

***Climate Change Adaptation and Mitigation: State Transportation, Regional, International, Local, Business, Utilities, Insurance Strategies: Synthesis***

**Prepared for**

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*Transportation Synthesis Reports (TSRs) are brief summaries of currently available information on topics of interest to WSDOT staff. Online and print sources may include newspaper and periodical articles, NCHRP and other TRB programs, AASHTO, the research and practices of other state DOTs and related academic and industry research. Internet hyperlinks in the TSRs are active at the time of publication, but host server changes can make them obsolete.*

**Request for Synthesis**

This synthesis and literature review was requested by Mark Maurer, PLA, PE, Highway Runoff Program Manager and Sandy Salisbury, Roadside Design and Site Development Manager, Project Development Division; and Carol Lee Roalkvam, Environmental Policy Branch Manager, Environmental Services Division, Washington State Department of Transportation. WSDOT is charged with designing, maintaining, and preserving its infrastructure to move people and goods throughout the state is working to assess and understand the impacts to its system brought about by climate change such as more extreme weather events, sea level rise, and increasing temperatures. The next step in this process is to develop adaptation strategies to help planners and project managers make our infrastructure more resilient.

The Federal Highway Administration (FHWA) in September 2010 selected WSDOT and four other organizations across the nation to pilot a model to assess the vulnerability of transportation infrastructure to climate change. As a result of this, WSDOT now has a reasonable idea of its infrastructure that might be impacted by climate change. WSDOT is working with other state agencies to determine the scope of impacts to WSDOT and other state assets, both built and natural.

This Synthesis includes available climate change adaptation strategies related to the built environment, such as when to abandon a road. While the review of literature is focused on transportation infrastructure, it includes other areas that may include strategies transferable to transportation facilities. It includes other governments, as arctic environments and island nations, and the basis of their abandonment decisions.

Outside of the transportation arena, the information provided includes:

- Adaptation strategies of local communities and what triggered those actions
- Adaptation strategies of energy companies and other utilities outside Washington State

- Insurance industry views of adaptation and their insuring decisions relevant to extreme weather events
- How businesses are adapting to climate change (e.g. decisions about where to build)

**Databases Searched**

- TRID - A Transportation Research Database at the Transportation Research Board (TRB)
- Research in Progress (RiP) – A Database of Current Transportation Research at TRB
- Previous Synthesis Reports on WSDOT Research Website
- Google
- Wisconsin DOT Transportation Synthesis Reports
- Federal Transit Administration (FTA) website
- Federal Highway Administration (FHWA) website
- International Transportation and other Research Websites

**Topic Areas**

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**Adaptation Research Underway or Recently Completed**

**Costs and Impacts of Extreme Weather Events on State DOTs**

NCHRP Synthesis 20-05/Topic 44-08 (New Research Project Underway)  
 Staff, Jon M. Williams; Transportation Research Board; Fiscal Year; 2012

Summary: TRB’s National Cooperative Highway Research Program (NCHRP) has issued a request for proposals to synthesize information on the fiscal implications of extreme weather events for state departments of transportation. Proposals are due August 10, 2012.

Tentative Scope of Work: The proposed research will compile and synthesize current DOT efforts in this area, briefly assess the effectiveness of such efforts, and recommend research toward more universal data acquisition efforts. . . .The information will enable DOTs to improve resilience of the transportation network to extreme weather events. This study will document the ways and extent to which DOTs are

collecting this important information and delivering it internally. It will also document the state of the practice in using asset management approaches and GIS as tools for identifying and protecting critical infrastructure elements.

<http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3360>

***Disaster Resilience: A National Imperative***

Authors: Committee on Increasing National Resilience to Hazards and Disasters; Committee on Science, Engineering, and Public Policy; the National Academies; August 2012

Summary: Increasing the nation's resilience to natural and human-caused disasters requires complementary federal policies and locally driven actions that center on a national vision, says a new report from the National Academies. This report calls for federal agencies to perform self-assessments of their programs and activities and share their analyses of key resilience programs with the public.

[http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=13457&utm\\_medium=email&utm\\_source=National%20Academies&utm\\_campaign=08062012WhatsNew&utm\\_content=Web&utm\\_term=](http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=13457&utm_medium=email&utm_source=National%20Academies&utm_campaign=08062012WhatsNew&utm_content=Web&utm_term=)

***Climate Change and Transportation: Summary of Key Information***

TRB Electronic Circular E-C164; National Research Council, National Academy of Sciences, National Academy of Engineering; TRB; and other organizations; July 2012

Summary: This report covers a variety of studies on climate change and discusses possible impacts to the transportation sector. The document includes references that identify the sources of findings from the studies cited.

<http://www.trb.org/Main/Blurbs/167508.aspx>

***Climate Change Adaptation: A Report on Climate Change Adaptation Measures for Low Volume Roads in the Northern Periphery (Sweden, Norway & Finland)***

By Adriána Hudecz, Arctic Technology Centre (ARTEK) at the Technical University of Denmark (DTU); ROADEX; Swedish Transport Administration; The ROADEX "Implementing Accessibility"; Lead Partner: The Swedish Transport Administration, Northern Region; Project co-coordinator: Mr. Krister Palo.; 2012

Summary: This report discusses ways to use interactive and innovative management for low traffic volume roads throughout the cold climate regions of the Northern Periphery Area of Europe. The report also provides a summary of the results of research into adaptation measures to combat climate change effects on low volume roads in the Northern Periphery and concludes with an appendix of recommended of good practice and adaptation measures which are considered suitable for use in the ROADEX partner areas.

[http://www.roadex.org/uploads/publications/Climate%20Change%20Adaptation%20\(2012\).pdf](http://www.roadex.org/uploads/publications/Climate%20Change%20Adaptation%20(2012).pdf)

***FHWA - 2010 Conditions and Performance: Chapter 12 Climate Change Adaptation: Abandon and Disinvest***

FHWA; 2010 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance Report; [www.FHWS.dot.gov](http://www.FHWS.dot.gov) Website; 2012

Summary: This report discusses the abandonment/disinvestment as an adaptation strategy or to discontinue service on a piece of transportation infrastructure or to make it ineligible for funding based on its condition or location. This decision is based on whether it makes financial sense to continue investing in a facility given likely future threats and its level of use. Although lower in infrastructure costs than other options, this is not a costless decision. Beyond its direct economic costs, abandonment could

lead to isolation of communities, political or public opposition, or loss of access. The state of Texas elected to abandon Texas Highway 87 because frequent storm events and erosion led to closure of the highway. . .

<http://www.fhwa.dot.gov/policy/2010cpr/chap12.htm>

### ***Hazard Mitigation: Integrating Best Practices into Planning***

By James C. Schwab; American Planning Association; Federal Emergency Management Agency; 2010

Summary: This report completed by APA for FEMA seeks to close the gap that often exists between hazard mitigation planning and other local planning and regulatory land-use processes. It introduces hazard mitigation as a vital area of practice for planners; provides guidance on how to integrate hazard mitigation strategies into comprehensive, area, and functional plans; and shows where hazard mitigation can fit into zoning and subdivision codes. Best practices and practical applications are provided.

<http://www.fema.gov/library/viewRecord.do?id=4267>

## ***State Adaptation Response***

### ***California***

#### ***Caltrans Issues Guidance on Incorporating Sea-Level Rise in Programming and Design of Projects***

California Department of Transportation; June 9, 2011

This guidance document addresses the consideration of sea-level rise in the design and programming of transportation projects in California. The guidance calls for an analysis of whether the potential exists for a project to be impacted by rising sea levels and whether to incorporate sea level rise adaptation measures into the project, with the results documented in the Project Initiation Document.

[http://www.dot.ca.gov/hq/tpp/offices/orip/Updated\\_Climate\\_Change/Documents/Sea\\_Level\\_Guidance\\_May2011.pdf](http://www.dot.ca.gov/hq/tpp/offices/orip/Updated_Climate_Change/Documents/Sea_Level_Guidance_May2011.pdf)

#### ***First Progress Report on California Climate Adaptation Strategy Released***

California Natural Resources Agency; Nov. 15, 2010

Summary: This report tracks the state's progress in implementing the state's multi-sector climate adaptation strategy finalized in 2009. Released at the Governors' Global Climate Summit at the University of California, Davis, the document describes the working and/or stakeholder groups that have been formed to develop plans and strategies for seven sectors: public health, biodiversity and habitat, oceans and coastal resources, water management, agriculture, forestry, and transportation and energy infrastructure.

<http://www.energy.ca.gov/2010publications/CNRA-1000-2010-010/CNRA-1000-2010-010.PDF>

#### ***California Infrastructure Adaptation Strategies***

California Infrastructure Adaptation Strategies; Climate Adaptation Working Group (California Energy Commission and California Department of Transportation); 2010

Summary: This report includes the adaptation strategies California state agencies developed and describes the changes in the planning, design, construction, operation, and maintenance of California's infrastructure. Infrastructure adaptation strategies developed thus far pertain to two aspects of development: transportation and energy.

[http://resources.ca.gov/climate\\_adaptation/docs/Statewide Adaptation Strategy - Chapter 10 - Transportation and Energy Infrastructure.pdf](http://resources.ca.gov/climate_adaptation/docs/Statewide_Adaptation_Strategy_-_Chapter_10_-_Transportation_and_Energy_Infrastructure.pdf)

## ***San Francisco Bay Area Metropolitan Transportation Commission***

### ***Adapting to Rising Tides: Transportation Vulnerability and Risk Assessment Pilot Project***

San Francisco Bay Area Metropolitan Transportation Commission; November 2011

Summary: The San Francisco region's MPO was one of five transportation agencies selected by FHWA in 2011 for a pilot project to test a draft [vulnerability and risk assessment conceptual model](#) for transportation infrastructure. The model is intended to serve as a framework to help transportation agencies assess the risk to infrastructure of projected climate change impacts. The Bay Area project inventoried potentially vulnerable transportation assets along a section of the Alameda County shoreline and measured their relative importance to the health of the broader transportation network. [http://www.mtc.ca.gov/news/current\\_topics/10-11/sea\\_level\\_rise.htm](http://www.mtc.ca.gov/news/current_topics/10-11/sea_level_rise.htm)

## ***Connecticut***

### ***Adapting to Connecticut's Changing Climate***

Department of Environmental Protection; State of Connecticut; March 2009

Summary: These fact sheets detail current observations and provide some cursory recommendations for alternative approaches to foster adaptation at the local and regional levels. <http://www.ct.gov/dep/lib/dep/air/climatechange/adaptation/090320facingourfuture.pdf>

## ***Delaware***

### ***Transportation Planning in Response to Climate Change: Methods and Tools for Adaptation in Delaware***

Authors: Oswald, Michelle; McNeil, Sue; Ames, David; Mao, Weifeng; Transportation Research Board Washington DC; Transportation Research Board 91st Annual Meeting; 2012

Abstract Summary: This study explores methods for analyzing potential climate change impacts such as sea level rise on transportation infrastructure in Delaware, specifically the I-95 corridor. The methods implemented for adaptation planning in northern Delaware provide an example of how agencies throughout the country can begin to adapt to climate change.

<http://pubsindex.trb.org/view.aspx?id=1129294>

## ***Florida***

### ***Development of a Methodology for the Assessment of Sea Level Rise Impacts on Florida's Transportation Modes and Infrastructure***

Author: Leonard Berry; Florida Atlantic University; Florida Department of Transportation; March 2, 2012

Summary: This report addresses the assessment of impacts from sea level rise (SLR) on Florida's transportation infrastructure for planning purposes. The research summarizes potential SLR impacts on Florida's coastal and low-lying transportation infrastructure, and lists currently available tools for infrastructure protection and adaptation of transportation networks and systems. The report also

provides short-term and long-term recommended actions for incorporating SLR into the FDOT planning process.

<http://dels.nas.edu/Report/Level-Rise-Coasts/13389>

### ***Florida's Adaptation Response***

FHWA Website; Climate Change; FHWA/AASHTO Climate Change Adaptation Peer Exchange; December 2009

Summary: This report documents FDOT's outreach to inform and engage citizens about current climate change activities during the development of the 2060 Florida Transportation Plan. Activities and discussions currently include:

- Working cooperatively to identify infrastructure at risk and to coordinate adaptation efforts;
- Considering the feasibility and cost-benefit analysis of alternatives needed to support future adaptation investment decisions (e.g., looking at risk, recognizing limited resources and the life expectancy of structures);
- Integrating adaptation into transportation asset management efforts statewide; and
- Identifying supportive research needs.

Florida's Action Plan and information about other climate-related activities are available at [www.flclimatechange.us](http://www.flclimatechange.us).

### **Barriers to Adaptation**

. . . . barriers to adaptation in Florida, including a lack of standardized climate projections, lack of coordination on data that is available and the politicized nature of the issue of climate change. . .

[http://www.fhwa.dot.gov/hep/climate/peer\\_exchange/peer07.cfm](http://www.fhwa.dot.gov/hep/climate/peer_exchange/peer07.cfm)

### ***Florida Stormwater Erosion and Sedimentation Control Inspector's Manual***

Florida Department of Environmental Protection Nonpoint Source Management Section; Tallahassee, Florida; July 2008

Summary: This updated version of the *Florida Stormwater, Erosion, and Sedimentation Control Inspector's Manual* is an important element of FDEP's training and certification program. It provides a "toolbox" of BMPs with instructions for their use and is designed to be a comprehensive reference source . . .

<http://www.dep.state.fl.us/water/nonpoint/docs/erosion/erosion-inspectors-manual.pdf>

## ***Hawaii***

### ***A Framework for Climate Change Adaptation in Hawaii***

Hawaii's Ocean Resources Management Plan Working Group; University of Hawaii, Center for Island Climate Adaptation and Policy; November 2009

Summary: This is a collaborative framework for adaptation planning in Hawaii, containing six elements: (a) Climate Change Adaptation Team; (b) Long-Term Vision; (c) Planning Areas and Opportunities; (d) Scoping for Climate Change Impacts to Major Sectors; (e) Vulnerability Assessment; and (f) Risk Assessment.

[http://hawaii.gov/dbedt/czm/ormp/reports/climate\\_change\\_adaptation\\_framework\\_final.pdf](http://hawaii.gov/dbedt/czm/ormp/reports/climate_change_adaptation_framework_final.pdf)

### ***Transportation Asset Climate Change Risk Assessment Report: Oahu MPO***

SSFMI International, Honolulu, HA; Island of Oahu Metropolitan Planning Organization; November 2011

Summary: This report documents work conducted by the Oahu MPO as part of a pilot project to test FHWA's draft [vulnerability and risk assessment conceptual model](#) for transportation infrastructure. The model is intended to serve as a framework to help transportation agencies assess the risk to infrastructure of projected climate change impacts. The Oahu MPO project conducted a stakeholder workshop to identify the most critical areas of transportation vulnerability on the island. Additional information on the pilot projects is available on FHWA's webpage, [Adaptation Conceptual Model Pilots](#). [http://www.oahumpo.org/reports/transportation\\_vulnerability\\_due\\_to\\_climate\\_change.html](http://www.oahumpo.org/reports/transportation_vulnerability_due_to_climate_change.html)

## ***Iowa***

### ***Iowa Climate Change Adaptation & Resilience Report: How Should Hazard Mitigation and Other Community Planning Programs Respond to Climate Change?***

Corporate Authors: Environmental Protection Agency; Federal Emergency Management Agency, WA DC; EPA; 2011

Abstract Summary: This report by the U.S. Environmental Protection Agency (EPA) on a pilot project working with Iowa stakeholders and governments to identify barriers to and incentives for considering regional effects of climate change in hazard mitigation planning and other community planning processes. . . Iowa communities have been experiencing floods that are growing more severe and frequent, and state and local planners are working to identify local planning approaches that improve resilience to future floods and help communities recover after disasters. . .

[http://www.epa.gov/smartgrowth/pdf/iowa\\_climate\\_adaptation\\_report.pdf](http://www.epa.gov/smartgrowth/pdf/iowa_climate_adaptation_report.pdf)

### ***Missouri River Flood of 2011: Transportation Impacts***

Iowa Department of Transportation; May 30, 2012

Summary: Iowa DOT has released a web-based "Storify" project chronicling the 2011 Missouri River flooding and its impacts on the state's transportation system. The flood covered 150 miles of western Iowa, causing extensive damage to roadways. The webpage features links to photos, video, news articles, and a narrative describing the events of the flooding and the efforts to rebuild.

<http://www.iowadot.gov/floods/>

## ***Kansas***

### ***Whether the weather is cold or hot, rainy or not, research is ensuring stormwater systems are designed for the future***

Source: Stacy Hutchinson; News release prepared by: Jennifer Tidball ; News and Editorial Services, K-State Today, K-State Newsmakers, News and Editorial Services, Kansas State University, Manhattan, KS; April 23, 2012

Summary: A Kansas State University team is researching how climate change is affecting rainfall and weather patterns throughout Kansas to help with future adaptation and mitigation strategies. The research team is updating rainfall distribution data to ensure current stormwater management systems can handle future weather changes.

<http://www.k-state.edu/media/newsreleases/apr12/rainfall42312.html>

## **Louisiana**

### ***Recommendations for Anticipating Sea-Level Rise Impacts on Louisiana Coastal Resources during Project Planning and Design (Draft)***

Louisiana Coastal Protection and Restoration Authority; LCPRA Website; Feb. 6, 2012

Summary: This draft technical report includes recommendations for state coastal planners and managers to incorporate sea-level rise (SLR) into planning and engineering for future habitat restoration and storm protection projects. The report recommends that planners and designers anticipate an average SLR on Louisiana's coast of 3.3 feet by the year 2100.

<http://coastal.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=240>

## **Maine**

### ***Climate Change and Transportation in Maine***

Judy Gates, Director Maine DOT Environmental Office; Maine Department of Transportation; Oct. 14, 2009

Summary: This report from the Maine Department of Transportation describes the projected effects of climate change on transportation infrastructure in Maine. The report also discusses appropriate strategies to address the impacts. The report was issued in response to state legislation directing state agencies, businesses, industry, and other stakeholders to convene a workgroup addressing the challenges of climate change.

[www.maine.gov/.../ClimateChangeandTransportationinMaine-Final.doc](http://www.maine.gov/.../ClimateChangeandTransportationinMaine-Final.doc)

## **Maryland**

### ***Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change Phase II: Building Societal, Economic, and Ecological Resilience***

Report of the Maryland Commission on Climate Change Adaptation and Response and scientific and technical working groups; University of Maryland, January 2011

Summary: This report outlines adaptation strategies to reduce the impacts of climate change, including sea level rise, increased temperature and changes in precipitation within the following sectors: Human Health; Agriculture; Forest and Terrestrial Ecosystems; Bay and Aquatic Environments; Water Resources; and Population Growth and Infrastructure. The Phase II Strategy provides the basis for guiding and prioritizing state-level activities with respect to both climate science and adaptation policy within short to medium-term timeframes.

[http://ian.umces.edu/pdfs/ian\\_report\\_299.pdf](http://ian.umces.edu/pdfs/ian_report_299.pdf)

### ***A Sea Level Rise Response Strategy for the State of Maryland***

Zoë Pfahl Johnson, NOAA Coastal Management Fellow; Maryland Department of Natural Resources October 2000.

Summary: This sea level response strategy was developed through an extensive review of related technology, data, and research, along with an assessment of Maryland's vulnerability based on the range of magnitude of impact, the physical characteristics of the coastline, and population growth



patterns. This report contains specific recommendations for reducing the State's overall vulnerability to sea level rise.

[http://dnrweb.dnr.state.md.us/download/bays/sea\\_level\\_strategy.pdf](http://dnrweb.dnr.state.md.us/download/bays/sea_level_strategy.pdf)

## **Massachusetts**

### ***Massachusetts Climate Change Adaptation Report***

Massachusetts Executive Office of Energy and Environmental Affairs; Submitted by the Executive Office of Energy and Environmental Affairs and the Adaptation Advisory Committee; Sept. 27, 2011

Summary: This report offers a blueprint for addressing climate change impacts in Massachusetts, including effects on natural resources and habitat, infrastructure, human health and welfare, local economies and governments, and coastal zones and oceans. . . protecting infrastructure and development from inundation, especially along coasts and in floodplains, and . . . in development and design practices. The report also reviews potential strategies for emergency response, natural habitats and watersheds, for redundant supply routes, and projections for municipal planning.

<http://www.mass.gov/eea/docs/eea/energy/cca/eea-climate-adaptation-report.pdf>

## **New Jersey**

### ***Climate Change Vulnerability and Risk Assessment of Transportation Infrastructure***

North Jersey Transportation Planning Authority; November 2011

Summary: NJTPA was one of five transportation agencies selected by FHWA in 2011 for a pilot project to test a draft [vulnerability and risk assessment conceptual model](#) for transportation infrastructure. The model serves as a framework to help transportation agencies assess the risk to infrastructure of projected climate change impacts. . . . It includes an inventory of transportation assets using available climate change/weather models and a risk assessment of the vulnerable transportation infrastructure. Additional information on the pilot projects is available on FHWA's webpage, [Adaptation Conceptual Model Pilots](#).

<http://www.njtpa.org/Plan/Element/Climate/FHWAConceptualModel.aspx>

## **New York State**

### ***Mainstreaming Climate Change Adaptation Strategies into New York State Department of Transportation's Operations***

Authors: David C. Major, Ph. D., Rae Zimmerman, Ph.D., John Falcocchio, Ph.D., Klaus Jacob, Ph.D., Megan O'Grady, Radley Horton, Ph.D., Daniel Bader, Joseph Gilbride, and Taylor Tomczyszyn; Columbia University Earth Institute Center for Climate Systems Research, Armstrong Hall, 2880 Broadway, New York NY; New York State Department of Transportation, Albany NY; October 11, 2011

Abstract Summary: This study identifies climate change adaptation strategies and recommends ways of mainstreaming them into planned actions, including legislation, policies, programs and projects in all areas and at all levels within the New York State Department of Transportation (NYSDOT). The results of the project include adaptation strategies and best practices; potential adaptation strategies for mainstreaming climate change into the NYSDOT's operations and investment, including the detailed results of climate risk management discussions with personnel from 2 Divisions, 12 Offices, and 1 Region; and a communications and technology transfer plan.

[https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-09\\_synthesisfinalReport1.pdf](https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-09_synthesisfinalReport1.pdf)

***Mainstreaming climate change adaptation strategies into NYS Department of Transportation operations: Final Report***

SPR\_C-08-09; Columbia University Earth Institute Center for Climate Systems Research; New York State Department of Transportation (NYSDOT); October 31, 2011.

Summary: This study identifies climate change adaptation strategies and recommends ways of mainstreaming them into planned actions, including legislation, policies, programs and projects in all areas and at all levels within the New York State Department of Transportation (NYSDOT).

[https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-09\\_synthesisfinalReport1.pdf](https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-08-09_synthesisfinalReport1.pdf)

## **Oklahoma**

***Making Decisions: An Assessment of the Climate-Related Needs for Oklahoma Decision Makers***

Authors: Riley, R., K. Monroe, J. Hocker, M. Boone, and M. Shafer; Southern Climate Impacts Planning Program; University of Oklahoma; Louisiana State University; February 2012

Summary: This document provides a climate needs assessment for the State of Oklahoma. The assessment finds that Oklahoma will be subject to rain events that are less frequent but more intense, increasing the risk of drought and floods. The assessment also identifies the types of information that long-range planners, including transportation planners, will need to effectively address climate impacts.

[http://www.southernclimate.org/publications/OK\\_Climate\\_Needs\\_Assessment\\_Report\\_Final.pdf](http://www.southernclimate.org/publications/OK_Climate_Needs_Assessment_Report_Final.pdf)

## **Oregon**

***ODOT's Climate Change Adaptation Strategy Report***

Liz Hormann, ODOT; ODOT Climate Change Technical Advisory Committee; Oregon Department of Transportation; April 2012

Summary: This report of the Oregon Department of Transportation provides an assessment of potential climate change impacts to ODOT; underscores the need for an in-depth vulnerability and risk assessment of ODOT's assets and systems operations; and highlights potential adaptation strategies and existing adaptive capacity within ODOT.

[http://www.oregon.gov/ODOT/TD/CLIMATECHANGE/docs/ODOT\\_Adaptation\\_Strategy\\_Final.pdf](http://www.oregon.gov/ODOT/TD/CLIMATECHANGE/docs/ODOT_Adaptation_Strategy_Final.pdf)

***Identifying Surface Transportation Vulnerabilities and Risk Assessment Opportunities under Climate Change: Case Study in Portland, Oregon***

Lindsay Walker, Miguel A. Figliozzi, Ashley R. Haire, and John MacArthur, Portland State University, Oregon Transportation Research and Education Consortium; 2011

Summary: This article discusses a method for transportation departments, using geographic information systems, to assess the vulnerability to climate change of various multimodal surface transportation systems. Using Portland, Ore., as a case study, the study outlines how climate change effects can be identified, prioritized, and their impacts assessed.

<http://trb.metapress.com/content/pv122013607m1k84/?p=703e6f75aa74408bac23cb3409252510&pi=5>

### ***The Oregon Climate Change Adaptation Framework***

The framework has been developed in parallel with the Oregon Climate Assessment Report (OCAR) by the Oregon Climate Change Research Institute (OCCRI); December 2010

Summary: This introduction to the Oregon Climate Change Adaptation Framework summarizes the key findings and recommendations of the participants in this initial effort to review the emerging science on climate change and evaluate what our priorities should be at a statewide level in terms of preparing people, communities and resources for the coming changes. A major determinant of recommended actions is the initial assessment of costs and benefits.

[http://www.oregon.gov/LCD/docs/ClimateChange/Framework\\_Final.pdf?ga=t](http://www.oregon.gov/LCD/docs/ClimateChange/Framework_Final.pdf?ga=t)

## ***Pennsylvania***

### ***Pennsylvania Climate Adaptation Planning Report: Risks and Practical Recommendations***

Pennsylvania Department of Environmental Protection; Jan. 27, 2011

Summary: This report represents the first statewide effort to identify practical strategies for addressing climate change impacts. The report includes the recommendations for Infrastructure, Public Health, and Safety, Natural Resources, and Tourism and Outdoor Recreation. Recommended actions for the transport sector include reviewing research for materials that have the potential to withstand higher temperatures to prevent buckling of roadways and bridges and performing more intense inspections of transportation infrastructure after high impact events in areas subject to erosion.

<http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-82988/7000-RE-DEP4303%20combined%20report.pdf>

### ***Pennsylvania Climate Impact Assessment: Report to the Department of Environmental Protection***

Authors: James Shortle, David Abler, Seth Blumsack, Robert Crane, Zachary Kaufman, Marc McDill, Raymond Najjar, Richard Ready, Thorsten Wagener, and Denice Wardrop; Environment & Natural Resources Institute, Penn State University; June 2009

Summary: This report describes the expected impacts of climate change on Pennsylvania, including temperature and precipitation impacts, as well as implications for water resources, forests and wildlife, aquatic ecosystems and fisheries, agriculture, energy, human health, tourism and outdoor recreation, insurance and economic risk - but not infrastructure.

<http://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/Climate%20Change%20Advisory%20Committee/7000-BK-DEP4252%5B1%5D.pdf>

## ***Rhode Island***

### ***Summary: Preliminary Assessment of Rhode Island's Vulnerability to Climate Change and its Options for Adaptation Action***

Brown University; February 2010

Summary: This report describes the likely impact of climate change on Rhode Island, and the implications for adaptation in Rhode Island.

<http://envstudies.brown.edu/links/SpecialReports.html>

## **Vermont**

### ***Lessons from Irene: Building Resiliency as We Rebuild***

Vermont Agency of Natural Resources; Feb. 13, 2012

Summary: This report from the Vermont Agency of Natural Resources' Climate Change Team examines impacts from the August 2011 Tropical Storm Irene to different sectors in the state, including transportation and buildings and infrastructure. State highway impacts include damage to 500 miles of roads and over 200 bridges at an estimated cost of up to \$250 million. The report cites Vermont's vulnerability to similar intense flooding events and provides questions regarding how the state and its communities can begin building flood resiliency.

<http://www.anr.state.vt.us/anr/climatechange/irenebythenumbers.html>

## **Virginia**

### ***Assessing Vulnerability and Risk of Climate Change Effects on Transportation Infrastructure – Hampton Roads Virginia Pilot***

Virginia Department of Transportation; November 2011

Summary: VDOT was one of five transportation agencies selected by FHWA in 2011 for a pilot project to test a draft [vulnerability and risk assessment conceptual model](#) for transportation infrastructure. The model is intended to serve as a framework to help transportation agencies assess the risk to infrastructure of projected climate change impacts. The Hampton Roads area project focused on developing tools for prioritizing which transportation assets were more vulnerable to climate change or were higher priority under different scenarios. Additional information on the pilot projects is available on FHWA's webpage, [Adaptation Conceptual Model Pilots](#).

[http://www.virginia.edu/crmes/fhwa\\_climate/](http://www.virginia.edu/crmes/fhwa_climate/)

### ***Virginia Case Study: Stemming the Tide: How Local Governments Can Manage Rising Flood Risks***

Submitted by Chris Coil; Georgetown Law Climate Change Website; May 1, 2010

Summary: This case study analyzes the authority of Virginia local governments to use existing land use regulations to adapt to sea level rise impacts. Specifically, this study looks at local authority to implement policy options identified in the Virginia's Climate Action Plan. Also available: Companion presentation slides.

<http://www.georgetownclimate.org/virginia-case-study-stemming-the-tide-how-local-governments-can-manage-rising-flood-risks>

## **Washington State**

### ***Adapting to a Changing Climate***

Washington State Department of Transportation; WSDOT CC Website; 2012

Summary: This web page provides information on Washington State DOT's adaptation efforts, including WSDOT's [Statewide Vulnerability Assessment Fact Sheet](#) and WSDOT's [internal guidance document for project-level greenhouse gas and climate change evaluations](#).

<http://www.wsdot.wa.gov/SustainableTransportation/adapting.htm>

### ***Climate Change Impacts, Preparation, Adaptation Website***

Washington State Department of Ecology; WA State ECY Website; 2012

Summary: This website provides a range of technical, scientific, and policy-related information about the impacts of climate change on Washington's communities and natural resources. It also describes actions underway by six state agencies, along with other representatives from across state government, to develop a draft climate change impacts response strategy for the state.

<http://www.ecy.wa.gov/climatechange/adaptation.htm>

### ***Preparing for a Changing Climate: Washington Change Response Strategy State's Integrated Climate***

Washington State Department of Ecology; April 3, 2012

Summary: This report, developed with several other state agencies, provides a broad framework for decision makers to ensure that consideration of climate change impacts is given a high priority in day-to-day work. The report calls for reducing risk of damage to infrastructure by identifying vulnerable areas and taking proactive steps to reduce risks, avoiding climate risks when siting new infrastructure and planning for growth, and enhancing capacity to prepare for impacts such as more frequent and severe flooding. The report also identifies seven high-priority adaptive strategies.

[http://www.ecy.wa.gov/climatechange/ipa\\_responsestrategy.htm](http://www.ecy.wa.gov/climatechange/ipa_responsestrategy.htm)

### ***Climate Impacts Vulnerability Assessment Report***

Washington State Department of Transportation; FHWA and WSDOT Websites; November 2011

Summary: This report documents work conducted by WSDOT as part of a pilot project to test FHWA's draft [vulnerability and risk assessment conceptual model](#) for transportation infrastructure. The model is intended to serve as a framework to help transportation agencies assess the risk to infrastructure of projected climate change impacts. The WSDOT project applied the model using scenario planning in a series of statewide workshops, using local experts, to create a qualitative assessment of climate vulnerability on its assets in each region and mode across the state. Additional information on the project is available in a [folio](#) published by WSDOT. Additional information on the pilot projects is available on FHWA's webpage, [Adaptation Conceptual Model Pilots](#).

[http://www.wsdot.wa.gov/NR/rdonlyres/B290651B-24FD-40EC-BEC3-EE5097ED0618/0/WSDOTClimateImpactsVulnerabilityAssessmentforFHWA\\_120711.pdf](http://www.wsdot.wa.gov/NR/rdonlyres/B290651B-24FD-40EC-BEC3-EE5097ED0618/0/WSDOTClimateImpactsVulnerabilityAssessmentforFHWA_120711.pdf)

## ***Regional Adaptation Response***

### ***Atlantic Coast Area***

#### ***The Potential Impacts of Global Sea Level Rise on Transportation Infrastructure - Atlantic Coast Study***

ICF International, Washington, DC; U.S. DOT; October 2008

Summary: This study assesses the potential net effects of sea level rise, and associated increases in storm surges, on transportation infrastructure coastal states and low-lying regions on the Atlantic coast from New York to Florida. Using statistics from the United Nations Intergovernmental Panel on Climate Change, the report describes several scenarios for sea level rise and provides a series of statewide and county maps that visualize the potential impacts of sea level rise on transportation infrastructure.

[http://climate.dot.gov/impacts-adaptations/sea\\_level\\_rise.html](http://climate.dot.gov/impacts-adaptations/sea_level_rise.html)

### ***Does Sea Level Rise Matter to Transportation Along the Atlantic Coast?***

By Jim Titus, J.D., Director, EPA Sea Level Rise Project; EPA Sea Level Rise Workshop; 2002

Summary: As of 2002 the extent to which today's decisions leave transportation infrastructure vulnerable to climate change was not assessed. This paper is part of a DOT process to motivate adaptation to climate change in the U.S. transportation sector. In this paper, the implications are a step toward a comprehensive assessment of how the transportation sector can adapt to sea level rise, and the appropriate measures to take.

<http://climate.dot.gov/documents/workshop1002/titus.pdf>

## ***Gulf Coast States***

### ***Impacts of Climate Variability and Change on Transportation Systems and Infrastructure – Gulf Coast Study***

Savonis, M. J.; V.R. Burkett; and J.R. Potter (eds.); USDOT & USGS; March, 2008

Summary: The research, sponsored by the U.S. Department of Transportation (DOT) in partnership with the U.S. Geological Survey (USGS), was conducted under the auspices of the U.S. Climate Change Science Program (CCSP). This report describes ways to incorporate climate change issues into transportation planning. The major drivers of climate change examined in the report are sea levels rise, warming temperatures, precipitation pattern changes, and increased intensity of storm activity.

<http://www.climatescience.gov/Library/sap/sap4-7/final-report/>

## ***Mid Atlantic States***

### ***Coastal Sensitivity to Sea-level Rise: A Focus on the Mid-Atlantic Region***

EPA, USDOT; Environmental Protection Agency; January 2009

Summary: This study assesses the impacts of sea-level rise on the physical characteristics of the Mid-Atlantic coast, on coastal communities, and the habitats that depend on them. The report examines multiple opportunities for governments and coastal communities to plan for and adapt to rising sea levels.

<http://www.epa.gov/climatechange/impacts-adaptation/>

## ***Midwest States***

### ***Midwest Adaptation Peer Exchange Report: Minimizing the Impacts of Climate Change on Transportation Systems in the Midwest***

Federal Highway Administration; Sept. 27, 2011

Summary: This report summarizes an April 2011 peer exchange hosted by FHWA on climate adaptation concerns for Midwest state departments of transportation and metropolitan planning organizations. Key topics addressed included criticality and vulnerability of transportation assets, hazard mitigation planning, asset management, and operational strategies. . .

[http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/workshops\\_and\\_peer\\_exchanges/midwest\\_adaptation\\_peer\\_exchange/index.cfm](http://www.fhwa.dot.gov/environment/climate_change/adaptation/workshops_and_peer_exchanges/midwest_adaptation_peer_exchange/index.cfm)

## **Western States**

### ***Adaptation Case Studies in the Western United States***

Authors: Joel Smith, Jason Vogel, Karen Carney, Colleen Donovan, Stratus Consulting, Inc., Boulder, CO; Georgetown Climate Center; Nov. 1, 2011

Summary: This report includes two case studies of the potential role of state governments in adapting to climate change impacts to wildlife and water resources the western United States.

[http://www.georgetownclimate.org/sites/default/files/Adaptation\\_Case\\_Studies.pdf](http://www.georgetownclimate.org/sites/default/files/Adaptation_Case_Studies.pdf)

### ***Climate Adaptation Priorities for the Western States: Scoping Report***

Governors' Climate Adaptation Work Group; Western Governors' Association; June 2010

Summary: This report calls for enhanced coordination between state and federal efforts to identify key scientific needs for western states related to climate change and identifies ways that western states can incorporate "smart" climate adaptation practices into resource management and decision making, addresses currently available climate science that supports adaptation planning, and identifies basic principles of importance to western states for consideration in legislation.

[http://www.westgov.org/index.php?option=com\\_joomdoc&task=doc\\_download&gid=1279&Itemid](http://www.westgov.org/index.php?option=com_joomdoc&task=doc_download&gid=1279&Itemid)

## **Pacific Northwest and West**

### ***Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future***

Authoring Body: Committee on Sea Level Rise in California, Oregon, and Washington; Department of Commerce; NOAA; Department of Defense: USACE; DOI/USGS; State of California; State of Oregon; State of Washington; National Research Council; June 22, 2012

Summary: This report describes the factors affecting sea level rise along the coasts of California, Oregon, and Washington. The report identifies that global mean sea level rise is modified based on regional factors such as ocean and atmospheric circulation patterns, the geological movement of continental and oceanic plates, and the effects of the loss of glacial ice.

<http://dels.nas.edu/Report/Level-Rise-Coasts/13389>

### ***Climate Change Impact Assessment for Surface Transportation in the Pacific Northwest and Alaska***

Authors: MacArthur, John, Oregon Transportation Research and Education Consortium; Mote, Philip; Ideker, Jason; Figliozzi, Miguel; Lee, Ming; Corporate Authors: Oregon Transportation Research and Education Consortium, Portland State University, Portland, OR; WSDOT, ODOT, IDT; ADOT; FHWA; 2012

Abstract Summary: This research is a preliminary vulnerability assessment of the risks and vulnerabilities climate change poses to the surface transportation infrastructure system in the Pacific Northwest (WA, OR, ID) and Alaska region. The report synthesizes data characterizing the region's climate; identifies potential impacts on the regional transportation system; identifies critical infrastructure vulnerable to climate change impacts; and provides recommendations for more detailed analysis and research needs.

<http://www.wsdot.wa.gov/research/reports/fullreports/772.1.pdf>

### ***State of the Practice in Adaptation Planning: Alaska, Idaho, Oregon, and Washington***

Authors: Walker, Lindsay, Figliozzi, Miguel A, Portland State University; Haire, Ashley R, Portland State University; MacArthur, John, Oregon Transportation Research and Education Consortium; Transportation Research Board; Washington, DC; 2011



Abstract Summary: This research summarizes surface transportation climate change literature and explores the efforts under way in the transportation planning realm with respect to adaptive preparations of transportation infrastructure for the effects of climate change. This research focuses on transportation facilities and operations in the Pacific Northwest region of the United States and builds on recent research on governmental climate change planning efforts.

<http://dx.doi.org/10.3141/2252-15>

## ***Tribal Adaptation Response***

### ***Tribal Climate Change Adaptation Options: A Review of Scientific Literature***

U.S. Environmental Protection Agency, Region 10; June 2009

Summary: This White Paper is a review of the scientific literature available and summarizes the physical changes in the climate due to climate change, the vulnerabilities of natural resources to these effects, and adaptation options that may be relevant to tribes in EPA Region 10.

[http://www4.nau.edu/tribalclimatechange/resources/docs/res\\_TCCAdaptation\\_WhitePaper6-26-09.pdf](http://www4.nau.edu/tribalclimatechange/resources/docs/res_TCCAdaptation_WhitePaper6-26-09.pdf)

## ***Transportation Adaptation and Mitigation Strategies***

### ***Adapting Infrastructure to Extreme Weather Events: Best Practices and Key Challenges***

AASHTO Workshop and Webinar; American Association of State Highway Transportation Officials; May/June 2012

Summary: The workshop, Adapting Infrastructure to Extreme Weather Events: Best Practices and Key Challenges, provided information on approaches to evaluating and mitigating the impacts of extreme weather events on transportation infrastructure. State DOT officials from across the country discussed their recent experiences with extreme weather impacts and shared perspectives on how to manage weather-related risks. The webinar featured case studies of efforts by the state DOTs in California, Iowa, and Washington to address adaptation issues and speakers described challenges and barriers state DOTs face in addressing those issues. For more information, link to the [workshop summary report](#), a [background white paper](#), and [Webinar Power Point presentations](#).

### ***Climate Change Vulnerability Assessment Pilot: Assessing Vulnerability and Risk of Climate Change Effects on Transportation Infrastructure: Pilot of the Conceptual***

Federal Highway Administration; FHWA CC Website; 2012

Summary: This document outlines a conceptual Risk Assessment Model that will be piloted by three to four State Departments of Transportation (DOTs) or Metropolitan Planning Organizations (MPOs) (hereafter, "transportation agencies") selected by the Federal Highway Administration (FHWA). Using feedback and lessons learned during this pilot phase, FHWA will refine this draft conceptual model and develop a final version for all transportation agencies. . .

[http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/ongoing\\_and\\_current\\_research/vulnerability\\_assessment\\_pilots/conceptual\\_model62410.cfm](http://www.fhwa.dot.gov/environment/climate_change/adaptation/ongoing_and_current_research/vulnerability_assessment_pilots/conceptual_model62410.cfm)

### ***FHWA/AASHTO Climate Change Adaptation Peer Exchange***

Highways and Climate Change FHWA, Highways & Climate Change, Resources, Peer Exchange Opening Presentations - FHWA/AASHTO Climate Change Adaptation Peer Exchange - Highways and Climate Change; FHWA; 2012



Summary: This report includes Presentations from FHWA, AASHTO, and State DOT Executives and staff. FHWA began staff reviewed climate change adaptation activities underway at FHWA Headquarters with a description of the definitions of two key terms: mitigation and adaptation.

Mitigation – Actions taken to reduce greenhouse gas (GHG) emissions, mitigating the severity of effects of climate change.

Adaptation – Actions to avoid, withstand, or take advantage of current and projected climate changes and impacts. Adaptation decreases a system's vulnerability, or increases its resilience to impacts.

FHWA's efforts on six related, but independent, adaptation efforts are discussed.

[http://www.fhwa.dot.gov/hep/climate/peer\\_exchange/peer05.cfm](http://www.fhwa.dot.gov/hep/climate/peer_exchange/peer05.cfm)

### ***Climate Change Adaptation***

The Fed Center, Fed Center Website; 20 12

Summary: The new Climate Change Adaptation Program Area supports Federal agency climate adaptation planning. Please check in periodically for new information.

- What is climate change adaptation & why do Federal agencies need to adapt?
- Background on the Implementing Instructions for federal agency climate change adaptation
- Federal framework for adaptation planning and guiding principles
- What is Climate Change Adaptation & Why is it Important?

. . . Background on the Implementing Instructions for Federal Agency Climate Change Adaptation

Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance, establishes an integrated strategy for sustainability within the Federal Government. . . The Implementing Instructions for Federal Agency Climate Change Adaptation Planning identify how agencies should respond to the adaptation requirements under the Executive Order.

Federal Framework for Adaptation Planning, and Guiding Principles

. . . The planning framework is not meant to be prescriptive or to provide detailed recommendations for project-level adaptation, those detailed options will be developed over time by each agency with the help of a growing set of planning tools, illustrative case studies, and lessons learned. . .

<http://www.fedcenter.gov/programs/climate/>

### ***Climate Change Adaption for Sustainable Transportation Systems***

Art Hirsch; TerraLogic Transportation Blog; Wednesday, April 25, 2012

Summary: This report indicates that if present trends continue, the total cost of global warming will be as high as 3.6 percent of gross domestic product (GDP). Four global warming impacts alone -- hurricane damage, real estate losses, energy costs, and water costs -- will come with a price tag of 1.8 percent of U.S. GDP, or almost \$1.9 trillion annually (in today's dollars) by 2100 (1). . . new transportation and other infrastructure projects are designed with flexibility and resiliency to accommodate climate change's short and long term impacts. Climate change needs to be part of the long term thinking for transportation planning, design, and operation and maintenance of transportation systems.

[http://terralogicss.com/blog/Sustainable\\_Transportation/post/Climate\\_Change\\_Adaption\\_for\\_Sustainable\\_Transportation\\_Systems/](http://terralogicss.com/blog/Sustainable_Transportation/post/Climate_Change_Adaption_for_Sustainable_Transportation_Systems/)

### ***Transportation Impacts & Adaptation: Climate Impacts on Transportation***

US EPA; USDOT; 2012

Summary: The report indicates:

- Climate change is likely to damage transportation infrastructure through higher temperatures, more severe storms, and higher storm surges.
- Coastal roads, railways and airports are vulnerable to sea level rise, which could lead to delays as well as temporary and permanent closures.
- Warmer winters can alleviate the costs of clearing ice and snow, especially in northern areas.

In the United States, transportation systems are designed to withstand local weather and climate. . . . However, due to climate change, historical climate is no longer a reliable predictor of future impacts.

<http://www.epa.gov/climatechange/impacts-adaptation/transportation.html>

### ***Assessing Criticality in Transportation Adaptation Planning***

ICF International, Washington, DC; Federal Highway Administration, U.S. DOT; June 13, 2011

Summary: Federal, state, and local transportation planners are considering the range of impacts that climate variability and climate changes may have on assets. Federal Highway Administration (FHWA) put forth a draft conceptual model to assist transportation agencies in systematically assessing the vulnerability of transportation assets.

[http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/resources\\_and\\_publications/assessing\\_criticality/index.cfm](http://www.fhwa.dot.gov/environment/climate_change/adaptation/resources_and_publications/assessing_criticality/index.cfm)

### ***Adapting to Climate Change: Another Challenge for the Transportation Community***

Authors: Schwartz Jr., and Henry G; Serial: Transportation Research E-Circular; Issue Number: E-C152

Publisher: Transportation Research Board; 2011

Abstract Summary: This paper focuses on adaptation and how the transportation community can develop solutions and approaches that will minimize or eliminate the impact of climate change. Most of these scenarios deal with transportation and others are included to demonstrate the breadth of the impacts.

<http://onlinepubs.trb.org/onlinepubs/circulars/ec152.pdf>

### ***Adapting Transportation to the Impacts of Climate Change: State of the Practice 2011***

Authors: Wenger, Joyce; Serial: Transportation Research E-Circular, Issue Number: E-C152;

Publisher: Transportation Research Board; 2011

Abstract Summary: This document focuses on transportation adaptation practices that can be implemented to yield benefits now and in the longer term. It highlights what climate change adaptation means for the transportation industry and why it is so important.

<http://onlinepubs.trb.org/onlinepubs/circulars/ec152.pdf>

### ***Real Solutions for Climate Change: State DOT Workshops on Climate Change***

Presented by: Cindy Burbank, Parsons Brinckerhoff; Sarah Siwek, Sarah J. Siwek & Associates, Inc.; Caroline Paulsen, American Association of State Highway and Transportation Officials (AASHTO); Diane Turchetta, Federal Highway Administration (FHWA); Kevin Walsh, Massachusetts Department of Transportation; Gina Campoli, Vermont Agency of Transportation; Perry Keller, West Virginia Department of Transportation; AASHTO; July 20, 2011

Summary of Workshop: Four key workshop purposes:

1. To build awareness of climate change challenges
2. To address both GHG mitigation and climate adaptation
3. To increase capacity of state DOTs to respond to climate change
4. To foster collaboration among state DOTs and their key partners

[http://climatechange.transportation.org/pdf/webinars/combined\\_gcc\\_workshop\\_webinars\\_110720.pdf](http://climatechange.transportation.org/pdf/webinars/combined_gcc_workshop_webinars_110720.pdf)

***Adapting Transportation to the Impacts of Climate Change: State of the Practice 2011***

Joyce Wenger, Wenger and Wenger Consulting; Special Task Force on Climate Change and Energy; Transportation Research Board, w.TRB.org; June 2011

Summary: This report focuses on transportation adaptation practices that can be implemented for benefits over time. It highlights addresses a broad range of adaptation issues facing state departments of transportation and metropolitan planning organizations, including the issue of risk and vulnerability, and adaptation strategies that have been implemented by various states in the United States that are providing successful results and that bear consideration by agencies across the country. An article on aviation focuses on unique aspects of dealing with adaptation in airport operations and the need to work and plan in close cooperation with a range of agencies and across regional boundaries, and to include weather forecasters and emergency responders.

<http://onlinepubs.trb.org/onlinepubs/circulars/ec152.pdf>

***Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use***

Submitted by Chris Coil; Georgetown Climate Center; November 1, 2011

Summary: The Adaptation Tool Kit explores 18 different land-use tools that can be used to preemptively respond to the threats posed by sea-level rise to both public and private coastal development and infrastructure, and strives to assist governments in determining which tools to employ to meet their unique socio-economic and political contexts. The report includes a top level analysis of the trade-offs between tools—the economic, environmental, and social costs and benefits, and the legal and administrative feasibility of implementing each tool.

<http://www.georgetownclimate.org/adaptation-tool-kit-sea-level-rise-and-coastal-land-use>

***Educating the Public on Climate Change Issues: DOT and MPO Best Practices***

ICF International, Washington, DC; Federal Highway Administration, U.S. DOT; June 15, 2010

Summary: This document summarizes outreach activities and public education initiatives used around the country by State Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs) to educate the public on transportation-related climate change issues. ([PDF - 129Kb.](#))

[http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/resources\\_and\\_publications/educating\\_the\\_public/index.cfm](http://www.fhwa.dot.gov/environment/climate_change/adaptation/resources_and_publications/educating_the_public/index.cfm)

***Regional Climate Change Effects: Useful Information for Transportation Agencies***

ICF International, Washington, DC; Federal Highway Administration, U.S. DOT; May 10, 2010

Summary: This document provides information on projected future climate change effects (changes in temperature, precipitation, storm activity and sea level rise) over the near term, mid-century and end-of-century. The report includes two appendices: maps for some of the climate change effects, and a "typology" of projected climate change information gleaned from recent reports.

[http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/resources\\_and\\_publications/climate\\_effects/](http://www.fhwa.dot.gov/environment/climate_change/adaptation/resources_and_publications/climate_effects/)

***Climate Change - Model Language in Transportation Plans***

ICF International, Washington, DC; Federal Highway Administration, U.S. DOT; May 2010

Summary: The report looks at MPOs and DOT's transportation plans to illustrate how climate change considerations have been integrated into the documents. The model language could be useful for agencies. ([PDF 89 KB](#))

[http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/resources\\_and\\_publications/model\\_language/index.cfm](http://www.fhwa.dot.gov/environment/climate_change/adaptation/resources_and_publications/model_language/index.cfm)

***Climate Change/Variability Science and Adaptive Strategies for State and Regional Transportation***

Authors: Lindquist, Eric, Texas A&M University, College Station, TX; Corporate Authors: Texas A&M University, College Station; Institute for Science, Technology and Public Policy, College Station, TX; Southwest Region University Transportation Center, Texas Transportation Institute, Texas A&M University, College Station, TX; 2010

Abstract Summary: This study provides a baseline understanding of current policy responses to climate change/variability at the state and regional transportation planning and decision levels. The report addresses a basic question: are state departments of transportation (DOTs) and metropolitan planning organizations (MPOs) in the United States addressing the issue of climate change in general and, more specifically, the issue of adaptation to potential climate change and variability impacts?

<http://swuttc.tamu.edu/publications/technicalreports/167165-1.pdf>

***FHWA/AASHTO Climate Change Adaptation Peer Exchange***

Corporate Authors: ICF International, Washington, DC; Federal Highway Administration, Washington, DC; 2009

Abstract Summary: The Federal Highway Administration (FHWA), with the support of the American Association of State Highway and Transportation Officials (AASHTO), convened a peer exchange on current climate change adaptation activities and strategic needs in Schaumburg, Illinois, on December 8, 2009. This workshop included senior officials of state departments of transportation (DOTs), FHWA headquarters and division offices and AASHTO. This report summarizes the results of the exchange, and is one of series of FHWA reports documenting the results of national peer exchanges on integrating climate change considerations into the transportation planning process.

[http://www.fhwa.dot.gov/hep/climate/peer\\_exchange/peer00.cfm](http://www.fhwa.dot.gov/hep/climate/peer_exchange/peer00.cfm)

***Literature Review: Climate Change Vulnerability Assessment, Risk Assessment, and Adaptation Approaches***

ICF International, Washington, DC; Federal Highway Administration, U.S. DOT; July 2009

Summary: This document details how vulnerability, risk, and adaptation assessments have been or could be used to integrate climate change impacts into transportation decisions and ultimately increase the adaptive capacity of the highway system.

[http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/resources\\_and\\_publications/vulnerability\\_assessment/index.cfm](http://www.fhwa.dot.gov/environment/climate_change/adaptation/resources_and_publications/vulnerability_assessment/index.cfm)

***Sustainability Peer Exchange – Center for Environmental Excellence by AASHTO***

Prepared by CH2M HILL and Good Company for the Center for Environmental Excellence by AASHTO; Best Practices Background, Transportation and Sustainability Peer Exchange May 27-29, 2009, Gallaudet University Kellogg Center; May 27-29, 2009

Summary: This document provides leading practices and methods that transportation professionals are using to address sustainability issues relating to transportation.

<https://www.dot.ny.gov/programs/greenlites/repository/AASHTO%20Sustainability%20Briefing%20Paper.pdf>

***FHWA/AASHTO Climate Change Adaptation Peer Exchange - December 2009***

FHWA; Climate Change Adaptation Workshop; 2009

Summary: This report provides an overview of Six Adaptation Efforts Underway in States. The report provides an overview of responses recently provided by FHWA Division Offices in to a survey of climate change adaptation activities in their state.

[http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/workshops\\_and\\_peer\\_exchanges/illinois\\_12\\_2009/peer06.cfm](http://www.fhwa.dot.gov/environment/climate_change/adaptation/workshops_and_peer_exchanges/illinois_12_2009/peer06.cfm)

***Adaptation Planning – What U.S. States and Localities Are Doing: Overview***

The PEW Center; PEW Climate Change Website; 2009

Summary: This report describes the preparation states and localities are undertaking including risk assessments, prioritization of projects, funding and allocation of both financial and human resources, solution development and implementation, and rapid deployment of information sharing and decision-support tools to address adaptation.

<http://www.flclimatechange.us/ewebeditpro/items/O12F18595.pdf>

***Strategies for Reducing the Impacts of Surface Transportation on Global Climate Change: A Synthesis of Policy Research and State and Local Mitigation Strategies***

Prepared by Cynthia J. Burbank, Parsons Brinckerhoff, Washington DC; Requested by: American Association of State Highway and Transportation Officials (AASHTO); February 2009

Summary: This report discusses the risks of temporary or permanent disruption of key parts of the U.S. transportation network is growing over time. It describes several valuable U.S. and European studies on adaptation, but significantly more work is needed, especially to estimate the localized and regional risks to infrastructure and the changes needed to meet those risks and states according to the *Stern Review on the Economics of Climate Change*, global gross domestic product could be 20 percent lower if the world fails to invest in climate adaptation and GHG reduction.

[http://www.ruraltransportation.org/uploads/nchrp20-24\(59\).pdf](http://www.ruraltransportation.org/uploads/nchrp20-24(59).pdf)

***Literature Review: Climate Change Vulnerability Assessment, Risk Assessment, and Adaptation Approaches***

ICF International, Washington, DC; Federal Highway Administration, U.S. DOT; July 2009

Summary: This document details how vulnerability, risk, and adaptation assessments have been or could be used to integrate climate change impacts into transportation decisions and ultimately increase the adaptive capacity of the highway system.

[http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/resources\\_and\\_publications/vulnerability\\_assessment/index.cfm](http://www.fhwa.dot.gov/environment/climate_change/adaptation/resources_and_publications/vulnerability_assessment/index.cfm)

***Literature Review: Transportation Adaptation in Response to Climate Change***

Michelle Oswald; University of Delaware, University Transportation Center; 2009

Summary: This report indicates adaptation practices support changes in infrastructure, land use, and development patterns and indicates the integration between mitigation and adaptation from climate change can provide a foundation for developing a decision tool for adapting to climate change through sustainable transportation planning.

[http://www.ce.udel.edu/UTC/Presentation%2009/Literature%20Review%20Climate%20Change%20Adaptation%20Oswald\\_090728.pdf](http://www.ce.udel.edu/UTC/Presentation%2009/Literature%20Review%20Climate%20Change%20Adaptation%20Oswald_090728.pdf)

***Integrating Climate Change into the Transportation Planning Process***

ICF International, Washington, DC; Federal Highway Administration, U.S. DOT; July 2008

Summary: This study reports on opportunities for States and MPOs to incorporate climate change considerations into long-range transportation planning (LRTP) processes that include adaptation and mitigation practices. The study also describes examples of current state and MPO practices that link climate change and the LRTP process.

[http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/resources\\_and\\_publications/integrating\\_climate\\_change/index.cfm](http://www.fhwa.dot.gov/environment/climate_change/adaptation/resources_and_publications/integrating_climate_change/index.cfm)

***On the Way to Greener Highways***

By Marlys Osterhues; FHWA Public Roads Magazine, Vol. 70 · No. 3; Dec. 2006

Summary: This study describes how a new public-private partnership promotes environmental stewardship while fostering innovative streamlining and market-based approaches to meeting transportation needs.

<http://www.fhwa.dot.gov/publications/publicroads/06nov/07.cfm>

***Transportation Functional Area Adaptation and Mitigation***

***Airport Climate Adaptation and Resilience***

Author: Baglin, Chris; Transportation Research Board; Serial: ACRP Synthesis of Airport Practice, Issue Number: 33; 2012

Abstract Summary: This synthesis study provides airport heads and their technical managers with a . . . review of the range of risks to airports from projected climate change and the emerging approaches for handling them. The literature review, survey, and interviews, and identifies the ways decision makers and their stakeholders use general information on climate effects and potential adaptation measures to define, plan for, and otherwise address climate risks to their own situation, including to their assets and operations. Detailed case examples capture several distinct approaches to airport climate change resilience and adaptation.

[http://onlinepubs.trb.org/onlinepubs/acrp/acrp\\_syn\\_033.pdf](http://onlinepubs.trb.org/onlinepubs/acrp/acrp_syn_033.pdf)

***Climate Change Adaptation and Preparedness Planning for Airports***

Authors: Stewart, Burr; Klin, Tom; Vigilante, Mary; Serial: Transportation Research E-Circular Issue Number: E-C152; Publisher: Transportation Research Board; 2011

Abstract Summary: This article lays out how climate change is likely to affect airports in the future, the adaptation actions that airport operators can start taking to prepare and adapt to these coming changes, and some of the research needed to help the industry adapt more quickly and efficiently.  
<http://onlinepubs.trb.org/onlinepubs/circulars/ec152.pdf>

***Assessing Criticality in Transportation Adaptation Planning***

ICF International, Washington, DC; Federal Highway Administration, U.S. DOT; June 13, 2011

Summary: This report from the Federal Highway Administration (FHWA) puts forth a draft conceptual model to assist transportation agencies in systematically assessing the vulnerability of transportation assets.

[http://www.fhwa.dot.gov/environment/climate\\_change/adaptation/resources\\_and\\_publications/assessing\\_criticality/index.cfm](http://www.fhwa.dot.gov/environment/climate_change/adaptation/resources_and_publications/assessing_criticality/index.cfm)

***The Implications of Climate Change on Pavement Performance and Design***

Authors: Li, Qiang; Mills, Leslie; McNeil, Sue; Corporate Authors: Delaware Center for Transportation Newark, DE; Research and Innovative Technology Administration; Washington DC; Delaware Center for Transportation, Newark, DE; 2011

Abstract Summary: This research explores the impacts of potential climate change and its uncertainty on pavement performance and therefore pavement design. Two tools are integrated to simulate pavement conditions over a variety of scenarios.

[http://www.ce.udel.edu/UTC/20110926\\_FinalReport\\_Pavement\\_ClimateChange.pdf](http://www.ce.udel.edu/UTC/20110926_FinalReport_Pavement_ClimateChange.pdf)

***Flooded Bus Barns and Buckled Rails: Public Transportation and Climate Change Adaptation***

Authors: Hodges, Tina; Federal Transit Administration; Corporate Authors: Federal Transit Administration; Washington, DC; 2011

Abstract Summary: This project provides transit professionals with information and analysis relevant to adapting U.S. public transportation assets and services to climate change impacts. The report gives examples of adaptation strategies and discusses how transit agencies might incorporate climate change adaptation into their organizational structures and existing activities such as asset management systems, planning, and emergency response.

[http://www.fta.dot.gov/documents/FTA\\_0...\\_Flooded\\_Bus\\_Barns\\_and\\_Buckled\\_Rails.pdf](http://www.fta.dot.gov/documents/FTA_0..._Flooded_Bus_Barns_and_Buckled_Rails.pdf)

***Climate Change and Transportation Engineering: Preparing for a Sustainable Future***

Authors: Meyer, Michael D, Weigel, Brent; Georgia Institute of Technology, Atlanta, GA; Serial: Journal of Transportation Engineering, Volume: 137, Issue Number: 6; Publisher: American Society of Civil Engineers; 2011

Abstract Summary: This paper examines the current practice of transportation system adaptation to climate changes and develops a conceptual framework of the different components of transportation infrastructure affected differently by a range of climate changes.

[http://dx.doi.org/10.1061/\(ASCE\)TE.1943-5436.0000108](http://dx.doi.org/10.1061/(ASCE)TE.1943-5436.0000108)

<http://ascelibrary.aip.org/teo>

***Transportation Adaptation's Bearing on Planning, Systems Management, Operations, and Emergency Response***

Authors: Radow, Laurel J, Federal Highway Administration; Neudorff, Louis; Serial: Transportation Research E-Circular, Issue Number: E-C152; Publisher: Transportation Research Board; 2011



Abstract Summary: This report suggests State and local governments and private infrastructure providers should incorporate climate change into their long-term capital improvement plans, facility designs, maintenance practices, operations, and emergency response plans. Recommendations include transportation providers work more closely with weather forecasters and emergency planners and assume a greater role in planning and emergency response and adaptation may be a criterion for system form and prioritization of projects.

<http://onlinepubs.trb.org/onlinepubs/circulars/ec152.pdf>

***Transportation Planning, Policy and Climate Change: Making the Long-Term Connection***

Authors: Lindquist, Eric, Texas A&M University, College Station, TX; Corporate Authors: University Transportation Center for Mobility, Texas Transportation Institute, Texas A&M University System; College Station, TX; Research and Innovative Technology Administration, Washington, DC; 2011

Abstract Summary: This report suggests that state and regional transportation planners are not integrating climate change science into their decision and planning processes and this is counterintuitive to the traditional long-range focus of the planning process. Coastal areas in particular are seen as vulnerable to climate change and variability, and thus comprise the regional focus of this study.

[http://utcm.tamu.edu/publications/final\\_reports/Lindquist\\_07-03.pdf](http://utcm.tamu.edu/publications/final_reports/Lindquist_07-03.pdf)

[http://ntl.bts.gov/lib/37000/37800/37827/Lindquist\\_07-03.pdf](http://ntl.bts.gov/lib/37000/37800/37827/Lindquist_07-03.pdf)

***Infrastructure, Engineering and Climate Change Adaptation – Ensuring Services in an Uncertain Future***

Corporate Authors: Royal Academy of Engineering, 3 Carlton House Terrace London, UK; Institution of Chemical Engineers; London, UK; Institution of Engineering and Technology; Stevenage, England; Institution of Mechanical Engineers; London, England; 2011

Abstract Summary: This report investigates sectors of infrastructure in the United Kingdom that may be vulnerable to the impacts of climate change. It explores the actions necessary to increase the flexibility and resilience of these infrastructure sectors. It also examines the ways in which the different infrastructures are interdependent, and how that impacts infrastructure vulnerability and risks.

[http://www.raeng.org.uk/news/publicati.../reports/Engineering\\_the\\_future\\_2011.pdf](http://www.raeng.org.uk/news/publicati.../reports/Engineering_the_future_2011.pdf)

***Climate Change Adaptation: What Federal Agencies Are Doing***

Authors: Cruce, Terri, Holsinger, Heather; Pew Center on Global Climate Change; Pew Center; Washington, DC; 2011

Abstract Summary: This report describes the efforts of federal agencies to adapt to climate change. Agency activities listed include the following agencies and sub-agencies: (1) Executive Office of the President and Interagency Initiatives - a. Interagency Climate Change Adaptation Task Force, b. Executive Order 13514 - Federal Leadership In Environmental, Energy, and Economic Performance, c. Council on Environmental Quality, d. Office of Science and Technology Policy, e. United States Global Change Research Program, f. National Climate Adaptation Summit; . . . (8) Department of Housing and Urban Development (HUD); (9) Department of the Interior (DOI) - a. Bureau of Land Management, b. Bureau of Reclamation, c. Fish and Wildlife Service, d. U.S. Geological Survey, e. National Park Service; (10) Department of Transportation (DOT) - a. Federal Highway Administration; and (11) Environmental Protection Agency (EPA).

[http://www.pewclimate.org/docUploads/F...rnmmentLeadershiponAdaptation\\_Nov2010.pdf](http://www.pewclimate.org/docUploads/F...rnmmentLeadershiponAdaptation_Nov2010.pdf)



***State Departments of Transportation Working to Adapt to a Changing Climate***

Authors: Paulsen, Caroline and Phillips, Amy; Serial: Transportation Research E-Circular, Issue Number: E-C152; Transportation Research Board; 2011

Abstract Summary: This report explores tools developed to help transportation agencies with vulnerability and risk assessments, and states are developing their own tools for adaptation planning. But the uncertainties surrounding climate change impacts remain a challenge, as transportation agencies continue to cite the need for consistent and reliable data to help predict sea level rise, temperatures, and storm events, and to protect vulnerable infrastructure.

<http://onlinepubs.trb.org/onlinepubs/circulars/ec152.pdf>

***Federal Highway Administration Activities Related to the Adaptation of Transportation Infrastructure to Climate Change Impacts***

Authors: Hyman, Rob; Lupes, Rebecca; Perlman, David; Serial: Transportation Research E-Circular Issue Number: E-C152; Transportation Research Board; 2011

Abstract Summary: This report describes FHWA's Sustainable Transport and Climate Change Team programs and initiatives to provide FHWA Division Offices, state departments of transportation (DOTs), and metropolitan planning organizations (MPOs) with the data and tools needed to identify and adapt to climate-related impacts on vulnerable transportation infrastructure. Three initiatives are described to illustrate the range of activities underway at FHWA: a report on regional climate change, an in-depth study of climate impacts in the Gulf Coast region, and pilot-testing of a conceptual model for risk and vulnerability assessments.

<http://onlinepubs.trb.org/onlinepubs/circulars/ec152.pdf>

***Synthesis of Climate Change and Transportation Research Efforts at State DOTs, State Universities, and Federal Level***

Corporate Authors: ICF International, Fairfax, VA; NCHRP, AASHTO, TRB; 2011

Abstract Summary: This white paper provides a synthesis of climate change and transportation research efforts at state departments of transportation (DOTs), state universities, and the Federal government based on a recent study requested by the National Cooperative Highway Research Program (NCHRP) and American Association of State Highway and Transportation Officials (AASHTO). The paper includes two sections, Climate Change Mitigation (Section 2) and Climate Change Adaptation (Section 3). Each section provides a synthesis of recent climate change and transportation research at the Federal, state DOT, and university levels. . . Research gaps and needs are summarized at the beginning of each section and described in detail at the end of the mitigation and adaptation sections.

[http://climatechange.transportation.or...CandTransSynthesis\\_NCHRP\\_7%2015%2011.pdf](http://climatechange.transportation.or...CandTransSynthesis_NCHRP_7%2015%2011.pdf)

***Summary Report: Workshops on Integrating Climate Change with Transportation Planning, October & November 2010***

Corporate Authors: Resource Systems Group, Incorporated, White River Junction, VT; Federal Highway Administration, Washington DC; 2011

Abstract Summary: This report provides a summary of five workshops on addressing climate change in the State and metropolitan transportation planning processes that the Federal Highway Administration (FHWA) sponsored in 2010. This report also provides an assessment of the workshop results and suggestions for further FHWA activity related to supporting consideration of climate change in transportation planning.

<http://www.fhwa.dot.gov/hep/climate/workshops/workshops.pdf>

***Responding to Climate Change in National Forests: A Guidebook for Developing Adaptation Options***

David L. Peterson, Constance I. Millar, Linda A. Joyce, Michael J. Furniss, Jessica E. Halofsky, Ronald P. Neilson, and Toni Lyn Morell; USDA; November 2011

Summary: This guidebook contains science-based principles, processes, and tools necessary to assist with developing adaptation options for national forest lands. . . .Regardless of specific processes and tools, the following steps are recommended: (1) become aware of basic climate change science and integrate that understanding with knowledge of local resource conditions and issues (review), (2) evaluate sensitivity of specific natural resources to climate change (rank), (3) develop and implement strategic and tactical options for adapting resources to climate change (resolve), and (4) monitor the effectiveness of adaptation options (observe) and adjust management as needed. . .

<http://permanent.access.gpo.gov/gpo18256/pnw-gtr855.pdf>

***Adaptation to Climate Change: A Review of Challenges and Tradeoffs in Six Areas***

Authors: Bedsworth, Louise W.; Hanak, Ellen; Public Policy Institute of California; Serial: Journal of the American Planning Association, Volume: 76, Issue Number: 4; Publisher: American Planning Association; 2010

Abstract Summary: These studies focus on institutional and regulatory challenges and tradeoffs that climate change poses in six particularly vulnerable areas: water resources, electricity, coastal resources, air quality, public health, and ecosystem resources.

<http://dx.doi.org/10.1080/01944363.2010.502047>

***Adapting to the Impacts of Climate Change***

Corporate Authors: National Research Council, Board on Atmospheric Sciences and Climate, Washington, DC Availability: National Academies Press, Washington, DC; 2010

Abstract Summary: This report calls for a national adaptation strategy that provides needed technical and scientific resources, incentives to begin adaptation planning, guidance across jurisdictions, shared lessons learned, and support of scientific research to expand knowledge of impacts and adaptation.

[http://www.nap.edu/catalog.php?record\\_id=12783](http://www.nap.edu/catalog.php?record_id=12783)

***2010 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance - Report to Congress***

Corporate Authors: Federal Highway Administration, Washington, DC; Federal Transit Administration; Washington, DC; 2010

Abstract Summary: This report to Congress provides decision makers with an objective appraisal of the physical conditions, operational performances, and financing mechanisms of highways, bridges, and transit systems based both on the current state of these systems and on the projected future state of these systems under a set of alternative future investment scenarios. The report offers a comprehensive, data-driven background to support the development and evaluation of legislative, program, and budget options at all levels of government.

<http://www.fhwa.dot.gov/policy/2010cpr/pdfs.htm>

<http://www.fhwa.dot.gov/policy/2010cpr/pdfs/cp2010.pdf>

***Federal Highway Administration Integrating Climate Change into the Transportation Planning Process: Final Report***

Prepared for Diane Turchetta, FHWA; Prepared by ICF International; July 2008

Summary: This study informs the practice and application of transportation planning among state, regional, and local transportation planning agencies to successfully meet growing concerns about the relationship between transportation and climate change. This report explores the possibilities for integrating climate change considerations into long range transportation planning at state DOTs and MPOs and reviews the experience of a number of DOTs and MPOs that are already incorporating climate change into their transportation planning processes and identifies their successes as well as challenges faced by these agencies.

<http://www.fhwa.dot.gov/hep/climatechange/climatechange.pdf>

***Summary Report: Peer Workshop on Adaptation to Climate Change Impacts--2008***

Corporate Authors: Federal Highway Administration; FHWA, Washington, DC; 2008

Abstract Summary: This report summarizes participant presentations and the key issues that emerged when officials of state departments of transportation (DOTs), FHWA headquarters and division offices and AASHTO met in peer workshop. To help support state DOT and other transportation agency efforts to adapt to climate change impacts, this report identifies suggestions from the peer exchange participants for potential elements of guidance, research and policy at the national level.

<http://www.fhwa.dot.gov/planning/statewide/pwsacci.htm>

## ***Stormwater Adaptation and Mitigation***

***International Stormwater Best Management Practices (BMP) Database***

International Stormwater Best Management Practices Database; BMPDB Website; 2012

Summary: This site contains the International Stormwater Best Management Practices (BMP) Database project website featuring a database of over 400 BMP studies, performance analysis results, tools for use in BMP performance studies, monitoring guidance, and other study-related publications. The project provides scientifically sound information to improve the design, selection and performance of BMPs.

<http://www.bmpdatabase.org/>

***A Sustainable Approach to Stormwater Management: Portland, Oregon***

City of Portland, OR; Stormwater Management Website; 2012

Summary: This study reviews Portland's Stormwater management systems. Portland received international attention for its projects and designs in sustainable stormwater management. For more information more about the program history and development, visit the Water Environment Research Foundation case study report for Portland.

<http://www.portlandonline.com/bes/index.cfm?c=34598>

***Welcome to the UNHSC-NEMO Innovative Stormwater Management Inventory!***

UNHSC-NEMO; Searchable State Website; 2012

Summary: This searchable and amendable inventory highlights innovative BMP strategies, such as Low Impact Development (LID) designs, implemented throughout New England. The purpose of the inventory is to provide real world examples of successful and innovative BMP installations throughout the region. It does not present performance data (which can be located at the International BMP Database).

<http://www.erg.unh.edu/stormwater/index.asp>

### ***Watershed-Ecosystem Based Approaches for Post-Construction Stormwater Management along Highway Corridors***

Art Hirsch; TerraLogic Transportation Blog; Sunday, November 06, 2011

Summary: This report looks at state, county and municipal departments of transportation (DOTs) and the financial resources expended on stormwater management, and especially the Municipal Separate Stormwater Sewer System (MS4) Permit requirements for post-construction best management practices. The report discusses the environmental and financial soundness of the approaches in protecting water quality.

[http://terralogicss.com/blog/Sustainable\\_Transportation/post/Watershed-Ecosystem\\_Based\\_Approaches\\_for\\_Post-Construction\\_Stormwater\\_Management\\_Along\\_Highway\\_Corridors/](http://terralogicss.com/blog/Sustainable_Transportation/post/Watershed-Ecosystem_Based_Approaches_for_Post-Construction_Stormwater_Management_Along_Highway_Corridors/)

### ***US EPA Perspective on Stormwater & Climate Change Adaptation***

Dr. Cindy Lin, USEPA R9; Slide presentation for Workshop on Impacts of Climate Change on Extreme Events/Severe Weather; Western States Water Council, CA DWR, Western Governors Association; March 22, 2011

Summary: EPA Climate Change Response Strategy for Water Program

- Stormwater Program
- Climate Change Adaptation for Stormwater program
- Learning from development and impacts
- What are data needs for EPA to effectively regulate flow and pollutant load with future climatic uncertainty?

<http://www.westgov.org/wswc/lin.pdf>

### ***Green Infrastructure in Arid and Semi-Arid Climates: Adapting Innovative Stormwater Management Techniques to the Water-limited West***

EPA; The American Recovery and Reinvestment Act (ARRA), Green Project Reserve of 2009, through the State Revolving Fund ,provided funding for a wide variety of qualifying projects in the categories of: green infrastructure, energy efficiency, water efficiency, and other innovative projects; 2009

Summary: “Green infrastructure” may seem incongruous with the landscapes of the arid and semi-arid West, but forward-thinking communities in these water-limited regions are increasingly recognizing green infrastructure as a cost-effective approach to stormwater management that conserves water supply.

[http://www.azwater.gov/AzDWR/waterManagement/documents/10504-08AridClimatesCaseStudy\\_v2.pdf](http://www.azwater.gov/AzDWR/waterManagement/documents/10504-08AridClimatesCaseStudy_v2.pdf)

### ***Protocol for Stormwater Best Management Practice Demonstrations***

The Technology Acceptance Reciprocity Partnership, Endorsed by California, Massachusetts, Maryland, New Jersey, Pennsylvania, and Virginia, Final Protocol 8/01-Updated: July 2003

Summary: This report is an agreed upon protocol by the states of California, Massachusetts, Maryland, New Jersey, Pennsylvania, and Virginia. The Protocol is a set of uniform criteria acceptable to the endorsing states.

<http://www.dep.state.pa.us/dep/deputate/pollprev/techservices/tarp/pdf/Tier2protocol.pdf>

## ***International Adaptation and Mitigation to Climate Change 2010 - 2012***

### ***Climate Change Adaptation: a Report on Climate Change Adaptation Measures for Low Volume Roads in the Northern Periphery (Sweden, Norway & Finland)***

By Adriána Hudecz, Arctic Technology Centre (ARTEK) at the Technical University of Denmark (DTU); ROADEX; Swedish Transport Administration; The ROADEX “Implementing Accessibility”; Lead Partner: The Swedish Transport Administration, Northern Region; Project co-coordinator: Mr. Krister Palo; 2012

Summary: This report summarizes recent published researches on climate change and its possible impact on low volume roads in the Northern Periphery. Its aim was to produce a practical guidance document for local engineers to help them to manage potential effects of climate change on their local road networks.

[http://www.roadex.org/uploads/publications/Climate%20Change%20Adaptation%20\(2012\).pdf](http://www.roadex.org/uploads/publications/Climate%20Change%20Adaptation%20(2012).pdf)

### ***Urban Adaptation to Climate Change in Europe: Challenges and Opportunities for Cities Together with Supportive National and European Policies***

Authors: Isoard, Stephane; Kurnik, Blaz; Foltescu, Valentin Leonard; Swart, Rob; Marinova, Natasha; van Hove, Bert; Jacobs, Cor; Klostermann, Judith; Kazmierczak, Aleksandra; Peltonen, Lasse; Kopperoinen, Leena; Oinonen, Kari; Havranek, Miroslav; Cruz, Maria Joao; Gregor, Mirko; Fons-Esteve, Jaume; Keskitalo, Carina; Juhola, Sirkku; Krellenberg, Kerstin; van Bree, Leendert; Corporate Authors: European Environment Agency, Copenhagen, Denmark; 2012

Abstract Summary: This report provides a European overview of the challenges and opportunities of urban adaptation to climate change and links them with other initiatives that provide more detailed information on local climate change impacts, and good practice guidance. . .

Record URL: <http://www.eea.europa.eu/publications/urban-adaptation-to-climate-change>

Order URL: <http://worldcat.org/isbn/9789292133085>

### ***Types of Cluster Adaptation to Climate Change: Lessons from the Port and Logistics Sector of Northwest Germany***

Authors: Osthorst, Winfried; Mänz, Christine; Maritime Policy & Management; Publisher: Taylor & Francis; Serial: Volume: 39, Issue Number 2; 2012

Summary: This article describes how climate adaptation of ports is predominantly referred to as technical responses to extreme events (e.g. coastal protection). . . The article gives an overview of the literature on climate adaptation and how it applies to ports and provides a preliminary sector . . . adaptation to climate change.

<http://dx.doi.org/10.1080/03088839.2011.650724>

### ***United Kingdom's Experience with Climate Change Adaptation and Transportation***

Authors: Kollamthodi, Sujith; Fordham, Damon; Stephens, Mia; Serial: Transportation Research E-Circular, Issue Number: E-C152; Publisher: Transportation Research Board; 2011

Abstract Summary: This report describes the United Kingdom's (U.K.) implementation of climate change policy frameworks as the first country to have a legally binding long-term framework to cut carbon emissions by 80%, enacted through the United Kingdom's Climate Change.

<http://onlinepubs.trb.org/onlinepubs/circulars/ec152.pdf>

### ***International Scan on Climate Change Adaptation***

Authors: Weiner, Edward; Serial: Transportation Research E-Circular, Issue Number: E-C152

Publisher: Transportation Research Board; 2011

Abstract Summary: This is a report of an international scan of The Netherlands, Venice, Italy, and two coastal states in Germany and their actions in recognizing the vulnerability of their transportation infrastructure to climate changes. The scan results will provide engineers and planners in the United States with new ideas on approaches that they can use in their own communities to adapt transportation to climate changes.

<http://onlinepubs.trb.org/onlinepubs/circulars/ec152.pdf>

***Adapting to Climate Change: Implications for Transport Infrastructure, Transport Systems and Travel Behaviour***

Authors: Taylor, M A, and Philp, M; University of South Australia, Institute for Sustainable Systems and Technologies; Source Agency: ARRB Group Limited; 500 Victoria, AU; Serial: Road and Transport Research, Volume: 19, Issue Number: 4; Publisher: ARRB Group Limited; 2010

Abstract Summary: This paper reviews land based transport related issues from considerations of climate change adaptation in Australia. The two main issues for climate change adaptation are sea level rise and the increased frequency and intensity of extreme weather events.

<http://worldcat.org/oclc/26087078>

***Building Resilience to Climate Change - an Adaptation Plan for Transport 2010-2012***

Department for Transport, UK; Source Agency: Transport Research Laboratory, Berkshire, UK; 2010

Abstract Summary: This is a report of the UK's legislative framework for action to adapt to the projected impacts of climate change. For the Department for Transport, this is meeting the strategic aim of 'transport that works for everyone' through planning, designing, maintaining and operating a transport system that is resilient to future change. The implications for the design, construction, maintenance and operation of roads, railways, ports and airports are outlined.

<http://www.nudgeadvisory.com/assets/uploaded/docs/76.pdf>

***Impact of Weather on Commuter Cyclist Behaviour and Implications for Climate Change Adaptation***

Authors: Ahmed, F; Rose, G; Jacob, C, Monash University, Atmospheric Science; Source Agency: ARRB Group Limited, Victoria, AU; 33rd Australasian Transport Research Forum, 29 September to 1 October 2010, National Convention Centre, Canberra, AU; 2010

Abstract Summary: This paper examines the relationship between weather and travel behavior with an emphasis on bicycling and assesses adaptation behavior in face of weather and climate change and the implications for government strategies seeking to increase the role of active transport in urban areas.

<http://trid.trb.org/view.aspx?id=1097035>

See [WSDOT Library](#) for Availability

***Tomorrow's Railway and Climate Change Adaptation: Phase 1 Report***

Corporate Authors: Rail Safety and Standards Board, London, UK; 2010

Abstract Summary: This paper examines the impact of extreme weather events on the railroad industry and the information needed on weather effects on its passengers, rolling stock and infrastructure, and staff to enable informed judgments to be made concerning adaptation policy to deliver a reliable railroad for the future. This paper presents how the current and future climate will impact the ability to achieve and deliver: (1) A safe railroad system, (2) A very reliable railroad system, (3) Increased capacity, (4) Value for money spent, and (5) A 'predict and prevent' approach.

[http://www.rssb.co.uk/sitecollectiondo...pdf/reports/research/T925\\_rpt\\_phase1.pdf](http://www.rssb.co.uk/sitecollectiondo...pdf/reports/research/T925_rpt_phase1.pdf)

***iRESM Initiative: Understanding Decision Support Needs for Climate Change Mitigation and Adaptation***

U.S. Midwest Region, J. Rice R. Moss, P. Runci, K. Anderson; Prepared for The U.S. Department of Energy under Contract DE-AC05-76RL0183; PNNL – 20104; Pacific Northwest National Laboratory, Richland, Washington; October 2010

Summary: This paper describes a modeling framework addressing regional human-environmental system interactions in response to climate change and related uncertainties and is intended as a research tool for the scientific community to explore regional mitigation and adaptation decisions, constraints, and opportunities under alternate climate policy and climate change future. This paper presents the results of the initial research into decision support needs for the first iRESM pilot region: the US Midwest.

<http://www.pnnl.gov/atmospheric/iresm/pdf/iRESMidwestStakeholderResearch.pdf>

***Climate Change Mitigation and Adaptation Measures for Inland Waterways in England and Wales***

Authors: Brooke, Jan; White, I; Inland Waterways Advisory Council, www.iwac.org.uk  
London, UK; 2010

Summary: This paper discusses mitigation and adaptation measures described as encouraging behavioral changes. Educating users about the implications of their actions and how modifying their behavior can help to save both money and be an effective way of achieving shared objectives.

[http://www.iwac.org.uk/downloads/reports/IWAC\\_Climate\\_Change\\_Inland\\_Waterways\\_Apr09.pdf](http://www.iwac.org.uk/downloads/reports/IWAC_Climate_Change_Inland_Waterways_Apr09.pdf)

***Business Response to Adaptation 2008 - 2012***

***Trends in Water Demand and Water Availability for Power Plants-Scenario Analyses for the German Capital Berlin***

Authors: Koch, Hagen Hagen; Vögele, Stefan; Kaltofen, Michael; Grünwald, Uwe; Climatic Change (Springer Science & Business Media B.V.); Vol. 110 Issue 3/4; February 2012

Abstract Summary: This paper analyses the effects of global change and options for adapting to water shortages for power plants in Berlin, Germany. The interconnection between power plants, and their demand for water, and water resources management/ water availability, is described.

See [WSDOT Library](#) for Availability

***Surprise as a Catalyst for Including Climatic Change in the Strategic Environment***

Authors: Haigh, Nardia and Griffiths, Andrew; Business & Society (Elsevier); Vol. 51 Issue 1; March 2012

Summary: This article discusses the electricity supply organizations inclusion of changing climate conditions in their local environment as part of their strategic planning considerations.

See [WSDOT Library](#) for Availability

***Types of Cluster Adaptation to Climate Change: Lessons from the Port and Logistics Sector of Northwest Germany***

Authors: Osthorst, Winfried; Mänz, Christine; Maritime Policy & Management (Elsevier; Vol. 39 Issue 2; March 2012



Summary: This article summarizes the literature on climate adaptation and its application to ports and gives a preliminary summary of different sector adaptation approaches to climate change.

See [WSDOT Library](#) for Availability

***Climate Change in Northern Sweden: Intra-Regional Perceptions of Vulnerability among Winter-Oriented Tourism Businesses***

Authors: Brouder, Patrick; Lundmark, Linda, Umeå University, Sweden; Journal of Sustainable Tourism (Taylor & Francis Ltd.); Vol. 19 Issue 8; November 2011

Summary: This paper studied the link between climate change and tourism and looked at the Upper Norrland, in Northern Sweden, measuring the perceptions of winter-oriented tourism entrepreneurs. The paper provides a model for mapping local differences to stimulate further study of climate change and tourism research and in local businesses education on adaptation techniques.

See [WSDOT Library](#) for Availability

***Climate Change, Adaptation, and Vulnerability: Reconceptualizing Societal–Environment Interaction within a Socially Constructed Adaptive Landscape***

Author: McLaughlin, Paul; Organization & Environment (Sage Publications Inc.); Vol. 24 Issue 3; September 2011

Summary: This article describes current climate change adaptation and vulnerability analyses within framework that combines organizational sociology looking at language, culture, and values; and political ecology looking at power, inequality, and marginalization.

See [WSDOT Library](#) for Availability

***Linking Corporate Climate Adaptation Strategies with Resilience Thinking***

Authors: Beermann, Marina; Journal of Cleaner Production; Vol. 19 Issue 8; May 2011

Summary: This study looked at risks and opportunities in coping with climate change caused impacts and corporate climate adaptation strategies and thinking about the concept of resilience. From a strategic management perspective, the research showed that mitigation is key element of long term adaptation and strategies.

See [WSDOT Library](#) for Availability

***Businesses See Opportunity in Adaptation, Report Finds***

Authors: Reisch, Marc; Chemical & Engineering News (UN GLOBAL Compact); Vol. 89 Issue 26; June 27, 2011

Summary: The article focuses on a survey report prepared by the United Nations (UN) Global Compact as of June 2011, which found that adapting to climate change provides a competitive advantage and business opportunity for companies.

See [WSDOT Library](#) for Availability

***Disaster Risk Reduction Or Climate Change Adaptation: Are We Reinventing The Wheel?***

Author: Mercer, Jessica; Journal of International Development (John Wiley & Sons, Ltd.); Vol. 22 Issue 2; March 2010

Summary: This paper explores the similarities and differences in disaster risk reduction strategies related to climate change and international development policy. It indicates support for all forms of risk reduction through integrating DRR and CCA strategies.



See [WSDOT Library](#) for Availability

***Business Strategies and the Transition to Low-Carbon Cities***

Authors: Whiteman, Gail, de Vos, D. Rene, Chapin, F. Stuart, Yli-Pelkonen, Vesa, Niemelä, Jari, Forbes, Bruce C.; Business Strategy & the Environment (John Wiley & Sons, Inc); Vol. 20, Issue 4; 2010

Abstract Summary: This article presents a conceptual model of the role of companies in urban climate change and mitigation and explains how a company partnered in a pilot project with the city of Rotterdam to test electric vehicles.

See [WSDOT Library](#) for Availability

***Climate Change Basics for Managers***

Authors: Wittneben, Bettina B. F., Kiyar, Dagmar; Management Decision (Emerald Group Publishing Limited), Vol. 47, Issue 7; 2009

Summary: The paper reviews the changes in the political environment related to climate change and business' response.

See [WSDOT Library](#) for Availability

***The Dynamics of Belief in Climate Change and Its Risks in Business Organizations***

Authors: Bleda, Mercedes' Shackley, Simon; Ecological Economics (Elsevier); Vol. 66 Issue 2/3; June 2008

Summary: This paper presents a simulation using the STELA software model. The researchers tested beliefs in climate change of a business using a systems dynamics approach.

See [WSDOT Library](#) for Availability

***Electrical Utilities and Adaptation 2005 - 2012***

***Impact of Climate Change on Building Energy Use in Different Climate Zones and Mitigation and Adaptation Implications***

Authors: Wan, Kevin K.W.; Li, Danny H.W.; Pan, Wenyan; Lam, Joseph C.; Applied Energy (Elsevier Science Publishing Company, Inc.); Vol. 97; September 2012

Abstract Summary: This article looks at the impact of climate change on energy use in office buildings in a city within each of the five major architectural climates across China and the potential shift in electrical power demand and the energy conservation measures considered in mitigating the impact of climate change on building energy use.

See [WSDOT Library](#) for Availability

***Adaptation to climate change among electricity distribution companies in Norway and Sweden: lessons from the field***

Authors: Inderberg, Tor Håkon , Løchen, Liv Arntzen; Local Environment (Routledge), Vol. 17 Issue 6/7; August 2012

Abstract Summary: The article analyses local adaptation to climate change in the electricity sector in Norway and Sweden. More specific, this article analyses the adaptive capacity of four local grid-companies in the two countries, based on national context, company size, and experience with weather events.

See [WSDOT Library](#) for Availability

***Impact of Climate Change on Energy Use in the Built Environment in Different Climate Zones – A Review***

Authors: Li, Danny H.W.; Yang, Liu; Lam, Joseph C.; Energy (Pergamon Press - An Imprint of Elsevier Science), Vol. 42 Issue 1; June 2012

Abstract Summary: This article reviewed studies on the impact of climate change on energy use in buildings in the different parts of the world and discusses potential mitigation and adaptation measures and suggests further research work.

See [WSDOT Library](#) for Availability

***Adaptation of California's Electricity Sector to Climate Change***

Author: Vine, Edward; Climatic Change (Springer Science & Business Media B.V); Vol. 111 Issue 1; March 2012

Abstract Summary: This paper describes adaptation challenges of electricity demand and supply in the residential and commercial sectors in California. The primary challenge is the demand as generation accounts for nearly 30% of greenhouse gas emissions. This sector is targeted in the state's efforts to reduce emissions and new energy conservation tools are needed.

See [WSDOT Library](#) for Availability

***Climate Change-Related Impacts In the San Diego Region By 2050***

Authors: Messner, Steven; Miranda, Sandra; Young, Emily; Hedge, Nicola; Climatic Change (Springer Science & Business Media B.V); Vol. 109; December 2011

Abstract Summary: This paper explores what the San Diego region may look like in the year 2050 as projected changes in regional climate conditions in the San Diego region focusing on interrelated issues of climate change, sea level rise, population growth, land use, and changes in water, energy, public health, wildfires, biodiversity, and habitat. The paper reviews the potential impacts and makes recommendations for changes in planning processes at the local and regional levels.

See [WSDOT Library](#) for Availability

***Residential Air-Conditioning and Climate Change: Voices of the Vulnerable***

Authors: Farbotko C; Waitt G; Health Promotion Journal of Australia (Official Journal of Australian Association of Health Promotion Professionals), Vol. 22 Spec No; December 2011

Summary: This paper looked at the role of air-conditioning of elderly public housing tenants prone to heat stress. The work includes a vulnerability analysis of domestic air-conditioning use and indicated air-conditioning contributed to emissions that cause climate change and is not a technology for reducing the risk of heat stress.

See [WSDOT Library](#) for Availability

***Simulating the Impacts of Climate Change, Prices and Population on California's Residential Electricity Consumption***

Authors: Auffhammer, Maximilian; Aroonruengsawat, Anin; Climatic Change (Springer Science & Business Media B.V), Vol. 109; December 2011

Abstract Summary: This study simulated the impacts of higher temperatures resulting from anthropogenic climate change on residential electricity consumption for California and the impacts of higher electricity prices and different scenarios of population growth.

See [WSDOT Library](#) for Availability

***Amazon and the Expansion of Hydropower in Brazil: Vulnerability, Impacts and Possibilities for Adaptation to Global Climate Change***

Authors: Soito, João Leonardo da Silva and Freitas, Marcos Aurélio Vasconcelos; Renewable & Sustainable Energy Reviews (Pergamon Press & Elsevier), Vol. 15 Issue 6; August 2011

Abstract Summary: This article evaluates the use of hydroelectric potential in Brazil and the expansion of the hydroelectric power in the Amazon, highlighting vulnerabilities, impacts, and the adaptation possibilities of hydroelectric energy.

See [WSDOT Library](#) for Availability

***An Integrated Approach For Climate-Change Impact Analysis And Adaptation Planning Under Multi-Level Uncertainties Part II. Case Study***

Authors: Cai, Y.P.; Huang, G.H.; Tan, Q.; Liu, L.; Renewable & Sustainable Energy Reviews (Pergamon Press & Elsevier), Vol. 15 Issue 6; August 2011

Abstract Summary: In this study, a large-scale integrated modeling system (IMS) was applied in support of a climate change impact analysis and adaptation planning of the energy management system in the Province of Manitoba, Canada. It may be a useful technique for decision makers in examining impacts of climate change on energy management systems and identifying desired adaptation strategies.

See [WSDOT Library](#) for Availability

***Climate Change, Nuclear Power, and the Adaptation–Mitigation Dilemma***

Authors: Kopytko, Natalie and Perkins, John; Energy Policy (Elsevier Science); Vol. 39 Issue 1; January 2011

Abstract Summary: This paper develops criteria to assess the adaptation–mitigation looking at two areas: (1) the ability of nuclear power to adapt to climate change and (2) the potential for nuclear power operation to hinder climate change adaptation.

See [WSDOT Library](#) for Availability

***An Integrated Framework for Quantifying and Valuing Climate Change Impacts on Urban Energy and Infrastructure: a Chicago Case Study***

Authors: Hayhoe, Katharine; Robson, Mark; Rogula, John; Auffhammer, Maximilian; Miller, Norman; VanDorn, Jeff; Wuebbles, Donald; Journal of Great Lakes Research (Elsevier Science ), Supplement 2, Vol. 36; June 2010

Abstract Summary: The article describes using a quantitative modeling framework that enables estimates of the economic impacts of climate change by observing the relationships between key climate thresholds and their impacts on energy and infrastructure.

See [WSDOT Library](#) for Availability

***Climate Change and Future Energy Consumption in UK Housing Stock***

Authors: Collins, Lisa; Natarajan, Sukumar; Levermore, Geoff; Building Services Engineering Research & Technology (Sage Publications, Ltd), Vol. 31, Issue 1; February 2010

Abstract Summary: This paper discusses impacts on gas and electricity consumption and carbon emissions from heating and cooling systems in existing dwellings up to 2080, assuming a widespread uptake of cooling systems. Predictions of future CO2 emissions will be useful to those in the building industry planning appropriate proportionate climate adaptation and climate mitigation measures and energy modeling.

See [WSDOT Library](#) for Availability

***Smart Grids: Opportunities for Climate Change Mitigation and Adaptation***

Author: Lyster, Rosemary; Monash University Law Review (Monash University, Faculty of Law), Vol. 36; 2010

Abstract Summary: This article assesses the Smart Grid's contribution to climate change mitigation and adaptation. The Smart Grid combines information, communications technology, and electrical capabilities to improve flexibility, security, reliability, efficiency, and the safety of the electricity system. The article assesses the regulatory consequences to the adoption of a Smart Grid in Australia.

See [WSDOT Library](#) for Availability

***The Next Generation of Scenarios for Climate Change Research and Assessment***

Authors: Moss, Richard H.; Edmonds, Jae A.; Hibbard, Kathy A.; Manning, Martin R.; Rose, Steven K.; van Vuuren, Detlef P.; Carter, Timothy R.; Emori, Seita; Kainuma, Mikiko; Kram, Tom; Meehl, Gerald A.; Mitchell, John F. B.; Nakicenovic, Nebojsa; Riahi, Keywan; Smith, Steven J.; Stouffer, Ronald J.; Thomson, Allison M.; Weyant, John P.; Wilbanks, Thomas J.; Nature (Nature Publishing Group ), Vol. 463 Issue 7282; February 2, 2010

Abstract Summary: This article describes a process for creating plausible scenarios to investigate challenging and important questions about climate change confronting the global community.

See [WSDOT Library](#) for Availability

***Least-Cost Adaptation Options for Global Climate Change Impacts on the Brazilian Electric Power System***

Authors: de Lucena, Andre Frossard Pereira; Schaeffer, Roberto; Szklo, Alexandre Salem; Global Environmental Change Part A: Human & Policy Dimensions (Pergamon Press - An Imprint of Elsevier Science), Vol. 20 Issue 2; May 2010

Summary Abstract: This paper applies an integrated resource planning approach to calculate least-cost adaptation measures to a set of projected climate impacts on the Brazilian power sector. The methodology considers the energy chain and interactions between energy supply and demand.

See [WSDOT Library](#) for Availability

***Electricity Demand in a Changing Climate***

Authors: Eskeland, Gunnar and Mideksa, Torben; Mitigation & Adaptation Strategies for Global Change (Springer Science & Business Media B.V), Vol. 15 Issue 8; December 2010

Abstract Summary: This study looks at electricity demand and the temperature aspects of climate change. Electricity consumption is of interest both from the perspectives of adaptation to climate change and emission reductions. The study looks only at the effects of climate change from electricity consumption.

See [WSDOT Library](#) for Availability

***Dynamic Modeling of Water Demand, Water Availability and Adaptation Strategies for Power Plants to Global Change***

Authors: Koch, Hagen; Vögele, Stefan; Ecological Economics (Elsevier Science), Vol. 68 Issue 7; May 2009

Abstract Summary: This paper describes a model integrating functions for the calculation of the water demand of power plants into a water resources management model and includes both short-term reactive and long-term planned adaptation. The model enables analysis of scenarios for socio-economic and climate change and the effects of water management actions.

See [WSDOT Library](#) for Availability

***Self-Organized Criticality of Power System Faults and Its Application in Adaptation to Extreme Climate***

Authors: Su Sheng; Li Yin Hong; Duan Xian Zhong; Chinese Science Bulletin (Springer Science & Business Media B.V.), Vol. 54 Issue 7, April 2009

Abstract Summary: This paper analyzed faults in a transmission and distribution networks in central China to understand and facilitate power systems' adaptation to climate variation in an economical and efficient way.

See [WSDOT Library](#) for Availability

***Impact of Climate Change on Pacific Northwest Hydropower***

Authors: Markoff, Matthew S.; Cullen, Alison C.; Climatic Change (Springer Science & Business Media B.V.), Vol. 87 Issue 3/4; April 2008

Abstract Summary: This report is an assessment of uncertainty in future PNW hydropower generation potential based on a comprehensive set of climate models and greenhouse gas emissions pathways and finds that the prognosis for PNW hydropower supply under climate change is worse than anticipated. This report suggests streamlining adaptation planning for PNW water and energy resources.

See [WSDOT Library](#) for Availability

***The Interaction between Emissions Trading and Renewable Electricity Support Schemes: An Overview of the Literature***

Authors: González, Pablo del Río; Mitigation & Adaptation Strategies for Global Change (Springer Science & Business Media B.V.), Vol. 12 Issue 8; November 2007

Abstract Summary: This paper analyzes the synergies and conflicts in the public promotion of electricity from renewable energy sources in countries with emissions trading schemes.

See [WSDOT Library](#) for Availability

***Business and Climate Change Risk: A Regional Time Series Analysis***

Authors: Romilly, Peter; Journal of International Business Studies (Palgrave Macmillan Ltd.), Vol. 38 Issue 3; May 2007

Abstract Summary: This article identifies a methodology using regional temperature risk profiles, and develops climate change risk rankings useful in weather-related risk analysis. Results are discussed related to the insurance and reinsurance markets.

See [WSDOT Library](#) for Availability

***Hydropower and Climate Change – A Reciprocal Relation***

Authors: Hauenstein, Walter; Mountain Research & Development (International Mountain Society), Vol. 25 Issue 4; November 2005

Abstract Summary: This article looked at the effects ongoing climate change on hydropower in Switzerland—principally on the amount of electricity produced, and safety of hydropower plants.

See [WSDOT Library](#) for Availability

***Climate Change and Energy Use: The Role for Anthropological Research***

Author: Henning, Annette; Anthropology Today (Wiley-Blackwell), Vol. 21 Issue 3; June 2005

Abstract Summary: This article discusses periods of social scientific energy research in Sweden, the role of the social sciences within energy studies, and the role of different types of energy use in Sweden from 1970. The Swedish government agreed on a strategy for adjusting the national energy systems and the energy program comprised at reducing carbon dioxide emissions and replacing electricity produced by nuclear power.

See [WSDOT Library](#) for Availability

## ***Insurance and Financial Industry and Adaptation 2002 - 2012***

### ***What Role for 'Long-term Insurance' in Adaptation? An Analysis of the Prospects for and Pricing of Multi-year Insurance Contracts***

Authors: Maynard, Trevor; Ranger, Nicola; Geneva Papers on Risk & Insurance - Issues & Practice (Palgrave Macmillan Ltd.), Vol. 37 Issue 2; April 2012

Abstract Summary: This articles reviews multi-year insurance contracts and provides analyses on their price implications in the retail insurance market and discusses other tools, as risk-based premiums and loans, as an adaptive response to natural catastrophe risks.

See [WSDOT Library](#) for Availability

### ***Engaging Financial Stakeholders: Opportunities for a Sustainable Built Environment***

Authors: Lützkendorf, Thomas; Fan, Wei; Lorenz, David; Building Research & Information (Routledge), Vol. 39 Issue 5; Sept.-Oct. 2011

Abstract Summary: This paper analyzes the role of the financial in development during the planning, construction, management and refurbishment stages and realization of sustainable development principles in relation to: roles and policy issues, climate change (mitigation and adaptation), energy efficiency, design and urban development quality.

See [WSDOT Library](#) for Availability

### ***Chapter 6: Insurance industry***

Authors: LeBlanc, Alice; Linkin, Megan; Annals of the New York Academy of Sciences; Vol. 1196 Issue 1; May 2010

Abstract Summary: The article focuses on the role of the private insurance industry in developing climate change adaptation pathways for the New York City region. It discusses how the experiences of insurance companies in translating risk information into commercial practices can help the risk management approach of the New York City Panel on Climate Change (NPCC). It states that the insurance industry risk assessment tools can be used to evaluate possible economic costs of climatic events.

See [WSDOT Library](#) for Availability

### ***Interdependency of Science and Risk Finance in Catastrophe Insurance and Climate Change***

Author: Kleindorfer, Paul; INSEAD Working Papers Collection (INSEAD), Issue 2; 2010

Abstract Summary: This paper describes the linkages between science and risk finance for catastrophe insurance and the risks associated with climate change.

See [WSDOT Library](#) for Availability

## ***A Global Review of Insurance Industry Responses to Climate Change***

Authors: Mills, Evan; Geneva Papers on Risk & Insurance - Issues & Practice (Palgrave Macmillan Ltd.), Vol. 34 Issue 3; July 2009

Abstract Summary: This article describes how insurers are adapting their business model to the realities of climate change, but it has not yet been demonstrated how some insurance lines might respond to climate change.

See [WSDOT Library](#) for Availability

***Climate Change and the Transformation of Risk: Insurance Matters***

Authors: Hecht, Sean B.; UCLA Law Review (UCLA Law Review), Vol. 55 Issue 6; August 2008

Abstract Summary: This article discusses the insurance industry's role as society's primary financial risk manager in developing institutions and practices to address the risks and loss associated with climate change.

See [WSDOT Library](#) for Availability

***Insurance against Climate Change and Flooding in the Netherlands: Present, Future, and Comparison with Other Countries***

Authors: Botzen, W. J.W.; Van den Bergh, C. J. M.; Risk Analysis: An International Journal (Wiley-Blackwell), Vol. 28 Issue 2; April 2008

Abstract Summary: This article discusses the role insurance can play in adapting to climate change impacts, with emphasis on the Dutch insurance sector, given the Netherlands vulnerability to climate change impacts. It provides a comparison of flood insurance approaches in the Netherlands, the United Kingdom, Germany, and France.

See [WSDOT Library](#) for Availability

***Editorial Insurance and Adaptation to Climate Change***

Authors: Chemarin, Sophie; Picard, Pierre; Geneva Papers on Risk & Insurance - Issues & Practice, Vol. 33 Issue 1; January 2008

Abstract Summary: The article discusses various reports published within the issue, including one by Arthur Charpentier examining the potential impacts that climate change will have on insurance and reinsurance markets, and an article by Kim Clemo examining how insurance companies can help small business adapt to climatic changes.

See [WSDOT Library](#) for Availability

***Study: Climate Change Increases Claims Exposure***

Best's Review; Vol. 108 Issue 3; July 2007

Abstract Summary: The article reports on the findings of the study "Limiting Liability in the Greenhouse: Insurance Risk-Management Strategies in the Context of Global Climate Change," by American climate experts. It reveals that climate changes increase the liability claims and cost adaptations of insurers. It also indicates that insurers could be liable for covering carbon emission, carbon-intensive operations and non-disclosure of climate change exposure.

See [WSDOT Library](#) for Availability

***Can Insurance Deal With Negative Effects Arising from Climate Policy Measures?***

Authors: Michaelowa, Axel; Climate Policy (Earthscan); Vol. 6 Issue 6; 2006



Abstract Summary: This article describes the issues surrounding mitigation and adaptation measures and possible adverse effects on developing countries and discusses an enterprise risk management approach. The report discusses the availability of renewable energy technology, mitigation measures, and economic diversification as an approach to loss prevention.

See [WSDOT Library](#) for Availability

***Climate Change, Insurance and the Buildings Sector: Technological Synergisms between Adaptation and Mitigation***

Author: Mills, Evan; Building Research & Information (Routledge), Vol. 31 Issue 3/4; May-August 2003

Abstract Summary: This study examines risk analysis and sustainable energy strategies and provides examples of energy-efficient and renewable energy technologies that may offer insurance loss-prevention benefits amid the threat of climate change.

See [WSDOT Library](#) for Availability

***Climate Change and the Insurance Sector***

Authors: Dlugolecki, Andrew; Keykhah, Mojdeh; Greener Management International (Greenleaf Publishing), Issue 39; Autumn 2002

Abstract Summary: This paper discusses the insurance industry's response to address climate change, and suggests a focus on adaptation, reducing vulnerability, and more informed investment policies may help to avert the impacts.

See [WSDOT Library](#) for Availability

***Water Utilities and Adaptation 2001-2012***

***Adaptation of Water Management to Regional Climate Change in a Coastal Region – Hydrological Change vs. Community Perception and Strategies***

Authors: Bormann, Helge; Ahlhorn, Frank; Klenke, Thomas; Journal of Hydrology (*Elsevier Science*); Vol. 454-455, August 2012

Abstract Summary: This paper presents a participatory study of community approaches to regional adaptation to climate change.

See [WSDOT Library](#) for Availability

***China's Huge Investment on Water Facilities: An Effective Adaptation to Climate Change, Natural Disasters, and Food Security***

Author: Li, Siyue; Natural Hazards (Springer Science & Business Media B.V.); Vol. 61 Issue 3; July 2012

Abstract Summary: This study reviews China's investment in water infrastructure for sustainable water use, discussing the 2011-plan, targeting reservoirs, wells, irrigation systems, inter-basin water transfer projects, as an effective adaptation to climate change, drought and flooding, and food security.

See [WSDOT Library](#) for Availability

***Adapting California's Water Management to Climate Change***

Authors: Hanak, Ellen; Lund, Jay; Climatic Change (Springer Science & Business Media B.V.); Vol. 111 Issue 1; March 2012



Abstract Summary: This study reviews the significant water management challenges California faces from climate change, affecting water supply, aquatic ecosystems, and flood risks, and looks at the State's adaptation tools and institutional capabilities that can limit vulnerability to changing conditions. See [WSDOT Library](#) for Availability

***Managing Adaptation of Urban Water Systems in a Changing Climate***

Authors: Short, Michael; Peirson, William; Peters, Gregory; Cox, Ronald; Water Resources Management (Springer Science & Business Media B.V.); Vol. 26 Issue 7; May 2012

Abstract Summary: review outlines the current major climate change adaptation challenges facing the water supply industry at large, with a particular focus on these challenges in an Australian context. It highlights knowledge gaps and strategies for adaptation responses to the range of potential impacts on water infrastructure and future water security.

See [WSDOT Library](#) for Availability

***Adapting California's Water System to Warm vs. Dry Climates***

Authors: Connell-Buck, Christina; Medellín-Azuara, Josue; Lund, Jay; Madani, Kaveh; Climatic Change (Springer Science & Business Media B.V.); Vol. 109; December 2011

Abstract Summary: This paper explores the independent and combined effects of changes in temperature and runoff volume on California's water supply and potential water management adaptations.

See [WSDOT Library](#) for Availability

***Adaptation of U.S. Water Management to Climate and Environmental Change***

Authors: Stroup, Laura J.; Professional Geographer (Taylor & Francis Ltd); Vol. 63 Issue 4; November 2011

Abstract Summary: This study addresses the current status of U.S. water resource management adaptation at the river basin scale, examining four large basins, the Colorado, Platte, and Delaware rivers, as well as the Everglades Basin, to represent a diverse, national perspective.

See [WSDOT Library](#) for Availability

***Assessing Water Resources Adaptive Capacity to Climate Change Impacts in the Pacific Northwest Region of North America***

Author: Hamlet, A. F.; Hydrology & Earth System Sciences (Copernicus Gesellschaft mbH); Vol. 15 Issue 5; 2011

Abstract Summary: This study looks at climate change impacts in Pacific Northwest Region of North America (PNW) as increasing temperatures and changes in the seasonality of precipitation (increasing precipitation in winter, decreasing precipitation in summer) and adaptation responses to these and other conditions.

See [WSDOT Library](#) for Availability

***Climate Change and Water Policy in Australia's Irrigation Areas: a Lost Opportunity for a Partnership Model of Governance***

Authors: Alston, Margaret; Whittenbury, Kerri; Environmental Politics (Routledge); Vol. 20 Issue 6; November 2011

Abstract Summary: This paper outlines the significant consequences of water policy for irrigation farming families and communities in Australia's Murray–Darling Basin – the food bowl of Australia. The

paper suggests a model of governance to guide climate change mitigation policies that enhance the capacity of rural people and communities to adapt to significant climate change.

See [WSDOT Library](#) for Availability

***Developing Coastal Adaptation to Climate Change in the New York City Infrastructure-Shed: Process, Approach, Tools, and Strategies***

Authors/Editors/Inventors: Rosenzweig, Cynthia (Author) Reprint Author ; Solecki, William D. (Author); Blake, Reginald (Author) ; Bowman, Malcolm (Author) ; Faris, Craig (Author) ; Gornitz, Vivien (Author) ; Horton, Radley (Author) ; Jacob, Klaus (Author) ; LeBlanc, Alice (Author) ; Leichenko, Robin (Author) ; Linkin, Megan (Author) ; Major, David (Author) ; O'Grady, Megan (Author) ; Patrick, Lesley (Author) ; Sussman, Edna (Author) ; Yohe, Gary (Author) ; Zimmerman, Rae (Author); Climatic Change; Vol.106 (1, Sp. Iss. SI); May 2011

Abstract Summary: This paper describes the comprehensive process, approach, and tools for adaptation developed by the New York City Panel on Climate Change (NPCC) in conjunction with the region's stakeholders who manage its critical infrastructure and presents the adaptation framework and the adaptation strategies developed based on a risk-management approach.

See [WSDOT Library](#) for Availability

***Issues of Drinking Water Quality of Small Scale Water Services towards Climate Change***

Authors: Delpla I; Baures E; Jung AV; Clement M; Thomas O; Water Science and Technology: A Journal of the International Association on Water Pollution Research (Pergamon Press); Vol. 63 (2); 2011

Abstract Summary: This study discusses the impacts of climate change on water quantity and quality, noting concerns related to water quality degradation in small scale water services (SSWS) and the vulnerability in treatment efficiency in extreme weather events.

See [WSDOT Library](#) for Availability

***The Use of Scenarios as the Basis for Combined Assessment of Climate Change Mitigation and Adaptation***

Authors: van Vuuren, Detlef P.; Isaac, Morna; Kundzewicz, Zbigniew W.; Arnell, Nigel; Barker, Terry; Criqui, Patrick; Berkhout, Frans; Hilderink, Henk; Hinkel, Jochen; Hof, Andries; Kitous, Alban; Kram, Tom; Mechler, Reinhard; Scricciu, Serban; Global Environmental Change Part A: Human & Policy Dimensions Pergamon Press - An Imprint of Elsevier Science ); Vol. 21 Issue 2; May 2011

Abstract Summary: This paper describes the use of two scenarios to explore the consequences of different adaptation and mitigation strategies under uncertainty—one with no mitigation and one with ambitious mitigation.

See [WSDOT Library](#) for Availability

***The Costs of Adaptation to Climate Change for Water Infrastructure in OECD Countries***

Authors: Hughes, Gordon; Chinowsky, Paul; Strzepek, Ken; Utilities Policy (Pergamon Press - An Imprint of Elsevier Science); Vol. 18 Issue 3; September 2010

Abstract Summary: This paper develops and applies a top-down approach to estimate the costs of adapting to climate change on a consistent basis for different climate scenarios. The analysis separates (a) the costs of maintaining service standards for a baseline projection of demand, and (b) the costs of changes in water use and infrastructure as a consequence of changes in climate patterns.

See [WSDOT Library](#) for Availability

***'Drought Proofing' Australian Cities: Implications for Climate Change Adaptation and Sustainability***

Authors: Isler, Phoenix Lawhon; Merson, John; Roser, David; World Academy of Science, Engineering & Technology; Vol. 70; November 2010

See [WSDOT Library](#) for Availability

***Climate Change Adaptation in a Developing Country Context: the Case of Urban Water Supply in Cape Town***

Authors: Ziervogel, Gina; Shale, Moliehi; Minlei Du; Climate & Development (Earthscan); Vol. 2 Issue 2, 2010

Abstract Summary: This article focuses on the processes impeding and facilitating adaptation to climate change within the urban water sector in the City of Cape Town, South Africa, exploring water management at the city scale, highlighting how actors currently respond to water stress and the challenges they face in integrating climate change information into water management.

See [WSDOT Library](#) for Availability

***Linking Water Policy Innovation and Urban Renewal: the Case of Rotterdam, the Netherlands***

Authors: van der Brugge, Rutger; de Graaf, Rutger; Water Policy; Vol. 12 Issue 3; 2010

Abstract Summary: This article investigates how the urban water management organizations in Rotterdam developed its climate adaptation strategy by creating urban development strategies that are sensitive to water issues.

See [WSDOT Library](#) for Availability

***Water Access, Water Scarcity, and Climate Change***

Authors: Mukheibir, Pierre; Environmental Management (Springer Science & Business Media B.V.); Vol. 45 Issue 5; May 2010

Abstract Summary: This article investigates approaches in the water sector and how they address the issues of scarcity and equitable access under projected climate change impacts.

See [WSDOT Library](#) for Availability

***Embracing Uncertainty in Freshwater Climate Change Adaptation: a Natural History Approach***

Authors: Matthews, John H.; Wickel, A. J.; Climate & Development (Earthscan); Vol. 1 Issue 3; 2009

Abstract Summary: This paper discusses adaptation practices and 'impacts thinking' and proposes a novel approach of 'adaptation thinking', that treats ecosystems as dynamic entities and emphasizes the shifting relationship between institutions and ecosystems, promotes flexibility and continuous scenario development, and collaboration between scientists, policymakers and development professionals.

See [WSDOT Library](#) for Availability

***Modeling the Hydrology of Climate Change in California's Sierra Nevada for Subwatershed Scale Adaptation***

Authors: Young, Charles A.; Escobar-Arias, Marisa I.; Fernandes, Martha; Joyce, Brian; Kiparsky, Michael; Mount, Jeffrey F; Mehta, Vishal K; Purkey, David; Viers, Joshua H.; Yates, David; Journal of the American Water Resources Association (Wiley-Blackwell); Vol. 45 Issue 6, December 2009

Abstract Summary: This model implementation documents potential changes in hydrologic metrics such as snowpack in the Sierra Nevada's and the initiation of snowmelt at a finer resolution than previous studies, in accordance with the needs of watershed-level planning decisions. Because the hydrologic

model presented is nested within a water resources planning system, a focus of future research is on management and adaptation of the water resources system in the context of climate change.

See [WSDOT Library](#) for Availability

***AMWA Report Examines Impact of Global Warming***

Author: Crow, Patrick; Water World; Vol. 24 Issue 2; February 2008

Abstract Summary: The article provides information on the report released by the Association of Metropolitan Water Agencies (AMWA) on the impact of climate change on urban water utilities in the U.S. AWWA's report states global warming would increase pressure on drinking water sources in the country that could lead to decrease supplies or flooding in some regions and suggested that water systems should identify short-term adaptation needs and lessen the emissions of greenhouse gases.

See [WSDOT Library](#) for Availability

***Adaptation of Urban Water Supply Infrastructure to Impacts from Climate and Socioeconomic Changes: The Case of Hamilton, New Zealand***

Authors: Ruth, Matthias; Bernier, Clark; Jollands, Nigel; Golubiewski, Nancy; Water Resources Management (Springer Science & Business Media B.V.); Vol. 21 Issue 6; June 2007

Abstract Summary: This study investigates possible water use and infrastructure needs for a range of climate and population projections, focusing on the city of Hamilton, New Zealand.

See [WSDOT Library](#) for Availability

***Managing Climate Change Risks in New York City's Water System: Assessment and Adaptation Planning***

Authors: Rosenzweig, Cynthia; Major, David C.; Demong, Kate; Stanton, Christina; Horton, Radley; Stults, Melissa; Mitigation & Adaptation Strategies for Global Change (Springer Science & Business Media B.V.); Vol. 12 Issue 8; November 2007

Abstract Summary: The New York City Department of Environmental Protection developed a climate risk management framework to ensure that NYCDEP's strategic and capital planning take into account the potential risks of climate change--sea-level rise, higher temperature, increases in extreme events, changes in drought and flood frequency and intensity, and changing precipitation patterns--on NYC's water systems. The approach focuses on the water supply, sewer, and wastewater treatment systems of NYC, and is applicable for other urban areas and those with coastal locations.

See [WSDOT Library](#) for Availability

***Adaptation Options for the Near Term: Climate Change and the Canadian Water Sector***

Authors: de Loe, Rob; Kreutzweiser, Reid; Moraru, Liana; Global Environmental Change Part A: Human & Policy Dimensions (Pergamon Press - An Imprint of Elsevier Science); Vol. 11 Issue 3; October 2001

Abstract Summary: This paper discusses issues relating to the selection of proactive, planned adaptation measures for 2001-2010 decade and offered a set of selection criteria used in three cases to illustrate identification of appropriate measures. Cases include municipal water supply in the Grand River basin, Ontario; irrigation in southern Alberta; and commercial navigation on the Great Lakes.

See [WSDOT Library](#) for Availability

## ***Local Agencies and Adaptation Response 2005 - 2012***

### ***Innovation Stormwater Policy: Minneapolis***

City of Minneapolis, MN; Stormwater Website; 2012

Summary: This report describes the City of Minneapolis stormwater management program where property owners could qualify for fee reductions of up to 100 percent by establishing onsite water-quality and/or water-quantity treatment systems, such as rain gardens, detention ponds and green roofs. The Minneapolis city council sought to achieve two principal policy objectives through its stormwater policy, including an equitable stormwater fee credit system and encouraging property owners to manage stormwater onsite.

[http://www.sustainablecommunityinitiative.com/index.php?option=com\\_content&view=article&id=68:innovation-stormwater-policy-minneapolis&catid=40:policy-innovations&Itemid=68](http://www.sustainablecommunityinitiative.com/index.php?option=com_content&view=article&id=68:innovation-stormwater-policy-minneapolis&catid=40:policy-innovations&Itemid=68)

### ***Climate Change Adaptation in Denmark: Enhancement through Collaboration and Meta-Governance?***

Authors: Hedensted Lund, Dorthe; Sehested, Karina<sup>1</sup>; Hellesen, Thomas<sup>1</sup>; Nellemann, Vibeke; Local Environment (Routledge) ; Vol. 17 Issue 6/7; August 2012

Abstract Summary: This article investigates Danish municipalities' adaptation to climate change and impact of governance.

See [WSDOT Library](#) for Availability

### ***Integrating Climate Change Adaptation into Civil Protection: Comparative Lessons from Norway, Sweden and the Netherlands***

Authors: Groven, Kyrre; Aall, Carlo; van den Berg, Maya; Carlsson-Kanyama, Annika; Coenen, Frans; Local Environment (Routledge); Vol. 17 Issue 6/7; August 2012

Abstract Summary: This study explores Integrating policy on climate change adaptation into civil protection looking at extreme weather management at the national level in Norway, Sweden and the Netherlands, and by local case studies three coastal cities of Bergen, Malmö and Rotterdam.

See [WSDOT Library](#) for Availability

### ***Implementing Adaptation to Climate Change at the Local Level***

Authors: Dannevig, Halvor; Rauken, Trude; Hovelsrud, Grete; Local Environment (Routledge); Vol. 17, Issue 6/7; August 2012;

Abstract Summary: This paper discusses implementation of climate adaptation measures in eight Norwegian cities.

See [WSDOT Library](#) for Availability

### ***Knowledge for Local Climate Change Adaptation in Sweden: Challenges of Multilevel Governance***

Authors: Nilsson, Annika E.; Gerger Swartling, Åsa; Eckerberg, Katarina; Local Environment (Routledge); Vol. 17 Issue 6/7; August 2012

Abstract Summary: This paper discusses the institutionalization of knowledge related to climate change adaptation in Sweden and the potential for learning.

See [WSDOT Library](#) for Availability

***Local Climate Change Adaptation: Missing Link, Black Jack or Blind Alley?***

Authors: Aall, Carlo; Carlsson-Kanyama, Annika; Hovelsrud, Grete; Local Environment; Vol. 17 Issue 6/7; August 2012

Abstract Summary: An introduction is presented in which the editor discusses various reports within the issue on topics including climate change mitigation (CCM), implementation of policies relating to climate change adaptation (CCA), and waste management by municipalities.

See [WSDOT Library](#) for Availability

***Local Government Response to the Impacts of Climate Change: An Evaluation of Local Climate Adaptation Plans***

Authors: Baker, Ingrid; Peterson, Ann; Brown, Greg; McAlpine, Clive; Landscape & Urban Planning (Elsevier Science); Vol. 107 Issue 2; August 2012

Abstract Summary: This study evaluated seven local climate adaptation plans in Southeast Queensland, Australia and provides recommendations for developing local climate adaptation plans.

See [WSDOT Library](#) for Availability

***Regional Challenges of Climate Change Adaptation in Finland: Examining the Ability to Adapt in the Absence of National Level Steering***

Authors: Juhola, Sirkku; Haanpää, Simo; Peltonen, Lasse; Local Environment (Routledge); Vol. 17 Issue 6/7; August 2012

Abstract Summary: This paper looks at the regional level in Finland to identify limits and barriers to regional implementation of climate change adaptation in the absence of national level guidance.

See [WSDOT Library](#) for Availability

***The Early Experiences of Local Climate Change Adaptation in Norwegian Compared With that of Local Environmental Policy, Local Agenda 21 and Local Climate Change Mitigation***

Authors: Aall, Carlo; Local Environment (Routledge); Vol. 17 Issue 6/7; August 2012

Abstract Summary: This article reviews the early experiences of local climate change adaptation in Norway compared with that of local environmental policy, the Local Agenda 21, and local climate change mitigation policies.

See [WSDOT Library](#) for Availability

***Vulnerability and Adaptation to Climate Change: A Review of Local Actions and National Policy Response***

Authors: Adhikari, Bhim; Taylor, Krista; Climate & Development (Earthscan); Vol. 4 Issue 1; 2012

Abstract Summary: This article explores community-based adaptation strategies drawing lessons from the field in four different countries of Asia and Africa.

See [WSDOT Library](#) for Availability

***Climate Change and Local Adaptation Strategies in the Middle Inner Mongolia, Northern China***

Authors: Liu, Shulin (Author) Reprint Author; Wang, Tao (Author); Environmental Earth Sciences (Thomson); Vol. 66 (5); July 2012

Abstract Summary: This paper analyzed meteorological stations distributed in the middle Inner Mongolia in northern China for evidence of climate change.

<http://0-www.springerlink.com.cals.evergreen.edu/content/121380/>

See [WSDOT Library](#) for Availability

***Possible Impacts of Climate Change on Extreme Weather Events at Local Scale in South-Central Canada***

Authors/Editors/Inventors: Cheng, Chad Shouquan (Author) Reprint Author; Auld, Heather (Author); Li, Qian (Author); Li, Guilong (Author); Climatic Change (Thomson); Vol. 112 (3-4); June 2012

Abstract Summary: This paper looks at weather typing and regression methods to analyze climatic change impacts on a number of extreme weather events and environmental problems in south-central Canada.

<http://0-www.springerlink.com.cals.evergreen.edu/content/100247/>

See [WSDOT Library](#) for Availability

***Transformational Adaptation When Incremental Adaptations to Climate Change Are Insufficient***

Authors/Editors/Inventors: Kates, Robert W. (Author); Travis, William R. (Author) Reprint Author; Wilbanks, Thomas J. (Author); Proceedings of the National Academy of Sciences of the United States of America (Thomson); Vol. 109 (19); 7156-7161; May 8, 2012

Abstract Summary: This study looks at transformational adaptations from Africa, Europe, and North America.

See [WSDOT Library](#) for Availability

***Special Issue Introduction: Adding Insult to Injury: Climate Change and the Inequities of Climate Intervention***

Authors: Marino, Elizabeth; Ribot, Jesse; Global Environmental Change Part A: Human & Policy Dimensions (Pergamon Press - An Imprint of Elsevier Science); Vol. 22 Issue 2; May 2012

Abstract Summary: This article examines opportunities and risks associated with climate-change discussions and intervention scenarios in adaptation and mitigation planning.

See [WSDOT Library](#) for Availability

***Climate Change as Governmentality: Technologies of Government for Adaptation in Three European Countries***

Authors: Keskitalo, E. Carina H.; Juhola, Sirkku; Westerhoff, Lisa; Journal of Environmental Planning & Management (Routledge) ; Vol. 55 Issue 4; May 2012

Abstract Summary: This paper looks at the role of regulative technology in government in climate change adaptation.

See [WSDOT Library](#) for Availability

***Integrating Climate Change Adaptation into Dutch Local Policies and the Role of Contextual Factors***

Authors: van den Berg, Maya; Coenen, Frans; Local Environment (Routledge) ; Vol. 17 Issue 4; April 2012

Abstract Summary: This paper examines integration of adaptation into Dutch local policies.

See [WSDOT Library](#) for Availability

***Social Innovation and Climate Adaptation: Local Collective Action in Diversifying Tanzania***

Authors: Rodima-Taylor, Daivi; Applied Geography (Pergamon Press - An Imprint of Elsevier Science); Vol. 33; April 2012



Abstract Summary: This study looks at social innovation in analyzing climate adaptation in institutional environments with challenging adaptation issues.

See [WSDOT Library](#) for Availability

***California's Local Health Agencies and the State's Climate Adaptation Strategy***

Author: Bedsworth, Louise (Author) Reprint Author; Climatic Change; Vol. 111 (1, Sp. Iss. SI); March 2012

Abstract Summary: This study describes California's public health institutions readiness to cope with the climate change related to the state's Climate Adaptation Strategy.

<http://0-www.springerlink.com.cals.evergreen.edu/content/100247/>

See [WSDOT Library](#) for Availability

***Preparedness for Climate Change among Local Health Department Officials in New York State: a Comparison with National Survey Results***

Authors: Carr JL; Sheffield PE; Kinney PL; Journal Of Public Health Management And Practice: JPHMP (Lippincott Williams & Wilkins); Vol. 18 (2); Mar-Apr 2012

Abstract Summary: This report looks at Climate-change adaptation strategies that address locally specific climate hazards are critical for preventing negative health outcomes and local public health care officials' role in local health department planning.

See [WSDOT Library](#) for Availability

***Planning for Climate Change Adaptation: Lessons Learned From a Community-Based Workshop***

Authors: Picketts, Ian M.; Werner, Arelia T.; Murdock, Trevor Q.; Curry, John; Déry, Stephen J.; Dyer, David; Environmental Science & Policy (Elsevier Science Publishing Company, Inc.); Vol. 17; March 2012

Abstract Summary: This report is of an adaptation workshop in Prince George, British Columbia, Canada to build local capacity and initiate an adaptation strategy.

See [WSDOT Library](#) for Availability

***Community-Based Adaptation: Lessons from a Grant Competition***

Authors: Heltberg, Rasmus; Gitay, Habiba; Prabhu, Radhika G.; Climate Policy (Earthscan); Vol. 12 Issue 2; 2012.

Abstract Summary: The article describes problems and challenges local communities have in adapting to climate change and ideas for policy changes.

See [WSDOT Library](#) for Availability

***Nepalgunj, the Centre of the World: Local Perceptions of Environmental Change and the Roles of Climate-Change Adaptation Actors***

Author: Ireland, Philip; Local Environment (Routledge); Vol. 17 Issue 2; February 2012

Abstract Summary: This paper explores community perspectives of environmental change and the role development actors in the regional Nepali town of Nepalgunj.

See [WSDOT Library](#) for Availability

***Integrating Climate Change Adaptation into Public Health Practice: Using Adaptive Management to Increase Adaptive Capacity and Build Resilience***

Authors: Hess, Jeremy J.; McDowell, Julia Z.; Luber, George; Environmental Health Perspectives (Superintendent of Documents); Vol. 120 Issue 2; February 2012

Abstract Summary: This paper explores public health's adaptive capacity and resilience to climate change.

See [WSDOT Library](#) for Availability

***Climate Change Mitigation and Adaptation in Strategic Environmental Assessment***

Authors: Wende, Wolfgang; Bond, Alan; Bobylev, Nikolai; Stratmann, Lars; Environmental Impact Assessment Review (Elsevier Science Publishing Company, Inc.) ; Vol. 32 Issue 1; January 2012

Abstract Summary: This study looked at countries implementing CO2 emission reduction targets to see if they met emission reduction requirements for the transportation, energy, housing, agriculture, and forestry sectors.

See [WSDOT Library](#) for Availability

***Adapting to Climate Change through Local Municipal Planning: Barriers and Challenges***

Authors: Measham, Thomas; Preston, Benjamin; Smith, Timothy; Brooke, Cassandra; Gorrdard, Russell; Withycombe, Geoff; Morrison, Craig; Mitigation & Adaptation Strategies for Global Change (Springer Science & Business Media B.V.); Vol. 16 Issue 8; December 2011

Abstract Summary: This paper discusses municipal planning and local adaptation and constraints and the use of place-based planning.

See [WSDOT Library](#) for Availability

***Capacities across Scales: Local to National Adaptation Policy in Four European Countries***

Authors: Westerhoff, Lisa; Keskitalo, E. Carina H.; Juhola, Sirkku; Climate Policy (Earthscan); Vol. 11 Issue 4; 2011

Abstract Summary: This study looks at planned adaptation at national to local levels in Italy, Sweden, Finland and the UK.

See [WSDOT Library](#) for Availability

***Climate Change and Health Effects in Northwest Alaska***

Authors: Brubaker, Michael; Berner, James; Chavan, Raj; Warren, John; Global Health Action (Co-Action Publishing); Vol. 4; 2011

Abstract Summary: This article provides examples of the adverse health effects, including weather-related injury, food insecurity, mental health issues, water infrastructure damage, and responses to these effects currently being applied in two Northwest Alaska communities.

See [WSDOT Library](#) for Availability

***Climate Change, Resilience and Transformation: Challenges and Opportunities for Local Communities***

Parent Book Series: International and cultural psychology; Authors: Edwards, Taegen; Wiseman, John, U; Climate change and human well-being: Global challenges and opportunities (Springer Science & Business Media); Weissbecker, Inka (Ed.) (PsycINFO Database Record (c) 2012, APA ; 2011

Abstract Summary: This book chapter discusses community resilience to climate change and the role of community foundations along with locally relevant, locally tailored, action in improving local climate change adaptation capabilities and outcomes.

(PsycINFO Database Record (c) 2012 APA, all rights reserved)

See [WSDOT Library](#) for Availability

***Perceptions of Climate Change and Adaptation Responses in a Local Community: the Barwon Estuary Complex, Victoria***

Authors: Scally, Jaclyne; Wescott, Geoff; Australian Geographer (Routledge); Vol. 42 Issue 4; December 2011

Abstract Summary: The Barwon Estuary Complex (BEC) on the Bellarine Peninsula, central Victoria, was the focus of a place-specific study on the impacts of climate change on their coastal community.

See [WSDOT Library](#) for Availability

***Setting the Foundation: Climate Change Adaptation at the Local Level***

Authors: Gremillion, Thomas M.; Environmental Law (00462276) (Environmental Law); Vol. 41 Issue 4; Fall 2011

Abstract Summary: This article looks at the role of local governments in response to climate change impacts.

See [WSDOT Library](#) for Availability

***Public Sector Responses to Climate Change: Evaluating the Role of Scottish Local Government in Implementing the Climate Change (Scotland) Act 2009***

Authors: Jackson, Tony; Lynch, William; Commonwealth Journal of Local Governance (University of Technology, Sydney); Vol. 8/9; May-Nov. 2011

Abstract Summary: This report reviews local government's role in implementing the Scottish government's new climate change obligations.

See [WSDOT Library](#) for Availability

***Forests and Climate Change in Latin America: Linking Adaptation and Mitigation***

Authors: Locatelli, Bruno; Evans, Vanessa; Wardell, Andrew; Andrade, Angela; Vignola, Raffaele; Forests (19994907), (MDPI Publishing); Vol. 2 Issue 1; March 2011

Abstract Summary: This paper looks at links between adaptation and mitigation in Latin American forests and climate change policies.

See [WSDOT Library](#) for Availability

***What is the Goal? Framing the Climate Change Adaptation Question through a Problem-Oriented Approach***

Authors: Roman, Carolina E.; Lynch, Amanda H.; Dominey-Howes, Dale; Weather, Climate & Society (American Meteorological Society); Vol. 3 Issue 1; January 2011

Abstract Summary: The article discusses how a problem-oriented and interdisciplinary approach was used at Alpine Shire, in northeast Victoria, Australia, to assess the tourism sector's vulnerability and adaptability to climatic change.

See [WSDOT Library](#) for Availability

***Adaptation to Climate Change***

Authors: Bedsworth, Louise W.; Hanak, Ellen; Journal of the American Planning Association (Routledge); Vol. 76 Issue 4; Autumn 2010

Abstract Summary: This article is a synthesis of adaptation planning issues in California, and examines the institutional and regulatory challenges and discusses obstacles to adaptation planning, successes overcoming barriers, and incorporating adaptation into planning.

See [WSDOT Library](#) for Availability

***Australian Local Government Action on Climate Change Adaptation: Some Critical Reflections to Assist Decision-Making***

Authors: Kennedy, D.; Stocker, L.; Burke, G.; Local Environment (Routledge); Vol. 15 Issue 9/10; Oct/Nov 2010

Abstract Summary: This paper discusses the limitations of risk management as a strategy for Australian local government climate change adaptation and explores the advantages of approaches.

See [WSDOT Library](#) for Availability

***Early Responses to Climate Change: An Analysis of Seven U.S. State and Local Climate Adaptation Planning Initiatives***

Authors: Poyar, Kyle Andrew; Beller-Simms, Nancy; Weather, Climate & Society (American Meteorological Society); Vol. 2 Issue 3; July 2010

Abstract Summary: This paper provides case studies of seven urban climate adaptation planning processes and the status of implementation of adaptation strategies.

See [WSDOT Library](#) for Availability

***Localizing Climate Change: Stepping up Local Climate Action***

Authors: Bond, Meghan; Management of Environmental Quality: An International Journal (Emerald Group Publishing Limited); Vol. 21 Issue 2; 2010

Abstract Summary: This paper provides recommendations on how local climate change action (both mitigation and adaptation) can be improved.

See [WSDOT Library](#) for Availability

***Improving Policy for Stormwater Management: Implications for Climate Change Adaptation***

Author: Tryhorn, Lee; Weather, Climate & Society (American Meteorological Society); Vol. 2 Issue 2; April 2010

Abstract Summary: This study looked at the municipalities in Tompkins County, New York, and their management and compliance with federal stormwater regulations, governance and other issues.

See [WSDOT Library](#) for Availability

***Moving from Agenda to Action: Evaluating Local Climate Change Action Plans***

Authors: Zhenghong Tang; Brody, Samuel D.; Quinn, Courtney; Chang, Liang; Wei, Ting; Journal of Environmental Planning & Management (Routledge); Vol. 53 Issue 1; January 2010

Abstract Summary: This study looked at forty adopted local climate change action plans in the US and assessed how well they prepare for climate change mitigation and adaptation and provided policy recommendations.

See [WSDOT Library](#) for Availability

***Climate Leadership Academy - Promising Practices in Adaptation & Resilience: A Resource Guide for Local Leaders***

Institute for Sustainable Communities; Produced in partnership with Center for Clean Air Policy; October 2010

Summary: The case studies of local agencies in this Resource Guide of Promising Practices in Adaptation & Resilience fall into one of four thematic groups:

### *Models for Adaptation Planning*

- Chicago Climate Action Plan
- Interviews on the Science/Policy Connection in the Chicago Climate Action Plan
- Miami-Dade County's Adaptation Planning Process
- New York City Climate Change Risk Assessment
- Toronto Climate Adaptation Planning
- Resource Snapshot: Preparing for Climate Change

### *Getting Commitment to Climate Adaptation*

- London's Climate Change Adaptation Strategy
- Snapshot: Boulder Residents Get Help from Artist Mary Miss to Connect the Dots

### *Bolstering Resilience by Integrating Adaptation into Local Planning and Operations*

- Seattle and Tucson Manage Risks to their Water Supplies
- Seattle Public Utilities' Flood Risk Management Strategies
- Briefing: Insurance Industry Takes Steps to Address Future Climate Impacts
- New Orleans' Community-Driven Adaptation and Planning
- Snapshot: "Dutch Dialogues" Inform New Orleans' Approach to Life on the Delta

### *Cross-Jurisdictional Collaboration*

- Southeast Florida Regional Climate Change Initiative.

These themes emerged from ISC's consultations with city adaptation practitioners and experts, and together constitute the scope of this Resource Guide.

[http://www.iscvt.org/who\\_we\\_are/publications/Adaptation\\_Resource\\_Guide.pdf](http://www.iscvt.org/who_we_are/publications/Adaptation_Resource_Guide.pdf)

### ***Introduction to "In Focus: Global Change and Adaptation in Local Places"***

Authors: Nelson, Donald R.; West, Colin Thor; Finan, Timothy J.; American Anthropologist (Wiley-Blackwell); Vol. 111 Issue 3; September 2009

Abstract Summary: This study looks at environmental change, globalization and integration into market economies, formal and informal institutions, disasters, and response ability.

See [WSDOT Library](#) for Availability

### ***Climate Change in Northern Quebec: Adaptation Strategies from Community-Based Research***

Authors: Tremblay, Martin; Furgal, Christopher; Larrivée, Caroline; Annanack, Tuumasi; Tookalook, Peter; Qiisik, Markusi; Angiyu, Eli; Swappie, Noah; Savard, Jean-Pierre; Barrett, Michael; Arctic; Supplement: Vol. 61; Dec. 2008

Abstract Summary: This paper looks at implications of warmer and shorter winters and risks to Arctic communities.

See [WSDOT Library](#) for Availability