

# CRISIS INDICATORS - LAND DEGRADATION SERVICE CHAIN



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*This service is coordinated by the Joint Research Centre with the efforts of other partners inside the G-MOSAIC project: Adelphi Research, IST, Astrium, and Z-GIS.*



*As a coordinator of the Crisis Indicator services the JRC organizes the production of the above mentioned products and ensures the quality of the product and the suitability to the user needs.*



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## INTRODUCTION

Environment and natural resources can play a role in the onset, duration, and termination of conflicts. Conflicts are not caused by environmental factors only. However, they can play a key role in the dynamics of conflicts. This role is complex and has an impact only in combination with other socio-economic factors. Generally speaking, it is often the lack of vital goods (such as food, but also access to land, work or housing) or the availability of valuable goods (such as diamonds, gold, etc.) coupled with poor economic conditions and weak constraints (state, foreign countries, etc.) that could contribute to (violent) conflicts. Earth observation (EO) data could help to measure both environmental and certain socio-economic factors.

The service chain information is derived from two sources:

- 1) Multi-temporal analysis of EO data aiming at identifying possible hot spots of change, which are potentially important for a crisis within a country,
- 2) Through situation monitoring using information about conflictive events, population, socio-economic data where available and other relevant datasets.

In this brochure, service products are provided for two service activations:

- > Multi-temporal land use analysis in Rural Zimbabwe
- > Land use and water quality in the Umbeluzi Watershed

## MULTI-TEMPORAL LAND USE ANALYSIS IN RURAL ZIMBABWE

### LINKING LAND USE CHANGES TO POLITICAL DECISIONS

Zimbabwe has a recent history of violent, sometimes racially-motivated conflict over land tenure and for control of its government. Since independence in 1980, Zimbabwe pursued a land reform and resettlement program addressing a racially skewed land distribution. More recently, in 2000, the Fast Track Land Reform Programme (FTLRP) was launched, leading to forced sale or seizure of almost all white-owned commercial farms.

The FTLRP resulted in a drastic reduction in commercial farming activities which had negative effects on investment in the agricultural sector and on inputs such as fertiliser, machinery and infrastructure. As a consequence, total agricultural

output and sales have become unstable with sharp drops throughout the last ten years. International observers report that many new farms are significantly under-utilised (FAO 2008).

Despite this, the Government of Zimbabwe has not declared any changes to the amount of land under cultivation since 2001. However, several studies revealed that the land reform process has created a new mosaic of land uses with resettlements, and changes in ownership and cultivation of former commercial farms.

The Land Degradation service uses remotely sensed data as a valuable alternative source of independent information for monitoring conditions in Zimbabwe.

### INSIDE THIS DATA SHEET

- > INTRODUCTION
- > CONCEPT OF THE SERVICE
- > PRODUCT EXAMPLES
- > REQUESTING THE SERVICE

### POINTS OF INTEREST

- > GEO-SPATIAL INFORMATION IN THE FIELD OF NATURAL RESOURCES AND CONFLICTS
- > SITUATION MONITORING



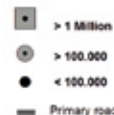
# CRISIS INDICATORS - LAND DEGRADATION SERVICE CHAIN



Land use, land cover 2008

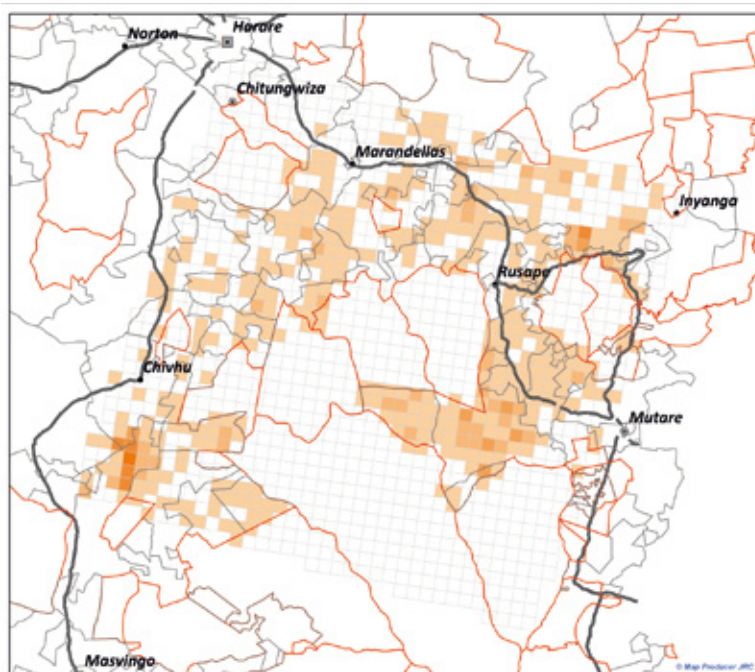


Settlements and roads



## LAND USE MAPPING

EO data can be used to obtain independent information on the land use pattern of a given area. On the right, land use patterns are shown for an area (190kmx190km) southeast of Harare, Zimbabwe in 2008. The information is derived from Landsat data using a semi-automatic classification method. In 2008, 54% of this area was used for cultivation.



Decrease of agriculture between 2001-2008 (%)



Land Tenure (1980ies)



Settlements and roads



## LAND USE CHANGE MAPPING

Changes in land cover can indicate changing land use practices, which can be linked to political decisions. The map on the left shows the changes in agricultural land use (cultivations) which are computed from the land use maps of 2001 and 2008. The changes occurred mainly outside communal land areas, in the commercial farming areas that were affected by the land reform program since 2000.



# LAND USE AND WATER QUALITY IN UMBELUZI WATERSHED

## MULTI-TEMPORAL LAND USE MAPPING AND WATER MODELLING

Multi-temporal land use mapping from Earth observation data is used in a Soil Water Assessment Tool (SWAT) to simulate the influence of changes in land use on the water quality. This supports the identification of potential triggers of future conflicts related to water scarcity and pollution. Such combination between geospatial information from EO data and water quality modelling is demonstrated by the example of the Umbeluzi watershed, which provides the drinking water for Maputo (Mozambique).

The multi-temporal land use analysis reveals an increase of sugarcane cultivations in Swaziland in the period 1988-2009 (right). The SWAT model results highlight that the same areas of the watershed show a high nutrient output (here nitrogen export), which pose a risk to the watershed. Such decrease in water quality can be a potential trigger of conflict between Swaziland and Mozambique.

The SWAT model simulates nutrient load in the river, inter alia. The graph below shows the increase in nitrate load as the river passes through areas of sugarcane cultivation, as measured at stations in Mnjoli (before) and Frontier and BPL (after crossing the plantations).

