

Climate, Energy and Community: Vermont 2012

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This is a compilation of my 2012 Weekly Planet articles (and two feature articles) from the Sunday Environment page in the Rutland Herald and Barre/Montpelier Time Argus. This series started in January 2008; and an overview paper is available¹. 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 living with the earth system.

I believe that earth scientists have a responsibility to communicate clearly and directly to the public² – as we all share responsibility for the future of the Earth. We must deepen 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.

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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.

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a) A year of weather disasters and climate inaction (January 15, 2012)

<http://www.rutlandherald.com/article/20120115/ENVIRONMENT/701159942>

January is always a good time to take stock of where we are. On cold days I am particularly grateful that last spring I stacked enough dry firewood for this winter!

It was another warm December. My Brussels sprouts lasted till last week, and kale is still surviving under glass. By the winter solstice, my rye cover crop had grown so tall that I started to turn it over with a spade, because the soil was not yet frozen. I was still able to dig as late as Jan. 2 before the real freeze-up for the winter came.

These freeze-up dates for both soils and small lakes are important markers for our winter cold season, which is shrinking by about one week per decade climate warming. As the Arctic and Canadian ice melts, less sunlight is reflected — which speeds the warming and causes more water to evaporate. The moister atmosphere traps more of the Earth's heat. Both processes are accelerating the warming of northern latitudes.

Another global climate conference was held in Durban, South Africa last month, but there was no action to reduce carbon dioxide emissions. Global CO₂ saw the largest jump on record in 2010. The gulf between climate policy and climate science has widened further. One commentator from the journal *Nature* remarked that the climate train has left the station, and the politicians were left behind.

A new round of negotiations known as the Durban Platform will attempt to draft a new global climate agreement by 2015, binding on all nations, with an implementation date of 2020. So although there was some recognition that one day we will have to do something, action was deferred till the end of the decade. Since we are already two decades late in reducing our fossil fuel use, this means that adaptation for the Earth and our children will become still more difficult.

There were some local efforts around the globe. Australia followed Europe and introduced a small carbon tax, aiming for a tiny 5 percent cut in carbon emissions by 2020. The European court upheld an EU airline carbon emissions tax in the face of opposition from US, Canadian and Chinese airlines, and this modest tax began on Jan 1, 2012. It is a measure of how greedy, self-centered and self-destructive our societies have become that these baby steps in the right direction are met with great opposition. The U.S. House of Representatives passed a measure two months ago directing the U.S. transport secretary to prohibit U.S. air carriers from participating in the EU scheme if it were to become reality.

The new Vermont Comprehensive Energy Plan is encouraging. It calls for the state to satisfy 90 percent of its energy needs from renewable sources by 2050, largely eliminating its reliance on fossil fuels. This will require a steady push towards much greater energy efficiency, especially in transportation, home heating and electric use. It will not be easy, but at least the state is heading in the right direction.

But the real climate news of 2011 was that there were 32 extreme weather disasters across the globe that each caused more than a billion dollars of damage. Ten states in the United States were affected by weather disasters — blizzards, floods, droughts and tornado outbreaks — including, of course, tropical storm Irene here in Vermont. The increase in extreme weather in the past decade is a worrying reminder of what lies ahead, and why we need to build a more resilient infrastructure.

For 20 years now the United States has refused to face its responsibilities for mitigating climate change. As I watch the sun set on a clear warm January day, I know we face the somber reality of still more weather disasters in our future.

Vermont Energy Plan: <http://www.vtenergyplan.vermont.gov/>

b) Vermont winters are changing rapidly (February 26, 2012)

<http://www.rutlandherald.com/article/20120226/ENVIRONMENT/702269943>

In early February temperatures in Pittsford reached 50 degrees at my home in Pittsford. Several times this winter it has rained hard, leaving the ground bare. Some of my lawn is still green. Vermont seems to be moving from a winter climate with permanent snow cover to milder winters typical of southern New England. The three-month period, November to January, was the 2nd warmest on record. I have been finding mosquitoes sluggish but alive in mid-winter both inside and outside – a reminder that more pests can over-winter as the climate gets milder.

Mean winter temperatures in Vermont are increasing almost 1 degree (F) per decade, and twice as fast as in summer. The US Department of Agriculture just released new plant hardiness zone maps, which tell us what plants and shrubs will likely survive the winter. Since the 1990 map, much of the United States, including Vermont, has become warmer by about half a zone, meaning a 5-degree increase in average extreme minimum winter temperatures.

Most of Vermont, except for the Northeast Kingdom, is classified as Zone 4b corresponding to mean minimum winter temperatures between -20 and -25 degrees (F), and Zone 5a which corresponds to the range -15 to -20 degrees. Where I live in Pittsford, minimum temperatures have not fallen below -10 degrees this year, corresponding to Zone 6 – more like winters in Connecticut in decades past.

Minimum temperatures are determined mostly by the amount of water vapor and clouds in the atmosphere at night. Under cloudy conditions, nighttime temperatures do not fall much. When the sky is clear, air temperature drops quickly at night. The extent of cooling depends on how much water vapor is in the air, because water vapor is a powerful greenhouse gas that reduces the cooling of the earth to space. Temperatures drop the most when the sky is clear, cold and dry. At warmer temperatures when we get rain rather than snow across the northeast, water continues to evaporate from the soil – and the extra moisture in the atmosphere slows the cooling at night.

The Earth's climate will continue to warm, driven by the burning of so much fossil fuel by the global economy. What can we expect in the future? We will see a slow acceleration of the same trends that have become clear in recent decades. The winter frozen season when the ground and lakes are frozen will shrink by about 7 days per decade, winters will get less severe and the summer frost-free growing season will lengthen.

You may have noticed that more vegetable crops are available at the winter farmers' markets. As winters warm with more greenhouse gases in the atmosphere, more plants can survive even in unheated greenhouses and under poly-tunnels. My kale under glass is healthy. The sun is now climbing rapidly in the sky at noon as we approach the spring equinox, and farmers with greenhouses can put out seedlings for early crops.

So far this winter and last winter have been very different. Last year there was less westerly flow and a rapid exchange of air between the north and the eastern US, giving cold temperatures in Florida, record warm temperatures in Canada, while Vermont had average temperatures with more snow. This year the flow has been more westerly over North America with fewer bursts of arctic air from Canada, and the winter has been warmer with less precipitation. We cannot yet predict this type of shift in the climate system. In the short term, we can only adapt and be grateful, whatever the climate brings. But in view of the long-term consequences of climate warming, our society would be wise to change direction.

USDA hardiness zones: <http://planthardiness.ars.usda.gov/PHZMWeb/>

c) A glimpse into the future of our Vermont climate (April 8, 2012)

<http://www.rutlandherald.com/article/20120408/ENVIRONMENT/704089969>

What a remarkably mild winter it was! West of the Green Mountains we had no permanent snow cover this winter to reflect sunlight and keep temperatures cold. In Pittsford I was able to turn over my rye cover crop until the ground froze on January 3, and I was able to start digging again on March 11. So the period when the ground was frozen was only 67 days, rather than the historic 150 days. This is a true measure of how short the winter really was.

Actually it was the only the second warmest winter — December to February — on record in Vermont, and across New England; the record is still held by the winter of 2001-2002. When we include March, which has been exceptionally warm, a new record will be set.

The climate is changing, but not exactly in ways we expected. Last winter a deep trough in the jet stream over the eastern United States and Western Europe brought snowy winters. But this year a quasi-stationary ridge in the jet stream over the eastern United States brought us a mild winter with little snow. Meanwhile over Europe the jet stream plunged south in February and brought very unusual arctic cold and snow. As with the wet weather in 2011, we are seeing an increase in climate extremes because the large-scale waves in the atmosphere seem to be slowing down while their amplitude is increasing.

Researchers are beginning to think it is the warming of the Arctic that is driving this change in climate towards more stationary weather patterns, but the research will take a few years to complete. The more basic challenge we face is that the burning of fossil fuels on such an immense scale is moving the rather unstable climate of our planet into unexpected directions — and we are not prepared because we cannot rely on the past as a guide.

So I am adapting on the fly. My kale wintered over under glass for the first time, and we have been eating the best fresh tender kale I have ever tasted. As an experiment, I then planted lettuce, arugula and spinach on March 1, which came up in time for the warmth of mid-March. Then I planted sugar snap peas on March 14, weeks before I usually plant, and they too have sprouted as temperatures rose into the 80s by the first day of spring.

This was by far the warmest Vermont weather we have seen in March. Daffodils came up in profusion — three weeks early — and our forsythia was glorious. I remember only 20 years ago being concerned, when we planted the first forsythia, whether it would flourish given our cold winters!

From a climate perspective, the combination of a warm stationary ridge over the northeastern part of the country with early snow and ground melt gave us this exceptionally early transition from a mild winter into an early spring. Typically this transition comes three days earlier for every degree increase in monthly mean temperature, and it has been advancing by about three days each decade as winters get warmer.

I did cover my lettuce, spinach and peas for the frosts in late March as a precaution, and I will wait till April to plant more. The resilience and adaptability of the natural world to a changing climate offers some reassurance. The dry, warm winter has simplified the recovery from the floods of tropical storm Irene and reduced spring flooding, but it has meant a very short ski season. It also means we move into warmer weather with less soil moisture than usual in spring.

This winter and early spring give us a glimpse into the future of our Vermont climate. The warming trend will slowly accelerate as we continue to burn fossil fuels, with increasing extremes of precipitation that will be less predictable.

d) Climate change requires us to become an energy-efficient society (May 20, 2012)

<http://www.rutlandherald.com/article/20120520/ENVIRONMENT/705209944>

After writing these columns about our changing weather and climate for four years, it seems time for some blunt realism. I read a pithy summary last month by Ken Caldeira on the Web site Climate Progress, which went like this: “When we use the atmosphere as a free waste dump for the CO₂ greenhouse gas emissions from our energy system, we are transforming the Earth to a hothouse climate that last existed on this planet when the dinosaurs were the top predators. Is this ethical and fair to our children, when we could convert our energy system to an efficient one that is not carbon-fuel based for only about 2 percent of our GNP?”

Well the dinosaurs will not be back to eat our grand-children, but this radical change in climate will drastically affect life on Earth. Yet we are surrounded by deception and outright lies everywhere. Jon Huntsman was the only Republican presidential candidate who accepted the science of climate change. Jokingly he thanked his wife for this — she said she would leave him if he denied the science like the other candidates. What are these politicians thinking? It was the integrity of the founding fathers that gave birth to the American dream. How can it survive without a respect for the land and the Earth?

Scientists are starting to protest more strongly about the fabricated arguments and personal attacks coming from those who are getting rich from the fossil fuel industry. With \$20-trillion of fossil fuel reserves at stake, the corruption is not surprising. But given the damage to life of Earth that is in progress, our opposition is essential.

Self-centered arguments abound. Our global demand for oil is pushing gas prices higher — so we complain it is costly to drive our heavy SUVs and trucks. In Europe, gas costs \$10 a gallon, so cars are smaller and more efficient. Not surprisingly, public transport is also far better.

There is no free lunch here — we are deeply in debt to the Earth. We have already used up our allowance of fossil fuel. But few are willing to pay the small price for the technologies that would help us make the needed transition to an energy-efficient society, where most of our energy comes from renewable resources. Fortunately Vermont is moving honestly towards this transition, one which will make our houses warmer and more comfortable in winter — and less costly to heat — and give us diverse sources of electricity. We still need to replace our vehicles with more efficient ones and develop a much better public transport system for the state.

In a recent 30-minute Insight interview on PEG-TV in Rutland, I discussed what is happening to the weather and climate of Vermont in recent months and years. The six months ending March 2012 set new high temperature records in every northern state from the Dakotas to Maine. I have enjoyed early lettuce and spinach and fresh vegetables this warm spring. But as the climate gives us a longer growing season in Vermont, people further south face much more difficult growing conditions from higher temperatures and longer droughts.

The future of the Earth — and the Vermont landscape — affects us all and our children. With the coming of another spring, we should resolve to find solutions that strengthen our connections to the Earth and slow the accelerating pace of climate change. We need well-designed solar and wind farms and high efficiency biomass plants that are sensitive to local issues.

We will never get away from our fossil fuel addiction if we are simply afraid of change. In Britain, the Red Flag law that required steam-driven coaches on highways to travel at 4 miles per hour with a flagman walking in front was not repealed until 1896, during my grandfather’s childhood. We resist change — but sometimes change is necessary.

Alan Betts on PEG-TV: <http://www.uvm.edu/~epscor/new02/?q=node/825>

e) A lost generation: No progress on reducing climate change (July 1, 2102)

<http://www.rutlandherald.com/article/20120701/ENVIRONMENT/707019999>

Twenty years ago, in a flush of enthusiasm at the end of the cold war, participants at a United Nations conference in Rio forged the Convention on Climate Change to protect the Earth. This led to the Kyoto Protocol to reduce greenhouse gas emissions. Unfortunately the U.S. Congress refused to sign this protocol, and it proved ineffective.

Meetings and scientific reports have followed every few years, with many declarations of intent — but no progress on binding international agreements. Global fossil fuel use has continued to rise. The follow-up meeting this month in Rio, called Rio+20, is promising far less.

Many governments have tried to direct investment towards developing and implementing renewable energy technologies to speed the transition away from fossil fuels as our primary energy source. Vermont is moving along this path. But political opposition to this energy transition has been rising, as those who maintain that climate change isn't for real have started to campaign against renewable energy as well.

There are two key issues here: One is financial and economic; the other is ideological. We have long subsidized the fossil fuel and nuclear industries. Now it would be smart to withdraw those subsidies and subsidize renewable energy instead. But the fossil fuel reserves are worth tens of trillions of dollars, and the industries involved are fighting to keep their subsidies. Our political system has become very costly, and consequently many politicians rely on kickbacks from wealthy industries for reelection. This means that companies can buy votes in Congress.

Many argue that without subsidies renewable energy is not yet competitive with fossil fuels. On the surface this is true. But fossil fuels only appear cheap because their extraordinary costs are being deferred to our children's lifetime. Worse still, these costs — climate change, weather extremes and species lost forever — cannot simply be paid off by our children in depreciated dollars. These are accumulative, long-term costs that for the most part cannot be mitigated.

The second ideological thread is a recent development. Twenty years ago the Republican governments of Ronald Reagan and George H. Bush pushed through the Montreal Protocol to protect the ozone layer and the Clean Air Act Amendments to reduce air pollution, despite industry opposition. They accepted the science and were proved right: Global regulation of gases that destroy ozone in the stratosphere was essential to save the Earth from an ozone catastrophe. They also understood the key role of the Environmental Protection Agency in regulating harmful air pollution from coal-fired power plants. And this awareness led to the reductions in harmful acid rain that was drifting eastward from these Midwestern power plants and affecting lakes and forests in the Northeast. They recognized that this was our common interest – to regulate human impacts on the Earth before they become too damaging.

We still face the same challenge. How do we balance the common interest against corporate profits and individual rights and freedoms? Our challenge is actually much broader — we must reconcile human interests with the preservation of the Earth's climate and its ecosystems, on which we are so dependent. Unfortunately, our collective awareness of these common interests seems to be slipping away, as society disintegrates into polarized groups, each convinced of different realities. The Internet has made it so easy to spread disinformation and cultivate different fantasy worlds.

Meanwhile summer is here. In the Arctic the sea ice is melting rapidly, and sea levels are rising as the Greenland ice cap melts. Our politicians may have buried their heads in campaign sands, but the Earth will have the last word.

Rio+20 Conference: <http://www.unccd2012.org/>

f) Vermonters debate wind energy: Public input is part of the process (July 8, 2012)

Elizabeth Gibson and Alan Betts

<http://www.rutlandherald.com/article/20120708/ENVIRONMENT/707089961>



*Searsburg
wind farm,
Vermont,
operating
since 1997*

Our environmental challenges are tractable if they are openly and honestly discussed. A heated topic right now is the 20-turbine wind project installation proposed for the ridgeline known as Grandpa's Knob, which spans the towns of Castleton, Hubbardton, West Rutland and Pittsford.

The developer, Reunion Power, is meeting with stiff opposition from local select boards and some community members. This kind of debate is becoming more familiar across the state as renewable energy technologies and wind power especially are being proposed — and in many cases — installed.

Regardless of any position on this project, a fundamental principle is at stake: the importance of the legal process in any well-functioning society. It is a process that depends on reliable information from all parties, open discussion and informed decisions.

The applicable process in this case is set forth by Section 248 that outlines the procedure by which the Public Service Board issues a "Certificate of Public Good" with regard to utility projects.

The Public Service Board is a quasi-judicial board that supervises the rates, quality of service and overall financial management of Vermont's public utilities. The PSB must review the developer's plans for the project and consider input from other parties, including the Agency of Natural Resources and members of the public.

This review process was the topic of an informational meeting sponsored by the Rutland Regional Planning Commission at the Rutland Intermediate School on June 30. As that meeting made clear, public input is an integral part of the review. The process is only as comprehensive as the various parties make it. The complex framework of a land-use decision such as this must rest on a solid foundation of information that spans local issues in the context of Vermont's patterns of energy uses and energy sources. The final decision is made only after all that information has been reviewed.

Input from a well-informed public, therefore, is crucial to the quality of the final decision. This requires us to develop our understanding of the state's energy and environmental challenges as well as our appreciation of local concerns.

Electricity consumption accounts for about one-third of Vermont's total energy use, after transportation and

heating. The state has enjoyed relatively stable electricity prices over the last 20 years, much of it provided by Vermont Yankee. But this year Vermont utilities are expected to end purchases from Vermont Yankee as they continue to transition to new long-term contracts with Hydro Quebec and others.

Most Vermonters agree that it's important to develop local power resources. And most recognize that we must find alternatives to burning fossil fuels because of their adverse impact on our environment. The importance of energy efficiency is likewise well understood.

Beyond this point, positions diverge. The parties have different concerns: environmental, economic, political and social. Despite these various perspectives, the glaring question remains: How can we as a society respond to the sober reality of climate warming?

Vermonters are having this conversation, in many contexts. What role do the various renewable energy technologies have to play in the state's future? How can our biomass resources be properly managed? Are large-scale wind turbines appropriate on our ridgelines? What about small-scale hydro power? And are we focusing enough attention on simple, energy-saving measures such as upgrading our aging housing stock?

No question arouses as much debate as the issue of large-scale wind installations. Some see them as a valuable economic resource and a symbol of hope as we make the great transition away from a fossil fuel economy which is devastating Earth's ecosystems. Others regard them as an insult to our ridgelines; one that threatens a unique and irreplaceable resource that is part of our identity as the Green Mountain State.

The proposed \$100-million Grandpa's Knob wind installation has already been opposed by officials in the towns of Castleton, Hubbardton, West Rutland and Pittsford. The Agency of Natural Resources has expressed reservations about the project.

But, as John Burke of the Public Service Board explained at the June 30 informational meeting, that does not stop the developer from seeking approval from the PSB. "They have every right do so," Burke said.

Reunion Power has not yet filed any application for a Certificate of Public Good with the PSB.

Steve Eisenberg, managing director of Reunion Power, says, "All we ask is the opportunity to present our project and for all stakeholders to keep an open mind until a site plan is on the table. Many of those who are against wind power and the project are working with misinformation. The true impacts and the facts will speak for themselves."

As Vermont moves forward with renewable energy, many complex and often conflicting issues are emerging. Vermont has large wind-power resources; although, many potential sites cannot readily be connected to the power grid. The state lacks an overarching policy on wind project development and location. Under the present system, the PSB addresses the pros and cons of each unique location on a case-by-case basis.

Some of the most significant issues at this juncture are: How can we best educate ourselves so we are contributing to a comprehensive review of these projects? If local opposition preempts PSB review, are we denying ourselves an important opportunity to develop our collective understanding of the complex issues involved? And in the long-term, how can we best prepare ourselves to deal with the challenges of crafting Vermont's energy future?

Vermont Public Service Board Section 248 Process: <http://psb.vermont.gov/statutesrulesandguidelines/>

g) Finding our way to a sustainable future

(August 19, 2012)

<http://www.rutlandherald.com/article/20120819/ENVIRONMENT/708199965>

This summer most of the central United States has been suffering the worst drought and highest temperatures in 75 years. These conditions follow record temperatures and reduced snow cover during winter and spring, with low rainfall in April, May and June. Wildfires have been more severe and extensive, and crop losses are expected. Except for the western United States, most states have seen record temperatures for the first seven months of this year.

Vermont has been exceptionally warm in 2012, with January to July temperatures running almost 5 degrees above normal. This was the first summer in years that I have had to water my vegetable garden a couple of times — in most Vermont summers since 2002 we've had rainfall well above normal amounts.

Last year's floods washed a lot of phosphorus into Lake Champlain from agricultural land and bank erosion. The excess of this nutrient, combined with warm temperatures, has led to excessive algal blooms in the lake. But conditions are even worse in the Midwest, where high temperatures and low stream flows have killed tens of thousands of fish.

There is no doubt that the climate is changing. The Arctic snow cover in June set a new record low, and in mid-August the sea ice is melting at a record pace. The warming of the Arctic appears to be changing the large-scale weather patterns in the northern hemisphere. Scientists are still trying to understand the many processes involved. At the same time the subtropical drought areas are spreading northward. Last year Texas and New Mexico were severely affected; this year it is the central United States.

Each year brings unique weather patterns, and this country sees only one small part of a global phenomenon. We can only grasp the broad picture when we look back at the whole year — or the past decade.

Our society is afraid to look critically at the broad picture, and we suffer as a consequence. The 2012 political platform of the Texas Republican Party actually opposes the teaching of “critical thinking skills” in schools, on the grounds that critical thinking challenges student's fixed beliefs and undermines parental authority.

Traditional beliefs and authority are immensely valuable if we are living with a stationary climate and a long-term, “seven-generation” vision of a sustainable society. But our society has a very short-term horizon, which treasures growth — till the bubble bursts — and is happy to trash the Earth if it is profitable. We must teach energy and climate literacy in our schools; yet in many parts of the country these subjects cannot be taught because they are correctly perceived to undermine traditional beliefs and vested interests.

What happens if we don't accept responsibility for our actions and policies? The Earth simply responds to our inputs of greenhouse gases and the contaminants we add to the waterways. We don't like that — but there is little we can do about it as long as we are heading defiantly in the wrong direction.

One central issue we must face is how to use our technology to benefit both humanity and the Earth. Technology created our present human world and many of our global environmental problems, and it is embedded in a world where humans struggle with greed, injustice, inequity and warfare. We need new technology to find our way to a sustainable future — but clearly we have to manage it better because the current impacts on the Earth have become unsustainable.

This means that by design, our infrastructure and our products must maximize their energy efficiency and minimize their waste streams. End-to-end recycling or remanufacturing is essential. The transition will take time and will require constructive community discussion because it is so radically different from our present economic model.

h) The leaders we've been waiting for

(October 7, 2012)

<http://www.rutlandherald.com/article/20121007/ENVIRONMENT/710079850>

The presidential election rushes towards us, but the Earth is not a hot topic. The downward spiral of sea-ice and snow cover in the Arctic is being ignored by the campaigns, despite new record lows that suggest the Arctic will be largely ice-free by late summer in a decade. The connection to the record temperatures and drought that have humbled America's food harvest are being airbrushed away.

No politicians are addressing the critical and tragic questions. How can we feed the world's people as extreme floods and droughts, driven by accelerating climate change, bring food scarcity? How many will starve this winter while we burn some of our shrunken corn supply as alcohol in our cars?

Last year the primary drought was in Texas, and the Governor's response was to pray for rain. This year the drought has spread across the heartland of the United States, and the political response is to deny that it is connected to national policies that are driving global climate change.

In our small state, Efficiency Vermont – the first energy-efficiency utility in the nation – has saved Vermont homes, businesses and schools millions of dollars in reduced energy costs through incentives and educational efforts. It is a small but important step toward transforming our society into an efficient one powered by renewable sources of energy.

Yet in the unreal world of Congress, Rep. Sandy Adams (R-Fla.), who sits on the House Science and Technology Committee, got 181 votes in favor when she introduced an amendment that would “prohibit the use of funds for maintaining, developing or creating any Web site which disseminates information regarding energy efficiency and educational programs on energy efficiency specifically to children under 18 years of age.”

How dangerous that our children might glimpse the truth: Either we create an energy-efficient society with open eyes or no amount of fossil fuel money can hide the collapse that is rushing towards us.

Policy analyst Dan Sarewitz has suggested that science actually makes environmental controversies worse, because “science supplies contesting parties with their own bodies of relevant legitimated facts about nature.”

In essence, each side selects the evidence that supports their case. The political world, where creative lying is now accepted, goes further and fabricates the supporting “evidence.”

In Vermont we see this played out in the controversy over wind power. At the core is a value issue – whether we want our ridgelines to be part of our working landscape, supplying us with local renewable power for decades to come, or whether undisturbed ridgelines are such a sacred part of Vermont's self-image that putting large turbines on them is unthinkable.

But we are not seeing a reasoned debate about this fundamental value choice. Wind developers are methodically plodding through the engineering and environmental steps to get approval from the Public Service Board, while opponents are rushing in to demonize wind farms on ridgelines, using selective “evidence” to make people fearful.

Exceptions are rare but informative. In Grafton, Allan Sands, the chairman of the Select Board and a retired Vermont state forester, says the key is to become educated firsthand. He is arranging visits to the Lempster wind project in New Hampshire, which has been operating since 2008. He said a lot of his concerns were dispelled by the visit and by talking to residents. He reports that the project site has experienced three or four dead bats, but the area around the towers shows clear signs of bear, deer and moose.

As campaigns based on fear undermine our society, it is wise to remember that it is the truth that sets us free. But it is up to us to take a stand. As 97-year-old activist Grace Lee Boggs succinctly puts it: “We are the leaders we've been waiting for.”

i) Extreme weather and climate change

(November 11, 2012)

<http://www.rutlandherald.com/article/20121111/ENVIRONMENT/711119989>

“Nature is an awful lot more powerful than we are.” New York City Mayor Michael Bloomberg

Extreme weather is increasing in the United States and around the world. How is this trend related to climate change?

Kevin Trenberth, senior scientist at the National Center for Atmospheric Research in Boulder, Co., comments, “The answer to the oft-asked question of whether an (extreme) event is caused by climate change is that it is the wrong question. All weather events are affected by climate change, because the environment in which they occur is warmer and moister than it used to be.”

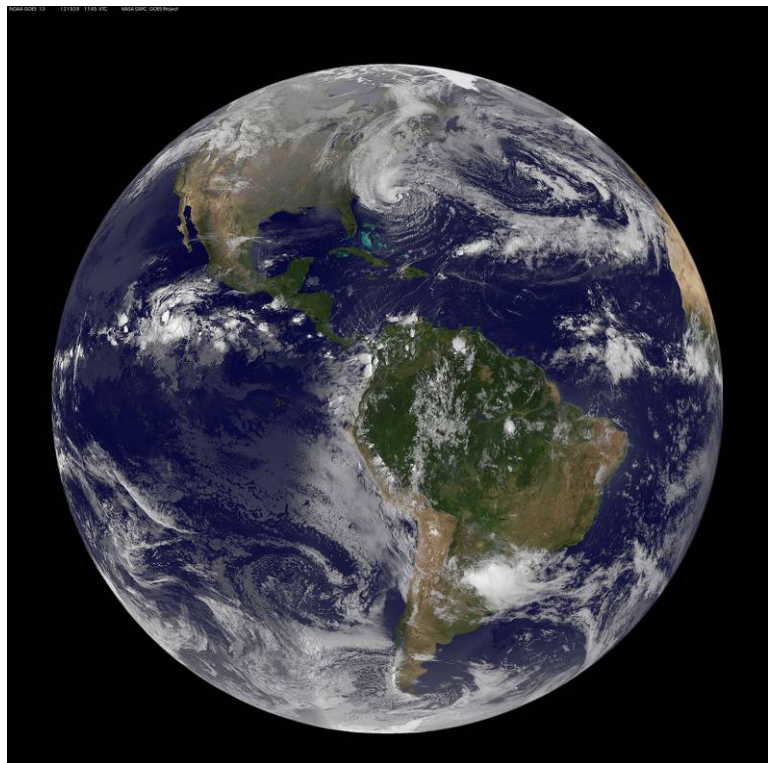
The recent superstorm that devastated the New York and New Jersey shorelines is a tragic example of the interplay between severe weather, the changing oceans and climate. As Hurricane Sandy churned up the east coast from the Caribbean, it turned toward the shore, merged with a strong mid-latitude system and developed into an extreme storm.

Several climate factors influenced both the strength of the storm and its devastating impact.

The New York City subway system was built about 110 years ago. During that period mean sea level has risen about a foot on the eastern seaboard, because one of the effects of climate change has been to warm the oceans and start the melt of some ice-sheets.

The strong long-lasting northeasterly winds from the storm, blowing towards the coast, generated a record storm surge of over 13 feet at high tide, which flooded the south end of Manhattan and many subway tunnels. On the New Jersey shore, the storm surge and damaging waves severely damaged many communities. Strong winds brought down trees and power lines across the Northeast, leaving nearly eight million customers without power.

The intensity of the storm was amplified by Gulf Stream temperatures that were as much as 5 degrees above normal. In high winds and at warmer temperatures, more water evaporates, moistening the atmosphere. The rising moisture condenses in thunderstorms, which release the tremendous heat of condensation and produce torrential rain – some coastal areas saw as much as eight inches of rain.



Credit: NASA Goddard Space Flight Center image from the NOAA GOES-13 satellite at 1145 UTC, October 28, 2012. On this satellite image of the Earth, Hurricane Sandy is coming up the east coast from the Caribbean. It is turning towards the shore and developing into an extreme storm, as it merges with a strong mid-latitude storm.

This huge energy release intensifies the storm, its winds and the storm surge further. The warmer ocean temperatures that play a key role in this amplification are partly caused by the ocean circulations in the Atlantic and also by the warming of the oceans as they absorb the extra energy that the Earth cannot radiate to space because of increasing greenhouse gases in the atmosphere.

Most hurricanes that track northward up the eastern seaboard curve towards the east, as they are steered by the westerly flow in the middle atmosphere. Sandy followed a typical track northward but then turned sharply to the northwest into the New Jersey shore, steered by an unusual atmospheric circulation. A strong blocking high pressure off the Greenland coast and a high-amplitude wave in the jet stream prevented Sandy from turning northeast. These conditions may be related to the warming of the Arctic, which is changing the winds in the northern hemisphere.

There was record Arctic sea-ice melt this fall. But these changes in weather patterns are still so new and the atmosphere so complex that it will take several more years of research to get a fuller picture.

Fortunately the European weather forecast model had correctly predicted Sandy's unusual track a week ahead, giving local communities and government agencies ample warning to prepare. Unfortunately some preparations take longer than a week. The storm surge from tropical storm Irene in August 2011 came within a foot of flooding the tunnels at the south end of Manhattan, making the storm risk to the subway system apparent. But sadly this warning was ignored.

Sea level is expected to rise three to five feet this century as ice sheets continue to melt in a warming climate. Unless we move away from a fossil fuel economy, this rise will continue to accelerate for centuries. A major storm like Sandy shows how much of the coastal zones are vulnerable to flooding.

In the short term, building resilience into our coastal infrastructure will buy us a decade or two. But we will have to face the unpopular reality that we cannot long protect homes built on coastal shorelines, especially the barrier islands. In the longer term, the costs from ongoing climate change to human society become unimaginably large – estimates exceed \$1000 trillion – and the costs to the Earth's ecosystems are incalculable. Wise risk management would spend the far smaller sum needed to transform our society into an efficient one, powered largely by renewable energy.

We can learn directly from catastrophes. Rebuilding following Irene has drawn our communities together and catalyzed a statewide reappraisal of how we could better manage our rivers and flood plains in preparation for more frequent extreme rain events in the coming decades.

Last week the Mayor of New York City, facing the devastation from Sandy, recognized a basic truth when he said, "Nature is an awful lot more powerful than we are." Bloomberg continued, "I want our president to place scientific evidence and risk management above electoral politics."

Perhaps if enough of us speak up at the grassroots level President Obama will appreciate these truths also, and start to realign the government and our energy system with the realities of the natural world — rather than the interests of the fossil fuel economy. This process will take a generation, and we must start now.

j) Water plays key role in weather and our lives

(November 25, 2012)

<http://www.rutlandherald.com/article/20121125/ENVIRONMENT/121129950/>

Early in the morning, I love to watch the clouds and the rising sun reflected in the still waters of the flood plain below our house. Water is at the heart of our lives and the climate of Earth. In the sky, water vapor, a crucial greenhouse gas, slows the cooling of the Earth to space. Too much can give us muggy summer nights, while too little gives us the bitter cold of clear nights in deep winter.

Without the greenhouse gases, water vapor and carbon dioxide, the Earth would not be habitable. Over hundreds of millions of years, plant life on Earth through photosynthesis has been drawing on the CO₂ in the atmosphere, storing some of it in the Earth as fossil carbon. Now we are burning these stored fossil fuels in a century or so, pushing the earth towards the much warmer climate of a hundred million years ago.

The balance between plants, water, CO₂ and sky is a fascinating one. Using a few percent of sunlight, plants convert CO₂ and water into their tissues and energy stores - like the carbohydrates which provide food for humanity. But at the same time, they also lose water when their stomata, the tiny pores in leaves, open to take in CO₂. The evaporation of this precious water absorbs much of the sun's energy, and this keeps the leaf and the surface of the Earth cool.



Reflected clouds at dawn in Pittsford (2 Nov 2012)

What is left of the sun's energy heats the surface — enough to drive thermals that lift the water vapor, cooling as it rises, until it condenses in the updrafts of clouds. This condensation releases the energy coming from the sun that evaporated the water, providing the driving force for thunderstorms, which transport water high in the atmosphere. Most falls out as rain, sometimes hail, while some flows out in cirrus clouds, evaporating again to give the Earth that precious greenhouse blanket of water vapor high in the atmosphere.

Plants take water from the soil, use some to grow and evaporate some into the air. Clouds lift the vapor and recycle most of it as rain in summer to moisten the soil downwind. On average, garden vegetables, field crops and forests need at least a tenth of an inch of water every day. Our summer rainfall averages about 3 to 4 inches a month, so it is just enough. The soil serves as a buffer; each foot of soil can store about two inches of water and supply roots with water for a couple of weeks if there is no rain. Trees that have deeper roots can withstand droughts for much longer periods.

In early spring the ground is saturated with water after snowmelt. This provides extra water for the flush of spring growth into the early summer. But last winter was warm, with much less snow that melted quickly. We began spring with less water in the ground, and we also had a drier summer in Vermont. This was the first summer in years that I needed to water my vegetables once or twice.

Much of the plains and mountain states had even less summer rain than Vermont, after a winter with below average snowfall. Because the spring soils were dryer, less water could evaporate — giving less rainfall as a result. When a high pressure settled in over the central part of the country, severe to exceptional drought conditions developed across 40 percent of the U.S. mainland. Without water the humidity fell, forest fires blazed, and record temperatures baked the land and shriveled crops.

Water plays a central role in most weather extremes and disasters. Wet soils and warm oceans increase evaporation and amplify storms and floods. Dry soils reduce evaporation and transpiration from plants, which can lock in drought over the continent.

Most of the time we take water for granted. But these extreme weather events remind us that water deserves our gratitude as a sustainer of life, and our humble respect as a major force in our climate.