Predicted by 2050:

1,000,000,000
(billion)
Global Water Refugees

“By 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world population will be under stress conditions.”
- United Nations

“Reduced water in the hydrological cycle caused by diversion, depletion and climate change could create more than 1 billion global water refugees by 2050.”
- Maude Barlow, Senior Advisor on Water Issues, United Nations
In 2050, Water Refugees will be from:

Where will they go?

The Water Stress Indicator shows the proportion of utilizable water currently withdrawn for direct human use and where this use is in conflict with environmental water requirements.

Source: The International Water Management Institute
Proposal:

Relocate Water Refugees to the U.S./Canada Great Lakes Watershed

The Great Lakes Contain

~20%
of the world’s fresh surface water supply

The Great Lakes Watershed Contains

<.01%
of the world’s population

Proposal: Design urban infrastructures required to ramp-up population density in the Rust Belt, which for decades has been losing population. Fund infrastructure improvements and create new jobs by investing heavily in the water-based natural capital and ecosystem services of the Great Lakes (see page 7 for economic descriptions).
Fact:

**Great Lakes Watershed Loss**

**Population Loss**

>1,000,000 (million) People migrated from the Rust Belt since 1990

**Ecological Loss**

~165,000,000,000 (billion) Gallons of Fresh Water naturally flow from the Great Lakes per day into the Atlantic Ocean
Speculation:

Populate and Densify the Great Lakes Watershed
How many people can fit?

122 New York Cities

= 1 billion people

19%

83 Toykos

= 1 billion people

34%
Fact:

Underutilized Post-Industrial Landscapes

Infrastructure rich, population poor

City boundary
## 17 Economies

<table>
<thead>
<tr>
<th>Ecosystem service</th>
<th>Ecosystem function</th>
<th>Examples</th>
<th>Rust Belt $ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas regulation</td>
<td>Regulation of atmospheric chemical composition</td>
<td>CO$_2$, O$_2$, balance, O$_3$ for UVB protection and SO$_2$ levels</td>
<td>Carbon credits</td>
</tr>
<tr>
<td>Climate regulation</td>
<td>Regulation of global temperature, precipitation and other biologically mediated climactic processes at global or local levels</td>
<td>Greenhouse gas regulation, DMS production affecting cloud formation</td>
<td>Lower heating / cooling</td>
</tr>
<tr>
<td>Disturbance regulation and energy landscapes</td>
<td>Capacitate, damping and integrity of ecosystem response to environmental fluctuations</td>
<td>Storm protection, flood control, drought recovery and other aspects of habitat response to environmental variability mainly controlled by vegetation structure</td>
<td>Flood abatement, geo-energy</td>
</tr>
<tr>
<td>Water regulation</td>
<td>Regulation of hydrological flows</td>
<td>Provisioning of water for agricultural (such as irrigation or industrial (such as milling) processes or transportation</td>
<td>Irrigation reductions, water sequestering</td>
</tr>
<tr>
<td>Water supply</td>
<td>Storage and retention of water</td>
<td>Provisioning of water by watersheds, reservoirs and aquifers</td>
<td>Local potable water</td>
</tr>
<tr>
<td>Erosion control / sediment retention / energy landscapes</td>
<td>Retention of soil within an ecosystem; geo-thermal energy</td>
<td>Prevention of loss of soil by wind, runoff, or other removal processes, storage of stilt in lakes and wetlands</td>
<td>Fertilizer reduction runoff, geo-energy</td>
</tr>
<tr>
<td>Soil formation</td>
<td>Soil formation processes</td>
<td>Weathering of prairie landscape and the accumulation of organic material</td>
<td>Topsoil production</td>
</tr>
<tr>
<td>Nutrient cycling</td>
<td>Storage, internal cycling, processing and acquisition of nutrients</td>
<td>Nitrogen fixation, N, P, and other elemental or nutrient cycles</td>
<td>Compost creation</td>
</tr>
<tr>
<td>Waste treatment</td>
<td>Recovery of mobile nutrients and removal or breakdown of excess or xenic nutrients and compounds; material recycling</td>
<td>Waste treatment, pollution control, detoxification</td>
<td>Nutrient farming, energy reduction, water treatment</td>
</tr>
<tr>
<td>Pollination</td>
<td>Movement of floral gametes</td>
<td>Provisioning of pollinators for the reproduction of plant populations</td>
<td>Plant genetics</td>
</tr>
<tr>
<td>Biological control</td>
<td>Trophic-dynamic regulations of populations</td>
<td>Keystone pest control of indigenous species</td>
<td>Pest reduction</td>
</tr>
<tr>
<td>Refugia</td>
<td>Habitat for resident and transient populations</td>
<td>Nurseries, habitat for migratory species, regional habitats for locally harvested species, or overwintering grounds</td>
<td>Increased bio-diversity</td>
</tr>
<tr>
<td>Food production</td>
<td>That portion of gross primary production extractable as food</td>
<td>Production of fish, poultry, livestock, crops, nuts, fruits by hunting, gathering, subsistence farming or fishing</td>
<td>Urban farming</td>
</tr>
<tr>
<td>Raw materials</td>
<td>That portion of gross primary production extractable as raw materials</td>
<td>The production of lumber, fuel or fodder; material recycling</td>
<td>Natural capital increases</td>
</tr>
<tr>
<td>Genetic resources</td>
<td>Sources of unique biological materials and products</td>
<td>Medicine, products for material science, genes for resistance to plant pathogens and crop pests, ornamental species (pets and horticultural varieties of plants)</td>
<td>Indigenous resourcefulness</td>
</tr>
<tr>
<td>Recreation</td>
<td>Providing opportunities for recreational activities</td>
<td>Eco-tourism, sport fishing, and other outdoor recreational activities</td>
<td>Social investment</td>
</tr>
<tr>
<td>Cultural</td>
<td>Providing opportunities for non-commercial uses</td>
<td>Aesthetic, artistic, educational, spiritual, and/or scientific values of ecosystems</td>
<td>Social equity</td>
</tr>
</tbody>
</table>

Proposal:

Cleveland

Old Economy

New Economy

Cuyahoga River

Waterway

Railway

Highway

Nutrient cycling

Genetic resources

Existing fabric

Recreation

Disturbance regulation

Soil formation

Raw materials
Proposal:

Detroit

Old Economy

New Economy

Existing fabric

Existing fabric

Water regulation

Waste treatment

Gas regulation

Biological control

Waterway

Food production

Refugia

Cultural

Old Economy

New Economy

Detroit River

09
Proposal:

Buffalo

Existing fabric

Gas regulation

Water supply

Climate regulation

Raw materials

Railway

Waste treatment

Waterway

Erosion control / sediment retention

Lake Erie

Buffalo River

New Economy

Old Economy