

# **Study of the Mangrove Forest with Earth Observation: Hyperspectral Field Data and Satellite Images for a Better Understanding of This Strategic Ecosystem and Its Relationship with Ethnic Communities of the Colombian Pacific Region**

**Nelson Nieto, Alexander Páez, González Mónica and Johan Avendaño (Colombia)**

**Key words:** Cartography; Coastal Zone Management; Cost management; Remote sensing; Mangrove forest; ethnic communities; afro-descendant communities

## **SUMMARY**

In the framework of the Colombian Ocean Commission, since 2019 the Geographic Institute Agustín Codazzi -IGAC-has actively participated in scientific expeditions to the Pacific region on the western coast of the Colombian continental territory, characterized by its environmental richness, an important extension of mangrove forest, and a historical vulnerability in the social and economic conditions of its populations, especially the indigenous and afro-descendant communities whose food and security and economy relies heavily on the ecosystem services of the mangrove forest. From the Directorate Research and Prospective of the IGAC, the proposal arises to integrate field data obtained from hyperspectral sensors with Earth observation images as an alternative to the use of direct methods in the study, characterization, and mapping of mangrove forest. In the three scientific expeditions so far, the research team have collected 112 spectral signatures of 7 different species of mangrove, all these representatives of the Colombian Pacific in the Sanquianga, Uramba Bahía Málaga and Utría national natural parks, using Red Tide and FLAME spectroradiometers from Ocean Optics (350-1000 nanometers), thus constituting one of the most important repositories of mangrove spectral signatures in Colombia.

From the spectral libraries consolidated and the implementation of separability analysis methods, including Spectral Angle Mapper, the Jeffries-Matusita distance and Ward's hierarchical discriminant analysis, the specific endmembers have been created for every mangrove species sampled along the Pacific Coast of Colombia. Furthermore, these endmembers have been employed in the exploratory analysis of the distribution of mangrove species, by using PlanetScope images of 3 meters of spatial resolution and four bands of spectral resolution (blue, green, red and near infrared), by means of the Spectral Angle Mapper for image classification with resampled spectral signatures and spectral unmixing

---

Study of the Mangrove Forest with Earth Observation: Hyperspectral Field Data and Satellite Images for a Better Understanding of This Strategic Ecosystem and Its Relationship with Ethnic Communities of the Colombian Pacific Region (12654)

Nelson Nieto, Alexander Páez, González Mónica and Johan Avendaño (Colombia)

FIG Working Week 2024

Your World, Our World: Resilient Environment and Sustainable Resource Management for all  
Accra, Ghana, 19–24 May 2024

analysis.

The results obtained showed that the PlanetScope images, even though they are not the images with the best spectral and radiometric qualities in the market, allow the identification of clearly distinguishable spatial distribution patterns of mangrove species, provided that different correction and improvement methods and algorithms are applied both to the images and the spectral signatures, however, it is certain that further field data collection is necessary to improve the classification of images and to validate the results. Despite the limitations experienced in the scientific expeditions and in the research conducted, the results obtained have led to the consolidation of a set of geospatial data that can be a key input to generate updated and accurate cartography of this strategic ecosystem, which facilitates its management, conservation, and planning, and its critical role in the substances and quality of life of indigenous and afro-descendant communities.

---

Study of the Mangrove Forest with Earth Observation: Hyperspectral Field Data and Satellite Images for a Better Understanding of This Strategic Ecosystem and Its Relationship with Ethnic Communities of the Colombian Pacific Region (12654)

Nelson Nieto, Alexander Páez, González Mónica and Johan Avendaño (Colombia)

FIG Working Week 2024

Your World, Our World: Resilient Environment and Sustainable Resource Management for all  
Accra, Ghana, 19–24 May 2024