Statewide Water Footprint Estimation

Concept, preliminary findings, and current research

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California Water Plan, Update 2013
Public Advisory Committee Meeting
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Department of Public Health Services
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td><strong>Water footprint</strong></td>
<td>The total volume of water consumed and needed to assimilate pollutants in the production of goods and services used by an individual or jurisdiction (e.g., state, country).</td>
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<tr>
<td><strong>Internal water footprint (of consumption)</strong></td>
<td>The portion of a jurisdiction’s water footprint that originates from <strong>within</strong> that jurisdiction.</td>
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<tr>
<td><strong>External water footprint (of consumption)</strong></td>
<td>The portion of a jurisdiction’s water footprint that originates from <strong>outside</strong> that jurisdiction.</td>
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Definitions

- Internal Water Footprint
- Water Footprint of Exports
- External Water Footprint
Water Footprint Components

Green water footprint
► volume of rainwater evaporated.

Blue water footprint
► volume of surface or groundwater evaporated

Grey water footprint
► volume of polluted water.
Consumptive Use

Blue Water

Green Water
Examples

Source: http://virtualwater.eu/
Methods

- Accounting Framework:

  \[
  \text{Internal water footprint} + \text{External water footprint} = \text{Total water footprint of goods consumed in California}
  \]

  - Water footprint of goods and services produced in California
  - Water footprint of goods produced in California and exported
  - Water footprint of goods imported and consumed in California

- Includes agricultural and industrial goods and residential, commercial and institutional direct uses
- 3 components: **Green, Blue, and Grey**
- Target Year: 2007
## Data Sources

<table>
<thead>
<tr>
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<th>Data Source</th>
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</thead>
</table>
| **Footprint of California’s production**       | DWR Land and Water Use Surveys, 1998-2005  
DWR Commercial, Industrial, Institutional water use survey, 1995  
DWR Water Plan Update 2009  
USDA County Agricultural Commissioners’ Production Data, 2007  
US Census Bureau, Economic Census, 2007  
USGS Estimated Water Use in the US, 2005  
Water Footprint Network, avg. industrial grey water factors, 1996-2005 |
| **Footprint of products produced in California and exported** | As above, combined with:  
US Census Bureau, Commodity Flow Survey, 2007  
US Census Bureau, Foreign Trade Statistical Program, 2007 |
| **Footprint of products imported and consumed in California** | US Census Bureau, Commodity Flow Survey, 2007  
US Census Bureau, Foreign Trade Statistical Program, 2008  
Water Footprint Network, WaterStat Database, 1996-2005 |
Results: major findings

- Californians, compared to the average American...
  ...have about the same total WF, related to same products
  ...rely much more on blue water
  ...have a much larger external footprint

- California, as a whole...
  ...is a net virtual water importer
  ...exports half of the blue water that goes into production
  ...imports more green water than statewide applied agricultural water
Blue and green water footprint

Internal Water Footprint

External WF

Footprint of California's Production

Footprint of Exported Products

Footprint of Imported Products

Total Water Footprint

Million acre-feet per year

Blue 21

Green 44

25

14

14

9

36

10

20

30

40

50

60

70
Blue and green water footprint

Water footprint for average Californian (gpcd) (Total = 1,510)

- Blue: 461
- Green: 1,049

Source: Pacific Institute analysis

Water footprint for average American (gpcd) (Total = 1,597)

- Blue: 173
- Green: 1,424

Source: Water Footprint Network

Water footprint for average human (gpcd) (Total = 845)

- Blue: 111
- Green: 734

Source: Water Footprint Network
Water footprint, by sector

Total Water Footprint = 64 million acre-feet
Domestic net water imports/exports, by product

- Prepared Foodstuffs And Fats And Oils
- Alcoholic Beverages
- Tobacco Products
- Animal Feed And Products Of Animal Origin
- Other Agricultural Products
- Industrial Products
- Live Animals
- Milled Grain Products And Preparations
- Cereal Grains
- Meat, and Preparations

Million acre-feet
Grey water footprint

The diagram shows the breakdown of water footprints into internal and external components. The internal water footprint includes the footprint of California's production, the footprint of exported products, and the footprint of imported products. The external water footprint is calculated as the sum of these internal footprints.

- Footprint of California's production: 20 million acre feet per year
- Footprint of exported products: 10 million acre feet per year
- Footprint of imported products: 30 million acre feet per year
- Total water footprint: 60 million acre feet per year

The grey water footprint is calculated as the total water footprint minus the footprint of imported products:

- Grey water footprint: 30 million acre feet per year

The footprints for an average Californian and an average American are also shown:

- Footprint for average Californian (gpcd): 954
- Footprint for average American (gpcd): 459

Source: Pacific Institute analysis

Source: Water Footprint Network
Grey water footprint

- United States, 12.60
- China, 8.33
- California, 8.08
- Mexico, 1.37
- Vietnam, 1.42
- Canada, 1.09
- Philippines, 0.91
- Other, 6.46

- Agricultural, 15.7
- Industrial, 24.6
- Other, 6.46
Conclusions

• Californians, compared to the average American...
  ...have about the same total WF, related to same products
  ...rely much more on blue water
  ...have a much larger external footprint

• California, as a whole...
  ...is a net virtual water importer
  ...exports half of the blue water that goes into production
  ...imports more green water than statewide applied agricultural water
Next Steps

Pacific Institute Lead:
• Calculating the Water Footprint of Energy Products
• Water Footprint Trends Analysis: 1990-2010
• Regional Water Footprints and Inter-Regional Flows

UC Davis Lead:
• Water Footprint Variance and Error Propagation Analysis
• Illustrate the Business Case for Water Footprint
Policy Questions

- How does the water footprint indicator affect our working definition of sustainability?

- How broadly should water management in California consider water resources elsewhere? Are there risks?

- How should the water related costs and benefits of exports be considered alongside other water management criteria?
Next Steps: Energy

- Million Acre-Feet per Year

- Green WF of Ethanol
- Blue WF of Ethanol
- Blue WF of Oil and Products
- Blue WF of Natural Gas (direct consumption)
- Blue WF of Electricity Generation
Next Steps: Trends

International Trade

Value (billion 2005 adjusted dollars)

<table>
<thead>
<tr>
<th>Year</th>
<th>Exports</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>$20</td>
<td>$50</td>
</tr>
<tr>
<td>2010</td>
<td>$150</td>
<td>$300</td>
</tr>
</tbody>
</table>

Domestic Trade

<table>
<thead>
<tr>
<th>Year</th>
<th>Exports</th>
<th>Imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>$200</td>
<td>$100</td>
</tr>
<tr>
<td>2007</td>
<td>$400</td>
<td>$400</td>
</tr>
</tbody>
</table>
Next Steps: Regional