Transportation and Climate Change

Robert Kafalenos, FHWA
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Greenhouse Gas Mitigation vs. Climate Change Adaptation?

Transportation Activity

Driving, shipping, transit, rail, operations, maintenance, etc.

GHG Emissions

CO2, CH4, N2O, +……..

Changes to Climate

Sea levels (lakes and streams), temperature, precipitation, storms

Impacts on Transport

Infrastructure, operations, users, suppliers, services, travel demand

GHG Mitigation Strategies

To slow down rate of change and reduce impacts

Climate Change Preparation and Adaptation

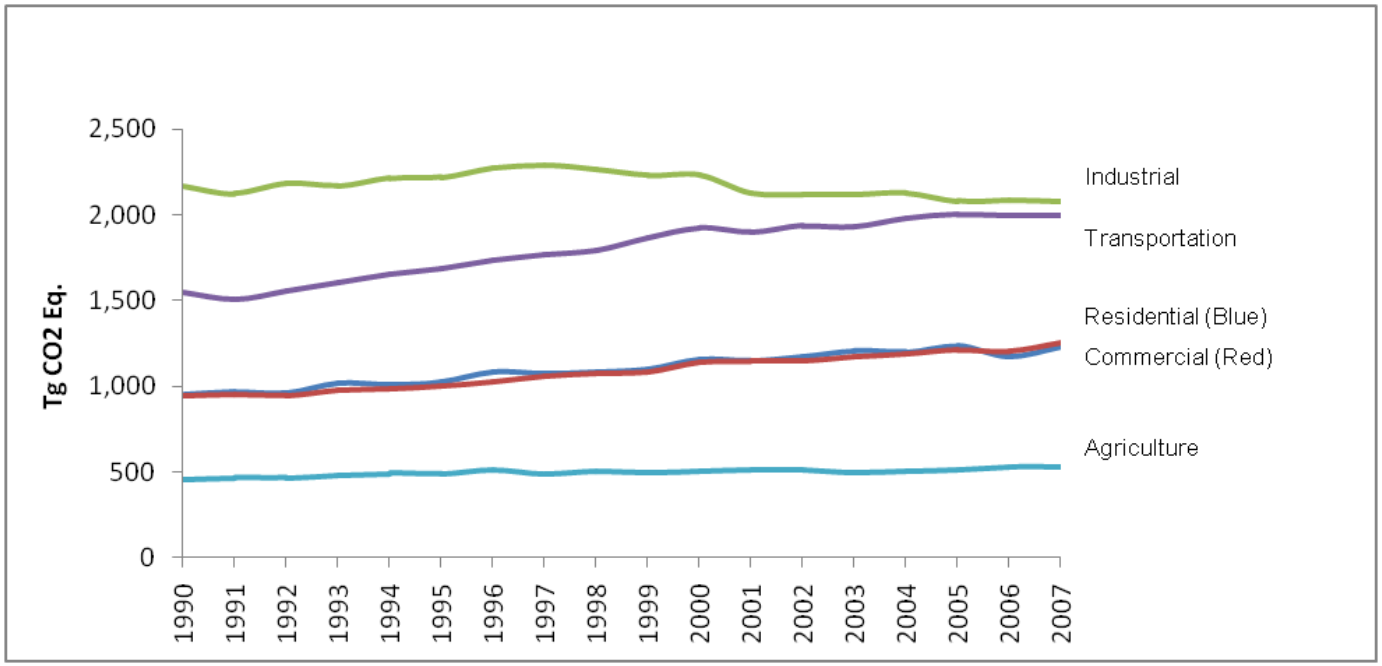
To plan for and deal with expected impacts

GHGs and Transportation

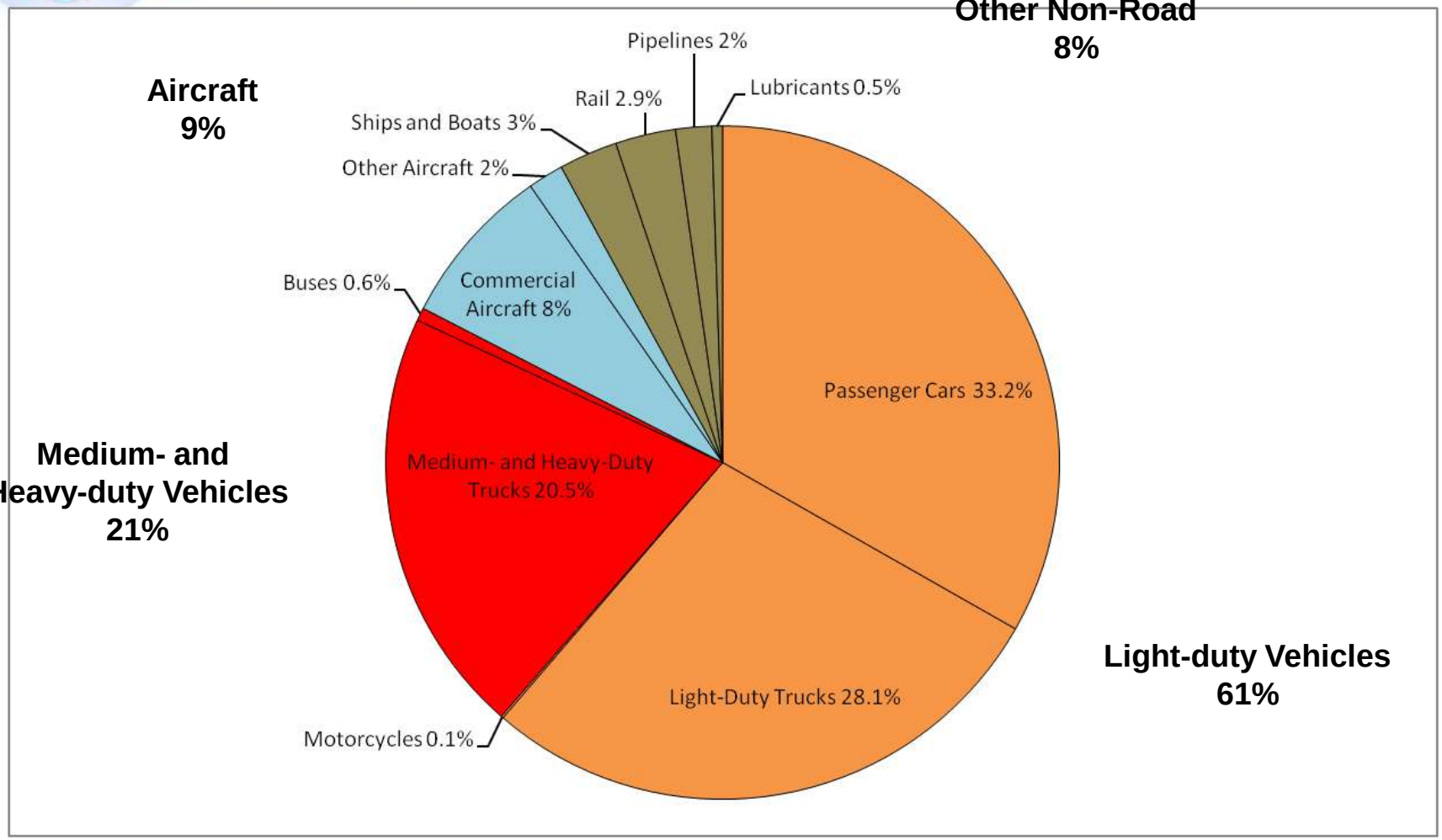
- After industry, transportation is leading source of U.S. GHG emissions
- Transportation sector accounts for 28% of GHGs nationally – much more in some states
- Transportation is among the fastest growing sources of GHG

U.S. GHG Emissions by Economic Sector, 1990-2007

(with Electricity distributed to End-Use Sectors)

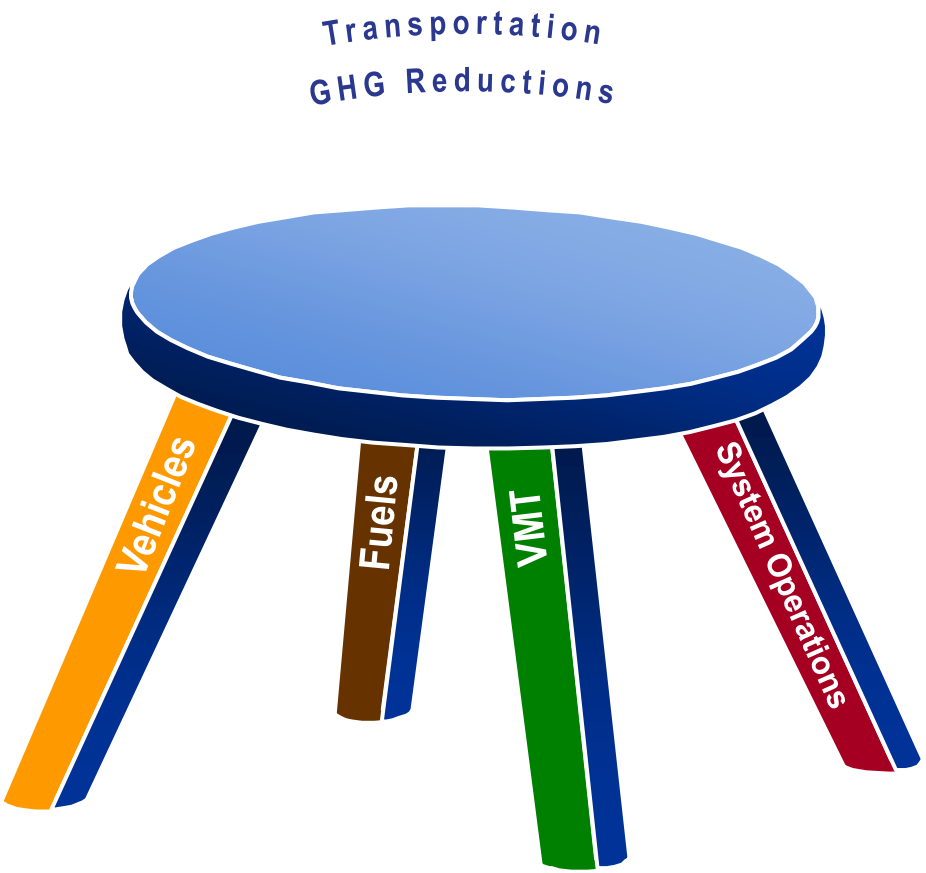


U.S. Transportation GHG Emissions by Source (2007)



Source: U.S. Environmental Protection Agency, *Inventory of Greenhouse Gas Emissions and Sinks, 1990-2007.*

GHG Mitigation
Multiple Transportation Strategies



- Raise vehicle energy efficiency
  - CAFE Standards
  - Improved vehicle technology
- Reduce carbon content of fuels
  - Alternative and low-carbon fuels
- **Improve vehicle/system efficiency and operations**
  - Congestion/bottleneck relief
  - Idle-reduction
- **Reduce <u>Growth</u> in VMT**
  - Land use
  - Non-motorized

GHG Reduction Strategies

- **System/vehicle Efficiency**
  - Traffic flow improvements
    - ITS, incident mgt
    - Real-time traveler information
    - Signal retiming
    - Congestion pricing
    - Improved Intermodal connections (Freight & passenger)
    - Reduced idling
    - Bottleneck relief

GHG Reduction Strategies

- **Travel Activity Reduction**
  - Reducing VMT growth
    - Land Use (TOD, mixed use)
    - Bike/ped
    - Transit
    - Pricing strategies (congestion, cordon, parking, PAYD insurance, etc.)
    - Commuter (telework, flexible schedules, etc.)

Construction, Maintenance & Agency Operations

- **Significant sources of GHG and energy use**
- **Should be accounted for in new initiatives**
- **Many opportunities to reduce GHG and energy cost from current system:**
  - LED lights
  - Alt fuel buses
  - Low carbon pavement
  - Energy-efficient buildings
  - Reduced roadside mowing
  - Solar panels/sequestration activities on ROW
  - Alt fuels and hybrid vehicles in DOT fleets

Climate Change
Why Address in Planning?

- Broader regional scope is more consistent with scope of climate change impacts
- Consistent with current planning factors
- Can incorporate by reference in NEPA document

FHWA Activities - *Mitigation*

- **Mitigation Guidebook** – Estimate GHG reductions of transportation strategies
- **Scenario Planning** – Workshops on integrating climate change considerations into scenario planning process
- **Operations Strategies** – Research on potential reductions
- **State Climate Change Action Plans** – Promoting development in States without plans; FHWA Division Offices are working with State DOTs to evaluate transportation component in others
- **Technical assistance** – Providing assistance to State DOTs and MPOs to update existing models, MOVES training
- **Carbon sequestration pilot program**
  - New Mexico, Minnesota

Adaptation

Climate change <u>effects</u>

- Outcomes of long-term variation in the climate
  - Changes in Precipitation, Temperature, tropical storms, (SLR)

Climate change <u>impacts</u>

- Consequences that climate change effects may have on infrastructure

<u>Adaptation</u>

- Changes in the way surface transportation infrastructure is planned, designed, constructed, operated, and maintained

Why be Concerned about Climate Change Impacts?

- Design life of transportation infrastructure: decades or longer
- As climate changes, our infrastructure will need to be able to handle new conditions
- Each region has unique transportation assets, and faces different vulnerabilities and risks

Flooded roadways in Houston

Climate Change Effects & Impacts

CLIMATE CHANGE EFFECT	SOME POTENTIAL IMPACTS (& ADAPTATION RESPONSES)
More frequent intense precipitation	• Increase in weather-related delays • Increased flooding of roads • Loss of visibility, lane obstruction • Bridge scour • Could affect structural integrity of roads, bridges, tunnels
Wind speeds	• More frequent truck rollovers, sign damage • Changes to testing of and design factors for wind speed • Need for stronger materials
Higher high temperatures, more hot days	• Asphalt deterioration • Thermal expansion of bridges • Changes to biodiversity (impacting pest management, wetlands commitments) • Longer construction seasons, night time construction • Pavement & structural design changes

What Are Possible Adaptation Responses?

- **Maintain & Manage**
  - Higher maintenance costs
- **Protect, Strengthen**
  - Sea walls and buffers
  - Design changes when rebuilding
- **Relocate & Avoid**
  - Move key facilities, site new facilities in less vulnerable locations
- **Abandon and Disinvest**
- **Enhance Redundancy**

Sources: WSDOT and Caltrans

Activities – *Adaptation*

- **FHWA strategy to address adaptation to climate change effects**
- **Climate change effects report, regional estimates**
  - Coordination with NOAA/USGS, etc.
- **Vulnerability/risk assessment conceptual model (& pilots)**
- **Peer exchanges (Dec 2008, Dec 2009, and more)**
- **Technical assistance on projects where adaptation is an issue**
- **Considering guidelines on adaptation in project development and environmental review**
- **Long-term Adaptation Research**
  - Gulf Coast study, Phase 2 (DOT)
  - Climate Change and Highway Infrastructure: Impacts and Adaptation Approaches (NCHRP)

FHWA Adaptation Strategy -- *Forthcoming*

- **Foundation and Plan for Climate Change Adaptation Activities**
  - Five core FHWA offices
- **Describes Key Areas where FHWA will Focus Attention**
- **Helps communicate a consistent message to stakeholders, public**
- **Provides a strategic foundation for future FHWA activities**

Vulnerability / Risk Assessment Conceptual Model

- **For Assessment of Transportation Systems and Infrastructure**
  - Develop inventory of infrastructure
  - Gather climate data
  - Assess risk and vulnerability
- **Use by State DOTs and MPOs to identify which assets:**
  - Are most exposed to threats from climate change
  - Could have the most serious consequences
- **Pilots**

Gulf Coast Study—Phase 2

- **Phase II**
  - Process for assessing critical transportation infrastructure, projecting climate change effects, evaluating vulnerability, and conducting detailed engineering assessments for vulnerable assets in Mobile
  - Lessons learned and replicable processes that could inform similar analyses in other MPOs
  - Transferrable tools and resources to assist MPOs nationwide
  - Timeframe: 2010-2012

Climate Change Effects (*draft* results)

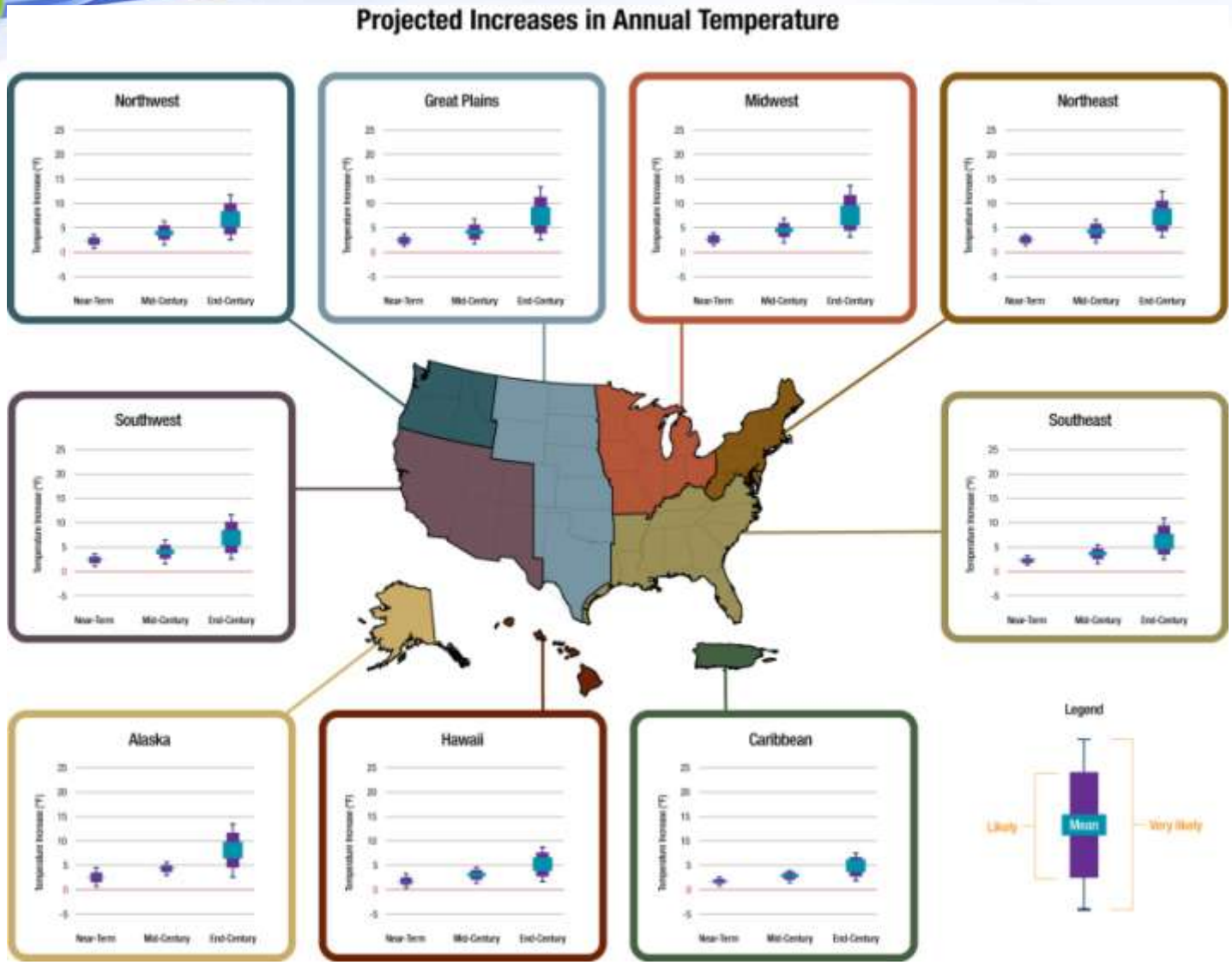
- Provides information on climate change projections for transportation decision makers
- Summarizes current science
- Short, medium and long term
- Based on low and high GHG emission scenarios
- Assistance from Climate experts -- NOAA, USGS, DOE

Climate Change Effects (*draft* results)

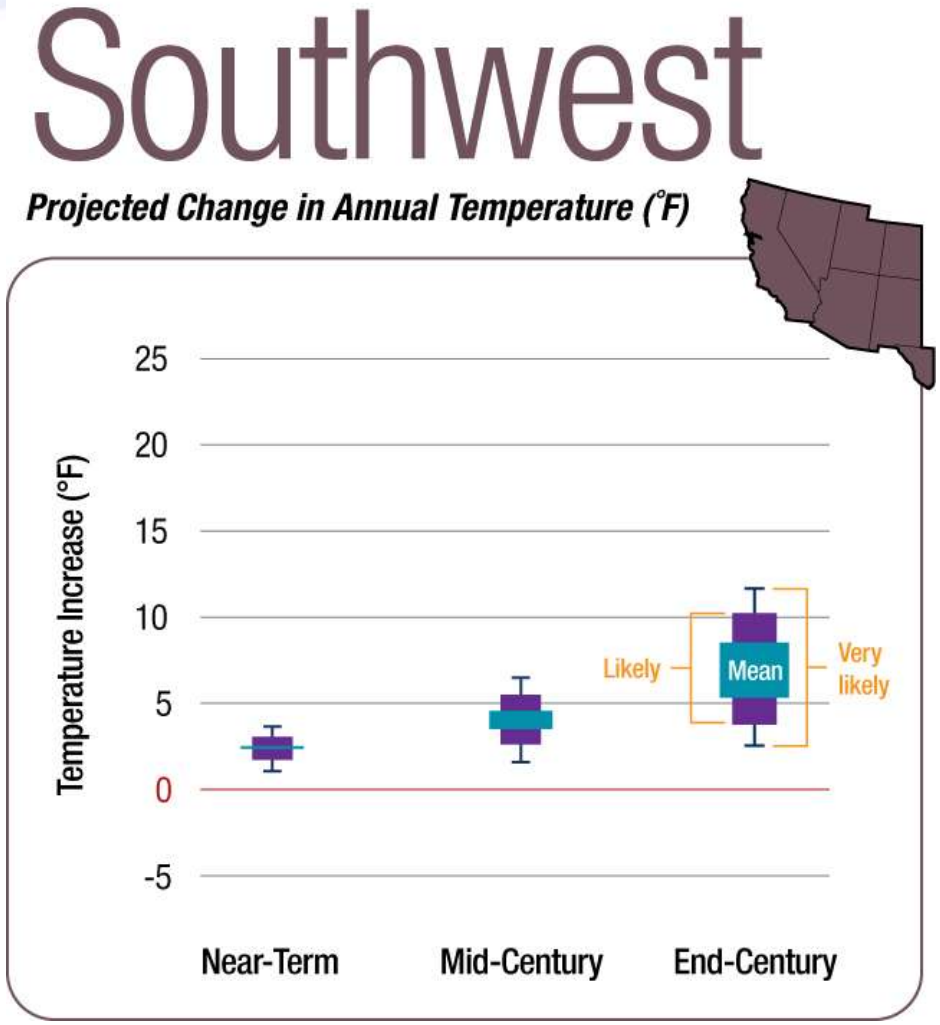
- **9 regions (6 continental US, Alaska, Hawaii, Caribbean)**
- **Projected *changes* by region:**
  - Annual, Seasonal Temperature (change in ^{o}F)
  - Seasonal Precipitation (% change)
  - Where data exists:
    - Sea level rise
    - Storm activity
- **Report currently in final review**

Annual Temperature Change (ºF)

Draft



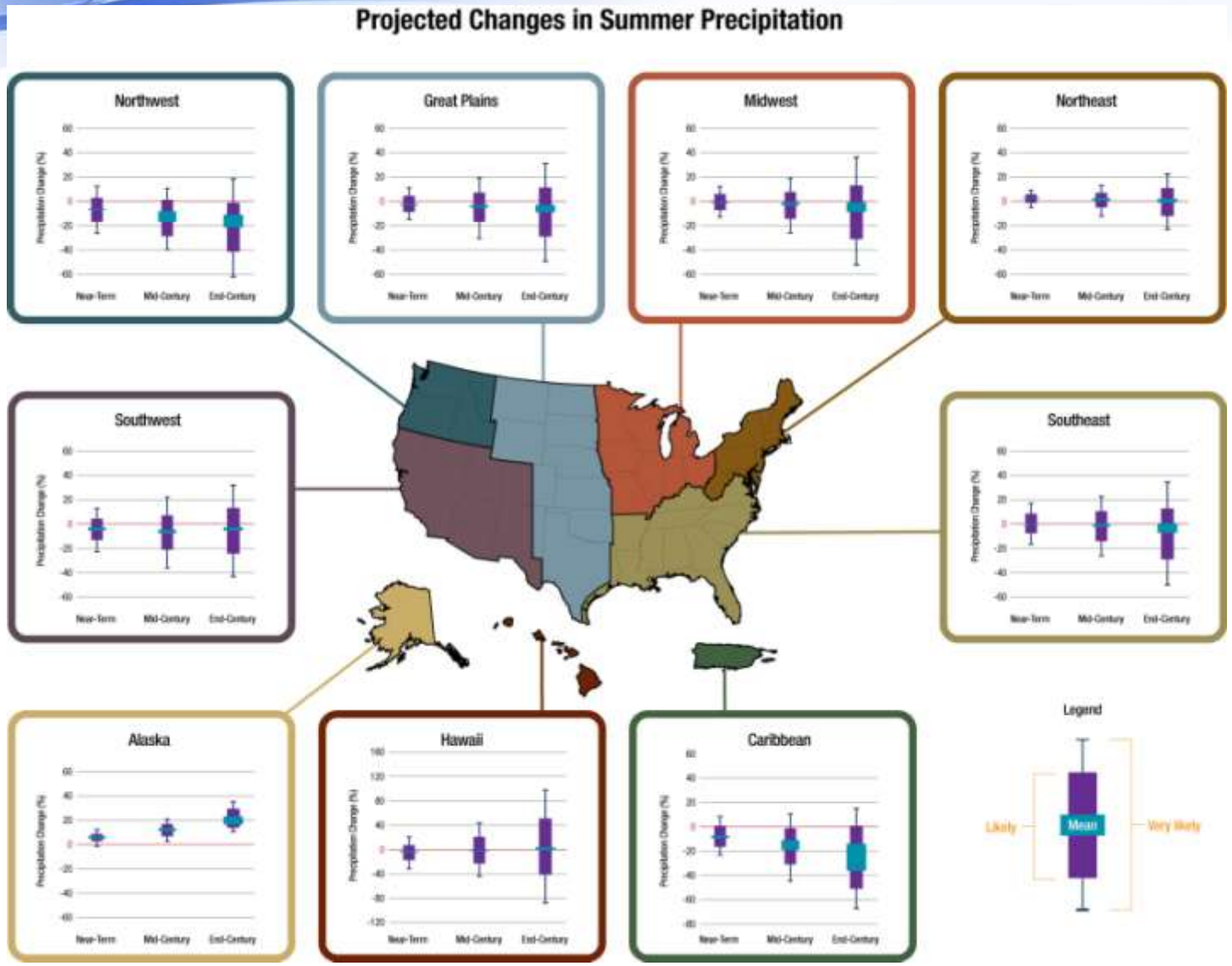
Southwest – Annual Temperature Change (ºF) *Draft*



- Near-term: 2010-2029
- Mid-century: 2040-2059
- End-century: 2080-2098

Projections compared to the baseline for 1961-1979

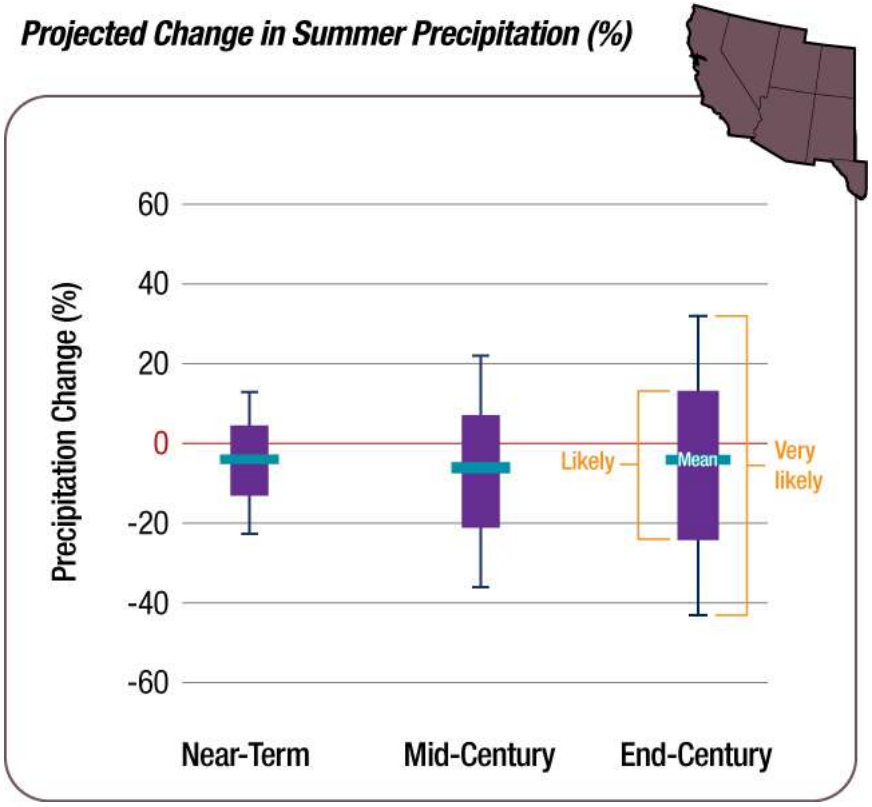
Change in Summer Precipitation (%)
Draft



Change in Summer, Spring Precipitation (%) *Draft*

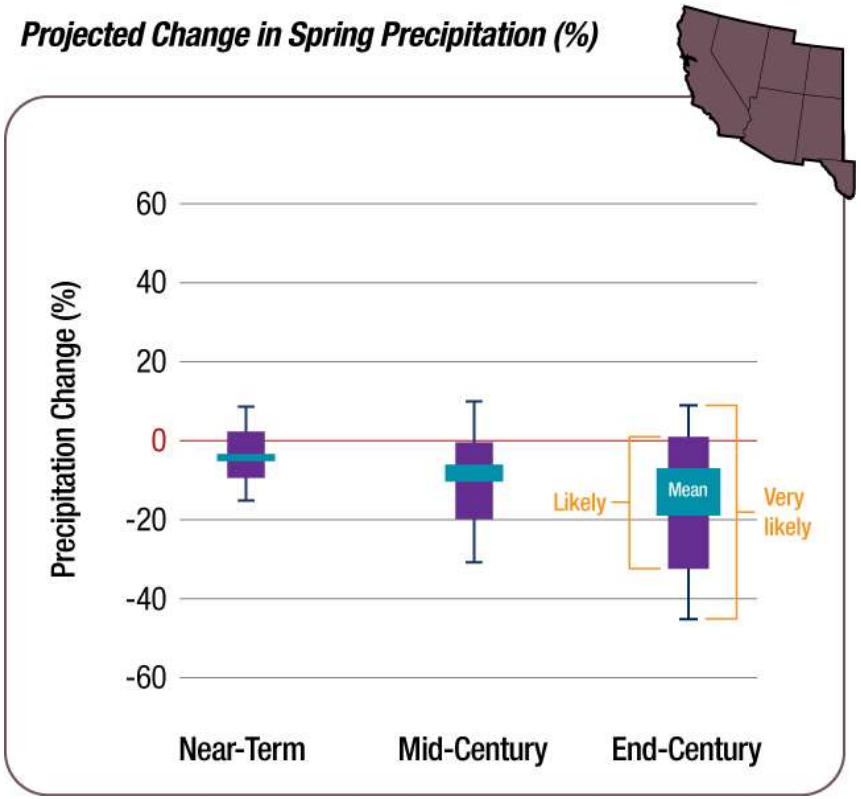
Southwest

Projected Change in Summer Precipitation (%)



Southwest

Projected Change in Spring Precipitation (%)



For More Information

Federal Highway Administration Climate Change Website:

http://www.fhwa.dot.gov/hep/climate/index.htm

US DOT Transportation and Climate Change Clearinghouse:
http://climate.dot.gov/index.html

Robert.Kafalenos@dot.gov

FHWA, Office of Natural and Human Environment

Sustainable Transport & Climate Change Team