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California Climate Adaptation Strategy Update 2012
Biodiversity Sector
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California was one of the first states in the nation to pursue a multi sector adaptation strategy known as the 2009 California Climate Adaptation Strategy[1] (CAS). The CAS provided comprehensive coverage of expected climate change impacts and identified strategies to address threats to each sector as well as overarching challenges. This document is not intended to replace the content in the CAS Biodiversity sector chapter but rather to build on the previously identified strategies and incorporate as appropriate new information and advances in climate science and adaptation planning that have taken place since 2009. State agencies and conservation partners have made significant accomplishments in adaptation planning and actions over the last few years and these activities are supporting the state's vision identified in the CAS. This update will highlight actions state agencies in California and partners have taken to date to implement the objectives in the 2009 Biodiversity CAS and articulate a collaborative plan for continued action into the near future.

Emerging Climate Change Threats to Biodiversity

Climate change along with other anthropogenic activities is causing increasing impacts to natural resources. While natural systems have some adaptive capacity to respond to change – many of these ecosystems lack the ability to survive the rate and scale of change associated with a changing climate. This is further compounded by existing threats and stressors related to human activities such as habitat loss and fragmentation, contaminants, water allocation conflicts, and direct species extirpation to name a few. We are presently experiencing biodiversity losses at a more rapid rate than ever before in human history[2]. Without embracing adaptation strategies that conserve and restore biodiversity we will continue to see an accelerated rate of decline.

The 2009 CAS provided comprehensive coverage of climate change impacts to the biodiversity sector with the exception of a discussion on extreme events. Extreme events and extreme variability are increasing with climate change and are occurring today. These extreme events such as fire, drought, flood, extreme temperature, and storm events can have significant impacts on habitat, species, and human communities. For example, changes in seasonal or annual average temperatures may not indicate an immediate effect on biodiversity, but extreme high or low temperatures may be lethal to some aquatic and, perhaps, terrestrial species. Other significant impacts that we now have greater scientific understanding of today include sea level rise, non native invasive species including pests and pathogens, changes to water supply, and habitat fragmentation. New climate related research is evolving rapidly and plays a critical role in informing biodiversity conservation planning and management actions. Now more than ever, we are seeing the need for greater collaboration not only across state agencies but also with partners entrenched in climate research in the academic community, federal research agencies, and science based collaborative partnerships such as Landscape Conservation Cooperatives and Climate Science Centers among others.

[1] http://www.climatechange.ca.gov/adaptation/
[2] Millennium Ecosystem Assessment (2005) http://www.maweb.org/en/index.aspx

Highlights since 2009: Climate Adaptation Actions Benefiting Biodiversity

The following section provides a sampling of actions that have been taken across state agencies in California since 2009. More information on individual state agency/department efforts to conserve biodiversity in a changing climate can be found on the California Climate Change Adaptation portal and DFG's Climate Science Program web page.

Collaborative Statewide Partnerships

Pursuing and maintaining collaborative partnerships is an intregal part of successful climate adaptation planning and action and was identified as a core strategy in the Biodiversity section of the 2009 CAS. The state agencies involved in biodiversity conservation efforts have been working to bring together representatives from multiple agencies and organizations to create a collective vision for biodiversity conservation in a changing climate. These kind of partnerships are necessary for promoting and leveraging the resources and expertise of multiple entities to respond to climate related impacts and challenges.

- **First Statewide Network of Marine Protected Areas Approved:** DFG and other state agencies collaborated with the public to complete a statewide network of marine protected areas. On June 6, 2012 California's Fish and Game Commission voted to adopt a new network of protected areas along the northern coast marking the completion of the United States' first statewide network of marine protected areas, and a huge step toward long-term environmental and economic health for the coast. Although this network was not specifically created to address concerns related to climate change, it supports one of the key strategies identified in 2009; this particular strategy focused on establishing a system of reserve areas to conserve existing biodiversity and support efforts to build resiliency as a short term response to climate change impacts.
- **DFG Climate Stakeholder Group Celebrates Four Years of Collaborative Action:** DFG's climate stakeholder group is a highly collaborative and productive collection of partners that have been meeting since 2008. Members include representatives from nongovernmental organizations, state and federal agencies, academic community, and private industry. Since 2008 the stakeholder group has developed several smaller working groups led by DFG to focus on key issues such as outreach, policy, and climate change research. Working groups have also supported workshops that were instrumental in disseminating climate change information and educating the public, stakeholders, and members of DFG. These highly successful working groups have not only helped create specific products, but have maintained an on-going dialogue that supports the DFG's efforts to collaboratively and successfully implement climate change adaptation actions relative to biodiversity across the state. For more information please visit the DFG Climate Stakeholders web page.
- **CA Department of Water Resources (DWR) Pursuing Biodiversity Conservation Actions on the Ground**: DWR is working collaboratively to incorporate biodiversity conservation into their management actions. Highlights of projects include but are not limited to:
  - DWR is working with others to implement projects that demonstrate subsidence reversal and carbon sequestration through wetland restoration in the western Delta (Twitchell Island Wetland Research and the Sherman Island Permanent Wetland projects). Through these demonstration projects, DWR will study the costs and benefits of these land use management practices to help define the potential value in a carbon market.

- DWR is working with the US Forest Service on a three-year investigation of the hydrologic effects of meadow restoration and how restored meadows can contribute to improved system operation as well as ecosystem functioning.
- DWR continues to pursue nonstructural flood risk reduction projects that are coupled with habitat conservation and agricultural protection through the Flood Corridor Program. The program includes three flood protection grant programs that have awarded over $91 million in grant funding covering over 19,000 acres statewide since 2000.

Collaborative National and Regional Partnerships

In addition to partnerships within California, state agencies are serving in a leadership role on national and regional climate partnerships that are working to conserve wildlife and habitat beyond California's borders. For example, the California Department of Fish and Game serves in a leadership role on climate committees for the Association of Fish and Wildlife Agencies (AFWA) and Western Association of Fish and Wildlife Agencies (WAFWA) coordinating and promoting collaborative climate actions across the western region and the nation. These committees provide a forum for discussion, information exchange, and identification of actions relative to all aspects of climate change as it relates to fish and wildlife across state agencies. The products and partnerships that have developed out of these committees are advancing conservation actions at a landscape scale and promoting regional partnerships for climate adaptation planning and action that leverage regional resources and expertise. These kind of collaborative partnerships are critical to current and future actions to safeguard wildlife and habitats in a changing climate.

Case Study: DFG Collaborates on the National Fish, Wildlife and Plants Climate Adaptation Strategy

The California Department of Fish and Game has been working with the Department of Interior, the National Oceanic and Atmospheric Administration, tribes, and other partners to develop a national climate adaptation strategy (NFWPCAS) that will provide decision makers and resource professionals with adaptation actions to promote species and habitat resiliency in the face of climate change. Bringing together representatives from multiple agencies and organizations is vital to the creation of a collective vision for responding to climate change impacts, especially those related to biodiversity, and is also a mainstay of DFG's vision for addressing climate change. To that end, DFG has taken a leadership role on the steering committee of the NFWPCAS and has fully embraced this unparalleled opportunity for federal, state, and tribal coordination at this scale. The adaptation strategies identified in this document are largely consistent with the strategies identified in the 2009 CAS and will serve as a common platform from which state and federal agencies can work. More information at http://www.wildlifeadaptationstrategy.gov/.

Photo courtesy of Meredith Osborne, CDFG

Collaborative Ecosystem-Level Partnerships

The emergence of new climate change partnerships in California is supporting collaborative regional and ecosystem level approaches to adaptation policy, management, and actions. Since 2009 there have been a growing number of collaborative efforts across the state in which many state agencies are involved. These partnerships are working vigorously to advance climate science and knowledge of

impacts on biodiversity as well as collaborative actions to safeguard resources now and in the future. Below are two examples of collaborative partnerships that are taking place within the state that are being led by non-state entities to put collaborative climate adaptation actions on the ground that benefit the implementation of the CAS and other state agency climate adaptation objectives.

- Landscape Conservation Cooperatives (LCC): The LCCs are governed by steering committees comprised of representatives from state and federal agencies, NGOs, academic institutions, tribes, and more. These cooperatives were created to facilitate communication and coordination among all partners to promote conservation actions on the ground. The LCCs support efforts to reduce the negative impacts of many landscape scale stressors, including but not limited to climate change.

- Bay Area Ecosystems Climate Change Consortium (BAECCC): BAECCC was formed to assess climate change impacts to the Bay Area and to identify management actions that will reduce negative impacts associated with climate change while preserving the many services and benefits that are derived from Bay Area ecosystems. Partners include state and federal agencies, NGOs, academic institutions, and more.

New Climate Tools and Online Resources Support Biodiversity Conservation

Since 2009 state agencies have made significant headway in creating tools and resources that can be used to support climate adaptation planning and actions to conserve biodiversity. Many of these tools such as CalAdapt and the California Essential Connectivity Project were created in conjunction with partners. Specifically, the California Essential Habitat Connectivity Project significantly advances a priority objective (connectivity) from the 2009 CAS, provides on-going tools to develop regional connectivity reports and is an important collaborative tool that supports implementation of objectives in the CAS. In addition, other tools such as DFG's Areas of Conservation Emphasis Mapping and Modeling Tool and the NOAA Sea Level Rise and Coastal Flooding Impacts Viewer are also important resources to help state agencies and partners develop adaptation strategies that plan for and/or minimize the impacts associated with climate change now and in the future.

Case Study: CA Invasive Plant Council: Tools for Building Adaptive Capacity of Ecosystems

The California Invasive Plant Council (Cal-IPC) is working with regional partners to build the adaptive capacity of ecosystems. With support from the California Landscape Conservation Cooperative, they have developed a new online atlas, CalWeedMapper, which shows which areas are most vulnerable to the spread of invasive plant species as California's climate changes. The tool allows natural resource managers to generate risk maps and summary statistics for areas they select, and to determine management priorities. The project team is now developing regional invasive plant management strategies in the Sierra, central coast and other parts of the state. Putting these regional strategies in place provides a clear programmatic vision for public and private funders, making clear what conservation activities are the top priorities, what conservation goals can be achieved and what financial resources are needed. Taking advantage of such "early detection/rapid response" opportunities is one effective strategy for using limited resources to protect functionality and enhance resilience of habitats at the landscape scale.

Collaborative Climate Change Research and Workshops

State agencies in California have been working diligently both independently and with partners to advance climate change research related to conservation of the states natural resources. Rather than listing each research project or workshop undertaken by state agencies and partners in the last few years, this section focuses on climate change vulnerability assessments related to wildlife and habitats. **Climate Change Vulnerability Assessments** are important tools for supporting planning related to climate change and were identified in the 2009 CAS as a priority for planning. Below is a sampling of vulnerability assessments conducted by state agencies and partners that have direct benefit to conservation and management efforts for biodiversity conservation in California.

- PRBO Conservation Science and the DFG used a self-developed framework to assess the vulnerability of 358 species, subspecies, and distinct populations of California birds and published those results in the open access journal PLoS ONE. The complete list of birds and their climate vulnerability scores are available online through the California Avian Data Center
- DFG, with support from the CA Landscape Conservation Cooperative, conducted a climate change vulnerability assessment for rare plants in California to inform conservation actions.
- California Energy Commission PIER program has overseen the State's third major assessment on climate change that explores local and statewide vulnerabilities to climate change.
- DFG created a Climate Change Vulnerability Assessment Resource Center to support information exchange and provide access to resources for those interested in learning more about climate change vulnerability assessment efforts related to wildlife and habitats.
- High-resolution elevation data (LiDAR) are available for nearly the entire coastline to support detailed sea-level rise vulnerability assessments. Thanks to a partnership with the NOAA Climate Science Center, this data is being incorporated into an interactive NOAA SLR and Coastal Flooding Impacts Viewer.

State Agencies Integrating Climate Change Considerations into Existing Planning and Policies Related to Allocation of Funds

Given limited resources, many state agencies are working to leverage existing funding more efficiently and effectively. For example, DFG and State Parks have integrated climate considerations into their Land Acquisition policies, and the Coastal Conservancy, DWR, and the Strategic Growth Council have incorporated sea level rise projections and guidelines into funding decisions for state grant programs. In addition, programs such as DFG's Fisheries Restoration Branch and Monitoring Programs now address climatic change considerations during their annual implementation processes.

Priority Climate Change Adaptation Strategies Going Forward

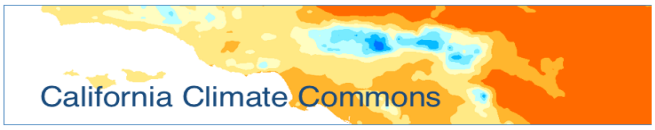
Building off the partnerships and progress that has been made to date, state agencies across California intend to continue pursuing actions to safeguard wildlife, and habitats from the impacts of climate change now and in the future. A sampling of goals and actions for achieving these objectives and continuing to implement the strategies identified in 2009 CAS are detailed below.

Goal 1: Create and Maintain Climate Change Partnerships that Support Biodiversity Conservation in a Changing Climate

- Pursue and maintain collaborative climate change partnerships with federal and state agencies, NGO's, academic institutions, local government, and collaborative partner groups to support adaptation planning and implementation to conserve biodiversity. (DFG)

- ❖ Pursue national, regional, and local coordination to promote conservation actions that conserve biodiversity beyond the borders of California such as initiatives through the Western Governor's Association, West Coast Governors Alliance on Ocean Health, WAFWA and AFWA, and the National Fish, Wildlife, and Plants Climate Adaptation Strategy. (All departments under the CNRA[3])
- ❖ Increase opportunities to work collaboratively with local government entities to increase communication and information sharing that supports collaboration and partnership around biodiversity conservation.
  - o Support integration of biodiversity strategies into the implementation of the Adaptation Planning Guide. (DFG, CalEMA, OPR)
  - o Coordinate and support actions to conserve biodiversity in the forthcoming guidance document for Local Coastal Programs. (DFG, CA Coastal Commission, OPC)

Case Study: California Climate Commons



The California Climate Commons (climate.calcommons.org) is an online environment where natural resource managers can quickly find climate change and related environmental information they need, communicate with each other and with the researchers producing the information, and then share lessons learned. It provides an easy point of entry to what can otherwise be an overwhelming world of rapidly changing data, rife with assumptions and uncertainties. It fosters participation in a community of practice for communicating, learning, and contributing, resulting in a greater shared understanding about the use of climate change science in conservation and more effective and coordinated conservation action. The goal of the Climate Commons is to support conservation practitioners in their application of climate adaptation science and help guide new research directions by facilitating more effective information exchange between the climate change research and conservation communities. The Commons is a collaboration of the California Landscape Conservation Cooperative, Sonoma Ecology Center, PRBO Conservation Science, and UC Davis Information Center for the Environment.

Goal 2: Continue to Integrate Climate Change into Management and Planning Activities

Promote the development and use of tools that promote biodiversity conservation in adaptation planning and management actions.

- ❖ Give budget allocation priority to projects/programs the clearly address climate change considerations in sustainability of their activities. (All departments under CNRA)
- ❖ Integrate new tools into current and future management and planning efforts to conserve California's biodiversity. Includes but is not limited to DFG's Areas of Conservation Emphasis mapping and modeling tool, California Essential Habitat Conservation Plan, State Wildlife Action Plan (SWAP), National Fish, Wildlife, and Plants Climate Adaptation Strategy, and DFG and CEC vulnerability assessments. (All departments under the CNRA)
- ❖ Thoroughly integrate climate change into the revision of California's Wildlife Action Plan and provide opportunities for partner involvement/input. (DFG)
- ❖ Continue to integrate climate change into the conservation strategies of Natural Community Conservation Plans (NCCPs) being planned, and into the adaptive management and monitoring strategies of NCCPs being implemented. (DFG)

[3] California Natural Resources Agency

- ❖ Promote environmental stewardship and biodiversity adaptation by integrating ecosystem connectivity into other state agency projects such as DWR's water management projects. (DFG & DWR)

Goal 3: Bring an Adaptive Management Process to the Forefront of Management and Planning Activities to Promote Biodiversity Conservation

- ❖ Create pilot projects that test approaches to putting adaptive management on the ground in the context of climate change. (All departments under the CNRA)
- ❖ Continue to integrate climate change into the adaptive management and monitoring strategies of NCCPs being implemented. (DFG)

Goal 4: Promote and Pursue Education and Outreach Opportunities to Build Internal Capacity, Strengthen Partnerships, and Increase Public Engagement to Support Biodiversity Conservation Actions

- ❖ Pursue collaborative outreach efforts with partners to increase climate literacy. (All departments under the CNRA).
- ❖ Build internal capacity by providing access to or promoting staff participation in climate training activities that provide a foundation of knowledge on climate change impacts to biodiversity and empower staff to integrate climate change into their professional responsibilities. (All Departments under CNRA)
- ❖ Increase communication with the public and partners in support of state actions that promote biodiversity conservation. (DFG, DWR, CDPH)
- ❖ Engage citizen scientists to promote public involvement and support data collection activities across many locations with limited costs. (DFG, State Parks)
- ❖ Work with partners to develop information to be used for public interpretation and classroom education related to biodiversity conservation in the face of climate change. (DFG, DWR, State Parks, CDPH)

Goal 5: Develop Conservation Practices to Maintain and Enhance Ecosystem Function

- ❖ State agencies in conjunction with partners should develop a technical scientific panel to facilitate credible and appropriate use of climate, ecosystem, and species data to inform the development of sound biodiversity conservation practices. (DFG and partners)
- ❖ All appropriate state agencies should continue to integrate climate change into management activities through updating and modifying land and resource management objectives to incorporate climate change impacts and nature-based adaptation into existing and new planning efforts. (All departments under the CNRA)
- ❖ As appropriate, all state agencies should coordinate with partners and local government to improve predictive capabilities relative to assessment of threats, appropriate management response and probability of achieving desired outcomes, and changes in wildlife habitat spatial distribution and quality. (All departments under the CNRA)

Goal 6: Focus on Regional Scale and Ecosystem-Level Approaches to Adaptation Planning and Management

- ❖ Build upon existing investments in terrestrial and marine conservation areas that promote connectivity and species protection. (All departments under the CNRA)

- ❖ Promote marine biodiversity through adaptive management and monitoring of Marine Protected Areas. (DFG, OPC, State Coastal Commission)
- ❖ Develop incentives for participation by private land owners and local land-use agencies in terrestrial/marine conservation efforts (i.e. Farm Bill programs (NRCS)).
- ❖ Promote coordination among existing state, federal, and private landholders to make sure that adjacent properties are managed consistently, in a way that maximizes biodiversity and preserves connectivity. (All departments under the CNRA)
- ❖ Support expansion of the Natural Communities Conservation program (NCCP) with an eye towards targeting areas most vulnerable to climate change and working with local jurisdictions to develop these plans. (DFG)
- ❖ Work collaboratively with state, federal, industry and other partners to conserve biodiversity while pursuing renewable energy projects. (DFG,CEC)

Goal 7: Manage Endemic and Other Priority Species Populations in Changing Climate

- ❖ Appropriate state agencies need to work together to develop cross sector management recommendations to minimize large scale biodiversity loss from catastrophic events, habitat conversion, and other impacts such as sea level rise that endanger endemic and priority species.
- ❖ Appropriate state agencies should continue to support and develop climate change research that supports management and planning efforts to conserve endemic and priority species.
  - o Continue to pursue vulnerability assessments for various ecosystems across the state to inform natural resource planning and management. (DFG,CEC)
  - o Integrate recently completed DFG and CEC vulnerability assessments into California's SWAP revision and other management/planning actions as appropriate. (DFG)
  - o Promote applied research efforts that are tied to management actions including but not limited to monitoring efforts that can track and detect changes associated with ecosystem level responses to climate change. (All state agencies)

Case Study: Rare Plant and Bird Species of Special Concern Vulnerability Assessments

Two state-wide climate change vulnerability assessments, specifically for rare and priority species populations, were recently conducted in California. DFG, with support from the California LCC, conducted a vulnerability assessment of 156 rare plant species in California to determine which will be subject to the biggest negative impacts from climate change. This study employed the NatureServe Climate Change Vulnerability Index in conjunction with other modeling tools. In 2011, PRBO Conservation Science and the DFG assessed the vulnerability of bird species of special concern in California using a self-developed framework and criteria for measuring vulnerability. Both assessments will be used to inform conservation planning in California, including management planning efforts within DFG.

Cross Sector Strategies

California State Agencies have made great advances in adaptation planning and actions related to biodiversity conservation since the release of the 2009 CAS. Even with California at the forefront on climate adaptation planning there remains a great deal of work that needs to be done to insure that individual agencies' actions are well coordinated and integrated. The state and its various agencies and

departments are at a crucial point in implementing their adaptation strategies and need to make it a priority to communicate and coordinate their efforts to the greatest extent possible. This is particularly important for the biodiversity sector because efforts to conserve biodiversity cannot be limited to a single agency's actions or responsibilities.

Comprehensive cross sector integration is critical to truly conserve biodiversity in the face of a changing climate. To support this, guiding principles should be adopted and promoted across all agencies that support uniform implementation of climate policies as well as an opportunity to make cultural changes within state agencies to address climate alongside core activities. Furthermore, developing a set of guiding principles allows for greater innovation and creativity in identifying what needs to be done differently, and provides opportunities for creative solutions to be developed. Guiding principles or ***"Climate Smart Principles"*** can be drawn from collaborative efforts such as the Adaptation 2011 Workshop[4] which brought together experts in natural resource conservation and climate adaptation to begin developing climate-smart conservation principles and actions that could be integrated into existing decision making processes. Adopting Climate Smart Principles across state agencies will guide overarching initiatives and policies that will encourage all departments to test, pilot, organize, and adapt their existing practices to reduce or sequester emissions and develop science-based management tools to address nature-based adaptation responses. For a more detailed list of Climate Smart Principles for State Agency Consideration please see Appendix I.

Goal 1: Promote Cross Sector Integration of Biodiversity Strategies into Other Sector Actions

- State agencies should, to the greatest extent possible, adhere to a set of climate smart principles or guidelines to promote biodiversity conservation during implementation of management activities with the intent to work collaboratively with partners to expand these guidelines for adoption by federal and local government entities, as well as nonprofit and private entities.
- Establish a cross-sector team under the California Natural Resources Agency and include other agencies to ensure that activities related to climate change and adaptation actions that impact biodiversity are not conducted in isolation.
- All state agencies should collaborate with other state agencies, federal government, and other organizations that are currently incorporating climate change into natural resource management and planning activities to jointly develop tools, venues, and methods that will support existing programs. Look to partnerships like the Landscape Conservation Cooperatives, Climate Science Centers, and others for support.
- The state should incentivize nature-based adaptation management in projects and grant award programs.
- The state should prioritize the identification of funding that can be used by agencies and stakeholders for applied research that directly supports the creation and implementation of nature based adaptation strategies to support conservation management actions in all state projects. Specifically, the interactions between ecosystem function, climate change, and new management techniques.
- Integrate and promote nature-based adaptation strategies within the topic of long-term transportation planning to conserve biodiversity. (DFG, CA DOT)

[4] Adaptation 2011: A Workshop Report http://ncseonline.org/sites/default/files/Adaptation%202011%20Final%20Highlights.pdf hosted by National Wildlife Federation and the National Council for Science and the Environment.

Related Planning, Investment, and Regulatory Processes (opportunities for integration and implementation)

To the greatest extent possible state agencies should attempt to establish a preference for nature-based strategies and invest in green infrastructure and solutions that respond to the impacts associated with climate change while also conserving wildlife, habitats, and ecosystem services that benefit all residents of the state. For example, a nature-based strategy such as forest conservation provides benefits to the atmosphere, helps regulate the climate by reducing and sequestering greenhouses gases (GHG), protects valuable habitat for many species, and protects drinking water. By supporting nature-based strategies we can not only safeguard natural resources but the human communities that depend on them. For example, restoration efforts for coastal wetlands and other natural areas benefit species and habitat conservation but can also protect human communities and property by buffering the impacts from sea level rise and extreme events. Promoting nature-based strategies to the maximum extent feasible will help catalyze cross-sector, cost-effective actions that provide many benefits to people and the environment including ecosystem services, which provide benefits to biodiversity conservation and human communities. Several new and ongoing planning efforts such as the California Water Plan Update, Water Quality Control Plans, Fire and Resource Assessment Program, Adaptation Planning Guide, State Multi-Hazard Mitigation Plan, and the CA Transportation Plan, among others provide unique opportunities to promote biodiversity conservation through nature-based strategies that address climate change challenges while having lasting benefits to both human communities and biodiversity conservation across the state.

Challenges to Implementation and Suggestions for Moving Forward

Challenge: Lack of Funding

- Identify sustainable funding mechanisms to support long term consistency and continuity in climate planning, implementation, and monitoring efforts.
  - Identify and prioritize the use of climate change mitigation funding and investment of Cap and Trade Auction revenues to not only support mitigation and sequestration activities but those that also have the co-benefit of supporting nature-based adaptation actions and biodiversity conservation.
  - In implementing responses to climate change, managers should attempt to quantify the economic benefits of the activity including the full suite of ecosystem services that are being protected/conserved for the benefit to the public to the greatest extent possible.
  - When appropriate, resource managers should attempt to quantify GHG emission reductions and emissions avoided, and changes in carbon stocks related to projects and programs to better articulate the benefits of nature-based adaptation and ecosystem services.
- Leverage existing funding efficiently and effectively
  - State agencies and local decision makers should avoid approving projects or granting funds for new developments in areas that are at increased risk from climate change impacts, especially from extreme events such as flood, wildfire, and sea level rise.

Challenge: Lack of Internal Capacity and Expertise

- All state agencies should make climate change a regular part of their internal communications efforts to build internal support and understanding of state adaptation actions.
- Maintain a strong website presence as a resource for staff and the public to access climate change information as well as information on individual Agency/Department climate change activities.

- ❖ Climate Change Training: Build internal capacity by providing access to or promoting staff participation in climate training activities that provide a foundation of knowledge on climate change and empower staff to integrate climate change into their professional responsibilities.

Climate Change Adaptation Research Needs in the Biodiversity Sector

Applied research and monitoring are essential for agencies and stakeholders to understand and best address the interactions between climate change, ecosystem function, and new management approaches. Please refer to research activities and biodiversity related research needs detailed in DFG climate change related research – Aug2011 and California DFG Climate Change Research Needs – Feb2012 for additional information. In addition, climate adaptation research needs include non-habitat baseline data and mapping that will be important to maximizing biodiversity in the coming years. As part of this baseline, it would be useful to know current land uses and land use policies throughout the state, as well as whether municipalities and permitting agencies have incorporated climate change impacts into their land use planning (i.e. General Plans, Local Coastal Programs). This information will be an important part of determining the best opportunities for habitat restoration and land acquisition. Furthermore, it will be important to coordinate and collaborate with partners to integrate state research needs with other partner's actions such as those of the Landscape Conservation Cooperatives and USGS Southwest Climate Science Center to name a few.

Appendix I: Climate Smart Principles for State Agency Consideration

1. **Safeguard People and Wildlife:** Employ strategies that enhance the capacity of human communities to adapt to extreme, climate change driven events by implementing nature-based solutions that also benefit fish, birds, other wildlife, plants and ecosystem services such as natural water storage and flow. Prioritize activities that provide co-benefits for people and nature—ecologically and economically.
2. **Make Climate Appropriate Decisions in Project Evaluation**: Consider the potential effects of climate change on existing and proposed projects to evaluate project merit. Avoid investing in projects that are likely to be undermined by climate-related changes.
3. **Plan for Co-Objectives of Climate Mitigation and Adaptation**: Develop a planning process that supports comprehensive climate response, aligning greenhouse gas mitigation strategies with adaptation actions. For instance, promote actions that help forests adapt to future climate variability, and sustain biodiversity while also promoting their ability to sequester carbon and other ecosystem services such as water storage and flow.
4. **Design Actions from a Landscape, Ecosystem, and Watershed Perspective:** Design actions in the context of broader geographic scales and regional contexts to account for likely shifts in species distributions and other ecological changes. Promote collaboration among various stakeholders to develop multi-scale and large-scale actions.
5. **Align Adaptation Strategies with Biodiversity and Ecosystem Function Goals:** Prioritize biodiversity and ecosystem function as a climate adaptation strategy. Ensure that specific actions taken to address climate change impacts align with broad scale nature conservation goals and do not exacerbate climate-related vulnerabilities of ecosystems.
6. **Develop Goals for Forward-Looking and Progressive Time-Scales:** Focus conservation and other goals on future climatic and ecological conditions rather than those of the past. Develop strategies for near-term and long-term timescales, including decades and centuries into the future.
7. **Use Adaptive Management:** Employ an adaptive management decision making framework that is flexible and responsive to changes in climate, ecology and economics. Base management decisions on continuous learning, monitoring, and evaluation. Develop, test and revise metrics to report regularly on what is working, what is not, and implement changes as needed based on that. Employ the latest in climate science, projections and scenario approaches to guide implementation and the adaptive management cycle.
8. **Prioritize Actions:** Prioritize actions based on their risks and benefits including the likelihood that they will reduce risks to built and natural environments.
    a. **No Risk Actions:** Prioritize actions that have high probability of producing beneficial adaptation outcomes and little or no-risk of failure to implement successfully.
    b. **High Vulnerability Actions:** Prioritize actions that improve the capacity of highly vulnerable ecosystems to adapt to climate change impacts. Prioritize strategies that utilize a precautionary approach to reducing risk and increased future costs.
    c. **Multi-benefit Actions:** Prioritize actions that produce the greatest combination of benefits under a range of possible future climate scenarios.
9. **Plan for Climate Extremes and Variability**: Ensure that actions address the impacts of increasing climate extremes and variability in addition to the impacts of longer term average temperature increases. Choose strategies and actions that provide the greatest benefits across a range of possible future climate scenarios. Also consider the impact of ecological and human responses to climate change.