Evaluating the global wastewater’s untapped irrigation potential

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Wastewater irrigation untapped potential is *theoretically* high.

**Global wastewater**
(km³ year⁻¹)

- Generation: 360 km³ year⁻¹
- Treatment: 188 km³ year⁻¹
- Reused: 41 km³ year⁻¹

Global crop net irrigation demand (km³ year⁻¹)

- Generation: 888 km³ year⁻¹

Global crops’ water footprint: 7,404 km³ year⁻¹

Mekonnen and Hoekstra, 2011; Jones et al., 2021
Four technological scenarios

In this research we have estimated the **irrigation potential of reclaimed wastewater** at a global, regional, and national scale, under **four different technological scenarios**.
Data

Irrigation requirements

Available treated wastewater
Jones, et al. (2021)

Available treated wastewater by treatment level

National division to wastewater treatment categories
Macedo, et al. (2021)

Crop production (irrigated, all crops)
IFPRI (2019)

Crop irrigation requirement
Bruckner, et al. (2019)

List of crops with irrigation restrictions (FAO)

Irrigation req. maps

Gravity model-based allocation procedure

Irrigation req. in service areas

Gravitational flow mask

Maximal conveyance distance

Discharge unallocated wastewater

Total available wastewater (m$^3$)
Irrigation demand (m$^3$)
Allocated wastewater by crop (m$^3$)
Total conveyance distance (km)
Discharged wastewater (m$^3$)

Water scarcity maps
Gassert, et al. (2013)
Water allocation

Available treated wastewater
Jones, et al. (2021)

National division to wastewater treatment categories
Macedo, et al. (2021)

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Total available wastewater (m$^3$)
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Total conveyance distance (km)
Discharged wastewater (m$^3$)

Irrigation req. in service areas

Gravitational flow mask

Maximal conveyance distance

Irrigated areas by WWTP I

Irrigated areas by WWTP II

Irrigated areas by both WWTPs

WWTP I

WWTP II

Water scarcity maps
Gassert, et al. (2013)
Irrigation service areas

Available treated wastewater
- Jones, et al. (2021)

National division to wastewater treatment categories
- Macedo, et al. (2021)

Crop production (irrigated, all crops)
- IFPRI (2019)

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- Bruckner, et al. (2019)

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Gravity model-based allocation procedure

Discharge unallocated wastewater

Total available wastewater (m$^3$)
- Irrigation demand (m$^3$)
- Allocated wastewater by crop (m$^3$)

Total conveyance distance (km)
- Discharged wastewater (m$^3$)

Irrigation req. in service areas

Gravitational flow mask

Maximal conveyance distance

Water scarcity maps
- Gassert, et al. (2013)
Treated wastewater can reach substantial irrigation shares

<table>
<thead>
<tr>
<th>Scenario</th>
<th>None</th>
<th>Only water scarcity</th>
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<tbody>
<tr>
<td>Baseline0</td>
<td>4.2%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Smt1</td>
<td>5.4%</td>
<td>3.5%</td>
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<tr>
<td>Smt2</td>
<td>6.2%</td>
<td>4%</td>
</tr>
<tr>
<td>Lt3</td>
<td>12.9%</td>
<td>8.1%</td>
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</tbody>
</table>
Irrigation share in major irrigated regions

SRES Regional division: NAM: North America; WEU: Western Europe; EEU: Central and Eastern Europe; CPA: Centrally planned Asia and China; FSU: Newly independent states of the Former Soviet Union; MEA: Middle East and North Africa; LAM: Latin America and the Caribbean; AFR: Sub-Saharan Africa; SAS: South Asia; PAO: Pacific OECD; PAS: Other Pacific Asia.
Economic growth can increase wastewater irrigation potential
Wastewater reclamation at baseline scenario
Investments in wastewater treatment plants as an expansion strategy
Wastewater conveyance as an intensification strategy

![Graph showing wastewater use and irrigation requirements](image-url)

- **Region code**:
  - Other
  - CPA
  - MEA
  - NAM
  - SAS

- **Wastewater capita (cubic meter)**:
  - 0
  - 50
  - 100
  - 150
  - 200

GATWIP: Global Assessment of the Treated Wastewater Irrigation Potential
Bridging the gap between the ‘practical’ and ‘theoretical’

Global wastewater
(km\(^3\) year\(^{-1}\))

Theoretical potential
360
40%

Practical potential

8 - 13%

71 - 115

Global crop net irrigation demand (km\(^3\) year\(^{-1}\))

888

Global crops’ water footprint: 7,404 km\(^3\) year\(^{-1}\)

Investment

41

5%

Reused

Large distance conveyance
Pressurized systems
Crop selection

Mekonnen and Hoekstra, 2011; Jones et al., 2021
Thank you for listening.

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