

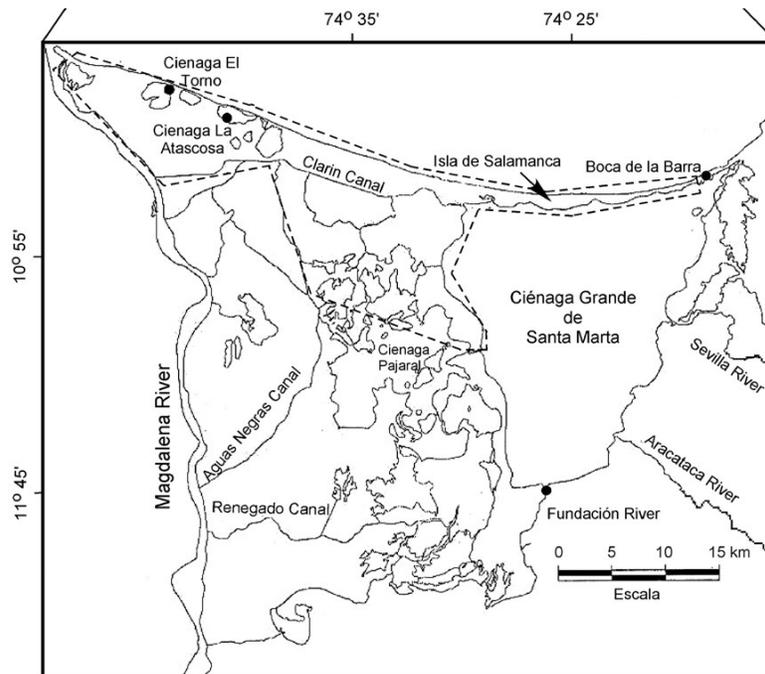
Ciénaga Grande de Santa Marta - Ramsar Site in the Caribbean Coast of Colombia

Fernando Jaramillo (30-12-2011)

Figure 1: Location of the Ciénaga Grande de Santa Marta (CGSM) - RAMSAR Site in Northern Colombia.



Figure 2: Tributaries and water bodies of the CGSM, as taken from Simard et al (2008)



Background Information

The Ciénaga Grande de Santa Marta (CGSM) is located on Colombia's Caribbean coast, with its boundaries reaching as far as 10° 37' to 11° 07'N and 74° 15' to 74° 51'W. The wetland is part of the delta of the Magdalena River; Colombia's largest river and South America's fifth largest (Simard et al., 2008), with an annual water discharge of approximately 7000 m³/s. The CGSM was designated as a UNESCO Biosphere Reserve in 2000 and was included in the Ramsar Convention in 1998. The CGSM is the largest lagoon–delta complex in Colombia, covering 1280 km².

Mainly three species of mangrove are found in the estuary; Black mangrove (*Avicennia Germanis*), White Mangrove (*Laguncularia Racemosa*) and Red Mangrove (*Rizophora Mangle*). During the last 30 years, the total mangrove coverage in the CGSM has reduced in approximately 50%, from an original extension of 511 km² (as recorded in 1956) to its minimum registered level in 1995 (226 km²) (INVEMAR, 2004). Other sources mention higher reductions of even 60% (Carola, 2000). Mangrove population starts decreasing almost linearly, reaching its minimum level in the mid 90's, when a project financed by the World Bank started in 1993 to reestablish the original hydrological characteristics of the estuary. In this project, the Colombian government established an environmental management plan (EMP) to restore the mangrove populations in the wetland, with its execution done by three Colombian institutions, CORPAMAG, INVEMAR and CORPES C.A. along with the technical cooperation of the German Agency for Technical Cooperation (GTZ) (Botero and Salzwedel, 1999).

Main research and management problems

Many theories have been discussed for the massive mortality of mangroves but the main reasons are mentioned as follows, all supposedly related with hyper salinity periods in the estuary.

1. Construction of a road that gradually blocked most of the western fresh water affluent into the estuary. The combination of this road construction and the sediments coming from the Magdalena River had almost blocked water input by 1995.
2. Construction of a national high way (Via al Mar) connecting two main cities, Santa Marta and Barranquilla initiated in 1956. It reduced considerably the water exchange between salt ocean water and fresh water from the estuary from an original width of 2 km to only 200m that currently exist. A gas duct construction was developed afterwards parallel to the highway.
3. The effects of the El Niño and la Niña climatic phenomenon are synthesized in 6 to 7 year large intensity cyclic variations, dry periods and inundation seasons. The dry periods are linked in the CGSM to hyper salinity.
4. High sedimentation and siltation of the estuary.

Although some effort has been put in the research of the ecological and faunal characteristics of the wetland, its hydrology has not yet been investigated as seen from the scientific literature available. Some of the points that GWEN could address about the CGSM are the following:

1. Understand the hydrological processes of the wetland, in order to supply important information for the restoration and management activities that are being taken, and that will continue in the future.
2. The function of the wetland as a source of attenuation and retention of nutrients or even metals (Perdomo et al., 1998) is still unknown. The fact that the CGSM is located close to the outlet of the largest river of the country implies that this wetland could be a major attenuator or retainer of nutrients coming from all the industrial, agricultural and populated areas of the Colombian inland.
3. It would be interesting to determine, if any, the “useful” life of the wetland, due to the high levels of sedimentation and siltation.

Possible end-users

This RAMSAR site has, due to its importance, many end users. Starting from the Colombian Government, the Ministry of the Environment, the National Park Unit (*Unidad de Parques Nacionales de Colombia*), and the regional environmental authorities including CORPAMAG.

INVEMAR, a Scientific Organization in Natural Habitats, in joint collaboration with CORPAMAG has done research on the wetland during the last decades. Collaboration opportunities exist with INVEMAR, and some of the main Universities in the country.

Site conditions

The wetland is delimited on its West and South West by the largest river in Colombia, the Magdalena River; on the North by the Caribbean Sea, although separated from it by a barrier island called Isla de Salamanca, which in turn has an inlet (Boca de la Barra) that connects the largest lagoon directly to the sea. The CGSM also receives fresh water and sediments from the East catchment by several rivers descending the foothills of the Sierra Nevada de Santa Marta, the highest coastal mountain range in the world.

The micro weather is defined as tropical arid with 6 to 7 dry months throughout the year. The main dry season extends from December to April and the wet season occurs in two main periods, May - June and September - November, the latter period accounting for 70% of the mean annual rainfall. The mean annual precipitation from 1970 to 2000 was 836 mm/yr. Since the 1990, precipitation has been altered by El Nino and la Nina climatic phenomena. The effects over the study zone involve 6 to 7 year intense cyclic variations between dry and inundation seasons. Recently, these periods have shortened in the country. The water depth in the main lagoon oscillates between 0.5 and 1.5 m and the mean annual depth of water is 0.9 m. The region is well known for its hydrological deficit of around 1 m/year due to its high evapotranspiration and low precipitation regimes (INVEMAR, 2005).

Monitoring and Data

According to Blanco et al (2006) precipitation data is available at four IDEAM (Colombian Institute for Environmental Studies) weather stations: Cocos, Tasajera, Sevillano and Prado Sevilla. Recent evaporation data is not available. Monthly surface salinity data can be taken from

10 sampling stations located in the CGSM, apparently only for the period 1993 to 2002. The monthly stream flow data for the Magdalena River and the Sevilla, Fundacion and Aracataca tributary rivers is available from their corresponding flow meter stations, installed by IDEAM. IDEAM has also temperature stations installed in the area.

However, more investigation on information availability is required.

Publications

The most relevant publications are the following:

Blanco, J., Vilorio, E. and Narvaez, J.: ENSO and salinity changes in the Ciénaga Grande de Santa Marta coastal lagoon system, Colombian Caribbean, *Estuar. Coast. Shelf Sci.*, 66(1-2), 157-167, doi:10.1016/j.ecss.2005.08.001, 2006.

Botero, L. and Salzwedel, H.: Rehabilitation of the Ciénaga Grande de Santa Marta, a mangrove-estuarine system in the Caribbean coast of Colombia, *Ocean Coastal Manage.*, 42(2-4), 243-256, doi:10.1016/S0964-5691(98)00056-8, 1999.

Cardona, P. and Botero, L.: Soil characteristics and vegetation structure in a heavily deteriorated mangrove forest in the Caribbean Coast of Colombia, *Biotropica*, 30(1), 24-34, doi:10.1111/j.1744-7429.1998.tb00366.x, 1998.

Carola, E.: Reasons for reforestation success and failure with three mangrove species in Colombia, *Forest Ecology and Management*, 131(1-3), 201-214, doi:10.1016/S0378-1127(99)00214-5, 2000.

Elster, C., Perdomo, L. and Schnetter, M.: Impact of ecological factors on the regeneration of mangroves in the Ciénaga Grande de Santa Marta, Colombia, *Hydrobiologia*, 413, 35-46, doi:10.1023/A:1003838809903, 1999.

Guzman-Alvis, A. and Carrasco, F.: Influence of a tropical lagoon discharge and depth on the structure of adjacent shelf macroinfauna (Southern Caribbean), *Cah. Biol. Mar.*, 46(1), 81-93, 2005.

Perdomo, L., Ensminger, I., Espinosa, L., Elster, C., Wallner-Kersanach, M. and Schnetter, M.: The mangrove ecosystem of the Ciénaga Grande de Santa Marta (Colombia): Observations on regeneration and trace metals in sediment, *Mar. Pollut. Bull.*, 37(8-12), 393-403, 1998.

Simard, M., Rivera-Monroy, V. H., Mancera-Pineda, J. E., Castaneda-Moya, E. and Twilley, R. R.: A systematic method for 3D mapping of mangrove forests based on Shuttle Radar Topography Mission elevation data, ICESat/GLAS waveforms and field data: Application to Ciénaga Grande de Santa Marta, Colombia RID G-7329-2011, *Remote Sens. Environ.*, 112(5), 2131-2144, doi:10.1016/j.rse.2007.10.012, 2008.