Rainwater harvesting in catchments: can green mosaic landscapes sustain agro-forestry uses?

Update of previous work

- Article published in the Journal of Hydrology "Improved framework model to allocate optimal rainwater harvesting sites in small watersheds for agro-forestry uses";

- Provisional patent application;
1. Study Aim

- The main objective of this work is to find suitable RWH sites as function of site and application specific parameters;
- The application workflow will be based on the agricultural and forestry applications and will be directed to the crop irrigation and wildfire combat;
- Is presented a “Green” infrastructure solution, as RWH systems, in alternative to traditional investments;
- Preserve the landscape and the surrounding ecosystems;
2. Study Area

- Average rainfall in the catchment approaches \(730 \text{ mm}\cdot\text{yr}^{-1}\);
- \(56.2\%\) of agricultural areas;
- \(43.2\%\) of forests and shrubs;
- Average of agriculture areas in the catchment approach 222ha;
- On average, irrigation consumes \(6733 \text{ m}^3\) of water per hectare per year.
3. Materials and Methods

3.1. Conceptual model

Fig. 5- Framework design.
3. Materials and Methods

3.2. Data

Physical parameters

Socio-economic indicators

Ecological contexts

Fig. 6- Parameters of MCA.
3. Materials and Methods

3.1. Conceptual model

**Fig. 5- Framework design.**
4. Results and discussion

Fig 7: a) Generic map b) and c) application oriented maps.
4. Results and discussion

Fig 7 - a) Generic map b) and c) application oriented maps.
4. Results and discussion

$V_0 = \left( -\frac{b \times q_s}{1+b} \right) \times \left( \frac{60 \times q_s}{a \times (1+b)} \right)^{\frac{1}{b}} \times C \times A_0 \times 1$

$q_s = \frac{6g}{C \times A_0}$

$A_0 = \frac{1}{C} \times \left( -\frac{6b \times q_s}{1+b} \right)^{b} \times \left( \frac{360q_s}{a \times (1+b)} \right) \times \left( \frac{10}{V_0} \right)^{b}$

$\rightarrow V_0 = 1494726 \text{ m}^3 \cdot \text{ha}^{-1} \cdot \text{yr}^{-1}$

$\rightarrow A_0 = 314.48 \text{ ha}$

$A \geq A_0$

384 potential sub-catchments!!
Long-term stream flow

H Ratio

Dn Ratio

Application-oriented suitability

Same for both applications

Long-term stream flow

Agricultural
Application in crop irrigation

Forest
Application in wildfire combat

Calculated for both applications

Application-oriented suitability

Dn Ratio

Dn Ratio

Dn Ratio

3m

6m

12m
4. Results and discussion

Fig 8 - a) Generic map b) and c) application oriented maps.
4. Results and discussion

Fig. 9 - Ranking results for both applications.

Agricultural Application in crop irrigation

Forest Application in wildfire combat
4. Results and discussion

<table>
<thead>
<tr>
<th>Sub-Catchment</th>
<th>Acumulate volume</th>
<th>Capable area to be irrigated on a 3m wall (m³/ha)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>18900</td>
<td>2.80707</td>
</tr>
<tr>
<td>2</td>
<td>99900</td>
<td>14.83737</td>
</tr>
<tr>
<td>3</td>
<td>8100</td>
<td>1.20303</td>
</tr>
<tr>
<td>4</td>
<td>601200</td>
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<td>5</td>
<td>319500</td>
<td>47.45284</td>
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<td>…</td>
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<td>520</td>
<td>4500</td>
<td>0.66835</td>
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<td>521</td>
<td>15300</td>
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<td>5.34680</td>
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<tr>
<td>524</td>
<td>10800</td>
<td>1.60404</td>
</tr>
</tbody>
</table>

< 100 ha (91.4%);
100 - 200 ha (6.3%);
> 200 ha (2.4%)

Fig. 10- Capable area to be irrigated on a 3m wall.
5. Conclusion

✓ Combining planning with application, it’s possible to adapt the model to any agro-forestry application;
✓ The storage capacity of the sub-basins is inversely proportional to the sustainability.
✓ The applied model demonstrates an enormous flexibility and potency of adaptation to different application-oriented needs.
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