Project no.: INCO-CT-2007-043602

VGT@Work

How "space" helps to manage ecosystems

SSA
FP6-INCO-DEV

PUBLISHABLE ACTIVITY REPORT

Period covered: from 2007/01/01 to 2009/08/31

Date of preparation: 2010/06/11

Start date of project: 2007/01/01

Duration: 32 months

Project coordinator

Else Swinnen

VITO

Revision: v2

1 Objectives and main achievements

VGT@Work, or how 'space' helps to manage ecosystems, aimed at making African EO experts familiar with the VGT4Africa products, their properties and limitations. Therefore, the **overall project objective** was to **train and support** (both on the scientific as on a technical level) **staff of our African partners** so that they became fully **autonomous** in the use of these products and to **reinforce their existing monitoring and reporting capacity**.

The objectives of this project were to

1. **build up the capacity** in the institutions of the two African partners in two targeted geographic areas: Western Africa and Botswana so that they could
2. develop their **operational environmental monitoring services** based on the exploitation of the VGT4Africa products delivered through the EUMETCast/DevCoCast system; and
3. ensure the sustainability after project completion by ensuring **autonomy of African staff**.

The main achievements in relation to the objectives are:

1. **Capacity building**
    a. Each African institution seconded three experts to each European partner institutions for a period of 10 to 12 weeks. Here the six experts became fully familiar with the products derived from the VEGETATION data and distributed through the GEONETCast system. The list of trainings is summarized in Table 2.
    b. Each European partner organized training at the African Institutes for follow-up training (see Table 3)
    c. Each African institution organized training for their end users, and for their own staff who did not participate to the training in Europe
2. **Operational monitoring services**
    a. The six experts developed and tested during their stay in Europe an integrated monitoring application geared to the needs of their end users. More information on the applications and their impact is provided in the two information boxes.
    b. The six experts have successfully installed and tested their application in the local environment of their institution. In addition, all applications have been integrated in their daily work.
3. **Autonomy of African staff**
    a. The applications are being used by the institutions for producing their information (bulletins, reports, etc.).
    b. Continuity of the input data is guaranteed by the DevCoCast (FP7) and Geoland2 (FP7) projects, that take over the task of the VGT4Africa project in producing and disseminating the products derived from SPOT-VEGETATION.

c. The AMESD project (EDF) builds on the experience of VGT@Work and the African centers for the implementation of its activities.

2 Context of the project

VGT@Work built on a **number of developments** that are relevant for the **Global dimension of GMES.** In a ***first step***, European **research projects** (GEOLAND, CYCLOPES, etc.) in the area of Earth Observation and environmental monitoring generated knowledge and developed methods to produce various added-value products to monitor terrestrial environment in a pre-operational manner (see Table 1).

In a ***second step*** the VGT4AFRICA project (FP6), brought these products into **operational** production and **disseminates** them via the GEONETCast data broadcasting system operated by EUMETSAT, to all countries in **Africa** equipped with a "PUMA" receiving station provided by the EDF-funded Meteosat Transition in Africa project. In this way, the African EO-experts receive 10-daily a number of added-value EO products related to land-management.

VGT@Work focused on the ***third and final step***, in which the **local African EO-experts become fully autonomous in the use of these products, by extracting relevant information out of them and by presenting this in a user-friendly form (bulletins, monthly reports, …) to their end-users** (e.g. the national policy makers, administration, etc.). This information should help the policy makers to make the correct decisions in support of a sustainable development in Africa.

Figure 1 sketches the relationship of VGT@Work with other European projects and the role of external organizations (EUMETSAT and PUMA).

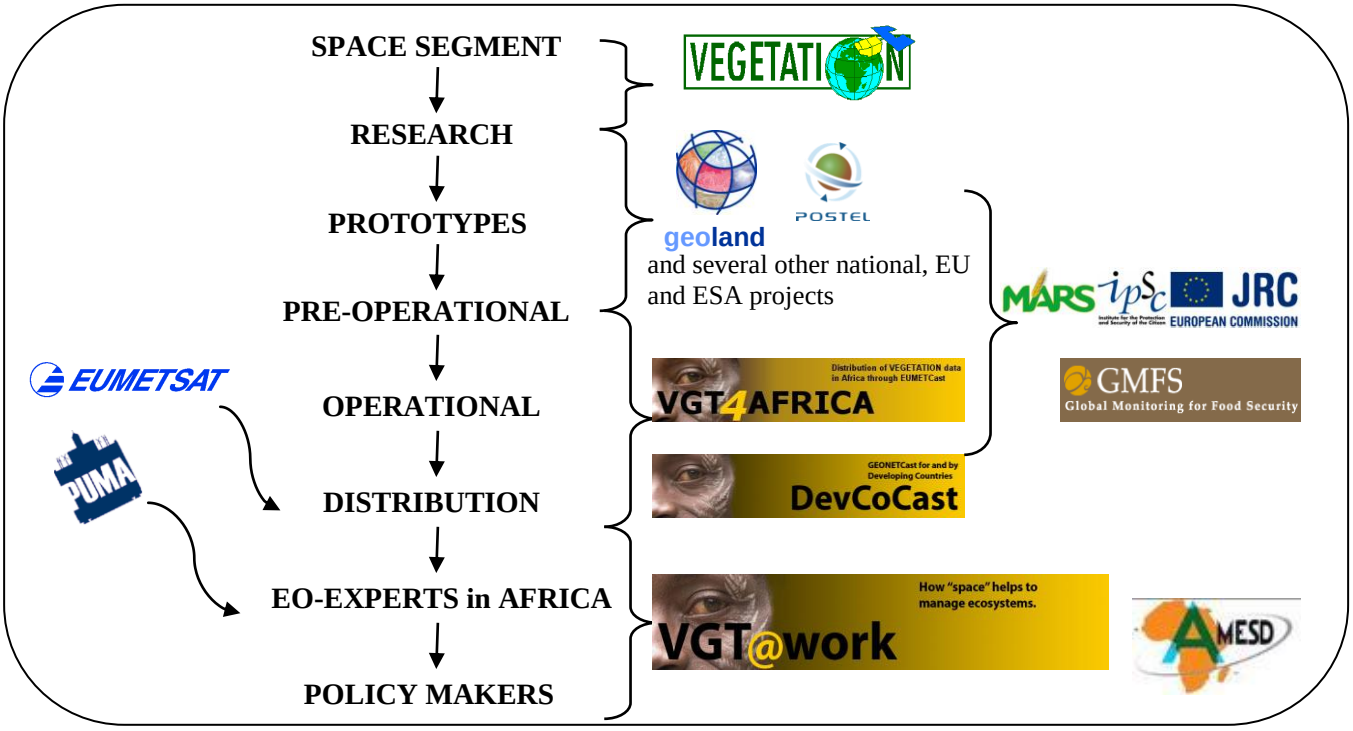


Figure 1 Situation of the VGT@Work project

3 Main applications developed

BMS

Near real time information to support decision making of the Botswana Government

M. I. Kusane developed an automated processing chain, starting from VGT4Africa products, to answer the data needs of the Botswana Government and other users. Formerly, the processing of the imagery was done manually. With the automated chain, many more input products can be handled, for more detailed regions, on a higher temporal frequency with a limited processing time. The new chain handles also the other VGT4Africa products than the NDVI, which opens opportunities for other applications and users. This automated chain is called the Vegetation Products Processing Application Prototype version 1.0 (VPPPv1). The main objective of the processing chain is to automatically extract, process and archive SPOT VGT-products delivered through the GEONETCast system and produces both Dekadal and Monthly vegetation products indicators and automatically disseminate quicklooks of these indicators to users for operational usage in Agricultural and Environment Resource Management.

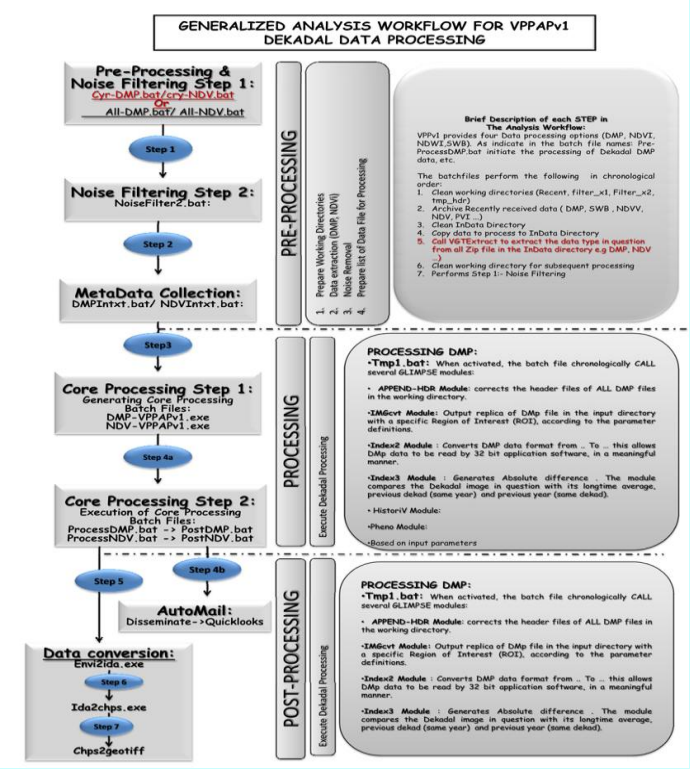


Figure 2 Workflow of the data processing developed at BMS

M. G. Keotsene focused on vegetation monitoring using the fCOver product. His work was integrated into the automated chain.

Efficient planning of resources for rangeland management

M. K. Dintwe, built an application, based on VGT4Africa data, for assessing the rangeland resources in Botswana based on the Vegetation Condition Index. He integrated this data with rainfall data for better interpretation of the EO data products.
His results lead to an improved planning of the field campaigns, in which the information derived from the satellite imagery is used to define the target areas.

AGRHYMET

Improved rangeland monitoring in the Sahel

Rangeland management requires knowledge on the availability of sufficient water and fodder for the animals. Cattle is moving in a north-south direction in the Sahel and their movements should not interfere with the cropland season. Therefore it is essential to know the current stage within the growing season.

M. J. Andigue and M. I. Garba assessed suitable indicators for rangeland monitoring in the Sahel based on the VGT4Africa products. One application focused on the availability of water using the Small Water Bodies product. Another application was built on the monitoring of the vegetation evolution using the fCover product and the phenology information, i.e. the onset, peak and senescence of vegetation growth.

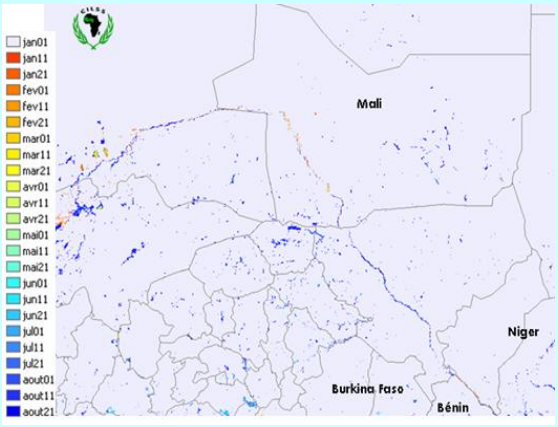


Figure 3 Date of the filling of small water bodies since January 2008

Crop monitoring

Crop yield statistics are usually collected at the level of the administrative unit. Therefore it is important to be able to monitor the current season 's productivity at the same spatial unit. M. I. Alfari developed an application in which the Dry Matter Productivity indicator for croplands are extracted for each administrative unit. These statistics can then be evaluated against the long term average for the specific vegetation indicator or to statistics. This application allows to monitor the overall performance of agriculture within certain geographic areas (e.g. administrative units) and to make year-to-year comparisons.

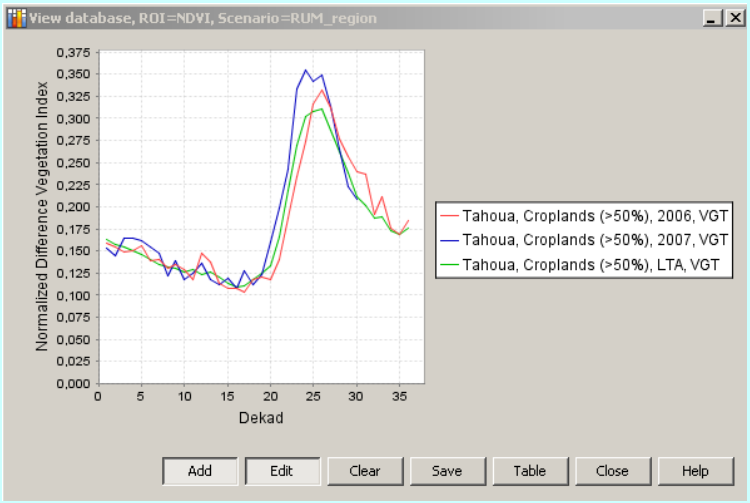


Figure 4 Evolution of the NDVI of croplands for the Tahoua district for 2006, 2007 and the long term average (LTA)

Faster access to data

All remote sensing data are now stored and maintained in one database, whereas formerly, each scientist managed their own datasets and many duplicates existed. For each bulletin, the data are centrally processed and then distributed to the various scientists dealing with specific aspects of the monitoring of the growing season.

Examples of AGRHYMET bulletins can be found at http://www.agrhymet.ne/eng/bulletin-mensuel.htm

4 Description of the activities and results

The activities performed during this project are described briefly below. More information can be found in the WP reports.

4.1 "Analysis Workflow" Identification

The first step concerned the identification of the end-users of the African partners and their information needs, and the selection of the applications to be developed. The African partners consulted their (potential) end-users using a questionnaire containing brief information on the data products, and their usage in various applications. The answers allowed us to get an overview of the mandates of the end-users, their focus, the data they already use, the data gaps and how they see potential in the usage of VGT4Africa data (see Table 1).

Table 1 List of all SPOT-VEGETATION derived datasets, distributed by VGT4Africa and DevCoCast

Product	Expresses	Example of application field
NDVI (Normalised Difference Vegetation Index	Is related to the photosynthetic activity of plants	Vegetation monitoring
NDWI (Normalised Difference Water Index	The moisture content in vegetation	Drought monitoring
Burnt area	The area that was burnt	Management of protected areas
Phenology	Describes the evolution of the growing season(s), i.e. the dates of the onset, the maximum productivity and the senescence, and the length of the growing season	Crop monitoring, rangeland monitoring
Small water bodies	Provides the location of small water bodies	Rangeland management for livestock
Albedo	The total reflection of the surface	Desertification monitoring
fCover	The fraction of the surface covered by vegetation	Desertification monitoring, crop growth monitoring
LAI (Leaf Area Index)	The total surface that all leaves from a spatial unit cover	Crop growth monitoring, vegetation productivity
DMP (Dry Matter Productivity)	The productivity of the vegetation. Here, meteo parameters are taken into account	Crop growth monitoring, rangeland monitoring
VPI (Vegetation Productivity Indicator)	The probability that the current NDVI occurred within the total time series	Evaluation of vegetation (natural and crops) against the historical database

In addition, the African partners described their current analysis workflows, how they communicate with the end-users (bulletins etc.) and which software they run.
All the information was summarized in a document 'Identification of end-user needs'. This was the basis document for the applications to be developed during the course of the project.

4.2 African staff training and "Analysis workflow" development

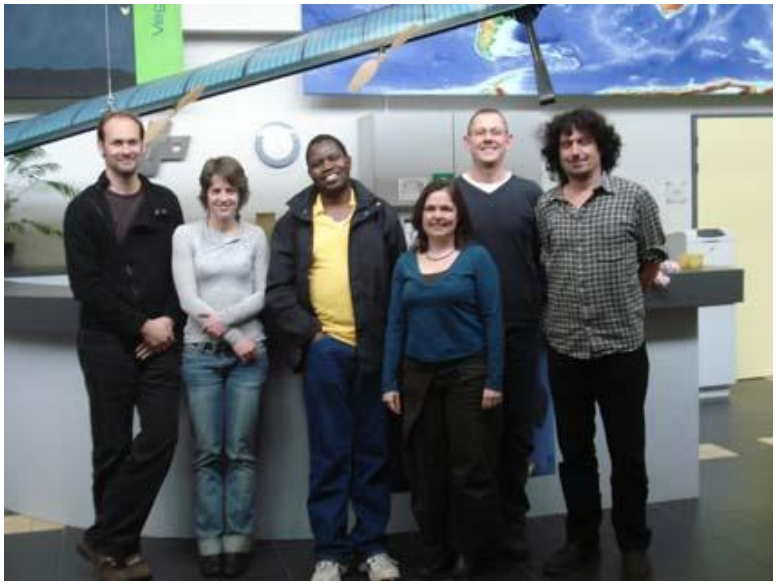
The next step consisted in building the "Analysis workflow" by the African partners. To do this, each African partner seconded one staff member to each of the European partners for a period of 10 to 12 weeks (see Table 2). During this period, European partners trained the African staff in the use of their products.

Table 2 Overview of the training sessions at the European Centers

Person	Institute	Training at	Period
Job Andigue	AGRHYMET	JRC-IES	08/10/2007-15/12/2007
Issoufou Alfari	AGRHYMET	VITO	19/10/2007-20/12/2007
George Keotsene	BMS	MEDIAS-France	27/10/2007-24/12/2007
Brahima Kone	AGRHYMET	MEDIAS-France	24/11/2007-27/12/2007
Isaac Kusane	BMS	VITO	14/01/2008-05/04/2008
Kebonyethata Dintwe	BMS	JRC-IES	13/03/2008-12/06/2008
Issa Garba	AGRHYMET	MEDIAS-France	14/09/2008-15/10/2008

Training encompassed formal and on-the-job training. The formal part included (i) scientific training: meaning and characteristics of earth observation-derived products, and (ii) training on software. Then, the African expert developed the "Analysis Workflow" for their application together with the European experts. The "Analysis workflows" enable them to extract relevant information from the VGT4Africa products for the usage in bulletins or by end-users. The setup of the "Analysis workflow" was such that it could be fully transferred, installed and maintained at the African partners. An overview of the applications developed are given in the two boxes.

Additional training was given at the two African centers, on topics defined by the African staff. Most of these training sessions were more on-the-job training than formal training sessions. In addition, European partners assisted in training the African end-users to interpret the results of the "Analysis Workflows". These training sessions are summarized in Table 3.



The "Analysis Workflow" is a rather abstract concept, but is includes all software programs, scripts, batch files or procedures to follow to derive information from the VGT4Africa products for specific end-users.

Figure 5 M. I. Kusane with VITO colleagues

Table 3 Overview of the training sessions at the African Centers

Person	Institute	Training at	Period	Subject
Etienne Bartholomé	JRC-IES	AGRHYMET	11/08	In-depth training on RS principles, content and interpretation of the VGT4Africa products
Bruno Combal	JRC-IES	BMS	11/08	In-depth training on RS principles, content and interpretation of the VGT4Africa products
Carolien Tote	VITO	AGRHYMET	18-22/05/2009	Review of the "Analysis Workflow"
Sven Gilliams	VITO	BMS	25-29/05/2009	Training to end-users and review of the "Analysis Workflow"
Bruno Combal	JRC-IES	AGRHYMET	20-31/07/2009	Continuity of the service in AMESD
Bruno Combal	JRC-IES	BMS	17-28/08/2009	Continuity of the service in AMESD

4.3 Integration of the "Analysis workflows"

The African staff installed their "Analysis workflows" at their institutes and integrated the operation in their daily work.
AGRHYMET focused on the integration of the satellite derived information in the monitoring of the growing season. Whereas formerly, mainly the NDVI was used to monitor the vegetation development, now other EO products are integrated in their daily work, these are small water bodies, phenology indicators and dry matter productivity. They also calibrated the information from these EO products with ground observation. In addition, the preparation and processing of the datasets was optimized. Examples of their bulletins can be found at http://www.agrhymet.ne/eng/bulletin-mensuel.htm

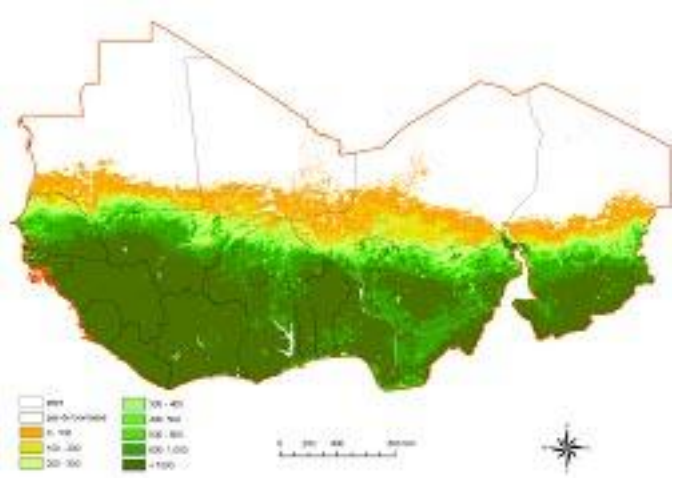


Figure 6 Total dry matter productivity per hectare for the year 2008 (AGRHYMET)

The mandate of BMS is to provide the other departments of the Botswana Government with information from satellite imagery, and the interpretation of the EO data is done at the specific departments. Therefore their focus was on the automation of the data ingestion, processing and dissemination. They now provide a large range of products, based on various EO indicators (NDVI, dry matter productivity and vegetation productivity indicator), and comparisons with the historical record or specific periods. They also process and disseminate tailor-made data for specific districts. A person from the Department of Forestry and Rangeland Resources who

was seconded to BMS for this project, developed an application using the vegetation condition index for the monitoring of the rangelands.

4.4 End-user training and promotion

The African staff promoted their applications to a wide range of end-users. For a number of end-users, specific training was given on the use of the products that is produced by the applications. Since training of the end-users is a continuous effort, it is an activity that will be continued beyond this project.
The services were presented and promoted at various occasions and for a wide audience. In order to do this, promotional material was prepared and distributed.

Figure 7 Promotion to district representatives at BMS

4.5 Operation and support

After the installation, testing and fine-tuning of the "Analysis Workflows" at the African centers, the applications are now operationally producing information on the state of the vegetation on a regular basis. Only little support was needed from the European partners in this process. The African staff now operate and maintain the "Analysis Workflows" autonomously.

Figure 8 M. K. Dintwe explaining the processing chain to potential end-users

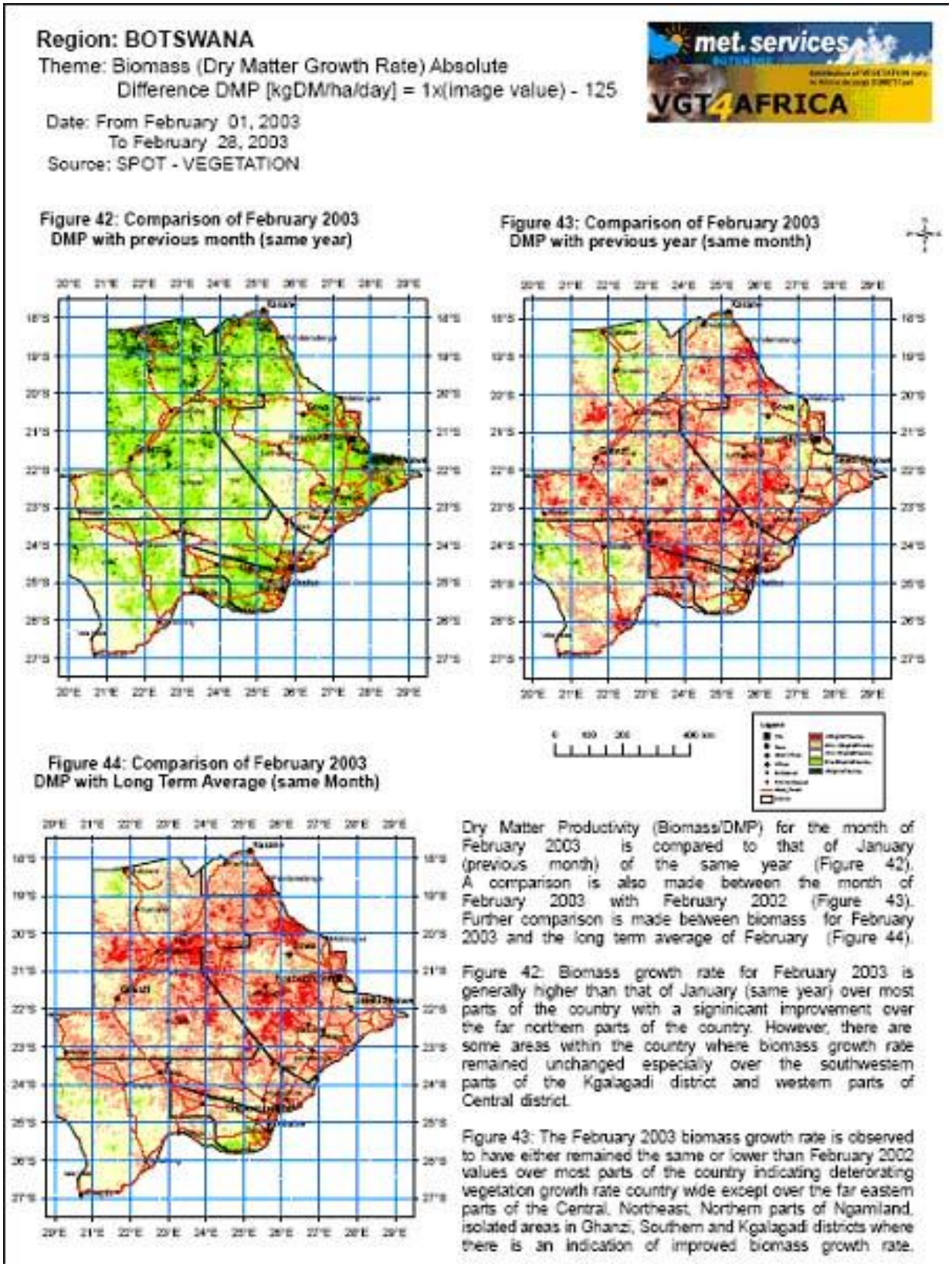


Figure 9 Example of operational output generated by BMS

5 Impact of the project

The impact of project results was ensured by the project design itself.
Indeed:

1) application design and development was ensured by African experts, with support from European partners. In this way, the applications were targeted to well identified and un-interpreted user needs and were implemented according to well known constraints of computer environment (both hardware and software),
2) the development was fully integrated in a pre-existing environmental information production process, whereby the African partners already delivered information to their local users.

The project had a large impact on the data availability at the African centers and their users. In general, information from the data is faster accessible, and more information is available. This improved the ability and the capacity to monitor the environment to a large extent and enhanced the policy support using remote sensing data.

The project had a positive impact on the **AMESD EDF project**, by identifying and testing ways of transferring efficiently advanced techniques into African institutions.

The project was closely related to and **took benefit from existing or completed European projects**: VEGETATION Programme (France, Belgium, Sweden, Italy, European Commission), FP4 “improvements for the VEGETATION mission”, FP5 CYCLOPES, FP6 GEOLAND, FP6 VGT4AFRICA, ESA GMFS, JRC GLC2000, JRC GBA2000, JRC “Africa Observatory for Sustainable Development”, POSTEL (France), GEOSUCCESS (Belgium). All these projects are forerunners or specific components of the GMES initiative.

6 Consortium

The consortium is composed of the partners from the VGT4Africa consortium, with addition of two African partners, i.e. AGRHYMET (Niger) and BMS (Botswana).

vito vision on technology	Flemish Institute for Technological Research (VITO), Belgium	Coordinator Scientific partner
EUROPEAN COMMISSION DIRECTORATE GENERAL Joint Research Centre	JRC-IES, Italy	Scientific partner
MEDIAS	MEDIAS-France, France	Scientific partner from 01/01/2007 till 31/12/2008
CILSS	AGRHYMET, Niger	Scientific partner
met. services BOTSWANA	Botswana Meteorological Service (BMS), Botswana	Scientific partner

7 Dissemination and use of the results

This plan for using and dissemination the knowledge[1] is meant to set out the terms of use and dissemination of the knowledge that aroused in the VGT@work project. This report therefore provides a complete picture of all activities undertaken, which were organized in order to fully exploit and disseminate the knowledge generated in this project.

7.1 Exploitable knowledge and it's use

This section presents exploitable results, defined as knowledge having a potential for application in research activities, for developing, creating or marketing a product or process or for creating or providing a service.

An overview, per exploitable result, of how the knowledge could be exploited or used in further research is provided. This overview was created by the project coordinator, obtaining input from each contractor that owns the knowledge and has an active role in its exploitation. Both past and planned future activities are included, as requested in the FP6 guidelines for reporting.

Exploi-table Know-ledge	**Exploitable product(s) or measure(s)**	**Sector(s)**	**Timetable for commercial use**	**IPR pro-tection**	**Owner / other involved partner(s)**
Software	Software for handling and working with products	Research	N/A	Licensed/ Free	Owned by Author.
Training material	Training guides, installation & software manuals, product guides	Research	non-commercial, free-of-charge use.	None	Owned by author. All partners are involved
Bulletins	Periodically generated reports/bulletins for the African end-users	Research	N/A	None	Owned by African end-users (Governmental organisations, etc).

[1] **Knowledge** means the results, including information, whether or not they can be protected, arising from the *project* governed by this *contract*, as well as copyrights or rights pertaining to such results following applications for, or the issue of patents, designs, plant varieties, supplementary protection certificates or similar forms of protection (Articl II.1.14 of the contract)

Related projects	Shared project and product information	Research	N/A	Defined per contract	All

VGT@work software

No software development activities were planned within VGT@work.
Nevertheless, in order to answer to specific needs, software was used which was developed in the framework of other projects (see VGTextract and GLIMPSE at VITO, SPADA and e-station at JRC). Secondly, scripts to automatically control and start the processing were written to set up the post-production chain.

The VGT@work software can be divided into 2 categories:

1. software to assist in the handling and use of the VGT4AFRICA products on one hand and
2. the product post-processing chain software on the other (the scripting).

The first kind of software was made available freely to the African partners. Of course, VGT@work does not change the ownership of this software.
All "application development" (whether scripts but also all other developments) were shared among all potential African users, and have an "unlimited exchange" label.

.

Training material

VGT@work training material was made available to and intended only for the African partners. All copyright-free material was freely distributed in the project. The main issue here is the intellectual property and copyrights owned by the initial publishers of graphic material, collected by the instructors and inserted in their presentations. This approach is well accepted in the academic world for ex cathedra teaching, but paper or electronic distribution is not allowed legally until all copyright issues have been settled with the initial editors. This task was much beyond the objectives and capacities of the VGT@work project.

Reports/bulletins

The reports and bulletins, generated during the project duration and based on the applications developed during the VGT@Work project, were and still are made available by our African partners to the African end-users, which are governmental departments or institutes, ministries, etc.

The end users are administrations in charge of the management of natural resources and food security which (1) ultimately give an advice to the policy makers on whether actions should be taken at their level and (2) dispatch information to local / extension services on the current situation and possible future developments.

The frequency of information delivery is once per month, but only during the season where the information is useful, e. g. second half of the vegetation growth and harvest season for crop monitoring.

For the AGRHYMET, the bulletins were and are produced every month and sent to different structures dealing with agriculture, environment, water resource, etc.. Also some technical partners received the bulletin like FAO, FEWS, USAID, etc.

The African partners are owner of these reports and bulletins and were and are further distributing and publishing them up to their needs, giving credit to the VGT@work project.

Other projects

Specific training actions were coordinated with several **other** European level **projects** which were also dealing with VEGETATION derived products. Examples are Geoland, GMFS, Geosuccess, Globcarbon, Cyclops and other. The focus was on data and information exchange and exchange of contacts. Many of these projects focused on the research, and only developed pre-operational products. The VGT4AFRICA project was a successor of many of these projects, where the results of those projects were disseminated to a wider public. On its hand VGT@work is a successor of the VGT4AFRICA project, whereby dedicated training was given to 2 interested users.

In a certain sense, the VGT@work was also a fore-runner of the AMESD project. All valuable knowledge acquired within the VGT@work project as well as all deliverables (software + training material) were handed over to the AMESD project at the end of the project. At this stage it is clear that VGT@work had a direct impact on the strategy formulation of the AMESD project for what regards the training activities.

VGT4AFRICA Products

The **products** were made available previously by the VGT4AFRICA project and now by the DevCoCast project, and the ownership of these products remain unchanged. So, the same IPR-rules which applied for the VGT4AFRICA project remain valid.

7.2 Dissemination of knowledge

The dissemination of knowledge activities include past and future activities. Each major activity is accompanied by a short description.

Planned/ Actual date	Type	Type of audience	Countries addressed	Size of audience	Partner(s) responsible / involved
Regularly, ie once per	Project information	African end-users	CILSS-countries (Western		AGRHYMET, BMS

month during project lifetime			Africa) + Botswana		
At start of project	Historical products	AGRHYMET, BMS	CILSS-countries Botswana		VITO
At start of project	Project website	General public, African end-users	Entire world		JRC, VITO, MEDIAS, AGRHYMET, BMS
	Training material and software	AGRHYMET BMS	CILSS-countries Botswana		JRC, MEDIAS, VITO
	Training	AGRHYMET BMS	CILSS-countries Botswana		JRC, MEDIAS, VITO
	Conferences	All VGT4AFRICA users	All African countries		JRC-IES, MEDIAS-France, VITO

On a regular basis, **e-mails** were and still are sent out to the African Partners to inform them of changes to product availability, project related news, etc. The VGT@work help desk (=VGT4AFRICA help desk) was and still is also available via direct e-mail for user support and for dissemination of knowledge regarding the use of products upon user request.

Furthermore, our African partners were provided with **historical products** on CD-ROM or during their stay at the European partner institute.

Training material and project related **software** and documentation were distributed to the users via postal mail (hard copy) and on CD-ROM at the end of each training session.

Dedicated pages to the VGT@work project were set up on the VGT4AFRICA **website**, http://www.vgt4africa.org . This VGT4AFRICA project website was available to the entire world constantly, but moved to the DevCoCast website (http://www.devcocast.eu/ViewContent.do?pageId=87). These pages on this website disseminated information related to all the VGT@work activities, training material, documentation, the official project logo, background information on the products, the project and its predecessors and any public deliverables. Furthermore, in a more restricted part of the website, products and non-public deliverables were made available to the project partners.