

RS & GIS FOR AGRICULTURAL DROUGHT ASSESSMENT & MANAGEMENT

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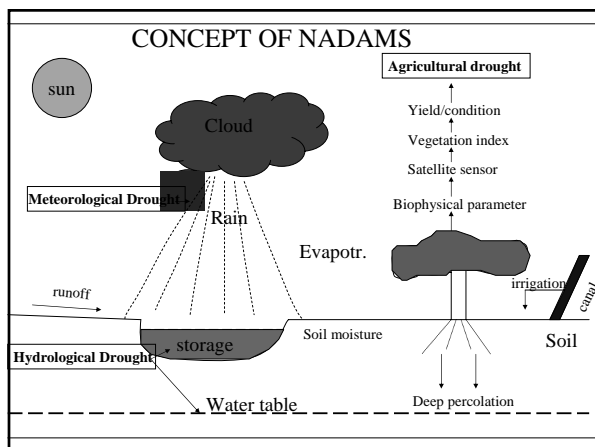
URL: <http://www.civil.iisc.ernet.in/~nagesh>

Acknowledgements

Dr A.T. Jeyaseelan, Scientist-F, NRSC, Hyderabad

National Agricultural Drought Assessment and Monitoring System (NADAMS), NRSA

- NRSA has initiated NADAMS in 1989 and is providing near real-time information on prevalence, severity level and persistence of agricultural drought at national/ state/ district level during kharif season.
- Country Level Monitoring: Course resolution NOAA AVHRR data
- State & District Level Monitoring: Medium resolution WiFS/ AWiFS data
- Information is sent to the concerned Central/ State authorities for taking necessary action on the ground
- Project covers 14 states of the country, which are agriculturally important and vulnerable to drought.



OBJECTIVE

- | | |
|----------------------------------|--|
| Initial objective (1986-1992): | To provide periodic drought monitoring during kharif at district level |
| Objective (1992-1996) | To provide monthly reports with subdistrict information |
| Objective (1996-2002) | To provide monthly reports at district and state level for Nationwide Monitoring
To provide monthly reports at Taluk/mandal level for 2 States |
| Current Objective (2002 onwards) | To provide district level for entire country.
River basin, irrigation and rainfed wise crop monitoring for comprehensive drought Monit.
Detailed monitoring over drought prone states
Through the year monitoring |

Achievements, Methodology, Results and Planned activities for I. Nationwide Monitoring

Established	NADAMS
Operational from	1989
Season monitored	Kharif Season (June to October)
Issued	Biweekly Bulletin during 1989-91 Monthly Detailed Reports since 1992
Sponsored by	Department of Agricultural and Cooperation Ministry of Agriculture (1989-1996)
Executed by	National Remote Sensing Agency/DOS
Supported by	i) India Meteorological Department ii) Central Water Commission iii) State Agriculture departments and iv) Other drought related agencies

National Agricultural Drought Assessment and Monitoring System (NADAMS)

Nationwide Monitoring

Service Provided

State wise reports at district level for fourteen Agriculturally important states of the country using 1km NOAA satellite data (Andhra Pradesh, Bihar, Chattisgarh, Gujarat, Haryana, Jharkhand, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Rajasthan, Tamil Nadu, Uttaranchal and Uttar Pradesh)

Summary reports at State level for Entire Country

Users

Central Agencies - Dept. of Agri and Cooperation, Planning commission

State Agencies - State Relief Dept., State Agri. Dept.

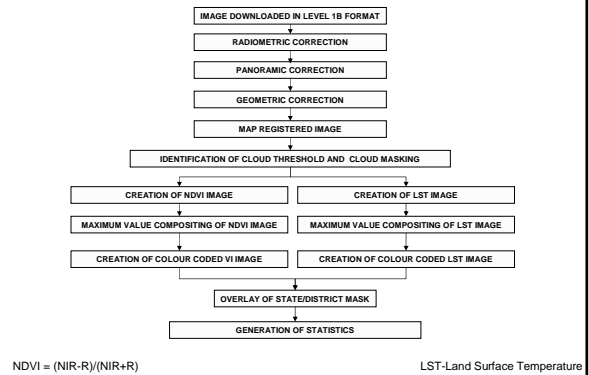
District report - District Collectors(District administration)



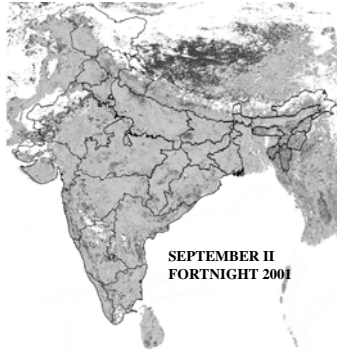
Time Composite Images

- If an image contains cloud cover in a portion but that imagery can be acquired everyday like in the case of NOAA AVHRR a time composite imagery can be produced without cloud cover
- Co-register images acquired over number of days (say 15 days)
- Area with cloud cover is identified from the first imagery and is replaced by the next imagery of the same area.
- Cloud cover (if any) from this composite imagery is replaced with the third imagery.
- This procedure is repeated 15 times (say over 15 days imageries)
- Composite imagery is used for further analysis
- NRSA used such time composited imageries of NOAA AVHRR over 15 days for Agricultural drought assessment and analysis.

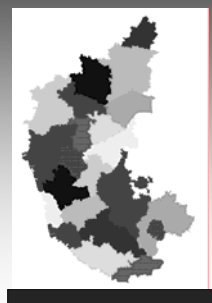
SATELLITE DATA PROCESSING METHODOLOGY



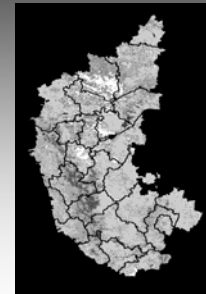
FINAL MAXIMUM VALUE COMPOSITED COLOUR CODED FORTNIGHTLY IMAGE



KARNATAKA STATE MASK

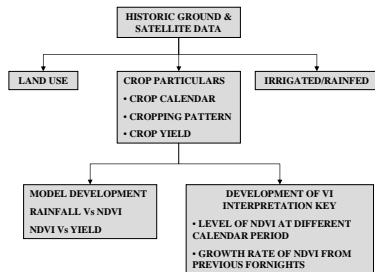


KARNATAKA STATE IMAGE



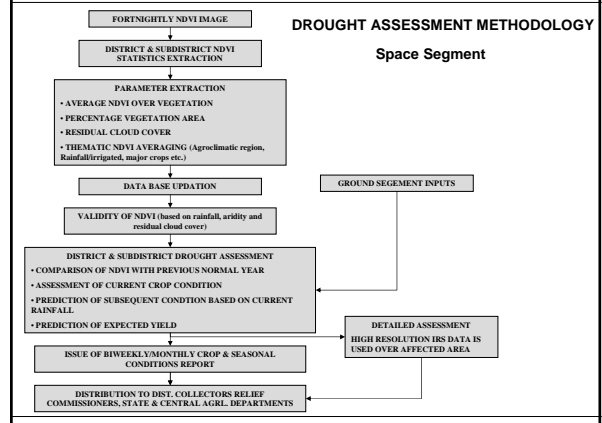
DROUGHT ASSESSMENT METHODOLOGY

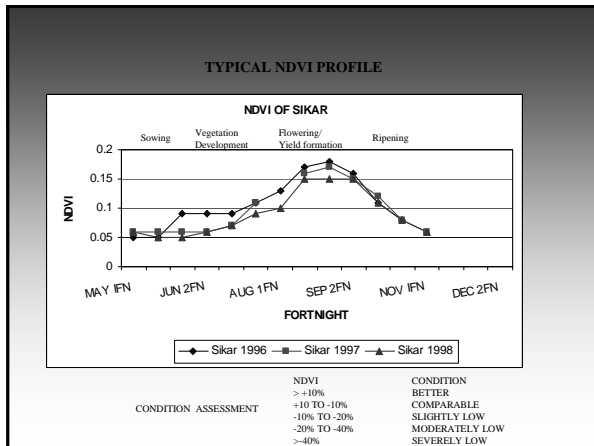
Ground Segment



DROUGHT ASSESSMENT METHODOLOGY

Space Segment





Regression Coefficients (R²) between NDVI and rainfall with crop yield

District	Major crop	R ² for crop yield and NDVI (0.06)	R ² with RF
Bangalore	Ragi	0.83	0.11
Bellary	Jowar	0.86	0.51
Belgaum	Jowar	0.85	0.05
Bidar	Jowar	0.75	0.05
Bijapur	Jowar	0.59	0.04
Chikmangalore	Ragi	0.72	0.68
Chitradurga	Ragi	0.74	0.73
Dharwad	Jowar	0.62	0.006
D.Kannada	Paddy	0.72	0.22
Gulbarga	Jowar	0.7	0.42
Hassan	Ragi	0.86	0.44
Kodagu	Paddy	0.49	0.24
Kolar	Ragi	0.93	0.4
Mandhya	Paddy	0.82	0.001
Mysore	Paddy	0.75	0.63
Raichur	Jowar	0.76	0.03
Shimoga	Paddy	0.89	0.81
Tumkur	Ragi	0.58	0.09
U.Kannada	Paddy	0.93	0.67

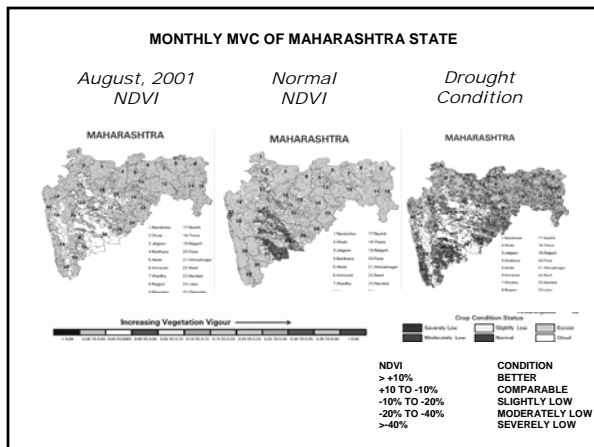
* RF: Seasonal Rainfall
 NDVI: Seasonal integrated vegetation index with threshold above 0.85.
 The district level regression coefficient (R²) between NDVI and yield and rainfall and yield indicates better correlation of NDVI and yield rather with rainfall and yield in all districts of Karnataka. However, the regression between NDVI and yield is found to be low (R² < 0.6) in Bijapur, Tumkur and Kodagu districts.

BIWEEKLY BULLETIN

- Issued at district level during June to December of 1989, 1990 and 1991 for 246 districts of 10 states
- Sent to Central and State Govt. Departments related with agriculture and revenue including district level officers totaling 700
- Provided timely reports with first cut alerts through telephone. In 3-4 days and printed bulletin in 10 days
- Bulletin contains vegetation index image, greenness comparison map and drought assessment report and progressive drought status at district level for every state.

MONTHLY REPORTS

- Issued during Kharif season since 1992 for 11 states till 2000 and for 14 states since 2001.
- Each state report contains district wise Agri. background, consolidated reports on rain and Agri. operation, satellite based assessment on current vegetation development, early warning on subsequent period condition, expected reduction in yield from major crops.
- Sent to Central and State Govt. Departments related with agriculture and relief.



DISTRICTWISE DROUGHT ASSESSMENT AND EARLY WARNING AS ON 30/09/2001

S.No	District	Cumulative Rainfall as on 26/09/2001	NDVI Condition	Early Warning
1	Panchkula	Excess	Better	Better
2	Amnabla	Excess	Normal	Normal
3	Yamunanagar	Deficient	Normal	Normal
4	Kurukshetra	Normal	Normal	Normal
5	Karnal	Normal	Normal	Normal
6	Kaithal	Excess	Normal	Normal
7	Jind	Normal	Slightly Low	Normal
8	Fatehabad	Normal	Moderately Low	Watch - Likely to improve
9	Sirsa	Normal	Moderately Low	Watch - Likely to improve
10	Hisar	Normal	Slightly Low	Normal
11	Panipat	Deficient	Normal	Normal
12	Sonapat	Deficient	Normal	Normal
13	Rohtak	Normal	Slightly Low	Normal
14	Bhiwani	Excess	Normal	Normal
15	Hajjar	Normal	Slightly Low	Normal
16	Mahendragarh	Deficient	Severely Low	Warning-Need for concern
17	Rawani	Excess	Moderately Low	Watch-Likely to improve
18	Gurgaon	Normal	Slightly Low	Normal
19	Faridabad	Normal	Normal	Normal

PROGRESSIVE DROUGHT STATUS UPTO OCTOBER 31, 2001

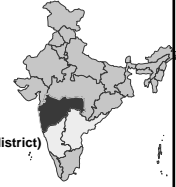
TABLE 3: PROGRESSIVE DROUGHT STATUS UPTO OCTOBER 31, 2001

S.No	District	15-30 June	01-15 July	16-31 July	01-15 August	16-31 August	01-15 September	16-30 September	01-15 October	16-31 October
1	Prachinika	Comparable	Moderately Low	Comparable	Better	Better	Better	Better	Moderately Low	Moderately Low
2	Amalapuram	Better	Comparable	Comparable	Better	Better	Comparable	Comparable	Severely Low	Severely Low
3	Vijayanagara	Better	Comparable	Comparable	Better	Better	Comparable	Comparable	Severely Low	Severely Low
4	Kondapet	Better	Comparable	Comparable	Better	Better	Comparable	Comparable	Severely Low	Severely Low
5	Kanur	Better	Comparable	Comparable	Comparable	Comparable	Comparable	Comparable	Moderately Low	Severely Low
6	Kothakota	Better	Comparable	Better	Comparable	Comparable	Comparable	Comparable	Severely Low	Moderately Low
7	Andhra Pradesh	Better	Comparable	Comparable	Comparable	Comparable	Comparable	Comparable	Severely Low	Moderately Low
8	Palnacheri	Better	Better	Better	Comparable	Comparable	Comparable	Moderately Low	Severely Low	Moderately Low
9	Srisa	Comparable	Better	Better	Comparable	Comparable	Comparable	Moderately Low	Severely Low	Moderately Low
10	Hisar	Better	Better	Better	Comparable	Comparable	Comparable	Slightly Low	Moderately Low	Moderately Low
11	Pantnagar	Better	Comparable	Comparable	Comparable	Comparable	Comparable	Comparable	Moderately Low	Moderately Low
12	Sonapat	Better	Comparable	Comparable	Comparable	Comparable	Comparable	Comparable	Moderately Low	Moderately Low
13	Kothak	Better	Better	Better	Comparable	Comparable	Comparable	Comparable	Slightly Low	Slightly Low
14	Rajahmundry	Better	Better	Better	Comparable	Comparable	Comparable	Comparable	Better	Better
15	Jajapur	Better	Better	Better	Comparable	Comparable	Comparable	Slightly Low	Comparable	Comparable
16	Mahendragiri	Better	Better	Better	Comparable	Comparable	Comparable	Slightly Low	Severely Low	Slightly Low
17	Rewari	Better	Better	Better	Comparable	Comparable	Comparable	Moderately Low	Moderately Low	Better
18	Surajpattana	Better	Better	Better	Comparable	Comparable	Comparable	Moderately Low	Slightly Low	Comparable
19	Parbhani	Better	Better	Better	Comparable	Comparable	Comparable	Comparable	Slightly Low	Slightly Low

Note

--- The current NDVI is compared with the corresponding period of normal NDVI
 * = Cloud cover is more than 20% of the geographical area
Caution: The comparative condition need to be viewed with caution if there is significant residual cloud cover even after time composition of daily satellite data for the month.

Achievements, Methodology, Results and Planned activities for Phase 2. Regional Monitoring



Service Provided

Detailed NADAMS monthly report at Mandal/Taluk (sub-district) level using WIFS data for Andhra Pradesh and Karnataka

Users

Central Agencies - Dept. of Agri and Cooperation, Planning commission

State Agencies - State Relief Dept., State Agri. Dept.

District report - District Collectors(District administration)

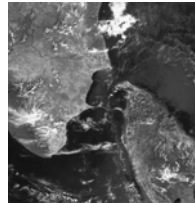
From 2006 - AWIFS based drought monitoring over Maharashtra

IRS WiFS (IRS P3) & AWiFS (IRS P6/ Resourcesat)

WIFS Sensor Characteristics

Resolution	188 x 188 (B3 & B4)
Swath	188 x 246 (B5)
Range/scan	770 Km
Spectral Bands	0.62 - 0.68 microns (B1)
	0.77 - 0.86 microns (B4)
	1.55 - 1.69 microns (B5)

AWiFS Image



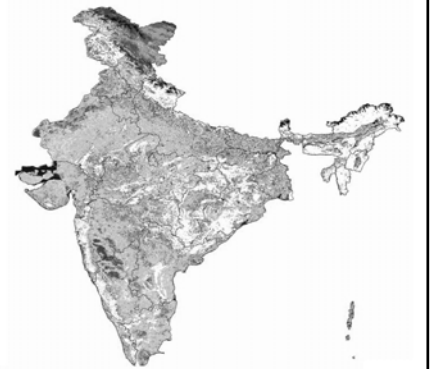
AWiFS Sensor Characteristics

Spectral Bands	B2, B3, B4 and B5
Swath	740 km (combined)
	370 km each head
Saturation radiance (mw/cm ² /sr/micron)	B2 - 53 B3 - 47 B4 - 31.5 B5 - 4.04
Integration time	9.56 msec
Quantization	10 bits
No. of gains	16

The AWiFS camera provides enhanced capabilities compared to the WIFS camera on-board IRS-1C/1D, in terms of spatial resolution (56 m Vs 188m), radiometric resolution (10 bits Vs 7 bits) and Spectral bands (4 Vs 2) with the additional feature of on-board detector calibration using LEDs. The spectral bands of AWiFS are same as LISS-III.

NADAMS

IRS WiFS monthly composite NDVI image of agricultural area, India, Sep. 2003



Source: <http://www.nrso.gov.in/engnrsa/spacesolutions/disaster/drought2.htm>

HIGHLIGHTS OF WIFS and AWIFS BASED ASSESSMENT

National Agricultural Drought Assessment and Monitoring System

September 2001

NADAMS

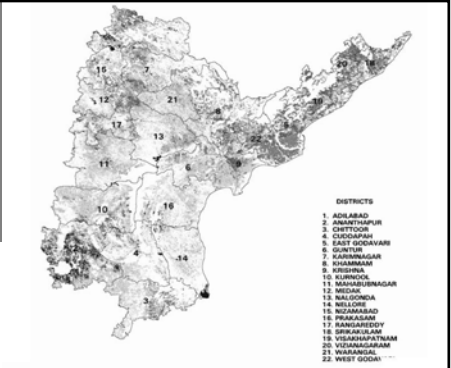
ANDHRA PRADESH

Water Resources Group
National Remote Sensing Agency
Dept. of Space, Gov. of India, Hyderabad

- Information By End of August**
- Table showing sub-district cropped area till the end of July and August and crop condition assessment
 - Maps of cropped area and condition assessment for each districts.
- Information By End of September**
- Table showing sub-district cropped area till the end of September, crop condition assessment and early warning
- Information By End of October**
- Table showing mandal wise cropped area, crop condition assessment and early warning on expected yield.
 - Sent to Central and State Govt. Departments related with agriculture, relief and district collectors

NADAMS

IRS WiFS monthly composite NDVI image of agricultural area, Andhra Pradesh Sep. 2003



Source: <http://www.nrso.gov.in/engnrsa/spacesolutions/disaster/drought2.htm>

