

Bob Hirsch

U.S. Geological Survey

From a worldwide perspective, there are some real difficulties in water supply for humanity. There are a lot of problems with water, basic sanitation, water supply, wastewater treatment and large numbers of people around the world who don't have that kind of safe, reliable supply of water. Within the U.S., we're very fortunate to have a wonderful infrastructure of water supply systems, drinking water, treatment and, sanitation. And, people do have safe drinking water. We do, within the United States, have issues of depletion of water, particularly in the western parts of the country and along some of our coastlines where water used by our cities or water used for agriculture is coming out of ground water and ground water levels are declining. However, most of the counties east of the 100th meridian, that is to say east of the line through Texas and the Dakotas, are blessed with a lot of water and only locally are we seeing problems of supply.

I'd also mention that worldwide this problem of depletion of ground water resources is fairly critical in a number of nations such as China and India, where they have attained self-sufficiency in terms of food supply in part by the mining of ground water, taking water out of the ground at a rate faster than it's being replenished by recharge. And that's a fundamentally non-sustainable situation and raises question about the sustainability of their food supplies in the long run. I think in some of these areas that are more arid and where we are relying on ground water particularly for agriculture, we need to find new kinds of crops that could be grown, or agriculture may need to shift to other areas of the world that are more adequately supplied with water.

There's been a lot of discussion about what climate change might mean for water resources. And, a lot of that research is really still fairly inclusive about the particular kinds of effects that climate change may have. However, there is one issue that I think we're fairly certain about and it's a phenomena we're already seeing in the United States, in areas of the country where winter snow pack is an important part of the regional water supply, areas like the Sierra Nevada that supply so much of the water to California, mountainous areas in New England and areas of the Rocky Mountain west. What we're seeing in these mountainous areas is more of the precipitation is falling as rain, less of it is snow and snow packs are melting at an earlier time. The storage of water, which is so important for the supplies of water for farms and for cities, is made up of a combination of snow pack storage, reservoir storage and soil moisture storage. And with this warming of the climate there's going to be less storage of water in snow packs and that means a decline in the reliable supply of water to areas such as the farms of California, the cities of California and other parts of the arid west and also potentially parts of New England.

As far as environmental degradation in general, I think in many parts of the United States, there certainly are some significant improvements in environmental quality with controls on out-point source pollution. We still do have problems of contamination of aquifers, and in particular, bacteria and pesticides and nutrients such as nitrogen that are increasing in concentrations in many of our nation's aquifers. I think in the long run this

will have implications for the quality of those waters, for drinking water purposes. People who currently rely on those waters and can use them without treatment may find that they need to go to something like point of use treatment, in order for those waters to be drinkable.

Well, there's been a lot of talk over the years over whether we are going to have wars over water and people often hypothesize that we will. In fact, history has demonstrated that that's really not a common phenomenon at all. In fact more often than not, people ultimately begin to collaborate and work together to solve their water resources problems. As difficult as the political situations are, for example in the Middle East, there is a degree, in fact, of cooperation there in dealing with the water supply. I think actually water has been and can be used in, in diplomatic processes, to bring people together for a common goal.

Technologies have played a very important role in the way we use water and there's been a lot of change over the last several decades. We have better and better ways of treating our wastewater, processes that render those waters that come out of our sewer systems, really quite adequate for many, many kinds of uses. We're really reusing and recycling our water supplies. Another new technology, which is becoming important, is something called aquifer storage and recovery. If you think about how we handle providing water in most parts of the world historically, it's been by building dams on rivers, storing water from periods when the rivers have a lot of flow in them to be used in times of low flow. Most of those potential dam sites have already been put to use and the cost and the environmental concerns about dams are such that it's unlikely that there'll be a lot more dam building in the future. What aquifer storage and recovery does is it uses the same principle of taking water in times of excess and putting it into the ground where it's not going to evaporate, and then withdrawing it from the ground in times of need. This really will help to stretch our water supplies in many, many, many parts of the world.

One of the issues that I think is very challenging to the management of water resources in the United States and around the world is how to provide adequate water supply for humans at the same time as protecting the natural systems, and biological communities. What we're finding in the United States is that many of our most significant conflicts over water really revolve around this question; when our waters were allocated initially, when our water supply systems were designed, there was very little consideration for the fish, shellfish, or birds that may depend on those water supplies. Our society now is looking to make sure that there is adequate water for the natural ecosystem. So, in a sense, that ecosystem now has a place at the bargaining table in the process of allocating our water resources. And figuring out the scientific underpinnings to answer the question, "Well, gee, how much water do the fish really need?" We know how much the farmers need. We know how much the cities need. We know how much industry needs. But what do the fish need? And it's a very difficult question to answer. But I think there are a lot of hopeful signs in terms of major efforts that are going on all over the United States and in other parts of the world, trying to resolve those questions and find ways of managing water that work for people and work for the ecosystem.

I look back at, at reports that were written 20, 30, 40 years ago about water resources in the United States and the projections that the use of water by our cities, by our industries, by farms was going to grow by leaps and bounds and that we were going to be in really dire straits. I've seen projections that were made, for example, in 1968 that said water use in the United States was going to grow from about 350 billion gallons per day at that time to over 800 billion gallons a day by the year 2000. What has actually happened is that that water use has only grown from about 350 up to about 400 billion. So we're at a level of water use that's actually half of what was predicted just a little over 30 years ago. I think this is because of human ingenuity, value systems, new technology and because water is a scarce resource, people find ways to adjust to that scarcity.

If you think about population growth in the United States over the last few decades, a lot of population growth has occurred in rather arid parts of the country, such as California and the Southwest. But people are growing plants that are more appropriate to that kind of arid environment rather than saying, "Oh, I need to have a quarter acre of green lawn that requires a large amount of water." I would also say that from a water quality standpoint we have a lot to be proud of in terms of success. In 1972 the nation passed the Clean Water Act, because our nation's rivers and lakes needed a fundamental level of quality and of treatment from our cities and water from our factories. And, the quality of our nation's rivers is vastly improved over what it was in 1972. That doesn't mean it's perfect. That doesn't mean it's where we want it to be. There are still issues, mostly associated with non-point source pollution, particularly from suburban development and from agriculture. But here again programs of our cities, of our counties, of the agricultural community are doing things to help improve upon the situation that comes from the impacts of those activities on our waters.

The quality of the source water that comes into our treatment plants is better than it was, and we have more and more advanced capabilities of treating our drinking water. One of the great advancements in this country through the Safe Drinking Water Act amendments that were passed about a decade ago is that the public knows much more about the quality of their water, and the public can make their voice heard in terms of the kind of quality of water that they want and the kind of investments that they want to make in those improvements.

I would also point to some environmental laws that have really helped clean up our waters. In the 1970s we banned the use of leaded gasoline. We know that our waters are much cleaner today with respect to lead than they were at that time. Also DDT was prevalent in our waters and had a major effect, on many birds and other wildlife and probably humans. That has been banned and we're seeing less, and less, and less DDT in our environment. The amount of sulfate deposition that occurs across the landscape of the United States is considerably decreased and has helped to really limit the problem of acid rain. Again, the acid rain problem hasn't gone away but real action by our government and by our industries has resulted in reversing the trends towards ever greater degradation.