

Using *JERS-1 SAR* images to locate weaknesses in the riparian forest in tropical lowlands of Colombia

Jan
Dr. Nathalie Beaulieu, Senior Research Fellow,
Dr. Erik Veneklaas, Senior Research Fellow,
Dr. William Bell, Chief Information Officer,



Objectives

In many countries, it is required by law to preserve a strip of forest on the banks of watercourses. Indeed, the riparian forest acts as a natural buffer against contamination and sedimentation, protects the banks against erosion, and forms a reservoir for plant biodiversity, a habitat for wildlife and biological corridors when it is continuous. In the savanna landscapes of Colombia, forests are only found close to rivers or streams due to edaphic constraints and burning practices, and they are threatened by logging.

The objective of this study is to locate sections where the riparian forest is either discontinuous or excessively narrow, in an area of savanna dominated by livestock agriculture. Our study area is located south of the Meta River, between the cities of Puerto Lopez and Puerto Gaitán, in the department of Meta, Colombia. Our goal is also to develop a tool that allows us to guide and monitor reforestation initiatives in spite of the cloud cover that affects this area during much of the year, and in spite of the haze caused by the burning of grasslands. In contrast to optical sensors, radar sensors have the ability to acquire images that are not affected by clouds or haze. The L-band (wavelength of 23.5 cm) used by the Synthetic Aperture Radar (SAR) aboard the Japanese JERS-1 satellite provides excellent contrast between forest and either natural or improved pasture.

Method

Two SAR images from the Japanese JERS-1 satellite, acquired in March 1996, were georeferenced to an ARC/INFO database of the area containing watercourses digitized from 1:25000 scale topographic maps, derived from aerial photographs acquired in 1979. The SAR images were made available to CIAT by the National Space Development Agency of Japan (NASDA), for research purposes, under the Global Rain Forest Mapping Program. The Colombian legislation states that a strip of forest 30-m wide should be preserved on either bank of watercourses. For the analysis of the narrow rivers draining the study area, a study buffer with a total width of 87.5 m, corresponding to 7 pixels of the JERS-1 images, was derived from the watercourse vectors, to examine an area slightly wider than that required for protection. A median filter was applied to the image mosaic to reduce speckle (a grainy noise typical of radar imagery); the image was then classified into forest and non-forest. Pixels of non-forest falling into the study buffer constitute the areas potentially needing reforestation, and which should be ground-checked. Image processing was conducted using EASI/PACE version 6.1 (PCI, inc.) on a Sun SparcStation 5.

Results

Figure 1 shows a close-up of the unfiltered JERS-1 SAR image over an area of 6.4 km x 6.4 km Southwest of Puerto Gaitán. Streams are displayed in blue, and the riparian forest appears bright. Figure 2 shows, in red, the areas potentially needing reforestation, overlaid onto the filtered SAR image, only shown in the 7-pixel wide strips following the river courses. Areas not falling into the study buffer areas appear in blue/green. Clusters of red on the extremities of streams are critical, because they allow contamination and sedimentation to directly enter the stream network.

In Colombia, farmers can benefit from economic incentives for reforestation. CORPOICA, the national institution in charge of agricultural development, will use the results of this study to focus reforestation and conservation initiatives towards the most environmentally critical areas.

Figures 1 and 2: Riparian Forest images

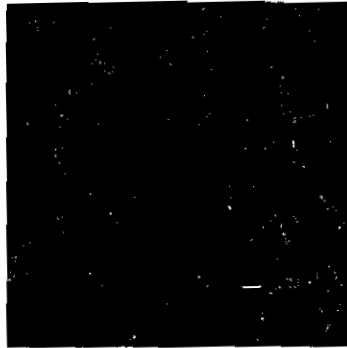


Figure 1. Close up of the unfiltered JERS-1 SAR image; the riparian forest is bright on the dark pasture background. Watercourses are displayed in blue.

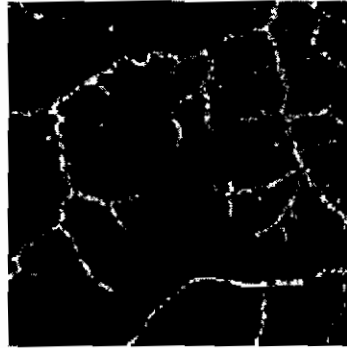


Figure 2. Areas potentially needing reforestation appear in red on the filtered JERS-1 SAR image. Areas not included in the study buffers are masked grey/green

Click on any thumbnail image to view it in the frame.

Notes

Note that in addition to the JERS-1 satellite, three other satellites now orbiting the Earth carry radar sensors: the European ERS-1 and ERS-2 and the Canadian RADARSAT, all using C-band (a wavelength of about 6 cm). Other operational applications of radar images in the tropics include monitoring of deforestation, mapping water bodies (such as reservoirs, coastal estuaries and aquaculture ponds) and mapping banana plantations. They also include the extraction of digital elevation models with stereo imagery or by interferometry. This study is paralleled by research on the potential of RADARSAT images to distinguish improved pastures from natural pastures, conducted by CIAT in the same geographic area, in the scope of the Canadian Globesar II program.

For further information contact Nathalie Beaulieu
n.beaulieu@cgnet.com