

## Digital Mapping of First-Order Drainages and Springs of the Guajiru River, Northeast of Brazil, Based on Satellite and Drone Images

**Authors :** Sebastião Milton Pinheiro da Silva, Michele Barbosa da Rocha, Ana Lúcia Fernandes Campos, Miquéias Rildo de Souza Silva

**Abstract :** Water is an essential natural resource for life on Earth. Rivers, lakes, lagoons and dams are the main sources of water storage for human consumption. The costs of extracting and using these water sources are lower than those of exploiting groundwater on transition zones to semi-arid terrains. However, the volume of surface water has decreased over time, with the depletion of first-order drainage and the disappearance of springs, phenomena which are easily observed in the field. Climate change worsens water scarcity, compromising supply and hydric security for rural populations. To minimize the expected impacts, producing and storing water through watershed management planning requires detailed cartographic information on the relief and topography, and updated data on the stage and intensity of catchment basin environmental degradation problems. The cartography available of the Brazilian northeastern territory dates to the 70s, with topographic maps, printed, at a scale of 1:100,000 which does not meet the requirements to execute this project. Exceptionally, there are topographic maps at scales of 1:50,000 and 1:25,000 of some coastal regions in northeastern Brazil. Still, due to scale limitations and outdatedness, they are products of little utility for mapping low-order watersheds drainage and springs. Remote sensing data and geographic information systems can contribute to guiding the process of mapping and environmental recovery by integrating detailed relief and topographic data besides social and other environmental information in the Guajiru River Basin, located on the east coast of Rio Grande do Norte, on the Northeast region of Brazil. This study aimed to recognize and map catchment basin, springs and low-order drainage features along estimating morphometric parameters. Alos PALSAR and Copernicus DEM digital elevation models were evaluated and provided regional drainage features and the watersheds limits extracted with Terraview/Terrahidro 5.0 software. CBERS 4A satellite images with 2 m spatial resolution, processed with ESA SNAP Toolbox, allowed generating land use land cover map of Guajiru River. A Mappir Survey 3 multiespectral camera onboard of a DJI Phantom 4, a Mavic 2 Pro PPK Drone and an X91 GNSS receiver to collect the precised position of selected points were employed to detail mapping. Satellite images enabled a first knowledge approach of watershed areas on a more regional scale, yet very current, and drone images were essential in mapping details of catchment basins. The drone multispectral image mosaics, the digital elevation model, the contour lines and geomorphometric parameters were generated using OpenDroneMap/ODM and QGis softwares. The drone images generated facilitated the location, understanding and mapping of watersheds, recharge areas and first-order ephemeral watercourses on an adequate scale and will be used in the following project's phases: watershed management planning, recovery and environmental protection of Rio's springs Guajiru. Environmental degradation is being analyzed from the perspective of the availability and quality of surface water supply.

**Keywords :** imaging, relief, UAV, water

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