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

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# 1. Introduction

Desertification and land degradation constitutes one of the most alarming geoenvironmental 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

Also, there is a requirement of large scale thematic mapping of micro-at 1:10,000 scale for deriving land and water resources development combating desertification and land degradation. Hence, it is proposed to can and demonstrate GIS based integrated geospatial techniques for desertification and land degradation of action plans for combating desertification and land degradation.

# 2. Participating Agencies

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

and

Space Applications Centre, Indian Space Research Organisation.

#### 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 Karnatakafor 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 multiparametric 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	
Development of automated techniques for digital  Desertification and Land Degradation Mapping  Procurement of satellite development	Responsibility
Procurement of satellite data	
Pre-processing of satellito data	SAC
Collection of ancillary data and	NBSSLUP
	NBSSLUP + SAC
rield validation/ accuracy account	NBSSLUP + SAC
	NBSSLUP + SAC
Exploring new sensors for Desertification and Land Degradation studies	NBSSLUP + SAC
Degradation studies	
Evaluation and development of techniques	Harrish a Pil
and of all clifford data and	NBSSLUP + SAC
mproved digital maps	NBSSLUP + SAC
	NBSSLUP + SAC

Desertification and Land degradation vulnerability assessment (1:50K)	
Collection of ancillary data and ground truth data	NBSSLUP + SA
Geospatial database creation	NBSSLUP
Geospatial modelling	NBSSLUP + SA
Vulnerability assessment maps	NBSSLUP + SA
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 + SAC
Ground truth data collection	NBSSLUP + SAC
Geospatial technique development	NBSSLUP + SAC
Action plan Maps	
Atlas of Action Plan Maps	NBSSLUP + SAC
Uploading of database on VEDAS	NBSSLUP + 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
Jploading 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	546
Ore processing for the same	SAC

Pre-processing of satellite data

Change detection Maps and analysis

Uploading of database on VEDAS

Preliminary DSM Maps

Ground truth/ validation

Quality Checking

Final DSM Maps

Atlas of DSM Maps

Final Technical Report

SAC

SAC

SAC

NBSSLUP

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NBSSLUP + SAC

NBSSLUP + SAC

# 8. Milestones/Schedule:

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

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g of agreement)				
Timeline (T0 – Signing of agreement)  T0 + T0 + T0 + T0 + T0 + T0 +  adation Mapping				
Tin T0 + T0 + T0	studies	50K)	10K)	
Development of automated techniques for digital Desertification and Land Degradation Mapping  Timeline (T0 – Signature)  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	Land Degradation studies	Desertification and Land degradation vulnerability assessment (1:50K)  Geospatial database creation  Geospatial modelling	Vulnerability assessment maps Uploading of database on VEDAS  Action plan for combating Desertification and Land Degradation (1:10K)	
Activity Development of automated techniques for digital validation/ accuracy assessment	Exploring new sensors for Desertification and I Evaluation and development of techniques Collection of ancillary data and ground truth data Improved digital maps	Desertification and Land degradation vulnerabity Collection of ancillary data and ground truth data Geospatial database creation Geospatial modelling	AS ertification and La	tround truth data
Activity  Development of automated technique.  Procurement of satellite data  Pre-processing of satellite data  Collection of ancillary data and ground Technique development.  Field validation/ accuracy assessment.	Exploring new sensors for Desertification Evaluation and development of techniques Collection of ancillary data and ground truth Improved digital maps	Desertification and Land deg Collection of ancillary data and Geospatial database creation Geospatial modelling	Vulnerability assessment maps Uploading of database on VEDAS  ction plan for combating Deserti  Procurement of satellite data	Collection of ancillary data and ground truth data Geospatial database creation Ground truth data collection
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#### 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.
- Any publication resulting out of this work will be brought jointly by SAC and NBSSLUP.

Signatures

प्रधान में नेजान प्रभाग Head Geo Science Division
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31/5/17

पमुख, क्षेत्रीय केन्द्र / Head Regional Centre एक् अपरामसण्डं भ्रायनिज्यो / ICAR-NBSS & LUP हेळाल, बेंगलोग Hebbal, Bengaluru-560024 S. Shay

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NBSSLUP

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