

JRC Global accessibility Map.

This work can help understand the pressure that arises from shrinking distances, and put the spotlight on the needs of populations living in highly urbanised and very remote areas alike. Another aspect of JRC work, performed in collaboration with many partners, is the Population Pressure pilot service, which focuses on urban areas and examines their development over time, since urban development can be used to indicate population growth.

#### Resources:

- <http://bioval.jrc.ec.europa.eu/products/gam/index.htm>
- <http://www.gmes-gmosaic.eu/project-overview/117>

### Responding to crises

Natural disasters cause more fatalities and irreversible damage in developing countries than anywhere else, and can cause sudden and acute food insecurity. JRC scientists have developed models to help predict devastating events such as tsunamis, earthquakes, floods and cyclones and to assess their impact on the affected region.



The deployment to Haiti in February and March 2010 was part of the European Commission contribution to the post-disaster needs assessment jointly organised with the United Nations and the World Bank.

Together with the United Nations, the JRC has developed the Global Disaster Alert and Coordination System (GDACS). It is triggered by major events and simultaneously alerts governments, rescue services, civil protection and humanitarian organisations. The JRC is involved not only in the emergency phase of the crisis management cycle, but also in the process of planning recovery and reconstruction after a disaster.

Some examples:

- JRC scientists used satellite data to rapidly assess the scope of the damage caused by the earthquake in Haiti in January 2010 to help rescue teams focus efforts and locate the worst hit areas. These were followed by more detailed damage assessments in the following days.
- JRC has developed a tsunami alert system which can alert coastal dwellers and local residents through sirens, loudspeakers and displays if ever a tsunami is heading for the coast. The JRC's software is based on a model that takes into account seismic parameters, such as the earthquake epicentre and magnitude, and pre-calculated potential tsunamis based on their historical locations.
- As experts in interpreting raw data from satellites, JRC scientists have also developed an algorithm to count the tents in refugee camps and assess the possible impact of a refugee crisis in certain areas.

#### Resources:

- <http://www.gdacs.org/>

### Monitoring food security in the media

European Media Monitor (EMM) is a tool developed by the JRC that automatically extracts, classifies and displays news items published in 43 languages. Through this tool, users can follow news developments in almost real time (the service is updated every 10 minutes) and are able to see what topics are the 'hottest' at that particular moment, and what countries are concerned. Food security is one of the themes that is continuously monitored through the tool.

#### Resources:

- <http://emm.jrc.it>

### Future orientations

The JRC through its cross-cutting expertise will continue to provide support to EU policies in the field of food security. One emerging area which the JRC is exploring is that of aquaculture, which is playing an increasingly important role as a food source. Around 1400 fished species are potentially available for domestication, but aquaculture production is based on only 36 species, the most cultivated of which are carp. JRC scientists are working on developing and estimating scenarios for the future expansion of aquaculture and its impact on both the food production system and the environment.



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# Science in support of food security

## Some JRC examples

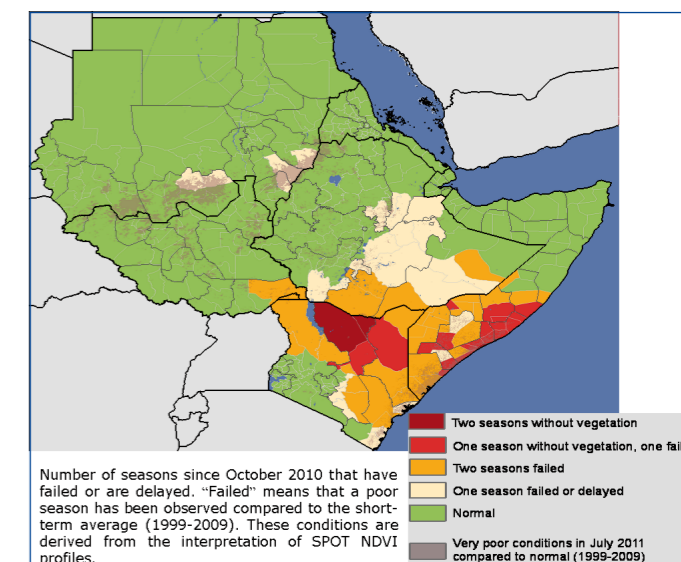
### Introduction

Food security is a complex topic which cuts across many scientific disciplines and is closely related to global challenges such as environment, climate, energy and migration. More than half of the people in the world now live in urban areas, and food supply chains are becoming increasingly complex and sensitive to disruption. Currently, world market food prices are increasing due to a combination of higher world oil prices, global population growth, climate change, loss of agricultural land to residential and industrial development, increased farming of non-food crops, and growing consumer demand, particularly in China and India. Furthermore, the ongoing global credit crisis has also affected farm credits in rich and poor countries, despite a boom in commodity prices.

The Joint Research Centre (JRC), the European Commission's in-house science service, works closely with EU bodies and external partners in their efforts to enhance food security worldwide. From rainfall to soil quality, plant innovations to ingredient testing, models to forecast crop yields and satellites to track affected population movements, JRC scientists are at the nexus of issues surrounding today's food security and its global governance.

### JRC partners

The JRC provides scientific advice to the policy Directorates-General of the European Commission. Much of its work is carried out in close collaboration with many research partners throughout Europe and beyond. On a global level, the JRC is playing an increasingly important role through, for example, assisting the Food and Agriculture Organisation of the United Nations and through its support to African, Caribbean and Pacific Observatory for Sustainable Development, which gathers scientific information, diagnostics and scenario building for development policies. The JRC manages several large-scale research facilities and hosts a number of unique pan-European and global databases, ranging from disaster preparedness and response to soil atlases.



Crop monitoring in the Horn of Africa.

### Crop monitoring and forecasting

The JRC pioneered and operates a crop yield forecasting system providing accurate and timely crop yield forecasts and crop production estimates for the EU territory and other strategic areas of the world. This work supports the EU's Common Agricultural Policy, by helping decision makers determine payments to farmers during the growing season. The information provided by the crop forecasting tool is also useful in relation to trade, development policies and humanitarian assistance.

The crop yield forecasting system combines satellite observations of Earth and of the weather with agro-meteorological and bio-physical modeling and expert statistical analysis. JRC scientists have developed specific applications to estimate rainfall, detect anomalies and produce early warning bulletins throughout the crop season, anticipating food insecurity risks such as severe droughts.

Having previously run pilot forecasting projects in key regional production areas such as Russia and the New Independent States, the Mediterranean Basin, Eastern Africa and South America (MERCOSUR countries plus Bolivia), the JRC has now extended its system to cover food insecure areas worldwide. The main activities today are focused on Sub-Saharan Africa. In this way, the JRC is instrumental in producing the first accurate global production estimates for key crops such as wheat and rice. Two special reports published by the JRC, the *Drought Bulletin for the Greater Horn of Africa* and a special issue of the *Food Security Bulletin*, provide an analysis of the severe drought which is causing a famine in Southern Somalia.

**Resources:**

- <http://mars.jrc.ec.europa.eu/mars/>

**Analysis of food price volatility**

Food prices vary following a set of factors including the interdependence between energy and agricultural markets, the consequences of non-food crop farming, the linkage between the depreciation of the US dollar and agricultural commodity prices, and the role of financial markets.

In developing countries, poor households spend 70% of their income on food which makes them particularly vulnerable to food price changes. Understanding the nature of agricultural commodity price volatility is one of the ways in which science can support the food system.



The JRC supports agricultural and trade policy through its work on strategic policy analysis of agricultural market and trade policies, based on advanced economic modelling tools and statistical methods. The tools and databases used cover the regional, national and international level to cope with the different dimensions of the Common Agricultural Policy (CAP), rural development, trade and other related policies. These tools are continuously adapted to new orientations, developments and challenges. Work in this field was published in the book *Methods to analyse agricultural commodity price volatility* (Springer, 2011).

**Resources:**

- <http://agriflife.jrc.ec.europa.eu/>

**Genetically modified organisms (GMOs)**

Genetically modified organisms (GMOs) play an important part in food production in many countries. Products derived from GMOs can be put on the EU market only if the GMOs have passed an authorisation procedure and the products are clearly labelled. This means that those involved in the food and feed trade should be aware of the rules and laws governing GMOs in order for shipped stock to be accepted at the port of destination. Clear rules lead to more stability in food and feed prices which are crucial in the context of global food security, as they are built on predictability and confidence.



*The JRC validates analytical methods for the detection and quantification of GMOs in food and feed.*

The JRC validates analytical methods for the detection and quantification of GMOs in food and feed. These methods are then applied in a standardised way by all EU control laboratories which greatly increases predictability for exporters. The JRC has validated more than 60 methods for the detection of GMOs in for instance maize, soybean, rapeseed, potato, cotton and sugar beet.

The JRC is also actively involved in the analysis of plant breeding techniques. Over the past 20 years, advances in biotechnology have been translated into new breeding techniques that present opportunities and challenges for regulators. In a recent report, the JRC examines the possibilities and constraints for the future application of seven different techniques. The Commission, with the assistance of a working group formed by EU experts, is currently evaluating these new techniques on the basis of the EU GMO and GMM (Genetically Modified Micro-organism) legislation.

**Resources:**

- [http://ihcp.jrc.ec.europa.eu/our\\_activities/gmo](http://ihcp.jrc.ec.europa.eu/our_activities/gmo)
- <http://ipts.jrc.ec.europa.eu/publications>

[www.jrc.ec.europa.eu](http://www.jrc.ec.europa.eu)

**Atmospheric pollutants and impact on agricultural ecosystems**

Field experiments have demonstrated that atmospheric ozone can damage crops, leading to yield reduction and a deteriorating crop quality. The resulting economic losses and threat to food security has become an issue of concern in world regions where the expanding economy has led to an increased emission of air pollutants in general and ozone precursors in particular.



The JRC is studying atmospheric pollutants to assess the current and likely future impact of climate and air pollution policies on global warming, ecosystems and human health. The research activities include detailed atmospheric measurements, critical assessment of existing data and modelling at local, regional, continental and global scales. A global analysis of the production yield loss due to ozone pollutions of major staple crops (wheat, rice, soybean and maize) in metric tonnes has been calculated by JRC scientists using an atmospheric chemical transport model.

**Resources:**

- <http://ies.jrc.ec.europa.eu/climate-change>

**Soil degradation**

Fertile soil is a natural resource that is much more limited than people might expect, yet it is completely essential to food production. The amount of fertile soil on the planet is under threat from pollution, erosion, poor management, over-production, desertification, and it might be further reduced by climate change. Soil degradation makes it increasingly difficult to produce food or generate income for rural populations. If the factors that lead to soil degradation are not addressed, over time the soil will become exhausted and infertile, which can increase desertification and lead to famine and civil unrest.

The JRC works together with international partners through the FAO Global Soil Partnership to classify different soil types and monitor their development. At the European level, the JRC provides tools and support for all the European Union's policies related to soil, through the European Soil Data Centre, the focal point for soil data in the EU.

**Resources:**

- <http://eusoils.jrc.ec.europa.eu/>



*A profile of the Chernozem, the most fertile dark and organic-rich top soil (photograph by Erika Micheli).*

**Exploitation and degradation of natural resources**

Access to natural resources is a mixed blessing for many poor countries. While a sensible exploitation of resources such as oil, gold, timber, diamonds, uranium and rare earth minerals greatly benefits local populations and the world at large, mismanagement can lead to environmental degradation and in some instances, to insecurity and armed conflict. Such problems are becoming increasingly widespread in regions like Central Asia, the African Great Lakes, and the Horn of Africa.

As a member of The Global Atlas and Information Centre on Natural Resources and Conflicts, the JRC enhances understanding of the links between the exploitation of natural resources and conflicts in specific parts of the world. For example, JRC scientists track hot-spots due to water shortages at a global level. JRC has also analysed data on about 1500 conflict events and tested their correlation to geographical information such as type of vegetation, population density, distance to roads, existence of national resources such as minerals. Among the factors that appeared to favour existence and intensity of armed conflict were economic underdevelopment, the proximity to mineral mines and the prevalence of grasslands or croplands.

**Resources:**

- <http://www.jrc.ec.europa.eu/conflicts-atlas>

**Population mapping**

The world now has close to 7 billion inhabitants. According to the FAO, by 2050 the world population will exceed 9 billion, and 70% more food will be needed to satisfy global demand. Today, about half of the world population lives in cities and people continue to move from rural to urban areas.

The JRC has developed, together with the World Bank, a global accessibility map that measures urbanisation from a new perspective: the time it takes to travel to a city of 50 000 inhabitants or more, by land or water. It shows how 90% of the world's inhabitant can access a city within 48 hours.