

**WELCOME!**  
**READY FOR CHANGE:**  
**PREPARING OREGON'S PUBLIC**  
**HEALTH AND EMERGENCY**  
**MANAGEMENT SECTORS**

May 4, 2011 Grants Pass, OR

# CLIMATE CHANGE CAUSES & EFFECTS: CONSEQUENCES FOR PUBLIC HEALTH AND EMERGENCY PREPAREDNESS

**Stacy Vynne** (Climate Leadership Initiative)

**Michael Heumann** (Oregon Health Authority)

Ready for Change \* Spring 2011

# Considerations for Today



- What threats does climate change pose towards public health and social services globally, nationally, locally?
- How do you fit in? What impacts and resulting consequences will you be dealing with in your community and line of work?
- What actions are we already taking? What barriers are we facing?
- Considering the projected impacts, how will the tools, resources, and communication strategies you learn about today be applied in your community?



Greenhouse Effect?

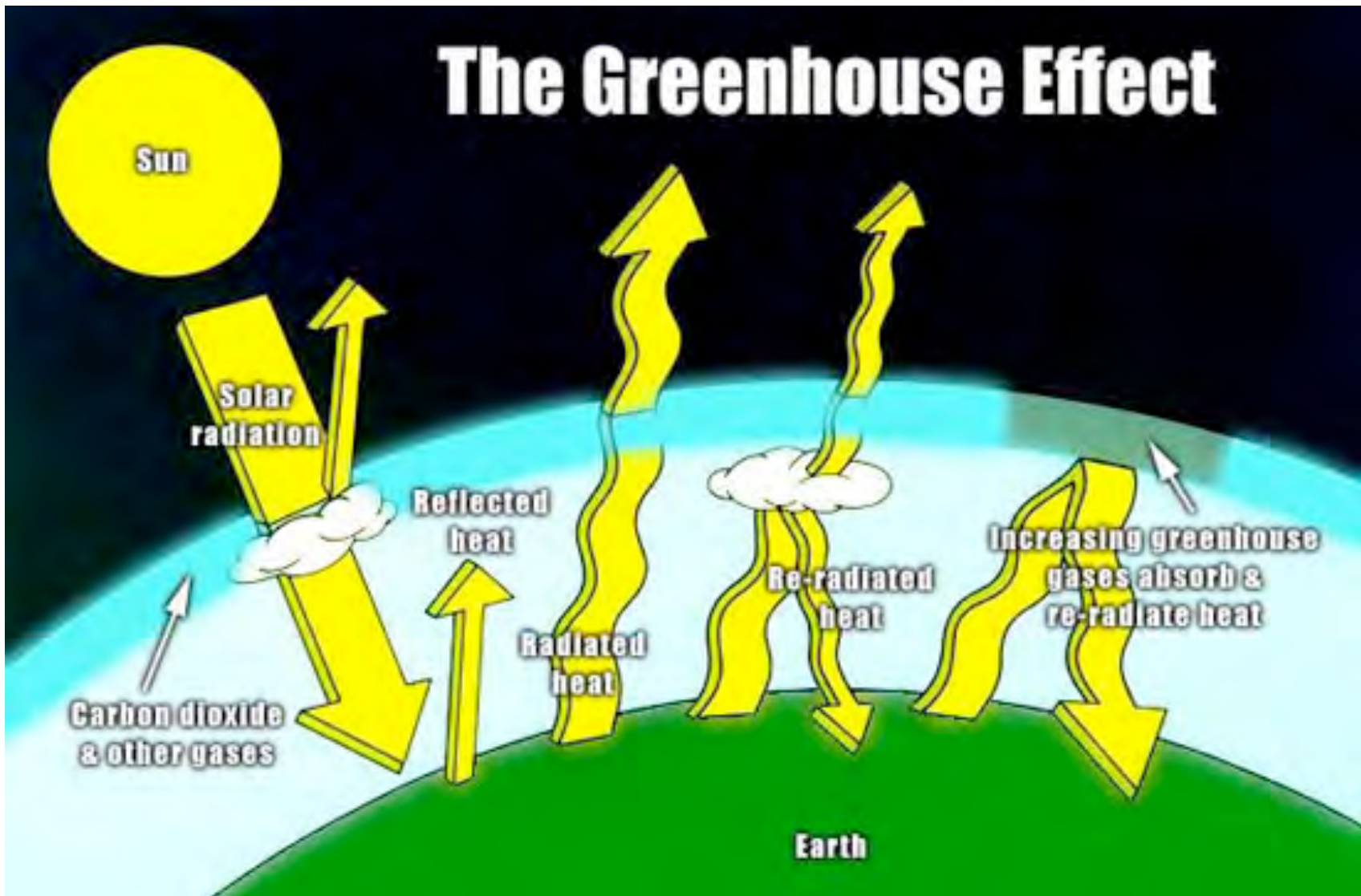
Weather?

Climate Change?

Global Warming?



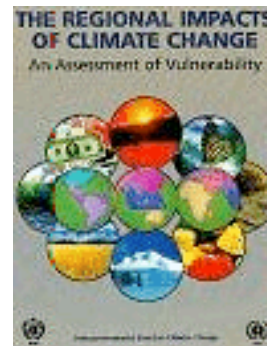
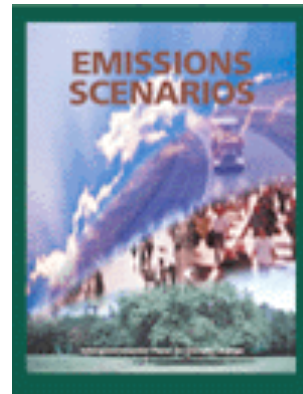
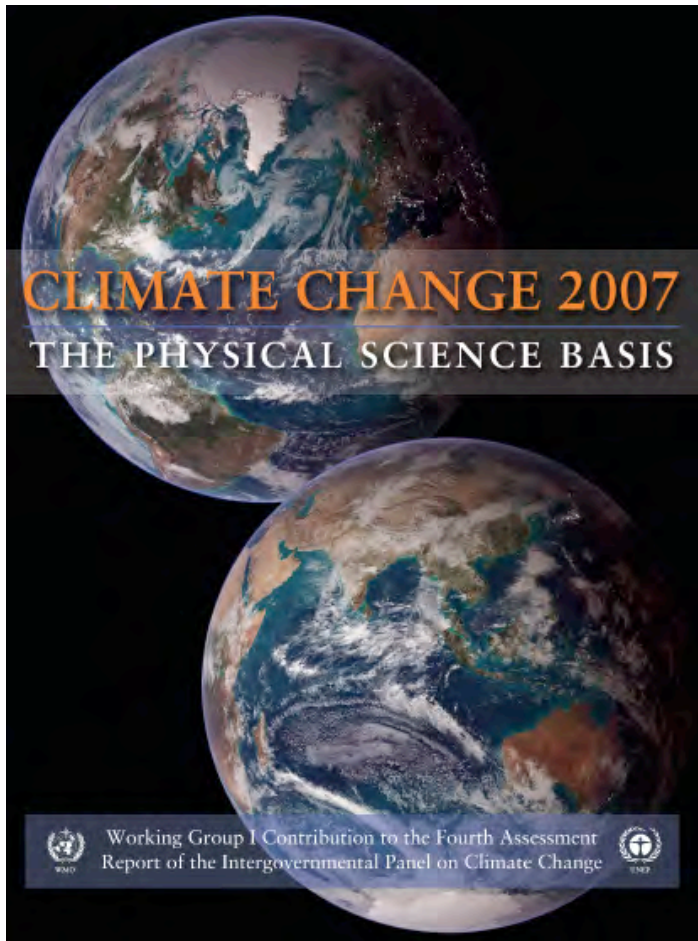
# The Greenhouse Effect







# Intergovernmental Panel on Climate Change (IPCC)



Climate Change 2007:  
Synthesis Report

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**Summary for Policymakers**

**An Assessment of the Intergovernmental Panel on Climate Change**

*This summary, approved in detail at IPCC Plenary XXVII (Valencia, Spain, 12-17 November 2007), represents the formally agreed statement of the IPCC concerning key findings and uncertainties contained in the Working Group contributions to the Fourth Assessment Report.*

Based on a draft prepared by:

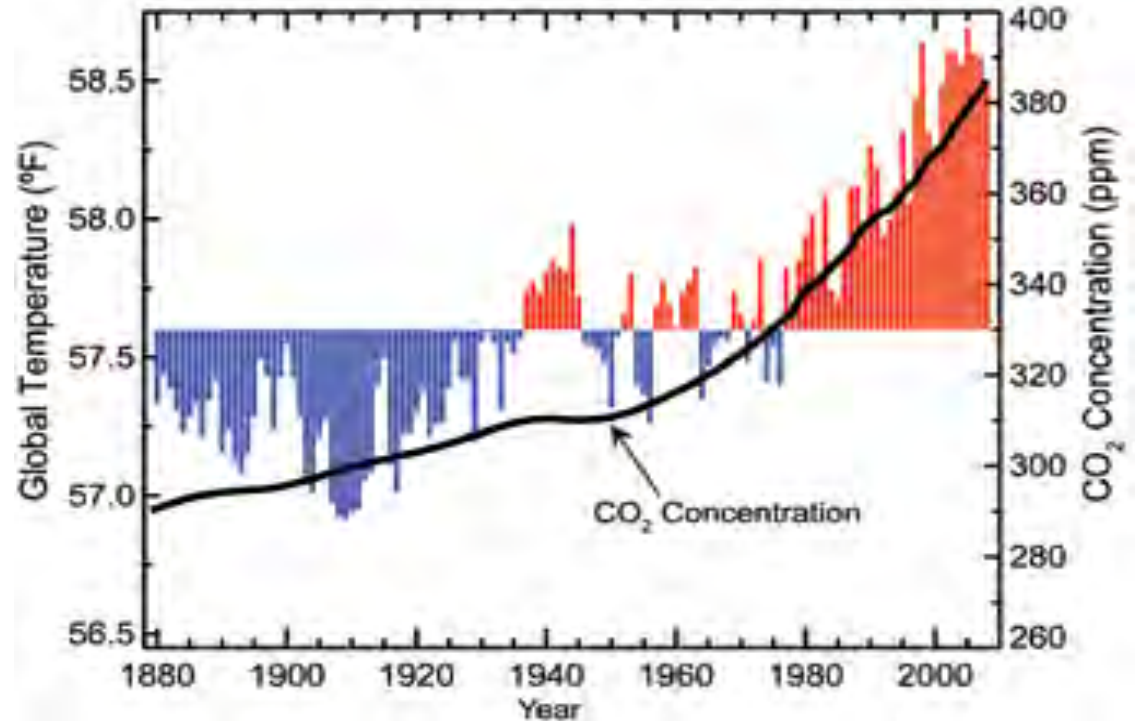
Lenny Bernstein, Peter Bosch, Osvaldo Canziani, Zhenlin Chen, Renate Christ, Ogunlade Davidson, William Hare, Saleemul Huq, David Karoly, Vladimir Kattsov, Zbigniew Kundzewicz, Jian Liu, Ulrike Lohmann, Martin Manning, Taro Matsuno, Bettina Menne, Bert Metz, Monirul Mirza, Neville Nicholls, Leonard Nurse, Rajendra Pachauri, Jean Palutikof, Martin Parry, Dahe Qin, Njavalli Ravindranath, Andy Reisinger, Jiawan Ren, Keywan Riahi, Cynthia Rosenzweig, Matilde Rusticucci, Stephen Schneider, Youba Sokona, Susan Solomon, Peter Stott, Ronald Stouffer, Taishi Sugiyama, Rob Swart, Dennis Tirpak, Coleen Vogel, Gary Yohe

[www.ipcc.ch](http://www.ipcc.ch)



# Climate Change is Happening

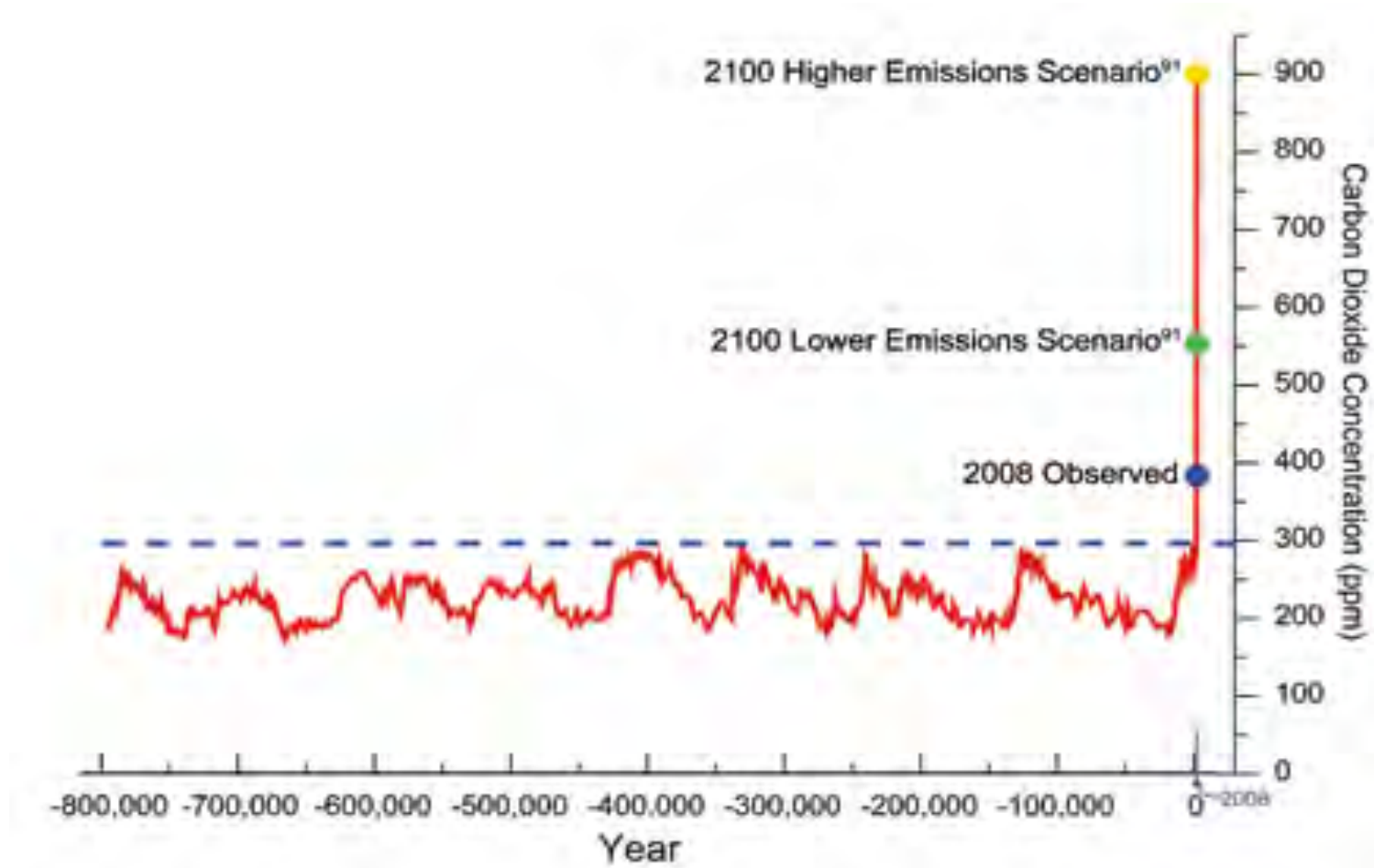
- Temperatures are increasing globally and regionally
  - 1.5° F increase in Pacific Northwest
- Human Caused



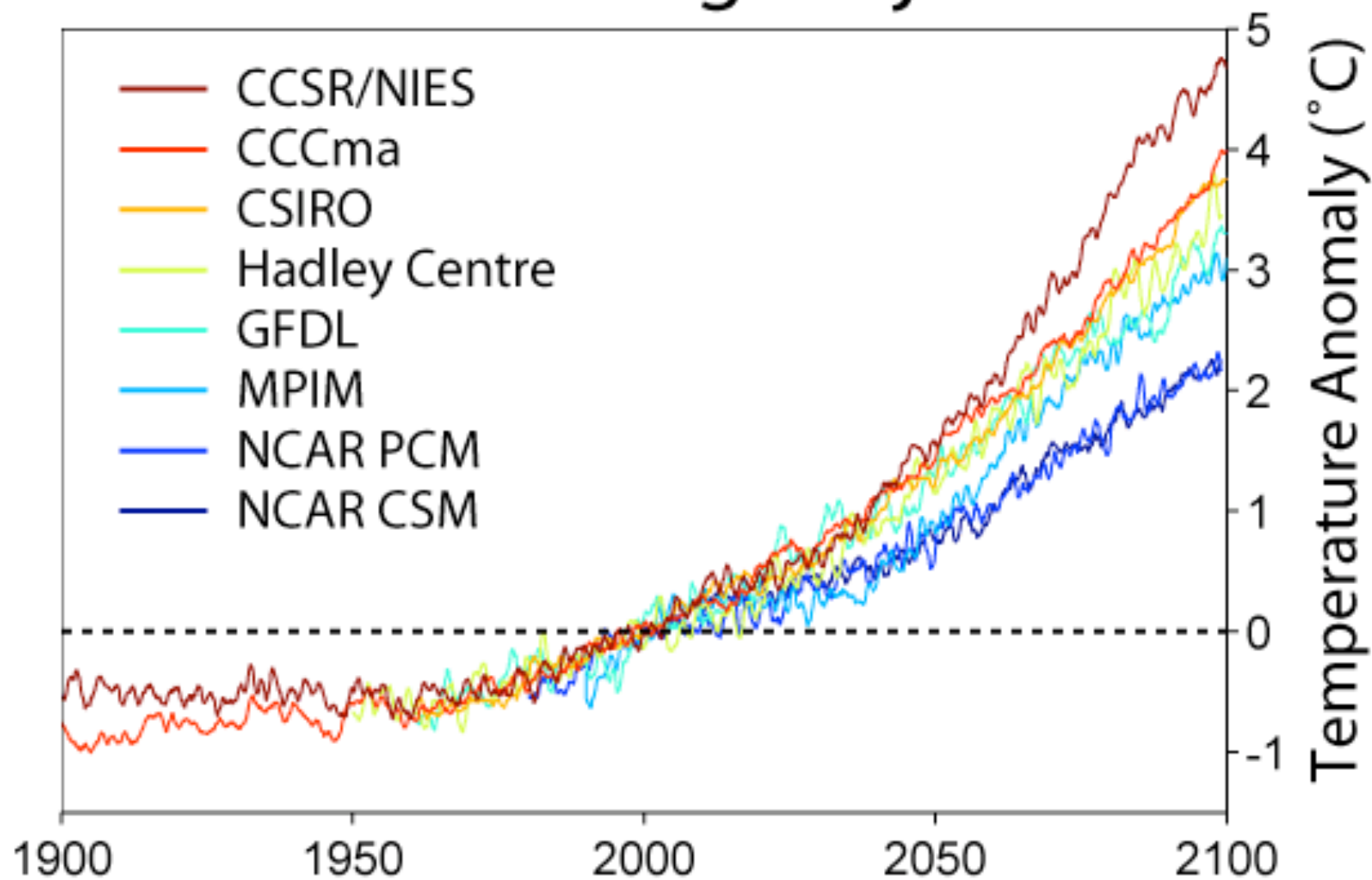
# CO<sub>2</sub> Levels Past 800 K Years (NOAA 2009)

Source: Global Climate Change Impacts in the U.S., NOAA 2009

10



# Global Warming Projections

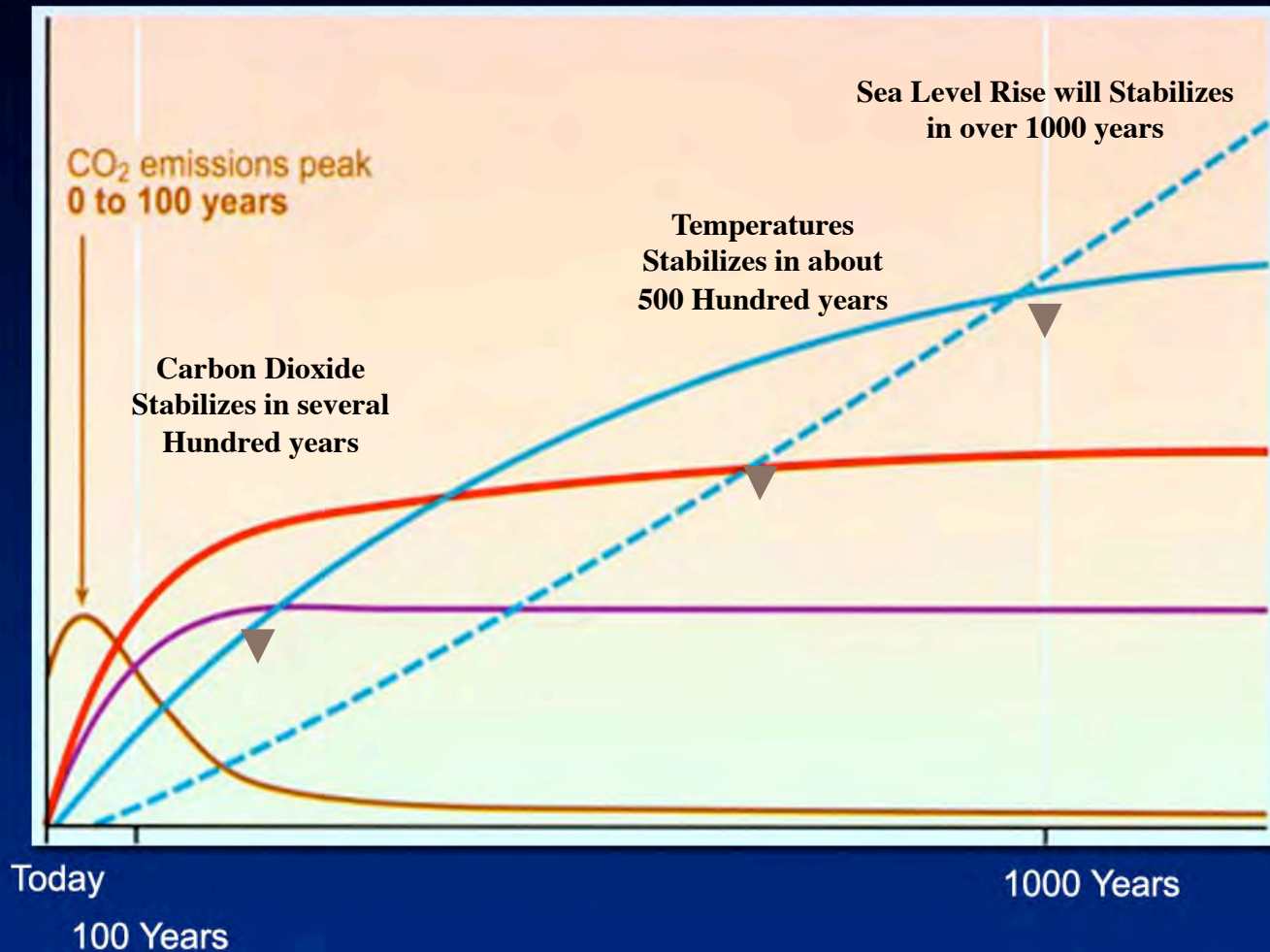




# CO<sub>2</sub> concentration, temperature, and sea level continue to rise long after emissions are reduced

Magnitude

Time to Equilibrium



Sea-level rise due to ice melting:  
SEVERAL MILLENNIA

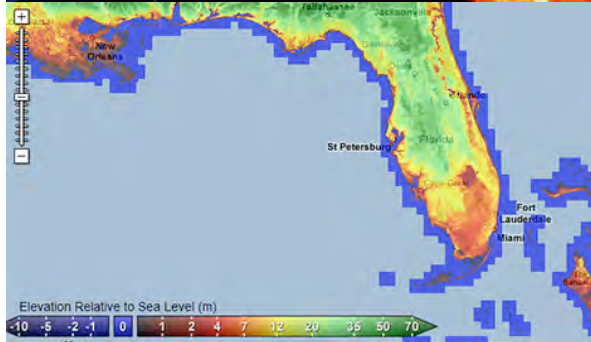
Sea-level rise due to thermal expansion:  
CENTURIES TO MILLENNIA

Temperature Stabilization:  
A FEW CENTURIES

CO<sub>2</sub> Stabilization:  
100 to 300 YEARS

CO<sub>2</sub> Emissions

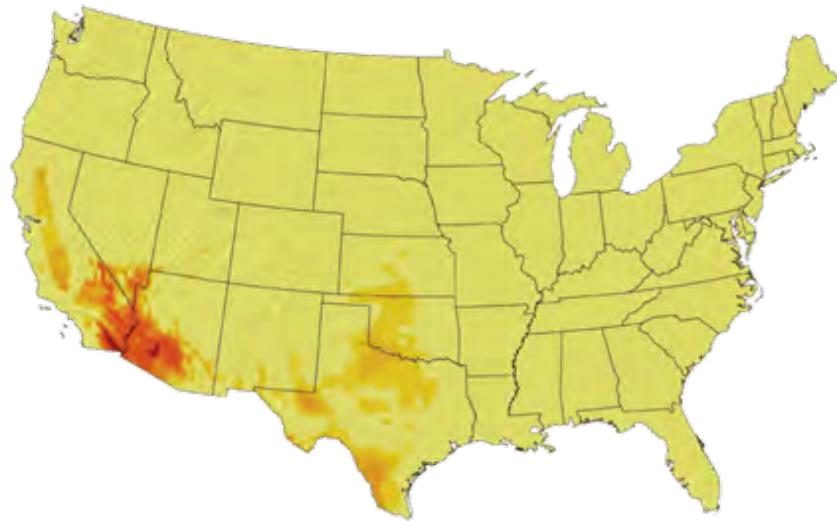
# Global Projections for Change



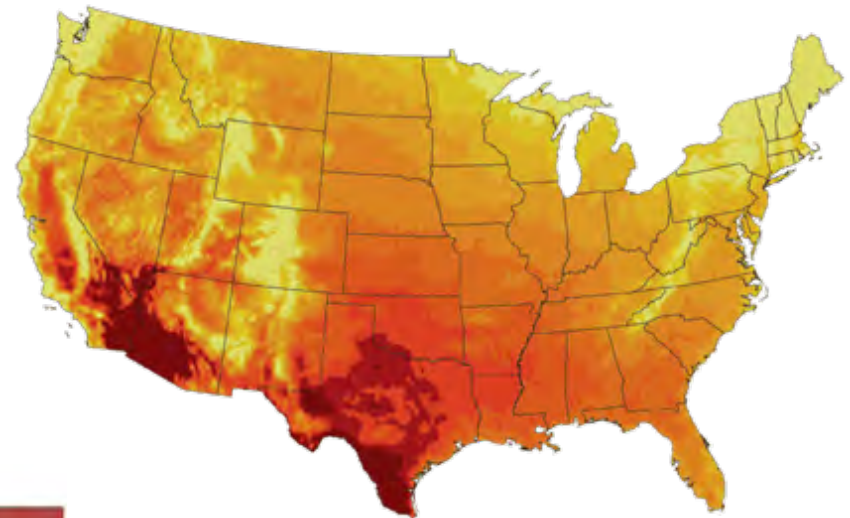
- **Higher Average Global Temperature**
- **Drought**
- **Heavy Precipitation**
- **Sea Level Rise**
- **Flooding**
- **Increased ozone levels**
- **Change in fire patterns**

# Number of Days Over 100° F

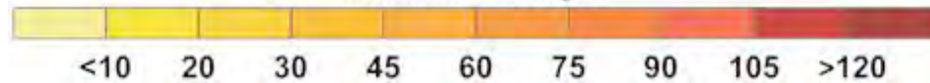
Recent Past, 1961-1979



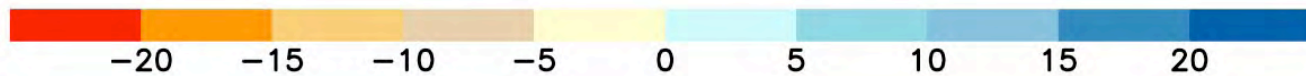
2080-2099



Number of Days



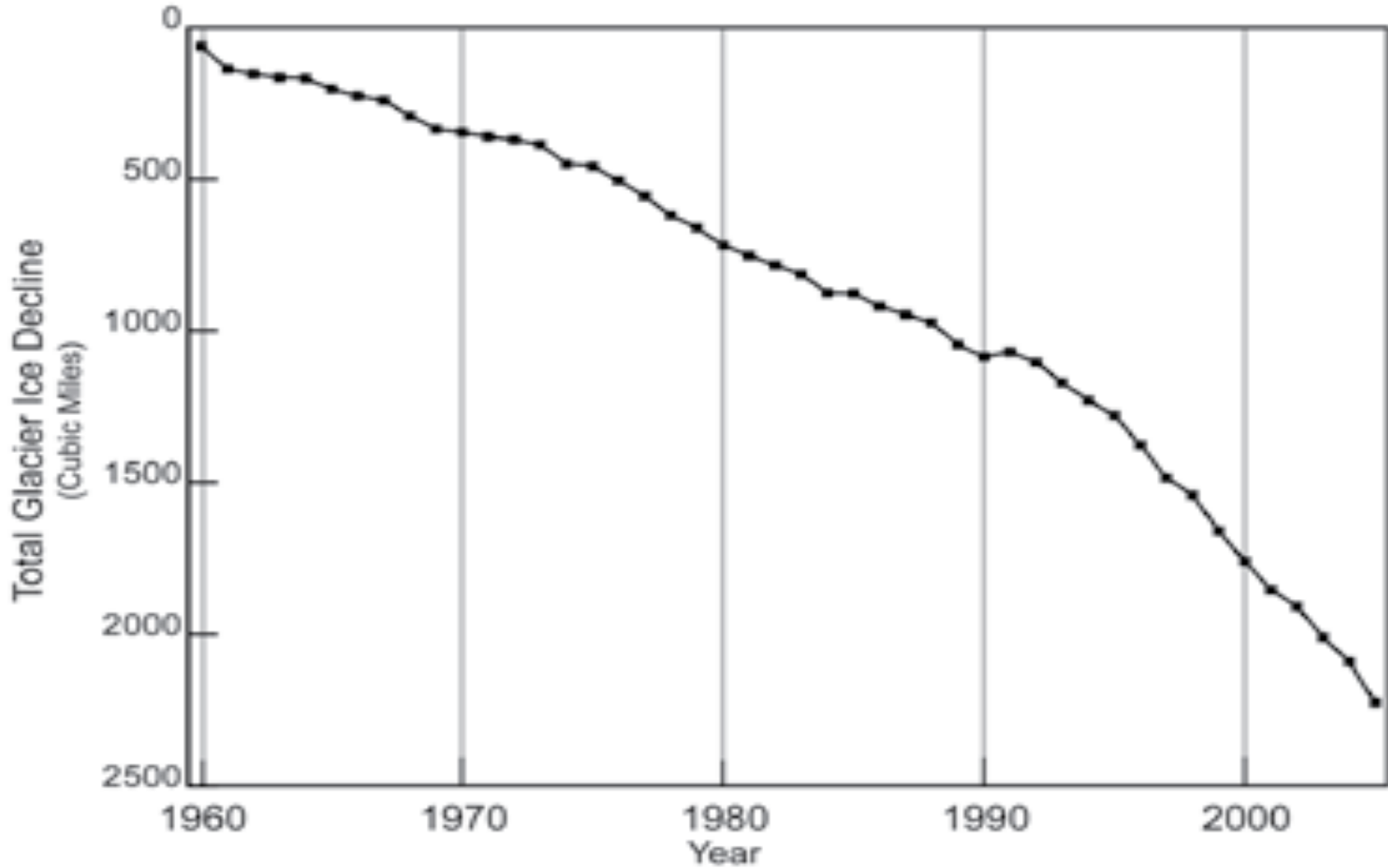
**Some areas are projected to become wetter,  
others drier with an overall increase projected**



**Annual mean precipitation change:  
2071 to 2100 relative to 1990**

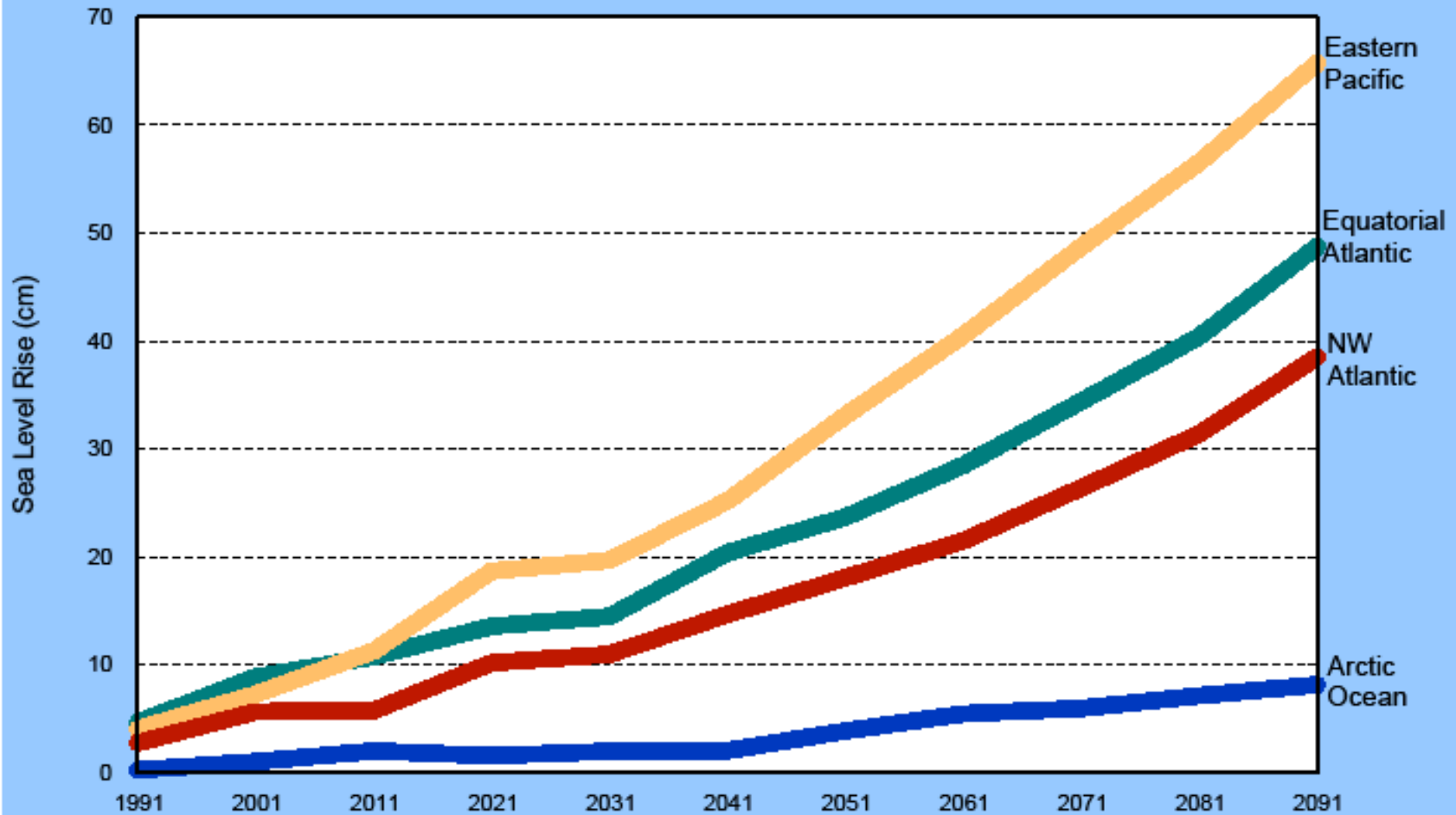
# Cumulative Decrease in Global Glacial Ice (1960-2010)

Source: Global Climate Change Impacts in the U.S., NOAA 2009



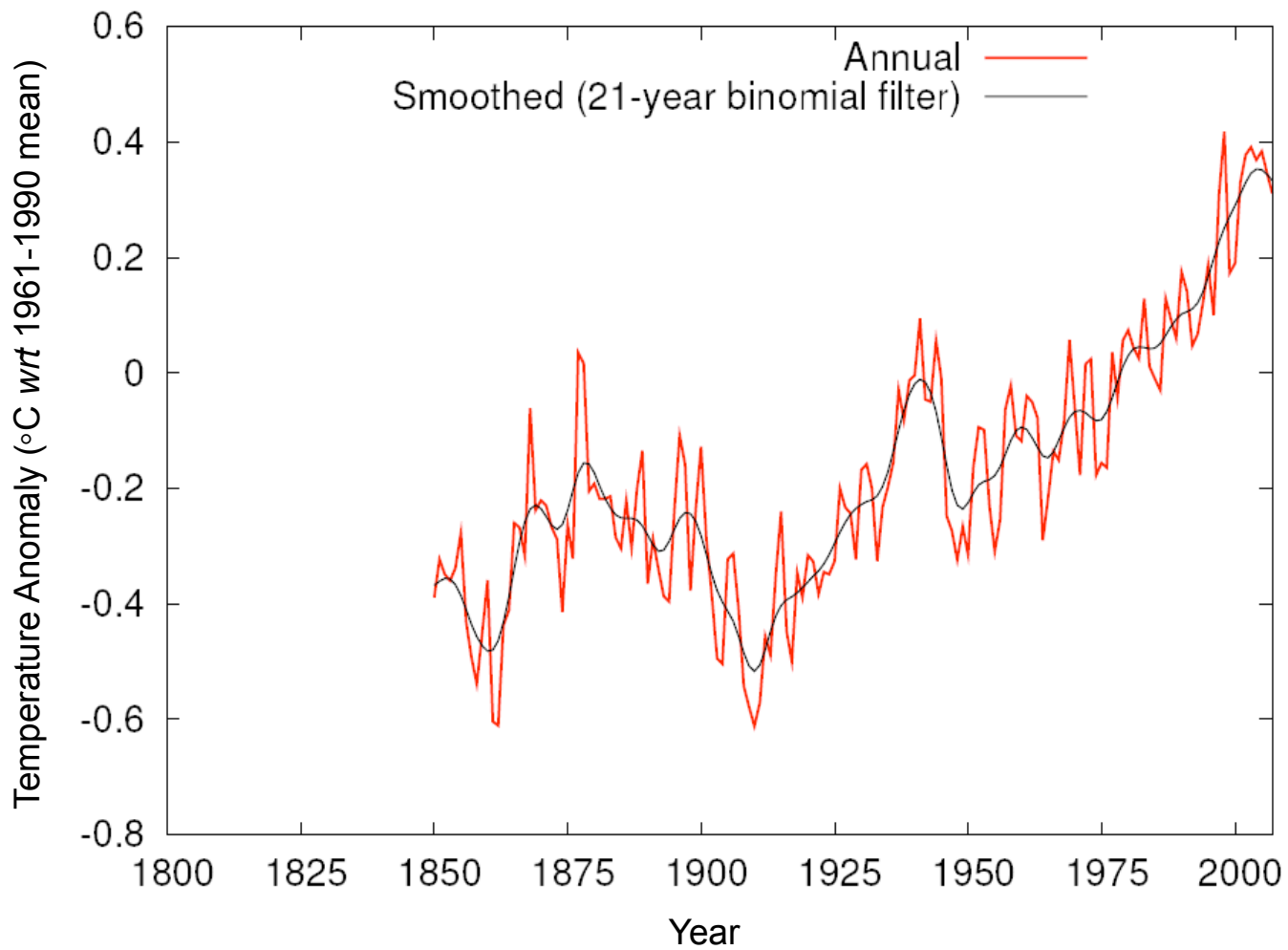


# Regional Changes in Sea Level

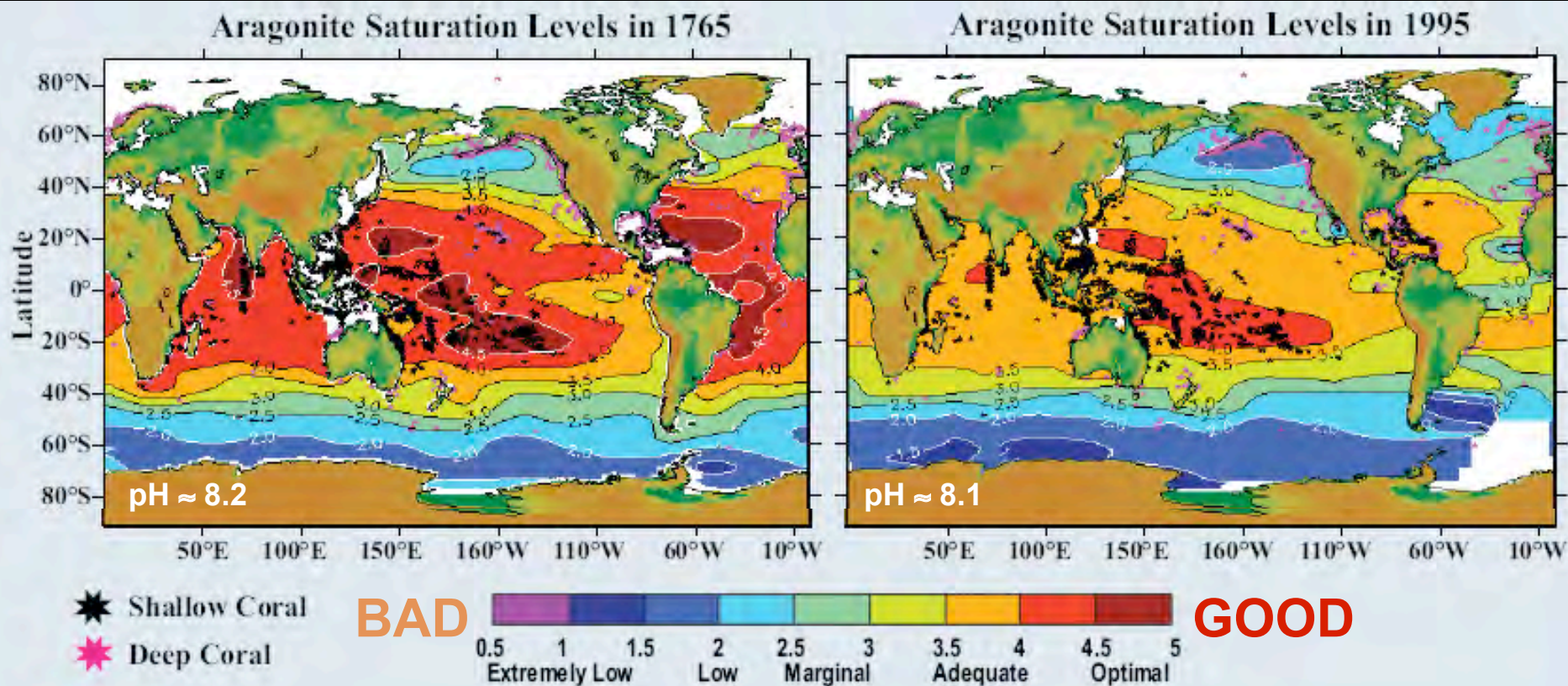


Source: Canadian Climate Change Model

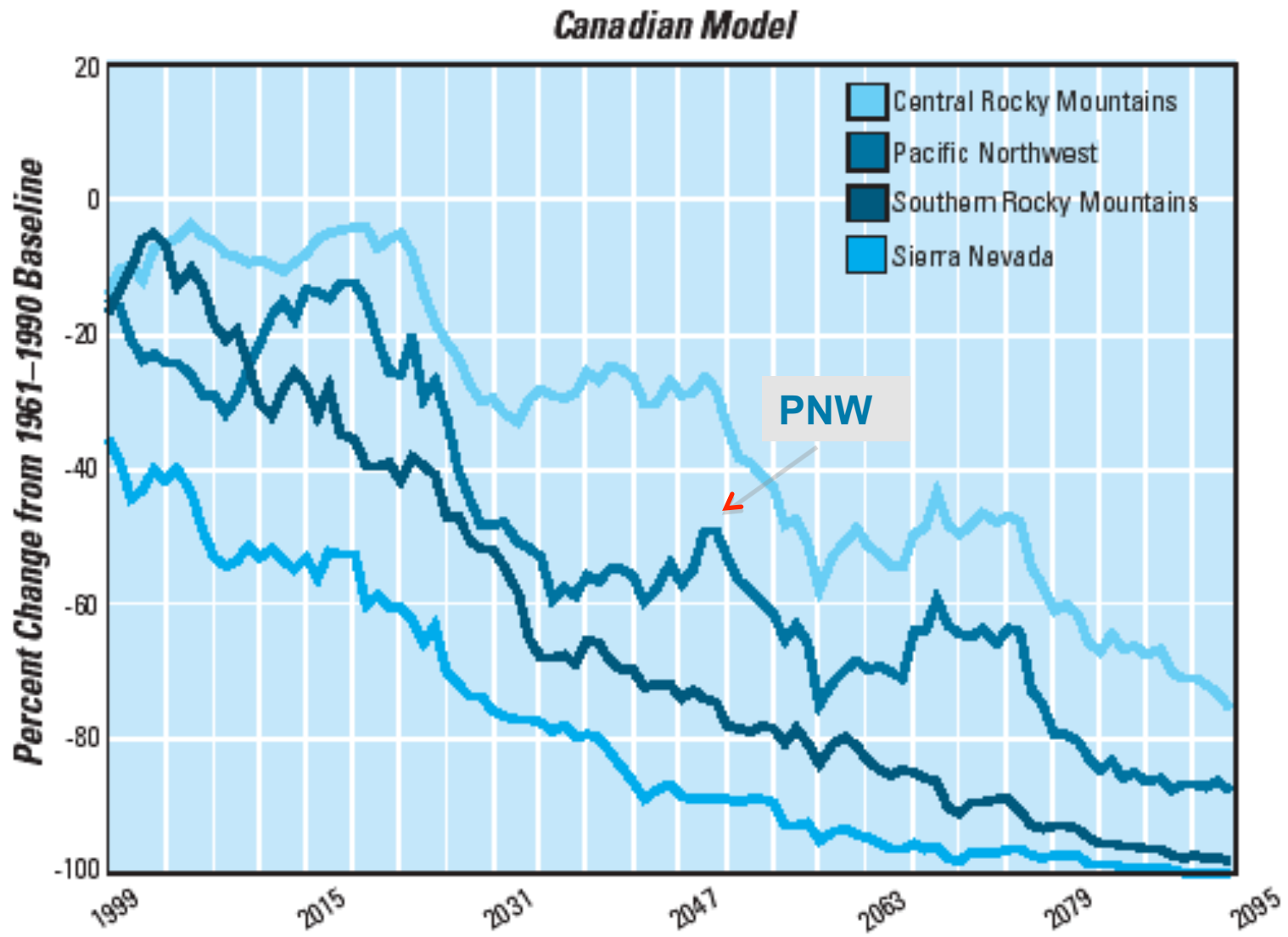
# The Oceans Are Warming



# The Oceans Are Acidifying

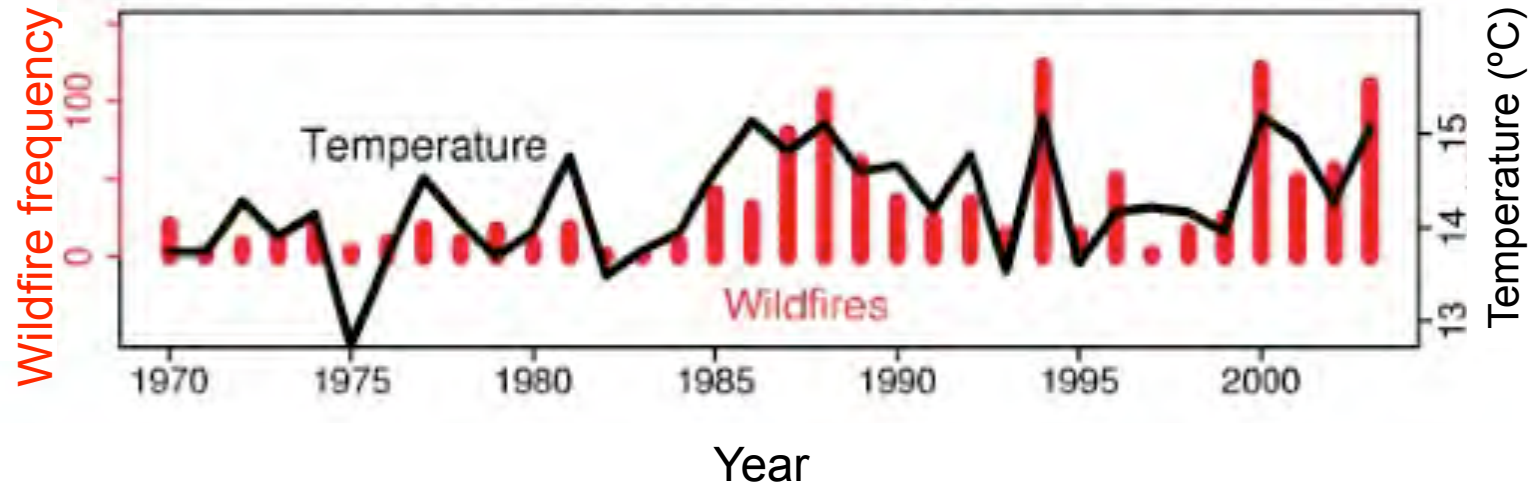


# Snowpacks are Projected to Diminish



# Increasing Risk of Wildfire

Western Wildfires and Spring-Summer Temperatures



6-fold increase in area burned since 1986

From Westerling et al. 2006. Science.

# CO<sub>2</sub> Concentration Increasing at Alarming Rate

- ↑ CO<sub>2</sub> stimulates plant growth and drought resistance, but also...
  - ...favors invasive species and production of allergens.
- Ocean has absorbed one-third of all increases in atmospheric CO<sub>2</sub> since beginning of industrial revolution, but also...
  - ...ocean acidification has increased 30% and threatens formation of calcium carbonate in shellfish and phytoplankton and disruption of marine food chain.
- At current emissions trajectory CO<sub>2</sub> acidification will increase 150% by end of century

Source: 2010 NAS study team

# Key Findings: USGCRP 2009 Report

- Temperatures in the US will rise 5-9 degrees F on average in the next 100 years.
- The potential impacts of climate change will vary widely across the nation (e.g. some areas drier, some wetter).
- Many ecosystems are highly vulnerable to the projected rate and magnitude of climate change.
- Widespread concern for change in water (drought, flooding, etc).
- Unknown impacts to agricultural sector (some areas more productive, others less).
- Near term increase in forest productivity (CO<sub>2</sub>); long term loss (fire, disease, drought).
- Increased damage to coastal and permafrost areas, particularly to infrastructure.
- Health of human population likely to be impacted.
- Exacerbation of existing threats.
- Uncertainties remain and surprises expected.

# Rogue Basin: Local Projections for Change



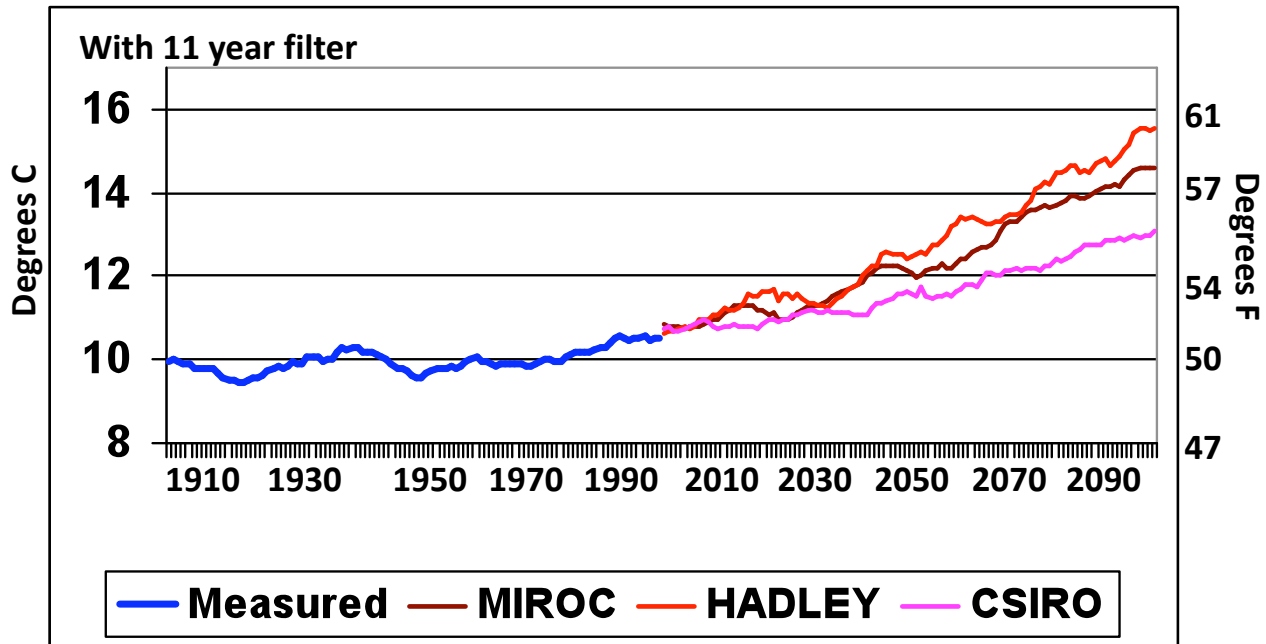
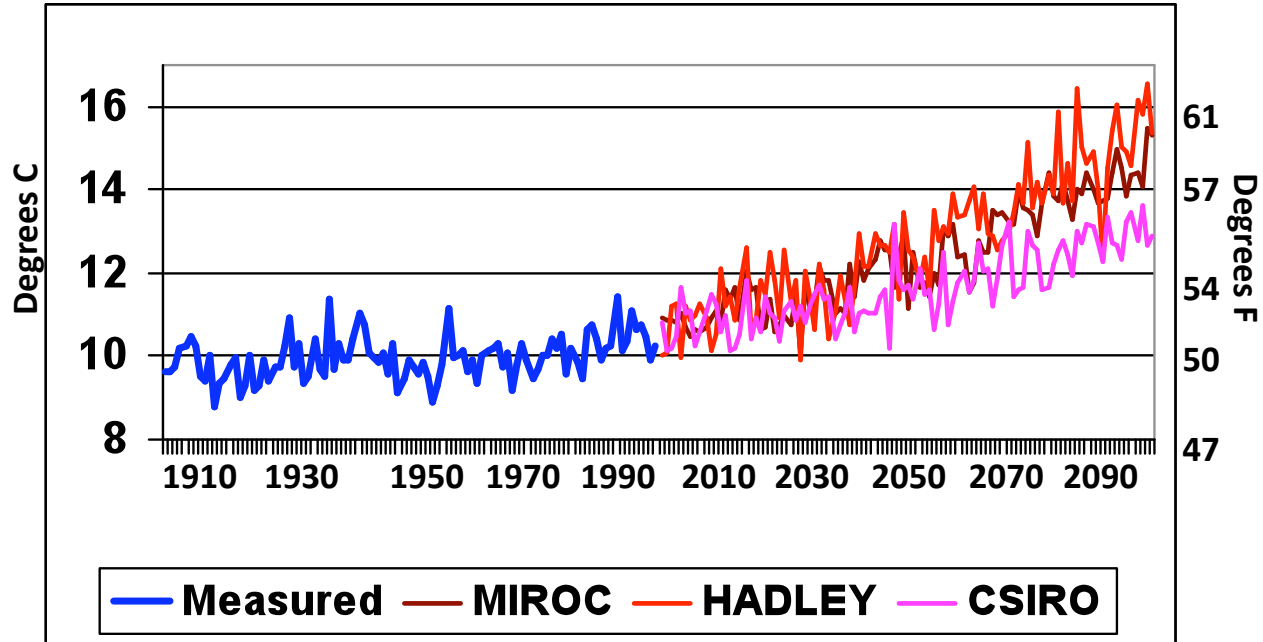


# Rogue Basin Temperatures



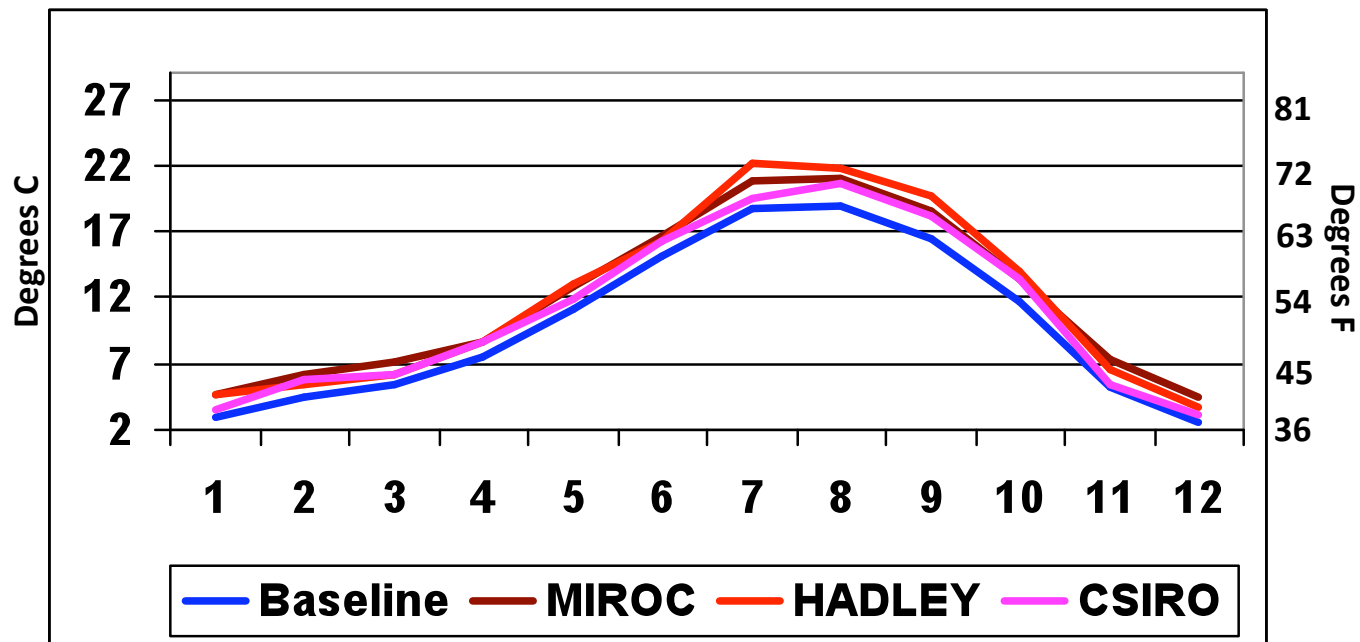
- Annual average temperatures are likely to increase from 1 to 3° F (0.5 to 1.6° C) by around 2040, and 4 to 8° F (2.2 to 4.4° C) by around 2080.
- Summer temperatures may increase dramatically reaching 7 to 15° F (3.8 to 8.3° C) above baseline by 2080, while winter temperatures may increase 3 to 8° F (1.6 to 3.3° C).

# Annual Average Temperature Across the Rogue Basin

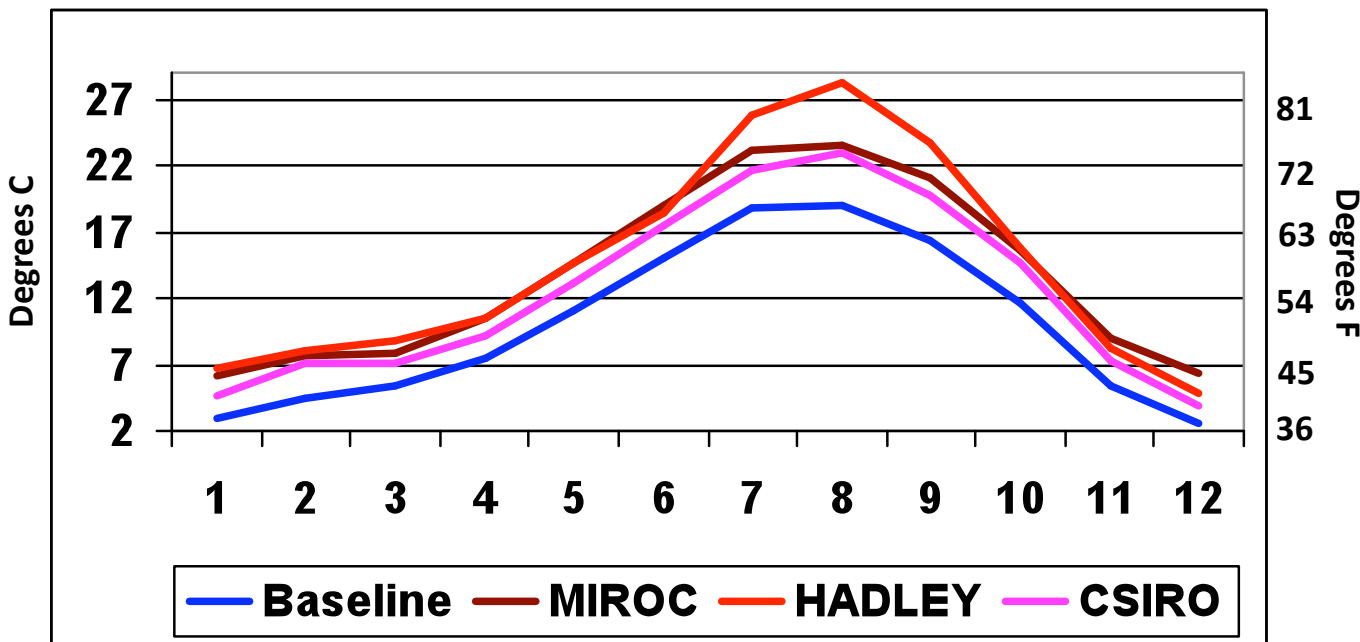


# Average Monthly Temperature Across the Rogue Basin

Baseline (1961-1990)  
vs  
2035-2045 Averages

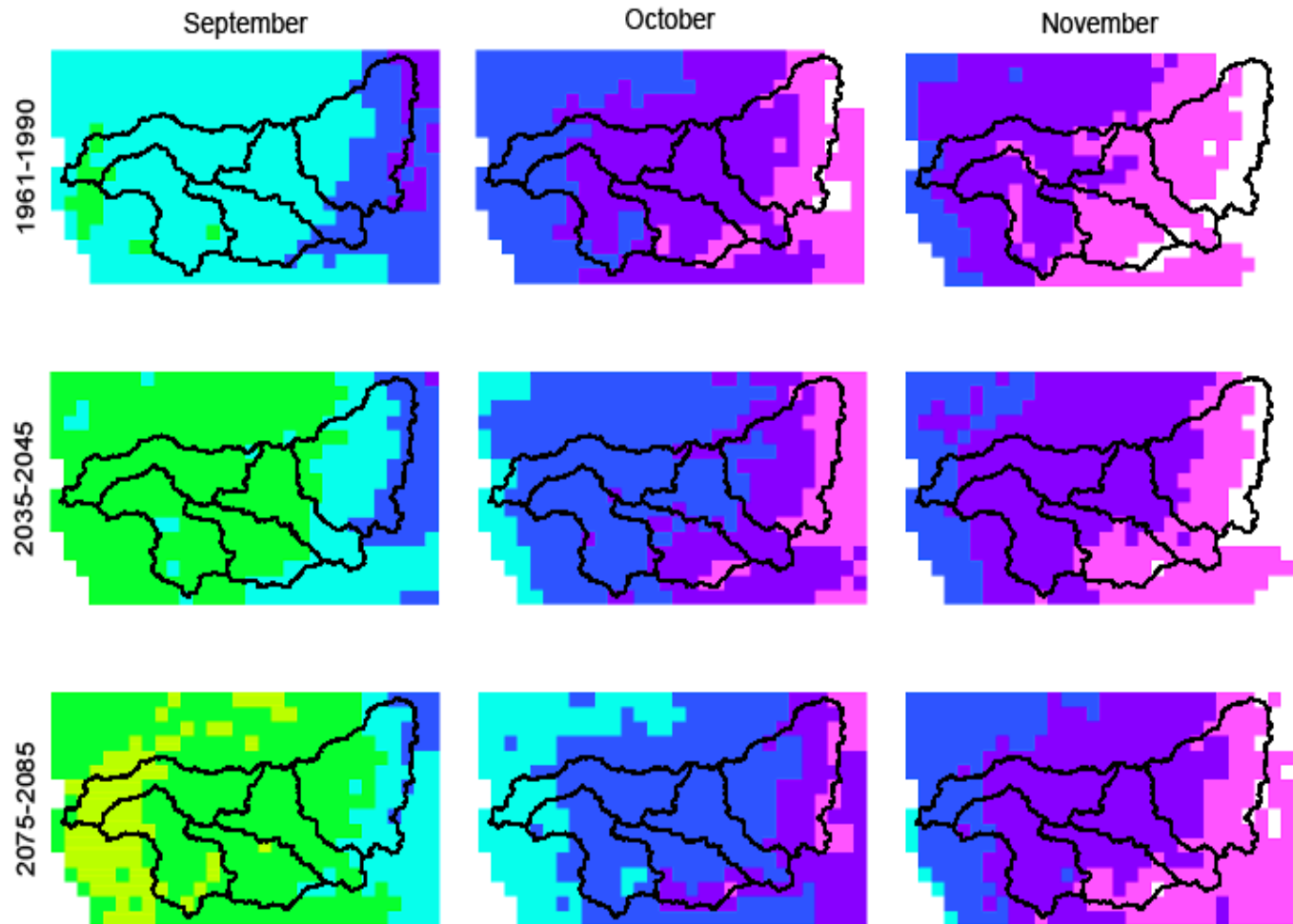


Baseline (1961-1990)  
vs  
2075-2085 Averages



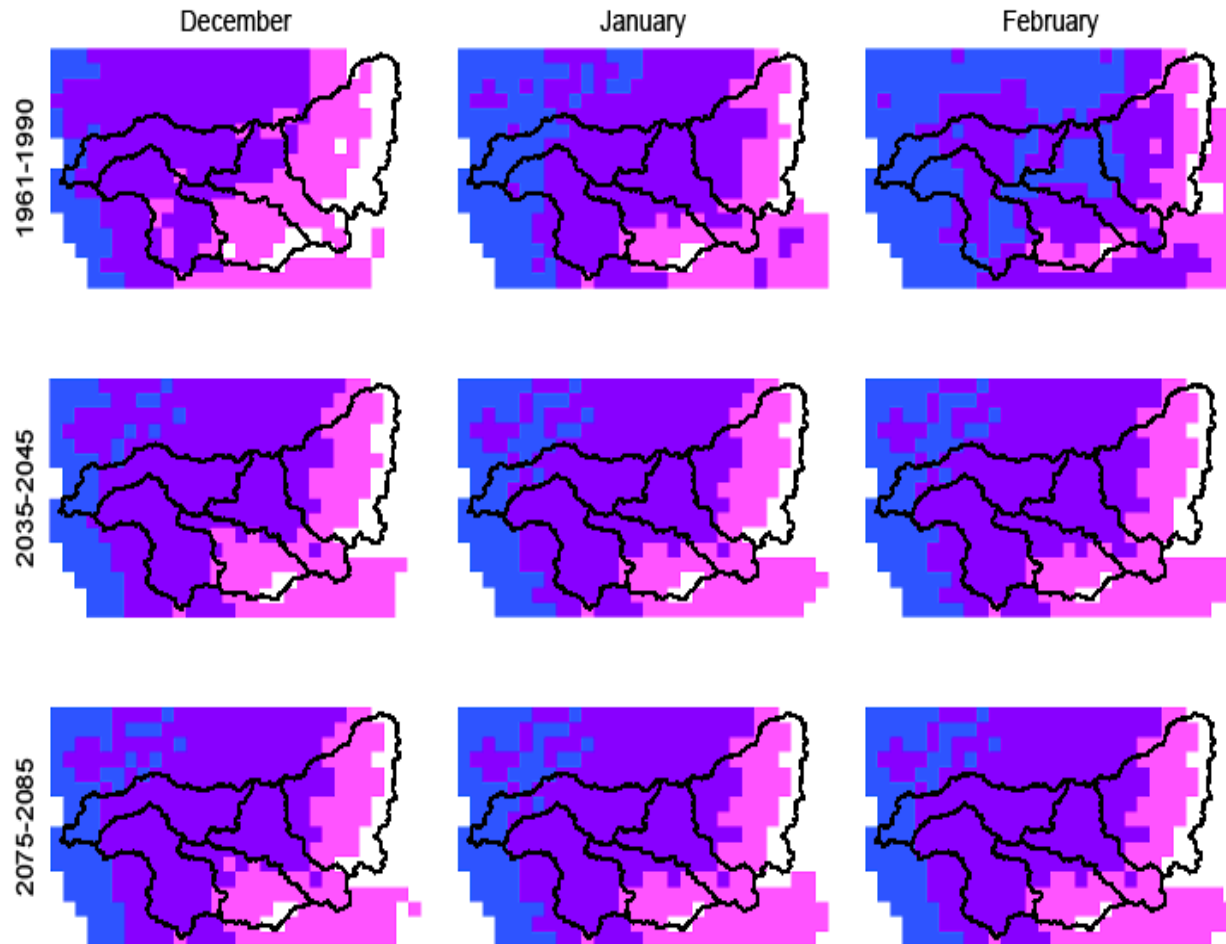
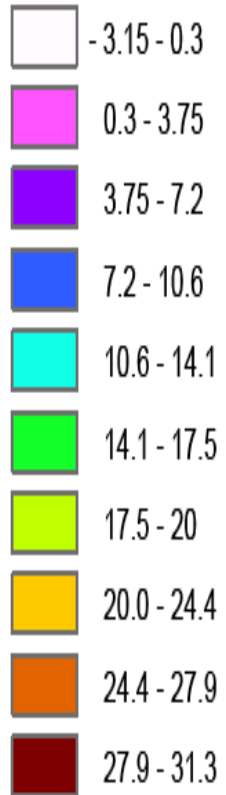
# Hadcm3A2 Fall Temperature

## Temperature



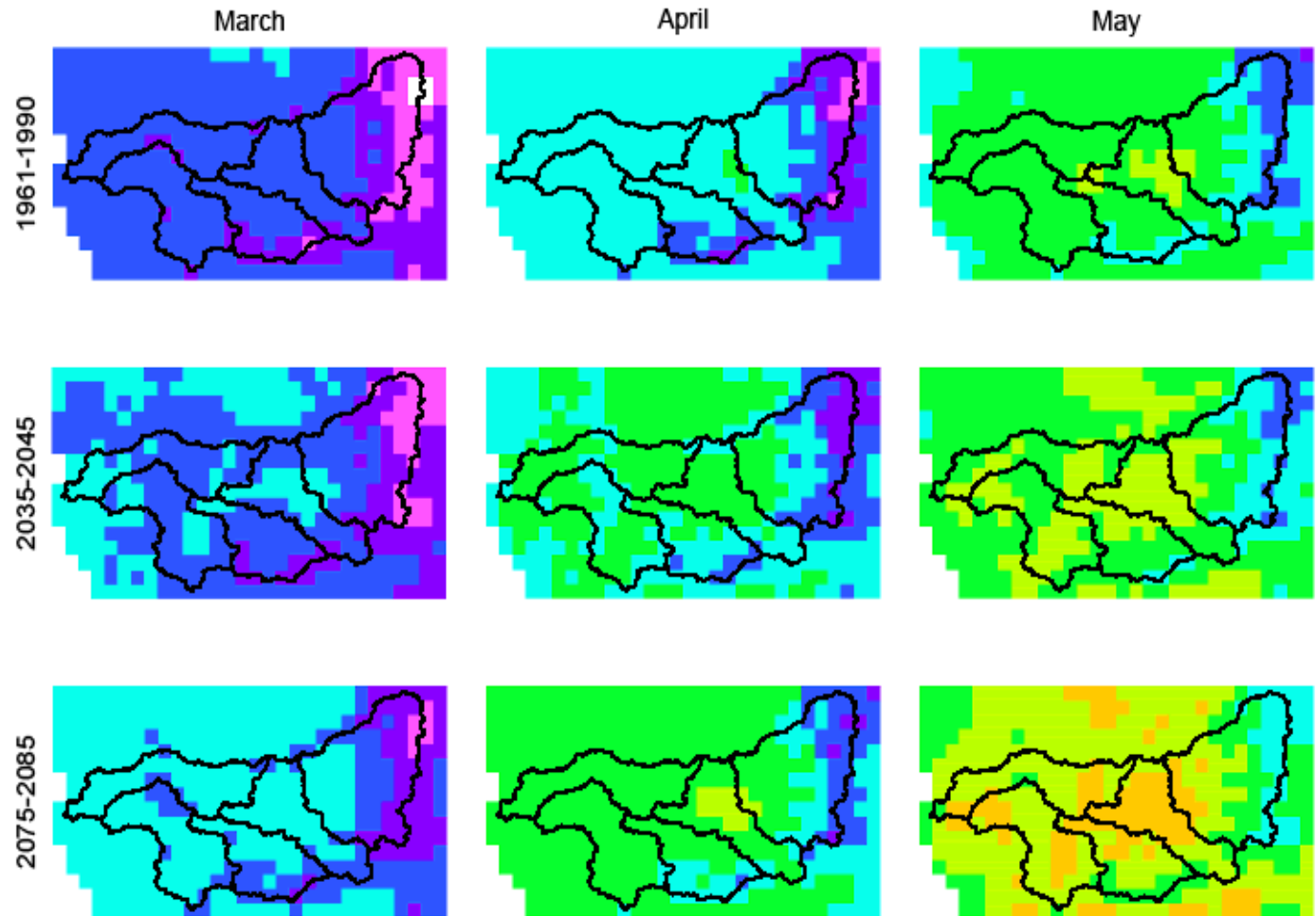
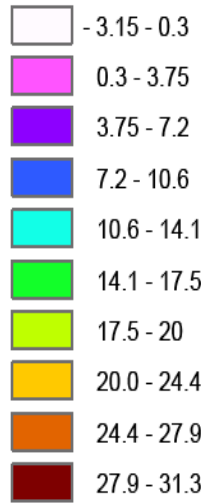
# Hadcm3A2 Winter Temperature

## Temperature



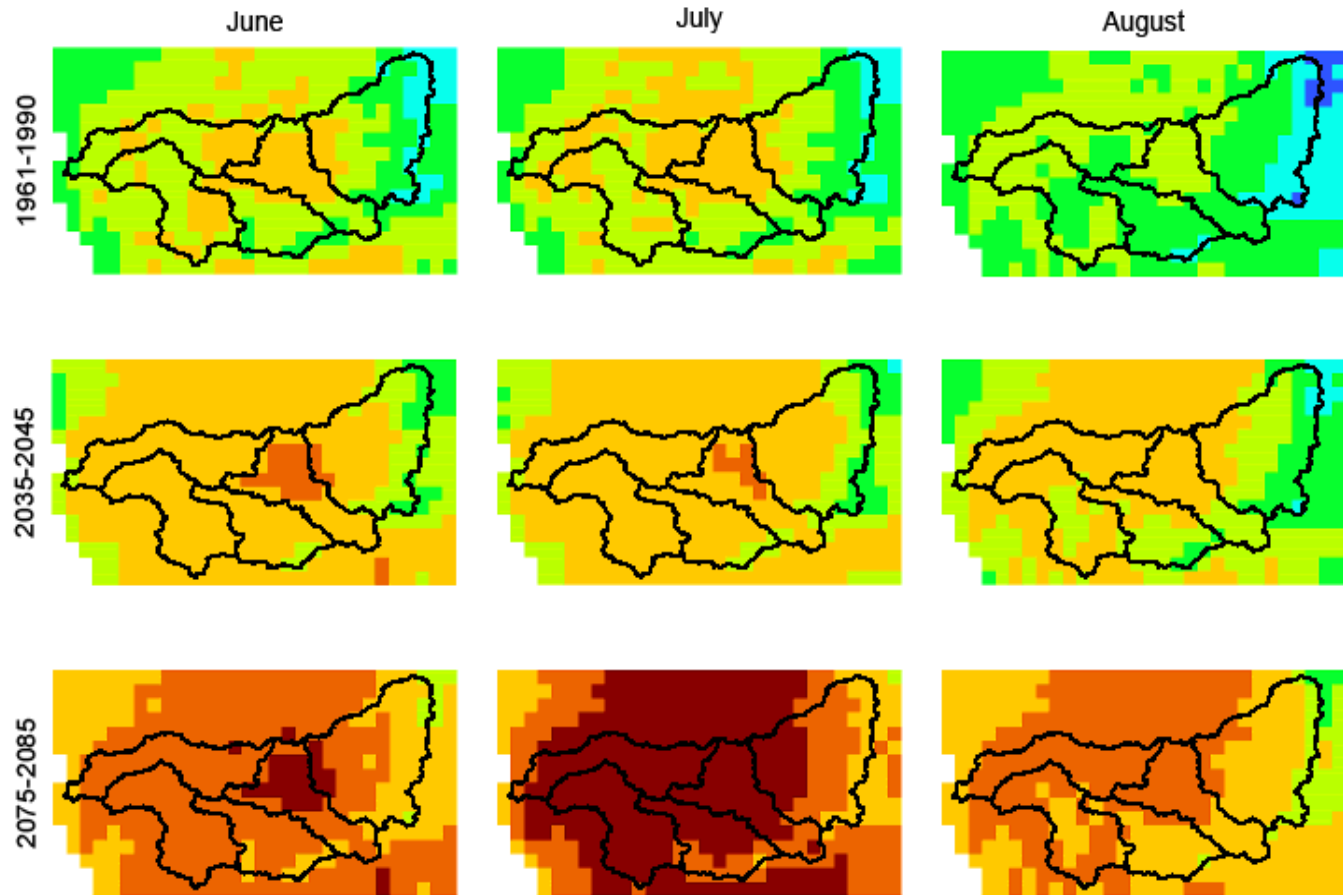
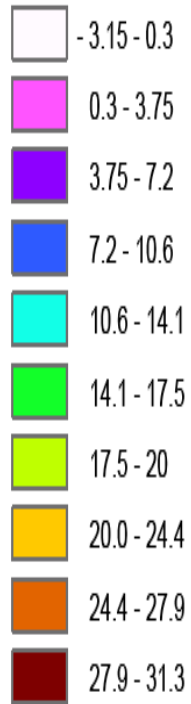
# Hadcm3A2 Spring Mean Temperature

## Temperature



# Hadcm3A2 Summer Temperature

## Temperature



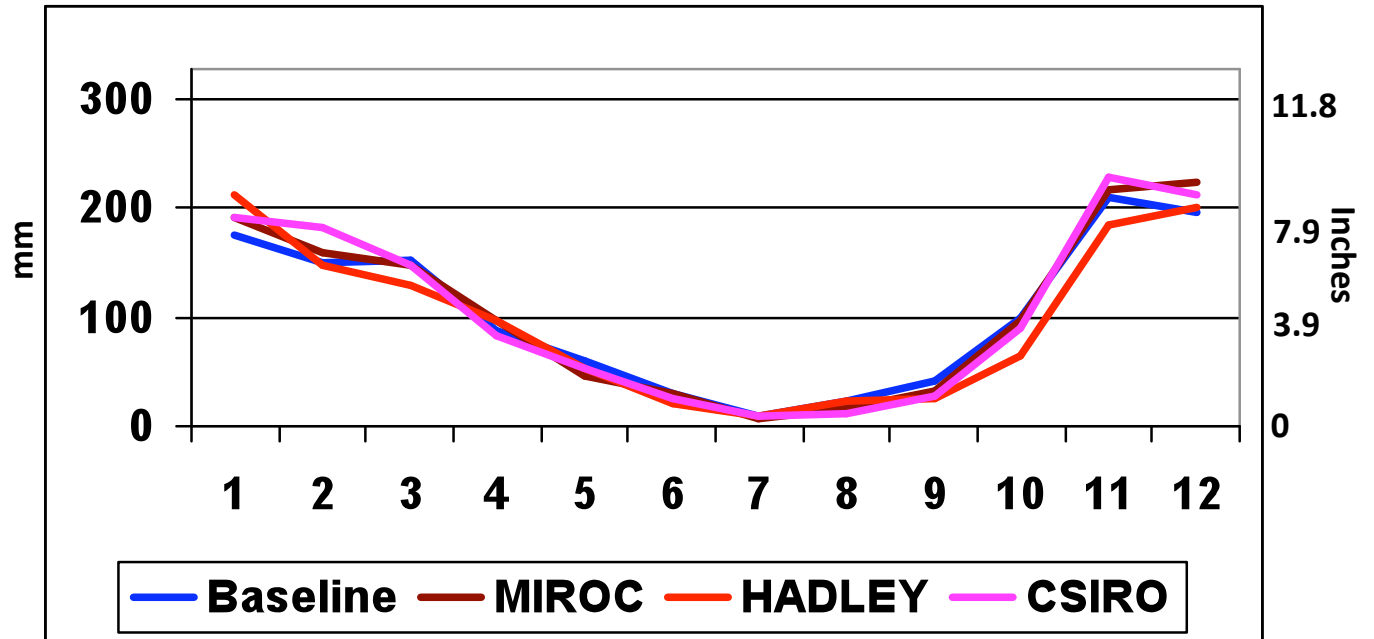
# Precipitation and Snowpack

- Annual precipitation may remain roughly similar to historical levels but increasingly is likely to **fall in the mid-winter months** rather than in the spring, summer and fall.
- Rising temperatures will cause **snow to turn to rain** in lower elevations and **decrease average January snowpack** significantly, with a corresponding **decline in runoff** and streamflows.
- According to one model, **snowpack will be reduced 75%** from the baseline by 2040, and another 75% from 2040 to an insignificant amount by 2080.

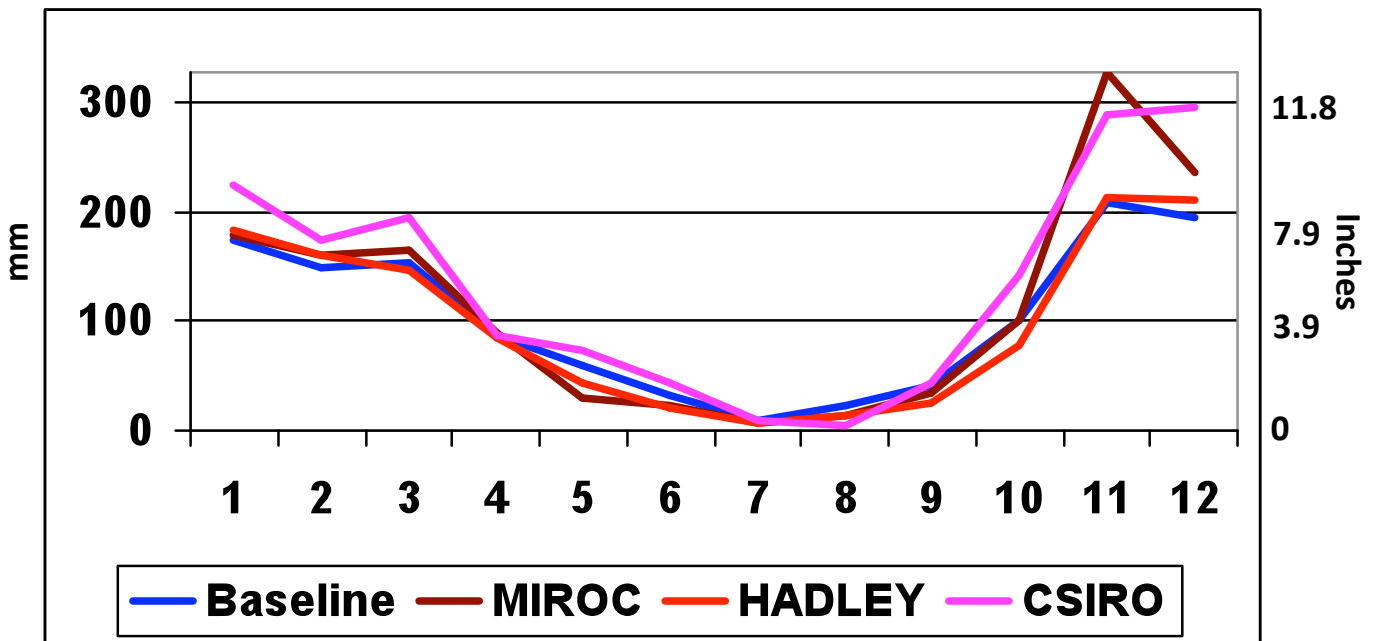


## Average Monthly Sum Precipitation Across the Rogue Basin

Baseline (1961-1990)  
vs  
2035-2045 Averages

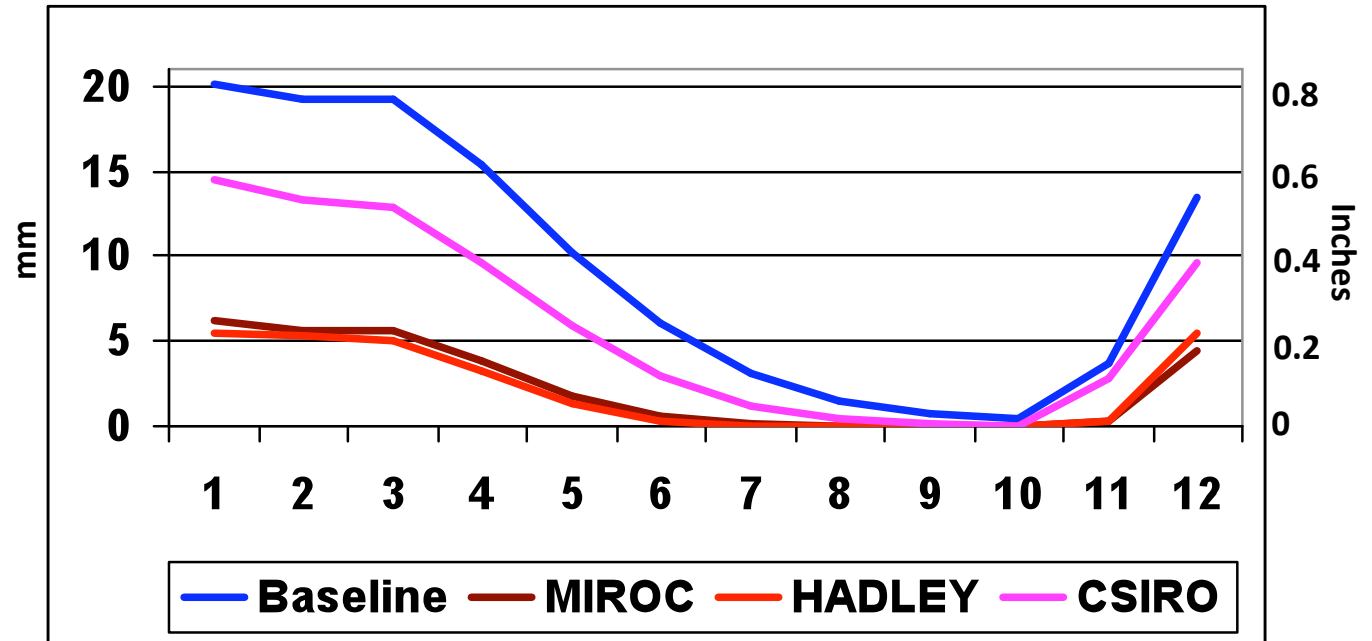


Baseline (1961-1990)  
vs  
2075-2085 Averages

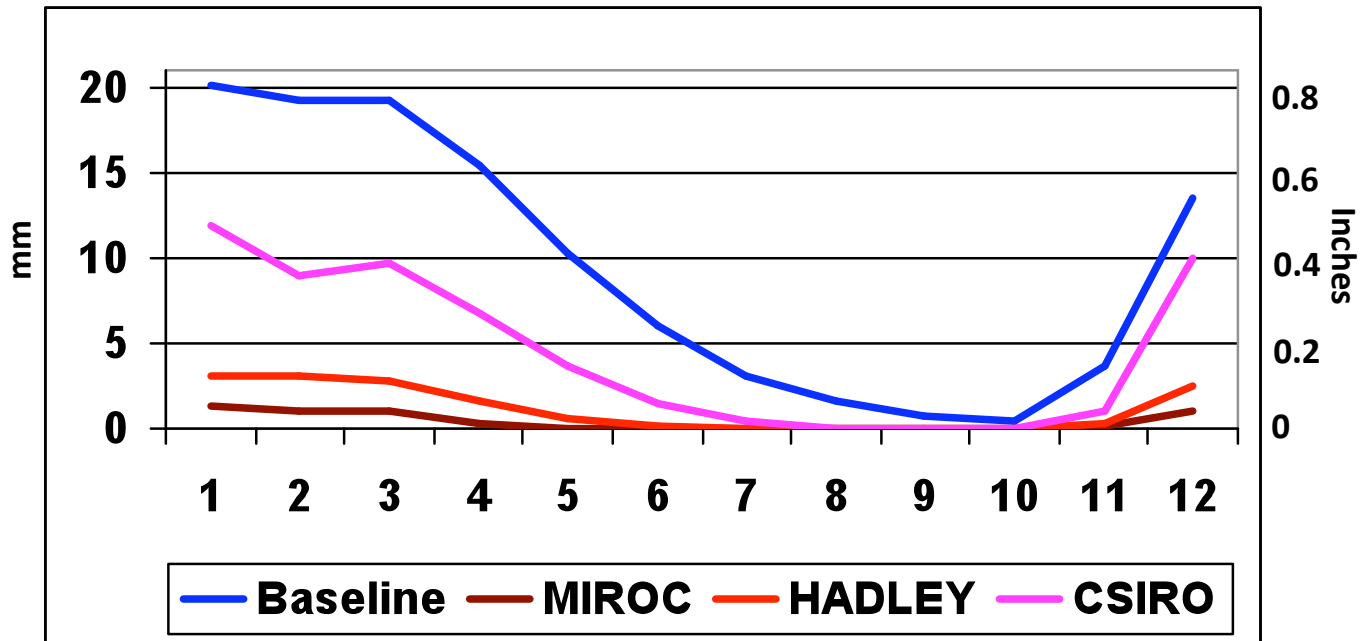


## Average Monthly Snow Accumulation Across the Rogue Basin

Baseline (1961-1990)  
vs  
2035-2045 Averages



Baseline (1961-1990)  
vs  
2075-2085 Averages



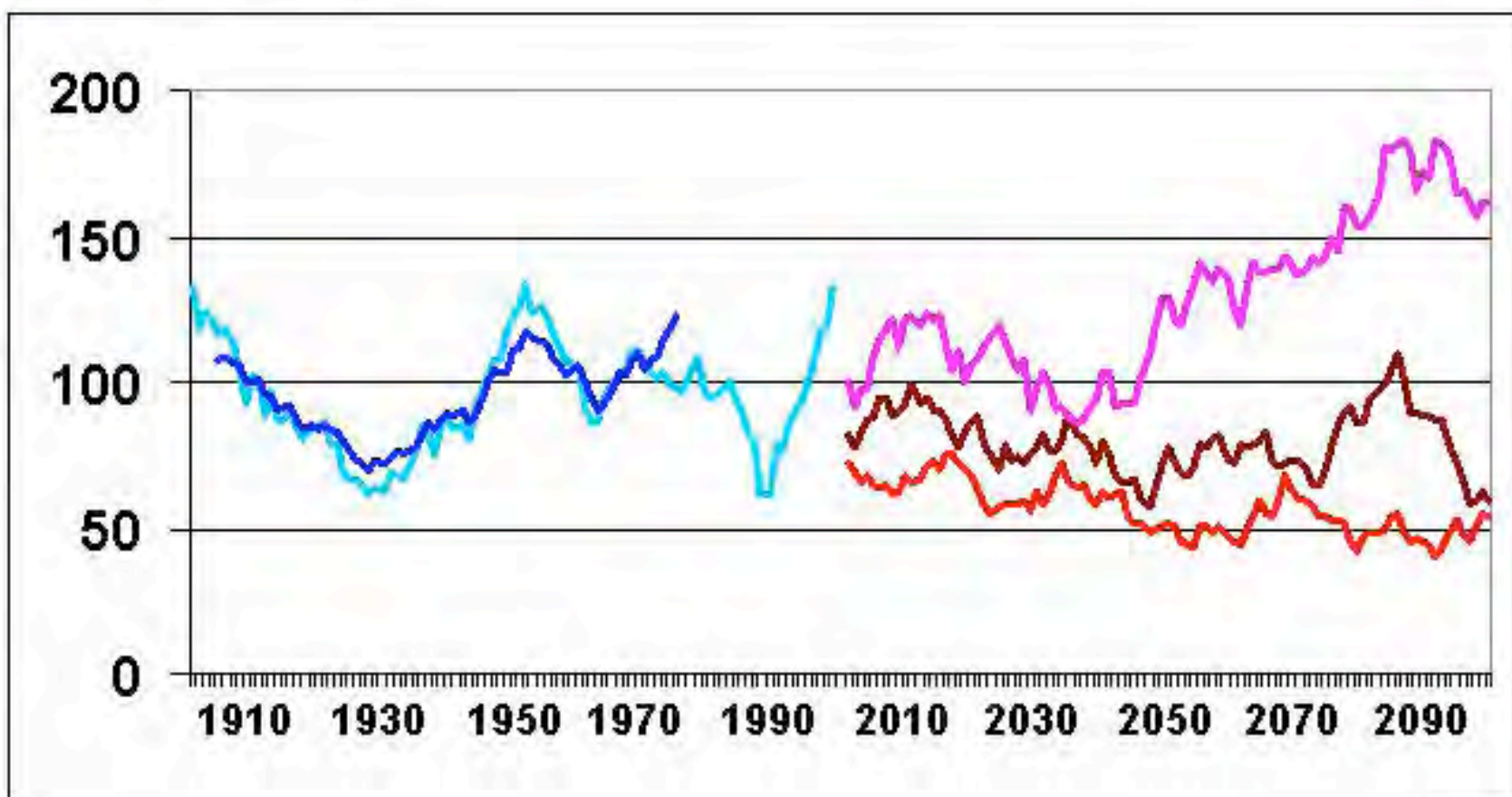
# Storms, Flooding, and Drought



- The Basin is likely to experience more **severe storm events**, variable weather, higher and flashier winter and spring runoff events, and increased flooding.
- Both wet and dry cycles are likely to last longer and be more extreme, leading to both periods of **deeper drought and those of more extensive flooding**.

**Annual Stream Flow at the Gold Rey  
Gauge (Ft<sup>3</sup> x 10<sup>9</sup>)  
Historical & Simulated  
With 11-yr Filter**

- MC1-Hist
- MC1-Miroc
- MC1-Had
- MC1-Csiro
- Gauge



# Resulting Impacts

- Altered flow patterns
  - Compromised water quality
  - Reduced suitable habitat
  - Increased disturbance
  - Magnification of existing stressors
  - Altered life history triggers
- *Changes in hydropower supply, impacts to ecosystem services, loss of agricultural and timber productivity, stress on utility and transportation infrastructure*

# Health Implications of Climate Change

## Higher Average Temperature

heat illness, skin cancer

## Drought

water quantity & quality, nutritional value of crops, mental illness

## Heavy Precipitation

mental illness, water quality

## Sea Level Rise

migration, water quality & quantity



## Flooding

water quality, mental illness, disease breeding grounds

## Increased ground ozone levels and CO<sub>2</sub>

respiratory disease, asthma and allergies

## Change in fire patterns

respiratory disease

## Others?

Communicable disease, new diseases, food/water access





Climate change is likely to result in **additional public health costs in Oregon of up to \$900 million by 2020 and over \$1 billion by 2040**

(if no action is taken to prepare)

CLI & EcoNorthwest 2009

# New Framing, Not New Issue



- Climate change is not a separate hazard in itself
  - Historical trends are not reliable for future planning
  - Consider how events will change in frequency and severity
- Not about adding work, but thinking creatively about integration and new collaborations.



# Impacts to Public Health and Emergency Preparedness

- ❑ Disasters as threats to the public's health
- ❑ Abrupt increases in illness, injury, or death
- ❑ Disruption of infrastructure
- ❑ Population displacement
- ❑ Psychological stress
- ❑ Changes in the environment

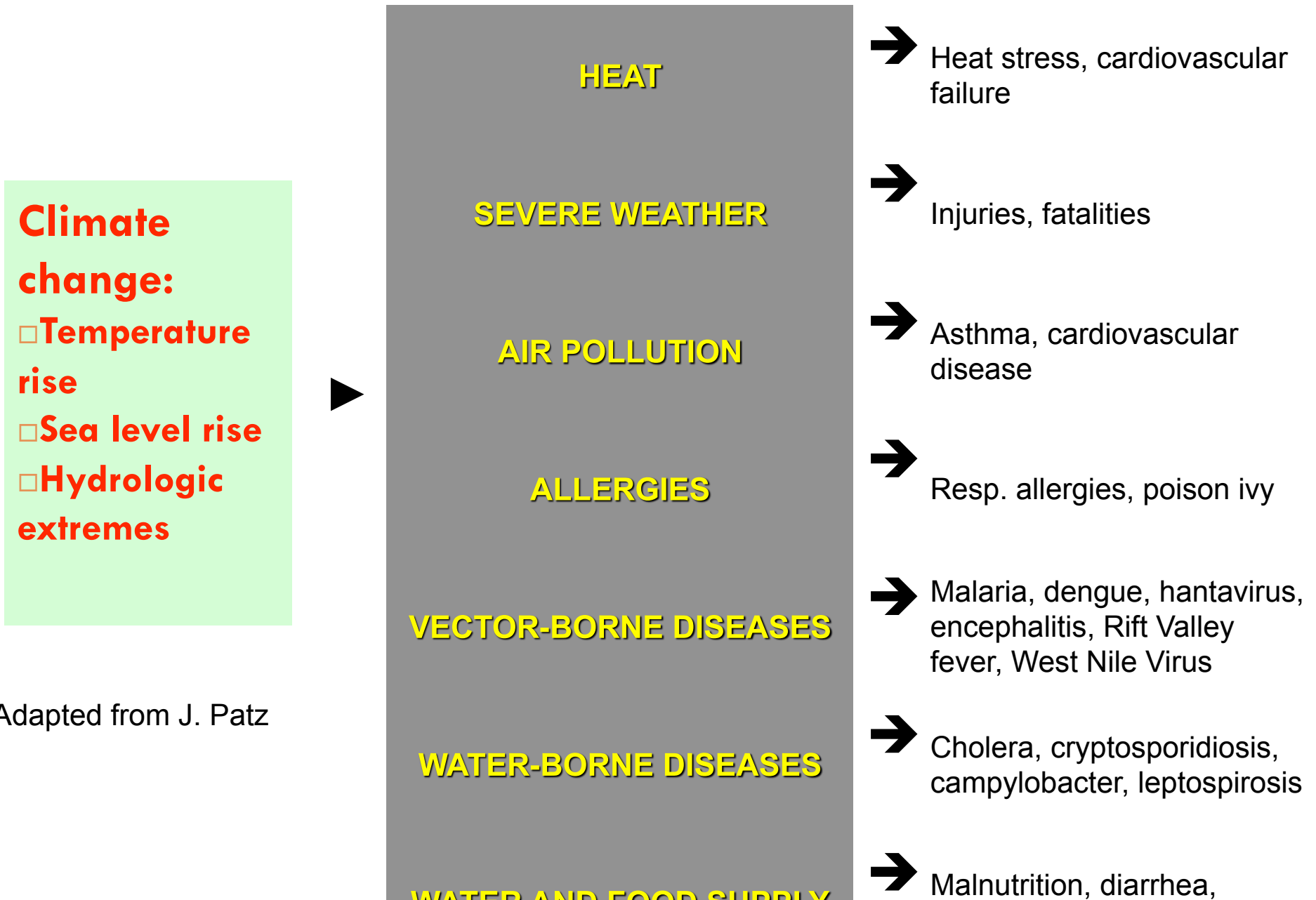


# Role of **Public** Health in Disasters



- Evaluate health impacts on communities and systems
- Assess water safety and sanitation
- Assist in shelter coordination
- Track disease, injuries, and fatalities
- Communicate what we know

# Potential Health Effects of Climate Change



Adapted from J. Patz

# Anticipated Events

*Environmental Health Perspectives* Volume 106, Number 3, March 1998

## **Dengue Fever Epidemic Potential as Projected by General Circulation Models of Global Climate Change**

**Jonathan A. Patz,<sup>1</sup> Willem J.M. Martens,<sup>2</sup> Dana A. Focks,<sup>3</sup> and Theo H. Jetten<sup>4</sup>**

<sup>1</sup> Department of Environmental Health Sciences, Johns Hopkins School of Hygiene and Public Health, Baltimore, MD 21205-2179 USA

<sup>2</sup> Department of Mathematics, Maastricht University, Maastricht, The Netherlands

<sup>3</sup> Center for Medical, Agricultural and Veterinary Entomology, Agricultural Research Service, U.S. Department of Agriculture, Gainesville, FL 32604 USA

<sup>4</sup> Department of Entomology, Graduate School for Production Ecology, Wageningen Agricultural University, Wageningen, The Netherlands

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# Un-anticipated Events



PNAS

Proceedings of the National Academy of Sciences of the United States of America www.pnas.org

PNAS | December 7, 2004 | vol. 101 | no. 49

## A rare genotype of *Cryptococcus gattii* caused the cryptococcosis outbreak on Vancouver Island (British Columbia, Canada)

S. E. Kidd<sup>\*†‡</sup>, F. Hagen<sup>§</sup>, R. L. Tschärke<sup>¶</sup>, M. Huynh<sup>†</sup>, K. H. Bartlett<sup>‡</sup>, M. Fyfe<sup>||</sup>, L. MacDougall<sup>||</sup>, T. Boekhout<sup>§\*\*\*</sup>, K. J. Kwon-Chung<sup>¶</sup>, and W. Meyer<sup>\*†,††</sup>

### Discussion

Until the recent emergence of cryptococcal infection on Vancouver Island, *C. gattii* had been considered to be restricted to areas with tropical and subtropical climates (2). The identification of large-scale colonization of *C. gattii* in the environment occurring in a temperate climate zone indicates a striking change in the distribution of this species. Furthermore, the identification of the *C. gattii*



**HHS 10  
Essential  
Services of  
Public Health**

**CDC PHEP  
Program**

**DHS National  
Preparedness  
Guidelines (NPG) and  
Target Capabilities List  
(TCL)**



**SAFER • HEALTHIER • PEOPLE™**















# Increase in diseases, insect pests and plant pests



# Disaster Management Cycle

*Humanitarian Action*

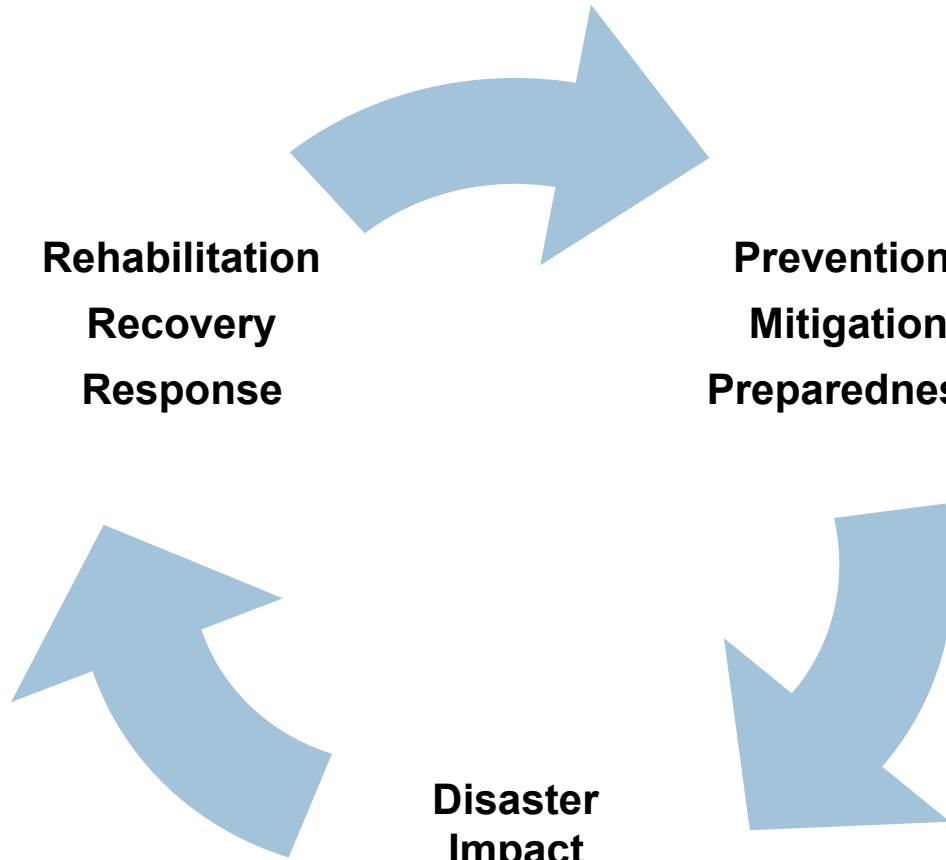


*Sustainable development*

Rehabilitation  
Recovery  
Response

Prevention/  
Mitigation  
Preparedness

Disaster  
Impact



# Capabilities-Based Planning

## Surveillance and Intervention

<b>Biosurveillance</b>
<b>Public Health Surveillance and Epidemiologic Investigation **</b>
<b>Public Health Laboratory Testing</b>
<b>Countermeasures and Mitigation</b>
<b>Responder Safety and Health</b>
<b>Medical Countermeasure Dispensing</b>
<b>Fatality Management</b>
<b>Non-Pharmaceutical Interventions</b>
<b>Mass Care</b>

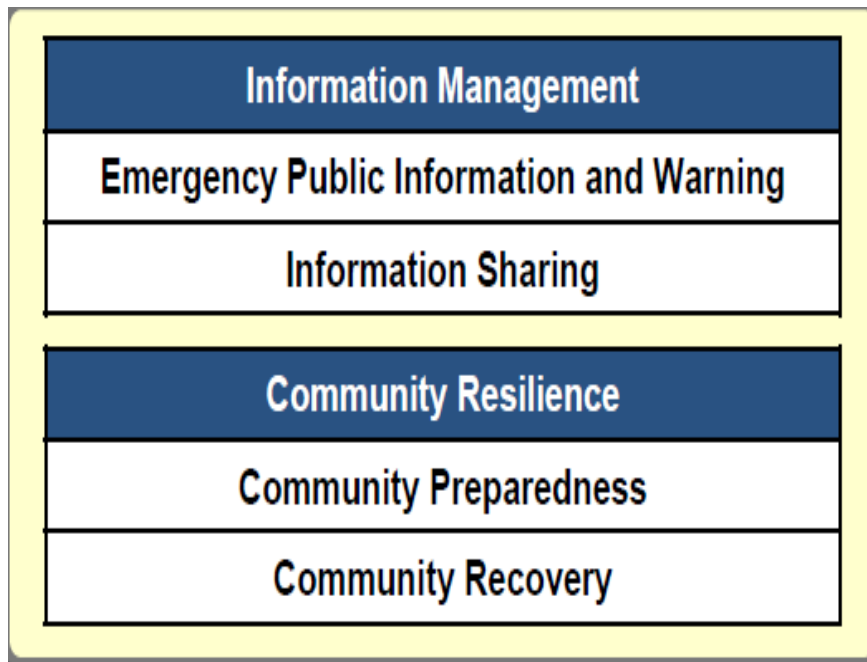
# Capabilities-Based Planning

## Emergency Management

<b>Surge Management</b>
<b>Medical Supplies Management and Distribution</b>
<b>Volunteer Management and Recruitment</b>
<b>Medical Surge</b>
<b>Incident Management</b>
<b>Emergency Operations Coordination</b>

# Capabilities-Based Planning

## General Program Capabilities



- Focus on communication:
  - internal
  - among partners
  - with the community
- Focus on increasing the ability of communities:
  - to survive and
  - rebound from disaster



# New Framing, Not New Issue



- Climate change is not a separate hazard in itself
  - Historical trends are not reliable for future planning
  - Consider how events will change in frequency and severity
- Not about adding work, but thinking creatively about integration and new collaborations.

# Framework for Change:

## Climate Mitigation & Adaptation



- Mitigation: reductions in greenhouse gas emissions
- Adaptation: adjustments in natural or human systems in response to – or in anticipation of - climate change conditions or effects
  - ▣ Simultaneous implementation of strategies
  - ▣ Integration with existing programs, staff, funding
  - ▣ Focus both internally and through engagement with public
  - ▣ Unique opportunities for collaboration and grantmaking

# What Are We Already Doing?

(preworkshop survey)

- Mix of knowledge from uninformed to very informed
- Majority are working on climate change on a voluntary basis because it's a personal interest – but part of job for some
- Highest concern around Heat, Flooding, Wildfire, Snowpack
- Health concerns range from cardiovascular disease to asthma and heat illness

# What Are We Already Doing?



- Limited action taken on adaptation, but some surveillance and warning systems in place
- Many actions are in development: adaptation planning, scenario planning, public outreach, etc
- Most are aware of Hazard Vulnerability Assessments and priorities include wildfire, flood, landslide, pandemic flu

# Immediate Steps



- Conduct vulnerability assessments
- Assess capacity and existing operations
- Identify local partnerships for service provision
- Develop internal trainings, awareness building mechanisms for staff
- Develop neighborhood brigades to provide education and check in on at-risk individuals
- Identify opportunities for modifying outreach (brochures, trainings, brochures, media)

# Medium Term Steps



- Develop strategies for reaching vulnerable populations
- Expand and update outreach and education materials to all sectors of community
- Implement trainings, neighborhood brigades
- Solidify partnerships
- Begin making internal changes to reduce GHG emissions

# Long Term Steps



- Operationalize preparedness into all public health and emergency preparedness strategies
- Consider greenhouse gas emissions/energy consumption in decision-making
- Widespread outreach and provision of tools to mitigate against health risks and prepare for impacts

# If You Only Remember 3 Things...



- Climate change is a public health issue
- Public health has an opportunity to be a leader
- Resources and tools are available to support action (focus for today!)

*Those of us working in public health should recognize that climate disruption affects promoting good health for us all. There is an opportunity now for us to lead by example and take some responsibility for the impact on the Earth's climate.*

-Dr. Mel Kohn (OHA)