

Raising awareness of urban and suburban hydric resource pollution in promoting urban water management in Northwest Uruguay.

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ABSTRACT

In the last decades the increasing human population, urbanization and consumption rate, dramatically increased the pollutants and nutrients in the urban waters, changing the urban stream channel morphology, perturbing the ecosystem reducing the biotic richness, lead to the called “urban streams syndrome” [1]. Some researches put their emphasis in urban impact and how to create efficient drainage systems for decrease industrial discharges and domestic wastewaters, sanitary sewer overflows problems, flow channelling and pipe systems for the urban stormwater runoff delivered to streams. All these issues are relevant to restore the streams in urban environments. In this sense, some advances towards an integrated management of urban water resources has been proposed in Uruguay [2]. Urban and suburban streams in Uruguay, as in case of the “Ceibal” in the North of Uruguay, have serious problems of pollution causing an important environmental impact, being a risk to human health. These problems have already been identified by the authorities of the Ministry of Environmental and the Universidad de la República (UdelaR) reporting a deterioration in the quality of water resources in Uruguay [3]. The quality of life in cities and towns have to be improved with coherent and sustainable approach to urban development policies. A decisive role in articulating the contributions of the different interdisciplinary stakeholder’s academic, civil and governmental, dealing with these environmental problems, is carried out by the *Water Urbans* interdisciplinary Project from the UdelaR. Firstly, identify the source of urban streams pollutants and the physical effects of urbanization [4], reducing wastewaters discharge are the principally goals for restore and protect urban streams. Secondly, an adequate and efficient management of these natural resource is vital in order to meet the demands associated with population growth, environmental/ecological sustainability and adaptability to climate change in water systems [5].

In this work, we monitored water physicochemical parameters, the stream flow and faecal coliforms in the “Ceibal”, in an attempt to evaluate the cause-effect of the pollutants among the ecosystem related to the anthropogenic impact in an urban area with the aim to raise public and government awareness of the conformation of sustainable cities.

METHODOLOGY

GEO REFERENCES AND MONITORING ZONES

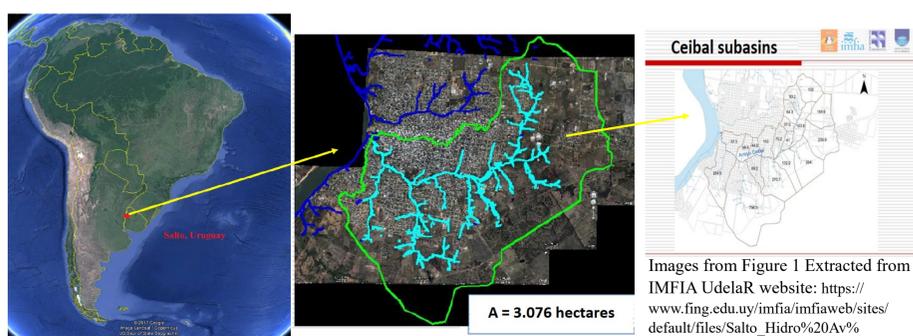


Figure 1. Ceibal stream area. At the left side: Salto city of Uruguay with a red point.

At center their basin and sub basins in cyan. At right side the sub basins over the urban plan.



Figure 2. Ceibal monitoring zones in green (Zone 1, Zone 2 and Zone 3) Salto city, North of Uruguay, limited by Uruguay river. Zone 1 is near the headwaters and the Zone 2 is near the mouth of the Uruguay river, reference: Google Earth.

SALTO: General Information

*It is the third most populous city of Uruguay with 104.166 habitants (Census 2011), 94% of whom live in urban áreas.

*It is affected by floods caused by the Uruguay river and also by torrential rainfall floods.

*Salto is a thermal capital because it is located on top of the Guaraní Aquifer, one of the world's main groundwater reservoirs.



MONITORED PARAMETERS (monthly)

Stream Flow (Doppler ADV Flow Tracker and Stream Pro ADCP), pH, Temperature, Electrical Conductivity (EC), Dissolved Oxygen (OD), Oxidation-Reduction Potential (ORP), Nitrate (NO_3^-), Ammonium (NH_4^+), Alkalinity, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Suspended Organic Matter (SOM), Thermotolerant coliform (fecal coliforms), Total Dissolved Nitrogen, Total Dissolved Phosphorous, Phosphate (PO_4^{3-}) (Reference: Water and Wastewater Standard Methods (APHA))

RESULTS

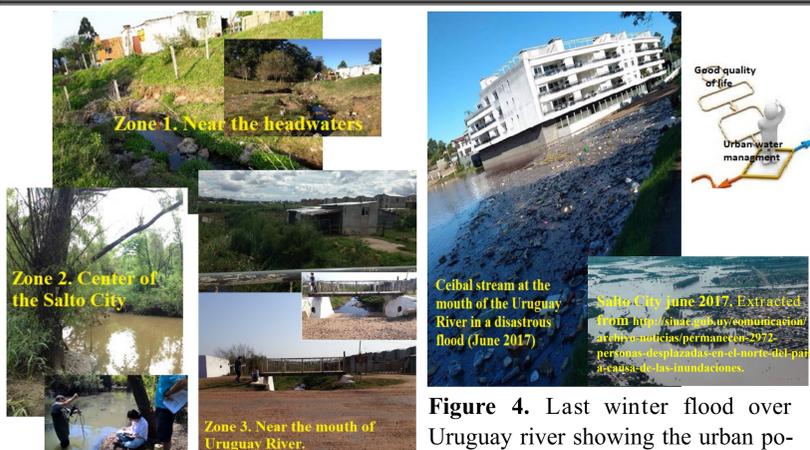


Figure 3. Photos from the monitored zones of the Ceibal stream. Stream Flow measurements.

Figure 4. Last winter flood over Uruguay river showing the urban pollution impact in the mouth of Ceibal stream. Near zone 2 that was affected by this flood.

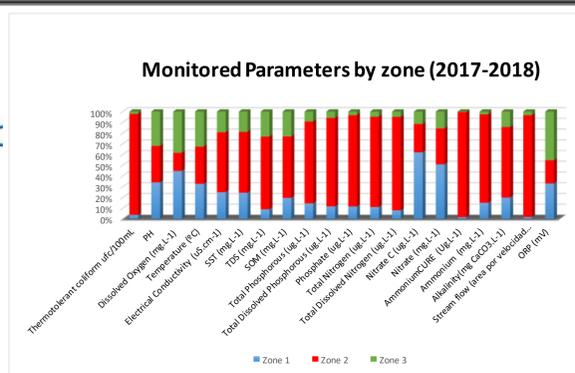


Figure 5. Ceibal monitored parameters results between Dec 2016 to Feb 2018 period, showing each relative percentage of the different parameters in Zone 1 (blue), zone 2 (red) and zone 3 (green). Chemical analysis were performed by duplicate. (Reference: Water and Wastewater Standard Methods (APHA)).

Ceibal visual monitoring relevant results:

- Ruptures in the sewerage networks.
- 60% of the available drinking water is lost through ruptures in the distribution network.
- Urban dwellings with inadequate sanitation and they discharged wastewater into Ceibal urban basin in an illegal way.



Figure 6. Photos from Ceibal visual monitoring. Water and City Workshop CENUR, Salto 8/7/15

CONCLUSIONS

- A year of physicochemical and microbiological characterization of three monitored zones from an important urban hydric source of Salto city (Ceibal urban stream) was performed.
- Zone 2 (near the mouth of the Uruguay river) has the highest pollution affecting local ecosystems. This zone is particular influenced by the Uruguay river flood and the climate change.
- Fundamental weakness characterized by visual monitoring: Haphazard and irregular urbanization caused by flood plains, Illegal dwellings with illegal sanitation across the stream, Suburban agricultural activities without agro effluents treatments and wastewater discharged directly into the stream, Domestic solid wastes accumulated over stream, glens, sewage and drainage networks, Uruguay river flood impacts over the urban stream. Stringent measures to control urbanization in flood-prone areas.
- Scientific methodology and technical support were developed for the National Integrated and Management Urban Water Plans of Uruguay.
- Guidelines for an Urban Water Governance implementation: a commitment from the stakeholders involved, ecofriendly policies, achieving coherence between social, governmental and private actions.

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