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RESEARCH ARTICLE

ROADMAP FOR ACHIEVING ADDITIONAL 2.5-3 BILLION TONS CO_2e SEQUESTRATION FROM FORESTRY SECTOR BY 2030.

Dr. J.V. Sharma and Ms. Priyanka Tiwari.

1. Director, Forestry & Biodiversity Division, The Energy and Resources Institute, Darbari Seth block, IHC, Lodi Road, New Delhi-110003.
2. Research Associate, The Energy and Resources Institute, Darbari Seth block, IHC, Lodi Road, NewDelhi-110003.

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Abstract

Forests are considered primarily as social and environmental resource, and secondarily as commercial resource in India. More than 350 million people derive their full or partial livelihood and sustenance need from forests. India has stabilized its forest and tree cover but quality of forests is degrading due to unsustainable harvest of fuel wood and other minor forest produce. Government of India has voluntarily communicated to UNFCCC to achieve additional 2.5-3 billion tons of CO_2e by 2030 from forestry sector on 2nd October, 2015 which was further ratified on 2nd October, 2016. However, India's mandate of high economic growth with schemes such as Make in India, Housing for All, Electricity for All for a population of 1.5 billion by 2030, will impact the quality of forests.

India has potential to sequester 3 billion tons of CO_2e by adopting conservation approach with conversion of open forests into moderately dense forests and afforestation largely through agroforestry. The financial resource of around INR 60000 crores per annum is estimated along with institutional and policy reforms such as capacity building of frontline staff and forest dependent community, involvement of private entrepreneur for improving the quality of forests, filling the vacancies of frontline staff, community based forest governance, investment on research and development, creation of national market for carbon trading and carbon neutrality for corporate/ industrial sector to achieve the target of sequestering additional 2.5-3 billion tons of CO_2e by 2030. While there is political commitment to take this target at global level, same kind of commitment must be shown to achieve it.

Introduction:-

Background and context

Forests in India are treated primarily as social and environmental resource, only secondarily as commercial resource. India is committed for implementing sustainable forest management practices (MoEF&CC, 2009). National Forest Policy, 1988 was launched four years before Earth summit where global community has agreed Forest Principles to implement sustainable forest management (UNCED, 1992; TERI, 2012). It embodies all elements of sustainable

Corresponding Author:-Dr. J.V. Sharma.
Address:-Director, Forestry & Biodiversity Division, The Energy and Resources Institute, Darbari Seth block, IHC, Lodi Road, NewDelhi-110003.

forest management. The prime objective of National Forest Policy is to maintain ecological security of the nation along with livelihood and subsistence rights of the forest dependent community including tribals' first claim on forests (TERI, 2012). There is strong legal and institutional framework available to implement the policy. The legal tools available for implementing policy into action are Indian Forest Act, 1927, Forest Conservation Act, 1980, Wildlife Protection Act, 1972, Forest Rights Act, 2006, Environment Protection Act, 1986, Biological Diversity Act, 2002 and state specific forest laws and rules formulated to implement central and state laws (Bhargav, 2007). Forest is in the concurrent list of the Indian Constitution. The responsibility of central government is policy and planning while responsibility of implementation lies with the state government. The Forest Rights Act, 2006 provides tenurial security to live, cultivate and forest governance (MoTA, 2010; Sharma, 2009; UNDP, 2012; Jain et al., 2015; AITPN, 2006; MoEF&CC, 2006; MoEF&CC, 2007). In this context, government of India has taken decision to go for Gram Sabha based forest governance. The community based forest governance is already in the north eastern states of India since ages. More than 350 million people derive their full or partial livelihood and sustenance need from forests, largely on unsustainable basis. Forest cover of the country is 70.83 million hectare which is 21.54% of the geographical area (FSI, 2017). The areas under very dense cover, moderately dense cover and open forests are 9.82 million hectare (2.99%), 30.83 million hectare (9.38%) and 30.18 million hectare (9.18%) respectively. Natural forests contribute about 95% to the forest cover of the country. The tree cover of the country is 9.38 million hectare which is 2.85% of the geographical area of the country. Total forest and tree cover in the country is 80.20 million hectare which is 24.39% of the geographical area of the country. The growing stock of India's forests is 4218.38 million cubic meter and growing stock of TOF is 1603.99 million cubic meter (FSI, 2017). There is increase in open forests but reduction of 0.34 million hectare of moderately dense forests, which indicates forest degradation (FSI, 2017). Major driver for forest degradation is unsustainable harvest of fuel wood and minor forest produce. Forests are home to 80% of country's biodiversity (FAO, 2010), provides 40% of energy needs, 30% of fodder supply, and 50% of grazing requirement along with other NTFPs. The sector provides livelihood support to one fourth of population living in 1,73,000 forest dependent villages. It contributes to sustainable development & meeting the SDGs. In view of the above, it is evident that the anthropogenic pressure endured by nation's forest is enormous. With rapidly growing population this pressure is set to rise in future. This will seriously affect the quality of forests and their sequestration potential. In this context to develop additional carbon sequestration sink of 2.5-3 billion tons of CO_2e through forestry sector is an exceedingly difficult and ambitious task that requires immediate reforms as well as strong political and financial commitment from the government. A brief analysis of impending challenges in attaining desired NDC goals through forestry, possible recommendations and a road map for achieving the NDC objectives are summarized in this document.

Forest degradation in India

India has successfully addressed the problem of deforestation. Forest Conservation Act, 1980 has played a key role in keeping balance between conservation and development. But forest degradation remains a key concern for quality of forests in India. Between 2003 and 2017 continuous improvement has been reported in India's forest cover as it increased by 21,506 square kilometers or 3.13%, whereas the growing stock (GS) in forests reduced significantly by 563.03 million cubic meters or 11.78% (Table-1).

Table 1:-Trends of forest resources as reported in India's State of Forest Reports (IFSR)

Forest resource accounting variable	ISFR 2003	ISFR 2005	ISFR 2009	ISFR 2011	ISFR 2013	ISFR 2015	ISFR 2017	Net Change between 2003 to 2017	% change between 2003 to 2017
Forest Cover (in square kilometer)	686,767[1]	692,027[2]	690,899	692,027	697,898	701,673	708,273	21506	3.13
Growing Stock in Forests (million cubic	4781.41	4602.04	4498.70	4498.73	4173.36	4195.05	4218.38	-563.03	-11.78

[1] Forest cover corrected for change of scale reported in IFSR 2009

[2] Forest cover corrected for change of scale reported in IFSR 2009

meters)									
Growing Stock in Forests and Tree outside forests (million cubic meters)	6413.75	6218.28	6098.20	6047.15	5658.05	5768.39	5822.38	-591.37	-9.22

Source: FSI 2003; FSI, 2005; FSI 2009; FSI 2011; FSI 2013; FSI 2015; FSI 2017

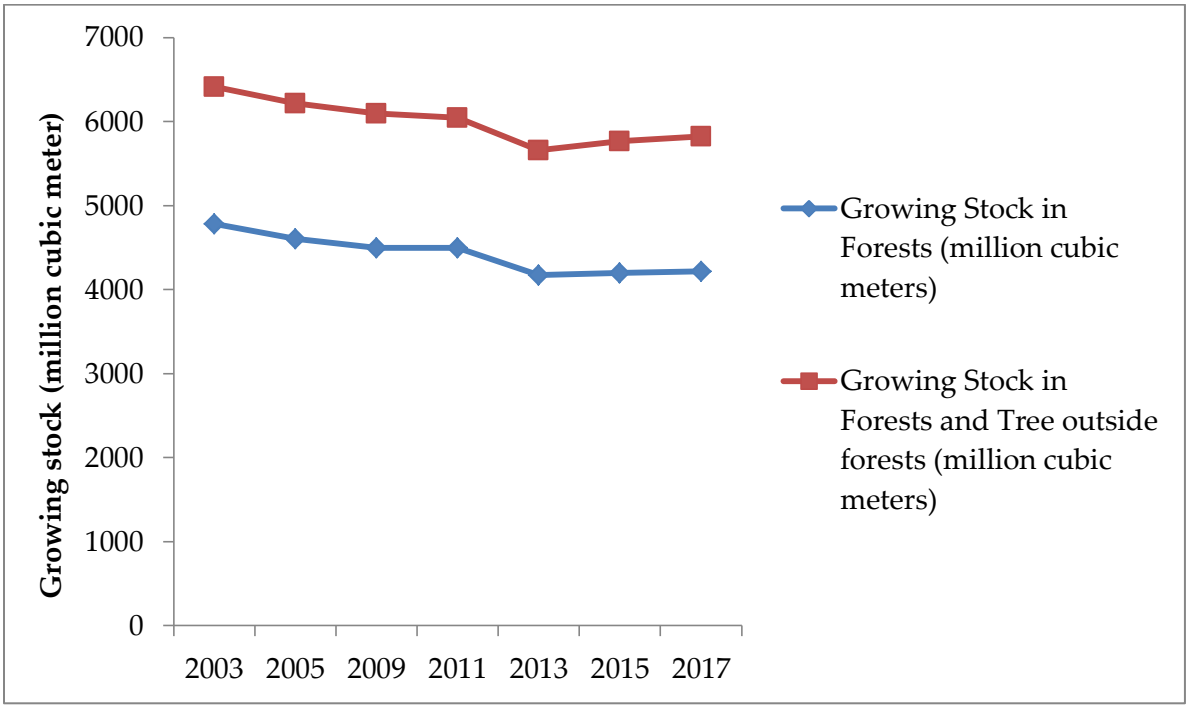

Figure 1:-Change in growing stock of forests and tree outside forests (In million cubic meter)

This reduction in growing stock despite increasing forest cover is an indicator of forest degradation (FSI, 2011). Within the recorded forest, 94.96% of forest is prone to crop injuries, 39.94 percent has inadequate regeneration, and 5.05 percent has no regeneration (FSI, 2015). Despite improved forest cover; sharp reduction in GS[3], inadequate regeneration, soil erosion[4] and significant crop injuries underline deteriorating forest health in India. Forest degradation directly impacts sequestration of GHGs and enhances emission. Given the context, estimated projections[5] of GHG emissions and removals from forestry sector (from 2015-2030) are presented as under.

Table 2:-Inventory of GHGs in Forestry Sector in India (BAU)

Estimated Emissions/Removals	2015	2020	2025	2030
Total emissions	482.84	539.16	587.71	626.95
Total removals	398.87	408.11	415.03	422.36
Net Emissions	83.97	131.05	172.68	204.59

[3] GS of Forests reduced by 282.68. Million cubic meters in six years between 2003 and 2011 in past 8 year while it reduced by 325.369 million cubic meters in just two years between 2011 and 2013.

[4] 87% of forest area in India is estimated to have soil erosion

[5]Biomass gain and loss method has been adopted for estimating GHG emissions and removals.

Source: (TERI Analysis)

Forest degradation is a critical parameter to monitor impacts on biodiversity and carbon sequestration but it is difficult to detect from spatial data (FAO, 2015). Annual average productivity of forests and tree outside forests has been considered for the estimation of carbon sequestration. Consumption of fuel wood, paper & pulp and forests fire have been considered for the estimation of emissions. Timber has been considered as locked carbon for long period. More than 90% contribution towards emissions is due to use of fuel wood for commercial and cooking purposes.

Materials & Methods:-

The study is based on secondary sources of data from India State of Forest Report (ISFR) 2017. Biomass gain and loss method has been adopted for estimating GHG emissions and removals and to assess the trends of growing stock and carbon stock as reported in ISFRs. Inventory of GHGs (BAU) has been taken from the analysis of TERI to estimate projections of emissions and removals from forestry sector (from 2015-2030). Annual average productivity of forests and tree outside forests has been considered for the estimation of carbon sequestration. Consumption of fuel wood, paper & pulp and forests fire have been considered for the estimation of emissions.

Result & Discussions:-

Forest dependence and unsustainable harvest

A significant population of India is dependent on forest resources for fulfilling their needs. Fuel wood, fodder and timber are three key direct services provided by forest to the community. Over 853 million people in India use fuel wood, 199.6 million of those collect fuel wood directly from forests, 38.49% of total livestock in India is directly dependent on forests for grazing, around 350 million people living in and around forests derive their full or partial sustenance needs from forests (FSI, 2011a).

Globally, India accounts for highest annual wood removal of 434,766 thousand cubic meters, 88.6% which is fuel wood (FAO, 2015). Annually, 216.47 million tonnes of fuel wood is consumed in India, of which 27.13% comes directly from natural forests. This rate of consumption is well beyond sustainable limits (FSI, 2011a) as 61.17% crops in forest area are prone to girdling and illicit felling for fuel wood and timber collection (FSI, 2015). Unsustainable harvest of forest produce and NTFPs degrade the ground and middle flora of the forests. Grazing affects 81 percent of country's forest area, heavy and excessive grazing and lopping for fodder affect vegetation. Around six percent of forest area is prone to injuries from lopping (FSI, 2015). Efforts have been made for fulfilling the increasing demand of fuel wood and timber from tree outside forests or farm forestry. The demand for timber required by various industries (construction, real state, production of agricultural equipments, pulp-wood) is primarily fulfilled from farm forestry in India. Still the intense pressure on natural forests for fuel wood, fodder, timber and NTFP for fulfilling the domestic and industrial needs is a major cause of forest degradation in India. Unsustainable harvest is major driver for forest degradation in India due to livelihood dependence of people living in and around forests. The use of fuel wood in future will keep on increasing considering the population growth, demand of rural energy, energy requirement of brick kilns due to more urbanization. With about 5 crore connections across several States, several of which are forest-rich, the 2016 Ujjwala scheme has reached a large underserved population, but the refilling of cylinders by the households still remains a challenge. As per a survey done by CRISIL in 2015, 86% of the people who received LPG cylinders as a part of Ujjwala scheme said they had not shifted from biomass to LPG because the price of refilling the cylinder was too high (CRISIL 2015). While official figures state that 80% of PMUY beneficiaries opt for at least one refill, field based media reports suggest that number of refills is far from sufficient to meet the cooking needs of the households. According to a June 2017 study undertaken by Centre for Science and Environment (CSE) in Uttar Pradesh, many of the families have not opted for the LPG connection despite being eligible, since refilling was not affordable. While it is argued that PMUY is an access centric scheme and not refill centric, the effectiveness of the Scheme is dependent on whether people refill their cylinders or revert to previous fuels, including fuelwood wood chips.

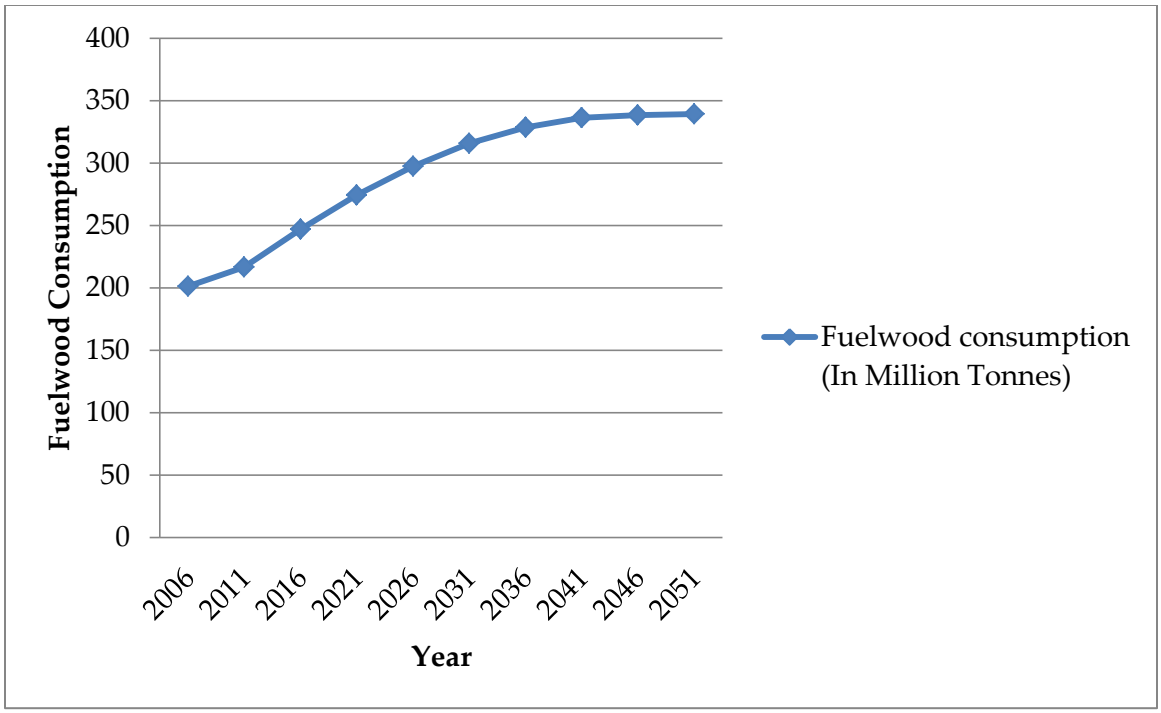

Figure 2:-Projections for Fuelwood consumption (In Million Tonnes)

Forest fires, invasive species pest and diseases

It has been reported that the 54% percent of the forests in India are prone to fire and over 90% of forest fire are human induced. Forest fire, though a natural phenomenon, if not controlled or managed properly can cause significant damage to the biodiversity of forest. Forest Survey of India has developed advanced forest fire detection and monitoring systems to control this hazard. Though the detection has become easier, the instances of fire have become more pronounced. State forest departments have dealt with many cases effectively in recent years but forest fire remains one of the key drivers of degradation in India. Forests are also prone to attacks by pest and diseases, but these are natural phenomenon. What is more concerning is the increasing extent of invasive species like *Lantana, Parthenium and Eupatorium*. These species often come up in degraded forest patches and spread extremely fast. The rapid growth and regeneration of these species suppress growth of indigenous species and affect local biodiversity.

Inadequate Human resource and their capacity

Management of forest resources is a difficult task which requires close interaction with local communities and in-depth idea of field. The presence of forest staff, particularly frontline staff on field is necessary for successful protection and management of forests. The department over the year has been operating well below its sanctioned strength at present the gap between sanctioned strength and in-field staff is 18%. The gap is more pronounced (20%) for forest guards who are the primary in-charge of on field operations. The overall sanctioned strength of department is limited in itself but understaffing makes the proper implementation of policy and programmes more difficult.

For the management, administration, protection and development of the Forest Sector there is an organized and uniform hierarchical structure with well-defined jurisdiction in most states of the country. The sanctioned strength of the field executive staff is more than the posts that got filled. The field executive staff as well as all other supporting staff is also recruited by state/UTs Governments and vacancies. The recruitments by the central governments and state governments to different positions however are not regular. The total number of filled positions and vacancies of the field executive staff in the forest department in the country are shown below in Table 3.

At present, there is scarcity of frontline staff and field executives including Divisional Forest Officers (DFOs) which is adversely impacting the forest development works.

Table 3:-Category-wise sanctioned strength, filled in positions and vacancy as in March 2010

Category	Sanctioned Strength	In Position in 2010	Vacancy in 2010

Indian Forest Services	3,034	2,650	284
State Forest services	3,337	2,734	603
Field Executive Staff	134,309	109,685	24,624
Forest Rangers	9,881	7,731	2,150
Deputy Rangers	7,118	6,052	1,066
Foresters	32,459	28,206	4,253
Forest Guards	84,451	67,696	17,155

Source: ICFRE Report, 2010

India has mandated for peoples' involvement in the forest conservation and protection with benefit sharing mechanism on the principle of care and share. There are more than 100,000 JFMCs that are managing more than 22 million forests in the country (TERI, 2016) with the involvement of more than ten million people. The communities are lacking the capacity particularly in the context of scientific knowledge for management, protection and conservation of forest resources. Capacity building of community is a key factor for the community based forest governance (MoEF&CC 2014). Though Forest Right Act, 2006 empowered Gram Sabha for the forest governance but devolution of empowerment is still awaited except in few pockets. The involvement of people is necessary for achieving 3 billion tons of CO_2e sequestration target.

Inadequate financial support for forestry sector

The allocation of plan budget to forestry sector at the central government level remains around 1% of total outlay since independence and it has become further lower after devolution of tax share to the state governments. The budget for forestry sector including the expenditure made by the state governments in India is 2.2% of GDP. India has innovated new and additional financial resources such as funds under CAMPA and allocation of financial resources on the basis of forest cover through Finance Commission in the recent past. At present, CAMPA have Rs 42000 Cr in the corpus which is not sufficient for catering even one year requirement if we plan to achieve additional 3 billion tons of CO_2e sequestration target by 2030. Poverty alleviation schemes have to be merged with forestry schemes to cater the income generating activities in 1,73,000 forest fringe villages covering more than 300 million people. Around 40% of the fund requirement could be met without making additional financial burden on the government. Rest 60% requirement needed for afforestation could be met with mandatory 20% allocation under MNREGA, IWMP and other rural development schemes. Another innovative mechanism for generating financial resources for forestry sector is to create national level market for carbon having policy and regulatory regime for corporates to be carbon neutral.

Climate change history and India's NDC

Climate change basically refers to the rise in average surface temperatures on Earth. Historical emissions since 1880 have resulted in rise in global temperature by 0.85 degree Celsius (MoEF&CC, 2009). As on 2009, the historical carbon space occupied by India is only 3%. The percentage share of India in global annual emissions as on 2018 is 7 percent. India, even though not a part of the problem, has been an active and constructive participant in the search for solutions. At the 19th COP in Warsaw in 2013 all countries were required to prepare NDCs and present them before COP 21 in Paris. Government of India has approved India's NDC saying it is balanced and comprehensive. India has communicated its NDC on 2nd October 2015 and it has been ratified on 2nd October, 2016. Now, it is India's responsibility to achieve its mandate. India has committed to reduce the emission intensity per GDP by 33-35% by 2030 from 2005 level and to create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2e through additional forest and tree cover by 2030. Over the years, several technological and methodological advances have taken place in mapping of forest cover in terms of better satellite data, higher scale maps and improved mode of interpretation. Therefore, it is suggested to take 2015 as the baseline year instead of 2005. As shown in Figure 3, the projection of carbon in forest and tree cover for the baseline year 2015 was 29.62 billion tonnes of CO_2e. As per BAU, the projected amount of carbon sequestered by 2030 will be 31.87 billion tonnes. In order to achieve the additional target of 2.5 to 3 billion tonnes of CO_2e, we will have to go above the BAU and sequester 34.37 to 34.87 billion tonnes of CO_2e.

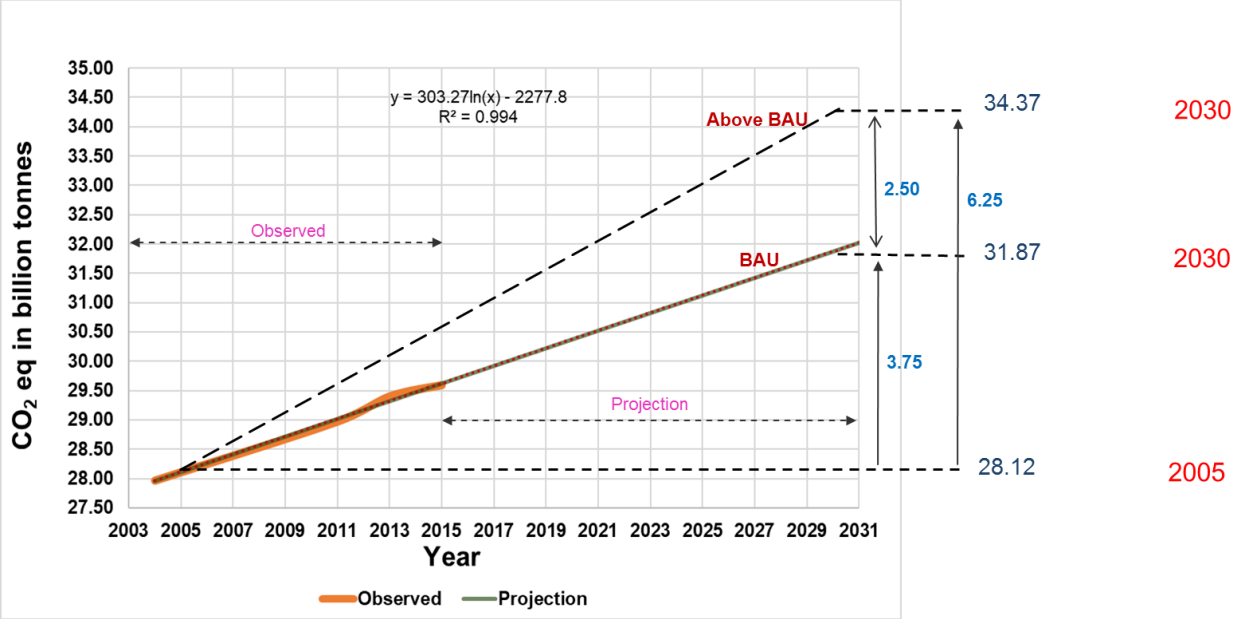

Figure 3:-Projection of carbon sink by 2030

Road map for achieving additional 3 billion tons of CO_2e sequestration

It is important to understand the latest status of forests and tree resource in India before preparing a roadmap to achieve 3 billion tons of CO_2e sequestration targets which is as under:

Table 4:-Forest and Tree cover of India as per ISFR 2017

Class	Area (km^2)	Per cent of Geographical Area
Forest Cover		
Very Dense Forest (> 70% canopy)	98,158	2.99
Moderately Dense Forest (40-70%)	3,08,318	9.38
Open Forest (10-40%)	3,01,797	9.18
Total Forest Cover*	**7,08,273**	**21.54**
Tree Cover	**93,815**	**2.85**
Total Forest and Tree Cover	8,02,088	24.39
Scrub (<10%)	45,979	1.40
Non Forest	25,33,217	77.06
Total Geographical Area	**32,87,469**	**100.00**

As mentioned in the above table, we have scope of converting around one third of 30 million hectares of open forests into moderately dense forests and part of moderately dense forests into dense forests through conservation approach and assisting natural regeneration. We will be able to achieve around one third of the target with conservation approach. Rest two third target could be met through afforestation on non-forest land. Forest is a concurrent subject. The responsibility of central government is policy and planning while responsibility of state government is management, development and conservation of forests. So the target has been distributed and further rationalized among the states based on the area under forest cover and potential area under agroforestry (Table 5).

Table 5:-Proposed distribution of NDC target for Indian states and union territories and State wise financial outlay needed for achieving NDCs through area under forest cover and agroforestry sector till 2030.

State	Area under forest cover (sq.km.)	Potential Area under agroforestry (sq.km.)	Target (in Million Tonnes of CO_2e)	Total Grant (In Crores/ year)	Total grant (in Crores) till 2030 (Taking 2015 as baseline

					year)
Andhra Pradesh	28147	16730	183.22	3664.49	54967.35
Arunachal Pradesh	66964	180	197.79	3955.86	59337.84
Assam	28105	2670	98.61	1972.12	29581.78
Bihar	7299	7950	69.22	1384.35	20765.32
Chhattisgarh	55547	6990	205.18	4103.60	61554.03
Goa	2229	110	7.21	144.18	2162.67
Gujarat	14757	10890	108.79	2175.89	32638.31
Haryana	1588	3520	25.82	516.37	7745.61
Himachal Pradesh	15100	0	44.36	887.14	13307.17
Jammu &Kashmir	23241	940	73.92	1478.42	22176.29
Jharkhand	23553	5340	101.28	2025.60	30383.94
Karnataka	37550	12930	188.01	3760.20	56402.96
Kerala	20321	940	65.34	1306.87	19602.99
Madhya Pradesh	77414	13450	308.24	6164.76	92471.39
Maharashtra	50682	19160	264.03	5280.52	79207.76
Manipur	17346	0	50.95	1019.10	15286.50
Meghalaya	17146	0	50.37	1007.35	15110.25
Mizoram	18186	0	53.42	1068.45	16026.77
Nagaland	12489	50	36.99	739.75	11096.32
Odisha	51345	8040	199.15	3982.93	59743.97
Punjab	1837	4200	30.64	612.73	9191.01
Rajasthan	16572	20510	171.94	3438.77	51581.56
Sikkim	3344	80	10.30	206.08	3091.20
Tamil Nadu	26281	6880	118.55	2370.97	35564.49
Tripura	7726	260	24.26	485.16	7277.44
Uttar Pradesh	14679	19710	161.57	3231.40	48471.01
Uttaranchal	24295	740	75.82	1516.30	22744.57
West Bengal	16847	4050	73.83	1476.56	22148.43
Puducherry	53.67	20	0.28	5.56	83.36
Delhi	192.41	60	0.93	18.52	277.74
Total	**680836.08**	**166400**	**3000**	**60,000**	**9,00,000**

(Source: ISFR 2017 & Rizvi etal 2014))

Outcomes

To achieve India's NDC goals a mix of **conservation** and **afforestation** approach is needed. The **conservation approach** will involve protection and conservation of open forests so that one third of the 30 million hectares of open forests i.e. 10 million hectares can be converted into moderately dense forests, and partly moderately dense forests can be converted into dense forests through assisting natural regeneration and reducing dependence on forests. This amounts to treating 2 million ha of open forests per year. On an average twenty five to thirty tons of CO_2 per hectare will be sequestered by providing livelihood to people and reducing dependence on forests, and also assisting natural regeneration. This would require a budgetary allocation of approximately INR 40000 crore per annum for assisting natural regeneration, providing income generating activities for the forest dependent communities, LPG and support for stall feeding to the livestock.

Agroforestry and tree plantation on non-forest land

The **afforestation approach** on the other hand will involve large scale plantation on non- forest land. The potential to achieve the target lies in agroforestry. The area under agroforestry is estimated to be 1,66,400 square kilometers (Rizvi etal 2014). At present, more than 80 percent demand of wood and wood products is met from agroforestry sector, 6 percent from natural forest and 12 percent from import. Agroforestry can contribute more than 2 billion tons of CO_2e by 2030 if government provides them Minimum Support Price (MSP) of timber produced by farmer. Minimum support price and institutional strengthening is important to avoid market failures for the farmers. Farmers will not grow trees for environmental benefits but for economic gains. The institutional mechanism is not very strong in this sector especially regarding Minor Forest Produce (MFP), Minimum Support Price (MSP) and timber

production. Without MSP it will be difficult to enable improvements in agroforestry production. Minimum support price is defined as the price at which government purchases crops from the farmers, whatever may be the price for the crops and it is an important part of India's agricultural price policy. MSP helps to incentivize the famers and thus ensures adequate food grain production in the country. Agroforestry species will generate 2 tons of CO_2e per tree after attaining the age of ten years. Compensation for carbon sequestration is also important. A simple formula has been worked out for MSP as explained below:

MSP = Cost of collection subject to adjustment to macro-economic variables considering 10 years rotation of agroforestry species

= C1 + C2 + C3 + C4 + C5

Where, C1 – Estimated value of family labour (Minimum daily wage rate)

C2 - Paid out cost (cost of seedlings, manure, Cost of material to store and carry collected MFP, transportation charges, premium of insurance to cover the personal risk during the process of collection and any other material inputs, depreciation of farm machinery and other expenses)

C3 – Opportunity cost (interest on the value of owned capital assets, rent paid for leased-in land and the rental value of owned land)

C4 – Value of carbon sequestration for 70% of the locked carbon

C5 – 50 % of C1

Agroforestry can supplement farm income, enable risk reduction and contribute towards climate resilience. Recommendations to increase agroforestry is to provide minimum support price for certain species, quality planting material should be made available, a statutory and institutional mechanism should be established for certification of planting stock and clonal plants, regular timber markets should be established to ensure transparent timber trade and prevent exploitation of farmers, provisions for harvesting and transportation of agroforestry produce should be made less stringent, an accreditation system should be developed for nursery planting stock and working plans should be prepared for agroforestry.

Plantation activities can also be done outside forests along the roadside, canals, railway lines, wastelands and highways, etc. Additional efforts have been put by National Highways Authority of India (NHAI) to increase the tree cover by plantations but it is getting difficult to achieve the target of 1.25 crores plantation. If NHAI achieves 100% of its target to create green highways, then by 2020 it will contribute 3-4% of the NDC targets. The target can be achieved by promoting sustainable livelihoods and employing around 1 lakh people through the greening of highways. 2.13 – 2.46 MT of CO_2 can be sequestered through green highways and contribute towards NDC goals.

In addition to the requirement of financial resource, there is need to have institutional strengthening, capacity building, innovative financial mechanism and policy interventions. The following suggestions might help in achieving the target:

1. Livelihood of forest dependent communities should be taken on priority to avoid unsustainable harvest of forest produce. Conservation plans must go with poverty alleviation programmes, particularly on forest fringe villages through implementing livelihood schemes, assisting natural regeneration, energy efficient cooking stoves and providing LPG.
2. Substantial financial allocations to the tune of around INR 60000 crore per annum to the forestry sector is needed for

1. Implementation of poverty alleviation schemes in forest fringe villages
2. Afforestation, reforestation, protection and management
3. Research and development of quality planting material
4. Implementing MSP Scheme for agroforestry
5. Capacity building and institutional Strengthening
6. Filling of the vacancies of frontline staff in the Forest Department has to be done.
7. Develop innovative financial mechanism for obtaining forest based carbon finance by formulating carbon neutrality policy at national level.
8. Forest governance to be synchronized with Gram Sabha based forest governance limiting forest department to technical guidance, monitoring and implementation of forest related legislations
9. Policy intervention to permit private sector for plantation and restocking of degraded forests
10. There is a need to produce high yielding varieties for promoting the agro forestry production.
11. The harvest of forest produce, particularly fuel wood and fodder is considered to be limited under sustainable limit to avoid forest degradation and to promote better regeneration.

12. The carbon assessment and socioeconomic survey has to be a compulsory exercise while preparing the working plan.
13. Industry has to be encouraged to plant more and high yielding varieties to produce more wood and sequester more carbon.

Conclusion:-

India has potential of achieving additional 3 billion Tons of CO_2e sequestration by 2030 with conservation and afforestation approach on forests and non-forest land. Around INR 60000 crore per annum is needed till 2030 for forest development, livelihood activities, implementing MSP scheme for agroforestry and providing LPG to the forest dependent communities. Innovative financial mechanism to obtain forest based carbon finance through carbon neutrality policy will boost the efforts towards achieving the target. It is not possible to achieve this target without involvement of people, private sector and other government departments. The most important is to have political commitment to achieve this target which needs to be strengthened. In the recent past, Chief Minister UP, Maharashtra and Andhra Pradesh have shown commitment towards having special drive for afforestation. The same kind of political commitment is needed from central government and other state governments on regular basis. It is important that all the massive plantations being carried out under different schemes must be maintained by the state government for at least seven years. They also need to have third party verification for the activities being taken. There is gap in the means of implementation for achieving NDC target which could be bridged through payment for ecosystem services (PES) scheme and carbon neutrality policy at national level.

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