



Universidad Nacional Autónoma de Nicaragua
Centro para la Investigación en
Recursos Acuáticos de Nicaragua



Analysis of the Relationship between Anthropogenic Pressures in the Watershed and the State of Contamination of Lake Cocibolca of Nicaragua

The Foundation of Ciudad del Saber and the Nicaraguan Research Center for Aquatic Resources (CIRA/UNAN) initiated a project in April of 2006 with the objective to evaluate the relationship between anthropogenic activities in the watershed and the actual state of contamination in the water of Lake Cocibolca.

The project activities have integrated biological, physical and chemical data of the water of the lake with results of satellite imagery and information collected from the watershed of Lake Cocibolca to accomplish the following 9 results. This report is aimed to summarize the activities completed to attain the given result. The technical results and their interpretation are presented in the appendix and all figures and tables refer to this report (Informe Técnico).

1. Biological, physical and chemical information obtained from monitoring of the Lake Cocibolca.

In correspondence with the organization of possible satellite information designated from the coordination of Ciudad del Saber, the day, 3 of May of 2006, was chosen for the intensive sampling of the Lake Cocibolca. The sampling was carried out in an area of 60km x 60km (Figure 15) according to previous information of possible areas of stronger and less contamination. Six different teams and boats were sent to their designated area at the same time to sample in four hours. A total of 48 points were sampled for 14 different parameters of the lake water (Table 13). The samples were analyzed in the laboratory of CIRA/UNAN and results are reported in Table 13.

This information was analyzed in Chapter XI of the technical report related to past studies and corresponding information from the watershed from result 2.

All data was processed in interpolation models to better understand the spatial distribution and the influence of watershed activities (Figures 16-25).

2. Information from past studies of the lake and its watershed organized.

Past studies of the lake and information on climate, soils, land use, hydrology, physical characteristics of tributaries, historical patterns of lake level, use of water, hydrological balance of surface water components, hydrogeology and hydrogeochemistry of the watershed were organized and analyzed (Chapter I-VII, Technical Report).

3. System of information for the watershed established.

Thematic maps of the watershed were elaborated for precipitation, temperature, geology, soil type, land use, potential land use, land slope, digital elevation model, political division in



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municipalities and hydrological division of sub watersheds which will be presented in the web portal of the Lake Cocibolca.

4. Analysis of results of lake water with data from corresponding satellite images performed.

Regression statistics comparing lake water results and the different reflectance bands of MODIS satellite images were applied and possible models were established (Chapter XII, Technical Report). The best correlation was obtained with suspended solids and total solids and the respective model was applied (Figure 26). It is important to note that the day of selected sampling was dominantly cloudy which interfered with conditions to acquire better correlation of data.

It is important to emphasize that professionals of CIRA/UNAN and SINIA were excellently trained by Dr. Steven Schill, geospatial scientist from The Nature Conservancy, Mesoamerica and Caribbean Region. The system of software needed for this analysis was also set up in CIRA/UNAN with his guidance.

5. Information from the watershed actualized in March of 2007.

In order to analyze activities in the watershed which affect the quality of lake water, a trip was organized to all 24 sub watersheds to systemize information related to location and documentation of point sources of contamination around tributaries and in shore areas of the lake (Figure 10). In order to evaluate better the incidence of these point sources, samples were analyzed for physical and nutrient chemistry parameters (Tabla 11); diffuse sources of contamination were also identified in the sub watersheds (Figure 11).

6. A model for estimating risk to Lake Cocibolca from the watershed elaborated.

The Decision Support System (DSS) from The Nature Conservancy was set up using ArcGIS 9.1 in order to evaluate the risk of contamination of Lake Cocibolca. Information from the thematic maps, the results of the actualized information from watershed activities and analysis from experts of watershed management were applied in order to develop the map of environmental risk from the watershed (Figure 12) which gives also the map of pressure of contamination from each tributary (Figure 13) and sub watershed (Figure 14).

7. Technical report of the integration of data from lake water, satellite imagery and watershed information completed.

All data produced from the above results was analyzed and their interpretation was elaborated in a technical report presented as appendix to this summary report.



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8. Capacity training and establishment of evaluation systems performed.

Key to the evaluation of all project results was the capacity training involving professionals of CIRA/UNAN and SINIA. The Nature Conservancy, Mesoamerica and Caribbean Region, facilitated training through the expertise of the geospatial scientist, Dr. Steven Schill on two occasions, one course in December of 2006 and three days of intensive training in April of 2007. He not only trained professionals to use the DSS tool and analysis of satellite imagery but also supported the establishment of these software systems for future application.

9. All project results presented in web portal.

This project has achieved the actualization and organization of information applying dynamic systems of information (ArcGis 9.1 and Decision Support System). This has also included the combination of new and past information for a more adequate interpretation of the influence of watershed activities on the Lake Cocibolca corresponding to the new trend of watershed management.

The results of the activities of this project and past studies along with the systems of data base of the lake are now being installed in the established web portal www.cocibolca.cira-unan.edu.ni in order to facilitate access to the information to scientists and public in general interested in Lago Cocibolca. All maps will also have shp format and can be accessed from the web page of SINIA (www.sinia.net.ni).

The information and systems of information of the Lake Cocibolca will be updated periodically and actualized in the web portal.

Managua, April 23, 2007