



# River Voices

## Connections and Opportunities

# Water, Energy and Climate Change

by Don Elder, President, River Network [www.rivernetwork.org](http://www.rivernetwork.org)

**C**limate change is arguably the most important issue of our time. The ways we currently produce and use energy are driving a period of climate change that is far faster and greater than any other in the history of the human race. These changes will have profound environmental, social and economic consequences in the decades immediately ahead, when the average global temperature is expected to rise by several degrees, and seasonal extremes are expected to rise by more still. Few living systems will be unaffected.

Climate change will place enormous new stresses on freshwater systems. Only the cleanest and healthiest will be resilient enough to continue to support abundant life and traditional human uses. Consequently, the work of river and watershed protection groups is now more important and urgent than ever.

However, there is a new dimension to our work today. We must do more than simply prepare for climate change. Every individual, organization and nation must do its part to help minimize it. Watershed protection groups in the United States have a particularly important role to play.

### Reducing Greenhouse Gas Emissions: An Urgent Global Imperative

Almost all climate models predict significant warming in the coming century. However, the

range of the predicted change varies three- to four-fold, depending on assumptions about how quickly and substantially we reduce greenhouse gas emissions.

Most climate scientists now agree that if we continue on our present emissions course, average global temperatures will increase between five and nine degrees Fahrenheit in the next 50-100 years; seasonal extremes will be greater still. This is more than enough to have calamitous, completely unacceptable consequences in every part of the globe. Difficult-to-predict feedback loops, such as changes in ocean circulation and releases of methane from melting permafrost, could increase average temperatures even more.

A change of 2-3 degrees is considered virtually inevitable at this point because of the momentum of change resulting from greenhouse gases already emitted.

While this amount of change will still have profound consequences, they pale in comparison to those that would be experienced at the higher range. Clearly, we must do everything in our power to reduce greenhouse gas emissions as drastically and quickly as possible.

How much must we reduce emissions? The emerging scientific consensus is that we must reduce them by 70% or more over the next fifty years, with much of that reduction coming in the next decade, in order to preserve a reasonable chance of limiting the change to 2-3 degrees and stabilizing the climate at a new, higher level by 2100. Since world population is expected to grow by 50% in the next few decades, we must reduce our *per capita* greenhouse gas emissions by 90% or more during that same time.





# River Network

*Connecting People, Saving Rivers*

## CONTENTS

- 1** Water, Energy and Climate Change  
*by Don Elder*
- 3** From the President
- 6** Possible Water Resource Impacts
- 8** River-friendly Responses  
to a Changing World  
*by Andrew Fahlund*
- 12** Municipal Water Efficiency  
*by Judith Barry*
- 13** Stormwater as a Resource  
*by Gary Belan*
- 14** Conservation, Efficiency and Reuse  
*by Don Elder*
- 16** Voices from the Field
- 20** Case Study: Cook Inlet  
*by Sue Mauger*
- 22** Case Study: Sierra Nevada Alliance  
*by Joan Clayburgh*
- 26** Case Study: Sustainable Building  
*by Margo Farnsworth & Gwen Griffith*
- 27** Resources & References

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## From The President

**I**n *Kids Say the Darndest Things*, Art Linkletter told of a boy who was asked by his teacher “How do you tell if a sweater is wool?” The boy’s response? “Hold it over a fire. If it burnt, it was wool.”

I think of this anecdote often when I hear grown-ups argue whether climate change is real, whether it’s serious, whether it’s driven mostly by humans today or whether unacceptable harm will be caused when atmospheric CO<sub>2</sub> reaches some specific point. It seems to me that given what we do and don’t know, it’s reasonable to take every precaution right now.

Some degree of human-induced change is inevitable. In fact, some degree has already occurred. Because of the momentum of complex climate system forces, much more is likely to occur even if we take the most aggressive measures possible today. What does this mean for our work?

First, I think it means that the work that we do to protect rivers and watersheds is more important today than ever. Climate change will place new stresses on freshwater systems. Those that already suffer from pollution, physical degradation and/or overuse will be less able to endure the new stresses than those that are already clean and healthy. By continuing to clean up, restore and protect freshwater systems, we are making them more resilient to change of all kinds.

Second, I think the watershed protection community has a big role to play in helping minimize climate change *itself*. Saving water saves energy, and saving energy saves water. Water development, transport, heating, cooling, treatment and disposal are a very large part of our energy. It could be much smaller in a few decades if we chart a new course today. We need to create a new model for water management in the United States—one that reduces pressures on freshwater resources, reduces energy use, and saves people a great deal of money in the long run.

We can do this. We must. The time to begin is right now.

*Don Elder*



cont. from page 1

The conclusion is inescapable: We must fundamentally change the way we produce and use energy on this planet, beginning with very significant changes in the next decade. Every year of delay will condemn us to a less healthy, less secure and less prosperous future.

**Water Efficiency:  
An Underappreciated Path to Quick,  
Significant Energy Savings**

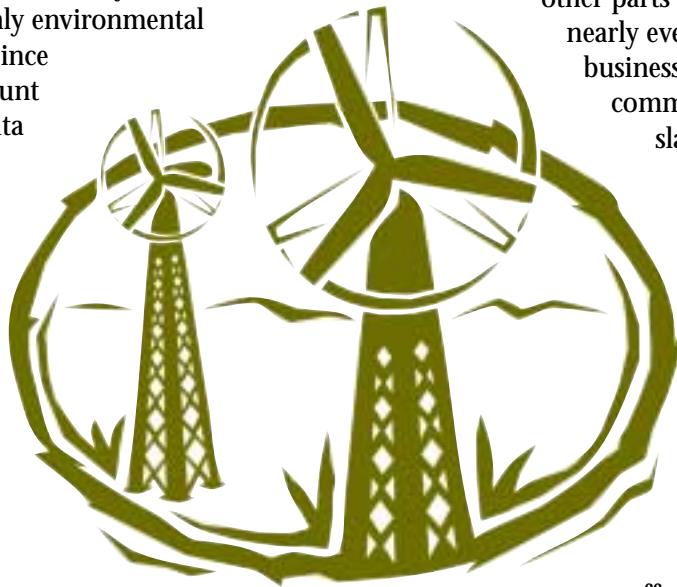
Serious work is underway on many fronts to develop new, cleaner sources of energy. However, it will be some time before many of them are fully available. The quickest, cheapest and safest energy is that obtained through conservation and efficiency. Once these savings are obtained, they are permanent. Their only environmental effects are positive. Since they reduce the amount of projected per capita energy use, they widen the number of new alternatives that can meet that use. Wind, solar and other clean sources can meet most or all of our long-term needs, *if* we reduce our long-term per capita use.

***Some of the largest, quickest energy savings can come from water savings.*** It takes a great deal of energy to develop, deliver, treat, pump, heat and cool water for municipal, agricultural, commercial and industrial use. It takes a great deal more to deliver and treat wastewater before it is disposed. California water and wastewater agencies currently spend more than \$500 million per year in energy costs. In the United States, municipal

water and wastewater systems use 75 billion kilowatt hours – 3% of total U.S. consumption of electricity, and as much as the entire energy-intensive pulp and paper and petroleum sectors *combined*. And this doesn't even begin to count the energy used in homes, on farms and in businesses and industries to pump, heat, cool and treat water and wastewater. 20-30% of the energy use of a typical household is water-related. For many businesses and industries, the figure is higher still.

Every time we use a little less water, we save water *and* energy. By adopting measures and programs already proven to work quickly and reliably in various parts of the United States and other parts of the world, nearly every household, business, industry and community could slash its water use and associated energy use by 20-40% or more in the next 5-10 years. There are numerous easy, proven and cost-effective water conservation and

efficiency programs that completely pay for themselves in years or even months. They are the lowest-hanging fruit we can pick as we take the first, crucial steps to reduce per capita energy use. Furthermore, saving this water can keep more water in our living freshwater systems, making them more resilient to the new stresses that climate change will bring.



## Longer-term Ways to Save Much More Water and Energy

While picking this low-hanging fruit is clearly the way to begin, we can and should do much more to save water and energy over the coming years and decades. The next step should be to reduce the waste that is inherent in the form of leaks and other inefficiencies in most municipal water systems. Most importantly of all, we must stop treating stormwater and treated sewage as waste to be thrown away, and start treating them as *resources* that can be used for many domestic, municipal and industrial purposes. The fact is that we only *drink* a tiny portion of our *drinking water*. We use most of the remaining water for jobs that can be done just as well by stormwater and treated sewage. The next big prize in water efficiency is turning this around. This could reduce our per capita drinking water and associated energy use by another 50% or more. It could also slash the amount of money we spend on water infrastructure in most populous areas.

Last but not least, we must begin now to promote patterns of growth and methods of development that use much less water and energy over the long term. Cluster developments with custom-designed stormwater and wastewater collection; treatment and reuse systems can use far less water and energy than sprawling developments. Well-planned communities can feature parallel distribution systems that make it much easier to reuse stormwater and/or treated wastewater for many indoor

and most outdoor uses. Highly efficient homes incorporating today's best technologies and techniques, already being built in some areas, can save even more water and energy, and save their owners tens of thousands of dollars in water and energy costs over the life of a typical mortgage. Highly efficient school buildings can save school districts hundreds of thousands of dollars in just a few years—dollars that can go to better education—instead of literally going out the window and down the drain.



## WHAT WATERSHED PROTECTION GROUPS CAN DO

Meeting our generation's climate challenge will require innovation and action in all sectors. By showing the way to better, more efficient water use, the watershed protection community can play a major role, not only in *preparing* for climate change, but in *minimizing* it as well. Here are some of the things you can do.

1. Show your community what's at stake for local resources.
2. Make it clear that saving water saves energy and money too.
3. Promote water conservation through education, local ordinances, etc.
4. Encourage and support water efficiency through education, local utility programs, etc.
5. Encourage municipal water systems retrofits and upgrades that reduce leaks and other waste.
6. Help people think about graywater, stormwater and treated sewage as *resources* that can help meet their needs, not *problems* to be simply thrown away.
7. Work with water *and* energy utilities to establish programs that speed the adoption of conservation, efficiency and reuse programs.
8. Develop a long-term vision for integrated management of all water resources in your area—and a short-term plan for beginning to move quickly in its direction.

# Possible Water Resource



## ALASKA

The state is lightly settled and abundant in water resources. Potential ecological, hydropower and flood impacts include:

- Increased spring flood risks
- Glacial retreat/disappearance in south, advance in north; impacts on flows, stream ecology
- Increased stress on salmon, other fish species
  - Flooding of coastal wetlands
  - Changes in estuary salinity/ecology
  - Increased frequency of intense precipitation events—increased risk of flash floods

## NORTHWEST

The Pacific Northwest has a large and rapidly growing population, particularly along the coast; with lightly populated rural areas. Water abundance decreases from north to south. The region relies heavily on irrigation for agriculture and on hydropower for electricity production. These uses, along with endangered species issues, are increasing competition for water in the region.

- Rise in snow line in winter-spring, possible increases in snowfall, earlier snowmelt, more frequent rain on snow—changes in seasonal streamflow, possible reductions in summer streamflow, reduced summer soil moisture
  - Possible increases in annual runoff in Cascades
- Changes in lake and stream ecology - warmwater species benefiting; damage to coldwater species (e.g. trout and salmon)



## WEST and SOUTHWEST

The West and Southwest have experienced rapid population growth but depend heavily on limited groundwater and surface water supplies. In the southern border region, there are also water quality concerns. Some rivers and canyons in the region are also subject to periodic flash flooding.

- Likely reduction in snowpacks and seasonal shifts in runoff patterns
- Possible declines in groundwater recharge—reduced water supplies
  - Increased water temperatures—further stress on aquatic species
- Increased frequency of intense precipitation events—increased risk of flash floods
- Possible summer salinity increase in San Francisco Bay and Sacramento/San Joaquin Delta

## MIDWEST

America's agricultural heartland is mostly rainfed, with some areas relying heavily on irrigation.

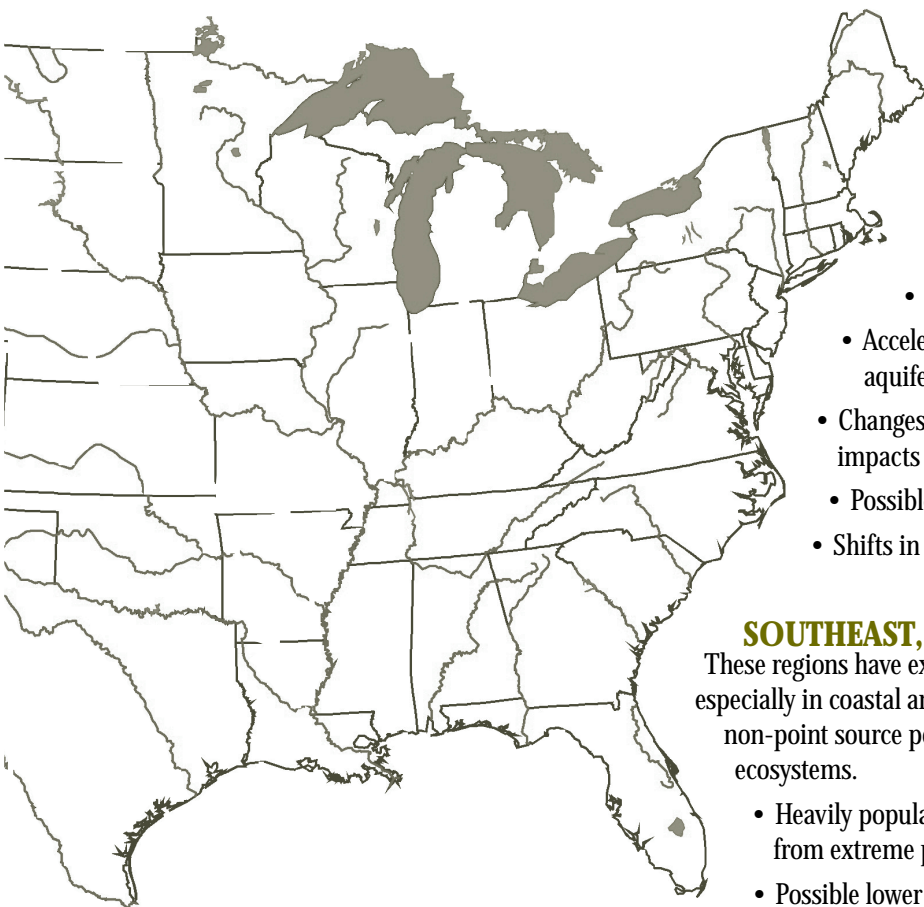
- Annual streamflow decreasing/increasing; possible large declines in summer streamflow
- Increases or decreases in irrigation demand and water availability—uncertain impacts on farm-sector income, groundwater levels, streamflows and water quality
  - Increased likelihood of severe droughts
  - Possible increasing aridity in semi-arid zones

# Impacts in North America

## GREAT LAKES

The states surrounding the Great Lakes are heavily populated. Variations in lake levels and flows now affect hydropower, shipping and shoreline structures.

- Possible lake-level declines
- Reduced hydropower production; reduced channel depths for shipping
- Decreases in lake ice extent—some years without ice cover
- Changes in phytoplankton/zooplankton biomass, northward migration of fish species, possible loss of coldwater species in certain areas



## NORTHEAST

The Northeast states have a large, mostly urban population. The region has generally adequate water supplies, with a large number of small dams, but limited total reserve capacity. Floodplains in the region are heavily populated.

- Decreased snow cover amount and duration
- Possible large reduction in streamflow
- Accelerated coastal erosion, saline intrusion into coastal aquifers
- Changes in magnitude, timing of ice freeze-up/break-up, with impacts on spring flooding
- Possible elimination of bog ecosystems
- Shifts in fish species distributions, migration patterns

## SOUTHEAST, GULF AND MID-ATLANTIC

These regions have experienced rapidly increasing population—especially in coastal areas. The region has some water quality and non-point source pollution problems, as well as stress on aquatic ecosystems.

- Heavily populated coastal floodplains at risk to flooding from extreme precipitation events, hurricanes
- Possible lower base flows, larger peakflows, longer droughts
- Possible increases or decreases in runoff/river discharge, increased flow variability
- Major expansion of northern Gulf of Mexico hypoxic zone possible—other impacts on coastal systems related to changes in precipitation/non-point source pollutant loading
- Changes in estuary systems and wetlands extent, biotic processes, species distribution

**SOURCE:** [www.epa.gov/climatechange/effects/water/northamerica.html](http://www.epa.gov/climatechange/effects/water/northamerica.html)

**REFERENCES** IPCC, 2001: *Climate Change 2001: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change [McCarthy, J.J., O.F. Canziani, N.A. Leary, D.J. Dokken, and K.S. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1032 pp.



Get Informed and Get Involved

## River-friendly Responses to a Changing World

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**T**here is no credible dispute to the fact that human activities threaten to drastically alter the climate of our fragile planet. As members of the river conservation community, we need to become better informed and more involved in confronting the climate crisis. There is no other issue that threatens rivers and all that depend upon them quite like global warming.

Each of us and the organizations to which we belong, must band together to help slow the rate of greenhouse gas emissions and stop the acceleration of warming before it gets any worse; we must also turn our attention to adapting to those changes to come. My suggestions for river-friendly adaptations to climate change assume that we succeed in arresting the out-of-control pace of greenhouse gas emissions. Unless we succeed in that task, adaptation will be futile.

Even under the best of circumstances, our planet is going to experience changes to which we will have to adapt. There are two clear paths before us as we deal with the changes wrought by global warming. One would be to continue the sort of big-ticket, hard infrastructure fixes that have served us poorly over the past century. To respond to the climate crisis by redoubling our efforts behind a failing approach can only be described as delusional. Instead, we as river advocates need to lead the way to a different path, one where we adapt by working with natural river systems—not against them—and work to preserve the myriad of benefits those rivers provide.



So, exactly how will climate change affect rivers? Unfortunately, exact models don't exist. An increase in average global temperature—2 to 3 degrees is considered a "best case scenario"—will increase average temperatures in most rivers, significantly threatening coldwater species such as trout and salmon. In addition, rainfall patterns will shift—some areas will get more precipitation, some less. Higher temperatures will cause mountain snowpack to melt earlier in the year, causing significant changes to river flow patterns, with less water available during the warmer and drier summer months. Changing water levels in our rivers pose greater challenges for farming, manufacturing, drinking water supplies and wildlife habitat. Even a small change in average global temperature is likely to cause whole ecosystems to shift northward and to higher elevations.

However, it is not the change in *averages* but the change in *extremes* that most people will notice. The most obvious consequence of climate change will occur at the extremes of the hydrologic cycle resulting in droughts and floods. Droughts and floods are perfectly natural phenomena that virtually all rivers experience in varying degrees and frequencies. In fact, most river ecosystems have evolved to depend upon the presence of these extremes. Most climate modelers predict that as a result of global warming, most regions will experience more pronounced and more frequent droughts or floods, and in some places people should expect to experience more of both. The hurricane season of 2005 or the current drought plaguing the Great Plains may be coming to a watershed near you.

The impacts of extreme events will not only directly affect river health, but will also lead to an increase in proposals for large,



expensive dam and levee projects and other massive infrastructure projects. This sort of response to droughts and floods has been the norm in water management for more than a century, and there is little reason to think that some decision makers won't immediately rely upon those old favorites when faced with the effects of global warming.

### **A Glimmer of Hope**

Global warming is just one more thing to add to a very long list of threats to rivers. We are already facing rapid population growth, unbridled resource extraction, unsustainable land use and inefficient water management, just to name a few. The good news is that most of the same river-friendly approaches we've used to address old threats to rivers can be used in response to global warming. Even better news is that many of these approaches to river and water resource management can also help us reduce greenhouse gas emissions and prevent things from getting worse.

Those approaches—already being implemented by the river conservation community—can be summed up in three main categories: 1) protecting and maintaining healthy watersheds; 2) restoring damaged rivers and floodplains and 3) efficiently managing water resources.

### **Protect and Maintain Healthy Watersheds**

North America is still blessed with many healthy, free-flowing and intact headwaters and watersheds. We must protect our remaining healthy systems and promote them as a vital part of our water supply and flood protection infrastructure. Healthy rivers, floodplains and wetlands absorb flood waters and act as barriers between storm surges and homes, buildings and people. Healthy watersheds also help recharge groundwater supplies, filter pollutants from our drinking water, provide critical habitat

for fish and wildlife and ensure places of enjoyment and recreation for communities. Cities such as Portland, Oregon and New York City have already demonstrated how watershed protection can save billions of dollars in avoided costs for water supply and treatment.

Riparian ecosystems host the greatest abundance of biodiversity than anywhere else on the planet. With the stresses that global warming will place on many already threatened species, maintaining healthy, intact riparian environments will be increasingly important. We have dozens of tools available, from purchase of riparian lands or easements to more regulatory approaches such as designation of Wild and Scenic Rivers or Outstanding Natural Resource Waters under the Clean Water Act.

Protecting and maintaining watershed lands in the midst of the built environment is also important for the better management of water in the face of climate change. The concentration of impervious surfaces like roofs, streets and parking lots causes water to run off quickly, picking up pollutants, overwhelming sewer systems and failing to recharge groundwater supplies. We must support more compact development, reducing impervious surface area, and foster the use of Low Impact Development (LID) approaches such as rain gardens, green roofs and stream buffers that slow run-off and infiltrate rainwater into the ground.

### **Restore Damaged Rivers and Floodplains**

Rivers are remarkably resilient systems. After being clogged with dams, straightened and channelized, severed from their floodplains or even buried underground, we provide clean abundant water, flood storage and protection and healthy riparian habitats. In just the last eight years, the United States has witnessed the removal of

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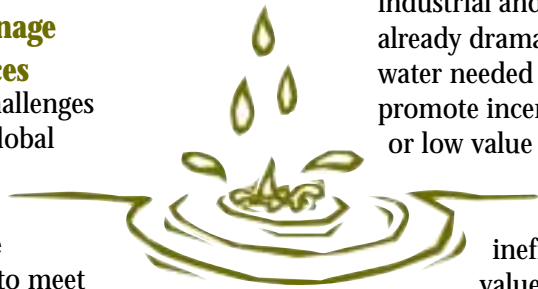
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more than 200 dams and watched as rivers come back to life, more resilient and able to handle the pressures of warming temperatures or changes in flow cycles.

Despite spending more than \$25 billion on federal levees and dams, national flood losses continue to rise. Poor land-use decisions have put more people at risk by allowing development in harm's way and by destroying the natural flood control functions of wetlands and floodplains. Communities like Tulsa, Oklahoma and Napa, California are charting a new course by relocating vulnerable homes, farms and businesses, directing new development away from flood-prone areas and restoring wetlands and floodplains.

### **Efficiently Manage Water Resources**

Water scarcity challenges exacerbated by global warming require that communities use innovative tools to meet critical water needs while protecting river health. Unfortunately, many communities assume that new reservoirs are the only option for increasing water supplies, that large centralized projects are worth the enormous expense and that the loss of free-flowing rivers is a price we must pay to have enough water. By looking carefully at the underlying environmental and economic justification for these projects, including their true cost-effectiveness compared with alternatives, communities can maintain adequate supplies at less cost while maintaining flows that sustain a river's ability to protect public health, provide recreational opportunities, sustain fish and wildlife habitat and promote economic development.



In particular, we pay far too little attention to the end uses of water. As with energy, efficiency should be the first principle applied to a water resource. The U.S. Environmental Protection Agency has launched the WaterSense program, which will provide consumers with information regarding water-efficient fixtures and appliances. Modeled after the successful EnergyStar labeling system, WaterSense will nationalize water efficiency standards for plumbing fixtures, appliances and landscape irrigation systems, and educate the public about the benefits of water conservation through a point-of-purchase marketing campaign.

Technology improvements in the urban, industrial and agricultural sectors have already dramatically reduced the amount of water needed for most activities. We should promote incentives that eliminate wasteful or low value uses of water, rather than support subsidies that encourage water inefficiencies. Shifting from low value uses to higher value ones takes political will, economic creativity and even changes to entrenched legal structures—but it is not impossible.

We also need to do a much better job integrating the individual components of water management systems—wastewater, stormwater and drinking water. By integrating these systems and ensuring that the infrastructure is maintained, communities can enjoy greater security over the quality and quantity of their water supplies, even with the added pressure of climate change. State College, Pennsylvania is an excellent example of an integrated approach and is not only enjoying dramatically improved water quality but also competitive rates and an enhanced quality of life.

While we will continue to rely upon existing surface storage reservoirs for our water supplies and flood control, we can and should regularly reevaluate the management of those facilities and adapt to changing conditions and needs. Currently, only hydroelectric dams regulated by the Federal Energy Regulatory Commission (FERC) undergo a regular review of their operations. In the face of uncertain hydrologic conditions, it would be wise to evaluate the operation of all dams to ensure more efficient management of water supplies, including flows for fish, wildlife and other ecosystem needs. Dam managers throughout the west are beginning to take such steps but we must insist that more join the effort.

Finally, new storage projects should only be considered after exhausting the alternatives of end use efficiency, market corrections and reoperation of existing infrastructure. After all the approaches are fully explored, most new dam projects simply won't meet the "cost-benefit" test, and those that do will likely involve multiple benefits, including augmentation of ecosystem flows.

### Lessons to Share

So what are some lessons we take from each of these three areas to deal with an inevitably changing global climate?

- ◆ **Work with nature, not against it** – Natural features such as wetlands and floodplains should be incorporated into water management strategies and not ignored or destroyed.
- ◆ **Small (and decentralized) is beautiful** – Managing stormwater through infiltration projects such as green roofs and rain gardens is preferable to expensive "big tunnel" projects.
- ◆ **Do more with less** – Efficient use of water can dramatically extend existing water supplies while maintaining or improving quality of life.

- ◆ **Large-scale engineering is the last line of defense, not the first** – Protect and restore wetlands and floodplains before turning to levees and dams.
- ◆ **Undertake adaptive management** – We can't predict exactly what will happen or precisely how to react, so we need to maintain flexibility in water management.
- ◆ **Use economics, don't let it use you!** – Eliminate subsidies that lead to bad decisions and look at the complete picture of costs and benefits before making choices about water management approaches.
- ◆ **Understand what existing climate change models have to say about potential future conditions in your watershed** – While they may not provide you with certainty around what to expect for your river, knowledge is power.

Healthy rivers are among a community's most valuable assets. A properly functioning river enhances public health and safety, produces economic benefits, provides recreation opportunities, enhances quality of life and promotes community pride. It is also home to the diversity of life that makes our planet so wonderful. Climate change, along with the likely knee-jerk responses to it, significantly threatens those values. The good news is that we have tried and true tools at our disposal that can help us adapt. We even know what to do to stop the problem from becoming worse than it is already likely to be. Our limitations are not technical, but political. The real challenge is to find the will to make it happen in time.



## A Cost-Effective Path to Saving Water, Energy and Rivers

# Municipal Water Efficiency

by Judith Barry  
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**T**he term "Wateryg" was coined by the Alliance to Save Energy to describe the strong link between water and energy in municipal water supply and wastewater treatment systems. Technical and managerial improvements in the efficiency of these systems not only yields significant energy, water and monetary savings, but reduces the greenhouse gas emissions associated with energy generation. Organizations can promote Wateryg as a cost-effective way to help protect watersheds by reducing cities' unsustainable demand for water and by mitigating the damaging impacts of changing rainfall and storm patterns anticipated from climate change.



Wateryg efficiency measures repay themselves quickly and the resulting savings in money and water reap many rewards: immediate improvements in water service, increased water delivery, reduced water and energy consumption and more revenue for system upgrades and new customer connections. Opportunities abound throughout all stages of a water supply system including improving the pumping systems; managing leaks; automating system operations; and regular monitoring.

These improvements often pay for themselves in months, most do so within a year, and almost all recover their costs within three years. Rates of return depend on local conditions, but approximate payback periods for some Wateryg measures are as follows:

- Immediate to Several Months: using capacitors to optimize electric installation power factors; improving operations and maintenance (O&M) procedures; managing pressure within the system (yields rapid payback where high leakage rates occur).

- 1-2 Years: improved metering of end use; using automated controls to shift demand away from peak electricity rate periods.
- 2-3 Years: installing a new automation system, variable speed drive or energy efficient pump or motor.

In many cities, the inefficiencies occur before the water even reaches the end user, making the water supply system itself the most appropriate focus. The pumping system is all important, since every liter of water that passes through the system represents a significant energy cost, a cost that is magnified by every liter lost to leaks. Pumping improvements range from low cost measures like soft starters for motors to higher cost measures like replacing inefficient pumps and installing variable speed drives. System automation saves water, energy and operation costs; improves service, and lengthens equipment life. Examples are optimizing pressure in the network, triggering alarms in case of emergency and turning off pumps. Regular monitoring of the system components, operations and performance is essential in order to track performance and evaluate it against a set of benchmarks and targets. Monitoring should be part of the larger O&M protocol, with regular measurements made on the pump system, motors and electrical system. It is a no- or low-cost efficiency enhancement within reach of all water utility budgets. Effective management of leaks can save enormous quantities of water and energy. Leakage rates can be lowered dramatically with automated controls that reduce pressure in the network, especially at night. Aside from a major pipe break, pressure management is generally more cost-effective than expensive repairs to numerous leaks in buried pipes.

*Wateryg principles have been applied in numerous cities around the world. For some typical examples, go to [www.wateryg.org/resources/casestudies/](http://www.wateryg.org/resources/casestudies/).*



## Don't Just Throw It Down the Drain

# Stormwater as a Resource

*It is better for civilization to be going down the drain than to be coming up it.*

– Henry Allen

**W**hile this quote may not be referring to stormwater specifically, it summarizes America's philosophy toward stormwater in general: If we don't put stormwater down the drain, it will just cause problems. And largely, that's how we treat stormwater today; a large volume of freshwater is captured on roofs, roads and other impervious surfaces and funneled off somewhere else. Unfortunately, this philosophy has a flaw in that the quick removal of stormwater often causes the problems we are trying to avoid. Stormwater accumulates pollution, dragging it into local streams and rivers; it exacerbates or causes flooding downstream; and, even worse, it can cause flooding at wastewater plants, leading to the dumping of sewage into our rivers. We are treating freshwater like a waste product and in the process creating other problems for ourselves. Civilization may not be coming up the drain, but our stormwater problems certainly are.

Presented with this dilemma, it's obvious that we need to start treating stormwater as a resource. This entails a radical change in thinking; keeping stormwater where it falls and utilizing it, rather than sending it down the drain. This idea is steadily becoming more popular around the country. Techniques that apply this philosophy include green roofs, rain cisterns, rain gardens and rain barrels, to name just a few.

These methods draw on basic concepts but use technology and innovation to make them cost effective, easy to use and able to reduce flooding and pollution problems. Green roofs can significantly reduce stormwater flows from a building and have the additional benefit of adding

insulation and green space. They can be built in a variety of ways, but the most popular method is a simple ultra light-weight grid system that can be installed on existing buildings. Rain cisterns and accompanying technology have gotten to the point where they can provide all the water needs of a household, even during droughts! Rain gardens and other specially designed landscaping techniques utilize stormwater to grow decorative plants and allow excess stormwater to slowly filter into the soil to become groundwater. Some designers have become so creative with these ideas, that they are incorporating stormwater into fountains, artificial streams, statues and other building artwork displays.

In today's world of diminishing resources, we should be looking for sustainable ways to use natural systems. By capturing rainfall for drinking water, landscaping, artwork and other uses, we not only keep water from going down the drain, we keep the problems from coming back up it.

by Gary Belan,  
Associate Director,  
Healthy Waters Campaign  
American Rivers  
[www.americanrivers.org](http://www.americanrivers.org)



### FOR MORE INFORMATION

The online **Rainwater Harvesting Guide** is a list of articles, review information, products and services related to rainwater harvesting and sustainability. [www.rain-barrel.net/category/rainwater-harvesting](http://www.rain-barrel.net/category/rainwater-harvesting)

**GreenRoofs.com** is an internet news media organization that seeks to inform, promote and inspire the earth friendly technology of organic greenroof architecture through the interchange of ideas, projects and news.

**Urban Design Tools**, a site developed through a Cooperative Assistance Agreement under US EPA Office of Water 104b(3) Program, provides watershed managers with a new set of tools and techniques that can be used to meet regulatory and receiving water protection program goals for urban retrofits, re-development projects and new development sites. [www.lid-stormwater.net](http://www.lid-stormwater.net)

## Keys to Sustainable Water Management

# Conservation, Efficiency and Reuse

*Note: This is a summary of a longer article that can be found at [www.rivernetwork.org/files/resource\\_library/conservation\\_efficiency\\_reuse.doc](http://www.rivernetwork.org/files/resource_library/conservation_efficiency_reuse.doc).*

by Don Elder  
President,

River Network

[www.rivernetwork.org](http://www.rivernetwork.org)

**M**any people believe that as population grows and people become more prosperous, water use must rise. I am not among them. Already, per capita water use is falling in many parts of the United States as a result of relatively modest efforts to save water. Yet we have hardly begun to tap the full potential of water conservation, efficiency and reuse. We are not running out of water. We are simply running out of time to manage water in the same old ways.

### Conservation

When I think of water conservation, I think of water habits. There are numerous practical habits that we all can develop that reduce the amount of water we use. Many of them are well known, and some are already practiced every day by millions of Americans. They include turning off the tap when brushing teeth, not running the dishwasher until it is full, not taking a tub bath when a quick shower will do, and so forth.

Basic water conservation is about good habits and common sense, not water hardship. With good habits, each of us can save thousands of gallons a year without any sacrifice at all. Since the simple conservation measures we all should take have been described and promoted in hundreds of other places, I will not dwell on them here.

### Efficiency

When I think of water efficiency, I think of hardware and programs. Efficiency is about getting more performance out of each drop

of water used. There are numerous water-saving devices—shower heads, toilets, washing machines and dishwashers, to name just a few—available today. Many are now required for new construction by federal, state or local law. This is one of the reasons per capita daily use has dropped significantly in thousands of cities across the country over the past two decades. Further savings will be realized over time as people move to newer homes with the modern devices that are now required for new construction.

However, these savings can be greatly increased and accelerated through well-designed programs that encourage and even subsidize retrofits in already-developed areas. Such programs can be particularly beneficial in low-income

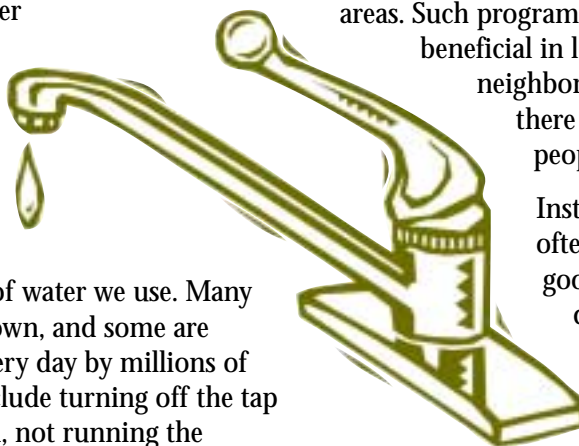
neighborhoods and areas where there are many retired people on fixed incomes.

Institutional retrofits also often make particularly good sense. Schools, dormitories, civic centers, sporting arenas, hospitals and other institutions serve

large numbers of people.

When they replace their water devices, they can save a great deal of water quickly. They can also save a great deal of money that can be much better spent on books, educational programs and health care than on water, sewer and energy bills.

Water and energy utilities need to work together to develop and finance water efficiency programs. After all, saving water saves energy, and saving energy saves water. Emphasizing demand-side management of water and energy together helps each type of utility meet its long-term public service obligations with less reliance on expensive



new supply-side projects such as new dams and new power plants. This will save utilities and their customers still more money in future years.

## Reuse

Our conservation and efficiency potential is currently only partially tapped. Our Reuse potential is hardly tapped at all. Through reuse of graywater, stormwater and treated sewage, we could slash the water and associated energy use of every city in this country by at least half over the next few decades.

Some day in the not too distant future, our practice of flushing toilets with drinking water will be viewed as being as archaic as using pigeons to carry text messages, as wasteful as sending every bottle and can to the landfill, and as disgusting as dumping raw sewage into rivers and lakes. Toilet flushing and numerous other water uses in and around the home do not require high-quality, expensive drinking water. Simple home graywater systems can meet these needs perfectly well—and dramatically reduce pressures on drinking water supplies.

Another current practice that will surely baffle future generations is letting all our stormwater run across our property, pick up pollutants, and enter the storm drain, where it must either be provided with costly treatment or allowed to pollute our public waters. By detaining more stormwater on each of our properties, we can reduce these downstream problems and secure additional personal water supplies that are perfectly good for many uses, both indoors and out. A growing number of homeowners, businesses and cities are doing just that.

Reuse of treated sewage could provide the greatest benefits of all. Instead of treating it as "wastewater," we can use it as a resource. Properly treated sewage is perfectly capable of meeting many of our industrial,

institutional and outdoor water needs. Dual distribution systems that provide businesses and homeowners the choice of using potable water for some needs and treated wastewater for the rest are already developed in many arid, populous areas of the country. They are beginning to be developed in others, including areas such as western Oregon that until recently were considered to be "water rich."

Water and energy utilities could greatly speed the development of reuse programs by simply re-directing some of the large amounts of money they already spend on securing new supplies. Every city in this country is sitting on a "conservation, efficiency and reuse reservoir" just waiting to be tapped. In almost every case, it can be secured more quickly, less expensively, with less controversy and with much less negative environmental impact than any other potential supply. In fact, the only environmental impacts of tapping our conservation, efficiency and reuse reservoirs—fewer dams, more water in streams, less energy used, less CO<sub>2</sub> emitted, etc.—are *positive*.



## FOR MORE INFORMATION

Money-Saving Water Conservation Tips:

[www.usgovinfo.about.com/library/weekly/aa082102a.htm](http://www.usgovinfo.about.com/library/weekly/aa082102a.htm)

WaterReuse: [www.watereuse.org/index.html](http://www.watereuse.org/index.html)

Water Conserve: [www.waterconserve.info/](http://www.waterconserve.info/)

"Water Sense: Efficiency Made Easy." [www.epa.gov/watersense/](http://www.epa.gov/watersense/)

California Urban Water Conservation Council: [www.cuwcc.org/home.html](http://www.cuwcc.org/home.html)

Alliance for Water Efficiency: [www.cuwcc.org/national\\_cwe.lasso](http://www.cuwcc.org/national_cwe.lasso)

*We work to stop dams, protect fish, preserve critical habitat, ensure laws are properly enacted and share a watershed conservation ethic within our communities. But—climate change? Why don't we just try for world peace? After all, is it even possible for a local watershed group to tackle an issue that has caused disagreement and debate internationally? The simple answer to a very complex problem is: yes. Below, are some actions River Network Partners are taking to do their part to help slow—if not reverse—the effects of climate change.*



Rock River Coalition (RRC) is working on a collaborative project to complete three immense rain garden projects. With some \$25,000 of grant “seed money,” we leveraged more than \$200,000 in completed projects from September through October of 2006. The relation between rain gardens and climate change is this: rain gardens (natural infiltration systems using native plants) reduce polluted stormwater from going into our lakes, streams and, in turn (especially in the Rock River Basin) the Gulf of Mexico. This helps protect aquatic life and the natural systems on which all life depends. Rain gardens are drought resistant and require little maintenance (watering) once established. Where traditional flower beds are wilting with the heat, rain gardens, with their 5-6 foot deep roots, thrive. In addition to protecting and conserving water resources, rain gardens also save energy, reducing fossil fuel use because there is less lawn to mow.

**Rock River Coalition (WI)**  
[www.rockrivercoalition.org](http://www.rockrivercoalition.org)

The Center for Environmental Law & Policy (CELP) is very concerned about threats to our water supplies resulting from climate change. We believe that the general public and government leaders are not sufficiently aware of the urgency of addressing future water shortages wrought by climate change. Therefore, among other things, CELP is preparing a critical report on the impact of climate change on Pacific Northwest water resources. The report's goal is to influence public opinion and government management strategies by detailing scientific predictions of water availability and offering potential policy solutions to predicted water shortages. The publication date is Fall, 2007. Meanwhile, we are incorporating climate change predictions as to water availability in each and every action we take in advocating for the public interest in the public's water resources.

**Center for Environmental Law & Policy (WA)**  
[www.celp.org](http://www.celp.org)



The Stony Brook-Millstone Watershed Association (the Association) has adopted stewardship practices on the land we own and manage and within our office buildings. There are many simple ways to conserve energy, water and resources. Our efforts are broken into five sections: water conservation, renewable energy and efficiency, non-toxic materials, natural resource conservation and education.

**Stony Brook-Millstone  
Watershed Association (NJ)**  
[www.thewatershed.org](http://www.thewatershed.org)



Northwest Watershed Institute (NWI) is working to protect and restore Tarboo Creek watershed, on Washington's Olympic Peninsula. In addition to conserving 450 acres of forest and floodplain, our large-scale tree-planting efforts—while initially designed primarily to benefit salmon & wildlife—also offset CO<sub>2</sub> emissions. Our projects range in size from 1/2 acre to 80 acres. In the past 3 years, we have planted more than 40,000 seedlings using a broad range of indigenous native trees and shrubs.



A favorite part of this program: we offered two local schools the chance to conduct a fundraiser by planting and “selling” the trees, which they do in the form of beautiful “honorary tree cards.” The schools earn the money from card sales (“In honor of Brooke Babblings, a tree is being planted...”), and we use their volunteer hours to leverage matching funds on agency grants for riparian restoration (back hoes, logs, etc.). Through this particular program, now in its third season, the schools have earned nearly \$20K, NWI raised \$120K in grant funding, building on volunteer hours and together, we’ve planted 5,000 native trees and shrubs. We’re now working on a “guidance document” to share this model with other watershed groups & schools.

**Northwest Watershed Institute (WA)**  
[www.nwwatershed.org](http://www.nwwatershed.org)



We have a major new project evolving that links energy use with watershed health. Specifically, we will show how we have accepted and incorporated massive costs and pollution in order to get our electricity. Over time, I will be calculating both the monetary and the environmental cost of *not* using renewable energy.

**Trees, Water & People (CO)**  
[www.treeswaterpeople.org](http://www.treeswaterpeople.org)

With global warming now a reality, communities need to make immediate decisions to both reduce green house gases and offset existing CO<sub>2</sub> levels. Forests play a vital role in both the increase and decrease of climate temperatures. But a survey of community action plans and presentations illustrate that addressing carbon sinks as a solution is being underutilized.

Model Forest Policy Program and volunteer professionals are producing an educational PowerPoint presentation along with an accompanying position paper explaining the relationships among forests, climate change, water and related critical human resources. Addressing forestry practices will be among the most important solutions citizens can implement.

**Model Forest Policy Program (MT)**  
[www.mfpp.org](http://www.mfpp.org)





In December, a tribally-focused climate change workshop was held in Yuma, AZ. Tribal representatives, agencies, nonprofits and partners discussed climate change issues and the impact to Indian Country.

**Tribal Lands Climate Conference (AZ)**  
[www.tribalclimate.org](http://www.tribalclimate.org)

Even if the United States were to adopt a strong climate change policy tomorrow, within 30 years there will be a significant sea level rise and alteration of the North Carolina estuarine system. In fact, the Albemarle Sound watershed has been identified as one of the continental edge locales in the world where the impacts of a changing sea level will be most severe. Last year, Environmental Defense developed an ecologically-based vision of North Carolina's environmental future for the entire state: *Horizon 2100*. *Horizon 2100* defines aggressive conservation as a comprehensive alternative to the current array of well-intentioned but ultimately underpowered and fragmented conservation strategies. The general vision describes the remarkable environmental future that is still available for NC, assuming sufficient political will and acknowledgement of certain inevitabilities, including the effects of climate change and sea-level rise, and the growing and changing state demographics.

Environmental Defense will develop a strategic plan for the Albemarle Sound watershed, which will serve as a place-based demonstration of aggressive and comprehensive conservation at landscape and watershed scale. The plan will define measures of success for each of the full range of ecosystem amenities and services, and outline necessary steps for protection and restoration.

**North Carolina Office of Environmental Defense (NC)**  
[www.environmentaldefense.org](http://www.environmentaldefense.org)

Friends of Milwaukee's Rivers instituted an Ecobucks program. The idea is to reward employees who get to work in a carbon-reducing manner. Every day that someone rides the bus, walks or bicycles to work, they get \$1. If they carpool or ride a scooter, it's .50 cents. We keep tabs on a calendar, and pay staff at the end of each quarter. We also keep bus tickets on hand so that if staff need to go to a meeting elsewhere in town, they can take the bus without worrying about having the right change.

**Friends of Milwaukee's Rivers (WI)**  
[www.mkeriverkeeper.org](http://www.mkeriverkeeper.org)



Climate change will affect estuaries and river valleys. Human settlement patterns in the lower Dungeness River valley have resulted in channel confinement, aggradation and related bedload instability, water quality impacts, increased flooding risk and species decline. These conditions may be exacerbated by storm events of increased severity; higher tides, saltwater intrusion and fluctuating groundwater levels. Several projects in the lower reaches of the Dungeness River are moving forward to address issues associated with habitat alteration and increased flooding risk.



The River's End project purchases property from willing sellers and restores the properties to estuarine floodplain habitat. River's End is located near an old channel of the river, which reactivates at certain flows. In addition, groundwater levels and tidal action exacerbate flooding in the area. Once the project is complete, functional floodplain in the river mouth area will then be over 150 acres and will reduce channel velocities, provide for sediment storage and allow for meander development.

Concurrent with and independent of the River's End project, the dike setback study's goal is to identify the risks associated with the diked reach, and to identify solutions that will restore floodplain habitat and reduce flood risk for landowners. Using several scenarios, models were run to determine likely outcomes. Based on this information, dike setback alternatives will be developed and vetted. Upon agreement of a design by stakeholders, setback construction will proceed.

**Clallam County (WA)**  
[www.clallam.net](http://www.clallam.net)

The Yukon River Inter-Tribal Watershed Council (YRITWC) currently has two initiatives addressing and mitigating climate change:

1) Developing and promoting renewable energy technologies and energy conservation measures throughout the watershed, especially regarding river transportation applications. The YRITWC is developing an electric outboard motor that can be powered by batteries and charged by the sun and/or river current, and that is particularly suited for small river boats used by many Indigenous people in the watershed.

2) Conducting a workshop on Indigenous observations and shifting animal populations directly related to climate change. This workshop, funded by the National Science Foundation and tentatively scheduled for late winter 2007, will include researchers, government agency personnel, indigenous land users and conservationists and will explore recent observations that climate change has resulted in increased beaver populations in the lower portion of the Yukon River watershed and decreased beaver populations in upper reaches of the watershed. Outcomes will include adaptive strategies, identifying future data collection needs and management responses.



**Yukon River Inter-Tribal Watershed Council (AK/YT)**  
[www.yritwc.com](http://www.yritwc.com)

## CASE STUDY

# Alaska Salmon Streams Routinely Violating Temperature Standards Cook Inlet

by Sue Mauger  
Stream Ecologist  
Cook Inletkeeper  
www.inletkeeper.org

**A**laska. For many people, Alaska conjures thoughts of flowing glaciers, magnificent wildlife and wild, healthy salmon. Today, however, Alaska stands out for another reason: it's ground zero for climate change impacts in the United States. *USA Today* recently labeled Alaska the "poster state" for climate change in the U.S., and across the state, there are growing examples of how climate change is rapidly unraveling the fabric of life in the Last Frontier. In southcentral Alaska, the effects of climate change are clearly visible; for example, a massive bark beetle epidemic—prompted by warming temperatures—has wiped out over four million acres of spruce forest, radically changing the landscape and affecting local watersheds for generations to come.

Inletkeeper's Stream Ecologist, Sue Mauger, talks to a CBS reporter about rising temperatures in Alaska salmon streams, July 2006

In response to these growing concerns, Cook Inletkeeper bolstered its salmon stream

monitoring efforts by adding continuous temperature dataloggers to four local salmon streams on the Kenai Peninsula—a popular area for sport, commercial and subsistence fishing south of Anchorage. While air temperatures across the state have increased an average of 3° F over the past 50 years—with winter temperatures increasing as much as 7° F—no one had systematically

collected in-stream temperatures to understand potential climate change effects to the state's beloved salmon runs.

Inletkeeper's Stream Ecologist, Sue Mauger, turned to Onset's

StowAway TidbiT temperature data logger as a cost-

effective, reliable tool to collect continuous temperature data during Alaska's long summer months. To protect and secure the data logger, Sue adapted a U.S. Geological Survey design of a simple PVC casing that allows ample water flow, anchors securely

to the river bottom and does not absorb notable solar radiation that might alter data readings. Sue deploys the dataloggers in the upper and lower reaches of the four targeted salmon streams each May, and collects them in September, when she downloads temperature data collected every 15 minutes over the previous five month period.



Onset's StowAway TidbiT temperature data logger fits securely into a housing anchored to the river bottom, where it collects a temperature reading every 15 minutes.

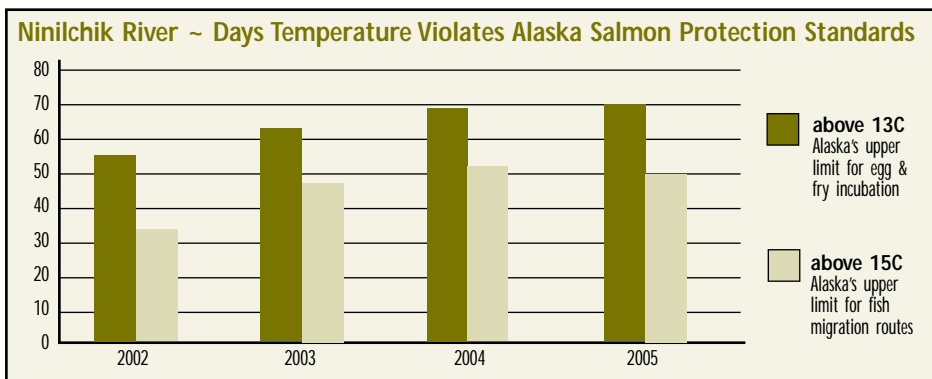


The results have been alarming. Over the past four years, each salmon stream monitored has been found to routinely—and, in some cases, increasingly—exceed state temperature standards established to protect incubating and migrating fish. The State of Alaska sets Water Quality Standards for temperature at 13° C (55.4° F) for salmon egg and fry incubation, and 15° C (59° F) for fish passage. On the Ninilchik River, for example, temperatures exceeded the incubation standard on nearly 70 days last summer, and violated the higher fish passage temperature standard over 50 days (see chart below).



The implications of warming salmon stream temperatures are potentially sweeping. While biologists elsewhere have recorded short-term increases in run strength after the onset of warming stream temperatures, there's also ample documentation showing increased salmon vulnerability to pollution, predation and disease from long term temperature changes. On the Yukon River, for example, warming temperatures have been implicated as an important cause of an increase in Ichthyophonus—a parasite that renders fish tissue mushy and inedible—in the River's renowned Chinook (King) salmon runs.

Inletkeeper is now looking to expand its temperature data logging work—to identify partners to help “wire” major salmon-bearing streams throughout the North Pacific basin.



### FOR MORE INFORMATION:

Inletkeeper's Salmon Stream Temperature Monitoring Project:  
[www.inletkeeper.org/Programs/SalmonStreams/Temperature.html](http://www.inletkeeper.org/Programs/SalmonStreams/Temperature.html)

StowAway's Tidbit Temperature Datalogger:  
[www.onsetcomp.com/Products/Product\\_Pages/temperature\\_pages/stowaway\\_tidbit\\_logger.html](http://www.onsetcomp.com/Products/Product_Pages/temperature_pages/stowaway_tidbit_logger.html)

## CASE STUDY

### Climate Change Toolkit

## Sierra Nevada Alliance

by Joan Clayburgh,  
Executive Director

Sierra Nevada Alliance

[www.sierranevadaalliance.org](http://www.sierranevadaalliance.org)

**F**rom Al Gore's movie "An Inconvenient Truth" to Tom Brokaw's special on Global Warming, the sea change in the United States' attention to global warming and the need to take action to reduce emissions has been significant over the last two years. Thankfully the debate on how to reduce emissions and by how much and when is getting the attention it critically deserves.

However, what seems to be lacking is the awareness that global warming has already impacted our environment and that even with aggressive emission reductions, impacts to water, wildlife and communities is going to be significant. For example, in the Sierra Nevada, even with aggressive reductions in emissions, scientists are modeling a decline of about 25-40% of the Sierra snowpack by mid-century.

The Sierra Nevada Alliance's mission is to protect and restore the natural environment of the Sierra Nevada for future generations. We have a network of over 81 conservation groups, many of them watershed and river conservation groups. We see climate change as one of the greatest challenges our natural environment and our river network has ever faced.

### The Toolkit

While there are many organizations promoting emission reductions, the Sierra Nevada Alliance has found few who focus on the actions we need to take to adapt to climate change in ways that protect our natural resources. To address this gap, the

Sierra Nevada Alliance developed the *Sierra Climate Change Toolkit: Planning ahead to protect Sierra natural resources and communities to help conservation leaders*. The Toolkit shares the basic science of climate change, how climate change affects the Sierra and how we can work together to plan ahead and protect natural resources in the face of significant change. The toolkit also promotes conservation and community leaders as the individuals who can take the lead in meeting the challenges of the changes ahead.

Currently, there are hundreds of resource planning processes occurring in the Sierra and thousands more around the country. These plans traditionally look to the weather, habitat and hydrology of the past as the backdrop upon which they plan. To date, few of these plans take into account climate change.

The range of current tools and assumptions for our planning needs to be re-evaluated and adjusted. For example, watershed studies are needed to show the impacts of increased rain (instead of precipitation falling as snow) and altered timing of runoff on potential erosion and slope failure. Operating procedures of dams for flood control and water storage will need to account for this new precipitation regime. Increased incorporation of weather forecasting and monitoring could increase the flexibility of water management systems. The current "year-class" concept (i.e., grouping of species by age) should be re-evaluated in light of current science. Fishery restoration should take into account warming impacts on water temperature and fish habitat.



Planning how to adapt to climate change now will be easier and more economical than waiting to react to a crisis. If we plan to adapt to a range of scenarios the scientists are predicting, we can come up with win-win solutions that protect our environment and local economies.

The *Sierra Nevada Alliance Sierra Climate Change Toolkit* reviews:

- the science of climate change and impacts on the global, national, state and regional level;
- the effects of greenhouse gas emissions and actions you can take to reduce them;
- information about climate change impacts and specific actions to plan ahead for:
  - o Hydropower Relicensing
  - o Watershed Assessment, Restoration and Protection
  - o Fish Restoration
  - o Forestry
  - o Flooding
  - o Land Use Planning
- messages and messengers;
- resources, reading and websites.

The toolkit also includes a CD with Power Point presentations that can be tailored for use by groups and by the community.

### **Message Development and Delivery**

The first step is to educate yourself and others on climate change; certain key phrases and terms will allow you to be more successful. Initial research by the Alliance into how local community members perceive climate change and the need to adapt identified common misperceptions and concerns. People are busy with their own work and fear adapting to climate change will add on more work and require more resources than they have. Many people believe climate change is something that will happen and not already underway. Many feel that global warming is an issue that can only be addressed at the federal and international level. Some believe this is an 'environmental issue;' this can be off-putting to some conservative members of the community. Others believe this issue is too complicated to understand. And finally, there are few efforts people see that are focused on adapting to climate change and consequently, they fear striking out alone.

All of the concerns listed above can be addressed through basic messaging,

*continued on page 24*

## **GUIDING PRINCIPLES**

The Sierra Nevada Alliance encourages all groups to use the five guiding principles to protect our rivers and other natural resources in the face of climate change.

- 1) Educate yourself and others regarding global, national, statewide and regional impacts of climate change.
- 2) Model and forecast a range of potential impacts from climate change on your target area/community/watershed.
- 3) Base all plans on an adaptive management model.
- 4) Monitor and track changes in weather, hydrology and ecosystems in your target community.
- 5) Prioritize projects that will succeed under multiple scenarios for the future.

## CASE STUDY: Sierra Nevada Alliance, cont.

cont. from page 23

education and discussion. Effective messages include:

- Scientists agree that the Sierra and other regions are warming up now, and snow is decreasing.
- Even under the best emission reduction scenarios, the warming trend will continue due to past emissions remaining in the environment.
- We must reduce emissions now *and* adapt to the changes already set in motion.
- Planning how to adapt to climate change now will be easier and cheaper than waiting for a crisis.
- Adapting to climate change can be part of existing planning processes and will not add on separate planning efforts.
- Elected officials, agencies and other funders will reward efforts that address how to adapt to climate change—this gives your effort a competitive edge.
- There is scientific information and resources available to help you plan at the local level.

As we all know, messengers are as important as message. For some audiences, conservation and river leaders are trusted sources. Other audiences may feel more comfortable with outside ‘expert’ presenters from academia, government agencies and other institutions. The Alliance has gathered an initial list of experts in California who may be available to help educate local communities and list them in our toolkit. It is well worth the time to recruit others to join your river group in educating your community and those involved in resource planning about climate change and the need to adapt.

### Modeling

Modeling a range of impacts on your river and watershed is also important. When folks see how different the future could be in their own backyard or river, they are much quicker to truly understand the importance of local action. Many watershed, river conservation and natural resource planning efforts already use models in their planning. In these cases, it is a matter of requiring the modelers to go beyond using only data from the last 100 years. The best consultants and modelers are already incorporating information from climate scientists.

### Adaptive Management

Adaptive management is important because while scientists agree that the climate is warming and there will be less snow, there is still a range of possible scenarios on how much precipitation will fall and when. Most models are global, and local models are still evolving. Consequently, ensuring your plan includes ongoing assessment and tracking and then adjusting your plan accordingly is critical for success. Adaptive management can be a structured decision making process with pre-defined management responses when goals are not being met. However, static plans that wait until the end of a process to gauge success are likely to fail in a changing climate.

And as noted above, tracking changes in your own river system will be critical to guiding on-going management. Ongoing monitoring of weather, hydrology, and local ecosystems is more important than ever in a changing climate.

### Prioritize

Finally, prioritizing projects that succeed under multiple scenarios ensures your investments are not literally thrown down the drain. If a restoration project or operating procedure only succeeds under a limited scenario and another project



succeeds under a range of different climates, better to place your resources on the more robust project or invest only a limited amount in the project that succeeds in only one scenario. One key principle is that the healthier an ecosystem is, the more able the system is to adjust to changes.

According to most scientists, climate change impacts are being seen now. Significant impacts are already in motion. Planning only based on the past is doomed for failure. Al Gore and Tom Brokaw are unlikely to show up to your local river and watershed group meetings to lead an effort to adapt to the changes ahead. Our ability to protect our natural resources through smart planning relies on local leadership insisting climate change be on the table today. We have seen that thoughtful planning can produce win-win solutions, and this is always easier to do outside of a crisis. There has never been a time in our history when the need for action today was so paramount to the quality of life in the future. So reduce emissions and adapt—and together we can make a difference that future generations will be grateful for.



*The Sierra Nevada Alliance's Sierra Water and Climate Change campaign alerts the public and decision makers to the impacts of climate change in the Sierra and ensures that smart resource protection elements mitigating climate change impacts are incorporated into Sierra watershed and other natural resource plans. We educate the public and resource managers on climate change, ways to reduce emissions and tips for adapting to the unavoidable changes that are and will occur. The Alliance tracks climate change in the region, represents Sierra interests in state water policy, promotes water conservation as a front line strategy to adapt and facilitates and participates in integrated regional water management planning and implementation.*



## FOR MORE INFORMATION

Toolkits are free online or can be purchased for \$10 from the Sierra Nevada Alliance.

To order: email [info@sierranevadaalliance.org](mailto:info@sierranevadaalliance.org) or call 530/542-4546.

To download the toolkit or for more information on the Sierra Nevada Alliance or their Sierra Water & Climate Change Campaign, visit: [www.sierranevadaalliance.org](http://www.sierranevadaalliance.org)

## CASE STUDY

# Sustainable Building Saves Water and Energy

by Margo Farnsworth,  
Senior Fellow  
and  
Gwen Griffith,  
BOB Project Director

Cumberland River Compact  
[www.cumberlandrivercompact.org](http://www.cumberlandrivercompact.org)



According to a sediment study completed in 2002, the annual weight of sediment leaving a single watershed in the Cumberland River Basin is equal to 22,500 African elephants.

Most watershed organizations recognize the importance of "dirt" in the water and many of us work on farms and private lands to rectify the damage it causes. Now, the Cumberland River Compact (The Compact) has taken the word to the streets through the Building Outside the Box (BOB) sustainable building project, funded in large part through an EPA Targeted Watershed Initiative Grant. Originally created to address siltation and water conservation, program leaders intuitively took a more holistic approach to residential green building, with both water friendly and energy efficient practices.

Built with developers beside three silt-impaired streams, demonstration houses are utilizing a number of techniques to reduce negative impacts, including rain gardens with automatic roof irrigation systems and overflow protection, native plantings, hydro-seeding and strategic disconnection of storm drains. These same homes are also achieving EPA Energy Star status and EarthCraft House certification.

In this Basin, 60%

or more of our power is coal-based. The energy efficiency of the demonstration homes is at least 40% higher than standard construction; this translates to 40% less coal burned to power each house. The average Tennessee house uses 1200 Kwh

of electricity per month. If we cut that by 40%, we save 480 Kwh with a corresponding reduction of coal burned every month as well. In addition, energy efficiency also saves water, as discovered by National Labs through their "Energy Water Nexus." When utilizing coal-burning technology, the production of each Kilowatt Hour requires 25 gallons of water. That means a house saving 480 Kwh not only saves on coal burned, but also saves 12,000 gallons of water per month!

The Compact's original project goal was 3 demonstration houses. In this third project year, our building partners have completed over 10 houses, committed another 60 to the program and pledged over 1000 more over the next several years. Energy saving features include insulated roof lines; extra sealed duct work with less than 5% leakage (30-40% air loss is typical); all Energy Star appliances; florescent lighting; tankless-on-demand water heaters; high efficiency HVAC systems and programmable thermostats. High performance house envelope sealing and insulation and non-vented, insulated crawl spaces help make the living spaces healthier as well.

With one house alone, the herd of dirty elephants would be completely unaffected by this work. However, with 60 or 160 or 1060, we begin to affect siltation as well as lending a hand in the areas of energy efficiency, healthier houses and fatter wallets.



Photo Credit: Gwen Griffith

This rain garden is fed directly from the roof, with pop-up overflow release for larger storm events.



Photo Credit: Gwen Griffith

This water-friendly house creates an energy efficient and healthy living space.

### FOR MORE INFORMATION

The **Cumberland River Compact** welcomes inquiries about BOB at: 615/837-1151. You can also view the project website (under construction) at: [www.buildingoutsidethebox.org](http://www.buildingoutsidethebox.org)

**EarthCraft House** is a green building program that serves as a blueprint for healthy, comfortable homes that reduce utility bills and protect the environment.

[www.southface.org/web/earthcraft\\_house/ech\\_main/ech\\_index.htm](http://www.southface.org/web/earthcraft_house/ech_main/ech_index.htm)

# Resources & References

**The Alliance to Save Energy** promotes energy efficiency worldwide to achieve a healthier economy, a cleaner environment and greater energy security. The website includes links to more focused topics on energy conservation. [www.ase.org](http://www.ase.org)

**Climate Change**, an essay authored by climatologist Stephen H. Schneider from Stanford University and Professor Terry L. Root from the University of Michigan is a straightforward and thorough essay on climate change and global warming. The essay includes detailed maps and graphs. [biology.usgs.gov/s++t/SNT/noframe/cl1110.htm](http://biology.usgs.gov/s++t/SNT/noframe/cl1110.htm)

**Climate Change 2001** is a 3-part, comprehensive and up-to-date scientific assessment of the consequences of, and adaptation responses to, climate change. [www.grida.no/climate/ipcc\\_tar](http://www.grida.no/climate/ipcc_tar)

The World Resources Institute's Issue Brief, **Climate Change 2005: Major New Discoveries**, is a thorough review of 2005's literature highlighting scientific discoveries and extensive research on climate change. [climate.wri.org/pubs\\_description.cfm?PubID=4175](http://climate.wri.org/pubs_description.cfm?PubID=4175)

**Climate Change Futures: Health, Ecological and Economic Dimensions** is a project of The Center for Health and the Global Environment, Harvard Medical School. Sponsored by Swiss Re and the United Nations Development Programme. [www.climatechangefutures.org/pdf/CCF\\_Report\\_Final\\_10.27.pdf](http://www.climatechangefutures.org/pdf/CCF_Report_Final_10.27.pdf)

**The Intergovernmental Panel on Climate Change** has been established by World Meteorological Organization and United Nations Environment Programme to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. [www.ipcc.ch](http://www.ipcc.ch)

An informative website on global warming and oil dependence is presented by the **Natural Resources Defense Council**. This site also offers in-depth information regarding urban sprawl, green living and U.S. environmental law and policy. [www.nrdc.org/globalWarming/default.asp](http://www.nrdc.org/globalWarming/default.asp)

The Sierra Nevada Alliance produced an online **Sierra Climate Change Toolkit** that offers insight and information regarding the impacts of global warming and steps you can take to address it locally. [www.sierranevadaalliance.org](http://www.sierranevadaalliance.org)

The **State of California** has a directory of organizations and news releases on initiatives that address climate change and greenhouse gas emissions. This is a great starting point for research on California's efforts in changing the path of global warming. [www.climatechange.ca.gov](http://www.climatechange.ca.gov)

**Stabilization Wedges: Solving the Climate Problem For the Next 50 Years Using Current Technologies** is a recent essay written by R. Socolow, R. Hotinski, J. Greenblatt and S. Pacala. The essay is accompanied by an engaging online power point presentation. [www.princeton.edu/~cmi/resources/stabwedge.htm](http://www.princeton.edu/~cmi/resources/stabwedge.htm)

**The U.S. Energy Information Administration** offers national and global information and analyses on household, building, industry and vehicle end-use energy consumption data. [www.eia.doe.gov/emeu/consumption/index.html](http://www.eia.doe.gov/emeu/consumption/index.html)

**The U.S. Environmental Protection Agency's Energy Star Program** is a joint program of the Environmental Protection Agency and the U.S. Department of Energy. The program focuses attention to energy efficient alternatives for domestic homes and businesses. [www.energystar.gov](http://www.energystar.gov)

The U.S. Environmental Protection Agency's Climate Change Site offers comprehensive information on the issue of climate change in a way that is accessible and meaningful to all parts of society—communities, individuals, business, states and localities, and governments. [epa.gov/climatechange/index.html](http://epa.gov/climatechange/index.html)

**The U.S. Geological Survey's** homepage provides an extremely comprehensive website that presents information on many topics ranging from general water information to regional studies conducted. [water.usgs.gov](http://water.usgs.gov)

**The United Nations Environment Program** presents an updated resource page on topics that remain focused on climate change and global warming. This website has informative graphs and maps of environmental and social impacts due from climate change. [climatechange.unep.net/](http://climatechange.unep.net/)

**The WaterReuse Association** is a nonprofit organization whose mission is to advance the beneficial and efficient use of water resources through education, sound science and technology using reclamation, recycling, reuse and desalination for the benefit of the public and the environment. [www.watereuse.org](http://www.watereuse.org)

## BOOKS

New South Wales Australian of the Year Award recipient, Tim Flannery, has written a book on climate change called **The Weather Makers**. Published by Atlantic Monthly Press. [www.theweathermakers.com](http://www.theweathermakers.com)

**Field Notes from a Catastrophe: Man, Nature and Climate Change** by Elizabeth Kolbert presents an argument for the urgent danger of global warming. Published by Bloomsbury Publishing PLC. [www.bloomsburypublishing.com](http://www.bloomsburypublishing.com)



## FUNDING

**The Merck Family Fund** has developed a list of foundations supporting a wide variety of climate change efforts, including initiatives related to transportation, smart growth, carbon trading and renewable energy. [www.merckff.org/climate\\_foundations.html](http://www.merckff.org/climate_foundations.html)



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