Interdisciplinary water research: experience on socio-technical innovations in WAT&ESAN

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Institute Cinara’s mission

Research and development institute on water supply, environmental sanitation and water resources conservation based at Universidad del Valle, Cali. COL

Cinara is a transdisciplinary research institute for development that works on environmental management with a special focus on water. We contribute to nature conservation, sustainable development, social equity and human talent strengthening, from an academic perspective and with a socio-ecological approach.
Location

Source: Mafla (2019)
Main socio-technical innovations

• **NBS for Water and Wastewater Treatment**

The solutions to be shown next underwent bench and pilot scale research for few years before translating them into fully-fledged designs and implementation at full-scale in small rural communities and small municipalities (2,000-70,000 p.e.)
Continuation…

Mondómo WTP. Rural community.

P= 3,000 people
Source: Cinara (2018)
Continuation...

El Cerrito, Municipal WWTP.

P = 50,000 people

ImWSP: HRAP® + BFP (85±5% BODr, 90% TSSr-f)

Source: DJI Drone (2020)
Continuation...

La Voragine, small rural WWTP.

P = 3,000 - 10,000 people

Use of native plants diversity (*H. psittacorum*)

ImCWs: ImST + UFAF + CW (90 ± 5% BODr, 92% TSSr)
River Bank Filtration-RBFi to improve raw water quality

- Technology in use in GER, NL, USA, IND & KOR.
- Natural process to improve raw water quality.
- Sanitary risk reduction prior to water treatment for human consumption.
- Turbidity peaks reduction and oxygen depletion attenuation due to organic matter pollution.

River Bank Filtration-RBFi to improve raw water quality

Main water source
River Cauca: Concession of 8m³/s

Population of Cali
2,500,000 people

Multiannual monthly flows (m³/s)
Max: 602 Min: 132

Main environmental problem:

Raw water quality with high turbidity peaks, low DO concentrations and micro-pollutants.
General layout of the RBFi solution for the city

Stretch of about 2 Km to place 8 to 10 wells with drains (each well yields 0.8 to 1.0 m$^3$ s$^{-1}$)
Water yielded by RBFi well

Raw river water
Some prejudices on NBS...

<table>
<thead>
<tr>
<th>Technologies for poor people</th>
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<tbody>
<tr>
<td>Very basic engineering (not sophisticated)</td>
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<tr>
<td>Land-extensive and costly</td>
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<tr>
<td>GHGs excess emissions</td>
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<tr>
<td>• ...All are very arguable statements...</td>
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However,...
Two illustrative examples of NBS

Melbourne Western WWTP: Urban wastewater AUS (2020)

- Area = 10,500 Has
- HRT = 10-35 days (Water class C, Water class A): Q (7-10 m³ s⁻¹)
- \( \Delta E = 70,000 \text{ MGWhr per year (Self-sufficient WWTP)} \)
- EC-SERV = pollution cleaning, water for pasture irrigation, habitat for migratory bird species*, landscape enjoyment*, education and scientific knowledge*.


Oman’s model WWTP: Wastewater from oil industry (2019)

- Area = 480 Has
- Q = 2 m³ s⁻¹
- Evaporation ponds = 140 Has for salts recovery
- Use of halophile native reeds (i.e., local biodiversity)
- Landscape restoration and soil recovery

The Social Dimension...
Community Learning Centres-CLCs

Centros Comunitarios de Aprendizaje en Agua y Saneamiento

Learning amongst peers
“Interaction spaces organized by communities so as to share info. and knowledge based on their experience and cultural practices related to everyday situations on water resources, water supply and sanitation management”
The pillars for knowledge management in CLCs are human talent and water leadership with gender approach. Thus, leaders share previous knowledge and experiences and get involved and committed to the process of new knowledge production.
Continuation...

PERSPECTIVES

CLCs are a new starting point for community-based knowledge management so as to promote changes in the ecosystems: society relationship, thus, leading to better scenarios of socio-ecological justice.

Current experience with CLCs points out to new challenges for community management of water and sanitation services, and opens up new paths for tackling more complex environmental problems.
Looking forward

NBS are feasible options for sustainable W&WWT in mid and small-sized cities (Andean region of LATAM).

Indirect wastewater reuse is a common practice in the Andean region since current WWT is very low (<30%), thus a burden of water-related diseases persist.

NBS seem to be sustainable alternatives to link WWT with effluent reuse in agriculture, in other words FEW nexus (bring together technical, economic and socio-cultural dimensions).

NBS for cities may offer multipurpose ecological functions (i.e., bioremediation of water pollution, ecological connectivity, landscape restoration, erosion control) that help building city’s resilience for climatic extreme events*
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Many thanks... 😊