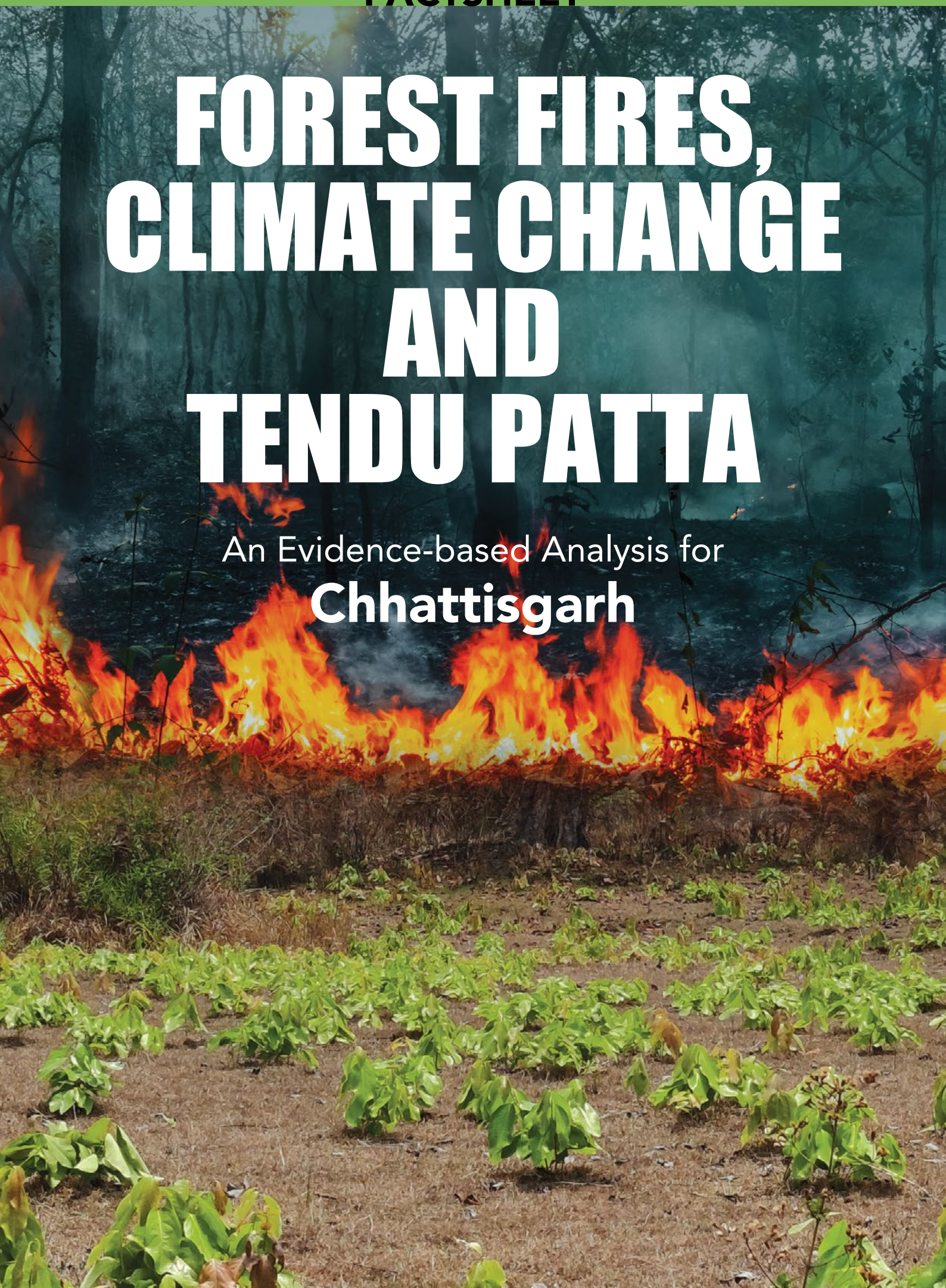
FACTSHEET

FOREST FIRES, CLIMATE CHANGE AND TENDU PATTA

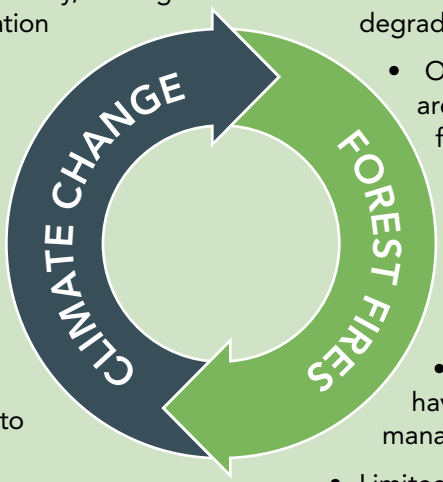
An Evidence-based Analysis for

Chhattisgarh



FOREST FIRES – A VITAL CONCERN FOR CHHATTISGARH

- Global temperature increase will exceed 1.5°C & 2°C during the 21st century, making extensive mitigation & adaptation action an urgent priority.
- Extreme weather events are becoming more frequent and intense – being closely witnessed by Chhattisgarh.
- The State Center for Climate Change is strengthening the state's commitment towards climate action given the high vulnerability of its population to climate change.
- The issue of increasing forest fire incidences needs to be addressed explicitly due to its circular relationship with climate change.



- Carbon sequestration benefits of forests are being threatened by rising degradation/forest fires.
  - Over 45% of Chhattisgarh's forest area is extremely to moderately fire prone.
  - 38,106 forest fires were recorded in the state during the last forest fire season (Nov 2020-June 2021), third highest among the states.
  - While tracking & alert systems have improved, control & management remains inadequate.
- Limited understanding of specific responsible factors (95% human-made) and restricting focused action.

TENDU LEAVES & FOREST FIRES

Leaves of tendu or *Diospyros melanoxylon* tree are widely used for making bidis.

>300,000 mt of tendu leaves are collected every year for producing >400 billion bidi sticks.

Uncontrolled fires are reported in the tendu areas, as there is a traditional practice of using fires to cut back the young exposed shoots of tendu plant and to injure its roots so that they may coppice and produce fresh, green, good quality leaves for bidi rolling.

The practice has no scientific validity and is prohibited by law and discouraged by the state, but is still widely practiced.

EXPLORING THE TENDU & FOREST FIRE LINKAGE IS IMPORTANT

- A prominent non-timber forest produce (NTFP) supported strongly by the state machinery – nationalized produce in Chhattisgarh since 1964
- Chhattisgarh is the second-largest producer of tendu leaves in the country, producing over 17 lakh standard bags annually (2017).

Tendu is used primarily to manufacture bidis, estimated to cost the nation ₹800 billion annually in illnesses and early deaths.

Significant contribution to forest health degradation, causing massive loss of flora and fauna and depletion of soil and water quality

IFOREST STUDY OBJECTIVE & APPROACH

- To establish linkages between collection of tendu leaves and forest fires
- To assess the impact in terms of burnt area & emissions

Focus on Chhattisgarh, Maharashtra & Odisha - 36 per cent of forest fires incidences, 35 per cent of tendu leaf collection

Utilize available satellite data on forest fires, vegetation type & emissions

Mix of mapping, spatial, statistical, modeling and back-of-the-envelope analysis tools

RESULT 1: SUBSTANTIAL OVERLAP IN TENDU AREAS & FOREST FIRE POINTS IN CHHATTISGARH

Data collection

MODIS Forest Fire Points (Source: MODIS)

Sample Point Data (Source: ISRO)

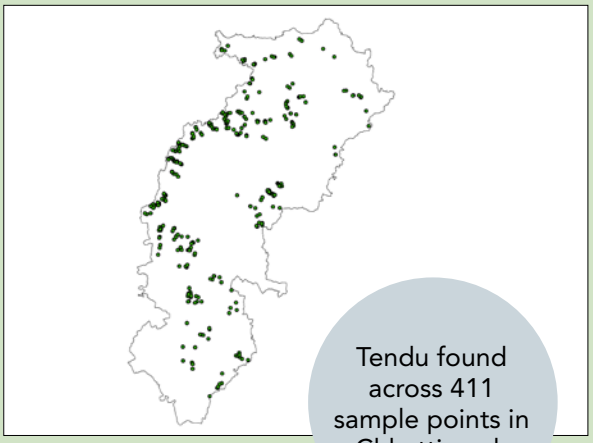
Vegetation Types Map (Source: ISRO)

Data collection

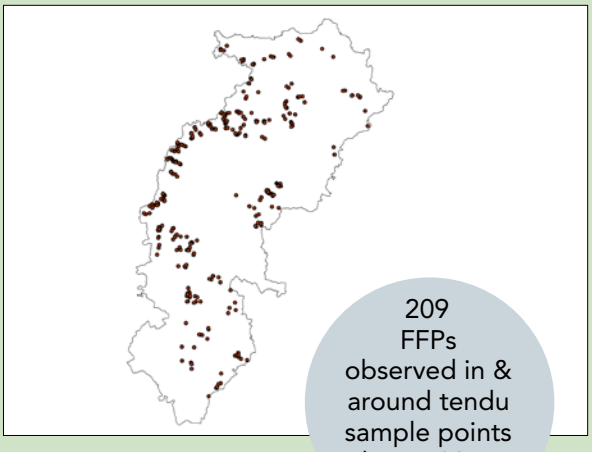
Reprojection → Clipping → Masking → Masking → Extraction → Correlation

Pre-processing

Distribution of tendu sample points



Distribution of tendu-linked FFPs for 2011-21

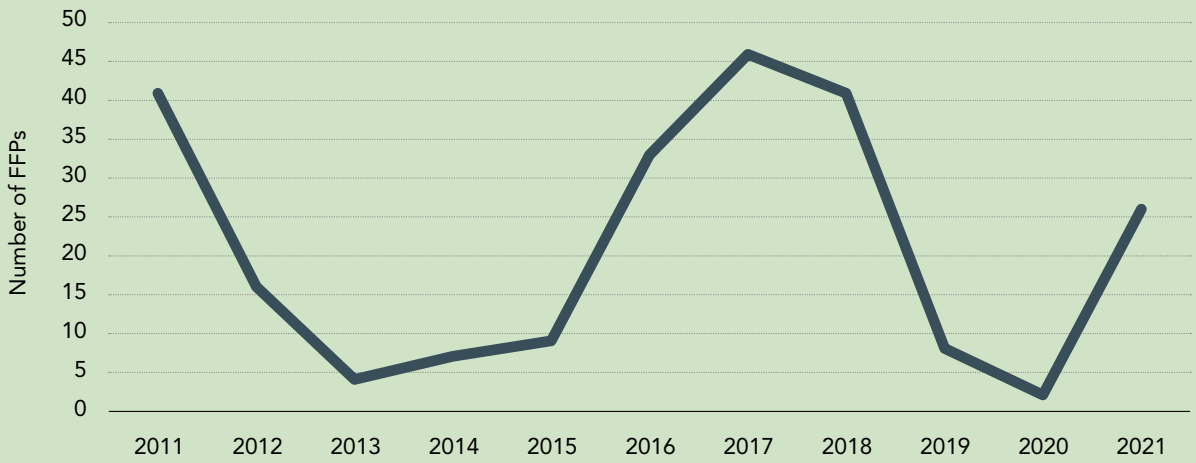


Source for forest fire points (FFPs): NASA's MODIS dataset

Source tendu sample points: P.S. Roy, S.P.S. Kushwaha, M.S.R. Murthy, A. Roy, M.C. Porwal, et al. 2012. Biodiversity Characterization at Landscape Level: National Assessment. Indian Institute of Remote Sensing, ISRO, Dehradun, India, ISBN: 81-901418-8-0

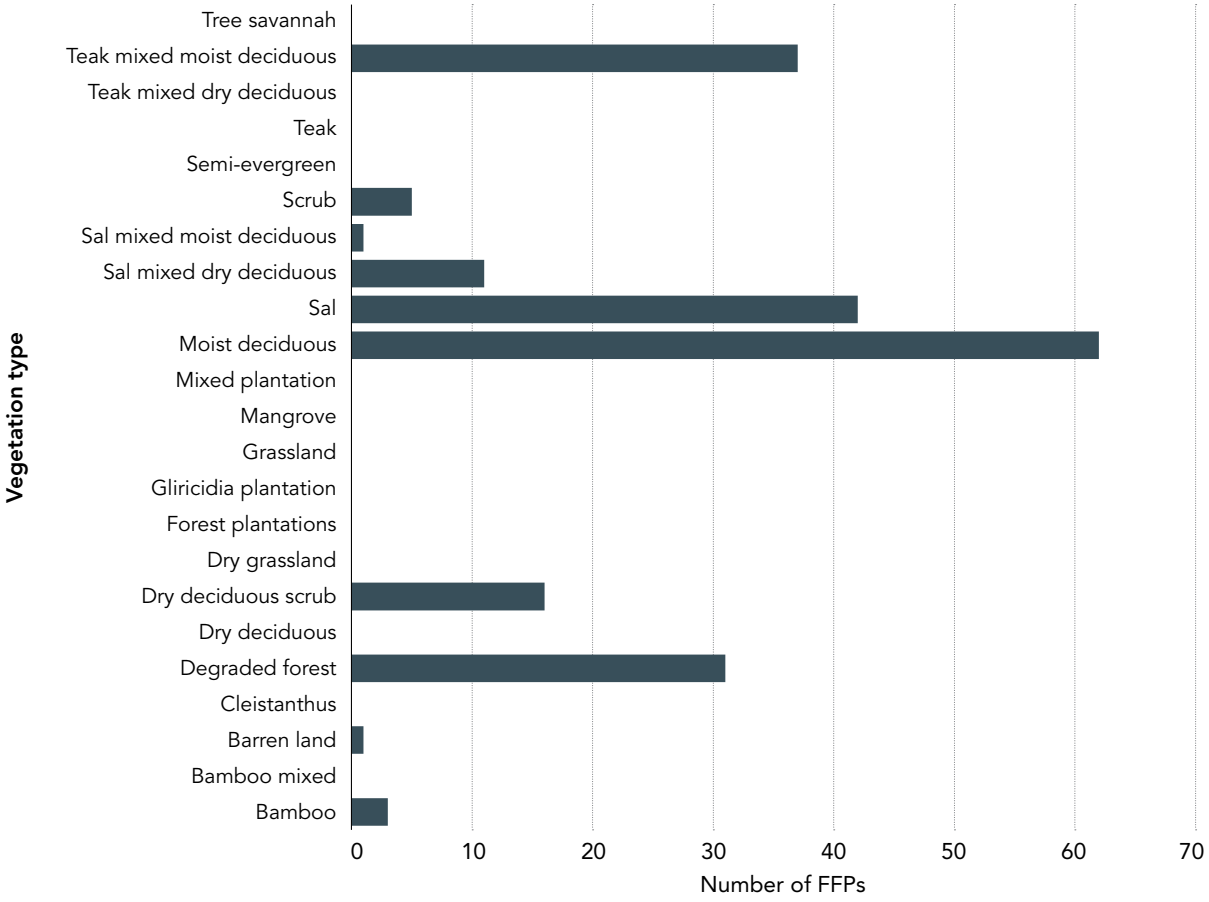
Tendu-linked FFPs observed to be fluctuating during the past decade, showing a decline around the mid-years (2013-2015) and then in 2020.

Tendu-linked forest fires during 2011-21



Tendu-linked FFPs observed to be predominantly occurring in moist deciduous, Sal and teak mixed moist deciduous forest areas in Chhattisgarh.

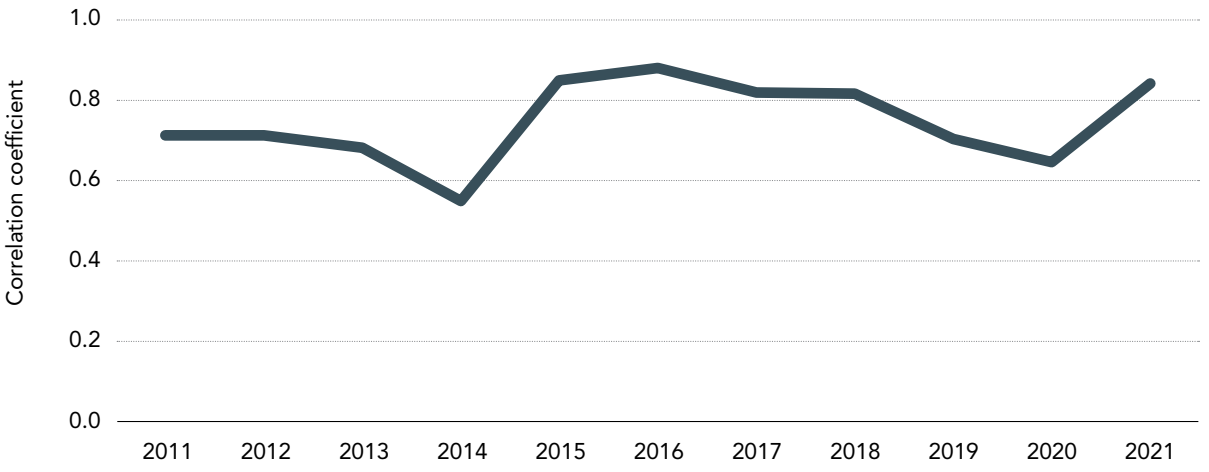
Vegetation type associated with tendu-linked FFPs in 2011-21



RESULT 2: STRONG POSITIVE CORRELATION EMERGING BETWEEN TENDU & FOREST FIRES

Correlation coefficient of over 0.7 for most years indicates tendu producing areas in Chhattisgarh appear to have a very high susceptibility to forest fires.

State-wise correlation between forest fires and tendu

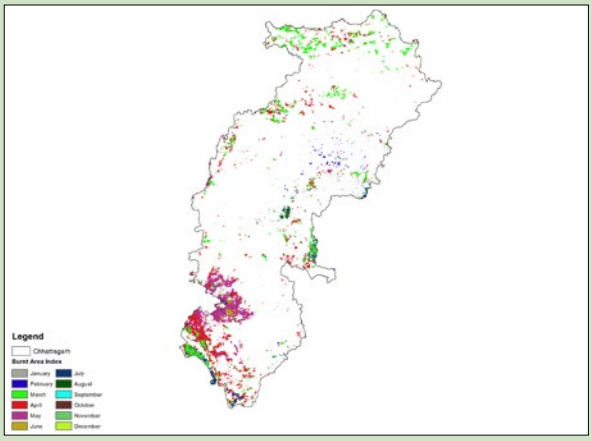


RESULT 3: TENDU-LINKED FIRES AFFECTING VAST TRACKS OF LAND

- Data from MODIS Burned Area Monthly Global; 500m resolution downloaded & clipped for 2011-21 for focus states
- Month-wise, state-wise burnt area index (BAI) distribution calculated

Total burn area due to forest fires in Chhattisgarh during 2011-21 is observed to be 15,217.5 sq km

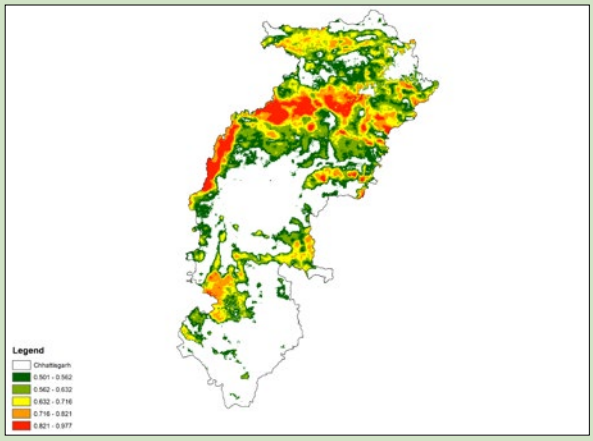
Burn Area Index during 2011-21



- Species distribution model (SDM) developed using Maxent model, tendu sample points & bioclimatic data (WorldClim)
- ROC curve and Jack knife test of variable importance conducted

SDM finds tendu to be located across 22,904 sq km ~ 38% of the state's forest land area

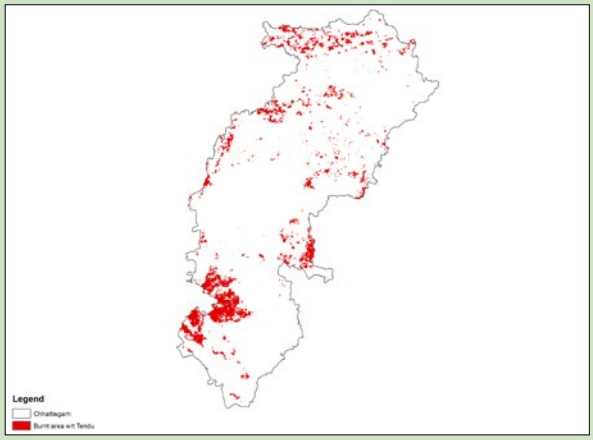
Potential species distribution of tendu



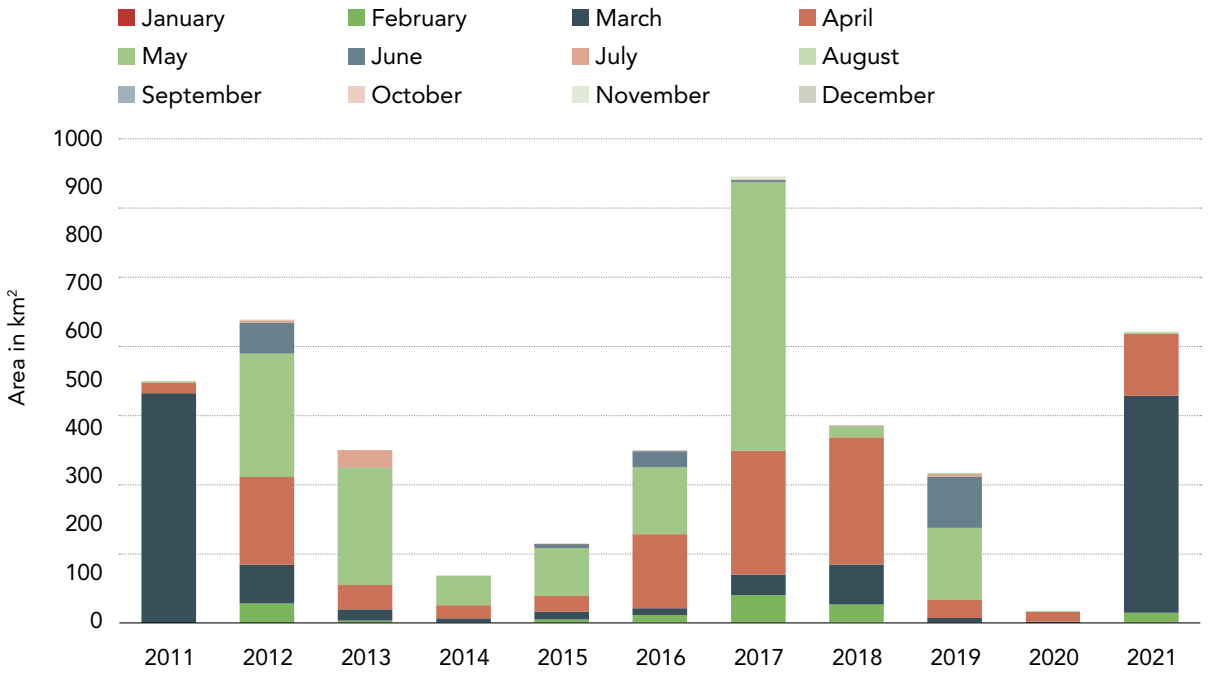
- Potential species distribution of tendu & BAI overlayed to calculate potential burnt area associated with tendu

Burnt area due to tendu-linked forest fires is estimated at 6,120 sq km for the 2011-21 period ~ 40% of the state's total burn area for the period

Burnt area with respect to potential tendu distribution for 2011-21



Year-wise, month-wise tendu-linked burnt area



Majority of the modeled tendu-linked burnt area is in March, April and May

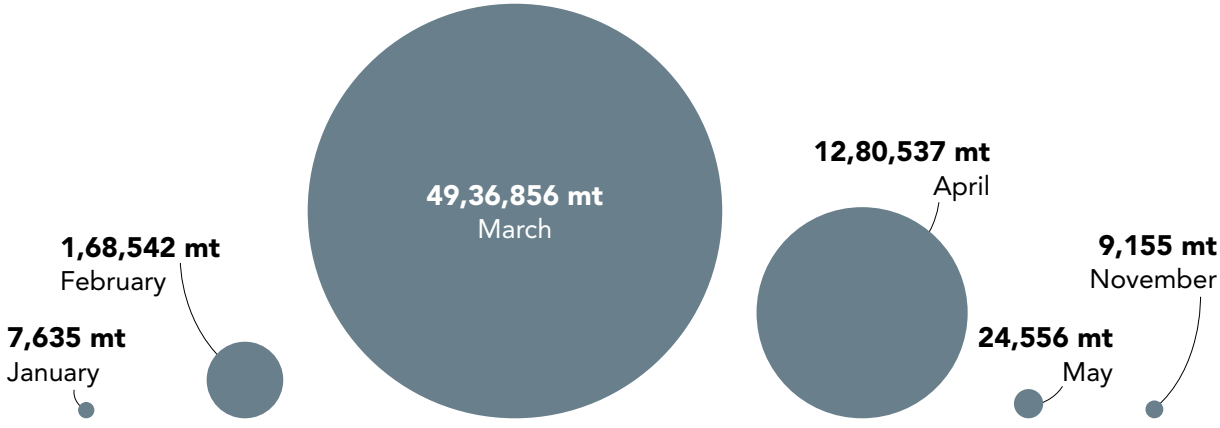
Modeled tendu-linked burnt area highest in 2012, 2017 & 2021, ranging from 800 sq km to 1,300 sq km

RESULT 4: TENDU-LINKED FOREST FIRES CONTRIBUTING SIGNIFICANTLY TO EMISSIONS

6.4 million mt of CO_2 emissions, Equivalent to annual emissions by 2.6 million cars, dominated by tendu related fires in Chhattisgarh during 2021

Data & Methodology: CO emissions data from the TROPOMI on the Sentinel 5 Precursor (S5P) satellite, treated for background emissions, and clipped for tendu BAI for the three states. CO_2 estimated assuming modified combustion efficiency for forest fires with smouldering combustion for dry deciduous type of forest.

Estimated CO_2 emissions attributed to tendu-forest fires in 2021



CONCLUSION

Fires are being widely used in tendu growing areas of Chhattisgarh.

- iFOREST's study quantifies the association as strong and positive based on satellite datasets.
- While the individual tendu fires may not always be affecting large tracts of land, these fires put together amount to quite a vast land area:
  - » Estimated 6,119 sq km of forest area burnt in Chhattisgarh during 2011-21 due to tendu, which is three times the size of Raipur district.
  - » Highest annual burnt area observed in 2012 is 877.5 sq km, which is nearly four times the size of Bilaspur city.
  - » Even in the COVID-affected 2020, tendu burnt area was estimated to be 34.5 sq km.
- State and central government laws and rules have had little impact on the ground.

THE WAY FORWARD

A clear and strong requirement emerges for strengthening the regulatory control on the use of fire for tendu patta collection from the climate and environment perspective. However, the way forward requires development and promotion of sustainable alternatives to tendu collection activity.

- Tendu collection, processing and related activities provide crucial short-term employment to a large proportion of forest dependent communities, especially during the lean agricultural season.
- The income being generated is low (estimated at ₹5,000 to ₹10,000 per family per season) but is valued supplementary income, given that the dependent families typically have very low levels of income, education, skills, land holding, and overall limited alternative employment opportunities.
- Any policy action against tendu collection needs to address the wellbeing of the dependent communities and create alternative livelihood opportunities.
- Successful examples exist of communities moving away from tendu collection. For instance, the Pachgaon village in Chandrapur district of Maharashtra banned tendu leaves collection in 2012, and has since developed bamboo as a key NTFP for income generation.
- Chhattisgarh has enormous untapped potential for development of sal, chironji, mahua, aragoana, dhawa and many other utility and medicinal NTFPs. Detailed analysis can help identify their growth potential as reliable alternatives for tendu collectors.
- Significant efforts and investments would be required for building market linkages and for developing value add industries to maximize the benefits for communities.
- The booming carbon market is potentially a strong source of funding in order to transition away from tendu, given study's findings on tendu's massive GHG contribution. Already, investment in low-carbon transition future of communities is a key priority area for carbon funds.
- Financial incentives and capacity support for communities would be the key for development of alternatives – critical for phase-out of tendu patta collection activity.