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California Climate Adaptation Strategy Update 2012
Biodiversity Sector
July 23, 2012

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 upon the new information and advances in climate science and adaptation planning. In addition, state agencies and conservation partners have made significant accomplishments in planning and actions that are helping the state to implement the objectives 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.

California State Agencies have made great advances in adaptation planning and actions related to biodiversity conservation since the release of the 2009 CAS. But 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 are not easily siloed into a single agency's actions or responsibilities. Therefore, comprehensive cross sector integration is critical to truly achieve the vision outlined in the CAS to conserve biodiversity in the face of a changing climate. To support this, guiding principles could 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 principles allows for greater innovation and creativity in identifying what needs to be done differently, and provides space for creative solutions to be developed. Guiding principles or ***"Climate Smart Principles"*** can be drawn from collaborative efforts such as the Adaptation 2011 Workshop[2] hosted by National Wildlife Federation and the National Council for Science and the Environment (NCSE) which brought together 80 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.

Key Characteristics of Climate Smart Conservation:

- **Conservation Actions Linked to Climate Impacts**: Conservation actions are designed to address the impact of climate change in concert with existing threats and are supported by explicit scientific rationale.
- **Set Forward Looking Goals**: Conservation goals focus on future, rather than past, climatic and ecological conditions; strategies take a long view (decades to centuries) but account for near-term challenges and transition strategies.

[1] http://www.climatechange.ca.gov/adaptation/

[2] Adaptation 2011: A Workshop Report
http://ncseonline.org/sites/default/files/Adaptation%202011%20Final%20Highlights.pdf

- **Robust in an Uncertain Future:** Actions provide benefit across a range of possible future conditions to account for uncertainties in future climate and in ecological and human response to climate shifts.
- **Safeguards People and Wildlife:** Actions enhance the capacity of ecosystems to protect human communities from climate change impacts in ways that also sustain and benefit fish, wildlife, and plants.

Adopting **Climate Smart Principles** across state agencies will provide clear initiatives and policy directions that will allow departments and commissions to test, pilot, and generally organize their existing practices to reduce or sequester emissions, and also to develop management tools to address nature-based adaptation responses. If state agencies can establish a preference for nature-based adaptation to the maximum extent feasible, this will help catalyze cross-sector, cost-effective actions that provide many benefits to people and the environment. For example, nature-based adaptation 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. While state government is currently composed of multiple agencies with different policy goals, they all recognize that the need to reduce emissions and adapt to climate change span all state activities. In terms of biodiversity conservation as well as many other sectors, it is critical that adaptation strategies be designed, and implemented, in a cross-sector manner, to achieve the level of success necessary to respond to a changing climate. For a more detailed list of Climate Smart Principles for State Agency Consideration please see Appendix I.

Emerging Climate Change Threats to Biodiversity

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 and was not fully explored in the 2009 CAS. Other significant impacts that we now have greater scientific understanding of today include **sea level rise, non native invasives, changes to water supply, and habitat fragmentation.** For example, we have far greater understanding of how non-plant invasives, particularly aquatic non-native invasives will respond to climate change. In addition, knowledge of pest and pathogen response is increasing and may not only impact biodiversity conservation but also directly impact human communities. The rate and extent of new climate research and its importance in informing biodiversity conservation management speaks to the need for greater collaboration not only across state agencies but also 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.

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 agencies efforts can be found on the California Climate Change Adaptation portal or biodiversity specific actions at DFG can be found on the department's Climate Science Program web page.

Collaborative Partnerships Support Implementation of the CAS

Pursuing and maintaining collaborative partnerships is an intregal part of successful climate adaptation planning and action and was identified as core strategedy in the CAS. The state has been doing an admirable job bringing 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.

- **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, private industry, and local land trusts. 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 state's efforts to collaboratively and successfully implement climate change adaptation actions relative to biodiversity across the state.

  Highlights of products include but are not limited to:

  - Outreach magazine: Confronting the Challenge: DFG's role in addressing Climate Change
  - State Wildlife Action Plan (SWAP) Climate Work Group resources for ecoregional teams
  - Climate Training Course Work Group to support DFG Climate College and Climate Training Resources
  - Workshop: "Bridging the Gap: Downscaling Climate Models to Inform Management Actions" (2010)

- **CA Department of Water Resources (DWR) Pursuing Biodiversity Conservation Actions on the Ground**: DWR is working collaboratively to incorporate biodiversity conservation actions into their management actions.

  Highlights of projects include but are not limited to:

  - DWR is working collaboratively 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 Partnerships Conserve Resources beyond California's Borders

In addition to partnerships within California, several state agencies including DFG serve in a leadership role on national and regional climate partnerships.

Highlights of products include but are not limited to:

- DFG 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.
- Steering committee and technical team lead for the National Fish, Wildlife, and Plants Climate Adaptation Strategy-expected release August 2012. (I[illegible])
- Technical team lead for the Association of Fish and Wildlife Agencies' Voluntary Guidance for States to Incorporate Climate Change into SWAP (DFG)
- Technical team member for the Ecosystems and Adaptation chapters of the National Climate Assessment led by the U.S. Global Change Research program. (DFG)
- Team lead WAFWA Director's Forum on Climate Change 2011 (DFG)
- Team lead on WAFWA Report: Multi-Sector Climate Change Adaptation Planning (DFG)
- Solicit input and collate WAFWA Annual Reports of State Agency Actions 2009-2012 (DFG)
- Lead author on "Conservation Actions for a Changing Climate: State Fish and Wildlife Agencies' Perspective 2012" (DFG)
- Western Governors' Association-Wildlife Council
- West Coast Governors' Alliance on Ocean Health

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

The Department of Fish and Game's (DFG) has been working with the Department of Interior, the National Oceanic and Atmospheric Administration and other states to develop a national climate adaptation strategy (Strategy) 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 national Strategy 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

Emergence of new climate change partnerships in California supports 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 many collaborative partnerships across 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.

- 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.
- 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.

New Tools and Online Resources Support Biodiversity Conservation in a Changing Climate

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 were created in conjunction with partners and are an important resource to support efforts to plan for or minimize the impacts of climate change now and in the future. A sampling of these tools include:

- CalAdapt
- California Essential Habitat Connectivity Project - a collaborative effort of CalTrans, DFG, and other partners.
- DFG's Areas of Conservation Emphasis mapping and modeling tool
- California's Wildlife Action Plan with climate considerations. (Revision underway)
- DFG's Climate Change Vulnerability Assessment Resource Center
- Unity-Integration-Action: DFG's Vision for Confronting Climate Change in California (2011)
- Climate change integrated into DFG Land Acquisition Policy
- DFG climate case studies highlighting adaptation actions on the ground (2011)
- DFG's Climate College to increase climate literacy and support staff and partners to become emerging climate leaders (2012)
- CO-CAT and Ocean Protection Council Science Advisory Team developed guidance on sea-level rise and adopted resolution to support the guidance. (See Ocean-Coastal chapter)

- Many state agencies (BCDC, State Lands Commission, CalTrans, Delta Conservancy) have developed sea-level rise guidance and policies and significant relevant state grant programs have incorporated SLR into funding decisions (e.g. Coastal Conservancy, Department of Water Resources, Strategic Growth Council). (See Ocean-Coastal chapter)
- Cal EMA is working jointly with the California Natural Resources Agency (CNRA) in the preparation and online publication of the Climate Adaptation Policy Guide (APG) to help California local governments to identify their own regionally relevant adaptation strategies.
- Public Health Research on mosquito borne diseases is being conducted by CA Department of Public Health and UC Davis School of Veterinary Medicine. (See Public Health chapter)
- NOAA SLR and Coastal Flooding Impacts Viewer

Collaborative Climate Change Research and Workshops

- California Bird Species of Special Concern climate vulnerability assessment (DFG in partnership with PRBO Conservation Science)
- Climate Change Vulnerability Assessment for Rare Plants (DFG through support from the CA LCC)
- CEC has funded 36 separate vulnerability assessments to better understand risks and adaptation measures.
- Several state agencies including but not limited to DWR, CNRA, and Caltrans participated in the National Academy of Sciences Sea Level Rise Assessment for the West Coast.
- High-resolution elevation data (LiDAR) are available for nearly entire coastline to support detailed sea-level rise vulnerability assessments and thanks to partnership with NOAA Climate Science Center; this data is being incorporated into interactive NOAA SLR and Coastal Flooding Impacts Viewer
- Tidal marsh bird population and habitat assessment for SF Bay under future climate change conditions (led by PRBO Conservation Science with state agency partners)
- Vulnerability analysis and monitoring program for detecting changes in San Francisco Bay tidal marsh bird populations resulting from climate change (led by PRBO Conservation Science with state agency partners)
- Determining landscape connectivity and climate change refugia across the Sierra Nevada (led by UC Berkeley with state agency partners)
- Developing an online invasive species risk-mapping tool: Climate change adaptation through strategic management of a top ecological stressor (led by California Invasive Plant Council with state agency partners)

Climate change workshops to support communication and collaboration

- Ocean Acidification-Shellfish II Workshop (2011)
- Marine Region hosts symposium on Ocean Acidification and Hypoxia at CalCOFI conference (2010)
- California World Oceans conference on "Fisheries Management and Ocean Acidification (2010)
- Ocean Acidification Effects on Shellfish Workshop: Findings and Recommendations (2010)
- "Bridging the Gap: Downscaling Climate Models to Inform Management Actions" (2010)

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 fish, wildlife, and habitats from the impacts of climate change now and in the future. Goals and actions for achieving these objectives and continuing to implement the strategies identified in 2009 CAS are detailed below.

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 natural resource 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 with other agencies to ensure that agency and department activities related to climate change and adaptation actions that impact biodiversity are not conducted in silos.
    - Convene sector leads regularly to develop specific recommendations for cross sector policy initiatives related to biodiversity.
    - Incentivize nature-based adaptation management in project development and grant awards.
    - Establish pilot programs, or pilots within existing programs (especially grant programs), and incentives to test how performance metrics related to adaptive management that supports biodiversity conservation can be implemented effectively to provide for greater reporting from expenditures.
    - Prioritize the identification of funding that can be used by agencies and stakeholders for applied research that directly supports conservation management on the ground. Specifically, the interactions between ecosystem function, climate change, and new management techniques.
    - Establish metrics to monitor species and habitats based on climate indicators and to the greatest extent possible adhere to these metrics across state agencies.

Guidance for Promoting Cross Sector Coordination Across State Agencies

- 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.
- 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.
- To the fullest extent possible, the state should include mechanisms in the CAS for integration with other state and regional planning processes for climate responses that are underway, such as the Adaptation Policy Guide, the California Department of Public Health adaptation guide, and several Office of Planning and Research efforts. Develop plans for near term and long term timescales; from 2050 and beyond since the scale of potential impacts and the level of uncertainty necessitate considerations over several decades.

- All state agencies should make climate change a regular part of their outreach and communications efforts to build public 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 Department's climate change activities.
- Identify sustainable funding mechanisms to support long term consistency and continuity in climate planning and implementation efforts.
    - Identify and prioritize the use of climate change mitigation funding 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, resources 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.

Sampling of Cross Agency Strategies Related to Biodiversity for Cross Sector Discussion

- Provide forest managers with an integrated assessment, and metrics for assessing the impacts of forest treatments at the fireshed scale over both the short and long term; identify areas of consensus, disagreement, and uncertainty in the assessment; discuss trade-offs between resource management options, which will require integrated metrics
- Work with CDFA, Dept of Pesticide Regulation and Cal OSHA to identify impacts on farm workers and rural communities of changes in agricultural and pest control strategies. Evaluate the health impacts of adaptation strategies before their adoption and consider alternatives or mitigation efforts (pesticides, GMOs, etc.) especially those that may also protect native biodiversity and support pollinators and other beneficial species.
- Oceans/Coastal: Collaborate with OPC, DWR, CalTrans, and DFG to identify areas at risk of flooding and storm surge, salt intrusion into coastal aquifers, risk to water treatment and other essential facilities, harmful algal blooms, safety and supply of fish and shellfish, public safety issues, and SLR impacts on low income communities. Work with OPR to encourage local public health agencies in coastal counties to become engaged in local planning and promote nature-based adaptation strategies that protect people and conserve biodiversity.
- Forestry: Reduce the risks of catastrophic wildfires for human communities' and following fire related disturbance events support efforts to minimize the establishment of fire prone invasive species.
- Public health/Biodiversity: Examine strategies to protect human health from invasive species, vector borne disease, and zoonosis and promote nature based strategies that can protect people and biodiversity. Specifically, promoting conservation of ecosystem services such as the benefits humans derive from wetlands, open space, etc.
- Work with OPR and CDFA to develop policies to promote urban agriculture and food security and strengthen ties between local sustainable agriculture and urban consumers

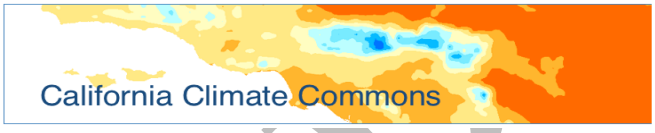
(Farm to Fork, Farm, to School, farmers markets, etc.). Especially those strategies that also conserve biodiversity and promote the conservation of ecosystem services that are vital to human health.

- Integration of climate adaptation within the topic of long-term transportation planning and biodiversity.

Goal 2: Create and Maintain Climate Change Partnerships

- State agencies should pursue and maintain collaborative partnerships with federal, NGO's, academic institutions, local government, and collaborative partner groups such as Landscape Conservation Cooperatives and USGS Southwest Climate Science Center.
- Pursue national, regional, and local coordination to promote conservation actions that extend 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.
- Convene state agency sector leads regularly to encourage communication and collaboration on specific cross-sector adaptation strategy objectives at the state level.
- Increase opportunities to work collaboratively with local government entities to increase communication and information sharing that supports collaboration and partnership around biodiversity conservation.
    - Specifically, coordinate with CalEMA to support integration of biodiversity strategies with the implementation of the Adaptation Planning Guide

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 3: Integrate Climate Change into Management and Planning Activities

Promote use of conservation planning and prioritization tools that promote biodiversity conservation in state wide adaptation planning and management

- Examples of tools include Areas of Conservation Emphasis mapping and modeling tool, California Essential Habitat Conservation Plan, State Wildlife Action Plan, National Fish,

Wildlife, and Plants Climate Adaptation Strategy, and DFG and CEC vulnerability assessments.

- Thoroughly integrate climate change into the revision of California's Wildlife Action Plan (SWAP) 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.
- Promote environmental stewardship and biodiversity adaptation by integrating ecosystem connectivity into other state agency projects such as DWR's water management projects.

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.

Bring an Adaptive Management process to the forefront of management and planning activities

- Create pilot projects to test approaches to putting adaptive management on the ground in the context of climate change.
- Continue to integrate climate change into the adaptive management and monitoring strategies of NCCPs being implemented.

Education and Outreach to Build Internal Capacity, Strengthen Partnerships, and Increase Public Engagement

All State Agencies should consider the following as appropriate:

- Pursue collaborative outreach efforts with partners to increase climate literacy.
- Create a climate community within individual state agencies to build internal capacity to empower staff to address climate change issues relative to biodiversity conservation by:
    - Establishing a climate training course (or partnering with another entity) to provide a foundation of knowledge on climate change impacts to biodiversity and access to tools and resources that will provide guidance for natural resources managers to integrate climate change into management actions and empower individuals to become emerging climate leaders. (See DFG Climate College)

    - To support the DFG Climate College, DFG is working collaboratively to create a "Climate Training Network" of online training webinars and presentations related to climate change and biodiversity
- Increase communication with the public and partners in support of state actions especially those that promote biodiversity conservation.
- Engage citizen scientists to promote public involvement and support data collection activities across many locations with limited costs.
- 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.

Develop Conservation Practices to Maintain and Enhance Ecosystem Function

- State agencies in conjunction with partners should develop as needed 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.
- 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
- 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.

Focus on a regional scale/ecosystem level approach to adaptation policy and management actions for biodiversity conservation while also utilizing existing terrestrial and marine conservation areas that promote connectivity and species protection.

- Promote marine biodiversity and adaptation through adaptive management and monitoring activities to support Marine Protected Area activities.
- Develop incentives for participation by private land owners and local land-use agencies in terrestrial/marine conservation efforts (i.e. NRCS Farm Bill).
- 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.
- Work collaboratively with state, federal, industry and other partners to conserve biodiversity while pursuing renewable energy projects.

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 and assessments that support management and planning efforts to conserve endemic and priority species.
    - Continue to pursue vulnerability assessments for various taxa across the state to inform natural resource planning and management. (DFG)

- Integrate recently completed DFG and CEC vulnerability assessments into California's Wildlife Action Plan revision and other management/planning actions as appropriate.
- 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.

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 the revision of the State's Wildlife Action Plan.

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

- California Fish and Wildlife Strategic Vision
- DFG's Strategic Planning Effort
- DFG's Science Initiative
- California's State Wildlife Action Plan
- Natural Community Conservation Plans (e.g. DRECP, Bay-Delta Conservation Plan, etc.)
- Landscape Conservation Cooperative initiatives
- National Fish, Wildlife, and Plants Climate Adaptation Strategy
- California Water Plan Update and Water Quality Control Plans (Basin Plans)
- Fire and Resource Assessment Program
- Environmental Goals and Policy Report
- Adaptation Planning Guide (APG)
- State Multi-Hazard Mitigation Plan
- CA Transportation Plan (CTP)

V. Climate Change Adaptation Research Needs in the Biodiversity Sector

Refer to research needs detailed in California DFG Climate Change Research Needs – Feb2012

- ***Integrate these needs with LCC and USGS Southwest Climate Science Center research priorities.***

Appendix I: Climate Smart Principles for State Agencies
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The first step in a cross sector approach is to create a set of 'Climate Smart Principles' for all agencies and departments to adopt:

1. **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.
2. **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 adapt forests to future climate variability while simultaneously improving their ability to sequester carbon.
3. **Develop Goals for Forward-Looking and Progressive Time-Scales:** Focus conservation 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.
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. **Use Adaptive Management:** Employ an adaptive management decision making framework that is flexible and responsive to changes in climate, ecology and economics. In consideration of future uncertainty, make management decisions based on continuous learning, monitoring, and evaluation.
6. **Prioritize Actions:** Prioritize actions based on their risks and benefits, as well as the likelihood that they will reduce the vulnerability of 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 in these natural communities.
    c. **Multi-benefit Actions:** Prioritize actions that produce the greatest combination of benefits under a range of possible future climate scenarios.
7. **Align Adaptation Strategies with Overall Biodiversity Goals:** Prioritize biodiversity as a climate adaptation strategy that builds resiliency in ecological systems. Ensure that specific actions taken to address climate change impacts align with broader conservation goals and do not exacerbate climate-related vulnerabilities of ecosystems.
8. **Safeguard People, Wildlife and the Economy:** 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, wildlife, and plants. Prioritize activities that provide co-benefits for people, wildlife, and the economy.
9. **Plan for Climate Variability**: Ensure that actions address the impacts of increasing climate variability in addition to the impacts of temperature change.

10. **Plan for Climate Uncertainty**: Choose strategies and actions that provide the greatest benefits across a range of possible future climate scenarios. In assessing this uncertainty, also consider the impact of ecological and human responses to climate change.
11. **Link Actions to Scientifically Determined Climate Impacts**: Base conservation strategies on scientific research and modeling of climate change impacts.