A Quarterly Newsletter of **Odisha Forestry Sector Development Project,** Phase-II Oct-Dec, 2023, VOL-7, ISSUE-3

From Project Director's Desk

In Odisha Forestry Sector Development project, Phase-II, the annual monitoring and review of progress of project activities "Sameekshya" conducted at Division level and State level. It serves as a unique monitoring mechanism, bringing together all stakeholders, including community members involved in project interventions, to exchange experiences, learnings, and challenges encountered during project implementation.

The Division level Sameekshya conducted with District level Officials from various line Departments also showcase the efforts undertaken for the holistic development of communities through Inter-Sectoral Convergence. Discussions and sharing of experiences significantly contribute to mutual learning among VSS members in implementing similar measures for their overall development.

The State level event "Sameekshya, 2023- Innovations and Best Practices" marks the conclusion of the Sameekshya Meetings held across all 12 Project Divisions, OFSDP-II during the period of 2023. A report of the State level Sameekshya has been incorporated in this edition of Banayan.

During last quarter, community members of OFSDP-II along with Ama Jangala Yojana and OFSDS-OMBADC participated in the 16th State level Kalinga Herbal Fair -2023-24. The platform offered a special platform for our VSS and SHGs to sale herbal products and showcase their project activities while augmenting substantial income in their pocket during the fair. It is heartening to mention that due to collective effort of all the Divisions OFSDS stall was awarded as the Best Stall in Government segment with maximum participation from forest fringe communities and made maximum business for the fourth consecutive time.

As a special feature on concurrent monitoring, evaluation and studies a detailed study titled "Impact Assessment of soil and moisture conservation activities under OFSDP-II – A SMAP approach using Google Earth Engine" has also been incorporated. The special feature also includes an article about Mahua flower value addition of Sambalpur Forest Division.

I am confident that the different domain-based success stories and assessment reports of the project will bring us closer to our objective and offer better results for the project.

Dr Meeta Biswal, IFS
PCCF (Projects) & Project Director
OFSDS

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"What we are doing to the forests of the world is but a mirror reflection of what we are doing to ourselves and to one another"

COVER STORY

BEYOND THE LAST MILE: COMMUNITY CENTRIC LIVELIHOOD INITIATIVES FOR FOREST FRINGE DWELLERS

The Odisha Forestry Sector Development Society (OFSDS), under the aegis of Department of Forest, Environment and Climate Change, Government of Odisha organized a day long State Level Conference "**Sameekshya, 2023: Innovations and Best Practices under Odisha Forestry Sector Development Project, Phase-II (OFSDP, Phase-II)**" on 1st November 2023 at Bhubaneswar. The state level Sameekshya, 2023 was the culmination of series of Forest Division level Annual Review Meetings 'Sameekshya 2023' held in all the 12 Forest Divisions under OFSDP, Phase II.

The Chief guest of the day, Shri Satyabrata Sahu, IAS, Additional Chief Secretary, Department of Forest, Environment & Climate Change, Government of Odisha inaugurated the workshop in the august presence of Shri Debidutta Biswal, IFS, Principal Chief Conservator of Forests and Head of Forestry Force, Odisha and Dr. Meeta Biswal, IFS, Principal Chief Conservator of Forests (Projects) and Project Director convened the Workshop.

In his address, the Additional Chief Secretary stated that livelihood promotion of the forest fringe community was the essential key for effective conservation and management of forest resources and OFSDP-II project has made an appreciable progress in this regard. He also emphasized that convergence of various government schemes of the line departments were the indicators of cohesion of government agencies towards the well-being of forest fringe dwelling communities and he lauded the special focus given by of OFSDP-II on constructive collaboration with the line departments. Shri. Sahu further appreciated the Micro plan re-visit process initiated by OFSDP-II in the VSSs under its jurisdiction and observed that the decentralized planning in the form of need-based Micro Plan for community development was an unique participatory exercise and it has empowered the community based organizations like VSSs and SHGs to a large extent. He particularly recognised the project initiative in establishing multiproduct clusters for enhancing the income generating activities of the forest fringe dwelling communities with the assistance of Management and Marketing Support Agency (MMSA) and the partnership with Entrepreneurs and Social Enablers.

In his address, Shri Debidutta Biswal, PCCF & HoFF, Odisha said that the OFSDP-II has been the pioneer amongst all the JICA assisted projects in South East Asia to integrate use of geo-spatial technology as a tool for decision making on sustainable forest management involving the community, coupled with the use of Information Management System (IMS) for concurrent monitoring and decision making. He appreciated the initiative of OFSDP-II to achieve effectiveness and transparency in sustainable forest management practices adopted with community participation with the aid of technological interventions, which is also in line with '5T' initiatives of Govt of Odisha. He also praised OFSDP-II for taking the lead role in ensuring sustainable livelihood security to the local communities with their active participation, because of which the project is being categorised as a **Well Performing Project** by the JICA, India.

In her opening address, Dr. Meeta Biswal, IFS, PCCF (Projects) & Project Director, Odisha Forestry Sector Development Society said that the primary objective of OFSDP, Phase-II is to achieve sustainable forest management along with ensuring long term livelihood security to the forest fringe dwelling communities in the targeted project area. She highlighted that 1211 number of identified Vana Surakhya Samitis (VSSs) of 12 Forest Divisions and 10 Eco-Development Committees (EDCs) in Badarama Wildlife Sanctuary under Bamra Wildlife Division of the State are actively engaged in forest protection apart from engaging themselves in plantation activities and livelihood promotion with interventions with the support of income generating activities and convergence schemes. The uniqueness of OFSDP-II, as she highlighted in her address, is the Standardized Operational Protocols (SOPs) and processes that are developed and established during the process of implementation of different activities under the project. Further, in her speech, she listed the major progresses achieved under OFSDP-II such as mobilization of funds to the tune of Rs. 403.10 crores through convergence schemes of 37-line departments benefitting so far 17.16 lakhs persons in the project area. In addition, the Revolving Fund (RF) which was a one-time grant provisioned under the project to each

VSS for extending loan facility to the Borrowing entities v.i.z SHGs, CIGs and Poorest of Poors (Pops) for taking up income generating activities had seen remarkable growth. During last year i.e 2022-23, 17b3 SHGs, 259 CIGs and 6415 PoPs had availed this facility during the 2022-23 financial year, she stated. The pioneering efforts of OFSDP-II in terms of initiating the field level CMRV exercise, a process of REDD+ readiness for climate change resilience and engagement of MMSA to support the forest fringe communities were also highlighted by her during the opening address.

On this occasion, several publications pertaining to OFSDS were released. The publications released on this occasion are Best Practices under OFSDP-II, Standard Operating Procedure (SOP) Manual of Harvesting and Primary Level Processing of Medicinal Plants under OFSDP-II, BCA Health Report Card 2023, Annual Reports 2023 of OFSDP-II, AJY and OMBADC.

"Sameekshya, 2023" was conducted in four Technical Sessions. Deliberations on Innovations and best practices and Status on Livelihood Initiatives under OFSDP II were held in first two sessions. Various community-based income generation activities promoted by different Divisional Management Units (DMUs) under the project were presented by respective DMU Chiefs (DFOs) and Social Enablers who were tirelessly working under the project for providing market support to the IGAs carried out by the community. The way-forward and strategies for project implementation and collaboration with new Social Enablers in the project was also discussed extensively.

The one-day workshop, began with the formal-welcoming by Sri Swayam Mallik, Deputy Project Director (CME&S), OFSDS was attended by the RCCFs, DFOs-cum-Divisional Management Unit Chiefs of 14 Forest Divisions, Scientists from NCSCM, Chennai, partner-NGOs of OFSDP–II, officials from PMU, Experts from PMC, Experts from MMSA and Social Enablers, all Subject Matter Specialists from all the OFSDP-II Forest Divisions and other stakeholders. Formal vote of thanks was offered by Sri Yasobanta Beriha, Deputy Project Director (A & F), OFSDS.

GLIMPSES OF STATE LEVEL SAMEEKSHYA – 2023:

Innovations and Best Practices of OFSDP-II


SHGs GIFT HAMPERS
OFSDP-II


JICA
SAMEEKSHYA-2023
Innovations and Best Practices
under Odisha Forestry
Sector Development Project, Phase-II
1st November, 2023
Plumeria Hall, Hotel VIVANTA
Bhubaneswar

COVER STORY

OFSDS PARTICIPATED IN 16TH STATE LEVEL KALINGA HERBAL FAIR 2023-24

Awarded as the Best Stall in Government segment with maximum participation from VSSs and SHGs represented by forest fringe communities for the Fourth consecutive time.

The Odisha Forestry Sector Development Society (OFSDS) participated in the 16th State Level Kalinga Herbal Fair 2023-24 organized by Odisha State Medicinal Plant Board for seven days from 5th December to 11th December 2023 at IDCO Exhibition Ground, Bhubaneswar. The exhibition-cum-sale counters in the Herbal Fair were put up by the eighteen Territorial Forest Divisions under OFSDP-II, AJY and OMBADC projects of Odisha Forestry Sector Development Society (OFSDS). The OFSDS stall was inaugurated by Shri Pradeep Amat, Hon'ble Minister, Forest, Environment & Climate Change Dept., Govt of Odisha in presence of Shri Satyabrata Sahu, IAS, Additional Chief Secretary, Shri Debidutta Biswal, PCCF & HoFF and Dr. Meeta Biswal, PCCF (Projects) & Project Director, OFSDS.

As many as 24 Self Help Groups from 18 Forest Divisions functioning under OFSDP-II and Ama Jangala Yojana participated in the exhibition. The VSS and SHG members numbering 66 from the Forest Divisions viz. Athamallik, Baripada, Boudh, Ghumusur – South, Ghumusur – North, Rairangpur, Jharsguda, Sundargarh and Forest Divisions of AJY viz. Keonjhar, Malkangiri, Koraput, Angul, Balangir, Baliguda, Phulbani, Nabarangpur, Banai and Rourkela under OFSDS took active part in the Herbal Fair during the seven days' exhibition.

PCCF (Projects) & PD, OFSDS interacting with VSS members at 16th State Level Kalinga Herbal Fair 2023-24

This was the fourth consecutive time, the VSS /SHG members of OFSDP, Phase-II and AJY took part in the State Level Kalinga Herbal Fair. This fair has special focus on harnessing natural environment with a thrust on herbal and organic products and health care activities. The VSSs / SHGs were chosen based on the NTFP and herbal product-based clusters which were promoted active by OFSDS for the participation in the fair. The exhibition paved the way for maximization of resource augmentation and livelihood earnings of these community stakeholders. A special millet-based food stall was also put up by the SHGs which became most popular among the visitors of the fair.

Senior Officials and Guests visiting OFSDS stall at 16th State Level Kalinga Herbal Fair 2023-24

Participating SHG members and VSS members represented by OFSDP-II and AJY at OFSDS Stall at 16th State Level Kalinga Herbal Fair 2023-24

A large segment of public visited the OFSDS stall to purchase their preferred products. The SHGs ensured availability of different types of products in varied categories viz. health care, wellness, grocery products, natural and forest products etc. The forest fringe community groups sold record number of products in this Mela and the overall sale was very encouraging to the participants and all stakeholders. The stalls generated an income of Rs10,40,813/- out of the sale of products during the seven days of exhibition.

SPECIAL FEATURE

Impact Assessment of soil and moisture conservation activities under Odisha Forestry Sector Development Project Phase II – A SMAP approach using Google Earth Engine

INTRODUCTION

Odisha has a rich repository of ecological and forest resources which has been integral part of its tradition and culture for generations and also adds substantially to the livelihood of the people of Odisha. In this context, the Odisha Forestry Sector Development Project (OFSDP) Phase II implemented with the assistance from JICA stands out as a crucial initiative aimed at promoting conservation and sustainable management of forests and natural resources in the state.

The Project Goal is to enhance forest ecosystem along with sustainable livelihood of local people by improving sustainable forest management, sustainable biodiversity conservation and community development, thereby contributing to harmonization between environmental conservation and socio-economic development in the Project area in Odisha. Consistent with the aforesaid goal the project has framed the following objectives:

- Restore degraded forest and augment forest resources
- Secure sustainable forest management by improving forest administration, community organizations and other stakeholders.
- Conservation and scientific management of the biodiversity
- Promoting inter-sectoral convergence
- Improve income of target forest dependents and their livelihood options

Soil and moisture conservation constitute an important component of the sustainable forest management initiatives under the project. The preservation of soil quality and the effective management of moisture resources are pivotal components of sustainable land management, with far-reaching implications for agriculture, ecology, and climate change adaptation. This project accordingly encompasses a diverse array of strategies and interventions designed to address the pressing challenges posed by soil degradation and moisture scarcity, with a particular emphasis on harnessing modern technologies and innovative approaches for monitoring and assessment.

But it is also equally important to assess intermittently the effectiveness of the aforementioned interventions. The assessment should be robust as well as cost effective. In recent years, technological advancements in remote sensing and satellite-based observations have revolutionized

environmental monitoring and assessment. Among these breakthroughs, the Soil Moisture Active Passive (SMAP) mission by NASA stands out as a remarkable endeavour. Equipped with advanced sensors, SMAP provides high-resolution data on soil moisture levels across the Earth's surface, offering unparalleled insights into soil health and hydrological dynamics (Entekhabbi et. al, 2010). Simultaneously, the integration of geospatial tools like Google Earth Engine has opened up new horizons for the efficient analysis of satellite data, allowing for more sophisticated and comprehensive land and resource management. This study thus leverages the cutting-edge capabilities of the SMAP mission and the computational prowess of Google Earth Engine to establish a robust framework for evaluation.

Literature Review

Soil and Moisture Conservation in Forestry Projects:

Soil and moisture conservation practices have long been recognized as crucial components of sustainable forestry projects worldwide. Effective conservation measures help mitigate soil erosion, improve water retention, and promote ecosystem health (Bastola et al., 2018). These practices are especially important in areas with high deforestation rates and vulnerable ecosystems, such as the state of Odisha in India.

Impact Assessment of Soil and Moisture Conservation Activities:

Impact assessments of soil and moisture conservation activities have been conducted in various regions to evaluate their effectiveness and benefits. Studies have used different methodologies, including field surveys, hydrological modelling, and remote sensing techniques, to assess changes in soil properties, vegetation growth, and water availability (Acharya et al., 2017; Guo et al., 2019).

Remote Sensing for Soil Moisture Monitoring:

Remote sensing, particularly satellite-based technology, has revolutionized environmental monitoring, including soil moisture assessment. The Soil Moisture Active Passive (SMAP) mission by NASA has been widely utilized to monitor soil moisture content at a global scale (O'Neill et al., 2013). SMAP data provides valuable information for impact assessments, enabling researchers to study changes in soil moisture over large areas and extended time periods.

Soil and Moisture Conservation in Odisha Forestry:

Studies specific to the Odisha region have highlighted the importance of soil and moisture conservation in forest management and the need for effective measures to combat soil erosion and water scarcity (Samal et al., 2016). However, limited research has focused on the quantitative impact assessment of conservation activities using remote sensing data, presenting an opportunity for further investigation.

SMAP Data Applications in Environmental Studies:

SMAP data has been widely used in environmental research, such as agriculture, hydrology, and ecological studies (Albergel et al., 2016; Zhang et al., 2018). The integration of SMAP data with other datasets has shown promising results in monitoring soil moisture dynamics and vegetation health.

Challenges and Limitations:

While remote sensing provides valuable information, it also comes with certain challenges and limitations. Factors such as spatial resolution, data availability, and the influence of vegetation on soil moisture measurements can affect the accuracy of the assessments (Liu et al., 2015). These considerations should be carefully addressed during the impact assessment.

Knowledge Gap and Research Objectives:

Despite the importance of soil and moisture conservation in forestry projects, there is a knowledge gap regarding the quantitative impact assessment of such activities under the Odisha Forestry Sector Development Project Phase II using SMAP data. This study aims to address this gap by evaluating the effectiveness of various conservation activities and their contributions to soil moisture retention, vegetation growth, and water availability in the project area. Accordingly, the objectives of the study can be stated as follows:

Objectives of the Study

1. Assessing the Impact: To evaluate the impact of soil and moisture conservation activities conducted under the Odisha Forestry Sector Development Project Phase II on soil health and moisture retention in the project areas.
2. Utilizing SMAP Data: To harness data from the Soil Moisture Active Passive (SMAP) mission by NASA to monitor and analyze soil moisture variations in the project region over time.
3. Leveraging Google Earth Engine: To utilize the computational capabilities of Google Earth Engine for processing and analyzing SMAP data, enabling a comprehensive evaluation of the soil and moisture conservation activities.

4. Spatial and Temporal Analysis: To conduct spatial and temporal analyses of soil moisture trends, identifying areas where conservation efforts have been particularly effective or require further attention.

By addressing these specific objectives, the study seeks to provide a comprehensive and data-driven assessment of the impact of soil and moisture conservation activities under the Odisha Forestry Sector Development Project Phase II. The research aims to contribute valuable knowledge to the field of environmental conservation, fostering a deeper understanding of the interplay between forestry management, soil and water resources, and sustainable development.

METHODOLOGY

Study Area

The study area encompasses select regions within the state of Odisha, India, where the Odisha Forestry Sector Development Project Phase II (OFSDP-II) has been actively implementing soil and moisture conservation activities. As stated hereinbefore Odisha Forestry Sector Development Project -II (OFSDP-II) an externally aided project funded by Japan International Cooperation Agency (JICA) is being implemented in 1,25,000 hectares assigned to the communities for protection and conservation thereby, covering a large area of intervention of about 57000 ha in the state of Odisha. The project is being implemented in 1211 Vana Surakhya Samitis of the state in 12 territorial Forest Divisions. Out of these VSS, 12 VSS were chosen for analysis depending on implementation of interventions for soil and moisture conservation.

Data Collection and Sources

SMAP Data Acquisition: The SMAP Level-4 (L4) Soil Moisture product (Reichle et al.) on Google Earth Engine includes surface soil moisture (0-5 cm vertical average), root-zone soil moisture (0-100 cm vertical average), and additional research products including surface meteorological forcing variables, soil temperature, evapotranspiration and net radiation. SMAP L4 provides uninterrupted soil moisture data. SMAP L-band brightness temperature data from descending and ascending half-orbit satellite passes (approximately 6:00 a.m. and 6:00 p.m. local solar time, respectively) are assimilated into a land surface model that is gridded using an Earth-fixed, global cylindrical 9 km Equal-Area Scalable Earth Grid, Version 2.0 (EASE-Grid 2.0) projection. The SPL4SMGP product includes a series of 3-hourly time-averaged geophysical data fields from the assimilation system. SPL4SMGP data are transformed to geographic coordinates using GDAL libraries before the data are ingested into Google Earth Engine.

USGS Landsat 8 Level 2, Collection 2, Tier 1 dataset provided by United State Geological Survey was also utilised for aiding the analysis. This dataset contains atmospherically corrected surface reflectance and land surface temperature derived from the data produced by the Landsat 8 OLI/TIRS sensors. These images contain 5 visible and near-infrared (VNIR) bands and 2 short-wave infrared (SWIR) bands processed to orthorectified surface reflectance and one thermal infrared (TIR) band processed to orthorectified surface temperature. They also contain intermediate bands used in calculation of the ST products, as well as QA bands. Landsat 8 SR products are created with the Land Surface Reflectance Code (LaSRC). All Collection 2 ST products are created with a single-channel algorithm jointly created by the Rochester Institute of Technology (RIT) and National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL).

Google Earth Engine (GEE): Google Earth Engine was utilized for data processing, analysis, and visualization. GEE provides access to a vast repository of other Earth observation data also and facilitates geospatial analysis through JavaScript-based code development.

Baseline Data: Baseline data has been collected by way of measurement of water levels of water bodies in the VSSs where the project interventions are underway.

Data Processing and Methodological Steps

Temporal Analysis: Time series analysis of SMAP soil moisture data was conducted to identify temporal trends in soil moisture levels. Seasonal and inter-annual variations were analyzed to understand the effects of soil and moisture conservation activities over time. Single-day average of SMAP L4 version 7, 3-hourly soil moisture was created. Surface soil moisture and root zone soil moisture was plotted over pre-determined time period i.e. for the period from 1st March to 30th June of a particular year. The two years that were chosen for evaluation pertained to the 2-3 years prior to project intervention and a similar period post project intervention. This would help in drawing conclusion for the effectiveness of soil and moisture measures implemented by the project.

Spatial Analysis: Spatial patterns of soil moisture were calculated using spatial statistics and geospatial analysis. The .shp files of the area of interest were uploaded to the code

editor for analysis. This included the creation of soil moisture anomaly maps and spatial correlation analysis. This ensured the study's geographic extent and temporal alignment

Impact Assessment: The impact of OFSDP-II soil and moisture conservation activities was assessed by comparing soil moisture trends before and after intervention of project initiatives in project areas. Statistical tests were employed to quantify the impact. Simultaneously the impact of the soil and moisture conservation measures were assessed by way of its effect on vegetation. Normalised Difference Vegetation Index (NDVI) was used to understand the change in vegetation of the region of interest. The change in the index was analysed over the period of project implementation i.e. from 2016 to 2022. A linear model and a harmonic model was fit to the data to understand the temporal variation not only across the seasons in a year but also the variation across the years.

Integration with Baseline Data: The soil moisture data were integrated with baseline data to provide a comprehensive understanding of the context in which soil and moisture conservation activities were implemented. The baseline data comprised of measurement of water table of water bodies in VSS area under study.

Policy and Management Recommendations: Based on the analysis and findings, evidence-based policy and management recommendations were developed for optimizing soil and moisture conservation strategies under OFSDP-II and similar projects in the region.

The methodology outlined in this study thus combines satellite-based soil moisture monitoring with geospatial analysis and on-ground assessments to comprehensively evaluate the impact of soil and moisture conservation activities implemented under the project. By integrating multiple data sources and analytical techniques, this methodology offers a holistic approach to assess the effectiveness of sustainable forest management interventions.

RESULTS AND DISCUSSION

The Table 1 below depicts the names of the Vana Surakhya Samitis, the Field Management Units and the Divisional Management Units (Territorial Forest Divisions) and the type of Soil and Moisture Conservation interventions taken up by the project that are being evaluated for their effectiveness. The location of the interventions have also been depicted.

Table No. 1: List of VSS included in the study

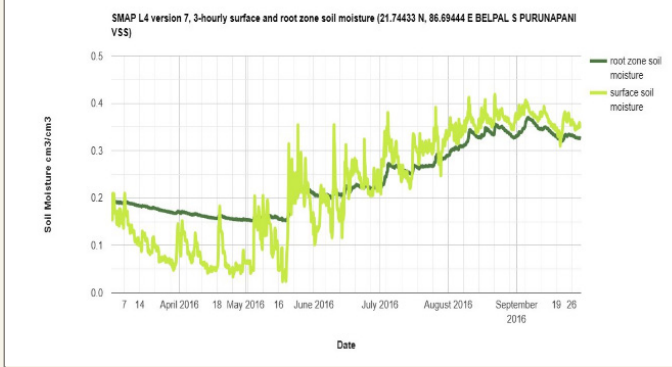
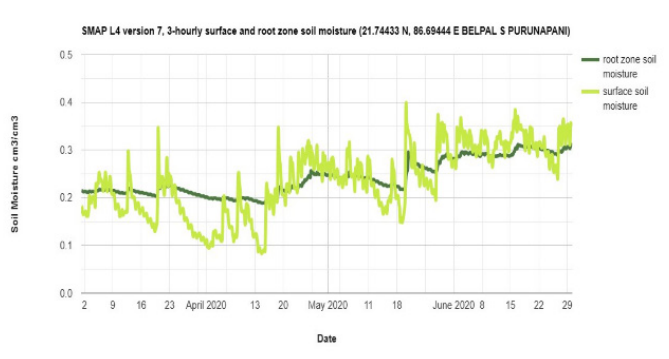
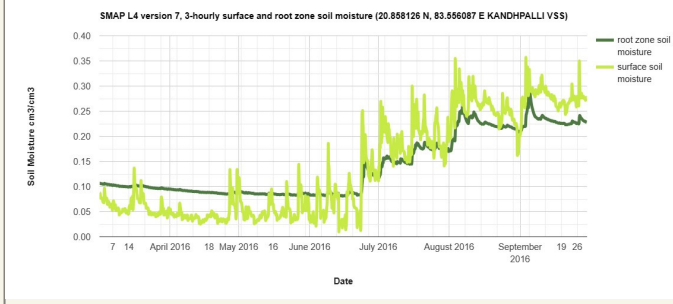
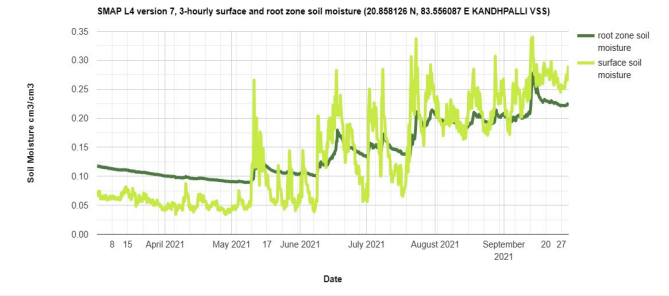
S.No	DMU	FMU	VSS	Year	Name of Structure	Lat	Long
1	Athamallik	Athamallik	Kamalpur	2017-18	WMCD	20.68	84.64
2	Sundergarh	Sundergarh	Bagnipani	2019-20	Pond	22.14	84.16
3	Boudh	Boudh	Karunapali	2017-18	LBCD	20.76	84.27
4	Ghumsur North	Jagannathprasad	Hajapalli	2018-19	LBCD	20.76	84.27
5	Dhenkanal	K.Nagar East	Kandar	2019-20	LBCD	21.07	85.69
6	Karanjia	Dudhiani	Jharbeda	2017-18	LBCD	21.78	86.02
7	Rairangpur	Badampahar	Khajuripada	2017-18	LBCD	22.14	86.08
8	Sambalpur	Padiabahal	Bhatli	2017-18	LBCD	21.34	84.17
9	Jharsuguda	Belpahar	Baghamunda	2017-18	Earthen check Dam	21.73	83.77
10	Ghumsur South	Badagada	Maniakathi	2019-20	LBCD	19.65	84.31
11	Baripada	Dukura	Belpal-S-Purunapani	2018-19	Pond	21.74	86.69
12	Subarnapur	Sonepur	Kandhpalli	2017-18	WMCD	20.86	83.56

The results of the impact assessment of soil and moisture conservation interventions under the Odisha Forestry Sector Development Project Phase II (OFSDP-II) using the Soil Moisture Active Passive (SMAP) approach in conjunction with Google Earth Engine (GEE) analysis reveal valuable insights into the effectiveness of these initiatives. The findings are discussed under several key categories:

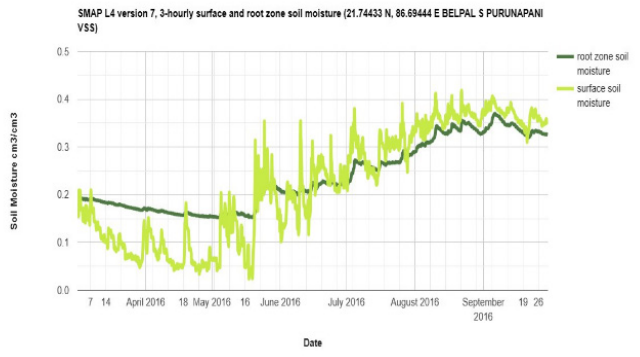
Temporal Analysis of Soil Moisture:

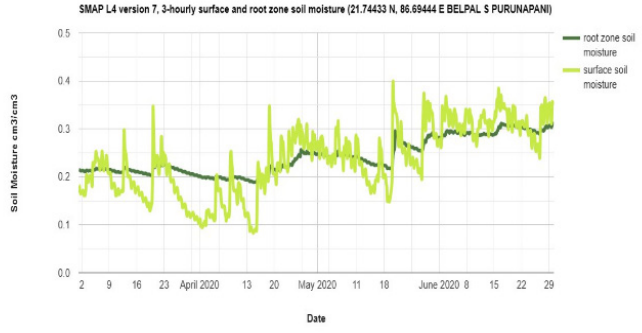
Temporal analysis of SMAP data shows notable variations in soil moisture levels over time. Data of root zone soil moisture and surface soil moisture were studied during the period from March to September of a particular year. Inorder to analyse the effectiveness of the interventions comparative study was carried out between the data recorded prior and post project interventions. Seasonal patterns of soil moisture, particularly during the monsoon season, are clearly evident. A clear trend of increased soil moisture levels in project areas is observed post project interventions. This indicates the positive impact of soil and moisture conservation activities. This trend has been depicted in Figure 1 shown wherein data has been analysed over 12 different VSS in the project divisions. The figure also depicts seasonal changes and interannual changes both in root zone soil moisture and surface soil moisture trends.

Figure 1: Assessment of soil moisture content before and after project interventions (Root Zone Soil Moisture and Surface Soil Moisture)

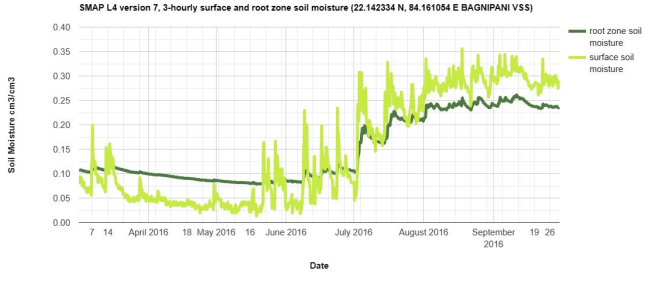
(a) Before project intervention	(b) After project intervention
Belpal S Purunapni VSS in Dukura FMU of Baripada DMU	
	
Kandhapalli VSS in Sonepur FMU of Subarnapur DMU	
	

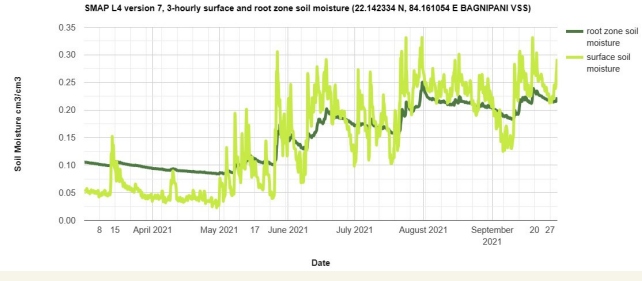
Kalamati VSS in Athmalik FMU of Athmalik DMU



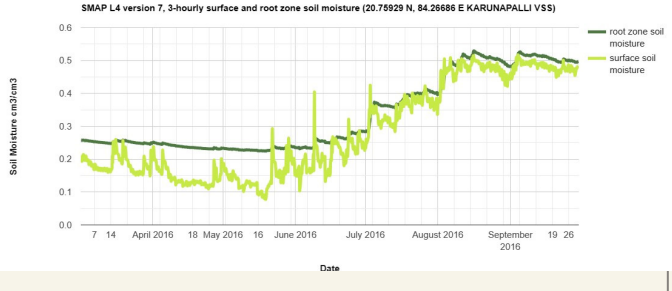


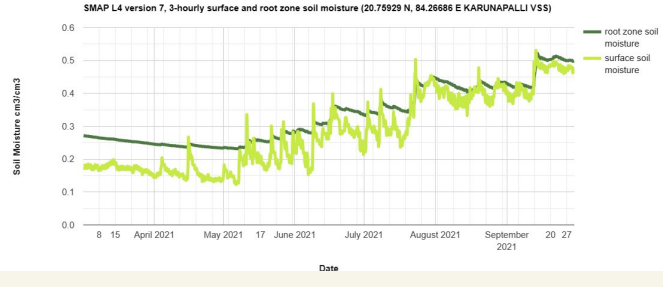
Baghnipani VSS in Sundergarh FMU of Sundergarh DMU



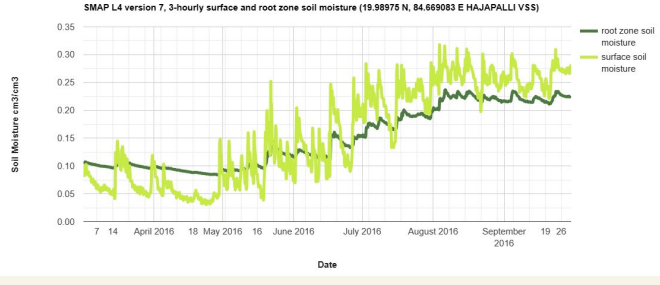


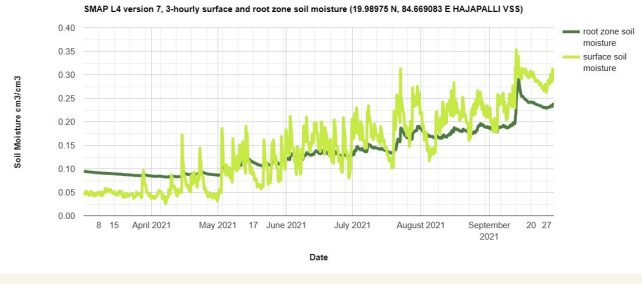
Karunapalli VSS in Boudh FMU of Boudh DMU



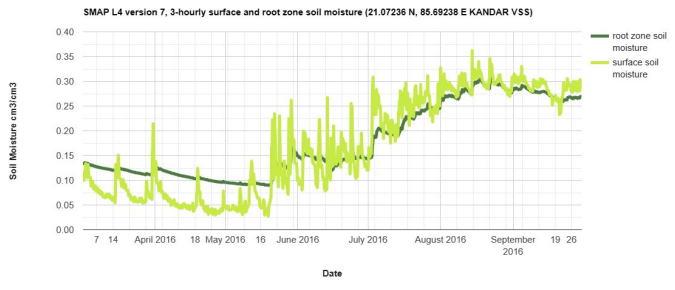


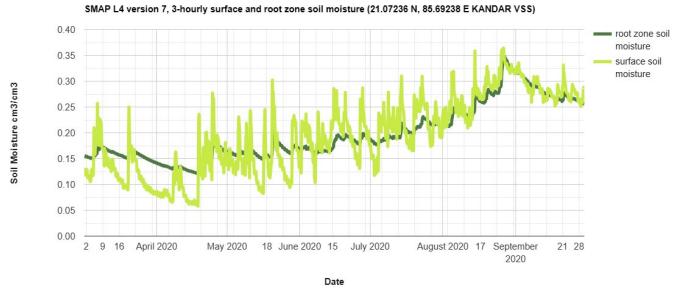
Hajapalli VSS in Jagannathprasad FMU of Ghumsur North DMU





Kandar VSS in Kamkhyanagar East FMU of Dhenkanal DMU





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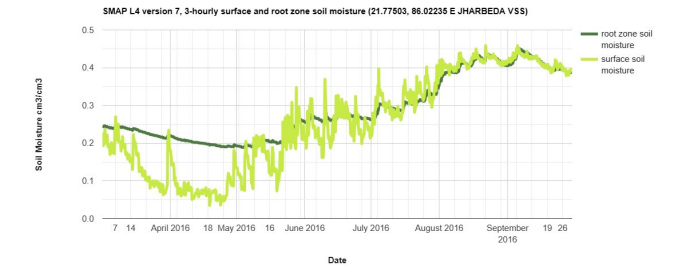

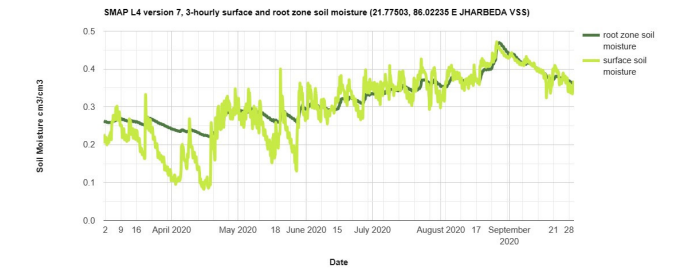

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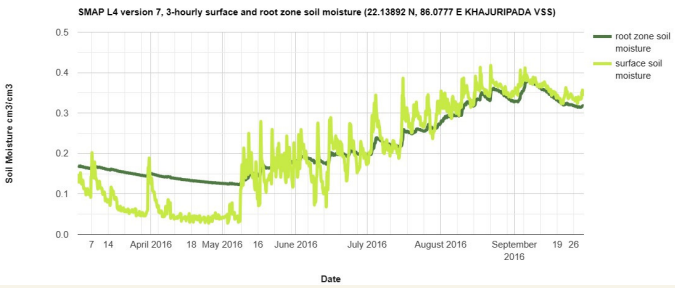

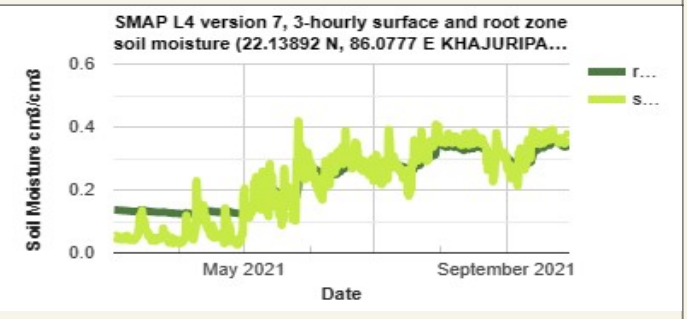

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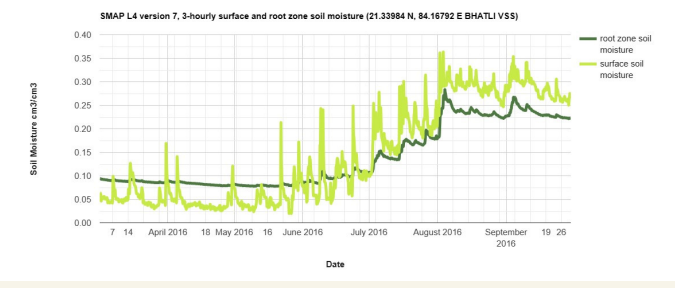
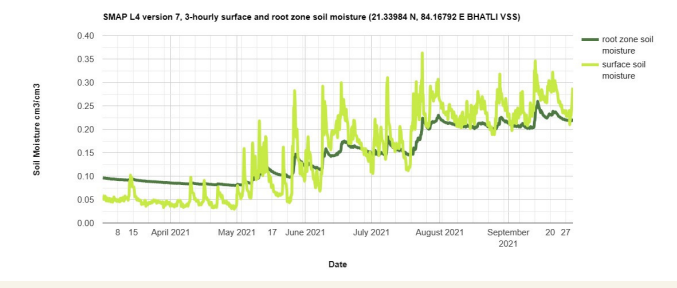
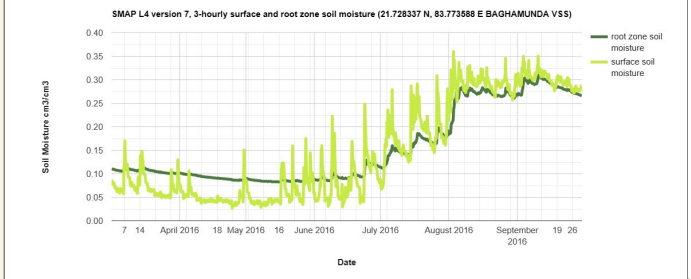
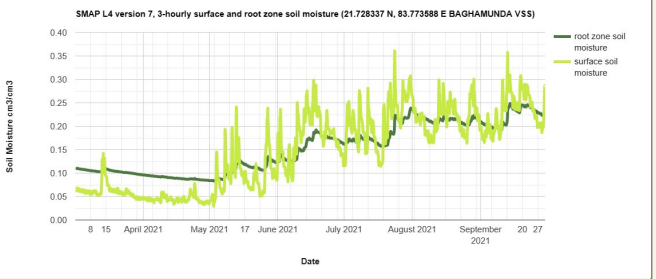


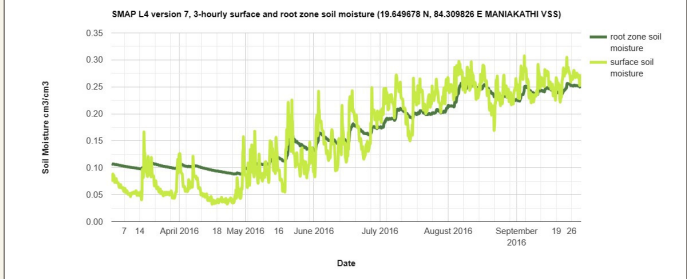


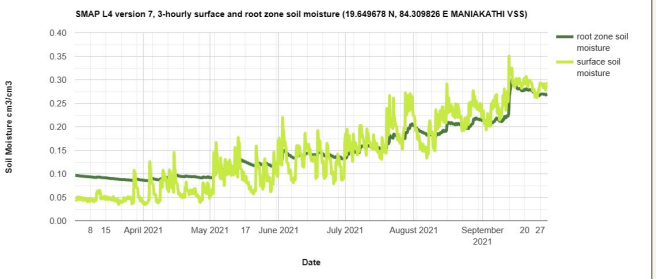
Baghamunda VSS in Belpahar FMU of Jharsuguda DMU





Maniakathi VSS in Badagada FMU of Ghumsur South DMU





Spatial Analysis:

For spatial analysis in Google Earth Engine 12 different regions i.e. VSS within project Divisions have been chosen to detect significant changes in soil moisture regimes. Areas of increased soil moisture are concentrated in areas where OFSDP-II conservation activities have been implemented. These areas correlate with the locations of afforestation and watershed management interventions. The VSSwise difference observed in root zone soil moisture and surface soil moisture before and after project interventions is depicted in the Table 2. Table 3 lists the results of one sample t tests for the observed difference in root zone soil moisture and surface soil moisture. It is found that the results are significant at a significance level of 10%.

Table 2: VSS wise difference observed in Root Zone Soil Moisture and Surface Soil Moisture before and after project interventions (in cm3/cm3)

DMU	FMU	VSS	Root Zone Moisture	Surface Soil Moisture
Athamallik	Athamallik	Kalamati	0.023153	0.030072
Sundergarh	Sundergarh	Bagnipani	0.002697	-0.001210
Boudh	Boudh	Karunapali	-0.001360	-0.000860
Ghumsur North	Jagannathprasad	Hajapalli	-0.013620	-0.013470
Dhenkanal	K. Nagar East	Kandar	0.019992	0.026286
Karanjia	Dudhiani	Jharbeda	0.028229	0.045712
Rairangpur	Badampahar	Khajuripada	0.015707	0.019290
Sambalpur	Padiabahal	Bhatli	0.007384	0.005405
Jharsuguda	Belpahar	Baghamunda	-0.002020	0.000072
Ghumsur South	Badagada	Maniakathi	-0.016200	-0.016440
Baripada	Dukura	Belpal-S-Purunapani	0.039963	0.058883
Subarnapur	Sonepur	Kandhpalli	0.004660	-0.000240

In order to correlate increased soil moisture regimes with vegetation density, analysis of variation of Normalised Difference Vegetation Index (NDVI) during the period of project intervention was carried out. This is depicted in Figure 2. The variation of NDVI was studied during the period of project implementation i.e. from 2016 to 2022. Both linear modelling and harmonic modelling of time series data of NDVI was carried out. Both the models suggest an increasing trend of NDVI over the period of study. The harmonic model with 2 cycles per year was used to fit the data. This depicts the variation across the seasons in a particular year. The analysis of NDVI indicates an increase in forest cover and vegetation density in project areas. This expansion of green cover thus corresponds with improved soil moisture conditions. The results suggest a positive correlation between soil moisture retention and vegetation growth, which is crucial for biodiversity conservation and ecosystem services.

Table 3: One Sample t Test for difference observed in Root Zone Soil Moisture and Surface Soil Moisture

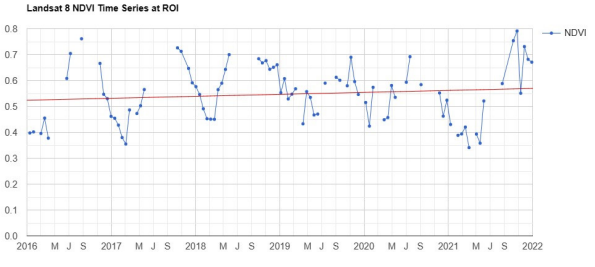
VARIABLE	ROOT ZONE SOIL MOISTURE	SURFACE SOIL MOISTURE
Mean	0.009048181	0.012792
Variance	0.000284677	0.000549
Observations	12	12
Hypothesized Mean	0	0
Df	11	11
t Stat	1.85770079	1.890428
P(T<=t) one-tail	0.045081193	0.04266
t Critical one-tail	1.795884819	1.795885
P(T<=t) two-tail	0.090162387	0.085321
t Critical two-tail	2.20098516	2.200985

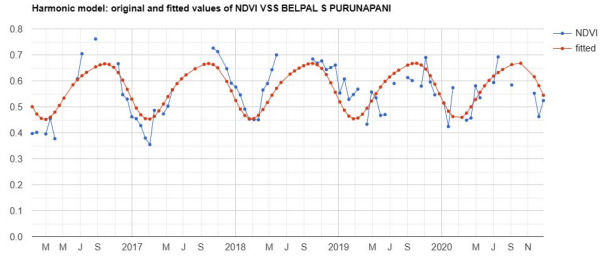
Figure 2: Variation of NDVI data during the period from 2016 to 2022. Fitting of a linear model and harmonic model to the data to account for observed variation.

(a) Linear Model fitting

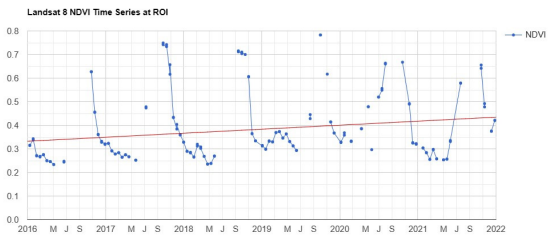
(a) Harmonic Model fitting

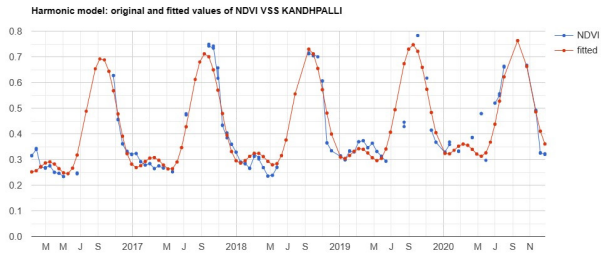
BELPAL S PURUNAPANI VSS





KANDHPALLI VSS





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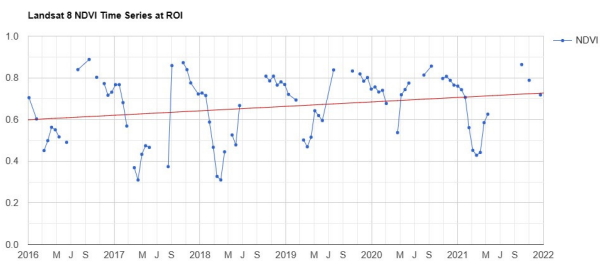

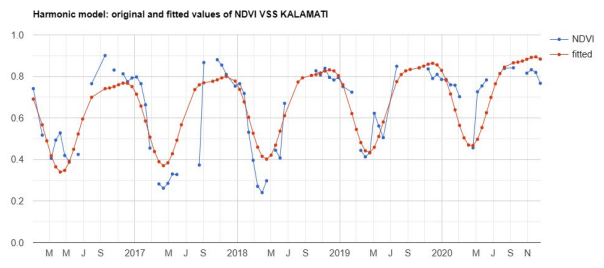

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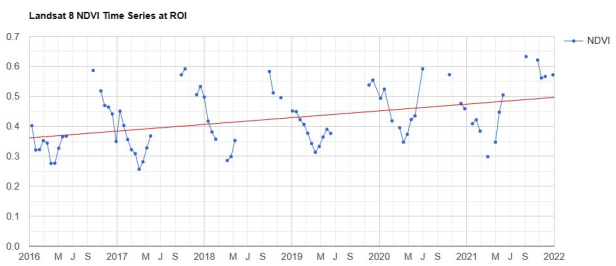

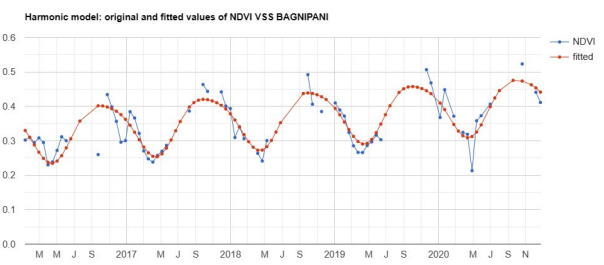

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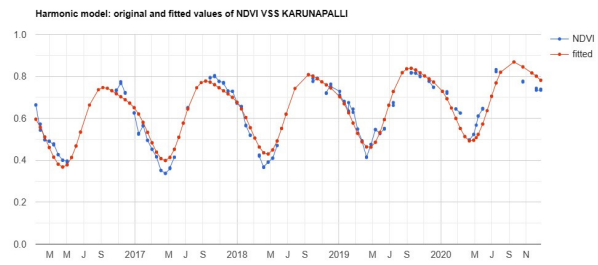

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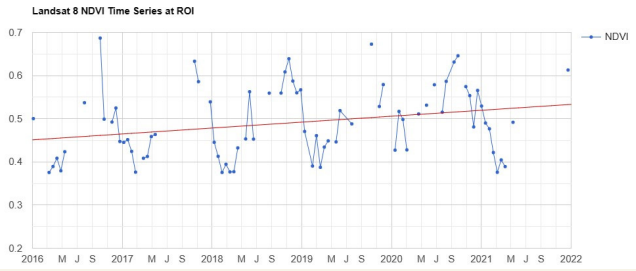

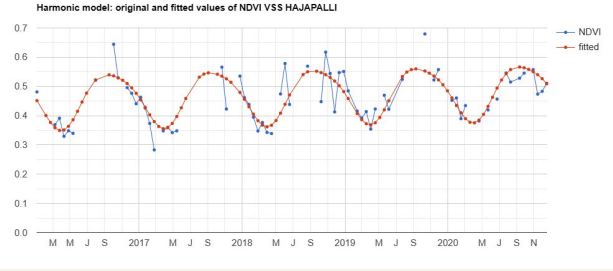

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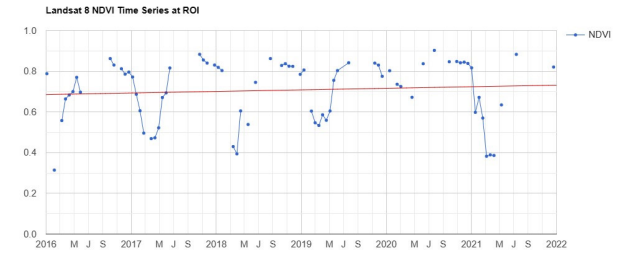

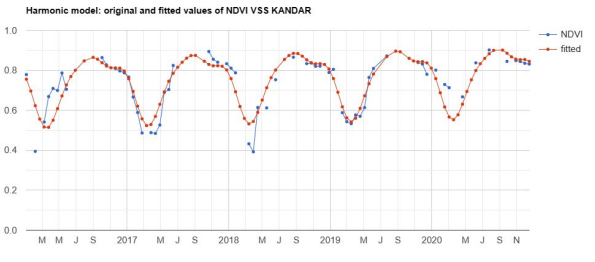

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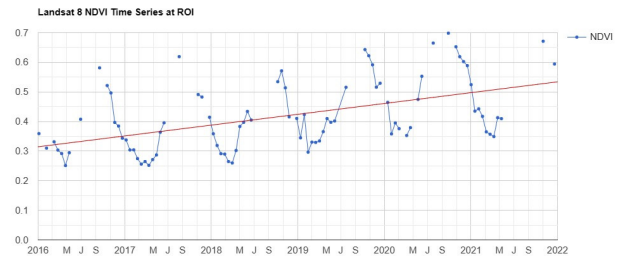

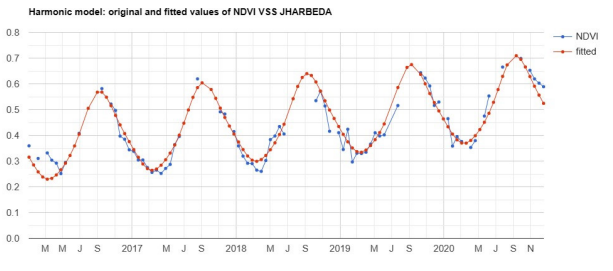

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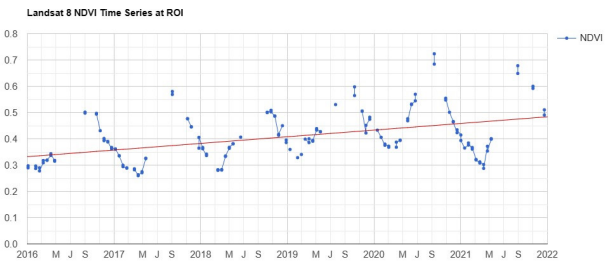
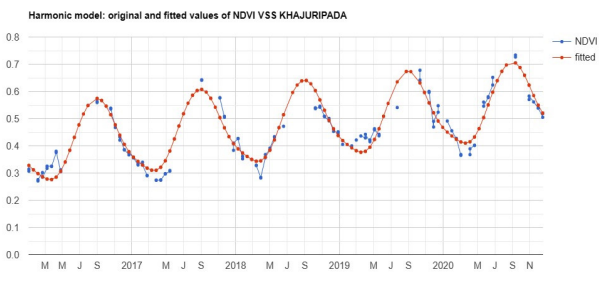
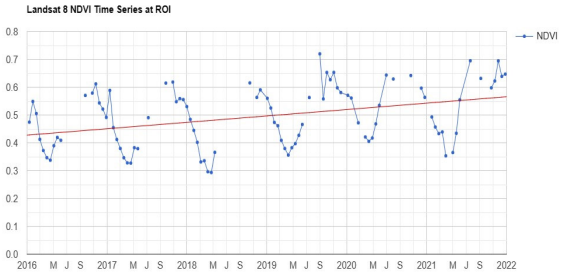
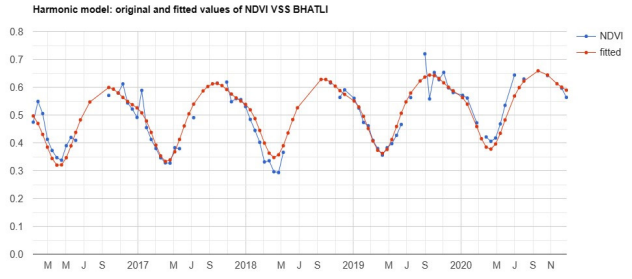




BHATLI VSS





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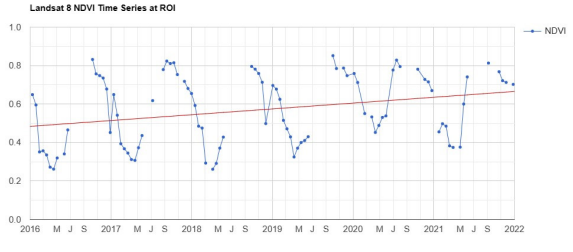
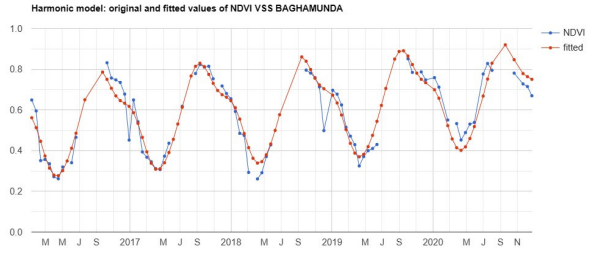
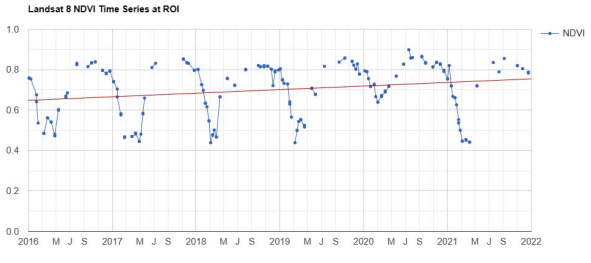
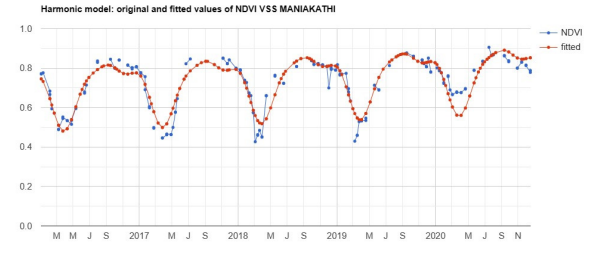




MANIAKATHI VSS





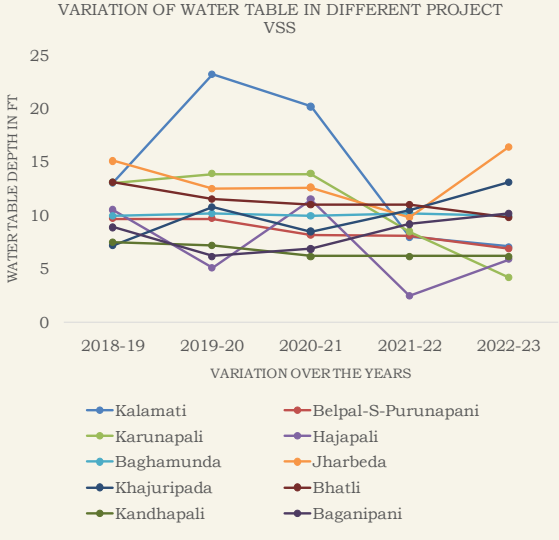
Field surveys involving measurement of water levels in the project areas were used to validate the SMAP data. This is depicted in Table 3 and Figure 3 shown. The data shows a decreasing trend as expected. It is pertinent to mention here that the data refers to the depth of the water level in water bodies like wells. An increase in water level implies decrease in distance from the ground level. This is captured in these findings. These results are in alignment with the improved soil moisture conditions observed in project areas as per the SMAP data. This underscores the importance of OFSDP-II interventions in sustainable forest management.

Table 4: Water Table of different water bodies (post Monsoon) (in feet)							
DMU	FMU	VSS	2018-19	2019-20	2020-21	2021-22	2022-23
Athmallik	Athmallik	Kalamati	13.1	23.2	20.2	8	7.1
Baripada	Dukura	Belpal-S-Purunapani	9.7	9.7	8.2	8.1	6.9
Boudh	Boudh	Karunapali	13.1	13.9	13.9	8.5	4.2
Ghumsur North	Jagannathprasad	Hajapali	10.5	5.1	11.5	2.5	5.9
Jharsuguda	Belpahar	Baghamunda	10	10.2	10	10.2	10
Karanjia	Dudhiani	Jharbeda	15.1	12.5	12.6	9.8	16.4
Rairangpur	Badampahar	Khajuripada	7.2	10.8	8.5	10.5	13.1
Sambalpur	Padiabahal	Bhatli	13.1	11.5	11	11	9.8
Subarnapur	Sonepur	Kandhapali	7.5	7.2	6.2	6.2	6.2
Sundergarh	Sundergarh	Baganipani	8.9	6.2	6.9	9.2	10.2

The temporal analysis demonstrates that OFSDP-II conservation activities contribute to increased soil moisture levels, particularly during critical periods such as the post-monsoon and pre-monsoon seasons. This finding underscores the effectiveness of afforestation and watershed management efforts in mitigating soil degradation and moisture scarcity. The evidence-based findings of this study offer valuable recommendations for policymakers and project managers. They underscore the importance of continued support for soil and moisture conservation initiatives and the need for scaling up successful interventions to maximize their impact.

The study's methodology, combining satellite-based soil moisture monitoring, geospatial analysis, and on-ground assessments, exemplifies a holistic approach to impact assessment in natural resource management. The integration of SMAP data and GEE analysis has proven to be a robust methodology for assessing the effectiveness of these initiatives. It showcases the potential of modern technology and interdisciplinary research to drive positive change in complex ecosystems.

FIGURE 3: Variation of water table in different project VSS across different years



CONCLUSION

The comprehensive assessment of soil and moisture conservation activities under the Odisha Forestry Sector Development Project Phase II employing a Soil Moisture Active Passive (SMAP) approach with Google Earth Engine (GEE) analysis has yielded significant insights and conclusions regarding the impact of these initiatives on the environment.

The temporal analysis of SMAP data reveals a clear and positive impact of OFSDP-II conservation activities on soil moisture levels in the project areas. The improved soil moisture retention, especially during critical periods, underscores the effectiveness of afforestation, reforestation, and watershed management efforts in mitigating soil degradation and enhancing moisture availability.

Spatial analysis depicts variation in soil moisture in areas where project activities have been implemented. This is closely associated with a rise in forest cover and vegetation density. The study indicates a direct correlation between improved soil moisture conditions and the growth of green cover, demonstrating the ecological benefits of the project.

The findings of this study have profound policy and management implications. They emphasize the importance of continued support for and scaling up of successful soil and moisture conservation interventions. Policymakers and project managers should consider the evidence-based recommendations provided in this study to optimize future strategies.

The study's methodology, which combines satellite-based soil moisture monitoring, geospatial analysis, and on-ground assessments, exemplifies an interdisciplinary and holistic approach to impact assessment in natural resource management. It underscores the potential of modern technology and interdisciplinary research to drive positive change in complex ecosystems.

While this study focuses on Odisha, its findings hold relevance and significance beyond regional boundaries. It contributes to the body of knowledge on sustainable land management, providing valuable insights for addressing land degradation, enhancing sustainability, and building resilience in ecosystems and communities worldwide.

In conclusion, this study demonstrates the substantial impact of soil and moisture conservation activities under OFSDP-II on soil moisture retention, ecological health, and community well-being. It underscores the vital role of innovative approaches, such as SMAP and GEE in advancing our understanding of conservation outcomes.

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SPECIAL STORY

EMPOWERING COMMUNITY WOMEN THROUGH CAPACITY BUILDING IN MAHUA FLOWER VALUE - ADDITION

Special Feature from Sambalpur Division….

In the midst of the lush forested landscapes, where the intoxicating aroma of mahua flowers dances on the breeze, unfolds the captivating tale of transformation led by Sanjukta Bhainsa, a resolute individual hailing from Jaduloisingh VSS under the Sadar Range. Guided by the dedicated Project Staff of Odisha Forestry Sector Development Project Phase-II (OFSDP-II), Sanjukta has achieved remarkable success through her journey in value-added mahua flower training.

Sanjukta's narrative traces back to her roots as a gatherer of mahua flowers, a traditional occupation of her community. Yet, the returns from this labor-intensive work were modest and had limited prospects for economic advancement. Recognizing the need for change, Sanjukta embarked on a quest to explore avenues for adding economic / market value to the abundantly available raw mahua flowers.

Interventions of OFSDP-II:

It was the intervention of OFSDP-II that steered Sanjukta's trajectory towards prosperity. Enrolling in the training program on value-addition of mahua flowers facilitated by the project staff, she embarked on a journey of skill enhancement and empowerment. Under their guidance, Sanjukta mastered various techniques in post-harvest handling, processing, and value addition of mahua flowers, including the creation of a diverse range of food items such as cakes, cookies, jams, and more, infused with the nutritive essence of mahua extract.

With newfound expertise and entrepreneurial zeal, Sanjukta established a small shop for the sale of value-added mahua products in her village. Her products, renowned for their quality and extended shelf life, garnered attention of not only from her own locally but also that of urban markets and trade fairs across the region. The ripple effect of Sanjukta's success reverberated throughout her community. By providing employment opportunities to local women, she empowered them to contribute to their family's income, leading to improved access to healthcare and education for the village as a whole.

Sanjukta's journey epitomizes not just economic transformation but also a shift in the collective mindset of her community. Her story serves as a beacon of inspiration, demonstrating the power of knowledge and skill empowerment to effect positive change. Sanjukta is not merely an entrepreneur; she is a mobilizer, a motivator, and a catalyst for community upliftment. Through her endeavours, she not only enhances the nutritional value of food for her family but also steers her community away from fast food and alcohol, while simultaneously fostering entrepreneurship for enduring market value.

In conclusion, Sanjukta Bhainsa's triumphant tale after undergoing value-added mahua flowers training, under the guidance of OFSDP-II's Project Staff, underscores the transformative potential of community empowerment. Her journey stands as a testament to the boundless opportunities that emerge when individuals are equipped with the tools to shape their own destinies.

Please send your comments and inputs to:

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