

Data and Analytical Needs

State forest resource assessments will identify, describe, and spatially define forest landscape areas where forestry program outreach and activity will be emphasized and coordinated...This component of a state's assessment should be geospatially based...States should identify information gaps as part of their assessment process. These geospatial information gaps will help focus future data development work at regional and national levels (excerpted from the U.S. Forest Service State and Private Forestry Farm Bill Requirement and Redesign Strategies).

KEY FINDINGS

Data Priorities – Framework Data

Framework data served critical functions in multiple Assessment chapters; in some cases data were insufficient or not current. Suggested action for each dataset is provided.

- *Vegetation*: Create and maintain statewide, consistent vegetation data that can be used for multiple purposes.
- *Development*: Explore options for statewide standardized parcel data to track residential and commercial development.
- *Land ownership*: Support and enhance efforts to capture and maintain parcel-based land ownership and protection status data.
- *Fire perimeters*: Continue and enhance collaborative efforts to update fire perimeters annually; improve completeness and quality of associated burn severity data.
- *Communities*: Develop an alternative method for mapping clusters of human settlement in unincorporated areas.
- *Tree mortality*: Continue USFS efforts to capture tree mortality by cause of death; develop a process for estimating data accuracy.
- *Forest survey data*: Enhance and adapt Forest Service inventory survey frequency and methods to meet near-term challenges related to climate change, fire and other threats, and better address urban forestry issues.

Data Priorities – Other Data

Suggested actions are provided for datasets that were critical for analyzing a single or small number of issues.

- *Fire Hazard Severity Zones*: Amend Government Code to include a reporting mechanism to track local government ordinances adopted in response to CAL FIRE's FHSZ recommendations.
- *Condition class*: Augment efforts to maintain and improve condition class data; capture management activities that can alter condition class; develop better techniques for applying the condition class metric to aggregated areas reflecting natural fire regimes.
- *Groundwater basins*: Create a more detailed statewide representation of groundwater basins with well locations, groundwater withdraws, recharge rates, and pollution levels.
- *Mountain meadows*: Systematically map mountain meadows statewide.

Data Gaps

There were several instances where critical data were not available to analyze important issues.

- *Exotic invasive species data*: Develop and maintain data for analyzing the threat from exotic invasive species.
- *Rangeland monitoring data*: Implement a comprehensive and consistent system to monitor rangeland condition and trends across all ownerships.
- *Energy use data*: Develop a method to measure energy use at a finer scale than counties.
- *Restoration data*: Establish a statewide database of all restoration projects and accomplishments.
- *Waterbodies beneficial uses*: Assemble a comprehensive list of beneficial uses for waterbodies.
- *In-stream flow data*: Develop detailed GIS based stream flow data to support estimating water supply.
- *Fisheries data*: Create stronger access to current data.
- *Riparian condition data*: Assemble a comprehensive riparian condition spatial dataset.

Analytical and Research Priorities

In addition to the need for better data, improved and if possible standardized analytical techniques would benefit future analyses.

- *Development projection*: Standardize statewide parcel data as a tool to project development and for establishing improved methodologies.
- *Ecosystem health*: Develop a standard methodology for analyzing ecosystem health and its various threats.
- *Forest growth simulation*: In order to better simulate alternative policies, programs, and scenarios, we must prioritize enhancements to components of the initial simulation model used for this assessment, such as disturbance regimes, benefits from ecosystem services, etc.
- *Wildlife habitat*: Continue current efforts by California Department of Fish and Game to identify critical habitats for restoration and protection priorities.
- *Statewide water balance model*: Develop a statewide model on a regional scale and incorporating climate change variables to significantly improve analysis of water supply.
- *Cumulative watershed impacts*: Standardize approaches to evaluate cumulative impacts to water quality from land management activities; comprehensively track management activities at the project level.
- *Climate change*: Increase funding to compile and distribute downscaled climate data from global climate models (GCM), and to develop appropriate methods for interpreting trends.
- *Soil organic carbon*: Complete high resolution statewide soils maps (SSURGO) and develop a standard methodology to estimate soil organic carbon base data from soil maps as a collaborative effort between NRCS and USFS.
- *Fisheries limiting factors*: Support additional research to better understand the interaction of fish and habitat. Develop appropriate analytical methods to identify where and how policies, programs, and projects can improve the status of fish populations.

DATA PRIORITIES

Analyses in the assessment chapters relied on data from various sources. Based on the summaries of data quality for each chapter, two main types of priority datasets were identified;

- Datasets that address multiple issues, sometimes called “framework data.”
- Datasets that were a critical component for analyzing specific issues.

Data Priorities – Framework Data

Datasets that contributed to analyses in multiple chapters, their uses, and any concerns about their quality are shown in Table A.1.

Table A.1. Framework datasets used for multiple purposes in this assessment

Data Theme (Number of Chapters)	Uses	Quality Issues
Vegetation (11)	Ecosystems, timber asset, rangeland asset, wildfire threat, forest meadows, riparian cover, tree canopy (urban forestry), green infrastructure, vegetation types (reporting unit)	Outdated, inconsistent, inadequate for urban forestry
Development (8)	Undeveloped lands, housing asset, energy use	10 year census cycle inadequate to track/project development, too coarse in rural areas
Land ownership (7)	Developable lands, protected lands, recreation areas, federal/private (reporting unit)	Problems identifying protection status, missing Dept. of Defense and BIA lands
Fire perimeters (7)	Fire threat input, burn severity, condition class input	Missing perimeters, quality of severity data
Communities (6)	Reporting unit	Census data inadequate for unincorporated places, misses areas, outdated
Tree mortality (5)	Forest pest current damage/future threat	Unknown accuracy
Forest survey data (3)	Timber growth/inventory, carbon storage and sequestration, biomass potential, understocked and overstocked stands	10 year update cycle, concentration on timberland

Particulars of data needs, current status of data capture and maintenance efforts, and suggestions for future actions are summarized by general theme below.

Vegetation

Need: Vegetation data contributed to analyses in every assessment chapter. It was used to map and rank critical assets such as ecosystems, timber, rangeland forage, biomass, carbon storage, forest meadows and riparian areas (for water analyses), urban tree cover, and green infrastructure. It also contributed to defining major threats such as wildfire, climate change, and urban heat potential. Various data sources were utilized in this assessment as the “best available” data. This often resulted in using data captured at different scales and standards, and at various time periods – some captured as long as twenty years ago. Invariably, this had a negative impact on the quality of analyses. Finally, mapping efforts within the state have typically focused on non-urban lands and were inadequate for addressing urban forestry issues.

Status: Various stakeholders have signed a Memorandum of Understanding recognizing the importance of vegetation data and the value of a collaborative approach. However, to date funding has not been allo-

cated to ensure that quality data are captured and maintained on a statewide basis with an adequate update frequency.

Suggested action: Allocate funds to create and maintain consistent statewide vegetation data that can be used for multiple purposes.

Development

Need: Development pressures are an ongoing threat to ecosystems, productive forest and rangeland (and agricultural) land, green infrastructure, watersheds and wildlife habitat. Also, housing and businesses are assets that are threatened by fire, forest pests, urban heat and air pollution. Development data was required for analyses in eight assessment chapters. Currently, the primary source for housing is the U.S. Census, which is captured at ten year intervals, by census block. The resolution of this data is coarse for rural areas, where scattered development occurs within huge census blocks.

Status: Nearly all California counties invest significant resources in maintaining digital parcel data, and most make the data publicly available in some form. However, it can be difficult or impossible to identify which parcels actually contain residential or commercial development. If the state would work with counties to develop a data standard and sharing agreements, and provide incentives for compliance, it could result in rich datasets for tracking the progression of development. The state sponsored a comprehensive needs analysis for use of parcel data by state agencies (Gooch and Marose, 2004). The state Geographic Information Officer has convened a working group and is exploring options for compiling standardized parcel data.

Suggested action: Continue to explore options for compiling statewide standardized parcel data from counties, which could be used to track residential and commercial development

Land ownership

Need: Land ownership and protection status data contributed to analyses in seven chapters: for defining developable lands versus protected areas; defining the recreation asset; and as a reporting metric, for example for federal versus private lands. Land ownership was derived from the California Protected Areas Database (CPAD) (GreenInfo Network, 2009), which is based upon county parcel data. However, not all counties contributed data to this effort, there are accuracy issues in certain counties, and protection status needs additional work, including consideration of lands managed by the Department of Defense and Bureau of Indian Affairs.

Status: CPAD is part of the national effort (PAD-US, 2009), and is being improved and updated regularly, but it is unclear whether this effort has guaranteed ongoing funding.

Suggested action: Support and enhance current efforts to capture and maintain parcel-based land ownership and protection status data.

Fire perimeters

Need: Fire perimeters are a data input that contributes to the development of critical datasets such as current fire threat, condition class, fire rotation, and Fire Hazard Severity Zones. Burn severity data associated with perimeters is critical for identifying wildfire-damaged areas in need of restoration. Existing fire perimeter

data provided a high quality data input that contributed to analyses in seven chapters. Data concerns relate mainly to missing perimeters, and quality and completeness of the burn severity data.

Status: Fire perimeter data is not a budgeted item for CAL FIRE and other fire service organizations. However, the data have been developed and maintained using various federal grants, CAL FIRE staffing, and annual contributions of perimeters from the various collaborators.

Suggested action: Continue and enhance collaborative efforts between the various fire protection agencies in California to annually update fire perimeters and improve the completeness and quality of associated burn severity data.

Communities

Need: Communities were used as an analytical reporting unit in six chapters. Priorities assigned to these communities could influence their potential to receive federal grants for various purposes. This is especially significant for unincorporated clusters of development that were not identified as “places” in the 2000 census, and thus were not recognized as communities in the analyses. Some small rural communities were mapped as huge census “places” (for example, the small community of Hayfork in Trinity County is almost 100,000 acres), which caused analytical difficulties and influenced quality of the results. Finally, the census did not include development that occurred in unincorporated areas since 2000.

Status: CAL FIRE maintains a dataset of incorporated city boundaries, and annexations are provided by Board of Equalization on a continuous basis. There is currently no alternative to using census data for identifying unincorporated communities. Statewide standardized parcel data would potentially provide the basis for more detailed community mapping.

Suggested action: Develop an alternative method for mapping clusters of human settlement in unincorporated areas throughout the state.

Tree mortality

Need: Tree mortality data was used to map and rank the forest pest threat, which contributed to analyses in five chapters. This data will become increasingly important in monitoring climate change over time. The accuracy of this data is critical if used to develop and monitor effectiveness of policies and programs that mitigate threats.

Status: Tree mortality data is captured by the U.S. Forest Service Forest Health Protection staff on an annual basis using aerial survey methods.

Suggested action: Continue current efforts by the U.S. Forest Service to capture tree mortality by cause of death, and develop a process for estimating data accuracy.

Forest survey data

Need: Forest inventory data provides for measuring and monitoring timber inventory and growth, carbon storage and sequestration, biomass energy potential, and understocked and overstocked stands. There are increasing threats, including climate change, to forest resources, and whether the current inventory frequency and methods provide the range of data to develop and monitor effective programs needs to be evaluated. The

increasing importance of urban forests suggests a need to expand the extent of survey efforts to include urban areas.

Status: Current efforts by the U.S. Forest Service's Forest Inventory and Analysis (FIA) program annually updates plot data on ten percent of California, with a complete inventory every ten years. Sampling procedures were designed for estimating timber statistics such as inventory and growth to a specific confidence level over broad timber resource regions of the state.

Suggested action: Continue current forest inventory efforts by the U.S. Forest Service, and consider enhancing and adapting survey frequency and methods as needed to meet near-term challenges related to climate change, fire and other threats, and to better address urban forestry issues.

Data Priorities – Other Data

Fire Hazard Severity Zones (FHSZ) in Local Responsibility Areas (LRA)

Need: FHSZ data was used to represent fire threat to communities.

Status: FHSZ data for Local Responsibility Areas (LRA) was based on CAL FIRE recommendations provided to local government. There is no required reporting mechanism that allows CAL FIRE to efficiently track which specific local ordinances have been adopted by local government in response to these recommendations.

Suggested action: Amend the Government Code to ensure there is a reporting mechanism that allows CAL FIRE to track local ordinances that have been adopted in response to FHSZ recommendations.

Condition Class

Need: Condition class was used in assessment analyses to develop landscape-level wildfire threat, which provides a measure of ecosystem susceptibility to damage from large fire events. There has been an identified need to develop a more robust methodology for analyzing wildfire and ecosystem health. It is likely that condition class will play a larger role, for example as a contributing factor for which stands and ecosystems are priorities for restoration.

Status: Condition class is currently derived from the best available vegetation data combined with measures of expected fire frequency and fire behavior.

Suggested action: Augment current efforts to maintain and improve condition class data, in part through improved vegetation mapping, by capturing management activities that can alter condition class, and better techniques for applying the condition class metric to aggregated areas reflecting natural fire regimes.

Groundwater basins

Need: Groundwater basins are a critical resource facing threats such as drawdown and pollutants. Information is needed on condition and use of groundwater basins (e.g., rates of withdraws and recharge).

Status: Bulletin 118 from Department of Water Resources provides periodic information on the status of Groundwater in California:

<http://www.water.ca.gov/groundwater/bulletin118/bulletin118update2003.cfm>

Suggested action: Create a more detailed statewide representation of groundwater basins that depicts monitoring well locations, groundwater withdrawals, recharge rates, and pollution levels.

Mountain meadows

Need: Mountain meadows are an important component of watershed function. Since they typically occur as smaller inclusions within larger vegetation types, they are often poorly represented by bioregional vegetation mapping efforts.

Status: Currently, the USFS provides a detailed inventory of meadows on the lands that they manage, but there is limited information on private lands.

Suggested action: Support a systematic effort to map mountain meadows, ideally as part of a comprehensive vegetation mapping strategy.

DATA GAPS

There were numerous cases where the quality of an analysis was compromised or an analysis could not be conducted due to missing data; each is described below.

Exotic invasive species

Need: Exotic invasive species were identified in this assessment as a significant threat to ecosystem health, wildlife habitat, timber and rangeland production, and green infrastructure. In addition, they can influence threats such as wildfire by altering fuel conditions and natural fire regimes.

Status: The threat from exotic invasive species was not effectively analyzed due to lack of quality statewide data. Data needed for each pest would include current extent, current and potential future damage, extent and effectiveness of control efforts, etc.

Suggested Action: Develop and maintain statewide data for analyzing the threat from exotic invasive species.

Rangeland monitoring

Need: Assessing current condition and trends in rangelands would allow for development of more effective policies and programs targeted towards protecting and restoring priority rangeland areas. Rangelands are complex systems, and an effective monitoring system would address factors such as soil erosion, water quality, riparian condition, changes in extent of rangeland vegetation, and impacts of exotic invasive species.

Status: There are numerous efforts to capture certain factors related to rangeland condition, but there is no consistent comprehensive statewide system similar to Forest Survey and Forest Health Monitoring on forestlands.

Suggested Action: Implement a more comprehensive and consistent system to monitor rangeland condition and trends across all ownerships in California.

Energy use

Need: Energy use is a threat component that can help prioritize areas for tree planting or maintaining existing tree canopy in urban areas. However, energy use data more specific than at the county level was not identified; housing density and commercial development were used as a proxy for energy use. Spatially explicit energy use data could identify areas that are more or less energy efficient than others, for example, due to local ordinances that set energy efficient building standards, or where different technologies can be applied (e.g., swamp coolers versus air conditioners). Such data could also prove useful in measuring the effectiveness of tree planting efforts and other projects and policies to improve energy efficiency.

Status: Data related to energy use at a finer scale than the county level was not available for assessment analyses.

Suggested Action: Develop a method to measure energy use at a finer scale than the county.

Restoration data

Need: With projects funded by a variety of state, federal, and NGO sources, it is difficult to track current restoration efforts and determine the effectiveness of investments. An inter-jurisdictional repository for all restoration projects could also encompass monitoring of restoration projects which would facilitate tracking the effectiveness of restoration strategies.

Status: There is a considerable amount of monitoring and reporting of restoration efforts, but no collective inter-jurisdictional repository.

Suggested Action: Establish a statewide database of all restoration projects across ownerships to track forest and rangeland restoration efforts and the success of projects.

Waterbodies beneficial uses

Need: Better information is needed to evaluate water resource assets and determine the highest priorities for protecting water quality.

Status: This information is collected independently by each of the Regional Water Quality Boards.

Suggested action: Regional Water Quality Control Boards need to assemble a comprehensive list of beneficial uses for waterbodies.

In-stream flow data

Need: Additional information is needed on the surface runoff and stream flow in upper watersheds to assist in developing priorities for watershed protection.

Status: The California Data Exchange Center (CDEC), managed by the Department of Water Resources maintains and distributes information on stream flow.

Suggested action: Develop more detailed statewide GIS-based stream flow data to support estimating water supply.

Fisheries data

Need: Fish are a critical resource facing a variety of threats, with some populations declining to the point of an official listing as threatened or endangered. A more comprehensive system for accessing data related to fish is needed to prioritize restoration and conservation of landscapes and habitats important for fish survival.

Status: Lack of access to high quality data sources was a limiting factor for analyzing fish in this assessment.

Suggested Action: Create a more comprehensive system for accessing current data related to fish for prioritizing restoration and conservation of landscapes and habitats important for fish survival.

Riparian condition

Need: Riparian areas are a critical asset for water quality, fish habitat, and wildlife habitat. Riparian areas have undergone extensive modifications, and many areas are currently in need of restoration.

Status: The U.S. Forest Service and BLM have captured riparian condition on all lands under the Northwest Forest Plan. California Department of Fish and Game has intensive stream-reach riparian condition data on all streams that have been surveyed, but the data are not all spatially linked. Statewide GIS data of riparian condition would assist in the analysis of water quality as well as wildlife and fish habitat.

Suggested Action: Fund an effort to assemble a comprehensive riparian condition spatial dataset.

ANALYTICAL AND RESEARCH PRIORITIES

The assessment chapters include various analyses, and the specific methodologies are documented in detail online (<http://frap.fire.ca.gov/assessment2010.html>). In some cases, there was an identified need to improve current analytical methodologies, or to conduct additional research. For each identified need, a suggested action is provided below.

Development projection

Need: Development is a significant threat that impacts wildlife habitat, working landscapes, water quality, and green infrastructure.

Status: The assessment identified the EPA's ICLUS tool (<http://cfpub.epa.gov/ncea/global/recordisplay.cfm?deid=216195>) as a reasonable starting point for looking at future development patterns. However, projection methods typically rely on census data, which has significant limitations. Standardized statewide parcel data would provide a much richer dataset to improve methods for projecting development.

Suggested action: Standardize and create stronger accessibility to statewide parcel data.

Ecosystem health

Need: Due to the lack of a common framework for defining and analyzing ecosystem health, a measure of ecosystem health was developed for this assessment which analyzed the impacts of development, wildfire and forest pests.

Status: There was no prior methodology for analyzing impacts of various threats on ecosystem health and numerous questions remain that should be answered prior to our next assessment cycle, for example:

- How are ecosystems defined, mapped and ranked across the landscape?
- Which ecosystems are more sensitive or resilient as related to fire or forest pest damage?
- At what point do natural processes such as fire and forest pests go beyond being a normal part of natural cycles and require human intervention?
- Which fire or forest pest damaged areas are most in need of restoration? Which are most likely to have a favorable response to various restoration treatments?

Suggested action: Develop standard methodologies for analyzing ecosystem health and its various threats as a collaborative effort between ecologists, fire scientists, pathologists, entomologists, other professionals and stakeholders.

Forest growth simulation

Need: To meet increasing demands from forestlands, particularly for ecosystem services under more diverse and magnified threats, California will need to revise or adopt new policies and programs. Modeling forest growth and management, future economic and non-economic benefits, and disturbance regimes from fire and forest pests under various scenarios can strongly inform policy direction.

Status: An initial simulation model was developed for this assessment using FIA field plots, standard growth and yield models, and stylized disturbance regimes resulting in initial estimates related to carbon storage and sequestration. A more robust model is needed to more fully address forest management options, ecosystem services, and disturbance regimes.

Suggested Action: CAL FIRE will lead an effort to improve the initial simulation model by identifying and prioritizing improvements to its components. Model support and development will be done in cooperation with other stakeholder agencies. Model run requests from policy bodies such as the Board of Forestry and Fire Protection and interagency groups will be supported to the extent that resources allow.

Wildlife habitat

Need: California natural areas are rapidly diminishing making it challenging for the California Department of Fish and Game to meet its mission to preserve, conserve and manage wildlife resources to sustain all wildlife species, and to protect and preserve native species that are experiencing significant decline.

Status: The California Department of Fish and Game is working on the Areas of Conservation Emphasis (ACE) project, which is expected to be completed in 2010. Ideally ACE will provide spatial data related to conservation priorities, as well as a robust methodology to identify areas in the future as conditions change.

Suggested action: Continue current efforts by California Department of Fish and Game to identify critical habitats for protection priorities.

Statewide water balance model

Need: With increasing pressure on water resources, the state of California needs a statewide assessment of water inputs and outputs. A water balance model would contribute to understanding water supply and water quality parameters.

Status: No statewide water balance model currently exists.

Suggested action: Develop a statewide water balance model at a regional scale and incorporating climate change variables to significantly improve the analysis of water supply.

Cumulative watershed impacts

Need: Cumulative impacts from forest management and other land management activities can adversely affect water quality. Spatial data is needed on the extent and types of management activities that are occurring. Standardized methods for evaluating cumulative impacts from forest management are also needed.

Status: There is extensive information collected by CAL FIRE on timber harvesting and other types of vegetation management. The U.S. Forest Service and other federal agencies have also developed detailed databases on management activities. Additional work is needed to integrate databases across agencies.

Suggested action: Adopt standardized approaches to evaluate cumulative impacts to water quality from land management activities; this requires consistent and comprehensive tracking of management activities at the project level.

Climate change

Need: Higher resolution data is needed that predicts trends in climate parameters that have been derived from global climate models (GCM). Methods for interpreting data and displaying trends would promote its use and integration into land use planning.

Status: unknown

Suggested action: Increase funding to compile and distribute downscaled climate data from global climate models, and to develop appropriate methods for interpreting trends.

Soil organic carbon

Need: Current statewide estimates are based on coarse resolution soil databases. These estimates could be improved by further development of higher resolution soils databases derived from SSURGO.

Status: NRCS is currently developing a class based method to estimate soil organic carbon at a regional level using NASIS soil maps, but there is currently no statewide effort or technical review.

Suggested action: Complete high resolution statewide soils maps (SSURGO) through a collaborative effort between NRCS and USFS, and develop a standard methodology to estimate soil organic carbon base data from soil maps.

Fisheries limiting factors

Need: Analysis of fish was severely limited due to the need for a more comprehensive understanding of the current status of fish habitat and populations, limiting factors for fish survival, and the relative impact of the various threats on fish populations.

Status: The interaction of fish populations and their habitat and the diverse threats that impact them is complex. Several watersheds have limiting factors analyses, especially those with special status species and undergoing a TMDL process. The current lack of knowledge, quality data, and appropriate analytical methods limits effectively addressing the problem of declining fish populations.

Suggested Action: Conduct additional research to better understand the interaction of fish populations and habitat, limiting factors for fish survival, and the relative impact of the various threats on fish populations. Likewise, develop appropriate analytical methods to identify where and how policies, programs, and projects can improve the current status of fish populations.