

Work Plan

EPSA/GHCAG/GSD/WP/7/2017

**Desertification and Land Degradation: Monitoring,  
Vulnerability Assessment and Combating Plans**

(Department of Space funded project)

(2017-2021)

**WORK PLAN**

Participating Agencies

**Space Applications Centre, ISRO, Ahmedabad**

and

**ICAR-National Bureau of Soil Survey and Land Use  
Planning, (NBSS&LUP), Bangalore**

**Space Applications Centre  
Indian Space Research Organisation  
Department of Space, Government of India  
Ahmedabad - 380015**

May 2017

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## 1. Introduction

Desertification and land degradation constitutes one of the most alarming geo-environmental global problem affecting two third countries of the world on which one billion people live (one sixth of world's population). Land degradation is reduction or loss of productive land due to natural processes, climate change and human activities. Desertification is land degradation in arid, semi-arid and dry sub-humid areas (also known as Drylands). The processes of desertification and land degradation are observed to have accelerated during recent years globally. There is a need to stop and reverse the process of desertification and land degradation. There are global efforts to combat desertification and land degradation through United Nations Convention for Combating Desertification (UNCCD). India is signatory to the UNCCD and committed to achieve desertification neutral status by 2030.

Space Applications Centre (SAC), Indian Space Research Organisation (ISRO), Ahmedabad has been working with Ministry of Environment, Forest & Climate Change (MoEF&CC), Government of India on monitoring of desertification and land degradation using remote sensing and Geographical Information System (GIS) techniques. SAC has published "Desertification and Land Degradation Atlas of India (Based on IRS AWiFS data of 2011-13 and 2003-05)". The digital database created in GIS environment on 1:500K has been uploaded on SAC Web Portal "Visualization of Earth Data and Archival System (VEDAS)". The outcome of the project is first of its kind, where changes in desertification and land degradation status (along with land cover and severity level) of entire country is available in digital form. This work has been appreciated by the MoEF&CC as well UNCCD. Further, work on bringing out changes in the desertification and land degradation status at 1:50 K for selected vulnerable areas (78 districts) using LISS-III data of 2011-13 and 2003-05 is under progress.

There is a requirement to monitor desertification and land degradation of the country at regular intervals using satellite data. The work done so far has been carried out using on-screen visual interpretation of satellite data. It is observed that although on-screen visual interpretation is based on interpretation keys defined for each of the class to be interpreted, it is subjective in nature and depends on the skill and experience of the person interpreting the data. It also takes lot of time in manually mapping different classes. Therefore, there is a need to go for digital semi-automated or automated mode for preparing digital desertification and land degradation maps. It is proposed to apply different digital classification approaches, evaluate the results and generate digital desertification and land degradation maps along with accuracy standards. Data from new sensors shall be explored for detection of land degradation units/indicators for further improving the desertification and land degradation maps.

In order to give early warning for desertification and land degradation, methodology for vulnerability assessment at 1:50,000 scale requires to be



developed and demonstrated for different agro-climatic zones of the country. Also, there is a requirement of large scale thematic mapping of micro-watersheds at 1:10,000 scale for deriving land and water resources development plans for combating desertification and land degradation. Hence, it is proposed to develop and demonstrate GIS based integrated geospatial techniques for desertification vulnerability modelling and preparation of action plans for combating desertification and land degradation.

## **2. Participating Agencies**

1. ICAR-National Bureau of Soil Survey and Land Use Planning, (NBSS&LUP), Bangalore.
- and
2. Space Applications Centre, Indian Space Research Organisation, Ahmedabad.

## **3. Objective**

There are three major work components under this work plan, viz. Research & Development (R&D), Semi-Operational and Operational. Objectives of each of the above mentioned components are given below:

### **3.1. Research & Development**

- To develop digital classification techniques for mapping land degradation in Andhra Pradesh, Telangana and Karnataka States.
- To utilize new sensors (microwave and hyperspectral) for detection of land degradation units/indicators.

### **3.2. Semi-Operational**

- To develop methodology/ tools for Desertification and Land Degradation Vulnerability assessment at 1:50K scale and demonstration of the same for Anantpur district in Andhra Pradesh, Mahbubnagar district in Telangana and Chamrajnagar district in Karnataka.
- To develop methodology/ tools for preparation of Action plans for Combating Desertification and Land Degradation at 1:10K scale by demonstrating for one micro-watersheds in each district selected for vulnerability assessment.

### **3.3. Operational**

- To carryout desertification and land degradation status mapping for Andhra Pradesh, Telangana and Karnataka States for timeframe 2017-18



on 1:500K scale and carry out change analysis wrt timeframe 2011-13 maps.

- To carryout desertification and land degradation status mapping for Anantapur district in Andhra Pradesh, Mahbubnagar district in Telangana and Bellary, Chamrajanagar districts in Karnataka for timeframe 2017-18 on 1:50K scale and carry out change analysis wrt timeframe 2011-13 maps.

#### **4. Project Duration**

The duration of the project is four years, from F.Y. 2017-18 to F.Y. 2020-21.

#### **5. Broad Approach**

##### **5.1. Digital classification techniques for mapping land degradation**

It has been observed that although on-screen visual interpretation is based on interpretation keys defined for each of the class to be interpreted, it is subjective in nature and depends on the skill and experience of the person interpreting the data. It also takes lot of time in manually mapping different classes.

Therefore, there is a need to go for digital semi-automated or automated mode for preparing digital desertification and land degradation maps. Efforts shall be made to apply different digital classification approaches, evaluate the results and improve further. Data from new sensors such as AVIRIS-NG, RISAT SAR and many other international missions shall be explored for detecting areas undergoing various processes of desertification/land degradation.

##### **5.2. Desertification Vulnerability Assessment**

Assessment of vulnerability towards desertification is an essential step towards its mitigation. Various parameters like climate condition, land use / land cover, soil type, representative vegetation of the area and anthropogenic factors play significant roles in the process of desertification.

It is proposed to carryout desertification vulnerability modeling using multi-parametric approach, viz. climate data, physical data, socio-economic data, etc.

##### **5.3. Combating Plan**

Preparation of action plans for combating desertification and land degradation on a large scale i.e., 1:10, 000 scale or at cadastral level involves integrated analysis in GIS environment along with in-situ data for proper assessment of land capability and defining strategies to improve not only land suitability to different land use practices, but also include employment generation for improving the socio-economic conditions by various means such as agro-industrial development, education and related infrastructure development, animal husbandry development, skill development and overall rural development through



land and water resources development plans. The priority areas shall differ from one micro-watershed to the other based on dominant desertification/land degradation processes, agro-climatic zones, socio-economic set-up etc. Action plans shall be formulated for each micro-watershed by considering all the factors mentioned above.

It is proposed to develop methodology for preparation of desertification combating plan in a one micro-watershed in each district selected for desertification vulnerability assessment.

#### **5.4. Desertification and land degradation status mapping**

Desertification and Land Degradation Status Mapping on 1:500K as well 1:50K using IRS AWiFS and LISS-III data of 2017-18 time frame shall be carried out following the methodology and classification system standardized during the previous studies/projects at SAC, ISRO. IRS AWiFS and LISS-3 Geo-coded digital satellite data will be analysed using onscreen visual interpretation techniques along with ancillary information to interpret Desertification and Land Degradation classes. Ground truth data and field checks will be carried out to finalize the maps. GIS databases of these maps will be used for change analysis for 2017-18 and 2011-12 time frame.

### **6. Man Power Requirement**

One Scientist/ Professor of ICAR-NBSS&LUP and 2 Research Fellow (full time) will be involved for this project.

### **7. Roles and Responsibility**

Activity	Responsibility
<b>Development of automated techniques for digital Desertification and Land Degradation Mapping</b>	
Procurement of satellite data	SAC
Pre-processing of satellite data	NBSSLUP
Collection of ancillary data and ground truth data	NBSSLUP + SAC
Technique development	NBSSLUP + SAC
Field validation/ accuracy assessment	NBSSLUP + SAC
Digital maps	NBSSLUP + SAC
<b>Exploring new sensors for Desertification and Land Degradation studies</b>	
Evaluation and development of techniques	NBSSLUP + SAC
Collection of ancillary data and ground truth data	NBSSLUP + SAC
Improved digital maps	NBSSLUP + SAC



**Desertification and Land degradation vulnerability assessment (1:50K)**

Collection of ancillary data and ground truth data	NBSSLUP + SAC
Geospatial database creation	NBSSLUP
Geospatial modelling	NBSSLUP + SAC
Vulnerability assessment maps	NBSSLUP + SAC
Uploading of database on VEDAS	SAC

**Action plan for combating Desertification and Land Degradation (1:10K)**

Procurement of satellite data	SAC
Pre-processing of satellite data	NBSSLUP
Collection of ancillary data and ground truth data	NBSSLUP + SAC
Geospatial database creation	NBSSLUP
Ground truth data collection	NBSSLUP + SAC
Geospatial technique development	NBSSLUP + SAC
Action plan Maps	NBSSLUP + SAC
Atlas of Action Plan Maps	NBSSLUP + SAC
Uploading of database on VEDAS	SAC

**Desertification and Land Degradation Status Mapping and change detection for timeframe 2017-18 and 2011-12 (1:500K)**

Procurement of satellite data	SAC
Pre-processing of satellite data	NBSSLUP
Preliminary DSM Maps	NBSSLUP
Ground truth/ validation	NBSSLUP + SAC
Quality Checking	SAC
Final DSM Maps	NBSSLUP
Change detection Maps and analysis	NBSSLUP + SAC
Atlas of DSM Maps	SAC
Uploading of database on VEDAS	SAC

**Desertification and Land Degradation Status Mapping and change detection for timeframe 2017-18 and 2011-12 (1:50K)**

Procurement of satellite data	SAC
Pre-processing of satellite data	NBSSLUP
Preliminary DSM Maps	NBSSLUP
Ground truth/ validation	NBSSLUP + SAC
Quality Checking	SAC
Final DSM Maps	NBSSLUP
Change detection Maps and analysis	NBSSLUP + SAC
Atlas of DSM Maps	SAC
Uploading of database on VEDAS	SAC
<b>Final Technical Report</b>	NBSSLUP



## 8. Milestones/Schedule:

The project is proposed for duration of four years (48 months).

Activity	Timeline (T0 – Signing of agreement)											
	T0 + 3	T0 + 6	T0 + 12	T0 + 18	T0 + 24	T0 + 30	T0 + 36	T0 + 42	T0 + 48			
<b>Development of automated techniques for digital Desertification and Land Degradation Mapping</b>												
Procurement of satellite data												
Pre-processing of satellite data												
Collection of ancillary data and ground truth data												
Technique development												
Field validation/ accuracy assessment												
Digital maps												
<b>Exploring new sensors for Desertification and Land Degradation studies</b>												
Evaluation and development of techniques												
Collection of ancillary data and ground truth data												
Improved digital maps												
<b>Desertification and Land degradation vulnerability assessment (1:50K)</b>												
Collection of ancillary data and ground truth data												
Geospatial database creation												
Geospatial modelling												
Vulnerability assessment maps												
Uploading of database on VEDAS												
<b>Action plan for combating Desertification and Land Degradation (1:10K)</b>												
Procurement of satellite data												
Pre-processing of satellite data												
Collection of ancillary data and ground truth data												
Geospatial database creation												
Ground truth data collection												



Handpost

Activity	Timeline (T0 – Signing of agreement)									
	T0 + 3	T0 + 6	T0 + 12	T0 + 18	T0 + 24	T0 + 30	T0 + 36	T0 + 42	T0 + 48	
Geospatial technique development										
Action plan Maps										
Atlas of Action Plan Maps										
Uploading of database on VEDAS										
<b>Desertification and Land Degradation Status Mapping and change detection for timeframe 2017-18 and 2011-12 (1:500K)</b>										
Procurement of satellite data										
Pre-processing of satellite data										
Preliminary DSM Maps										
Ground truth/ validation										
Quality Checking										
Final DSM Maps										
Change detection Maps and analysis										
Atlas of DSM Maps										
Uploading of database on VEDAS										
<b>Desertification and Land Degradation Status Mapping and change detection for timeframe 2017-18 and 2011-12 (1:50K)</b>										
Procurement of satellite data										
Pre-processing of satellite data										
Preliminary DSM Maps										
Ground truth/ validation										
Quality Checking										
Final DSM Maps										
Change detection Maps and analysis										
Atlas of DSM Maps										
Uploading of database on VEDAS										
<b>Final Technical Report</b>										



## 9. Deliverables

The following deliverables will be submitted to SAC by ICAR- NBSS&LUP:


1. All software and tools developed under this project.
2. All maps along with Geospatial database.
3. Final technical report

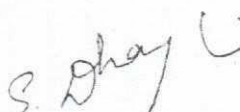
## 10. Budget (in INR)


S. No.	Head	2017-18	2018-19	2019-20	2020-21	Total
1	Services	780000	780000	874000	874000	3308000
2	Travel	200000	200000	200000	200000	800000
3	Contingency	10000	10000	10000	10000	40000
4	Institutional Charges	149000	149000	163000	163000	624000
Total		1139000	1139000	1247000	1247000	4772000


1. Satellite data to be purchased by DOS.
2. Any publication resulting out of this work will be brought jointly by SAC and NBSSLUP.

Signatures

  
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Project Director  
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