Web Geographic Information System to visualize the Patiño Aquifer vulnerability to contamination

Acuífero Patiño
Estudio del Riesgo de Contaminación

Liz Báez[a], Juan Pablo Nogues[a b], and Cynthia Villalba[a]

[a]Laboratorio de Computación Científica y Aplicada. Facultad Politécnica - Universidad Nacional de Asunción.

[b]Facultad de Ciencias de la Ingeniería - Universidad Paraguayo Alemana.

LCCA
UNIVERSIDAD NACIONAL DE ASUNCIÓN
FACULTAD POLITÉCNICA
Laboratorio de Computación Científica y Aplicada

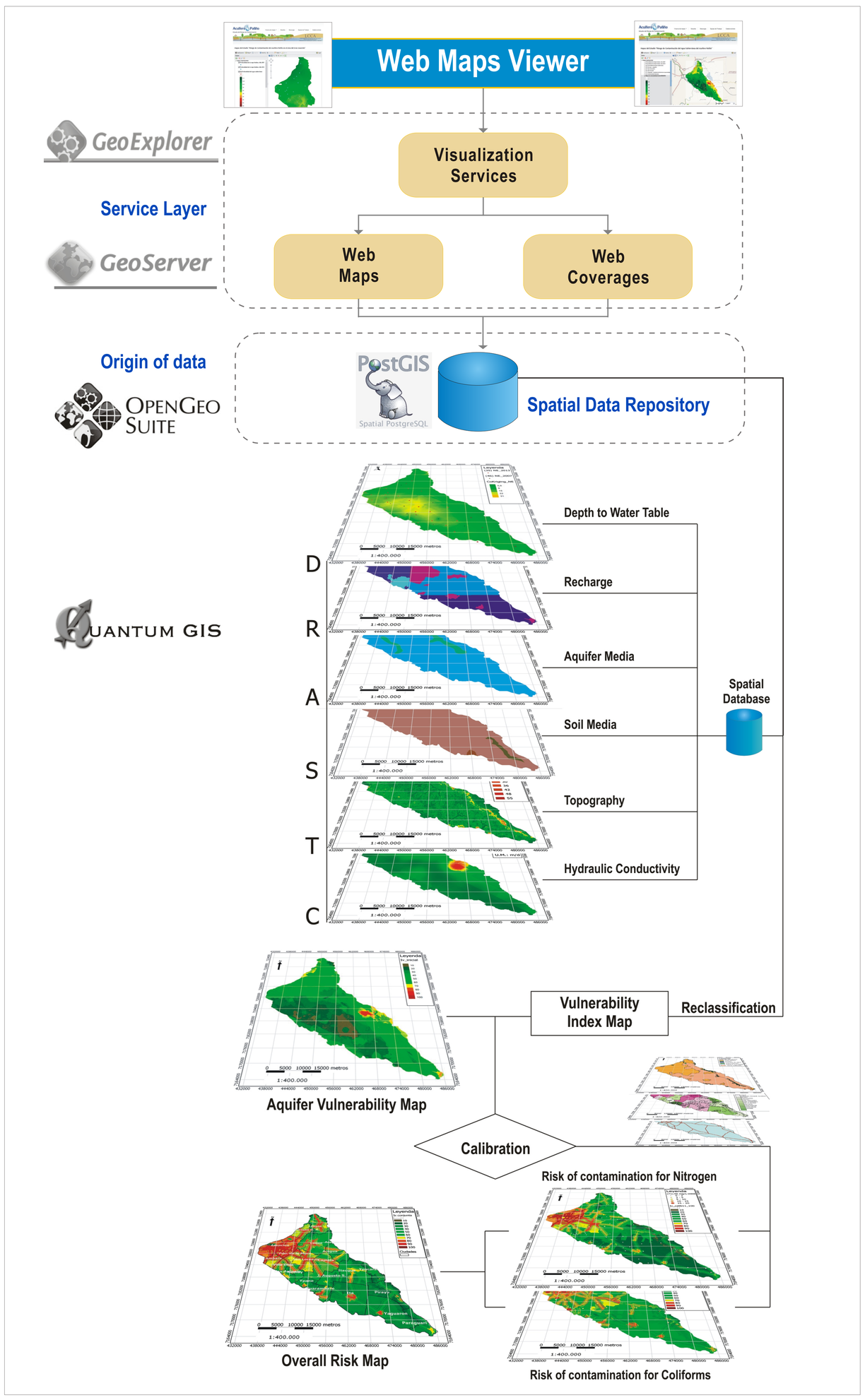
Background

The project "Mapeo de la Vulnerabilidad y Riesgo de Contaminación del Agua Subterránea del Gran Asunción" [1] evaluated the risk of contamination of the Patiño aquifer. Patiño aquifer is located in the Eastern Region of Paraguay, is a free aquifer of 1173 km², supplied the largest and most densely populated urban zone of the country, Asuncion and other cities in the Central departments and some Paraguari Department, with more than 2.976.400 inhabitants. The methodology used in the above mentioned work was a modified version of the well established DRASTIC method [2]. The procedure consisted in the collection and analysis of existing geospatial data and maps, with hydrogeologic and anthropogenic information (such as density of septic tanks, roads and land use), distributed across different institutions and not available on web. The evaluation of the geospatial information acquired was used to create an initial map of the modified DRASTIC vulnerability index. This map was then calibrated, using known groundwater concentrations of nitrogen and coliforms, in order to obtain a more accurate vulnerability and the risk map. The results of the calibration were separated into three maps of risk of contamination: one for nitrogen, another for coliforms and one that mapped the overall risk, which was obtained by overlaying the first two maps.

Aims

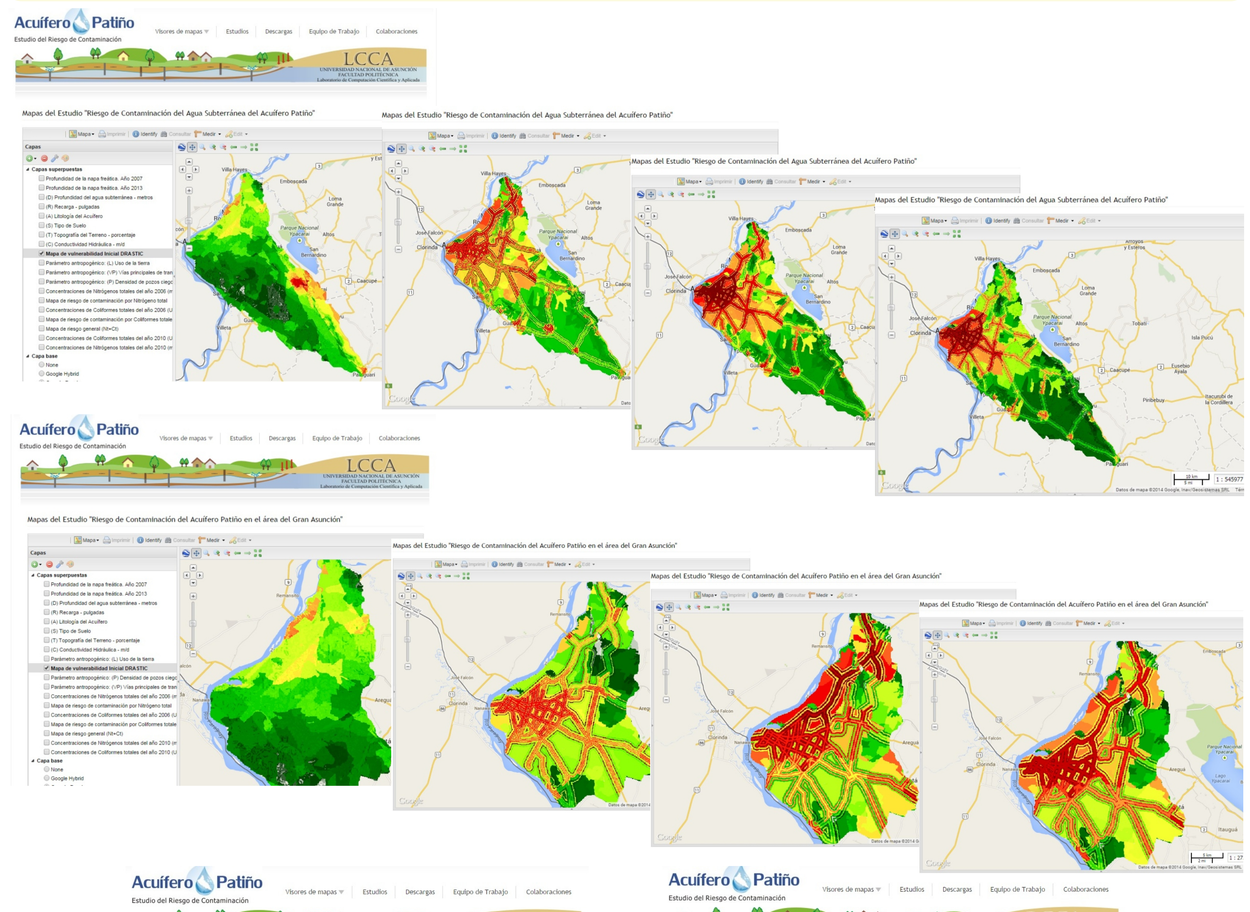
The work presented here aims to exploit the potential of information technology (IT), Geographic Information Systems (GIS) and the Open Geospatial Consortium (OGC) standards to generate interactive maps through layers on a server, sharing data, information and georeferenced maps in a web map viewer, including the results obtained in the project "Mapeo de la Vulnerabilidad y Riesgo de Contaminación del Agua Subterránea del Gran Asunción" [1].

Method and Approach



Results and Conclusions

The web map viewer is available at http://www.cc.pol.una.py/estudio_patino



These maps can help policymaker, urban planners and technicians to identify the areas with the highest vulnerability and risk of contamination, as well as set public policies regarding urban planning, monitoring and environmental regulations.

Future Work

- Include results from a contaminant transport model, to study the implication of dynamic effects on the vulnerability map.
- Based on the information of the vulnerability map design a system for continuous monitoring for the Patiño aquifer.
- Extend the measurement analysis over more than two pollutants, looking at heavy metals and petroleum-based substances.
- Modify the web viewer for: allowing maps dynamically change, implement metadata and downloads of shapes.
- Implementation of POSH method (Pollutant Origin Surcharge Hydraulically), to characterize the potential sources of pollution on the basis of two factors: the type of anthropic activity, and estimate the probable hydraulic loads.

References

[1] BAEZ, L, VILLALBA, C, NOGUES, JP, 2014. Mapeo de la Vulnerabilidad y Riesgo de Contaminación del Agua Subterránea del Gran Asunción, CONACyT Proyecto INV 20, Facultad Politécnica - Universidad Nacional de Asunción. Paraguay.

[2] ALLER, L, LEHR, JH, PETTI, R, BENNETT, T, 1987. DRASTIC: A standardized system to evaluate groundwater pollution potential using hydrogeologic settings, National Water Well Association/Benett and Williams Inc, Ohio.

Acknowledgements

The authors would like to thank Ing. Andres Wehrle, Dr. Félix Carvallo, Universidad Católica de Nuestra Señora de la Asunción and Dr. Félix Villar, Facultad de Ingeniería, Universidad Nacional de Asunción, for providing valuable information and knowledge for the development of the study.

The authors would like to thank Dra. Larissa Rejalaga, Facultad de Ciencias Agrarias, Universidad Nacional de Asunción, for provide data from "Land Use" of the study area.

The authors would also like to thank Direccion General de Salud Ambiental (DIGESA), for sharing the data measures of Total Coliform and Nitrates between 2010 and 2012.

Finally, the authors would like to express gratitude to Prof. Cristian Cappo, for their help in setting up the necessary tools in the web server LCCA.

And to the following Institutions:

CONACYT