



Real Time Monitoring of Forest
Fire Alerts-Response in Odisha
Using Geospatial Technologies



Status of Forests in Odisha

- **Geographical area of Odisha is 155,707 Sq Km, out of which 52,156 Sq Km (which is 33.5%) is under Forest Cover as per ISFR 2021.**
- **Recorded Forest area of Odisha is about 61,204 Sq. Km.**
- **Odisha experiences forest fires mainly during the month of January to June.**
- **As the Forests in Odisha are deciduous type, the intensity of Forest Fire depends on the quantum of dry leaves on forest floor, wind flow in the fire affected area & rain during the month of Jan & Feb .**
- **In some places in the state the forest fire is also caused due to the burning of forests by local tribals still using “Slash and Burn” method of farming.**

Automated Forest Fire Response System (Data Collection)

Screen display of fire app showing the auto fetching Forest Fire Alerts from NRSC-FSI server, navigating to the fire spot, response and mitigation through App. and syncing to the server for monitoring.

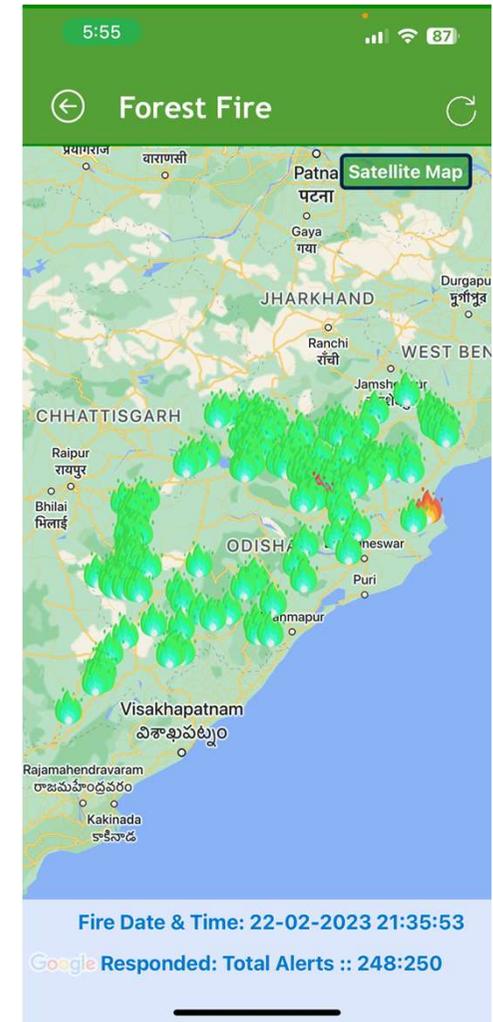
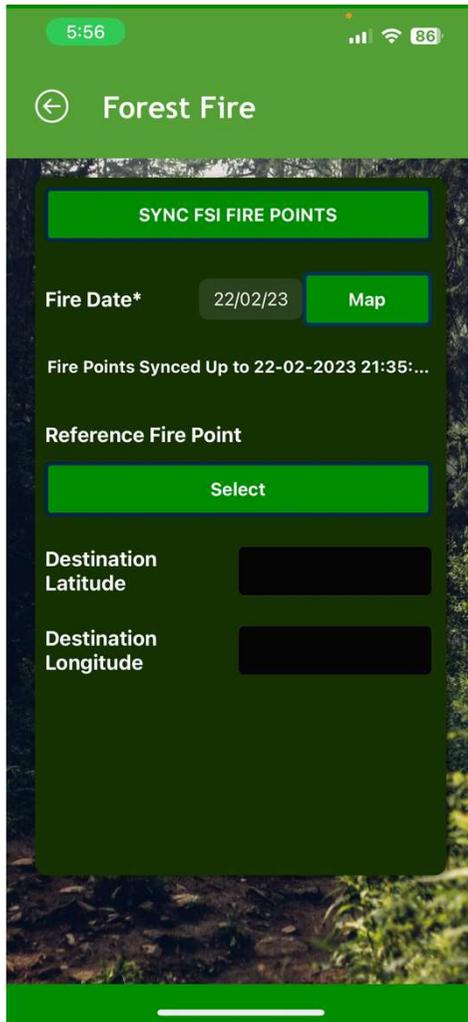


Key Features of Odisha Forest Fire Management

- 1. Forest Fire Alerts are received from NRSC-Forest Survey of India through direct API.**
- 2. Automatic Geo-Data processing in OFMS Server and fire alerts sent to Smartphones of beat level forest officials as per their geographical jurisdiction. About 8000 mobiles are registered & are now in use.**
- 3. Offline navigation to fire alert point, data collection with geo tagged pictures and action taken using OFMS mobile application.**
- 4. Data sync from mobile to OFMS Central Server for proper reporting of fire alert status on a near online basis.**

- 5. Past data visualization and report yearly, quarterly, monthly, weekly or customised date range for repeat fire analysis and vulnerable zone mapping.**
- 6. Zonation based Forest fire analysis can be made for forest blocks for planning the preventive action and staff allocation for fire fighting.**
- 7. Maximum week analysis to show the most fire prone weeks across the state for preventive planning and staff allocation.**
- 8. Fall back mechanism for forest fire alert generation using NASA or NRSC data.**
- 9. District Level Committee under the Chairmanship of Collector: District Level Action Plan for an coordinated effort with other relevant Line Departments.**

OFMS @ Mobile (Odisha Forest Management System)



Forest Fire Management On Field



Forest, Environment & Climate
Change Department , Govt. of Odisha



Forest Fire Management @ OFMS (Odisha Forest Management System)

FSI Fire Points

Search

Circle: Division: Range: Fire Date From: Fire Date To:

Total FSI Fire Points: 29 (Repeat points : 1) / Physically Attended points : 17 /
Web Responed : 0 / Total Responed : 17 / Pending File Points : 12
Last File Upload : 23-02-2023 09:49:25

Show 10 entries

| Circle | Division | Range | Fire Date | Total Points | Repeat Points | Attended Points | Responed | Pending | |
|-------------|---------------|--------------------|------------|--------------|---------------|-----------------|----------|---------|--|
| Bhubaneswar | Khordha | Balugaon | 23-02-2023 | 2 | 0 | 0 | 0 | 2 | |
| Rourkela | Deogarh | Barkote | 23-02-2023 | 2 | 0 | 2 | 2 | 0 | |
| Rourkela | Keonjhar | Bhuyan & Juangpirh | 23-02-2023 | 2 | 0 | 2 | 2 | 0 | |
| Berhampur | Ghumsur South | Buguda | 23-02-2023 | 5 | 1 | 0 | 0 | 5 | |
| Rourkela | Keonjhar | Keonjhar | 23-02-2023 | 1 | 0 | 1 | 1 | 0 | |
| Koraput | Nabarangpur | Nabarangpur | 23-02-2023 | 1 | 0 | 0 | 0 | 1 | |
| Berhampur | Ghumsur South | Polnsara | 23-02-2023 | 2 | 0 | 0 | 0 | 2 | |

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ODISHA STATE FOREST DEPARTMENT

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Forest Fire Mapper @ OFMS (Odisha Forest Management System)

- Satellite data plays a vital role in identifying and mapping forest fires and in recording the frequency at which different Vegetation types/zones are affected.
- Past data visualization and report yearly, quarterly, monthly, weekly or custom date range for repeat fire analysis and vulnerable zone mapping.
- A geographic information system (GIS) is being used effectively to combine different forest-fire-causing factors for demarcating the forest fire risk zone map.

Odisha Forest Management Systems (Forest Fire Mapper)

Q Search Criteria

Baripada

Select Sanctury

SIMILIPAL SOUTH WILDLIFE

Select FB

Select Range

Select Section

Select Beat

2020,2021,2022

From 1 January

To 1 May

Submit Reset

Map View:

None Satellite Roads Terrain

Fire Details

| | |
|------------------|--------------------------|
| Fire ID | FFXXXXXX |
| Fire Size | Normal |
| Fire Occurance | Not Repeat |
| Satellite Source | SNPP |
| Fire Date | 11-04-2022 |
| Fire Time | 19:46:07 |
| Latitude | 21.8829 |
| Longitude | 86.2658 |
| Circle | BARIPADA |
| Division | SIMILIPAL NORTH WILDLIFE |
| Range | GURGURIA WL |
| Section | KALIANI |
| Beat | BILAPAGHA |

Fire Legends

- 2020 : 112
- 2021 : 1068
- 2022 : 119
- 2023 : 0



Odisha Forest Management Systems (Forest Fire Mapper)



Date wise >>

Search Criteria

Angul

Select Division

Select Range

Select Section

Select Beat

- 2017
- 2018
- 2019
- 2020
- 2021
- 2022
- 2023

Submit Reset

Map View:

- None
- Satellite
- Roads
- Terrain

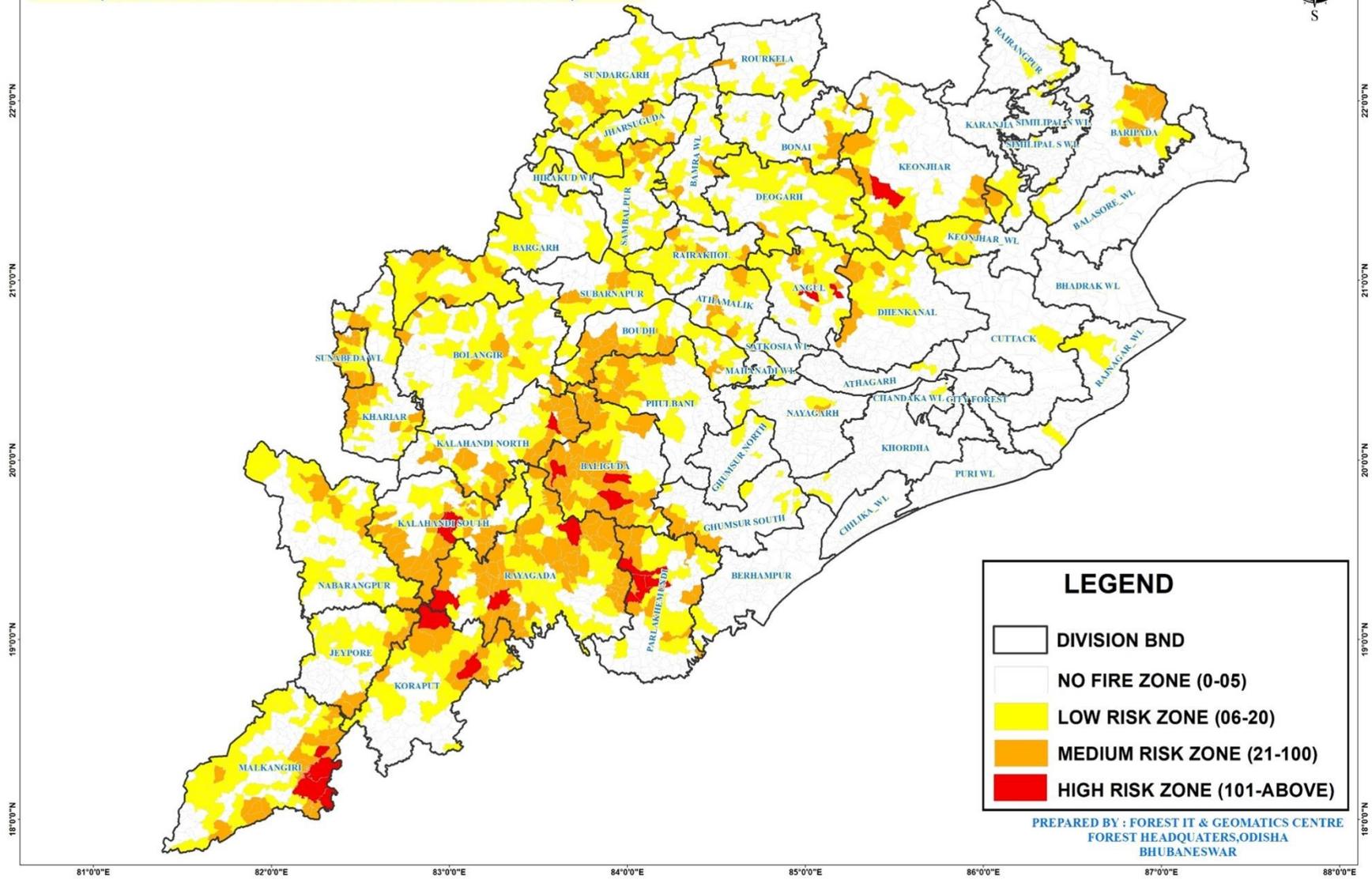
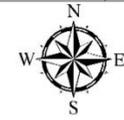


Forest Fire Data



| | January | February | March | April | May | June | July | August | September | October | November | December |
|---------------|------------------------------|------------------------------|--------------------------------|-------------------------------|------------------------------|----------------------------|----------|----------|-----------|----------|----------------------------|-----------------------------|
| WEEK-1 | 47 05-01-2022 : 9 | 72 07-02-2022 : 12 | 37 05-03-2022 : 9 | 94 05-04-2022 : 32 | 78 02-05-2022 : 40 | 2 06-06-2022 : 1 | 0 | 0 | 0 | 0 | 3 01-11-2022 : 2 | 4 05-12-2022 : 2 |
| WEEK-2 | 29 08-01-2022 : 11 | 77 14-02-2022 : 18 | 96 14-03-2022 : 36 | 55 11-04-2022 : 18 | 5 08-05-2022 : 4 | 3 14-06-2022 : 1 | 0 | 0 | 0 | 0 | 9 11-11-2022 : 4 | 4 14-12-2022 : 2 |
| WEEK-3 | 55 19-01-2022 : 17 | 66 16-02-2022 : 17 | 592 20-03-2022 : 244 | 289 17-04-2022 : 94 | 6 21-05-2022 : 2 | 1 19-06-2022 : 1 | 0 | 0 | 0 | 0 | 4 16-11-2022 : 2 | 17 15-12-2022 : 6 |
| WEEK-4 | 28 28-01-2022 : 7 | 57 24-02-2022 : 12 | 558 25-03-2022 : 131 | 247 27-04-2022 : 67 | 0 | 3 26-06-2022 : 3 | 0 | 0 | 0 | 0 | 8 28-11-2022 : 3 | 10 22-12-2022 : 4 |

**FOREST FIRE VULNERABLE MAP OF ODISHA-2022
(BEATWISE SNPP & MODIS DATA- 28849)**



LEGEND

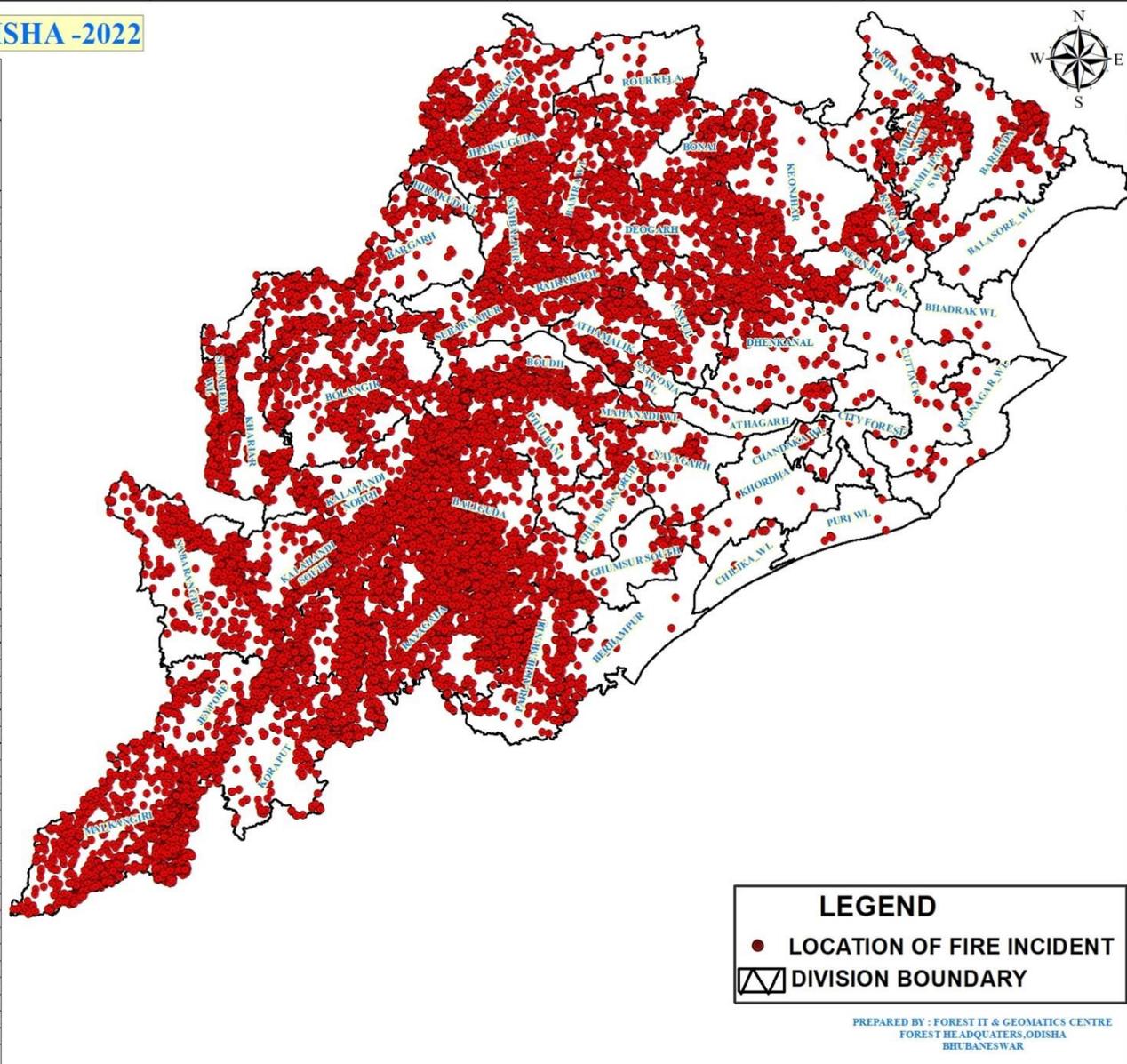
-  DIVISION BND
-  NO FIRE ZONE (0-05)
-  LOW RISK ZONE (06-20)
-  MEDIUM RISK ZONE (21-100)
-  HIGH RISK ZONE (101-ABOVE)

PREPARED BY : FOREST IT & GEOMATICS CENTRE
FOREST HEADQUARTERS, ODISHA
BHUBANESWAR

FOREST FIRE MAP OF ODISHA -2022

Forest Fire incidences as reported by FSI in Fire Season 2022, from 01.02.2022 to 02.06.2022

| Sl. No. | Name of the Division | No. of fire incidences in forest area FSI | No. of fire incidences in non-forest area FSI | Total |
|--------------|----------------------|---|---|--------------|
| 1 | Angul | 1114 | 111 | 1225 |
| 2 | Athamallik | 368 | 69 | 437 |
| 3 | Athgarh | 38 | 4 | 42 |
| 4 | Balasore WL | 14 | 4 | 18 |
| 5 | Baliguda | 2027 | 206 | 2233 |
| 6 | Bamra WL | 278 | 149 | 427 |
| 7 | Baragarh | 554 | 147 | 701 |
| 8 | Baripada | 411 | 127 | 538 |
| 9 | Berhampur | 84 | 10 | 94 |
| 10 | Bhadrak WL | 0 | 9 | 9 |
| 11 | Bolangir | 1017 | 172 | 1189 |
| 12 | Bonai | 428 | 11 | 439 |
| 13 | Boudh | 913 | 89 | 1002 |
| 14 | Chandaka WL | 35 | 2 | 37 |
| 15 | Chillika WL | 0 | 9 | 9 |
| 16 | Cuttack | 83 | 36 | 119 |
| 17 | City | 0 | 10 | 10 |
| 18 | Deogarh | 577 | 166 | 743 |
| 19 | Dhenkanal | 257 | 292 | 549 |
| 20 | Ghumsur North | 104 | 3 | 107 |
| 21 | Ghumsur South | 294 | 17 | 311 |
| 22 | Hirakud WL | 84 | 0 | 84 |
| 23 | Jeypore | 373 | 164 | 537 |
| 24 | Jharsuguda | 195 | 295 | 490 |
| 25 | Kalahandi North | 1311 | 128 | 1439 |
| 26 | Kalahandi South | 1087 | 570 | 1657 |
| 27 | Karanja | 113 | 7 | 120 |
| 28 | Keonjhar | 650 | 279 | 929 |
| 29 | Keonjhar WL | 246 | 7 | 253 |
| 30 | Khariar | 713 | 23 | 736 |
| 31 | Khurda | 45 | 4 | 49 |
| 32 | Koraput | 606 | 438 | 1044 |
| 33 | Mahanadi WL | 28 | 6 | 34 |
| 34 | Malkangiri | 735 | 1301 | 2036 |
| 35 | Nawarangpur | 595 | 126 | 721 |
| 36 | Nayagarh | 186 | 2 | 188 |
| 37 | Parlakhemundi | 1055 | 270 | 1325 |
| 38 | Phulbani | 511 | 47 | 558 |
| 39 | Puri WL | 1 | 5 | 6 |
| 40 | Rairakhol | 458 | 29 | 487 |
| 41 | Rairangpur | 56 | 19 | 75 |
| 42 | Rajnagar WL | 0 | 29 | 29 |
| 43 | Rayagada | 2327 | 635 | 2962 |
| 44 | Rourkela | 129 | 87 | 216 |
| 45 | Sambalpur | 317 | 281 | 598 |
| 46 | Subarnapur | 281 | 62 | 343 |
| 47 | Satkosia WL | 26 | 3 | 29 |
| 48 | Similipal South | 42 | 77 | 119 |
| 49 | Similipal North | 101 | 22 | 123 |
| 50 | Sunabeda WL | 448 | 2 | 450 |
| 51 | Sundargarh | 704 | 269 | 973 |
| TOTAL | | 22019 | 6830 | 28849 |



LEGEND

- LOCATION OF FIRE INCIDENT
- ▭ DIVISION BOUNDARY

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FOREST HEADQUARTERS, ODISHA
BHUBANESWAR



Odisha State Forest Department

OFMS Forest Fire Report : Season 2023
From: 01-02-2023 To: 19-02-2023
Odisha Forest Department



Odisha State Forest Department

Division wise Firepoint Attended Status Summary Report

| | | | | |
|--------------|----------------|------------------------|----------------------|---|
| Circle : All | Division : All | Date From : 01-02-2023 | Date To : 19-02-2023 | Report Generated On : 20-02-2023 07:47:46am |
|--------------|----------------|------------------------|----------------------|---|

State Total

| Total Alerts | Attended Alerts % (Numbers) | Unattended Alerts % (Numbers) |
|--------------|------------------------------|-------------------------------|
| 2290 | 96.33 (2206) | 3.67 (84) |

| SL. NO. | Circle | Division | Total Alerts (Numbers) | Attended Alerts % (Numbers) | Unattended Alerts % (Numbers) |
|---------|-------------|-------------|-------------------------|------------------------------|-------------------------------|
| 1 | Bhubaneswar | Bhadrak WI | 7 | 42.86 (3) | 57.14 (4) |
| 2 | Baripada | Balasore WI | 6 | 50 (3) | 50 (3) |
| 3 | Bhubaneswar | City Forest | 2 | 50 (1) | 50 (1) |
| 4 | Bhubaneswar | Rajnagar WI | 8 | 62.5 (5) | 37.5 (3) |
| 5 | Bhubaneswar | Chandaka WI | 7 | 71.43 (5) | 28.57 (2) |
| 6 | Angul | Athagarh | 8 | 75 (6) | 25 (2) |





Odisha State Forest Department

| SL. NO. | Circle | Division | Total Alerts (Numbers) | Attended Alerts % (Numbers) | Unattended Alerts % (Numbers) |
|---------|--------------|--------------------------|------------------------|-----------------------------|-------------------------------|
| 7 | Bhubaneswar | Puri WI | 4 | 75 (3) | 25 (1) |
| 8 | Berhampur | Berhampur | 10 | 80 (8) | 20 (2) |
| 9 | Bhawanipatna | Sunabeda WI | 31 | 80.65 (25) | 19.35 (6) |
| 10 | Angul | Angul | 63 | 85.71 (54) | 14.29 (9) |
| 11 | Bhubaneswar | Khordha | 17 | 88.24 (15) | 11.76 (2) |
| 12 | Angul | Dhenkanal | 52 | 90.38 (47) | 9.62 (5) |
| 13 | Bhawanipatna | Khariar | 85 | 90.59 (77) | 9.41 (8) |
| 14 | Sambalpur | Jharsuguda | 59 | 91.53 (54) | 8.47 (5) |
| 15 | Baripada | BARIPADA | 231 | 92.21 (213) | 7.79 (18) |
| 16 | Baripada | SIMILIPAL NORTH WILDLIFE | 14 | 92.86 (13) | 7.14 (1) |
| 17 | Berhampur | Paralakhemundi | 45 | 93.33 (42) | 6.67 (3) |
| 18 | Koraput | Rayagada | 79 | 93.67 (74) | 6.33 (5) |



Odisha State Forest Department

| SL. NO. | Circle | Division | Total Alerts (Numbers) | Attended Alerts % (Numbers) | Unattended Alerts % (Numbers) |
|---------|--------------|-------------|------------------------|-----------------------------|-------------------------------|
| 31 | Rourkela | Bonai | 29 | 100 (29) | 0 (0) |
| 32 | Koraput | Jeypore | 49 | 100 (49) | 0 (0) |
| 33 | Rourkela | Keonjhar | 129 | 100 (129) | 0 (0) |
| 34 | Koraput | Malkangiri | 44 | 100 (44) | 0 (0) |
| 35 | Bhawanipatna | Subarnapur | 22 | 100 (22) | 0 (0) |
| 36 | Baripada | KARANJIA | 9 | 100 (9) | 0 (0) |
| 37 | Baripada | Keonjhar WI | 62 | 100 (62) | 0 (0) |
| 38 | Angul | Satkosia WI | 4 | 100 (4) | 0 (0) |
| 39 | Angul | Mahanadi WI | 1 | 100 (1) | 0 (0) |
| 40 | Angul | Athamallik | 1 | 100 (1) | 0 (0) |
| 41 | Angul | Cuttack | 4 | 100 (4) | 0 (0) |
| 42 | Baripada | RAIRANGPUR | 40 | 100 (40) | 0 (0) |



Odisha State Forest Department

| SL. NO. | Circle | Division | Total Alerts (Numbers) | Attended Alerts % (Numbers) | Unattended Alerts % (Numbers) |
|---------|--------------|----------------------------|------------------------|-----------------------------|-------------------------------|
| 43 | Baripada | SIMILIPAL SOUTH WILDLIFE | 4 | 100 (4) | 0 (0) |
| 44 | Bhawanipatna | Kalahandi North | 11 | 100 (11) | 0 (0) |
| 45 | Bhawanipatna | Kalahandi South | 30 | 100 (30) | 0 (0) |
| 46 | Bhawanipatna | Bolangir | 55 | 100 (55) | 0 (0) |
| 47 | Berhampur | Phulbani | 3 | 100 (3) | 0 (0) |
| 48 | Berhampur | Boudh | 4 | 100 (4) | 0 (0) |
| 49 | Berhampur | Ghumsur North | 6 | 100 (6) | 0 (0) |
| 50 | Bhubaneswar | Nayagarh | 12 | 100 (12) | 0 (0) |
| 51 | Bhubaneswar | Chilika Wl | 0 | 0 | 0 |
| | | Total (All Circles) | 2290 | 96.33 (2206) | 3.67 (84) |



Thank You



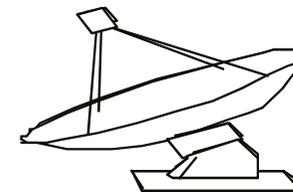


Forest Fire Management- Monitoring and Alert System



Forest Survey of India

Ministry of Environment, Forest and Climate Change,
Dehradun, Uttarakhand, sunilchandra.iitr@gmail.com



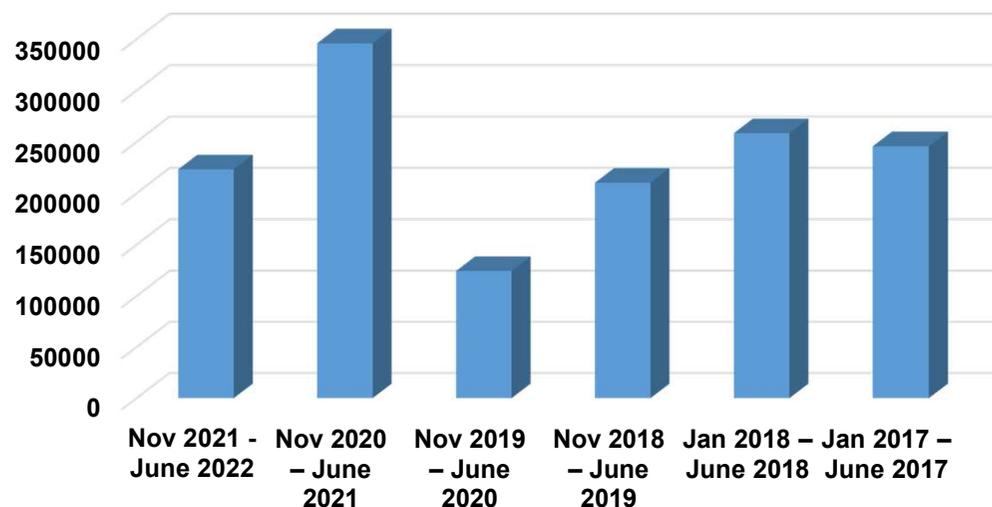
Forest Fires in India- Some Facts

- According to the India State of Forest Report, 2021 the estimated fire-prone area under extremely, very high, highly and moderately fire prone is 2.81%, 7.85% and 11.61% and 13.19% respectively
- Total forest fire-prone area within the recorded forest area is 35.46% (ISFR 2021)
- The extent of forest area annually experiencing surface fire which affects ground flora and organic matter is estimated to be 3.69% of the recorded forest area. (ISFR 2013)
- Further, about 2.3% of the total forest of the country is found to be affected by forest fire annually-FSI



Forest Fires in India – Some Statistics

| Fire Season | No. of detections (SNPP-VIIRS Sensor) |
|-----------------------------|---------------------------------------|
| Nov 2021 - June 2022 | 2,23,333 |
| Nov 2020 – June 2021 | 3,45,989 |
| Nov 2019 – June 2020 | 1,24,473 |
| Nov 2018 – June 2019 | 2,10,286 |
| Jan 2018 – June 2018 | 2,58,480 |
| Jan 2017 – June 2017 | 2,45,783 |



Total Fire Prone Forest Area is 35.46% of the forest cover (as per ISFR 2021)

| State | 1 st Nov 2020 – 30 th June 2021 |
|----------------|---|
| Odisha | 51,968 |
| Madhya Pradesh | 47,795 |
| Chhattisgarh | 38,106 |
| Maharashtra | 34,025 |
| Jharkhand | 21,713 |
| Uttarakhand | 21,487 |
| Andhra Pradesh | 19,328 |
| Telangana | 18,237 |
| Mizoram | 12,846 |
| Assam | 10,718 |

| State | 1 st Nov 2021 – 30 th June 2022 |
|----------------|---|
| Madhya Pradesh | 32,728 |
| Chhattisgarh | 25,972 |
| Maharashtra | 22,052 |
| Odisha | 22,014 |
| Andhra Pradesh | 14,138 |
| Telangana | 13,737 |
| Uttarakhand | 12,985 |
| Jharkhand | 9,419 |
| Mizoram | 8,734 |
| Assam | 8,158 |

Forest fire detections

| STATE | Nov,2018-Jun,2019 | | Nov,2019-Jun,2020 | | Nov,2020-Jun,2021 | | Nov,2021-Jun,2022 | | Nov,2023-23 Feb 2023 | |
|-----------------------|-------------------|-----------------|-------------------|-----------------|-------------------|-----------------|-------------------|-----------------|----------------------|---------------|
| | MODIS | SNPP-VIIRS | MODIS | SNPP-VIIRS | MODIS | SNPP-VIIRS | MODIS | SNPP-VIIRS | MODIS | SNPP-VIIRS |
| ANDAMAN & NICOBAR Is. | 6 | 37 | 15 | 39 | 2 | 16 | 3 | 33 | 0 | 1 |
| ANDHRA PRADESH | 1748 | 15746 | 1080 | 9996 | 2888 | 19328 | 1716 | 14,138 | 625 | 3630 |
| ARUNACHAL PRADESH | 926 | 2617 | 660 | 1786 | 1109 | 3914 | 1116 | 3,449 | 228 | 1057 |
| ASSAM | 1940 | 5935 | 3000 | 8924 | 3387 | 10718 | 2305 | 8,158 | 184 | 690 |
| BIHAR | 203 | 2450 | 50 | 614 | 537 | 5179 | 222 | 3,024 | 12 | 122 |
| CHANDIGARH | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| CHHATTISGARH | 1608 | 25750 | 416 | 6360 | 3112 | 38106 | 1942 | 25,792 | 416 | 1756 |
| DADRA & NAGAR HAVELI | 0 | 19 | 1 | 21 | 3 | 33 | 1 | 15 | 0 | 3 |
| DAMAN & DIU | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 1 |
| DELHI | 2 | 20 | 3 | 21 | 5 | 14 | 5 | 3 | 0 | 4 |
| GOA | 11 | 140 | 4 | 47 | 10 | 45 | 5 | 20 | 4 | 22 |
| GUJARAT | 224 | 2885 | 202 | 2770 | 422 | 3803 | 236 | 2,769 | 97 | 413 |
| HARYANA | 24 | 135 | 39 | 68 | 25 | 152 | 37 | 135 | 23 | 39 |
| HIMACHAL PRADESH | 142 | 1446 | 80 | 536 | 533 | 4110 | 601 | 5,280 | 78 | 425 |
| JAMMU & KASHMIR | 62 | 661 | 62 | 438 | 131 | 1098 | 524 | 4,282 | 9 | 52 |
| JHARKHAND | 363 | 6221 | 101 | 2613 | 1563 | 21713 | 630 | 9,419 | 120 | 820 |
| KARNATAKA | 1228 | 8078 | 538 | 4232 | 932 | 5784 | 800 | 4,973 | 742 | 4378 |
| LADAKH | | | | | | | | | 48 | 406 |
| KERALA | 192 | 1162 | 142 | 864 | 51 | 296 | 61 | 504 | 0 | 2 |
| LAKSHADWEEP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MADHYA PRADESH | 2723 | 22108 | 1383 | 9537 | 7103 | 47795 | 3908 | 32,728 | 587 | 3184 |
| MAHARASHTRA | 2516 | 26939 | 1102 | 14018 | 4297 | 34025 | 2309 | 22,052 | 509 | 2510 |
| MANIPUR | 1752 | 7384 | 2475 | 8800 | 3252 | 10457 | 1638 | 5,544 | 373 | 1634 |
| MEGHALAYA | 1545 | 5797 | 1826 | 6762 | 2052 | 7658 | 1431 | 6,322 | 134 | 850 |
| MIZORAM | 2795 | 7597 | 2816 | 7361 | 4345 | 12846 | 2105 | 8,734 | 178 | 451 |
| NAGALAND | 1057 | 2898 | 1248 | 2905 | 1726 | 4975 | 1309 | 3,471 | 270 | 1116 |
| ODISHA | 2123 | 19159 | 1326 | 10602 | 5307 | 51968 | 2086 | 22,014 | 776 | 3497 |
| PUDUCHERRY | 0 | 4 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| PUNJAB | 77 | 214 | 52 | 153 | 171 | 635 | 128 | 428 | 37 | 58 |
| RAJASTHAN | 386 | 3025 | 420 | 3461 | 447 | 3402 | 238 | 2,703 | 59 | 349 |
| SIKKIM | 11 | 64 | 5 | 47 | 17 | 63 | 11 | 26 | 10 | 16 |
| TAMIL NADU | 752 | 4402 | 187 | 1368 | 202 | 1220 | 151 | 1,035 | 66 | 386 |
| TELANGANA | 1246 | 15262 | 1042 | 12132 | 2566 | 18237 | 1372 | 13,737 | 407 | 2947 |
| TRIPURA | 1195 | 3083 | 1467 | 4369 | 1664 | 5015 | 310 | 2,609 | 7 | 60 |
| UTTAR PRADESH | 855 | 4428 | 396 | 1548 | 1667 | 8608 | 905 | 5,428 | 208 | 617 |
| UTTARAKHAND | 1578 | 12965 | 167 | 759 | 2710 | 21487 | 1337 | 12,985 | 280 | 1459 |
| WEST BENGAL | 257 | 1653 | 141 | 1320 | 548 | 3287 | 233 | 1,520 | 321 | 1249 |
| TOTAL | 29,547 | 2,10,286 | 22,447 | 1,24,473 | 52,785 | 3,45,989 | 29,675 | 2,23,333 | 6,808 | 34,204 |

Forest Fire Scenario in India

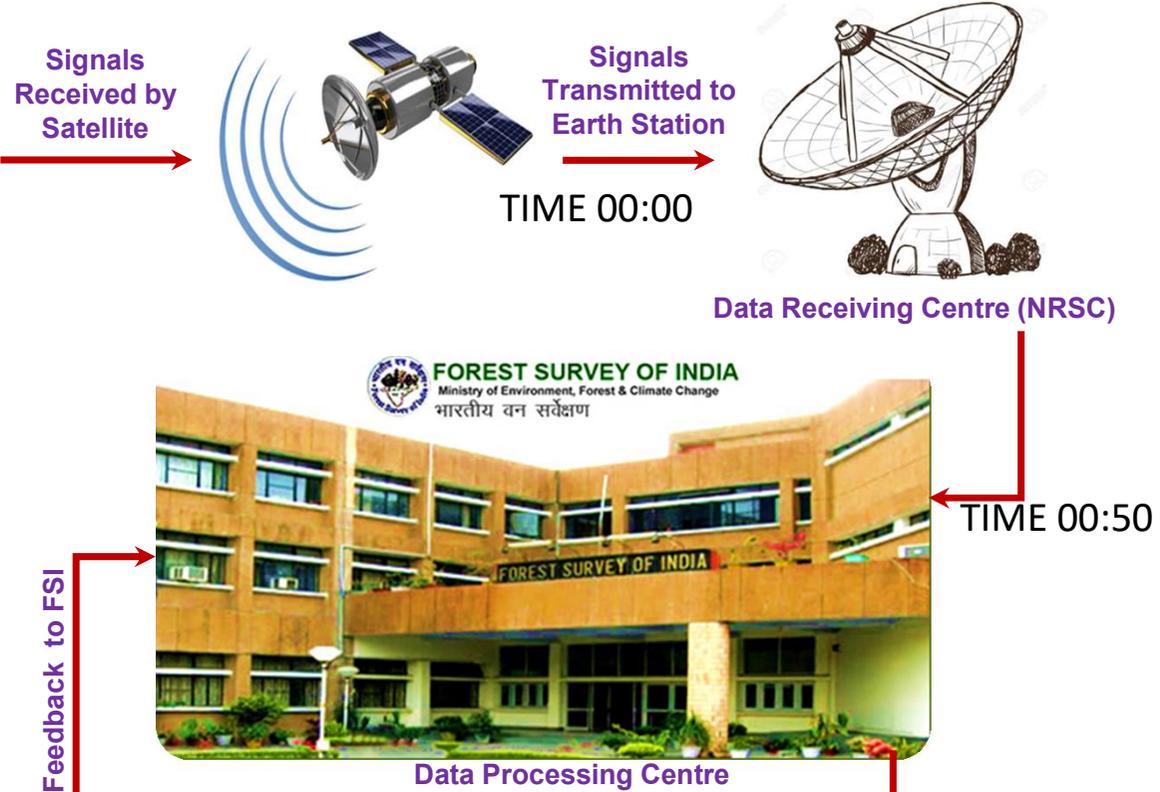
- Most fires are man-made (intentional and unintentional)
- NTFP collection, pasture burning, shifting cultivation, encroachment, Tendu Leaves, Mahua collection etc.
- Most are ground fires affecting the ground vegetation and lower storey
- Lack of modern fire fighting methods; Mostly put out by state forest departments with the help of locals
- Many areas are annually affected in Western Himalayas, North Eastern States, Central highlands
- Pine Forests and deciduous forest types are mostly affected

Forest fire studies- some initiatives in FSI

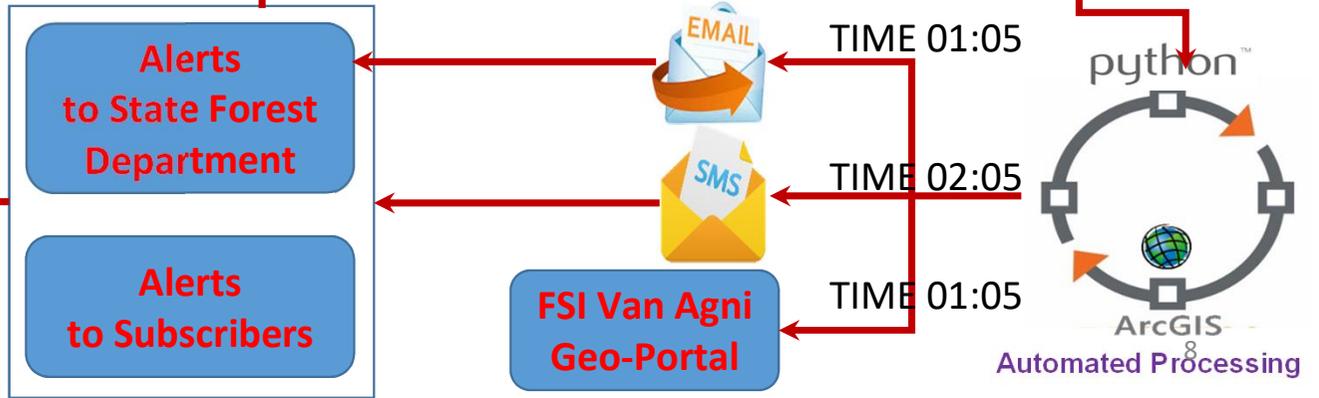
- **Burnt area assessment for Uttarakhand state during the wild fires of years - 1995 and 1999**
- **Monitoring of Forest Fires (Nov 2004-2011)**
- **Near Real time forest fire monitoring (2012 onwards) in collaboration with NRSC**
- **Forest fire vulnerability assessment at country level using fire points, and other parameters including forest cover and forest types, rainfall, poverty index(2012)**
- **Burnt area assessment for Maharashtra(2014)**
- **Pre warning alert system for forest fires(2016)**
- **Burnt area assessment in the country for 2015 and 2016**
- **Large Fire Monitoring Programme(2019)**
- **Creation of a Forest Fire Portal(Van Agni)**
- **Mapping of extent and damages caused by large forest fires**
- **Fire Risk Zonation for the West Himalayan States using RS and Field Inventory variables(2022)**
- **Burnt area assessment for Kerala and Uttarakhand(2022)and Manipur(in progress)**

Near Real Time Monitoring

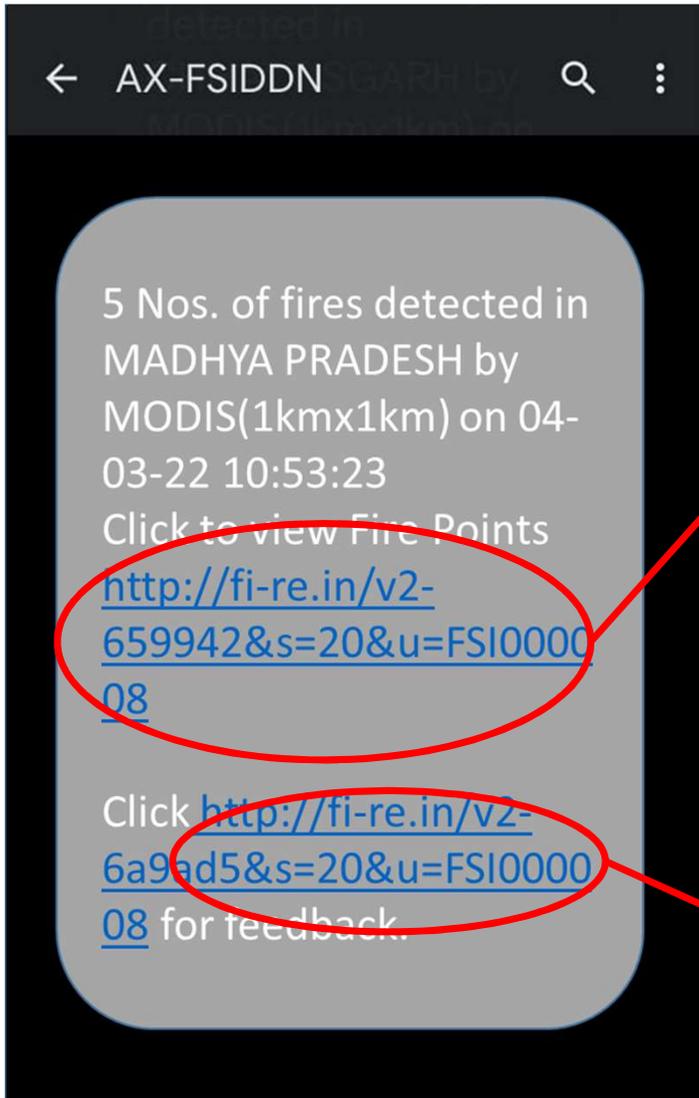
Near Real Time Forest Fire Monitoring (MODIS & SNPP-VIIRS)



Suppression and Mitigation of Forest Fires



A SMS Alert



2 Fire Points MADHYA PRADESH ▾

| # | Fire Date | Fire Time | Latitude | Longitude | Source | State | District | Circle & Others |
|----|------------|-----------|------------|------------|--------|----------------|-------------|--|
| 1. | 04-03-2022 | 10:53:23 | 22 48 44 N | 79 08 18 E | MODIS | MADHYA PRADESH | NARSIMHAPUR | SEONI CIRCLE Division: NARSINGHPUR DIVISION Range: KARELI RANGE Block: KARELI RANGE BLOCK Beat: SIMIRYA BEAT Compt. No.: 178 |
| 2. | 04-03-2022 | 10:53:23 | 24 27 53 N | 81 31 51 E | MODIS | MADHYA PRADESH | REWA | REWA CIRCLE Division: REWA DIVISION Range: REWA RANGE Block: REWA RANGE BLOCK Beat: MAHADANDI BEAT |



2 Fire Points

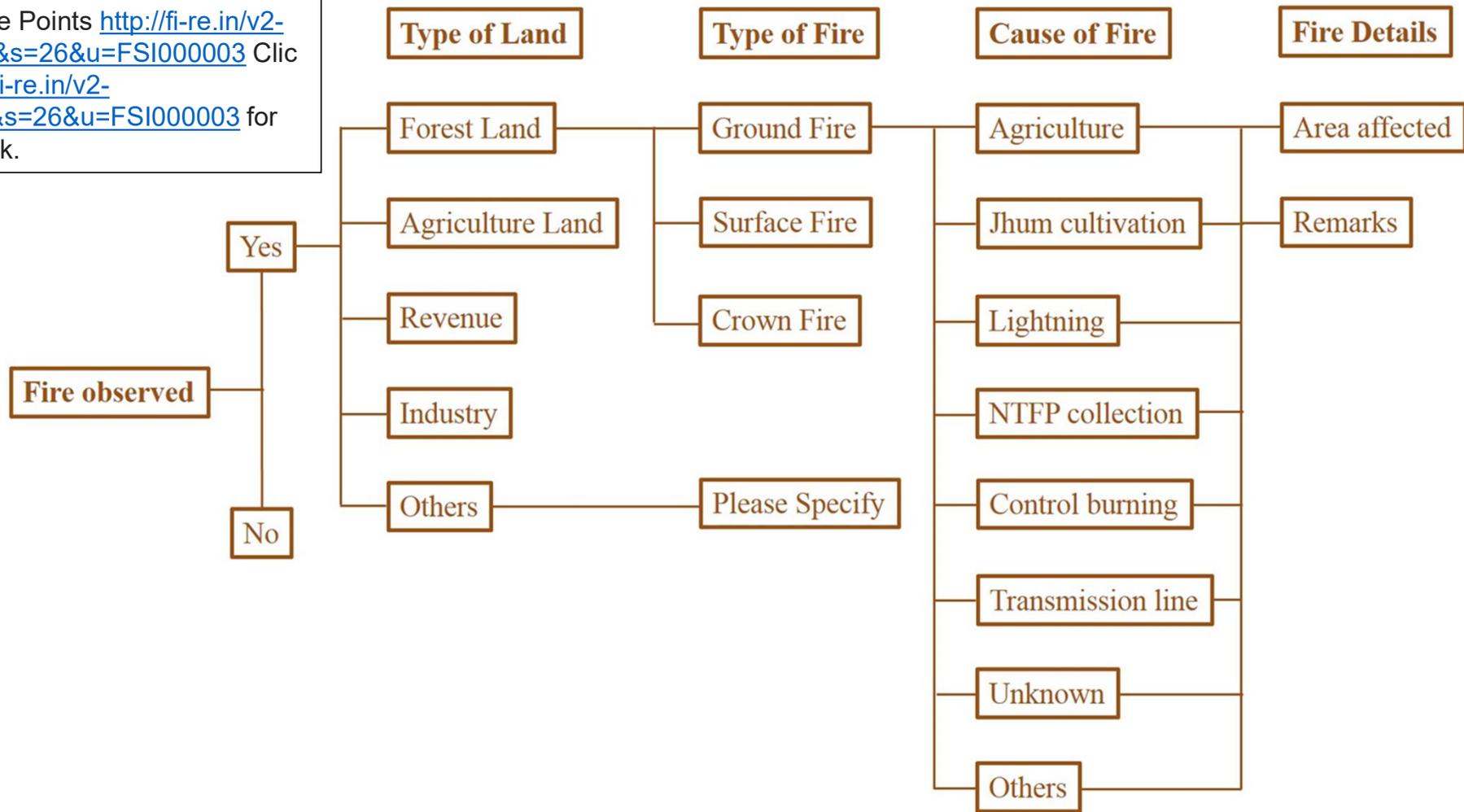
| # | Alert Details | Fire Observed | Type of Land |
|--------------------------|---|--------------------|--------------|
| <input type="checkbox"/> | 22 48 44 N / 79 08 18 E State: MADHYA PRADESH District: NARSIMHAPUR Circle: SEONI CIRCLE Division: NARSINGHPUR DIVISION Range: KARELI RANGE Block: KARELI RANGE BLOCK Beat: SIMIRYA BEAT Compt. No.: 178 Source: MODIS | Is Fire Observed ▾ | |
| <input type="checkbox"/> | 24 27 53 N / 81 31 51 E State: MADHYA PRADESH District: REWA Circle: REWA CIRCLE Division: REWA DIVISION Range: REWA RANGE Block: REWA RANGE BLOCK Beat: MAHADANDI BEAT Compt. No.: 55 Source: MODIS | Is Fire Observed ▾ | |

Information Dissemination at Beat Level

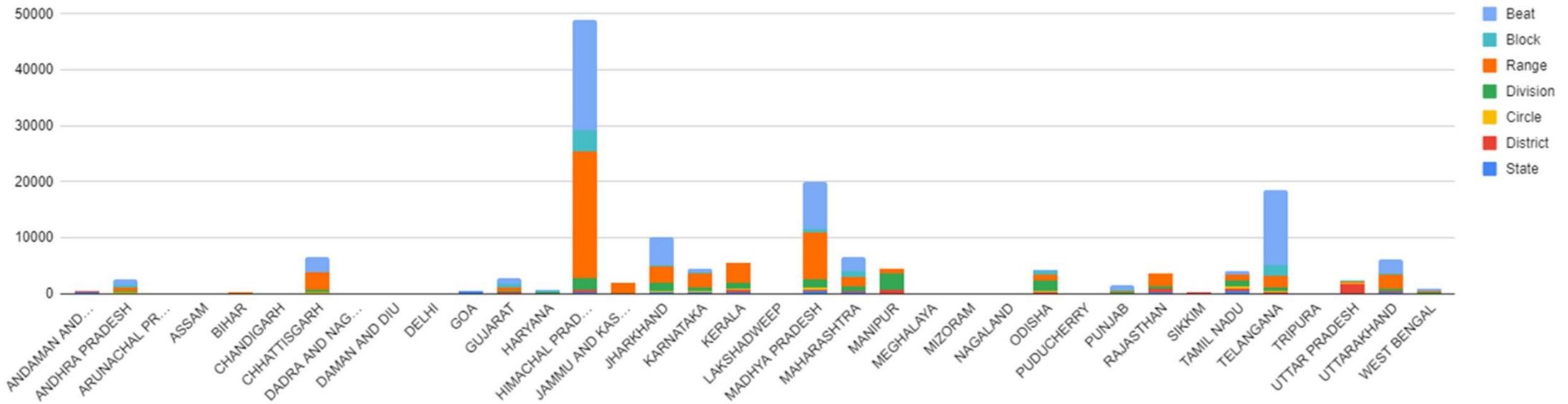
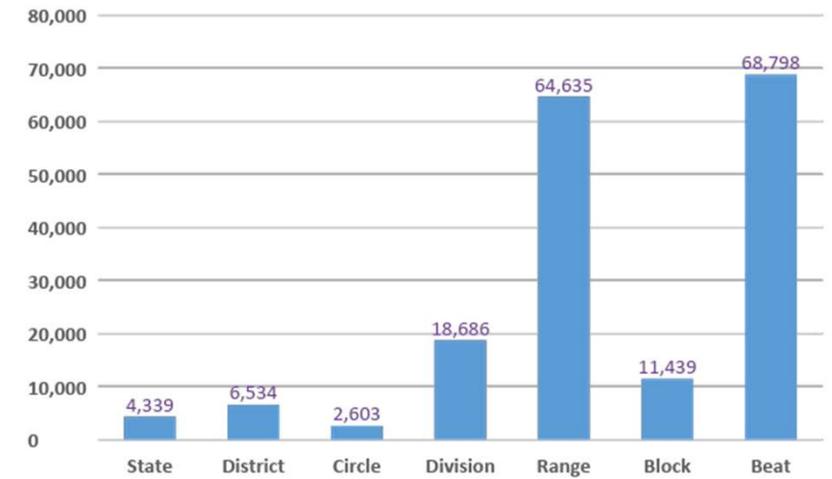


9 Nos. of fires detected in ODISHA by SNPP(375mx375m) on 29-05-19 13:34:32 Click to view Fire Points <http://fi-re.in/v2-07d5dc&s=26&u=FSI000003> Click <http://fi-re.in/v2-b6f186&s=26&u=FSI000003> for feedback.

Feedback System



| Subscription Level | No. of Subscribers |
|--------------------|--------------------|
| State | 4339 |
| District | 6534 |
| Circle | 2603 |
| Division | 18686 |
| Range | 64635 |
| Block | 11439 |
| Beat | 68798 |
| Total | 177034 |



Ground Truthing in few of the fire affected regions



Large Forest Fire Monitoring Programme

Large Forest Fire Monitoring Programme

- **To enable SFDs to monitor large forest fire events and provide special emphasis in fire control of these events**
- **To provide disaster escalation support in order to bring in timely additional support from other agencies such as District Administration, SDMA, NDMA etc.**
- **National Large Forest Fire Database would help in future planning especially in development of State Crisis Management Plans, Working Plans**
- **To support rehabilitation of fire affected areas**

AN EMAIL ALERT FOR LARGE FOREST FIRE

KMZ & CSV FILE OF 2 ACTIVE LARGE FOREST FIRES OF HIMACHAL PRADESH DETECTED IN SNPP_20190528_1353

Office/FSI_CSV x

fsilargeforestfire2018@gmail.com

to cccfpc, apnagar, apnagar, biswastapas007, anupampal88, harshijn18, sk7shatty7, me, abhishek.choudhery23, evforester

Sir/Madam,

It is to bring to your attention that 2 of LARGE FOREST FIRES are currently active in HIMACHAL PRADESH as per the recent satellite data pertaining to SNPP_20190528_1353.

Forest Survey of India is currently testing the LARGE FOREST FIRE MONITORING PROGRAMME using near real time SNPP-VIIRS data.

Herein, FSI will disseminate Large Forest Fire alerts with the objective to identify, track and report serious forest fire incidents so as to help monitor such fires at senior level in the State Forest Department and also seek timely additional assistance that may be required to contain such fires.

Please find enclosed the Large Forest Fire polygons of HIMACHAL PRADESH as a KMZ file attachment.

- KMZ file is google earth compatible and would be uploaded automatically on google earth.

- Kindly click on the fire pixels for detailed administrative information as well as time-span of the fire.

- For a particular large-fire, Active fire pixels are depicted in color RED in contrast with Previous fire pixels in a single kmz file to track its spread, extents and time-span.

Please find enclosed CSV file for the Large Forest Fire polygons detailed of HIMACHAL PRADESH.

We would really appreciate if you could share your feedback on this new initiative which will help us to improve and provide useful information to the decision makers.

You may revert to us for queries or feedback.

With Regards,

Forest Fire Monitoring Team,

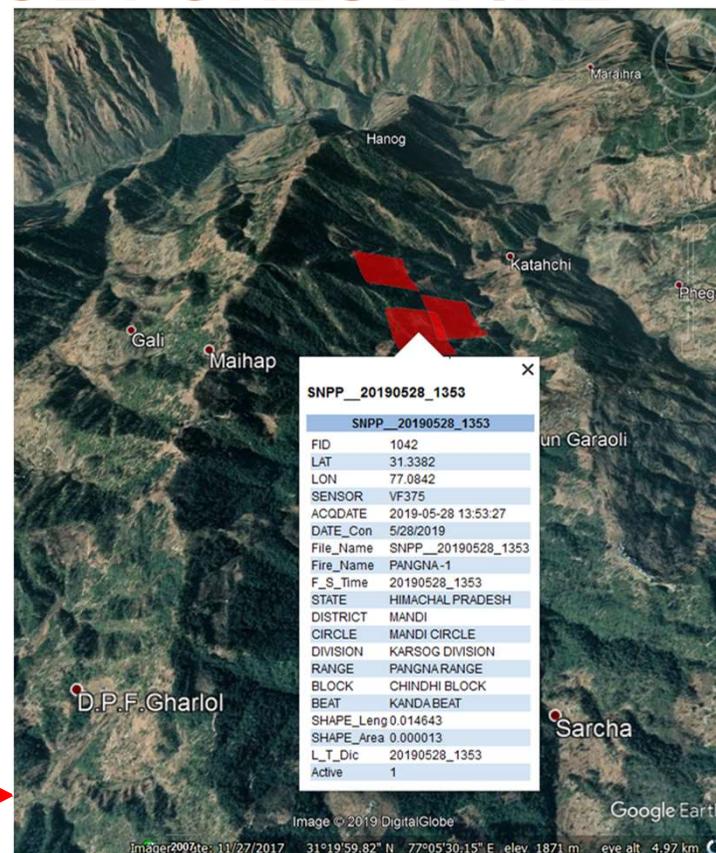
Forest Survey of India,

Ministry of Environment, Forest and Climate Change,

Kaulagarh Road, Dehradun- 248195.

0135-2754191 Ex-272

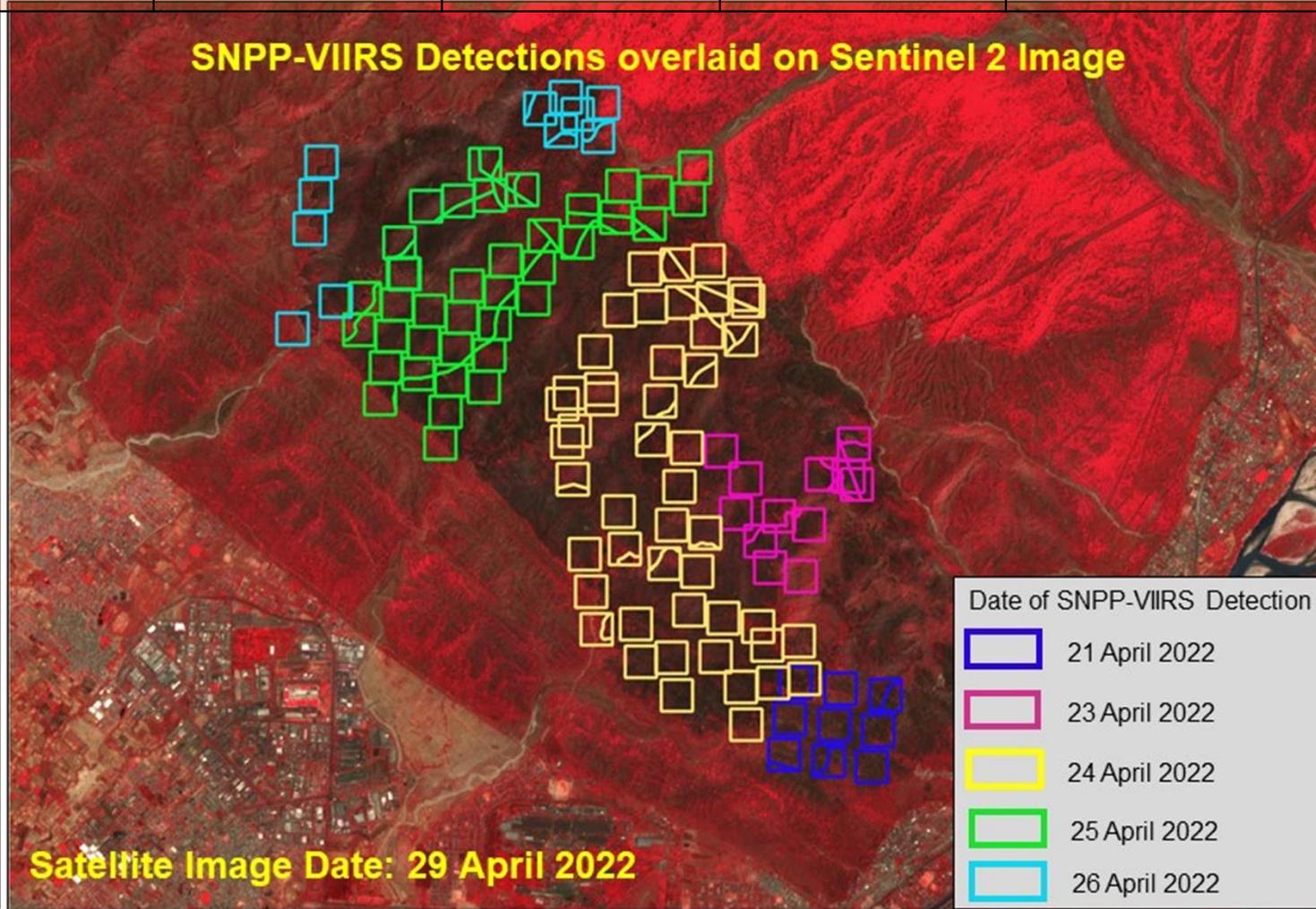
2 Attachments



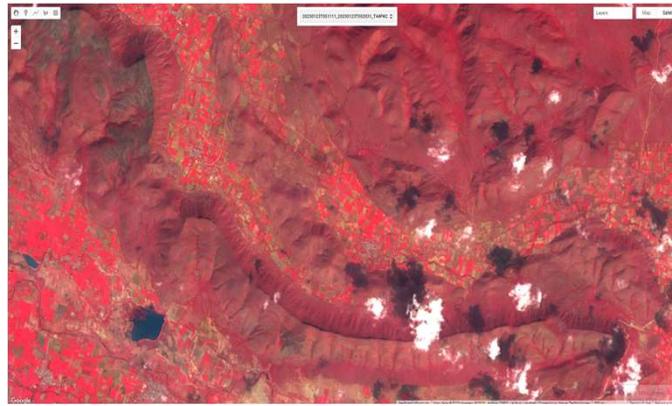
| LAT | LO | SENSOR | ACQDATE | FIRE NAME | FIRST DETECTED | STATE | DISTRICT | CIRCLE | DIVISION | RANGE | BLOCK | BEAT | LATEST DETECTED | STATUS* |
|---------|---------|--------|------------------|-----------|----------------|------------------|----------|-----------------|------------------|---------------|---------------|------------|-----------------|---------|
| 31.0184 | 76.8745 | VF375 | 28-05-2019 13:53 | KUTHAR -1 | 20190528_1353 | HIMACHAL PRADESH | SOLAN | BILASPUR CIRCLE | KUNIHAR DIVISION | KUTHAR RANGE | PATTA BLOCK | AWAD BEAT | 20190528_1353 | 1 |
| 31.0185 | 76.8719 | VF375 | 28-05-2019 13:53 | KUTHAR -1 | 20190528_1353 | HIMACHAL PRADESH | SOLAN | BILASPUR CIRCLE | KUNIHAR DIVISION | KUTHAR RANGE | PATTA BLOCK | AWAD BEAT | 20190528_1353 | 1 |
| 31.0191 | 76.8775 | VF375 | 28-05-2019 13:53 | KUTHAR -1 | 20190528_1353 | HIMACHAL PRADESH | SOLAN | BILASPUR CIRCLE | KUNIHAR DIVISION | KUNIHAR RANGE | CHANDI BLOCK | GOELA BEAT | 20190528_1353 | 1 |
| 31.0191 | 76.8775 | VF375 | 28-05-2019 13:53 | KUTHAR -1 | 20190528_1353 | HIMACHAL PRADESH | SOLAN | BILASPUR CIRCLE | KUNIHAR DIVISION | KUTHAR RANGE | PATTA BLOCK | AWAD BEAT | 20190528_1353 | 1 |
| 31.3377 | 77.0782 | VF375 | 28-05-2019 13:53 | PANGNA -1 | 20190528_1353 | HIMACHAL PRADESH | MANDI | MANDI CIRCLE | KARSOG DIVISION | PANGNA RANGE | CHINDHI BLOCK | KANDA BEAT | 20190528_1353 | 1 |
| 31.3382 | 77.0842 | VF375 | 28-05-2019 13:53 | PANGNA -1 | 20190528_1353 | HIMACHAL PRADESH | MANDI | MANDI CIRCLE | KARSOG DIVISION | PANGNA RANGE | CHINDHI BLOCK | KANDA BEAT | 20190528_1353 | 1 |
| 31.341 | 77.0825 | VF375 | 28-05-2019 13:53 | PANGNA -1 | 20190528_1353 | HIMACHAL PRADESH | MANDI | MANDI CIRCLE | KARSOG DIVISION | PANGNA RANGE | CHINDHI BLOCK | KANDA BEAT | 20190528_1353 | 1 |

Case Study - Haridwar

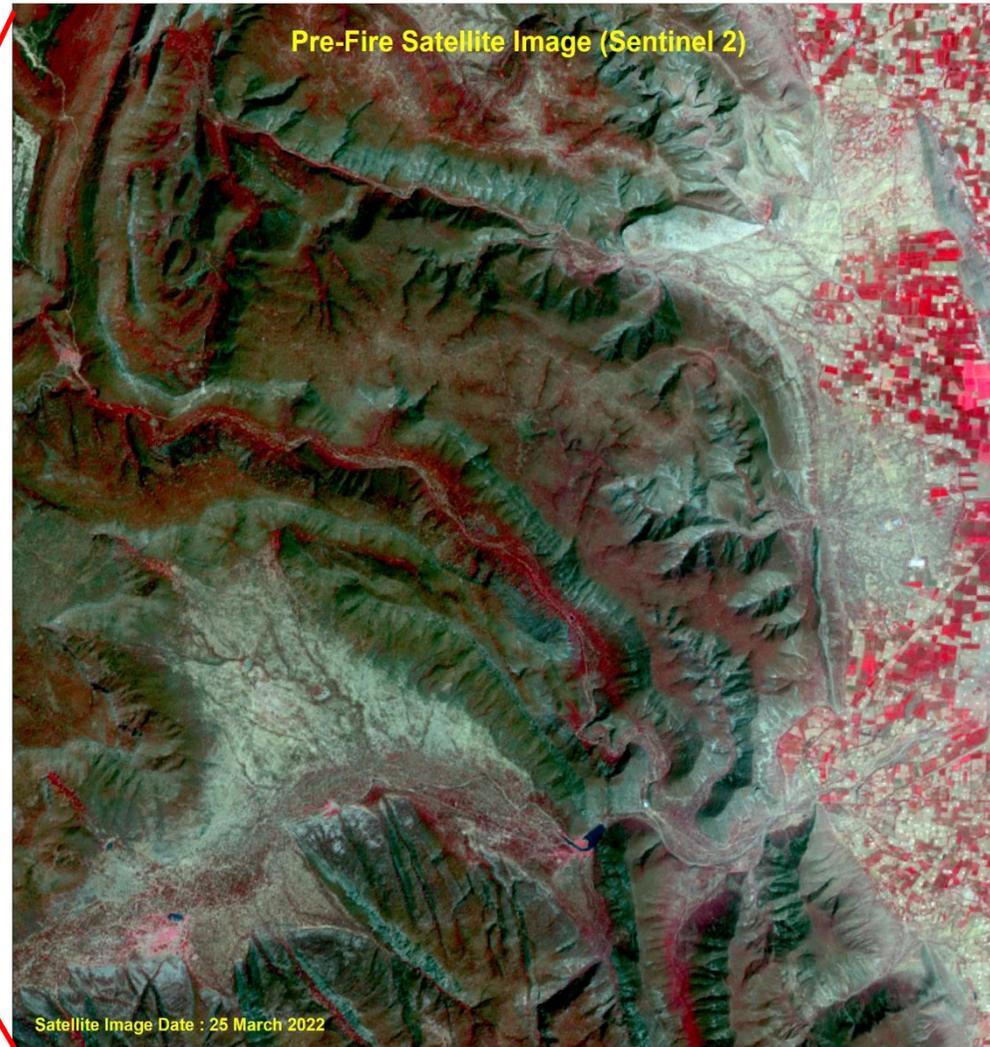
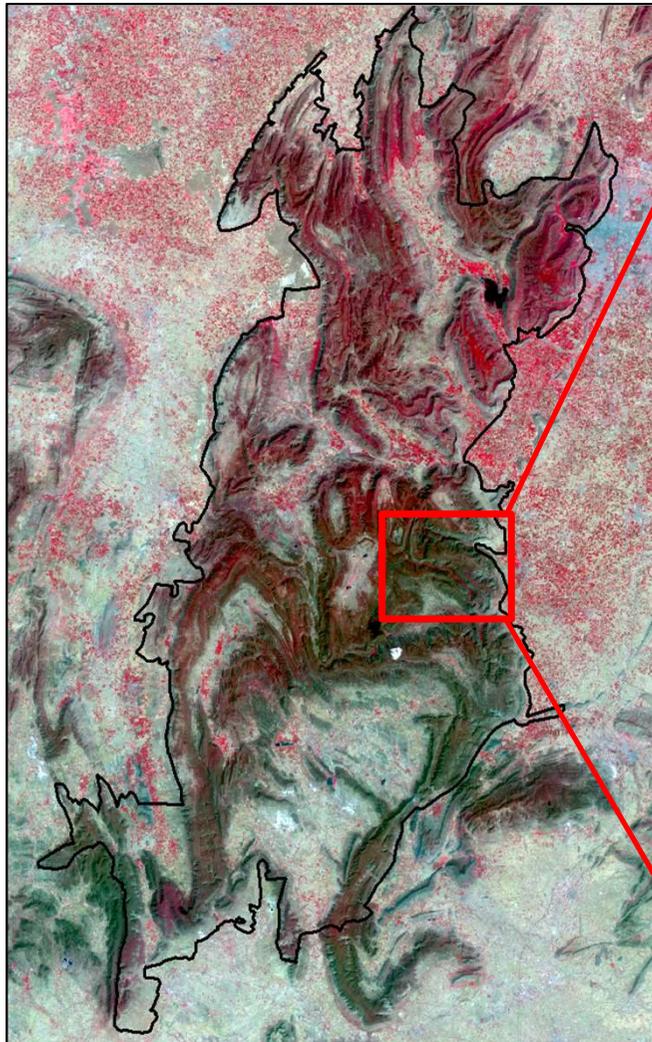
| Fire Name | State | First Detection Time | Last Detection Time | No. of Days fire remained active |
|-------------|-------------|----------------------|---------------------|----------------------------------|
| HARIDWAR -1 | UTTARAKHAND | 2022-04-21 | 2022-04-26 | 5 |



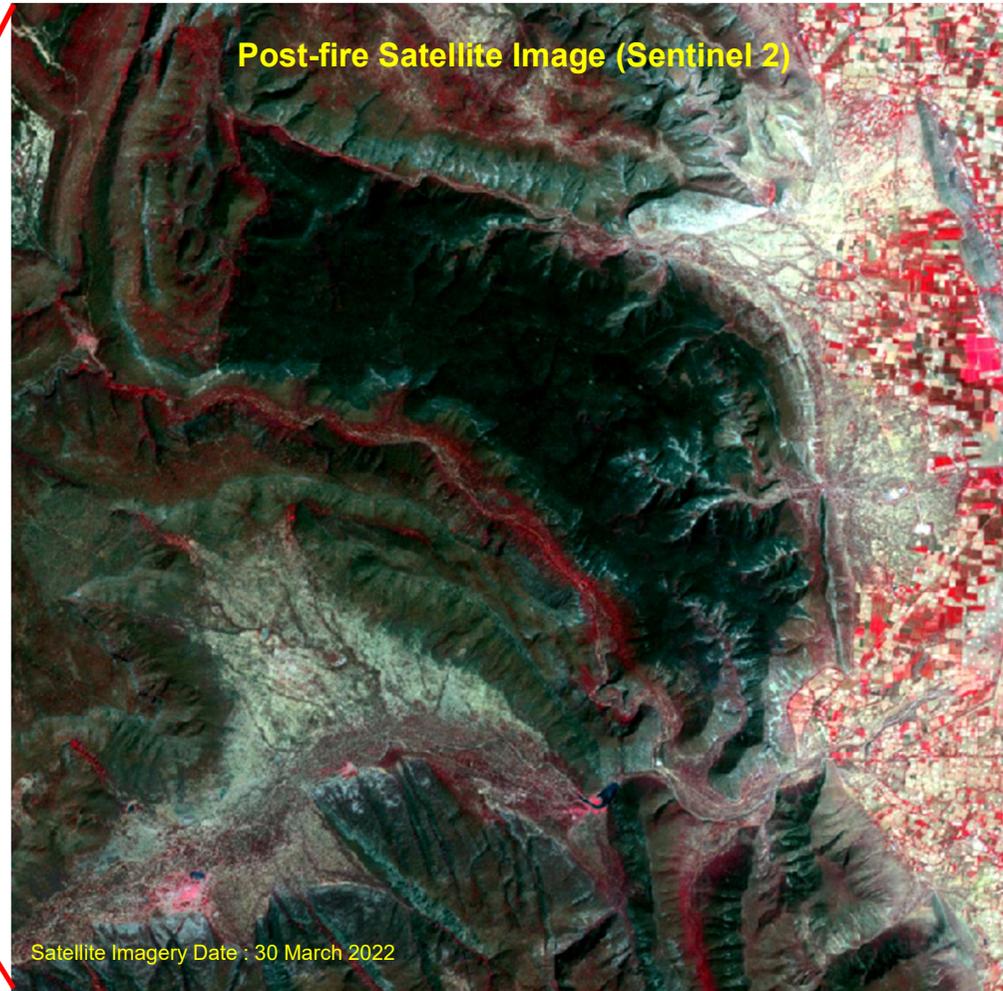
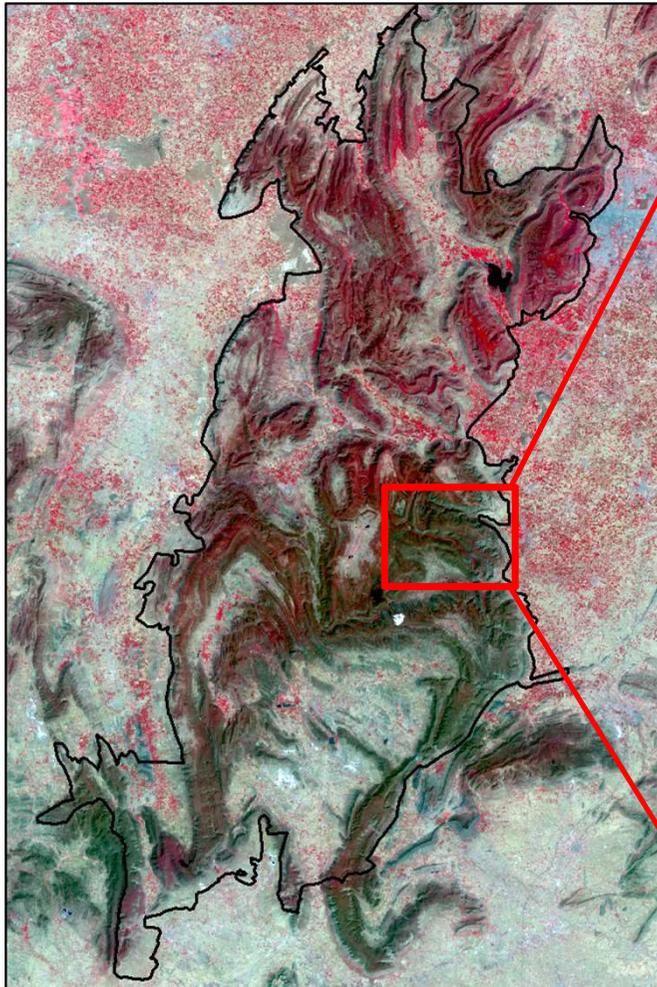
Large Forest Fire Validation using Sentinel-2 Image(Prakasham District, Andhra Pradesh) Period 6th Feb-17th Feb., 2023



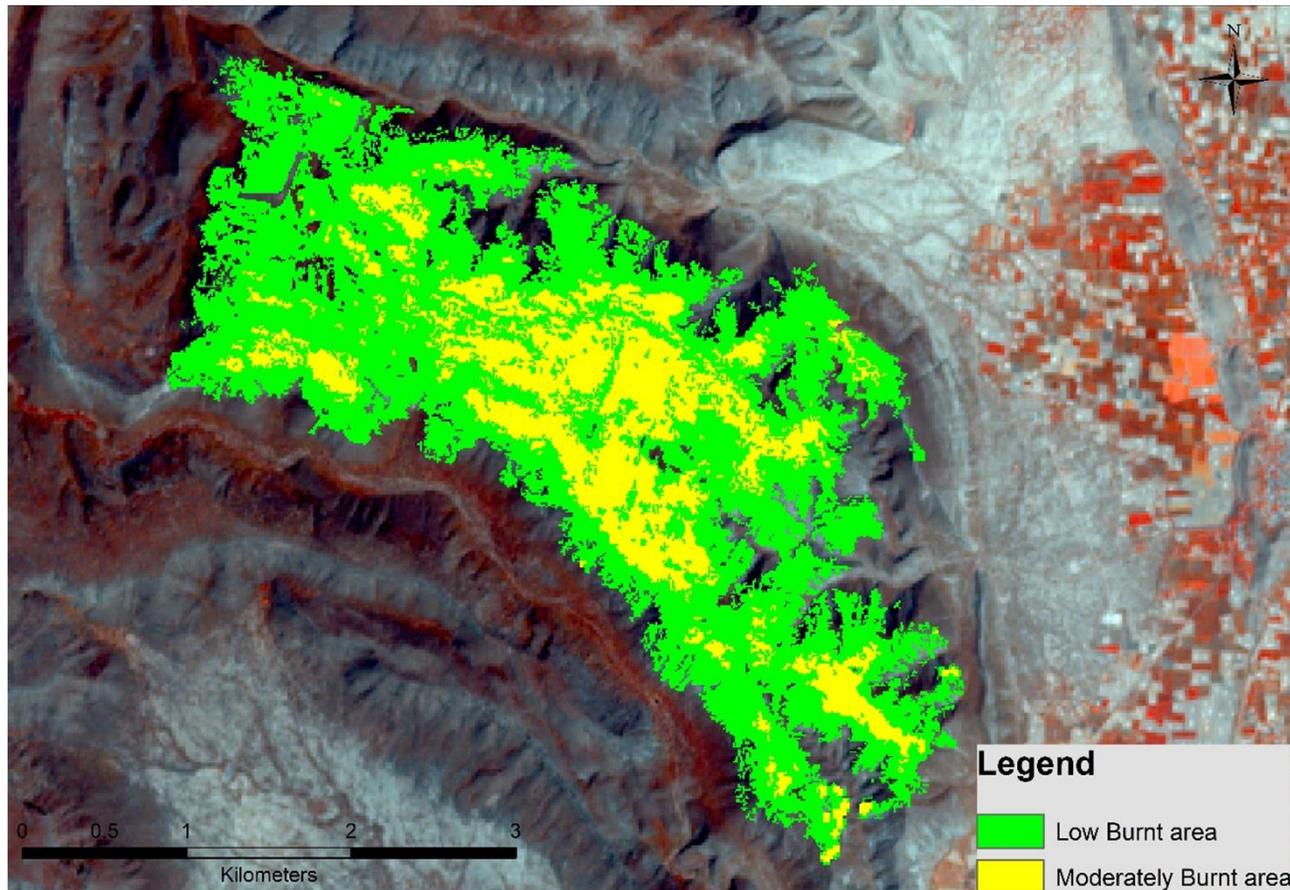
Pre-Fire Satellite Image(Sariska Tiger Reserve)



Post-Fire Satellite Image



Mapping of Fire Affected Area



| Affected Area (in ha) | | |
|-----------------------|----------------|---------------------|
| Moderately Burnt Area | Low Burnt Area | Total affected area |
| 208.90 | 640.84 | 849.74 |

Ground Verification of Fire Affected Areas(Sariska Tiger Reserve)



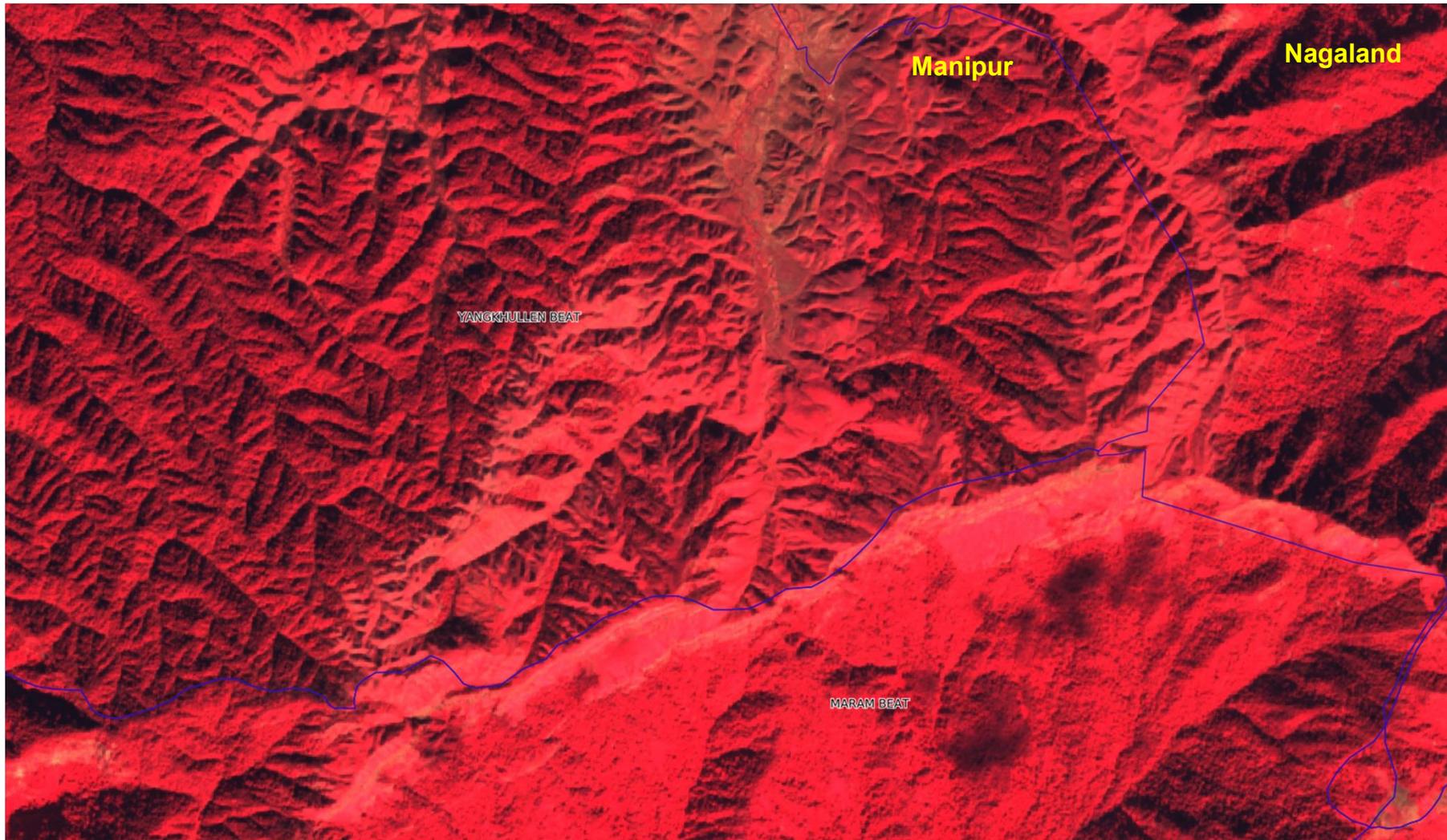
Field Photos of Moderately Burnt Areas



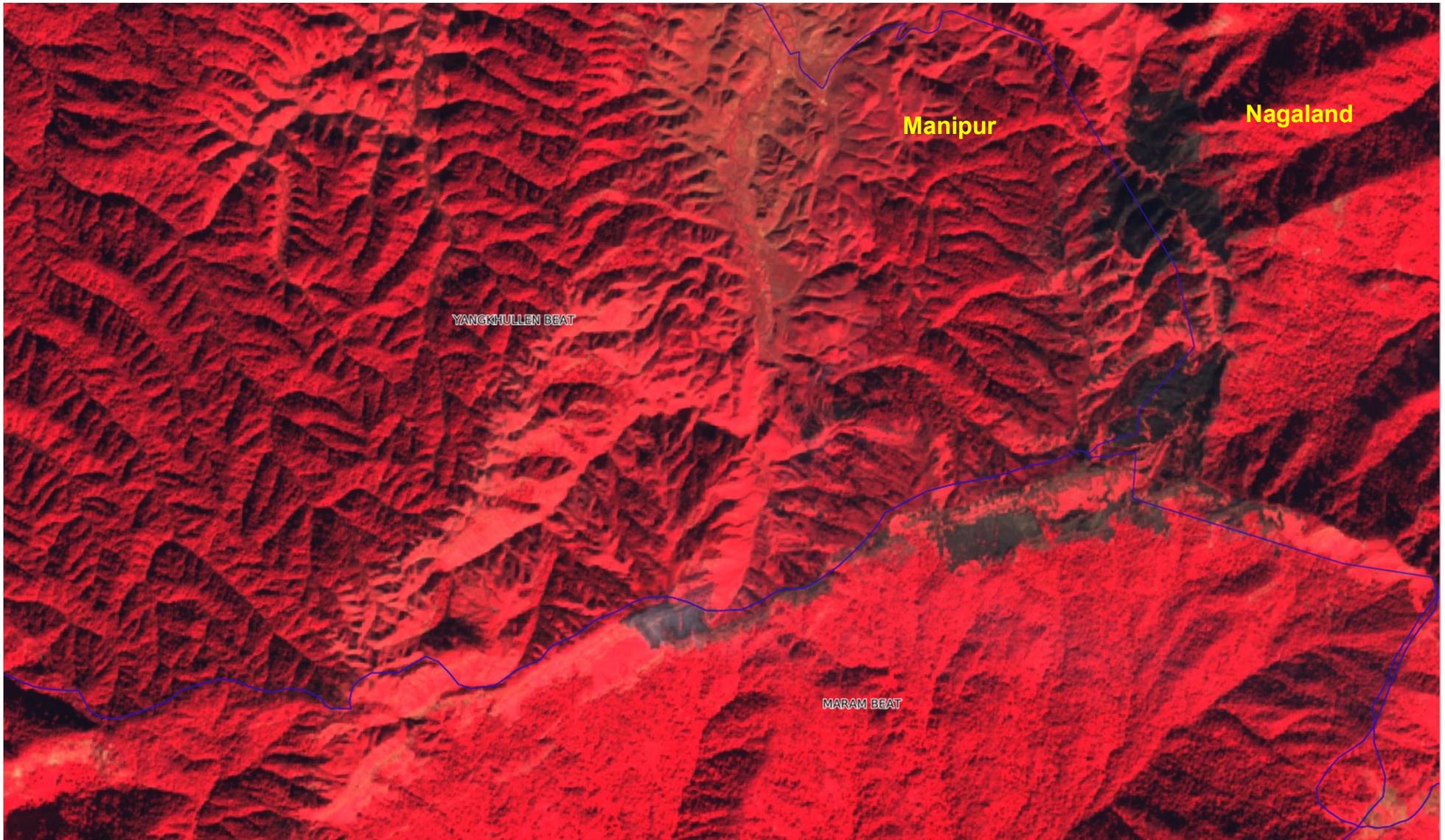
Field Photos of Low Burnt Areas

Case study in North East Region(Dzokou Valley)

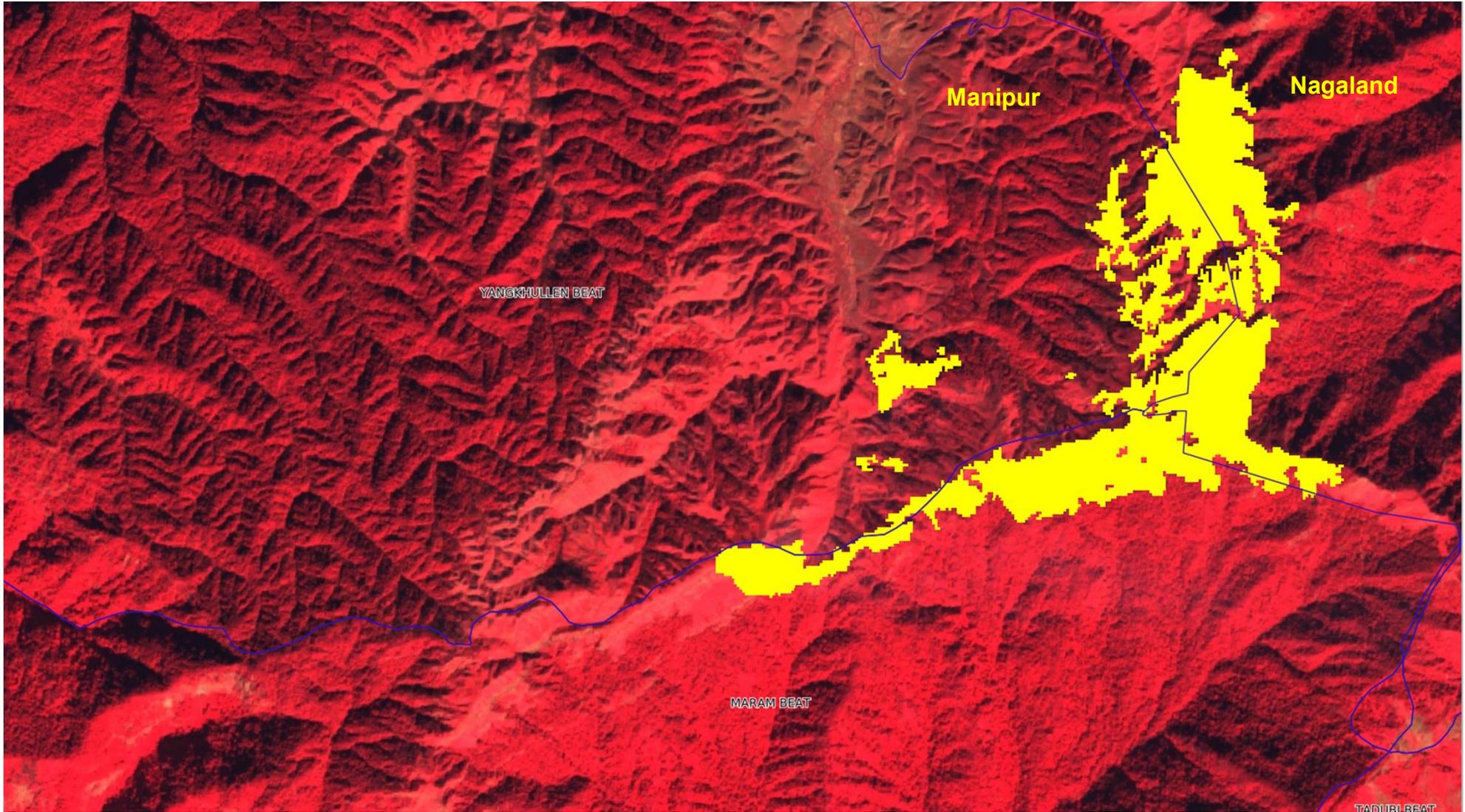
Dzokou Valley



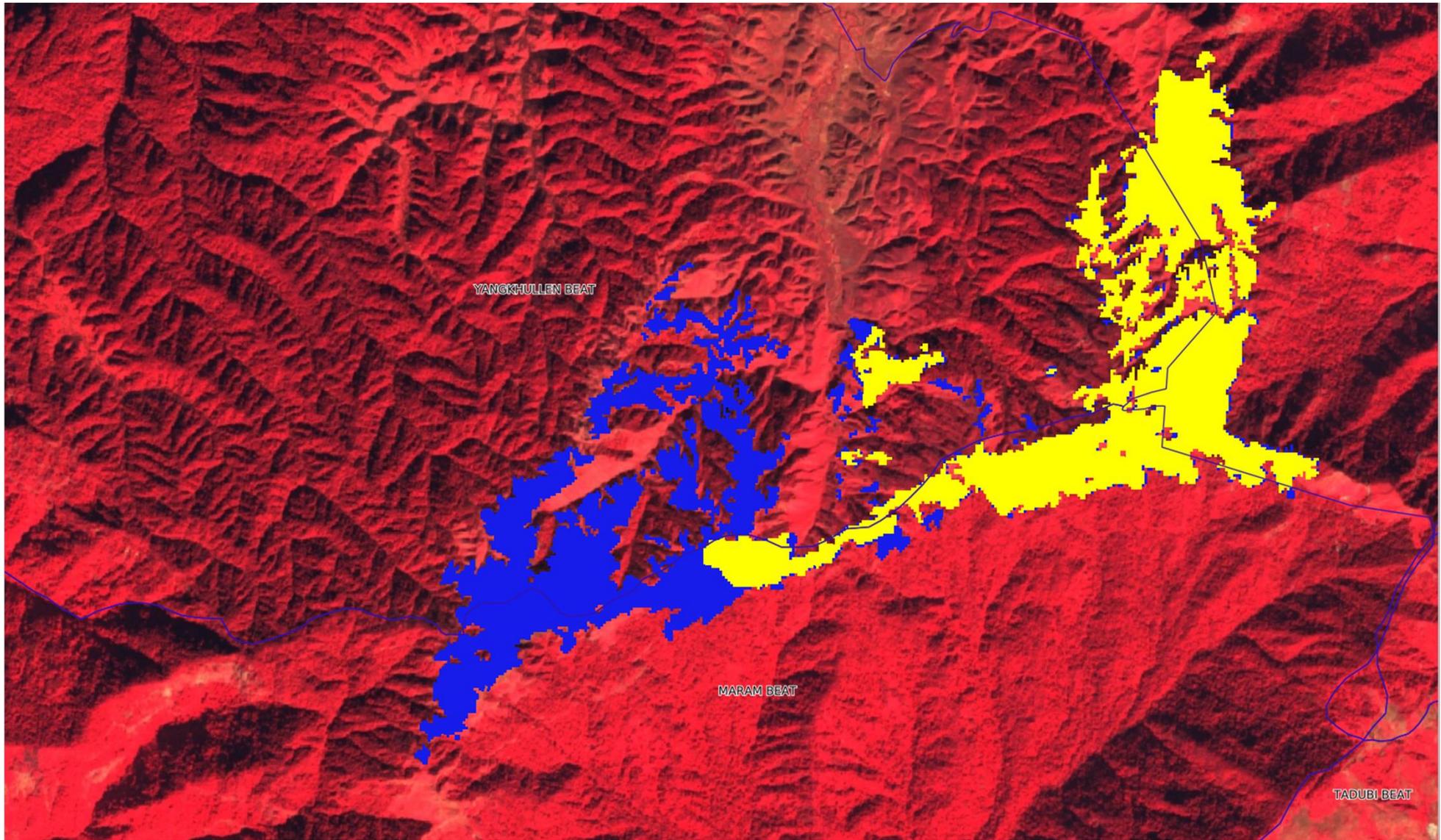
Sentinel 2 Satellite Image for 24th Dec, 2020
No Fire Detected (Pre fire Image)



Sentinel 2 Satellite Image for 3rd Jan, 2021



Burnt area as on 03rd Jan, 2021. Area affected 329.49 Ha



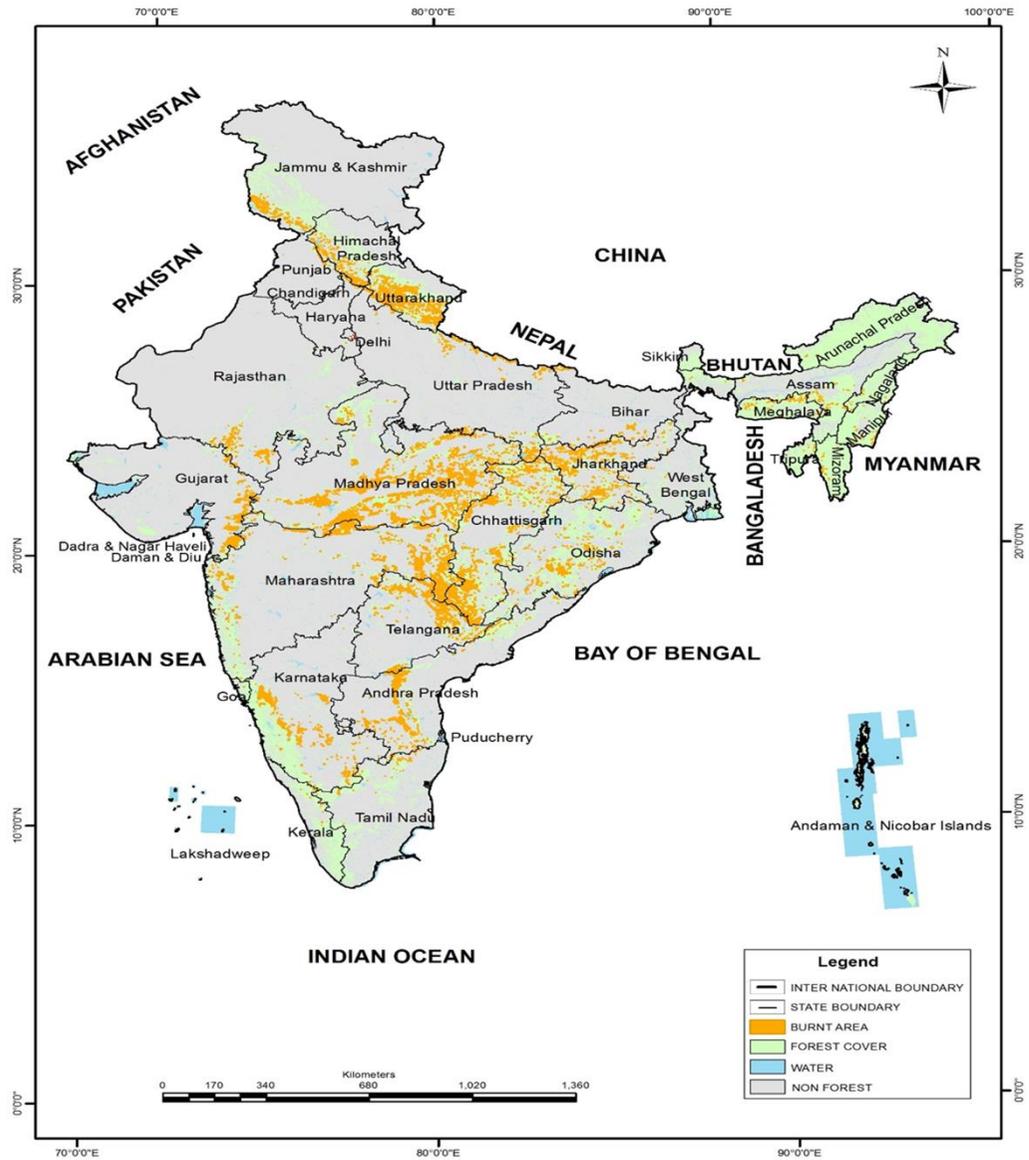
Burnt area as on 08th Jan, 2021. Area affected 627.12 Ha

Information Dissemination in the Head of Forest Force Group

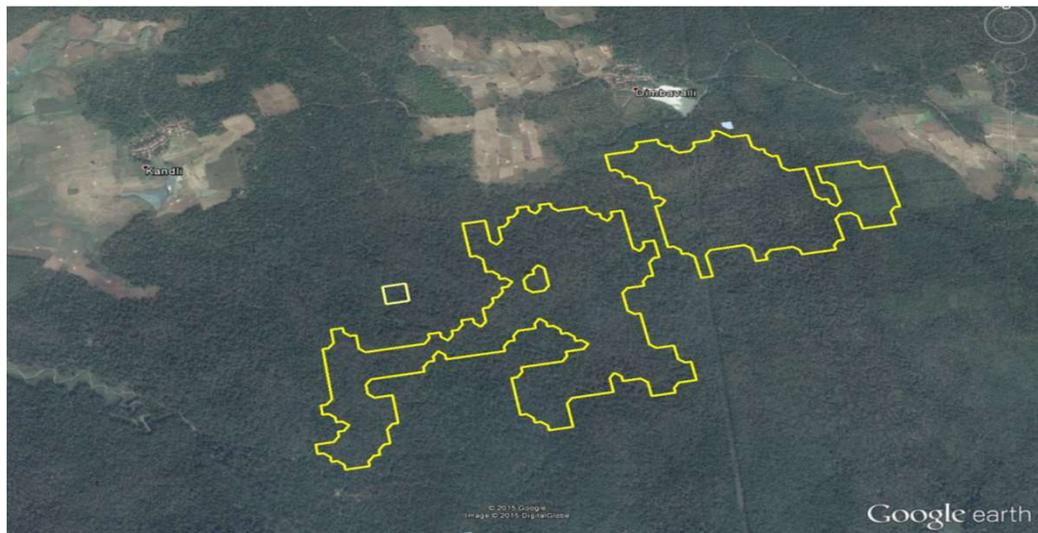
Detail of Large Forest Fire Event active for ≥ 5 days on 25-Feb-2023 till 03:16 AM

| S.No | LFFE Name | State/UTs | District | First Detection (YYYYMMDD) | Latest Detection (YYYYMMDD) | Number of Active Days | Circle | Division | Range | Long. | Lat. | Approx. area of detected pixels (ha) |
|------|------------|----------------|--------------------------|----------------------------|-----------------------------|-----------------------|-------------------|------------------------------------|-------------------------------|---------|---------|--------------------------------------|
| 1 | SIDHOUT -2 | ANDHRA PRADESH | KADAPA | 20230220 | 20230225 | 5 | KURNOOL CIRCLE | KADAPA DIVISION | SIDHOUT RANGE | 79.0265 | 14.5012 | 428.97 |
| 2 | GUNDALA -2 | TELANGANA | KOTHAGUD EM, MAHABUBABAD | 20230219 | 20230225 | 6 | KOTHAGUDEM CIRCLE | YELLANDU DIVISION, GUDURU DIVISION | GANGARAM RANGE, GUNDALA RANGE | 80.3007 | 17.8992 | 312.52 |

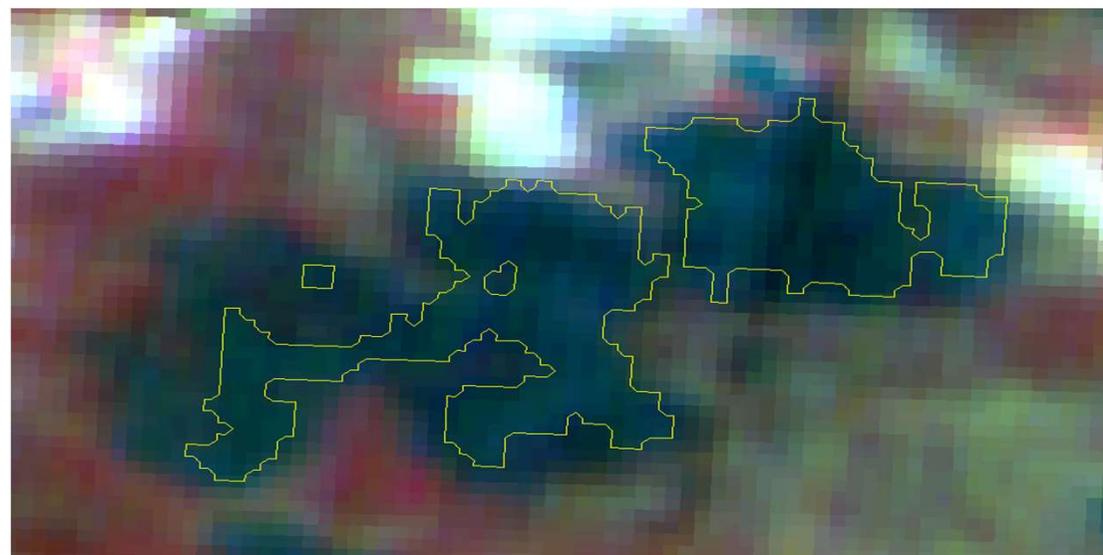
Burnt Area Assessment using AWiFS Data



Burnt Area Polygon disseminated to State Forest Fire Nodal officer

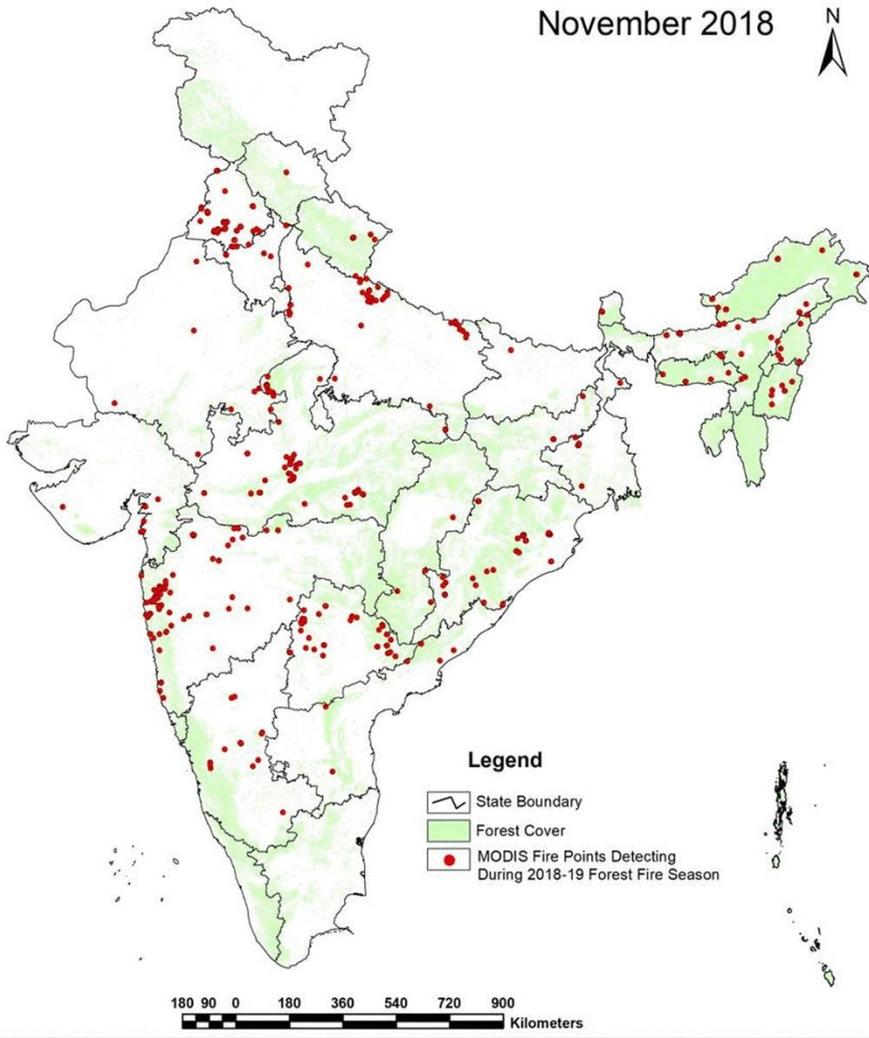


Burnt Area Polygon as Shape File overlaid on AWiFS Image



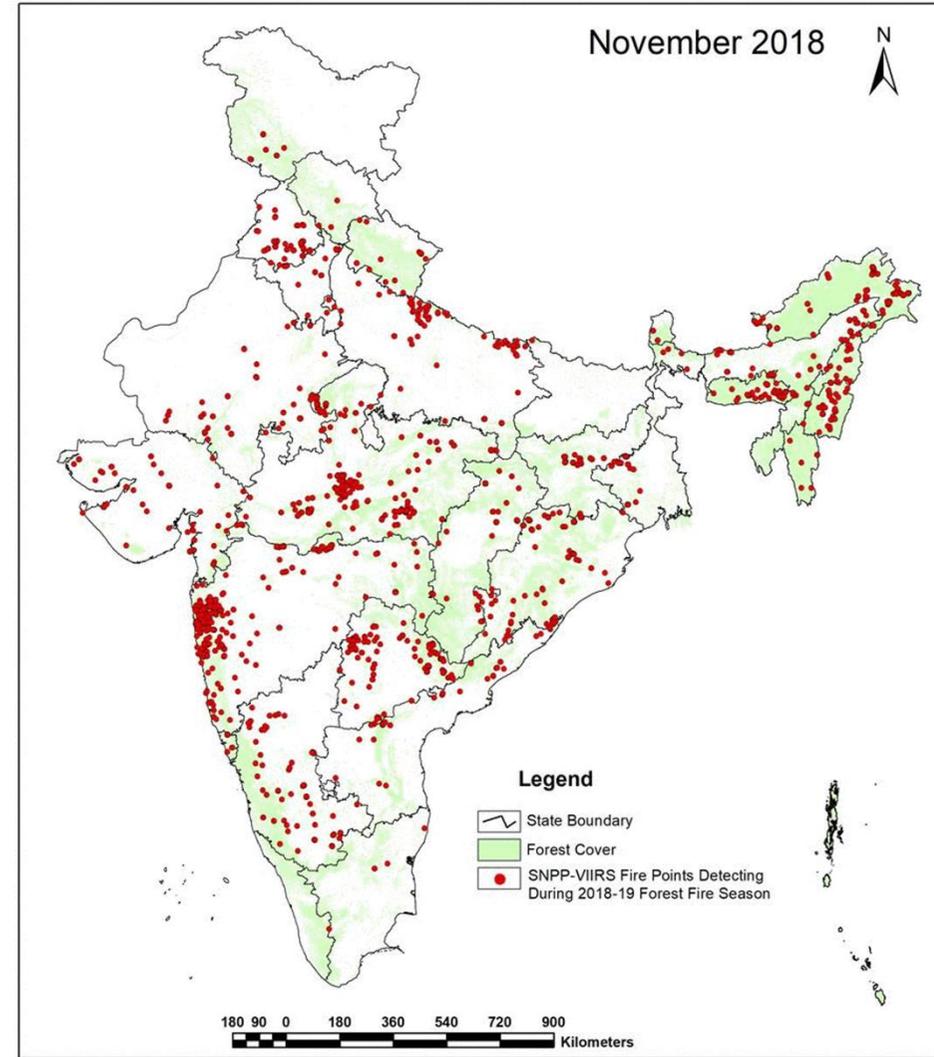
Month wise MODIS Points

November 2018



Month wise SNPP-VIIRS Points

November 2018



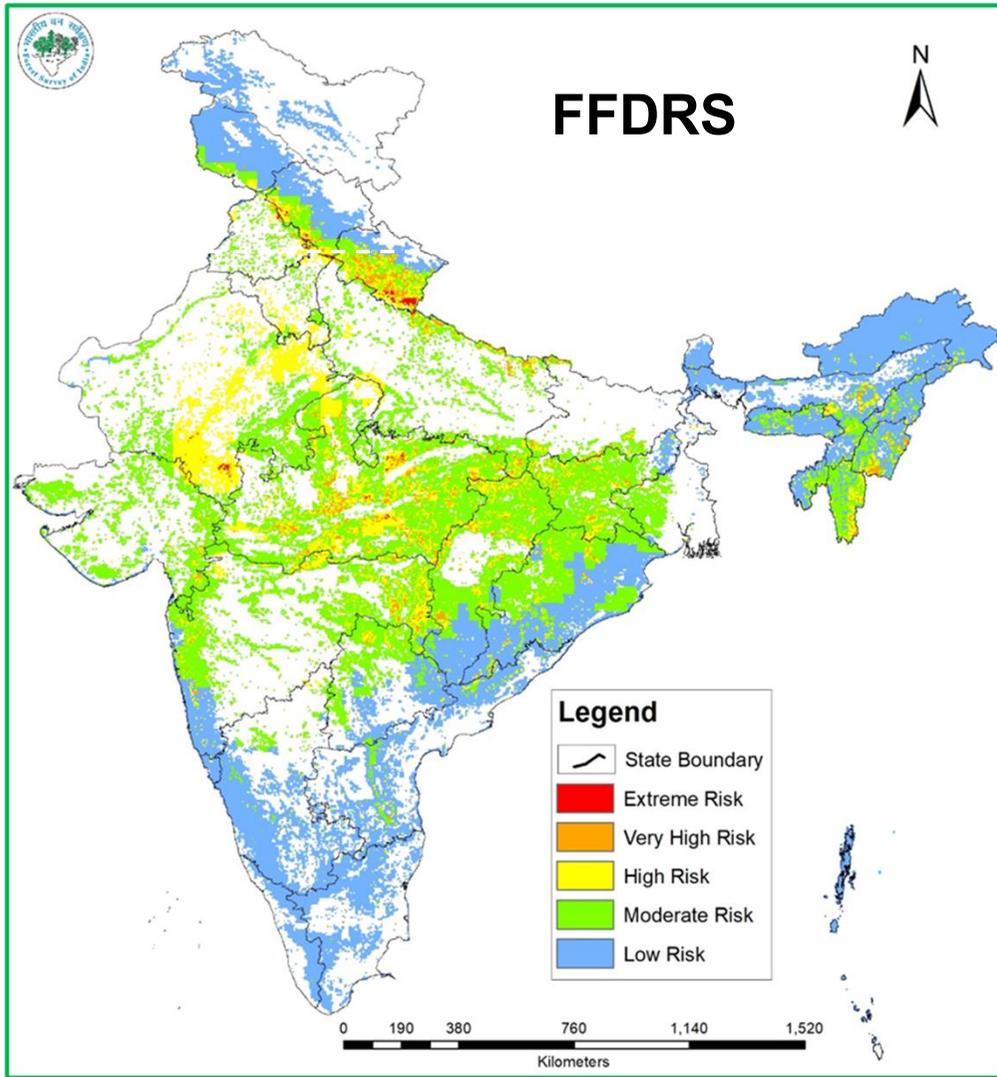
Method used to estimate the state wise crucial period of fire season

Real Time WMS Services (Use of services in Maharashtra Forest Geo-Portal)

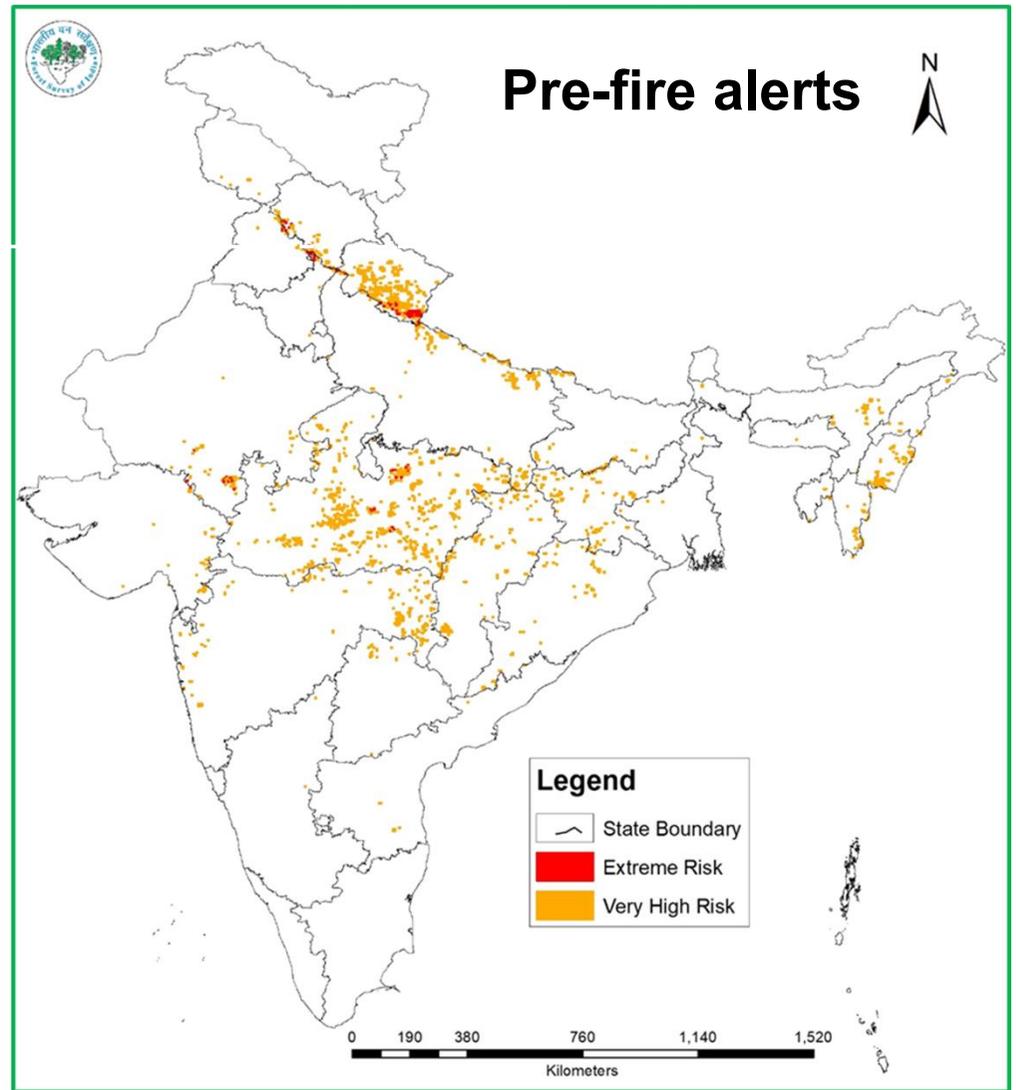
The screenshot displays the Maharashtra Forest GeoPortal web application. The browser address bar shows the URL http://117.239.200.171/mfd_portal/. The page header includes the logo for "Maharashtra Forest GeoPortal" and "HEXAGON GEOSPATIAL". The main interface features a map of Maharashtra with various layers and tools. The "Layers" panel on the left lists several services, including "Near Real Time Forest Fires", "SNPP_Maharashtra", "MODIS_Maharashtra", "Previous Fire Incidents", "Check Post (CheckNaka)", "Tiger and Leopard Deaths", "Plantation Sites", "Nursery Data", "Forest Admin Boundaries", "Political Admin Boundaries", "Fire Prone Area Classification", "Forest Type", "Forest Cover Map 2017", "Google Maps", and "Open Street Map". The map shows a complex pattern of orange and yellow areas, likely representing forest fires or fire-prone areas, overlaid on a green background representing forest cover. A blue line represents a river. The map is surrounded by a toolbar with various navigation and analysis tools. The bottom right corner of the map area contains a scale bar and the text "Map data ©2019 Google Terms of Use 8 km".

http://117.239.200.171/mfd_portal/

Pre Fire Alert Programme



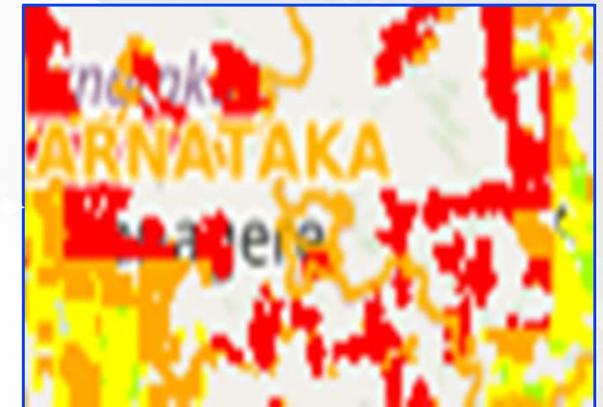
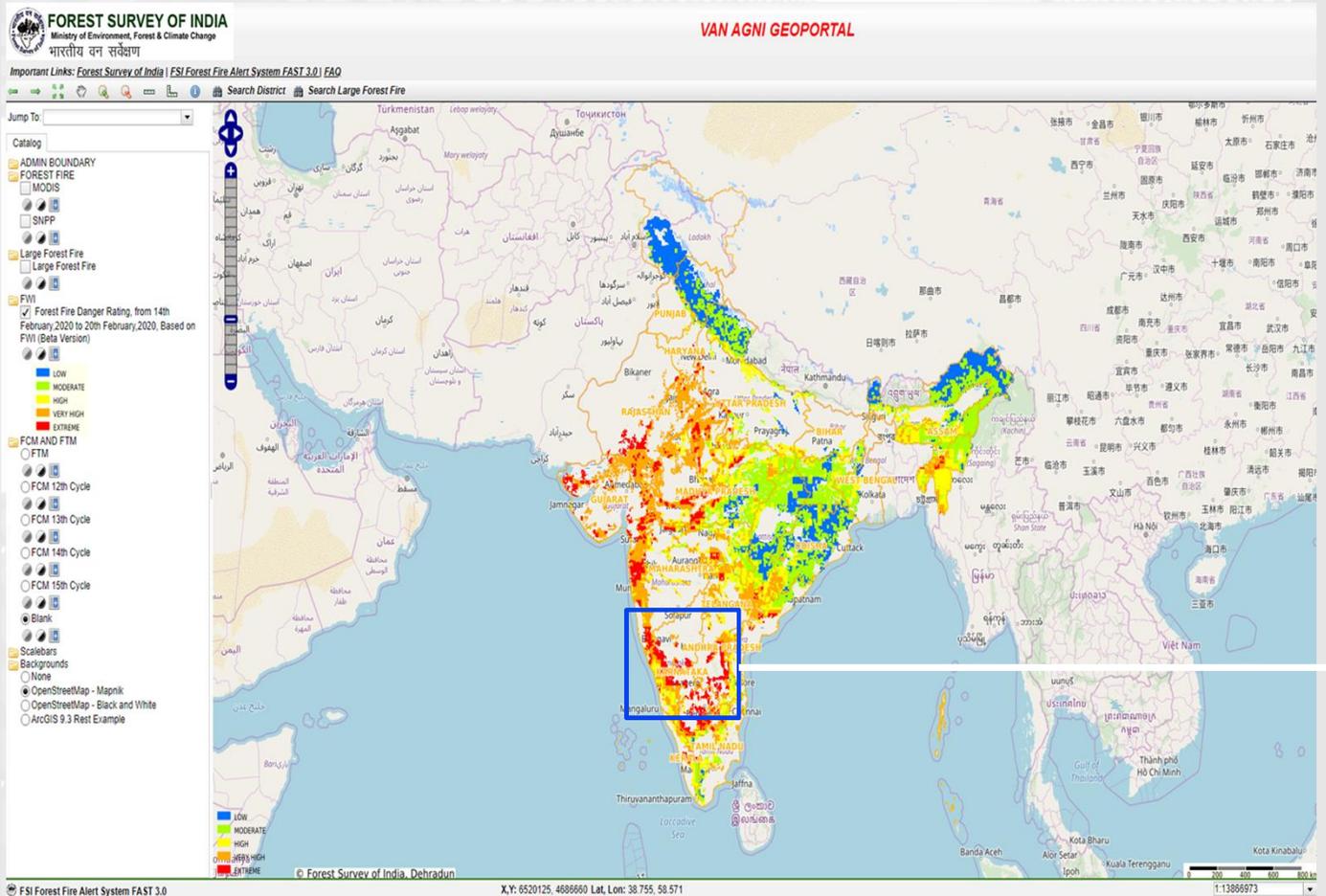
*Uploaded weekly on FSI Van-Agni Portal



Disseminated weekly as e-mail alert to PCCF(HoFF) & State Nodal Officer

Information about 5 km X 5 km grids falling into Extreme risk to Very high risk classes are disseminated as Pre-fire alerts in the form of KML file

Van Agni Geo-portal



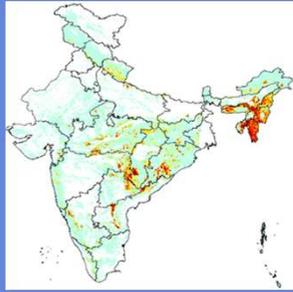
Uploaded on FSI Van Agni-geo Portal once a week

http://vanagniportal.fsiforestfire.gov.in/fsi_fire/fire.html?off=modfire2018/modis;snppfire2018/snpp;LargeFire2018/LargeFire&on=FWI/FWI

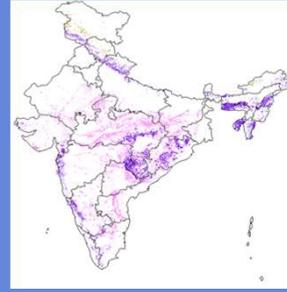
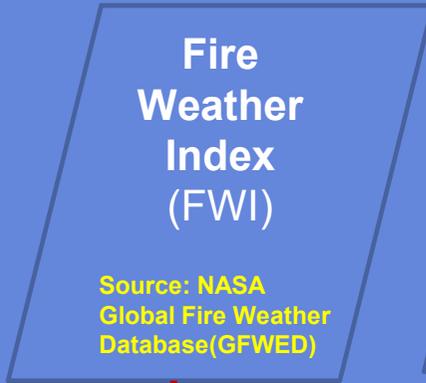
Pre-Fire Alert System



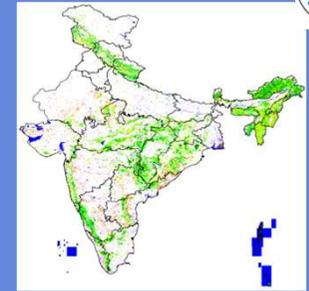
Physiographic Zone



Archive Forest Fire Data



Vulnerable Forest Types



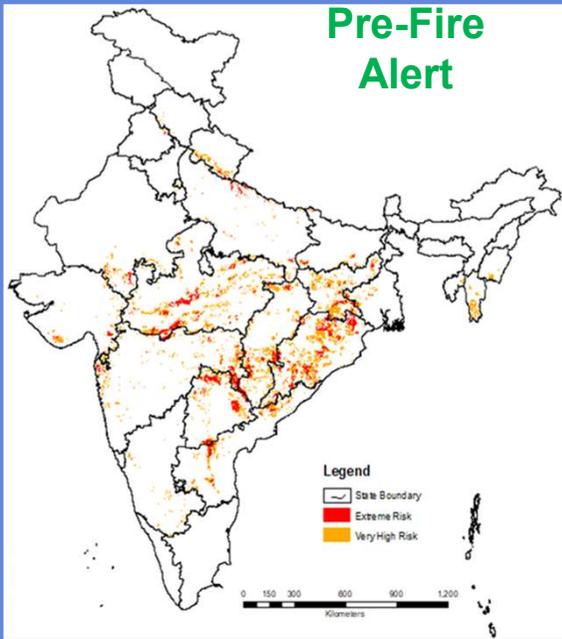
Forest Cover

- Categorization**
1. Extreme Risk
 2. Very High Risk
 3. High Risk
 4. Moderate Risk
 5. Low Risk

Masking

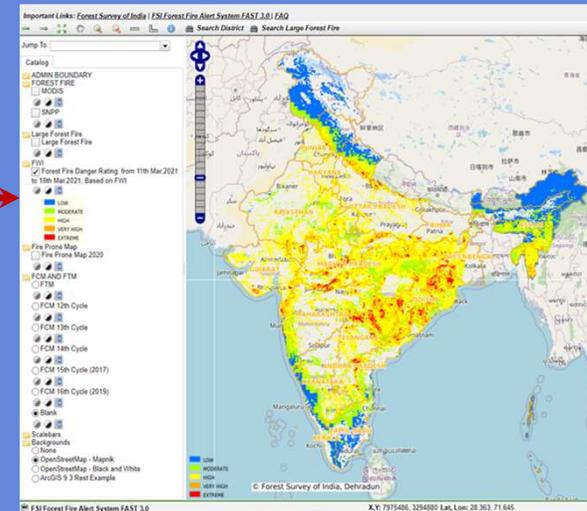
Forest Fire Danger Rating

- Extreme Risk
- Very High Risk
- High Risk
- Moderate Risk
- Low Risk



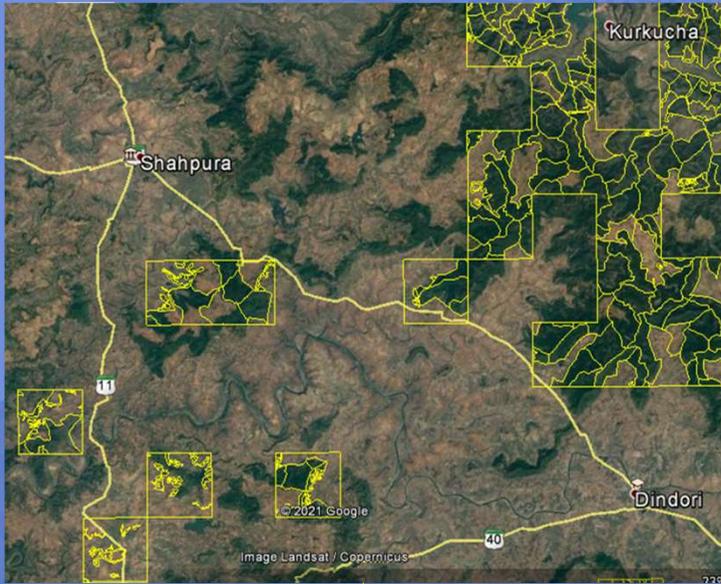
Dissemination of alerts through e-mail comprising KML file to

- PCCF (Head of Forest Force)
- Forest Fire Nodal Officer of SFD
- NDMA
- SDMA



Forest Fire Danger Rating (FFDR) uploaded weekly on Van Agni Geo-Portal

Pre-Fire Alert Dissemination through e-mail Alert



- Extreme Risk
- Very High Risk
- High Risk
- Moderate Risk
- Low Risk

Early-warning for Forest Fire Alerts KMZ of Early_Warning_02_18_2021

Forest Survey of India
to pccfmp, apccfprot, mali.misforest, me ▾

Sir/Madam,
Forest Survey of India provides Early-warning alerts for forest areas based on Fire Weather Index. Such areas have higher probability of having large and high intensity forest fires during the period. In the current early-warning alert generated on 2021_02_18 (YYYY_MM_DD), certain areas in your subscription area have been identified. The Early-warning areas in the form Google Earth compatible KMZ file are attached with this email for your information. This alert is valid only till 2021_02_25(YYYY_MM_DD).
We hope the Early-warning is of use to you in planning forest fire management. Kindly provide your feedback on this issue.

[Early_Warning_02_18_2021_MADHYA_PRADESH.kmz](#)

With Regards,
Forest Fire Monitoring Team,
Forest Survey of India,
Ministry of Environment, Forest and Climate Change,
Kaulagarh Road, Dehradun- 248195.
0135-2754191 Ex-272

Early_Warning_02_...

← Reply ↶ Reply all ➦ Forward

```
File Edit Format Run Options Window Help
import os, tarfile, shutil, time, glob, email, getpass, imaplib, sys, csv, string, smtplib,
from datetime import datetime, timedelta
from email.mime.multipart import MIMEMultipart
from email import encoders
from email.message import Message
from email.mime.audio import MIMEAudio
from email.mime.base import MIMEBase
from email.mime.image import MIMEImage
from email.mime.text import MIMEText
print "Python Library Import Done"
print ""*50

#####
India_Forest_shp = r"Z:\2019-20\FWI_2019_20\Python\MasterData_NRT_20191031.gdb\Ma
India_State_shp = r"Z:\2019-20\FWI_2019_20\Python\india_state\INDIA_state_GCS.sh
D_Path = raw_input("Please Enter The Folder Path for Pre-Warning SHP File:")
#####
os.chdir(D_Path)
Identity_Box = D_Path + '\\'+ "1_Identity_Box"
if "1_Identity_Box" not in os.listdir(D_Path):
    os.mkdir(Identity_Box)
    print "1_Identity_Box FOLDER CREATED SUCCESSFULLY"
    print ""
else:
    print "1_Identity_Box Folder is there.."
    print ""
R_Identity_Box = D_Path + '\\'+ "2_R_Identity_Box"
if "2_R_Identity_Box" not in os.listdir(D_Path):
    os.mkdir(R_Identity_Box)
    print "2_R_Identity_Box FOLDER CREATED SUCCESSFULLY"
    print ""
else:
    print "2_R_Identity_Box Folder is there.."
```



Integration of fire alert system with Common Alerting Protocol(CAP) Integrated Platform

- ❑ Integrated Public Alert System-सचेत, an early warning platform based on Common Alerting Protocol (CAP).
- ❑ FSI designated as one of the five alert generating agencies(AGA). Entrusted with the Forest Fire Alert generation through CAP platform to SDMAs.
- ❑ The CAP platform is aimed to be widely used by National and State Disaster Management Authorities(SDMA) for dissemination of alerts, advisories and other useful information to the masses.
- ❑ It provides a converged platform for dissemination of targeted alerts to people in vernacular languages through SMS.
- ❑ As a one-stop solution and a concrete step towards realizing Hon'ble Prime Minister's 10 point Agenda for Disaster Risk Reduction, soon messages for forest fires will be disseminated over all available communication media including, Cell Broadcast, Radio, TV, Siren, Social Media, Web Portal and Mobile Application through SDMA's



सर्चेत Integrated Alert System



Welcome schandra_fsi

🔄 Last updated: 25 Feb 2023, 5:39 PM

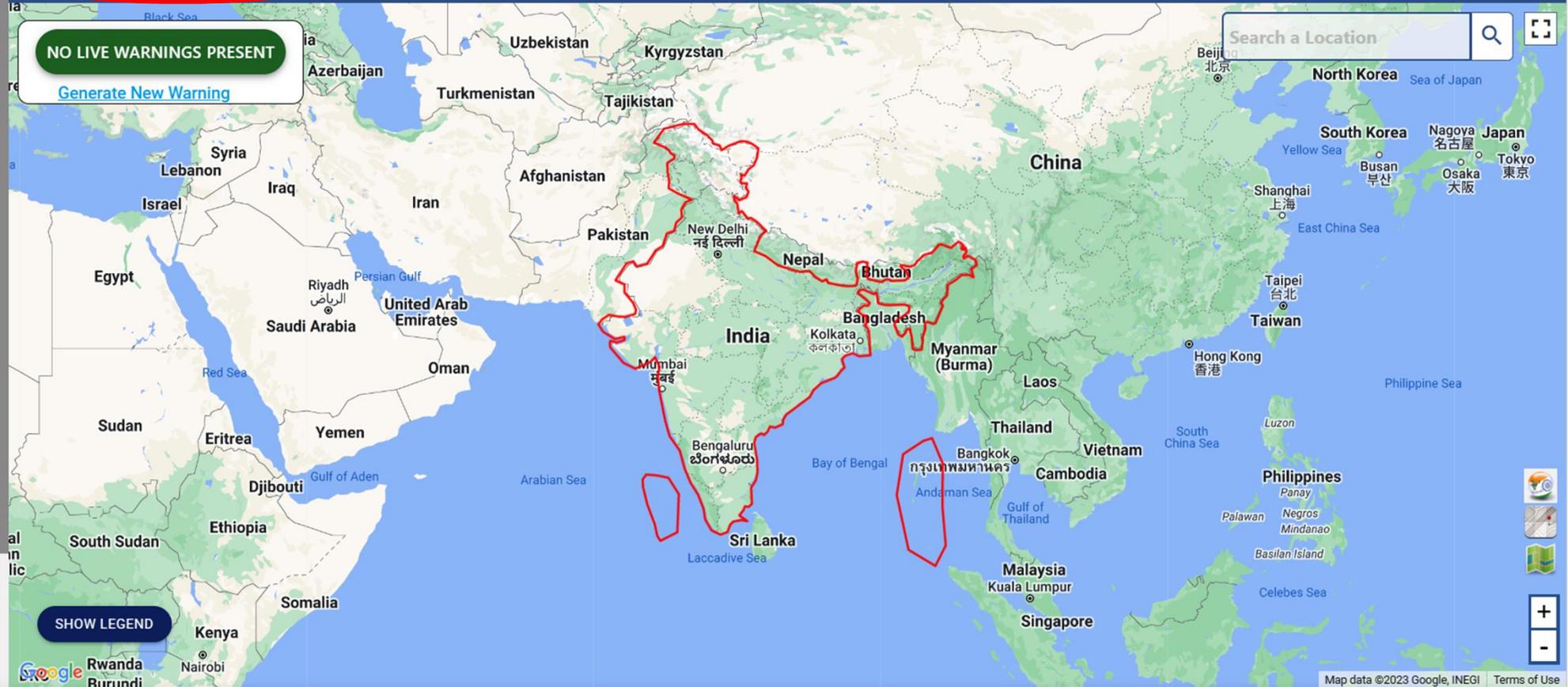
No Live Warnings by FSI

NO LIVE WARNINGS PRESENT

[Generate New Warning](#)

Search a Location 🔍

- 🏠 Home
- ⚠️ New Warning
- 🔔 All Warnings
- 📊 Statistics
- 📁 Templates
- 👥 Group Notification



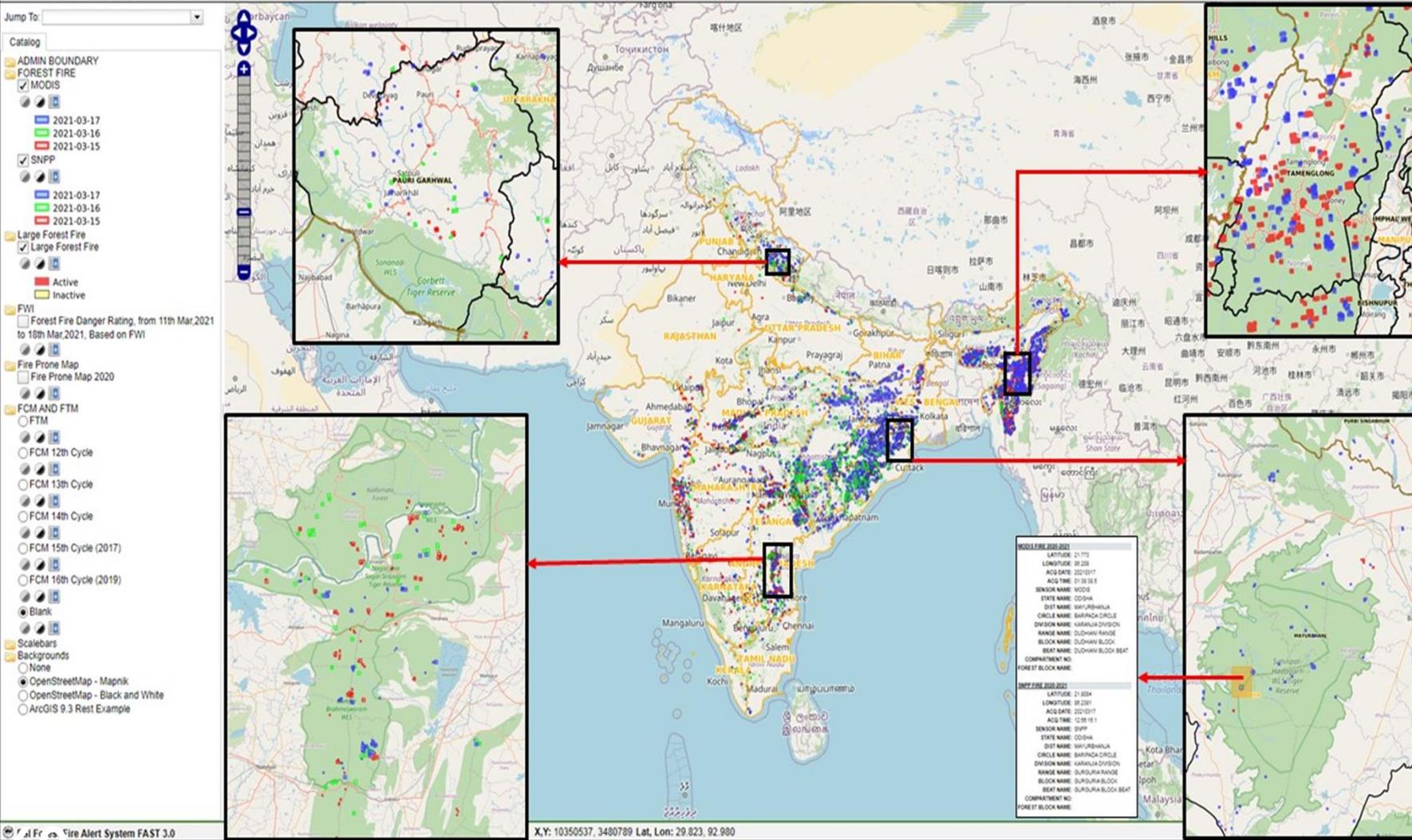
SHOW LEGEND

Van Agni Geo-Portal



Important Links: Forest Survey of India | FSI Forest Fire Alert System FAST 3.0 | FAQ

Search District Search Large Forest Fire



Layers available in Van Agni Geo-portal

- ❖ Forest Fire Detections
 - ✓ MODIS
 - ✓ SNPP-VIIRS
- ❖ Large Forest Fire
- ❖ Forest Fire Danger Rating
- ❖ Fire Prone Forest Area
- ❖ Forest Cover Map (FCM)
- ❖ Forest Type Map (FTM)

40 WMS (information of last 3 days) & WFS (information of last 5 days)- Maharashtra, Madhya Pradesh, Odisha, Uttarakhand and Karnataka



Discussions...

Forest Fire Team

Forest Survey India

Ministry of Environment, Forest and Climate change

Kaulagarh road Dehradun -248195

www.fsi.nic.in

E-mail forestfiremonitoring@gmail.com

Forest Fire Control Room No-Ph: 0135-2752901



National Meet on Disaster Risk Management
Trends and Technologies

Enhanced NRT Services for Forest Fire Management

G RAJASHEKAR, GROUP HEAD, FEG, NRSC

If you do not burn the forest,
it will burn.

— A Kattunayakan Adivasi saying

Destructive and irreversible
force



OR

Inherent and fundamental
process influencing most
terrestrial ecosystems



Strange to say, that, obvious as the evils of fire are, and beyond all question to any one acquainted with even the elements of vegetable physiology, persons have not been found wanting in India, and some even with a show of scientific argument (!), who have written in favor of fires. It is needless to remark that such papers are mostly founded on the fact that forests *do* exist in spite of the fires, and make up the rest by erroneous statements in regard to facts.

- Globally, fire emissions are responsible for 5 to 8% of the 3.3 million annual premature deaths from poor air quality, and fire is the primary cause of elevated mortality from air pollution across much of the tropics.
- Fires affect global climate through changes in vegetation and soil carbon, surface albedo, and atmospheric concentrations of aerosols and greenhouse gases.
- Climate feedbacks on fire activity are complex and vary by biome and level of fire suppression.

- Fires play an integral role in shaping ecosystem properties and have widespread impacts on climate and biogeochemical cycles.
- Frequent fires are essential for maintaining savanna ecosystems), where as more episodic events in forests create a mosaic of habitats in different stages of postfire succession.
- Introduction or exclusion of fire from the landscape may lead to rapid shifts in vegetation structure and composition, carbon stocks, and biodiversity.

Received: 3 April 2019 | Accepted: 6 February 2020
DOI: 10.1111/1365-2745.13403

ESSAY REVIEW

Journal of Ecology

Fire as a fundamental ecological process: Research advances and frontiers

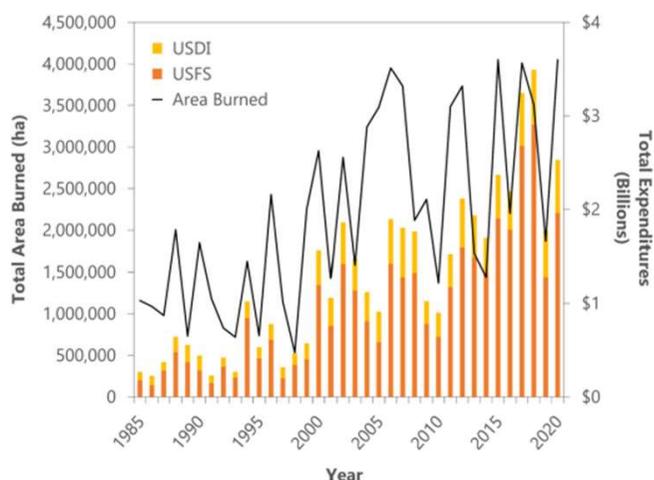
Kendra K. McLauchlan¹ | Philip E. Higuera² | Jessica Miesel³ |
Brendan M. Rogers⁴ | Jennifer Schweitzer⁵ | Jacquelyn K. Shuman⁶ |
Alan J. Tepley² | J. Morgan Varner⁷ | Thomas T. Veblen⁸ | Solny A. Adalsteinsson⁹ |
Jennifer K. Balch⁸ | Patrick Baker¹⁰ | Enric Batllori¹¹ | Erica Bigio¹² |
Paulo Brando¹³ | Megan Cattau¹⁴ | Melissa L. Chipman¹⁵ | Janice Coen⁶ |

Given projected increases in fire risk from climate change, fire management will be increasingly important for maintaining ecosystem function, air quality, and other services that influence human well-being.

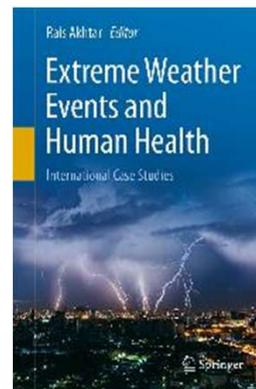
Have western USA fire suppression and megafire active management approaches become a contemporary Sisyphus?



- MegaFire (landscape scale) Active Management Approach (MFAMA) includes dozerlines, chemical retardants and igniters, backburns, and cutting trees (live and dead) etc.



Wildland Fire, Extreme Weather and Society: Implications of a History of Fire Suppression in California, USA



Current fire and smoke science views fire as a land management tool
Public opinion favors the exclusion of fire

- Fire is a natural process integral to health of forest.
- Fire has been systemically removed creating a backlog of fuels as vegetation accumulates.
- Suppression of fire along with extreme weather create large high intensity burns Extreme weather / climate change is increasing the duration of the fire season.
- The result is large catastrophic fires not typical of these ecosystems.
- Returning fire to the historic role it has played in sustaining these systems reduces the probability of catastrophic fire

Miller, Jay D., et al. "Quantitative evidence for increasing forest fire severity in the Sierra Nevada and southern Cascade Mountains, California and Nevada, USA." *Ecosystems* 12 (2009): 16-32.

Schweizer, Donald, et al. "Wildland fire, extreme weather and society: Implications of a history of fire suppression in California, USA." *Extreme Weather Events and Human Health: International Case Studies* (2020): 41-57.

DellaSala, D.A. et al., 2022. Have western USA fire suppression and megafire active management approaches become a contemporary Sisyphus? *Biological Conservation*, 268, p.109499.

Article

Limited increases in savanna carbon stocks over decades of fire suppression

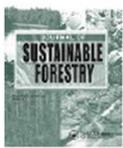
<https://doi.org/10.1038/s41586-022-04438-1>

Yong Zhou^{1,2✉}, Jenia Singh³, John R. Butnor⁴, Corli Coetsee^{5,6}, Peter B. Boucher³, Madelon F. Case^{2,7}, Evan G. Hockridge³, Andrew B. Davies³ & A. Carla Staver^{1,2✉}

Received: 24 June 2021

Accepted: 14 January 2022

not fully considered in afforestation or fire-suppression schemes but may mean that the decadal sequestration potential of savannas is negligible, especially weighed against concomitant losses of biodiversity and function.



Journal of Sustainable Forestry

ISSN: (Print) (Online) Journal homepage: <https://www.sandfonline.com/loi/vjfs20>

Impact of Forest Fire Frequency on Tree Diversity and Species Regeneration in Tropical Dry Deciduous Forest of Panna Tiger Reserve, Madhya Pradesh, India

Tapas Ray, Dinesh Malasiya, Radha Rajpoot, Satyam Verma, Javid Ahmad Dar, Arun Dayanandan, Debojyoti Raha, Parvaiz Lone, Praveen Pandey, Pramod Kumar Khare & Mohammed Latif Khan

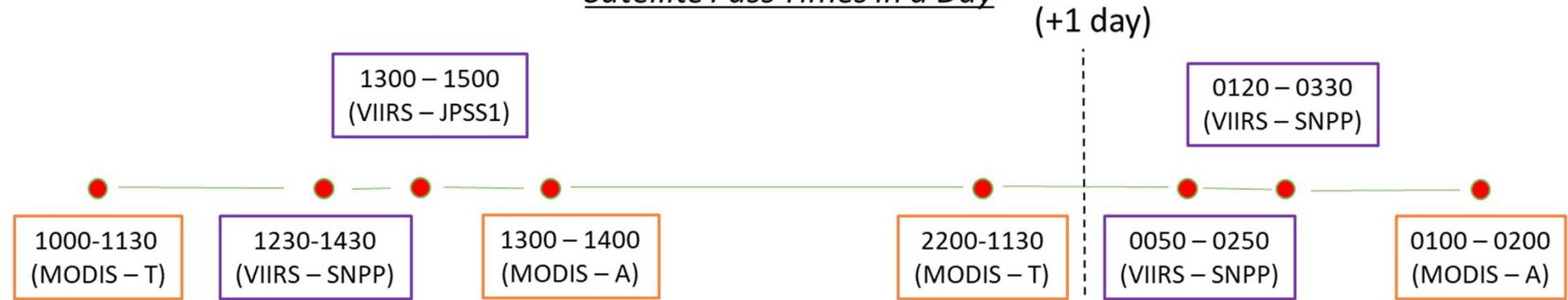
- Tree species diversity was higher at moderate fire frequencies than controls, but decreased with increasing fire frequency classes.
- Results suggest that **low fire frequency inhibited** the regeneration of seedling densities but enhanced the species richness and tree density. Similarly, **high fire frequencies also inhibited** the growth of regenerating seedlings.
- Regeneration of species was significantly different among all fire frequency classes.

Zhou, Y., Singh, J., Butnor, J.R., Coetsee, C., Boucher, P.B., Case, M.F., Hockridge, E.G., Davies, A.B., Staver, A.C., 2022. Limited increases in savanna carbon stocks over decades of fire suppression. *Nature* 603, 445–449.

Ray, T., Malasiya, D., Rajpoot, R., Verma, S., Dar, J.A., Dayanandan, A., Raha, D., Lone, P., Pandey, P., Khare, P.K., others, 2021. Impact of Forest fire frequency on tree diversity and species regeneration in tropical dry deciduous Forest of Panna Tiger Reserve, Madhya Pradesh, India. *Journal of Sustainable Forestry* 40, 831–845.

Long Duration Fire Events (LDFE)

Satellite Pass Times in a Day

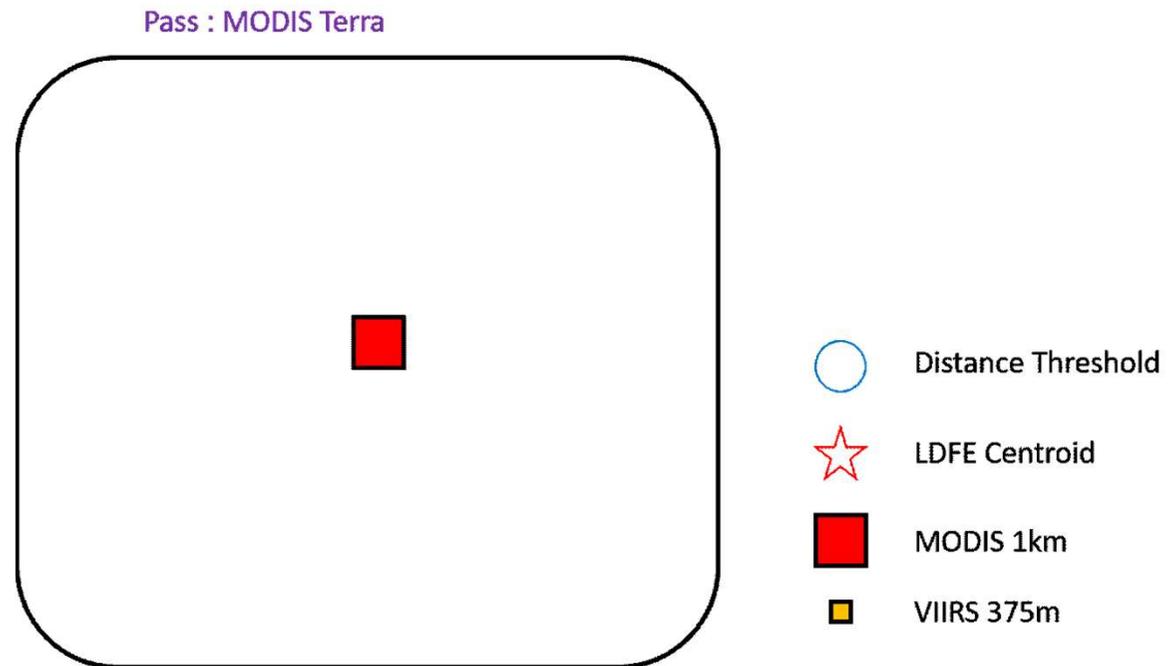


| Sensor | Platform | Launch date | Spatial Resolution |
|--------|----------------|-------------|--------------------|
| MODIS | Terra | 1999 | 1km |
| | Aqua | 2002 | 1km |
| VIIRS | S-NPP | 2011 | 375m / 750m |
| | JPSS-1/NOAA-20 | 2017 | 375m/ 750m |

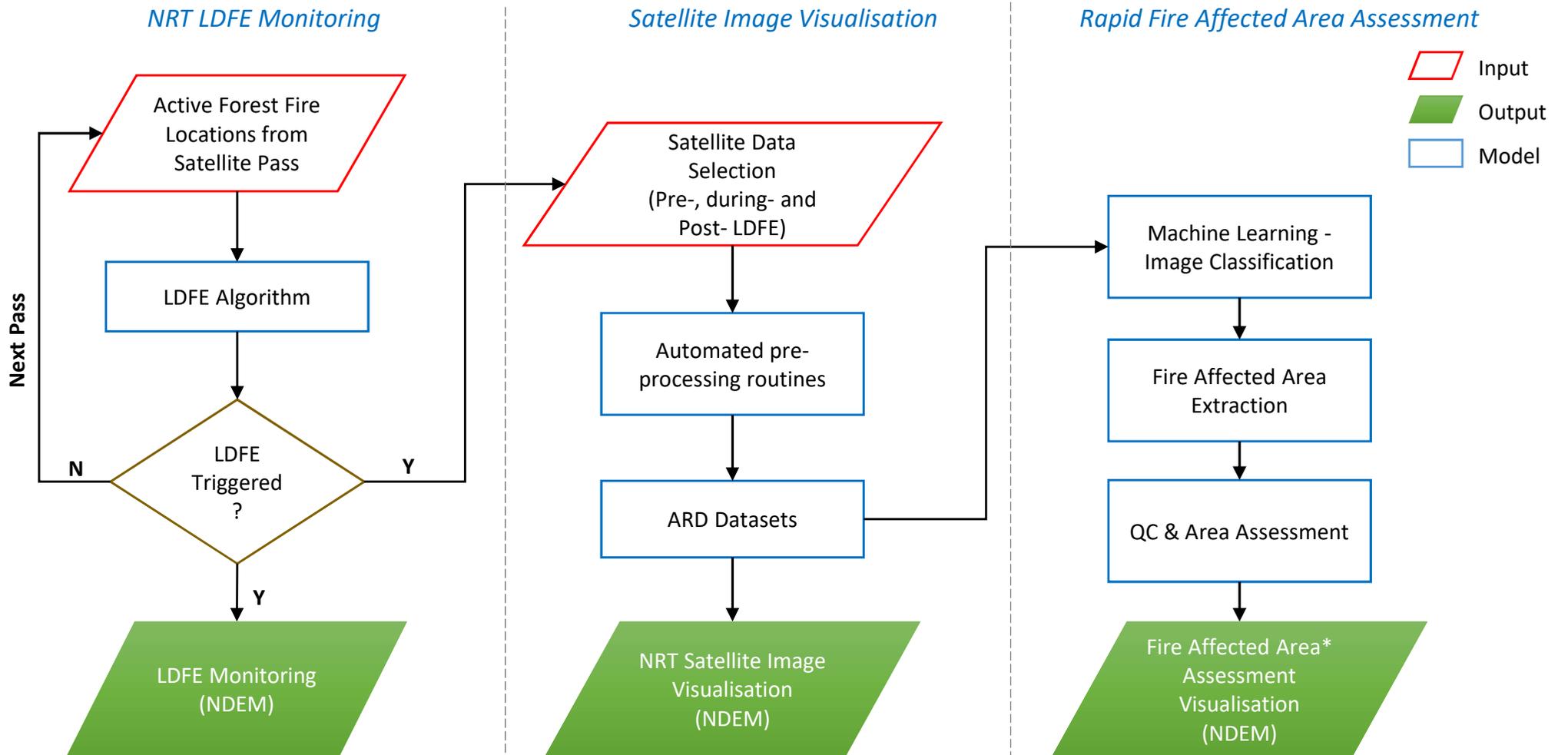
- A long duration fire event (LDFE) is defined as any continued fire activity at/ around a location > 48 hours)
- Spatial and temporal clustering in AFL across successive satellite passes

Conditions used

- All AFL from VIIRS/MODIS are monitored.
 - LDFE Initiation is not dependent on Satellite/Sensor
- Each AFL is monitored with a distance threshold (here 2 km) in the subsequent satellite passes to observe the activity
- The LDFE is triggered if an AFL activity over an area is persistent for >48 hours (2 days).
- The LDFE is declared closed if there was no fire activity observed in four (04) subsequent satellite passes.

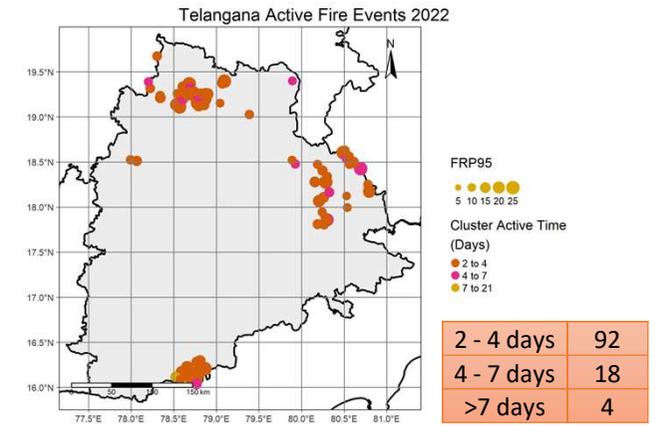
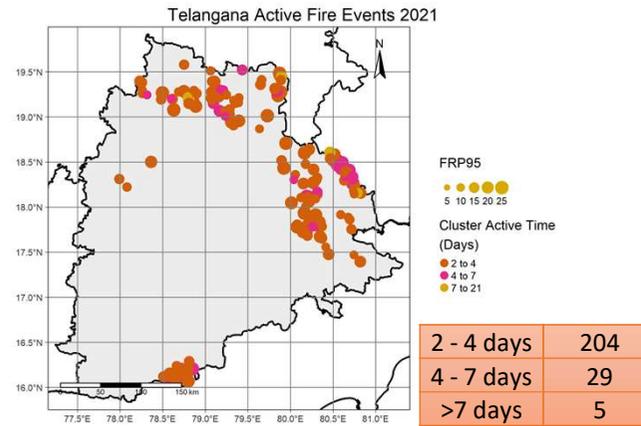
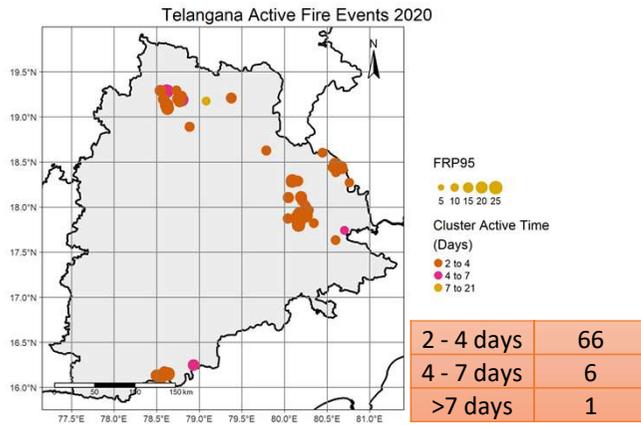


Automated Process Flow for LDFE and Rapid Fire Affected Area Assessment (RFAA)



**Fire affected area is intended for disaster management input*

LDFE in previous years : Telangana



| Year | AFL Counts | LDFE Counts (>2 Days) |
|------|------------|-----------------------|
| 2020 | 25460 | 73 |
| 2021 | 48898 | 238 |
| 2022 | 32242 | 114 |

Machine Learning Based Rapid Fire Affected Area Assessment

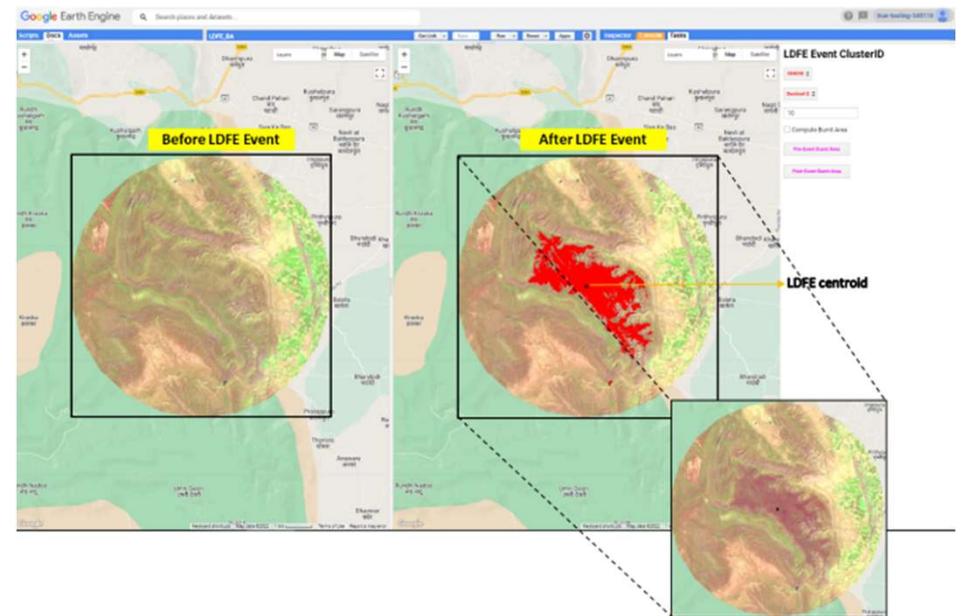
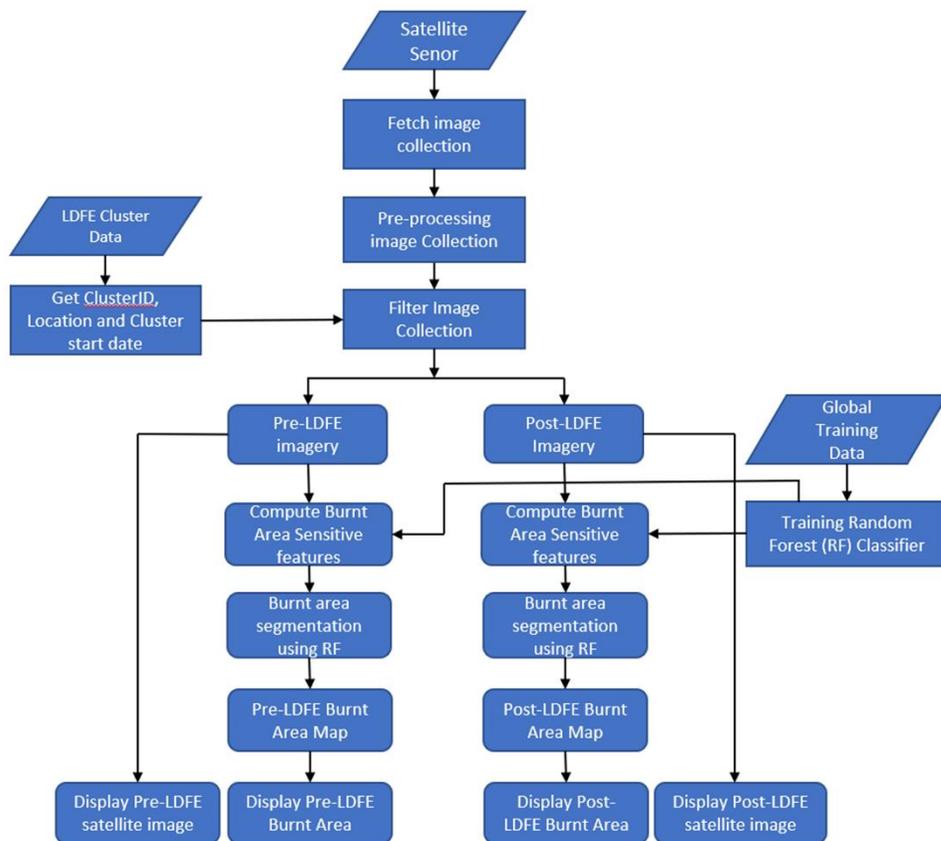


Image Data from Bhoonidhi, the ISRO EO data hub

LDFE Cluster ID 566 (11 – 17 Feb 2023)

Cluster ID: 566

Start Time: 11-Feb-2023 13:21 Hrs

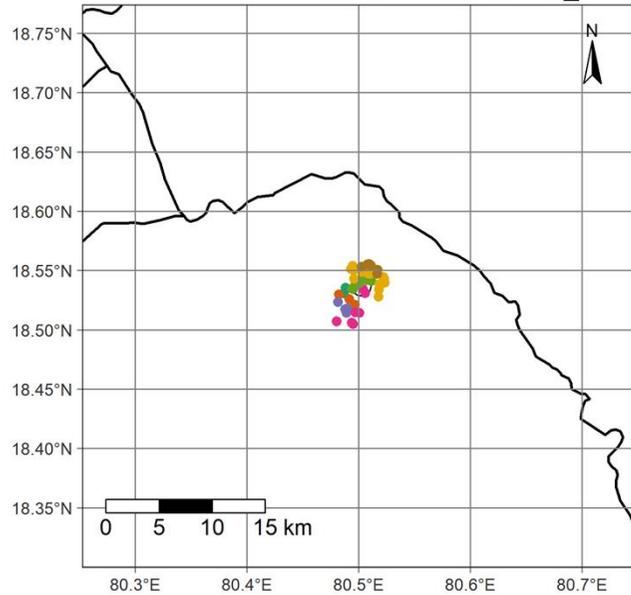
End Time: 17-Feb-2023 02:19 Hrs

Active Time: 5.5 Days

Total Fires : 48

FRP_p95 : 26.4

TS LDFE Event - TS_566



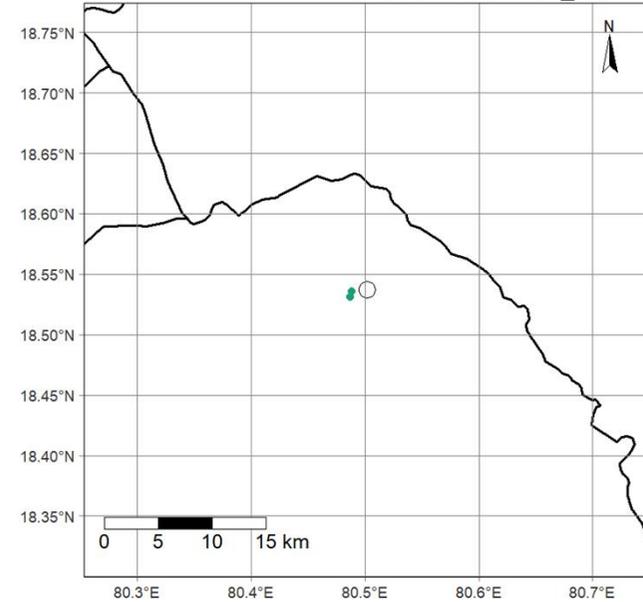
ClusterID

○ 566(48)

Date

- 2023-02-11(2)
- 2023-02-12(3)
- 2023-02-13(4)
- 2023-02-14(7)
- 2023-02-15(10)
- 2023-02-16(16)
- 2023-02-17(6)

TS LDFE Event - TS_566



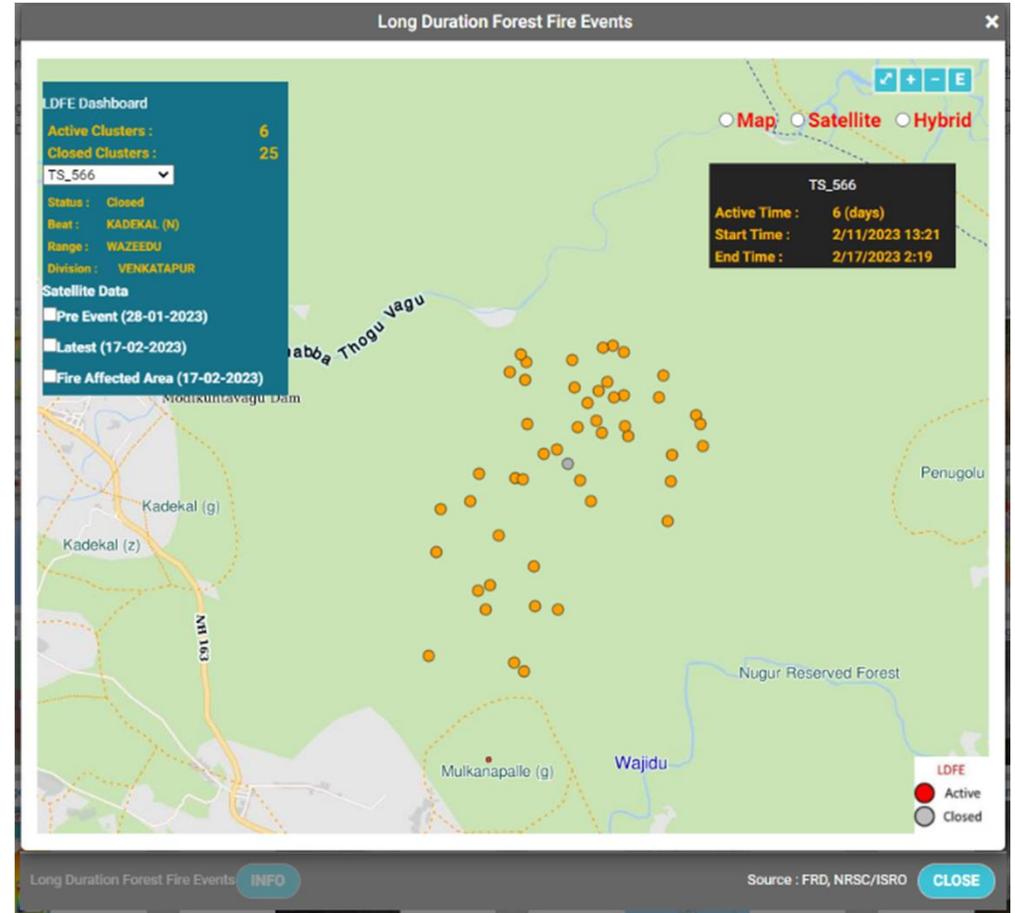
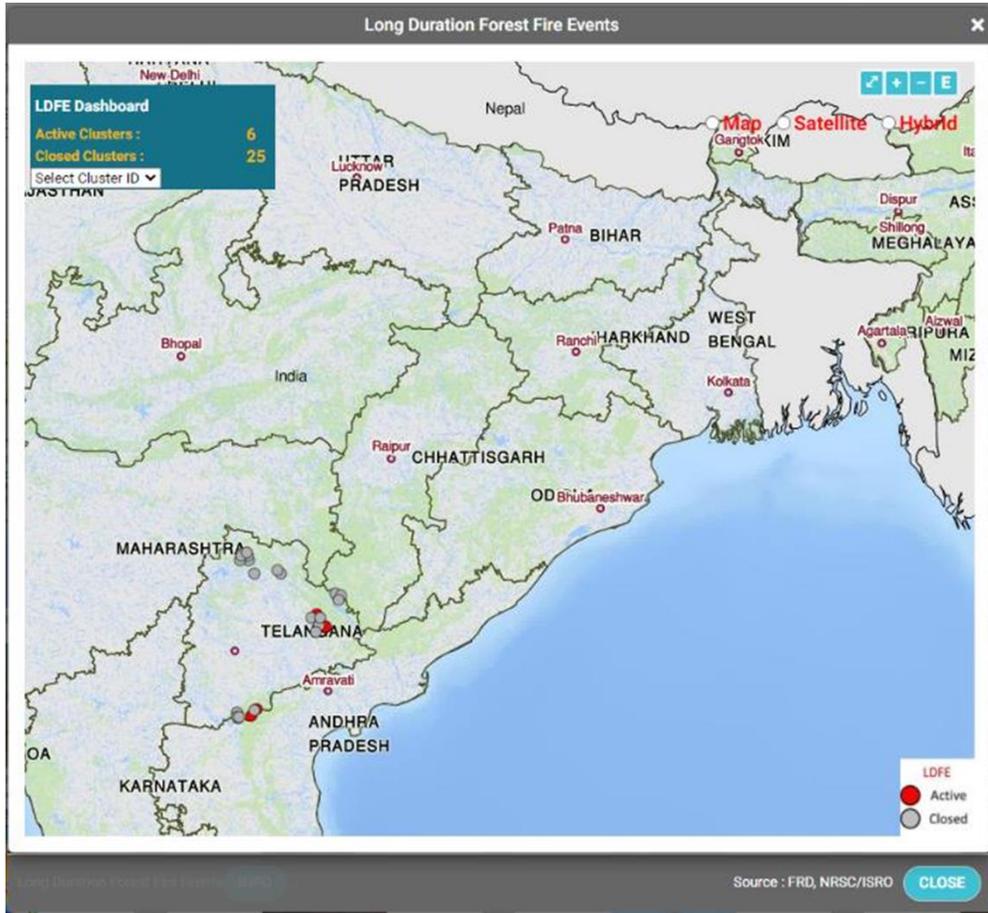
ClusterID

○ 566(48)

Date

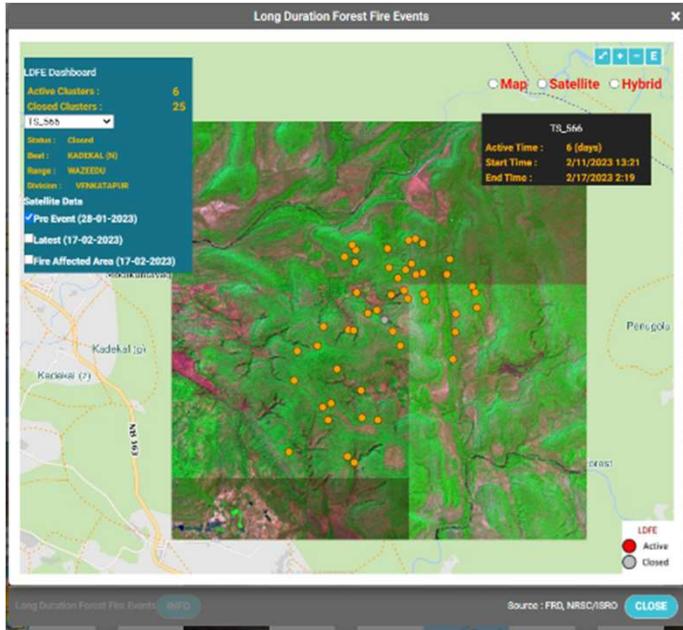
- 2023-02-11(2)
- 2023-02-12(3)
- 2023-02-13(4)
- 2023-02-14(7)
- 2023-02-15(10)
- 2023-02-16(16)
- 2023-02-17(6)

<https://ndem.nrsc.gov.in/login.php>



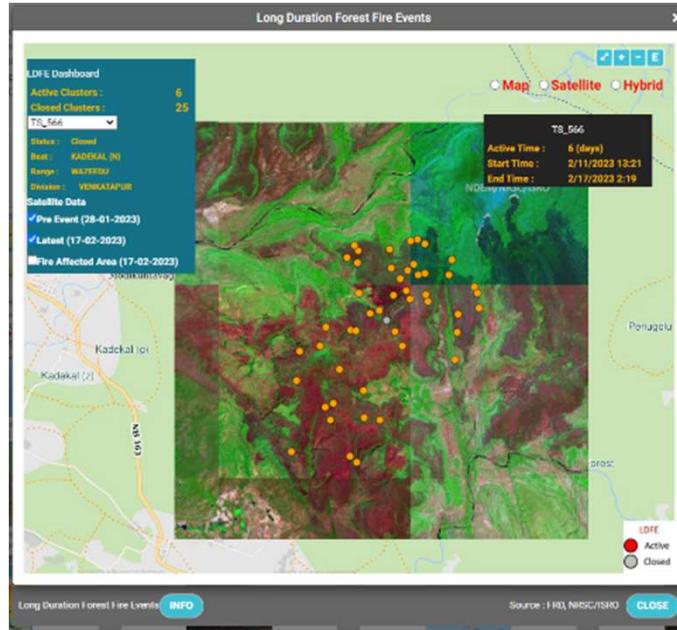
Telangana Cluster ID - 566

RFAA on NDEM for Cluster 566



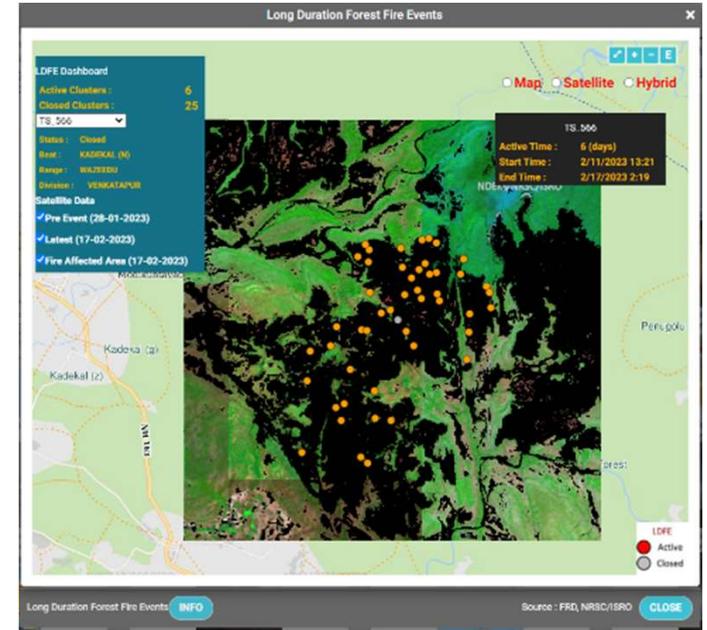
Sentinel-2; 28-Jan-23

Pre Event Satellite Data



Sentinel-2; 17-Feb-23

Post Event Satellite Data



Area Affected: ~50.48 sq. km

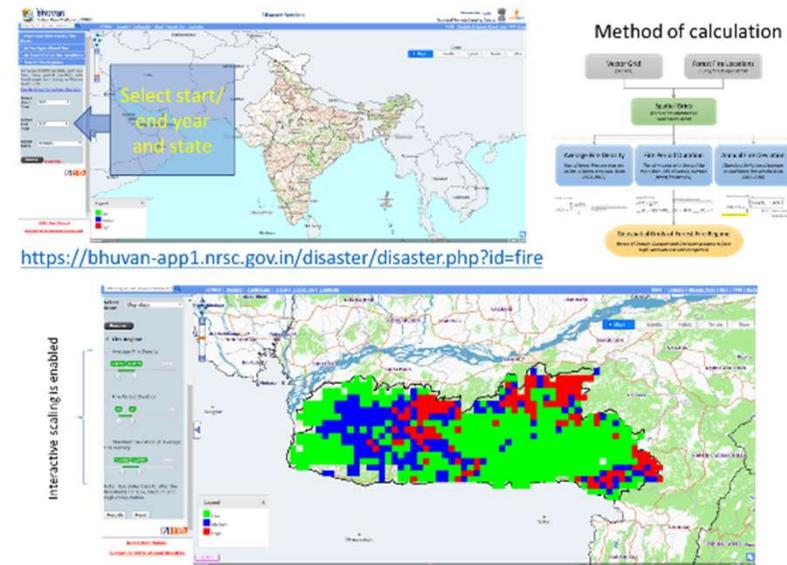
Fire Affected Area

Regimes describe the spatial and temporal characteristics of fires

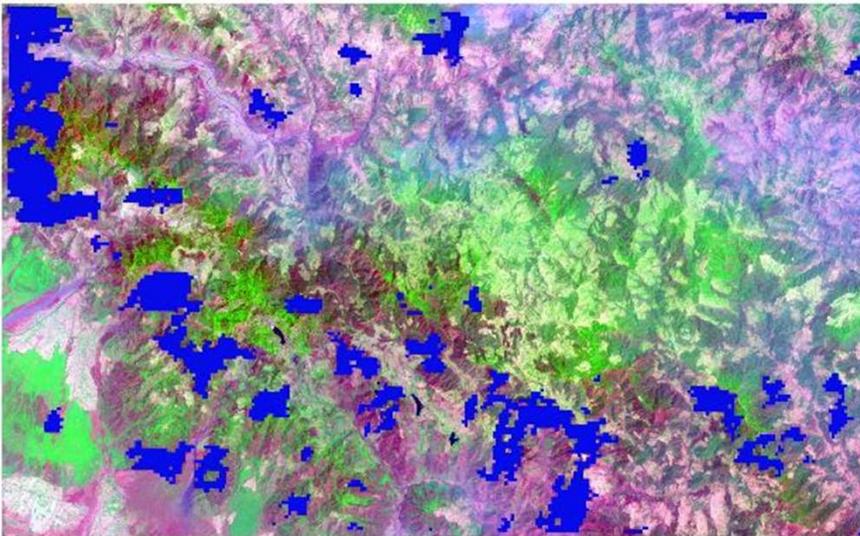
Five key characteristics of fire regimes

- i. Size
- ii. Frequency
- iii. Intensity
- iv. Season
- v. **Extent**

group regions with similar fire characteristics and identify global units of fire (i.e., pyromes).



FIRE CCI BURNT AREA - 2016



Fire CCI is dependent on MODIS AFL (Lizundia-Loiola, J. et al., 2020)

Global validation, Franquesa et al 2022

- the low density of MODIS active fires within the omitted burned areas (density of active fires = 0.07–0.11) compared to the areas of agreement (DAF = 0.44–1.52) is one of the main causes of the BA underestimation of the FireCCI51 product
- High agreement for fire patches > ~75 to 100 ha
- High Errors in cropland fires (which we are not concerned with)

Fire Regimes in India AFL and Burned Area

| SI No | Category | Parameter | Source |
|-------|--------------------------|--|--------|
| 1 | Fire Incidence | Mean Annual Area Burned | AREA |
| 2 | | Mean Annual Active Fire Density | AFL |
| 3 | Inter annual variability | Inter annual CoV in annual area burned | AREA |
| 4 | | Inter annual CoV in annual active fire density | AFL |
| 5 | Fire Seasonality | Fire Season Duration | AREA |
| 6 | | Fire Peak Month | AFL |
| 7 | Fire Intensity | Fire Radiative Power | AFL |
| 8 | Size distribution | Gini Index | AREA |
| 9 | Forest Type | Percentage (EG/SEG/MD/DD) affected by fire | AREA |

Parameters in green are from fire_cci

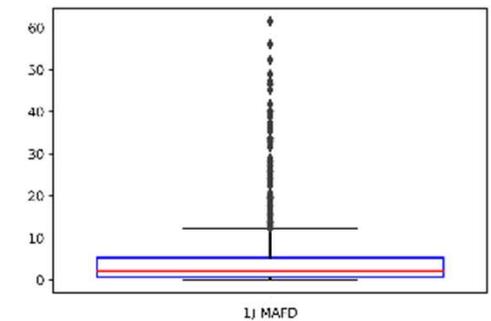
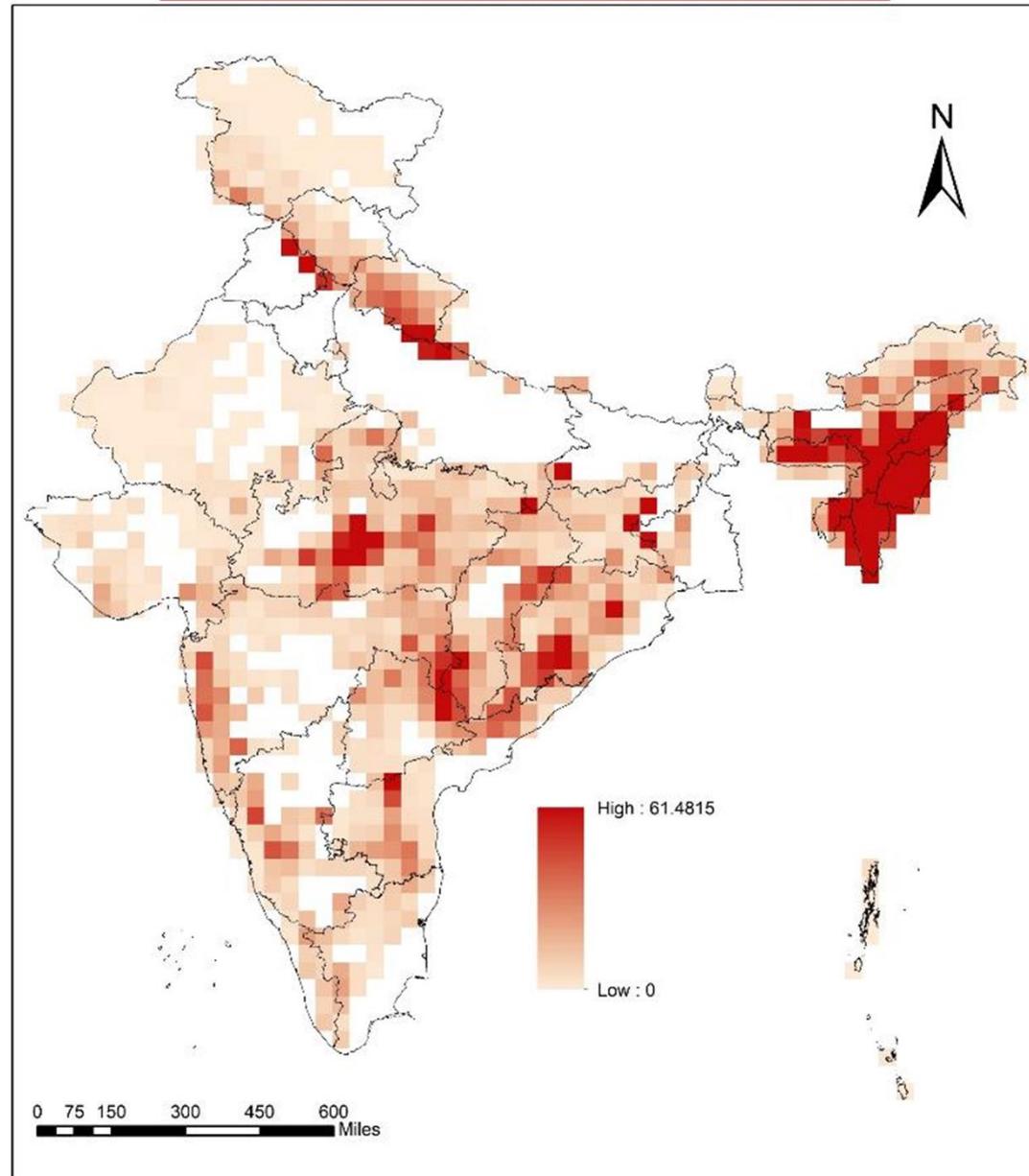
Strategy

- Compute at 0.5° grid level
- Cluster for fire regime

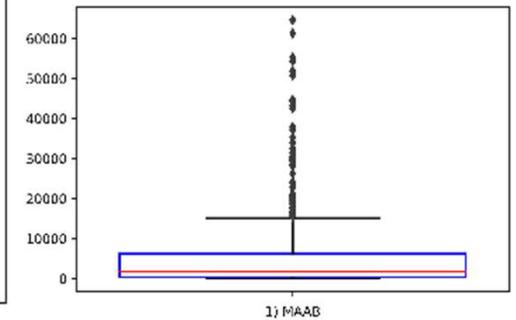
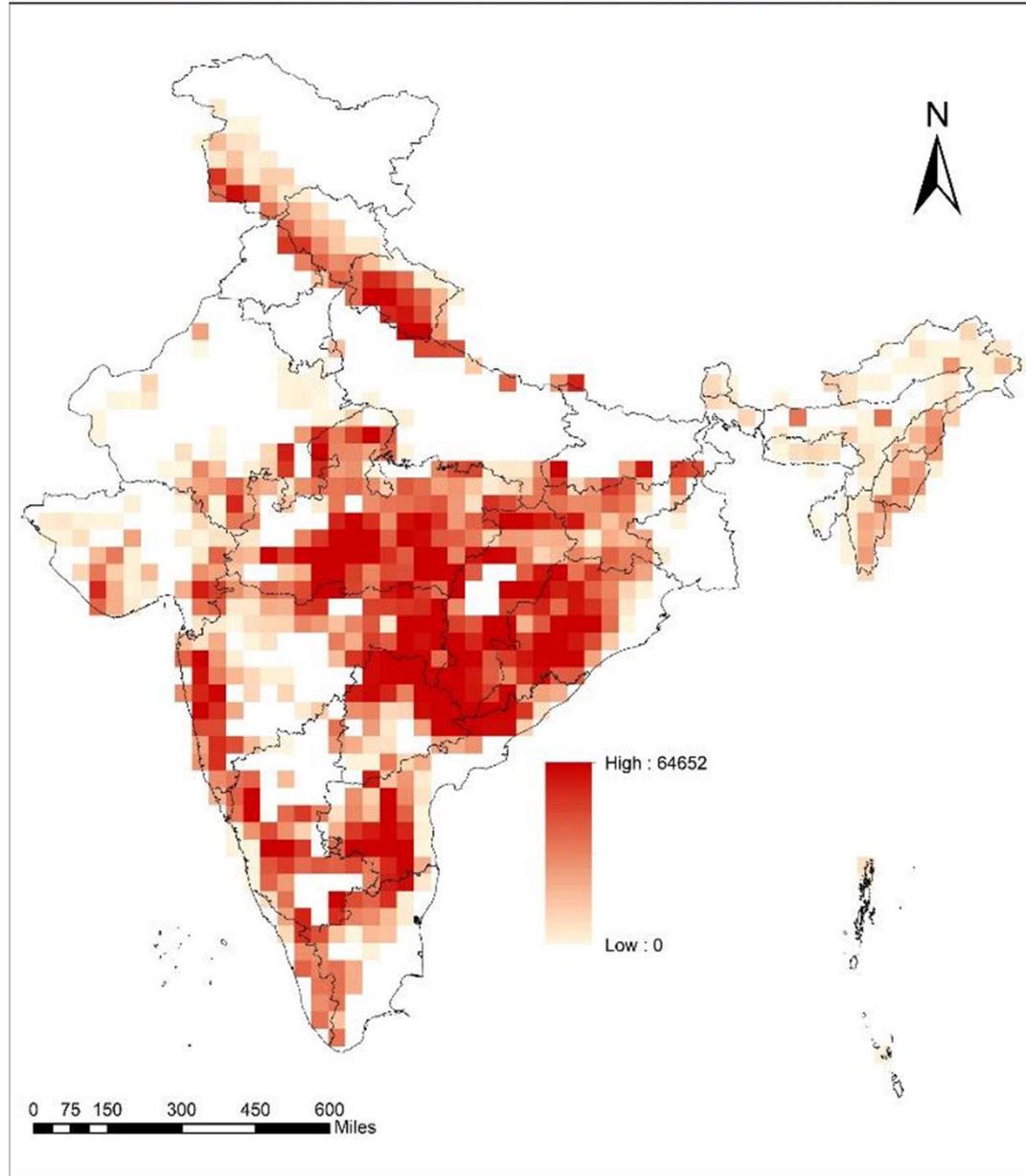
Expected Uses

- Fire return interval at 1 km resolution
- Climate influences and other drivers of fire

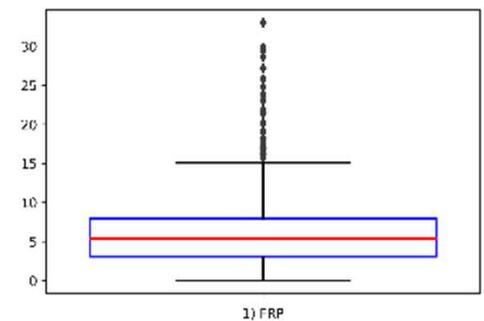
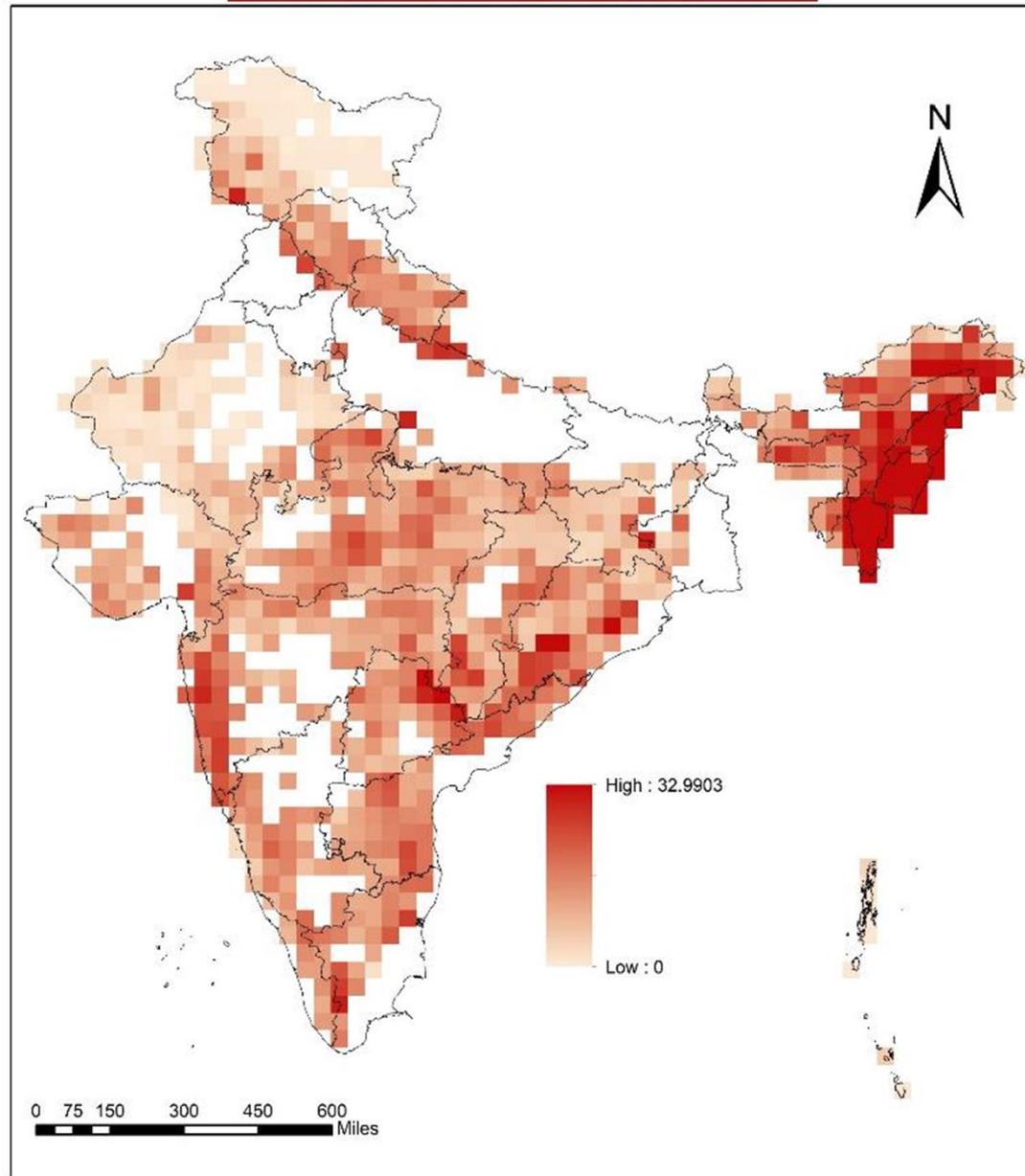
MEAN ANNUAL FIRE DENSITY (MAFD)



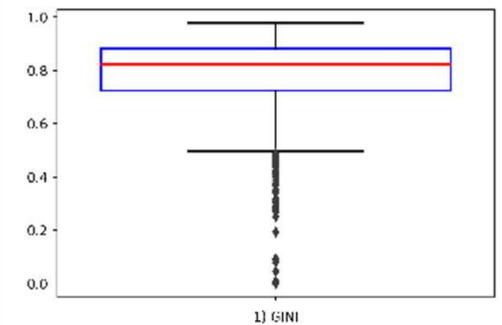
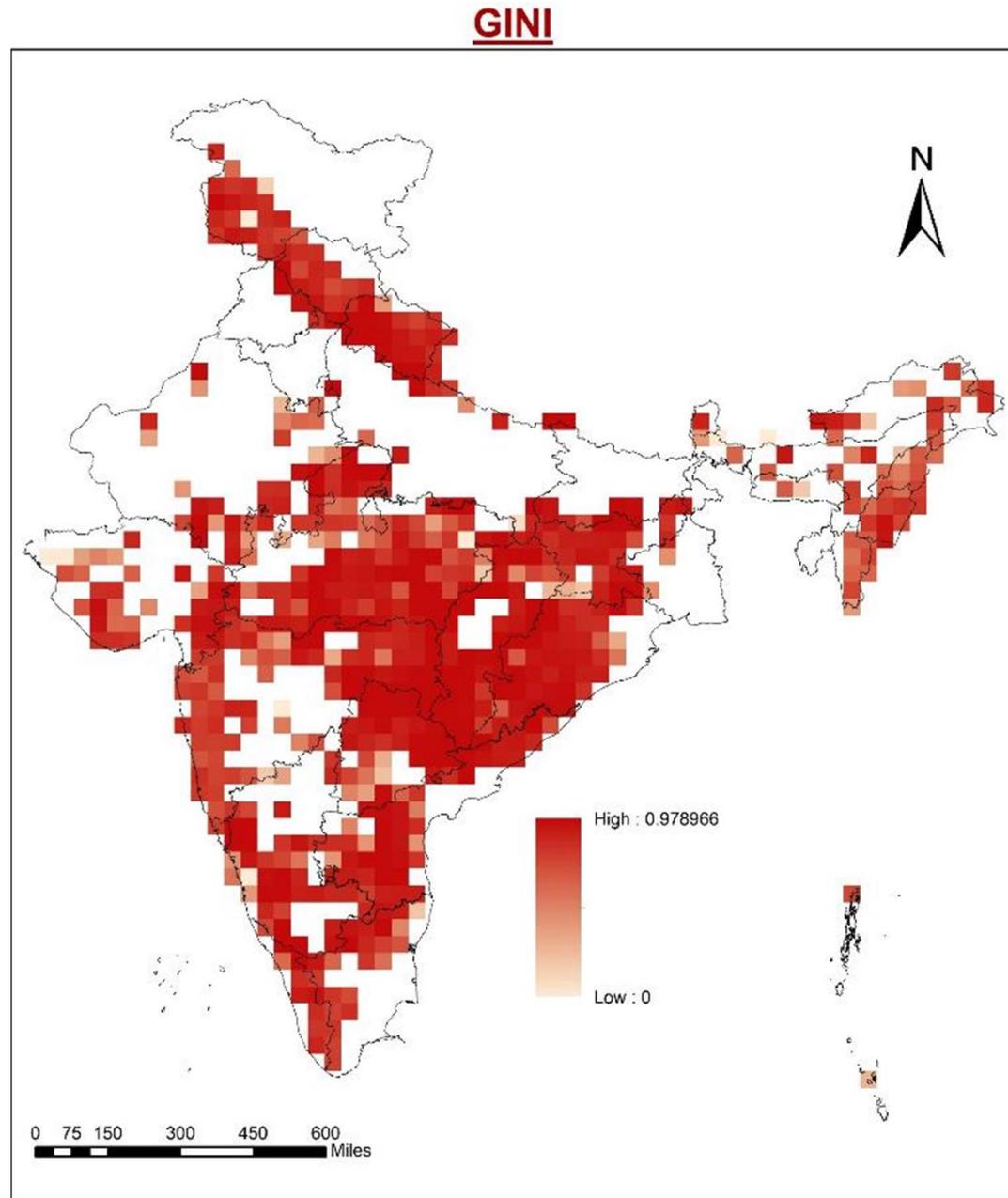
MEAN ANNUAL AREA BURNT (MAAB)



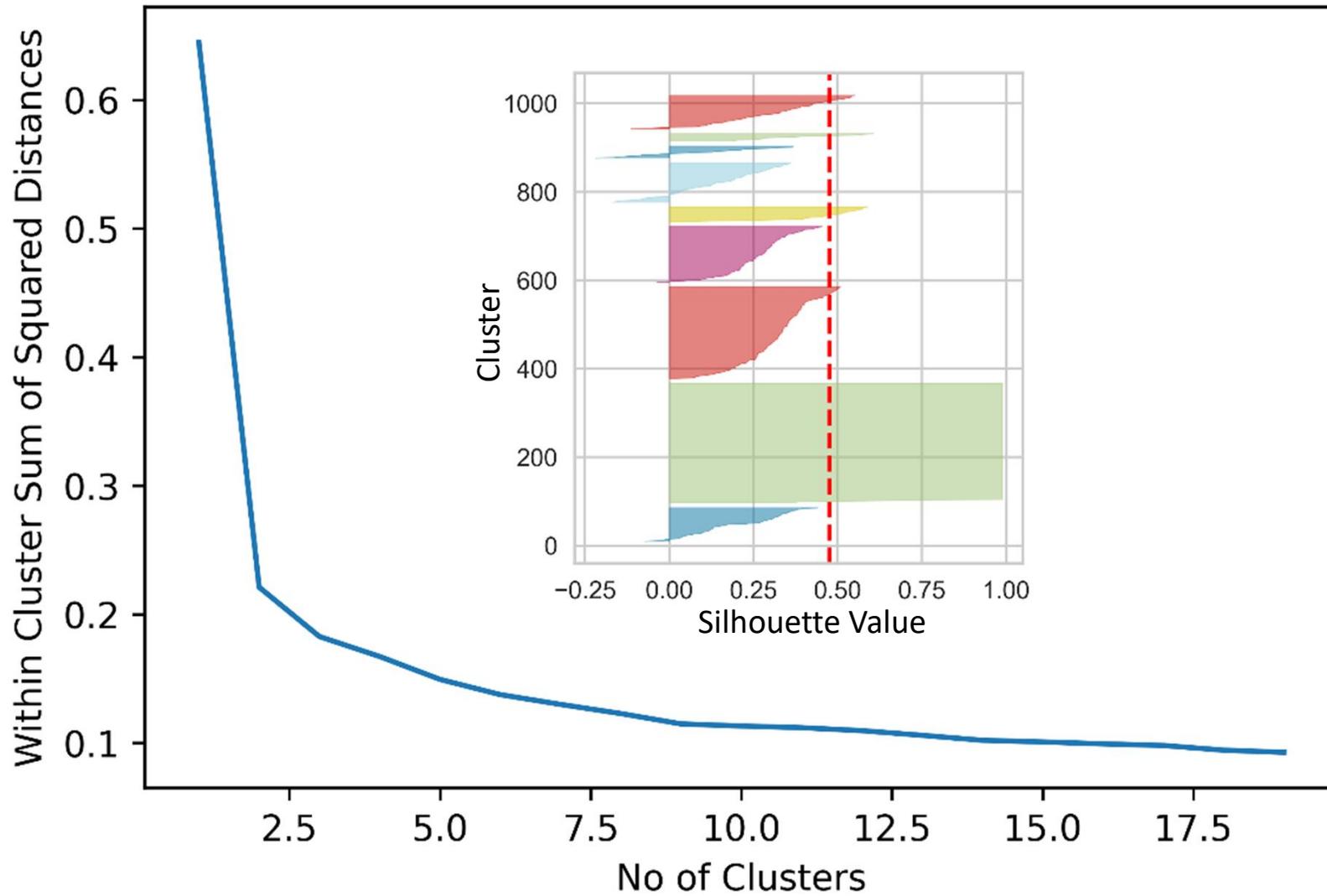
FIRE RADIATIVE POWER (FRP)



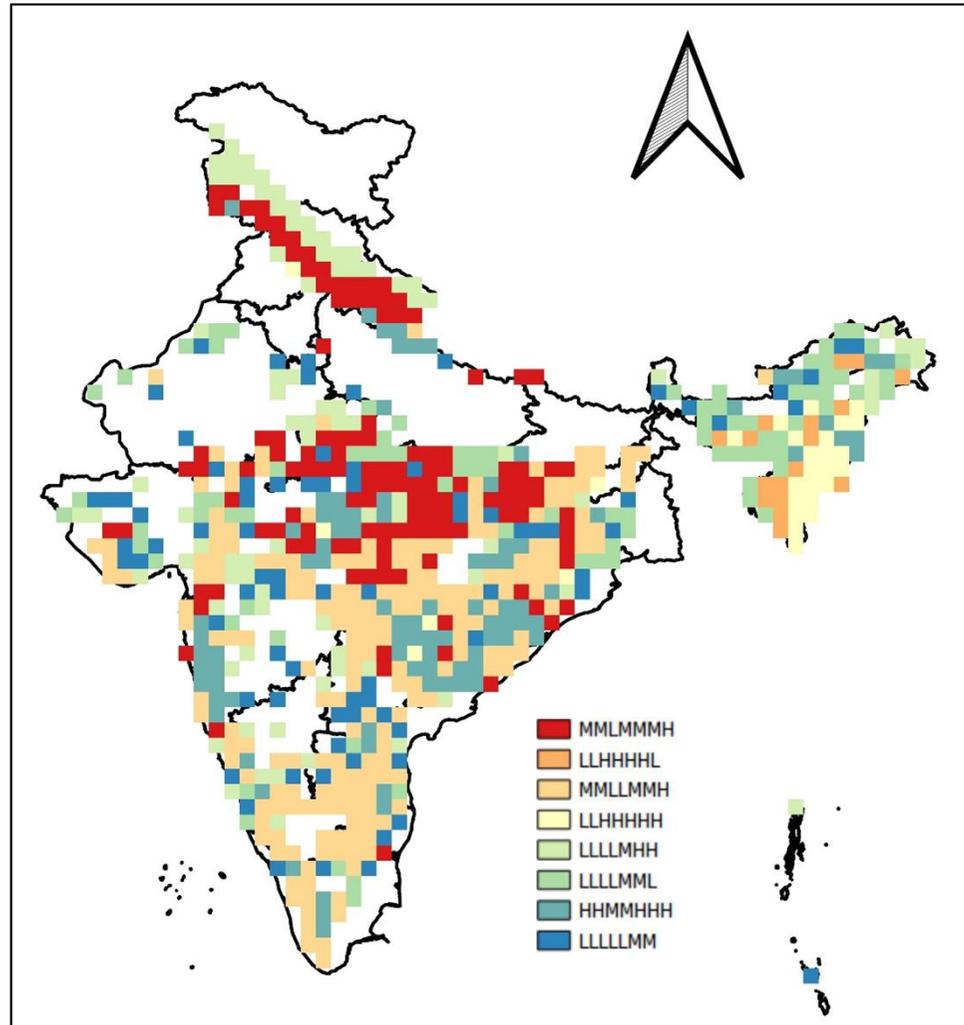
Fire Regimes in India AFL and Burned Area (Gini of fire_cci patches)

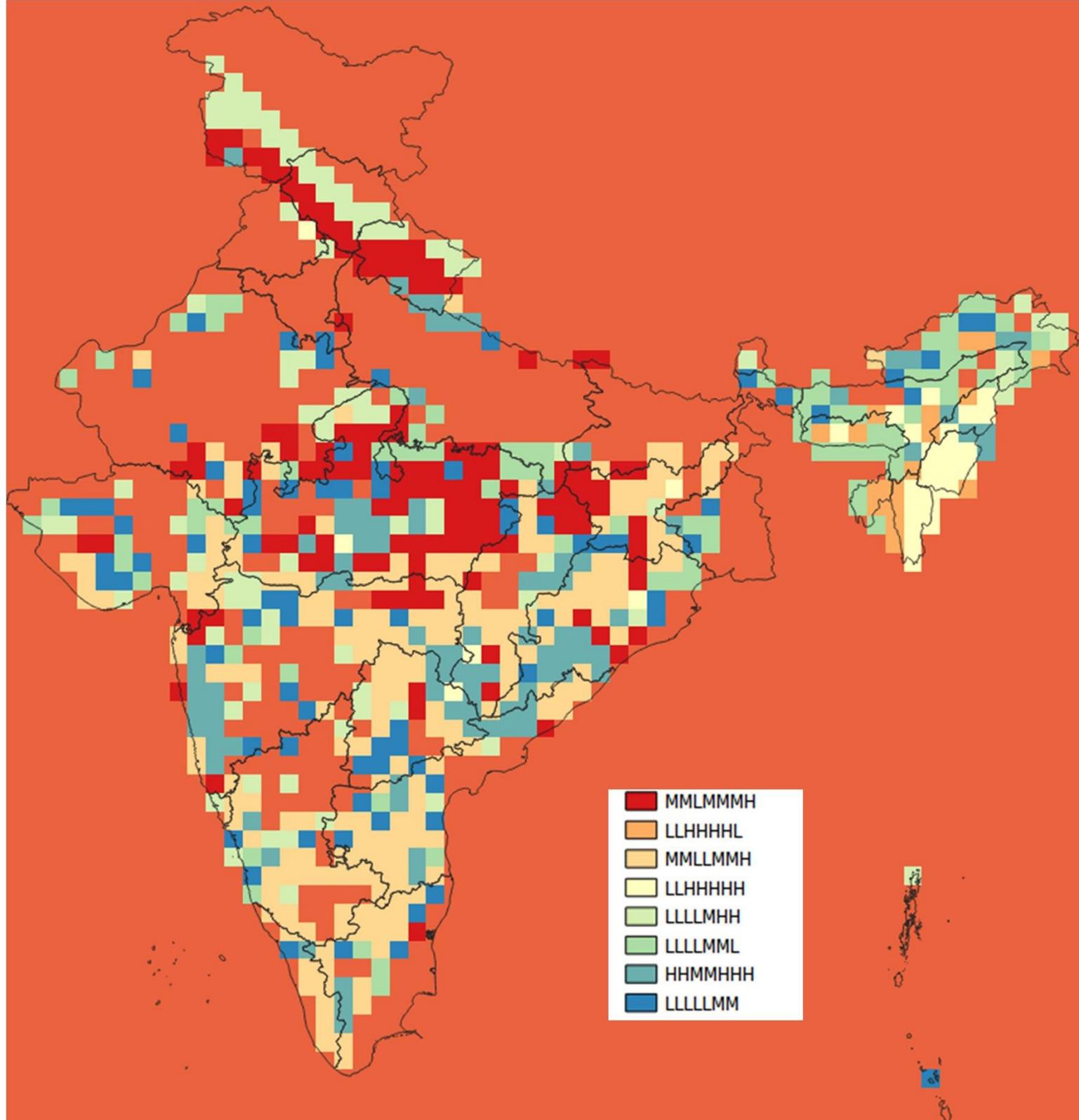


Fire Regimes in India AFL and Burned Area (Cluster analysis)



FOREST FIRE REGIMES







THANK YOU FOR YOUR TIME

Bhoonidhi: Data for Urgent Usage

ub

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We enable access to our extensive archive of Remote Sensing data from various satellites, including Indian and Foreign Remote Sensing sensors over the past 40 years. We also facilitate the Regional distribution of Sentinel and Landsat data over India.

Bhoonidhi
ISRO's EO Data HUB

भूनिधि
इसरो इओ डाटा हब

Bhoonidhi Vista

EOS-04 MRS data
within 4 hours after acquisition

Browse & Order

VISTA : visualize online

VISTA **Bhoonidhi STATS**

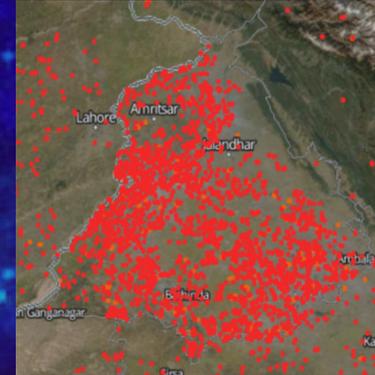
Delivery Mode :
SFTP , Https , API lib

bhoonidhi.nrsc.gov.in





Earth Observations for Farm Fire Management

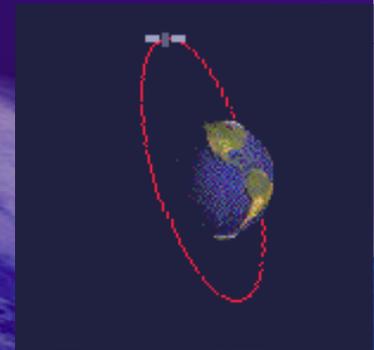
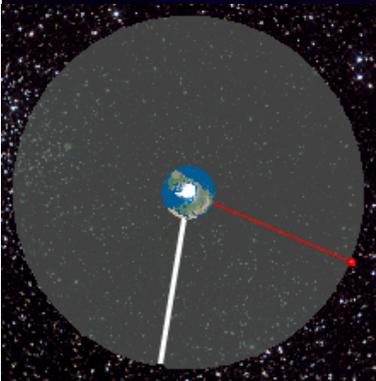


Anil Sood, Ph D
Scientist 'SG'

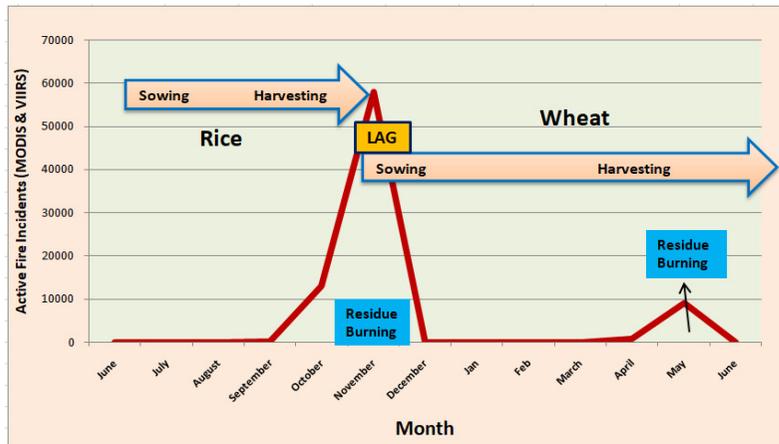
Email: anilsood@prsc.gov.in;
anilsoodprsc@gmail.com

PUNJAB REMOTE SENSING CENTRE,
LUDHIANA

National Meet on Disaster Risk Management –
Trends and Technologies
, Hyderabad, 28th Feb, 23



Dominance of rice-wheat system



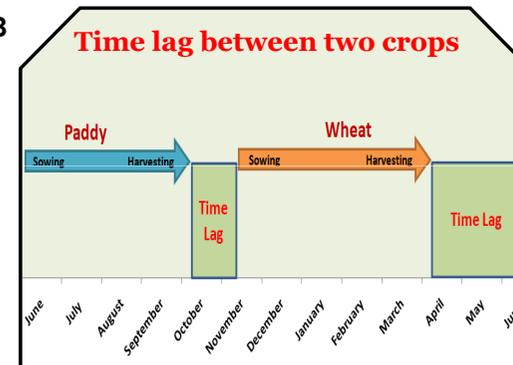
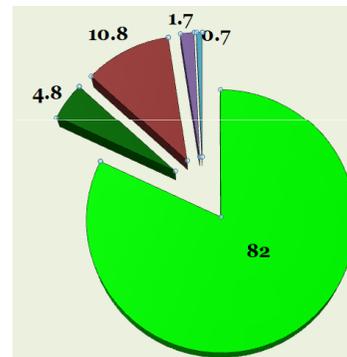
| | Paddy | Wheat |
|---------------------|---------|---------|
| Area (Mha) | ≈ 3.0 | ≈ 3.5 |
| Straw produced (MT) | ≈ 20 | ≈ 18 |
| Burnt (%) | ≈ 70-75 | ≈ 10-15 |

Mechanized farming



Shortage of Labour

LAND UTILISATION IN PUNJAB



Storage Problem

In Punjab, this interval is further shortened by the water conservation law – **Punjab Preservation of subsoil Water Act 2009**, which governs the paddy sowing date coincides with the onset of the monsoons to minimize dependence on groundwater for irrigation



Major impacts of Crop Residue Burning

Atmospheric Environment

Human Environment

Soil Environment

Declining microbial biomass

Climate Pollutants

Why harmful for air

One ton of stubble on burning releases

- 2 kg of SO₂
- 3 kg of PM
- 60 kg of CO
- 1460 kg of CO₂
- 199 kg of ash



Smog & Haze

Aerosol & Particulates

Chronic Heat & Lungs Diseases

Declining Soil Fertility

Loss of soil biodiversity

Loss of soil organic carbon

Loss of valuable nutrients

Paddy straw contains (per hectare)

- 339 kg Nitrogen
- 6 kg Phosphorus
- 140 kg Potassium
- 11 kg Sulphur



Health problems gets aggravated



Reduced Visibility leads to Accidents



Smog & Haze due to residue burning

Health hazards due to stubble burning

Suffering

Watery eyes

81.25%

Health problems get aggravated during or shortly after

48.98%

Coughing (congestion in the chest)

34.09%

Respiratory allergies

11.93%

Health hazards due to stubble burning

Suffering

Asthma (shortness of breath, congestion in chest)

10.80%

Bronchial problems

1.14%

Experience nose/throat irritation due to smoke

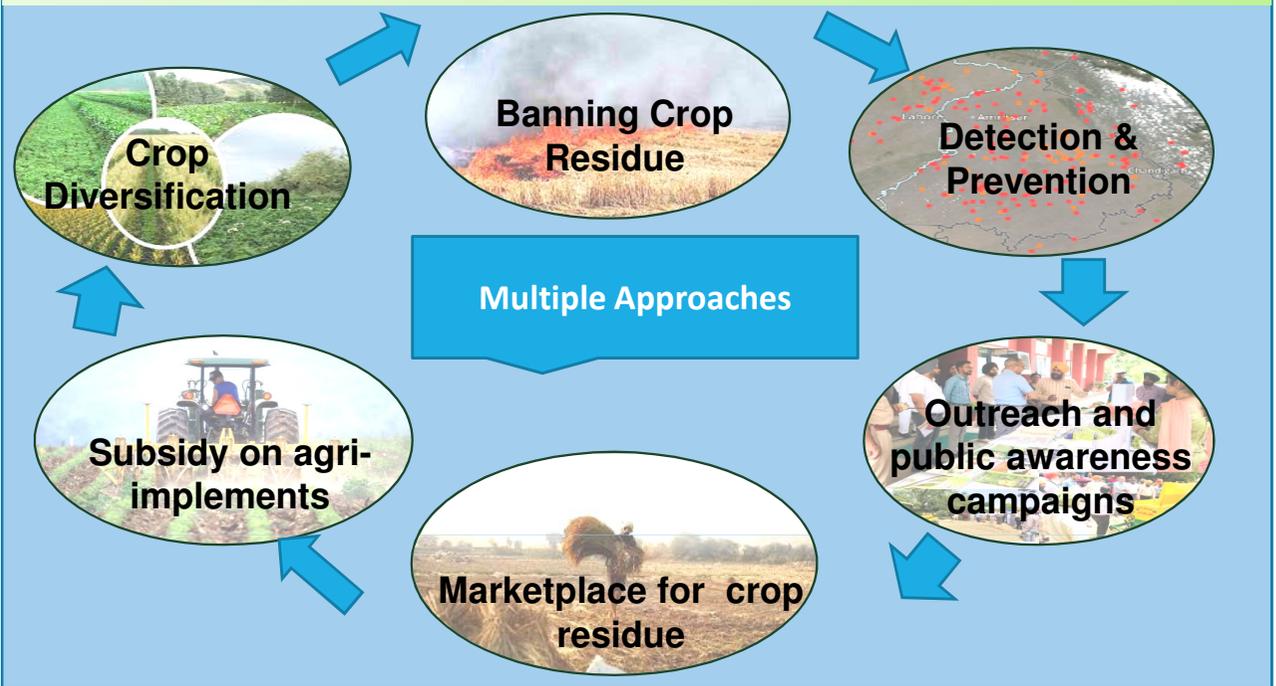
1.65%

Any other problem

3.98%



How to prevent Residue Burning?



Effective and Greater Scope of subsidy provisions



Outreach and public awareness campaigns



Production of Biogas Mulching Material Packaging Material

Poultry Farms Mushroom Cultivation

Paper & Board Making Fuel in Brick Kilns

Soil Stabilization Temporary Shelters Energy Pallets

Alternative uses of Straw



Crop Diversification



CROP DIVERSIFICATION



Paddy Straw power plant



Establishment of a larger number of biomass based power projects, where a large amount of paddy straw may be absorbed



Sculptures from paddy straw



Paddy Straw used for sewage and sludge composting and disposal



Animal Bedding



Fodder for Animals



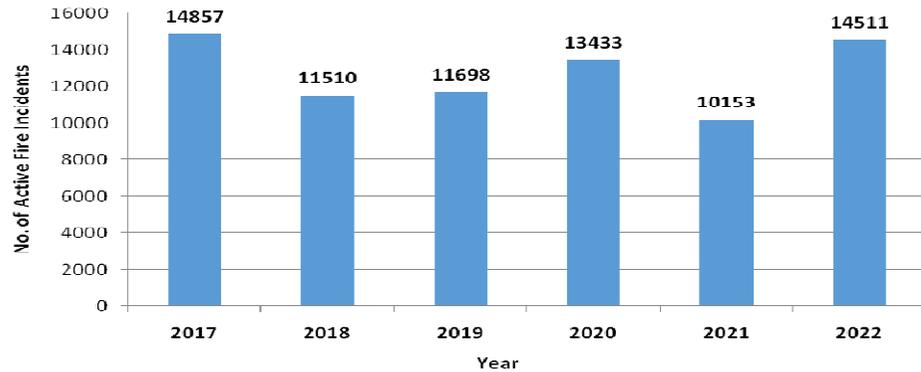
Decompose Paddy Straw into useful compost



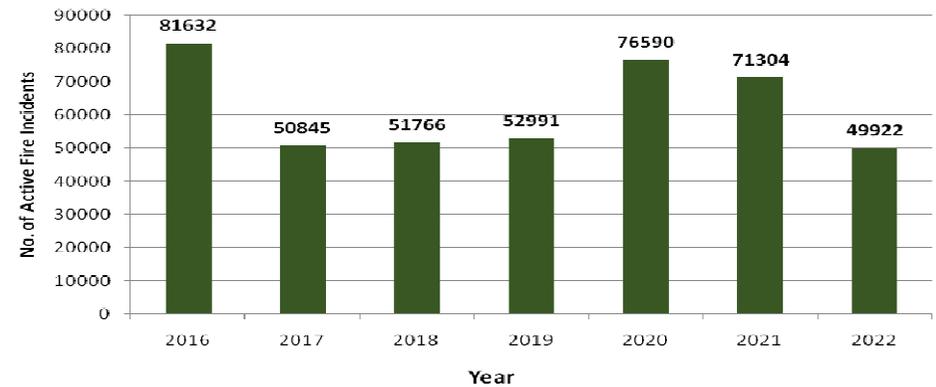
Trends Over the Years



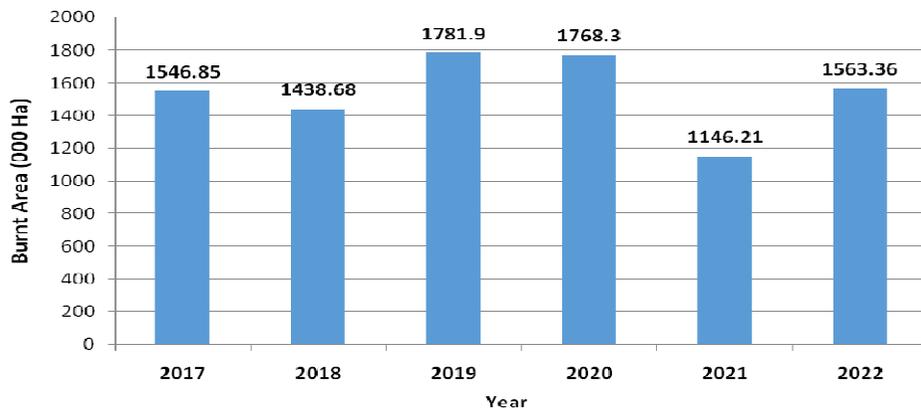
No. of Fire Incidents of Wheat Residue Burning (Punjab)



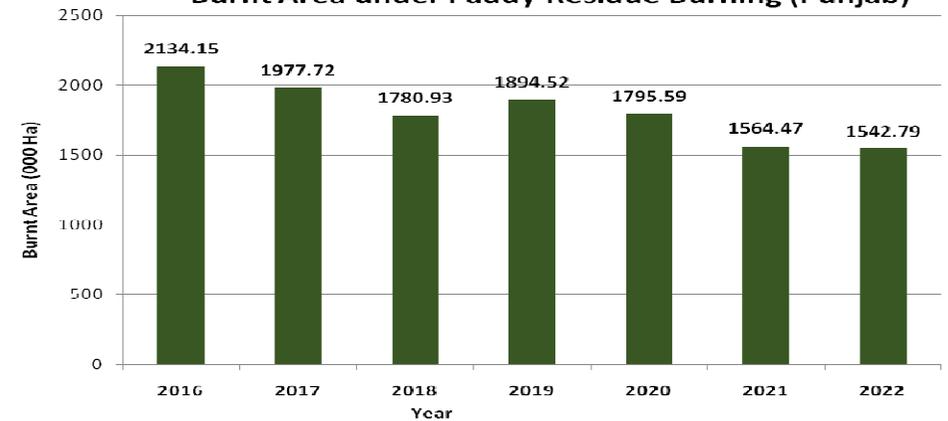
No. of Fire Incidents of Paddy Residue Burning (Punjab)



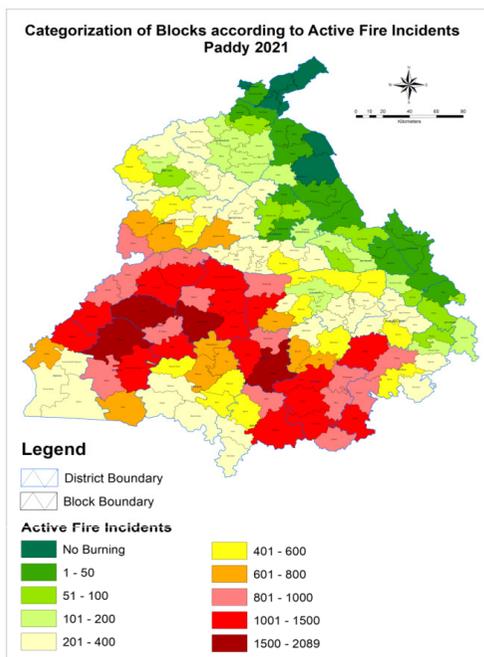
Burnt Area under Wheat Residue Burning (Punjab)



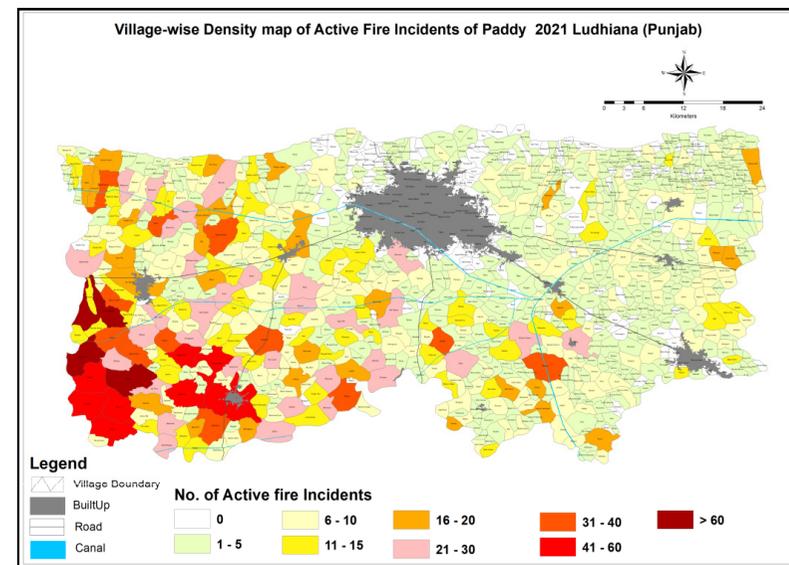
Burnt Area under Paddy Residue Burning (Punjab)



HOTSPOT DISTRICTS/BLOCKS/VILLAGES IDENTIFIED



| Parmal – District-wise area under URVs | | | | | |
|--|------------|---------------|-----------|------------------------------|---------------|
| District | Pusa 44 | Peeli Pusa | CR 212 | Any other (specified) | Total URVs |
| Barnala | 54.8 | 15.2 | 1.87 | - | 72.8 |
| Sangrur | 51.2 | 13.4 | 2.1 | - | 66.7 |
| Faridkot | 11.6 | 1.1 | 11.6 | 9.0 (125) | 61.2 |
| S Mkt. Sahib | 24.0 | - | 17.0 | 19.2 (28P67) | 60.5 |
| Moga | 36.5 | 1.3 | 3.1 | 11.6 (Dogar Pusa) | 56.7 |
| Ludhiana | 44.6 | 1.6 | 0.1 | 2.31 (Supreme 110) | 53.4 |
| Mansa | 11.3 | 17.4 | 16.3 | 4.4 (665) | 51.7 |
| Bathinda | 17.3 | 9.8 | 14.1 | 5.2 (125, 27P31, 27P68) | 47.9 |
| Patiala | 34.5 | 2.0 | 1.4 | 3.8 (666, 25P35) | 42.3 |
| Fazilka | - | - | 11.5 | 29.8 (27P68, 27P31, S212) | 41.1 |



| List of Hotspots District based on number of fire incidents reported | | | | |
|--|----------|------|------|------|
| Sr. No. | District | 2019 | 2020 | 2021 |
| 15 Sept to 30 Nov | | | | |
| 1 | FIROZPUR | 5027 | 6960 | 6288 |
| 2 | LUDHIANA | 2445 | 4338 | 5817 |
| 3 | MOGA | 3136 | 5866 | 6515 |
| 4 | PATIALA | 4016 | 5306 | 5368 |
| 5 | SANGRUR | 6667 | 9708 | 8006 |

Districts having more incidence of Active Fire have more area under unrecompensed and long duration Varieties

| District | Block | No of Fire Incidents (2021) |
|----------|-------------|-----------------------------|
| Ludhiana | Jagraon | 1021 |
| | Sidhwan Bet | 928 |
| | Raikot | 699 |
| | Pakhowal | 496 |
| | Machhiwara | 467 |



Status of Active fire incidents and classified burnt area due to paddy residue burning declined in adopted villages of district Fatehgarh Sahib from year 2017 to 2020

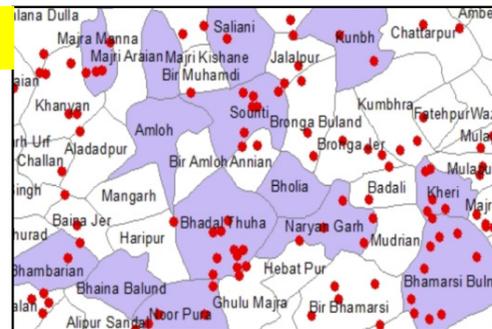
Number of Active Fire Incidents

| sno | District | Tehsil | Block | Village | 2017 | 2020 |
|-----|-----------------|--------|-------|---------------|------|------|
| 1 | Fatehgarh Sahib | Amloh | Amloh | Amloh | 0 | 0 |
| 2 | Fatehgarh Sahib | Amloh | Amloh | Bhadal Thuha | 9 | 4 |
| 3 | Fatehgarh Sahib | Amloh | Amloh | Bhaina Balund | 0 | 1 |
| 4 | Fatehgarh Sahib | Amloh | Amloh | Bhambarian | 2 | 0 |
| 5 | Fatehgarh Sahib | Amloh | Amloh | Bholia | 0 | 1 |
| 6 | Fatehgarh Sahib | Amloh | Amloh | Kunbh | 3 | 1 |
| 7 | Fatehgarh Sahib | Amloh | Amloh | Ladpur s | 6 | 1 |
| 8 | Fatehgarh Sahib | Amloh | Amloh | Majri Kishane | 0 | 0 |
| 9 | Fatehgarh Sahib | Amloh | Amloh | Naryan Garh | 4 | 1 |
| 10 | Fatehgarh Sahib | Amloh | Amloh | Saliani | 1 | 1 |
| 11 | Fatehgarh Sahib | Amloh | Amloh | Sounti | 7 | 0 |

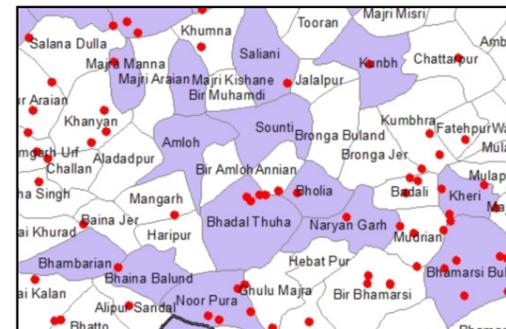
Burnt Area (000 HA)

| sno | District | Tehsil | Block | Village | 2017 | 2020 |
|-----|-----------------|--------|-------|---------------|------|------|
| 1 | Fatehgarh Sahib | Amloh | Amloh | Amloh | 0.21 | 0.03 |
| 2 | Fatehgarh Sahib | Amloh | Amloh | Bhadal Thuha | 0.68 | 0.22 |
| 3 | Fatehgarh Sahib | Amloh | Amloh | Bhaina Balund | 0.35 | 0.08 |
| 4 | Fatehgarh Sahib | Amloh | Amloh | Bhambarian | 0.37 | 0.04 |
| 5 | Fatehgarh Sahib | Amloh | Amloh | Bholia | 0.34 | 0.09 |
| 6 | Fatehgarh Sahib | Amloh | Amloh | Kunbh | 0.26 | 0.07 |
| 7 | Fatehgarh Sahib | Amloh | Amloh | Ladpur(s) | 0.06 | 0.19 |
| 8 | Fatehgarh Sahib | Amloh | Amloh | Majri Kishane | 0.31 | 0.07 |
| 9 | Fatehgarh Sahib | Amloh | Amloh | Naryan Garh | 0.57 | 0.15 |
| 10 | Fatehgarh Sahib | Amloh | Amloh | Saliani | 0.07 | 0.07 |
| 11 | Fatehgarh Sahib | Amloh | Amloh | Sounti | 0.45 | 0.13 |

2017



2020



From districts Fatehgarh Sahib, Sangrur, Ludhiana and Patiala Total Villages Adopted are: 75



MOBILE AND WEB BASED APPLICATION READY



<https://play.google.com/store/apps/details?id=com.kawal.crbims>

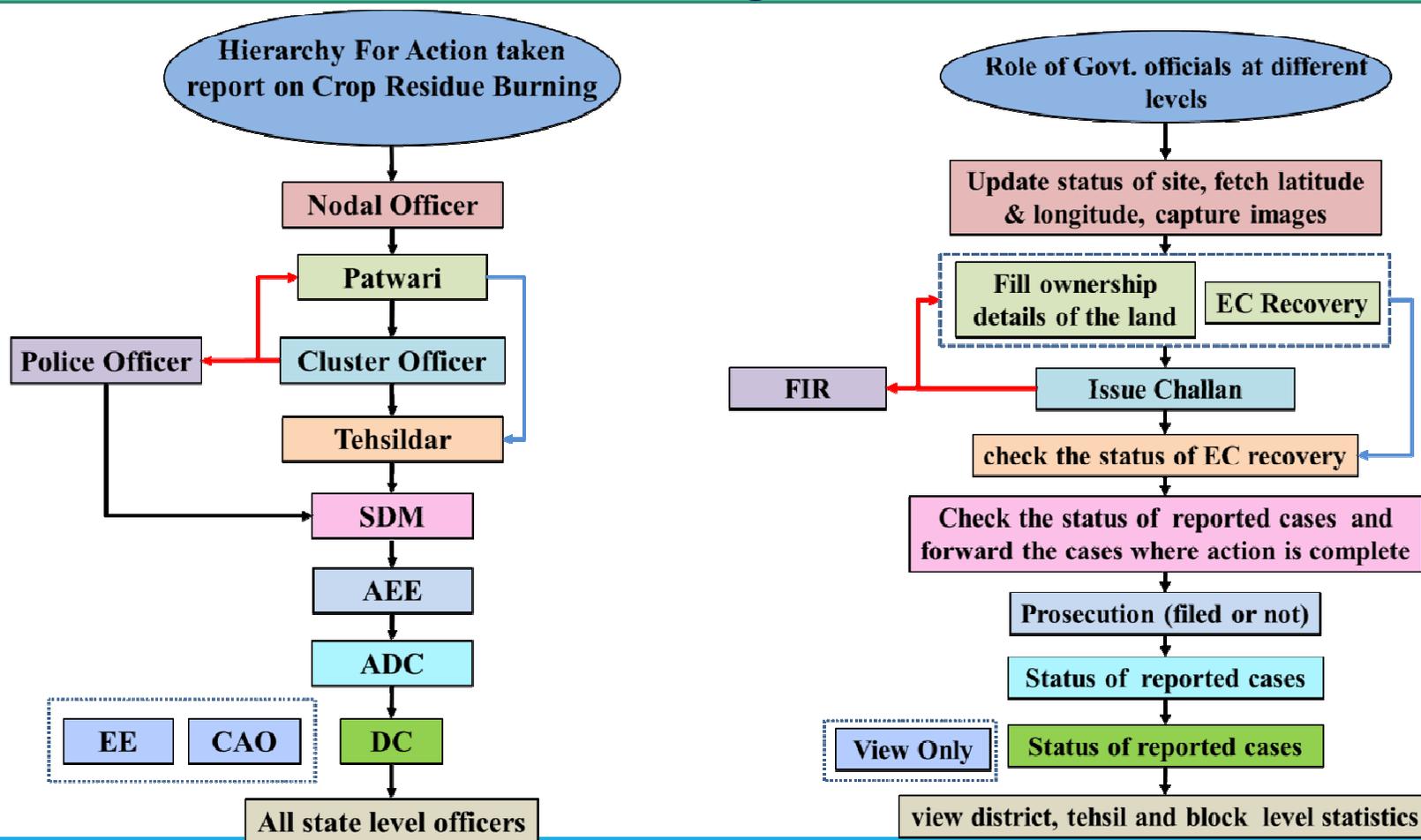
- Mobile App for Both Android and IOS platforms ready
- Role based Login for Village Nodal, Cluster, Sub division/Tehsil and district level.
- End to end reporting and action taken for each fire incidents.
- SMS alert will be sent to field functionaries to take action on incidents of stubble

- Village/Cluster/Tehsil/District level Officers have been appointed by the District Administrations of all the Districts for upcoming paddy season 2022
- 8441 Field functionaries have been appointed for the upcoming paddy season.
- Data of all the districts has already been provided to PRSC and has been uploaded to the system database.



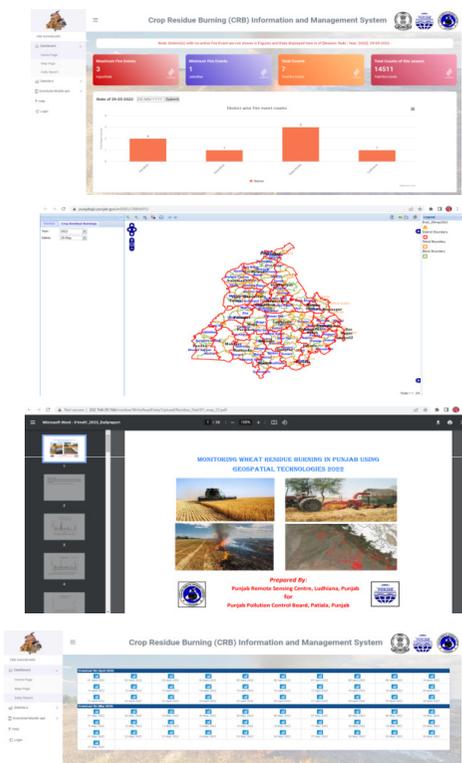
MOBILE APPLICATION FLOW

Monitoring Mechanism



ਪੰਜਾਬ ਰਾਜ ਲਈ ਵੈੱਬ - ਜੀ ਆਈ ਐਸ ਅਧਾਰਤ ਫਸਲਾਂ ਦੀ ਰਹਿੰਦ-ਖੂੰਹਦ ਸਾੜਨ ਦੀ ਸੂਚਨਾ ਅਤੇ ਪ੍ਰਬੰਧਨ ਪ੍ਰਣਾਲੀ ਦਾ ਵਿਕਾਸ

Development of Web-GIS Based Crop Residue Burning Information & Management System for Punjab State



Scanner QR code
Or
visit this url:



<http://202.164.39.166/residue/Index.aspx>

| ATR-1 : Action Taken Report by the DCs - Stubble Burning as on [Season: Kharif/Paddy Year: 2022] | | | | | | | | | | | | | | |
|--|-----------------|--|---|---|--|--|--|--|---|---|----------------------------------|---|--|---------|
| Sr No. | District | No. of Fire incidents reported by PRSC upto date | No. of sites visited within 48 hrs by the Sub-Divisional Team | No. of site in which no residue crop burning observed | Nos of cases in which environmental compensation imposed | Total amount of environmental compensation imposed [in] | Total amount of environmental compensation recovered [in] | Nos of cases in which red entry made in khasra Girdawari | Nos of cases in which Prosecution filed under section 39 of Air Act, 1981 | No of cases in which FIR filed U/s 188 of IPC | No of cases u/s 107/151 of CrPC. | No of cases of imposition of EC on Harvest Combines | No of cases pending for visit from the total incident reported upto date | Remarks |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 1 | Amritsar | 1542 | 40 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | | | 1502 | |
| 2 | Barnala | 2910 | 372 | 246 | 0 | 0 | 0 | 0 | 0 | 0 | | | 2538 | |
| 3 | Bathinda | 4592 | 1436 | 835 | 3 | 22500 | 0 | 2 | 0 | 0 | | | 3156 | |
| 4 | Faridkot | 2693 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | | 2692 | |
| 5 | Fatehgarh Sahib | 1149 | 204 | 141 | 0 | 0 | 0 | 0 | 0 | 0 | | | 945 | |
| 6 | Fazilka | 2856 | 1099 | 809 | 0 | 0 | 0 | 0 | 0 | 0 | | | 1757 | |
| 7 | Firozpur | 4295 | 48 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | | | 4247 | |
| 8 | Gurdaspur | 854 | 832 | 141 | 75 | 192500 | 0 | 4 | 0 | 0 | | | 22 | |
| 9 | Hoshiarpur | 259 | 210 | 111 | 0 | 0 | 0 | 0 | 0 | 0 | | | 49 | |
| 10 | Jalandhar | 1388 | 33 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | | | 1355 | |
| 11 | Kapurthala | 1279 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | 1273 | |
| 12 | Ludhiana | 2682 | 133 | 71 | 0 | 0 | 0 | 0 | 0 | 0 | | | 2549 | |
| 13 | Malerkotla | 677 | 20 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | | | 657 | |
| 14 | Mansa | 2815 | 388 | 275 | 0 | 0 | 0 | 0 | 0 | 0 | | | 2427 | |
| 15 | Moga | 3609 | 1827 | 903 | 0 | 0 | 0 | 0 | 0 | 0 | | | 1782 | |
| 16 | Muktsar | 3884 | 457 | 290 | 0 | 0 | 0 | 0 | 0 | 0 | | | 3427 | |
| 17 | Pathankot | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | 1 | |
| 18 | Patiala | 3336 | 29 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | | | 3307 | |
| 19 | Rupnagar | 246 | 68 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | | | 178 | |
| 20 | Sangrur | 5239 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | 5238 | |
| 21 | SAS Nagar | 162 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | 162 | |
| 22 | SBS Nagar | 270 | 167 | 73 | 3 | 7500 | 0 | 0 | 0 | 0 | | | 103 | |
| 23 | Tarn Taran | 3184 | 375 | 72 | 0 | 0 | 0 | 0 | 0 | 0 | | | 2809 | |
| | Total | 49922 | 7746 | 4094 | 81 | 222500 | 0 | 6 | 0 | 0 | | | 42176 | |



Apps developed to prevent Residue Burning

ਆਈ-ਖੇਤ ਪੰਜਾਬ ਐਪਲੀਕੇਸ਼ਨ ਸੇਵਾ ਪ੍ਰਦਾਤਾ ਅਤੇ ਕਿਸਾਨ ਦੇ ਵਿਚਕਾਰ ਪੁਲ ਦੀ ਤਰ੍ਹਾਂ ਕੰਮ ਕਰ ਰਹੀ ਹੈ

ਕਿਸਾਨ



ਡੈਸ਼ਬੋਰਡ ਖੋਲ੍ਹਣ ਲਈ ਲਿੰਕ
<https://ikhet.punjab.gov.in/>



ਮੇਥਾਈਲ ਐਪ ਡਾਊਨਲੋਡ ਕਰਨ ਲਈ ਲਿੰਕ
<https://play.google.com/store/apps/details?id=com.acm.newikhet>

i-ਖੇਤ ਪੰਜਾਬ

ਲੋੜ:
 ਘੱਟ ਜ਼ਮੀਨਾਂ ਵਾਲੇ ਛੋਟੇ ਕਿਸਾਨਾਂ ਕੋਲ ਖੇਤੀ ਮਸ਼ੀਨਰੀ ਦੀ ਉਪਲਬਧਤਾ ਅਤੇ ਖੇਤੀ ਮਸ਼ੀਨਾਂ ਤੱਕ ਪਹੁੰਚ ਦੀ ਘਾਟ, ਉਤਪਾਦਨ ਵਿੱਚ ਗਿਰਾਵਟ ਦਾ ਮੁੱਖ ਕਾਰਨ ਬਣਦਾ ਹੈ ਅਤੇ ਸਿੱਟੇ ਵਜੋਂ ਖੇਤੀ ਉਤਪਾਦਨ ਅਤੇ ਵਾਤਾਵਰਣ ਸੰਬੰਧੀ ਗੰਭੀਰ ਮੁੱਦੇ ਖੜੇ ਹੁੰਦੇ ਹਨ
 ਕਿਰਾਏ ਦੀਆਂ ਸੇਵਾਵਾਂ, ਚਾਹੇ ਉਹ ਰੈਂਟਲ, ਕਸਟਮ ਜਾਂ ਲੀਜ਼ਿੰਗ ਸੇਵਾਵਾਂ ਹੋਣ, ਅਜਿਹੇ ਕਿਸਾਨਾਂ ਲਈ ਬਹੁਤ ਉਪਯੋਗੀ ਸਿੱਧ ਹੋ ਸਕਦੀਆਂ ਹਨ



ਉਪਯੋਗਤਾ:

- ਕਸਟਮ ਹਾਇਰਿੰਗ ਉਹਨਾਂ ਕਿਸਾਨਾਂ ਨੂੰ ਕਿਰਾਏ ਦੇ ਅਧਾਰ ਤੇ ਖੇਤੀ ਉਪਕਰਣਾਂ ਅਤੇ ਮਸ਼ੀਨਰੀ ਦੀ ਪੇਸ਼ਕਸ਼ ਕਰਦੀ ਹੈ ਜੋ ਖਰੀਦਣ ਦੇ ਸਮਰੱਥ ਨਹੀਂ ਹਨ
- ਇਸ ਐਂਡਰਾਇਡ ਅਧਾਰਤ ਮੇਥਾਈਲ ਐਪਲੀਕੇਸ਼ਨ ਦੀ ਵਰਤੋਂ ਕਰਦਿਆਂ ਕਿਸਾਨ ਸਹਿਕਾਰੀ ਸੁਸਾਇਟੀ, ਹੋਰ ਕਿਸਾਨਾਂ ਅਤੇ ਕਸਟਮ ਹਾਇਰਿੰਗ ਸੈਂਟਰਾਂ ਤੋਂ ਕਿਰਾਏ 'ਤੇ ਖੇਤੀ ਮਸ਼ੀਨਰੀ ਲੈ ਸਕਦੇ ਹਨ
- ਇਹ ਐਪ ਕਿਸਾਨਾਂ ਲਈ ਇੱਕ ਪਲੇਟਫਾਰਮ ਪੇਸ਼ ਕਰਦਾ ਹੈ ਜਿੱਥੇ ਉਹ ਆਪਣੇ ਸਥਾਨ ਦੀ ਚੋਣ ਕਰਕੇ ਖੇਤੀ ਮਸ਼ੀਨਰੀ ਤੱਕ ਪਹੁੰਚ ਸਕਦੇ ਹਨ ਅਤੇ ਇਸ ਐਪ ਤੇ ਆਪਣੇ ਆਪ ਨੂੰ ਰਜਿਸਟਰ ਕਰਕੇ ਆਪਣੀ ਮਸ਼ੀਨਰੀ ਕਿਰਾਏ ਤੇ ਲੈ/ਦੇ ਸਕਦੇ ਹਨ





ਸੀਜ਼ਨ ਦੀ ਸ਼ੁਰੂਆਤ ਤੋਂ ਪਹਿਲਾਂ ਜ਼ਿਲ੍ਹਾ ਪੱਧਰੀ ਐਪ ਦੀ ਵਰਤੋਂ ਸੰਬੰਧੀ ਟ੍ਰੇਨਿੰਗ

Trainings conducted at District Level before the Start of the Season regarding Application of Apps



Print media

Kisan Melas

AV clips

Field Demonstrations

Hoardings and Jingles

Awareness Vans



Action Plan for Control of Burning of Crop Residue in Punjab



Action Plan for
Control of Burning
of
Crop Residue in the State of Punjab



June, 2022
(Latest)
Govt. of Punjab

- In compliance to the directions given by CAQM, the final Action Plan Control of Burning of Crop Residue in Punjab was submitted to the Commission in July 2022
- In 2022, all departments worked in close coordination to achieve the targets prescribed in action plan
- For 2023, the action plan is under department consultation and drafting stages, and will be prepared by March 2023
- Initial/indicative aspects of the action plan for 2023 will be discussed today

**State Policy for co-firing
20% stubble in brick kilns
notified in November 2022**

**~2000 brick kilns in Punjab
expected to consume xx lac
tonnes of paddy straw**

**Small scale pelletization
plants to be co-managed by
brick kiln industries being
promoted**

**State level and district wise
orientation/onboarding of
brick kiln owners and
associations in progress**



Key components of State Action Plan 2023 (work in progress)

Decentralized planning: Each district and block preparing their plan of action – to aggregate into State Action Plan

Increased focus on ex-situ and crop diversification while continuing to cover the ground under in-situ

Incentivization of Gram Panchayats by State Government and continued behavior change to be focused upon

Monthly meetings with all stakeholder departments and district admins throughout the year



CONCLUSIONS

- **Short window period to sow next crop**
- **Burning is an easy and *no-cost option* ?**
- **Lack of awareness and sensitivity**
- **High initial and operating cost of machinery**
- **Under utilization of machinery due to its use for short span**
- **Psychological fear of delay in wheat sowing, pest/disease attack**
- **Faith in tillage system and doubts of crop establishment with full straw load**
- **Lack of high capacity paddy straw based plants (briquettes, pellets, ethanol etc.)**
- **Presence of high silica, potassium, chlorides (boilers)**
- **Competition in cost of generation of power**
- **Bio-energy plant vs. solar power plant**
- **Limited use as dry fodder due to high silica (intake, digestibility, palatability)**
- **Low density material needs lot of space for and quick decomposition during storage**

The government of Punjab has attempted to curtail this problem, through numerous measures and campaigns designed to promote sustainable management methods.

These efforts often fail due to insufficient infrastructure for residue collection, transport cost and storage facilities. Due to the large annual volume, many different uses are needed to absorb the crop residue supply.

Some progress has been made to address “crop residue Burning Issue. Obviously more efforts are needed to motivate the Farmers about the benefits of not burning !!!!!

Need policy and its strict implementation to check burning of crop residues in field-----



Discussion

Questions and clarifications...



THANK YOU



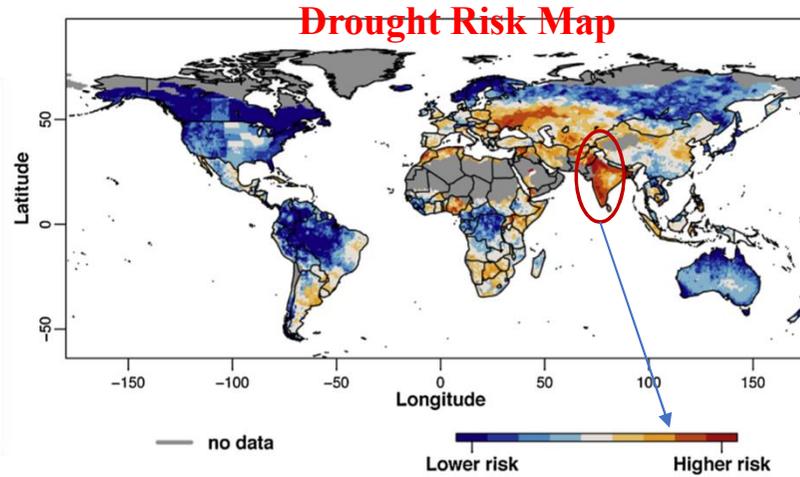
EO data for Agricultural Drought Assessment



Dr.V M. Chowdary
Group Director & Scientist/Engineer 'G'
Agricultural Sciences and Applications
Group
Remote Sensing Applications Area, NRSC
chowdary_vm@nrsc.gov.in

Drought Scenario

Global: 38% of the land area and 70% of the total population (Eslamian & Eslamian, 2017)
 India: 16% of land area in India and more than 50 million people
 During 2000-2019 several areas in India have experienced drought events.

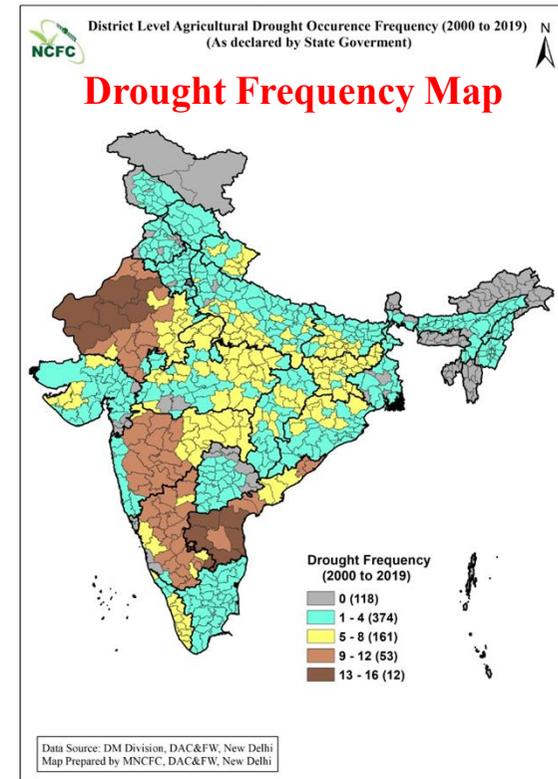


Total person affected (1901-2020) (Source: EM-DAT)

| Country | Total person affected (1901-2020) |
|----------------------------|-----------------------------------|
| India | 530,000,000 |
| China | 78,812,000 |
| Brazil | 77,141,879 |
| Ethiopia | 54,400,000 |
| Kenya | 41,982,602 |
| Thailand | 37,625,000 |
| Iran (Islamic Republic of) | 31,100,000 |
| Dem People's Rep of Korea | 31,074,486 |
| Niger | 28,278,702 |
| Malawi | |

Drought occurrences (1901-2020) (Source : EM-DAT)

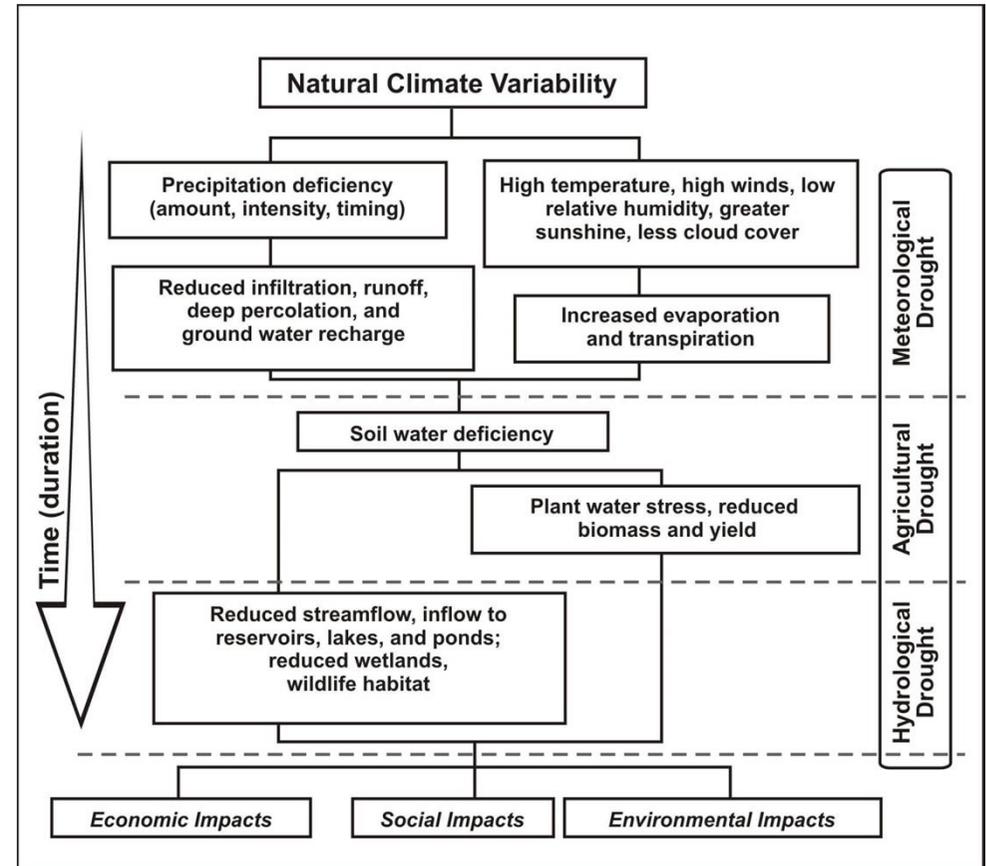
| Country | Drought occurrences (1901-2020) |
|--------------|---------------------------------|
| China | 50 |
| Brazil | 19 |
| USA | 17 |
| Ethiopia | 16 |
| India | 16 |
| Kenya | 16 |
| Niger | 16 |
| Somalia | 16 |
| Mauritania | 15 |
| Burkina Faso | 14 |



What is drought? **No universal definition**

Types of drought:

- **Meteorological drought:** due to abnormally low precipitation in the area.
- **Agricultural drought:** depletion in soil moisture levels, thereby cannot help plants to sustain.
- **Hydrological drought:** loss in water from sub-surface soil, groundwater, and reservoir.
- **Socioeconomic drought:** impact of drought conditions on supply and demand of some economic goods.



(Source: National Drought Mitigation Center, University of Nebraska-Lincoln, U.S.A.)

26 Feb. 2003

PRESENDIAN EXPRI BANGALOR

Too many borewells spell war in Chamrajnagar

With drought hitting the district for third consecutive year, demand for water is rising

By VINAY MADHAV

Bangalore Feb 25: Chamrajnagar farmers seem to be caught between the devil and the deep sea. Open wells in the district are dead and forgotten. The water table in areas that are not connected to canals is also dipping fast. An abundance of borewells in Chamrajnagar has become a curse. Most of the borewells in South Kanara are facing severe depletion. The age during recession and the irrigated fields in the district are facing a threat of salinity.

and around 5,700 borewells dug by the district are used for irrigation, production of water. With the water table dipping fast, the borewells are becoming a curse.

Environmental Impacts

Agriculture here depended on rain, which was about 730 mm every year. A decade ago, borewells came in handy for farmers and horticulturists here. However, now alarm bells are ringing, as the ground water aquifers have started depleting. At the moment, there are an estimated 40,000 irrigation borewells in the district.

700 borewells in the district, open wells are being forgotten," said the Agriculture Department Director Shivaraj. "You can grow anything in this district, provided you have water. With no other economic activity, people are forced to explore new water resources," Shivaraj explains.

100,000 DROUGHT HIT

SUPREME COURT THAT 2,55,900 VILLAGES IN 254 DISTRICTS OF 10 STATES FACE WATER CRISIS, GETS RAPID RESPONSE FOR SLEEPING OVER THE ISSUE

drought
farmer
dam
project
govern
monsoon
affect
crop
pradesh
produce
need
people
severe
centre
latur
time
official
resource
area
nagaminister
last
drink
sugarcane
crisis
make
tankernation
ever
rain
level
applies
crore
worst
dry

Social Impacts



Economic Impacts

Mumbai, May 10: In more bad news for the drought-hit Marathwada, only two per cent water is left in dams in the parched region, while 15 per cent is left in the state, a meeting of Maharashtra Cabinet was informed here today.

and 25 per cent in the entire Maharashtra at this time last year. Water is being supplied to 10,500 villages and hamlets through 5,159 water tankers, an official said. Altogether 397 cattle fodder camps are now operational in Beed.

of drought Marathwada in the past five years. Each of its 8,522 villages have been affected for two consecutive years. Latur in Marathwada

Centre was the next instalment would be due states utilised it is inadequate, steps to provide help under National Calamity Contingency Fund, he said. Regarding the demand for waiving and writing off loans, he said he was in the process of discussing the matter with the finance minister as it involved much wider arena and different authorities. Singh said the Centre had already held a stock-taking meeting with agriculture and relief ministers of 12 drought-affected states, at which it was decided to ask Nabard and co-operative agencies to postpone

the 'food for work' programme to states facing acute resource crunch. Stating that food output would be adversely affected due to drought conditions caused by poor monsoon, Singh said substantial damage had already been caused to coarse cereals like bajra, oilseeds and pulses. Paddy prospects would also be affected, though it may recover to some extent if rainfall takes place in the next 10 days, he said. On the criticism that the meteorological department had failed in forecasting monsoons, he said there were so many variables in this science that it was not always possible to be accurate. Singh expressed confidence that there would be no starvation anywhere due to drought and other

INDIA TODAY

WHAT'S WRONG WITH THE WEATHER

- Monsoon failure leads to drought in two-thirds of India
- Eastern Bihar gets twice the average rainfall causing floods
- Rising temperatures are drying the source of the Ganga

Drought impact is an observable loss or change at a specific time because of drought

This is the fourth year western Maharashtra.

National Agricultural Drought Assessment and Monitoring System (NADAMS)

- District level/sub district drought monitoring - 17 states: NRSC operationalized the methodology at MOAFW
- Implementation of drought manual 2016
- Satellite based indices, Rainfall data, Ground information on Sowing progression and Irrigation Statistics are used for drought assessment
- **Drought Warning (Normal, Watch & Alert) is given in June July & August, while Drought Declaration (Mild, Moderate & Severe) in September & October**

Crop Weather Watch Group (CWWG)
(Department Of Agriculture & Farmers Welfare)

Agencies involved with Drought Monitoring/ Management in India

Ministry of Agriculture & Farmers' Welfare

- Overall coordination, Inter-Ministerial Crop Weather Watch Group (CWWG), Leading IMCT for Drought Assessment

India Meteorological Department

- Weather Forecasting, Drought Assessment using Rainfall

Central Water Commission

- Monitoring Storage situation in Major Reservoirs

MNCFC, DACFW and ISRO

- Space technology based drought assessment (NADAMS)

ICAR

- Contingency planning

DOLR/ MOWR/DACFW

- PMKSY-Watershed Development-Water Harv. Str. /Irrigation/Use efficiency

National Institute of Disaster Management

- Capacity Building

Drought: INDICATORS versus INDICES

Indicators:

Variables or parameters used to describe drought conditions (Ex. P, T, streamflow, groundwater levels, reservoir levels, soil moisture)

Indices:

Typically computed numerical representation of drought severity, assessed using climate or hydrometeorological inputs including the indicators

Approaches for monitoring drought:

1. Using a single indicator or index
2. Using multiple indicators or indices
3. Using composite or hybrid indicators

Selection of indicators and indices: Key questions?

to determine drought onset, termination and various severity levels?

- Sensitivity to climate, space and time
- Are the chosen indicators, indices and triggers the same, or different?
- Availability of long period of record
- Are the indicators/indices easy to implement

Leading solutions of early warning systems worldwide

- US Drought Monitor
- European Drought Observatory (EDO)
- GEO Global Agriculture Monitoring Project (GEOGLAM)
- Soil Moisture Data viewers
- Global Agricultural Drought Monitoring and Forecasting System
- Earth Observation Monitor (EOM)
- Experimental African Drought Monitor
- Global Integrated Drought Monitoring and Prediction System (GID-MaPS)
- Agriculture Stress Index System (ASIS)

Monitoring indices: SPI, NDVI, VHI, SPEI and focus more on hazard

Mandatory Indicators

Triggar I

Rainfall Related Indices

- Actual Rainfall
- Normal Rainfall
- Rainfall Deviation /SPI
- Dry Spell

Filed verification

- Real time field visits
- Validation of drought assessment
- GT in 5 sites, each, of 10% of Villages

Impact Indicators

Triggar II

Satellite based Vegetation Indices

- NDVI (Normalized Difference Vegetation Index)
- NDWI/LSWI
- VCI of NDVI
- VCI of LSWI

Moisture based Indices

- MAI (Moisture Adequacy Index)
- PASM (Percent Available Soil Moisture)

Hydrological Indices

- RSI (Reservoir Storage Index)
- GWDI (Ground Water Drought Index)
- SFDI (Stream Flow Drought Index)

Crop planting/sowing status (manual collection)

- Area under crops

Criteria for declaration

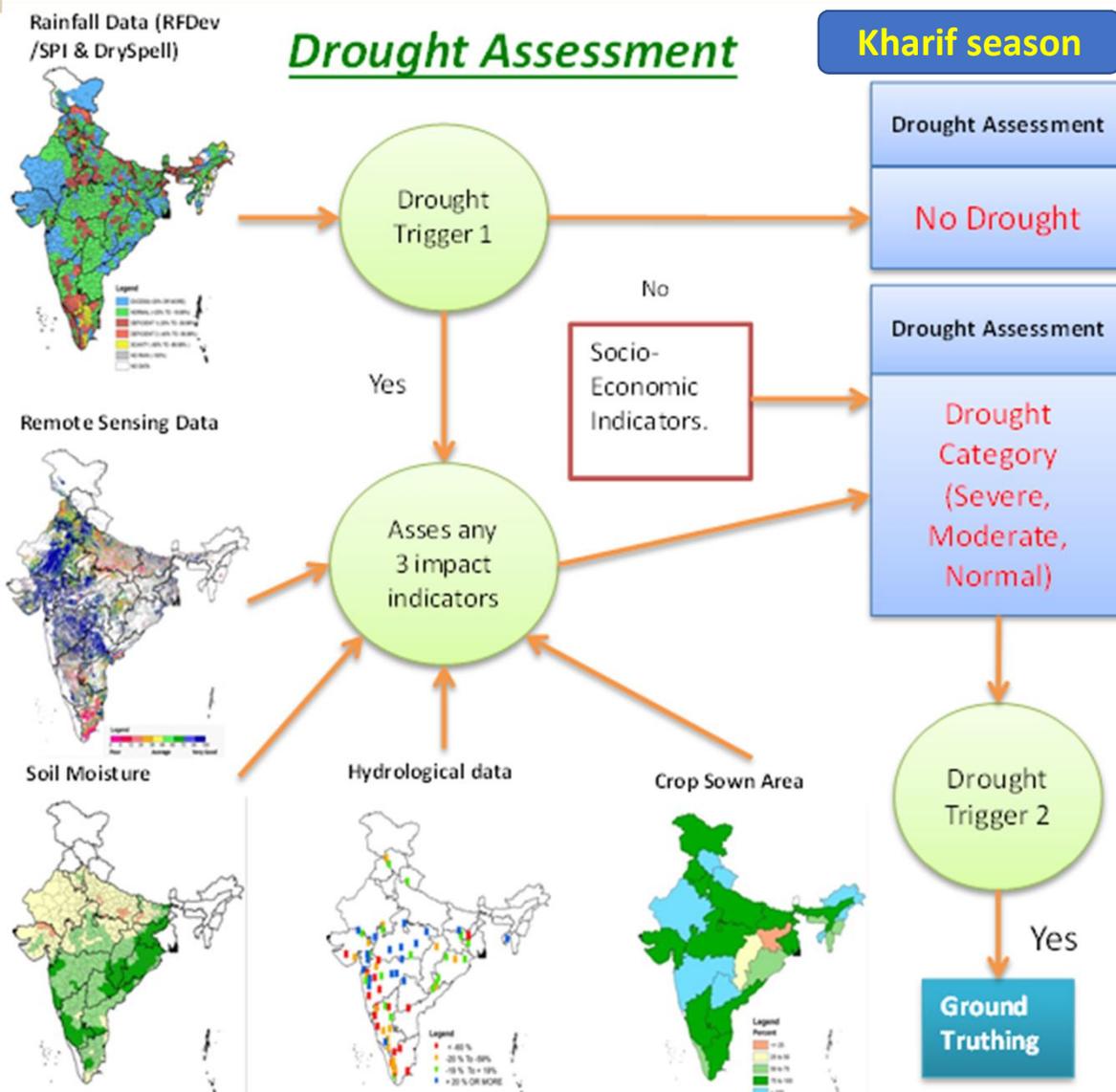
3 to 4 of 6 impact indicators are to be satisfied

- **Severe drought:** if two of the selected 3 impact indicators are in Severe category and 1 is in Moderate category
- **Moderate drought:** (i) if two of the selected 3 impact indicators are in 'Moderate' class. (ii) if two of the selected 3 impact indicators are in severe and 1 is in Normal category

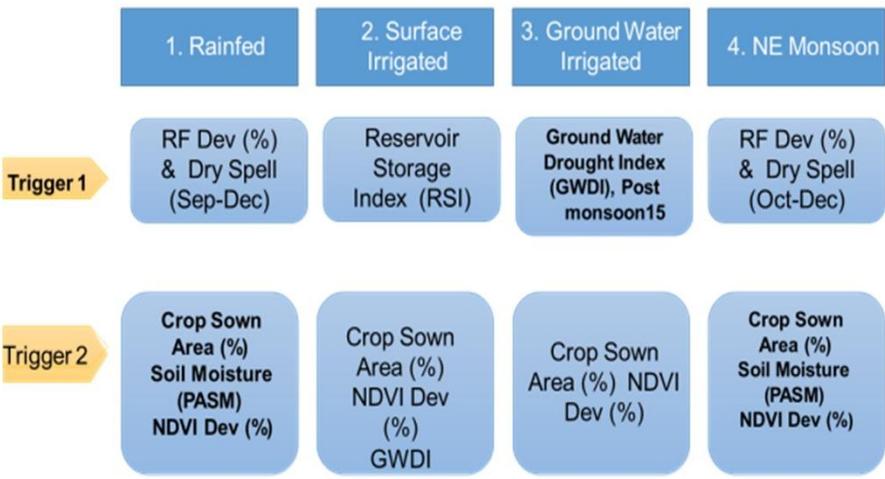
Key Variables, Indicators and source of Data for drought monitoring

| S.I. No. | Key Variables | Indicators/Index | Source of Data |
|----------|--------------------------------|--|--|
| 1. | Rainfall | Rainfall Deviation/SPI/Dry Spell | IMD District level weekly |
| 2. | Crop Sown Area | Deviation from Normal | MODIS (250m), PROBA-V(330m) fortnightly NDVI products |
| 3. | Satellite Based Crop Condition | NDVI, NDWI Deviation from Normal VCI of NDVI/NDWI | Satellite derived fortnightly NDVI products of Resourcesat -2 AWiFS (56m), MODIS (250m) |
| 4. | Soil Moisture | Percent Available Soil Moisture | Water Balance model developed by NRSC (Input: NOAA CPC Rainfall, Global PET) |
| 5. | Reservoir Levels | RSI | CWC |
| 6. | Ground Water | Ground Water Drought Index | Post Monsoon Groundwater Data from Central Ground Water Board |
| 7. | Irrigated Area and sources | Rainfed and irrigated area | DES/State Govts. |

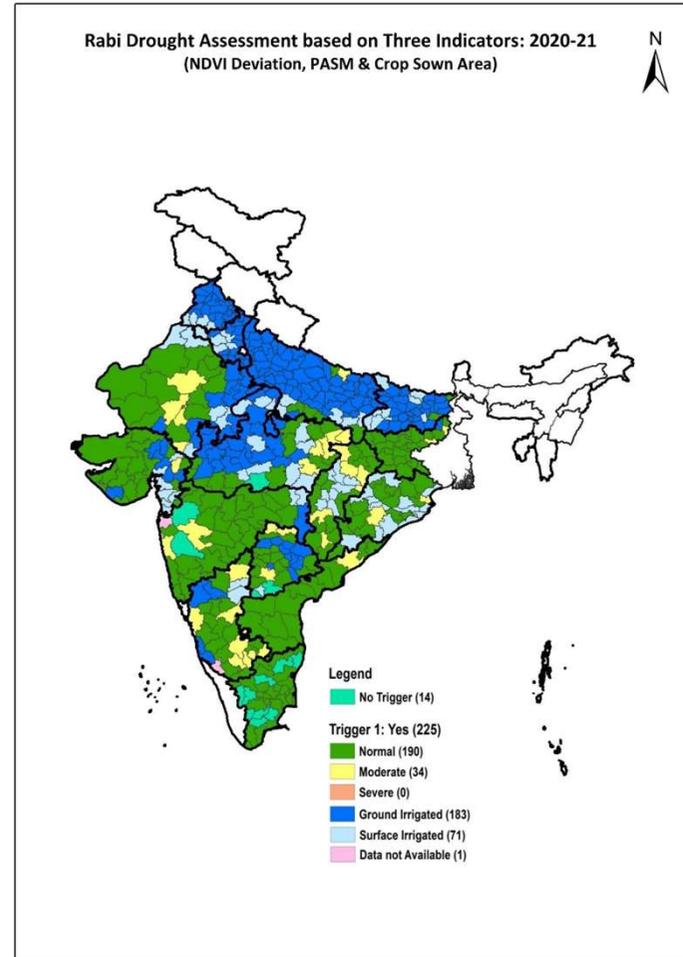
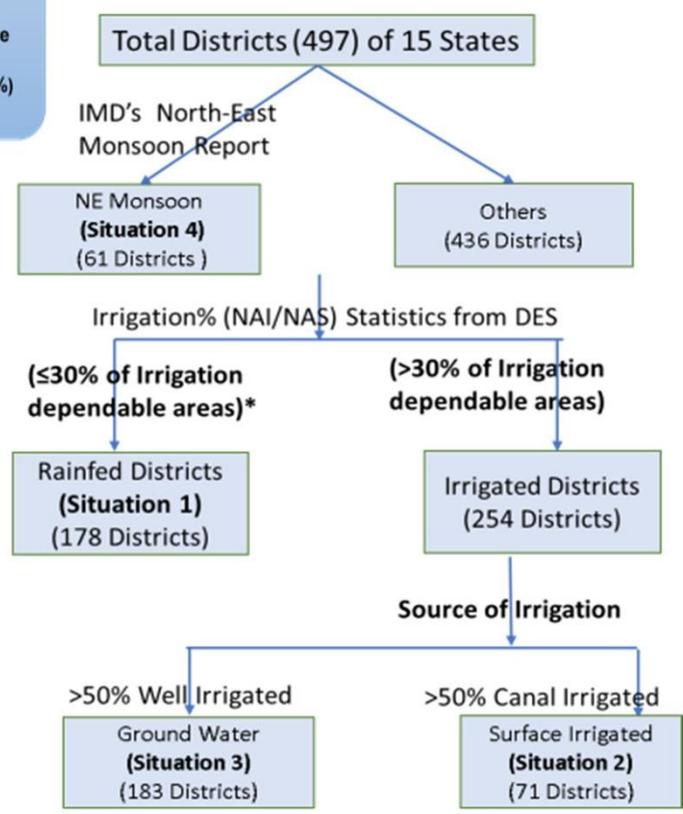
NADAMS



Rabi drought assessment for different crop situations



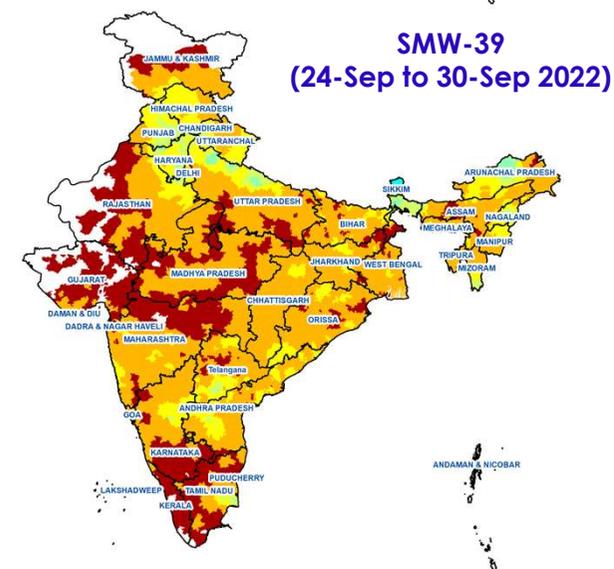
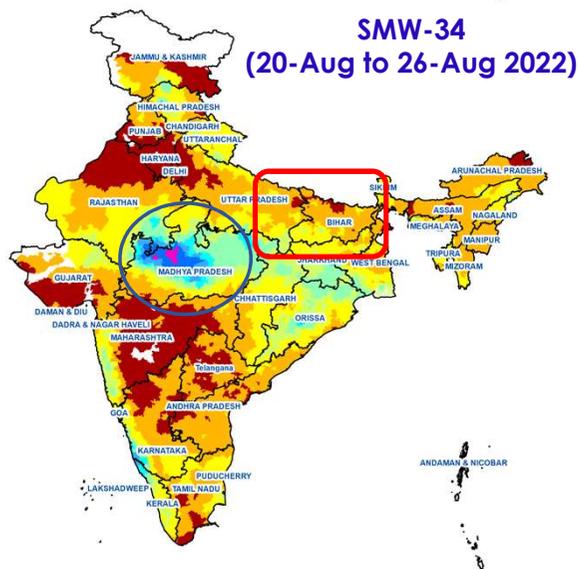
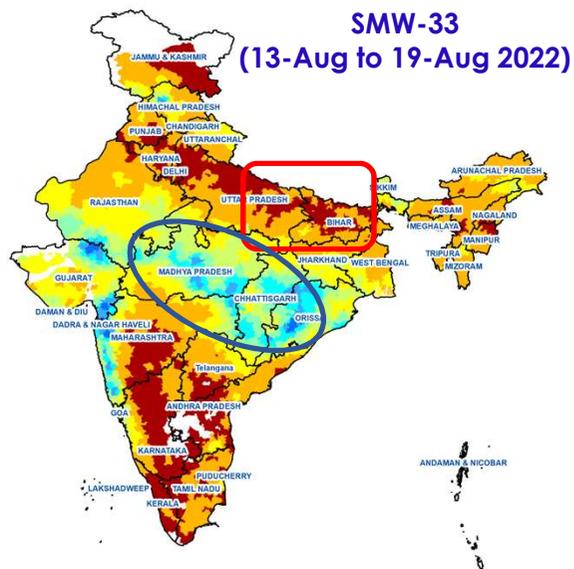
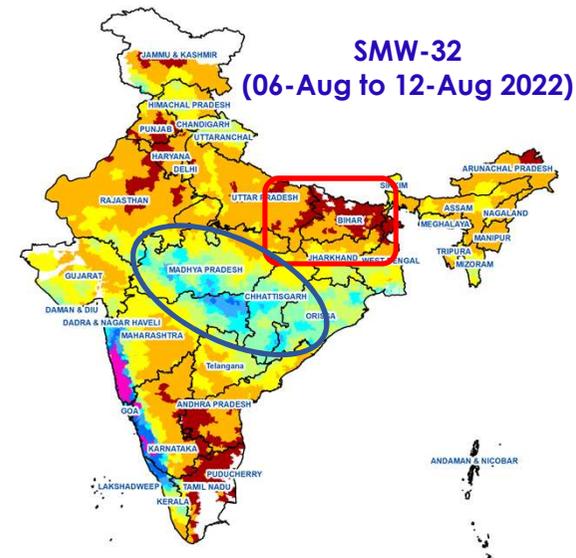
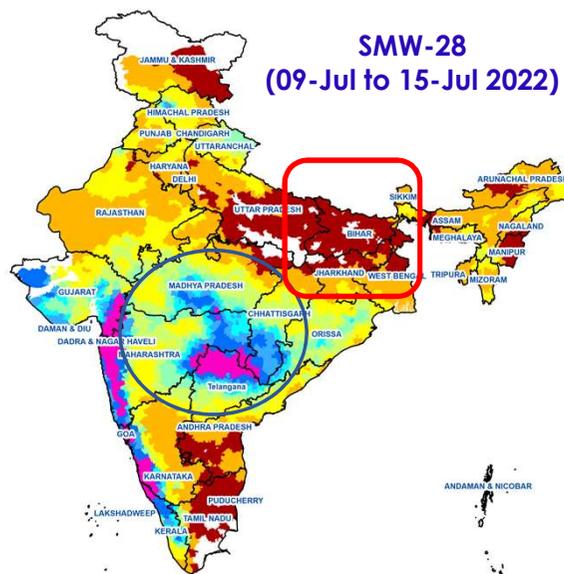
Cropping Situations



Weekly Cumulative Rainfall (kharif 2022)

- Derived from 0.25 Deg gridded IMD daily rainfall data
- Averaged to sub-districts of India

- Significant higher rainfall observed in MP, Mah, Telanagana
- Scanty rainfall observed in UP, Bihar, Jharkhand and parts of west Bengal



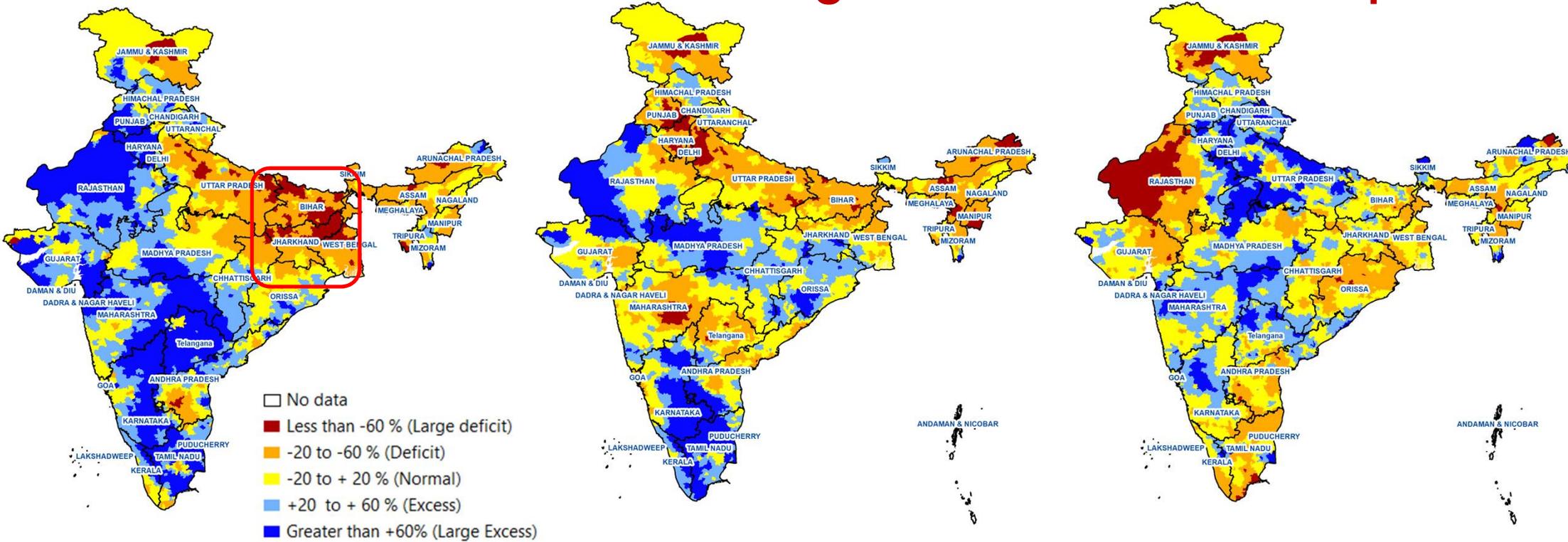
- No rainfall/ No data
- Less than 10 mm
- 10 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- 250 - 300
- 300 - 400
- More than 400 mm

Rainfall deviation from the Normal (Monthly)

Jul 2022

Aug 2022

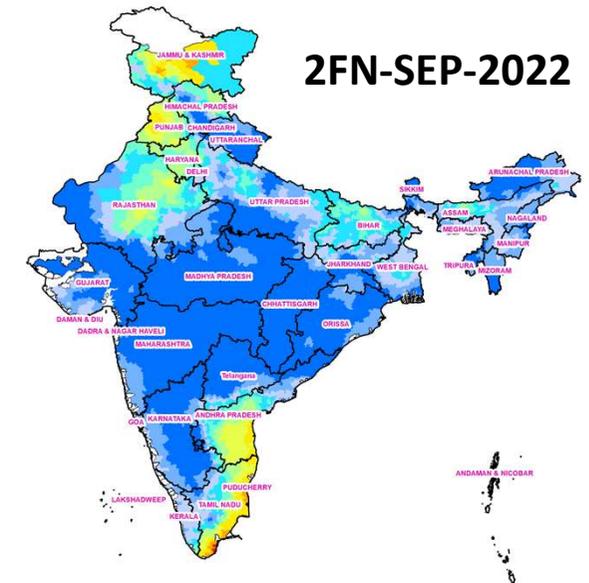
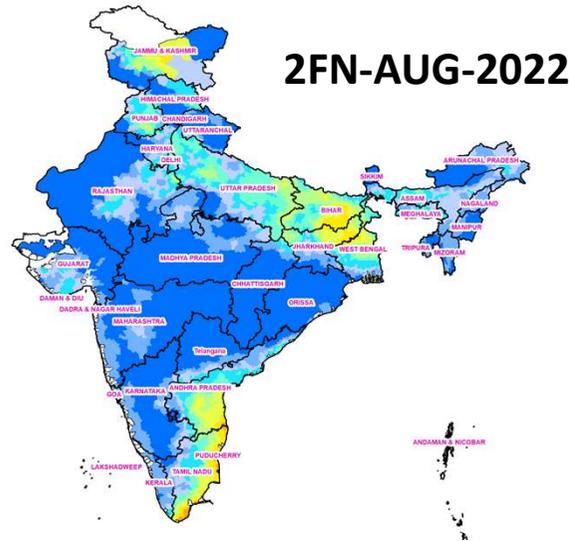
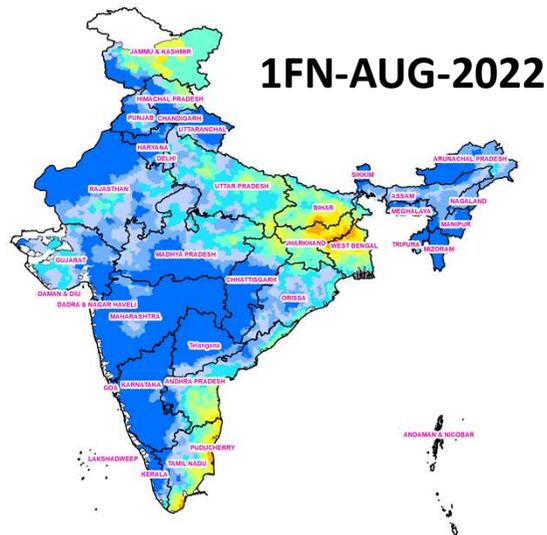
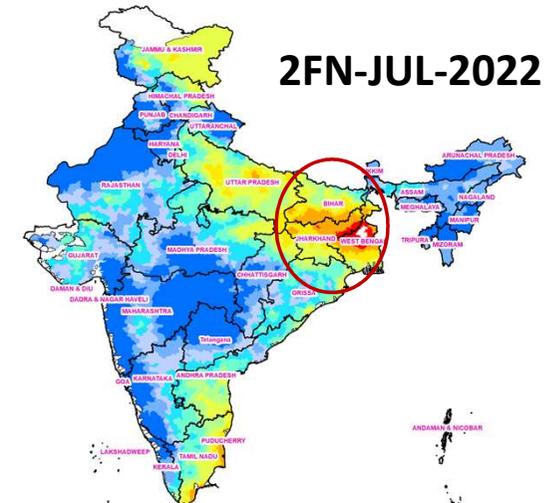
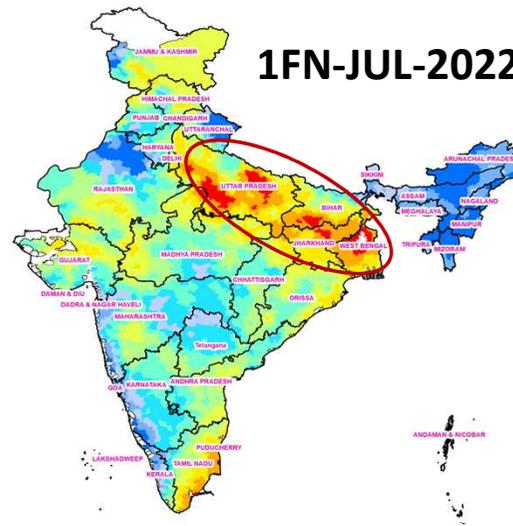
Sep 2022



Root zone Soil Moisture Index (SMI)

(Fortnightly averaged)

- Derived from SMAP L4 Global 3-hourly 9 km gridded Root Zone Soil Moisture (rzsm) Data
- Daily averaged rzsm converted to SMI by normalizing with long term max and mean for each pixel

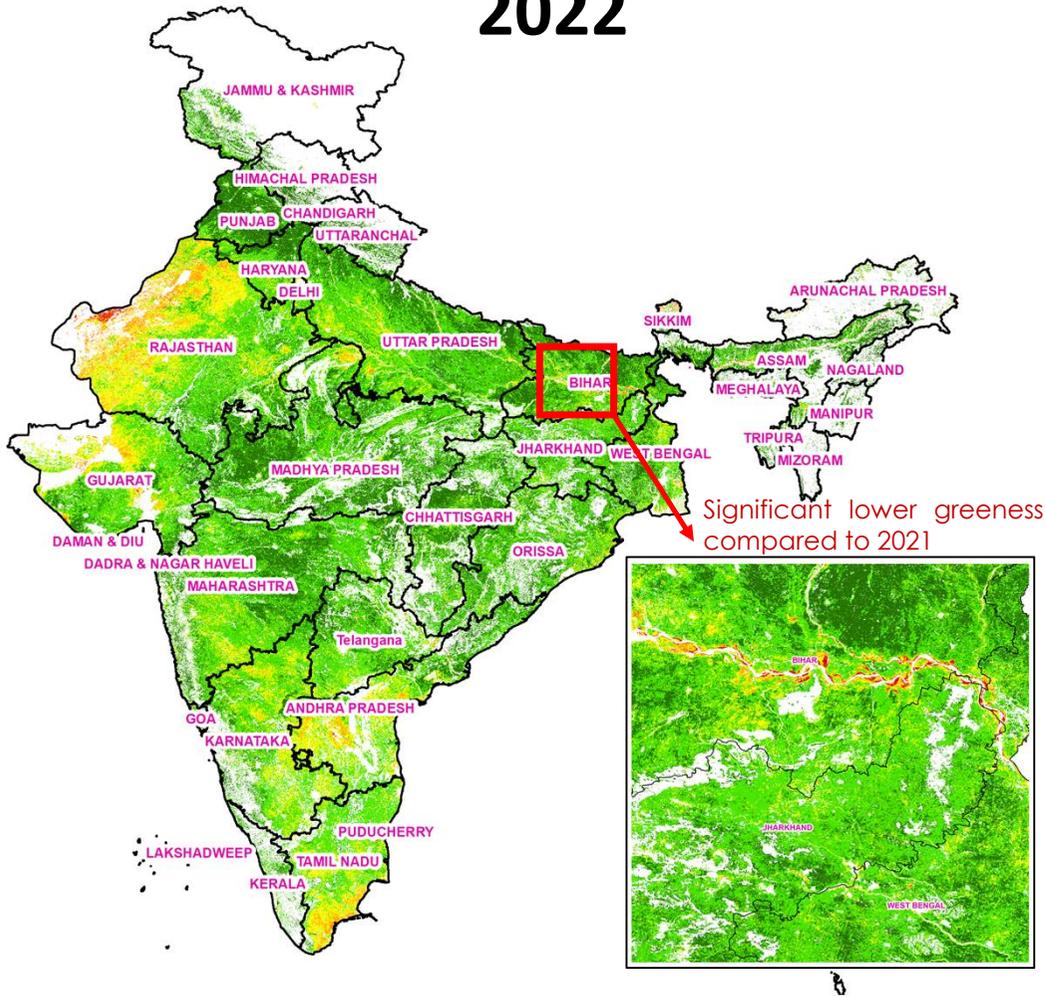


- No Data
- SMI < 10 %
- 10 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 80
- 80 - 90
- SMI > 90 %

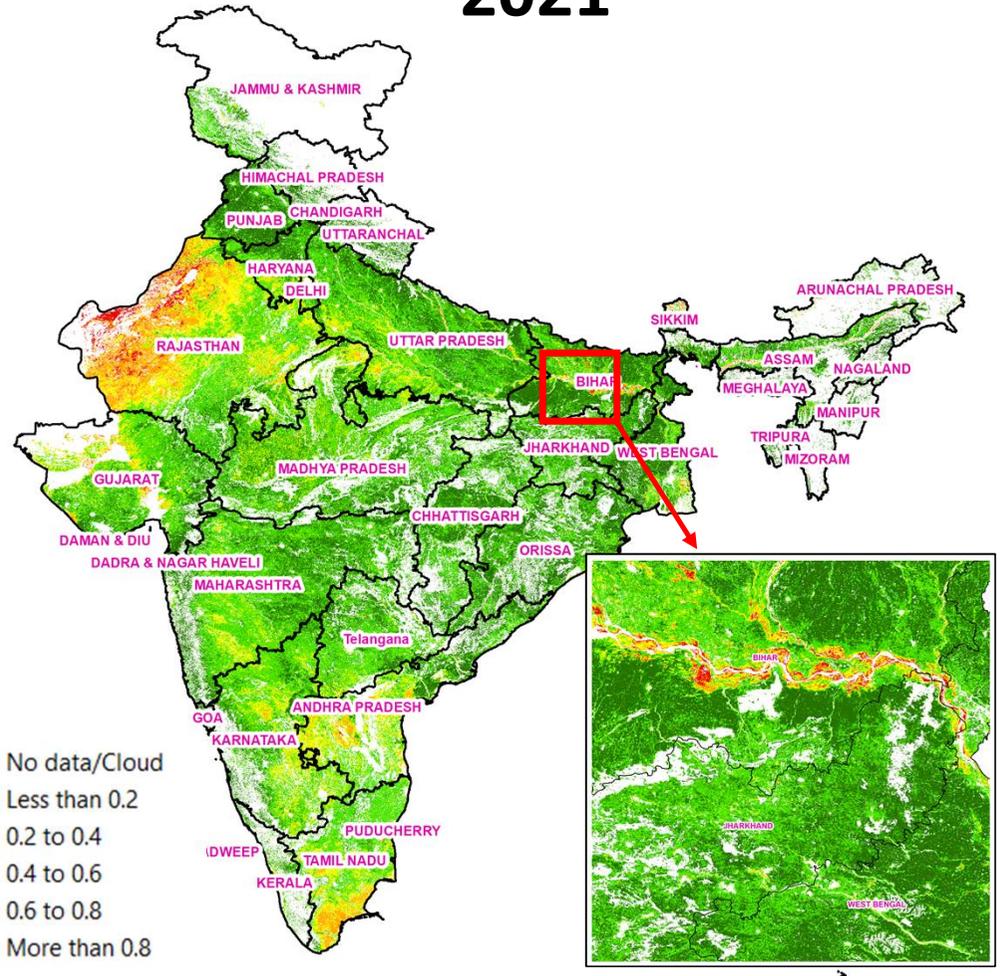
NDVI (MODIS 250m)

(Maximum composite Aug to Sep)

2022

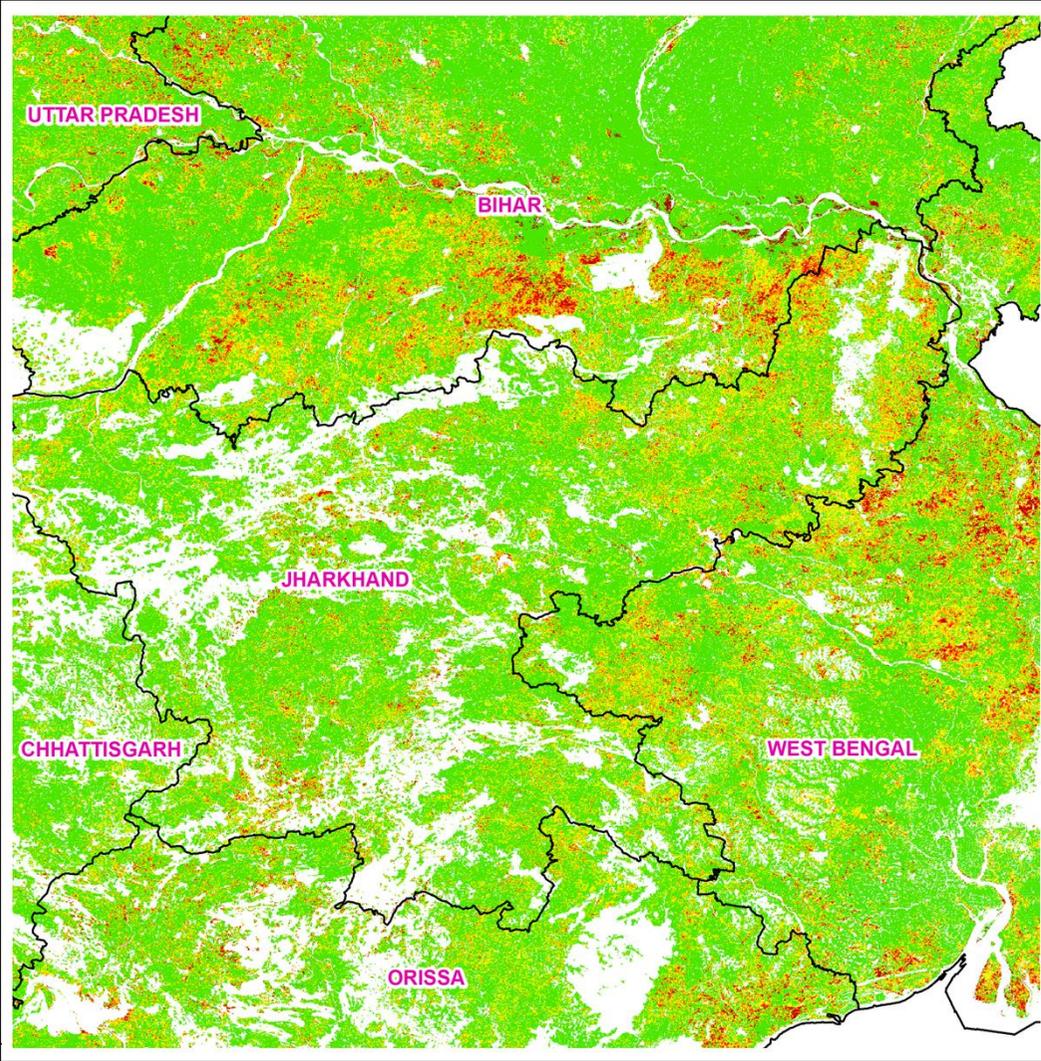
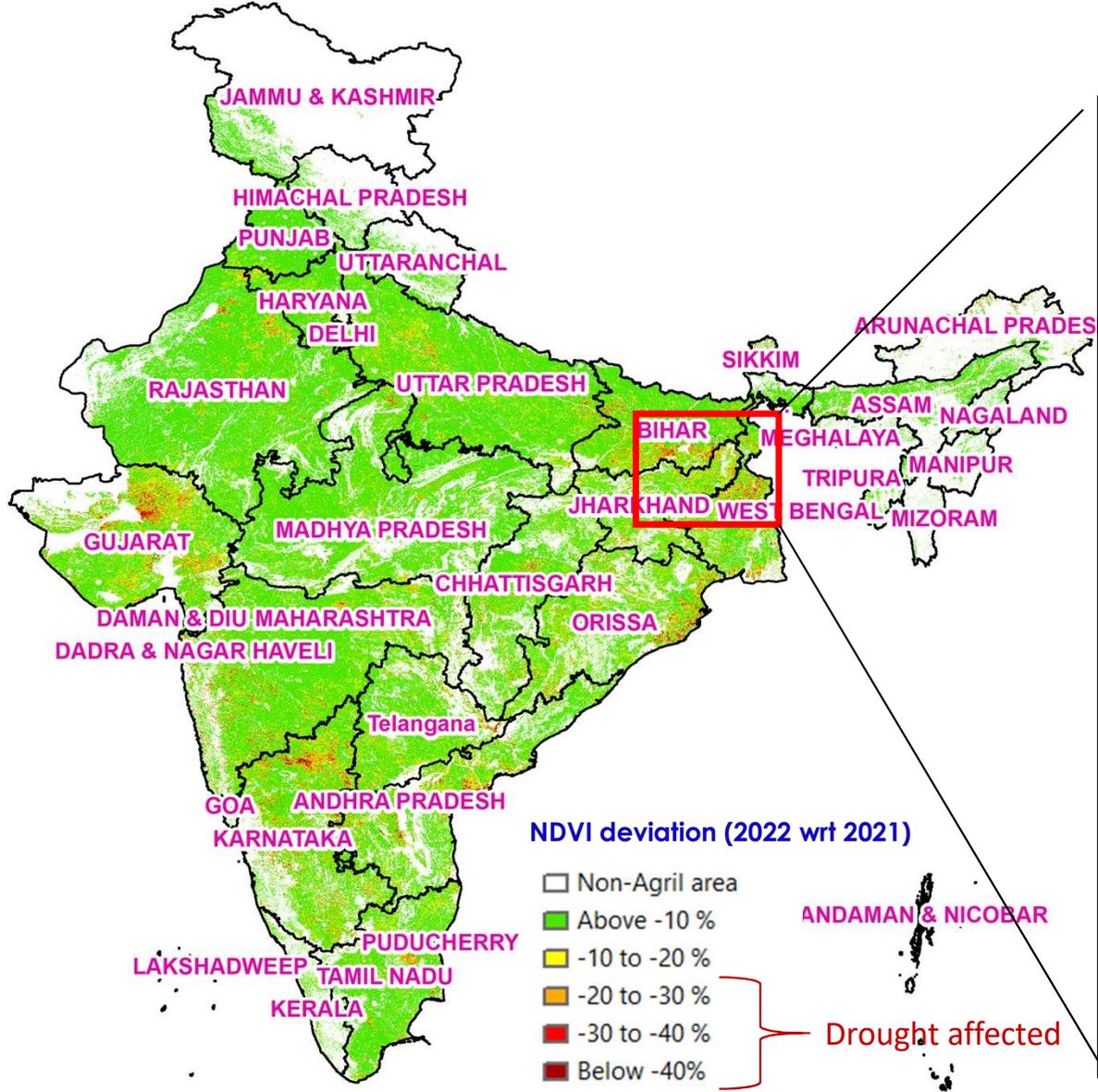


2021



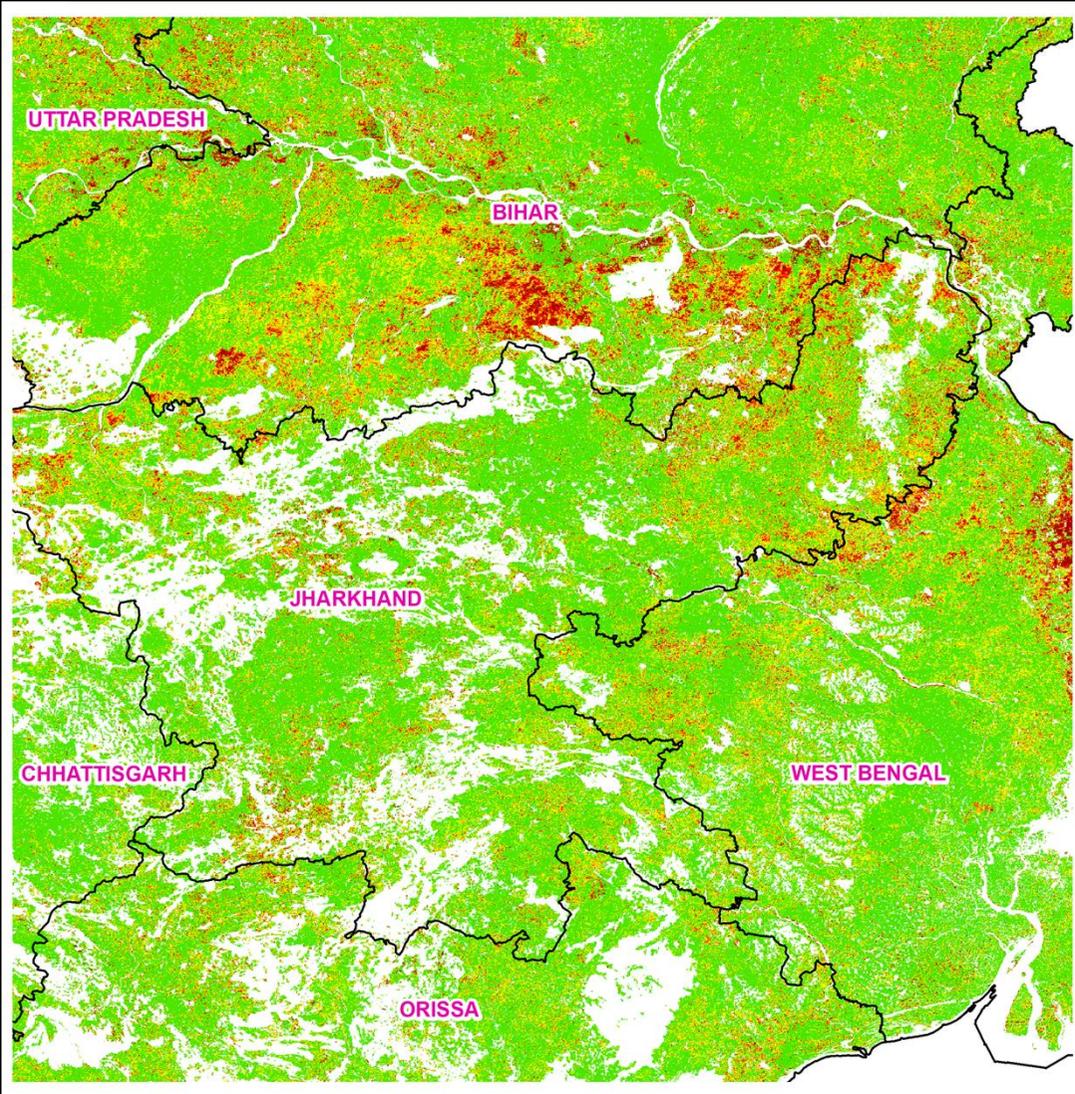
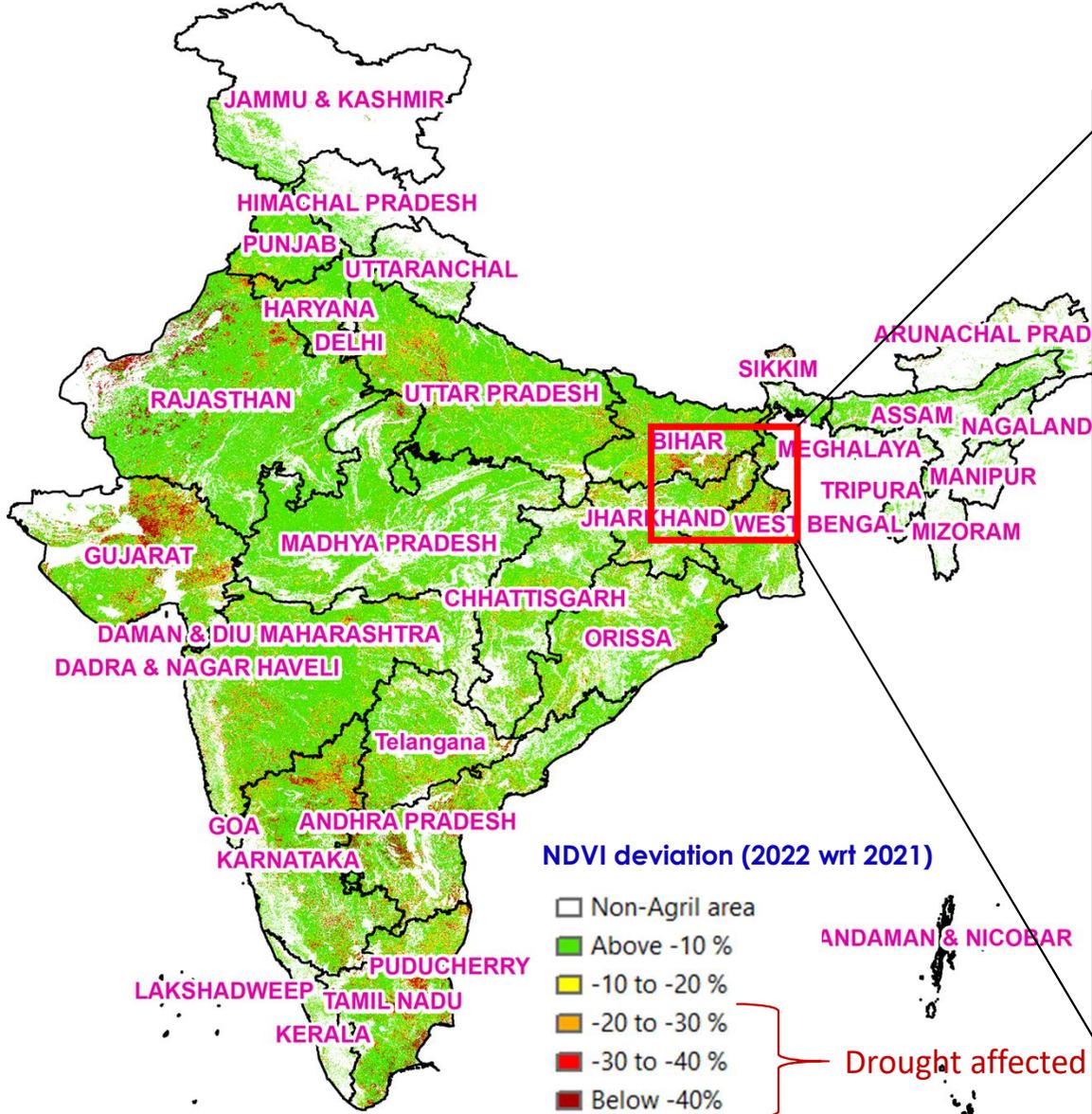
NDVI Anomalies

(% deviation from 2021)



LSWI Anomalies

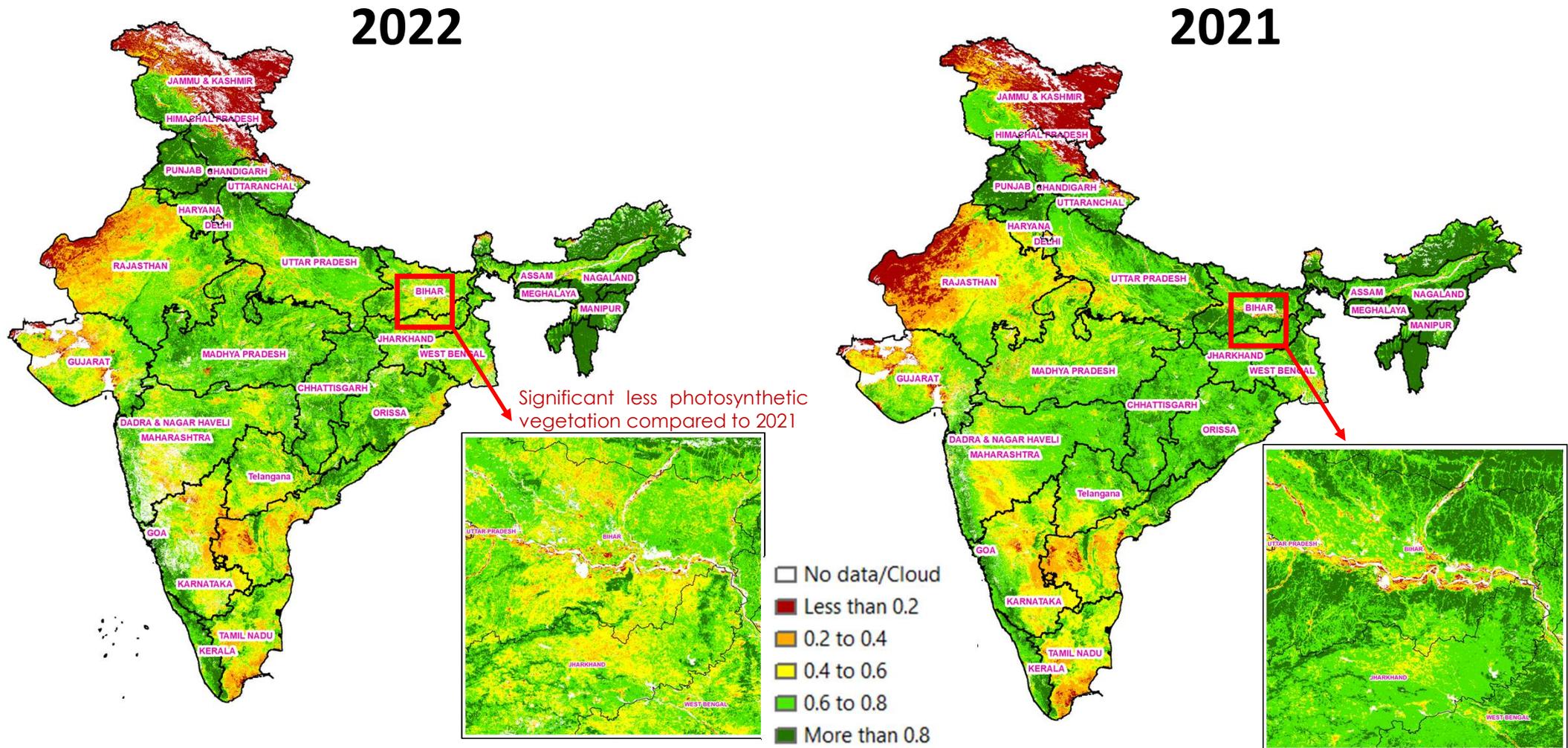
(% deviation from 2021)



Fraction of absorbed PAR (FAPAR)

(Maximum composite Aug to Sep)

➤ FAPAR (300 m) derived from Sentinel-3/OLCI, PROBA-V from Copernicus global land service



Assessment of Agril. Drought (kharif 2022)

Drought manual criteria over the above blocks

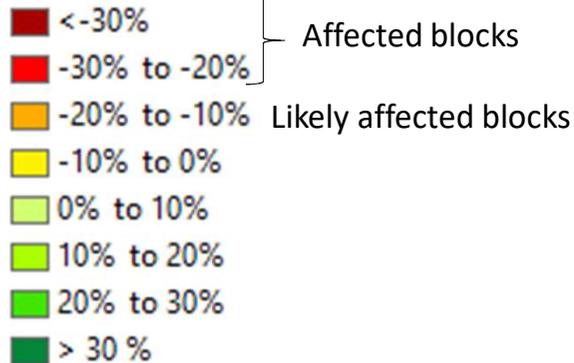
Mandatory indicator - rainfall

- District wise data of IMD satisfied
- Block wise rf data with State to be checked

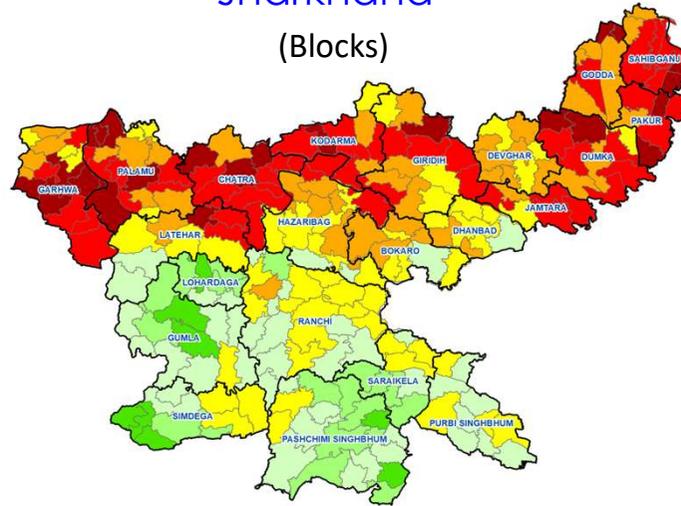
Impact indicators –

- NDWI/LSWI deviations - satisfied
- root zone soil moisture - satisfied
- Crop sown area data is to be checked
- Ground water data is to be checked
- Hydrological indices data to be checked

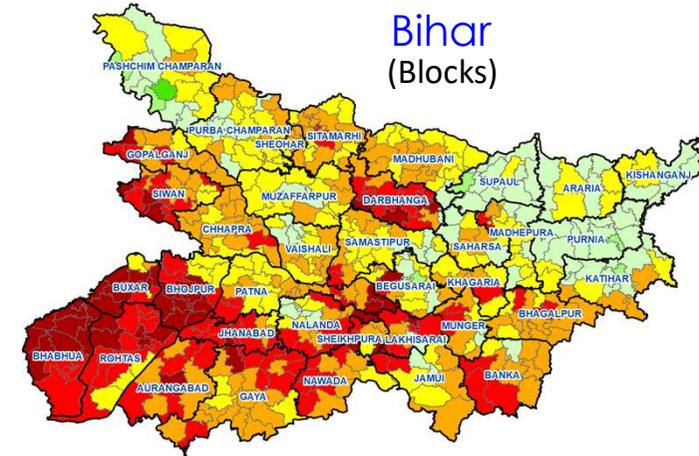
% Dev. of LSWI/NDWI from normal



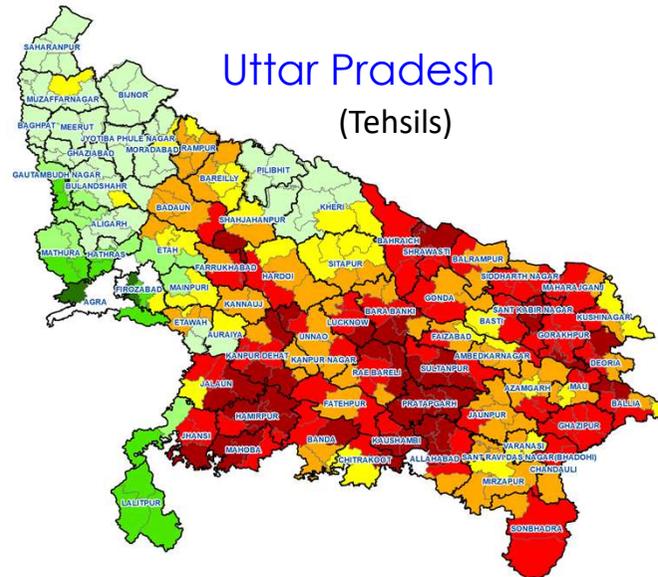
Jharkhand
(Blocks)



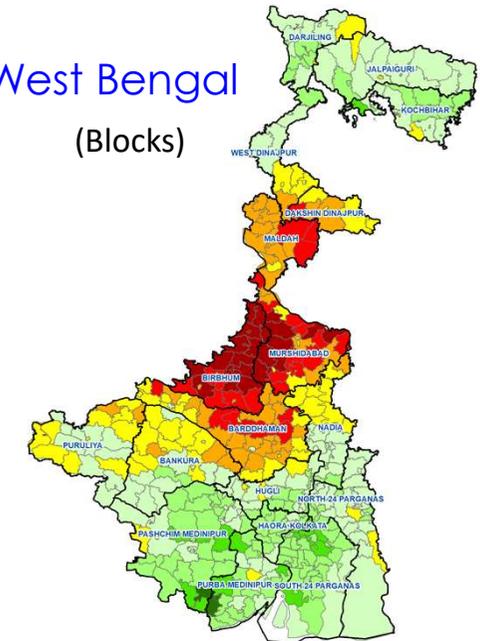
Bihar
(Blocks)



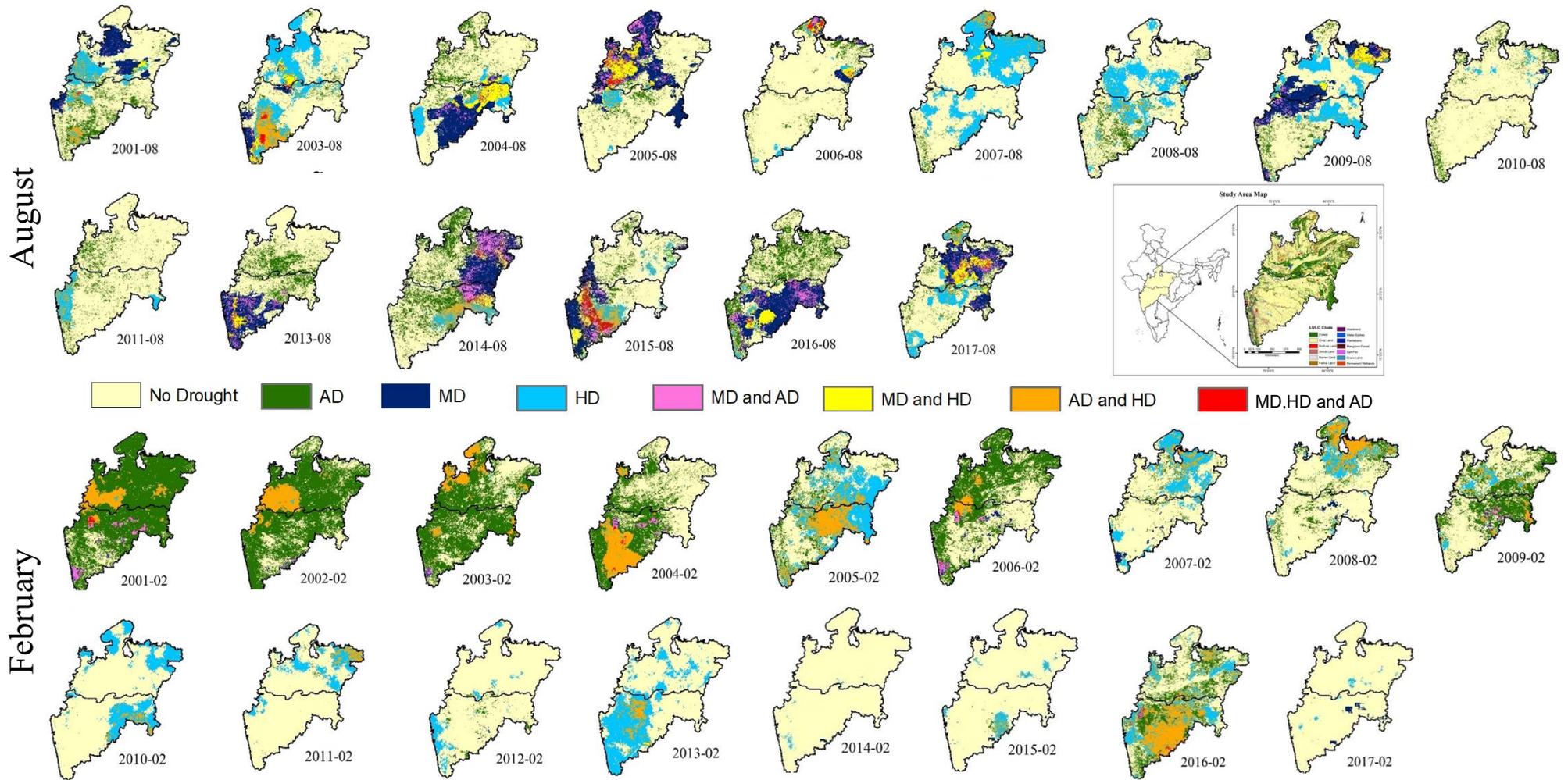
Uttar Pradesh
(Tehsils)



West Bengal
(Blocks)



AREA VULNERABLE TO MULTIPLE DROUGHTS



➤ All of the 3 droughts: Pune,Nashik(2003), Indore and Ujjain(2005),Chambal(2006), Pune,Nashik and Aurangabad(2015)

Way Forward:

- **Granularity**
- Drought Forewarning
- **Drought proofing at micro level**
- **Ingesting Satellite Precipitation gridded products (SPPs) (TRMM, CHIRPS, GPCC, PERSIANN _CDR, IMERG-GPM,INSAT)**
- **Downscaling of SPPs using co-factors that include bio-physical (Vegetation Index, LST), Elevation, geolocation, aspect and slope) and ML**



Thank You

Advances in Forest Fire Research using Geo-informatics

Earth Observation for Forest Fire Risk & Forest Fire Spread Modelling

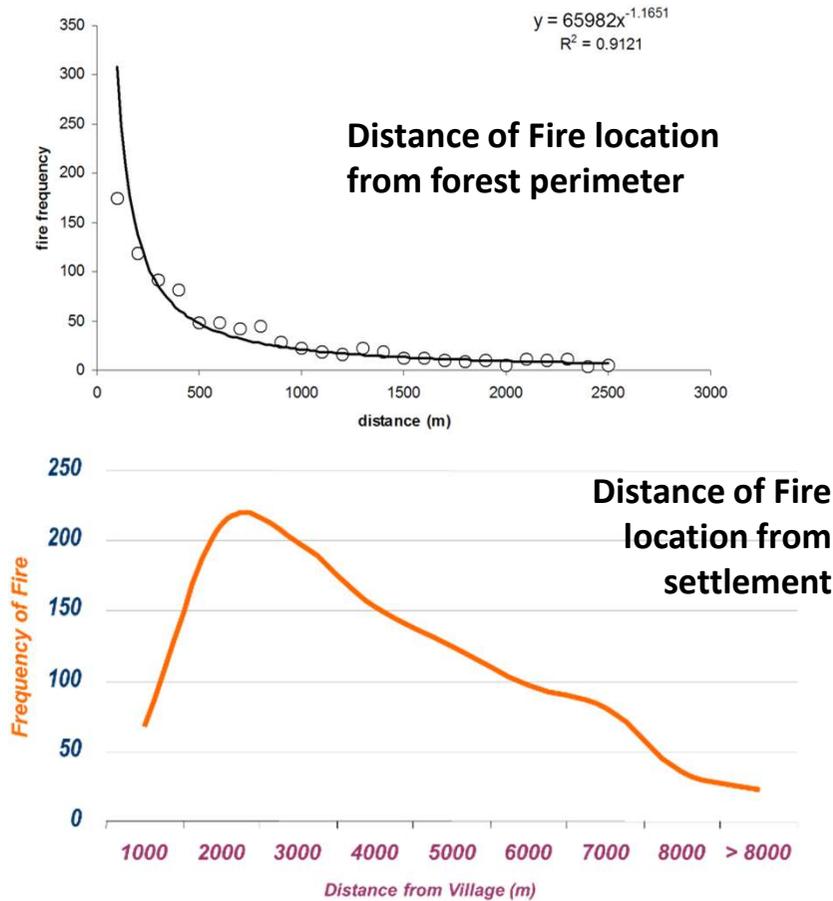


Arijit Roy

Indian Institute of Remote Sensing

Indian Forest Fires: Anthropogenic activity

Almost 95% of Forest Fires are caused by Humans

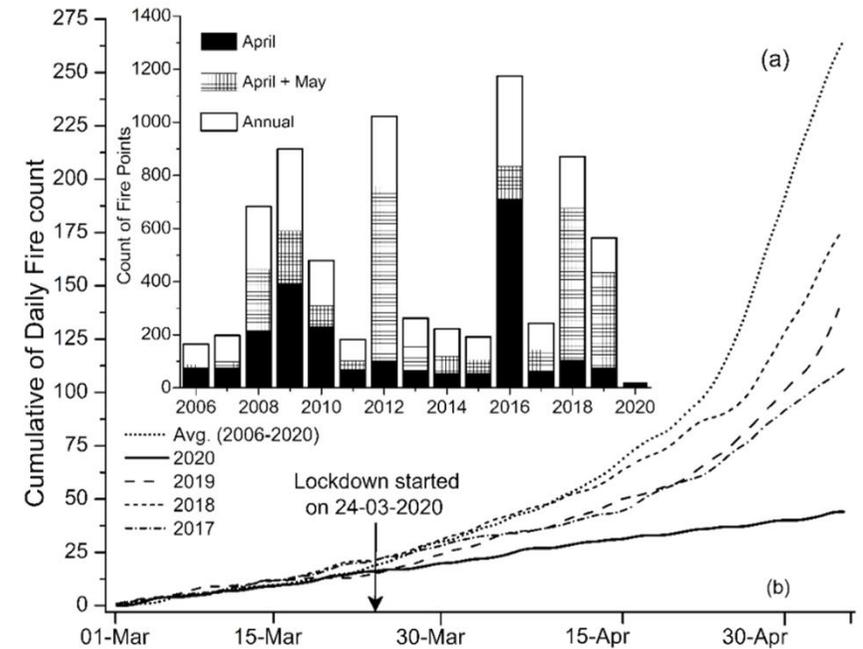


RESEARCH COMMUNICATIONS

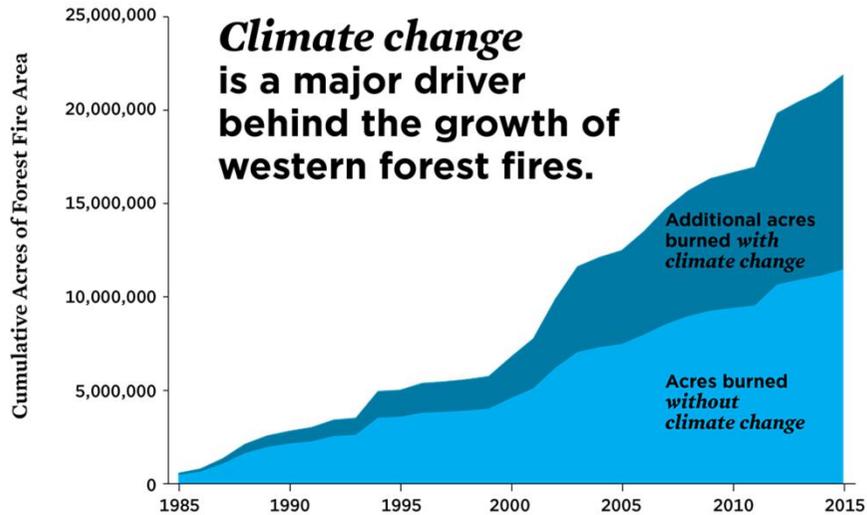
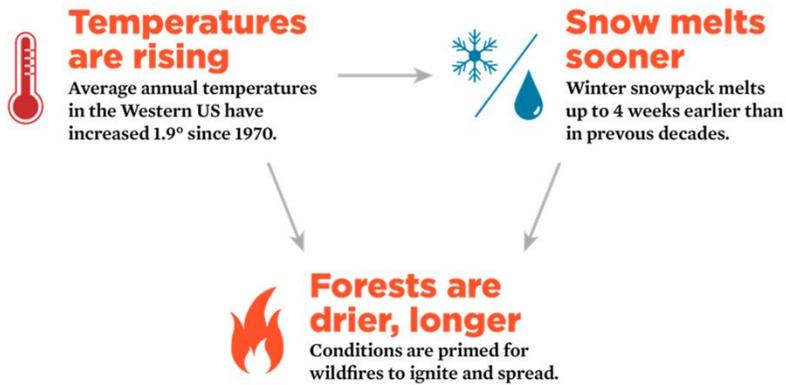
COVID-19 lockdown a window of opportunity to understand the role of human activity on forest fire incidences in the Western Himalaya, India

Amitesh Gupta, C. M. Bhatt, Arijit Roy* and Prakash Chauhan

Indian Institute of Remote Sensing,
Indian Space Research Organisation, 4, Kalidas Road,
Dehradun 248 001, India

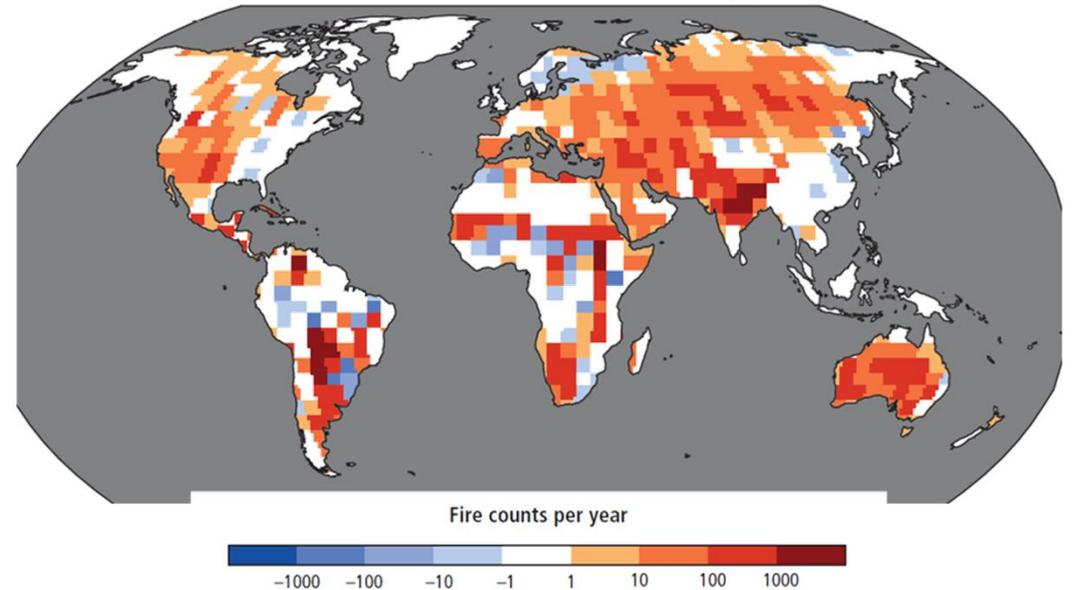


Climate Change and Forest fire



Large Global Forest Fire Increase at 1.8°C Warming

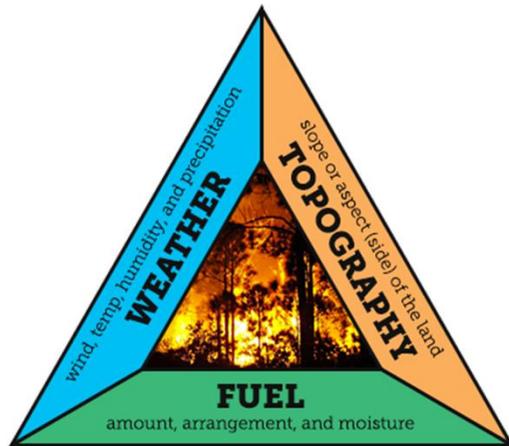
Global mean from 1850



IPCC AR5 WG2 Figure 4-6 | Projected changes in meteorological fire danger, fire probability, and fire frequency

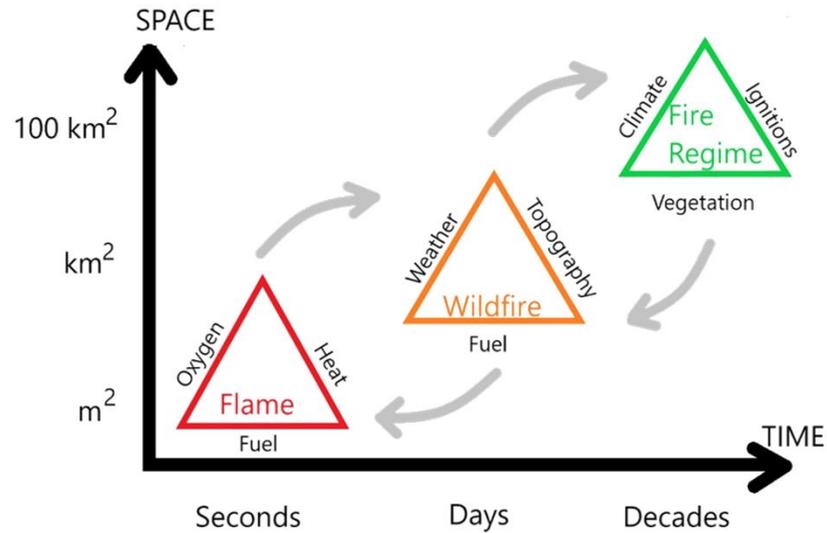
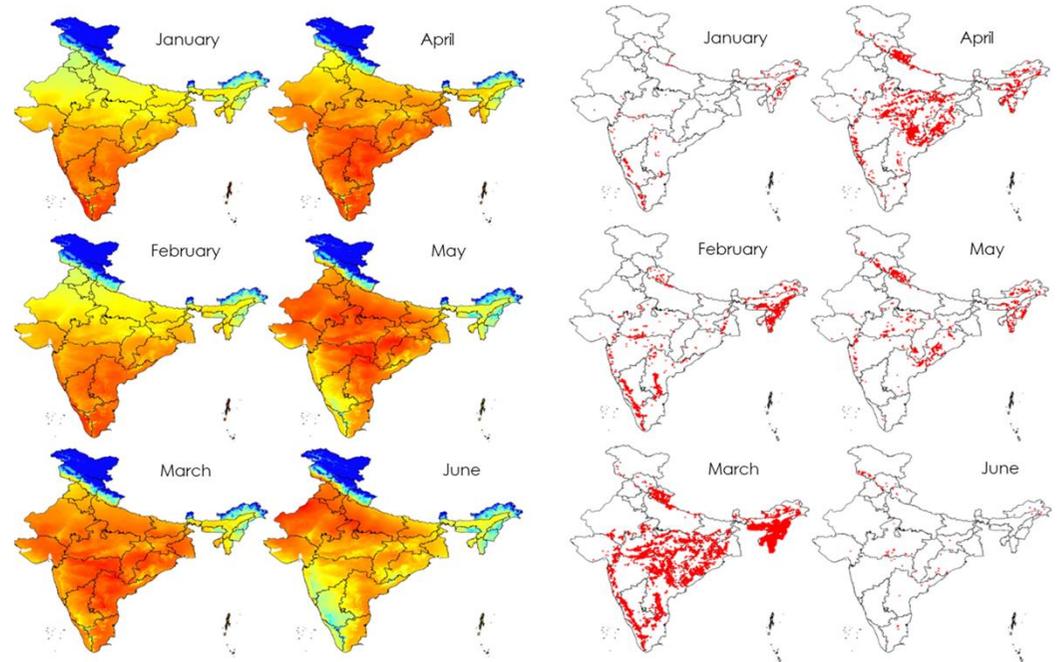
Global warming has shown to result in increased forest fire incidences across all continents

Science of Forest Fire



Fire Behavior Triangle

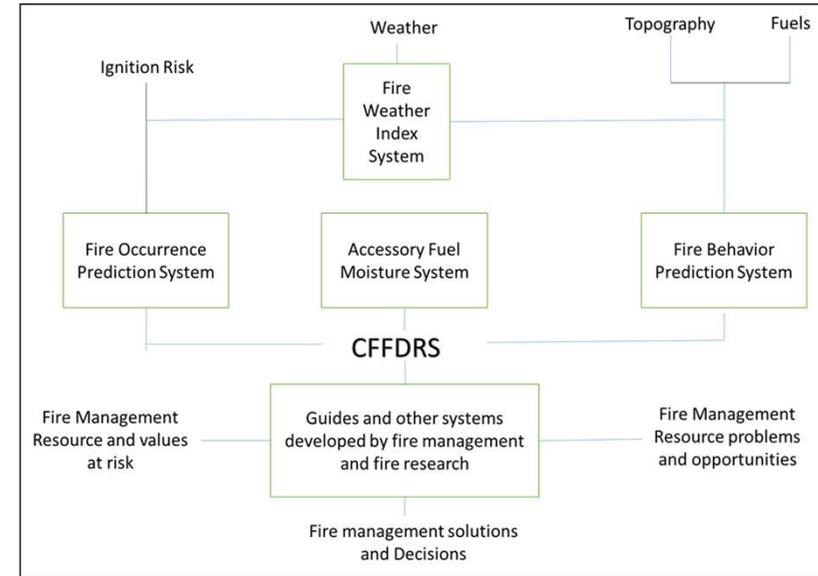
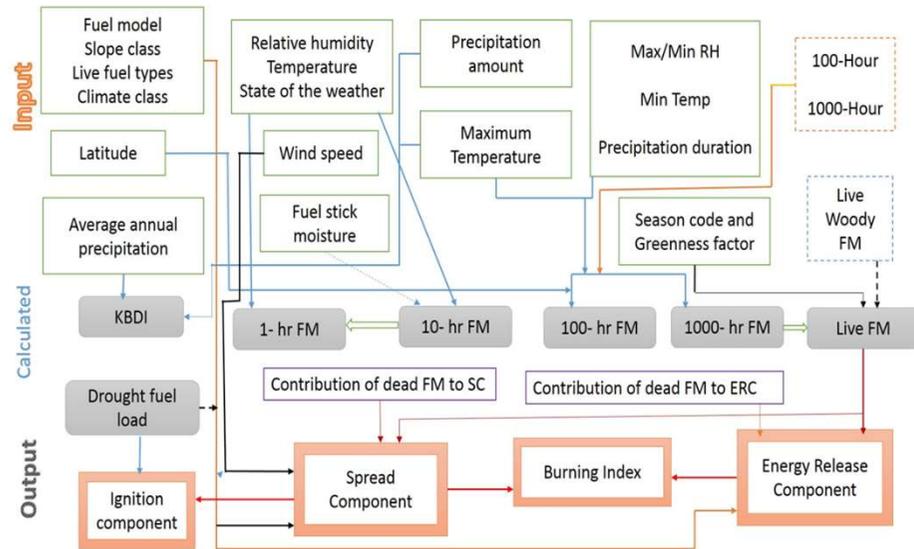
Temperature regimes vis-à-vis fire occurrences in India



Modelling the impact of weather, topography and fuel characteristics

Existing Fire Danger systems

US NFDRS

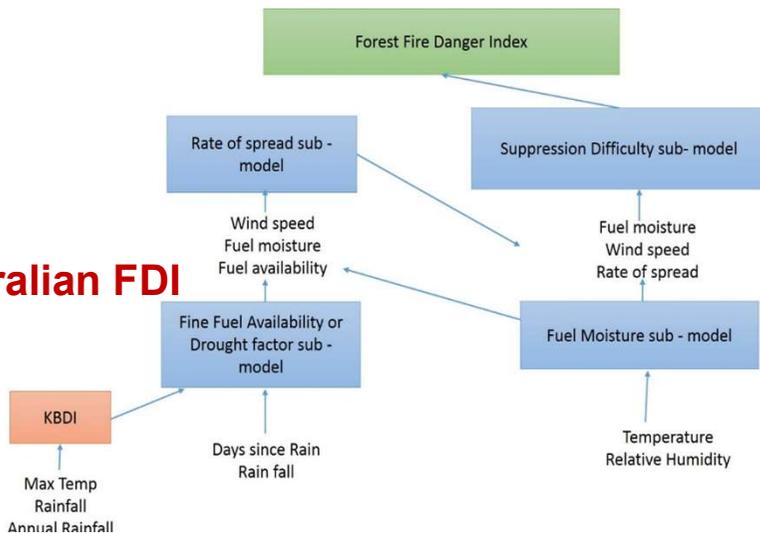


Canadian FDRS

Issues in adapting Canadian FDRS in India

- ❖ FWI calculation needs a set of automatic weather station parameters, such as air temperature, wind speed, and relative humidity during the mid-day; and point locations data of 24-h accumulated rainfall.
- ❖ Interpolation technique for Canadian FWI need high density of AWS
- ❖ Global Canadian FWI has spatial resolution of one degree.

Australian FDI



Fire Danger Rating System - Importance

- ❖ The Fire Danger Rating System considers all the factors affecting the fire danger and indexing into different classes of fire danger
- ❖ For issuing warnings to the public, implementing the mitigation measures for controlling fires.
- ❖ The Fire Danger Rating system is an integration of dynamic and static fire danger rating indices, based on weather parameters & other constant parameters such as fuel characteristics, topographic conditions.

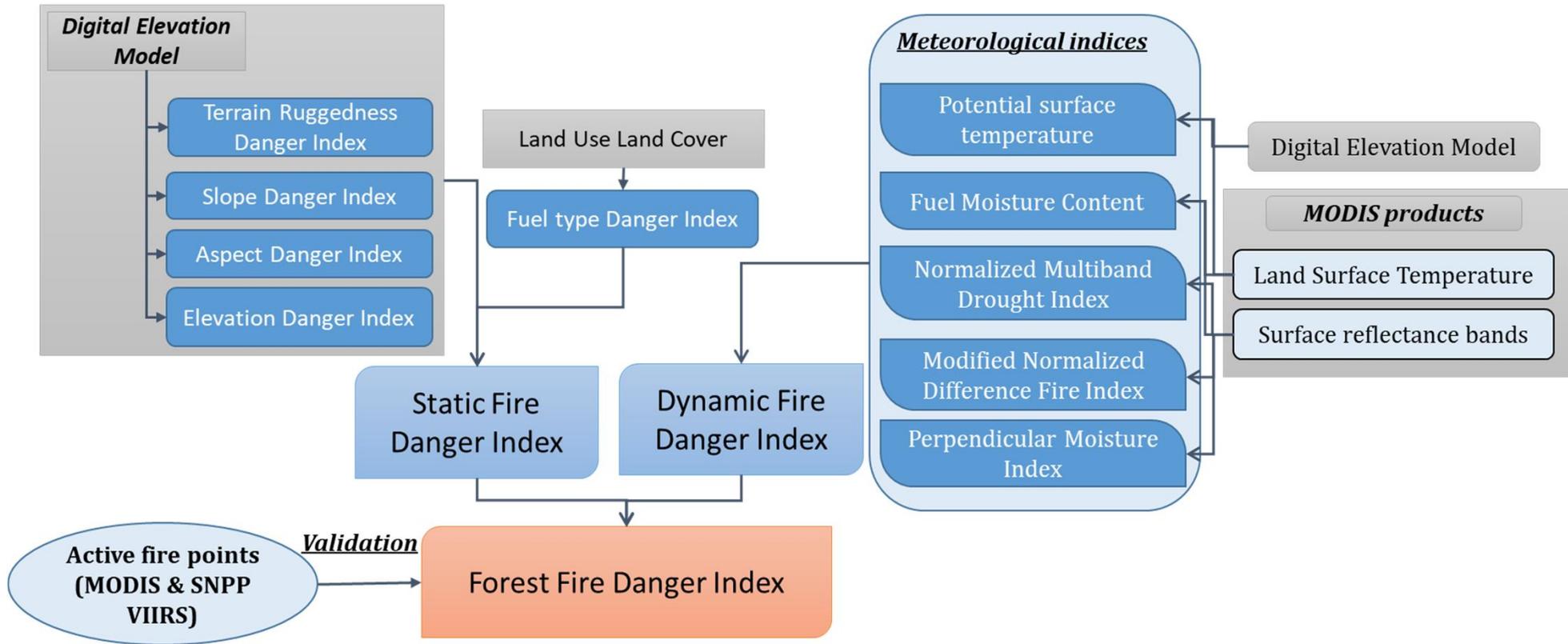
Two biophysical components:

DYNAMIC INDEX (Fire weather Index): based on weather parameters such as air temperature, relative humidity, wind speed and rainfall

STATIC INDEX: based on the constant parameters such as fuel characteristics, topographic conditions, vegetation type, edaphic conditions.

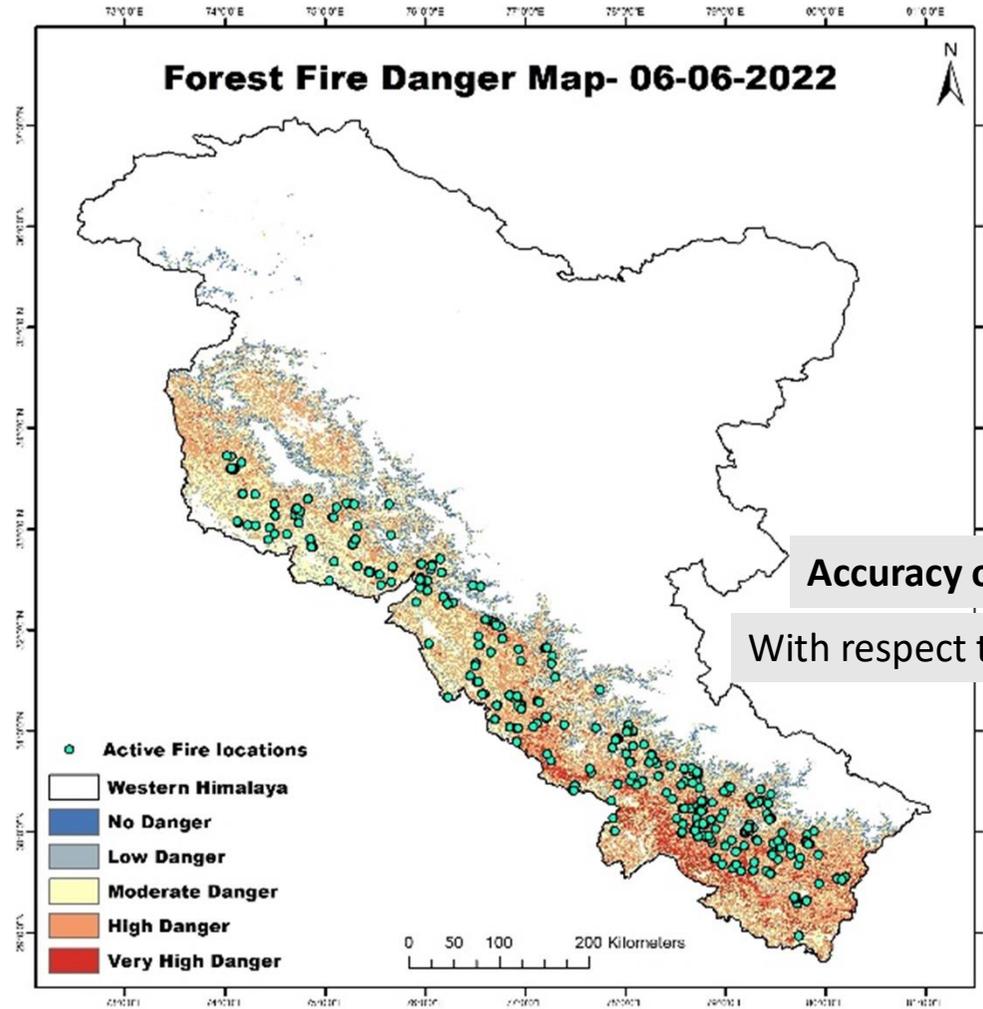
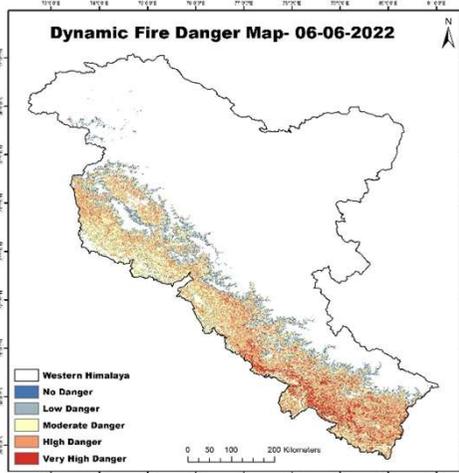
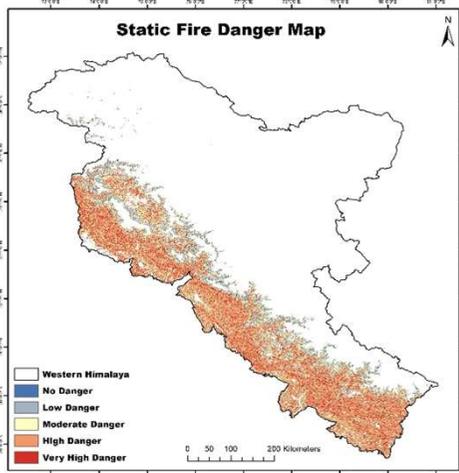
This is then integrated to provide the fire danger rating

Developing satellite based Forest Fire Danger maps for Western Himalaya



Meteorological Inputs:

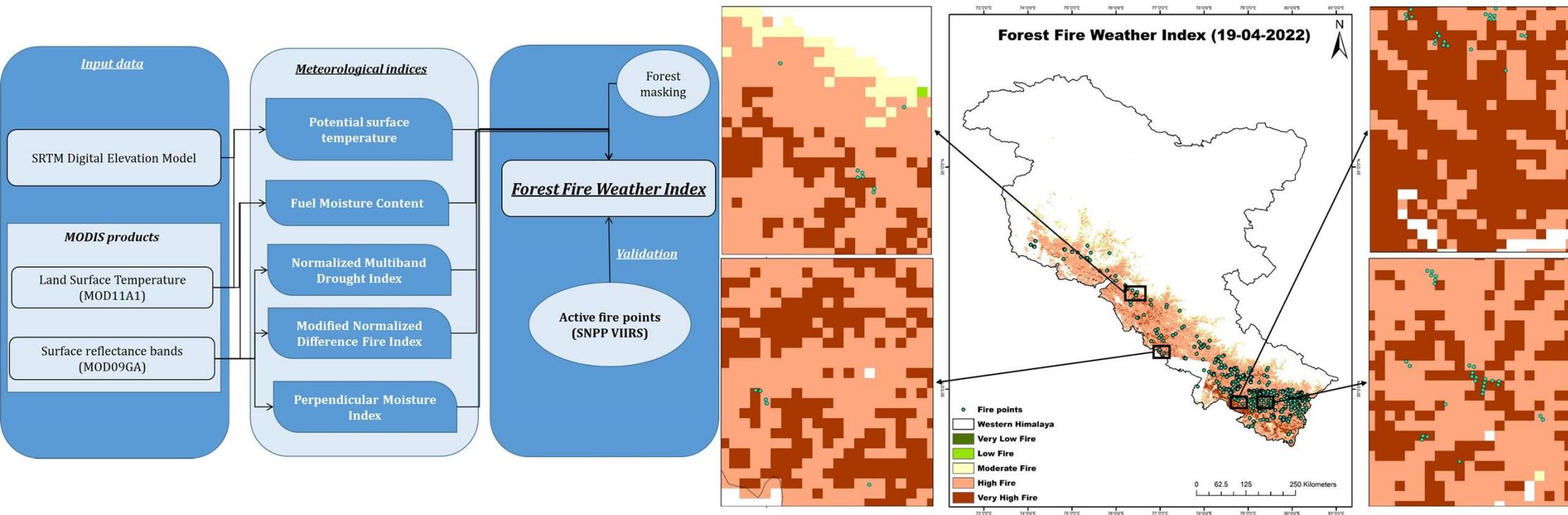
- ❖ MODIS
- ❖ WRF – Inputs
- ❖ AWS network



Accuracy of 86% to 98%.

With respect to actual fire occurrence

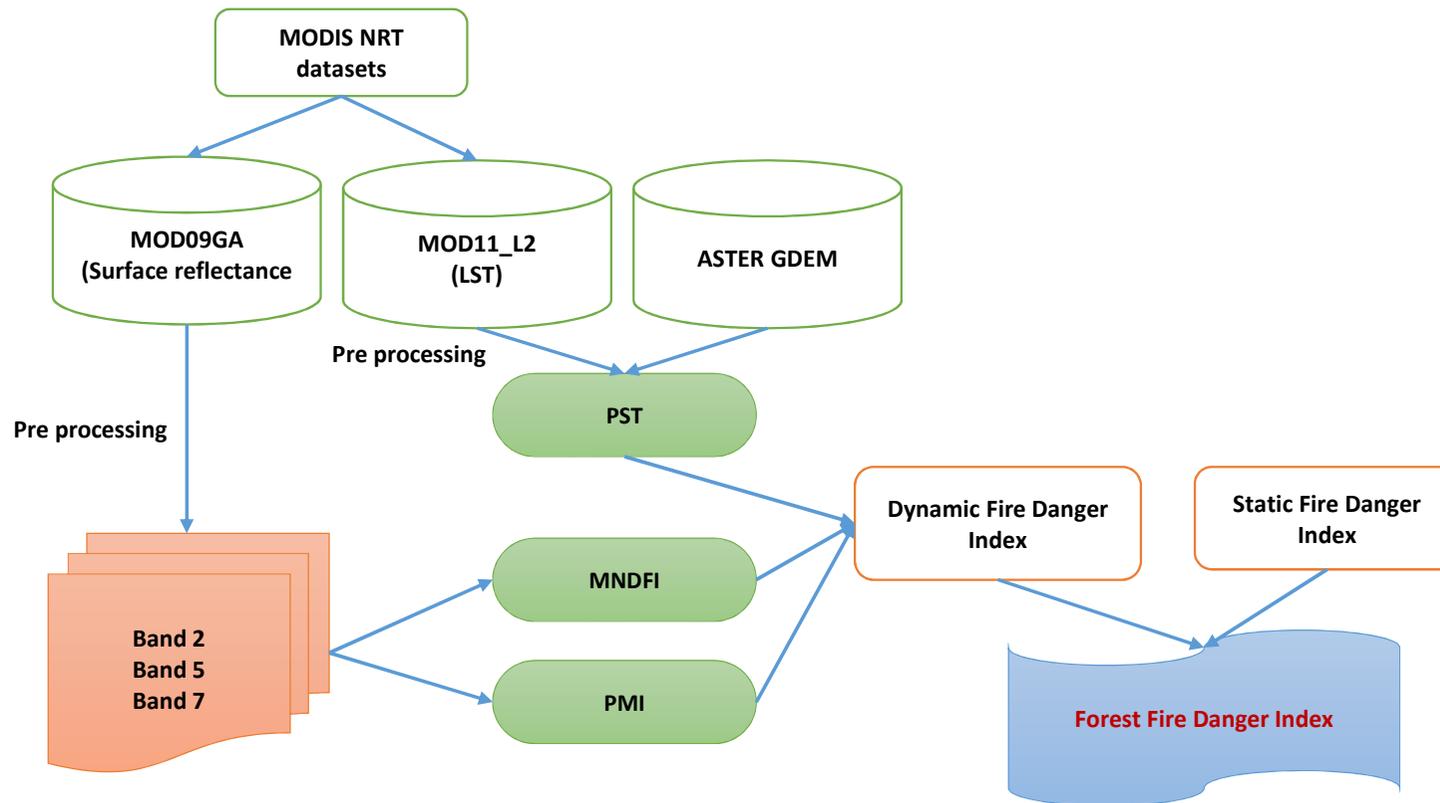
Satellite based Forest Fire Weather Index for Western Himalaya



Accuracy ranges from 80% to 98% for the peak fire season with the average accuracy of about 87%.

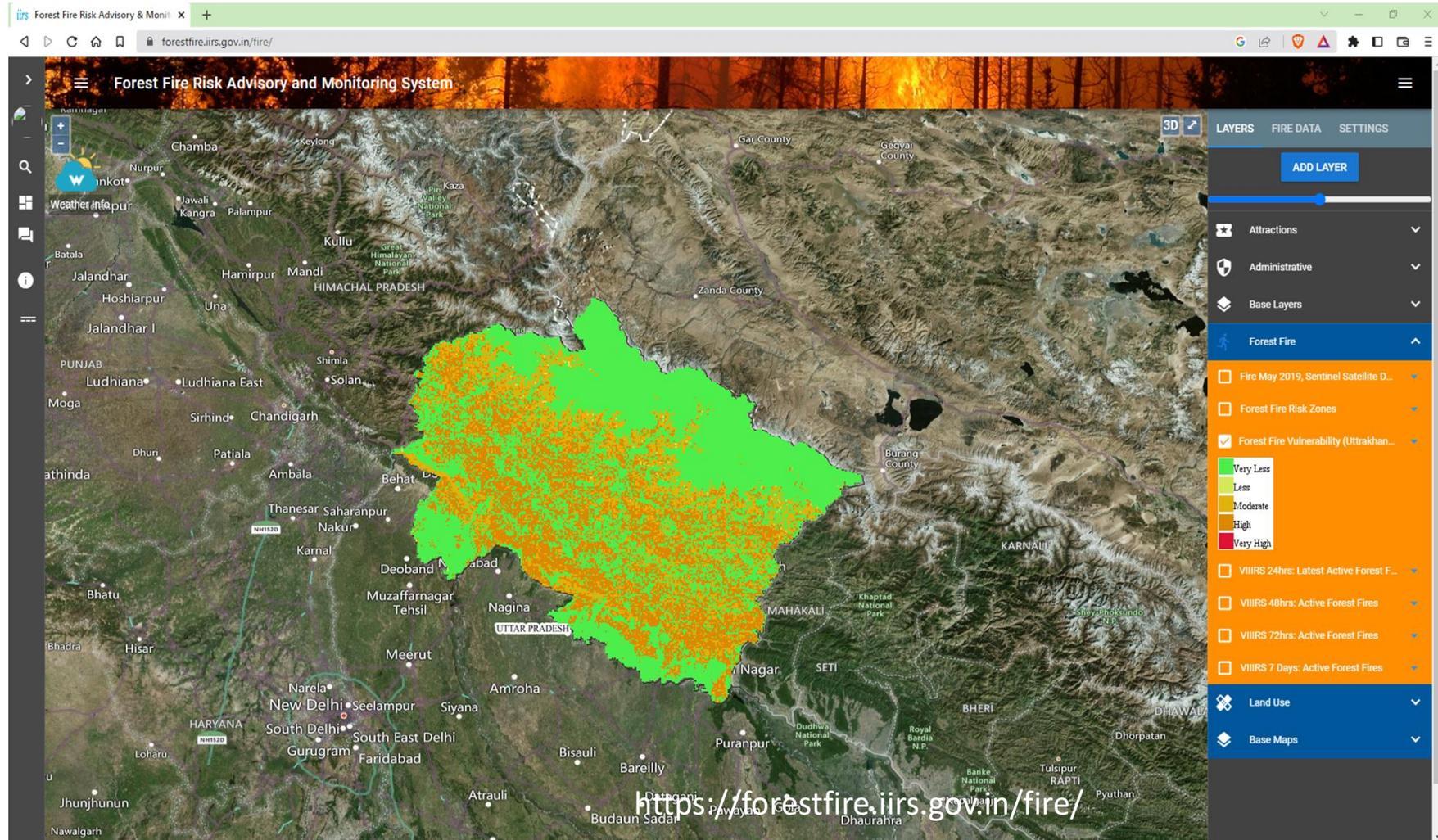
Automation of Fire Danger Index

Since this product is dynamic and need to be run daily hence the entire system has been automated and has been calibrated for 3 states of Western Himalaya (J&K, HP, UK)

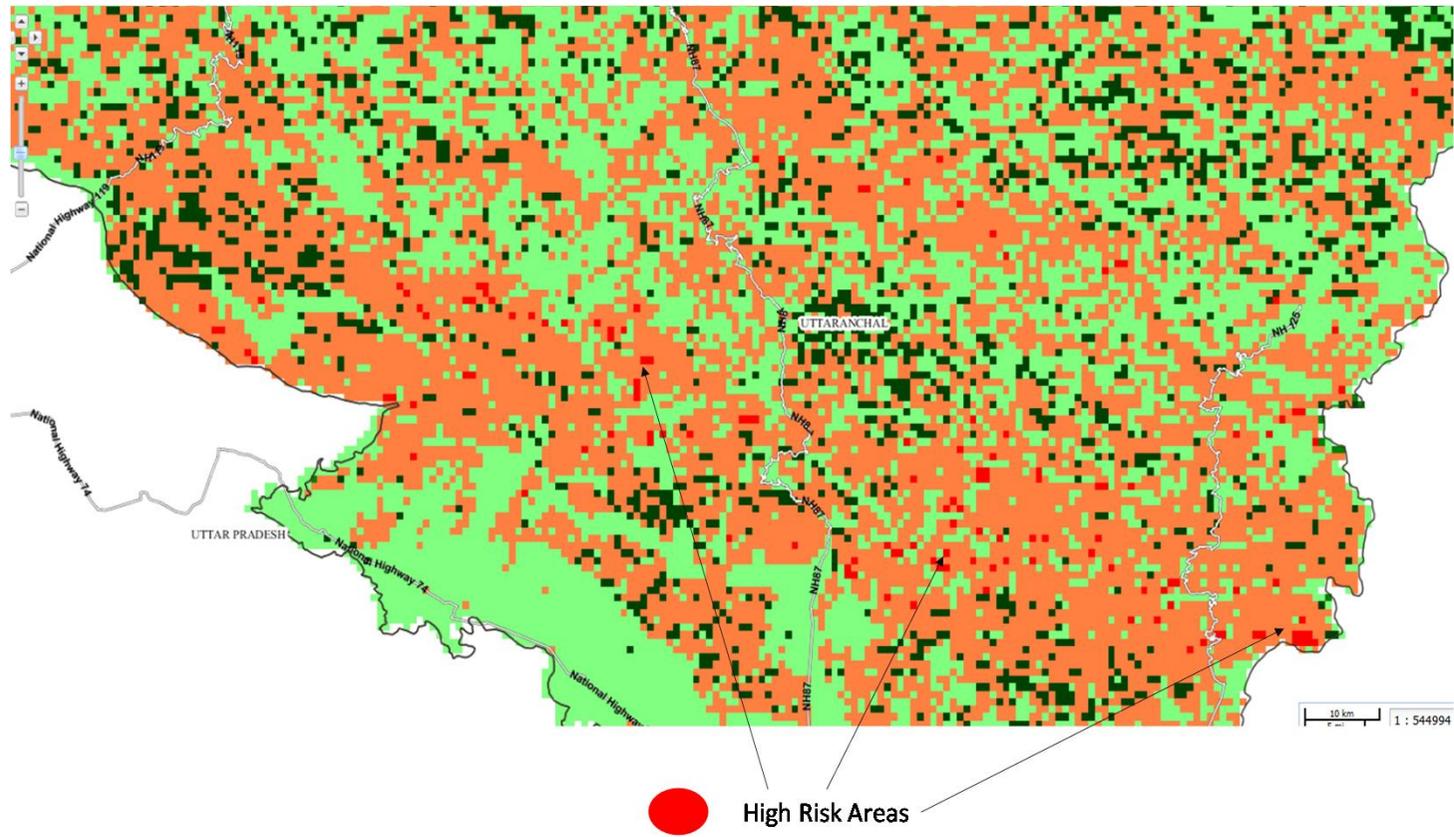


- Daily product 30 minutes after the MODIS (TERRA) pass is being provided.
- *Experimental Product for Uttarakhand being disseminated during fire season*

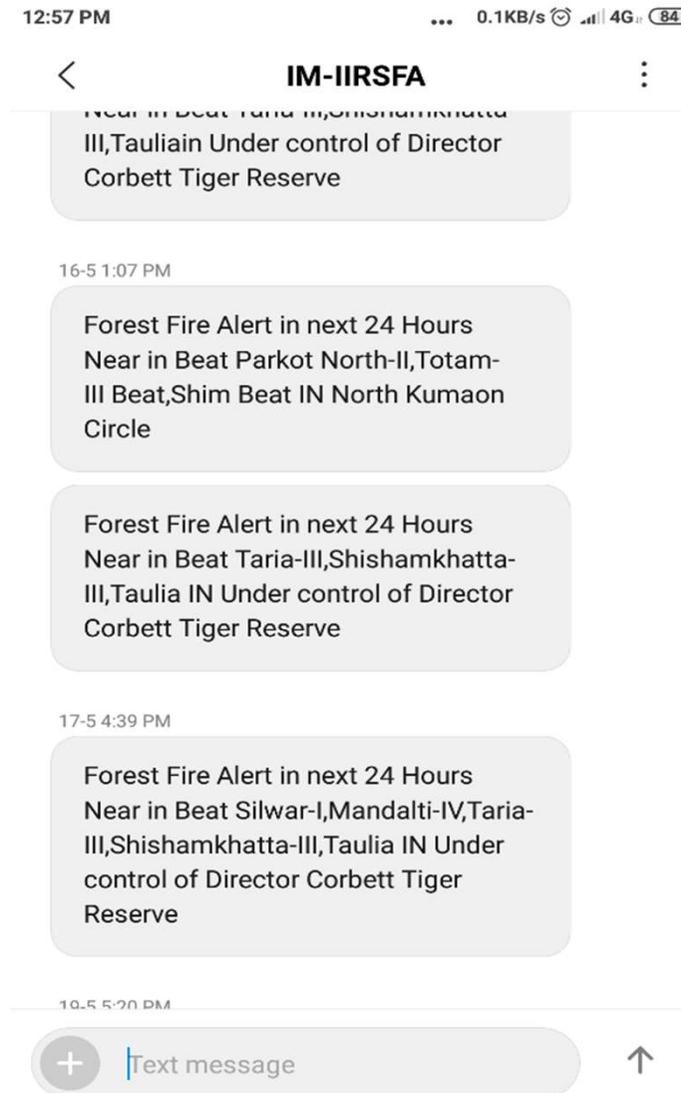
Automated Forest Fire Risk Advisory



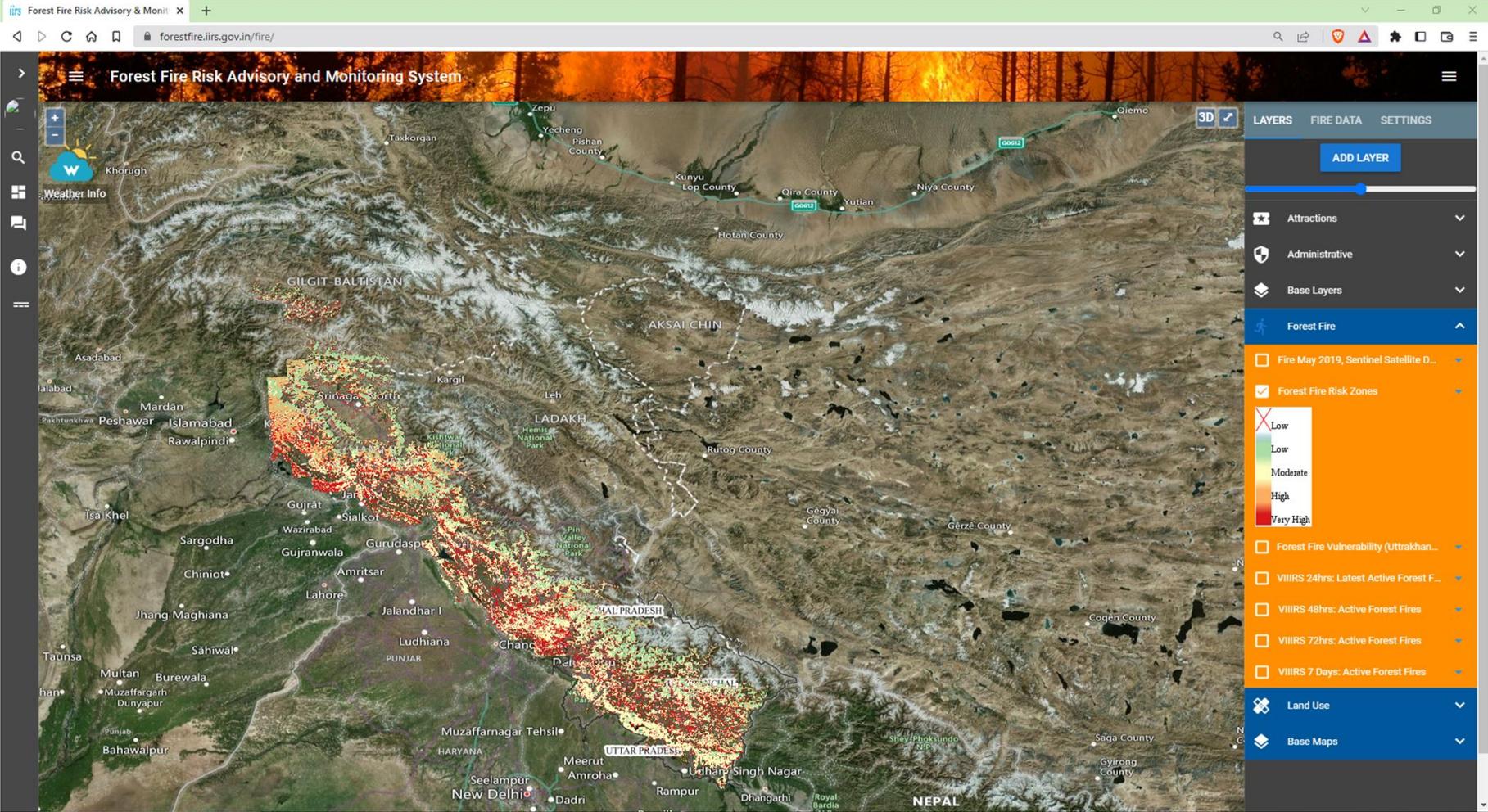
Close up view of Forest Fire Risk Map



Fire Risk map and daily advisories are generated for field officials and decision makers. The advisories are sent to the forest officials of Uttarakhand State as SMS. The each SMS is having a unique URL for taking further field report and validation of the alerts.



Forest Fire Risk Zones based on Daily Fire Risk Advisory

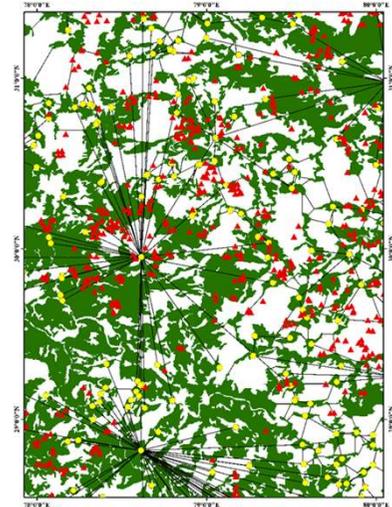
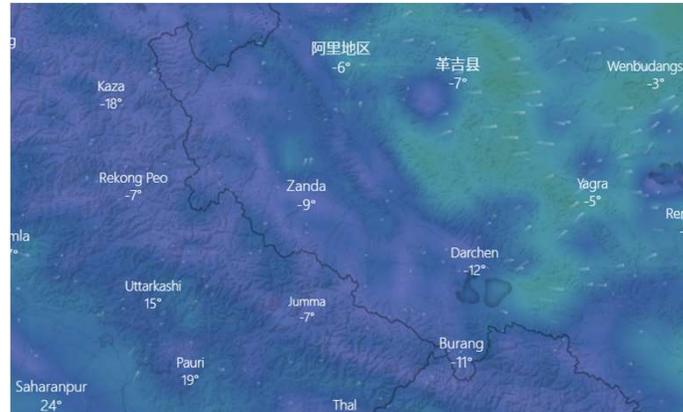


Modelling Fire Spread: GR-CA-WRF

Graph Theory for functional connectivity

Fire Spread is dependent on:

- ❖ Fuel availability
- ❖ Connectivity among patches
- ❖ Meteorological conditions
 - ❖ Wind Speed and direction
 - ❖ Temperature
 - ❖ Humidity profiles



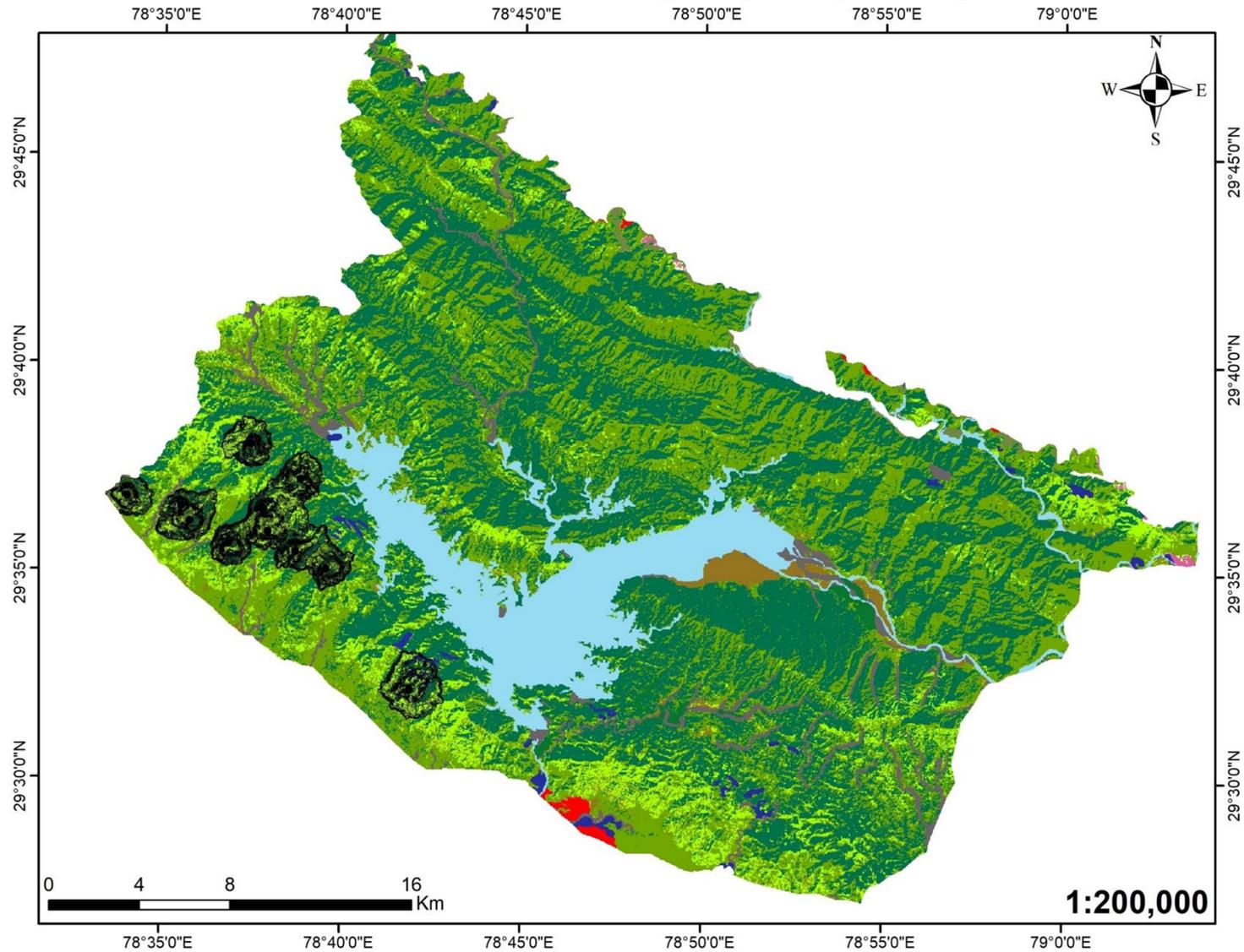
- ❖ Temperature, precipitation and Wind (through WRF)
- ❖ Work on integration of MOSDAC output with the CA-FRAMS model



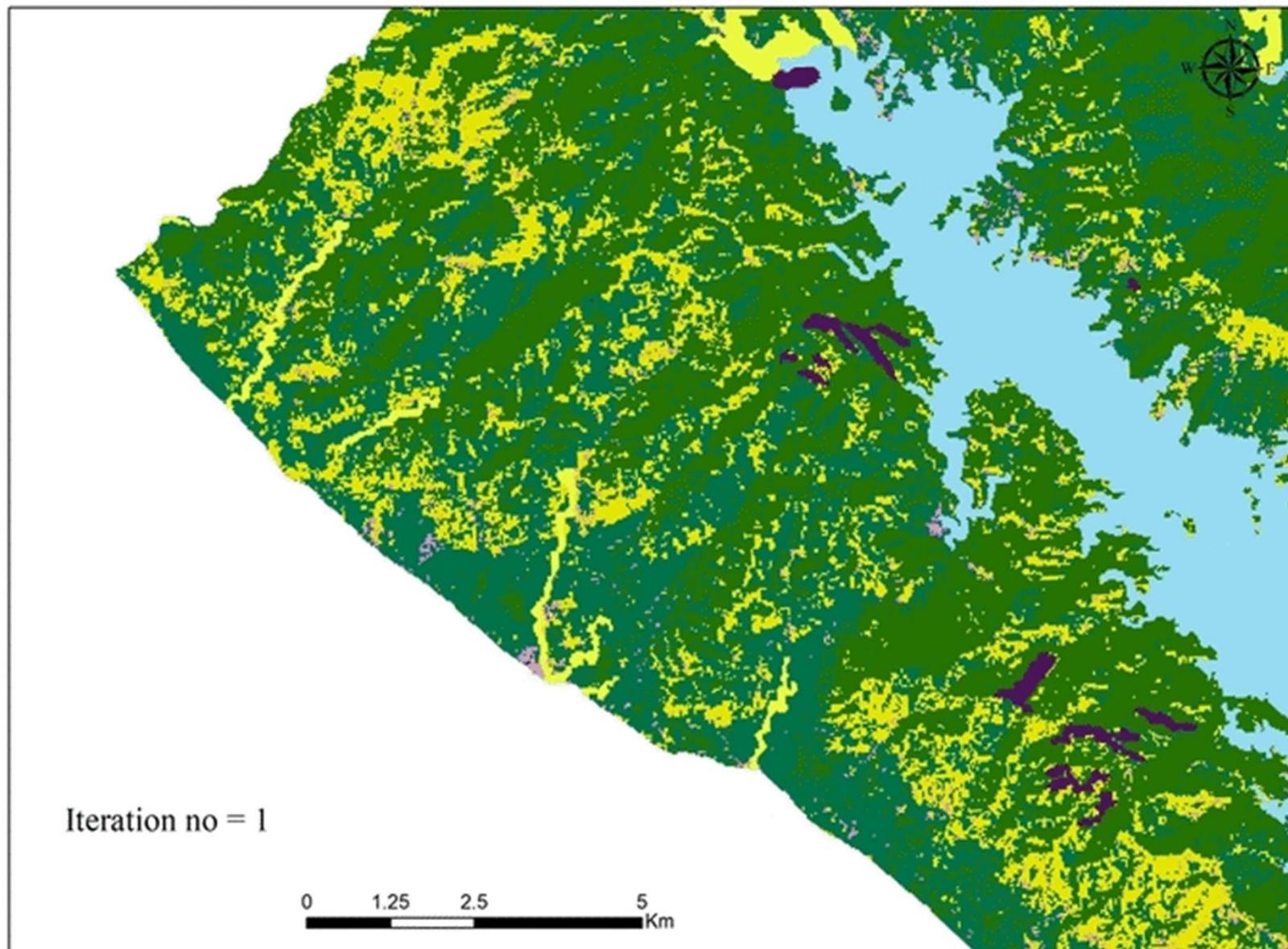
Cellular Automata Model for fire spread

FIRE SPREAD IN CNP (Site-1)

Fire Event in Corbett national park (25th April,2016)

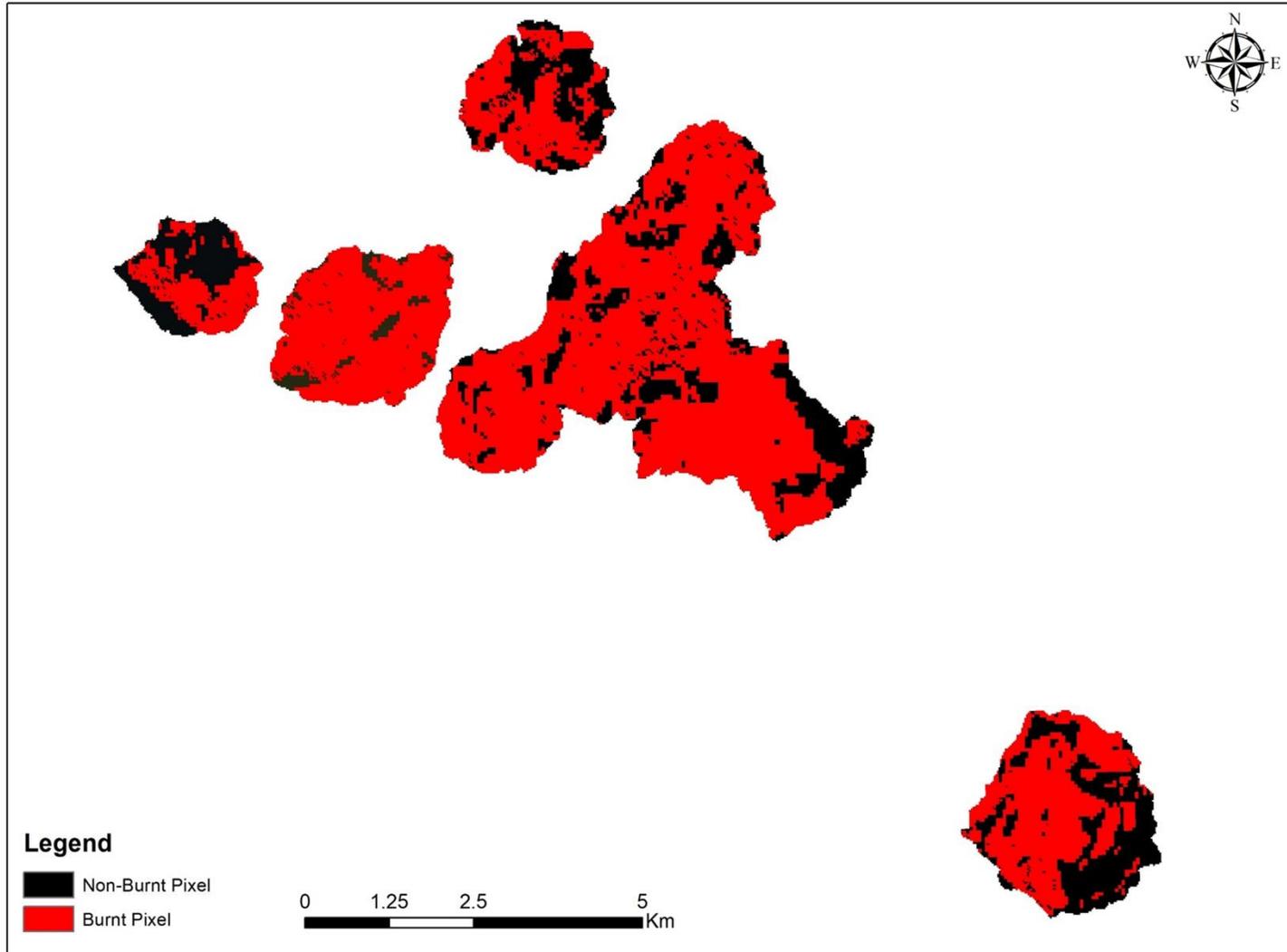


Forest Fire spread Path (CTR)



ACCURACY ASSESSMENT

Forest Fire spread-Accuracy Assessment (CTR)

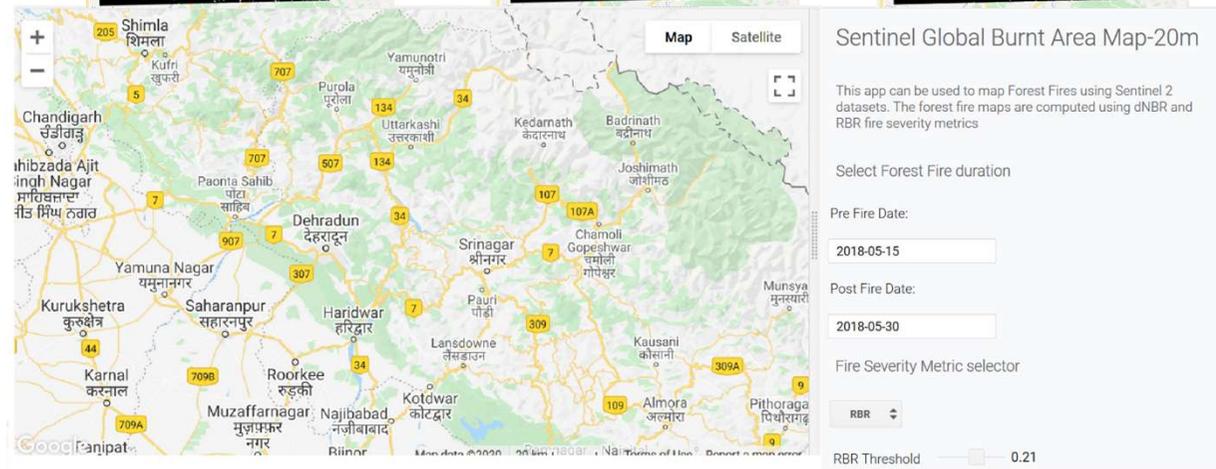
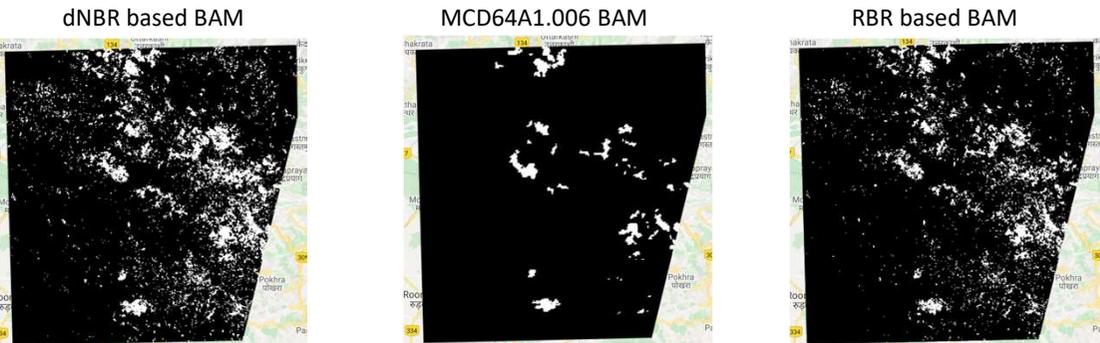


GEE based BASM Product

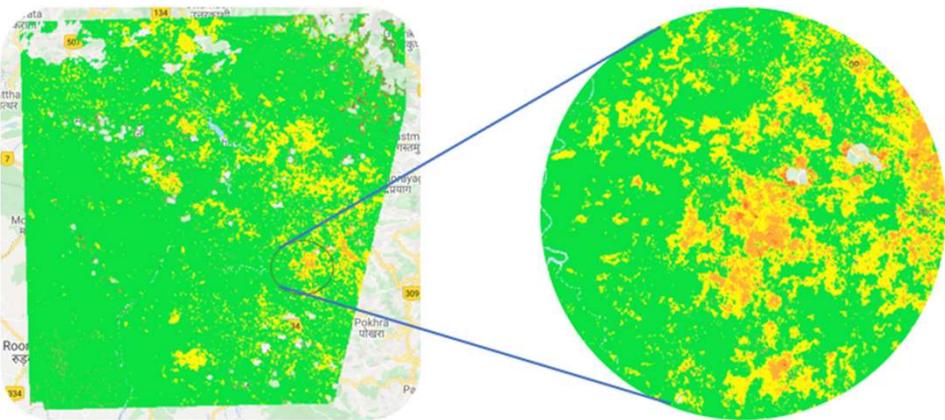
- Depicted below is a Forest Fire Burnt Area Severity Mapping (BASM) product developed using Google Earth Engine (GEE) and is based on dNBR and RBR thresholding technique

- Validation done over Uttarakhand Region for the forest fires of May 2018, results show that the product can detect small fires better than MCD64A1

| Severity Level | dNBR Range (scaled by 10^3) | dNBR Range (not scaled) |
|-------------------------------------|--------------------------------|-------------------------|
| Enhanced Regrowth, high (post-fire) | -500 to -251 | -0.500 to -0.251 |
| Enhanced Regrowth, low (post-fire) | -250 to -101 | -0.250 to -0.101 |
| Unburned | -100 to +99 | -0.100 to +0.99 |
| Low Severity | +100 to +269 | +0.100 to +0.269 |
| Moderate-low Severity | +270 to +439 | +0.270 to +0.439 |
| Moderate-high Severity | +440 to +659 | +0.440 to +0.659 |
| High Severity | +660 to +1300 | +0.660 to +1.300 |



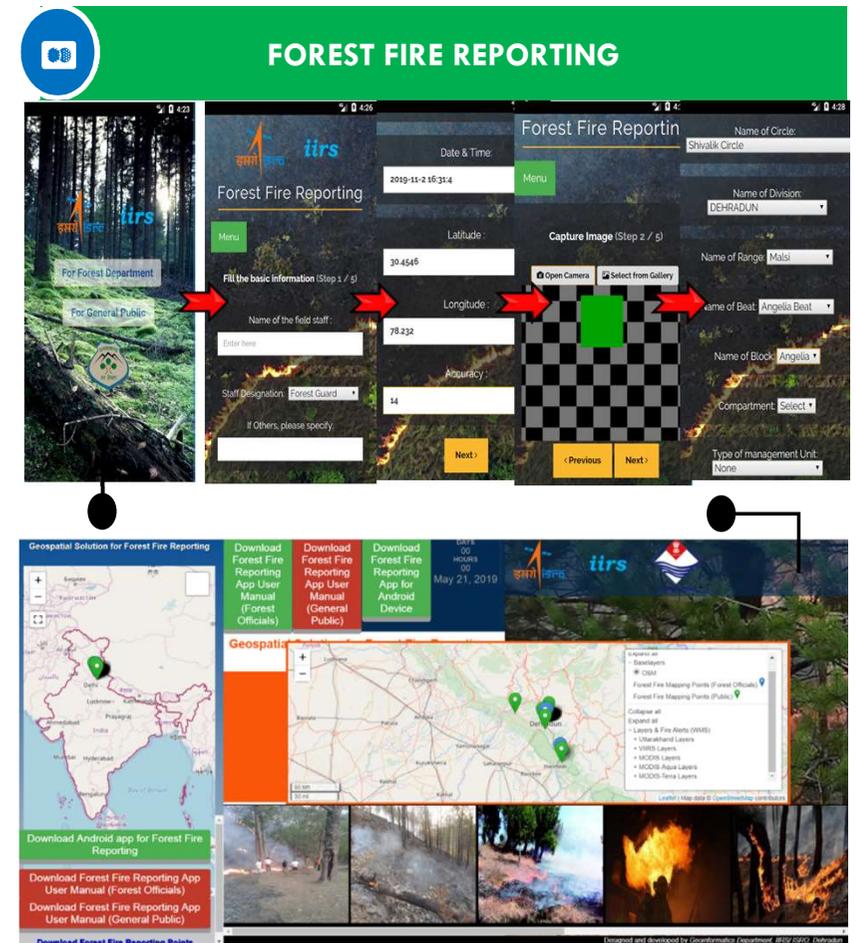
A Web Application to provide an interactive and easy to use interface in development stage (shown above)



Mobile based App for Forest Fire Reporting & Monitoring



- Geospatial solution developed consists of **android based mobile app** and **web based dashboard**
- The geospatial solution is being used by **J & K Forest Department** and demonstrated to **Uttarakhand Forest Department** and **Mexican Government**
- Geospatial solution provides **near real time surveillance** during **active forest fire**
- Mobile app allows geotagging of the forest fire site along with field information about the active forest fire like Causes of fire, Type of fire, Species and area affected, Topography, road accessibility, Type of damage,
- The geotagged forest fire site is monitored on web-based dashboard for interactive visualization
- **SMS service** on a dashboard allows Immediate action in the field for decision support through SMS service of Dashboard





2017



2018

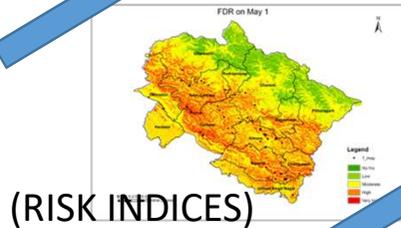
Way forward

**INFORMATION
GENERATION &
DISSIMINATION**

SPACE AGENCIES

UN Charter

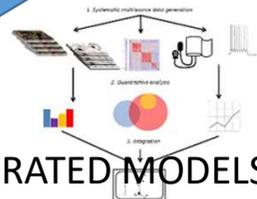
CEOS/Sentinel Asia
Wildfire WG



(RISK INDICES)

Forest Fire Danger Index

(INTEGRATED MODELS)



Spread Models

Human activity index

Back propagation algorithm

ANALYSIS GROUP

ISRO, FSI, NDMA,
Academia etc.

Ground observation
**GOVERNMENT
DEPARTMENTS**
Space based
communication



(SENSOR WEB)

(DECISION
SUPPORT SYSTEM)

SDSS

Real time data
reception and model
output dissemination



Will ensure effective disaster risk management for forest fires

THANK YOU FOR YOUR KIND ATTENTION

21.04.2016 18:25

21.04.2016 18:26

18.05.2016



21.04.2016 18:26

Acknowledgements:

- Our research Team and Students at IIRS (Suresh Babu, Dhruval Bhavsar, Rajkanti Kala, Shanti Kumari, Shailja Mamgain, Kamal Pandey, Harish Karnatak)
- Indian Institute of Remote Sensing, ISRO

19.05.2016