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## Water for tomorrow



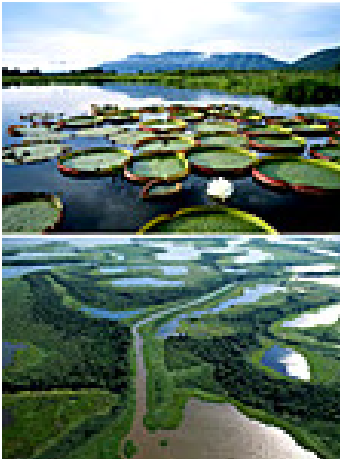
Worldwide water usage has increased six times since the 1900s. That's twice the rate of human population growth. According to the United Nations, nearly half the world's population will experience critical water shortages by the year 2025.

The Nature Conservancy began an initiative to help protect freshwater resources, transforming the way large river systems are preserved and protected. Now IBM has joined the effort, providing a state-of-the-art support system for understanding the impact of land use decisions on river basin ecosystem services such as water quantity, water quality, crop production and biodiversity.

What impact will construction of a new dam have on the water supply of a town downstream? Will clear-cutting a forest in the upper part of a river's watershed imperil the fish stocks local people depend on for food?

Addressing these questions will help government organizations set policy and management decisions to help conserve the natural environment and benefit residents at the same time. The project will initially focus on three large river systems: the Mississippi River basin in the United States, Brazil's Paraguay-Paraná River system and China's Yangtze River.

## The Great Rivers



### The Paraguay-Paraná

Flowing through Argentina, Brazil and Paraguay, the Paraguay-Paraná river system covers an area of almost 1 million square miles. Those living along the river have watched it become murky, clouded with sediment from upstream. Scientists have determined that one of the main culprits was rapid deforestation of the Atlantic Forest, which once spanned 330 million acres—an area twice the size of Texas. Today, about 7 percent of this forest remains. With the loss of forested areas along streams that feed the Paraná, little buffer remains to filter sediment from water destined for the river.

#### Fast facts:

- The second largest river system in South America.
- An environmental law requires 20 percent of Brazil's agricultural lands be forested.
- The eastern part of the basin has been modified by several centuries of human settlement and by some of the largest hydraulic works in the world.



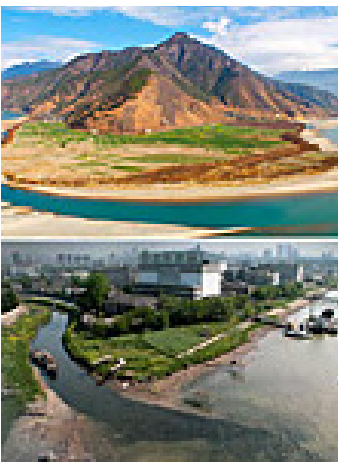
### The Mississippi

The remarkable diversity of plants, invertebrates, amphibians, reptiles and mammals depending on the freshwater habitats found in the river system

includes a fourth of the continent's fish species. The same region is home to more than 30 million people, half of whom rely on the Mississippi River and tributaries as sources of drinking water. Levees, dams and changes in how land is used have altered the life-giving process of ebb-and-flow. As a result, biological diversity, water quality, productive forests and other critical habitats are declining.

**Fast facts:**

- Part of the largest river system in North America.
- A raindrop falling in the headwaters of Lake Itasca, Minnesota, would arrive at the Gulf of Mexico in about 90 days.
- By the year 2000, more than 50 percent of the wetlands in the contiguous United States had been drained or filled.



**The Yangtze**

More than 350 million people live within the watershed of China's Yangtze River, which is more than the entire population of the United States. A large percentage of this population depends upon the river directly for food, water and electricity. Alongside the human population lives a diverse array of species, including more than 300 species of fish. The demand for freshwater and electricity in China has led to the building of massive dams, including the Three Gorges Dam, and changes on the surrounding landscape.

**Fast facts:**

- The longest river in Asia and third longest river in the world.
- One of the world's busiest waterways, with cargo transportation reaching 795 million tons in 2005.
- The baiji, or river dolphin, was declared functionally extinct in 2006.

## The Technology

From wildlife to transport to agriculture, much is dependent on the world's river systems. And small changes can have catastrophic effects. For example, in the summer of 1993, flooding in the Upper Mississippi River Basin caused between 12 and 16 billion dollars worth of damage.

To anticipate these impacts, government and environmental organizations create intricate scientific models. Traditionally each organization develops its own models, recreating what many other organizations have done or plan to do.

IBM is working with its partners to help scientists bring together their models and develop a decision support system for scientists that facilitates integrated water management and improves collaboration and communication between key stakeholders within a given river basin. We are investigating uses of immersive technology, creating river basin "metaverses."



The world's rivers are going 3D. Real-world data can help model a river basin, transforming it into a digital metaverse.



A researcher can place her avatar into the metaverse, exploring potential changes such as soil erosion, fish populations and water levels.



Researchers can even move inland, measuring the environmental impact from agriculture, construction and transportation projects.



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