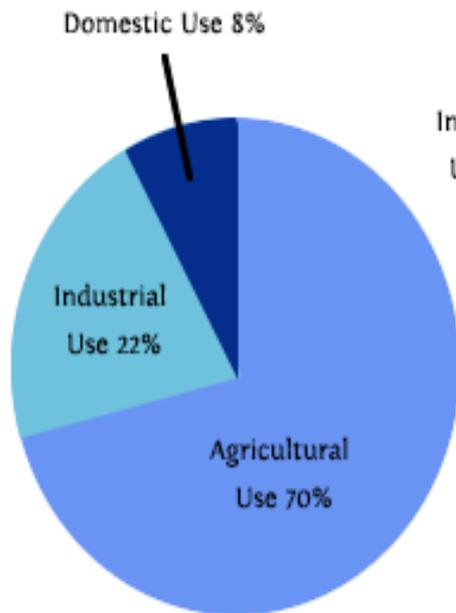
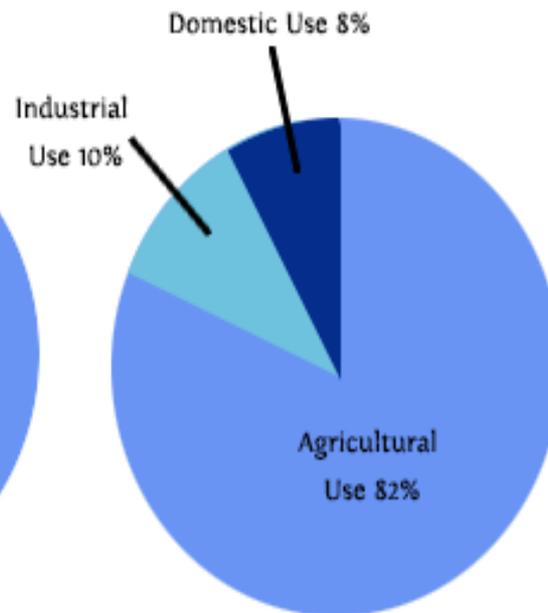


# Uses and the Depletion of Freshwater

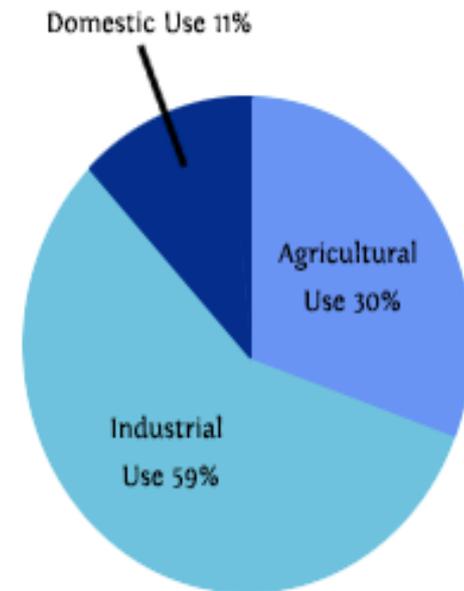
# GLOBAL USE OF WATER ACROSS INCOME GROUPS



**WORLD**

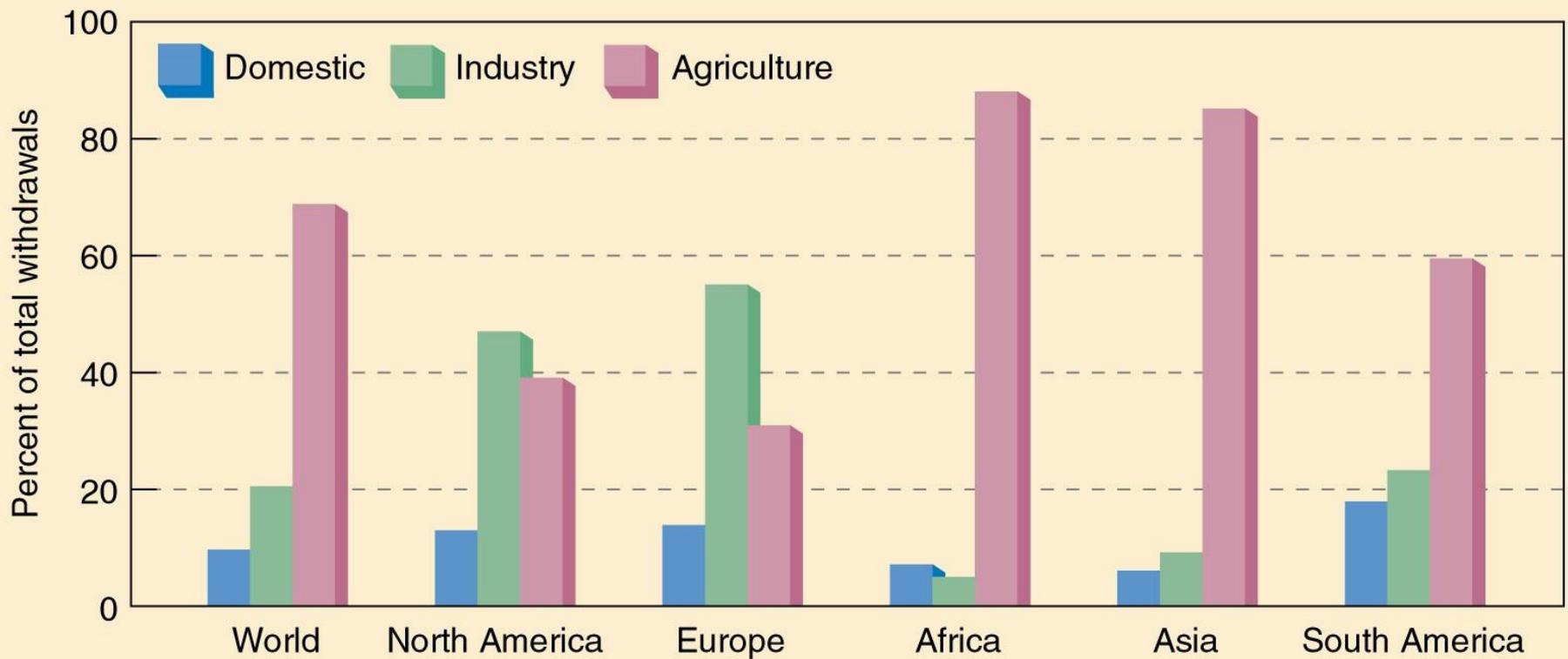


**LOW AND MIDDLE INCOME  
COUNTRIES**



**HIGH INCOME COUNTRIES**

# Human Uses of Water



# Use of Water

- Largest use of water is irrigation (70%), second is industry (20%) and third is for direct human use (10%).
- These percentages vary greatly from one region to another, depending on natural precipitation and the degree to which the region is developed.

# Consumptive vs. Nonconsumptive

- Nonconsumptive uses – the water is contaminated with wastes, but remains available to humans for the same or other uses if its quality is adequate or if it can be treated to remove undesirable materials.
- Consumptive uses – the used water does not return to the water resource. It can percolate into the ground or return to the atmosphere through the water cycle, but it is gone from human control.

# Depletion of Freshwater

- Ensuring adequate quantities of freshwater for our basic needs is an endeavor as old as our species.
- When our water usage exceeds what a lake, river, stream or aquifer can provide, we must either reduce our use, find another water source, or be prepared to run out of water.
- Data indicates that at present our freshwater consumption in much of the world is unsustainable, and we are depleting many sources of surface water and groundwater.
- This depletion is causing shortages of freshwater.

# Depletion of Surface Water

- What is left of the Colorado River after all the diversions is just a small trickle making its way to the Sea of Cortez over the sediments of the once rich delta.
- The Rio Grande, another river making a similar entrance into the Gulf of Mexico. Actually, within the past few years, the Rio Grande has dried up completely before making it to its mouth.
- In China, the Yellow River has run dry with increasing frequency in the past few years, along with the Nile River of Egypt.



# Rio Grand River upstream



Dried up Rio Grande River



# Aral Sea

- Once the fourth largest lake on Earth, has lost four-fifths of its volume in 40 years and could disappear altogether in the near future.
- This dying inland sea, on the border of present-day Uzbekistan and Kazakhstan, is victim of farming and irrigation practicing for cotton.
- The former Soviet Union instituted large scale cotton farming in this region by flooding the dry land with water from the two rivers leading into the Aral Sea.
- Eventually, this led to the shrinking of this sea, while the soil became waterlogged and salinized.
- Today, what cotton grows on this damaged soil cannot bring the regional economy back, and scientists are struggling with ways to save the Aral Sea, whose ecosystems have been seriously damaged.
- The fishing industry has also been destroyed as a result.

1957



The level of the Aral Sea in the late 1950s is customarily used as the reference to see how much water has been lost.

1982



In the early 1980s, the accelerating drop of the sea level is evident. Salinity is rising, fisheries are shrinking.

2000



The Aral Sea splits into North and South. Not only has it lost most of its water, but fishing is also nearly gone. The Kok-Aral Dam begins to slow waters in the North Aral Sea to rise.

2015



Despite expansion of the North Aral Sea, only some eight percent of the water volume of the late 1950s remains.

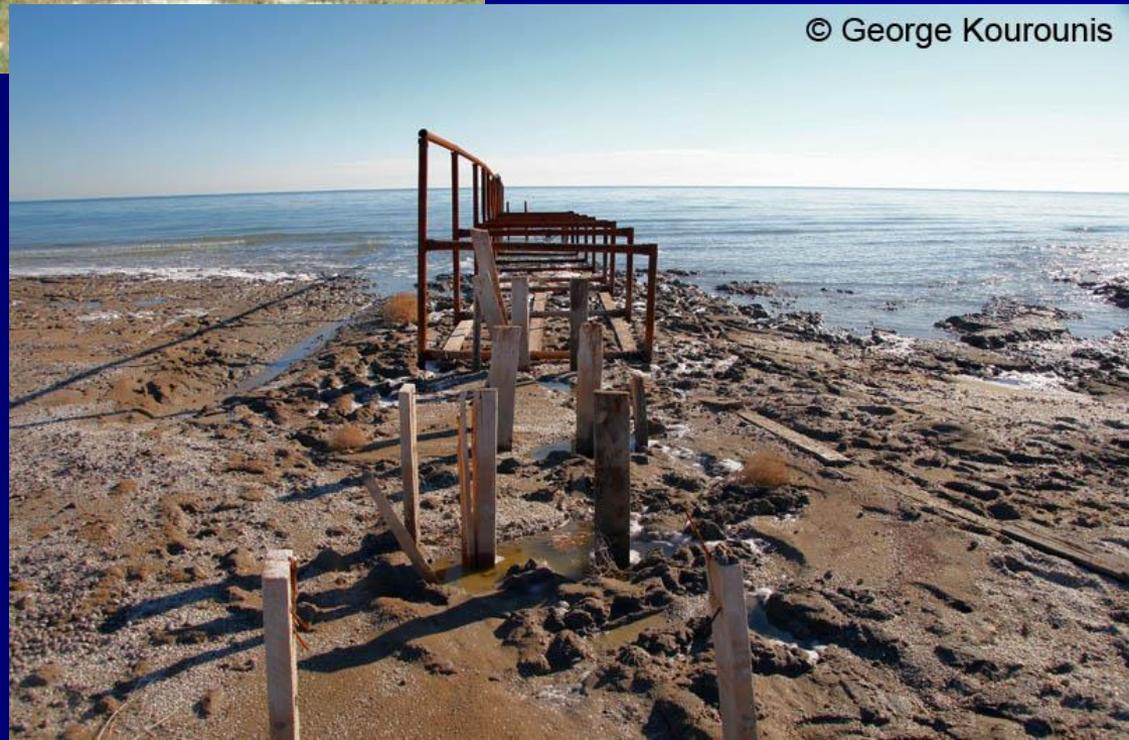


## The Aral Sea

Image sources: [www.alexandre.leroux.net/water/pictures/boat\\_over\\_aral\\_sea.jpg](http://www.alexandre.leroux.net/water/pictures/boat_over_aral_sea.jpg)  
and [maguires.com/patupe/photos.htm](http://maguires.com/patupe/photos.htm)

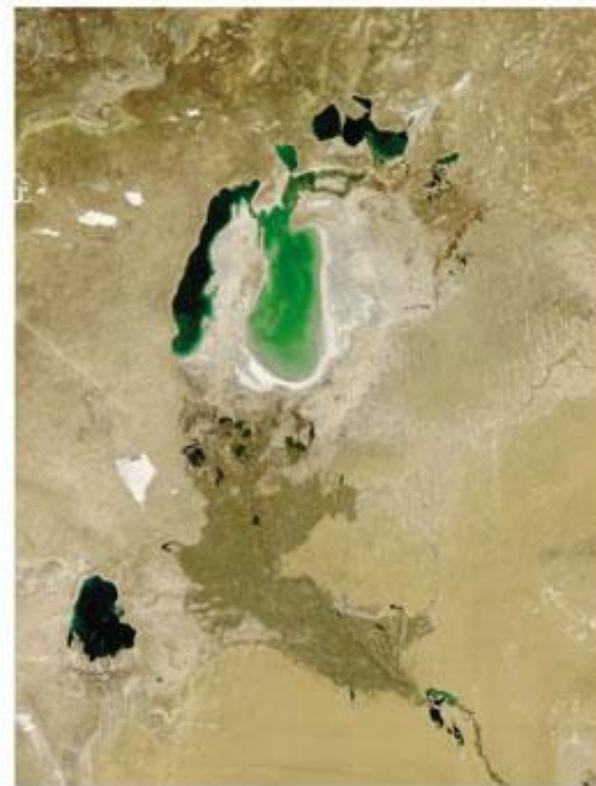


© George Kourounis





(a) Ships stranded by the Aral Sea's fast-receding waters



(b) Satellite view of Aral Sea, 2002



(c) The shrinking Aral Sea, then and now

# Depletion of Groundwater

- Groundwater is even at greater risk of depletion than surface water because most aquifers recharge either very slowly or not at all.
- Thus it is easier to withdraw the water, a process called water mining, much more rapidly than it can be replenished.
- Globally, over the past 60 years we have been withdrawing groundwater in amounts that increase 2.5 – 3% annually, greater than the population growth.

# Problems with depletion of Groundwater

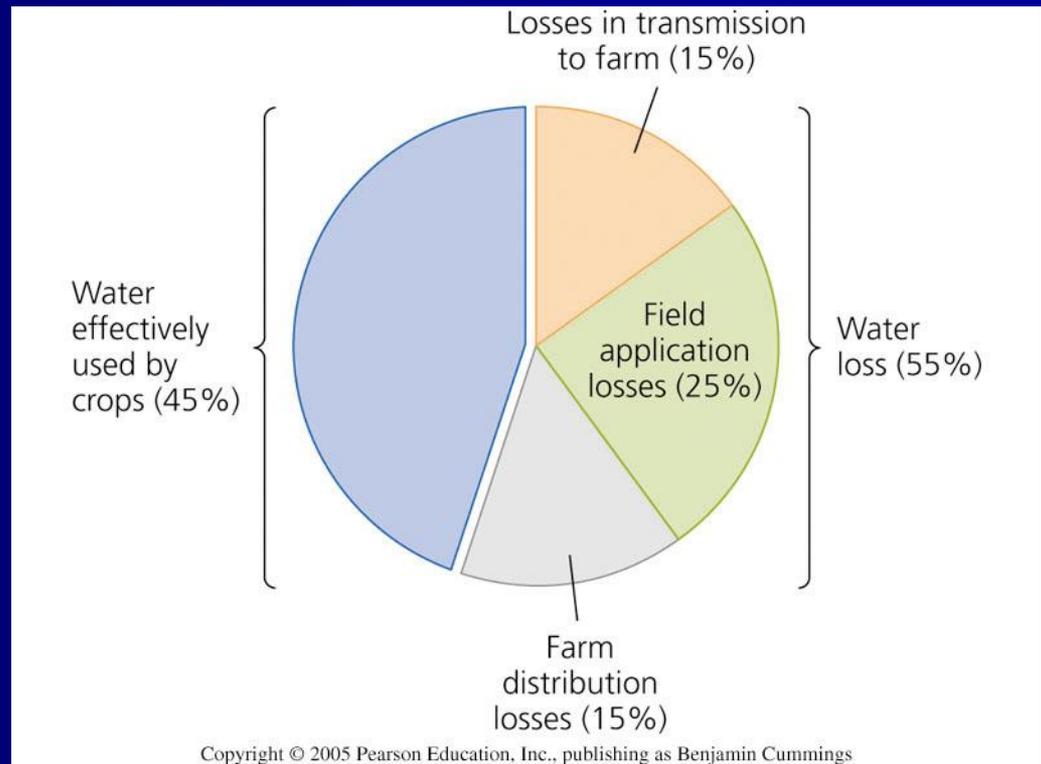
- As aquifers are depleted, water tables drop. The water is then harder to extract and eventually can run out.
- Overpumping of groundwater in coastal areas can cause saltwater intrusion, making it undrinkable.
- Subsidence and Sink holes are other problems associated with overpumping.
- Ex. Water tables in India dropping by as much as 10 ft per year

# Falling Water Tables

- This not only causes problems for farmers and others who depend on wells for water, but also does vast ecological harm.
- Permanent wetlands exist where water tables are high enough to reach the surface, so when the water table drop, wetland ecosystems dry up.

# Inefficient Irrigation

- Worldwide, the amount of land under irrigation has been increasing.
- Whether from aquifers or surface bodies of water, the majority of the freshwater we use for irrigation is lost before it ever reaches the crops.





# Inefficient Irrigation



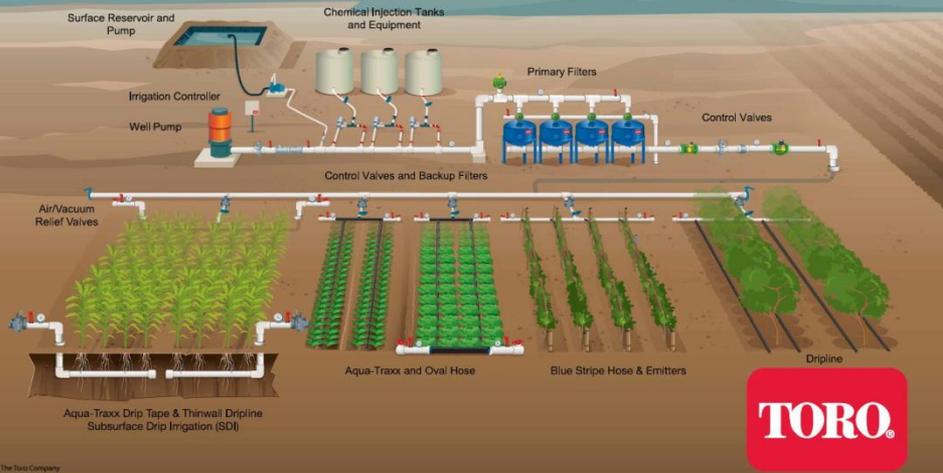
Flood and Furrow Irrigation

- Inefficient “flood and furrow” irrigation, in which fields are liberally flooded with water that may evaporate from shallow standing pools, accounts for 90% of irrigation worldwide.
- Over-irrigation leads to waterlogging and salinization, which affects 1/5 of farmland today and reduces world farming income by \$11 billion.
- Unfortunately, huge amounts of groundwater are being used up for little gain; because of the dry climate and inefficient irrigation methods.

# One Solution...

## ■ Drip Irrigation

### Typical Drip System Layout



# Water Wars

- Freshwater depletion leads to shortages, and the scarcity of any vital resource can lead to social conflict including hostility and armed clashes between political states.
- Many predict that water's role in regional conflicts will only increase as human population continues to grow in water poor areas.
- A total of 261 major rivers whose watersheds cover 45% of the world's land area cross national borders and are shared by at least two nations.
- The World Bank's VP for environmental affairs and the World Water Commission's chairman has remarked that "the wars of the 21<sup>st</sup> century will be fought over water".



**"Many people think that in the Middle East its water and not oil that will be the source of the next wars."**

**Allen Hammond, World Resources Institute**