

2013 SENATE NATURAL RESOURCES

SCR 4024

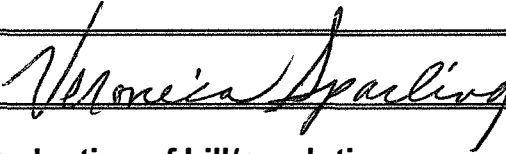
2013 SENATE STANDING COMMITTEE MINUTES

Senate Natural Resources Committee Fort Lincoln Room, State Capitol

SCR 4024
March 7, 2013
19571

☐ Conference Committee

Committee Clerk Signature



Explanation or reason for introduction of bill/resolution:

A concurrent resolution directing the Legislative Management to study the effects of climate change on this state

Minutes:

Attachments

Chairman Lyson opened the hearing for SCR 4024.

Sharon Buhr, a concerned health care provider from Valley City, presented written testimony. See attachment #1. (Ends at 10:59)

Senator Triplett asked whether this resolution was meant as a public political statement or whether Ms. Buhr really expected a study to be done.

Ms. Buhr stated she was depending on the senators to determine that.

Senator Triplett asked if Ms. Buhr has researched how much money the universities in our state are spending to research this issue.

Ms. Buhr said she hadn't.

There was some general discussion about climatic changes and whether we know what causes them.

Senator Unruh stated that the studies referred to in Ms. Buhr's testimony were from 2008. She asked whether Ms. Buhr had used any more recent studies in her researching of the issue.

Ms. Buhr said she could provide more recent studies. She chose this one because it was from the National Conference of State Legislatures. She felt that was an appropriate source to cite for this committee. (See page 8 and 9 of attachment #1.) Ms. Buhr also referenced attachment #2 that had websites of studies done on global warming. (Ends at 17:30)

Senator Hogue asked Ms. Buhr what she thinks of the NASA studies that detail the expanding footprint of the icecap at the South Pole.

Ms. Buhr said she would have to research that more.

Verl Reineke testified in favor of SCR 4024. See attachment #3. He spoke as someone trained in theology. He feels the passage in Genesis 2:7 that instructs man to till the earth instructs us to serve the earth, to take care of it. See attachment #3. (Ends at 24:50)

Mike McEnroe, representing the North Dakota Chapter of the Wildlife Society, spoke in favor of SCR 4024. See attachment #4.

Senator Hogue asked Mr. McEnroe whether there was data on the habits of the migratory birds.

Mr. McEnroe said he could provide the committee with the data. (This was submitted on March 12, 2013 and is attachment #7.)

There was discussion about the trends of the waterfowl migration changing. (Ends at 29:50)

Opposition

Charlie Bullinger, private citizen, who is trained as a scientist and has lived here his whole life, spoke in opposition to SCR 2024. He has studied this issue since the mid-1990's. He feels this is a global issue and he doesn't feel a study done on North Dakota would add much to the knowledge base on the topic. There are others studying this much more widely. He distributed a copy of an environmental engineering newsletter that is published weekly. See attachment #5. He emphasized the highlighted parts of the newsletter. He feels qualified to speak on this issue because he has been in emission control for over 30 years. He is a Registered Professional Engineer in North Dakota and Minnesota, and he is an advisor to three international committees: he chairs one of those committees. One of those committees is seeking solutions to the carbon dioxide issue. The real issue is that it is a complex problem and won't have a simple solution. He has patented a device that reduces emissions and improves efficiency. He travels the world widely. He handed out a report he got last week. He read from attachment #5, page 6, paragraph 2 "The Week Was..." and on page 7, paragraph 1, "More Failing....." and paragraph 2 on page 7 about Roy Spencer. The measurements show no warming. It is ill advised to spend taxpayer money and take on a global issue that many others are studying. Climate change involves many other variables. He also read from attachment #6 printed in 1922.

Jeff Magrum, Emmons County Commissioner, feels the state is already spending a lot of money on climate change. The new Tier Four engines, required by the federal government, have lower emissions. The federal government is also requiring them to add urea to the blades in the county. That is an additional expense to the counties.

Senator Triplett, District 18, is familiar with the Energy and Environmental Research Center in Grand Forks. They have one of the largest CO2 sequestration projects in the history of the world. This was funded by the Bush administration quite a few years ago through the Department of Energy who defined 7 geographic regions across the US and put out requests for proposals within those regions. The Energy and Environmental Research

Center in Grand Forks was successful in getting one of the contracts to work on CO2 sequestration and utilization in the Great Plains area over a 10 year period. The amount spent in the Great Plains area over the 10 year period is somewhere around a billion dollars. Large studies require large funding. What the legislature could do would not add to the body of knowledge.

Chairman Lyson closed the hearing for SCR 4024.

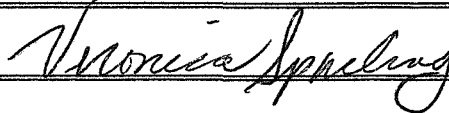
2013 SENATE STANDING COMMITTEE MINUTES

Senate Natural Resources Committee
Fort Lincoln Room, State Capitol

SCR 4024
March 8, 2013
19654

☐ Conference Committee

Committee Clerk Signature



Explanation or reason for introduction of bill/resolution:

A concurrent resolution directing the Legislative Management to study the effects of climate change on this state

Minutes:

Chairman Lyson opened the discussion for SCR 4024.

Senator Unruh made a Do Not Pass motion.

Senator Burckhard: Second

Senator Triplett said if there were more time she might want to amend this bill, but even at that the topic is too large a study for an interim committee to take on. She does appreciate the concern for the topic.

Roll Call Vote: 7, 0, 0

Carrier: Senator Triplett

Date: 3-8-13
Roll Call Vote #: 1

2013 SENATE STANDING COMMITTEE
ROLL CALL VOTES
BILL/RESOLUTION NO. 4024

Senate Natural Resources Committee

☐ Check here for Conference Committee

Legislative Council Amendment Number _____

Action Taken: ☐ Do Pass ☒ Do Not Pass ☐ Amended ☐ Adopt Amendment
☐ Rerefer to Appropriations ☐ Reconsider

Motion Made By Unruh Seconded By Burckhard

Senators	Yes	No	Senators	Yes	No
Senator Lyson	✓		Senator Triplett	✓	
Senator Burckhard	✓		Senator Murphy	✓	
Senator Hogue	✓				
Senator Laffen	✓				
Senator Unruh	✓				

Total (Yes) 7 No 0

Absent 0

Floor Assignment Triplett

If the vote is on an amendment, briefly indicate intent:

REPORT OF STANDING COMMITTEE

SCR 4024: Natural Resources Committee (Sen. Lyson, Chairman) recommends **DO NOT PASS** (7 YEAS, 0 NAYS, 0 ABSENT AND NOT VOTING). SCR 4024 was placed on the Eleventh order on the calendar.

2013 TESTIMONY

SCR 4024

#1

Testimony on the Climate Change Resolution, SCR 4024
Senate Natural Resources Committee
Thursday, March 7, 2013 at 9:45 am
Fort Lincoln Room of the State Capital

Chairman Lyson and the Senate Natural Resources Committee, thank you for letting me speak with you today. And thank you to Senator Robinson and the other legislators who have had the forethought to co-sponsor this important resolution.

My name is Sharon Buhr, and I am from Valley City. You may wonder why I am speaking to you today about the importance of climate change. I am a health professional and am worried when reading scientific journals over the past few years on how global warming is causing increases in vector-borne diseases like malaria and other diseases that are common causes of death in children over the world. One of the many references is Environmental Health Perspectives, March 2011.

In addition I own a farm near Tower City, which my great grandfather homesteaded in 1879. North Dakota is a very special place for me, and I want to see the land and the people of North Dakota protected. Climate change may not affect what happens in my life but that of my children and grandchildren—and yours.

WHAT ARE WE TALKING ABOUT WHEN WE SAY CLIMATE CHANGE?

1. For all of human history until about 300 years ago, our atmosphere contained 275 parts per million (ppm) of carbon dioxide. That is a useful amount, because without some carbon dioxide and other greenhouse gases that trap heat in our atmosphere, our planet would be too cold for life on Earth.

Now in 2013 our planet has 392 ppm of carbon dioxide, and this number is rising by about 2 ppm every year.

350 parts per million is what scientists and climate experts are stating is the safe upper limit for carbon dioxide in our atmosphere. Above 350 ppm we risk reaching dangerous 'tipping points', a point in time when the earth's climate begins to change in ways we can't undo in our lifetimes, or many, many generations. An example of a tipping point is the melting of the polar ice caps and the Greenland ice sheet. They have melted faster in the last 20 years than in the last 10,000. A comprehensive satellite study confirms that the melting ice caps are raising sea levels at an accelerating rate.

Bottom line, we need to decrease the carbon dioxide in our atmosphere from 392 ppm down to 350 ppm.

2. Because of the increase in carbon dioxide in the atmosphere, the temperature of the earth has risen 1.4 degrees Fahrenheit (0.8 degrees C) over the past century. It is projected to rise another 3.2 - 7.2 degrees F over the next hundred years.

An international accord of 167 countries in 2009, called the Copenhagen Accord, agreed to accept the scientific view that the increase in global temperature should be below 2 degrees Celsius (or 3.6 degrees F).

At the 30th Annual Red River Basin Land and Water International Summit Conference in Grand Forks in January, the keynote speaker stated that there is a gradient between the North Pole and the equator, but we are losing this gradient as the ice cap melts. Because of climate change the jet stream has become unstable, and it is now 'all over the place' which is one reason we're having more extreme events.

Small changes in the average temperature of the planet can translate to large and potentially dangerous shifts in climate and weather. Many places have seen changes in rainfall, resulting in more floods, droughts, or intense rain, as well as more frequent and severe heat waves. As these and other changes become more pronounced in the coming decades, they will present challenges to our society and our environment. It is important that North Dakota study what is happening with climate change in relationship to our state.

HOW WILL CLIMATE CHANGE AFFECT NORTH DAKOTA?

The National Conference of State Legislatures has studied 13 states in relationship to how climate change will affect them. North Dakota was one of these states. I have attached their report for you entitled, *North Dakota—Assessing the Costs of Climate Change*. As I understand it, this group is a bipartisan organization that serves the legislators of the nation's 50 states. It provides technical assistance to legislators on the most pressing state issues. Its website has a wide variety of insightful papers on climate change.

This organization states clearly that "the earth's climate is changing, and some states are beginning to see the effect—an increase in extreme temperature events, lower water levels in lakes and streams, and increased forest fire risk are a few of the visible signs."

In the specific document on North Dakota the National Conference of State Legislatures continues, "In the coming decades, a changing climate is likely to affect North Dakota's economy. The most recent climate modeling predicts higher temperatures and worsening droughts for the state. These changes could be more pronounced if global emissions of greenhouse gases are not reduced. Agriculture, water resources and tourism may be affected in a variety of ways and could result in significant losses."

A new study out of the University of Washington states that as the planet warms, the labor capacity will be reduced. In other words, people who work outdoors will not be able to work as long outside in peak months of heat. That can certainly affect our economy. If carbon dioxide and other greenhouse gases continue to rise scientists are projecting New York City will be as hot as Bahrain is today.

The December 17, 2012 issue of Newsweek, specifically addressed North Dakota. They asked the question, 'what will we eat' if temperatures continue to rise. A Stanford

University professor states that already a mere rise of 1 degree Fahrenheit over the past 50 years has caused a 5.5% decline in wheat production. This affects us in North Dakota. This affects me, my farm. All farmers know that what crops are raised on their land depends on the climate.

For the health of all the people in North Dakota, for our children and grandchildren, and to protect the beautiful state we live in, I URGE YOUR COMMITTEE TO VOTE TO SUPPORT Climate Change Resolution, SCR 4024 and to recommend funding the resolution so a proper study of climate change in North Dakota can take place.

Thank you.

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NORTH DAKOTA

ASSESSING THE COSTS OF CLIMATE CHANGE

CLIMATE TRENDS IN NORTH DAKOTA

The climate in North Dakota can be severe: blizzards, floods, droughts, tornadoes, hail storms, thunderstorms, high winds, severe cold spells, and extreme heat are not uncommon.¹ The state experiences cyclical droughts, with semi-arid conditions prevailing in the western half of the state. The eastern half receives most of the precipitation, primarily as rain in the spring and summer.²

During the past 100 years, the average annual temperatures in the northern and central Great Plains have risen by about 2° F. The latest IPCC report predicts the state could experience an increase in temperature of nearly 7° F by 2100.³ Extreme weather events in North Dakota—including periods of decreased rainfall and severe drought, and more intense rainfall when precipitation occurs—are projected to increase in frequency.^{4,5}

These changes in climate are likely to cause economic losses to North Dakota's vital agricultural sector. If drought and climate variability increase as predicted, crop and livestock productivity are likely to decrease. Climate change also may cause losses in the tourism industry and increase the cost of maintaining infrastructure.

ECONOMIC IMPACTS⁶

Agriculture

The agricultural sector is a prominent part of North Dakota's economy, with wheat contributing the most to North Dakota's income—about \$4.5 billion annually.⁷ The state also produces flax, seed potatoes, barley, sugar beets, oats, soybeans and sunflowers.⁸ In 2006, North Dakota was 11th in the nation in agricultural exports, with an estimated value of \$1.9 billion. The agricultural sector supports about 22,300 jobs, both on the farm and in the food processing, storage and transportation industries.⁹

The state agricultural sector has experienced significant losses due to drought. In 2002, the state lost \$223 million due to crop damage caused by drought.¹⁰ The drought in 2006 cost the livestock industry more than \$32 million, according to economists at North Dakota State University. The losses occurred largely due to an increase in the cost of feed, which rose more than 50 percent in some areas due to smaller harvests. The same 2006 drought inflicted more than \$425 million in damages to crops, resulting in nearly \$309 million in crop insurance indemnity payments.¹¹ Grazing also

OVERVIEW

In the coming decades, a changing climate is likely to affect North Dakota's economy. The most recent climate modeling predicts higher temperatures and worsening droughts for the state. These changes could be more pronounced if global emissions of greenhouse gases are not reduced. Agriculture, water resources and tourism may be affected in a variety of ways and could result in significant losses. Since state economies are directly linked to the economies of neighboring states and regions, policymakers may wish to consider both state and regional policies.



was drastically reduced due to drought conditions, forcing producers to sell livestock as well as land, and many cattle did not survive.¹² Drought conditions cost the state on average an estimated \$228 million annually, resulting in the loss of approximately 360 jobs each year.¹³ Droughts also are costly because they increase the probability of fire. During the 2006 drought, approximately 45,000 acres of grassland burned, and 50 percent of counties were under burn bans throughout the summer.¹⁴

North Dakota's agricultural sector also has seen losses due to an increase in crop pests, which has been attributed to factors such as erratic weather conditions and higher winter temperatures—conditions consistent with the effects of climate change.¹⁵ Agricultural losses from plant diseases exceed \$1 billion annually and reduce business activity in the state, resulting in additional indirect losses. Fusarium head blight in wheat, barley and durum resulted in nearly \$5 billion in losses from 1993 to 2005. Direct losses to farmers' income from the disease during 2005 were estimated at \$171 million, while the overall effect on the state's economy was a loss of more than \$544 million.¹⁶

Other diseases and insects infect a range of commodities, reducing state revenue by several hundred million dollars annually.¹⁷ A recent report by the Harvard Medical School found that projected climate change impacts—such as droughts, higher temperatures, and more frequent intense weather events—will help spread plant pests and diseases and are likely to create more losses for the agricultural sector.¹⁸

An economic analysis by researchers at Towson University estimated that, due to pest outbreaks, 2,500 people lose their jobs each year, while the economic impact tops \$1.5 billion dollars annually.¹⁹

Water Supplies and Infrastructure

Droughts and rainfall events also affect infrastructure and water supply. The worst drought in North Dakota's history lasted from 2000 to mid-2006, straining public water supplies throughout the period. On August 23, 2006, the U.S. Army Corps of Engineers was forced to increase flows from Garrison Dam in North Dakota to supplement the low water levels of the downstream Oahe Reservoir along the Missouri River. Lake Oahe was at a record low of 1,571.3 feet above sea level (compared to a typical average of 1,610 feet).²⁰ The drought directly affected hydropower production and contributed to the worst fire season on record.²¹

Drought also has affected North Dakota's transportation infrastructure. In Fargo, the clay beneath the city has shrunk from lack

of moisture, leading to cracked sidewalks, driveways and streets.²²

Heavy rains may cause problems for the water system and infrastructure. Drought-like conditions inhibit soil absorption of rainwater, resulting in an increase in runoff and the likelihood of flash floods following heavy rain. In 2002, the state experienced \$2.35 million in flood damages to roads, streets, bridges and water drainage systems in rural areas.²³ In 2004, 679 housing units were damaged due to floods along the Red River Basin.²⁴ Since climate change models project more extreme weather events coupled with drier conditions, North Dakota will likely experience further damage to its infrastructure, disrupting critical services and inflicting economic losses.

OTHER ECONOMIC IMPACTS

Hunting and Fishing

In 2006, nearly 400,000 sports enthusiasts spent \$260 million on hunting and fishing in North Dakota, providing about 5,000 jobs.²⁵ Rainbow trout anglers—who spend more than \$1 million on retail items each year—may reduce their fishing excursions, since fish populations are expected to suffer from higher temperatures and lower stream flows.²⁶

Lower water levels in Lake Sakakawea, one of the largest man-made lakes in the country, will affect the cold-water habitat necessary to sustain the forage fish species that serve as the food base for bigger game fish.²⁷ As water levels have decreased, reducing shoreline access for anglers' boats, local business income has declined. Continued changes in the water levels and temperatures will likely undermine this economically important recreational activity.

Hunting is likely to be affected by climate change as well. North Dakota's prairie potholes—the most productive waterfowl nesting grounds in the nation—currently provide nesting grounds for waterfowl that produce more than 3.8 million offspring each year.²⁸ Waterfowl hunting is a profitable industry in the state; trip and equipment expenditures topped \$44 million in 2001.²⁹ By 2080, climate change could reduce wetlands in the Prairie Pothole Region and areas of the northern Great Plains by 91 percent.³⁰ This could drastically reduce duck populations, not only in North Dakota but along the entire Mississippi flyway. Populations of other bird species such as the greater prairie chicken are likely to decline due to loss of habitat. Reduced hunting activity due to declining bird populations could cause losses for small businesses in the region of more than \$7 million because of decreased expenditures on food, lodging, transportation and equipment.³¹



Changes in the location and range of habitats are likely to affect bird watchers. In 2006, wildlife enthusiasts spent approximately \$23 million in North Dakota.³² Nearly 35 bird species found in North Dakota today are predicted to move their summer habitat out of North Dakota, and habitat for some 20 bird species is expected to shrink.³³ Birds are an extremely important link in ecosystems, providing pollination, seed dispersion and insect control for agricultural production. The economic effects on the agricultural industry from reduced bird numbers may be significant.

Hydroelectric Dams

Although electricity generation in North Dakota is dominated by coal, hydroelectric power represents an important alternative energy source, accounting for 4 percent of the state's total electricity production.³⁴ In future years, however, maintaining and expanding this level of production might be compromised due to climate change. Climate models suggest drier conditions, which will lower water levels in crucial reservoirs and undermine hydroelectric energy production.

Garrison Dam on the Missouri River, the fifth largest dam in the United States, forms Lake Sakakawea. The dam, the fifth largest electricity generation plant by capacity in the state,³⁵ also is used for flood control and irrigation and is vital for recreation, fish and wildlife.

Figure 1. Missouri River



Source: USGS, 2008 *Dams and Reservoirs of the Upper Missouri River*; nd.water.usgs.gov/lewisandclark/dams.html.

Lake Oahe, the fourth largest manmade reservoir in the United States, spans both North Dakota and South Dakota. The dam that created the lake provides hydroelectric power and flood control; regulates downstream flows for navigation, recreation, fish and wildlife; and provides water for drinking and irrigation.³⁶ The

fishery in Lake Oahe yielded \$27.64 million per year in revenue in the mid-1990s. This declined to approximately \$11.25 million per year by 2004 due to lower water levels caused by drought and water allocation decisions.³⁷

The potential electricity production from both dams may be greatly diminished in the future as water levels decrease.

Lower water levels also are likely to affect the public water supply and recreational activities associated with the reservoirs.

CONCLUSION

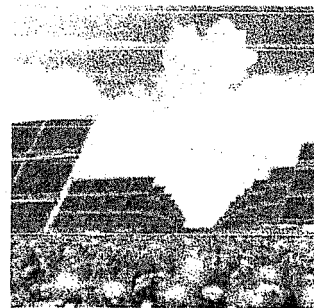
Climate is predicted to increase the likelihood of drought, which could impose considerable costs on North Dakota farmers. To gain a better picture of how these changes could affect farmers, improved assessments of how climate change may alter the state's supply of water for agriculture are needed. These assessments can help during the development of water management plans that can ensure crop productivity during periods when water is scarce. Policymakers may wish to encourage research that helps create state-specific assessments of how changes in temperature and precipitation may affect agriculture. Promoting research into adaptation options—such as the potential for farming drought-tolerant crops and using water-conserving tillage practices—may help avoid serious loss if droughts become more common.

Since water availability also will affect residential, business and power sectors, policies that promote the collaboration of all sectors may be necessary. Better research on the effects of drought and of increased flooding on these sectors will help policymakers and stakeholders evaluate water security and develop plans for water conservation and drought response. Planning for reduced electricity contribution from hydropower, possibly by substituting alternatives such as wind, is likely to prevent income losses and the potential power shortages that could be caused by loss of hydropower.

Since climate change is likely to bring changes for wildlife populations and their habitat, thereby affecting tourism income, policymakers may wish to promote more research on how a changing climate could affect North Dakota's ecological resources and investigate preservation approaches that increase the odds that wildlife will be able to adapt to a changing climate. Creating large, inter-connected wildlife preserves with varied ecosystems may improve animals' ability to adapt to climate change.

MISSING INFORMATION AND DATA GAPS

General climate predictions relating to the entire state of North Dakota must be made cautiously due to its variable topography. Many possible scenarios could result from climate change, which makes the prediction of economic impacts challenging. Better assessments on how climate change will affect North Dakota's variable climate are needed.



NOTES

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These reports are the result of collaboration between the National Conference of State Legislatures and the University of Maryland's Center for Integrative Environmental Research. Funding for these publications was provided by the Environmental Defense Fund.



ECONOMIC AND ENVIRONMENTAL COSTS OF CLIMATE CHANGE

OVERVIEW

The earth's climate is changing, and some states are beginning to see the effects—an increase in extreme temperature events, lower water levels in lakes and streams, and increased forest fire risk are a few of the visible signs. National Air and Space Administration (NASA) research shows that the eight warmest years (globally) on record have occurred since 1998¹ and predicts that summer high temperatures in the eastern half of the United States are likely to rise by 10° F by 2080.² These changes are likely to affect state forest, agriculture, tourism and water resources. These reports incorporate the latest scientific research to provide policymakers with a solid understanding of how the changing climate could affect their state, and how future changes will impact its economy, environment and people.

State and local decision makers play a critical role in developing and investing in sectors—such as water, energy, agriculture, tourism, forestry, transportation and public health—that are likely to be affected by climate change. These reports build on research by the Center for Integrative Environmental Research (CIER) at the University of Maryland, which explores how climate change could affect the economies and natural environments of states throughout the country. The research highlights the importance of planning for the possible effects of climate change on state natural and economic resources and explores options for reducing these effects.

INTRODUCTION TO CLIMATE CHANGE

Most of the nation's most prominent scientific bodies support the conclusion that human activities have been the dominant force driving the warming trend of the past 50 years and that the earth's climate will continue to warm throughout this century.³ The list includes NASA, the National Academy of Sciences,⁴ the

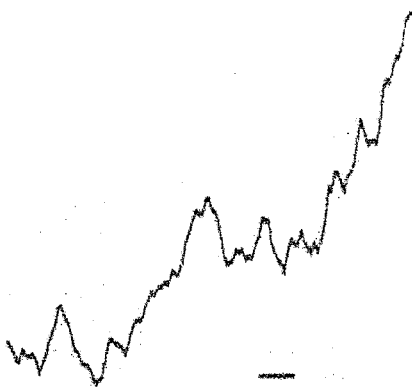
National Oceanic Atmospheric Administration (NOAA)⁵ and many others.

Global temperatures have risen about 1° F over the past century (see Figure 1). Figure 2 illustrates how different emissions reduction scenarios could affect temperature increases by 2100. The global average rise in temperature—according to the best available models—is projected to be between 3.2° F to 7.2° F. Many scientists think that an increase greater than 3.2° F could have catastrophic effects, such as reaching a tipping point where warming accelerates, causing dramatic sea level rise, land loss, declines in food production and other serious negative outcomes. To avoid this scenario, models indicate that global greenhouse gas emissions should be reduced by about 80 percent by 2050 (see line B1 in Figure 2).

WHAT IS THE GREENHOUSE EFFECT?

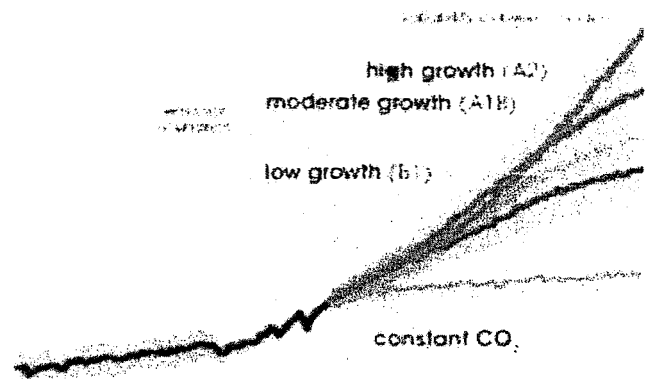
The earth is abundant with life due to the blanket of greenhouse gases that trap some of the sun's energy and allow the rest to escape into space. Without this blanket, temperatures on earth likely would be similar to those on the moon, varying from 280° F below zero on the dark side to 260° F on the side facing the sun. Human activity has changed the composition of these gases that reflect heat back to earth, increasing the amount of energy that is trapped. The result has been a global change in climate. According to research by the European Project for Ice Coring in Antarctica, atmospheric carbon dioxide (CO₂)—the most abundant greenhouse gas—is at its highest concentration in at least 650,000 years, with much of the increase appearing in the last 100 years.⁶ Other important greenhouse gases—methane (CH₄), nitrous oxide (N₂O) and chlorofluorocarbons (CFCs)—also saw unprecedented atmospheric increases during the past century.

Figure 1. Global Surface Temperature



Source: NASA <http://data.giss.nasa.gov/gistemp/2007/>, 2007.

Figure 2. Emissions Reduction and Temperature Increases



Source: NASA Earth Observatory, 2007.

OPTIONS FOR STATE POLICYMAKERS

States nationwide are implementing policies to address climate change—17 have greenhouse gas reduction targets, and five have made these targets enforceable. These states aim for a 50 percent to 80 percent emissions reduction by 2050. California, Oregon, Massachusetts and Washington are requiring power plants to meet greenhouse gas emissions standards, which will help the states meet their reduction targets. Twenty-five states have implemented renewable portfolio standards and many have passed renewable energy and energy efficiency incentives. Analysis of state policies that reduce greenhouse gas emissions—such as renewable portfolio standards and energy efficiency—have not been found to substantially affect electric rates, and energy efficiency has been found to save ratepayers money in most cases. New Jersey has projected that its greenhouse gas reduction plan will provide a net economic benefit. States also are creating incentives for nuclear energy and carbon sequestration from coal-fired power plants as greenhouse gas reduction options.

The least cost approach to reducing greenhouse gas emissions and meeting energy demand usually is energy efficiency. Businesses, consumers, state governments and industries find that energy efficiency investments return money by reducing energy consumption. Since buildings account for approximately half of U.S. energy consumption and greenhouse gas emissions, energy efficient building codes, green building requirements and retrofit policies are popular state options. Policymakers also are addressing greenhouse gas emissions from transportation and industry, the next largest contributors of greenhouse gases after buildings.

Minnesota has seen returns of \$3 for every \$1 spent on its energy efficiency programs. The state recently passed a law that requires its utilities to meet 1.5 percent of demand each year through energy efficiency. These efforts are predicted to meet state energy demand growth, while the state's renewable energy standard of 25 percent by 2025 will reduce dependence on energy generated from fossil fuel.

California is considering requirements that all new residential buildings built after 2020 and new commercial buildings built by 2030 consume no more energy than they generate. These “zero net energy” buildings, which have been built since the 1980s, incorporate highly energy efficient designs along with on-site clean distributed generation—such as solar or wind power—to satisfy energy needs.

If and when Congress enacts national climate change legislation, the states that have developed climate-friendly technologies and energy resources may have an advantage. States that are leading the way in creating policies now may also have more leverage in influencing the federal debate.

Since information about the localized impacts of climate change is still lacking, states may wish to promote research that

will more accurately predict potential changes at the regional and state level. Detailed assessments of potential climate outcomes and how they will affect various industries and ecosystems provide policymakers with the knowledge to create effective policies that will help the state adapt to changes while protecting its economy. Since climate change touches on many sectors, identifying and analyzing costs of inaction and policy implementation will be essential to creating effective policies.

The following conclusions can be drawn for all states.

- Although, these reports focus on the potential economic outcomes that changes in state climates may bring, the changes seen already have produced significant costs in some states. These have arisen from the changing climate's influence on infrastructure, agriculture, forestry and other sectors. These costs are likely to increase if greenhouse gas emissions are not significantly reduced.
- The effects of climate change should not be considered in isolation. Every state's economy is linked to the economies of surrounding states as well as to the national and global economy. Since state economies are directly linked to the economies of neighboring states and regions, policymakers may wish to consider both state and regional policies to address climate change.
- More information on the localized effects of climate change—including its impacts on water resources, ecology health and natural resources—is needed to improve state mitigation and adaptation strategies. Better data on local outcomes would improve estimates of economic effects that climate change will have on a state.

NOTES

1. National Air and Space Administration, “Global Temperature Trends: 2007 Summation,” data.giss.nasa.gov/gistemp/2007/, (2007).
2. National Air and Space Administration, “Study Suggests Extreme Summer Warming in the Future,” www.nasa.gov/centers/goddard/news/topstory/2007/extreme_summer.html, (May 9, 2007).
3. Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2007: Summary for Policymakers*, www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf, (2007).
4. National Academy of Sciences, *Understanding and Responding to Climate Change: Highlights of the National Academies Reports*, dels.nas.edu/dels/rpt_briefs/climate-change-final.pdf, (2005).
5. National Oceanographic Air Administration, *Global Warming FAQ*, www.ncdc.noaa.gov/oa/climate/globalwarming.html, (2007).
6. Urs Siegenthaler et al., “Stable Carbon Cycle–Climate Relationship During the Late Pleistocene” *Science* 310, no. 5752 (November 2005): 1313–1317.

#2

Testimony on the Climate Change Resolution, SCR 4024
Senate Natural Resources Committee
Thursday, March 7, 2013 at 9:45 am
Fort Lincoln Room of the State Capital

Chairman Lyson and the Senate Natural Resources Committee:

My input consists of two recent reports, published scientific reports by experts. The first indicates that arctic ice is melting much faster than previously estimated. The second discusses opening up of commercial sea routes in the arctic to normal ships.

The first was published last month, "CryoSat-2 estimates of Arctic sea ice thickness and volume" by Seymour W. Laxon and others in Geophysical Research Letters. The press release can be found at <http://www.nerc.ac.uk/press/releases/2013/03-cryosat.asp?cookieConsent=A>. Most models project that the arctic ocean could be ice free by the end of the century, but the Pan-Arctic Ice Ocean Modeling and Assimilation System (PIOMAS) indicates that this will happen between 2013 and 2018. The PIOMAS model is tracking closer to the actual satellite data than the other models. (Ice free would mean that if you divided the arctic ocean into grids then on some day, all of the grids would have less than 15% ice coverage http://nsidc.org/arcticseaicenews/faq/#area_extent.)

The second was published this month in the Proceedings of the National Academy of Science and can be found at <http://www.pnas.org/content/early/2013/02/27/1214212110.full.pdf+html>. The Northeast route opened up in 2006 to regular ships, i.e. not only ice breakers but normal ships. The Northwest corridor and the route through the North Pole are expected to open up to normal ships by 2040.

Gilbert Kuipers, PhD
Associate Professor
Department of Science
Valley City State University
Valley City, ND 58072

Testimony for SCR 4024
3/7/13

Verle Reinicke
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Chairman Lyson and members of the committee:

My name is Verle Reinicke. I am a resident of Bismarck and the state for almost 45 years.

I speak in favor of passage of SCR 4024. It gives voice to the recognition of the reality of climate change, a voice sorely needed in the face of so much denial language. The evidence of its reality is overwhelming in the scientific community, despite those naysayers who protest to the contrary. Scientists, who are members of the Intergovernmental Panel of Climate Change, have significant unanimity of agreement, as high as 97%, that this is a reality, something virtually unheard of among scientists.

My discipline is theology and biblical studies. I've spent 39 years of my life as a Lutheran pastor of the church, having retired in 2007, all of it in western North Dakota. A prevalent notion voiced is that humans are not a major contributor to this malaise. That is not supported biblically. Creation theology tells us that we are part of the created order. What we do has an affect on the creation. The verbs in Genesis 1 to subdue and have dominion mean that we are called to care for the created order and help it to realize all that it can be. We are to help it blossom and flourish. The verb in Genesis 2 often translated as "till" can also be rendered "serve." Contrarily, if we do not tend it properly, it can respond negatively.

Dr. Terrance Fretheim, emeritus professor of Old Testament, Luther Seminary, St. Paul, MN, in his recent book, *God and World in the Old Testament* argues that the plagues in Exodus are the direct result of Pharaoh's political, economic and social policies. He says that because of that the creation acts hypercreationally, his term. That is, the creation responds by doing things beyond what it would normally do. Dr. Walter Brueggemann, the premier Old Testament theologian in this country, says this insight of Fretheim's is a very significant breakthrough. I was reading this when Hurricane Katrina hit the Gulf Coast.

Another problem is that many do not appreciate the difference between weather and climate. Weather is short-term, and climate is long-term. Climate is the cumulative effect of weather patterns over long periods of time. For instance, in the

spring of 2011, after exceptionally heavy snowfall the previous winter in our area, followed by record, torrential, rains in the spring, National Public Radio ran a story reporting the work of a scientist at Montana State University, Bozeman, of a study of tree rings in the mountainous west covering 1000 years. His work demonstrated that the Rockies are getting drier. The wet year was an anomaly. The short-term weather was contrary to the longer-term climate study he had conducted.

Often, I've heard people cite particular weather events as proof that climate change is not real or significant. Climate and weather are different. It's mixing apples and oranges.

Finally, I'm citing an article which appeared in the December 10, 2012, issue of Newsweek, titled "The End of Pasta." (I would have provided the text of the article had my printer not failed. If you do a Google search for the title you will find it.) Briefly stated, it talks about how the increase in temperature, the result of climate change, has resulted in the shifting the area in North Dakota where durum is grown. It is getting less and less easy to grow it in the eastern part of the state because it has become wetter there. The growing area has moved farther west into less desirable and productive soils. A plant built at Carrington has become obsolete because shipping costs have become too high.

This is but one example of the reality of the rise in climate temperatures are having on our state.

I urge the passage of this resolution, calling for a study. We need to stop pretending that something isn't, in this case, climate change, when it is.

Thank you.

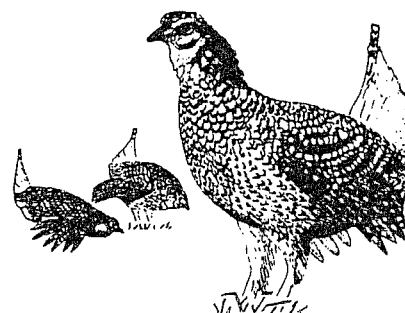
44



North Dakota Chapter

THE WILDLIFE SOCIETY

P.O. BOX 1442 • BISMARCK, ND 58502



**TESTIMONY OF MICHAEL R. McENROE
NORTH DAKOTA CHAPTER, THE WILDLIFE SOCIETY
SENATE CONCURRENT RESOLUTION 4024
SENATE NATURAL RESOURCES COMMITTEE
MARCH 7, 2013**

Chairman Lyson and members of Committee:

For the record; Mike McEnroe, representing the North Dakota Chapter of The Wildlife Society. The Chapter supports Senate Concurrent Resolution 4024 directing Legislative Management to study the effects of climate change on the State.

Climate change, probably a better name than global warming, is a fact. We are experiencing more unstable weather conditions; hotter, drier, wetter, more frequent storms, more unusual storms. Daily news reports bear this out. One can argue whether this is human caused, or whether it can be affected or corrected by man's actions. SCR 4024 does not study the cause or try to assess blame. It proposes to study the effects on North Dakota.

Scientific data show that migratory birds are arriving back in North Dakota 3-4 weeks earlier than 50 years ago. Data are suggesting that the warmer and drier weather is causing changes in bird nesting and brood success compared to the past because of changes in the plant community.

These same data also suggest changes in the plant communities that may alter livestock forage production. We are seeing huge increases in corn and soybean acreages in North Dakota. We are seeing changes in the flow pattern and runoff into the Missouri River; less snow pack, earlier runoff. These climate factors will affect agriculture in North

Dakota. Missouri River changes will affect water supplies for irrigation, hydropower, municipalities, the energy industry, fish and wildlife and recreation. While we may argue about the cause, it is in the best interests of the State to anticipate and deal with climate change, rather than try to play catch-up and deal with an issue that affects virtually all of the State after it happens.

The agricultural, human health, and insurance industries are already looking at effects of climate change on their respective industries.

I urge support for SCR 4024, and let the State investigate what is happening with climate in North Dakota.

Thank you. I will try to answer any questions that the Committee may have.

ENVIRONMENTAL ENGINEERING NEWSLETTER

4 MARCH 2013

Please be aware any Newsletter URL ending in **020701.pdf** is available for downloading only during the six days following the date of the edition. If you need previous Newsletter entries contact George at ghh@att.net.

Please Note: This newsletter contains articles that offer differing points of view regarding climate change, energy and other environmental issues. Any opinions expressed in this publication are the responses of the readers alone and do not represent the positions of the Environmental Engineering Division or the ASME.

George Holliday

This week's edition includes:

ENVIRONMENT – A. SOURCE: EPA, ENERGY DEPT. NOMINEES COULD BE ANNOUNCED THIS WEEK

President Barack Obama could announce his choices to head the Environmental Protection Agency and the Department of Energy as soon as this week, a source familiar with the matter said. Gina McCarthy, the EPA Office of Air and Radiation assistant administrator, is expected to be nominated as EPA chief. Nuclear physicist Ernest Moniz, who is the director of the Massachusetts Institute of Technology's Energy Initiative, will be nominated as energy secretary, the source said

<http://www.reuters.com/article/2013/02/20/obama-cabinet-epa-energy-idUSL1N0BK72220130220>

B. COURT APPROVES BP, JUSTICE DEPT. DEAL ON GULF SPILL FIGURES

About 810,000 barrels of oil that BP captured from its leaking Macondo well in the Gulf of Mexico in 2010 won't be included in the calculation of fines against the company under the Clean Water Act, according to U.S. District Judge Carl Barbier. Both BP and the Department of Justice agreed that the captured oil "never came into contact with any ambient sea water and was not released into the environment in any way," the order states. The ruling could reduce BP's Gulf spill-related penalties by up to \$3.5 billion.

From Wall Street Journal

A federal judge in New Orleans agreed late Tuesday to a stipulation that could reduce BP ~~BP LN -1.53%~~ PLC's maximum penalty under the Clean Water Act in connection with the Deepwater Horizon accident by as much as \$3.5 billion.

Under the stipulation agreed to by the Justice Department and BP, and signed by U.S. District Judge Carl Barbier, 810,000 barrels of oil that were captured from the leaking well in the Gulf of Mexico before reaching the ocean won't count toward any potential fines under the act.

The amount of oil that spilled into the Gulf will, along with other factors, determine how much BP pays in fines under the Clean Water Act. If the judge determines BP was "grossly negligent" instead of simply negligent, the company could be subject to fines as high as \$4,300 per barrel of oil spilled, although other factors will also be considered. Those determinations will be made during two upcoming trials, one of which is scheduled to begin next week.

The two sides agreed that 810,000 barrels of collected oil "never came into contact with any ambient sea water and was not released into the environment in any way" other than through approved flaring, according to Judge Barbier's order.

Thomas Claps, an analyst with Susquehanna Financial Group, wrote in a note that the order is a "significant pre-trial battle" that reduces BP's "worst-case scenario" fines under the act by about \$3.5 billion.

"Therefore, according to U.S. government flow rate estimates of approximately 4.9 (million) barrels of oil spilled, the 'worst-case scenario' of [more than \$21 billion] in fines for BP has now been reduced to approximately \$17.6 billion, a significant decrease," Mr. Claps wrote. BP says the size of the spill is much less, at most 3.1 million barrels.

C. ENVIRONMENTAL PROTECTION AGENCY

Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of document availability and request for comments.

SUMMARY: The Draft Inventory

of U.S. Greenhouse Gas Emissions and

Sinks: 1990-2011 is available for public review. Annual U.S. emissions

for the period of time from 1990 through 2011 are summarized and

presented by source category and sector. The inventory contains

estimates of carbon dioxide (CO₂), methane (CH₄),

nitrous oxide (N₂O), hydrofluorocarbons (HFC),

perfluorocarbons (PFC), and sulfur hexafluoride (SF₆)

emissions. The inventory also includes estimates of carbon fluxes in

U.S. agricultural and forest lands. The technical approach used in this

report to estimate emissions and sinks for greenhouse gases is

consistent with the methodologies recommended by the Intergovernmental

Panel on Climate Change (IPCC), and reported in a format consistent

with the United Nations Framework Convention on Climate Change (UNFCCC)

reporting guidelines. The Inventory of U.S. Greenhouse Gas Emissions

and Sinks: 1990-2011 is the latest in a series of annual U.S.

submissions to the Secretariat of the UNFCCC. Copies of the Inventory are available at,

<http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html>

<http://www.gpo.gov/fdsys/pkg/FR-2013-02-22/pdf/2013-04142.pdf>

2) HEALTH – A. INFLUENZA (21): VACCINE EFFECTIVENESS IN SENIORS

Influenza vaccine over the past few months has provided moderate protection overall but didn't have a significant impact on protecting seniors, a study from the US Centers for Disease Control and Prevention (CDC) revealed today [21 Feb 2013; full text available at Interim adjusted estimates of seasonal influenza vaccine effectiveness

<http://www.candp-environment.net/Health/Health020701.pdf>

B. OLIVE OIL DIET CURBS STROKES

A diet common in coastal areas of Southern Europe, particularly one with lots of olive oil and nuts, cuts the risk of stroke and other major cardiovascular problems by 30% among high-risk people, according to a new study.

There's a large body of research linking a Mediterranean diet—one heavy on fruits, vegetables, fish and beans—to heart health. But this study, **published Monday in the New England Journal of Medicine**, is significant both for its size—it followed 7,447 people in Spain over almost 5 years—and its scientific rigor. Few previous studies have succeeded in proving a direct link between a diet and a reduction in life-threatening events like strokes, instead assessing the diet's impact only on weight loss or certain cardiovascular risk factors, like blood pressure or cholesterol.

Enlarge Image

One More Reason to Love the South of France

What subjects were advised to eat in the Mediterranean diet study

MEDITERRANEAN DIET		LOW-FAT DIET (CONTROL GROUP)	
RECOMMENDED	AT LEAST	RECOMMENDED	AT LEAST
Olive oil	4 tbsp/day	Low-fat dairy products	3 servings/day
Tree nuts and peanuts	3 servings/week	Bread, potatoes, pasta, rice	3 servings/day
Fresh fruits	3 servings/day	Vegetables	2 servings/day
Vegetables	2 servings/day	Lean fish and seafood	3 servings/week
Fish (especially fatty fish), seafood	3 servings/week	DISCOURAGED	AT MOST
Legumes	3 servings/week	Vegetable oils (including olive oil)	2 tbsp/day
Wine with meals (optional)	7 glasses/week	Commercial bakery goods, sweets, pastries	1 serving/week
DISCOURAGED	LESS THAN	Nuts and fried snacks	1 serving/week
Commercial bakery goods, sweets, pastries	3 servings/week	Red and processed fatty meats	1 serving/week
Spread fats	1 serving/day	Fatty fish, seafood canned in oil	1 serving/week
Red and processed meats	1 serving/day		

Source: New England Journal of Medicine

The study is "hugely important," says Steven Nissen, chairman of the department of cardiovascular medicine at the Cleveland Clinic, who was not involved in the study. Dr. Nissen notes that the preventive effect of the diet is similar to the effect of taking statins, the cholesterol-lowering drugs, which research has shown to reduce the risk of major cardiovascular events by about 25% to 30%. "What we can say to patients is this very palatable Mediterranean diet looks to be healthiest. I'm going to change my own diet; add some more olive oil, some more nuts."

The participants, who were between 55 and 80 years old, didn't have cardiovascular disease when they enrolled in the study, but were at high-risk for developing it because they had diabetes, were smokers, had high blood pressure, abnormal cholesterol, had strong family history of heart problems or were obese. Many were on medications to treat their risk factors: Almost half were taking drugs for high blood pressure and more than 40% took statins.

The participants were divided into three groups. Two groups were advised to follow a Mediterranean diet, which also encourages wine with meals and limits red meat, soft drinks and commercial baked goods. One of the Mediterranean diet groups was told to consume at least four tablespoons of olive oil per day. The other was told to eat 30 grams of nuts (walnuts, almonds and hazelnuts) every day. (The participants were given the olive oil and nuts.) The control group was told to follow a low-fat diet consisting of fruits, vegetables, low-fat dairy products, bread, pasta and fish. All participants could eat as much as they wanted and didn't receive any exercise advice. Many of the researchers have financial ties to the food and pharmaceutical industries.



Getty Images

A diet common in coastal areas of Southern Europe, particularly one with lots of olive oil and nuts, cuts the risk of stroke and other major cardiovascular problems by 30% among high-risk people.

Participants in the Mediterranean diet groups had quarterly training sessions with dietitians and were given surveys to assess their adherence to the diet. Every year, they also had blood and urine tests to measure certain biomarkers to confirm their consumption of the extra olive oil and nuts. The researchers said that extra-virgin olive oil was used in the study because it contains more polyphenols, which have been shown to improve cholesterol levels, than refined olive oil. Low-fat diet advocates point out that while the control group participants were advised to follow a low-fat diet, they didn't necessarily do so. Indeed, the researchers said that "changes in total fat were very small" during the course of the study among the participants in the control group. Still, because the benefit demonstrated by the Mediterranean diet was so striking, the study was stopped early. Clinical trials are sometimes halted early to allow all participants to switch to a clearly beneficial treatment.

At the end of the study, 3.8% of the Mediterranean-diet-plus-olive-oil and 3.4% of the Mediterranean-diet-plus-nuts groups suffered a heart attack, stroke or death from cardiovascular disease. By comparison, 4.4% of members in the control group suffered this outcome. The

differences in the risk of stroke were statistically significant. The differences in the risk of heart attack weren't, possibly because of the low incidence of heart attacks among people in the study, researchers said.

"In Spain, we are losing the Mediterranean diet," said Ramón Estruch, a professor at the University of Barcelona and a lead author of the study. He pointed to a need to tell people, "Remember what you learned at home from your grandmother and grandfather. It is really healthy."

A version of this article appeared February 26, 2013, on page D3 in the U.S. edition of The Wall Street Journal, with the headline: Olive Oil Diet Curbs Strokes

3) SAFETY – A. WORKER CRUSHED TO DEATH DUE TO MIS-ALIGNED CRANE

An assembly technician was fatally injured while he was attempting to move a 19,400 kg (42,770 lb) subsea tree cap with an overhead crane, and was trapped between the heavy load and a nearby bunker wall.

<http://www.eandp-environment.net/Safety/Safety020701.pdf>

B. OSHA REVISES FLAME-RESISTANT CLOTHING REQUIREMENTS

OSHA issued a new guidance document in December regarding the use of personal protective equipment (PPE) by oil and gas well workers. This document was posted this month on OSHA's website.

In this revised memo, OSHA clarified that its 2010 memo that suggested employers would be cited for a violation of the PPE standard whenever workers were not wearing flame-resistant and fire-retardant clothing was not the intent of the 2010 memo.

OSHA stated that employers would only be cited if OSHA could additionally prove that a reasonable person would recognize the existence of a hazardous condition that would require the use of PPE. Although this is not a change from the typical case law analysis for the PPE standard, it is a shift in OSHA's enforcement position regarding the use of PPE specific to the oil and gas industry.

This new enforcement position was taken as the result of a ruling by a Federal Occupational Safety and Health Review Commission Judge in June 2012 that vacated a PPE citation issued to an employer in the oil and gas industry (Secretary of Labor v. Petro Hunt, LLC, OSHRCJ, No. 11-0873, 6/6/12). In that case, the Judge ruled that the 2010 memo was impermissible rulemaking by OSHA. OSHA's newly clarified position is an attempt to deflect the Judge's ruling that the memo was rulemaking on the part of the agency.

C. BP IS ACCUSED OF SACRIFICING SAFETY FOR LOW COSTS IN SPILL TRIAL

A renowned forensic engineer accused BP of putting cost control ahead of safety before the 2010 Gulf of Mexico oil spill in the first day of testimony in the civil trial over the incident. "There is ample evidence of intense pressure within the system to save time and money," Bob Bea, co-founder of the Center for Catastrophic Risk Management at the University of California, Berkeley, said. "With stress and pressure come sacrifices to safety."

4) TRANSPORTATION. A. SEN. LANDRIEU MAKES CASE FOR KEYSTONE XL PIPELINE APPROVAL

Sen. Mary Landrieu, D-La., made her case for the approval of TransCanada's Keystone XL pipeline. Bitumen will be produced from Canada's oil sands, Landrieu said. "The question is: Who are they going to send it to? Are they going to send it to their good friend, the United States, to our refineries in Texas and Louisiana? Or are they going to ship it somewhere else in the world," she said.

<http://fuelfix.com/blog/2013/02/20/senate-democrat-touts-support-for-keystone-xl/>

COMMENTS:

A. THE WEEK THAT WAS: 2013-02-23 (FEBRUARY 23, 2013)

By Ken Haapala, Executive Vice President, Science and Environmental Policy Project (SEPP)
THIS WEEK:

Failing Models: In his August testimony before the US Senate Committee on Environmental and Public Works, John Christy, the co-developer of the satellite temperature record, presented a graph showing that the models relied upon by the UN Intergovernmental Panel for Climate Change (IPCC) are clearly failing. The graph compares the projections of 34 climate models with actual observations, both at the surface (called surface-air) and the lower troposphere (the atmosphere from the surface to about 10 km (about 33,000 feet). The statistical mean of the projections is well above the observations – with a statistical significance of more than two standard deviations. The difference shows that the models are not useful in estimating future temperatures. Thus, the claims that by emitting greenhouse gases (GHG), particularly carbon dioxide (CO₂), humans are causing unprecedented and dangerous future global warming have no scientific basis. [Note that the projections from a few of the models do not exceed the observations, however, statistically, they are outliers.]

As expected, the graph is causing some consternation in the Climate Establishment, which needs to explain away the divergence for the upcoming IPCC Fifth Assessment Report (AR5), which is due out later this year. On Climate Etc, Judith Curry discusses some of these attempts. One time tested method is to expand the error range for the models. [Expanding the attributed error range was done in an article by Santer, et al, which tried to explain away the inability to find atmospheric hot spot above the tropics in the model projections that was called the distinct human fingerprint. That article included a large number of Climate Establishment co-authors. Please see NIPCC vs. IPCC (2011). NIPCC is the Nongovernmental International Panel on Climate Change.]

In the efforts presented by Curry, expanding the error range of the models to explain away the divergence between warming from model projections and observations may be a temporary quick-fix but it is far from satisfactory. One issue the method raises is that if the observations continue to show no warming trend, then the error range would have to be increased in the future – to the point of showing a possible global cool?

More significantly, adding to the error range reinforces a question that many skeptics have asked of the modelers for a number of years. How can you be so certain of the results of the climate models? Of course, the certainty cannot be scientifically addressed and the IPCC used opinion polls of the modelers. Now that the uncertainty is becoming more public, it will be more difficult

for the Climate Establishment to bury uncertainty in an obscure appendix in a report thousands of pages long. Please see link under Challenging the Orthodoxy and

http://www.sepp.org/science_papers/ICCC_Booklet_2011_FINAL.pdf

More Failing: In a rare, somewhat technical post, John Christy provides additional information on the failing of the models and highlights two areas of confusion. One area of confusion is regarding the difference between surface temperature trends and lower troposphere temperature trends. This is a different issue than the magnitude of the temperature trends for the surface and the magnitude of the temperature trends for the lower troposphere. The greenhouse effect takes place in the atmosphere and the models predict that the warming trend should be more pronounced in the lower troposphere than on the surface. This is a different concept than the temperatures for the atmosphere as compared with the surface. Until recently, the reverse was observed. The measured warming trend on the surface was more pronounced than the measured warming trend of the lower troposphere. Thus, the models were failing. The fact that there is now no measured trend in the surface and the atmospheric measurements indicates that the models are continuing to fail because the models project the warming trend in the atmosphere will be stronger than the trend in on the surface. Please see link under Challenging the Orthodoxy

Tropical Sea Surface Temperatures: On his blog Roy Spencer, the other co-developer of the satellite temperature record, addresses the issue of tropical sea surface temperature trends as measured by the Tropical Rain Measuring Mission (TRMM) Microwave Imager (TMI), which went operation in 1998. Contradicting the models, the measurements show no warming. Even after calculating the effects of El Nino and La Nina activity, the measured trend is one-third of that predicted in the models. The failure of the tropical sea surface to warm as models project may give the Climate Establishment further consternation in preparing the IPCC AR5. Please see link under Challenging the Orthodoxy.

Energy of Hurricanes: The web site of the US National Oceanic and Atmospheric Administration (NOAA) posts a question: how much energy does a hurricane release? The posted answer is provided Chris Landsea who calculates that for the average hurricane the energy released from the condensation of water vapor to form clouds and rain is about equivalent to 200 times to total world-wide electrical generating capacity, for each day. Only about one part in four hundred of this energy release drives the swirling winds that are associated with the hurricane.

Five time IPCC expert reviewer Vincent Gray takes these calculations a bit further. He compares the average energy loss over a year for an average of eleven hurricanes lasting one week with the heat supposedly increase in warming from the enhanced greenhouse effect from GHG emissions since 1750. [His calculations do not include energy release from other cyclones, thunderstorms, etc.] Gray concludes that hurricanes, alone, “conceal any possible much smaller effects of greenhouse gases which could never be identified. **The models are not only wrong. They are irrelevant.**” [Boldface added] See link under Changing Weather.

Feel-Good Legislation: Leaders of several Western European nations are beginning to feel the anger of the general population for requiring wind and solar power in place of traditional sources of electricity. Wind and solar are more costly and unreliable sources of electricity. Thus they

require duplication by traditional sources. One example of this feel good legislation is the UK's Climate Change Act of 2008 which requires reductions in carbon dioxide emissions over a series of five year periods. As coal-fired power plants are being squeezed out, electricity rates are increasing significantly. For some time, the politicians who advocated for the legislation have acted in typical political fashion – evade and obfuscate any responsibility.

This week Alastair Buchanan, the outgoing head of Britain's regulator of electricity and natural gas, Ofgen, announced that with the retirement of coal and nuclear plants there may be a significant gap in the in between the ability of the nation to generate electricity as compared with its consumption and that electricity prices may go significantly higher.

Ten years ago John Brignell of Number Watch, articulated the problem in plain English, something one would hope the British politicians could understand. He laid out five principles for electricity generation, which were promptly ignored. The principles are:

1. Energy should be obtained from a variety of sources, lest one should fail.
2. There should be a reliable and continuous source to service the base load.
3. There should be further instantly available sources to accommodate demand surges.
4. Unpredictable and intermittent sources should be avoided.
5. Policy should not be decided by trends, fashions or religious convictions.

Following the fad of dangerous global warming, the politicians have squandered huge sums of money on unpredictable and intermittent sources such as wind and solar. Some have maintained that if the wind farms are geographically separated, then wind could provide base load. As discussed in last week's TWTW, the study of the Eastern Australian Grid, with wind farms that are geographically separated over broad distances, shows the concept is completely false. The wind farm system frequently failed to meet the extremely low level of performance of two percent of installed capacity. There is no justification to continue to believe that wind power can be reliable, if enough capacity is installed. Given the unreliability of wind, it is doubly false to claim domestic wind is a secure energy source. Please see links under Questioning the Orthodoxy and Questioning European Green.

Washington's Energy Plan: A number of commentators have expressed their views of the administration's energy plan, largely from what President Obama stated in his Inauguration Speech. Marita Noon takes an unusual approach. She examines the document prepared for the speech and what appears to be the underlying foundation for the president's plan. A major failing contained in these documents is the false belief that energy efficiency of doing more work with less energy can be achieved by government mandates. If the simple goal is to reduce energy use, then the simple solution is to do no work. The most effective way of achieving energy efficiency is by people and organizations trying to cut energy costs in imaginative ways.

If one believes that one of the key's to prosperity is reliable and affordable energy, the future under the energy plan is not promising. The country may be following the bleak future that Western European politicians are laying out for their countries.

A Bold, New, International Plan: The prerelease of an upcoming article by some American scientists contains disturbing elements that claim the need to modify human behavior in order to save humanity. Of course, all this would be done under the auspices of the UN and its enlightened scientists as found in the IPCC and in the New Millennium Project. Since the concepts are not fleshed out, perhaps TWTW is overreacting. But one of the authors of the plan is Paul Ehrlich, author of the Population Bomb. In a separate article he states that odds of

sustaining human civilization under the current conditions are 10% or less. He uses this and similar questionable arguments to try to justify centralized control. In the view of TWTW, if human civilization is to fall, the fall will be brought on the likes of Paul Ehrlich and his appeal for misanthropic, authoritarian organizations.

Amplifications and Corrections: In commenting on the failure of government agencies to assure rigorous science is performed under scientific grants, Stan Young states that one of the big issues is the failure to require all data be provided for public scrutiny if a study uses federal funds. On March 5, the House Science Research Subcommittee will hold a hearing on Scientific Integrity and Data Transparency. It will be interesting to see if many of the nation's independent scientific institutions will publically support such action.

<http://www.sepp.org/twtwfiles/2013/TWTW%202-23-13.pdf>

B. A SHORT VIDEO ON PYROPROCESSING

http://nuclearstreet.com/nuclear_power_industry_news/b/nuclear_power_news/archive/2013/02/20/argonne-video-highlights-nuclear-fuel-recycling-research-022002.aspx .

C. RADIATION MONITORING PROGRAM UNDER FIRE

By David McCumber

WASHINGTON — Assistant administrator Gina McCarthy is widely expected to be President Barack Obama's choice to head the Environmental Protection Agency, but a key program under her oversight has drawn sharp criticism from its internal watchdog.

Soon after a huge earthquake and tsunami damaged the Fukushima nuclear power plant in March 2011, the EPA announced that its U.S. air-monitoring system had detected very low levels of radioactive material associated with the Japanese disaster.

But as a critical report from the EPA's inspector general later detailed, the monitoring network, known as RadNet, was in disarray when radiation began spewing from Fukushima. Fully 20 percent of RadNet monitors across the United States were inoperative, and had been for an average of 130 days.

Monitors in Laredo, Harlingen, El Paso, Lubbock and Corpus Christi were among the 25 that were inoperative at the time of Fukushima.

In its report, the inspector general faulted maintenance of the monitors and also pointed out that implementation of the program was incomplete and years behind schedule.

Now, nearly two years after Fukushima, the EPA did not specifically respond to questions about which monitors are now working, and whether an additional 10 planned monitors have been installed. "EPA is actively working to address questions and concerns within the inspector general's report," an agency official said this week.

The April 2012 inspector general's report was unequivocal. "Because EPA did not manage RadNet as a high-priority program, parts shortages and insufficient contractor oversight contributed to the extensive delay in fixing broken monitors," it said.

The EPA official said Tuesday that even with the broken monitors, the RadNet system was able to provide sufficient data to determine airborne levels of radioactivity from Fukushima.

In a random sampling of 12 monitors from May 1, 2010 to April 30, 2011, the inspector general's office found more than 41 percent of filter changes were not made. At the Houston monitoring station, for example, 30 of the 104 changes were not made, and in Fort Worth, 39 were not made.

D. REPORT: FLAWS IN EPA DRILLING POLLUTION DATA

Limited data and unreliable estimates on air pollution from oil and natural gas production is hindering the Environmental Protection Agency's efforts to police the drilling boom, the agency's internal watchdog said in a report released Thursday.

http://seattletimes.com/html/politics/2020407242_apusepadrillingpollution.html

E. CARBON MANAGEMENT TECHNOLOGY CONFERENCE – CALL for ABSTRACTS

October 21-23, 2013

Hilton Alexandria, VA

Call for Abstracts Deadline: April 15, 2013

For abstract submission instructions: <http://fscarbonmanagement.org/content/cmtc-2013-call-abstracts>

The purpose of the Carbon Management Technology Conference (CMTC 2013) is to draw professionals from all engineering disciplines to share their expertise and provide their perspectives on the reduction of greenhouse gas emissions and adaptation to changing climate. The conference builds on topics from the CMTC 2012

(<http://fscarbonmanagement.org/content/2012-carbon-management-technology-conference>)

The focus of this Conference is on engineering perspectives regarding key issues, including technologies, strategies, policies, uncertainties, and metrics for evaluating alternatives. Experts, practitioners and those participating in policy will share their findings and experience with the readiness, effectiveness, and implementation of options involved in meeting the carbon management challenges. Engineering expertise, experience, and perspectives are critical to developing a viable path to meeting these challenges.

Additional CMTC 2013 information: <http://fscarbonmanagement.org/content/cmtc-2013>

Topics to Include:

- Carbon capture, utilization and storage
- Carbon management pathways from electricity generation to end-use
- Potentially game-changing technology and evaluation
- Engineering challenges and solutions for adaptation to climate change

Abstracts will be used to select presentations (papers are optional but encouraged). To submit an abstract go to: <http://fscarbonmanagement.org/content/cmtc-2013-call-abstracts>

Sponsoring Organization

The Carbon Management Technology Conference is sponsored by eight organizations:

- [American Institute of Chemical Engineers](#)
- [American Society of Civil Engineers](#)
- [American Society of Mechanical Engineers](#)
- [Association for Iron & Steel Technology](#)
- [Institute of Electrical and Electronics Engineers-USA](#)
- [The Minerals, Metals & Materials Society](#)
- [Society for Mining, Metallurgy, & Exploration](#)
- [Society of Petroleum Engineers](#)

Call for Abstracts Deadline: Friday, April 15, 2013

For more information about the Carbon Management Technology Conference 2013

Visit: <http://fscarbonmanagement.org/content/cmtc-2013>

or Email: carbonmanagement@foundersocieties.org

F. TROPICAL SSTS SINCE 1998: LATEST CLIMATE MODELS WARM 3X TOO FAST

I'd like to address the more general question of tropical sea surface temperatures since 1998. Why haven't they warmed? Of course, much has been made by some people about the fact that even global average temperatures have not warmed significantly since the 1997/98 El Nino event.

<http://www.drroyspencer.com/>

Roy Spencer

G. APPARENT REASON FOR JANUARY 2013 TROPOSPHERIC WARMTH

NASA's Tropical Rain Measuring Mission (TRMM) has been, in my opinion, a huge success. It has been operating for over 15 years now, which makes me feel pretty old since I was involved in the early design of the TRMM Microwave Imager (TMI) that flies on TRMM. I campaigned for it to carry 10.7 GHz channels which would allow sensitivity to heavy rain, as well as all-weather sea surface temperatures. TRMM also carries the first spaceborne precipitation radar, which was built by Japan.

<http://www.drroyspencer.com/>

Roy Spencer

H. CHANGING AMBIANT TEMPERATURE

In the last month, Hansen has added an average of 0.15°C to his GISS temperature record without saying anything about it. This made me wonder once again how one could adjust temperature records back to 1880 with any degree of certainty that the adjustments were correct. I looked at the Wunderground temperature map at 2:30PM today February 21, 2013. Conditions

are high thin clouds, without sunshine but bright conditions. My thermometer reads 75F. There are 38 official temperature and weather measurement stations within 25 miles of Willis TX. The temperatures of the 38 ranged from 77F down to 68F. Here are the number of readings at each temperature:

77F -1 station
76F- 3 stations
75F- 1 station
74F- 7 stations
73F- 7 stations
72F- 9 stations
71F- 4 stations
70F- 3 stations
69F- 2 stations
68F -1 station

I suppose that one could have some chance of being correct if he/she said the temperature outside was about 73F. But if one adjusted the averages back to 1880, I would say he/she did not have a "snowball's chance in hell" of being correct. Hansen was already quite a bit higher than the other 4 temperature record keepers.

I consider it a marvel that we are living in a world where there are 38 official temperature measurement stations within 25 miles of where I live and each of these stations reports automatically to a single entity every 15 seconds day and night. On the other hand I consider it unimaginable that at same time we have intelligent people trying to force everyone to pay for remediations for a natural phenomena that cannot be measured closer than plus or minus 5F. And allow adjustments of .15C back to 1880?

Think about that a bit. Have we gone bonkers as the Brits say?

J Frank

I. SENATORS SANDERS, BOXER PROPOSE CLIMATE CHANGE BILLS

Earlier this month, Senators Bernie Sanders (I-VT) and Barbara Boxer (D-CA) introduced comprehensive legislation on climate change. Sen. Boxer is Chair of the Senate Committee on Environment and Public Works. Sen. Sanders sits on the Environment Committee and also is a member of the Senate Energy Committee.

Under the legislation, a fee on carbon pollution emissions would fund investments in energy efficiency and sustainable energy technologies, such as wind, solar, geothermal and biomass. The proposal would also provide rebates to consumers to offset any potential rising prices of oil, coal or gas.

The proposal is drafted as two measures, the Climate Protection Act and the Sustainable Energy Act, which can be found at: <http://www.sanders.senate.gov/imo/media/doc/0121413-ClimateProtectionAct.pdf> and <http://www.sanders.senate.gov/imo/media/doc/021413-SustainableEnergyAct.pdf> respectively.

In summary, the Sanders/Boxer legislation would:

- Price carbon by setting a long-term emissions reduction goal of 80 percent or more by 2050 and enacting a carbon fee of \$20 per ton of carbon or methane equivalent, rising at 5.6 percent a year over a ten-year period;
- Include jurisdiction for fracking under the Safe Drinking Water Act, while also containing the provisions from the FRAC Act to ensure disclosure of chemicals used in the fracking process; and,
- Invest in energy efficiency and sustainable energy to further reduce remissions, create jobs and position America as a leader in clean technology.

A more detailed summary of the legislation is available at:

<http://www.sanders.senate.gov/imo/media/doc/021413-2pager.pdf>

Amie Feldman

J. ASME ENERGY FORUMS

ASME recently launched a new year-long Energy Forum initiative

(<http://www.asme.org/events/asm-energy-forum>) comprising free webinars on energy topics.

February's topic was hydrokinetics. Future topics will be as follows:

- March 2013 Concentrated Solar Power
- May 2013 Waste-To-Energy
- July 2013 Wind Farms
- September 2013 Fuel Cell Vehicles & Stations
- November 2013 Fracking

Webinars are free and open to both ASME members and non-members.

Arnold Feldman

K. CALIFORNIA GIRDS FOR ELECTRICITY WOES

SAN FRANCISCO—California is weighing how to avoid a looming electricity crisis that could be brought on by its growing reliance on wind and solar power.

Regulators and energy companies met Tuesday, hoping to hash out a solution to the peculiar stresses placed on the state's network by sharp increases in wind and solar energy. Power production from renewable sources fluctuates wildly, depending on wind speeds and weather.

California has encouraged growth in solar and wind power to help reduce greenhouse-gas emissions. At the same time, the state is running low on conventional plants, such as those fueled by natural gas, that can adjust their output to keep the electric system stable. The amount of electricity being put on the grid must precisely match the amount being consumed or voltages sag, which could result in rolling blackouts.

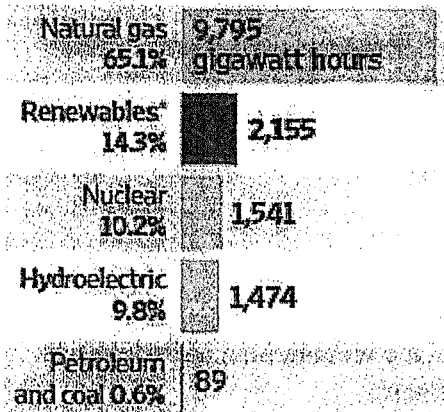
At Tuesday's meeting, experts cautioned that the state could begin seeing problems with reliability as soon as 2015.

California isn't the only state having trouble coping with a growing share of renewables. Texas also needs more resources, such as gas-fired power plants, that can adjust output in response to unpredictable production from wind farms.

Renewable power has seen a boom in both states. On Feb. 9, wind farms in Texas set a record for output, providing nearly 28% of the state's supply for the day. Production hasn't hit that level yet in California, but the state's goal is to get one-third of its electricity from renewable resources by 2020.

More Wind, Solar

California's electricity sources
in November 2012



*Excluding hydroelectric

Source: Energy Information Administration

The Wall Street Journal

"I think we're going to end up closer to 40%," said Robert Weisenmiller, chairman of the California Energy Commission, the state's policy and planning agency for electricity. A decade ago, California was hit by an electricity crisis marked by price surges and rolling blackouts, stemming from market manipulation and tightening electricity supplies in a newly deregulated market. To prevent a recurrence, state regulators passed rules requiring utilities to line up enough energy to meet even high power demand, with a special emphasis on in-state renewable resources.

"California has been well served by the procurement process since the crisis," said Steve Berberich, chief executive of the California Independent System Operator, which runs the state's grid. "The problem is we have a system now that needs flexibility, not capacity."

Changes in California's market have attracted lots of new generation; the state expects to have 44% more generating capacity than it needs next year. Grid officials say they expect the surplus to fall to 20% by 2022, though it will remain high for about a decade.

However, the surplus generating capacity doesn't guarantee steady power flow. Even though California has a lot of plants, it doesn't have the right mix: Many of the solar and wind sources added in recent years have actually made the system more fragile, because they provide power intermittently.

Electricity systems need some surplus, so they can cover unexpected generator outages or transmission-line failures, but having too much can depress the prices generators can charge for electricity. In part because of low power prices, many gas-fired generation units aren't profitable enough to justify refurbishments required by pending federal regulations under the Clean Water Act. That means they are likely to be shut by 2020, adding to the state's power woes.

By July, state officials hope to have a plan in place addressing the problem. Turf issues among state and federal regulators could complicate the process.

Michael Peevey, president of the California Public Utilities Commission, which regulates utilities, said action is clearly needed, but he isn't sure whether the market needs "small adjustments or a major overhaul."

Utility executives are calling for immediate action, pointing to the risk of rolling blackouts. "We see the issue hitting as soon as 2013, 2014, 2015," said Todd Strauss, the head of planning and analysis for PG&E Corp., a big utility serving Northern California, who attended Tuesday's meeting. "If we thought it was far out, we wouldn't be here."

A version of this article appeared February 27, 2013, on page A3 in the U.S. edition of The Wall Street Journal, with the headline: California Girds for Electricity Woes.

Regards
George

THE CHANGING ARCTIC.

By GEORGE NICOLAS IFFT.

[Under date of October 10, 1922, the American consul at Bergen, Norway, submitted the following report to the State Department, Washington, D. C.]

The Arctic seems to be warming up. Reports from fishermen, seal hunters, and explorers who sail the seas about Spitzbergen and the eastern Arctic, all point to a radical change in climatic conditions, and hitherto unheard-of high temperatures in that part of the earth's surface.

In August, 1922, the Norwegian Department of Commerce sent an expedition to Spitzbergen and Bear Island under the leadership of Dr. Adolf Hoel, lecturer on geology at the University of Christiania. Its purpose was to survey and chart the lands adjacent to the Norwegian mines on those islands, take soundings of the adjacent waters, and make other oceanographic investigations.

Dr. Hoel, who has just returned, reports the location of hitherto unknown coal deposits on the eastern shores of Advent Bay—deposits of vast extent and superior quality. This is regarded as of first importance, as so far most of the coal mined by the Norwegian companies on those islands has not been of the best quality.

* R. L. Holmes: Quart. Journ. Royal Meteorol. Soc., January, 1905.

The oceanographic observations have, however, been even more interesting. Ice conditions were exceptional. In fact, so little ice has never before been noted. The expedition all but established a record, sailing as far north as $81^{\circ} 29'$ in ice-free water. This is the farthest north ever reached with modern oceanographic apparatus.

The character of the waters of the great polar basin has heretofore been practically unknown. Dr. Hoel reports that he made a section of the Gulf Stream at 81° north latitude and took soundings to a depth of 3,100 meters. These show the Gulf Stream very warm, and it could be traced as a surface current till beyond the 81^{st} parallel. The warmth of the waters makes it probable that the favorable ice conditions will continue for some time.

Later a section was taken of the Gulf Stream off Bear Island and off the Isfjord, as well as a section of the cold current that comes down along the west coast of Spitzbergen off the south cape.

In connection with Dr. Hoel's report, it is of interest to note the unusually warm summer in Arctic Norway and the observations of Capt. Martin Ingebrigtsen, who has sailed the eastern Arctic for 54 years past. He says that he first noted warmer conditions in 1918, that since that time it has steadily gotten warmer, and that to-day the Arctic of that region is not recognizable as the same region of 1868 to 1917.

Many old landmarks are so changed as to be unrecognizable. Where formerly great masses of ice were found, there are now often moraines, accumulations of earth and stones. At many points where glaciers formerly extended far into the sea they have entirely disappeared.

The change in temperature, says Captain Ingebrigtsen, has also brought about great change in the flora and fauna of the Arctic. This summer he sought for white fish in Spitzbergen waters. Formerly great shoals of them were found there. This year he saw none, although he visited all the old fishing grounds.

There were few seal in Spitzbergen waters this year, the catch being far under the average. This, however, did not surprise the captain. He pointed out that formerly the waters about Spitzbergen held an even summer temperature of about 3° Celsius; this year recorded temperatures up to 15° , and last winter the ocean did not freeze over even on the north coast of Spitzbergen.

With the disappearance of white fish and seal has come other life in these waters. This year herring in great shoals were found along the west coast of Spitzbergen, all the way from the fry to the veritable great herring. Shoals of smelt were also met with.

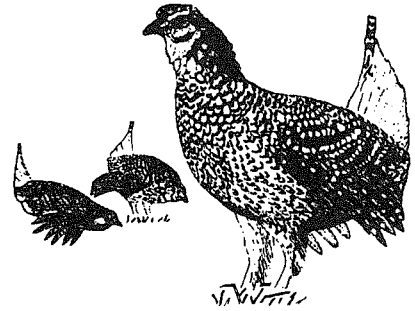
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North Dakota Chapter

THE WILDLIFE SOCIETY

P.O. BOX 1442 • BISMARCK, ND 58502



March 12, 2013

Chairman Lyson and
Members of the Senate Natural Resources Committee
North Dakota State Legislature

Chairman Lyson:

At last week's hearing on SCR 4024, I was asked a question on the earlier spring arrival of migrating birds in North Dakota. Attached are data and the methods, results, and conclusions from a research study conducted in south-central North Dakota between 1965 and 2004. The data were presented in a poster session at a North Dakota Chapter of The Wildlife Society annual conference several years ago, Lawrence Igl from the U.S Geological Survey's Northern Prairie Wildlife Research Center in Jamestown, ND.

In addition, committee members asked about the winter survey data on Canadian Geese wintering along the Missouri River. The Game and Fish Department waterfowl biologists are out of State this week. I will get those data from them as soon as they return next week.

I know that SCR 4024 has failed, but I promised that I would get the information for the Committee.

Sincerely,


Mike McEnroe
Legislative Liaison, NDCTWS

- breeding and stopover areas in North America for waterfowl, shorebirds, and other migratory species.

BACKGROUND AND METHODS

In 1965, the federal government established Northern Prairie Wildlife Research Center (NPWRC) a research facility near Jamestown in Stutsman County, North Dakota. The Center's earliest mission focused primarily on waterfowl and their breeding habitats in the Prairie Pothole Region. Recognizing that many researchers and managers would benefit from knowledge concerning where migratory species are expected to return in spring, NPWRC staff have been collecting first-arrival data for waterfowl and other migratory birds moving into or through Stutsman and seven surrounding counties (Barnes, Foster, Griggs, Kidder, La Moure, Logan, and Wells counties) since 1965. Data were collected in generally the same manner in each year. For each migratory bird species, data were recorded as the date (month/day/year) of the first observed arrival of each species in the eight county area. Reflecting NPWRC's early emphasis on waterfowl, data collected prior to 1992 included first-arrival dates for mostly waterfowl and several common, easy-to-identify, or charismatic non-waterfowl migratory bird species. First-spring arrival dates were recorded for 248 species; in this poster, I limit the analyses to the 53 species that had sample sizes greater than or equal to 25 years. I report median arrival dates for individual species in lieu of averages because medians are less affected by extremes or chance clusters. To evaluate trends in migration over time, I regressed first arrival dates for each species with year as the explanatory variable. To evaluate whether first arrival dates were related to spring temperatures, I used linear regression to compare first arrival dates and minimum, average, and maximum temperatures in February, March, April, and May. Historic weather data for Jamestown were obtained from the State Climatology Office of North Dakota. Statistical analyses were conducted with SAS statistical software, and I used a significance level of $P \leq 0.05$.

RESULTS

- Between 1892 and 2004, the minimum, average, and maximum temperatures in Jamestown have consistently increased for the months of February, March, April, and May, with the greatest increases occurring in February and March.
- The temperatures during February and March warmed by over 4.6 °F and 1.5 °F, respectively, during the 40-year study period (i.e., 1965-2004).

For the 53 species evaluated, the median arrival dates (over all years) ranged from 16 March to 12 May.

Fifty (94.3%) of the 53 migrant species showed advances in spring arrival (i.e., earlier arrival) and 39 (78.0%) of those 50 species had significantly ($P \leq 0.05$) advanced the timing of their spring arrival over the 40-year period (average 13.7 days earlier \pm 0.8 standard error).

Two species (Upland Sandpiper and Marbled Godwit) showed no trend in arrival dates throughout time.

Only one species (Say's Phoebe) showed a trend toward later arrival (2 days later), although not significantly so ($P = 0.69$).

RESULTS (continued)

- Seven species (Wood Duck, Common Goldeneye, Ruddy Duck, American Kestrel, Belted Kingfisher, American Tree Sparrow, Red-winged Blackbird) advanced their arrival dates by 20 or more days between 1965 and 2004.
- The earliest-arriving species had more variable first arrival dates than the later-arriving species (Pearson product moment correlation for mean vs. standard deviation of first arrival dates: $r = -0.67$; $P < 0.0001$); this pattern has been noted elsewhere in North America and in Europe.
- The arrival dates of 36 (67.9%) of the 53 species were negatively related ($P \leq 0.05$) to temperature, indicating that these species arrived earlier as spring temperatures increased.
- The arrival dates of 29 (80.6%) of these 36 species were significantly related to a temperature variable from the month of March.
- Sixteen of 20 (80%) anseriform species (swans, geese, and ducks) arrived significantly earlier ($P \leq 0.05$) with higher temperatures in March.
- Among the nine charadriiform species (plovers, shorebirds, terns, and gulls), four species (American Avocet, Killdeer, Wilson's Snipe, and Ring-billed Gull) arrived significantly earlier ($P \leq 0.05$) as spring temperatures increased.

CONCLUSIONS

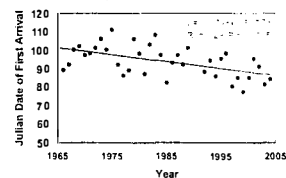
In summary, many species have advanced their spring arrival dates between 1965 and 2004 in south-central North Dakota. Although species differ in their adaptability, life history strategies, dispersal abilities, and physiological tolerances, many species show phenological adaptability to increasing spring temperatures in this region. Only a few species (e.g., Upland Sandpiper) were less flexible in their response to warming temperatures and have not increased in phenological earliness, as would be expected for migratory species that are regulated by photoperiod or by a signal other than local temperature. Moreover, there is no evidence available to indicate whether nesting habitat or food resources have advanced accordingly, which may result in a mismatch between the timing of arrival of migrants and optimal nesting habitat or food resources in south-central North Dakota. For example, a migratory bird species that is regulated by photoperiod may arrive on or about the same date every year but its critical food resources for nesting may no longer be available because the food resource's life cycle is regulated by temperature. Likewise, a migratory species that is regulated by temperature may arrive on its nesting grounds earlier as spring temperatures increase, but its critical food resources for nesting may not have advanced and may not be synchronized with the species' nesting cycle. Thus, the greatest impact of increasing spring temperatures on a species might not be the change in timing of migration, but rather effects on synchronization between migration and the species' food and habitat resources. The results from this study suggest that more attention should be given to the ecological importance of climatic warming in the conservation of migratory birds in the Prairie Pothole Region.

Species	Number of years reported	Median arrival date	Year	Number of days earlier *	Temperature variable that is most strongly associated with first arrival date **
Pied-billed Grebe	30	12 April	102	11	March Maximum
American White Pelican	33	12 April	102	13	May Minimum
Double-crested Cormorant	31	15 April	105	12	February Maximum
Great Blue Heron	31	9 April	99	18	February Maximum
Black-crowned Night-Heron	27	27 April	117	18	May Maximum
Tundra Swan	38	3 April	93	8	February Average
Canada Goose	38	16 March	75	18	March Average
Greater White-fronted Goose	37	31 March	90	16	March Average
Snow Goose	35	30 March	89	18	March Maximum
Wood Duck	29	3 April	93	29	March Maximum
Mallard	38	23 March	82	13	March Maximum
Gadwall	37	1 April	91	19	March Maximum
Northern Pintail	37	24 March	83	12	March Maximum
American Wigeon	37	31 March	90	10	March Maximum
Northern Shoveler	38	4 April	94	15	March Maximum
Blue-winged Teal	37	10 April	100	14	March Maximum
Green-winged Teal	37	4 April	94	13	March Maximum
Canvasback	37	2 April	92	11	March Maximum
Redhead	36	30 March	89	11	March Maximum
Ring-necked Duck	37	31 March	90	14	March Maximum
Lesser Scaup	36	28 March	87	18	March Maximum
Common Goldeneye	35	27 March	86	22	March Minimum
Bufflehead	34	7 April	97	12	March Maximum
Common Merganser	33	30 March	89	14	March Maximum
Ruddy Duck	36	16 April	106	27	May Minimum
American Coot	34	9 April	99	14	March Maximum
Sandhill Crane	31	6 April	96	19	March Maximum
Northern Harrier	37	16 March	75	15	March Average
Red-tailed Hawk	32	24 March	83	17	March Maximum
American Kestrel	31	18 March	77	23	March Maximum
American Avocet	28	20 April	110	17	May Maximum
Killdeer	38	28 March	87	11	March Average
Wilson's Snipe	36	13 April	103	3	April Average
Willet	32	22 April	112	2	March Minimum
Upland Sandpiper	33	5 May	125	0	April Minimum
Lesser yellowlegs	26	15 April	105	10	April Maximum
Marbled Godwit	35	19 April	109	0	May Average
Franklin's Gull	29	12 April	102	6	March Maximum
Ring-billed Gull	34	23 March	82	14	March Average
Belted Kingfisher	29	14 April	104	28	February Average
Mourning Dove	33	4 April	94	15	March Maximum
Northern Flicker	28	6 April	96	18	April Minimum
Say's Phoebe	28	21 April	111	-2	April Maximum
Western Kingbird	25	9 May	129	15	February Maximum
Tree Swallow	25	20 April	110	5	April Minimum
Barn Swallow	32	30 April	120	5	March Maximum
American Robin	35	17 March	76	14	February Average
American Tree Sparrow	25	16 March	75	27	March Maximum
Red-winged Blackbird	34	20 March	79	20	March Maximum
Yellow-headed Blackbird	27	15 April	105	15	March Minimum
Common Grackle	32	29 March	88	15	March Average
Bobolink	26	12 May	132	13	April Maximum
Western Meadowlark	38	20 March	79	2	April Maximum

* Positive values indicate earlier arrivals, and negative values indicate later arrivals. A bold value indicates a statistically significant ($P < 0.05$) relationship between first arrival date and year.

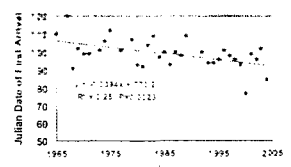
** A bold temperature variable indicates a statistically significant ($P < 0.05$) relationship between first arrival date and that variable.

Northern Shoveler



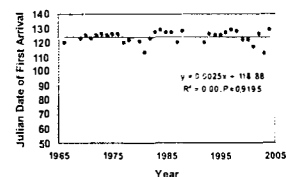
March Max: $R^2 = 0.12$ ($P = 0.0109$)

American Coot



March Max: $R^2 = 0.15$ ($P = 0.015^*$)

Upland Sandpiper



Temperature: Not significant