

Climate Change and the Public Interest

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***Committee on Natural Resources,
Fish, and Wildlife***

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Dr. Alan Betts (bio)

- **Independent Vermont climate scientist**
 - funded by NSF and NASA since 1980
- **Fellow of the AGU, AMS, RMS, AAAS**
- **Past-president of Vermont Academy of Science and Engineering**
- **Author of 170 reviewed papers**
- **Recipient of several prestigious awards**
- ***Details at* <http://alanbetts.com/about>**

Climate Science is Critical

- **Climate change is accelerating**
 - *Shifting energy system away from fossil fuel is only way to slow down changes*
 - **Science and technology are critical**
 - Social issues go far beyond science
 - **Honesty is critical**
 - Deception means Earth wins & we lose

Collective Global Climate Statement

An international coalition of **33 meteorological and climate societies and institutions** have released a **Collective Global Climate Statement to coincide with Earth Day on 22nd April.**

“ The scientific evidence is now overwhelming: our planet is warming, largely due to emissions of greenhouse gases from human activities.”

Climate developments demand enhanced evidence-based action

Scientific evidence

The scientific evidence is now overwhelming: our planet is warming, largely due to emissions of greenhouse gases from human activities. A recent report from the World Meteorological Organization highlights that in 2016 a new record for global average temperature was set (approximately 1.1°C above the pre-industrial level), sea ice extent reached record lows, global sea level increased to a new record, and a wide range of extreme climatic events displaced hundreds of thousands of people across the world. Greenhouse gas concentrations in the atmosphere have now also reached a record level with carbon dioxide surpassing 400 parts per million, about 44% higher than in the pre-industrial era.

The Paris Agreement needs to be implemented urgently

The social, environmental and economic impacts of climate change will continue to grow unless action is taken now. Meeting the challenge effectively and efficiently requires an immediate and collective global response that is fit for the scale and urgency of the threat, is supportive of the UN Sustainable Development Goals, and is implemented through appropriate policies informed by evidence.

To avoid the largest risks we urge governments to implement fully and urgently the commitments they made in Paris in 2015 to ensure the future global temperature increase is limited to well below 2°C above the pre-industrial levels, to pursue efforts to limit the increase to 1.5°C and to cut greenhouse gas emissions to net zero¹ in the second half of this century.

A global, evidence-based response is essential

A key element of the Paris Agreement is a commitment from governments to review collective progress periodically, as new science and the experiences of implementing the agreement accrue. Policies can only be informed by robust evidence if there is a sustained, global, collaborative commitment to maintaining and developing an appropriate scientific evidence base.

Evidence includes the monitoring of the state of the climate through the Global Climate Observing System and the assessment with models of the risks to human societies and the natural world at local, regional and global levels associated with different levels of future emissions. New evidence and knowledge needs to be evaluated independently and synthesized for it to be useful for policymakers and governments. All such efforts, including the work of the Intergovernmental Panel on Climate Change, must continue to receive the appropriate funding and resources to enable them to provide the necessary scientific advice.

Role of meteorological and climate services

Meteorological and climate services are an essential element of the response to climate change. They provide early-warning information and understanding of present-day climate variability, projections of future changes, and they inform mitigation and adaptation options. We encourage national meteorological services and private meteorological bodies to continue to develop effective tools and systems for use by decision makers.

Development opportunities

Tackling climate change and addressing the Sustainable Development Goals together presents the opportunity for improving the quality of people's lives in many different ways. This includes protection of the natural environment and the services it provides, improvement to people's health and the development of new services and technologies bringing jobs and prosperity.

Prompt action is required now to build the foundations of our future success. That will require the widest possible cooperation and collaboration, between countries, business sectors, civil society and science, including education, research and innovation.

¹ Net-zero balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases.



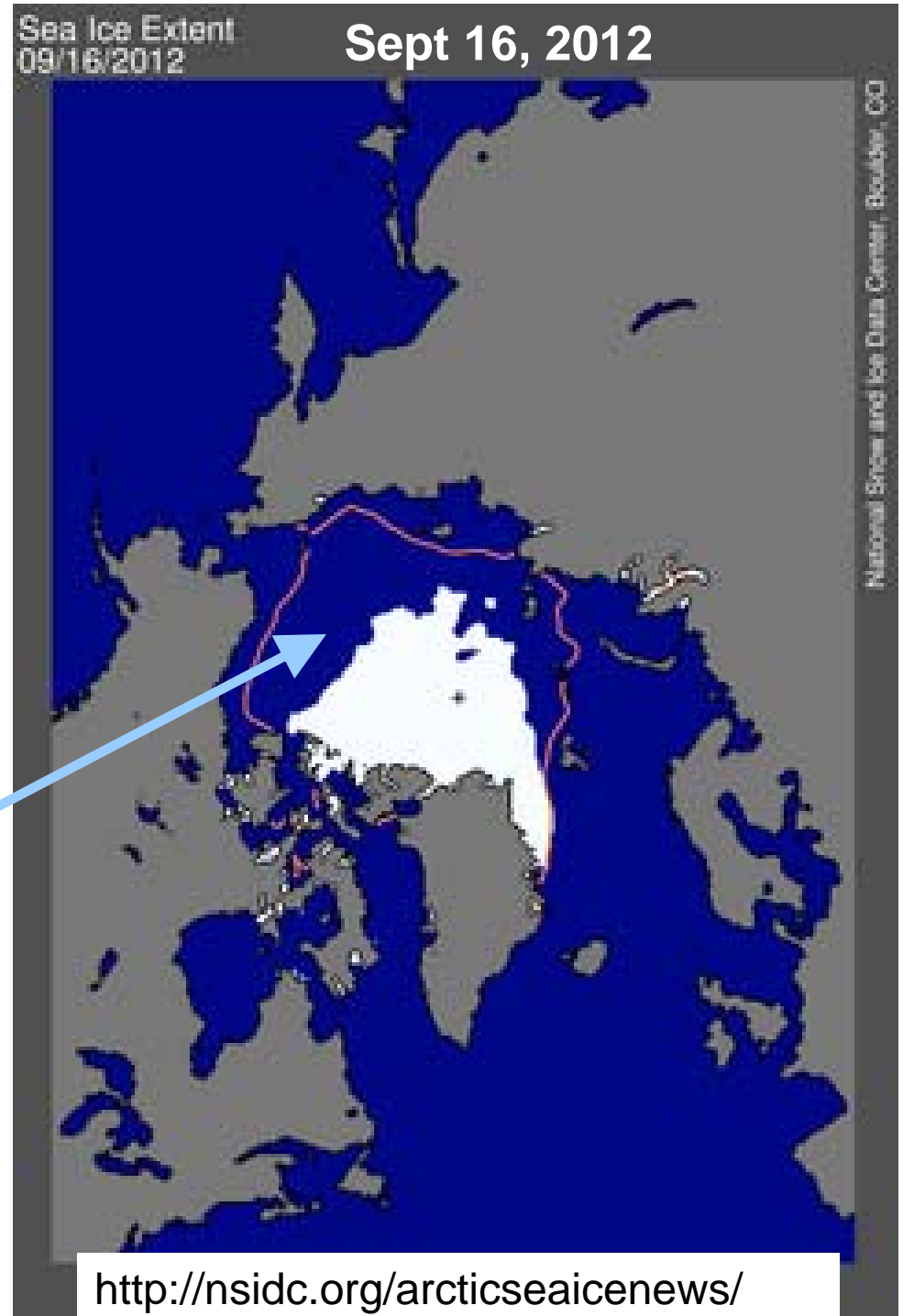
Fundamentals

- ***Burning fossil fuels: transforming climate***
 - *Many water cycle amplifying feedbacks*
 - *Heading for high CO₂ “Carboniferous era climate”*
 - *Ice melting; Climate extremes increasing*
- **Avoidance of responsibility for decades**
 - Politicians, professionals, public
 - Climate change accelerates with ‘business-as-usual’
- **Linked to unmanaged waste streams**
 - Soluble by changing system guidelines
 - Pricing CO₂ emissions
 - Create efficient society, based on renewable energy
- **Choices are value based**

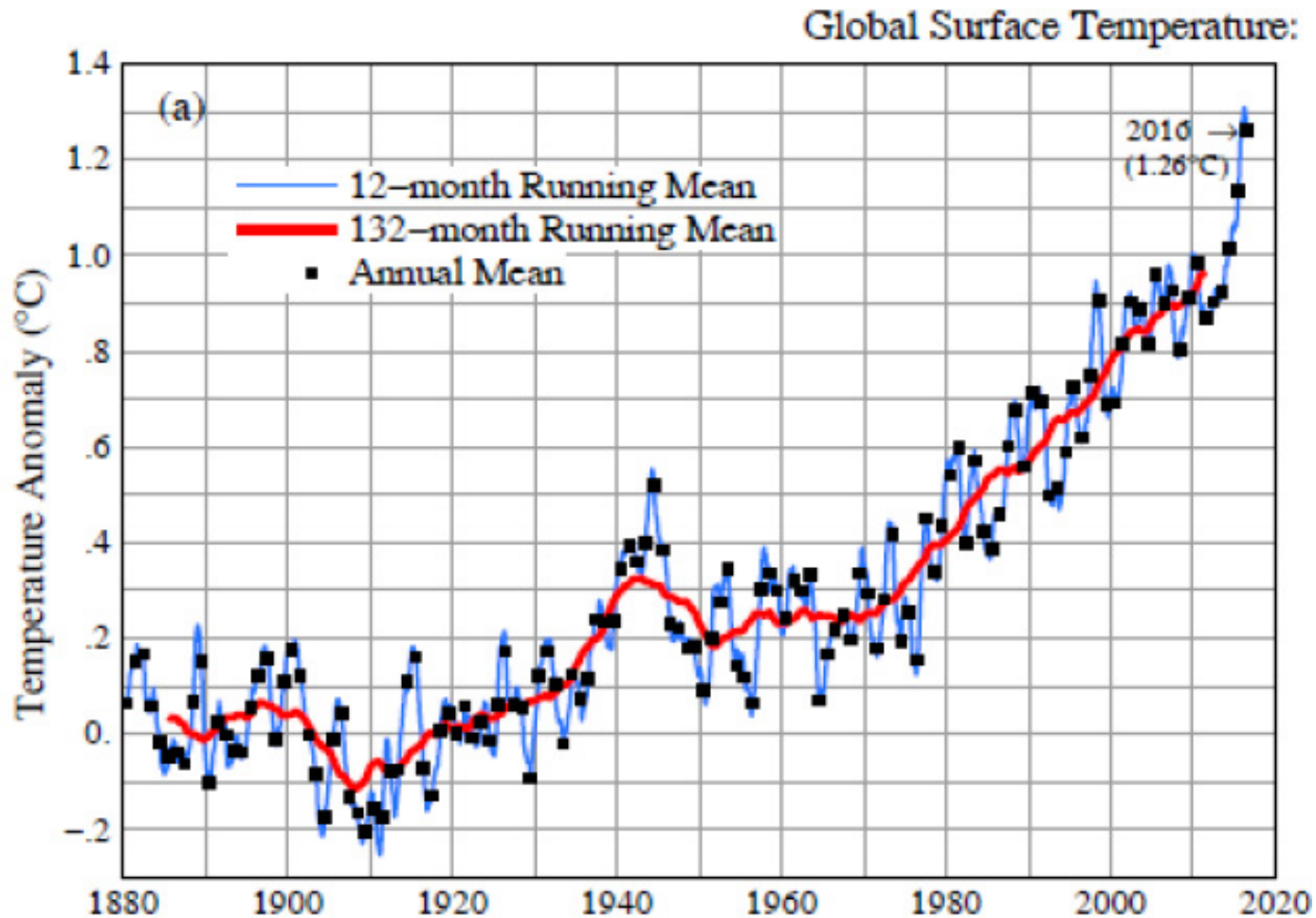
- **Half the Arctic Sea Ice Melted in 2012**
- **Open water in Oct. Nov. gives warmer Fall in Northeast**

- Feedbacks amplify:
- **Less ice, less reflection of sunlight**
- **More evaporation, larger vapor greenhouse effect**
- Same feedbacks as in our winters

(Arctic sea-ice at new record lows: Oct 2016 - present)



Long-term Global Mean Trend 1880-2016



Gardening in Pittsford, Vermont in January



January 7, 2007

December 2006:

- Warmest on record



January 10, 2008

Warm Fall:

- Record Arctic sea-ice melt
- Snow cover in December,
ground unfrozen

February 5, 2016

(Digging in Feb. first time ever)

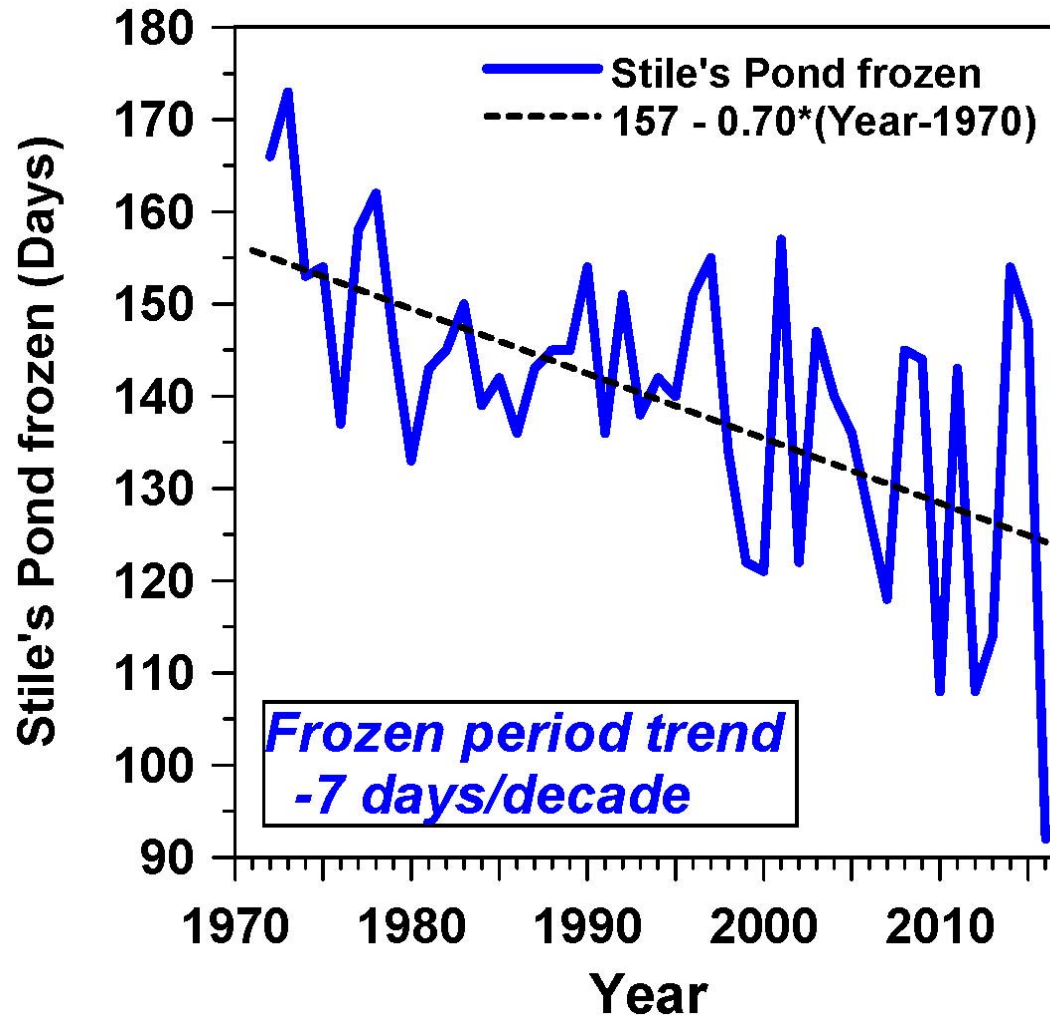


March 3, 2017



Vermont's Reference Lake

Frozen Period Shrinking: variability huge



Steve Maleski: "Eye on the Sky"

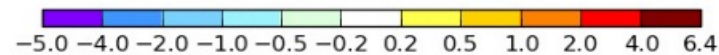
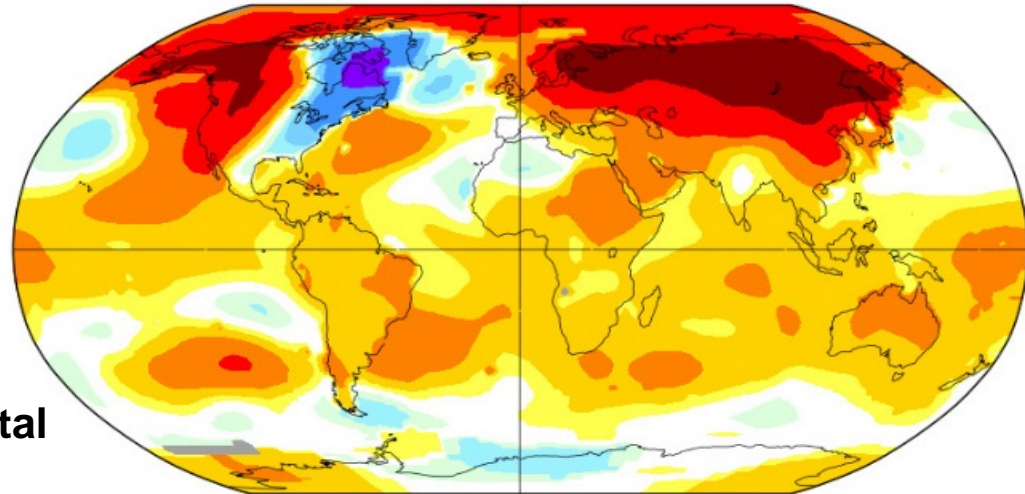
Jan-Feb-Mar 2015

Warm Atlantic, cold NE, strong coastal storms - Boston record snow

Jan-Mar 2015

L-OTI(°C) Anomaly vs 1951-1980

0.86



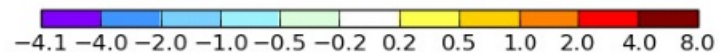
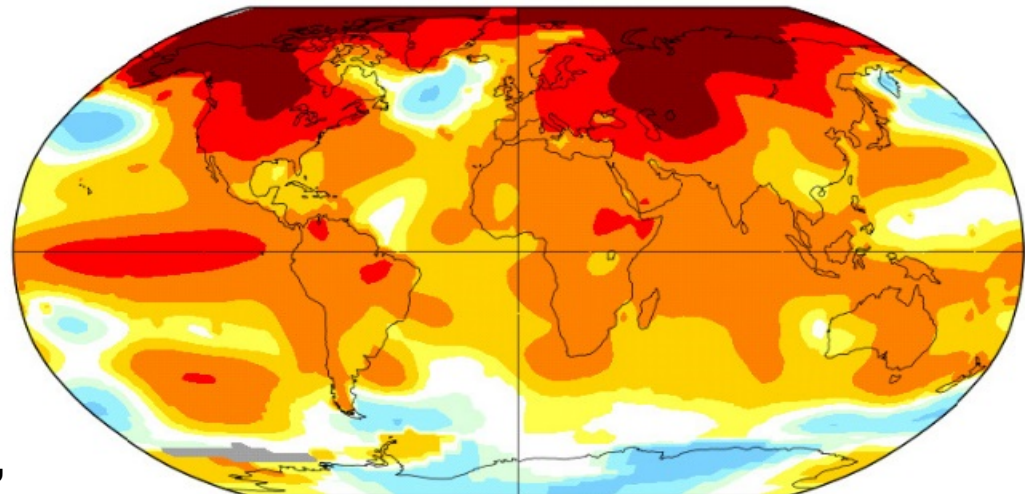
Jan-Feb-Mar 2016

Warm Atlantic, warm NE, little snow, warm Arctic

Jan-Mar 2016

L-OTI(°C) Anomaly vs 1951-1980

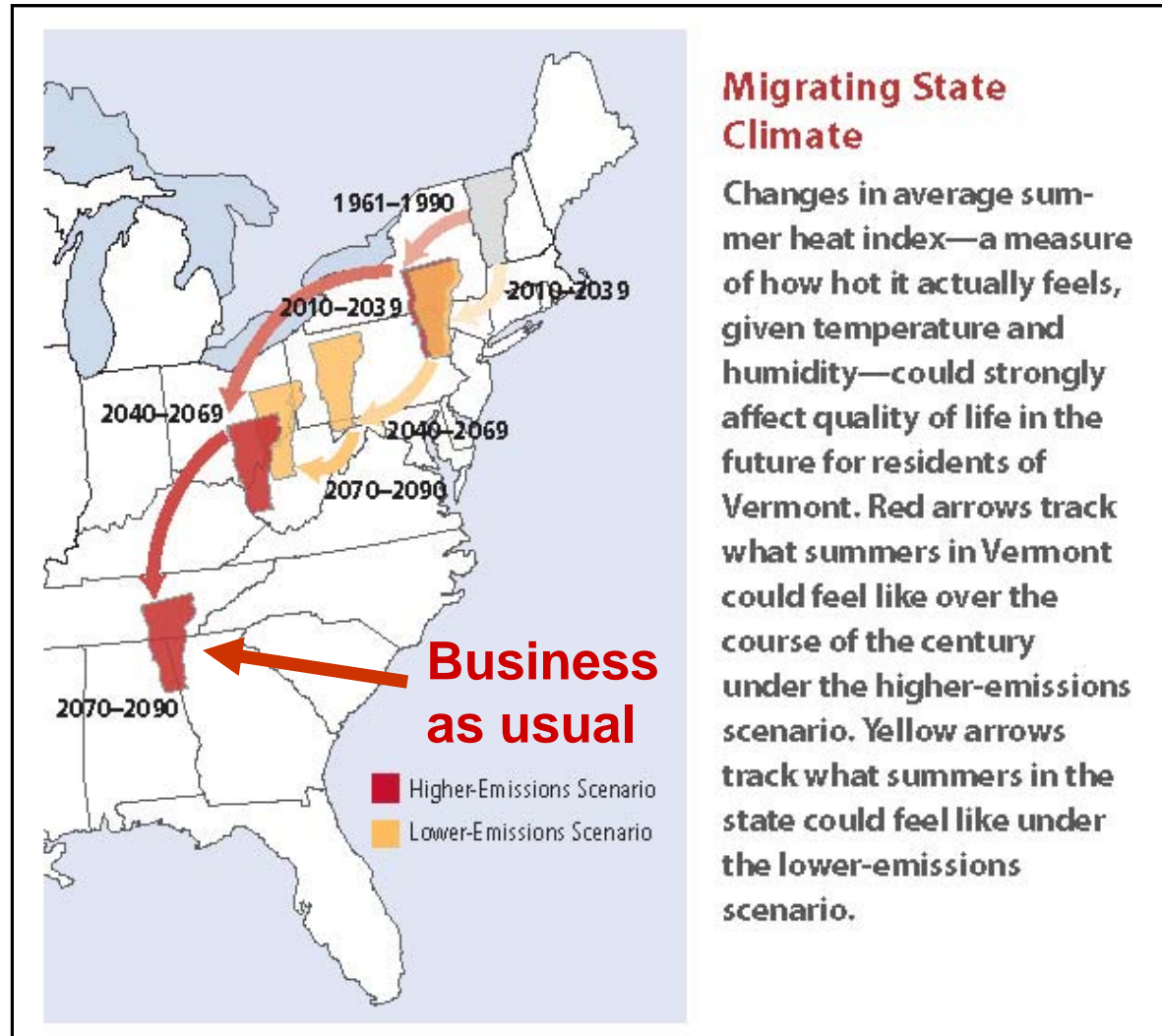
1.24



Vermont's Future Climate with **High** and **Low** GHG Emissions

What
about VT
forests?

Sub-tropical
drought areas
moving into
southern US



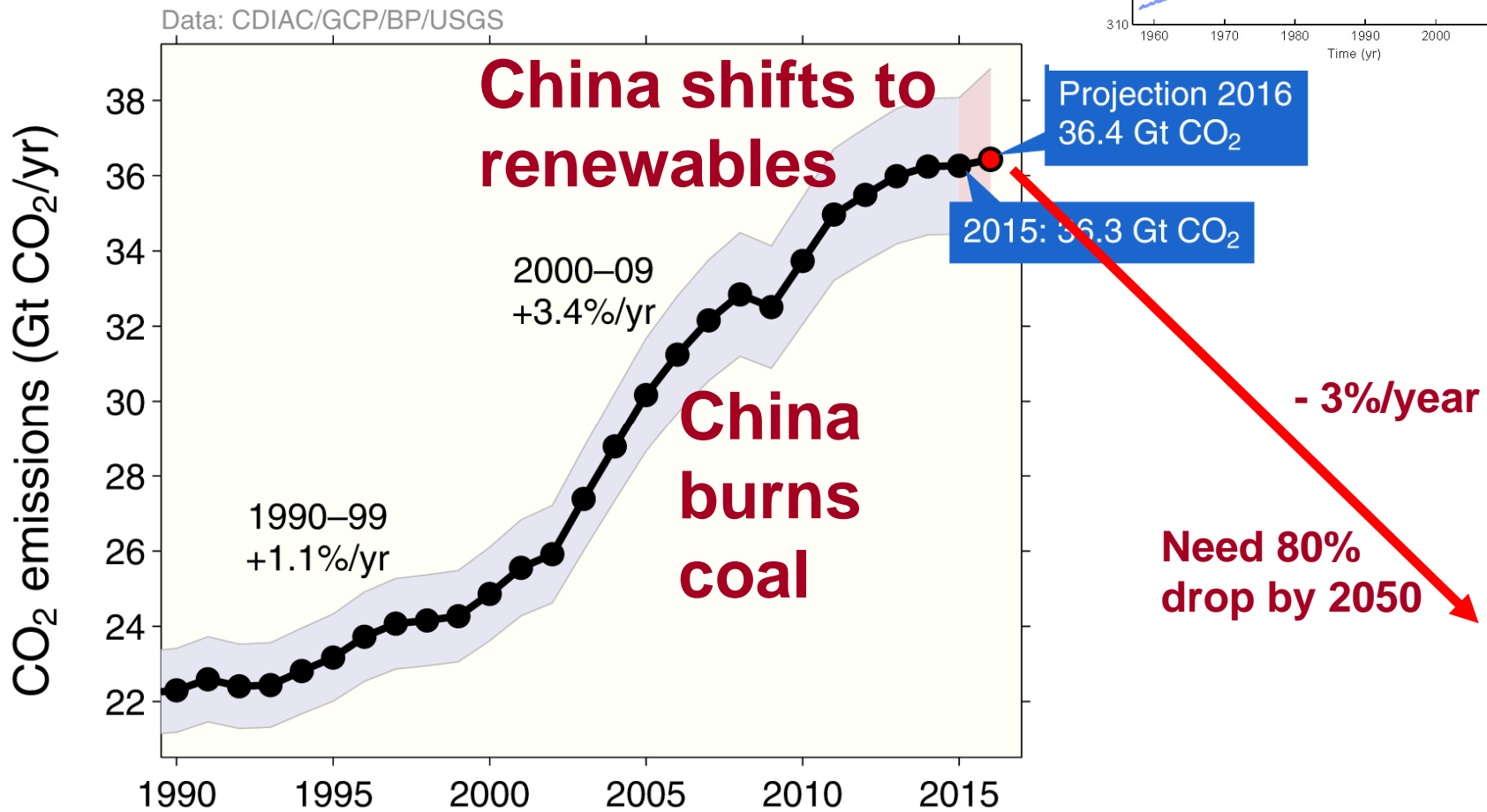
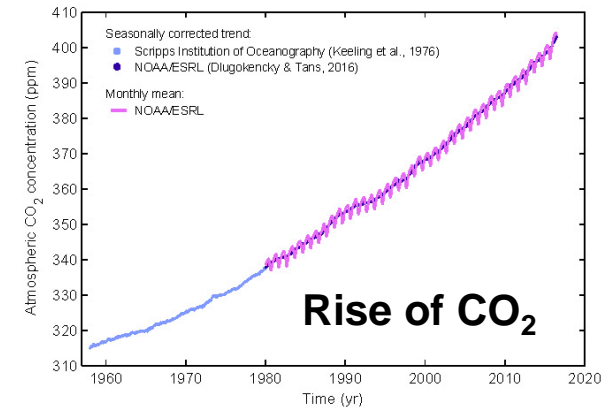
**NECIA,
2007**

Can We Stop “Dangerous Climate Change”?

(UNFCCC 1992)

- **Yes: Quickly stabilize atmospheric CO₂**
- **This means an 80% drop in CO₂ emissions!**
- **Technically possible but very difficult**
 - **Fossil fuels have driven our industrial growth and population growth for 200 years**
 - **“Lifestyle” has become dependent on fossil fuels**
 - **Powerful vested interests**

Growth of CO₂ Emissions Flat for 3 years



Efficiency Comes First

- **We need to double or triple our energy efficiency because...**
 - **We cannot replace current fossil fuel use with biofuels & renewable energy**
 - **Fossil fuel reserves are enough to push CO₂ to 1,000 ppm**
 - *Radically change climate/wipe-out many species*
 - *In time melt icecaps, raise sea-level 150ft*

System Guidelines

- **Reeducation of society and its 'systems'**
 - Transition is huge: needs change of mindset
- **Fully cost CO₂ emissions/pollution**
- *Develop renewable energy*
 - *Power, housing, transport*
 - *Maximize energy efficiency*

Issue of Values

- **Do we continue to exploit the Earth**
 - For greater ‘economic growth’
 - For a wealthy few
 - What will be left for our children?
 - What happens to the ecosystems we depend on?
- **Fundamental practical moral issue**
 - Accept our responsibility for Earth’s future
 - Co-operate with the Earth (or we lose)

Discussion

alanbetts.com

(articles and talks)

What is a pollutant?

- **First it was the obvious hazards to health**
 - Smoke/smog from burning coal and exhausts
 - Toxic contaminants dumped in drinking water
 - These were regulated by the Clean Air and Clean Water legislation in 1980's & 1990's
- **But many of our waste products that look harmless to humans are hazards to life on Earth**
 - CFCs that destroy the ozone layer that protects life
 - CO₂ from burning fossil fuels, driving climate change
 - Plastics dumped into the oceans
- ***In our disconnected human world, these are harder for us to deal with***