meghalaya | Khasi, Jaintia & Garo | Packing leaf is used to pack traditional cake, lunch, *Myrica esculenta* (Sohphie), *Elaegnus latifolia* (Soh Shang, Chhokhua), pinapple sliced fruits etc. |
| | Tripura | Jamatia, Tripuri | It is used to pack sliced cucumber, tamarind and berry to sell in the market |
| To prepare traditional dishes | Assam | Mishing, Deuri Tai Ahom, Tiwa, Assamese, Bengali, Singphoos | Traditional food item prepared from sticky rice called *Tupula* by wrapping in packing leaf and are served in special occasion and to special guest. Mishing and Deuri tribes used extensively packing leaf in all traditional festivals and religious ceremonies as wrapping material during food items preparation. It is used as wrapper to prepare steamed fish. Boiled recipes serve by Singphoos packed with the leaf of *Phrynium pubinerve* have a high position in their society and traditionally used in different festivals , socio religious occasions and used to serve special guest. |
| | Nagaland, Mizoram, Meghalaya, | Naga, Mizo,Kuki, Kom, Lepcha | *Aakhone*, is an ethnic fermented soybean food of Nagaland and *Bekang* is a fermented soybean food of Mizoram and packing leaf is used to |

| | | | |
|---|---|---|---|
| | Manipur, | | prepare this food item. |
| | Meghalaya | Khasi | Packing leaf is an integral part for preparation of traditional dishes like *Pusla, Tpumakrut, Pudoh. Putyndong* is an indigenous cylindrical rice based food is prepared using packing leaves. |
| | Mizoram | Mizo | *Tam-um* a Mizo dishes is prepared with the help of packing leaf. *Chhangban* a traditional rice dish and for making sticky bread or sticky rice cake packing leaves are used extensively |
| | Nagaland | Ao Naga | Packing leaf is used to prepare *Jangpangnatsu* a fermented food product made from crab by Ao Naga |
| | Arunachal Pradesh. | Galo | Packing leaf is used to prepare bamboo based fermented foods |
| Cultural uses | Assam | Mishing | Mishing wrapped all the agricultural implements through packing leaf at the first day of sowing for good harvest |
| Religious | Assam | Mishing, Deuri | Leaf of *Phrynium pubinerve* used by Mising as wrapper for the religious traditional food items. During *Dobur ui* ritual Mising people sacrifice cock, hen and pig to traditional deities and offer on packing leaf. The Po:ro Arug (fermented rice of Po:ro Apong) along with ginger and rice grains are placed on leaves of kamro (*Phrynium pubenerve*) as offering to the deities. |
| | Arunachal Pradesh | Adi, Hill Miri | Hill Miri of Arunachal Pradesh used packing leaves extensively in religious ceremonies and considered as holiest of plants. Leaves are used in rituals by the Adi tribe of Arunachal Pradesh. |
| Medicinal uses | Assam | Tiwa, Karbi | Extract of rhizome are make hot on burner and keep it for 15 minutes to become cool after that, one drop extract applied against earache |
| | Tripura | Jamatia, Chakma,Halam | Leaf paste applied against bone dislocation and make bandage with white cloth |
| | Arunachal Pradesh | Mishmi, Adi | Dried Seeds are crushed and make into powder and one table spoon mixed in half cup luke warm water and taken during chest pain |
| | Meghalaya | Khasi, Garo | Packing leaf is used to prepare herbal medicine against skin diseases. Paste of fresh rhizome is applied externally against boils |
| To harvest honey | Assam | Jaintia | Bamboo torch are made with dry and fresh leaves of *Phrynium pubinerve* to produce smoke which helps to cut honey comb from tree |
| Prepare rain coat/hat | Mizoram | Mizo | Rain hat prepared with the leaves of *Phrynium pubenerve* and used during rainy season for outdorr agriculture activities. |
| Container | Arunachal Pradesh | Nocte | It is a tradition to serve tapioca or rice beer prepared from conically folded packing leaves in special occasion to special guest. |
| | Mizoram | Mizo | Packing leaves are placed inside bamboo basket to store water. |
| | Assam | Jaintia | Jaintia of Assam bordering with Meghalaya used conical shaped bamboo basket inside lined with packing leaf to collect and store honey, jaggery |

| | | | |
|---|---|---|---|
| Packing kitchen item | Assam | Tiwa, Karbi | Packing leaves are used for packing salt, mustard seeds, sesame, black pepper, dry chilli,jaggery etc. |
| Food plate | Arunachal Pradesh. | Adi | Leaves used for packing rice grains during community festival |
| | Assam | Rabha,Assamese, Tiwa, Karbi | *Phrynium pubinerve* leaves are using as plate in community feast at Chandubi festival and Joon Beel mela |
| Food | Meghalaya, Manipur | Garo, Kuki | Fresh rhizome of *Phrynium pubinerve* wash and boiled properly then taken as food |
| Fodder | Arunachal Pradesh | Aka, Nyishi, Miji | Fresh leaves are used as fodder for cattle and pig |

**Plate1:** Photographs of field study carried out on packing leaf

**Fig.1** Interaction with villagers

**Fig.2** Collection of information

**Fig.3** Group discussion

**Fig.4** Harvesting packing leaf

**Fig.5** Packing leaf plant

**Fig.6** Jaggery packed with leaf

**Fig.7** Using as plate in local restaurant

**Fig.8** Silk worm wrapped in packing leaf by the vendor to sell in the market

**Fig.9** Betel leaf and areca nut wrapped in packing leaf by the shop keeper

**AUTHOR DETAILS:**

**ARINDAM BARMAN*[1], ASHISH KAR[2] AND SHEENA HAORONGBAM[3]**

[1*]Department of Horticulture, North-Eastern Hill University, Tura Campus, Chasingre, Meghalaya- 794002, India

[2]The Energy and Resources Institute (TERI), North Eastern Regional Centre, Chachal, VIP Road, Hengrabari, Guwahati-781 036, Assam, India

[3]Department of ABM&FT, North-Eastern Hill University, Tura Campus, Chasingre, Meghalaya- 794002, India

**Background:** Global production and consumption of plastics are increasing gradually day by day. Non-recyclable plastic is creating problems as it remains uncollected and scattered, causing damage to the environment. Considering the adverse environmental impacts of plastics and polythene bags, it is desirable to promote alternative packing material. *Phrynium pubinerve* (Sla Lamet/Reru) is a plant, the leaves of which are being used in Meghalaya, Mizoram, Nagaland, Manipur, Arunachal Pradesh Assam of northeast India as wrapping and packing material as alternative of plastic. It is a shrub belonging to the family Marantaceae and almost round the year availability of the leaves makes it a suitable packing material for boiled rice, pan, tiffin, meat, and vegetables in Meghalaya. *Phrynium pubinerve* is the most common wrapping and packing material in Meghalaya. Rhizome of packing leaf used as vegetable and to heal wound in some pockets of Meghalaya. The leaves are used in community feast, traditional rituals and also to prepare fish curry by wrapping packing leaf. It is also used as wrapping material in lieu of plastic sheet for air layering propagation of Khasi mandarin ongkwai village of Meghalaya.

The leaves are sold in the market in bundle form and are collected mostly from wild sources. Natural population of Sla Lamet / Reru is gradually decreasing due to overexploitation of wild population. Unsustainable harvest from wild is also causing threat and damage of the wild population. Cultivation of packing leaf will reduce the pollution in the environment and will also help to enhance income of the local population.

**Cultivation technique:** Packing leaf can be grown 100 m to 800 m above mean sea level. It is a shade loving plant. It grows well along natural stand and shady areas. One hectare area can accommodate 800 plants with a spacing of 3.5 m x 3.5 m. It grows well in humus rich soil and in temperature ranging 12°C to 35°C. Seedlings may be raise through seed and rhizome. Healthy seedling may be transplanted to field at the height of 50-60 cm. The seedlings can be planted in the field through pit digging. After plantation watering is required to pick up the growth of seedlings. After plantation it takes 1-2 years to attain harvestable stage.

This Brochure was published under the project "Cultivation of Packing Leaves Plant for Livelihood Enhancement of ST Communities and Promotion of Packing Leaves as Substitute of Plastics in Meghalaya" (Project ID: NMHS / 2018-19/ SG52/ 52) funded by National Mission for Himalayan Studies (G.B. Pant National Institute of Himalayan Environment and Sustainable Development, Almora, Uttarakhand, India

Extension Bulletin-1

**NEHU Tura Campus & TERI**

# Packing leaves and their commercial cultivation for livelihood promotion

**TERI Northeast Regional Centre**
**Chachal, VIP Road, Hengrabari,**
**Guwahati-781036**

**Management:** Three weeding (April, July, and October) is required in every year to keep the plantation weed free. Unhealthy leaves should be plucked from the base and burnt. FYM may be applied after one month of plantation for proper growth of the plant. Shade is required for good growth of the plant.

**Intercropping:** Packing leaf can be planted in the vacant place of Arecanut, Khasi mandarin, Banana, Dalchini, Bay leaf, Cashew nut, timber plantation site. as intercropping and orchard space can be utilized properly for additional income from same plot. The orchards plants will also provide shade for packing leaf plant.\

**Harvesting:** A mature plant usually have 6-8 leaves, and 4-6 older leaves are can be harvested by cutting from the base, leaving two younger leaves for regeneration per season. In three months' time, the plant produces again the same number of leaves which become ready for harvesting. In one year, farmers could harvest three times from the same plant.

From systematic cultivation and well maintained plot farmers may expect 9600 to 14400 leaves from one ha area.

**Marketing:** Packing leaf has got a very good market in Meghalaya. A small inter-state marketing with Assam and a small quantity is traded to Bangladesh via Dawki market. The growers bring the product to the local market where they sell it to the traders, who in turn directly sell it to the consumer at different local and regional markets. May to December is the peak season of packing leaf in the market. Shelf life of packing leaf is 25- 35 days. It can be used after 2-3 months if dried properly on kitchen chulla heat.

**Income:** Existing selling price of packing leaves vary from 25 paise to 50 paise depending on demand, season, leaf quality and place. A farmer can earn Rs.2400 to Rs.3600 (if selling price 25 paise) and if the selling price is 50 paise then income will go up to Rs. 4800 to Rs.7200 from one ha area. These can be an additional income from packing leaf

cultivation of one ha area if farmers do cultivation in arecanut, orange, banana, bay leaf, cashew nut, dalchini plantation area. Moreover, farmers can earn extra income by producing seedling and selling them in the market. The petiole of packing leaf is 30 cm to 50 cm and that can be also be used as binding material instead of plastic.

**Scope:** The packing leaf has few scopes and are summarize below (a).In one hectare natural forest 200 to 225 plants are found whereas in systematic plantation 800 plants / ha can be grown (b) Farmers can properly utilize their unutilized land in the orchard by planting Packing leaf as intercrop and can earn additional income from the same farm land (c) Packing leaf has very good market for whole Meghalaya, Assam and also international demand in Bangladesh (d) It is available throughout the year in the plantation plot (e) very less input is required for plantation and management (f) easy to carry from farm field to market (g) Pan, green Vegetables remain fresh if wrap with packing leaves (h) Packing leaf has good shelf life (i) The plant has cultural significance among some tribes of Northeast India (j) The leaf is used for fermentation of soya bean; to store water in a bamboo basket lined with packing leaf. Leaf used to wrap the steam rice balls retains some of its heat besides making it convenient for the farmer to carry it to the agricultural fields.

**Background:** *Phrynium pubinerve* (packing leaf) is an herb with creeping root stock. Leaves oblong, acuminate, base rounded or obtuse, leaves up to 52cm long and 35 cm broad at mature stage; petiole up to 60 cm long. Leaves of *Phrynium pubinerve* are being used as wrapping and packing material as alternative of plastic. It is used for many other purposes in Northeast India and glimpses of its uses are highlighted here. In Khasi it is called Sla-la-met and in Garo called as Reru (Meghalaya). In Adi language it is called Atkam pat; among Galo known as Ekkam; in Hill Miri known as Kamyir ook (Arunachal Pradesh); in Assamese it is called Kou-Pat; in Tai known as Tong Sing; in Karbi called as Loru; in Mishing called as Kamro; among Bengali known as Kitta patta (Assam) ; Mizo called it Hnahthial (Mizoram).

**Cultural uses**: Mishing and Deuri tribe (Assam) used leaf of the *Phrynium pubinerve* extensively in all traditional festivals and religious ceremonies as wrapping material during food items preparation. Mishing wrapped all the agricultural implements through packing leaf at the first day of sowing for good harvest

**Religious:** Leaf of *Phrynium pubinerve* used by Mising as wrapper for the religious traditional food items. During *Dobur ui* ritual Mising people sacrifice cock, hen and pig to traditional deities.

The Po:ro Arug (fermented rice of Po:ro Apong) along with ginger and rice grains are placed on leaves of kamro (*Phrynium pubenerve*) as offering to the deities. Hill Miri of Arunachal Pradesh used packing leaves extensively in religious ceremonies and considered as holiest of plants. Leaves are used in rituals by the Adi tribe of Arunachal Pradesh.

**Medicinal uses:** Whole plant of *Phrynium pubenerve* is warmed over fire when a sap starts oozing out from the plant. The sap is applied as drops internally in to the ears. 2-3 drops once daily in the morning against earache sometimes rhizomes are also used against earache by the Karbi tribe (Assam). Mature leaves of *Zanthoxylum acanthopodium*, *Pteridium aquilinum* rhizome, *Sarcandra glabra* leaves are grinded. Fine mixture is then wrapped into many small packets with *Phrynium pubinerve* leaf and the packets are heated in the fire and covered with ash so that they do not get burnt.

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Extension Bulletin-2 (2019)

# Manifold uses of packing leaves in Eastern Himalayan States

**TERI Northeast Regional Centre**
**Chachal, VIP Road, Hengrabari,**
**Guwahati-781036**

After half an hour, all the packets are taken out while it is hot and the contents of each packet is then emptied into a piece of white cloth and tied at one end. It is then fomented on the body of persons suffering from leprosy and in treating various kinds of skin diseases. In case of boils, rhizome paste of *Phrynium pubenerve* is applied locally by the Khasi tribe. The paste of rhizome is used to relieve mental stress. The crushed seeds are taken during chest pain by the Adi tribe. Chakma tribe applied leaf paste against bone dislocation.

**Traditional dishes:** A traditional food item prepared from sticky rice called Khao Nong or Tupula Bhat (Steamed rice ball) nicely wrapped in freshly collected leaves of *Phrynium pubinerve*. It is also used as wrapper to prepare steamed fish in Assam. The boiled recipes serve by Singphoos of Assam packed with the leaf of *Phrynium pubinerve* have a high position in their society and traditionally used in different festivals , socio religious occasions and to serve special guest.

**Traditional honey harvesting**: *Pnar* tribes of Cachar district, Assam is use smoke and chase technique for cutting the comb. They first prepare a bamboo torch with dry and fresh leaves of *Phrynium pubinerve* to produce smoke. For collecting honey from the tree they use a bamboo basket. They then arrange the packing leaves (Sla-la-met) in the basket to collect the honey. They place packing leaves inside the basket in such a manner that the honey does not come out of it.

**Rain coat/hat**: The rain hat is called Lukhu, prepared by Laker tribe of Mizoram. Hat is formed of two circular piece of bamboo latticework, dome shaped and rising to a flattish peak, between which are placed the waterproof leaves of *Phrynium pubenerve* (Chaihua).

**Container**: It is a tradition of Kasiks (Nocte tribes) of Arunachal Pradesh to drink distilled tapioca or rice beer prepared from conically folded packing leaves when the moderator bearing news or information regarding the marriage ceremony. In Mizoram packing leaves are placed inside bamboo basket to store water.

**Packing material**: Packing leaves are used by Karbi tribes for packing kitchen items. *Aakhone*, is an ethnic fermented soybean food of Nagaland and *Bekang* is a fermented soybean food of Mizoram and packing leaf is used to prepare this food item. Packing leaf is used to prepare Bamboo based fermented foods by Galo tribe of Arunachal Pradesh. *Jangpangnatsu* is a fermented food product made from crab by Ao Naga of Nagaland. And packing leaf is used to prepare this food. To prepare *Tam-um* (fermented mustard), *Chhangban* a traditional rice dish and for making sticky bread or sticky rice cake packing leaves are used extensively.

In Meghalaya, traditionally boiled snacks are prepared by mixing the pounded non-sticky rice with melted jaggery and a pinch of baking soda. Small portion of the mixture is taken on a fresh packing leaf wrapped properly with it and keep in the vessel containing boil water and steam or boil till the leaf turns brown. This snack called *Pusla* in Khasi and *Tpumakrut* in Jaintia and usually prepared during festivals, marriage, occasions. *Putyndong* is an indigenous cylindrical rice based food is commonly prepared by the Khasi tribe of Meghalaya using packing leaves. Traditional boiled: pork patty is prepared by stuffing inside the powdered rice paste *Pudoh* in Khasi

**Food plate**: Leaves used for packing rice grains which is consumed during community festival by the Adi tribe of Arunachal Pradesh. *Phrynium pubinerve* leaves are using as plate in community feast at Chandubi Festival (Assam).

**Food**: Fresh rhizome of *Phrynium pubinerve* wash and boiled properly then taken as food in in isolated pockets of Manipur and Meghalaya.

**Fodder:** In Arunachal Pradesh leaves are used as fodder for cattle and pig.

**Nikanio pangchakani:** A.gilsak gimik tariani ba bikotani a.sel aro plasticko salantio jakkalani barianio dingtanganiko ong.ata. Gimatna man.gijagipa plasticko jakkalanichi namgijako ra.baa maina iara chimongna man.gija dongkamgipa aro pipraanichi samtangtango donggiparangko nosto ong.ata. Plastic aro polythene bagko jakkalgija samtangtango donggiparangko nosto ong.ataniko champengna gita uni pal dintang kadepgipa bostuko jakkalaniko tang.doatna nanga. *Phrynium pubinerve* (Re.ru) pangni bi.jakko Meghalaya, Mizoram, Nagaland, Manipur, Arunachal Pradesh, Assamni northeast India a.songni bakrango bostuko kadepna plasticni pal jakkala. Ia chongipa pangni ma.pangara Marantaceaeoni ong.a aro ia pangkora bilsi antian man.kamaia gita ong.ani gimin song.gimin mi, pan, mesal, be.en aro mesurangko katomna jakkaltogipa Meghalayao ong.a. *Phrynium pubinerve* (Re.ru) pangko bosturangko kadepna aro katomna Meghalayao jakkalbata. Ia pangni ja.pangko mesu gita jakkala aro mata bu.ako namatna badiaba Meghalayani bakrango jakkala. Noksul songsul alanio, dakbewal gita aro song.gimin na.tok bi.jakko kadepna ia pangni bi.jakko jakkala. Khasi mandarin (komila) pangko jelatna re.ru bi.jakko air layeringna (mitap mitap dake balwajokna gita pangko wene taria) kadepna plastic pa.ranggipani pal iako Meghalayani ongkwai songo jakkala.

Re.ru pangni bi.jakko bajaro katome tarie pala aro mongsongbate ia pangkora buringonikosa am.e manbata. Chatelgipa re.ru pangni jelani ka.sine komiangani a.selara buringni sam bolrangko agre simsakgija jakkalnichisa ong.a. Dontonggija chatelgipa sam bolrangko ra.achi buringo chagipa sam bolrangni jelaniko nosto ka.a. Re.ru pangko ge.anichi samtangtango dongipa bosturangko nosto ka.aniko komiata aro ia biapo dongipa manderangni kamaianiko bariatna dakchaka.

**Ge.ani niam:** Re.ru pangni bi.jakko 100m oni 800m onachubate apalate ge.na gita mana.Ia pangara salakimko nangbata. Re.ru pangara sronge chaa baksa salakimgipa biapo name chabata. Sa hectare biapo 800 pangko chakgate 3.5 m x 3.5 m apalate ge.na man.a. Ia pangara a.sal gnangipa biapo aro adita ding.a 12°C-oni 35°C-ona ong.oba name chana man.a. Ia bimik nadaldalko bitchil ba jadilchi chaata. Namgipa bimik nadaldalko ge.jite 50-60cm ong.e chugipa bakrao ge.a. Ia bimik nadaldal pangko bakrao a.kol cho.e ge.a. Ge.ani ja.mano chi on.a nanga jedakode bimik nadaldalgiparang name dal.rorona man.gen. Ge.ani jamano re.ru pangni bi.jakko bilsisaoni bilsigni ong.aosa akani somoi soka.

Extension Bulletin-1
(Garo language)

**TERI &NEHU Tura Campus**

# Kadepna jakkalgipa pangni bi.jak aro iako ge.e palanichi janggi tangani gadangko ra.doa


**TERI Northeast Regional Centre**
**Chachal, VIP Road, Hengrabari,**
**Guwahati-781036**



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**Nirok simsakani:** Charamramgipa samsirangoni ge.gimin pangko champengna gita bilsi antian changgittam dake (April, July, aro October) samsiko pike galna nanga. Bi.jak namgijagipako ja.pangniko aka aro so.e gala. Re.ru pangna a.sal gnangipa (FYM) a.mangko jasa ong.e ge.ani ja.mano name dal.roroe chana gita a.salko on.a nanga. Re.ru pangara name chana gita salakimko nangbata.

**Panggipin baksa ge.dima:** Re.ru pangko Arecanut (gue), Khasi mandarin (komila), Banana (te.rik), Dalchini, Bay leaf (tez pata), Cashew nut, boltongrang baksa bangbang ong.e donggipa biapo ge.na gita man.gen. Jekai pangrangko ge.dimna aro bangbang ong.e donggipa baganni a.ako name jakkale apsan biaponiko tangka man.dapna dakchaka. Bagano ge.gipa bolrangba re.ru pangna salakimko on.a dakchaka.

**Akani somoi:** Bregimin pangara pangnan kingdokoni ge.chet bi.jak gnang aro bi.jak gitchamko ge.brioni ge.dokko ja.pangniko rate ra.na man.a, dambegipa bi.jak kingniko bilsi kario rittimtaina rakkina nanga. Jagittamni somoio, apsan dake re.ru pangni bi.jakkrang ritim taion ake ra.na nama. Bilsisao, game cha.giparang changgittam dake apsan pangoniko bi.jakko ake ra.na man.a. Niamko ja.rike ge.anio aro a.a tong.sako name rakkiachi game cha.giparang king hajalritchadokoni hajalchi.bri bi.jakkrangko (9600-14400) sa hectare biaponiko man.a ka.donga.

**Bading chiwalani:** Re.ru pangara Megahalayo donggipa bajarrango namen dam gnang. Ia pangni bi.jakko Assam a.songoba pala aro Ia pangko bang.gija Dawki bajaroniko Bangladeshona palata.Ge.e game cha.giparang re.ru pangko bajarona ra.bae bregiparangna palata, jemangan ra.na am.a uamangna rang.sanan dingtang biaprangchi palatskaa. May jaoni December ja kario bajaro palako manbata. 25oni 35salona ia pangni bi.jak name dongkama. Re.ruko ja 2oni 3 jagittamona chankolo name ran.ate donode jakkalna man.a.

**Kamai:** Re.ru pangna tik ka.gimin palani dam gong 25oni gong 50ona nanganio pangchake baria, karinikri, bi.jak namanikri aro biapnikri. Ge.e game cha.giparang gong2400oni gong3600ona tangka man.a (palani dam gong 25 ong.ode) aro tangka gong 50 ong.genchimode tangka man.ani gong 4800oni gong 7200ona man.ani tang.dogen hactare sa biaponiko. Re.ru pangni bi.jakara tangka man.dapna dakchaka.

Re.ru pangko sa hactare biapo ge.e cha.giparang ge.aniko arecanut(gue), orange(komila) banana(te.rik), bay leaf (tez pata), cashew nut dalchini baksa ge.ani biapo ge.aniko dakode. Aroba ge.e game cha.giparang bimik nadaldalko tarie arc bajaro palgenchim ong.ode tangka man.aniko bariata Re.ru pangni ga.teng 30 cm oni 50 cmona ong.a arc plastic ni pal iachi katome jakkalskana mana **Miksongani:** Re.ru pangni bi.jakkara banggija miksongani gnang aro ka.mao iako kan.dike talata (a) Hectare sa ong.gipa buringo 200oni 225ona man.a jeon niamko ja.rike pang 800ko / hactareo ge.na man.a (b) Ge.e game cha.giparang jakkalgijagipa baganni biapko name jakkale gipin pang baksa ge.chapna man.a aro bang.en man.dapaniko man.a (c re.ru pangara gimikchin jekai Meghalaya, Assan bajarrango aro Bangladeshni a.palchi namen dan gnang (d) Re.ru pangni bi.jakko bilsi gimikan man.a (e) Re.ru pangko ge.na aro nirokna bang.e koro ong.ja (f) ia pangko a.baoni bajarona ra.bana altu (g)Pan bi.jak, tangsekgipa mesurangba name dong re.ru pangni bi.jakchi katome dono (h) re.ru pangn bi.jakara ru.utaona baigipa ong.a (i) re.ru pangn bi.jakara jatni dakbewalnikri namgni bang.a Nortl East Indiao (j) re.ru pangni bi.jakko soya beank soate tarina jakkala; re.ru pangni bi.jakchi tarigipa kokchengo chiko chimonge dona. Bi.jakchi m tomgipako katome dono dinge donga maina indak dakanichi ge.e game cha.giparangna a.bachi reang ran.a jakkaltoa.

**Nikanio pangchakani:** *Phrynium pubinerve* (Re.ru) bi.jakara changrogijagipa boldim ja.dil ja.pang baksa wengipa ong.a.Ia pangni bi.jakara ro.dronga, ro.choka, ja.pang bo.roma ba ro.dingding dake chone petchoka, 52cm ong.e bi.jak ro.a aro 35cm apala bi.jakni breani gadang soko; bi.jakni ga.tong 60cm ro.a. Re.ru bi.jakko kadepna aro bostuko katomna plasticni pal jakkala. Northeast Indiao re.ru dingtang dingtang nanganirangna jakkala aro ia pangko jakkalanio nangchongmotaniko iano nimraka. Khasi ku.sikchi Sla-la-met minga aro Garo ku.sikchi re.ru minga (Meghalaya). Adi ku.sikchi Atkam pat minga; Galoni gisepo Ekkam minga; Hill Mirichi Kamyir ook minga (Arunachal Pradesh); Assamesechi Kou-Pat minga; Taichi Tong Sing minga; Karbichi Loru minga; Mishingchi Kamro minga; Bengalini gisepo Kitta patta minga (Assam) ; Mizochi Hnahthial minga (Mizoram).

**Jatni jakkalanirang**: Mishing aro Deuri jat (Assam) ia pangni bi.jakko dakbewal gita maniani salo aro toromni gita manianio cha.aniko tario kadepna jakkala. Mishing jat ge.na jakkalgipa bostuko ia pangni bi.jakchi ge.na skang kadepe dona jedakode akani somoio namgen.

**Toromni gita:** Mising jat maniani salo cha.aniko kadepe on.a jakkala. *Dobur ui* maniani salo Mising jatrang do.bipa, do.bima aro wakko dakbewalnikri boli on.a.

Po:ro Arug (miko soate tarigipa Po:ro Apong) e.ching baksa aro merongko dime kamro (reru/ *Phrynium pubenerve*) bi.jakko done cha.na on.a. Arunachal Pradesh Hill Mirio bi.jakko toromni maniani salo jakkala aro ia pangni bi.jakko rongtalgipa ine chanchia. Arunachal Pradesho Adi jat ia pangni bi.jakko dakbewalnikri jakkala.

**Samna jakkala:** *Phrynium pubenerve* (Re.ru) panggimikko wa.al kosako ding.bomata jensalo pangni sekki ka.sine ong.kata. Re.ru pangni sekkiko nachil ning.o tingtotata.salantin pringo changsa chang gni-gittam dake tingtotate nachil saako namata basakoba pangni ja.pangko nachil sa.dikako namatna Karbi jatrang (Assam) jakkala. Bregimin bi.jakrang jerangan *Zanthoxylum acanthopodium* (Bokay timber), *Pteridium aquilinum* ja.pang (Eagle fern), *Sarcandra glabra* (Nine knotted flower) bi.jakrangko natkninga. Name bringiminko chone chone re.ru bi.jakchi kadepa aro

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Extension Bulletin-2 (Garo language)

**NEHU Tura Campus & TERI**

# Salaram jol Himalayan State-o re.ru pangni bi.jakko bang.a kamna jakkala

**TERI Northeast Regional Centre**
**Chachal, VIP Road, Hengrabari,**
**Guwahati-781036**

Kantasa ata ja.mano, kadepgipa bostuko ding.mitingon bikota aro re.ru bi.jak kadepgipaniko cha.aniko ra.gale ba.ra gipoko donskaa aro ku.chotko kaa. Re.ru pangni bi.jakko be.eno konchi ritamko sanna nonge jakkala aro be.enni bang.a rokom sabisiko sanna jakkala. Be.en chibomitingo, Khasi jat re.ru pangni ja.dilko dokdepe nongdapa. Pangni ja.dilko dokdepe tapo giskni neng.akoba namata. Adi jat ia pangni bitchilko bnekate ka.tong saana jakkala. Chakma jatrang greng rongretana bi.jakko bnekate tapa.

**Jatni cha.rongbewal:** Cha.ronggipa cha.aniko stapgipa merongoniko taria jekon Khao Nong ba Tupula Bhat (Stapgipa miko bo.romate taria) minga name dake akdaldalgipa re.ru bi.jakchi kadepa. Na.tok ritako kadepna Assamo jakkala. Assamni chu.gipa Singphoo jatrang dakbewal gita bi.jak ritako, re.ru bi.jako on.a aro dakbewalgita dingtang dingtang manianirango, tomromni gita maniani salo aro sokbagipa mandena on.a.

**Jatni dakbewal gita bija bitchiko raa**: Cachar districtni *Pnar* jat, Assamo bija birangko (honey comb) rate ra.ani cholko wal.kuchi bijarangko arikate rate raa. Skanggipa re.ru pangni gitalgipa ran.gipa bi.jakko wasingo sike so.e walkuata. Bija bitchiko boloniko ra.na gita kopatchiko jakkala. uamang kopatchio re.ru bi.jakko (Sla-la-met) name done tarie bija bitchiko ra.a. .

Bija bitchi seljana gita kopatchi ning.o re.ru bi.jakko name dona.

**Mikka waao gana chola kot ba topiko taria**: Mizoramo donggipa Laker jatrang mikka waao gana chola kotko taria jekon Lukhu ine minga. Topiko wa.achi wengni dake kae mikkangchina songchoke nadoe dalgape, gisep gita chi napjana gita re.ru bi.jakko (Chaihua) done taria.

**Bostu sike dona jakkalani**: Arunachal Pradesho Kasikhs(Nocte tribes) jatrang ta.bolchuko rite cheke ringna ba chubrokko pe.demgipa re.ru pangni bi.jakoniko taria je somoio kobor on.timgipa bia ka.ani koborko on.a. Mizoramo ia pangni bi.jakko kopatchi ning.o name tarie done chiko ra.na jakkala.

**kadepna jakkalgipa bostu**: Karbi jatrang re.ru pangni bi.jakko babilsini bosturangko katomna jakkala. Nagalando, soya beanko soate *Aakhone* minggipa cha.aniko taria aro Mizoramo soya beanko soate *Bekang* miggipa cha.aniko re.ru bi.jakko jakkale taria. Arunachal Pradeshni Galo jatrang me.achi soate tarigimin cha.anirangko tarina re.ru bi.jakko jakkala.Nagalando donggipa Ao Naga jatrang ang.keko soate *Jangpangnatsu* minggipa cha.ani bostuko taria. Aro re.ru bijako ia cha.aniko tarina jakkala. *Ṭam-um* (soatgimin laisak), *Chhangban*ara jatni chabewal pura bi.jak aro stapgipa minil pitako tariana ba wantiko re.ru bi.jakko depna jakkalronga.

Meghalayao, jatni cha.bewal ritgipa cha.anirangko stapgijagipa mini purako brine mitaiko on.e taria aro bang.gija sodako pudapa. Brine tarigimin cha.anini bakko bang.gija akdaldalgimin bi.jako name kadepe aro me.diko done chi dingani bibachi ba ritachi kadepgipa re.ru bi.jak gitchakmrang ong.jana kingking dona. Khasichi ia cha.aniko *Pusla* ine *minga* aro Jaintiachi *Tpumakrut* ine minga aro basakoba alani somoio, bia ka.ao, maniani salo tarironga. Khasi jatrang Meghalayao *Putyndong* minggipa michi tarigipa cha.aniko re.ru bi.jakchi kadepna jakkala. Jatni cha.rongbewal rita bi.jak; wak mitimko mini pura baksa dapdape stapate *Pudohko* Khasirang taria.

**Cha.ani chachakani**:Arunachal Pradesho donggipa Adi jatrang maniani salo miko re.ru bi.jakko depe cha.na jakkala. Assamo chandubi minggipa maniani salo cha.anirangko cha.chakna re.ru bi.jakko jakkala.

**Cha.ani**: Re.ru pangni gitalgipa ja.dilko sugale aro name dake rite uni ja.mano cha.ani gita Manipur aro Meghalayani chel.gipa bakrango jakkala.

**Ran.gimin jeng:** Arunachal Pradesho re.ru pangni bi.jakrangko matchu aro wakna jeng gita jakkala.

**Background:** Ka jingpynmih bad ka jingpyndonkam ia ki plastik ka la nang kiew katba dang iaid ki sngi. . Non-recyclable (bym lah ban pynthymmai pat) plastik ki pynmih ia ki jingeh namar ba kim pyut bad ki sah da ki phew-phew snem ha ka mariang bad lada um lum bha ia ki,kin saphriang kylleng bad pynduh noh ia ka jingsboh jong ka khyndew bad ka jingbhabriew jong ka mariang. Lada ngi pyrkhat bha ia ki jingduh jong ki beg plastic bad ki beg polythene , ka long kaba donkam ban ai jingmut da kiwei ki lad ban punduna ia ki jingpyndonkam jong kine ki mar . *Phrynium pubinerve* (Sla Lamet/Reru) u dei u jait

sla ba ju pyndonkam ha kiba bun rukom khamtam eh ha kaba ngi song jingsong um tang ha ka jylla Meghalaya hynrei kum ha Mizoram, Nagaland, Manipur, Arunachal Pradesh Assam jong ka northeast India kum ki kynja jingsong ne jingthep ,kaba long da kawei pat ka lad ban punduna ia ki jingpyndonkam ia ki beg plastik. Une u jingthung u dei u kynja dieng phyrngop ba kynthup ha ka family Marantaceae .Une u jingthung u im baroh shisnem bad ia ki sla lah ban pyndonkam kum ki jingteh song ia ki mar ki matta kum ia ka ja, u kwai, tiphin, ka doh, bad ki jhur . *Phrynium pubinerve* u dei u jingtehsong uba ju pyndonkam bha ki briew jong ka Ri Meghalaya. Rhizome (u jingtang ba mih hapoh ka khyndew), lah pyndonkam ruh kum u jhur bad ki don ki shnong ba juh pyndonkam ruh kum u kynbat ha jylla jong ngi. Ia ki sla la ju pyndonkam ha ka por khawai-dawai,ha ki por lehniam bad kumjuh ruh la pyndonkam kum ka song ha kaba shet dohkha . la pyndonkam ruh ia ki sla kum u kynja jingtap ne jingsiang ha ka jaka jong ki plastik siang na ka bynta ka air layering propagation (ka rukom pynkha ia ki jingthung da kaba pait tnat bad tehsong ha ki jaka sngem ha uwei pat u khiew ban pynkha na u tnat kmie ) kum ba leh ha u soh Khasi mandarin (soh niamtra) ha ka shnong ongkwai jong ka Ri Meghalaya.

Hadien ba lah wan kheit ia kine ki sla na ki khlaw , ki die ha ki iew ki hat hadien ba ki lah dep song. Hynrei ka jingmih jong une u Sla Lamet / Reru ka la nang duna namar ka jing leh bymsuidniew ki briew.Ka rukom kheit kulmar ia kine ki sla na ki khlaw ki btap ruh ki pynmong bad pynduh noh ia u jingthung .Kumta ngi dei ban pynneh bad sumar bha ia une u jingthung khnang ba kan long ka jingmyntoi ia ngi ki khun bynriew ha ki pateng kiba hadien khang ba suki pa suki ngi lah ban pynduh jait ia ki plastik beg kiba long ka jingma ia ka mei mariang.

**Cultivation technique (ka rukom thung):** Une u sla lamet/reru u long bha ban thung kumba 100 m haduh 800 m halor ka sla duriaw (above sea level). U dei u jingthung ba sngewtynnad ia ki

# Extension Bulletin-1

## (Khasi language)

### TERI & NEHU Tura Campus

# Packing leaves and their commercial cultivation for livelihood promotion


**TERI Northeast Regional Centre**
**Chachal, VIP Road, Hengrabari,**
**Guwahati-781036**



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jaka ba sngem bad ba kah syrngiew.Ha ka shi hektare ka area ngi lah ban thung haduh 800 tynrai bad ka jingjngai ka dei ban long 3.5 m x 3.5 m uwei na uwei u tynrai. U mih bad san bha ha ki khyndew sboh bad ka temperature kumba 12°C haduh 35°C. Une u jingthung lah ban pynkha na ki symbai ne u jingtang ba mih hapoh ka khyndew. Ia ki symbai ba bha lah ban thung ha kper hadien ba ki lah jrong kumba 50-60 cm .Kine ki sla jingthung la thung da ka pit-digging (tih thliew).Ynda lah dep thung ngi dei ban ai um ban un heh un san bha u jingthung . Ngi lah ban ot hadien 1-2 snem .

**Management(jingsumar):** lai sien ha ka shisnem ngi dei ban pynkhuid niut (April, July, and October) ba ka kper bad u jingthung un long uba bha bad ba khuid. Ia ki sla kiba don jingpang dei ban ot bad ban thang shijaka . Ai sboh mrad hadien shibnai na ka sngi ba thung khang ban un heh bha u jingthung. Ka jingkah syrngiew ka long kaba kongsan na ka bynta ka jing heh jing san bha jong u Sla.

**Intercropping(ki jingthung jong u Sla Lamet bad kiwei bad ki jingthung):** Une u sla ,la lah ban thung lang bad u kwai , u soh niamtra , ka kait, Dalchini, sla tyrpad, cashew, bad diengbah. Ka jingthung lang ia u Sla Lamet bad kine ki jait jingthung kan iarap ban ai jingmyntoi shuh shuh ban nym sepei ka jaka . Kine ki jingthung ruh ki iarap ban ai syrngiew ia u Sla Lamet.

**Harvesting(ka por ot):** U jingthung uba lah iaw u mih kumba 6-8 sla, bad ngi lah ban ot 4-6 sla kiba iaw bad ieh 2-3 tylli ki sla lung ban kin nang heh . Hadien 3 bnai' u jingthung un met biang bad un pynmih biang ki juh ki number jong ki sla ba lah ban ot biang . Ha ka shi snem, ki nongrep ki lah ban ot lai sien na ujuh u tynrai.Lada ki sumar bha ia une u jingthung ki nongrep ki lah ban ioh kumba 9600 haduh 14400 ki sla na shi hectre area.

**Marketing (ka jingkhaii):**Kine ki sla jingsong ki man bha ha Meghalaya. Ka jing ia die ia thied bad kiwei pat ki state kum ka Assam, wat sha ri Bangladesh lyngba ka iew Dawki . Ki nongrep ki juh wanrah ia kine ki mar sha ki iew ki hat bad ba ki die . Jymmang haduh Nohprah ki dei ki bnai ba iaid bha ka jingkhaii jong une u sla jingsong ha ki iew ki hat. Ngi lah ban pynsah ia kine ki sla hadien ba ot kumba 25- 35 sngi. Lah ban pyndonkam biang hadien 2-3 bnai tad ynda ki lah tyrkhongbha.

**Income (jingioh):** ha ka por kaba mynta ka dor die jong une u sla ka dei 25 paise haduh 50 paise, ka shong ruh ha ka jingdawa bad ka jaka .U nongrep u lah ban iohnong kumba Rs.2400 haduh Rs.3600 lada die ha ka dor 25 paise ,lada ki die ha ka dor 50 paise ka jingioh ka lah ban kiew kumba Rs. 4800 haduh Rs.7200 na shi hectre area. Kine ki long ki jingiohnong na kine ki Sla song. Da thung haduh shi hectare area une u Sla Lamet bad kiwei pat ki jingthung kum u kwai, sohniamtra, ka kait, sla tyrpad, cachew , dalchini u nongrep u lah ruh ban ioh nong kham bun da kaba khaii lang kine ki jingthung ha iew. U thning ba pyniasoh u sla bad u jyntang (petiole) jong ki sla jingsong u dei kumba 30 cm haduh 50 cm ,lah ban pyndonkam ruh kum u kynja jingteh ha ka jaka ki plastik .

**Scope(ka lad):** Ki sla jingteh song ki don kine jingthmu :(a).Ha ka shi hectare ba mih ha khlaw lah shem kumba 200 to 225 tynrai hynrei ha ki kper lah ban thung kyrpang ki mih kumba 800 tynrai . (b) ki nongrep ki lah ban pyndonkam bha ia ki jaka ki puta da kaba thung ruh kiwei ki jait jingthung ban ioh nong kham bun. (c) Une u sla song u iaid bha ha ki iew ki hat khamtam ha ka jylla Meghalaya, Assam ki jylla kiba hajan wat shaduh Bangladesh (d)Une u jingthung u mih baroh shisnem (e)U dei u jingthung ubym da donkam ban sumar bniah . (f) U long uba sting bad ba suk ban rah (g) U kwai ,tympew ,bad kiwei pat ki kynja jhur sla ki im bha da kaba song da une u sla (h)Une u jait sla u kham im slem ban ia kiwei ki sla (i) Kine ki sla ruh ki don la ki jong ki bynta ha ka jing lehniam lehrukom (j) la pyndonkam da kine kisla ban pdem ia u rymbai, . la ju pyndonkam ruh ban song ja ba kan shongsyaid..

**Background:** *Phrynium pubinerve* u dei u kynbat ba don u tynrai ba par shapoh ka sla kyndew . Ki sla ki long kiba shaltuin, kiba nep na tduh, ki pyllun na trai, bad ki sla ki jrong kumba 52cm bad iar kumba 35 cm ynda ki la kham iaw. Ki sla jong u *Phrynium pubinerve* la ju pyndonkam kum ki jingteh song ha ki jaka jong ki plastic .Ia une u sla la ju pyndonkam bha ha northeast India . Ha ka ktien Khasi la khot u Sla-la-met bad ha ka ktien Garo ki ju ong u Reru (Meghalaya). Ha ka ktien Adi la khot u Atkam pat; hapdeng ki Galo pat la ju khot kum u Ekkam; ha Hill Miri ki khot u Kamyir ook (Arunachal Pradesh); da ka Assamese pat ki khot u Kou-Pat; ha ka ktien Tai la ju khot u Tong Sing; bad da ka Karbi la khot kum u Loru; ha ka ktieng Mishing lah khot kum Kamro; bad hapdeng ki Bengali lah ai kyrteng kum u Kitta patta (Assam) ;ki nong mizo ki ong u Hnahthial (Mizoram).

**Jinghikai tynrai (Cultural uses)**: Ki Mishing and Deuri (ki jait bynriew ki nong Assam) ki pyndonkam ia une u sla *Phrynium pubinerve* ha ki por lehniam leh khawai kum ki jingtehsong ia ki jingbam . Ki briew Mishing ki ju song ia ki symbai shwa ba kin rep ha kine ki sla namar ba ki ngeit ba ki jingthung ki plung bha bad seisoh bha ynda lah dei ka por ot.

**Jingleh niam (Religious):** Ki sla jong u *Phrynium pubinerve* ba pundonkam da ki briew Mising ia une u sla haba ki teh song ia ki jingbam ha ka por lehniam .Ka jinglehniam jong ki kaba ki khot *Dobur ui* da ki Mising ki ia knia ia ki syiar ki sniang bad kiwei kiwei .

U Po:ro Arug (khaw pdem of Po:ro Apong) bad u sying bad u khaw la buh halor u sla kamro (*Phrynium pubenerve*) kum ki jingai sngewbha ia ki Blei . ki paid Hill Miri jong ka Arunachal Pradesh ki ngeit ba kine ki sla ki long kiba khuid bha.. Ki sla la pyndonkam da ki nong Adi jong Arunachal Pradesh ha ka por lehniam.

**Dawai (Medicinal uses):** Haba pynsyaid ha ding ia une u sla *Phrynium pubenerve* ki mih ki um bad ia kane ka um lah pyndonkam kum ha dawai shkor da ki nong Karbi (Assam). U sla iaw jong u *Zanthoxylum acanthopodium*, *Pteridium aquilinum* rhizome(u jyngtang ba mih hapoh khyndew), bad u sla *Sarcandra glabra*lah la dung bad song ha u sla *Phrynium pubinerve* bad la pynkhluid ha ka ding da kaba kyllan da u dpei ban nym ing. Hadien shiteng kynta ,lah shim ia

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**Extension Bulletin-2**

**(Khasi language)**

**TERI & NEHU Tura Campus**

# Manifold uses of packing leaves in Eastern Himalayan States

**TERI Northeast Regional Centre**
**Chachal, VIP Road, Hengrabari,**
**Guwahati-781036**

kine ki song bad la pynlait ia ki ha ka jain sada bad teh skhem bad la ju pyndonkam ha kaba kyllan ha ka. met u briew ba pang niangthohlieh bad kiwei ki khniang jingpang sniehdoh. Da pang tohjaw ki briew khasi ki tah da u jyngtang ba mih na kyndew jong u *Phrynium pubenerve* . ia ki symbai sa dung bad la ju pyndonkam ha kaba pang shadem . Ki nong Adi bad Chakmaki ki ju tah ruh da lait doh .

**Jingbam tynrai (Traditional dishes):**ki jingbam ba shet da u khaw shulia ,Khao Nong lane Tupula Bhat la song bha hakine ki sla *Phrynium pubinerve.* La ju pyndonkam ruh da shet dohkha ha Assam. Ki jingbam tynrai da ki nong Singphoos jong Assam ki ju pyndonkam bha ia une u sla *Phrynium pubinerve* ha ka por lehniam leh rukom ne ki por khawai dawai ,ban sam jingbam ia ki briew ba wan jngoh kai.

**Khlong ngap (Traditional honey harvesting)**: Ki nong *Pnar* na Cachar distrit (Assam)ki shu synhaw da ka tdem ding ban shim ia ka rew ngap .Ki thang da ki prew bad ki sla ba im jong u *Phrynium pubinerve* ba kan mih bha ka tdem.Ban lum ia ka ngap ki ju pyndonkam da ki kriah ba lah siang bha da kine ki Sla-la-met khnang ba ka ngap kam nym sepei ne jaw sharud.

**Tupia da slap (Rain coat/hat)**: ka tupia iada slap ,(Lukhu), ba la shna da ki nong Laker jong ka Mizoram. Ia kane ka tupia la shna bad pynwandur da ki siej bad ki sla *Phrynium pubenerve* (Chaihua).

**Jingdiang (Container)**:Ha ki jingleh niam tynrai jong ki nong Kasiks (Nocte tribes) jong Arunachal Pradesh ki ju pyndonkam bha habd buh ia ki jingdih jong ki kum ki kyaid ba la shna na u khaw bad phandieng.ki shna ha ka dur jong ka khoh . Ha Mizoram kine ki sla la ju siang hapoh ki siej ban buh um .

**Jingsong (Packing material)**:Ki khasi ruh ki pyndonkam ia une u sla ban tehsong . Ki jingbam *Aakhone*, jong ki nong nagaland, *Bekang* jong ki nong Mizoram ,la ju song ha kine ki sla. La ju pyndonkam ruh ban song lungsiej ba la pdem da ki nong Galo jong Arunachal Pradesh. *Jangpangnatsu* ka dei ka tham ba lah pdem ba la shet da ki nong Ao Naga jong ka Nagaland.. *Ṭam-um* (tyrso pdem ), *Chhangban* ka jingbam tynrai ba la shet da u khaw,u kpu bad ka ja shulia bad la ju pyndonkam ruh ia une u sla ban tehsong .

Ha Meghalaya,ki jingbam khasi bad jaintia ba la shet na u khaw shulia kum u *Pusla* (khasi) ne u *Tpumakrut* (jaintia) . Ia u khaw shulia la dung bad ngi khleh bad u mithai (gur) bad la ai khyndiat u soda .Ngi song khyndiat ha ka sla bad buh ha u khiew ba don um thnam haduh b aka sla kan kylla rongktieh . Ia u *Putyndong* ruh ngi ju song da kaba pyndonkam ia kine ki sla lamet. *Pudoh* –ngi shim khyndiat u khaw shulia balah dep dung nangta ngi thep ka doh sniang hapdeng bad song ha ka sla lamet nangta ngin sa shet ha ka um thnam haduh b aka sla kan kylla rong .

**Pliang (Food plate)**: ki sla lah ju pyndonkam da ki nong Adi jong Arunachal Pradesh ban song ja bad jyntah . Ki sla *Phrynium pubinerve* la ju pyndonkam ruh kum ka pliang ha ka por khawai ia Chandubi (Assam).

**Jingbam (Food)**:Ki nong Manipur bad Meghalaya ki ju bam ia U jyngtang ba mih napoh na kyndew jong u sla *Phrynium pubinerve* hadien ba lah dep pynkhuid bad phon .

**Jingbam sniang (Fodder):** ia une u sla la ju ai ia bam ia ki mrad ba ri kum ki sniang ki masi ha Arunachal pradesh

**Appendix-3a: Awareness programme**

Total eighteen (18) awareness programmes were organized at different locations of Ri-Bhoi district and West Garo Hills district of Meghalaya. Awareness programme organized during 2020 and 2021 at different locations with small gathering due to COVID-19 restrictions. Aims of the programmes were to make aware community about the benefits of packing leaves.

**Photographs of Awareness programme**


Awareness programme at Umklai village


Awareness programme at Mawkangi village


Awareness programme at Umklai village

Awareness programme at Mawkangi village

Awareness programme at Ri-Bhoi district

Awareness programme at Ri-Bhoi district

Awarness programme at Ri-Bhoi district

Awarness programme at Ri-Bhoi district

Awareness programme at Ri-Bhoi district

Awarness programme at Ri-Bhoi district

Awareness programme at Ri-Bhoi district

Awareness programme at West Garo Hills district

Awareness programme at Ri-Bhoi district


Awareness programme at Ri-Bhoi district

## Appendix-3b: Capacity building

Total six (06) capacity building programmes were organized for beneficiaries at different project sites. Capacity building programme were organized during 2020 and 2021 at different locations with small gathering due to COVID-19 restrictions. Topics covered in the training programme on nursery development and management, plantation of packing leaves, plantation management, harvesting technique, primary processing, grading, value addition and marketing

### Photographs of capacity building programme, Meghalaya

Capacity building at Nartap village

Capacity building at Mawkangi village


Nursery Capacity building at Umklai village

Capacity building at Umklai village

Capacity building at Umklai village


Capacity building at Pahammawlein village


Capacity building at Ganol Songma village


Capacity building at West Garo Hills district


Capacity building at Ri-Bhoi district

Capacity building at Nartap


Capacity building at Umklai

Capacity building at West Garo Hills

Release of brochure in Garo language at West Garo Hills district, Meghalaya

HoD, Department of Horticulture, NEHU, Tura campus delivering his talk in the capacity building programme at West Garo Hills district, Meghalaya

HoD, Department of Horticulture, NEHU, Tura campus distributing packing leaf seedlings among beneficiary at West Garo Hills

HoD, Department of Horticulture, NEHU, Tura campus delivering his talk in the capacity building programme at West Garo Hills district, Meghalaya

Dr. Ashish Kar, PI of the project (TERI) distributing packing leaf seedlings among beneficiary at West Garo Hills district, Meghalaya

Dr. Arindam Barman, PI of partner Institute (NEHU-Tura campus) distributing packing leaf seedlings at West Garo Hills district

PI of the partner Institute, NEHU, Tura campus delivering his speech

Women participant in training programme at West Garo Hills district

Participant in training programme at West Garo Hills district, Meghalaya

**Appendix-3c: Project Completion Workshop**

One (01) project completion workshop was organized at Byrnihat, Ri-Bhoi district, Meghalaya. The project completion workshop was organized for beneficiaries and other stakeholder (SHG, NGO, University and Govt. official) with small gathering due to COVID-19 restrictions. The objective of the workshop was to discuss and disseminate the findings among the experts, concerned project beneficiaries and with different stakeholders. Total 37 participants attended in the workshop and shared their experience, discussed about scope and benefit on packing leaves. Agenda and photographs of the workshop given below

**Agenda**
**For**
**Project Completion Workshop**

**Under the project** "Cultivation of Packing Leaves Plant for Livelihood Enhancement of ST Communities and Promotion of Packing Leaves as Substitute of Plastics in Meghalaya"

**Sponsored by:** National Mission on Himalayan Studies (NMHS), GB Pant National Institute of Himalayan Environment and Sustainable Development (GBPNIHESD), Kosi-Katarmal, Almora, Govt. of India

**Date**: 08-01-2022

**Venue**: Byrnihat, Ri-Bhoi district, Meghalaya

**Programme Agenda**

| | |
|---|---|
| 09.30 am - 10.00 am | Registration |
| 10.00 am to 10.30 am | Breakfast |
| 10.30 am to 10.40 am | Welcome address by Director, TERI-NE, Guwahati |
| 10.40 am to 11.00 am | Introduction of the participant |
| 11.00 am to 11.30 am | Key note address by Dr. Naba Kumar Goswami, Senior Fellow & Area Convenor, TERI-NE, Guwahati |
| 11.30 am to 12.30 pm | Achievement and experience sharing of the project: by Dr. Ashish Kar, PI of the Project, TERI-NE, Guwahati |
| 12.30 pm to 13.00 pm | Talk by Resource person- Dr. Prasenjit Bhagawati, Assistant Professor, Assam Down Town University, Guwahati |
| 13.00 pm to 14.00 pm | Lunch break |
| 14.00 pm to 15.00 pm | Talk by Resource person- Mr. Marcel Kharbani, Extension Officer, Directorate of Soil and Water Conservation, (Research and Training), Conservation Training Institute, Byrnihat, Ri-Bhoi district, Meghalaya |
| 15.00 pm to 15.30 pm | Experience sharing of the beneficiary |
| 15.30 pm to 15.45 pm | Tea break |
| 15.45 pm to 16.30 pm | Discussion (Question and answer of stakeholders) |
| 16.30 pm to 16.40 pm | Vote of thanks |

## Photographs of Project Completion Workshop, Meghalaya

Mr. Marcel Kharbani, Extension Officer, Conservation Training Institute delivering talk

Dr. Ashish Kar, PI of the project delivering his talk

Interaction with the participant


Dr. Naba Kumar Goswami delivering key note address

Participant of the workshop

Dr. Prasenjit Bhagawati, Assistant Professor, Assam Down Town University delivering his talk

Interaction with the participant

Women beneficiary sharing her experience

Project beneficiary sharing his experience

Stakeholder sharing his views on packing leaves

Interaction with the participant

Displaying value added product (mat) developed from packing leaf petiole

Displaying value added product (bowel) developed from packing leaf petiole

Displaying value added product (hand fan) developed from packing leaf petiole

## Appendix- 4: Value added products

Total five new items have been developed from the packing leaf plant parts. Raw material was harvested from beneficiary plantation sites. Value added products are being used for different purposes. The products are below

1. Hand fan used for fanning oneself in hot weather
2. Bowel to keep household items
3. Bowel to carry items
4. Mat for praying and seating
5. Pen/pencil/ eraser bag for students
6. Money wallet to keep note and coins

**Value added products developed from packing leaf plant parts**

Hand fan to create a breeze in hot weather

Bowel developed from packing leaf plant parts to keep household items

Money wallet developed from packing leaf plant parts to keep currency

Bowel with handle developed to carry items


Pen/pencil/ eraser bag developed for student

Mat prepared for seating

**Handmade value added products developed from packing plant leaves**

Handmade dish prepared from leaf of packing plant (upper side view) to use for meal

Handmade dish prepared from leaf of packing plant (lower side view) to use for meal

Handmade plate prepared from leaf of packing plant (upper side view) to use for snacks

Handmade plate prepared from leaf of packing plant (lower side view) to use for snacks

Handmade bowel prepared from leaf of packing plant (upper side view) to use for curd and also to keep flower

Handmade bowel prepared from leaf of packing plant (lower side view) to use for curd and also to keep flower

**Purpose of experiment**: To promote cultivation of Packing Leaves Plant for Livelihood Enhancement of ST Communities and also to use packing leaves as substitute of plastic

**Scope:** Global production and consumption of plastics are increasing gradually day by day. Non-recyclable plastic is creating problems as it remains uncollected and scattered, causing damage to the environment. Considering the adverse environmental impacts of plastics and polythene bags, it is desirable to promote alternative packing material. *Phrynium pubinerve* (Sla Lamet/Reru) is a plant, the leaves of which are being used in Meghalaya, Mizoram, Nagaland, Manipur, Arunachal Pradesh and Assam as alternative wrapping and packing material of plastic. It is a shrub belonging to the family Marantaceae and almost round the year availability of the leaves makes it a suitable packing material. Source of packing leaf collection is mostly from forest for self-consumption as well as for earnings by the local community. To promote cultivation and enhance livelihood National Mission on Himalayan Studies has funded the project

## Inputs

| Sl No | Name of the product/Instrument / Accessories | Quantity | Quality/Function |
|---|---|---|---|
| 1 | GPS | 2 | To take GPS reading of the intervention sites |
| 2 | Measuring tape | 2 | To measure the plantation plot |
| 3 | Paper & drawing sheet, pencill, eraser, scale, note book | Depending upon necessity | To note down the different information and preparing Social & Resource maps |
| 4 | Camera | 2 | To take photos during survey and field visit and project activities |
| 5 | Cover file | Depending upon necessity | For filing the records, documents etc |
| 6 | Colour paint/Sketch/Marker | Depending upon necessity | For demarcation, mapping index etc. |
| 7 | Stapler/Pin | 5 | To pinning up the different documents |
| 8 | Household Survey sheet | Depending upon necessity | To record the house hold level information |

## Methods

Cultivation of packing leaf is a step by step process and mainly consists of five steps viz., base line survey, selection of beneficiary, capacity building, awareness programme and cultivation of packing leaves

**Approaching the village**

a) Approaching the local people and the local village Head to communicate about the packing leaf project with the help of small oral presentation explaining the purpose of the project.

b) Communicate the people through village head about the base line survey for collecting some basic information required for the project

**1. Baseline survey:**

Before start of the baseline survey, FGD will be carried out to brief about the programme and to aware the communities about the baseline survey. Baseline survey will be carried out by finalizing date and time from the village head. Preliminary data will be collected from the village head about the household. Accordingly house to house visit will be done to collect the basic information of the families through a household survey sheet.

**1b.Validation of information**

The information provided by the local people at the time of baseline survey regarding area available for packing leaf cultivation, packing leaf availability etc. could have variance within the village and there could be number of instances where such situation would arise. It is expected that in most of the instances there are no records available to validate the information with the local people. Hence, this information remains in form of estimates, but there is a need to validate these estimates. Such validation is will be done by asking same question to number of people in a group and to check the variations in the answers. These variations could be posed to the group to validate by themselves so as to arrive at a proper estimate or a range which is available in the village.

**2. Selection of beneficiaries**

Beneficiary will be selected based on following criteria

- Low income groups of tribal communities
- Farmers with low income status and ST category
- Availability of waste land, marginal land, Arecanut plantation and Khasi mandarin plantation (for intercropping) with farmer for cultivation
- Willingness to work together with other families in groups

**3. Awareness programme**

Fifteen awareness programmes will be organised in the rural and urban areas to promote its uses as substitute of plastic. Two awareness programme will be organized in district Head quarter; one awareness programme will be organized in State capital and 12 awareness programme will be organized in the three block of the project sites to create mass awareness about packing leaf as substitute of plastic. Awareness generation will be using leaflet, audio-visual show, street gathering, banner and poster etc.

**4. Capacity building**

Capacity building will be organized for all the beneficiaries on selection and collection of planting material, cultivation practices, plantation management, harvesting time and technique, post-harvest management, quality aspect and marketing. The resource person for the capacity building programme will be from TERI, Guwahati, Agriculture Department, Meghalaya, Forest Department, Meghalaya and persons who are actively involved in this venture. Special hands on training would be provided as confidence building measure. Total four capacity building programme will be organized in the project villages. Mode of training will be through speech, distribution of brochures etc.

**5. Cultivation of packing leaves in the field**

**Production of Quality Planting Materials at Nursery and propagation technique:**

Production of seedling through rhizome in the nursery:

Whole or split mother rhizome is used for as planting material. Well developed, disease free and healthy rhizome will be selected from the mother plant. For sowing both the mother-rhizomes, the fingers are used. The fingers will be cut into pieces of 4-5 cm long and the mother rhizomes will be planted as such and split into two each having at least one active bud. The seed is sometimes sprouted under moist straw before sowing. Small pits will be made with hand hoe in the nursery bed in rows with spacing of 30 cm and covered with soil and dry powdered cattle manure. The optimum spacing in furrows and ridges is between 45-60 cm between the rows and 25 cm between the plants.

**Climate and soil:** Packing leaf can be grown 100 m to 800 m above mean sea level. It is a shade loving plant. It grows well along natural stand and shady areas. One hectare area can accommodate 800 plants with a spacing of 3.5 m x 3.5 m. It grows well in humus rich soil and in temperature ranging 12°C to 35°C.

**Cultivation**

Preparation of land: The land will be prepared before early monsoon showers. The soil will be brought to a fine tilth by giving about four deep ploughing. Hydrated lime @ 500 - 1000 kg/ha will be applied for laterite soils based on the soil pH followed by thorough ploughing. Immediately with the receipt of pre-monsoon showers, beds of 1.0 m width, 30 cm height and of convenient length will be prepared with spacing of 50 cm between beds. Planting will be done by forming ridges and furrows.

Seed Material: As discussed above whole or split mother and finger rhizomes will be used for planting and well developed healthy and disease free rhizomes will be selected as planting material.

Seed Rate: 800 numbers of rhizomes is required for planting one hectare of packing leaf.

**Planting:** Pits of size 30 cm x15 cm will be made with a hand hoe on the beds with a spacing of 6 m x 6 m. Pits will be filled with well decomposed cattle manure or compost; seed rhizomes will be placed over it and then it will be covered with soil. The plantation is suitable as intercropping in other plantation site as packing leaf required partial shade for good growth. Planting is usually carried out in the months of April and May where the rainfall starts early.

**Manure and Fertilizer Application:** Farmyard manure @ 400kg/ha will be applied in the basal part of the plant just after plantation depending on the organic matter status of the soil. Vermicompost @200kg/ha may be applied at the time of earthing up (60 days after sowing) and at second earthing up (120 days after plantation) @200kg/ha.

**Mulching:** The crop is to be mulched immediately after planting and the same may be repeated 90 days after planting and after weeding, application of fertilizers and earthling up.

**Weeding:** Weeding has to be done thrice at 60, 90 and 120 days after planting depending upon weed intensity. Every year at least three weeding is required in the month of April, June, and Sept for established plantation plot.

**Irrigation**: Immediately after plantation regular irrigation is required for fifteen days. Depending upon the weather and the soil conditions, about 15 to 20 irrigations are to be given in clayey soils and 30 irrigations in sandy loams at the initial six months after plantation.

**Plant Protection and Management:**

Leaf Spot caused by *Colletotrichum sp* is generally observed during June-Sept. Symptom of the disease are elliptic to oblong, 4-5 cm long, 1-3 cm wide spots on leaves. Later on spots become yellow with greyish-white center. In devastating cases leaves become dry and finally loss many leaves of the plant by decaying. Foliar application of Mancozeb (2.5 g/l) during June-September at 15 days interval is may be effective and accordingly step will be taken.

**Harvesting of leaves:**

A properly managed packing leaf crop is ready for harvesting in twelve to eighteen months depending on the variety and time of sowing. The crop is generally harvested during January to March. The leaves usually turn pale green and little brown in maturity. Harvesting of mature leaves will be carried out by hand plucking or through secateurs by leaving two to four young leaves for next season. In a year three times leaves can be harvested.

**Precautions:**

1) Documentation of activities in a proper way for avoiding confusion
2) Make things readily available for field survey
3) Avoidance of sensitive issues during baseline survey
4) Selection of land based on feasibility study
5) Careful movement in the hilly areas

## Appendix-6: Model Demonstration plot technique

Ten demonstration model plots (packing leaf with banana; packing leaf with areca nut & betel vine; packing leaf with ginger, upland paddy and garlic; packing leaf with areca nut; packing leaf with pineapple; packing leaf with black turmeric, scented basil (high value medicinal plants); packing leaf with dalchini; packing leaf with orange and packing leaf with broom grass) were developed for showcase and to encourage other beneficiary. These techniques help to get maximum income from a single plot. These models are encouraging to other farmers to adopt such models.

### Model demonstration plantation sites

Demonstration technique - packing leaf intercrop with areca nut and betel vine

Model demonstration plot packing leaf intercrop with areca nut

Model demonstration plot at Mawkangi village packing leaf intercrop with banana

Model demonstration plot at Umklai village packing leaf intercrop with Pineapple and areca nut

Model demonstration plot at Pahamwlein packing leaf intercrop with unutilized land of areca nut plantation plot

Model demonstration plot at Mawkangi village packing leaf intercrop with dalchini plantation

Model demonstration plot packing leaf intercrop with upland paddy, ginger and garlic

Model demonstration packing leaf intercrop with upland paddy, ginger and garlic

In demonstration plot packing leaf planted in orange orchard

Model demonstration plot -packing leaf intercrop with black turmeric, scented basil (high value medicinal plants)

Model demonstration plot packing leaf intercrop with broom grass

Packing leaf intercrop with banana at demonstration plot

Annexure-I

# Consolidated and Audited Utilization Certificate (UC) and Statement of Expenditure (SE)

## For the Period: 2019 - 2022

| | | |
|---|---|---|
| 1. | Title of the project/Scheme/Programme: | **Cultivation of Packing Leaves Plant for Livelihood Enhancement of ST Communities and Promotion of Packing Leaves as Substitute of Plastics in Meghalaya** |
| 2. | Name of the Principle Investigator & Organization: | The Energy and Resources Institute |
| 3. | NMHS-PMU, G.B. Pant National Institute of Himalayan Environment, Kosi-Katarmal, Almora, Uttarakhand Letter No. and Sanction Date of the Project: | GBPNI/NMHS-2018-19/SG 10 dated 21-12-2018 |
| 4. | Amount received from NMHS-PMU, G.B. Pant National Institute of Himalayan Environment, Kosi-Katarmal, Almora, Uttarakhand during the project period (Please give number and dates of Sanction Letter showing the amount paid): | **Letter No:** GBPNI/NMHS-2018-19/SG 10 dt 21.12.2018 – Rs 23,10,000.00<br><br>**Letter No:** GBPNI/nmhs/2018-19/SG 10/172/167 dt 09.11.2020 Rs 7,92,112.00<br><br>**Letter No:** GBPNI/NMHS-2018-19/SG 10 dt 21.12.2018 Rs 6,13,800.00 |
| 5. | Total amount that was available for expenditure (Including commitments) incurred during the project period: | **Rs 37,95,000.00** |
| 6. | Actual expenditure (excluding commitments) incurred during the project period: | **Rs 37,95,518.00** |
| 7. | Unspent Balance amount refunded, if any (Please give details of Cheque no. etc.): | **NIL** |
| 8. | Balance amount available at the end of the project: | **( - ) Rs 518.00** |
| 9. | Accrued bank Interest: | Rs 9,548.00 |

Certified that the expenditure of **Rs 37,95,518.00 (Rupees Thirty Seven Lacs Ninety Five Thousand Five Hundred Eighteen only)** mentioned against Sr. No. 6 was actually incurred on the project/scheme for the purpose it was sanctioned.

Date: 29th June 2022

(Signature of Principal Investigator)

Ashish Kar
Project Investigator (PI)
The Energy and Resources Institute
Darbari Seth Block, IHC Complex
Lodhi Road, New Delhi-110 003

(Signature of Registrar/ Finance Officer)

PARAG APTE
Manager
Project Monitoring Unit
The Energy and Resources Institute
Darbari Seth Block, IHC Complex
Lodhi Road, New Delhi-110 003

(Signature of Head of the Institution)

REMIGIUS FERNANDES
Assistant General Manager-Project Monitoring
The Energy and Resources Institute
Darbari Seth Block, India Habitat Centre
Lodhi Road, New Delhi-110 003

OUR REF. No.

ACCEPTED AND COUNTERSIGNED

Date:

COMPETENT AUTHORITY
NATIONAL MISSION ON HIMALAYAN STUDIES (GBP NIHE)

# Statement of Consolidated Expenditure

## [The Energy and Resources Institute]

Statement showing the expenditure of the period from Sanction No. and Date : GBPNI/NMHS-2018-19/SG 10 dated 21-12-2018

1. Total outlay of the project : Rs 3,795,000.00

2. Date of Start of the Project : 11th January 2019

3. Duration : 3 years

4. Date of Completion : 10th January 2022

a) Amount received during the project period : Rs 37,15,912.00

b)Unspent amount carried forward from pervious Financial Year : **NIL**

c) Total amount available for Expenditure : Rs 37,15,912.00

| S. No. | Budget head | Amount received | Expenditure | Amount Balance/ excess expenditure |
|---|---|---|---|---|
| 1 | Salaries | 452400.00 | 468000.00 | -15600.00 |
| 2 | Travel (Domestic) | 365000.00 | 375519.00 | -10519.00 |
| 3 | Contingency | 145000.00 | 150000.00 | -5000.00 |
| 4 | Activities & other project cost as per project need | 2032112.00 | 2058000.00 | -25889.00 |
| 5 | Overhead | 321400.00 | 344000.00 | -22600.00 |
| 6 | Non Recurring Equipment | 400000.00 | 399999.00 | 1.00 |
| 7 | Add :Accured Bank Interest | 9548.00 | 0.00 | 9548.00 |
| 8 | **Total** | **3725460.00** | **3795518.00** | **-70057.00** |

Certified that the expenditure of **Rs.37,95,518.00 ( Rupees: Thirty Seven Lacs Ninety Five Thousand Five Hundred Eighteen only)** mentioned against Sr. No.8 was actually incurred on the project/ scheme for the purpose it was sanctioned.

Date: 29th June 2022

Ashish Kar
Project Investigator (PI)
The Energy and Resources Institute
Darbari Seth Block, IHC Complex
Lodhi Road, New Delhi-110 003

PARAG AFLE
Manager
Project Monitoring Unit
The Energy and Resources Institute
Darbari Seth Block, IHC Complex
Lodhi Road, New Delhi-110 003

REMIGIUS FERNANDES
Assistant General Manager-Project Monitoring
The Energy and Resources Institute
Darbari Seth Block, India Habitat Centre
Lodhi Road, New Delhi-110003

OUR REF. No.

ACCEPTED AND COUNTERSIGNED

Date:

COMPETENT AUTHORITY
NATIONAL MISSION ON HIMALYAN STUDIES (GBP NIHE)

Web www.teriin.org

The Energy and Resources Institute
Darbari Seth Block
I H C Complex
Lodhi Road
New Delhi – 110 003
Tel. 2468 2100 or 7110 2100
E-mail mailbox@teri.res.in
Fax 2468 2144 or 2468 2145
India +91 • Delhi (0) 11

Regional centres within India

**North-Eastern** Regional Centre
Guwahati
Tel. (361) 233 4790
E-mail terine@teri.res.in
Fax (361) 233 4869

**Southern** Regional Centre
Bangalore
Tel. (80) 2535 6590 (5 lines)
E-mail terisrc@teri.res.in
Fax (80) 2535 6589

Goa
Tel. (832) 245 9306 or 245 9328
E-mail terisrc@teri.res.in
Fax (832) 245 9338

**Western** Regional Centre
Mumbai
Tel. (22) 2758 0021 or 4024 1615
E-mail terimumbai@teri.res.in
Fax (22) 2758 0022

**Himalayan** Centre
Mukteshwar
Tel. (5942) 286 433
E-mail praveen.sharma@teri.res.in
Fax (5942) 286 460/433

TERI **Japan**
Tokyo
Tel. (+81 3) 3519 8970
E-mail teri@iges.or.jp
Fax +81 33 5195 1084

**Annexure-II**

**Remigius Fernandes**
**Assistant General Manager - PMU**

Project Code: NA/2018/22
Date: June 29, 2022

**National Mission on Himalayan Studies,**
G.B. Pant National Institute of Himalayan Environment and Sustainable Development (GBPNIHESD)
Kosi-Katarmal, Almora - 263643, Uttarakhand, India

**Consolidated Interest Earned Certificate**

Dear Sir, Ma'am,

It is informed that we have earned **Rs 9548.00** during the period 2018 – 2022 under the project "**Cultivation of Packing Leaves Plant for Livelihood Enhancement of ST Communities and Promotion of Packing Leaves as Substitute of Plastics in Meghalaya**"

Details of Interest mentioned below :

| | |
|---|---|
| 2018 – 2019 | Rs 1462.00 |
| 2019 – 2020 | Rs 7964.00 |
| 2020 – 2021 | Rs 0.00 |
| 2021 - 2022 | Rs 122.00 |
| **Total** | **Rs 9548.00** |

Thanking you,

Yours sincerely,

**Remigius Fernandes**

**Annexure-III**

# Consolidated Assets Certificate

## Assets Acquired Wholly/ Substantially out of Government Grants

**(Register to be maintained by Grantee Institution)**

Name of the Sanctioning Authority: National Mission on Himalayan Studies,Ministry of Environment, Forest and Climate Change

1. Sl. No. 1
2. Name of Grantee Institution: The Energy and Resources Institute
3. No. & Date of sanction order: GBPNI/NMHS-2018-19/SG 10 dated 21-12-2018
4. Amount of the Sanctioned Grant: Rs 37,95,000.00
5. Brief Purpose of the Grant: Cultivation of Packing Leaves Plant for Livelihood Enhancement of ST Communities and Promotion of Packing Leaves as Substitute of Plastics in Meghalaya
6. Whether any condition regarding the right of ownership of Govt. in the property or other assets acquired out of the grant was incorporated in the grant-in-aid Sanction Order: No
7. Particulars of assets actually credited or acquired as per Annex IV attached.
8. Value of the assets as on 10.01.2022 : Rs 3,08,159.00
9. Purpose for which utilized at present: Scientific Research
10. Encumbered or not: No
11. Reasons, if encumbered : Not Applicable
12. Disposed of or not : No (Field Installation)
13. Reasons and authority, if any, for disposal : Not Applicable
14. Amount realised on disposal: Not Applicable

Any Other Remarks: _____

Ashish Kar

**(PROJECT INVESTIGATOR)**

**(Signed and Stamped)**

Project Investigator (PI)
The Energy and Resources Institute
Darbari Seth Block, IHC Complex
Lodhi Road, New Delhi-110 003

**(FINANCE OFFICER)**

**(Signed and Stamped)**
PARAG AFLE
Manager
Project Monitoring Unit
The Energy and Resources Institute
Darbari Seth Block, IHC Complex
Lodhi Road, New Delhi-110 003

**(HEAD OF THE INSTITUTION)**

**(Signed and Stamped)**
REMIGIUS FERNANDES
Assistant General Manager-Project Monitoring
The Energy and Resources Institute
Darbari Seth Block, India Habitat Centre
Lodhi Road, New Delhi-110 003

**Annexure-IV**

## List or Inventory of Assets/ Equipment/ Peripherals

| S. No. | Name of Equipment | Quantity | Sanctioned Cost | Actual Purchased Cost | Purchase Details |
|---|---|---|---|---|---|
| 1 | Trolley Cart | 4 | 400000.00 | 22900.00 | Invoice No :TERI/SH/SI/01 dt 26.05.2020<br>Vendor : SAHISTA INFRATECH |
| 2 | Plastic Tray | 16 | | 12801.00 | |
| 3 | Khurpi | 16 | | 4800.00 | |
| 4 | Shovel | 4 | | 1820.00 | |
| 5 | Hoe | 4 | | 1900.00 | |
| 6 | Crowbar | 4 | | 2780.00 | |
| 7 | Sprayer | 4 | | 10600.00 | |
| 8 | Water Can | 4 | | 1700.00 | |
| 9 | Plastic Pipe | 4 | | 1500.00 | |
| 10 | Construction and Erection of shade house | 1600 | | 339198.00 | |
| | **Total** | | | **399999.00** | |

Ashish Kare
**(PROJECT INVESTIGATOR)**

**(Signed and Stamped)**

Project Investigator (PI)
The Energy and Resources Institute
Darbari Seth Block, IHC Complex
Lodhi Road, New Delhi-110 003

**(FINANCE OFFICER)**

**(Signed and Stamped)**

PARAG AFLE
Manager
Project Monitoring Unit
The Energy and Resources Institute
Darbari Seth Block, IHC Complex
Lodhi Road, New Delhi-110 003

**(HEAD OF THE INSTITUTION)**

**(Signed and Stamped)**

REMIGIUS FERNANDES
Assistant General Manager-Project Monitoring
The Energy and Resources Institute
arbari Seth Block, India Habitat Centre
Lodhi Road, New Delhi-110 003

**Annexure-V**

## Letter of Head of Institution/Department confirming Transfer of Equipment Purchased under the Project to the Institution/Department

To,

The Convener, Mountain Division
Ministry of Environment, Forest & Climate Change (MoEF&CC)
Indira Paryavaran Bhawan
Jor Bagh, New Delhi-110003

**Sub.:** Transfer of Permanent Equipment purchased under Research Project titled "Cultivation of Packing Leaves Plant for Livelihood Enhancement of ST Communities and Promotion of Packing Leaves as Substitute of Plastics in Meghalaya " funded under the NMHS Scheme of MoEF&CC – reg.

Sir/ Madam,

This is hereby certified that the following permanent equipment purchased under the aforesaid project have been transferred to the Implementing Organization/ Nodal Institute after completion of the project:

1. Net (shade) house (4 nos.)
2. Trolley cart (4 nos.)
3. Plastic tray (16 nos.)
4. Khurpi (16 nos.)
5. Shovel (4 nos.)
6. Hoe (4 nos.)
7. Crowbar (4 nos.)
8. Sprayer (4 nos.)
9. Water cans (4 nos.)
10. Plastic garden pipe (4 nos. roll)

Head of Implementing Organization:
Name of the Implementing Organization:
Stamp/ Seal:
Date:

***Copy to:***

1. The Nodal Officer, NMHS-PMU, National Mission on Himalayan Studies (NMHS), G.B. Pant National Institute of Himalayan Environment (NIHE), Kosi-Katarmal, Almora, Uttarakhand-263643

REMIGIUS FERNANDES
ssistant General Manager-Project Monitoring
The Energy and Resources Institute
arbari Seth Block, India Habitat Centre
Lodhi Road, New Delhi-110 003

**Annexure-VI**

## Details, Declaration and Refund of Any Unspent Balance

Please provide the details of refund of any unspent balance and transfer the balance amount through RTGS (Real-Time Gross System) in favor of **NMHS GIA General** and declaration on the official letterhead duly signed by the Head of the Institution.

Kindly note the further Bank A/c Details as follows:

| | |
|---|---|
| **Name of NMHS A/c:** | NMHS GIA General |
| **Bank Name & Branch:** | Central Bank of India (CBI), Kosi Bazar, Almora, Uttarakhand 263643 |
| **IFSC Code:** | CBIN0281528 |
| **Account No.:** | 3530505520 (Saving A/c) |

In case of any queries/ clarifications, please contact the NMHS-PMU at e-mail: nmhspmu2016@gmail.com

# FORM GFR 19-A
## Form of Utilisation Certificate
## 2018 - 2019

| Sl. No. | Letter No. and Date | Amount (Rs) |
|---|---|---|
| 1. | GBPNI/NMHS-2018-19/SG 10 dt 21.12.2018 | 23,10,000.00 |
| | **Total** | 23,10,000.00 |

Certified that out of **Rs 23,10,000.00 (Rupees Twenty Three Lacs Ten Thousand only)** of grants-in-aid sanctioned during the year 2018 - 2019 in favour of **The Energy and Resources Institute** under the Ministry/Department letter No. GBPNI/NMHS-2018-19/SG 10 dt 21.12.2018 as given in the margin and **0.00** on account of unspent balance of the previous year, a sum of **Rs 1,82,890.00 (Rupees One Lac Eighty Two Thousand Eight Hundred Ninety only)** has been utilized for the purpose of for which it was sanctioned and that the balance of Rs **21,27,110.00 (Twenty One Lacs Twenty Seven Thousand One Hundred Ten only)** remaining unutlized at the end of the year has been has been surrendered to Government (Vide No dated) / will be adjusted towards the grants-in-aid payable during the next year. Interest earned is **Rs 1,462.00** and additional expenditure of **Rs NIL** has been incurred from internal resources and will be adjusted against next release.

Certified that I have satisfied myself that the conditions on which the grants-in-aid was sanctioned have been duly fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purpose for which it was sanctioned.

Kind of checks exercised.
1. Cash Book verified regularly
2. Bank Pass Book verified
3. Chartered accountant checked the expenses and certified
4. Account audited by competent authority

Place: New Delhi
Date: June 29, 2022

REMIGIUS FERNANDES
Assistant General Manager-Project Monitoring
The Energy and Resources Institute
Darbari Seth Block, India Habitat Centre
Lodhi Road, New Delhi-110 003

# FORM GFR 19-A
## Form of Utilisation Certificate
## 2019 - 2020

| Sl. No. | Letter No. and Date | Amount (Rs) |
|---|---|---|
| 1. | NIL | - |
| | **Total** | - |

Certified that out of **Rs NIL** of grants-in-aid sanctioned during the year 2019 - 2020 in favour of **The Energy and Resources Institute** under the Ministry/Department letter No. NIL as given in the margin and **Rs 21,27,110.00 (Rupees Twenty One Lacs Twenty Seven Thousand One Hundred Ten only)** on account of unspent balance of the previous year, a sum of **Rs 21,27,110.00 (Rupees Twenty One Lacs Twenty Sven Thousand One Hundred Ten only)** has been utilized for the purpose of for which it was sanctioned and that the balance of Rs **NIL** remaining unutlized at the end of the year has been has been surrendered to Government (Vide No dated) / will be adjusted towards the grants-in-aid payable during the next year. Interest earned is **Rs 7,964.00** and additional expenditure of **Rs 1,91,607.00 (Rupees One Lacs Ninety One Thousand Six Hunred Seven only)** has been incurred from internal resources and will be adjusted against next release.

Certified that I have satisfied myself that the conditions on which the grants-in-aid was sanctioned have been duly fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purpose for which it was sanctioned.

Kind of checks exercised.
1. Cash Book verified regularly
2. Bank Pass Book verified
3. Chartered accountant checked the expenses and certified
4. Account audited by competent authority

Place: New Delhi
Date: June 29, 2022

REMIGIUS FERNANDES
Assistant General Manager-Project Monitoring
The Energy and Resources Institute
Darbari Seth Block, India Habitat Centre
Lodhi Road, New Delhi-110 003

# FORM GFR 19-A
## Form of Utilisation Certificate
## 2020 - 2021

| Sl. No. | Letter No. and Date | Amount (Rs) |
|---|---|---|
| 1. | GBPNI/NMHS-2018-19/SG-10/172/167 dt 09.11.2020 | 7,92,112.00 |
| | **Total** | **7,92,112.00** |

Certified that out of **Rs 7,92,112.00 (Rupees Seven Lacs Ninety Two Thousand One Hundred Twelve only** of grants-in-aid sanctioned during the year 2020 - 2021 in favour of **The Energy and Resources Institute** under the Ministry/Department letter No. GBPNI/NMHS-2018-19/SG-10/172/167 dt 09.11.2020 as given in the margin and ( - ) **Rs 1,91,607.00 (Rupees One Lacs Ninety One Thousand Six Hunred Seven only)** on account of unspent balance of the previous year, a sum of **Rs 6,00,505.00 (Rupees Six Lacs Five Hundred Five only)** has been utilized for the purpose of for which it was sanctioned and that the balance of Rs **NIL** remaining unutlized at the end of the year has been has been surrendered to Government (Vide No dated) / will be adjusted towards the grants-in-aid payable during the next year. Interest earned is **Rs NIL** and additional expenditure of **Rs 1,79,543.00** has been incurred from internal resources and will be adjusted against next release.

Certified that I have satisfied myself that the conditions on which the grants-in-aid was sanctioned have been duly fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purpose for which it was sanctioned.

Kind of checks exercised.
1. Cash Book verified regularly
2. Bank Pass Book verified
3. Chartered accountant checked the expenses and certified
4. Account audited by competent authority

Place: New Delhi
Date: June 29, 2022

REMIGIUS FERNANDES
Assistant General Manager-Project Monitoring
The Energy and Resources Institute
arbari Seth Block, India Habitat Centre
Lodhi Road, New Delhi-110 003

# FORM GFR 19-A
## Form of Utilisation Certificate
## 2021 - 2022

| Sl. No. | Letter No. and Date | Amount (Rs) |
|---|---|---|
| 1. | GBPNI/NMHS-2018-19/SG-10/172/167/186 dt 09.11.2021 | 6,13,800.00 |
| | **Total** | **6,13,800.00** |

Certified that out of **Rs 6,13,800.00 (Rupees Six Lacs Thirteen Thousand Eight Hundred only** of grants-in-aid sanctioned during the year 2021 - 2022 in favour of **The Energy and Resources Institute** under the Ministry/Department letter No. GBPNI/NMHS-2018-19/SG-10/172/167/186 dt 09.11.2021 as given in the margin and ( - ) **Rs 1,79,543.00 (Rupees One Lacs Seventy Nine Thousand Five Hundred Forty Three only)** on account of unspent balance of the previous year, a sum of **Rs 4,34,257.00 (Rupees Four Lacs Thirty Four Thousand Two Hundred Fifty Seven only)** has been utilized for the purpose of for which it was sanctioned and that the balance of Rs **NIL** remaining unutlized at the end of the year has been has been surrendered to Government (Vide No dated) / will be adjusted towards the grants-in-aid payable during the next year. Interest earned is **Rs 122.00** and additional expenditure of **Rs 79,605.00** has been incurred from internal resources and will be adjusted against next release.

Certified that I have satisfied myself that the conditions on which the grants-in-aid was sanctioned have been duly fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purpose for which it was sanctioned.

Kind of checks exercised.
1. Cash Book verified regularly
2. Bank Pass Book verified
3. Chartered accountant checked the expenses and certified
4. Account audited by competent authority

Place: New Delhi
Date: June 29, 2022

REMIGIUS FERNANDES
Assistant General Manager-Project Monitoring
The Energy and Resources Institute
Jarbari Seth Block, India Habitat Centre
Lodhi Road, New Delhi-110 003