

Climate Disruption and Resource Resilience

Alison Field-Juma

The results are in: 2012 was the hottest year on record for the continental US. Every single state exceeded its average annual temperature and every single state contained a location that hit its record warmest year. Nineteen states (including Massachusetts) had a record high annual temperature. One notable warmest year record occurred in New York City's Central Park, which has a period of record dating back 136 years.

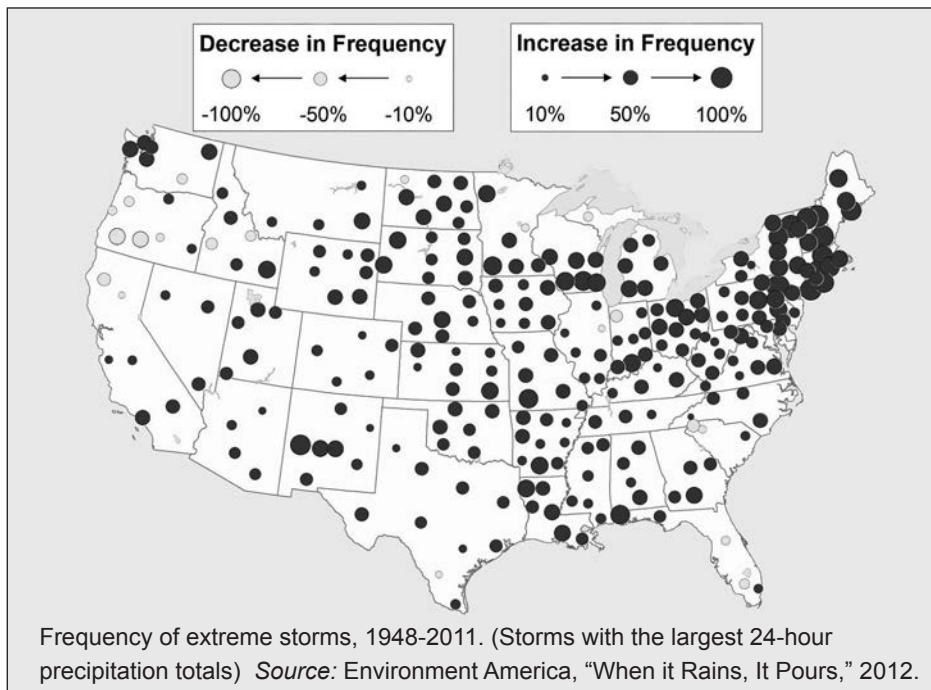
As well as temperatures going up, more rain is falling as heavy downpours. Very heavy precipitation events (the heaviest 1%) now drop 67% more precipitation in the Northeast and 31% more in the Midwest than they did 50 years ago. Less precipitation is falling as snow, meaning that the gradual snowmelt in the spring is being replaced by spring downpours.

As the below figure shows, there is a very clear trend in extreme precipitation—and our region is at the epicenter. Extreme downpours and snowstorms in New



England have become 85% more frequent since the 1950s. This means that in Massachusetts, heavy rain or snow storms that 60 years ago would have occurred, on

average, once per year now occur once every 9 months. In New Hampshire, they are recurring, on average, every 5-6 months—in other words, twice as often.



So when it rains, it is more likely to pour, and pour hard. As a result, rain water is less likely to soak into the ground and "re-charge" our aquifers and wells. Instead it quickly carries pollutants and eroded soil into the streams and rivers, creating flooding in the process. All that stormwater can overwhelm wastewater treatment plants, reducing wastewater treatment, as well as flood septic systems and wash pollutants into local streams.

And when the flood is gone, so is the water. When rainfall runs off instead of soaking into the ground, the amount of water stored as groundwater and in aquifers decreases. Cool, clean groundwater should feed streams during the dry months, so with its loss it is more likely

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OARS

Protecting, preserving, and enhancing the Assabet, Sudbury, and Concord Rivers, their tributaries and watersheds for the purposes of public recreation, water supply, and wildlife habitat.

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A Climate of Change

Funny how the winter, ostensibly our “slow” time of year, never is! In addition to crunching all the data collected in the summer and fall, we have been planning several events to inspire us all and provide the information we need to seek solutions to our rivers’ challenges.



Coming up first, we are pleased to bring you OARS’ 5th Wild and Scenic Environmental Film Festival, entitled “A Climate of Change.” It will be on March 6, 7-10 pm, at the Fine Arts Theater in Maynard. I hope to see you there for an evening of beautiful and thought-provoking films!

Next our 2013 Water Forum, called “Choosing the Fate of our Water Resources: Adapting to Climate Disruption,” will be held on April 6. Always memorable events, past OARS’ water forums have tackled water pollution, dam removal, and innovations to restore the water balance. We aim to offer new information and solutions to you in an engaging way.

This year we are very excited to bring you several of our region’s top experts on the local impacts of climate change and practical local solutions using green infrastructure. We will also give you the latest data on the health of our three rivers. Using a game format, the second half of the forum will challenge us to invest our scarce resources so that our communities can be resilient in the face of climate disruption. It may be a game, but the purpose is serious. Will we succeed? There is only one way to find out—save the date: Saturday April 6, 8:30 am-1 pm at Clock Tower Place in Maynard (see page 7).

The lead article in this Newsletter aims to provide some background on what we in Massachusetts are doing about climate change when it comes to water resources. It is followed by an article on OARS’ project on wild brook trout. Come spring, we will be out in the streams again, come drought or high water!

On a personal note, I would like to express our deep gratitude to Dave Griffin of Maynard who has stepped down after five years as OARS’ President. Dave, among many other contributions, ably led OAR through its transformation into OARS. We are very pleased that he will be continuing on the OARS Board of Directors, and will be as busy as ever with his engaging writing and photo documentation of the life of the rivers.

Our new Board President, Pete Shanahan of Acton, has served on the OARS Board since 2006, giving freely of his technical expertise in analysis and modeling of environmental water quality and hydrology, as well as providing a thoughtful approach to the development of the organization. We are thrilled to be working with Pete in this new role. We are also very pleased that Rick Tardiff of Wayland has joined the Board as Treasurer. His wealth of experience as a CPA working with non-profit organizations and his appreciation of the Sudbury River which flows behind his home, make us feel very lucky that he has joined us. Welcome Rick!

Very truly yours,

A handwritten signature in black ink, appearing to read 'Alison'.

Alison Field-Juma
Executive Director

Make way for kayaks!

When paddlers on the Wild & Scenic section of the Assabet River in West Concord reported that the river had been completely blocked by two fallen trees OARS knew we had a problem. Safe recreational use is one of the great values of our rivers, and yet there has been no mechanism to tackle obstructions to safe passage. New guidelines prepared last year by the Appalachian Mountain Club (AMC) and MassWildlife/Riverways Program recommend minimizing removal of woody debris from rivers to maximize wildlife habitat, and consulting with local conservation commissions and landowners before whipping out that saw.

OARS brought the concern to the Concord Natural Resources Commission, and in July and August the two collaborated to produce a protocol for passage clearing that respected both wildlife and recreation. On a sunny morning in August the protocol was put to the test by some ten OARS and AMC volunteers, Concord Natural Resources staff, and the landowner. Just about everyone got wet and safe passage was cleared through a massive tangle of branches and trunks. An appropriate amount of woody material was left in the river and the rest was removed by truck from the site.

Lessons learned:

- Start early to get everyone on board with the plan, especially the local Conservation Commission and landowner(s), and use the Protocol
- Wait for low water levels
- Since legal jurisdictions are not always clear, the effort requires goodwill from all parties and a willingness by everyone to contribute to the effort: town, landowner(s), and watershed group

For more information, go to <http://www.outdoors.org/conservation/issues/rivers/river-recreation-ecology.cfm> to read “Trees, Paddlers and Wildlife: Safeguarding Ecological and Recreational Values” and watch a YouTube video on safely navigating around obstructions (co-starring our own Julia Khorana!)



Using the new passage clearing protocol, OARS and AMC volunteers and the Concord Natural Resources staff cleared passage for recreational paddlers on the Assabet. *Top: Before. Bottom: After.*

OARS' Executive Director, Alison Field-Juma, received The National Society of the Daughters of the American Revolution's Conservation Award from the DAR's Old Concord Chapter for her work with OARS. This is one of the Society's highest honors and is awarded for outstanding wildlife and nature center work, resource management, and conservation-related media work.



Photo: Alison (right) with Board Member Pam Rockwell and OARS new Board President Pete Shanahan.

Celebrate our rivers through photography: Announcing OARS' 2013 Photo Contest!

The 136 submissions for our 2012 Photo Contest, a lively awards ceremony and gallery opening at Artscape in Bradford Mill, and a calendar with 12 winning photos have convinced us to hold a photo contest once again. We will be looking for photos that reflected unique perspectives of our three beautiful rivers and the roles they play in our communities. Details coming soon.

The winning photos are featured on our website:
<http://www.oars3rivers.org>.

that streams will dry up and rivers become sluggish during the summer and fall. Research shows that stream temperatures are already rising in response to both rising air temperatures and reductions in groundwater flows to small streams.

That is good news if you are an invasive water chestnut plant or a carp, or one of the other species that can capitalize on warmer conditions and outcompete native vegetation and wildlife. Maybe we should just embrace them! But before we do that, we should consider what services a healthy water balance and native species diversity provide to us.

In a healthy watershed, most of the rain and snowfall soak into the soil where they are either used by growing plants and returned to the atmosphere, or flow deeper into the watertable where they feed streams and rivers. Once in the ground, stormwater also supports the thousands of wells of homeowners, municipalities, and businesses that withdraw the water. When the water re-emerges in streams and rivers as clean base flow, the clean water dilutes and conveys treated sewage out to the sea, and it provides a habitat for an amazing diversity of animal and plant life enjoyed through fishing, photography, bird watching and many other activities. The water floats our boats, flushes out nuisance

nutrients and vegetation, supplies drinking and irrigation water, and gives our communities inspiring and calming vistas of nature.

A watershed can do all these (often conflicting) things because it has water as its lifeblood—it hosts an abundantly complex physical and biological system. There are many studies that put dollar figures on these services, as well as those of wetlands and floodplains, and they are millions and billions of dollars. Global ecosystem services have been estimated to be worth \$33 trillion. Protecting the watershed of New York City's drinking water supply saved the city \$6-8 billion in treatment costs. But, of course, some services are valuable beyond measure.

In an unhealthy watershed, large areas are paved, polluted stormwater is piped directly into rivers, wells suck streams dry, nutrients fuel excessive aquatic plant growth, invasive plants and animals reduce the diversity of species, and wetlands and floodplains are filled. Such a watershed cannot provide any of the ecosystem services properly.

Massachusetts has made a significant effort to not be caught flat-footed in the face of extreme weather. The Global Warming Solutions Act of 2008 directed state agen-

cies to develop a report on strategies for adapting to the predicted changes in climate. In 2011 the Massachusetts Climate Change Adaptation Report was released. It makes for compelling reading (available on our website). The anticipated climate disruption impacts are disturbing, particularly in that they are already occurring, were avoidable, and are happening faster than the models predicted. But the actions that we can take to minimize the negative impacts are encouraging and within our abilities if we have the will.

The adaptation report lays out Guiding Principles that, for natural resources and habitat, include: protecting ecosystems of sufficient size; maintaining large-scale ecosystem processes, preventing isolation of ecosystems and maintaining diversity; and using nature-based adaptation solutions. The strategies it proposes include: ecological management and restoration; monitoring and research; and land protection.

The goal is to build resilience into our ecosystems so that they can resist damage from climate extremes and rebound from damaging effects. How can we apply this in our watershed? We can:

1. **Improve and protect stream flow:** recharge stormwater and reduce impervious cover, increase water conservation (private wells are not the solution), and protect and reconnect natural flood plains.
2. **Restore river and stream continuity:** remove dams and replace culverts to allow wildlife passage. Where natural floodplains are protected and continuity is restored, streams and rivers will be more resilient to disruption by the changing climate and native wildlife can move around to survive and reproduce.
3. **Restore the water balance:** recharge and re-use wastewater and stormwater. A combination of water conservation, efficient water use and water re-use, and recharge of stormwater are essential to keeping water where we need it.

Top five hidden health risks of extreme precipitation and flooding

1. **Drowning while driving:** Almost half of 2010 flood fatalities involved people who drowned while attempting to drive through floodwaters.
2. **Waterborne diseases contaminating drinking water:** Drinking water infrastructure and wells can be overwhelmed, which reduces or prevents water purification.
3. **Sewage back-up in plumbing or basements:** Flooding can cause local sewage lines and septic tanks to overflow, sometimes resulting in sewage backing up into residences.
4. **Bacteria, sewage, and other contaminants in waterways:** During flooding, untreated sewage, pesticides, and street contaminants (motor oil, dog excrement, etc.) can flow into local rivers, lakes, and ponds.
5. **Mold and dangerous indoor air quality:** Water intrusion anywhere in a building can cause toxic mold to grow in ceilings, walls, or insulation.

Source: Union of Concerned Scientists, "After the Storm," 2012. <http://bit.ly/zAxGhT>

4. Reduce green house gas emissions: with the impacts of climate disruption staring us in the face we should be motivated to substantially reduce our greenhouse gas emissions.

Our communities will benefit from the research we can do and the wise investments we can make armed with knowledge and a longer-range vision.

References:

National Research Council. 2004. *Valuing Ecosystem Services: Toward Better Environmental Decision-Making*. The National Academies Press.

Union of Concerned Scientists:
<http://bit.ly/zAxGhT>.

Climate Disruption and Jobs

Massachusetts' 136-page Clean Energy and Climate Plan for 2020 contains a "portfolio" of established and new measures that reduce energy waste, save money, and stimulate the adoption of clean energy technologies, thereby creating jobs at the same time that they reduce GHG emissions. It is estimated that 42,000 to 48,000 jobs would result from full implementation of the plan in 2020. These would be jobs that fill every niche in the clean energy supply chain—electricians, installers, researchers, architects, manufacturers, plumbers, energy auditors, technicians, and scientists—and jobs throughout the economy as lower fossil-fuel energy expenses lead to more spending on in-state goods and services.

Source: <http://1.usa.gov/14O5kYO>



The climate effects on native brook trout project is funded by the Massachusetts Environmental Trust.

Drought Threatens River Traffic

"Drought in the Mississippi River Valley is affecting barge traffic. While trade groups fear that river traffic could come to a halt entirely, the U.S. Army Corps of Engineers is dredging the river . . . to maintain a navigable waterway. . . . According to the American Waterways Operators (AWO) trade association, in December and January alone, the Mississippi River generates \$130 million in wages and supports 20,000 jobs. However, AWO estimates that every 1 inch of water loss decreases barge carrying capacity by 17 tons — the equivalent cargo of about 130 tractor-trailer trucks per tow of 30-45 barges."

Source: *Stormwater Report*, Jan. 2013. Water Environment Federation.
<http://bit.ly/X0gKWT>.

Climate effects on native brook trout

Sue Flint

"Tools are needed to forecast where important changes may occur and how conservation efforts should be prioritized." (Haak *et al.*, 2010)

Eastern Brook Trout are among the most sensitive of our native fishes in Massachusetts. Dependent on cold, flowing streams throughout their life cycle, they will be among the first to lose habitat with a warming climate. They are, therefore, harbingers of change for all species. Recent studies have shown that climate change has resulted in changes in stream temperatures and in the behavior and breeding success of trout. To protect our cold-water streams and trout, we need to continue work to understand and predict where and how the effects of climate change will be felt and prioritize conservation efforts. "Basic fish distribution monitoring programs are needed so that anticipated shifts in species distributions can be accurately described in future decades to provide a clearer understanding of how salmonids integrate and respond to changes in thermal conditions" (Isaak *et al.*, 2010).

In addition, we need to act now to ensure that our streams are resilient to disturbances associated with climate change. How? All of the streamflow and groundwater protection, Low Impact Development, riparian area protection, and river continuity efforts already being worked on will help rivers by: reducing impervious areas, increasing groundwater recharge, reducing and treating stormwa-

ter runoff, reconnecting streams with their natural flood plains, and protecting flood plains and river-edges from development.

In 2012, OARS began a collaboration with Greater Boston Trout Unlimited, USGS Conte Fish Labs, Sudbury Valley Trustees, and the Sudbury Conservation Commission to study several small trout streams in the Sudbury River watershed. Work in 2013 will include stream temperature monitoring, and habitat assessments. Fish population surveys on these streams will contribute to USGS regional modeling of trout populations and climate change.

References:

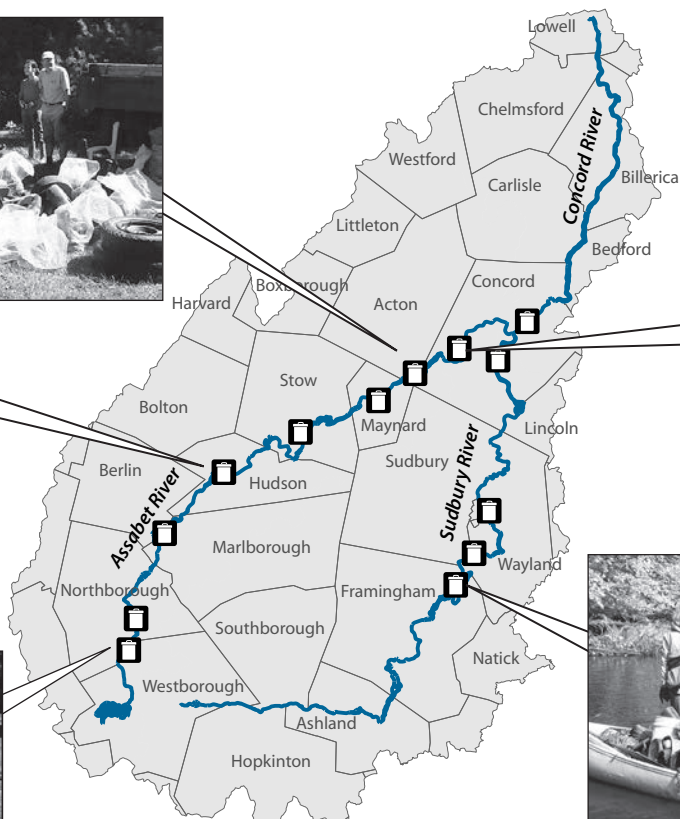
Haak, A.L., *et al.* 2010. "The potential influence of changing climate on the persistence of salmonids of the inland west." U.S. Geological Survey Open-File Report 2010-1236, 74 p.

Isaak, D.J., *et al.* 2010. "Climate change effects on stream and river temperatures across the northwest U.S. from 1980-2009 and implications for salmonid fishes." *Climatic Change*, DOI 10.1007/s10584-011-0326-z.

Warren, Dana R., *et al.* 2012. "Elevated summer temperatures delay spawning and reduce redd construction for resident brook trout (*Salvelinus fontinalis*)."
Global Change Biology, 18.6: 1804-1811.

An amazing day for our rivers!

More than 200 volunteers came out to pull trash from the Assabet, Sudbury, and Concord Rivers in eleven towns on Saturday, September 15. A big thank you to all our sponsors, donors, and volunteers who made our 26th Annual River Cleanup a huge success!



Visit www.oars3rivers.org and go to "events" for photos of the cleanup.

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Marlborough: Classic Pizza, Home Depot, Papa Gino's
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Northborough: Monti's Pizza, Northboro House of Pizza
Stow: Shaw's Supermarket

Sudbury: Papa Gino's, US Fish & Wildlife

Wayland: Donelan's Supermarket, Starbucks

Westborough: Uno's Pizza, Bertucci's

Other: B-P Trucking, McGeoghean Waste Systems

Towns:

Acton Natural Resources Department
Concord Highway Department
Hudson DPW
Framingham DPW
Marlborough DPW
Maynard DPW
Northborough DPW
Stow Highway Department

Thanks to our site leaders, scouts, and boat haulers:

Don Burn, Amber Carr, Pat Conaway, Mike Duclos, Bill Fadden, Alan Fierce, Carolyn Gouchoe, Bob Guba, Jim Hawks, Dick Lawrence, Marty Moran, Eric Rober, Priscilla Ryder, Katrina Scheiner, Drew and Kathy Simmons, Pete Tobin, and Laurie Ullman.

Upcoming Water Forum—A Morning Well-Spent!

Choosing the Fate of our Water Resources: Adapting to Climate Disruption

Saturday, April 6, 8:30 am - 1:00 pm

Clock Tower Place, Maynard, MA

"For stakeholders to grasp climate risks in a meaningful way, we need to explore new ways to be able to grapple with variability and uncertainty that is context-specific."

Games for a New Climate

Senator Jamie Eldridge

Water infrastructure needs in the Commonwealth

Suzanne Flint (OARS)

Current state of our rivers

Dr. Paul Kirshen (University of New Hampshire)

Effects of climate change on our rivers and adaptation

Bob Zimmerman (Charles River Watershed Association)

New approach to wastewater: Littleton's Smart Sewer project

Scott Horsley (Horsley Witten Group)

New green stormwater projects in Massachusetts

Janot Mendler de Suarez and Dr. Pablo Suarez (Boston University)

Make decisions about investments in municipal infrastructure with a changing climate (*Games for a New Climate*)

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Sudbury, and Concord Rivers!

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- If your employer has a matching gift program, please include the company's form.
- Your membership dues are tax deductible and include a subscription to the *OARS Newsletter*.

Thank you for your support!

Welcome, New Members!

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Michelle Bociek and David Witherbee
John and Betsy Boyd
Johanna and John Boynton
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and inspiration"*

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www.oars3rivers.org

