

Table X: A Sample of Sectors, Potential Climate Change Impacts, and Adaptation Measures

Sector	Impacts	Adaptation Measures
Hydrology and water resources	<ul style="list-style-type: none"> • Shift in the timing of spring snowmelt to earlier in the spring • Increased risk of drought • Increased risk of flooding • Increased competition for water • Warmer water temperature in lakes and rivers • Changes in water quality (variable by parameter) 	<ul style="list-style-type: none"> • Expand the implementation of sustainable urban drainage systems including permeable pavements, green roofs, stormwater retention ponds, constructed wetlands and swales • Create natural eco-system buffers for vulnerable water bodies & low-lying areas • Expand capacity of storm sewers, overland flow routes to manage extreme weather events • Flood-proof buildings in vulnerable locations • Educate the public on the need for proper grading to drain water away from their homes • Conduct water quantity audits every few years. • Encourage mulching, drought tolerant plants and drip irrigation for drought affected areas.
Agriculture/Forestry	<ul style="list-style-type: none"> • Changes in crop yields (varies by crop) • Potential ability to “double crop” • Increased risk of heat stress • Increased demand for irrigation water due to longer and warmer growing season • Increased risk of pest outbreaks and weeds 	<ul style="list-style-type: none"> • Change planting dates • Plant different varieties or crop species • Develop and promote alternative crops • Develop new drought and heat-resistant varieties • Encourage more use of intercropping • Use sustainable fertilizer and tillage practices (improving soil drainage, no-till, etc) • Use improved crop residue and weed management • Use more water harvesting techniques • Encourage better pest and disease control for crops • Implement new or water-efficient irrigation systems • Reduce water leakage, soil moisture conservation – mulching • Improved livestock management

		<p>(Providing housing and shade, change to heat-tolerant breeds, change in stocking rate, altered grazing and rotation of pasture)</p> <ul style="list-style-type: none"> • Encourage the use of agro-forestry practices
<p>Biodiversity, Aquatic Ecosystems and Forests (including parks and urban forests)</p>	<ul style="list-style-type: none"> • Increase in growth and productivity in the near-term where soil moisture is adequate and fire risk is low • Shift in the distribution and range of species • Increased risk of insect outbreaks • Increased risk of forest fire • Increased competition from invasive species • Shift in the distribution and range of species • Loss of species not able to adapt to changes • Increased competition from invasive species • Loss of habitat • Shifts in species range and distribution • Increased competition from invasive species • Increased stress on coldwater species in lakes and rivers 	<ul style="list-style-type: none"> • Protect existing ecosystems (parks, tree stands, waterways, ponds, lakes, ravines, wetlands, etc.) and develop connected greenway system to allow natural species migration • Create and preserve green spaces in low-lying areas for flood management • Increase shoreline buffers to protect against increased runoff from more intense storms • Enhance conditions for street tree survival and growth (increase space for roots, control soil compaction, increase watering and maintenance, plant appropriate species) • Monitor and control pests and invasive species that can expand with warmer winters
<p>Recreation</p>	<ul style="list-style-type: none"> • Increased opportunities for warm season activities • Reduced opportunities for cold season recreation due to decreased snowpack and/or reduced snow or ice quality • Increased reliance on snow-making at ski areas • Shifts in tourism dollars within a community from one recreation sector to another or from communities losing recreational opportunities to communities gaining opportunities 	<ul style="list-style-type: none"> • Consider extension of services and marketing for a longer summer season • Manage tourism growth in areas that will benefit from climate change and in areas that will be hurt. For example, make sure that facilities are sufficient to take advantage of longer, warmer summers while helping communities that are hurt by losses in winter sports¹ • Create policy initiatives that offset economic dislocation in areas and populations especially hard hit by the negative effects of lost tourism through climate change
<p>Energy</p>	<ul style="list-style-type: none"> • Reduced heating demand during winter months • Increased cooling demand during 	<ul style="list-style-type: none"> • Expand conservation and demand side management to reduce peak loads during heat waves that make

	<p>summer months</p>	<p>transmission systems vulnerable to blackouts</p> <ul style="list-style-type: none"> • Increase tree planting and maintenance(particularly where they shade pavement or buildings) green roofs and high-albedo surfaces to reduce urban heat and unsustainable energy demand for air conditioning • Implement weatherization programs to reduce building loads, especially for low-income • Expand distributed energy systems to reduce vulnerability to transmission interruptions from storms and high winds
<p>Transportation</p>	<ul style="list-style-type: none"> • Fewer travel disruption and lower maintenance and infrastructure costs associated with snow and ice • More travel disruptions associated with landslides, road washouts and flooding • Increased road surface damage due to higher temperatures 	<ul style="list-style-type: none"> • Evaluate the vulnerability of port facilities and associated infrastructure due to changes in water level and increased wave activity • Assess and retrofit vulnerable transportation infrastructure systems such as culverts, tunnels, bridges, subway entrances, roads near waterways, etc. • Ensure critical components such as switch gear or substations are above flood levels • Encourage less purchasing and use of road salt • Encourage more resurfacing and other road maintenance
<p>Infrastructure</p>	<ul style="list-style-type: none"> • Need for new or upgraded flood control and erosion control structures • More frequent landslides, road washout, and flooding • Increased demands on stormwater management systems with the potential for more combined stormwater and sewer overflows 	<ul style="list-style-type: none"> • Take account of the increased risks of flooding, heat waves, intense storms, windspeed and other climate change effects in building development standards • In areas with flooding potential, retrofit ground-floor spaces for flood-compatible uses such as car parking, • Plan for moving uses out of the floodplain. • Design buildings for improved natural ventilation • Ensure roof systems and cladding materials can cope with higher wind speeds

<p>Business</p>	<ul style="list-style-type: none"> • Price volatility in energy and raw product markets due to more extreme weather events • Increased insurance premiums due to more extreme weather events • Fewer shipping disruptions due to snow and ice • Impacts on business infrastructure located in floodplains 	<ul style="list-style-type: none"> • Conduct long and short term jobs analysis to identify which sectors/occupations will be positively/negatively impacted, with an eye towards job creation opportunities • Re-tool education and job training programs for new workforce to take advantage of green economy growth • Promote activities that will promote climate change adaptation and the responsible use of state resources through education and outreach
<p>Health</p>	<ul style="list-style-type: none"> • More heat-related stress, particularly among the elderly, the poor, and other vulnerable populations • Fewer extreme cold-related health risks • Increase in vector-borne illnesses (e.g., West Nile) • Reduced summer air quality in urban areas due to increased production of ground-level ozone 	<ul style="list-style-type: none"> • Conduct public education on climate-related health threats (vector-borne diseases, heat, air pollution, floods and storms) and prevention • Interventions to reduce heat island effects including street tree planting, green roofs, high albedo roof and road surfaces • Interventions to reduce air pollution including emissions reduction measures and air quality warning systems • Interventions to prevent impacts from expansion of vector-borne diseases • Interventions to reduce health and security impacts from extreme weather events
<p>Emergency response</p>	<ul style="list-style-type: none"> • Increased demand on emergency response services related to extreme weather events (e.g., heat, flooding, storms) 	<ul style="list-style-type: none"> • Assess the vulnerabilities and adaptive capacities of different regions, communities and population groups • Provide extreme cold weather and extreme heat announcements via news media • Increase active intervention by public health and volunteer agencies (e.g., street patrols to locate and care for homeless people) • Increase the availability and accessibility of heated and air-conditioned public buildings, drop-in centers and shelters • Develop new guidelines for managing

Sources:

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Resources:

ICLEI Oceania: Local Government Climate Change Adaptation Toolkit. 2008. <Http://www.iclei.org/index.php?Id=adaptation-toolkit>, Accessed April 10, 2009. A number of templates and worksheets.

Pew Center on Global Climate Change

<Http://www.pewclimate.org/docuploads/Adaptation.pdf>, Accessed April 10, 2009.