Climate, Energy and Community: Vermont 2011

Alan K. Betts
Atmospheric Research, Pittsford, VT 05763
akbetts@aol.com
http://alanbetts.com/writings

This is a compilation of my 2011 Weekly Planet articles from the Sunday Environment page in the Rutland Herald and Barre/Montpelier Time Argus**.** This series started in January 2008; and the set of 2008 columns has a longer introductory narrative. These columns go through the seasons, dealing with weather, climate, climate change, energy and policy issues. They blend science with a systems perspective, and encourage the reader to explore alternative and hopeful paths for themselves, their families and society. They are written them so that a scientist will perceive them as accurate (although simplified); while the public can relate their tangible experience of weather and climate to the much less tangible issues of climate change, energy policy and strategies for 'managing' the earth system. The future of our societies and the Earth depends on our creativity and willingness to work together, and move beyond historic frames of reference. This year I revisit many broad Earth system issues in a Vermont context. Water is a dominant theme, as there have been two major floods in the state in 2011.

I believe that earth scientists have a responsibility to communicate clearly and directly to the public[1] – not just to their colleagues – as we all share responsibility for the future of the Earth. We must broaden our collective understanding, so we can make a collective decision to create a resilient future.

Footnote: All my articles can be freely reused under a Creative Commons license. The old Herald web references have not been maintained. You can find articles at http://rutlandherald.com/section/archives. However, they charge for access.

List of topics in 2011 *[Index is live]*

Reference:

1. Betts, A. K. (2011), Communicating Climate Science. *EOS Transactions, 92*, No. 24, 14 June 2011. *Available at http://alanbetts.com/research/paper/communicating-climate-science/#abstract*

Acknowledgment: This work was supported by the National Science Foundation under Grant No. 0529797. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

a) New Year's reflections on our responsibility for the Earth (January 2, 2011)

http://www.rutlandherald.com/article/20110102/NEWS01/701029941

At the beginning of a new year as we enter the depths of winter, it is useful to review what is happening to our planet and what we learned in the past year. Climate change is forcing us to face something that nobody wants to face: Humanity is now responsible for the future of Earth. Developments in science and technology and the market economy have created our industrialized world, which is rapidly using up raw materials and fossil energy supplies while polluting the atmosphere and oceans.

You might think that scientists would feel deeply responsible for this, but most are isolated in their own research worlds. The book "Frontiers of Illusion" by Dan Sarewitz, written more than a decade ago, outlines the traditional myth that society benefits most when scientists are left alone to do their research.

Our climate problem is one unfortunate consequence of this hands-off attitude toward science and technology, exacerbated by our "free market" philosophy. Yet climate scientists still see their task as simply trying to understand and model all the complexities of the Earth system as accurately as possible, so we will be better able to estimate the climate risks we face. The scientists naively assume that our politicians will use this valuable information to redirect the economy away from fossil fuels and thus steer us away from the looming precipice of irreversible climate change.

But we live in a democracy, and this reality is the last thing that we and our elected leaders want to face. Politicians will say and do almost anything to avoid responsibility for difficult and painful decisions. Their main goal is to stick to policies that will get them re-elected — however absurd and shortsighted these may seem to our children, who must face the consequences. Politicians respond to the climate change problem by simply offering scientists more borrowed money to keep quiet and do more research. And there is always plenty to do.

Although climate research is sold to the public as necessary to provide governments with better guidance for the future, it is less and less useful for this — at least in the United States. The Earth system has such an unpredictable richness and complexity that our computer models cannot predict the future in enough regional detail to give cover for difficult political choices.

So at the national level our paralysis has deepened, and progress toward global governance on climate issues is even slower than the slow advance of global change. Where does this leave informed citizens, who realize that humanity must respect Earth system limits or face the consequences? Yes, it is up to us to cheerfully do what needs to be done to build a new resilient path for our communities.

Here in Vermont we can do this with the support of our businesses and Legislature. In fact, this has been a year of visible progress — in retrofitting homes to reduce fuel use and starting the long transformation of our energy economy. The first megawatt-scale solar farm came on line in Vergennes last month, thanks to the vision of developer Ernie Pomerleau, who led the Governor's Climate Change Commission a few years ago.

Small but efficient biomass power plants are moving forward, and a few new wind farms may get built. The local food and farm markets are steadily expanding. Fuel-efficient cars are becoming more readily available, but we still need a rural transportation system to reduce our dependence on single-occupancy vehicles.

So gather again before the winter fires and dream of what we can build together this coming year that will help secure the future for our children and for life on Earth.

Efficiency Vermont: www.efficiencyvermont.com/
Renewable Energy Vermont: www.revermont.org/

b) Winter reflections on more signs of climate change (February 13, 2011)

http://rutlandherald.com/article/20110213/ENVIRONMENT/702139907

As a climate scientist, I like to look back in winter on the year that has passed and ask what we have learnt. The year 2010 tied with 2005 as the warmest year on record, and brought much extreme weather around the globe. Temperatures in Moscow reached 100 degrees for the first time, contributing to fierce forest and peat fires. Pakistan set a new temperature record of 129 degrees, followed by catastrophic floods that submerged a fifth of the country. In northwest Amazonia, the Rio Negro fell to its lowest recorded level since records began in 1902. By the end of the year, a strong La Nina brought massive floods to Queensland in Australia, which continued into January.

The Earth's climate system has always been rather unstable, and now it is being driven by the increase in greenhouse gases and the warming of the Arctic into new patterns, which are giving us new extremes of weather. The Arctic warming may be accelerating. In 2010 Canada set a new temperature record of 5.4 degrees (F) above normal – almost a degree above the previous record set in 1998. Most of Nunavut and northern Quebec was at least 7.4 degrees above normal. The Arctic sea-ice continues to melt away in summer and refreeze more slowly in winter. This winter has set new record lows for sea-ice cover in December and January. Hudson's Bay did not freeze over until mid-January, far later than "normal." Of course what was considered normal in the last decades of the twentieth century is now history.

Why is the frozen north warming so much faster than the Earth as a whole? There are two amplifying climate factors. As snow and ice cover are reduced, less sunlight is reflected — and so the north warms faster. If the Arctic waters and bays are unfrozen, then more water evaporates into the dry Arctic air. Water vapor is a powerful greenhouse gas, which stops the Earth's heat from radiating away into space, so again the north warms faster. Over the past four decades, Vermont has also been warming twice as fast in winter as in summer. These climate processes are familiar to us because they also work in the opposite sense. The heavy snowfalls in December gave us a chilly January by reflecting sunlight and reducing evaporation and water vapor in the air. Our nighttime January temperatures plunged as a result.

Now a new third factor has entered the picture. Last winter and this past December, a remarkable climate shift took place. The polar vortex, which used to trap the very cold air around the pole, got much weaker. This allowed frigid air to spill out into the central and south-eastern U.S. (as well as Europe). Exceptional snowfalls occurred up the east coast, while relatively warm air flowed up into Canada and the Arctic.

Weather and climate are fascinating, and every year we make new breakthroughs in understanding. Scientists love all this detail and complexity. Still, when rapid change comes like this year, it takes us a few years to fully analyze what has happened. Meanwhile the public and politicians just wish the problem of climate change would go away, so we can get back to the good old days! Perhaps those days are also now part of our history.

This is the snowiest winter in years. Last Saturday evening, I found myself plowing snow at night amid falling rain and vivid lightning and thunder. It was beautiful, but a little uncanny in early February.

National Climatic Data Center: http://www.ncdc.noaa.gov/sotc/
Environment Canada: http://ec.gc.ca/adsc-cmda/

c) Let's be honest about our global interdependence (April 3, 2011)

http://rutlandherald.com/article/20110403/ENVIRONMENT/704039963

Climate change is only one of the many global challenges facing us in the coming decades. Most of these challenges are interconnected — meaning that we cannot deal with them separately. But first we must be honest and recognize our global interdependence.

Global food prices are the highest in more than 20 years, and this is terrible news for the poor around the world. A major factor is climate change, which brought more extreme weather around the globe in 2010 and reduced crops. Rising food prices have been one small factor, along with political oppression, in the unrest in Africa and the Middle East.

U.S. corn reserves are expected to hit a minimum this year, but for a different reason — we are diverting so much corn to make ethanol to mix with gasoline to fuel our cars. And as the price of oil goes up, we divert more food production to biofuels. The price of oil is rising for several reasons. Global demand is up again after the global recession. China now sells more cars every year than the United States does. But global oil production is flat, and the debate is on as to when we will reach "peak oil." A report by the U.S. military suggests a peak in 2012 and real global shortages of oil by 2015. Meanwhile conflict in Libya reduces the flow of oil.

Economic philosophy maintains that prices will rise until our demand is met. But can we really meet the global demand for oil? We are taking ever greater risks in our pursuit of oil: drilling for it in deeper water and extracting oil from shale at great environmental cost — as well as converting food to fuel. The claim has been made for years that Saudi Arabia has huge oil reserves and can ramp up production. Recent WikiLeaks documents suggest that Saudi Arabia may have overestimated its reserves by 40 percent. Few believe we can cope with rising global demand for liquid fuels this decade.

WikiLeaks has introduced a new openness into our global discussion. For years our fearful leaders have tried to hide the truth about many problems. Now this edifice of secrecy is crumbling. And it is about time: To deal with our global problems we must be honest about them. Now the Internet is making it harder for our leaders to hang on to power through deceit. The resurgence of democratic yearnings across Africa and the Arab world is another call for greater openness in society. Yet the political response of the United States, as world resources slip from its grasp, has been to spend more on the military and incur huge deficits by cutting taxes!

Our global society has become more interdependent and at the same time more vulnerable, because we keep discounting the mounting risks we face. The catastrophe in Japan is a tragic example. Situated on the Pacific Rim, Japan faces frequent large earthquakes. Some generate powerful tsunamis, which lead to immense loss of life. Despite this, the Fukushima complex of six reactors was built on the coast, and it was not designed to survive a major earthquake and tsunami. Nuclear reactors and fuel-rod storage ponds are not fail-safe. If they are damaged and their cooling systems lose power, fuel rods overheat, melt and release radiation.

Here in Vermont we must plan with greater urgency for a much more energy-efficient society to make the transition away from oil and nuclear power to renewable energy sources. We don't even know what that mix will be, so we need vision, experimentation and flexibility. The past is not our future: we must create the future, which means a lot of collaboration and inspired work.

d) Real power lies in resilience, not risk (May 8, 2011)

http://rutlandherald.com/article/20110508/ENVIRONMENT/705089943

Our technology has brought us astonishing successes that we could not have imagined a few decades ago. But at the same time it often places our society at risk. In fact, technological change has come so fast that it has far outstripped our ability to grasp and handle risk. We know what to do if we can see a threat right in front of us — that is how we have survived as a species for thousands of years. But we would rather ignore threats we cannot clearly see or don't fully understand, to limit costs.

The bullet trains in Japan were programmed to stop at the first tremor; the system worked well, and no trains were derailed. The nuclear reactors also were programmed to start shutdown when they felt the earthquake. This worked, but reactors can't just be stopped like trains — they need active cooling for months. So when the tsunami destroyed all the power systems, a predictable disaster unfolded. The utility had decided what risks it was willing to pay for, so when a bigger event came along, it was labeled an "act of God." Hardly — it was an act of human foolishness to put six nuclear reactors on the coast, a short distance from a major fault line, with only limited protection against the tsunamis that have flooded the area in the past.

Nuclear power has always demanded that we don't properly price risk, because nuclear power and nuclear accidents have such far-reaching costs. Vermont Yankee is storing dangerous nuclear waste from decades of operation in a storage pond and in dry casks. This waste also contains enough plutonium-239 to make hundreds of nuclear weapons.

Vermont may now be faced with the storage of this nuclear material for centuries. What is the cost of this long-term nuclear guardianship role, which bears large risks? Did we build it into the price of the electricity that the plant has generated over the past 39 years? No — on paper the federal government accepted the nuclear waste storage risks, but it has not followed though with its commitments. With the United States deeply in debt, who will pay for all the deferred costs?

After Japan, we must again ask what risks Vermont Yankee was actually designed for. It was designed for small earthquakes, and it was built just above the flood plain of the Connecticut River. It has backup power from the close-by Vernon dam on the river, and from diesel generators. Of course, it is vulnerable to terrorist attack by aircraft — not a consideration when the plant was built forty years ago. And unfortunately the frequency of heavy rain, which has increased more than 60 percent since the reactor was designed, is predicted to go on increasing as the climate warms. If the "maximum probable flood" were now recalculated for this century, it would be larger. A more extreme flood might well be a threat to the plant and to the backup power supply provided by the Vernon dam.

Vermont Yankee's dry cask storage is on the river side, at a nominal height of 18 inches above the maximum probable flood. It was placed by the river to limit the radiation dose at the school across the street. It is clearly foolish to store radioactive waste on the edge of the flood plain, perhaps for centuries. But the risks involved were ignored — because there was nowhere else to put this dangerous waste.

The power of our technological achievements comes with large risks. We have to ask whether we want a society that has resilience, or a society that stumbles as the risks that we have ignored to cut costs bring us crisis after crisis. Resilience would bring us greater peace of mind and could spread justice in the world.

Vermont Adaptation planning: http://www.anr.state.vt.us/anr/climatechange/Adaptation.html
Gambling with the Planet: http://www.project-syndicate.org/commentary/stiglitz137/

e) Floods and more floods get our attention (June 19, 2011)

http://timeargus.com/article/20110619/ENVIRONMENT/706199941

The spring transition from deep snow to new growth came especially fast this April. After a very snowy winter, it was a delight to see the daffodils open within 2 weeks of snowmelt. By the first of May, I was mowing my lawn – the part that wasn't under water - and by the end of the month torrential storms and hot weather had arrived. It has been extremely wet. The soil was saturated by snowmelt, and the frequent storms gave some of the highest flood levels I have seen on the Otter Creek below my house.

Further north Lake Champlain reached a new record level of 103 ft — the highest in 150 years of records — as heavy rains flooded the basin. The lake has been above flood stage for 2 months. Severe storms and tornado warnings have affected Vermont, although these are just faint downstream echos of the devastating tornados that have killed so many across the United States this spring.

Some floods are sudden, like the Barre flood that shut down the Rutland Herald and Times Argus printing press last month. Some floods are slow moving, as in the rise of Lake Champlain and the rolling disaster down the mighty Mississippi, which also lasted for weeks. For the first time, three sets of flood spillways had to be opened to save cities and oil refineries downstream, but hundreds of thousands of acres of farmland were flooded instead. While many states, including Vermont, have had record precipitation this spring, Texas has experienced a record drought.

All floods get our attention. The floods along the Mississippi again show the challenge of managing both rivers and risk. The floodplain is of course good farmland, but why do we build in floodplains? We ignore the risks and try to manage the river, rather than human behavior. After the 1927 Mississippi flood, the Army Corps of Engineers was given the task of river management. Yet in recent years, the frequency of severe flooding along the Mississippi has greatly increased. Robert Criss, a hydrologist at Washington University in St. Louis comments: "We had a 500-year flood in 1993, a 70-year flood in 2001, and a 200-year flood in 2008, and every year since then, we have had another 10-year flood." And now 2011 will be a year of another 200- or 500-year flood. Perhaps this will convince us that our twentieth century statistics should be relegated to history.

Two things are happening. As we try to control the river by confining it within levees, the water level rises. And as the climate warms, precipitation rates are increasing rapidly. Vapor pressure goes up steeply with temperature, and the energy released when vapor condenses in clouds intensifies storms. One year the Mississippi will break its banks and carve out a new channel.

Here you can see some of the fantasies that run through our society. We are powerful, and our engineers can control the river. We are a free nation, and we can build where we like. We are not responsible for the changing climate that is accelerating the water cycle. The 100-year floods every few years must be acts of God, because we don't "believe" in climate change.

These floods will wash away our fantasies, and sometime this century we will come to a more honest and humble understanding of our relationship to the Earth. We will have to, because another very slow moving flood is quietly underway: the accelerating rise of sea level. There was record melt of the Greenland icecap in 2010, and the best estimate of sea level rise is now 3 to 5 feet this century. Lake Champlain may subside in a few weeks, but sea level rise will flood coastal development everywhere, and this will continue for many centuries.

Mississippi floods: http://en.wikipedia.org/wiki/2011_Mississippi_River_floods

f) Our children's future is a changing natural world (July 31, 2011)

http://rutlandherald.com/article/20110731/ENVIRONMENT/707319981

I am often asked whether the more extreme weather of the past few years is caused by climate change. I do regard extreme weather as one symptom of the Earth's changing climate. But I am really being asked deeper questions, such as: "Is it our fault, and will things get worse as we continue to dump greenhouse gases into the atmosphere?"

The answer is probably yes, because our climate models predict this. But we still do not understand many of the details because the climate system is so complex and so interconnected.

We understand how water vapor increases as the climate warms, and we know that storms intensify when vapor condenses and releases energy in clouds. We understand that the flow of warm moist air from the Gulf of Mexico, capped by the flow of dry unstable air from the western mountains and deserts, sets up conditions for severe storms and tornadoes in spring. But it may take years of analysis to fully understand why the tornadic storms this spring were so violent, and why even Springfield, Mass., saw a damaging tornado.

Much extreme weather — especially floods and droughts — comes when the very large-scale weather patterns are nearly stationary for weeks or months. This can affect large regions around the globe.

From March to June, a band of states from Kentucky to Vermont had the highest precipitation in the 117-year record. I am sure you remember the spring floods. At the same time, Texas had the lowest precipitation on record. The same quasi-stationary weather pattern was the cause of both extremes; however, in a global sense, we don't know why stationary weather is becoming more frequent as the climate changes. We can see the Arctic is melting quite rapidly. We know this is caused by the warming of the earth, driven by increasing greenhouse gases. But so far we haven't understood in detail how this is changing our mid-latitude weather and climate.

Over the past decades we have developed measures to protect our national parks and forests. That felt good, and life in our cities went on as usual — until now, when our human impacts have become global. Stewardship of the Earth is much more difficult for humanity to accept, because now our way of life must change. The waste products of so many people, dumped without thought into the atmosphere and oceans, is unsustainable. And so the climate of the planet is changing. The northern icecap is melting, and storms are intensifying. The oceans are threatened by agricultural runoff, increasing acidity as carbon dioxide dissolves, and overfishing.

As a society we must change direction and build a more sustainable and resilient way of life. This is not easy because we don't like change, and there are so many wealthy vested interests opposing it. But change we must, because we cannot manage the Earth. We can only reduce our impacts, primarily our waste streams. This will slow the rate of climate change, and give the Earth and ourselves more time to adapt.

Responsibility for our children comes easily, because we love them and understand their needs. Their lives are interwoven with ours, and their survival and their future matter deeply to us. Responsibility for the Earth is just as important, so we must also understand and love the natural world — and see how it is interwoven with our lives, our food and our survival.

This summer, sit in the woods and by streams and lakes and immerse yourself in nature's world. This is your future and your children's future.

g) The second flood of 2011 (September 4, 2011)

http://www.rutlandherald.com/article/20110904/FEATURES/709049919

The catastrophic flooding from the rain bands of Hurricane Irene last Sunday and Monday was the second major flood in Vermont this year. The wet spring brought severe flooding on the Winooski River: Lake Champlain hit a record level and was above flood stage for about two months. Rainfall in Vermont during the months of March, April and May set a new record. Summer rainfall was above average, and the ground never really dried out.

So my first thought when I saw the projected track of Irene up the Connecticut River was that severe flooding was a real threat. Indeed, when the strong easterly winds on the north side of Irene's storm circulation hit our north-south mountain ranges they dumped 6 inches of rain, destroying roads and bridges, and cutting off more than a dozen towns. A week later, crews working 15-hour days have built temporary roads to allow emergency crews, supplies and people to get in and out.

It is really too soon to draw lessons, but floods are a recurring feature of Vermont's mountain terrain. We were surprised by the severity of this flood — perhaps because the media focused so much on coastal damage from winds and storm surges as the hurricane moved up the East Coast. By the time Irene reached Vermont, it had been downgraded to a tropical storm and direct wind damage was small. But when 5 to 6 inches of rain falls on wet soils, mountains streams rise very fast and flood in a few hours. They feed into the larger rivers, which then take only a day or two to peak.

Mostly people had time to evacuate, but what they had to leave behind was lost, as houses and businesses in the floodplain were swept away. A tropical storm in 1927 and the New England hurricane of 1938 also produced major floods in Vermont. Old-timers in Pittsford say that this August 2011 flood matched the July 1811 flood on the Otter Creek.

Our road and rail networks now look more fragile than we had realized. This is because they lie in the mountain valleys, along the streams. When Vermont was first settled, some key roads ran over the mountains and not along the rivers, for just this reason. Of course, horses instead of cars were used for transportation then — much slower, but able to travel on washed-out roads and over the mountains in winter. When our roads wash out now, we have no backup method of transport — just a backpack, a few ATVs and some National Guard helicopters. Those walking the Long Trail got soaked last Sunday, but many will just have dried out and continued on foot, perhaps unaware of the floods beneath them.

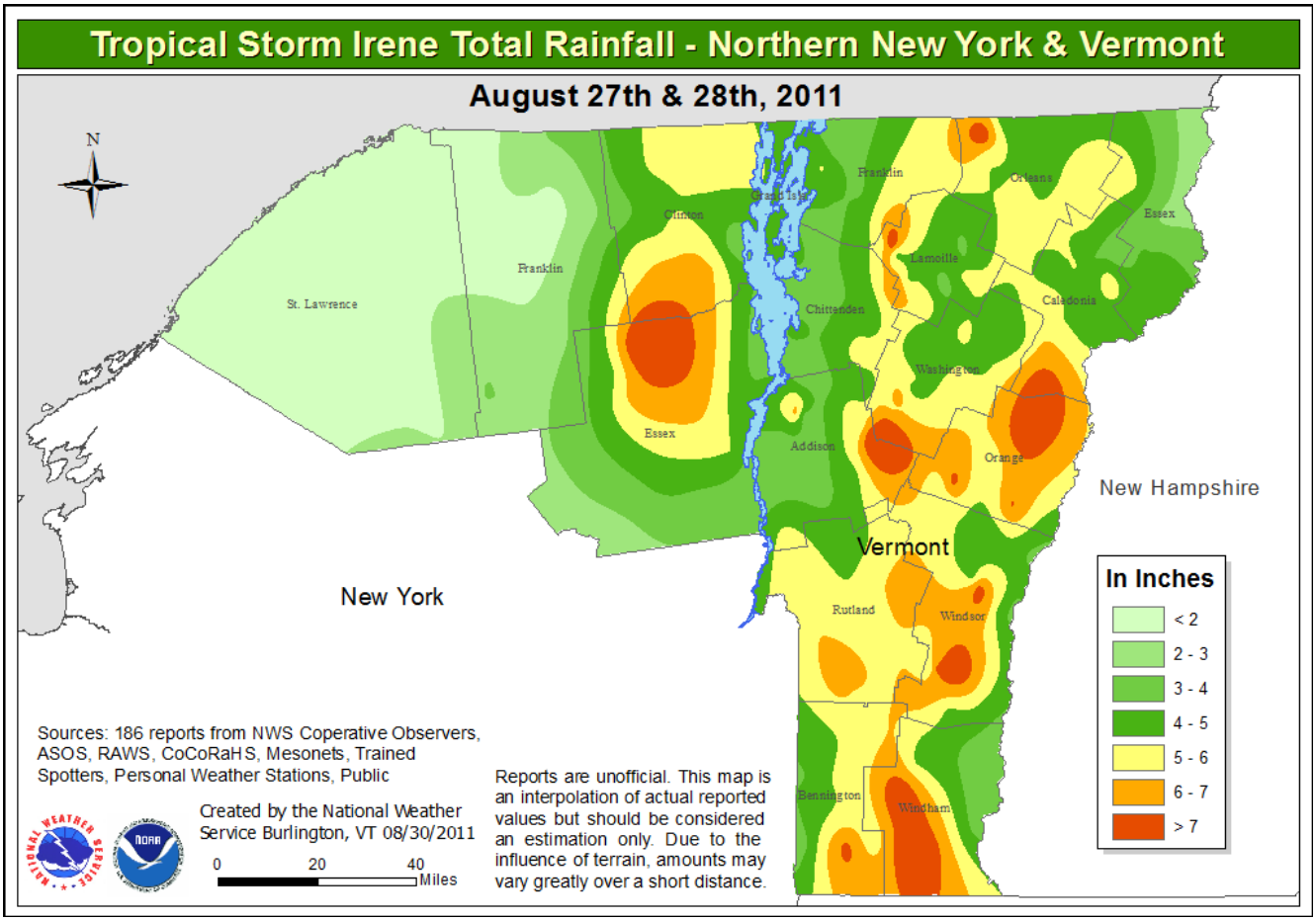
Our first tasks are to reach out to our flooded neighbors in need and help rebuild the current infrastructure that we depend on. But, where we can, we must rebuild with greater resilience in mind. Heavy rain events have become much more frequent in the past 50 years, and we expect this trend to continue as the climate warms. Some lessons are obvious — leave more room for flood waters. We must build bigger culverts and higher bridges, and build further back from the floodplains. Of course floodplains are good farmland, and now the farmers whose crops were washed away need our help.

Our communities can draw many lessons on vulnerability and resilience from this 2011 flood.

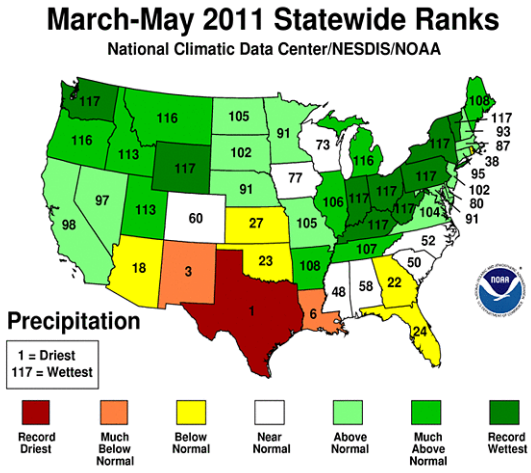
Secondary roads that have proved critical for access in this flood may need more attention. Backup water supplies have proved invaluable in some communities, like Rutland. The new alternative energy systems we are building should be able to function on a town-wide level when cut off from the

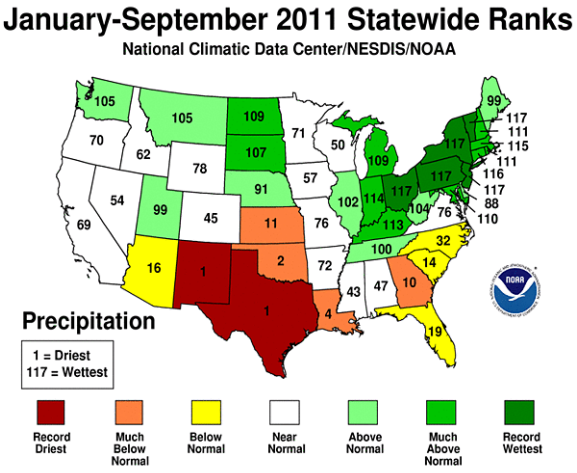
Vermont grid. But our strength is our communities and our neighbors, as shown by the grassroots recovery effort that we are witnessing throughout Vermont.

Vermont State Climate Office Irene page: http://www.uvm.edu/~vtstclim/?Page=Irene_flooding_2011.html



NOAA precipitation maps: http://www.ncdc.noaa.gov/temp-and-precip/maps.php





h) Vulnerability and resilience after tropical storm Irene (September 11, 2011)

http://www.rutlandherald.com/article/20110911/ENVIRONMENT/709119910

In Pittsford the springs on my hillside never dried out this summer, and 8.1 inches of rain had already fallen in August when tropical storm Irene arrived two weeks ago. I expected widespread flooding — but I was still not prepared for the 5.5 inches of rain that fell in 24 hours. Our old Victorian house was built 165 years ago on a bluff far above the floodplain of the Otter Creek. The cliff is sandy and prone to landslides. After massive slides about sixty years ago, invasive shrubs and locust trees were planted to protect the bank. When Irene arrived, a landslide brought down some large trees across our power line.

With so much devastation around the state I expected to be without power for a week, so I was in awe when the CVPS crews arrived early next morning. A repair truck and a logging team with a crane worked four hours to remove a massive old maple tree and restring the lines. These repair crews had many long days ahead, but with route 4 East to Killington washed out, they had to wait for a temporary road to be built before they could even reach the cut-off mountain towns.

Big storms reveal our vulnerabilities and remind us that we must plan ahead. Our house had needed extensive work when we bought it 20 years ago. Water was flowing across the dirt basement. We dug the basement out and installed drainage pipes covered with gravel. Since then heavy rains have found ways through the old stone foundation several times. I fixed those leaks, but during Irene I needed old fiberglass roofing to divert water that was pouring from the roof away from the basement. Then in driving rain I dug a ditch, a project I had neglected for years, to channel water around the vegetable garden. But I was too late to prevent a twenty foot wide mudslide that swept away the bank nearby. Fortunately I had deliberately oversized a new culvert under our road a few years ago, and it proved just big enough at the peak of the storm.

With so much rain on wet ground, mountain streams rose swiftly, flooding towns and destroying roads and bridges across Vermont. More than a dozen mountain towns were cut off. Our road and rail networks proved vulnerable. Resilient Vermont communities got to work — long before state and federal help could be mobilized, community members were repairing roads and rescuing neighbors.

Within a few days local and state crews built emergency roads to the isolated towns. By the following Thursday, the town of Rochester received a delivery of 100 loaves of bread, sent via back roads from Baba-a-Louis bakery in Rutland. But it will take much longer to restore our entire damaged infrastructure — power, water and sewage — to its original condition.

This disaster has drawn our communities together. More frequent heavy rainfall events are likely, so let us ask the hard questions and plan ahead. Clearly we must leave more room for floodwaters. What was most critical in responding to this crisis? Did we have adequate back-up power systems, food and water supplies and fuel for heavy equipment? Do we need east-west paths across the mountains for emergency use? This was a warm-season flood, but Vermont also has had major floods with snowmelt and winter rain on frozen ground.

The Wardsboro excavator Harvey Plimpton spoke for Vermont's community spirit when he said: "Nobody gave us permission. We just started because we knew what had to be done. We put in 120 hours last week. We worked until we couldn't work. We still have a long way to go."

Central Vermont Regional Planning Commission: www.centralvtplanning.org/
Rutland Regional Planning Commission: www.rutlandrpc.org/
Vermont State Climate Office Irene page: http://www.uvm.edu/~vtstclim/?Page=Irene_flooding_2011.html

i) Understanding and dealing with a changing world (October 23, 2011)

http://www.rutlandherald.com/article/20111023/ENVIRONMENT/710239910

It has been an extraordinary year dominated by water and flooding. Precipitation has set new records from Ohio to Vermont. Slow moving weather patterns have favored rain in the northeast but extreme drought in Texas. In addition, evaporation-precipitation feedback has given us extra rain showers on many days. More rain increases the evaporation from the ground and wet leaves and the transpiration from plants. This increases the humidity near the surface. The moist air cools as it rises in thermals from the surface, and the humidity increases until the air becomes saturated and cloud droplets form — this is cloud base. As evaporation puts more water vapor into the air, the cloud base gets lower. And as more water flows up and condenses in clouds, rainfall increases. More rainfall keeps the ground wet, and the cycle continues.

Some days we have seen afternoon thunderstorms popping up everywhere on the weather radar maps. Other days the extra evaporation has simply intensified the bands of rain coming through with warm and cold fronts. Most of the water with tropical storm Irene had evaporated from the ocean, but the stronger evaporation over the wet land increased the rain a little more. And because the soils were already saturated, the very heavy rain just ran off — with catastrophic flooding as a result.

Day after day in the first week of October, we experienced very low clouds and fog in the early morning. Some days a steady drizzle fell, reminding me of the moorlands of England where I grew up. Then high pressure moved in as the weather pattern shifted very slowly to the east, giving us a warm glorious week with temperatures reaching the seventies.

I am still waiting for the first frost on my vegetable garden. The weather has been either too warm — or too wet and cloudy. I am grateful to still have basil and some tomatoes. My last spring frost was on April 20, so my growing season between frosts has set a new record of over 180 days. Everything is connected, and the global climate is changing. Further north in the Arctic, the melting sea ice almost set a new record last month.

When I give talks on climate change, a few listeners get angry when they realize we are endangering the well-being of the Earth and of our children and grandchildren. Some people feel overwhelmed and react with despair, because the challenge seems so great and our political systems so paralyzed. Others resonate with the fact that I am speaking from a position of hope, as I map out what is happening to the Earth and to Vermont. Sometimes a person will look up from their despair and ask with burning clarity, “Why are you so hopeful?”

This is a much deeper question than understanding and responding to climate change. For us as human beings, hope opens doors to possibilities that expand our vision and deepen our sense of communion. But despair closes us off from the real world of possibilities into a dark and isolated world.

Imagine the hope and joy of a summer sunrise immersed in the dawn chorus. Hope opens doors and frees us to be creative and joyfully work with each other and with the Earth as things change around us.

Climate change presents humanity with many difficult choices. If we first recognize the truth and choose hope over despair, we are freeing ourselves to work together and meet the challenges facing us.

NOAA precipitation maps: http://www.ncdc.noaa.gov/temp-and-precip/maps.php (see P9)

j) A miraculous protocol saved the ozone layer (December 4, 2011)

http://www.rutlandherald.com/article/20111204/ENVIRONMENT/712049924

Last month I was in Washington, D.C., for a meeting to review and celebrate the miraculous global agreement in 1987 known as the Montreal Protocol. I say "miraculous," because it was pushed through by a Republican administration with Democratic support — and ratified unanimously by the U.S. Senate. You may remember that this was an agreement to phase out the chlorofluorocarbons (CFCs) and other compounds containing chlorine and bromine that catalyzed the destruction of the stratospheric ozone layer that protects all of life from dangerous ultraviolet (UV) radiation.

The scientists sounded the alarm, and the dramatic ozone hole over Antarctica made the threat real to the public. Despite large scientific uncertainties, a Republican administration looked at the colossal risks, overruled business interests and negotiated the most far-reaching and successful global environmental agreement of all time. Without this agreement, we would now be in the midst of a global catastrophe. Stratospheric ozone would already have fallen by 20 percent, with a corresponding dangerous increase in UV radiation — and by mid-century the global fall of stratospheric ozone would have been so large that crop yields and life over the whole planet would have been seriously damaged. Of course we humans were worried because going out in the sun without full protection would have meant rapid sunburn, as well as a huge rise in skin cancer.

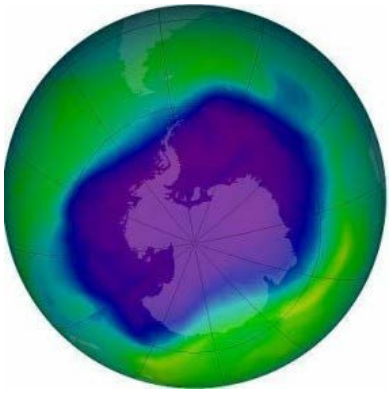


Figure 1. Antarctic Ozone Hole, September 24, 2006. (NASA's Ozone Hole Watch)

The Montreal Protocol allowed for sequential tightening of the reductions as the scientific evidence accumulated, and the total phase-out has been accomplished with remarkable speed and minimal cost. It will still take decades for the Antarctic ozone hole to recover, but we managed to save the rest of the planet just in time.

The reduction of these ozone-depleting gases is a clear example of why we must continually seek ways to eliminate the long-lasting waste products from our industrial civilization. This particular case had a big, unexpected benefit. Because the CFCs are powerful greenhouse gases, eliminating both the CFCs and their initial replacements, the HCFCs, has slowed climate change significantly. In fact, the Montreal Protocol has reduced the greenhouse-gas warming of the Earth by five times as much as the rather unsuccessful Kyoto Protocol.

This celebratory meeting had a second purpose: to contrast the success of Congress 20 years ago when it passed this global environmental agreement with its complete failure now to address the equally large threat to the Earth's climate from carbon dioxide, the greenhouse gas resulting from the burning of fossil fuels. Rather than phase in adaptive regulations to transform our energy economy and reduce emissions, the political response has been to deny the scientific evidence. Once again we face another catastrophe of our own making.

The public reacted strongly to the threat of ozone loss, because it grasped the imminent danger of skin cancer. What will be the similar wake-up call for climate change? Perhaps the increase in extreme weather around the globe — especially the more frequent floods and droughts that we are already experiencing — will convince enough people that the climate is changing now.

Over the past 20 years, the political system seems to have lost touch with the real world. During the worst drought on record, we see the tragic silliness of a presidential candidate praying for rain in Texas while campaigning for policies that are guaranteed to increase drought in the southern United States. If we want our prayers to be answered, we must work with the Earth rather than against her.

The Montreal Protocol: www.epa.gov/ozone/intpol