# *GIM INTERNATIONAL INTERVIEWS GILBERTO CâMARA*

# Saving the World the Brazilian Way

Deforestation in the Brazilian Amazon rainforest has been reduced from 27,000km2 in 2004 to 6,500 km2 in 2010, thanks to the earth observation technologies of that country's National Institute for Space Research (INPE). And, as an emerging economy, Brazil should also contribute to the world's environment, thinks INPE director Gilberto Câmara. He wants to export successful monitoring methods to other endangered regions, such as Africa and Asia. Câmara shared with GIM his sense of engagement and vision for the future.

# What projects are you working at INPE at the moment?

Our team is working hard on a release of TerraLib 5.0, our open-source library for GIS classes and functions designed to support innovative GIS applications. There are many good open-source libraries that support the OGC standards. However, emerging geospatial applications need tools that go beyond current OGC requirements. At INPE we want to extract information from our remote-sensing image database, where we have data starting in the 1970s, to describe changes in land use. OGC does not as yet cover the needs of land change and dynamic modelling. Think of TerraLib 5.0 as openJUMP or gvSIG with added support for accessing data from different sources and for spatiotemporal data such as mobile sensors. A second project, closely related to Terralib, is TerraMe, open-source software for dynamical modelling. Think of TerraME as a kind of Repast or PCRASTER tightly coupled to a spatiotemporal database. The long-term goal of the TerraLib and TerraME projects is to support data-intensive GIS, a new way of processing geospatial data by moving the software to where the data is, rather than the other way around. We consider data-intensive GIS tools will make it easier to work with large amounts of images available from big repositories. In short, we are developing open-source GIS software that goes beyond OGC standards and is focused on representing and modelling change.

### What is the biggest challenge for space institutes like INPE?

As a space institute, one of our main goals at INPE is to make good use of satellite data. Next year we will launch CBERS 3, the first of a new generation of remote-sensing satellites developed with China. These will have four instruments, ranging from a 5-metre camera with 60-kilometre swath to a 60-metre camera with a 700-km swath. CBERS 3, with the US LANDSAT-8, the European Sentinel-2 and 2A, and India's Resourcesat-2, will form part of a virtual constellation of land-imaging satellites. Combining them gives us midrange-resolution data with fast temporal cycles and global coverage: ideal for land management. The challenge is to integrate these data sources, allowing access to the archives and developing GIS tools that capture and describe change. If we succeed in combining data from different sources we will be able to understand how our planet is changing, and hopefully take the right action at all levels, from local to global.

# INPE is monitoring deforestation in Amazonia using satellite imagery. How does this work?

In the last thirty years Brazil has cut down about 500,000km2 of rainforest, a huge amount and a significant contribution to global warming. Since 2005, Brazil has managed to significantly reduce the loss of rainforest by using high temporal remote-sensing data plus effective rule of law. INPE provides daily alerts on newly deforested areas and sends this data to our Environment Protection Agency and the Federal Police. The law agents go to the field, arrest illegal loggers and bring them to justice. This work has been very effective and has shown how to use remote sensing for operations. As a result, deforestation in Amazonia fell 400% between 2004 and 2010. We did this by connecting the satellite image to the law-enforcement agent in the field.

# There's a new law going through parliament at the moment that grants permission for logging companies to fell trees. How do you view this?

I look at it in a positive way. Brazil has a Forest Code that dates from the 1960s which regulates the protection of natural resources. Before recent action by the federal government the Forest Code existed only on paper, since most illegal loggers were not punished. Promoting the rule of law in Amazonia has forced loggers to recognise the need to express their views openly and to propose changes in the Code to fit their interests. Since they are now facing sanctions, they want to change the law. This has led to intense public debate on the limits between forest protection and agricultural production: a necessary step in Brazil's route towards become a developed country. Brazilian scientists (I'm one of them) are now trying to convince our congressmen to update the Forest Code for the better and to avoid any setback in our environmental legislation.

# Is Brazil getting enough credit from the rest of the world for its efforts to reduce deforestation?

In general, the rest of the world has recognised our good results in reducing forest felling. Amazonia is a global resource mostly located within Brazilian borders. Fortunately, most of us in Brazil firmly believe that we have to protect the world's most bio-diverse ecosystem. However, there will always be a struggle against those Brazilians who consider only their own short-term interests. Thus it is important that the rest of the world continues to follow what happens in Amazonia and in all the world's tropical environments, and reminds us (the caretakers) of our duties.

You are working with China on the CBERS project. In your view, is China making good use of the potential of this satellite imagery? China is unique. It is going through an incredible change, with fast growth at the expense of huge cost to the environmental. China has a very good space programme, including putting men into space. So it's productive to work with China in satellite development. There is a lot of current public investment in all fields of research. This has led to an increase in resources dedicated to remote-sensing applications, especially in top institutes at the Chinese Academy of Sciences. I sense a positive trend, with good researchers showing local and federal government authorities the power of information coming from space.

#### Are you considering taking INPE's earth-observation monitoring skills into the field of urban planning?

We have a national mandate for monitoring the rainforest and agricultural areas in Brazil. That keeps us busy. Since there are many good proprietary and open-source solutions for cadastral applications and urban planning, there's no need for INPE to develop another. We like to focus on technologies that are not for sale or already available as open-source software.

Can other countries make use of your experience in applying satellite data for the conservation of the environment? Yes, of course. We are working with the UN Food and Agriculture Organization (FAO) to use our experience in Africa for supporting countries in the Congo Basin. We hope the Congo rainforest, which is still largely pristine, will not suffer the same fate as Amazonia in the 1970s and 1980s. We hope to help them by applying the expertise we have without any commercial interest. I feel that the BRIC countries have become global players now, and therefore we should act accordingly, taking responsibility for sustainable development practices.

### Where will we stand ten years from now?

We are moving from describing land cover at a specific time, derived from a single image, to understanding land change distilled from lots of images. In ten years' time I hope we will have the technologies and knowledge to extract information from a sequence of images. Today remote-sensing images are like photographs that capture the moment. In ten years, I hope we will be using remote-sensing images like movie frames that show objects and processes of change.

# Glimmering through all the archived material and presentations you have given in the past is the spirit of social engagement. Where does this come from?

(Hesitates) Oh, it's hard to say. One does not choose one's personality. We are not in the Netherlands, where everything is organised and institutions are all firmly established. I believe the scientist has a duty: to apply Science to improving the society he lives in. That's easier said than done, and the possibilities differ from one scientific field to another. But for geospatial engineers it's easy to see many ways in which we can make the world better. We can contribute on environmental, education, poverty, health or public safety issues. Brazil has suffered through many years of high inflation, low growth and appalling inequality. Recently we have made progress in reducing social injustice and reducing poverty. Still, there's much to do in Brazil to build a better country that can play a positive role in the world.

https://www.gim-international.com/content/article/saving-the-world-the-brazilian-way