Seed Ball Technique and Drone Bombing for Afforestation: Exploring possibilities for Meghalaya

Date: 26th November, 2021
Time: 12 Noon

Minutes of the Meeting

Having seen the recent success and international interest in seed ball method of afforestation where drones are being used to bomb the seed balls over barren lands for rapid afforestation, a meeting between Centre of Excellence, Marut Drones and officials from Forest Department, Soil and Water Conservation Department, Autonomous District Councils, Government of Meghalaya as well as Forest Officials from Telangana was held in the MBMA State Headquarters, Shillong with an option for the participants to join online as well.

The meeting started with the Director and Co-Chairman of Centre of Excellence, Dr. Subhash Ashutosh welcoming the participants and appraising the gathering of the success of seed ball bombing in International scenes and also in India, especially in the State of Telangana. He expressed his keen interest in learning of the costs, operations and methods of seed ball bombing and how it may be adopted for rapid afforestation projects in Meghalaya and how it might fare against the conventional method. The Director mentioned that afforestation work is high on the priority list of almost every concerned department and the Hon'ble Chief Minister of Meghalaya has urged the people to set a target for a Greener Meghalaya to address Climate Change and other ecological problems. The meeting had been convened on a short notice in order to learn from the experts in the field of Seed ball Bombing – Marut Drones and also from the Forest Officials of Telangana to know from their experience of utilising this technology for large scale afforestation.

The stage was handed over to the experts from Marut Drones to give a presentation on the techniques, operational details, steps involved in field execution including economics of Seed ball Bombing Technology. The following points were shared by Marut Drones:

1. **Brief on the Organization:**
   Marut Drones started working on deforestation and reforestation area since 2014 after seeing the successful use of drones in UK and Canada to counter deforestation and officially established the Company in 2019.. The Drone that is used by them is called 'Seedcopter'. Till date they are the only aerial seedling company in India. Their method is to tackle afforestation aerially and to make the project inclusive by working closely with the Forest Department in understand local species of trees/plants and providing seeds and materials to the local NGOs, Self-Help Groups, communities, etc to make the seed ball s. With the mandate of the Government of India to increase forest cover in India, Marut Drones works with the objective of including rural youth and women in bringing change to the ecological cover of India.

2. **Philosophy of Work:**
   - Work at a rapid scale in order to tackle about a lakh plantation in a day.
   - Work has to be easy which means multiple drones can be flown by a single pilot or single software.

- Work has to be cost-effective
- Increase the diversity of the plantation while still giving importance to the endemic species.

3. **Five-Step Process:**
   - Identify and map the area
   - Identify the species of plant in the area using hyperspectral and multispectral sensors
   - Collaborate with Forest Department to understand the terrain and the latest species of plant
   - Engage with local community to prepare the seed ball s
   - Geo-tag the area and proceed with dropping the seed ball s with the drone.

4. **Campaigns and Achievements of Marut Drones:**
   - Marut Drones has been extensively working with the Agricultural University of Telangana since the State Government of Telangana has asked for a Feasibility study on the preparation and improvement of seed ball s and technology.
   - Marut Drone is also undertaking the 'Campaign of Hara Bhara' which aims to plant 1 billion trees by 2030 throughout India in 900 Forests touching every District in India. The ultimate aim is to engage Corporations, Community, Rural youth and Women in being a part of the change and scaling up the process of reforestation by adopting the technology. In the initial stages of the campaign, Marut Drones had used local women, school children and self-help groups to prepare the seed ball s. With the need to prepare the seed ball s by March in order to disburse the seeds by June, Marut Drones also plans to engage jail inmates in seed ball preparation.
   - Case studies for the Campaign were done in Telangana in 2019 in Veeranapali Forest in Silsila District. 5 (five) species of plants were planted in 320 hectares of forest land.
   - With the help of Government of India, different species of plants were planted in 5 (five) hectares of land in Udaipur in different terrains for the Forest Department.
   - Feasibility Study was done in Amangal district, Telangana over 240 hectares of land.
   - During Covid, the Campaign initiated in Telangana, was endorsed by the Minister for Industries, Mr. K T Ramanrao, Forest Minister and other Ministers of the State. The Forest Department of the state as well as NGOs and other players were heavily involved in the state-wide Campaign. Rana Daggubati (actor) was the Brand Ambassador of the Campaign in order to amplify and gain attention on the Hara Bhara campaign.
   - Currently in talks with renowned Padmashree winners, Cricketers, Actors and Environmental Activitists to be Brand Ambassaors for the campaign in order to get the information to the masses.

- The Campaign has also been recognised by media houses Nationally and was awarded Forbes 30 under 30 as well as 'Emerging Start-up Technology Award for Drones and AI' from NASSCOM
- Marut Drones has created a Dashboard where tree counts, species type, areas where work has been done, green cover areas to monitor the work. With the extensive help from the State Government, Marut Drones has been able to kick off the campaign of planting a thousand seed ball s in every hectare of land. Every District has given 100-500 hectares of forest area. The Campaign has been recognised by the Govt. of India and it is being extended to the states of Tamil Nadu, Andhra Pradesh, Uttarakhand and Assam.

Post the presentation from Marut Drones, time was given to the participants to bring forward their questions.

1. The Director of CoE asked if **the permission to fly the drones given by the Ministry of Civil Aviation was specific to the State of Telangana only or if they could fly it all over India.** Marut Drones replied that the Permission granted was centralised which gives them access to fly all over India but they need to add maps of the new territory so that the Ministry could add it to the permission. In case of International Borders, a special letter needs to go out to the Ministry of Civil Aviation citing no cameras or spy detectors are in built in the drones.

2. **What are the procedures used in surveying the land type, terrain and forest species before carrying out the plantation?** To this question Marut Drones replied that soil type, and tree species plays a vital role in understanding the type of seed ball to be used – either soil based seed ball or charcoal seed ball. For gaining this insight, they seek the help of the Forest Department. In case of the seed ball size, due to seeds of varying dimensions, the sizes range from 30mm to 45mm. Multiple seeds are put inside each seed ball so that its survival is guaranteed. Each seed ball survives for 40-45 days before it germinates.

3. The next question asked was, **'How much weight the drones could carry in each flight'** to which the reply was that the drone could carry around 1,000 seed ball s weighing up to 10 kgs. In a day, 25,000 seed ball s could be planted on an average depending on the terrain. In some cases, the DFOs had requested them to plant the seeds directly since they would germinate faster.

4. The Director mentioned that in Meghalaya, there was no history of the utilisation of seed ball s so **whom would they engage to make the seed ball s.** Marut Drones had engaged local communities, self-help groups and NGOs till date, in making the seed ball s since the knowledge is already with them. They simply provide the seeds and raw materials to aid the process.

5. The Director then asked **how the monitoring process was done after the dispersal of the seed ball s.** Marut Drones said that seek the help of FROs to get the ground-truthing done and then use remote sensors bi-annually or annually to monitor the green cover percentage and plant count using the before and after data.

6. The next question was **the survival rate of the plantation** to which Marut Drones replied that it was highly dependent on the amount of rainfall received, soil type and seeds used. But the guaranteed survival rate was around 30-40% till date. They also reiterated that the technology was mostly being sought out to carry out reforestation activity in the inaccessible areas.

7. The Director also asked if they had **any experience in treating mine-affected areas, barren land due to shifting cultivation and landslide prone areas.** Marut Drones replied that it was currently under talks and they ahd mostly worked in areas which are inaccessible to humans.

8. The next question was on **the cost of carrying out such afforestation activity**. Since Marut Drones had planted 50 lakh seed ball s till date, the cost had been kept at Rs2 per seed ball which covers the operations cost and technology cost. Major part of the cost for acquiring seeds, fertilisers and labour cost is covered by the State Government and different departments.

9. The next set of questions was asked by the General Manager, KM Division, MBMA, Mr. Wankit Swer. His first question was **whether the drones were able to carry multi species seed ball s in one flight** since planting the same species throughout one area would create bio-diversity issues. Marut Drones replied that they map the area and narrow down on the smaller areas according to the species of trees available. The mapping is then handed over to the Forest Department who gives instructions on the area where seeds are to be dropped. Several species of seed ball s can be dropped in a single area to allow multi species growth.

10. The GM also asked in community lands where the people rely on the land for livelihood such as cattle grazing, vegetable plantation, etc., **how the Company deals with identifying such lands** to which Marut Drones replied that the input on the areas to be covered under seed ball bombing are provided by the Forest Department.

11. The next question was about **how much time was saved using the technology as opposed to the conventional method of reforestation.** Marut Drones replied that one hectare of land could be covered in 15 minutes according to their experience and global studies have proved that drone technology is 10 times faster than human intervention. The time taken to prepare seed ball s, taking into

consideration the process of procuring raw materials, normally took about 10 days with an average of 5 people working per day.

12. Based on the survival rate of 30% provided earlier, the GM asked, if **in order to ensure the survival of 1000 trees, then should the plantation be carried out 4 times more.** Marut Drones replied that since the survival rate depended on the terrain, species type and rainfall, it would differ from region to region.

13. The GM also asked if **the local community was mobilised from their end or if they sought the help of Departments** to which Marut Drones replied that the Department does the community mobilisation.

14. The Deputy Project Director, CLLMP, MBMA, Mr. James Kharkongor asked **how the technology would prevent the seed ball s from rolling down the hill** once they were dropped from the drones. Marut Drones said that in order to prevent that, charcoal based seed ball s could be utilised. But also since they did not have much expertise in the aforementioned area, they would seek clarity on the matter from the experts.

Experience on Seed ball Bombing from Mr. Akbar, PCCF, Hyderabad.

Mr. Akbar started off by greeting the participants in the discussion. He explained that he had started with the seed ball dispersal in 2017 with the Telangana Haritha Haram Programme which was a massive tree plantation drive. This drive was done manually. During this drive, the District Collectors were engaged intensely since the Chief Minister himself was invested in the programme and a total of 1 (one) Crore Seed ball s were prepared and dispersed. The limitations of mass plantation drives, however, was that after germination, the survival rate of the plants were low since they were dispersed in unprotected areas and there was no day-to-day follow up. Seed selection was also vital depending on the area chosen in order to ensure germination and survival.

He commended the efforts of Marut Drones in covering remote areas and committing to the campaign since the technology supplements the work of the Departments and makes it easier. The fact that the drones are GPS enabled also eases the site selection. Most of the ground truthing and research needed to be done by the Forest Departments. He also shared the simple techniques of preparing seed ball s by using easily available fertilizers, jaggery, jiva amrutham, etc. He also shared how trees like neem were dispersed in the crevices of the plateau which could grow in the hardy areas. He encouraged the use of drone technology but cautioned against dispersing the seeds at the right time. He said that plantation should be done around April or May right before the monsoon starts so that the seeds get moisture to germinate and survive. He also stressed on the need to protect the plantation area in order to ensure survival and to start off on a pilot project since the Drone technology was not an established technology.

The meeting concluded with the agreement on the need to have more research done and to exchange documents on rates, permissions, etc.

SL.No	Name	Company/Organisation	Mode
1	Dr. Subhash Ashutosh, Co-Chairman & Director Center of Excellence for NRM & Sustainable Livelihoods	Centre of Excellence	Offline
2	Mr. Mohd. Jalaluddin Akbar, IFS, Chief Conservator of Forest	Govt. of Telangana	Online
3	Mr. James Khakongor, Deputy Project Director	MBMA	Offline
4	Mr. Wankit Swer, General Manager	MBMA	Offline
5	Mr. Fettleman Dohling, Manager	GIS	Online
6	Mr. Prem Kumar Vislawath, Founder and Chief Innovator of Marut Drones	Marut Drones	Online
7	Mr. Sahil Swaroop, Product Manager	Marut Drones	Online
8	Ms. Dokatchi K Marak, Manager	MBMA	Offline
9	Mrs. Angelica Kahit Dympep, Admin. Associate	Centre of Excellence	Offline

Participants

ANNEXURE- I

SEEDC🌲PTER

Reforestation made Scalable

ABOUT

SEEDCOPTER

ABOUT SEEDCOPTER

Incorporated in April 2019, by IIT Alumni and mentored by RICH & IIIT Hyderabad.

We use Data Science, Drones, Seedball Technology combined with Ecological Science to find optimal land restoration options

WHO WE ARE?

A commercially established company which operates in the Arena of UAV Aerial Seeding

OUR VISION

To realize the dream of Sustainable Reforestation and to create a reforestation ecosystem guided by Data (Science) and Community (Science and People)

OUR MISSION

Seedcopter is a pioneer in the field of aerial seeding for reforestation.

We work to conserve the present day forests through rapid reforestation of burnt, fragmented and degraded forest land

Slide Continues...

WHAT ARE WE SOLVING?

Deforestation
Under 20% of the Earth's original forests have remained unaffected by human intervention

Biodiversity Loss
Wild mammals, birds, fish and reptile populations have declined by 60% in the last 50 years
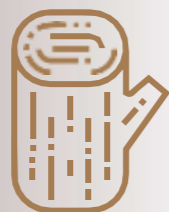
Climatic change
To prevent the rise in catastrophic temperature and effect on rural livelihood.

Women and Rural employment
Enabling local communities in environment conservation and empowering them through employment

THE SOLUTION

Aerial seeding of seedballs with the help of drones and local community involvement

01

Forest regeneration at a rapid pace

02

Easy to scale with multiple drones

03

Cost Effective and Generates Local Employment

04

Diverse Forests involving native tree species
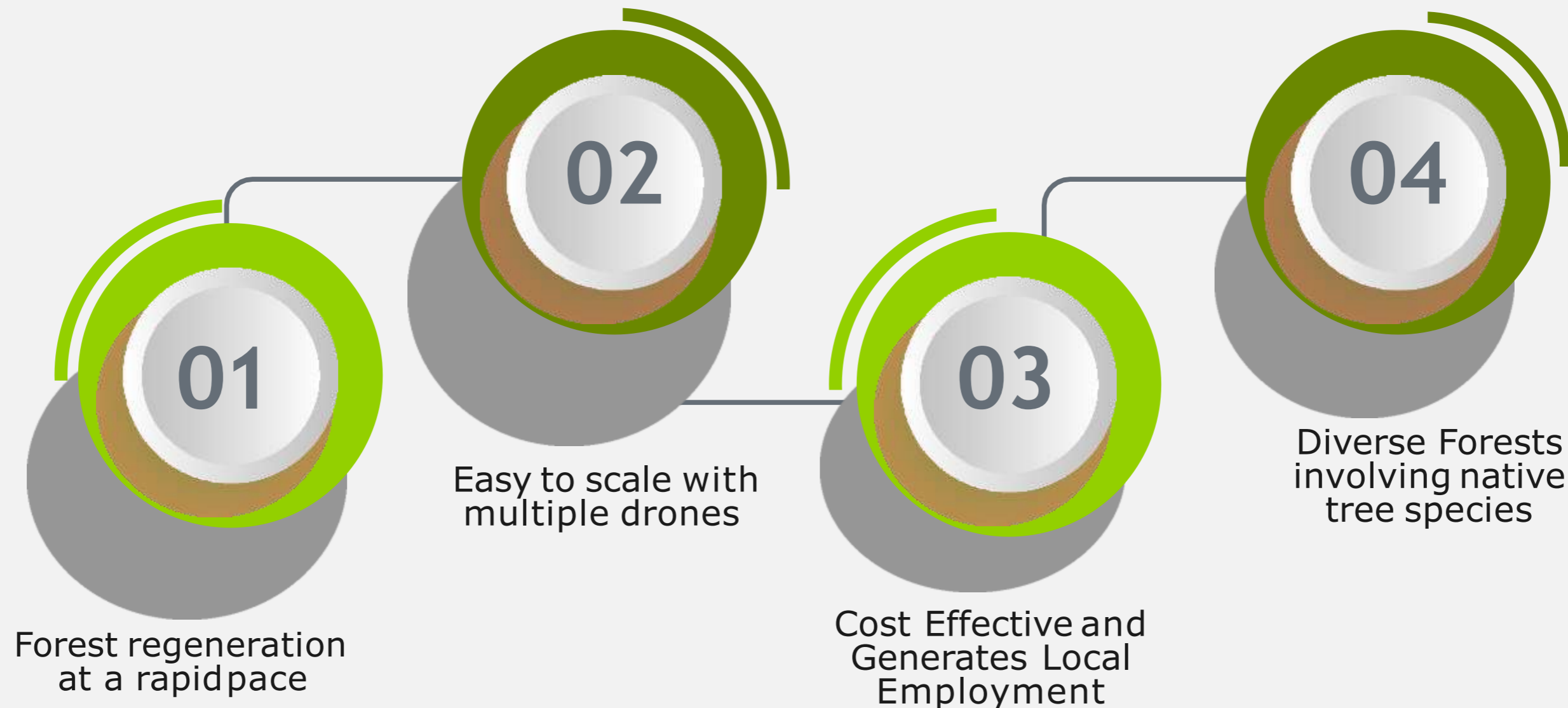
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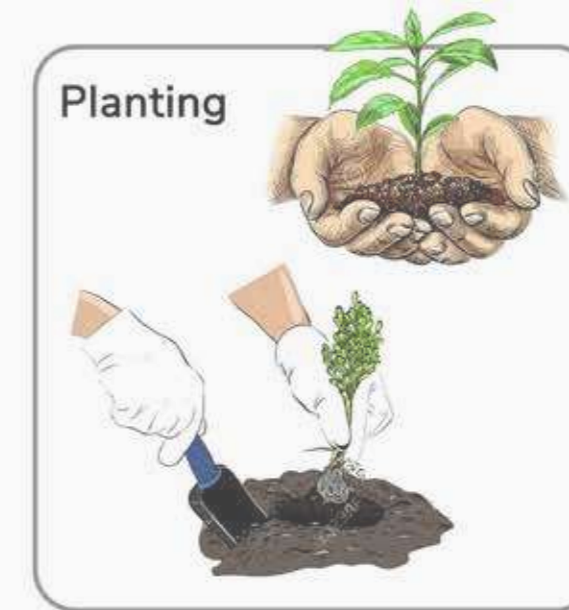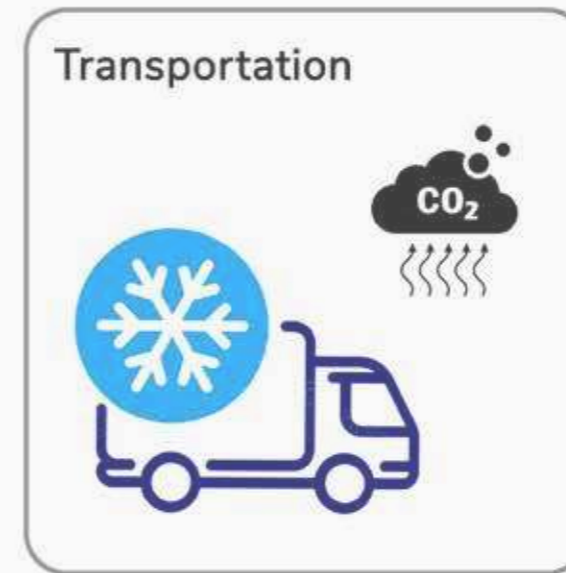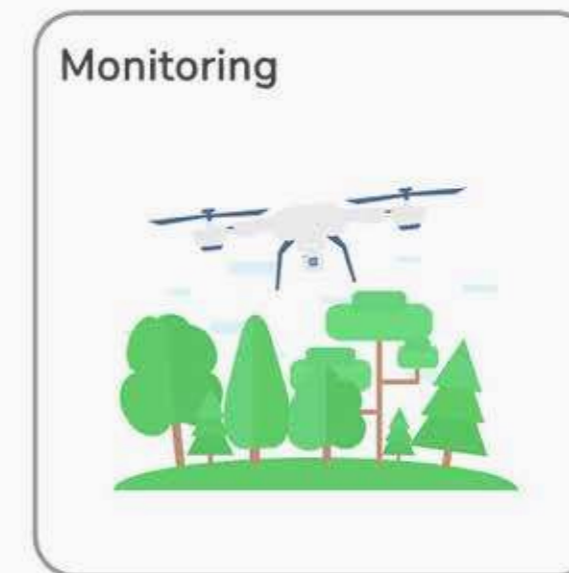
METHODOLOGY

AERIAL SURVEY & MAPPING

Hyper spectral image technology generates a topographical map. Area to be seeded is identified based on certain parameters

UNDERSTANDING THE REQUIREMENTS

Ecological science and Forest Management practices are taken into account while selecting the species to seed to minimise invasive specie

SEED-BALL PREPARATION

Seed balls are then created as per local soil requirements. Seedballs are created by local communities who are dependent on the forest area.

DRONE DEPLOYMENT

Drones are deployed to spray seeds over designated areas; reaching areas over treacherous terrain too. We fly the drones along predetermined flight map that is digitally rendered from the topographical survey.

GEO TAGGING DRONE PATH

The path followed by the drones are geotagged, facilitating periodic drone monitoring of sown area to collect tree statistics. This allows for frequent future checks and implement corrective measures.

RESEARCH ONGOING

GOVT OF TELANGANA SUPPORT FOR ONGOING RESEARCH

RESEARCH PARAMETERS

› Seedball preparation

› Improvising Drone technology for this use case

› Developing SoPs for Aerial seeding of Seedballs

Jayesh Ranjan IAS
Principal Secretary to Government

Information Technology, Electronics & Communications Department
Government of Telangana

D.O. Lr.No.ITEC-14/Drones/DGCA/1/2018, Dated: 20.03.2020

Dear _Prof Pavan Rao garu_

Sub:- ITE&C Department, Govt of Telangana – Drones– Availability of Professor Jayashankar Telangana State Agricultural University (PJTSAU) Campus for testing of drone solutions- Testing efficiency of Seed Ball seeding drone –Support from PJTSAU- Reg.

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The Department of Information Technology, Electronics & Communication, Government of Telangana has been supporting start-ups in developing products for solving problems in agriculture and allied sectors using emerging technologies.

M/s Marut Dronetech- a fast emerging start-up incubated out of T-Hub, has designed and fabricated the country's indigenously built seed ball seeding drone. We have piloted the drone in Veeranapalli forest in Sircilla district on 17th Feb 2020 as a part of the "Telangana ku Haritha Haaram" project of the Government of Telangana. The project has been well appreciated by the Hon'ble Minister, Shri K.T.Rama Rao Garu.

Further to the pilot, the Startup would like to conduct scientific trials to develop an operational protocol for seed ball seeding using drones. Also, planning to test endurance and efficiency of Seed Ball seeding drones in operating over different terrains.

Hence, we request you to kindly permit M/s Marut Dronetech to test the seed ball seeding drones at PJTSAU and to offer the domain expertise of your scientists to guide them in conducting the above-mentioned trials. We look forward to your continued support in designing new drone-based solutions for agriculture, realising the mission of combating climate change and restoring forests using emerging technologies.

In this context we also request you to make your campus available for drone companies to test out their agricultural solutions.

Looking forward to hearing from you.

With _regards,_

Yours faithfully,

(JAYESH RANJAN)

IMPACT

HARA BAHARA

1 BILLION trees to be planted by 2030 in India by impacting **900 FORESTS.**

To build a network of communities for afforestation activities

To bring awareness at grass-root level about the effects of deforestation

To involve influencers to raise their voice about the climate change

Building a platform for corporates and organizations to contribute for the cause

CAMPAIGN FORMAT

› Local communities will be engaged in the seedballs preparation

› Seedcopter Drones will drop the seedballs in the areas affected by deforestation

› Encourage corporates, governments, influencers and NGOs to contribute

CASE STUDY

Project Name	Seed Dispersed	Area covered
VEERANAPALLI FOREST, TELANGANA	15,000	320 hectares
UDAIPUR, RAJASTHAN	10,000	5 hectares
MAHABUBNAGAR (Guinness World Record Seedballs)	1,14,88,061	-
AMANGAL RESERVE FOREST, TELANGANA	12,000	248 hectares

KTR
@KTRTRS

Seeding through drones as part of Haritha Haaram at Veernapalli in Sircilla constituency today#HappyBirthdayKCR#EachOnePlantOne

2,104   11:02 AM - Feb 17, 2020

CASE STUDY-2021

KAMAREDDY	LINGAMPETA PA	02-Sep
MEDAK	SURARAM	03-Sep
AMANGAL	RAMMUNTHALA	04-Sep
MEDCHAL	KEESARA	6-Sep

CASE STUDY-2021

YADADRI BHUVANAGIRI	RAIGIRI- II	8-Aug
SANGAREDDY	AURANGANAGAR	22-Sep
VIKARABAD	PARGI	04-Oct
GADWAL	MALKAPUR	12-Oct

CASE STUDY-2021

HYDERABAD	KBR PARK	1-Oct

CASE STUDY-2021

SIDDIPET	AKUNUR	13-Oct
NAGARKURNOOL	AMRABAD	19-Oct
NALGONDA	CHERUKUPALLY	21-Oct
MAHABOOBNAGAR	MALKAPUR	22-Oct

CASE STUDY-2021

NARAYANAPET	KOTAKONDA	26-Oct
JANGAON	ASWARAOPALLY-I	27-Oct
WGL_U	MIRZAPUR	28-Oct
WARANGAL R	PAKHAL RF	30-Oct

CASE STUDY-2021

JAGITYAL	ARSIKOTA	9-Nov
NIZAMABAD	MANCHIPPA PAR	09-Nov
NIRMAL	SIRPALLY	10-Nov
ADILABAD	SATNALA	10-Nov

CASE STUDY-2021

ASIFABAD	SAMELA	11-Nov
MANCHERIAL	RYALI	11-Nov
PEDDAPALLY	KHAMMAMPALLY	12-Nov
MAHABUBABAD	MOTHLATHIMMAPURAM	16-Nov

CASE STUDY-2021

KHAMMAM	JAMALAPURAM	16-Nov
BHADRACHALAM	CHERLA	17-Nov
MULUGU	RAMAPPA-I	18-Nov
BHUPALPALLY	JAKARAM-I	18-Nov

AMBASSADORS

RANA DAGGUBATI

Actor and star of "Aranya", Indian film actor, Producer, Visual Effects Co-ordinator, and Photographer known for his works in Telugu, Tamil and Hindi cinema

JADAV PAYENG

Environmental activist and Padma Shri awardee from Assam

DARIPALLI RAMAIAH

Environmental activist and Padma Shri awardee from Telangana

MEDIA COVERAGE

Eye in the sky: Telangana turns to drones for safeguarding forests

If all goes well, aerial vehicles will fly over State's forests to monitor smuggling & poaching

AIHIK SUR @Hyderabad

FOR a while now, the Telangana Forest Department has been struggling with cases of poaching and teakwood smuggling. In order to combat these issues, the department is now looking towards drones that can scan forests. It is expected that the drones would identify and locate smugglers and hunters, who often taken opt for routes that are hard to trace.

A while back, the forest department got in touch with the Information Technology, Electronics and Communications (ITE&C) department to discuss the various issues it was facing. Apart from detecting smugglers and poachers, the department was looking for options that would help them with better implementation of the Haritha Haram plantation drive.

"As of now, officials manually disburse seedballs into the forest. With the help of drones, the seeds could be sprayed down to the location, superseding the need for manual labour," an official said.

The forest officials also want drones to identify various kinds of plant species through hyperspectral imaging sensor. However, this does not seem very likely to come to fruition, because as per sources, drone startups do not use that particular sensor.

Meanwhile, it is also learnt that there have been incidents where poachers lay metal traps to capture animals. Officials are also hoping that drones will detect such traps. Lastly, they also wanted the technology to help measure trees.

Based on these requirements, a meeting was recently held between the forest department officials, ITE&C, and various drone startups at the T-Hub.

Based on the presentations made during the meeting, officials are now formulating a pilot project to address the mentioned issues.

DGCA guidelines a roadblock?

However, the Directorate General of Civil Aviation's (DGCA) guidelines regarding drones or unmanned aerial vehicles may prove to be tricky for the State government. For instance, the DGCA guidelines do not allow unmanned aerial vehicles to "discharge or drop substances", unless cleared by the authority. "We will be taking permission for the same," a senior official said. The other guideline which may pose as a hindrance is the Beyond Visual Line of Sight (BVLoS), which entails that drone pilots must maintain a direct visual line of sight at all times while flying — unless permission is taken separately.

GREAT EXPECTATIONS

Forest dept is hoping that drones would help them implement the Haritha Haram plantation drive in a better manner, by spraying down seedballs into the forests

Officials want drones to identify various plant species through hyperspectral imaging sensor

They also hope that drones will detect metal traps laid by poachers to capture animals

> As of now, officials manually disburse seedballs in the forest. With the help of drones, the seeds can be sprayed down from air, superseding the need for manual labour
> Forest official

Bleeding edge: City-based firms propose deploying leading tech

EXPRESS NEWS SERVICE @Hyderabad

SEVERAL drone startups, including a few based in Hyderabad, presented their solutions to the issues that the Forest Department has been facing.

At T-Hub, various startups including city-based Marut Drones and Thanos, Bengaluru-based Aarav Unmanned Systems, Telemetry and few others were invited. Based on their presentations, the State government is now formulating a pilot project.

The presentation made by Marut Drones, accessed by Express, shows that leading technologies will be deployed to solve issues such as detecting illegal activities including smuggling, poaching, etc. For instance, the images that drones capture will be processed to churn out outputs such as 3D model of the picture, contours, digital elevation model and so on.

Marut Drones also have the technology to survey forests during the night. Speaking to Express, Prem Kumar Vislawath, founder of Marut Drones, said, "Since we have done pilot projects in forest areas for West Bengal and Assam governments, we understand the problems the department here is facing."

Marut Drones was founded by an alumni team from IIT, Guwahati. They are registered in the T-Hub, and mentored by RICH and IIT Hyderabad. They have also been selected for the Facebook India Innovate Accelerator.

Now, drones sow seeds as farming takes hi-tech way

TIMES NEWS NETWORK

Hyderabad: Tree plantation has gone hi-tech in Telangana with city-based startup Marut Drones pressing its drones into service for dropping seed balls in Veernapalli in Sircilla as part of the Telangana government's Haritha Haaram programme.

Explaining the process, Marut Drones co-founder Prem Kumar Vislawath said, drones are first used to survey and map the terrain that helps determine the number of trees to be grown based on various parameters like soil and climate, among others, following which seedballs are created by local communities and dropped by drones in the targeted areas.

On Monday, drones did seeding by releasing over 15,000 seed balls, consisting of Velaga, Gangaravi, Gummadi Teak, Seema Chinta, Raavi and Sitaphal seeds, from around 40 to 50 feet above the ground in Sircilla.

He pointed out that the advantage of using drones is that it can accomplish the task much faster and the path followed by the drones are geotagged, facilitating periodic monitoring of the sown area to collect tree statistics.

"The entire process cuts down on manpower, time, danger to the tree-planters and results in nearly 10-fold reduction in the cost of forest landscape reforestation," he said.

In fact, the box for releasing the seed balls was 3D-printed with the help of technology developed at T-Works, a state-run incubator for electronics startups.

Founded by a team of Indian Institute of Technology (IIT) Guwahati alumni, Marut Drones has been mentored by T-Works and RICH and was recently selected for Facebook's India Innovation Accelerator Programme.

With its drones being used for seeding, Marut Drones intends to make reforestation scalable through 'Drone Swarms' that can plant up to 1 lakh trees a day. The startup has also built India's first drone to eradicate mosquito larvae and water hyacinth and has tested its solutions in some of the lakes in and around the city.

Founded by a team of Indian Institute of Technology, Guwahati alumni, Marut Drones has been mentored by T-Works and RICH

TECH T@LK

Sowing through drones, a unique gift to CM

STATE BUREAU
Hyderabad

Haritha Haram was celebrated in a novel way at Veernapalli village in Sircilla Assembly constituency, represented by Minister for IT and Municipal Administration KT Rama Rao, on Monday.

Marking the 66th birthday of Chief Minister K Chandrashekhar Rao and following a call given by Rama Rao to celebrate the occasion by planting saplings and sowing seeds, seeding was done through drones in the village.

Over 15,000 seeds were airdropped in Veernapalli. Marut Drones, a Hyderabad-based startup promoted by Prem Kumar Vislavath, was engaged for the purpose.

The box for releasing seed balls was 3D-printed with the technology developed by T-Works, a State government incubator for electronics startups. Activists of the TRS from Sircilla constituency coordinated the activity with District Forest Officer Asha, Forest Range Officer Venugopal and others.

Former TESCOB chairman Konduru Ravinder Rao, MPP Malothu Bula, MPTC Santosh, ZPTC member Gugulothu Kalavathi, Veernapalli sarpanch Madugula Mallesham, local leaders Thota Agaiah, Gugulothu Suresh, Chand Pasha (ZP cooption member) took the lead.

After the Chief Minister's call that afforestation should be taken up in barren lands and around forest areas, the TRS activists from Sircilla sought to sow the seeds in open areas. TRS workers and students of a few schools in and around the village enthusiastically participated in the process of mixing seed with jeevamrutham (an organic fertilizer) and soil to make seed balls.

Prem Kumar said he had given them the specifications about the size of the seed balls for the drones to hold and drop them at designated places. Rama Rao appreciated the efforts.

Seeds of velaga, gangaravi, gummadi teak, seema chinta, raavi, and sitaphal were sown on Monday.

Over 15,000 seeds were airdropped in Veernapalli of Sircilla with the help of Marut Drones, a Hyderabad-based startup.

Telangana Today

AWARDS, RECOGNITIONS AND GRANTS

- "Emerging Technology Award " for Drones and AI at the 6th Annual NASSCOM Technology Conference 2019

- Recognized under Forbes 30 under 30 Asia 2020

facebook India Innovation Accelerator · PURDUE UNIVERSITY · Forbes 30 UNDER 30 · RICH · NASSCOM · t-hub · NIDHI PRAYAS · ACTION FOR INDIA

THANK YOU!

SEEDCOPTER

www.seedcopter.com

ANNEXURE-II

AV-29017/17/2021-SDIT-MOCA
Government of India
Ministry of Civil Aviation

Rajiv Gandhi Bhavan, New Delhi
04 Aug 2021

Subject: Conditional exemption from Unmanned Aircraft System (UAS) Rules, 2021 to Government of Telangana for conducting "Telangana Ku Haritha Haram" afforestation project in the Telangana using drones

1. Whereas, Government of Telangana ('the Applicant') had, vide email dated 16 July 2021 sought an exemption from UAS Rules, 2021 for the afore-mentioned purpose.
2. Whereas, based on the undertaking provided by the Applicant, approval of the Standard Operating Procedure (SOP) shall be obtained by the Applicant from Directorate General of Civil Aviation (DGCA) for the afore-mentioned purpose.
3. Now, therefore, the Central Government, in exercise of the powers conferred by Rule 70 of the UAS Rules, 2021, grants conditional exemption from UAS Rules, 2021 to the Applicant for the afore-mentioned purpose. This exemption shall be subject to the terms and conditions of the said SOP and shall be valid for a period of one year from the date of approval of the said SOP or until further orders, whichever is earlier.

(Amber Dubey)
Joint Secretary to the Government of India

To:

1. All Ministries/ Departments of the Government of India
2. Chief Secretaries/ Administrators of all States/ Union Territories
3. DGPs/ Heads of Police of all States/ Union Territories
4. Additional Secretary (Internal Security), Ministry of Home Affairs (MHA), New Delhi
5. Joint Director, Intelligence Bureau (Shri Janardan Singh), New Delhi
6. Director, G-Wing, Ministry of Defence, New Delhi
7. Gp Cpt K.B. Mathews, Air Headquarters, IAF, New Delhi
8. DG, Directorate General of Civil Aviation (DGCA), New Delhi
9. DG, Bureau of Civil Aviation Security (BCAS), New Delhi
10. Chairman, Airports Authority of India (AAI), New Delhi
11. PS to HMoSCA (IC), Ministry of Civil Aviation, New Delhi
12. Sr. PPS to Secretary, Ministry of Civil Aviation, New Delhi
13. National Informatics Centre (NIC) team, Rajiv Gandhi Bhavan, New Delhi
14. Digital Sky Platform

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ANNEXURE-III

Government of India
Directorate General of Civil Aviation
Opp: Safdarjung Airport
New Delhi – 110003

भारत सरकार
महानिदेशक नागर विमानन का कार्यालय
सफदरजंग ऐयरपोर्ट के सामने
नई दिल्ली-११० ००३

TELEPHONE: +91-11-24622495
Email Id: Drone.dgca@gov.in

Ref. No. संख्या DGCA-31031/23/2021-DRONE-Dte
Dated: दिनांक: 17.08.2021

Telangana Forest Department	Marut Dronetech Private Limited
Government of Telangana	T- Hub Foundation, IIT Hyderabad Campus,
Aranya Bhawan , Saifabad,Hyderabad	Gachibowli, Hyderabad 500032

Subject: - Approval of SOP-Standard Operating Procedure for drone based Reforestation activity in 33 districts of Telangana State using Drone Technology.

Sir,

Reference may please be made to your application dated 16.07.2021 on the above mentioned subject.

Director General of Civil Aviation, India hereby grants approval of SOP-Standard Operating Procedure to Telangana Forest Department, Government of Telangana & Marut Dronetech Pvt.Ltd for drone based Reforestation activity in 33 districts of Telangana State using Drone Technology.

Sl. No.	Validity		Scope of approval
	From	To	
(1)	(2)	(3)	(4)
1	17/08/2021	16/08/2022	Drone based Reforestation activity in 33 districts of Telangana State.

Conditions:
1. Exemption must be obtained from MOCA from UAS Rules 2021, before operations.
2. Operating restrictions must be adhered to as stipulated in extant Govt. regulations.
3. Compliance of conditions on the permissions or exemptions from various agencies such as MOCA/DGCA/MOD/IAF/AAI/State/District/Civic Authorities.
4. Third Party Insurance shall be in place before operations, copy shall be submitted to DGCA.
5. Adherence to SOP, however these may change, for any unavoidable conditions if arises which may be recorded in writing.
6. Telangana Forest Department, Government of Telangana & Marut Dronetech Pvt.Ltd shall be responsible for safe operation and legal issue if any on account damage occurred to any person or property.
7. DGCA & MOCA shall not be liable for any direct, indirect, incidental or consequential loss or damage to any life/property arising from or related to this activity.
8. This SOP shall be valid exclusively for Telangana Forest Department, Government of Telangana & Marut Dronetech Pvt.Ltd.
9. The above approval is without prejudice to the compliance of the provisions of UAS Rules 2021, Applicable Civil Aviation Requirements (CAR) and various Circulars issued by DGCA from time to time. Further, if at any time during the aforesaid validity of this approval any violations found then this approval may be altered, suspended or cancelled without giving any reasons thereof.

This issues with the approval of Competent Authority.

Yours Sincerely,

(R.P Kashyap)
Director Operations -Drone Directorate
For Director General of Civil Aviation

Copy to :-
1. Jayesh Ranjan Principal Secretary, Govt. of Telangana
2. ED (ASM) AAI headquarters
3. Rama Devi -OSD , Govt. of Telangana
4. SDIT Section. MOCA

आर. पी. कश्यप / R.P. Kashyap
निदेशक (प्रचालन)/Director (Ops.)
नागर विमानन महानिदेशालय
Directorate General of Civil Aviation
भारत सरकार / Govt. of India
सफदरजंग हवाई अड्डा / Safdarjung Airport
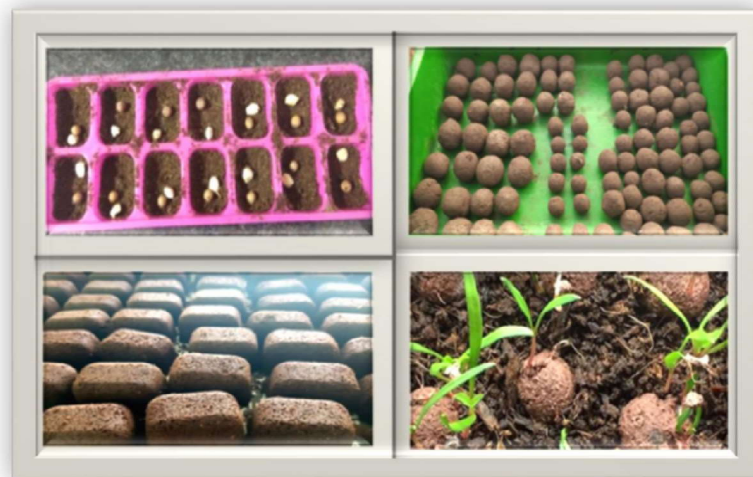नई दिल्ली-110003 / New Delhi-110003

17/08/2021

ANNEXURE-IV

Proposal on

STUDY OF EFFICACY AND STRENGTH OF SEED BALL TECHNOLOGY IN DIFFERENT REGIONS OF INDIA

INDIAN COUNCIL OF FORESTRY RESEARCH AND EDUCATION
Dehradun, Uttarakhand

STUDY OF EFFICACY AND STRENGTH OF SEED BALL TECHNOLOGY IN DIFFERENT REGIONS OF INDIA

Introduction

Using 'seed balls or seed cakes', for afforestation of degraded forest areas, was found to be economical and easy method to develop greenery in comparison to other method like planting container seedlings, direct sowing, stump planting etc. There were reports of its importance from various states in India and reported that,it is technique used in Ancient Egypt, on farms, after the annual flooding of the Nile River and became familiar (*www.downtoearth.org*;15.11.2018) to other part of the world, after this technique was re-introduced by Masanobu Fukuoka (the natural farming pioneer)and it was also found successful in Kenya (www.seedballskenya.com). Seed balls or seed cakes are improvised form of seed pellets. It is dressing the seeds with suitable inert materials, fertilizers, plant growth regulators, fungicides, insecticides, pesticides, etc. for facilitating seed germination, protection from predation of seeds by birds, insects or other animals, survival and establishment of seedlings. Seed balls can be used for direct dibbling, broadcasting and aerial seeding. Considering usefulness of this technique, a pilot level project for testing its efficacy in field is proposed with following objectives to implement in 20 states of the country with full participation of State Forest Departments.

Objectives

1. To conduct training and create awareness on seed ball technology to field staff of SFDs and community.
2. To prepare and test the effectiveness of seed balls through field trials.
3. To assess and monitor the growth and progress of the seed ball trials.

Methodology

1. Training and capacity building to staff of SFDs and the community

a. ICFRE has designated nodal of officers at its research institutes to network with their jurisdiction states. The State Forest Departments would nominate a nodal officer for implementing the program and networking with ICFRE nodal officers. Nodal Officer of SFD would identify suitable field staff (Range officers/ foresters) to be trained in preparation and implementation of the seed ball technology trials. The nodal officers of ICFRE institutes would impart training on seed pretreatments, seed ball making and related details to the SFD officials.

b. A second level training and awareness on seed ball technology would be imparted at the community level by ICFRE nodal officers. The Nodal officer of SFD would co-ordinate with ICFRE nodal officers in bringing the tribal community, self-help groups and NGOs for the training programs. Two trainings will be conducted to mobilize community on seed ball technology by ICFRE. A training booklet / manual will be prepared.

2. Mapping of area, Seed ball preparation and laying of trials

a. The SFDs would collect quality seeds of native species mostly orthodox seeds (long viability) well in advance. As prescribed in the training, SFD would subject seeds to suitable pre-treatments for making seed balls. SFD would procure the necessary ingredients for seed ball preparation and prepare seed balls or seed cakes.

b. Nodal officer of SFD will identify suitable land and map the area. Care would be taken to select areas with minimum soil depth of 2 to 3 feet, demarcate 15 ha per state/UT @ 5 ha per trial plot in three different zones. These 3 zones could be (1) Partly moist area (2) Dry area and (3) Degraded/ mine spoil area. In case of hilly states it could be 3 different elevations eg. Himachal Pradesh. Land preparation mainly involves removal of weeds, retilling or raking of the soil with a sharp edged long bamboo pole or long metal tool during dibbling of the seed balls, fencing to protect the plot from grazing and create semi-circle bunds to catch the rain water

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along the slopes or water holes to accumulate rain water. Nodal officer of SFD would lay the seed ball trial atleast one week ahead of the onset of rains in the selected areas. There should be 4-5 rains after the seed balls are introduced. The quantity of seed balls used would be 1000 balls/ ha. The SFD would record the germination count after two months of dibbling in the seed ball data recording sheet **(Annexure-1)** and inform the ICFRE nodal officer. The trial plots should be protected and maintained for two years. In the second year, gap filling would be done using 500 seed balls/ha.

3. **Assessment and monitoring of the seed ball trials**

The plant survival would be assessed by ICFRE nodal officer at intervals of 4 months (from the date of dibbling) until two years. The data recorded would be compiled, analysed and results obtained would be reported. Throughout the study period the ICFRE nodal officer would co-ordinate with the SFD nodal officer. A best practices booklet pertaining to seed ball technology would be published by ICFRE.

Project team: The project will be implemented by a team of Scientists of ICFRE institutes with active collaboration of State Forest Departments through the Nodal Officers, with Dr. R. Anandalakshmi, Scientist-F, IFGTB as overall Project Coordinator.

S. No.	Nodal Officers of ICFRE Institutes	State Forest Department/ UT
1	Dr. R. Anandalakshmi, Scientist- F, IFGTB, Coimbatore	Tamil Nadu
		Kerala
2	a) Dr.Manisha Thapliyal, Scientist-F, FRI, Dehradun b) Shri Deepak Mishra I.F.S.,FRI,Dehradun	Uttarakhand (Shivaliks)
		Uttar Pradesh (Bundelkhand, Vindhyas)
		Punjab (Shivaliks)
		Haryana(Shivaliks&Aravallis)
		Delhi
3	a) Dr.Vinod Kumar, Scientist, IFB, Hyderabad b) Dr.Pravin H. Chawhaan, Scientist-G, IFB, Hyderabad	Telangana
		Odisha (Raigada, Sundargarh, Keonjhar)
4	Dr.N.Ravi, Scientist E, IWST, Bengaluru	Karnataka
		Andhra Pradesh
5	a) Dr.Maitreyee Kundu, Scientist-F, TFRI, Jabalpur	Madhya Pradesh (Bundelkhand)
		Chhattisgarh (Vindhyas)

	b) Dr.Nanita Berry, Scientist-E, TFRI	
6	Dr.Yogeshwar Mishra, Scientist-G, IFP, Ranchi	Bihar (Vindhyas)
		Jharkhand (Chota Nagpur Plateau, SanthalParagan region)
		West Bengal (South-West)
7	a) Dr.N.K.Bohra, Scientist-C, AFRI, Jodhpur & b) Dr.Genda Singh,Scientist-G, AFRI, Jodhpur	Rajasthan
		Gujarat
8	Dr.P.S. Negi, Scientist D,HFRI, Shimla	Himachal Pradesh(Shivaliks)
		Jammu

Project period: 2 years

Outcome

1. A standard protocol for best practices of seed ball technology will be developed.
2. The seed ball technology can be extended for large scale afforestation programs and for greening wastelands
3. The forest based communities will be trained in seed ball technology which would help to restore degraded forest areas and generate employment opportunities for the communities involved.

Budget:

A. Budget for ICFRE (Amount in Lac Rs.)

Sl. No.	Components	Heads	(year 1)	(year 2)	Total Amount
1.	Training and capacity building (1 training to SFD and 2 trainings to community)	Materials &Supply	0.25	0.25	0.50
		Travel	0.50	0.50	1.00
		Training expense	2.00	1.00	3.00
		Contingency	0.25	0.25	0.50
		SubTotal	**3.00**	**2.00**	**5.00**
	For 8 ICFRE institutes @Rs.5.00 lakhs per institute (for component 1)		**24.00**	**16.00**	**40.00**
2.	Assessment and monitoring of the seed ball trials	M&S	0.50	0.50	1.00
		Travel	2.00	2.00	4.00
		Booklet	-	1.50	1.50
		Contingency	0.75	0.75	1.50
		Sub Total	**3.25**	**4.75**	**8.00**
	For 8 ICFRE institutes @Rs.8.00 lakhs per institute (for component 2)		**26.00**	**38.00**	**64.00**
	Total ICFRE Budget		**50.00**	**54.00**	**104.00**

B. <u>Budget for SFDs (Amount in Lac Rs.)</u>

(Mapping of area, Seed ball preparation and laying of trials)

Sl. No.	Components	Total units	Year 1	Year 2	Total amount
1.	Survey and identification of plantation areas in three different zones and laying of sample plots.	15 ha	0.30	0	0.30
2.	Site preparation including removal of Invasive Alien Species – medium growth and create semi-circle bunds/water holes in the planting areas	15 ha	6.00	2.40	8.40
3.	Engaging labours to collect seeds from identified tree species or purchase based on local rate	-	0.30	0.20	0.50
4.	Purchase of identified ingredients for preparing seed balls	-	0.70	0.40	1.10
5.	Engaging labours to create the seed balls	-	0.30	0.20	0.50
6.	Engaging labours to prepare the land by carrying out activities such as harrowing etc., to break the soil surface & to dibble the seed balls within the marked plots.	15 ha	0.60	0.30	0.90
7.	Erection of display boards	3 nos.	0.30	-	0.30
8.	Documentation and travel	-	1.50	1.50	3.00
9.	Fencing the sample plot	15 ha	15.00	-	15.00
		Total	25.00	5.00	30.00
	For 20 SFDs @ Rs.30.00 lakhs per SFD		500.00	100.00	600.00

Budget Abstract <u>(Amount in Lac Rs.)</u>

S.No.	Components	Year I	Year II	Total Amount
1.	Training and capacity building (ICFRE)	24.00	16.00	40.00
2.	Mapping of area, Seed ball preparation and laying of trials (SFDs)	500.00	100.00	600.00
3.	Assessment and monitoring of the seed ball trials (ICFRE)	26.00	38.00	64.00
	GRAND TOTAL	550.00	154.00	704.00

SEED BALL DATA : RECORDING SHEET   ANNEXURE-1

Location: Division:
Field staff name & contact number:
Plot Size:
GPS co-ordinates:
Landmark/tags:

State: Date of dibbling:

No. of seed Balls (with 4 seeds) dibbled:

Species used: 1)   2)   3)   4)

Seed source & date of collection:
Pretreatments done:
Remarks:

Species name	No. of seeds used for dibbling/ trial & seed weight in g.	No. of seeds germinated after 2 months of dibbling	Germination % after 2 months of dibbling	Date of germination count	No. of plants surviving at the end of 1st – 4 months	Date of plant survival count	No. of plants surviving at the end of 2nd – 4 months	Date of plant survival count	No. of plants surviving at the end of 3rd – 4 months	Date of plant survival count	Plant survival % at the end of one year

Nodal officer ICFRE Institute: Nodal Officer, SFD:

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