Global Monitoring for Environment and Security and Africa (GMES & Africa)

OSS_North_Africa_ Land & Water

Earth Observation for Sustainable Land and Water Management in North Africa

Recruitment of a consulting firm for the extension of operational earth observation service for land degradation monitoring

THIS CALL OF TENDERS TARGETS THE AFRICAN PRIVATE SECTOR

Terms of reference

[AC/OSS/TLD&SIG_MISLAND/07062022-8]

June 2022

1. Table of Contents

List of acronyms

Acronym	Full description
AU:	African Union
AUC:	African Union Commission
CNCT :	Centre National de Cartographie et de Télédétection /National Centre of Mapping and Remote Sensing
CRASTE-LF:	Centre Régional Africain des Sciences et Technologies de l 'Espace en Langue Français
CRTEAN:	Centre Régional de Télédétection pour les Etats de l'Afrique du Nord
CUCT	Centre Universitaire de Cartographie et de Télédétection
DRC:	Desert Research Centre
EO:	Earth Observation
GIS:	Geographic Information System
GMES:	Global Monitoring for Environment and Security
LCRSSS:	Libyan Centre for Remote Sensing and Space Sciences
LULC:	Land Use / Land Cover
OSS:	Observatoire du Sahara et du Sahel / Sahara and Sahel Observatory
RS:	Remote Sensing
SLM:	Sustainable Land Management
SLWM:	Sustainable Land and Water Management
UNA:	Université de Nouakchott El Asriya

1. Introduction

The second phase of the «**Earth Observation for Sustainable Land and Water Management in North Africa**» project is in line with the continuity of the first phase and aims at addressing and solving global challenges in North-Africa as well as contributing to a more sustainable management of water and natural resources and tackling climate change based on Space science and technology applications.

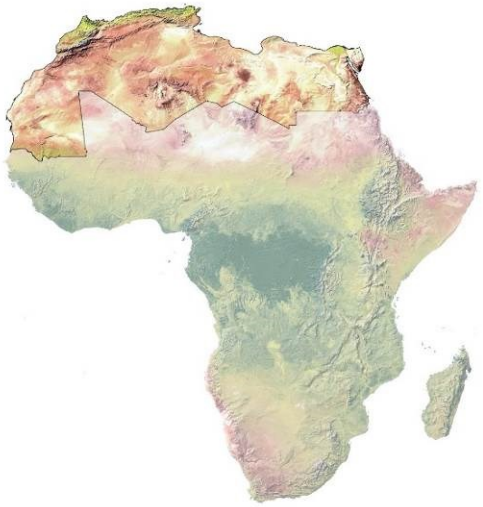

Figure 1: Action zone of GMES North Africa Land and Water consortium

The overall objective of this project is to support decision-making in the sustainable management of natural resources and water through products and services based on Earth Observation (EO) data and techniques. It is achieved through the following specific objectives:

- Developing and sustaining decision support services for natural resource and water managers;
- Boosting regional cooperation and promoting the exchange of know-how on natural resources and water management in North Africa; and
- Capacity building and awareness raising for all partners and end users on the potential and better consideration of technical data and Earth Observation applications.

The second phase activities are based on the capitalization of the first phase achievements with respect to the operational EO services in support of the sustainable management of natural resources and the socio-economic transformation for the North-Africa region aligned with the national policies and strategies. The activities are defined in continuity but with new ideas and thoughts to improve the first phase' achievements and can be summarized as follows:

- Improvement of policy and institutional framework: for a sustainable management of water and natural resources;
- Strengthening Earth Observation data and information access through consolidating extending the services developed in the first phase;
- Capacity development of partners and end-users;
- Engagement of academia and private sector in the services development and delivery;
- Strengthening communication and exchanges;
- Efficient knowledge management and development of a set of practices;
- Boosting cross-fertilization and cooperation for experiences sharing and resources optimization.

Two services will be operationalized during this phase which are:

- Water abstractions and seasonal agriculture monitoring;
- Land Degradation Monitoring and Assessment.

The Monitoring Integrated System for Land Degradation Monitoring (MISLAND) was developed by a collaboration between the OSS and Locate-IT under the GMES and Africa programme. MISLAND (www.misland.oss-online.org) can be considered as a Decision Support System(DSS) utilizing earth observation data to deliver information, promote awareness and, aid in decision making toward realizing Land Degradation Neutrality (LDN) in North Africa.

The core system provides information to monitor SDG indicator 15.3.1 (Proportion of land that is degraded over the total land area) through its three sub-indicators that, according to UNCCD, represent a minimum that should be complemented and enhanced by national (or sub-national) indicators for a more accurate picture of land degradation.

Therefore, in order to improve the understanding and multi-faceted nature of the active processes behind land degradation, MISLAND service provides in addition to SDG 15.3.1 indicator a rich kit of harmonized indicators for land degradation monitoring well adapted to North-Africa, namely:

- Vegetation loss and gain hotspots at 30m;
- Forest changes, forest risk assessment and burnt fires quantification at 30m/10 m;
- Vulnerability to desertification using MEDALUS approach;
- Vulnerability to water, wind and coastal erosion;
- Forest Carbone assessment.

These ToRs are elaborated for the extension of MISLAND to cover Africa region and integrate additional sub-indicators according to the road map that will be defined in the continental land degradation workshop planned for October 2022. The technical specifications of this extension are detailed in the annexes. The land degradation monitoring for Africa will be called from now and onwards DSS.

2. DSS Objectives

The main objective of this DSS is to strengthen North-African policy-makers', environment and agriculture and water resources manager's, planners', scientists' and citizens' capacities to assess and monitor land degradation and the impact of restauration actions through time.

The DSS focuses on the provision of evidence-based proofs on land degradation and its spatiotemporal distribution and therefore on the hotspots where priority action should be conducted or awareness-raising campaign should be planned.

The DSS will represent a platform to assess and analyse EO data and derived products to support monitoring and decision making, to deliver information in a used-friendly way whilst leveraging awareness raising among decision makers, water and natural resources managers and the general public. In addition, the DSS must be aligned to the following criterion:

- It can be used operationally by technical staffs in charge of environment monitoring and natural managers for monitoring land degradation and restauration and assessing their hotspots through **interactive geo-services**.
- It can be used by decision makers and stakeholders through **mapographics** with intuitive graphic chart and well-focused messages
- It can be used by public users where the maps of different indicators will be produced at regular basis to be defined according to the indicator. For example, it can be yearly for SDG 15.3.1 indicator and seasonally for forest fires. The maps will be accessible through an **interactive web mapping** dashboard where public users can intuitively discover and visualize the different products and export them.
- It can be used through **mobile app**

The consultant is expected to apply for the development of the service through the provision of an application including a detailed technical offer and a financial offer.

The DSS will be the property of the consortium where a full technology transfer will be conducted after the achievement of the development phase. It is recommended for the DSS to be developed in open source license, so that it can be made available for the OSS and its GMES&Africa North Africa partners.

2.1. Design and Development

The DSS will provide a dashboard for interactive visualization of EO-related products land degradation/restauration theme for different sets of users, ranging from decision makers (where summary information is displayed) to technical managers (who will analyse the georeferenced products). It will have 4 components:

- **Geo-services**: allowing the time-series EO data collection, processing and analysis in order to produce, analyse and visualize interactively the land degradation-related products, in a user-friendly way, with a download and maps creation on the fly functionalities. It encompasses maps creation functionality that will be carried out intuitively with a predefined symbology for the different products.

  The DSS must ensure the products' update systematically. In 2023 for example, the long-term mean vegetation indices will integrate the data for 2022.

- **MapoGraphics**: The products must be presented to decision makers through Mapographics that capture the most important messages to highlight. For example, in a one page, it can contain the map of the land vulnerability to erosion, the description of the index, the different charts and statistics. (Figure 2). The mapographics will be also delivered as interactive digital atlases that can be printed out.

- **Interactive web mapping**: Unlike the geo-services dashboard where the user has to choose the indicator, the processing parameters and the time stamp in order to query the datacentre to deliver the product, the interactive web mapping interface is meant to provide land degradation-related products directly consultable through intuitive web map interface. The users can check the product in the left pane for example, then the product is displayed on the right pane with a simple legend and with export functionality.

- **Mobile apps**: it's foreseen to develop an android apps that serves land degradation products:
    - **Forest/Bush fires event:** using daily Sentinel-3 data
    - **Forest/Bush fires impact**: using Sentinel2 / Landsat imagery
    - **Forest fire risk assessment**: using the developed model in MISLAND
    - **Vegetation loss/gain**: using long-term Landsat-derived vegetation trends
    - **Vulnerability to wind, coastal and water erosions, desertification**.
    - **Other products judged relevant**.

- **Desktop-GIS plugin**: the QGIS plugin will allow the same functionalities as the geo-services in a desktop environment. Hence, it allows technical staff wishing to undertake more advanced analysis to use their own data in GIS environment without sharing them on the internet, and have a full control of processing parameters unlike by-default one used in the web services.

The users can undertake interactive maps creation, including the products display with the predefined symbology and layout preparation for map generation. The default layout will take into consideration the GMES&Africa graphic chart (mainly the logos of the OSS, GMES&Africa, and AUC & EC). The service will also allow the maps exports (for their future use in reports and bulletins for example)

In order to guarantee the operational service delivery, the consultant will guarantee the delivery of the DSS, its deployment and maintenance, the development of technical guides and reports, the capacity building materials that will be used as supports for training the end-users on the service use. The full technology transfer and the warranty for the GMES life time will be ensured by the consultant.

The proposal will include also capacity building sessions for end-users. The OSS and AUC, along with the consortium partners and active end-users will support in terms of logistics preparation and organization at the national level. The training plan and session contents will be developed in a collaborative approach

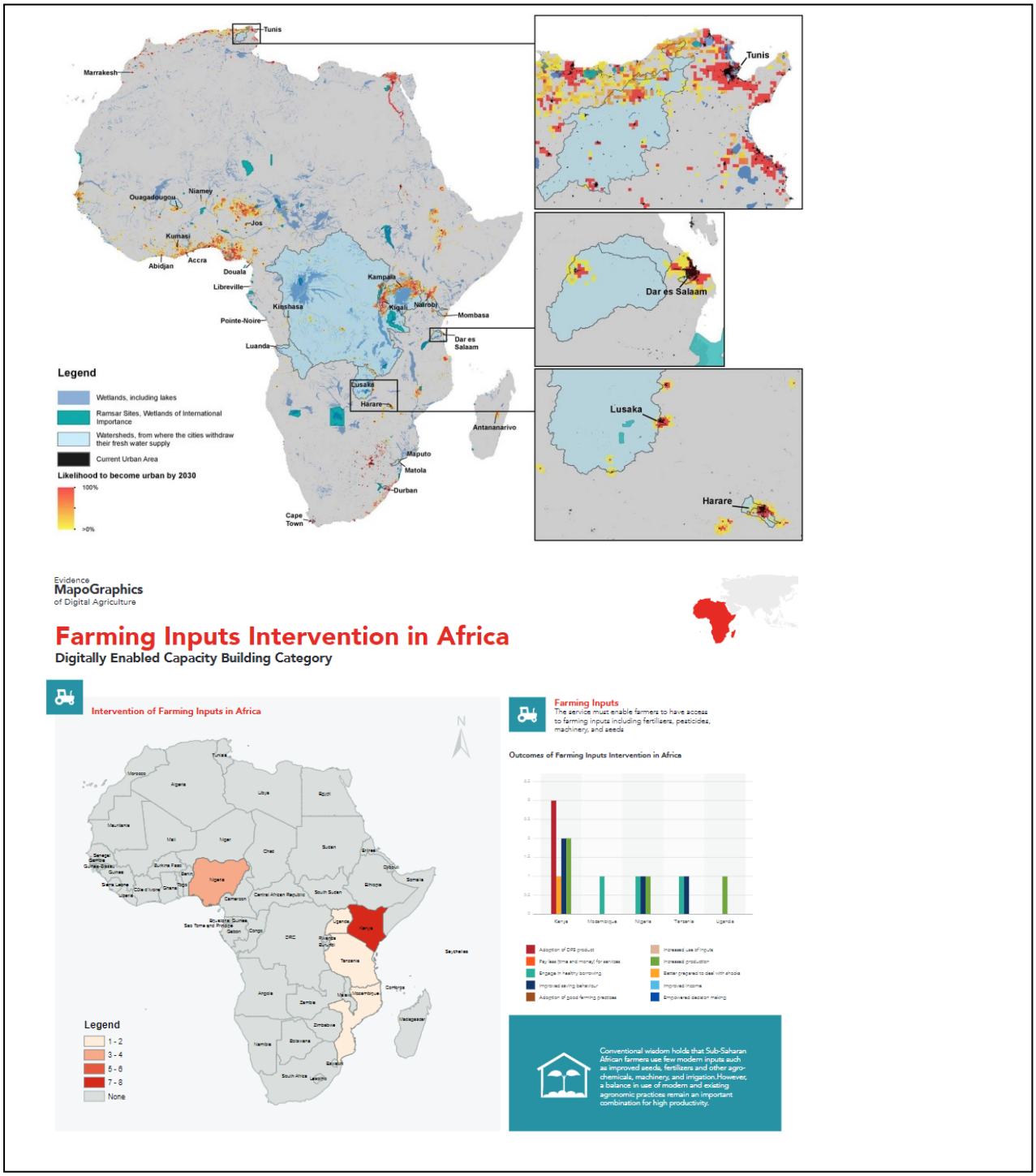

Figure 2: Overview of expected mapographics

2.2. Service ownership

The developed tool is the property of the OSS and its partners and meant to be used at a larger scale by the partners and end-users in the framework of GMES&Africa and beyond. The system and its components will be fully used, maintained and upgraded by the GMES consortium, without requiring any additional rights requests or payment of any extra rights.

The OSS and its partners have the right to copy or distribute the system components to third parties, to upgrade it and to implement new algorithms and functionalities, without any prior permission or request.

2.3. Service feedback collections

The DSS is meant to evolve according to the growing end-users needs and to be interactive in a user-friendly way. If the interface or a module is malfunctioning or the products do not correspond to the end-user's expectations, the end-users should have the possibility to contact the admin team and to provide their feedback.

The DSS must include a feedback collection mechanism and the technical offer must include a section describing how the consultant will handle the feedback collection and management. The Frequently Asked Questions (FAQs) section should be taken into consideration. The moderation service should be also described in the technical offer.

2.4. Service versioning

Based on the first prototype results and the growing end-users needs, the need for new functionalities, the processing customization and some regions' specificities are expected to be raised. Therefore, the service is called to evolve. The versioning must be taken into consideration in the service development cycle.

In other words, the first prototype of the service will be tested by the GMES partners and presented to the end-users. Hence, the feedback collection will be carried out in order to reflect the needs in terms of functionalities, dashboards, options and customization that will be handled to release the new version of the service.

2.5. Capacity building

Two types of capacity building will be provided in the framework of this call:

- Capacity building on the DSS use for end-users;
- Capacity building on the DSS administration and maintenance.

Since the DSS is the property of the OSS and its partners, their technical teams should be able to ensure its administration and maintenance. Therefore, the consultant should secure the full technological transfer of the DSS and its components to the OSS team.

The capacity building materials that will be used as supports for training the end-users on the DSS use will be developed in the framework of this consultancy, which includes also the organization of capacity building sessions for end-users.

Based on the first phase experience, all the trainings will be conducted on the version deployed at OSS level and in virtual format.

The OSS will support the trainings in terms of logistics preparation and organization at the national/regional levels. The training plan and session contents will be developed in a participatory approach.

3. Duration of the Mission

The Consultant shall undertake the performance of the assigned services in accordance with the schedules and deadlines set forth in the Terms of Reference.

4. Qualifications of the Consultant

The consultant (consulting firm) will be selected on the basis of the following qualifications:

4.1 Specialty:

Preferably having as a recognized field of specialization of geomatics and GIS apps development

4.2 Number of years of experience:

The mission subject of this contract is preferably aimed at specialized offices with a number of years of experience greater than or equal to 10 years.

4.3 References:

The mission covered by this contract is preferably aimed at specialized firms with a number of references greater than or equal to three (3).

4.4 Profile of Experts

The mission will be carried out by a team where the key staff to be mobilized by the consulting firm must have the qualifications following:

- specialist in computer science, geomatics, environment, agriculture, remote sensing, natural resource management and other related and relevant fields;
- having experience in remote sensing / environment and
- Solid experience in EO-derived application development, in Python for geospatial development, web interfaces design, EO data and products processing and analysis.

- Solid experience in land degradation monitoring: development of monitoring platforms, definition and conception of land degradation monitoring indicators and models, evaluation and assessment of different monitoring approaches and indicators and their accuracy and relevancy.

They shall also possess the following skills:

- Ability to work closely with a group of national and international experts, meet strict deadlines and plan work according to priorities;
- Excellent initiative, good analytical and synthesis skills, ethics and honesty;
- Good communication skills and the ability to interact productively in a teamwork environment.
- Fluency in French and/or English, knowledge of Arabic is a plus;

5 Deliverables and submission procedure:

It's worth noting that a regular meeting (face-to-face or through remote calls) should be undertaken regularly, during the development process of the service.

5.1 Deliverables and deadlines

The deliverables can be summarized in the following points:

- **Datacenter**: delivered and set at the OSS premises to ensure that the service is up and running. The technical specifications must take into consideration the service coverage so that the processing capabilities and disk storage ensure that the service is fully operational.
- **Land degradation monitoring services**: up and running, with different components and interfaces described in 2.1 for data acquisition, processing and analysis, interpretation and exports. This service will integrate the available models and indicators developed for North-Africa but extended to cover the African continent. The service also will integrate the models and indicators that will be discussed and agreed on the next continental workshop on land degradation monitoring that will be organized by OSS, as well as other indicators judged relevant (Vegetative stage assessment of field crops, RUSLE, drought risk, etc)
- **Service maintenance**, feedback collections mechanism
- **Technical documents detailed and summary format**:
  - Service architecture and components
  - Technical description of the different indicators and the scientific background behind
  - Guides and tutorials for hands-on
  - Technical reports and DSS's related documentation
- **Capacity building:**

  - Trainings on the DSS use
  - Training on DSS administration and maintenance
  - Capacity building materials and training sessions according to the agreed content and time table
  - Short demonstration videos for the DSS and its functionalities and interfaces
  - **Full technology transfer**
- **Promotional videos:**
  - Promotional videos on the use of MISLAND
  - Didactic videos per functionality / theme (teasers)
  - Short animations (Gifs, etc) highlighting specific functionalities or outputs.

It's worth noting that the development plan and deadlines will be discussed with the selected consultant:

- The first prototype is expected to be delivered before December 30th ,2022
- The first official public release up and running, integrating the end-user's feedbacks, is expected by April 30th, 2023.
- The technical documents as well as the capacity building materials are expected to be delivered by April 15th, 2023.
- The training of the IT team in charge of the DSS administration and maintenance is expected before April 15th ,2023
- The end-user's capacity building training sessions are expected to be undertaken as soon as the first public prototype released and end before October 30th, 2023.
- The final release, integrating the first round of user's feedbacks, and the full delivery of all the requested mobile apps, must be up and running before December 28th ,2023

The development will be made with the full involvement a restricted committee including the OSS team and GMES partners. Regular virtual meetings are planned to monitor the overall progress, to provide feedbacks and recommendations based on the past experiences and similar initiatives.

5.2 Remuneration and payment procedure

For the whole package described in this present document (ToRs), the financial offer will be proposed by the consultant. The financial offer will be negotiated with the OSS according to the offer consistency and the technical specifications in the ToRs. The technical offer will be also discussed with the OSS according to the technical consistency and feasibility of the different tasks and components.

Accordingly, a contract will be prepared by the OSS and the consultant.

The payment will be made by the OSS to the bank account specified by the consultant, upon validation by the OSS of the tasks requested. It will be carried out in several instalments, which

will be defined, by mutual agreement with the consultant, in the contract. A first proposal can be presented as follow:

- **50%** of the overall amount will be paid once the first prototype of the service up and running and the capacity building materials, including the technical documents, delivered

- **50 %** of the overall amount of the cost will be provided once the datacentre delivered and correctly established at the OSS premises, and the final release of the DSS received and validated, the reviews reflecting the end-users feedbacks integrated and the capacity building sessions achieved.

The payment can be negotiated if requested and a mutual agreement with the consultant will be reached accordingly.

5.3 Content of the offer

The Tenderer is invited to submit his file containing the administrative file, the technical offer and the financial offer, which must be provided separately.

a) The administrative file:

- A recent extract from the trade register or any other equivalent document required by the law of the country of origin,
- The Consultant's reference form (according to the model attached in Annex 4).

b) Technical offer:

- **A detailed technical offer** for carrying out the mission, detailing the approach proposed by the Tenderer for the realization of the mission, as well as a schedule of realization through a detailed chronogram (prototype development, versioning …), including the different stages of the realization of the consultation. The offer must also describe how the technical aspects are handled: DSS design and architecture, approaches for handling data over Africa, different components management, etc. This will include the literature to be used.
- The references of the Consultant in the field of **land degradation monitoring** and related platforms and mobile apps development justified by copies of certificates of good execution, indicating the date of realization of the services.
- The detailed and signed curriculum vitae of the Consultant (according to the standard OSS CV template downloadable at the following link: **[OSS CV Template]**
- The list of the members of the team proposed by the Consultant and their curriculum vitae's (according to the standard OSS CV template downloadable at the following link: **[OSS CV Template]**
- Other references deemed useful

Please note that it's possible to keep the technology currently adopted in MISLAND, or to adopt other solutions judged relevant. ToR's of mobile Apps will be developed separately.

c) Financial offer:

In order to better compare the applicants' offers, it is highly recommended that applicants provide a breakdown of their financial offer. In addition, applicants should take note that payments can only be made based on the products delivered i.e. on presentation of the result of the services specified in the ToRs and after validation of these deliverables **by the monitoring committee (composed by OSS and GMES partners)**.

The offer should be valid for three months, starting from the day following the deadline submission.

5.4 Deadline and Submission modalities

Tenderer are invited to apply by sending their offers by e-mail to: **procurement@oss.org.tn**

Mentioned in the subject line:

- "GMES&Africa - Notice of call for applications for the development of GMES-EO services – Land degradation monitoring service **[AC/OSS/TLD&SIG_MISLAND/07062022-8]**

The deadline for receiving offers is **June 30th, 2022** at 3 p.m. (Tunis time).

5.5 Offer evaluation

Offers will be evaluated based on the weighted rating method:

- Weight of technical criteria: 70%
- Weight of financial criteria: 30%

Contract award should be made based on the evaluation of offers determined as follows:

- Compatibility / acceptability and
- Obtaining the best score on a predetermined set of criteria weights specific technical and financial.

Only applications having obtained a minimum of 70 points would be considered for the evaluation financial.

The Tenderer is rated according to the following grid:

Table 1: Evaluation grid of the technical offers

	Land Degradation monitoring service
Qualifications & Experiences (50 pts)	**Diploma and proposed experts' experiences *(20pts):*** - Diploma - Proposed experts' experiences in relation with proposed tasks: land degradation monitoring, development of platforms and geo-services, development of mobile apps, etc - Language skills - Proven experience with similar projects
	References in the field of study: Scientific releases, ... *(10pts) :* - Land degradation monitoring through remote sensing; - Modelling of vulnerability to degradation (desertification, erosion, ...); - Mapping of degradation hotspots -Remote Sensing / Geo-spatial Science and Technology;
	References in the field of study: Design, Development, ... *(20pts) :* - Development of web services, geoportal and map viewing interfaces; - Development of geospatial processing chains; - Design / Development of platforms for monitoring natural resources through remote sensing -Integration of big-data analytics and cloud computing infrastructures and services
Methodology (50 pts)	**Methodology *(50 pts)***
	ToRs compliance *(20 pts)*
	Organization, planning and comments *(20 pts)*
	Proposals *(10 pts)*

Annex 1: Technical specifications

1.1. Land degradation monitoring service

Globally, 80 percent of land degradation is caused by agriculture. Since 1950, 65 percent of Africa's cropland, which millions depend on, has been affected by land degradation by mining, poor farming practices and illegal logging. [1]

The North African sub-region represents the full range of aridity indicator, as extended areas of hyper-arid and arid climate with relatively limited areas of semi-arid and arid sub-humid conditions in the highlands of the sub-region.

Most Northern African countries experience – in addition to highly variable rainfalls – recurrent long and severe drought spells. Algeria, Tunisia and Libya experienced droughts in the late eighties till 1993. Morocco has experienced a drought in one year out of every three years over the past few decades, UNEP (2002).

For that, the land degradation monitoring service aims to provide evidence-based proofs on land degradation and its spatiotemporal distribution and therefore on the hotspots where priority action should be conducted or awareness-raising campaign should be planned. It will provide reliable information on land degradation and trends will support the countries to combat degradation in one or more of the land use categories for better program planning and awareness raising.

At the regional level, the basic indicators will include the three main sub-indicators of SDG 15.3.1, namely: LULC and its changes, land productivity and carbon stocks (surface and underground). These sub-indicators represent a minimum that should be complemented and enhanced by national (or sub-national) indicators for a more accurate picture of land degradation (rainfall erosivity, terrain slope, soils erodibility, socio-economic factors …), according to the country specificities as well as data availability and accessibility.

Land degradation is defined by UNCCD as a complex issue that refers to the long-lasting reduction or loss of biological and economic productivity of lands caused by human activities, sometimes exacerbated by natural phenomena.

In addition to LDN sub-indicators, the service will provide land degradation hotspots (LDHs) through different models and approaches such as vegetation hotspots that are produced via the analysis of time-series vegetation indices data and are used to characterize areas of different sizes where the vegetation cover and the soil types are severely degraded.

It's worth noting that degradation can be caused by different factors: excessive human pressure, drought conditions, forest fires, hydrological erosion… The idea behind is not to determine the causes, but to highlight the consequences, and raise awareness to take these facts into consideration in plans development and intervention strategies.

[1] Source : http://www.ipsnews.net/2018/08/land-degradation-triple-threat-africa/

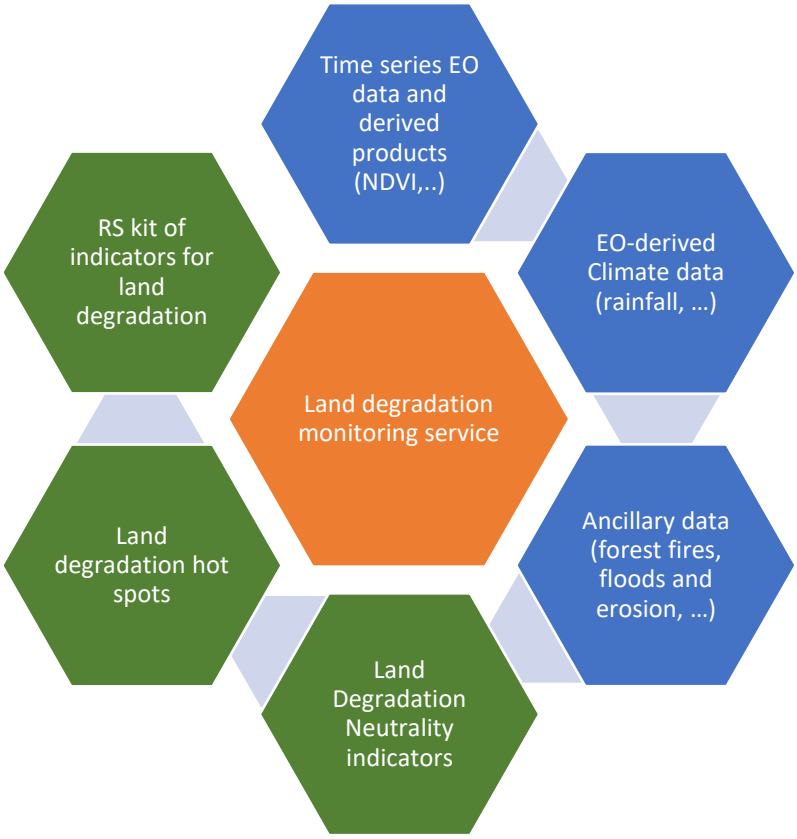

Figure 3: Overview of Land Degradation Service

The DSS will extend the actual MISLAND-North Africa to cover the continent, which implies that the different indicators judged relevant in other African regions will be taken into consideration. A special attention will be given to high resolution data where it's recommended to include the Landsat time-series data and derived products (relevant vegetation indicators and other products) in the processing chain, because of the long-term archive availability at higher spatial resolution (30m).

1.2. Overview of the common characteristics of DSS:

1.2.1. Products delivery format:

The delivery format is tailored to the specific end-user needs and depends on their expertise in processing and interpreting EO products:

- **GIS format** (raster and vector formats): data is delivered via FTP server or download links, and will be available for free through the dissemination platform (developed by the OSS).
- **Web maps**: data is available through a web portal as interactive maps with interrogation and export capabilities,
- **Summary materials**: data is summarized in statistics in tables and graphs for decision makers and water resources managers. This will raise awareness and support the improvement of

strategies and direct decision-making process by providing timely information on irrigation areas and extension as well as on water consumption.

- **Periodic bulletins** to target a larger audience: mainly observed climate trends from EO data and products summary
- **Technical report** details the developed/adapted approach and the interactions with the water abstraction monitoring service.

An interactive Help module must also be integrated where more details on the technical processes and parameters as well as the interpretation of the different indicators will provided in two languages (FR/EN)

1.2.2. Time frequency of output products

The service will integrate a systematic collection of new satellite derived data and ancillary data (NDVI, rainfall, …) as well as new Sentinel-2 acquisitions from the Copernicus catalog and other relevant sources. As soon as the images downloaded, the products are updated and fetched to the processing pipelines and visualization interface.

For example, the availability of a cloudless image of Sentinel-2 image acquired in the data and being available for download will trigger its collection from the Copernicus Hub (or other relevant sources) to the OSS data center, its processing to estimate the evapotranspiration and its availability through the service visualization dashboard.

The service will guarantee the data collection and processing the data in order to:

- **Develop baseline datasets**: rainfall long term average, NDVI long term average,
- **Generate products**: EO-derived products, such as degradation/restauration hot spots systematically produced and fetched to the visualization component.
- **Time series analysis**: Identification of abnormalities and the comparison of time series products between years (swipe view for example)
- **Summary** and time-series samples at an administrative level (watershed, basin, district)

1.2.3. Geographic Coverage

Two different levels can be distinguished:

- **Continental level**: where the harmonized kit of indicators covers the African continent. The DSS will offer the assessment of land degradation and restauration at different administrative boundaries levels as well as regional level (according to the 5 regions defined in the GMES guidelines)

- **Regional/local levels**: where customized models well adapted to specific regions will be implemented to provide a realistic overview of land degradation/restauration that reflects the landscape evolution.

Combination between both levels can be foreseen if ancillary data are not made available. By default, DSS will be up and running using publicly available datasets (EO-derived vegetation indices, DEM, world soil database, etc)

The **additional models** will be provided along with the roadmap developed after the continental land degradation workshop, with the customization possibility of the geographic coverage.

The DSS must foresee the geographic coverage functionality, that administrators can upload the region of interest in vector format (shape file for example), expressed by the end-users.

It's important to suggest EO-derived products and additional relevant functionalities. The decision makers will have the possibility, through these datasets and derived products, to monitor for example the climate-related data and assess the vegetation response.

1.2.4. **Target users:**

Different categories of beneficiaries are expected to use and discover the DSS, including but not only environmental agencies, water and natural resources managers, desertification focal points at the national level, decision makers, students, researchers and academia, as well as general public audience.

Hence, the service should adapt the visualization interface to meet the main different end-users' categories:

- **Decision makers**: who are interested in an overview od land degradation in their area of interest in a very intuitive and simple way
- **Water and natural resources managers**: who want to get access to a catalogue of land-degradation-related products with a possibility of products exports for their use in field visits or in their reports (maps, statistics, …)
- **RS experts**: who want to customize the processing parameters and conduct more advanced analysis with cross-validation schemes and export functionalities (in GIS format)
- **Public users**: who want to discover the products at the pilot sites level, as well as over the country to the continent level.

The web interface must be developed in a way that different users can be able to discover and export the products.

The web interface scheme should be included in the technical proposal. It's recommended to draw inspiration from **COPERNICUS Land Service** described in the link below as well as from references in the "**useful links and references**" section:
https://www.copernicus.eu/sites/default/files/Copernicus%20Land%20Monitoring%20Service%20factsheet%20status%20October%202018.pdf

1.3. Ancillary data management

Two scenarios should be foreseen, and the service is expected to run in both cases:

- **No input data is provided** by the end-users: the service will use the freely available climate Data and time-series satellite imagery, as well as other ancillary data available in international data sources (soil, climate, .etc)
- **Ancillary data are made available**: these data can be used in the more advanced modeling and calculation, so upload functionalities and processing integration must be taken into consideration. For example, detailed soil maps and LULC datasets to be used instead on internationally available ones.

The DSS prototype will be developed using the first option, means that no input data are provided. The first prototype will be validated using the data provided by a champion user and covering a well-defined pilot site demonstration area.

It's worth noting that the DSS will integrate the authentication access for administrators and granted users. The registered partners (GMES national partners) will have access to geospatial products covering their respective countries, can download/upload data and can edit the data to make corrections they deem necessary, hence changes made are depicted on the map directly.

A disclaimer will be produced to announce the model chosen and the accuracy expected.

It's worth noting that the approaches chosen, the products as well as the functionalities will be discussed during the kick-off meeting with the steering committee which will be defined later by the OSS.

1.4. Components:

The service can be decomposed according to the following scheme to different components: data centre for data collection and storage, webservices for data processing and visualization, and capacity building materials (trainings, help,) as described in 2.1.

All codes must be well documented, preferably in python. The architecture of the different components as well as the main functionalities must be documented as guide and/or short videos. **The technical offer must detail the processing methodology as well as the platforms and literature to be used**

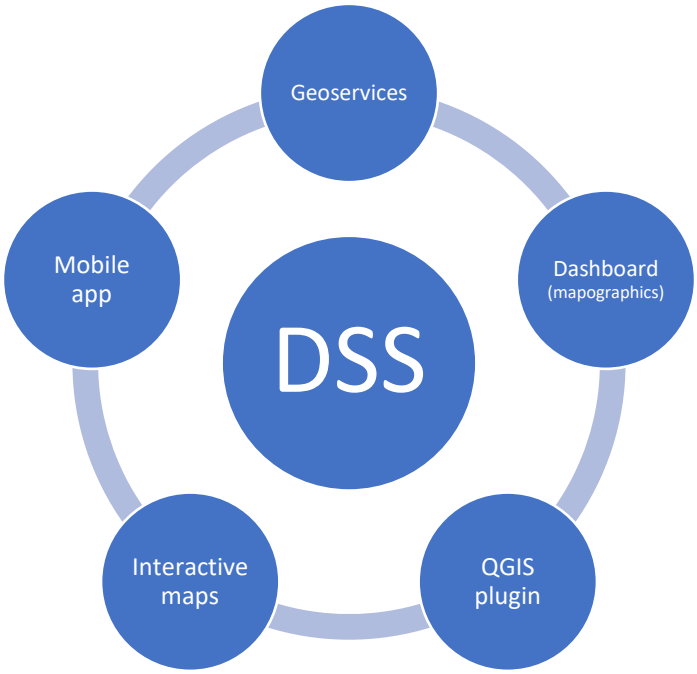

Figure 4: DSS components

1.4.1. Datacentre:

The datacentre should ensure that the service is fully operational using internal resources which implies that the technical specifications required are respected and taken into consideration:

- **Storage infrastructure**: to ensure the storage facility of datasets covering Africa continent, extensible.
- **Computing resources**: 64 cores minimum
- **Networking infrastructure**: in order to ensure the connection with the OSS-servers (public IP) using high-debit linkage

This datacentre will be provided in the framework of this consultancy, deployed and hosted at the OSS premises. This platform should offer tailored tools and services for handling big Earth

Observations and geospatial data triggered by the requirements specifications of the services characteristics.

As for the IT equipment, the consultant will advise the technical team on the system requirements based on the initial estimations of data volumes, processing ability and hosting issues. Then, he will be in charge of delivering the IT equipment of the agreed characteristics, setting them at the OSS premises and deploying the system.

1.4.2. Geoservices:

The geo-webservices are expected to be intuitive and interactive. They should integrate the following functionalities:

- **Data collection**: the webservice is in charge of collecting input data into the datacentre, as well as new acquisitions as soon as they are available.
  The list of data products contains:
  - **Landsat- derived vegetation indices** such as NDVI, which are used for vegetation long-term analysis and land productivity assessment
  - **Climate data**: rainfall (CHIRPS), temperature, …
  - **Soil data**: Harmonized World Soil DataBase (HWSDB)
  - **Any products required for the different processing pipelines**

This list is not exhaustive, it is a changing list which may be updated according to the service evolution as well as the requirements of the proposed approaches.

It's recommended that the plugin will be written in Python. This will guarantee an efficient portability and mutualisation of codes (Webservice & GIS plugin) since the main codes related to data collection, processing and even visualization are the same.

- **Data processing:**
  - **Global products** of the different indicators and models that will be visualized through the interactive web mapping interface
  - **Specific products** related to the three services

- **Data visualization:** the service must integrate an intuitive dashboard for data visualization and interpretation allowing:
  - **Visualization** of time-series data (vegetation indices, …)
  - **Analysis** of changes and trends
  - **Interact** with data: interrogate values, inspect elements, etc
  - **Summary** of data per area, per district or predefined delimitation boundaries (shape file uploaded by the user)
  - **Interactive** dashboard: per region / per district where results are aggregated
  - **Map export**: geo-pdf, PDF, JPG, and in SIG format (georeferenced raster/vector data)
  - **Statistics export** for reporting and advanced-analysis

  - **Animation** of the different indicators (NDVI reflecting the crop growth, evapotranspiration, …)
- **Service Monitoring**: statistics on service usage, plugin-download, etc.
- **Capacity building and Help modules**: interactive help and guiding tour as well as capacity building materials (video, tutorials, …) must be provided.

1.4.3. Mapograhics:

For decision makers and stakeholders, the products will be aggregated at the different administrative levels according the provided data for ADM (district, governorate, regional and national levels) and provided with intuitive mapography allowing raising awareness and easy messages interpretation.

1.4.4. Interactive web mapping interface:

Unlike the webservice where the products are generated according to the end-user's request in an interactive mode, by-default general products are produced systematically and made available for intuitive visualization through interactive web interface. The summary products covering the action zone of the project are produced through the aggregation of the different results and prepared for intuitive visualization and export of maps, statistics, graphs and summary.

For example, a user can check the left pane to activate the vulnerability to desertification and in the right pane the map of vulnerability to desertification will appear accordingly.

This component must integrate an intuitive dashboard for data visualization and interpretation allowing:

- **Visualization** of the different products derived (SDG 15.3.1, vulnerability to erosion, etc)
- **Analysis** of changes and trends
- **Interact** with data: interrogate values, inspect elements, etc
- **Summary** of data per area, per district or predefined delimitation boundaries (shape file uploaded by the user)
- **Interactive** dashboard: per region / per district where results are aggregated
- **Map export**: geo-pdf, PDF, JPG, and in SIG format (georeferenced raster/vector data)
- **Statistics export** for reporting and advanced-analysis
- **Overlay of products** through simple check boxes

1.4.5. Mobile Apps:

Using mobile apps, it's expected to each a higher audience through the delivery of useful and relevant information related to land degradation such as:

- Visualization of the fires of the last few days that are registered through Terra and Aqua Sensors along with Sentinel-3,
- Quantification of burnt area using Landsat and Sentinel;
- Visualization of vegetation loss and gain hotspots at 30m;
- Assessment of forest changes, forest risk assessment;
- Visualization of different derived products through MISLAND such as the vulnerability to desertification using MEDALUS approach, the vulnerability to water, wind and coastal erosion;
- **Other products and functionalities judged relevant.**

1.4.6. **Plugin QGIS**

The plugin must include the same functionalities as the web service: data collection, processing, analysis and visualization. It should also integrate the possibility of connection into the GMES dissemination platform and/or MISLAND platform to visualize and download the data directly.

1.5. **Documentation and trainings**

All codes should be well documented, the detailed description of each module should be provided along with the webservice:

- Technical guide describing the modules and the inter-relation between.
- Technical guide describing the processing steps and the scientific background behind (evapotranspiration estimation, irrigated area mapping…), the algorithms used and their scientific background
- Tour guide for the different DSS' components for non-experts' users
- The DSS customization guide
- The DSS maintenance guide
- Materials judged relevant to ensure the DSS appropriation and easy hands-on

The consultant will be mobilized to guarantee a full technology transfer through training of trainers (ToTs), training end-users on the DSS use, trainings on its administration and maintenance. During these trainings, participants are expected to master how to use the DSS and customize it, and interpret the output products.

The consultant will produce an extension kit for end-users, the content of which will be specified in the methodology note. This kit should include at least the extension modules that will be used during the training sessions, explanatory booklets in web video and paper format and/or tutorials.

Annex 2: References and useful links

- MISLAND : www.misland.oss-online.org
- OneSoil platform for crop monitoring : https://map.onesoil.ai/2018#2/44.35/-43.66
- IRRISAT platform for irrigation monitoring : https://irrisat-cloud.appspot.com
- EEFLUX METRIC platform: https://eeflux-level1.appspot.com
- JRC ASAP High Resolution Viewer : https://mars.jrc.ec.europa.eu/asap/hresolution/?region=214

Annex 3: GMES Services

In line with the first phase, two services will be developed under the project:

- Seasonal agriculture and water abstractions monitoring: this service will be the fusion of L122 and L231
- Land degradation monitoring: this service will be the extension of L221 to cover the entire African continent.

The services details are described here below:

L122 : Monitoring, follow-up and evaluation of water in irrigated areas

- Mapping irrigated areas and their long-term spatial and temporal monitoring.
- Multi-scale methodologies for estimating, monitoring and evaluating the areas irrigated by remote sensing as well as the volumes of water withdrawn for irrigation.
- Indicators on resource status and anthropogenic pressures and natural factors, crop water productivity.
- A system for monitoring uncontrolled/unauthorized irrigated area extensions and overexploitation of aquifers.
- Simulation and projection of scenarios of the evolution of the state of water resources and their uses for decision-making.

→ Use and impact of results: Development of approaches for quantitative estimation of water withdrawals.

L221: Monitoring and assessment of land degradation

- Multi-scale indicators on land degradation.
- Operational land degradation monitoring services at regional and local scales.
- Capacity building of agencies on indicator calculation.
- Characterization and analysis of land degradation hotspots.
- An online degradation information system.

→ Use and impact of results: Development of integrated approaches to land degradation assessment - Contribution to the analysis of indicators for monitoring degradation.

L231 : Seasonal Agricultural Monitoring, Early Warning and Assessment

- Multi-scale maps of land use and its changes.
- Remote sensing indicators for monitoring agricultural campaigns.
- Methodologies for spatio-temporal monitoring of agricultural areas.
- Tools for disseminating agricultural campaign monitoring products at defined time intervals (newsletters and information systems).
- Drought early warning bulletins (water and agricultural).

→ Use and impact of results: Assessing pressures on biodiversity - Contribution to regular monitoring of ecosystem status.

Annex 4: Referencing form

<table>
<tr><th colspan="4">CONSULTANT'S CONTACT INFORMATION</th></tr>
<tr><td colspan="4">Company name:</td></tr>
<tr><td colspan="2">Legal form:

Tax ID number:

Date of registration:

Place of registration:</td><td colspan="2">Tax number:

Date of registration in the commercial register:</td></tr>
<tr><td colspan="2">Capital:</td><td colspan="2">Website:</td></tr>
<tr><td colspan="2">Name, first name, nationality and position of the legal representative:</td><td>Position:</td><td>E-mail:</td></tr>
<tr><td colspan="2">Name, first name and nationality of the Contact Person:</td><td>Position:</td><td>E-mail:</td></tr>
<tr><td colspan="4">Legal address in the country of activity:</td></tr>
<tr><td>Zip code:</td><td colspan="2">City:</td><td>Country:</td></tr>
<tr><td colspan="2">Telephone:</td><td colspan="2">Fax:</td></tr>
</table>

PLEASE RETURN THIS DOCUMENT DULY COMPLETED AND SIGNED BY THE LEGAL REPRESENTATIVE.

Done at ……., on ……..

Signature and stamp