



Maize (corn) pictured here on sale at a rural market, is a staple food commodity. Photo courtesy Marc Bernard

TACKLING POST-HARVEST LOSSES

MARC BERNARD AND HINRICH PAULSEN DESCRIBE HOW OPEN SOURCE GIS IS BEING EMPLOYED TO ADDRESS A SERIOUS FOOD SECURITY ISSUE IN SUB-SAHARAN AFRICA

The world is currently afflicted by crises of all sorts - financial, political and environmental – with the issue of climate change often grabbing the headlines. Another concern, that of food availability, has grown in line with the rapid explosion in population levels over recent decades but has seldom found itself in the spotlight. However, rising food prices in 2008 put this issue firmly on the global agenda. The reason why is simple: food production and distribution is energy-intensive. Dwindling natural resources, coupled with rising fuel prices, the effects of climate change and, most of all, population growth, makes the availability of food a serious issue, not least across the African continent.

Against this background, the reduction of post-harvest losses (PHL) is a key issue. After all, reducing such losses can be a far more efficient response to food shortage than increasing production (with its attendant need for more energy-intensive fertilisers, pesticides and oil). Tailored, up-to-date information is fundamental in designing and implementing appropriate loss reduction measures, and the key here for decision-makers is to know where losses occur and to what extent.

APHLIS (African Post Harvest Loss Information System) is a cutting-edge Geographic Information System that relies on a Shared Database (SDB) to provide such up-to-date loss estimates for sub-Saharan Africa.

An evolving solution

APHLIS is a project funded by the Joint Research Centre of the European Commission that sets out to provide loss estimates at provincial level for 39 African nations. Its scope covers different cereals, climate zones, farm scales, and a variety of post-harvest crop management factors. Importantly, its calculations must be fully transparent and based on the latest scientific findings. To comply with this, APHLIS has to be sufficiently flexible to accommodate improved loss data and algorithms over time. The current algorithm for estimating losses was developed in collaboration with the Natural Resources Institute of the University of Greenwich (NRI), one of the leading institutes in this field.

To assure the provision of timely information, the system relies on the real-time gathering and pooling of data by local experts of public institutions in the 39 countries. This activity is being undertaken in collaboration with the Forum for Agricultural Research in Africa (FARA).

Decisions regarding investments into loss-reduction may well be made at sub-provincial level and APHLIS must also be able to furnish estimates for geographic units that are smaller than provinces. However, an off line solution is needed here to cope with the poor connectivity in many parts of Africa. Sustainability is another major issue as, in common with many projects, APHLIS has a limited (three-year) funding window.

For this reason, the technical concept should deliver a solution that can be maintained with limited resources when the project ends.

Technical approach

To meet the sustainability challenge, APHLIS separates data management from data processing. The decentralised gathering, pooling and sharing of data is facilitated through a GIS-enabled Shared Database (SDB). The latter is not APHLIS-specific and can be used by diverse thematic projects that need to manage numerical and georeferenced data.

Sharing of the data management component in this way realises substantial economies of scale, both for system developers and data entry operators. The SDB allows complete referencing of data and uses matrices to link figures to geometries, objects, variables, units, time and source of information. Project coordinators are able to generate data matrices according to their specific needs by combining different objects and variables; by defining the period and interval of their observations, and by defining the reference area. For this purpose the SDB provides the functionality for on-line digitising of the areas of observation. To allow off-line data management, data matrices can be exported and imported as Comma Separated Values (CSV) files.

Data is transferred to the APHLIS system through an application programming interface that adheres to the Service Oriented Architecture (SOA) paradigm. The algorithm for the estimation of losses was implemented in the database in cascading views in such a way that no computation is necessary in the front-end. This maximises flexibility of the system and allows for scientific progress in loss estimation.

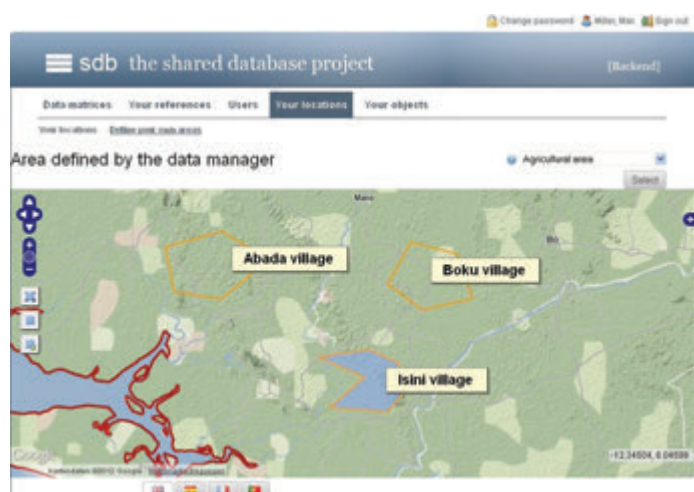
The software employed for the database is PostgreSQL, with the spatial extension PostGIS installed. This ensures that not only technical data but also geometries, i.e. areas, can be stored directly in the database. The map client is provided by the popular OpenLayers JavaScript library. The latter is embedded into GeoExt, a JavaScript-based framework that provides rich web-mapping functionality.

As Internet access in the field is often problematic, a simple spreadsheet application to calculate the losses can be downloaded and used offline. It allows practitioners to estimate losses at a geographical scale smaller than provinces. Estimates derived with the downloadable calculator can be used as input into the SDB as a means of sharing more situation and location-specific information.

Considered decision

To further enhance the sustainability of APHLIS, a conscious decision was made to adopt Free and Open Source Software (FOSS). Its licensing conditions underpin four fundamental freedoms, as defined by the Free Software Foundation:

1. The freedom to run the program for any purpose
2. The freedom to study how the program works and adapt it to user needs



Defining individual areas in the WebGIS



Traditional store for cereals in the Soroti district (Uganda). Photo: Marc Bernard

3. The freedom to redistribute copies
4. The freedom to improve the program and make it available so that the whole community benefits

The sustainability arises out of the fact that no licensing costs apply and its explicit right to improve the programs used in APHLIS this project stands a good chance of developing in a beneficial manner over time.

Results

APHLIS provides estimates of cereal grain losses at provincial scales for sub-Saharan Africa and is increasingly being used by practitioners in the field. The data gathered by the APHLIS network is made available to the public at a global scale and can be reused for other purposes. The investment in the system is particularly sustainable since the components used are available under Open Source licenses. The APHLIS project adopts an innovative approach towards sustainability by encouraging the mutual exchange of raw data between different thematic networks.

Outlook

The intention is to apply the same concept for other thematic portals for improved decision-making at different levels. For this, an abundance of positive feedback has already been received and more is welcome. Since mobile phones are popular devices, and in widespread use in Africa, they are targeted as input devices for data gathering. Appropriate work is underway to facilitate their use. Since the strategic decision to use FOSS was made, engaging the Open Source community in Africa and encouraging collaboration has been intensified. Last but not least, a transfer of the described technology and know-how to other parts of the world is desirable.

WEB LINKS

Natural Resources Institute:
www.nri.org

Forum for Agricultural Research in
Africa (FARA): www.fara-africa.org

Joint Research Centre of the European
Commission (JRC): <http://mars.jrc.ec.europa.eu/mars>

APHLIS: www.aphlis.net

Shared Database: <http://sdb.afriis.org>

PostgreSQL: www.postgresql.org

PostGIS: www.postgis.org

OpenLayers: www.openlayers.org

GeoExt: www.geoext.org

Free Software Foundation: <http://fsfe.org/about/basics/freesoftware.en.html>

SimpleThings: www.simplethings.de

Marc Bernard is the Knowledge Management Coordinator at the Federal Office for Agriculture and Food in Bonn, Germany (www.ble.de) while Dipl.-Geogr. Hinrich Paulsen is the General Manager at terrestris GmbH & Co. KG, also in Bonn (www.terrestris.de)

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