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Science Strategy for Cotoni-Coast Dairies, an Onshore Unit of the California Coastal National Monument

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Cover photo:
Cotoni-Coast Dairies in California. Photograph by Bob Wick, BLM.

Science Strategy for Cotoni-Coast Dairies, an Onshore Unit of the California Coastal National Monument

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Executive Summary

The Bureau of Land Management (BLM) is responsible for managing approximately 245 million acres of public lands and approximately 710 million acres of subsurface mineral estate. The BLM manages public lands under the principles of multiple use and sustained yield "in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values" (43 U.S.C. 1701(a)(8)). About 38 million acres of BLM-managed lands are National Conservation Lands, which are managed to conserve, protect, and restore nationally significant landscapes that have outstanding cultural, ecological, and scientific values for the benefit of current and future generations. Science is a formal part of managing National Conservation Lands, formally called the National Landscape Conservation System (NLCS), and national monuments and national conservation areas are required to develop and regularly update science strategies through a science planning process.

The California Coastal National Monument is one of 910 designated areas in the NLCS. Established in 2000, the monument encompasses the entire 1,100-mile coastline of California, including the reefs, islands, rocks, and pinnacles present above mean high tide within 12 nautical miles from the shoreline. Onshore lands of the monument occur in six units, one of which is Cotoni-Coast Dairies (the unit).

Near Davenport in Santa Cruz County, Cotoni-Coast Dairies extends from the Santa Cruz Mountains to the marine coastal terraces overlooking the Pacific Ocean. Ecologically rich and diverse ecosystems make up the unit, which contains extensive cultural, archaeological, and historical resources, some of which date back at least 10,000 years. The six perennial streams that flow through the unit provide habitat for freshwater and anadromous fish, and vibrant riparian and wetland areas support numerous aquatic and terrestrial wildlife. The unit also supports a variety of avian species and monarchs. Grasslands, scrublands, woodlands, and forests surround the riparian corridors and include diverse vegetation communities.

This science strategy describes the scientific mission of the unit, science previously conducted on or near the unit, and partners who have contributed to produce this science. Further, it identifies priority science needs, outlines the unit's plan to meet those science needs in coordination with partners, shares scientific protocols for conducting new research, and identifies systems of communication to help ensure science information generated from this research is shared throughout the BLM, with partners, and with the public. The fundamental goals of the science strategy are to support and expand partnerships, while identifying priority science information needs of unit management and partners, and clearly outline pathways for conducting, communicating, and applying that science.

This science strategy is the product of a collaborative effort between resource managers, scientists, and conservation partners that have a connection to Cotoni-Coast Dairies. The strategy was developed in accordance with BLM Manual 6220, which provides guidance for science strategy content. Science needs were identified through conversations with unit staff and scientific and management partners. The science needs reflect the information needed to effectively manage the resources, objects, and values for which the unit was designated. The draft strategy was reviewed by Central Coast Field Office staff; monument, district, and state office staff; scientists; and partners.

Information generated through this planning process and implementation of this science strategy can inform future management actions in Cotoni-Coast Dairies. Collaboration and open communication with existing and potential science partners is critical to the success of implementing this science strategy, protecting the objects of Cotoni-Coast Dairies, and informing management decisions. This science strategy is an evolving publication that will be revised and updated, as needed.

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1. Introduction and Role of Science in Land Management

The Bureau of Land Management (BLM) is responsible for managing approximately 245 million acres of public lands, mostly in the Western United States, and approximately 710 million acres of subsurface mineral estate nationwide. The mission of the BLM is to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations. In accordance with the Federal Land Policy and Management Act (FLPMA) of 1976, the BLM manages public lands under the principles of multiple use and sustained yield. FLPMA requires that "the public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition (section 102(a)(8)).

The BLM's National Landscape Conservation System (NLCS)—also known as National Conservation Lands—was administratively established in 2000 and legislatively codified in the Omnibus Public Land Management Act of 2009. The NLCS encompasses 56 national monuments, national conservation areas, and similar designations, which, together with additional designation types (e.g., wilderness areas, wilderness study areas, wild and scenic rivers, and national scenic and historic trails), comprise 910 distinct designated areas spread across approximately 38 million acres of public lands managed by the BLM.

The BLM manages National Conservation Lands to conserve, protect, and restore nationally significant landscapes that have outstanding cultural, ecological, and scientific values for the benefit of current and future generations (16 U.S.C. 7202(a)). Science and the scientific process inform and guide the conservation, protection, and restoration of the resources, objects, and values for which these lands were designated (BLM 2017). Further, the BLM promotes these lands as sites for scientific research (BLM 2017). Therefore, science is strategically planned for the lands that comprise the NLCS. In particular, national monuments and national conservation areas are required to develop and regularly update science strategies through a science planning process (BLM 2017).

The BLM has defined science as the knowledge and study of the world based on facts learned through experiments and systematic observations (Kitchell et al. 2015). This definition is broad and, in the context of the NLCS, is intended to be inclusive of basic and applied research in natural and social sciences as well as inventory and monitoring initiatives (BLM 2007).

The goals of science in the NLCS (BLM 2007) are to:

- Gain scientific understanding of NLCS resources and landscapes and the benefits they provide the American public.
- Apply scientific understanding to management, education, and outreach.

The Department of the Interior (DOI) prioritizes the inclusion of Indigenous Knowledge in both scientific research and management. Indigenous Knowledge is defined as "a body of observations, oral and written knowledge, innovations, technologies, practices, and beliefs developed by Indigenous Peoples through interaction and experience with the environment" and is "applied to phenomena across biological, physical, social, cultural, and spiritual systems" (DOI 2023).

The use of Indigenous Knowledge with other scientific approaches can help "generate a more holistic understanding of social and ecological processes" (DOI 2023). This science strategy acknowledges the depth of Indigenous Knowledge about Cotoni-Coast Dairies and seeks to respectfully expand consideration of local and Indigenous Knowledge over time, including in relation to awareness of sacred places or cultural resources.

Core local partners and land managers of Cotoni-Coast Dairies provided their perspectives on what constitutes science to help inform this science planning process (refer to Appendix A). To unit partners:

- "Science is a collection of facts, in a management sense, to help guide management decisions and help test hypotheses. Science informs management decisions and tells you what to do and that what you are doing is effective."
- Science is "the study of knowledge" and a "systematic way of collecting knowledge."
- Science "allows us to study natural phenomenon" and "can inform education and how people interact with the land, and how the land is managed."
- "Our people have been scientists since the very beginning. We learned about oceans, seasons, plants, and taking care of Mother Earth—because of that, we learned how to take care of water, how to take care of migrating fish, salmon, birds, and more."

1.1 Purpose of National Landscape Conservation System Science Strategies

NLCS science strategies should identify research needs and provide a foundation for incorporating physical, biological, and social science into management, decision making, and outreach (BLM 2011). The science planning process supports "identifying science needed to address management issues, communicating those needs to science providers, and incorporating the results into the decisionmaking process" (BLM 2007). BLM Manual 6220, "National Monuments, National Conservation Areas, and Similar Designations" (BLM 2017) identifies requirements for science strategy content and considerations for conducting research and using science to inform management.

The components of a science strategy are:

1. Identification of the scientific mission of the unit and the strategy for integrating science into management.
2. Summary of the scientific background of the unit.
3. Identification and prioritization of management questions and science needs.
4. Plan for meeting the unit's science needs.
5. Topics for which scientific protocols should be developed, or are in use, including authorizing and tracking research activities.
6. A description of the system for organizing scientific reports to facilitate communications within and external to the BLM.

The BLM's Central Coast Field Office, National Conservation Lands program, and U.S. Geological Survey (USGS) worked together to develop this strategy. The effort was initiated in November 2023. The project team designed the process to meet all required aspects of science strategies outlined in BLM Manual 6220 (BLM 2017) and supplemented by BLM Instruction Memorandum 2015-139 (BLM 2015). Methods for different aspects of the process are described in the relevant sections (2, 3, and 7) and in Appendix D.

Prior to this science strategy, USGS and BLM staff coordinated with multiple NLCS units, field/district/state offices, and at the national NLCS level to develop guidance for completing science strategies for NLCS units. This previous work was foundational to this effort and informed this science strategy.

1.2 Description of Cotoni-Coast Dairies

The following description of Cotoni-Coast Dairies was derived from its resource management plan amendment (BLM 2021) and the proclamations that established and expanded the California Coastal National Monument (refer to Appendices B and C). These documents can provide a more comprehensive description of the unit and the monument, its land ownership patterns, and the objects of historic and scientific interest for which the unit and monument were designated.

The California Coastal National Monument was established on January 11, 2000, by Presidential Proclamation 7264 (refer to Appendix B). The monument encompasses the entire 1,100-mile coastline of the State of California, including the reefs, islands, rocks, and pinnacles present above mean high tide within 12 nautical miles from the shoreline. Because the California coast is so long and rich in values and resources, the monument was established to protect those diverse resources, objects, and values present along the coast, including geologic features, wildlife such as seabirds and sea mammals, and the upper rocky intertidal zone.

On March 11, 2014, the first boundary enlargement for the monument occurred through Presidential Proclamation 9089. This proclamation established Point Arena-Stornetta Public Lands as the first onshore unit of the monument due to its unique geologic features, coastal bluffs and shelves, onshore dunes, coastal prairies, and water resources connected to the mouth and estuary of the Garcia River.

On January 12, 2017, the second boundary enlargement for the monument occurred through Presidential Proclamation 9563 (refer to Appendix C). This established five additional onshore units to the monument, including Trinidad Head, Waluplh-Lighthouse Ranch, Lost Coast Headlands, Piedras Blancas, and Cotoni-Coast Dairies, as well as added protections to the offshore Orange County Rocks and Islands, all of which were designated to protect the unique natural and cultural resources present along the coast. Within the proclamation, Cotoni-Coast Dairies was identified as needing a resource management plan amendment prior to opening the unit for public access.

Located in Santa Cruz County, Cotoni-Coast Dairies consists of 5,843 acres of public land and is the largest onshore unit of the monument (Figure 1). The unit is adjacent to Davenport,

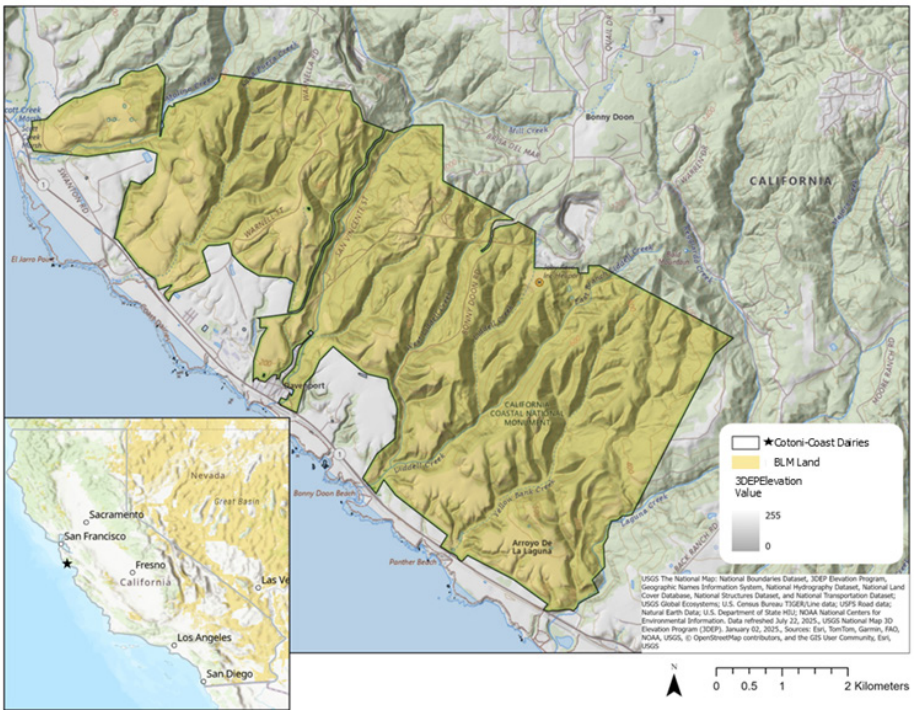

Figure 1. Map of Cotoni-Coast Dairies, an onshore unit of the California Coastal National Monument.

California, a small coastal community with a population of less than 400 people. The area known as Cotoni-Coast Dairies has a long history, and the name of the unit celebrates the habitation and use of the property, including logging, limestone quarrying, cement production, farming, and livestock grazing. Cotoni is from the Cotoni Tribelet of Ohlone, while Coast Dairies is derived from the Coast Dairies Land Co., a Swiss land and dairy operation reflecting the industry that used the landscape for over a century to produce cheese starting in the late 1800s. There are many Indigenous and historic resources on the property that are monitored, protected, and studied (Amah Mutsun Land Trust 2021).

In 1998, conservation groups along the Central Coast, including the Trust for Public Land, purchased the Coast Dairies property to protect it from future urban or industrial development. The Trust for Public Land donated most of this land to the BLM in 2014. In 2017, the Coast Dairies property was designated as a unit of the California Coastal National Monument and renamed Cotoni-Coast Dairies. Designation as a unit of a monument provided formal status as part of the NLCS. Today, visitors can see remnants of the unit's history through the historic cheese barn (Figure 2) and domesticated cattle (*Bos taurus*) allotments.

After years of planning, which included extensive conversations with the community and relevant partners, Cotoni-Coast Dairies published a resource management plan amendment to open the unit for public access (BLM 2021). Since plan approval, BLM staff from the unit and field office have worked with local partners, stewardship groups, and the broader community to develop recreation trails, natural and cultural resource interpretation, and other communication materials. The unit opened to the public in August 2025 and plans to continue its collaboration with local partners and land managers to improve understanding, interpretation, and conservation of resources (Amah Mutsun Land Trust 2021).

Figure 2. The historic cheese barn that is still present on Cotoni-Coast Dairies. Photograph by Salah Ahmed, BLM.

1.3 Cotoni-Coast Dairies Science Ethics

Cotoni-Coast Dairies is committed to providing science and research opportunities in the unit. Cotoni-Coast Dairies operates under guiding principles to encourage the advancement of science by the BLM and interested collaborators. As part of the DOI, Cotoni-Coast Dairies follows the scientific integrity and ethics policies published by the Department (DOI 2014, 2025). A guiding principle is the BLM's expectation that all research and education partners—including researchers, students, and community scientists—are committed to responsible research while maintaining high standards of professional and ethical conduct. In addition, Central Coast Field Office staff have adopted the International Academy of Science's code of ethics (International Academy of Science 2025) as a supplement to relevant federal requirements and guidance. The Society for California Archaeology (2020) Code of Ethical Guidelines are also relevant to science conducted at Cotoni-Coast Dairies.

1.4 Scientific Mission of Cotoni-Coast Dairies

Protection and understanding of the unique natural and cultural resources at Cotoni-Coast Dairies provide both an opportunity and a responsibility for scientific research. The following three points are the scientific mission of the unit:

1. Scientific inquiry is strongly encouraged at Cotoni-Coast Dairies, including science that informs management actions and increases knowledge about specific cultural and natural resources and processes.
2. Science at Cotoni-Coast Dairies is placed soundly within the context of the surrounding landscape, supporting landscape, and regional analyses that can benefit all neighboring landholders, land management entities, and communities.
3. Cotoni-Coast Dairies is poised to serve as a world-class research location, including for long-term and interdisciplinary studies, and a center for undergraduate and graduate education, field schools, and community science.

The scientific mission of the unit and the monument as a whole occurs within national and state-level contexts. At the national level, the BLM's mission for the NLCS includes four themes (BLM 2011):

Theme 1: Ensuring the conservation, protection, and restoration of NLCS values.

Theme 2: Collaboratively managing the NLCS as part of the larger landscape.

Theme 3: Raising awareness of the value and benefits of the BLM's NLCS.

Theme 4: Building upon the BLM's commitment to conservation.

Theme 1 includes three goals (of six total) that focus on science and data specifically:

Goal 1B: Expand understanding of the NLCS values through assessment, inventory, and monitoring.

Goal 1C: Provide a scientific foundation for decision making.

Goal 1D: Use the NLCS as an outdoor laboratory and demonstration center for new and innovative management and business processes that aid in the conservation, protection, and restoration of NLCS areas.

At the state level in California, the "National Conservation Lands Five-Year Strategy: 2013–2018" (BLM 2013) identified actions related to each of these three national science and data-related goals. Note, actions will be updated when a new 5-year plan is created. Under Goal 1B, these state-level actions include (paraphrased):

- Continue inventories of natural and cultural resources, including completion of trail condition assessments; inventory resources, objects, and values for which designations were established; and compare wilderness study area conditions from original inventories to assess restoration effectiveness.

- Develop data collection protocols that are consistent and repeatable across landscapes and partner boundaries.
- Work with federal, state, and local agencies to implement the BLM's Assessment, Inventory, and Monitoring (AIM) strategy, including incorporating AIM into wilderness character monitoring.
- Sponsor agreements with nongovernmental organizations to facilitate inventorying and monitoring of resources, objects, and values.
- Create citizen science programs that involve youth and local communities.
- Develop websites and strategically use social media to facilitate the reporting of monitoring data, effects to resources, and conditions of resources.
- Develop a strategy for monitoring wilderness study areas.

Under Goal 1C, state-level actions in California include (paraphrased):

- Develop a California science strategy using BLM staff and scientists that includes an assessment of landscape vulnerabilities and identifies research needs.
- Finalize inventories of natural and cultural resources.
- Prioritize research efforts that consider adaptation and mitigation actions under a changing climate and the effectiveness of management actions.
- Communicate with NLCS units from similar ecoregions and states to improve understanding of natural and sociological processes.

Under Goal 1D, state-level actions in California include (paraphrased):

- Increase citizen participation and interpretation programs available on National Conservation Lands, including through current programs such as National Public Lands Day, National Trails Day, and National Science Week.
- Expand partnerships with youth organizations to provide important fieldwork.
- Promote National Conservation Lands to universities and research partners.
- Use innovative research techniques for restoration.
- Communicate research findings to internal and external media outlets.
- Provide field school programs and other research opportunities through academic institutions.

Together these national-level goals and state-level actions provide a framework for application of the National Conservation Lands program in California and conservation, protection, and restoration of the objects that Cotoni-Coast Dairies was designated to protect.

1.5 Designated Objects for Protection at Cotoni-Coast Dairies

The scientific mission of Cotoni-Coast Dairies connects directly to the objects the unit was designated to protect. The following are objects described in the proclamation for the unit (refer to Appendix C), primarily using language taken directly from the proclamation:

- Marine coastal terraces overlooking the Pacific Ocean (Figure 3).
- Soils and vegetation that have sustained wildlife and people alike for millennia.
- Lithic scatter sites and shell middens demonstrate that inhabitants [Costanoan or Coastal People (also called the Ohlone) and the Cotoni, a tribelet of this group] moved between the coastal ecological zones and upland environments, making use of the landscape's diverse resources.
- Six perennial streams flow from the coastal mountains down to the Pacific Ocean.
- Vibrant riparian areas and wetlands found within riparian corridors and in meadows and floodplains.

Figure 3. Cotoni-Coast Dairies and its marine terraces. Photograph by Bob Wick, BLM.

- Red alder (*Alnus rubra*) and arroyo willow forests.
- Habitat for anadromous and freshwater fish, including threatened steelhead (*Oncorhynchus mykiss*) and coho salmon (*Oncorhynchus kisutch*) and the endangered tidewater goby (*Eucyclogobius newberryi*).
- Habitat for the threatened California red-legged frog (*Rana draytonii*) and a wide range of other amphibians and reptiles.
- Grasslands, scrublands, woodlands, and forests. Members of the coastal prairie grassland community, including purple needlegrass (*Nassella pulchra*) and other native species, such as California oatgrass (*Danthonia californica*) and blue wildrye (*Elymus glaucus*). Sedges, including California buttercup (*Ranunculus californicus*), brownhead rush (*Juncus phaeocephalus*), California sagebrush (or coastal sagebrush) (*Artemisia californica*), and coyote brush scrub (or coyotebrush) (*Baccharis pilularis*). Native trees, including Douglas-fir (*Pseudotsuga menziesii*) and coast live oak (or California live oak) (*Quercus agrifolia*). Coastal trees such as madrone (or Pacific madrone) (*Arbutus menziesii*), California bay (or California laurel) (*Umbellularia californica*), Monterey pine (*Pinus radiata*), knobcone pine (*Pinus attenuata*), and coast redwood (or redwood) (*Sequoia sempervirens*). Understory species, including redwood sorrel (*Oxalis oregana*) and elk clover (or California spikenard) (*Aralia californica*).
- Occasional freshwater seeps.
- A vast and varied mammalian population, including California voles (*Microtus californicus*), dusky-footed woodrats (*Neotoma fuscipes*), black-tailed jackrabbits (*Lepus californicus*), mule deer (*Odocoileus hemionus*), gray fox (*Urocyon cinereoargenteus*), bobcats (*Lynx rufus*), and mountain lions (*Puma concolor*). A variety of avian species, including black swifts (*Cypseloides niger*), orange-crowned warblers (*Leiothlypis celata*), American kestrels (*Falco sparverius*),

Cooper's hawks (*Astur cooperii*), white-tailed kites (*Elanus leucurus*), peregrine falcons (*Falco peregrinus*), Wilson's warblers (*Cardellina pusilla*), downy woodpeckers (*Dryobates pubescens*), and tree swallows (*Tachycineta bicolor*). Various bat species, including the Townsend's big-eared bat (*Corynorhinus townsendii*).

1.6 Benefits of Science Strategies and of the Process of Developing Them

A number of benefits have been identified (including in Carter et al. 2023) related to the process of developing science strategies, the science strategies themselves, and implementing the completed science strategies. Benefits include:

- Identifying and prioritizing science needs so the most pressing needs of the unit can be addressed in a timely manner with limited resources.
- Helping ensure that decision makers have access to relevant science and are familiar with the format, applicability, and limitations of that science.
- Helping guide and define management actions so that actions have the intended effect based on high-quality science information.
- Helping ensure compliance with law and policy (e.g., National Environmental Policy Act) as a result of making progress toward addressing science needs identified in the science strategy.
- Helping the unit and partners obtain funding for science and prioritize and justify efforts when seeking funding.
- Promoting BLM efforts to work with external partners and to share science results with partners and staff in a variety of mediums (e.g., newsletters, presentations, seminars).
- Connecting scientists and managers and encouraging direct dialogue between the two, including through identifying a clear science point of contact in the BLM, which can support coproduction of actionable science products (Selby et al. 2024) and help ensure scientific results are communicated to other BLM staff.
- Facilitating incorporation of the latest scientific findings into the unit's resource management plan and other BLM plans, tools, initiatives, and strategies through both development and updates to the science strategy.
- Providing opportunities to identify additional science needs as a result of using science in unit decision making.
- Serving as a consolidated resource to help train new staff on science and data needs, availability, and protocols in the unit.

1.7 Integrating Science into Management at Cotoni-Coast Dairies

A core focus of the NLCS is to use science to further conservation, protection, and restoration of NLCS resources and values (BLM 2011). Information generated through this planning process and implementation of this science strategy can inform future management actions in Cotoni-Coast Dairies, as well as updates and revisions to the resource management plan amendment for the unit. The Cotoni-Coast Dairies science point of contact is responsible for ensuring that scientific findings are communicated to the field manager and monument manager so that scientific information is used in unit management.

Integrating science into management requires scientists, managers, and partners to commit to communicating with each other. Direct communication between scientists, resource specialists, field office staff, the monument manager, BLM district office, and BLM state office is encouraged. If a researcher has identified a specific science need they are interested in addressing, they are strongly encouraged to contact the Central Coast Field Office so that they can be connected with the resource specialist best suited to assist them in

developing and funding proposals, understanding specific science needs, and connecting with management staff. The unit additionally encourages the synthesis of existing science information that could inform management decisions. If researchers have the capacity, conducting research in a coproduction framework is encouraged. Practical, easy-to-use tools are available to guide coproduction of science with BLM staff (Selby et al. 2024).

2. Scientific Background of Cotoni-Coast Dairies

2.1 Methods

This section contains information about existing science and data specific to Cotoni-Coast Dairies, gathered through a literature search of published scientific articles and reports. The literature search included a review of past inventory, planning, and environmental impact analysis work relevant to the unit. A search was also conducted of two citation indices: Web of Science and Scopus (accessed through the USGS Library). Search terms included key place names related to the unit, derived from the monument and unit proclamations (refer to Appendices B and C).

The list of search terms was refined through pilot searches using Google Scholar search engine and Web of Science. The final search phrase was:

"california coastal national monument" OR "cotoni coast dairies" OR "cotoni coast" OR "coast dairies" OR "coast dairies land and cattle company" OR "big basin redwoods state park" OR "natural bridges state beach" OR "davenport" OR "davenport landing" OR "scott creek beach" OR "bonny doon beach" OR "san vicente beach" OR "sharktooth beach" OR "panther beach" OR "hole in the wall beach" OR "scott creek bluffs" OR "wilder beach" OR "old cove landing trail" OR "fern grotto beach" OR "ohlone bluff trail" OR "table rock" OR "greyhound rock" OR "needle rock" OR "3 mile beach" OR "4 mile beach" OR "ano nuevo state seashore" OR "younger lagoon university of California natural reserve" OR "north coast rail trail" OR "san vicente redwoods" OR "santa cruz mountains" OR "monterey formation" OR "santa cruz mudstone formation" OR "santa cruz coastal terrace" OR "amah mutsun" OR "wilder ranch state park" OR "yellow bank creek" OR "laguna creek" OR "majors creek" OR "scott creek" OR "liddell creek" OR "ferrari creek" OR "agua puerca creek" OR "molino creek" OR "san vicente creek" OR "wilder creek" OR "baldwin creek" OR "steelhead trout" OR "oncorhynchus mykiss" OR "coho salmon" OR "oncorhynchus kisutch" OR "tidewater goby" OR "eucyclogobius newberryi" OR "california red-legged frog" OR "rana draytonii" OR "california newt" OR "taricha torosa" OR "california tiger salamander" OR "ambystoma californiense" OR "rough skinned newt" OR "taricha granulosa" AND "santa cruz" AND "california"

All products identified through this search were then reviewed to determine whether the research was within or overlapping current unit boundaries or included notable landmark names found within or adjacent to the unit. The following products were excluded: photographs, drawings, primary cultural or historical documents (e.g., collections related to historical onsite development), and documents unavailable online (e.g., older publications).

2.2 Scientific Studies, Inventory, and Monitoring in Cotoni-Coast Dairies

Cotoni-Coast Dairies has been the site of only a handful of biological, physical, and cultural studies since its recent designation and name change in 2017. Because of this, the scientific background review includes publications with notable landmark names found within or adjacent to the unit (e.g., Santa Cruz Mountains, Scott Creek) and resources compiled by the Central Coast Field Office staff that have previous names and other relevant locations such as "Coast Dairies" and "Central Coast." The following sections briefly describe the types of research, by resource, that have occurred on or near Cotoni-Coast Dairies and list their citations.

2.3 Landscape-Scale Studies in the Central Coast

The Central Coast of California, which includes landmarks such as the Santa Cruz Mountains and Cotoni-Coast Dairies, has a unique history of landscape-scale research efforts that vary in topics and complexity. Given the proximity of urban areas to the Central Coast, in addition to its soils and geology, researchers have worked to determine the potential effects of environmental change on future land uses, landscape weathering, species, and water availability (Van Schmidt et al. 2023; White et al. 2008; Yovovich et al. 2020; Turner et al. 2021; Reilly et al. 2015; Beakes et al. 2014; Sakuma et al. 2013). The vegetation types of the Central Coast provide rich habitat for various species and multiple land uses, including grazing (Bartolome et al. 2014; Baker et al. 2006; Willett 2001). Water quantity and quality is of particular concern, especially for rare, threatened, and endangered species present along the coast (Chartrand et al. 2015; Deitch et al. 2018; Osterback et al. 2018; Nicol et al. 2015). Citations for these studies are:

Baker, L.M., M.Z. Peery, E.E. Burkett, S.W. Singer, D.L. Suddjian, and S.R. Beissinger. 2006. Nesting habitat characteristics of the marbled murrelet in central California redwood forests. The Journal of Wildlife Management 70 (4): 939–946.

Bartolome, J.W., B.H. Allen-Diaz, S. Barry, L.D. Ford, M. Hammond, P. Hopkinson, F. Ratcliff, S. Spiegal, and M.D. White. 2014. Grazing for biodiversity in Californian Mediterranean grasslands. Rangelands 36 (5): 36–43.

Beakes, M.P., J.W. Moore, S.A. Hayes, and S.M. Sogard. 2014. Wildfire and the effects of shifting stream temperature on salmonids. Ecosphere 5 (5): 1–14.

Chartrand, S.M., M.A. Hassan, and V. Radić. 2015. Pool-riffle sedimentation and surface texture trends in a gravel bed stream. Water Resources Research 51 (11): 8704–8728.

Deitch, M.J., M. Van Docto, M. Obedzinski, S.P. Nossaman, and A. Bartshire. 2018. Impact of multi-annual drought on streamflow and habitat in coastal California salmonid streams. Hydrological Sciences Journal 63 (8): 1219–1235.

Nicol, C.L., D.P. Smith, and F.G.R. Watson. 2015. Exploring particle density effects on partial mobility of steelhead spawning gravels. River Research and Applications 31 (1): 62–69.

Osterback, A-M.K., C.H. Kern, E.A. Kanawi, J.M. Perez, and J.D. Kiernan. 2018. The effects of early sandbar formation on the abundance and ecology of coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*) in a central California coastal lagoon. Canadian Journal of Fisheries and Aquatic Sciences 75 (12): 2184–2197.

Reilly, S.B., A. Corl, and D.B. Wake. 2015. An integrative approach to phylogeography: Investigating the effects of ancient seaways, climate, and historical geology on multi-locus phylogeographic boundaries of the Arboreal Salamander (*Aneides lugubris*). BMC Evolutionary Biology 15 (241): 1–17.

Sakuma, K.M., E.P. Bjorkstedt, and S. Ralston. 2013. Distribution of pelagic juvenile rockfish (*Sebastes* spp.) in relation to temperature and fronts off central California. California Cooperative Oceanic Fisheries Investigations Reports 54: 167–179.

Turner, N.B., G.B. Bentall, C. Young, A.B. Johnson, and W.G. Standley. 2021. The Respect Wildlife Campaign: A collaborative effort to reduce human disturbance to California's coastal wildlife. California Fish and Wildlife 107 (3): 284–294.

Van Schmidt, N.D., T.S. Wilson, L.E. Flint, and R. Langridge. 2023. Trade-offs in adapting to changes in climate, land use, and water availability in California. Ecology and Society 28 (4).

White, A.F., M.S. Schulz, D.V. Vivit, A.E. Blum, D.A. Stonestrom, and S.P. Anderson. 2008. Chemical weathering of a marine terrace chronosequence, Santa Cruz, California I: Interpreting rates and controls based on soil concentration–depth profiles. Geochimica et Cosmochimica Acta 72 (1): 36–68.

Willett, T.R. 2001. Spiders and other arthropods as indicators in old-growth versus logged

redwood stands. Restoration Ecology 9 (4): 410–420.

Yovovich, V., M.L. Allen, L.T. Macaulay, and C.C. Wilmers. 2020. Using spatial characteristics of apex carnivore communication and reproductive behaviors to predict responses to future human development. Biodiversity and Conservation 29: 2589–2603.

2.4 Archaeological, Cultural, and Historic Resources

The Amah Mutsun Tribal Band has historic roots along the Central Coast (Gomez 2024). Studies have assessed the historic food and plant sources used by Indigenous peoples (Marks-Block et al. 2019, 2021; Bowcutt 2013), including their use of burning, tilling, and gathering to promote land stewardship (Cuthrell 2013; Taylor et al. 2023; Fine et al. 2013; Marks-Block and Tripp 2021; Souther et al. 2023; Marks-Block 2020; Immel 2007). One study assessed the status of cultural resources present along the Central Coast, including how resources may be threatened by coastal erosion (Sanchez et al. 2021). Citations for these studies are:

Bowcutt, F. 2013. Tanoak landscapes: Tending a Native American nut tree. Madroño 60 (2): 64–86.

Cuthrell, R.Q. 2013. Archaeobotanical evidence for Indigenous burning practices and foodways at CA-SMA-113. California Archaeology 5 (2): 265–290.

Fine, P.V.A., T.M. Misiewicz, A.S. Chavez, and R.Q. Cuthrell. 2013. Population genetic structure of California hazelnut, an important food source for people in Quiroste Valley in the Late Holocene. California Archaeology 5 (2): 353–370.

Gomez, A.R. 2024. (Re)riteing the land: Sogorea Te' Land Trust, Amah Mutsun Land Trust, and Indigenous resurgence in California. American Indian Culture and Research Journal 47 (2): 1–20.

Immel, D.L. 2007. Two Research Approaches to Ecocultural Restoration in California: Experimental Reintroduction of Showy Indian Clover and Reconstructing an Ethnobotany of the Salinan Tribe. Ph.D. dissertation. University of California, Davis.

Marks-Block, T.A. 2020. Karuk and Yurok Prescribed Cultural Fire Revitalization in California's Klamath Basin: Socio-Ecological Dynamics and Political Ecology of Indigenous Burning and Resource Management. Ph.D. dissertation. Stanford University, Department of Anthropology.

Marks-Block, T., and W. Tripp. 2021. Facilitating prescribed fire in northern California through Indigenous governance and interagency partnerships. Fire 4 (3): 37.

Marks-Block, T., F.K. Lake, and L.M. Curran. 2019. Effects of understory fire management treatments on California Hazelnut, an ecocultural resource of the Karuk and Yurok Indians in the Pacific Northwest. Forest Ecology and Management 450: 117517.

Marks-Block, T., F.K. Lake, R. Bliege Bird, and L.M. Curran. 2021. Revitalized Karuk and Yurok cultural burning to enhance California hazelnut for basketweaving in northwestern California, USA. Fire Ecology 17 (6): 1–20.

Sanchez, G.M., M.A. Grone, A.J. Apodaca, R.S. Byram, V. Lopez, and R.A. Jewett. 2021. Sensing the past: Perspectives on collaborative archaeology and ground penetrating radar techniques from coastal California. Remote Sensing 13 (2): 285.

Souther, S., S. Colombo, and N.N. Lyndon. 2023. Integrating traditional ecological knowledge into US public land management: Knowledge gaps and research priorities. Frontiers in Ecology and Evolution 11: 988126.

Taylor, A., A. Sigona, and M. Kelly. 2023. Modeling spatial distributions of Amah Mutsun priority cultural plants to support Indigenous cultural revitalization. Ecosphere 14 (1): e4374.

2.5 Changing Environmental Conditions

Climate science along the Central Coast has primarily focused on marine fog, clouds, and air quality chemistry (Weiss-Penzias et al.

2018, 2019; Schneider et al. 1998; Sawaske and Freyberg 2015). The USGS published a climate vulnerability assessment for two other onshore units of the California Coastal National Monument (Thorne et al. 2021), and a nonprofit produced a climate vulnerability assessment for the Santa Cruz Mountains (EcoAdapt 2021). More specifically, the California Department of Fish and Wildlife published a climate vulnerability assessment for terrestrial vegetation (Thorne et al. 2016), and others assessed how plant phenology along the Central Coast may shift under changing environmental conditions (Oshiro 2017). Another resource includes simulations of climate effects on the area and its surrounding watershed (Flint and Flint 2012). Citations for these studies are:

EcoAdapt. 2021. Santa Cruz Mountains Climate Change Vulnerability Assessment and Adaptation Strategies Synthesis Report. EcoAdapt, Bainbridge Island, WA.

Flint, L.E., and A.L. Flint. 2012. Simulation of Climate Change in San Francisco Bay Basins, California: Case Studies in the Russian River Valley and Santa Cruz Mountains. Scientific Investigations Report 2012–5132. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.

Oshiro, J. 2017. Plant Phenology, Climate and Climate Change. Ph.D. dissertation. University of California, Santa Cruz.

Sawaske, S.R., and D.L. Freyberg. 2015. Fog, fog drip, and streamflow in the Santa Cruz Mountains of the California Coast Range. Ecohydrology 8 (4): 695–713.

Schneider, M., O. Luxenhofer, A. Deissler, and K. Ballschmiter. 1998. C_1–C_{15} alkyl nitrates, benzyl nitrate, and bifunctional nitrates: Measurements in California and south Atlantic air and global comparison using C_2Cl_4 and $CHBr_3$ as marker molecules. Environmental Science & Technology 32 (20): 3055–3062.

Thorne, J.H., R.M. Boynton, A.J. Holguin, J.A.E. Stewart, and J. Bjorkman. 2016. A Climate Change Vulnerability Assessment of California's Terrestrial Vegetation. California Department of Fish and Wildlife, Sacramento, CA.

Thorne, K.M., C.M. Freeman, K. Buffington, and S.E.W. De La Cruz. 2021. Climate Change Vulnerability Assessment for the California Coastal National Monument: Trinidad and Point Arena-Stornetta Units. Open-File Report 2021-1050. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.

Weiss-Penzias, P., A. Sorooshian, K. Coale, W. Heim, E. Crosbie, H. Dadashazar, A.B. MacDonald, Z. Wang, and H. Jonsson. 2018. Aircraft measurements of total mercury and monomethyl mercury in summertime marine stratus cloudwater from coastal California, USA. Environmental Science & Technology 52 (5): 2527–2537.

Weiss-Penzias, P.S., M.S. Bank, D.L. Clifford, A. Torregrosa, B. Zheng, W. Lin, and C.C. Wilmers. 2019. Marine fog inputs appear to increase methylmercury bioaccumulation in a coastal terrestrial food web. Scientific Reports 9: 17611.

2.6 Geology, Geologic Maps, and Paleontology

As the largest landform to affect landscape changes along the Central Coast, the geology of the Santa Cruz Mountains has been studied extensively (Baden et al. 2022, 2024; Anderson 1990; Valensise and Ward 1991; Schwartz et al. 1998; Gudmundsdottir et al. 2013; Clark 1981). Other landforms that are unique to the Central Coast, such as marine terraces, have received some attention (Rosenbloom and Anderson 1994; Matsumoto et al. 2022; Anderson et al. 1999; Bradley 1956, 1957; Bradley and Addicott 1968). Previous research assessed causes of the 1989 Loma Prieta earthquake (Kasai and Maison 1997; Phelps et al. 2015; Huang et al. 2016), in addition to other historic, less severe earthquake events (Prentice and Ponti 1997; Lindley and Archuleta 1992; Foxall et al. 1993; Streig et al. 2014; Tuttle and Sykes 1992; Toppozada et al. 2002). Some publications have examined the causes of landslides (Wills and McCrink 2002; Xu et al. 1996), sediment transportation (Sherry et al. 2012; Finnegan et al. 2017; Xu et al. 2002; Perg et al. 2003), and faults along the Central Coast (Boehm and Moore 2002; Schmidt and Montgomery 1995; Horns and Verosub 1995;

Weber and Allwardt 2001). One study assessed the hydrocarbon geochemistry of cold seeps near Davenport, a town adjacent to Cotoni-Coast Dairies (Lorenson et al. 2002). There are a few paleontology studies on plant and marine fossils present in the area (Muhs et al. 2006; Leslie et al. 2019; Cowart and Byrne 2013), including an assessment of the effects of climate and human land use on historic vegetation and fire regimes (Cowart 2014) and a study defining the age of marine terraces (Perg et al. 2001). Citations for these studies are:

Anderson, R.S. 1990. Evolution of the northern Santa Cruz Mountains by advection of crust past a San Andreas fault bend. Science 249 (4967): 397–401.

Anderson, R.S., A.L. Densmore, and M.A. Ellis. 1999. The generation and degradation of marine terraces. Basin Research 11: 7–19.

Baden, C.W., D.L. Shuster, F. Aron, J.C. Fosdick, R. Bürgmann, and G.E. Hilley. 2022. Bridging earthquakes and mountain building in the Santa Cruz Mountains, CA. Science Advances 8 (8): eabi6031.

Baden, C.W., D.L. Shuster, J.H. Hourigan, J.T. Gooley, M.R. Cahill, and G.E. Hilley. 2024. Crustal block-controlled contrasts in deformation, uplift, and exhumation in the Santa Cruz Mountains, California, USA, imaged through apatite (U-Th)/He thermochronology and 3-D geological modeling. Geological Society of America Bulletin 136 (7-8): 2789–2814.

Boehm, A., and J.C. Moore. 2002. Fluidized sandstone intrusions as an indicator of Paleostress orientation, Santa Cruz, California. Geofluids 2 (2): 147–161.

Bradley, W.C. 1956. Carbon-14 date for a marine terrace at Santa Cruz, California. Geological Society of America Bulletin 67 (5): 675–678.

Bradley, W.C. 1957. Origin of marine-terrace deposits in the Santa Cruz area, California. Geological Society of America Bulletin 68 (4): 421–444.

Bradley, W.C., and W.O. Addicott. 1968. Age of first marine terrace near Santa Cruz, California. Geological Society of America Bulletin 79 (9): 1203–1210.

Clark, J.C. 1981. Stratigraphy, Paleontology, and Geology of the Central Santa Cruz Mountains, California Coast Ranges. Geological Survey Professional Paper 1168. U.S. Department of the Interior, U.S. Geological Survey, Washington, DC.

Cowart, A.D. 2014. Paleoenvironmental Change in Central California in the Late Pleistocene and Holocene: Impacts of Climate Change and Human Land Use on Vegetation and Fire Regimes. Ph.D. dissertation. University of California, Berkeley.

Cowart, A., and R. Byrne. 2013. A paleolimnological record of Late Holocene vegetation change from the central California coast. California Archaeology 5 (2): 337–352.

Finnegan, N.J., R.A. Klier, S. Johnstone, A.M. Pfeiffer, and K. Johnson. 2017. Field evidence for the control of grain size and sediment supply on steady-state bedrock river channel slopes in a tectonically active setting. Earth Surface Processes and Landforms 42 (14): 2338–2349.

Foxall, W., A. Michelini, and T.V. McEvilly. 1993. Earthquake travel time tomography of the southern Santa Cruz Mountains: Control of fault rupture by lithological heterogeneity of the San Andreas fault zone. Journal of Geophysical Research: Solid Earth 98 (B10): 17691–17710.

Gudmundsdottir, M.H., K. Blisniuk, Y. Ebert, N.M. Levine, D.H. Rood, A. Wilson, and G.E. Hilley. 2013. Restraining bend tectonics in the Santa Cruz Mountains, California, imaged using ^{10}Be concentrations in river sands. Geology 41 (8): 843–846.

Horns, D.M., and K.L. Verosub. 1995. Paleomagnetic investigation of late Neogene vertical axis rotation and remagnetization in central coastal California. Journal of Geophysical Research: Solid Earth 100 (B3): 3873–3884.

Huang, M.H., R. Bürgmann, and F. Pollitz. 2016. Lithospheric rheology constrained from twenty-five years of postseismic deformation following the 1989 Mw 6.9 Loma Prieta earthquake. Earth and Planetary Science Letters 435: 147–158.

Kasai, K., and B.F. Maison. 1997. Building pounding damage during the 1989 Loma Prieta earthquake. Engineering Structures 19 (3): 195–207.

Leslie, M.S., C.M. Peredo, and N.D. Pyenson. 2019. *Norrisanima miocaena*, a new generic name and redescription of a stem balaenopteroid mysticete (Mammalia, Cetacea) from the Miocene of California. PeerJ 7: e7629.

Lindley, G.T., and R.J. Archuleta. 1992. Earthquake source parameters and the frequency dependence of attenuation at Coalinga, Mammoth Lakes, and the Santa Cruz Mountains, California. Journal of Geophysical Research: Solid Earth 97 (B10): 14137–14154.

Lorenson, T.D., K.A. Kvenvolden, F.D. Hostettler, R.J. Rosenbauer, D.L. Orange, and J.B. Martin. 2002. Hydrocarbon geochemistry of cold seeps in the Monterey Bay National Marine Sanctuary. Marine Geology 181 (1–3): 285–304.

Matsumoto, H., A.P. Young, and J.E. Carilli. 2022. Modeling the relative influence of environmental controls on marine terrace widths. Geomorphology 396: 107986.

Muhs, D.R., K.R. Simmons, G.L. Kennedy, K.R. Ludwig, and L.T. Groves. 2006. A cool eastern Pacific Ocean at the close of the Last Interglacial complex. Quaternary Science Reviews 25 (3–4): 235–262.

Perg, L.A., R.S. Anderson, and R.C. Finkel. 2001. Use of a new ^{10}Be and ^{26}Al inventory method to date marine terraces, Santa Cruz, California, USA. Geology 29 (10): 879–882.

Perg, L.A., R.S. Anderson, and R.C. Finkel. 2003. Use of cosmogenic radionuclides as a sediment tracer in the Santa Cruz littoral cell, California, United States. Geology 31 (4): 299–302.

Phelps, G.A., K.M. Schmidt, and M. Barall. 2015. Comparison of 1989 Loma Prieta earthquake damage to mapped lineaments along the range front of the Santa Cruz Mountains, California. Geosphere 11 (2): 342–353.

Prentice, C.S., and D.J. Ponti. 1997. Coseismic deformation of the Wrights tunnel during the 1906 San Francisco earthquake: A key to understanding 1906 fault slip and 1989 surface ruptures in the southern Santa Cruz Mountains, California. Journal of Geophysical Research: Solid Earth 102 (B1): 635–648.

Rosenbloom, N.A., and R.S. Anderson. 1994. Hillslope and channel evolution in a marine terraced landscape, Santa Cruz, California. Journal of Geophysical Research: Solid Earth 99 (B7): 14013–14029.

Schmidt, K.M., and D.R. Montgomery. 1995. Limits to relief. Science 270 (5236): 617–620.

Schwartz, D.P., D. Pantosti, K. Okumura, T.J. Powers, and J.C. Hamilton. 1998. Paleoseismic investigations in the Santa Cruz mountains, California: Implications for recurrence of large-magnitude earthquakes on the San Andreas Fault. Journal of Geophysical Research: Solid Earth 103 (B8): 17985–18001.

Sherry, T.J., C.D. Rowe, J.D. Kirkpatrick, and E.E. Brodsky. 2012. Emplacement and dewatering of the world's largest exposed sand injectite complex. Geochemistry, Geophysics, Geosystems 13 (8).

Streig, A.R., T.E. Dawson, and R.J. Weldon. 2014. Paleoseismic evidence of the 1890 and 1838 earthquakes on the Santa Cruz Mountains section of the San Andreas fault, near Corralitos, California. Bulletin of the Seismological Society of America 104 (1): 285–300.

Toppozada, T.R., D.M. Branum, M.S. Reichle, and C.L. Hallstrom. 2002. San Andreas fault zone, California: M ≥5.5 earthquake history. Bulletin of the Seismological Society of America 92 (7): 2555–2601.

Tuttle, M.P., and L.R. Sykes. 1992. Re-evaluation of several large historic earthquakes in the vicinity of the Loma Prieta and peninsular segments of the San Andreas fault, California. Bulletin of the Seismological Society of America 82 (4): 1802–1820.

Valensise, G., and S.N. Ward. 1991. Long-term uplift of the Santa Cruz coastline in response to repeated earthquakes along the San Andreas fault. Bulletin of the Seismological Society of America 81 (5): 1694–1704.

Weber, G.E., and A.O. Allwardt. 2001. The Geology from Santa Cruz to Point Año Nuevo—The San Gregorio Fault Zone and Pleistocene Marine

Terraces. pp. 1–32. In: Stoffer, P.W., and L.C. Gordon, eds. Geology and Natural History of the San Francisco Bay Area: A Field-Trip Guidebook. U.S. Geological Survey Bulletin 2188. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.

Wills, C.J., and T.P. McCrink. 2002. Comparing landslide inventories: The map depends on the method. Environmental & Engineering Geoscience 8 (4): 279–293.

Xu, Z., S.Y. Schwartz, and T. Lay. 1996. Seismic wave-field observations at a dense, small-aperture array located on a landslide in the Santa Cruz Mountains, California. Bulletin of the Seismological Society of America 86 (3): 655–669.

Xu, J.P., M. Noble, and S.L. Eittreim. 2002. Suspended sediment transport on the continental shelf near Davenport, California. Marine Geology 181 (1–3): 171-193.

2.7 Soils

Several soil studies available for the Central Coast assessed the soil chemistries and weathering rates present within marine terrace grassland systems (Balan et al. 2023; Moore et al. 2010; Maher et al. 2009; Munster and Harden 2002; Pinney et al. 2002; Schulz et al. 2010, 2011, 2016, 2018; Tipper et al. 2010; White et al. 2006, 2012a, 2012b; Lawrence et al. 2021). A couple of studies addressed changes to soil characteristics in response to wildfire disturbance (Niebrugge 2012; Crable 2014). One paper described general soil surveys conducted along the Central Coast during the twentieth century (Bowman and Estrada 1980). Citations for these studies are:

Balan, S.A., H. Welsh, and R. Amundson. 2023. Comparative C, N, and S cycling along a Californian grassland chronosequence. Geoderma 439: 116682.

Bowman, R.H., and D.C. Estrada. 1980. Soil Survey of Santa Cruz County, California. National Cooperative Soil Survey.

Crable, M.T. 2014. Evaluating Five Years of Soil Hydrologic Response Following the 2009 Lockheed Fire in the Coastal Santa Cruz Mountains of California. Master's thesis. California Polytechnic State University, San Luis Obispo.

Lawrence, C.R., M.S. Schulz, C.A. Masiello, O.A. Chadwick, and J.W. Harden. 2021. The trajectory of soil development and its relationship to soil carbon dynamics. Geoderma 403: 115378.

Maher, K., C.I. Steefel, A.F. White, and D.A. Stonestrom. 2009. The role of reaction affinity and secondary minerals in regulating chemical weathering rates at the Santa Cruz Soil Chronosequence, California. Geochimica et Cosmochimica Acta 73 (10): 2804–2831.

Moore, J., J.L. Macalady, M.S. Schulz, A.F. White, and S.L. Brantley. 2010. Shifting microbial community structure across a marine terrace grassland chronosequence, Santa Cruz, California. Soil Biology and Biochemistry 42 (1): 21–31.

Munster, J., and J.W. Harden. 2002. Physical Data of Soil Profiles Formed on Late Quaternary Marine Terraces Near Santa Cruz, California. Open-File Report 2002-316. U.S. Department of the Interior, U.S. Geological Survey.

Niebrugge, L.K. 2012. Assessment of site and soil characteristics of rill erosion following the Lockheed Fire in the Little Creek Watershed, Swanton Pacific Ranch. Master's thesis. California Polytechnic State University, San Luis Obispo.

Pinney, C., J. Aniku, R. Burke, J. Harden, M. Singer, and J. Munster. 2002. Soil Chemistry and Mineralogy of the Santa Cruz Coastal Terraces. Open-File Report 2002-277. U.S. Department of the Interior, U.S. Geological Survey.

Schulz, M.S., D. Vivit, C. Schulz, J. Fitzpatrick, and A. White. 2010. Biologic origin of iron nodules in a marine terrace chronosequence, Santa Cruz, California. Soil Science Society of America Journal 74 (2): 550–564.

Schulz, M., D. Stonestrom, G. Von Kiparski, C. Lawrence, C. Masiello, A. White, and J. Fitzpatrick. 2011. Seasonal dynamics of CO_2 profiles across a soil chronosequence, Santa Cruz, California. Applied Geochemistry 26: S132–S134.

Schulz, M., D. Stonestrom, C. Lawrence, T. Bullen, J. Fitzpatrick, E. Kyker-Snowman, J. Manning, and M. Mnich. 2016. Structured heterogeneity in a marine terrace chronosequence: Upland mottling. Vadose Zone Journal 15 (2): 1–14.

Schulz, M., C. Lawrence, D. Muhs, C. Prentice, and S. Flanagan. 2018. Landscape from the Waves—Marine Terraces of California. Fact Sheet 2018–3002 U.S. Department of the Interior, U.S. Geological Survey.

Tipper, E.T., J. Gaillardet, P. Louvat, F. Capmas, and A.F. White. 2010. Mg isotope constraints on soil pore-fluid chemistry: Evidence from Santa Cruz, California. Geochimica et Cosmochimica Acta 74 (14): 3883–3896.

White, A.F., M.S. Schulz, D.V. Vivit, A.E. Blum, and D.A. Stonestrom. 2006. Controls on soil pore water solutes: An approach for distinguishing between biogenic and lithogenic processes. Journal of Geochemical Exploration 88 (1–3): 363–366.

White, A.F., D.V. Vivit, M.S. Schulz, T.D. Bullen, R.R. Evett, and J. Aagarwal. 2012a. Biogenic and pedogenic controls on Si distributions and cycling in grasslands of the Santa Cruz soil chronosequence, California. Geochimica et Cosmochimica Acta 94: 72–94.

White, A.F., M.S. Schulz, D.V. Vivit, T.D. Bullen, and J. Fitzpatrick. 2012b. The impact of biotic/abiotic interfaces in mineral nutrient cycling: A study of soils of the Santa Cruz chronosequence, California. Geochimica et Cosmochimica Acta 77: 62–85.

2.8 Vegetation

The diversity of vegetation types present along the Central Coast is reflected in a wide range of studies on vegetation in the region. As one of the iconic species present in the area, multiple publications are specific to redwoods (Francis et al. 2020; Carroll et al. 2014; Katuna et al. 2024; Oba 2021), including studies that assessed the effects of fire and changing environmental conditions on the species (Jones and Russell 2015; Cowman and Russell 2021; Mahdizadeh and Russell 2021; Lorimer et al. 2009; Potter 2023; Lazzeri-Aerts and Russell 2014; Woodward 2021; Striplen 2014; Lazzeri-Aerts 2011). Many studies highlight the importance of coastal grasslands, including different methods for restoring grassland (Barry et al. 2006; Potts et al. 2012; Buisson et al. 2008; Corbin and D'Antonio 2004; Evett and Bartolome 2013; Fick and Evett 2018; Hektner and Foin 1977; Nolan 2021; Stromberg et al. 2001; Ford and Hayes 2007) and riparian species (Lennox et al. 2011). A few publications refer to forests and other vegetation resources broadly (Gilbert et al. 2010; Kenny 2020; Thomas 1958), including forests in the Santa Cruz Mountains facing disturbance (Potter 2016). Other papers more broadly highlight grassland systems (Hopkins 1987; Hayes and Holl 2003, 2011) and Douglas-fir populations (Griffith et al. 2015) along the Central Coast. Other studies address invasive species, including Cape ivy (*Delairea odorata*) (Robison 2006; Robison and DiTomaso 2010), French broom (*Genista monspessulana*) (Alexander and D'Antonio 2003a, 2003b; DiTomaso et al. 2006; Herrera 2009), eucalyptus (*Eucalyptus* spp.) (Fork et al. 2015), Monterey pine (*Pinus radiata*) (Ferchaw et al. 2013; Millar 1999), Monterey cypress (*Hesperocyparis macrocarpa*) (Griffin 1972), and *Phytophthora ramorum*, a pathogen known to cause sudden oak death (Garbelotto et al. 2003, 2020; Gillis 2014). Many papers highlight the intersection between disturbances (e.g., grazing, recreation) and plant management strategies, including fuels mitigation (Ratcliff et al. 2022; Lesage et al. 2022; Holl et al. 2014a, 2014b; Luong and Loik 2021; Holl et al. 2021; Luong et al. 2023; Hayes 2002; Fehmi and Bartolome 2003; Hopkinson et al. 2020; Skaer et al. 2013; Lesage 2020; Luong 2022; Hatch et al. 1999; Bartolome et al. 2004; Moyes et al. 2005; Merriam et al. 2006). A couple of papers focus on rare, endemic, threatened, or endangered plant species found along the Central Coast, but not within the unit's boundaries (Kluse and Doak 1999; del Valle et al. 2020), and one paper describes the water use and evapotranspiration of forest systems (Solum and Malama 2022). Table 1 shows plant inventory datasets and community science tools used by Central Coast Field Office staff.

Table 1. Inventory and monitoring data sources for vegetation resources relevant to Cotoni-Coast Dairies.

Resource or Database	Types of Relevant Data	Status of Data
Calflora (available at calflora.org)	Plant occurrence data, including photographs, observer, date of record, and county.	Ongoing data collection beginning in 2022 by BLM staff
iNaturalist (available at inaturalist.org)	Species occurrence data, including photographs, observer, date of record, and county. Note: This database includes data for any type of species and is not limited to vegetation.	Periodic data available since 2011

Citations for these studies are:

Alexander, J.M., and C.M. D'Antonio. 2003a. Control methods for the removal of French and Scotch broom tested in coastal California. Ecological Restoration 21 (3): 191–198.

Alexander, J.M., and C.M. D'Antonio. 2003b. Seed bank dynamics of French broom in coastal California grasslands: Effects of stand age and prescribed burning on control and restoration. Restoration Ecology 11 (2): 185–197.

Barry, S., S. Larson, and M. George. 2006. California native grasslands: A historical perspective. Grasslands (Winter 2006): 7–11.

Bartolome, J.W., J.S. Fehmi, R.D. Jackson, and B. Allen-Diaz. 2004. Response of a native perennial grass stand to disturbance in California's coast range grassland. Restoration Ecology 12 (2): 279–289.

Buisson, E., S. Anderson, K.D. Holl, E. Corcket, G.F. Hayes, A. Peeters, and T. Dutoit. 2008. Reintroduction of *Nassella pulchra* to California coastal grasslands: Effects of topsoil removal, plant neighbour removal and grazing. Applied Vegetation Science 11 (2): 195–204.

Carroll, A.L., S.C. Sillett, and R.D. Kramer. 2014. Millennium-scale crossdating and inter-annual climate sensitivities of standing California redwoods. PLOS One 9 (7): e102545.

Corbin, J.D., and C.M. D'Antonio. 2004. Competition between native perennial and exotic annual grasses: Implications for an historical invasion. Ecology 85 (5): 1273–1283.

Cowman, D., and W. Russell. 2021. Fuel load, stand structure, and understory species composition following prescribed fire in an old-growth coast redwood (*Sequoia sempervirens*) forest. Fire Ecology 17: 1–13.

del Valle, J.C., J.A. Herman, and J.B. Whittall. 2020. Genome skimming and microsatellite analysis reveal contrasting patterns of genetic diversity in a rare sandhill endemic (*Erysimum teretifolium*, Brassicaceae). PLOS One 15 (5): e0227523.

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2.9 Water Resources

Water resource-related studies available for the Central Coast highlight stream-aquifer connectivity challenges present within a local watershed (Malama et al. 2021) and variations in flood severity across Santa Cruz Mountains watersheds during a 1998 flooding event (Ralph et al. 2003). One study examined how ocean current patterns on the continental shelf near Davenport, California, responded to the 1997–1998 El Niño phenomenon (Ryan and Noble 2005). Additional studies with cross-cutting themes (e.g., wildlife, vegetation) are listed in section 2.3, "Landscape-Scale Studies in the Central Coast." Citations for the water resources studies are:

Malama, B., D. Pritchard-Peterson, J.J. Jasbinsek, and C. Surfleet. 2021. Assessing stream-aquifer connectivity in a coastal California watershed. Water 13 (4): 416.

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2.10 Wildlife, Including BLM Sensitive and Federally Protected Terrestrial, Aquatic, and Avian Species

The Central Coast is known for its diversity of terrestrial and aquatic wildlife species. Many studies have assessed the status of salmonid populations (Pfeiffer and Finnegan 2017; Searcy et al. 2022; Hayes et al. 2004; Osterback et al. 2018; Sawaske 2014; National Marine Fisheries Service 2016, 2023), including the impacts of avian predation patterns (Frechette et al. 2013). Genomic studies, including the use of

environmental DNA (eDNA) methods, have been a common approach for documenting salmonid populations across the Central Coast and its perennial streams (Martínez et al. 2011; Pregler et al. 2023; Apgar et al. 2017; Barnett and Spence 2011; Aguilar and Garza 2008). Many studies specific to steelhead (*Oncorhynchus mykiss*) have been conducted (Ohms et al. 2022, 2024; Bond et al. 2008, 2022; Sogard et al. 2012; Hayes et al. 2008, 2011; Rundio and Lindley 2019; Osterback et al. 2014; Garza et al. 2014; Beakes et al. 2010; Satterthwaite et al. 2009, 2012), including behavioral studies (Pipal et al. 2012; Hayes et al. 2012). Coho salmon (*Oncorhynchus kisutch*) have also received attention (Kaczynski and Alvarado 2006), including through studies that tracked populations using eDNA methods (Bond et al. 2019; Spence et al. 2021). Beyond salmonids, one study assessed the population status of the threespine stickleback (*Gasterosteus aculeatus*) (Wasserman et al. 2020).

While fish species have received a fair amount of research attention along the Central Coast, other aquatic wildlife species, such as salamanders (e.g., California tiger salamander (*Ambystoma californiense*), Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*)) (Keller et al. 2021; Miller et al. 2024), California mussel (*Mytilus californianus*) (Mislan et al. 2014), and California red-legged frog (*Rana draytonii*) (Spranger et al. 2024; Bulger et al. 2003), have also been studied. Research on birds, such as Monterey hermit thrushes (*Catharus guttatus slevini*) and marbled murrelets (*Brachyramphus marmoratus*), is also available (Singer et al. 1991; Nelson et al. 2021; Felis et al. 2023), including methods-specific studies for monitoring populations (Borker et al. 2015) and assessments of species interactions between birds and fish (Frechette et al. 2012, 2013, 2015; Osterback et al. 2013).

Terrestrial wildlife studies have predominantly focused on mountain lion (*Puma concolor*) populations living in the Santa Cruz Mountains (Nisi et al. 2022a, 2022b, 2023; Suraci et al. 2019; Gray et al. 2016; Allen et al. 2024; Wang et al. 2015a, 2015b, 2017; Dunford et al. 2020). One study researched the population dynamics of other mesopredators found along the Central Coast, including bobcats (*Lynx rufus*), striped skunks (*Mephitis mephitis*), and Virginia opossums (*Didelphis virginiana*) (Reilly et al. 2022), while another assessed the coast for potential suitable habitat for tule elk (*Cervus canadensis nannodes*) (Connor et al. 2023). Studies are also available on the status of smaller wildlife species, such as the house mouse (*Mus musculus*) (Jones and Law 2018), butterflies (including the monarch butterfly, *Danaus plexippus*) (Pellet 2008; Longcore et al. 2020; Saniee and Villablanca 2022; Griffiths and Villablanca 2015; Fisher et al. 2018; Dingle et al. 2005; Griffiths 2014), and the Ohlone tiger beetle (*Cicindela ohlone*) (Cornelisse and Duane 2013; Cornelisse 2013; Knisley and Arnold 2013). Citations for these wildlife studies are:

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3. Science Needs and Management Questions for Cotoni-Coast Dairies

3.1 Methods for Identifying and Prioritizing Science Needs

This section presents the science needs that were identified for Cotoni-Coast Dairies. To identify potential science needs related to resources, objects, and values for Cotoni-Coast Dairies, structured brainstorming sessions were conducted with resource specialists (refer to Appendix D). Prior to each brainstorming session, specialists received background information on the resources, objects, and values of interest in the unit from the California Coastal National Monument Resource Management Plan (BLM 2005), the associated Cotoni-Coast Dairies resource management plan amendment (BLM 2021), and other relevant documents.

At the brainstorming sessions, specialists were asked to consider potential needs for four types of science information: data on resources of concern, scientific studies relevant to any potential effects of proposed actions on resources, methods for measuring the potential effects of proposed actions on resources, and effective mitigation actions for protecting resources (Carter et al. 2023). Specialists were also asked to consider the purpose of science strategies (BLM 2011), issues and management actions in the resource management plan amendment for the unit, and science needs that, if filled, would help inform their work for the unit, the monument, and the BLM as a whole (BLM 2011). Brainstorming sessions were structured using the identified objects for the unit and a comprehensive list of cultural and natural resources, administrative resources and issues (e.g., water rights, built infrastructure), and management actions and stressors (e.g., invasive species, wildfire) that might affect the resources of interest (e.g., vegetation, protected birds) (refer to Appendix E).

BLM staff identified criteria for prioritizing needs according to public safety or statutory, permitting, and reporting requirements as of summer 2025 (e.g., Endangered Species Act, Clean Water Act, National Historic Preservation Act, National Environmental Policy Act, tribal consultation). Science needs were eligible for high priority if they were directly related to one or more statutory, permitting, or reporting requirements or public safety. Additional methodological details for the needs identification and prioritization processes are provided in Appendix D.

Some issues and topics were not able to be fully considered, including Native and local peoples, co-stewardship, geology, and paleontology. While there was engagement with a core set of unit partners as part of this planning effort, broader engagement is anticipated as the strategy is implemented. It is suggested that potential information needs related to Native and local peoples, co-stewardship, and emergent threats be further explored in future updates to this strategy. It is also worth noting that this science strategy process was not designed to collect information needs related to Indigenous Knowledge (or Traditional Ecological Knowledge). Indigenous Knowledge will be an important complement to the science information needs identified here, including finding ways to incorporate traditional practices into applied science and management actions at Cotoni-Coast Dairies. Finally, it is important to note that the science needs identification and prioritization processes did not include a search of the literature to determine if data, science, methods, and effective mitigation measures that were identified as needs may exist in the literature. Thus, some potential needs

may reflect needs for more accessible science information, or for compiled, summarized, or synthesized science products, rather than needs for new research.

Pressing management questions change as management decisions are made and new concerns arise. Thus, the scientific needs and priorities will remain fluid, and opportunities for research will remain open and inclusive. The absence of a topic identified as a need should not be interpreted as a lack of interest in potential partnership efforts.

3.2 Priority Science Needs for Cotoni-Coast Dairies

Across 13 categories, 260 science needs were identified (Table 2) for Cotoni-Coast Dairies, with 78 (30%) of those needs labelled as high priority (see Tables 3–15). The five categories with the highest number of needs are: vegetation (39), wildlife (34), fire and fuels (31), recreation (26), and cultural resources (25). Across all categories, there is a consistent need for baseline data on the presence and condition of priority resources, as well as for ongoing monitoring of resources. The importance of establishing and tracking resource conditions is highlighted throughout Tables 3–15.

Table 2. Number of science needs by category identified by Central Coast Field Office staff and partners of Cotoni-Coast Dairies.

Science Needs Categories	Number of Needs
Community science, outreach, and partnerships	21
Cultural resources	25
Data, methods, or monitoring	8
Fire and fuels	31
Grazing	15
Historic and surrounding land uses	11
Hydrology and water resources	21
Public safety	11
Reclamation and restoration	9
Recreation	26
Transportation and infrastructure	9
Vegetation	39
Wildlife	34
Total	**260**

Table 3. Cotoni-Coast Dairies science needs that relate to community science, outreach, and partnerships. Note: Needs labeled as high priority are tied to public safety or at least one statutory, permitting, or reporting requirement.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
1	Community science, outreach, and partnerships	Aquatic wildlife	Determine how the unit can best provide interpretive materials related to salmon, salmon habitat, and related restoration efforts to the public.	High
2	Community science, outreach, and partnerships	Aquatic wildlife	Explore communication and outreach efforts to strengthen public understanding and support of conservation efforts for California red-legged frogs, with a focus on the local community.	High
3	Community science, outreach, and partnerships	Adapting to changing conditions	Determine how the BLM can partner with the local community or state to address potential effects of changing environmental conditions on natural resources and infrastructure (e.g., roads, trails).	
4	Community science, outreach, and partnerships	Grazing	Determine how the unit can best interpret and share information about the benefits of cattle grazing for fire risk and fuels reduction with the public, as visitation is expected to increase.	
5	Community science, outreach, and partnerships	Historic and surrounding land uses	Determine how the unit can collaborate on actions with partners that are embedded in the mosaic of different land managers present in the Santa Cruz Mountains.	
6	Community science, outreach, and partnerships	Historic and surrounding land uses	Determine how to best use educational opportunities within the unit, together with museum and tribal partners, to potentially influence behaviors outside the unit (especially in the context of invasives).	
7	Community science, outreach, and partnerships	Data, methods, or monitoring	Determine how to use community science to document natural recovery of vegetation in the unit.	
8	Community science, outreach, and partnerships	Data, methods, or monitoring	Determine how to use current community science photography points to monitor landscape recovery in the unit.	
9	Community science, outreach, and partnerships	Data, methods, or monitoring	Create community science projects, such as vegetation monitoring through iNaturalist and camera rests for smart phones.	
10	Community science, outreach, and partnerships	Data, methods, or monitoring	Determine how to work with community scientists to monitor the potential effects of changing environmental conditions in the unit and broader landscape.	
11	Community science, outreach, and partnerships	Invasive species	Determine how the unit can best communicate to the public the effects of nonnative, invasive plant species (e.g., eucalyptus, *Eucalyptus* spp.).	

Table 3. Continued.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
12	Community science, outreach, and partnerships	Invasive species	Determine how weeds can be effectively managed with minimal staff (e.g., one staff member) or with volunteers.	
13	Community science, outreach, and partnerships	Recreation	Understand how community participation in volunteer activities leads to greater buy-in and stewardship of the property.	
14	Community science, outreach, and partnerships	Transportation and infrastructure	Determine educational opportunities for infrastructure elements (e.g., signs along Bonny Doon Road).	
15	Community science, outreach, and partnerships	Vegetation	Identify and implement a community science effort to collect plant species distribution data (through iNaturalist or CalFlora), especially for nonnative plant species, with minimal support needs from unit staff.	
16	Community science, outreach, and partnerships	Wildlife	Use community science to monitor wildlife populations (e.g., reptiles, amphibians).	
17	Community science, outreach, and partnerships		Determine how to use science communication to improve relationships with neighbors.	
18	Community science, outreach, and partnerships		Determine how to best engage and involve all partners with an interest in the unit to develop relationships with the unit and its resources, conduct science, and contribute to resource protection and management efforts.	
19	Community science, outreach, and partnerships		Determine how to best engage with and support science efforts led by partners and neighboring communities.	
20	Community science, outreach, and partnerships		Determine how to best work with adjacent landowners to identify joint science opportunities and long-term management goals.	
21	Community science, outreach, and partnerships		Create partnerships between agencies and institutions to develop management plans for critical resources (e.g., water, fish restoration).	

Table 4. Cotoni-Coast Dairies science needs that relate to cultural resources. Note: Needs labeled as high priority are tied to public safety or at least one statutory, permitting, or reporting requirement.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
1	Cultural resources		Identify Indigenous and ethnobotanical values of the landscape.	High
2	Cultural resources		Analyze potential interactions between existing rights-of-way actions and cultural resources.	High
3	Cultural resources	Adapting to changing conditions	Monitor the historic cheese barn for effects from natural phenomena such as flooding.	High
4	Cultural resources	Community outreach	Through communications, increase public understanding of cultural, archaeological, and historic resources.	High
5	Cultural resources	Data, methods, or monitoring	Implement long-term upkeep, monitoring, and stabilization mechanisms on the historic cheese barn.	High
6	Cultural resources	Data, methods, or monitoring	Identify methods for doing cultural resource work quickly, safely, and effectively with limited resources.	High
7	Cultural resources	Data, methods, or monitoring	Conduct comprehensive class III inventories (including transects of areas with potential effects for proposed projects and existing rights-of-way) for known resource types (precontact and Indigenous cultural, historical, and archaeological artifacts).	High
8	Cultural resources	Data, methods, or monitoring	Monitor potentially sensitive areas for general degradation tied to erosion, grazing, and people and for effects on archaeological, cultural, and historic resources.	High
9	Cultural resources	Public safety	Identify how to address hazardous materials or situations to mitigate effects on cultural resources.	High
10	Cultural resources	Public safety	Monitor impacts to archaeological, cultural, and historic resources from visitation, unauthorized access, and looting.	High
11	Cultural resources	Public safety	Identify areas with higher potential for illegal cannabis grow sites and inventory them for cultural resources.	High
12	Cultural resources	Vegetation	Inventory trees for cultural values to avoid effects from direct and indirect actions.	High
13	Cultural resources	Data, methods, or monitoring	Survey cultural sites across the unit and identify where they correspond with trespass locations. Use this information to guide installation of trail cameras, development of real time monitoring, and barrier hardening to more effectively curb trespass and prevent damage to sites.	

Table 4. Continued.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
14	Cultural resources	Data, methods, or monitoring	Use stable isotope research to learn more about the seasonality of historical shellfish harvesting.	
15	Cultural resources	Data, methods, or monitoring	Conduct systematic ground surveys of historical sites in partnership with and led by the Amah Mutsun Land Trust, including revisits to Indigenous sites previously discovered.	
16	Cultural resources	Data, methods, or monitoring	Identify low impact approaches, including ground penetrating radar and integrated cultural resource surveys, to locate more Indigenous sites present in the unit.	
17	Cultural resources	Vegetation	Study the effect of Indigenous stewardship practices on selected plant taxa.	
18	Cultural resources	Vegetation	Conduct grassland phytolith abundance surveys near Indigenous settlement areas.	
19	Cultural resources	Vegetation	Identify how Indigenous practices, such as fire and harvesting, were used within the unit's old buckeye groves.	
20	Cultural resources	Vegetation	Conduct studies of historic wood charcoal and wood fuel uses and reconstruct the unit's woody environment.	
21	Cultural resources		Determine how historic post-settlement use affected native plants and animals.	
22	Cultural resources		Determine the location and significance of Indigenous village sites in the unit.	
23	Cultural resources		Re-implement local and traditional Indigenous stewardship practices on the landscape.	
24	Cultural resources		Better understand Indigenous settlement and stewardship of food plants and animals present in the unit, with a focus on small seeds, hazelnuts, acorns, buckeyes, Indian potato, fish bones, and elk.	
25	Cultural resources		Piece together historic trade routes in the unit and work to preserve these as cultural resources.	

Table 5. Cotoni-Coast Dairies science needs that relate to data, methods, or monitoring. Note: There are no high-priority needs for this category. AIM = Assessment, Inventory, and Monitoring.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
1	Data, methods, or monitoring	Adapting to changing conditions	Improve the use of data collected by the onsite automated weather station to measure/monitor weather conditions and effects on these lands. Use data collection underway in the Santa Cruz Mountains and other regions to inform understanding of current conditions and project future conditions for Cotoni-Coast Dairies.	
2	Data, methods, or monitoring		Consider the use of other data collection efforts (that use "standardized" methods) that are not coordinated through the BLM or AIM to use with remote sensing products.	
3	Data, methods, or monitoring		Determine how to combine AIM-derived remotely sensed data and climate data to understand larger landscape-level effects, particularly in the unit.	
4	Data, methods, or monitoring		Determine how to increase utilization of emerging technologies and process resulting data to address landscape-level issues in the unit (e.g., deploying additional monitoring equipment, using unmanned aerial vehicles for data collection).	
5	Data, methods, or monitoring		Determine how to use unit data to advance long-term ecological research and monitoring programs and identify and answer landscape-level questions.	
6	Data, methods, or monitoring		Determine approaches for developing systems and partnerships that facilitate the BLM's ability to analyze and use large datasets collected onsite, including wildlife trail camera imagery.	
7	Data, methods, or monitoring		Reassess locations of AIM lotic and riparian/wetland point data and understand how data inform management (e.g., data in existence, what data convey, current location efficacy).	
8	Data, methods, or monitoring		Determine how the unit can coordinate with the AIM program to improve AIM data collection efforts in the unit.	

Table 6. Cotoni-Coast Dairies science needs that relate to fire and fuels. Note: Needs labeled as high priority are tied to public safety or at least one statutory, permitting, or reporting requirement. IFTDSS = Interagency Fuel Treatment Decision Support System.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
1	Fire and fuels	Aquatic wildlife	Determine the effects of fire on coho salmon and steelhead habitat in San Vicente and other watersheds.	High
2	Fire and fuels	Aquatic wildlife	Determine how to design/approach planned fuels reduction treatments and projects to minimize potential adverse effects to steelhead habitat.	High
3	Fire and fuels	Cultural resources	Determine the potential effects of future fire regimes, including duration, fuel type, and intensity, on archaeological, historic, and cultural resources.	High
4	Fire and fuels	Cultural resources	Monitor the effects of fuel reduction work (fuel breaks, targeted grazing, prescribed burns, etc.) on archaeological, cultural, and historic resources.	High
5	Fire and fuels	Historic and surrounding land uses	Identify best management practices (e.g., mowing) in grasslands to reduce fine fuel loads, especially given proximity of grasslands to people, communities, and roads.	High
6	Fire and fuels	Adapting to changing conditions	Determine the efficacy of current fuels treatment strategies alongside changing environmental conditions (e.g., longer burn seasons, more intense rainfall).	
7	Fire and fuels	Community outreach	Monitor regrowth after fire (including experimental/prescribed burns) in different sites to understand how regrowth of vegetation differs across sites with different characteristics, including the speed of revegetation. Incorporate the use of volunteers to help introduce the community to the BLM and resources in the unit.	
8	Fire and fuels	Community outreach	Explore how fire risk mitigation work with the Davenport community can continue to be strong and build community relationships.	
9	Fire and fuels	Community outreach	Monitor the effectiveness of tree felling within the San Vicente watershed to determine if this effort should be repeated and implemented in other areas. Determine if this partnership should expand to other areas of the unit.	
10	Fire and fuels	Community outreach	Determine which components of fire management are working well to foster community engagement (e.g., fuels reduction plans) and implement these components to other management issues.	
11	Fire and fuels	Community outreach	Determine how to implement broadcast (or pile) burning in the unit in a manner that is conscientious of the local community.	
12	Fire and fuels	Community outreach	Determine how the BLM can better assist fire mitigation efforts of neighbors and partners (e.g., Sempervirens Fund).	
13	Fire and fuels	Community outreach	Explore how fuels treatments in the unit and neighboring properties do or could complement and strengthen each other and be more mutually beneficial to the unit landscape.	

Table 6. Continued.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
14	Fire and fuels	Cultural resources	Determine the historic fire regime for the unit and how Indigenous peoples contributed to this cycle. Determine if fire management practices can be implemented based on this knowledge (e.g., review frequency of burns using redwoods).	
15	Fire and fuels	Data, methods, or monitoring	Identify how data in IFTDSS could be updated more frequently to better inform proactive fuels management efforts on and around the unit.	
16	Fire and fuels	Data, methods, or monitoring	Assess how fuel types changed in the burned area pre- to post-fire using field survey methods. Determine the area of change for each fuel type and how these findings compare to data and model projections in IFTDSS. Results could potentially feed back into the IFTDSS system.	
17	Fire and fuels	Grazing	Identify how to best monitor fuels reduction success after planned fuels reduction treatments, particularly in relation to goat grazing.	
18	Fire and fuels	Historic and surrounding land uses	Determine if fire scars could be used to study historic fire frequency and seasonality.	
19	Fire and fuels	Hydrology and water resources	Determine how potential hazards, such as flooding and wildfire, can be best addressed and mitigated in the management context of an NLCS unit.	
20	Fire and fuels	Invasive species	Assess the ways invasive plant species affect fuels.	
21	Fire and fuels	Invasive species	Determine fire risk associated with decadent nonnative pines near the old quarry system, how removal of those trees would affect fuels and fire risk, and how that could be done without invasion and dominance by French broom.	
22	Fire and fuels	Recreation	Determine how changing fire risk and regimes are likely to affect recreation and other activities in the unit.	
23	Fire and fuels	Recreation	Determine the types of visitors who are most likely to use fuels reduction treatment areas as recreation spots.	
24	Fire and fuels		Determine how wind and extreme drought will change fire regimes.	
25	Fire and fuels		Determine the most effective ways to reduce fine fuels along trail corridors (e.g., mechanically, herbicide application, prescribed grazing).	
26	Fire and fuels		Understand the fuel loading status of upland forest zones. Treatments to reduce woody fuel loads could include prescribed fire or mastication plots, control plots, and sampling to measure soil carbon in A and O horizon (duff) to assess total carbon.	

Table 6. Continued.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
27	Fire and fuels		Understand local historical fire regimes, including through ethnohistorical and ethnographic reviews, to effectively reimplement them in the unit.	
28	Fire and fuels		Conduct contemporary experiments on cultural burning and its effect on native flora and fauna.	
29	Fire and fuels		Determine how prescribed fire can be used in the unit to steward and sustain ecosystems.	
30	Fire and fuels	Monarch butterflies	Monitor planned fuels reduction treatments to identify potential direct or indirect effects to monarchs and their breeding, migratory, and overwintering habitat.	
31	Fire and fuels	Monarch butterflies	Integrate monarch habitat considerations into the design of planned fuels reduction treatments and projects to evaluate potential ecological outcomes and guide mitigation efforts.	

Table 7. Cotoni-Coast Dairies science needs that relate to grazing. Note: Needs labeled as high priority are tied to public safety or at least one statutory, permitting, or reporting requirement.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
1	Grazing	Aquatic wildlife	Better understand the interaction between grazing and ponds for California red-legged frogs.	High
2	Grazing	Cultural resources	Examine the potential effects of grazing on archaeological, historic, and cultural resources, especially in lieu of changing fences or the initiation of virtual fences (Figure 4).	High
3	Grazing	Cultural resources	Inventory fence lines, troughs, etc., to determine whether cattle congregate in areas of cultural concern.	High
4	Grazing	Hydrology and water resources	Continue to explore avenues (e.g., spring development, troughs) to keep cattle separate from creeks in the unit.	High
5	Grazing	Community outreach	Determine how to best convey information on grazing use and benefits to the public.	
6	Grazing	Community outreach	Consider whether some of the grazing strategies and studies that California Polytechnic State University is conducting might be useful or could be connected with Cotoni-Coast Dairies.	
7	Grazing	Soils	Determine how cattle have affected soil microbiology.	
8	Grazing	Soils	Determine how the absence of large herds of native ungulates has affected soil chemistry.	
9	Grazing	Hydrology and water resources	Explore potential concerns associated with cattle access to a small portion of Agua Puerca (cattle need to cross the creek here and have access year round).	
10	Grazing	Invasive species	Determine how grazing can minimize invasive annual grass encroachment. Determine how monitoring can be implemented to ensure that fuels reduction and other objectives are being met.	
11	Grazing	Recreation	Monitor the effects of grazing leases, cattle, and other livestock grazing on the trail systems (e.g., cattle using and crossing trails, which cause areas upslope to collapse), surrounding watersheds (e.g., erosion), and visitor experiences (e.g., hiking, biking).	
12	Grazing	Invasive species	Explore potential for greater use of pasture rotation to help control thistles (*Cirsium* spp.).	
13	Grazing	Invasive species	Explore potential for use of targeted grazing outside currently grazed areas to control invasive plants.	

Table 7. Continued.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
14	Grazing	Wildlife	Assess concerns related to cattle depredation from mountain lions (*Puma concolor*) and coyotes (*Canis latrans*).	
15	Grazing	Wildlife	Determine if wildlife, habitat, plants, or plant communities could benefit from maintained, heavily managed, rotational, and/or prescribed grazing.	

Figure 4. A cow at Cotoni-Coast Dairies wearing an e-collar to support tracking and virtual fencing efforts. Photograph by Ben Hoke, BLM.

Table 8. Cotoni-Coast Dairies science needs that relate to historic and surrounding land uses. Note: Needs labeled as high priority are tied to public safety or at least one statutory, permitting, or reporting requirement.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
1	Historic and surrounding land uses	Public safety	Assess the large area of dolomite/limestone mine tailings in the Liddell Creek drainage for stability and potential for removal.	High
2	Historic and surrounding land uses	Data, methods, or monitoring	Monitor and compare resource status across similar landscapes with varying land ownership and practices (e.g., Swanton Pacific Ranch and timber management practices, state parks and grassland restoration efforts, cattle grazing).	
3	Historic and surrounding land uses	Invasive species	Determine how reclamation related to the beltline and removal of planted Monterey pines can be done to reduce the potential spread of invasive species and how the BLM can monitor the outcomes.	
4	Historic and surrounding land uses	Invasive species	Sample genetic information for native versus planted Monterey pines in the unit, including any potential hybridization, to inform removal of planted, nonnative trees as part of cement plant reclamation.	
5	Historic and surrounding land uses	Reclamation and restoration	Determine ways in which reclamation of former limestone mining sites influences the restoration of downstream redwood forests.	
6	Historic and surrounding land uses	Reclamation and restoration	Determine how to monitor the shale quarry native vegetation reclamation to ensure effectiveness.	
7	Historic and surrounding land uses	Reclamation and restoration	Consider the effects of different reclamation strategies for areas affected by mining within the management context of an NLCS unit.	
8	Historic and surrounding land uses	Reclamation and restoration	Determine which remediation options are possible and would be most effective for Cemex's rights-of-way along Cement Plant Road.	
9	Historic and surrounding land uses	Transportation and infrastructure	Determine how to update/correct historically incorrect property lines for modern management. Determine if any special considerations are needed given the unit status.	
10	Historic and surrounding land uses		Determine the use history of the unit (e.g., Indigenous community use, grazing) and determine how those uses are still seen on the landscape.	
11	Historic and surrounding land uses		Determine how the agricultural parcel on the boundary of the unit affects BLM resources, objects, and values, and vice versa.	

Table 9. Cotoni-Coast Dairies science needs that relate to hydrology and water resources. Note: Needs labeled as high priority are tied to public safety or at least one statutory, permitting, or reporting requirement.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
1	Hydrology and water resources	Aquatic wildlife	Identify potential partners and water rights holders, including those related to the presence of salmon habitat, that could support instream work, such as work identified in the National Marine Fisheries Service (2016) recovery plan.	High
2	Hydrology and water resources	Data, methods, or monitoring	Determine how the BLM can install, collect, and analyze data from stream gauges to assess and monitor water quality.	High
3	Hydrology and water resources	Historic and surrounding land uses	Determine how to best return dynamic processes to riparian areas considering required Cemex remediation and changing environmental conditions.	High
4	Hydrology and water resources	Public safety	Explore the best options to restore upland areas of San Vicente Creek where water outflows are causing erosion and have the potential to lead to future flooding. Monitor changes in erosion, land cover, vegetation composition, and suitability of instream habitat for salmon.	High
5	Hydrology and water resources	Public safety	In the AB junction area and associated fill in the riparian area, determine the condition of this large, long culvert and the best strategy for improving culvert function (e.g., lining). Determine the potential for culvert failure and associated effects to West Liddell Creek, which parallels Bonny Doon Road.	High
6	Hydrology and water resources	Reclamation and restoration	Determine the feasibility and ways of removing the inoperable, unmaintained dam on/above Molino Creek (which has an associated 20-foot dropoff and is considered a historic structure on BLM land).	High
7	Hydrology and water resources	Reclamation and restoration	Research potential changes likely to result from dam removal on/above Molino Creek.	High
8	Hydrology and water resources		For an upcoming proposed project to dredge a creek channel adjacent to San Vicente Creek, determine plausible onsite mitigation strategies.	High
9	Hydrology and water resources	Public safety	Understand conditions that lead to overflow, effects of overflow on dam integrity, associated liability, and how frequency or intensity of overflow conditions change with changing environmental conditions.	High
10	Hydrology and water resources	Public safety	Determine how future environmental conditions might affect culvert function and streamflow in relation to nearby houses.	High
11	Hydrology and water resources	Public safety	Predict how human-made, dirt (and sometimes lined) ponds will hold up to earthquakes or flooding events.	High
12	Hydrology and water resources	Public safety	Assess the stability (and potential for mass failure) of the drainage just south of the Santa Cruz water intake.	High

Table 9. Continued.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
13	Hydrology and water resources	Public safety	Conduct a hydrological study to determine which kind of managed water system (which could have species benefits as well) addresses the flooding issue associated with the two culverts on San Vicente Creek that back up during floods, affecting San Vicente Road and associated houses built in the floodplain.	High
14	Hydrology and water resources	Public safety	Assess the stability of the ponds, potential for failure of berms, and sedimentation areas in the Liddell and San Vicente drainages.	High
15	Hydrology and water resources	Adapting to changing conditions	Determine which areas need to be made more resilient to changing environmental conditions and increased waterflow.	
16	Hydrology and water resources	Adapting to changing conditions	Determine how changing environmental conditions, sea level rise, and erosion could affect coastal habitats, streams, and infrastructure resiliency.	
17	Hydrology and water resources	Data, methods, or monitoring	Determine if new hydrologic information could help improve future proposed actions (e.g., infrastructure development, restoration) along San Vicente Creek and neighboring boundaries.	
18	Hydrology and water resources	Invasive species	Determine vectors for invasive species into the waterways.	
19	Hydrology and water resources	Reclamation and restoration	Determine the best strategies for reclamation of the human-made ponds.	
20	Hydrology and water resources	Reclamation and restoration	Determine the best approach to, and feasibility of, addressing the sediment dams around the cement plant that may need removal or stabilization and how North American beaver (*Castor canadensis*) dam analogs could be beneficial in Liddell Creek in light of drainages, the Santa Cruz pipeline, and many other hydrological complexities.	
21	Hydrology and water resources	Reclamation and restoration	Determine if options for stream habitat restoration may be associated with railroad trail development.	

Table 10. Cotoni-Coast Dairies science needs that relate to public safety. Note: Needs labeled as high priority are tied to public safety or at least one statutory, permitting, or reporting requirement.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
1	Public safety	Community outreach	Determine how to best convey and address public safety issues associated with eucalyptus trees (*Eucalyptus* spp.) in and around the unit, particularly in instances in which the community may feel strongly.	High
2	Public safety	Community outreach	Determine how the BLM can best understand and work to change mindsets so that illegal collectors (e.g., mushroom foragers) discontinue poaching/illegal collection, both to decrease take and to decrease other connected effects (e.g., creating illegal trails, illegal camping).	High
3	Public safety	Community outreach	Determine how to most effectively address future emergency situations and/or tie into partner emergency services, considering the high staff turnover rates in those agencies. Consider equipment, education, and certification aspects.	High
4	Public safety	Data, methods, or monitoring	Identify seasonal and social windows for short-term, high-impact illegal uses (e.g., mushroom hunting) and methods that could be used to track these windows.	High
5	Public safety	Data, methods, or monitoring	Develop a system to rapidly detect illegal camping, potentially through community connections, signage, fences, or other approaches, especially in the Liddell and San Vicente watersheds.	High
6	Public safety	Data, methods, or monitoring	Identify and test strategies to effectively decrease dumping and determine how to best rapidly detect illegally dumped materials, especially those that may be hazardous (e.g., car batteries).	High
7	Public safety	Data, methods, or monitoring	Determine how the BLM can best detect people engaged in illegal collection before they remove materials. Also, determine how the BLM can effectively identify people who have illegally removed materials and potentially have those materials returned.	High
8	Public safety	Monarch butterflies	Assess the status of monarchs at the eucalyptus overwintering grove and the status of eucalyptus trees from a public safety perspective.	High
9	Public safety	Wildlife	Determine how the unit can best prevent and decrease illegal hunting of wildlife species by different groups.	High
10	Public safety		Determine locations where trespassers are encroaching on biological and cultural resources.	High
11	Public safety		Determine locations that need better physical barriers to prevent illegal use.	High

Table 11. Cotoni-Coast Dairies science needs that relate to reclamation and restoration. Note: Needs labeled as high priority are tied to public safety or at least one statutory, permitting, or reporting requirement. AIM = Assessment, Inventory, and Monitoring.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
1	Reclamation and restoration	Aquatic wildlife	Determine how reclamation efforts related to the ponds will affect California red-legged frogs and how those efforts can minimize any potential negative effects on other sensitive species.	High
2	Reclamation and restoration	Data, methods, or monitoring	Determine how AIM plots can be used to help evaluate the effectiveness of restoration efforts, fuels reduction treatments, etc.	
3	Reclamation and restoration	Grazing	Determine how the absence of large native ungulates affected vegetative species composition. Also, determine how cattle have or could fill this niche if carefully managed.	
4	Reclamation and restoration	Invasive species	Determine if restoration (versus preservation) measures could be implemented to manage invasive species, especially in relation to grazing.	
5	Reclamation and restoration	Vegetation	Determine how to restore meadows in the unit, including through the use of prescribed burns and invasive species removal.	
6	Reclamation and restoration	Vegetation	Understand the variety of native grasses, herbs, and woody taxa in the unit and identify best practices to restore them to historical extents.	
7	Reclamation and restoration	Vegetation	Identify the most effective restoration practices for native coastal prairie species.	
8	Reclamation and restoration	Wildlife	Determine how the unit can restore species that play important ecosystem roles or species that require reintroductions (e.g., beaver, elk).	
9	Reclamation and restoration		Determine if opportunities exist for habitat restoration in the unit and at the landscape level.	

Table 12. Cotoni-Coast Dairies science needs that relate to recreation. Note: Needs labeled as high priority are tied to public safety or at least one statutory, permitting, or reporting requirement.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
1	Recreation		Effectively prioritize areas in the unit with overlapping resources (cultural, biological, hydrological) within the recreation management zones and manage these areas using adaptive management strategies.	High
2	Recreation	Adapting to changing conditions	Determine how best management practices for trail design could be adjusted to anticipate changing environmental conditions, including flooding.	
3	Recreation	Community outreach	Determine sustainability of the trail system (Figure 5) and how to use interpretative information to communicate this to the public.	
4	Recreation	Data, methods, or monitoring	Monitor off-highway vehicle and dirt biking activities to understand locations and timing of occurrence to inform law enforcement efforts and address direct habitat degradation, sediment sources, and pollutant sources, especially in the San Vicente watershed.	
5	Recreation	Data, methods, or monitoring	Develop a monitoring plan for future effects of the yet to be constructed trail system on species and resources (e.g., sensitive species).	
6	Recreation	Data, methods, or monitoring	Monitor effects of heavy recreation use on unit trails and surrounding areas (e.g., trash, pet waste) and assess strategies to educate the public on respectful visitation practices.	
7	Recreation	Data, methods, or monitoring	Monitor and quantify the proliferation of social trails, especially on the lower loop, and explore to what extent the creation of social trails could be exacerbated by existing cattle trails. Study the effectiveness of deterrents (e.g., fencing, trail closed sign or more descriptive sign) to social trail creation.	
8	Recreation	Data, methods, or monitoring	As visitor numbers expand, determine the best ways to collect information on visitor use and trends, including who visits, why, time spent visiting, and locations visited. Determine how outcomes-focused management surveys could support this effort.	
9	Recreation	Fire and fuels	Determine the best ways to deter and monitor increased foot traffic and off-highway vehicle use, including e-bikes, around fuels reduction treatment areas, especially tank traps and dozer lines.	
10	Recreation	Grazing	Understand how the presence of people may affect cattle use of the grazing allotment and vegetation (e.g., changing calving areas).	
11	Recreation	Grazing	Identify likely issues and solutions associated with future public access and the grazing operation at the north end of the unit next to the corral; cattle (*Bos taurus*) include mothers with calves that may attract visitors.	

Table 12. Continued.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
12	Recreation	Grazing	Monitor the presence of dogs (*Canis familiaris*), including off leash/escaped dogs, and how it may affect grazing.	
13	Recreation	Hydrology and water resources	Continue monitoring water quality as recreation develops, specifically for Agua Puerca/Ferrari Creek and Molino Creek, as well as smaller drainages.	
14	Recreation	Invasive species	Determine if invasive plant species affect visitor experiences.	
15	Recreation	Soils	Monitor erosion associated with the creation of social trails and assess whether split rail fences could be effective for limiting erosion.	
16	Recreation	Transportation and infrastructure	Understand the sustainability and access of trails in relation to the parking lot location.	
17	Recreation	Transportation and infrastructure	Determine visitor behavior at the new parking lot.	
18	Recreation	Wildlife	Determine the effects of different types of visitor use and appropriate/sustainable uses on wildlife species.	
19	Recreation	Wildlife	With support from the California Department of Fish and Wildlife, understand what sustainable hunting looks like in the unit and how partnerships could improve understanding. Assess game populations (e.g., conditions, herd size, territory, fluctuation in herd size). Determine if other species belong on the hunting list (e.g., coyote (*Canis latrans*), wild turkey (*Meleagris gallopavo*)).	
20	Recreation		Determine what observational information regarding mountain bike and nonmotorized recreation use can provide the best guidance for adaptive management or other forms of management for sustainable long-term use.	
21	Recreation		Study trail materials for durability in the face of grazing, erosion, hiking, and biking.	
22	Recreation		Determine how to let people visit, access, restore, and use resources (e.g., water, grazing) while maintaining the unit's landscape in a sustained fashion for the long-term.	
23	Recreation		Determine if some areas should be off limits for pets (other than service animals).	

Table 12. Continued.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
24	Recreation	Monarch butterflies	Take advantage of the design of the recreation management zones (two open to the public, two closed) and cell phone data to design and implement a study to understand the effects of recreation presence and absence on monarchs and other sensitive species in the unit.	
25	Recreation	Mountain lions	Determine if visitor use affects mountain lion (*Puma concolor*) movement.	
26	Recreation	Mountain lions	Determine effects of current activities and future increased visitor traffic on mountain lions and their habitat.	

Figure 5. Recreation trail at Cotoni-Coast Dairies. Photograph by Ben Hoke, BLM.

Table 13. Cotoni-Coast Dairies science needs that relate to transportation and infrastructure. Note: Needs labeled as high priority are tied to public safety or at least one statutory, permitting, or reporting requirement. NEPA = National Environmental Policy Act; AIM = Assessment, Inventory, and Monitoring.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
1	Transportation and infrastructure	Hydrology and water resources	Determine the effects of logging roads and landing areas on stream turbidity. Determine how the road system contributes to sedimentation of waterways and effects salmon habitat and other threatened and endangered species.	High
2	Transportation and infrastructure	Soils	Determine how alternative road design could be tested on Warrenella Road to mitigate erosion and unauthorized use of various adjacent ecosystems.	High
3	Transportation and infrastructure	Community outreach	Plan, together with partners, for increased traffic in the unit, including needs for towing and rules to manage traffic systems.	
4	Transportation and infrastructure	Data, methods, or monitoring	Design a study to understand and monitor the anticipated effects stated in NEPA analyses for the trail system and parking lots.	
5	Transportation and infrastructure	Data, methods, or monitoring	Determine how the unit can use AIM and other standardized monitoring protocols to help understand the effects of new infrastructure development.	
6	Transportation and infrastructure	Invasive species	Implement an early detection program to identify stinkwort (*Dittrichia graveolens*), which could be introduced through imported gravel associated with parking lot or other construction, rights-of-ways (Pacific Gas and Electric Company substation), or administrative sites.	
7	Transportation and infrastructure		Determine how current land users (e.g., logging trucks, Pacific Gas and Electric Company, lease holders) will use important travel routes, such as Warrenella Road, under changing environmental conditions.	
8	Transportation and infrastructure		Determine the effects of significant infrastructure in and around the unit (e.g., Bonny Doon Road, Davenport) on resources and management of the unit.	
9	Transportation and infrastructure		Determine how the BLM can best avoid or minimize adverse effects of remediation or rehabilitation on cultural or natural resources.	

Table 14. Cotoni-Coast Dairies science needs that relate to vegetation. Note: Needs labeled as high priority are tied to public safety or at least one statutory, permitting, or reporting requirement. AIM = Assessment, Inventory, and Monitoring.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
1	Vegetation		Identify interactions between forest health, watersheds, threatened and endangered species, and cultural resources within the unit.	High
2	Vegetation	Invasive species	Identify and assess methods that could restore nonnative grasslands back to native grassland species—grazing, mechanical pulling, chemical treatments, prescribed fire, or a combination of methods.	High
3	Vegetation	Adapting to changing conditions	Determine how to use terrestrial and lotic AIM indicators to understand the effects of erosion and changing environmental conditions in the unit.	
4	Vegetation	Adapting to changing conditions	Determine which native vegetation communities are most vulnerable to changing environmental conditions. Determine if locations should be prioritized for varying plant treatments.	
5	Vegetation	Adapting to changing conditions	Assess forest health in the unit. Understand how to manage forest landscapes for forest health and resiliency, including in relation to fire and changing environmental conditions.	
6	Vegetation	Adapting to changing conditions	Determine if warmer and drier weather would lead to a contraction of the range and presence of coast redwoods (*Sequoia sempervirens*), which are near their southern range limit.	
7	Vegetation	Adapting to changing conditions	Identify vegetation management practices, especially in upland forests, that should be implemented considering changing environmental conditions.	
8	Vegetation	Cultural resources	Understand the ecology and cultural history of oak forests and hazelnut groves in terms of Native American food sources and propagating those resources for tribal peoples and nations.	
9	Vegetation	Cultural resources	Determine the use of Indigenous Knowledge to propagate native plants.	
10	Vegetation	Data, methods, or monitoring	Determine how to install AIM terrestrial plots in the unit. Determine how riparian and lotic AIM data can continue to be collected and used more.	
11	Vegetation	Data, methods, or monitoring	Determine if the unit could be used as a laboratory to test the effectiveness of AIM data collection efforts for accurately characterizing vegetation types at the unit scale.	
12	Vegetation	Data, methods, or monitoring	Determine if there are improvements in remote sensing-derived vegetation products (e.g., Rangeland Analysis Platform; Rangeland Condition Monitoring, Assessment, and Projection) if paired with AIM terrestrial data collection.	

Table 14. Continued.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
13	Vegetation	Data, methods, or monitoring	Inventory the unit using remote sensing/satellites and drones in addition to ground surveys to understand different landscapes and habitat types.	
14	Vegetation	Data, methods, or monitoring	Catalog different habitat types, including through mapping of native and invasive grassland habitats.	
15	Vegetation	Invasive species	Determine ways to prevent English ivy (*Hedera helix*) from decimating native vegetation communities.	
16	Vegetation	Invasive species	Determine which native vegetation communities are most imperiled by the presence of invasive plant species.	
17	Vegetation	Invasive species	Determine the success rate of weed mitigation strategies used in the unit by the Pacific Gas and Electric Company.	
18	Vegetation	Invasive species	Determine the best measures to control existing invasive plant species (e.g., thistles (*Cirsium* spp.), poison hemlock (*Conium maculatum*), French broom (*Genista monspessulana*)) along trails given limited resources.	
19	Vegetation	Invasive species	Determine the best measures to control bull thistle (*Cirsium vulgare*), red star-thistle (*Centaurea calcitrapa*), mustard (*Brassica* spp.), and other weeds in the nonnative grassland areas.	
20	Vegetation	Invasive species	Determine the effectiveness of treatment strategies (e.g., manual thinning) to minimize French broom.	
21	Vegetation	Invasive species	Explore effective strategies for reducing the presence and spread of French broom, which could include chemical or mechanical approaches or prescribed grazing.	
22	Vegetation	Invasive species	Identify where invasive species are creating harm and habitat loss.	
23	Vegetation	Invasive species	Determine potential management strategies for eucalyptus trees (*Eucalyptus* spp.) (e.g., manual thinning, prescribed burning).	
24	Vegetation	Invasive species	Determine if there are areas in the unit that have no invasive species and are still intact. If so, determine how these areas can be monitored to prevent future encroachment.	
25	Vegetation	Invasive species	Determine how to monitor invasive annual grasses to understand species trends over time. Determine how to use monitoring to understand treatment effectiveness.	
26	Vegetation	Invasive species	Determine feasible methods for control of French broom, especially on extremely steep slopes embedded in forest and coastal scrub.	

Table 14. Continued.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
27	Vegetation	Invasive species	Determine the most effective methods to treat Cape ivy (*Delairea odorata*) in riparian zones and whether biocontrol is an option.	
28	Vegetation	Invasive species	Determine the best methods to manage nonnative plant growth in areas where it might interfere with trails or pose a fire risk. Determine if other methods are feasible, in addition to mowing and/or applying herbicide.	
29	Vegetation	Invasive species	Identify the most effective removal and eradication methods for poison hemlock (*Conium maculatum*), purple pampas grass (*Cortaderia jubata*), yellow star-thistle *(Centaurea solstitialis*), and other problematic weeds present in the unit.	
30	Vegetation	Reclamation and restoration	Inventory nectar and pollinator plant species to help prioritize conservation and restoration efforts.	
31	Vegetation		Determine the presence of dominant annual grasses in the unit.	
32	Vegetation		Determine the relationship of the unit's climate and annual plant functional diversity.	
33	Vegetation		Determine methods for reintroducing native grasses.	
34	Vegetation	Monarch butterflies	Identify monarch overwintering, nectaring, and breeding sites in the unit.	
35	Vegetation	Monarch butterflies	Identify suitable habitat for monarchs across the unit and the condition of the habitat.	
36	Vegetation	Monarch butterflies	Determine how removal of eucalyptus trees—invasive but historically present—could affect habitat availability/suitability for monarchs.	
37	Vegetation	Monarch butterflies	Determine the benefits of eucalyptus trees for monarchs and how their removal could change habitat use for monarchs.	
38	Vegetation	Monarch butterflies	Determine if other eucalyptus groves adjacent to the unit could be thinned for visitation while still supporting use by monarchs.	
39	Vegetation	Monarch butterflies	Understand the importance of the unit for providing monarch habitat along the California coast and how changing environmental conditions affect this habitat.	

Table 15. Cotoni-Coast Dairies science needs that relate to wildlife. Note: Needs labeled as high priority are tied to public safety or at least one statutory, permitting, or reporting requirement.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
1	Wildlife	Anadromous fish	Identify pinch points for anadromous fish in unit creek systems that prevent fish from making it to higher elevations in those systems. Determine if datasets, such as the California Department of Fish and Wildlife Passage Assessment Database, could provide support.	High
2	Wildlife	Anadromous fish	Using the National Marine Fisheries Service (2016) Coastal Multispecies Recovery Plan, determine the status of steelhead (*Oncorhynchus mykiss*) and coho salmon (*Oncorhynchus kisutch*) in stream systems in the unit.	High
3	Wildlife	Anadromous fish	Identify status and recovery opportunities for salmon species present within the unit.	High
4	Wildlife	Anadromous fish	Determine if the unit's streams currently provide suitable habitat for steelhead and coho salmon. Determine how the BLM can prioritize such habitats for management and restoration.	High
5	Wildlife	Anadromous fish	Use the National Marine Fisheries Service (2016) recovery plan to guide identification of streams that provide suitable habitat for coho salmon. Identify recovery actions for fish species in coastal areas within and outside BLM-managed lands.	High
6	Wildlife	Anadromous fish	Use the National Marine Fisheries Service (2023, 2024) 5-year reviews to understand the status of coho salmon and steelhead present in the unit. Determine which habitat has been documented historically and the potential for suitable habitat in unit stream systems.	High
7	Wildlife	Anadromous fish	Explore how the BLM can partner with other organizations that manage watershed sections downstream of the unit to address fish passage barriers that limit anadromous fish migration between the ocean and watersheds onsite.	High
8	Wildlife	Anadromous fish	Explore ways the BLM can address barriers on BLM sections of watersheds to improve onsite habitat, particularly once the lower barriers downstream of BLM sections are addressed.	High
9	Wildlife	Aquatic wildlife	Determine potential negative effects of other sensitive native species on California red-legged frogs (*Rana draytonii*).	High
10	Wildlife	Aquatic wildlife	Understand historical gene flow and population structure of California red-legged frogs.	High
11	Wildlife	Aquatic wildlife	Determine how the unit can monitor the pond habitat where California red-legged frogs are present and if this is high-quality habitat.	High

Table 15. Continued.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
12	Wildlife	Aquatic wildlife	Determine the values that constructed California red-legged frog ponds within floodplains add to recovery of the species. Assess how the constructed breeding ponds on the terrace could best be used to support California red-legged frog conservation.	High
13	Wildlife	Aquatic wildlife	Understand how translocation efforts may affect genetic structure of the California red-legged frog population, in relation to U.S. Fish and Wildlife Service approvals (e.g., less than 2-kilometer distance movement restriction).	High
14	Wildlife	Aquatic wildlife	Understand reproduction rates of California red-legged frogs in individual ponds within and around the unit, including on lands owned by the Trust for Public Land. Considering this, assess the BLM's role and influence in population persistence.	High
15	Wildlife	Aquatic wildlife	Identify U.S. Fish and Wildlife Service recovery plan activities that could benefit tidewater gobies (*Eucyclogobius newberryi*) in and near the unit.	High
16	Wildlife	Aquatic wildlife	Research movement patterns of California red-legged frogs in and around ponds on BLM and Trust for Public Land property during and beyond the breeding season and how this relates to recolonization of individual ponds and metapopulation structure.	High
17	Wildlife	Aquatic wildlife	Research interactions between California red-legged frogs and west coast newts (e.g., California newt (*Taricha torosa*), rough-skinned newt (*Taricha granulosa*)), including through the foundation of work done at Upper Molino Pond (where there are many newts and 30 California red-legged frog egg masses were relocated, and there is documentation of California red-legged frog egg and tadpole predation by newt larvae).	High
18	Wildlife	Aquatic wildlife	Map genome of the rough-skinned newt to understand whether mega larvae are the offspring of a hybrid event and to help inform conservation efforts for California red-legged frogs.	High
19	Wildlife	Aquatic wildlife	Expand experiments exploring to what extent newts are affecting California red-legged frogs, including through predation on eggs, using existing pond array.	High
20	Wildlife	Aquatic wildlife	Conduct research to determine why Upper Molino Pond may never have had successful reproduction of California red-legged frogs.	High
21	Wildlife	Aquatic wildlife	Determine which invasive species may be competing with California red-legged frogs in ponds.	High
22	Wildlife		Identify and map the primary migration or flyover corridors that are heavily used by terrestrial or aerial wildlife species of management interest or concern.	High

Table 15. Continued.

Number	Primary Resource or Activity Category	Subcategory	Science Needs	Priority
23	Wildlife	Birds	Assess onsite areas that support seasonal movement or flyover use specifically by nonraptor or other bird species of interest—particularly those dependent on wetland, riparian, or grassland habitats during migration.	High
24	Wildlife	Aquatic wildlife	In and around the unit, monitor additional species (e.g., Santa Cruz black salamander (*Aneides niger*)) through threatened and endangered species studies, including presence, habitat preferences, and population status and trend.	
25	Wildlife	Aquatic wildlife	Work with land management partners to document what appears to be widespread newt overwintering syndrome.	
26	Wildlife	Mountain lions	Research mountain lion (*Puma concolor*) population dynamics across the Santa Cruz and Diablo Mountain Ranges. Determine areas most used by mountain lions onsite and as migratory corridors to and from surrounding areas in the Santa Cruz Mountains.	
27	Wildlife	Monarch butterflies	Collect information that would allow the BLM to develop a comprehensive monarch management plan for the unit.	
28	Wildlife	Data, methods, or monitoring	Monitor recovery of threatened and endangered species protected under the Endangered Species Act.	
29	Wildlife	Birds	Determine if there is potential habitat for marbled murrelets (*Brachyramphus marmoratus*) in the unit. Also, determine which areas of the unit may provide migratory or flyover corridors for marbled murrelets.	
30	Wildlife	Birds	Implement bird monitoring in the unit, including nest searching and point count methods.	
31	Wildlife	Birds	Using community science and other partnerships, monitor avian populations present in the unit.	
32	Wildlife	Birds	Obtain more information about the presence, habitat preferences, and population status and trend of grasshopper sparrows (*Ammodramus savannarum*) in and around the unit.	
33	Wildlife		Survey American badger (*Taxidea taxus*) presence/absence within the unit.	
34	Wildlife		Research historical presence of rare bumblebees (*Bombus* spp.) in and around the unit.	

4. Meeting Science Needs for Cotoni-Coast Dairies

4.1 Science Roles and Contacts for Cotoni-Coast Dairies

The primary point of contact for all scientific and educational inquiries affecting the unit is the science and education coordinator, a designee of the field manager of the Central Coast Field Office. All scientific research proposals are directed through the science and education coordinator, who is responsible for the following:

- Maintaining a current inventory of science needs/opportunities.
- Coordinating with other BLM Central Coast Field Office subject matter experts and other unit and monument staff, as appropriate, to evaluate science proposals.

Other points of contact and roles related to science in Cotoni-Coast Dairies are:

- Science and education coordinator: New science inquiries.
- Science and education coordinator: Information distribution related to science.
- Scientific research authorization and processing roles: The unit and monument anticipate transitioning to the Recreation and Permit Tracking Online Reporting (RAPTOR) system for issuing scientific research authorizations (https://permits.blm.gov). In the interim, research authorizations are coordinated by contacting the unit directly (refer to Appendix F for additional details on natural resource-related permits). Roles for issuing research authorizations include:
    - Authorization administrator (science and education coordinator): Coordinates processing of authorizations, such as working with interdisciplinary teams to complete technical and compliance reviews, coordinating BLM funds with proposal inquiries, and serving as a liaison with other BLM managers and subject matter experts.
    - Authorized officers (field manager or assistant field manager for the Central Coast Field Office): The individuals with the delegated authority to approve authorizations.
    - Other permit types, such as paleontology permits or special recreation permits, are processed through separate modules in RAPTOR. Certain types of permits within the BLM, for example grazing research permits (free), have separate processes that should be shared with the field manager for review.
    - Permits to conduct work on cultural resources have separate, additional processes, including required permits administered by the BLM California State Office (permit for archaeological investigations). This is a required first step for conducting any archaeological research on BLM-managed lands, including inventories or excavations. Subsequent fieldwork authorization is tiered off the permit from the BLM California State Office at the field office level.
    - There are separate DOI standard permit conditions, California State special permit conditions, and field office-specific permit conditions that are agreed upon. Deviating from those conditions by an applicant could terminate a permit or cause the applicant to receive a warning at the BLM state office level.

4.2 Cotoni-Coast Dairies Partners and Collaborators

Collaboration and open communication with existing and potential science partners is critical to the success of implementing this science strategy, protecting the objects of Cotoni-Coast Dairies, and informing management decisions. Staff at the USGS connected with a subset of the unit's partners to inform this science planning process (refer to section 1, section 3, and Appendix A).

Existing local partners, land managers, and collaborators are identified in the following list, and some have conducted work on or around the unit (e.g., "Coast Dairies Long-Term Resource Protection and Use Plan: Existing Conditions Report for the Coast Dairies Property," Environmental Science Associates 2001, 2004). Other local and state partners, land managers, and entities will be added, as appropriate, with updates to this science strategy. Partners and collaborators of Cotoni-Coast Dairies include:

- Amah Mutsun Land Trust
- CalWild
- Santa Cruz Museum of Natural History
- University of California Research University System
- University of California Santa Cruz Natural Reserve System
- University of California Santa Cruz Arboretum and Botanic Garden
- Santa Cruz Mountains Stewardship Network, which includes multiple organizations previously listed, many of the land managing organizations in the Santa Cruz Mountain region, and the Jasper Ridge Biological Preserve of Stanford University
- Swanton Pacific Ranch, an educational and research facility adjoining the unit and operated by California Polytechnic State University (Cal Poly), San Luis Obispo
- Santa Cruz County Resource Conservation District
- USGS
- National Oceanic and Atmospheric Administration
- California Department of Fish and Wildlife
- CAL FIRE

As management questions and needs are not limited by jurisdictional boundaries, the success of management efforts in one geographical area will often be dependent on management efforts in another area. Regular conversations, interagency workgroups, and attendance at regional, state, and national meetings and conferences can help foster these relationships and collaborative opportunities. Collaborative networks among partners are one of the more effective ways to facilitate these efforts. For example, collaboration with Cooperative Ecosystem Studies Units partners promotes collaboration while further conserving, protecting, and restoring the nationally significant landscapes of the NLCS.

4.3 Citizen Science

Citizen science (hereafter, community science) can be useful for both monitoring resource conditions in the unit and for conducting new research. These voluntary contributions of time, observations, knowledge, and experience can provide valuable support for scientific research. BLM science goals have several clear connections to community science and advocate for creating a network of community scientists on BLM-managed lands (Kitchell et al. 2015).

Science needs identified in this strategy related to community science (refer to Table 3) can be used to further support and guide community science efforts in the unit. The science and education coordinator and other subject matter experts intend to encourage public use of community science and crowdsourcing websites in authorized areas to help document species distribution, including through ebird.org for bird observations, calflora.org for botanical observations, and inaturalist.org for observations of any species. Additional platforms may be incorporated over time based on BLM interest and capacity.

4.4 Data Management

Unit staff identified a number of science needs related to data collection and management (refer to Table 5). In addition to these specific data needs, there are broader needs for data to support effective management in the unit. The BLM will continue to seek out legacy data, including land management plans, and those data will be incorporated into future documents.

Data Repository

Across resource categories, there is an ongoing need to identify and evaluate the flow of data of all types associated with the unit. Specifically, data from the unit need to be curated in a robust and useful data repository. This is no small task: there is a large volume of both existing data and incoming, new data. For example, data are available that predate the establishment of the unit that exist only in paper form, while cutting-edge remote sensing platforms offer volumes of potentially useful data each year. Due to the volume of new data being created, data storage capacity within the unit will be necessarily limited and restricted to special projects and analyses. Reconciling these very different data sources and managing them effectively to support analysis, decision making, and adaptive management will be an ongoing challenge for unit staff. Importantly, data repository needs span larger domains than this unit, and unit staff would like to engage in agencywide conversations about data accessibility and management.

Cultural Data

Cultural sites in the unit have specific data needs (refer to Table 4). Unlike other resources, the sensitivity of cultural sites to human disturbance and looting requires that cultural data be carefully held. There is a central data repository for cultural data in the BLM, the Cultural Data Viewer, available to unit staff to assist in decision making. There is much work to be done identifying, dating, and protecting cultural sites in the unit.

Vegetation Data

Vegetation data are vital for understanding the effects of management interventions over time and sustaining a healthy landscape (refer to Table 14). Understanding the status and trends of riparian vegetation, spatially explicit occurrence and abundance of nonnative plants, and vegetation data that provide feedback about the effectiveness of management actions are all priority data needs. Datasets such as those available through the Assessment, Inventory, and Monitoring (AIM) program, the California Department of Fish and Wildlife's Vegetation Classification and Mapping Program (VegCAMP), and the Vegetation Management Action Portal (VMAP) can help address these questions.

Water Data

A number of science needs identified for the unit relate to water resources (refer to Table 9). Many possible avenues exist to develop a more robust understanding of the hydrological systems of Cotoni-Coast Dairies, including through stream temperature monitoring; quantitative data on stream flows, groundwater levels, and groundwater recharge areas; and working across administrative boundaries to develop a holistic management strategy that connects the multiple land managers that manage different sections of the watersheds upstream and downstream of the unit. BLM water rights must be reported to the California Water Accounting, Tracking, and Reporting System (CalWATRS) on an annual basis by the field office.

Effects of Changing Environmental Conditions

Finally, there is a great need for data on projected environmental changes, particularly related to wildfire risk, to effectively protect, conserve, and restore resources in the unit and address public health and safety concerns. Appendix G contains information about the projected environmental changes for the region in which the unit is located. However, adaptive management is a process, not a destination. Collecting, compiling, and summarizing information about how changing environmental conditions are affecting the unit is expected to be a continuing area of focus for scientists and managers.

5. Science Protocols for Cotoni-Coast Dairies

This section identifies applicable policy and guidance, where scientific protocols exist (or are needed), and the procedures for authorizing and tracking research projects.

Three broad protocols unit staff would like to promote are:

- Use of peer-reviewed and publicly accessible protocols for monitoring the status and trends of objects for which Cotoni-Coast Dairies was designated.
- Use of monitoring protocols that are tailored to identifying needs for resource conservation and on-the-ground treatments, with an emphasis on protocols that capture pre- and post-treatment conditions.
- Use of and integration with the BLM's AIM program, which operates on all BLM-managed lands (https://www.blm.gov/aim).

5.1 Science Guidelines at Cotoni-Coast Dairies

Scientific research conducted in the unit must be approved in compliance with regulations and policy, including the following:

- Prior to approving a research proposal, compliance reviews under legal, reporting, and statutory requirements (e.g., National Environmental Policy Act, Endangered Species Act, National Historic Preservation Act, other applicable internal policy guidance) must be completed if the project has potential to have significant effects on unit resources.
    - Special conditions may be applied to projects in areas with management constraints, such as developed recreational areas.
- Policy compliance for use of unmanned aerial systems (UASs) (or drones) needs to be confirmed. While utilization of these systems is of interest to advance research, if researchers plan to use drones for any purpose, it must be clearly stated in the research proposal and approved by associated authorization.
- Applicable DOI and BLM scientific policies need to be considered, including the "Integrity of Scientific and Scholarly Activities" (DOI 2014) and the Ethics Toolkit for Researchers and Scientists (DOI 2025).
- Researchers must adhere to the science ethics standards adopted by unit staff (International Academy of Science 2025; Society for California Archaeology 2020).
- As appropriate, guidance such as the DOI's Information Quality Guidelines must be followed.
- Safety considerations should be reviewed and addressed in special conditions, including conditions to ensure that all materials and vehicles used onsite would not start a fire or pose other risks to public safety.

5.2 Workflow for Science Conducted at Cotoni-Coast Dairies

To ensure that scientific inquiries are effective and efficient, and do not conflict with legal requirements and agency direction, scientific research at Cotoni-Coast Dairies will conform to the following workflow:

1. Researcher submits a proposal.

Scientific research proposals should be submitted to the science and education coordinator and include contact information for

the principal researcher, a summary of proposed research, the proposed timeline for fieldwork, and, if applicable, an outline of proposed plans for publication and public outreach. All research will require coordination and communication with the BLM, sharing information requested by the BLM, and close-out reporting. Publications and public outreach materials are strongly encouraged, and researchers receiving authorizations are responsible for sharing these materials with the BLM at the time of publication or when the materials are shared with other organizations (e.g., sharing poster or oral presentations given at scientific conferences).

2. The proposal is considered by the Cotoni-Coast Dairies leadership team.

The BLM will determine whether the proposal is (1) complete, (2) conforms to the resource management plan amendment, and (3) meets the unit's scientific mission. If so, the BLM will then determine whether NEPA analysis or further regulatory compliance is necessary. When funding and workload allows, BLM staff may lead NEPA analysis. Otherwise, the applicant will be required to lead or fund the required NEPA analysis.

3. Authorization is granted to conduct research.

Once all requirements have been completed, the BLM will authorize the research. Authorization will include stipulations such as time limits, communication for site access, and sharing information requested by Central Coast Field Office (e.g., publications and public outreach materials). Refer to Appendix F for a sample form and associated stipulations for natural resource studies.

4. BLM Law Enforcement and unit and monument staff are made aware of the authorization.

Cotoni-Coast Dairies staff and BLM Law Enforcement representatives will be given a copy of the form so that they are aware of potential interactions with researchers in the unit and monument.

5. Research is initiated.

Research must be conducted according to the stipulations outlined in the authorization form (refer to Appendix F for a general template, though this will be amended over time as appropriate and is not applicable to cultural resource studies). Application for another authorization will need to be submitted to the science and education coordinator if the research will require more than the timeline specified in the initial authorization to complete. Communication with the BLM should include the status of research and preliminary findings.

6. Research is completed.

Upon conclusion of the study, the researcher is expected to share requested information with the designated BLM representative (usually the science and education coordinator), including research background, findings, a summary of any public outreach efforts, and citations if the research is published. Researchers are strongly encouraged to share all outreach materials and citations prepared after the research has been conducted regardless of the length of time between completion of research and publication dates.

6. Organization and Communication of Science Conducted at Cotoni-Coast Dairies

The Cotoni-Coast Dairies resource management plan amendment (BLM 2021) and section 2 of this strategy provide summaries and lists of science conducted on or near the unit for key resources, objects, and values of the unit and monument. Annual manager's reports also provide a list of scientific research projects and publications that unit staff are aware of, including literature obtained from the BLM Library, Interior Library, USGS ScienceBase, Google Scholar, and other science databases. Together, these reports meet the requirement in BLM Manual 6220 to provide (1) a bibliographic list of completed reports from science in the unit and (2) any syntheses of relevant scientific information. This information will be kept updated as unit and monument plans and reports are updated and revised. Staff at the Central Coast Field Office encourage researchers from other agencies and organizations to provide access to their science, including existing datasets for ongoing studies conducted in and around the unit. Additionally, the unit hopes to elevate science efforts within the BLM and, through this strategy, propose ways in which the Central Coast Field Office can serve as a model for other BLM units with science interests but limited capacity.

6.1 Science Communications for Cotoni-Coast Dairies

RAPTOR, along with national programmatic and agency data systems such as AIM databases, USGS ScienceBase, Figshare, BLM Library, DOI Library, and Central Coast Field Office databases, will serve as the primary repositories for ongoing and existing scientific research in the unit.

Public communications occur in coordination with a BLM public affairs specialist and the field and monument manager. Updates on activities and findings may be shared on BLM websites, via social media feeds or blog posts, and through press releases and community outreach events. The BLM Library or other publicly accessible regional or national data systems (such as BLM AIM databases, USGS ScienceBase, or Natural Heritage Program systems) are used whenever possible. Publications will be open access when possible (consistent with legislation such as the Foundations for Evidence-Based Policymaking Act of 2018, Public Law 115–435). Publicly available plain language summaries are encouraged and made available on the unit website when appropriate.

When possible, the unit intends to participate in or host public symposia or other events where scientific findings are shared with partners. The unit and monument encourage the participation of BLM staff in producing science, including community science, and sharing findings at local and national professional meetings and at other venues for sharing science that are likely to be attended by individuals and organizations with an interest in science at Cotoni-Coast Dairies.

6.2 Interpretation for Cotoni-Coast Dairies

Throughout the process of developing this science strategy, BLM staff and partners identified the need for effectively interpreting information about resources, processes, and management actions in the unit for the public. Multiple science needs relate to interpretation (refer to Tables 3–15). Beyond these specific needs, unit staff and partners may consider broader themes in efforts to interpret the meaning and significance of science and management efforts in ways that are clear and accessible to the public.

Interpretation can be a useful tool for creating connections and building new understanding. Specific topics that unit staff would like to see prioritized in future interpretation efforts include:

- Research and education.
- Reducing litter and food waste onsite to minimize effects to wildlife.
- Promoting public awareness of problems of invasive plant and wildlife introductions and best management practices to limit their spread (e.g., using signs, logos, and messaging from California State Parks).
- Fire history, prescribed fire methods, ecological benefits of fire, and potential acceptance of prescribed fire as a management tool.
- Precontact trade routes and trails that cross the unit.
- Cultural resource protection as a fundamental purpose of the unit.
- Awareness of illegal trade of cultural artifacts and preventing looting or destruction of cultural sites.
- The geological history of the unit, including tectonics, unique and interesting geological features such as marine terraces, and physiography.
- Historical land uses and the physical legacy of these uses that persist today (e.g., agriculture, grazing, logging, mining).
- Connections between the landscape history and human history across time.

Interpretation is especially important for people visiting Cotoni-Coast Dairies to recreate. The types of activities, number of people, and places where people recreate will change as public access evolves. These changes are reflected in many of the science needs related to recreation and may warrant the development of a formal interpretation plan for the unit as capacity allows. Creating connections between user groups, the unit, and the monument is an ongoing goal of interpretation. Interpretation is also a valuable opportunity to help visitors understand current regulations and the purpose of those regulations, as voluntary compliance with regulations, rather than enforcement, is the goal.

7. Cotoni-Coast Dairies Science Strategy Review and Updates

7.1 Review Process for the Science Strategy

Initial review of this strategy was conducted by resource specialists in the Central Coast Field Office who have responsibilities related to the unit. BLM staff (in addition to science strategy authors) who provided input to the strategy included the monument manager, district office manager, district office communications specialist, state office public affairs, and state aquatic resource lead. The strategy was also shared with external partners involved in the science planning process. The strategy was subsequently reviewed by four peer reviewers familiar with the NLCS science planning process as part of USGS Fundamental Science Practices.

7.2 Updates to the Science Strategy

This science strategy is considered an evolving publication that will be revised and updated. Scientific needs that emerge during implementation of the science strategy will be added to subsequent versions, and priorities will be adjusted as needed to meet the unit's scientific mission. An annual review of the strategy, concurrent with development of the annual monument manager's report, is intended to facilitate this maintenance. Potential annual updates or appendices may include updated management needs, science priorities, and scientific accomplishments (e.g., updated list of published science products from the unit, review of new and ongoing scientific research authorizations). A thorough review and update of the science strategy is anticipated in conjunction with evaluation of the resource management plan amendment. Future coordination with Indigenous peoples and other partners with an interest in science and education is anticipated to both implement and update the strategy over time.

Appendix A: Partner Conversations to Inform the Science Planning Process for Cotoni-Coast Dairies

As part of the science planning process for Cotoni-Coast Dairies, scientists at the U.S. Geological Survey (USGS) hosted informal conversations with unit partners to inform the unit's definition of science and gather partner input on science needs. This appendix includes content of the email invitation sent to partners, conversation script and questions, sample size, organizations represented in conversations, and responses to questions 4–7. Partner responses to the definition of science (question 1) are included within section 1 of this strategy, and partner science needs (questions 2 and 3) are included within section 3 of the strategy.

A.1 Email Invitation to Partners

The USGS Fort Collins Science Center works on a variety of projects with the Bureau of Land Management (BLM) to help facilitate and strengthen the integration of science into decision-making on public lands, and to support conservation and restoration efforts for priority resources, objects, and values. The specific project that we would like to talk to you about is focused on developing Science Strategies for BLM National Monuments and National Conservation Areas to help prioritize and support science efforts to better understand and manage resources in these landscapes. Each National Monument and National Conservation Area managed by the BLM is required to develop a science strategy outlining priority management questions and science needs for managing the unit's resources (BLM 2017).

As we begin to think about science planning for C-CD, we are interested in learning more about your relevant science and science activities for informing future management on the unit. We will be asking you approximately five questions, and depending on the length of your responses, we expect this will take up to 15 minutes of your time.

We hope the information we gather from these conversations can help us identify what relevant science and science activities look like for this unit.

How Will the Results of the Conversation be Used?

We are inviting you to participate in an informal conversation. Your responses will be used as feedback for the unit on what to include within their science strategy. Example quotes from our conversation may be used in the final strategy to illustrate the types of science and science activities that were addressed in the strategy effort, with your consent. Involvement in the study is voluntary. This means that you can choose whether to participate and that you may withdraw from the study at any time without penalty.

To make sure we understand your responses and capture your views accurately, we would like to take notes during your conversation using Microsoft Word.

Who Will See My Responses to the Questions?

All information we collect during these conversations will be stored in a secure data folder which will only be accessible to our project team at the USGS Fort Collins Science Center and our information technology (IT) team. We

will assign a number to your responses, and only the research team will have the key to indicate which number belongs to which participant. No one at the BLM (including the BLM project team) will have access to identifiable information linking you to your responses. In any articles that we write or any presentations that we give, we will not reveal individually identifiable details including your name, your position, your office, your associates, etc.

Privacy Advisory

Whenever one works with email or the internet, there is always the risk of compromising privacy, confidentiality, and/or anonymity. Your confidentiality will be maintained to the degree permitted by the technology being used. There is also a minor risk of this interview information being made public through a Freedom of Information Act (FOIA) request.

Your response indicates your willingness to participate in this study. If you have any questions, concerns, or complaints about the research, contact the Principal Investigators.

A.2 Conversation Script and Questions

Opening: Thank you for agreeing to speak with us about your perceptions of science at Cotoni-Coast Dairies. We have five questions for you and have scheduled 15 minutes for our conversation today, but we do not need to use the full time if it's not needed. Before we get started, we want to let you know that you are more than welcome to interject or ask for clarification at any point. This is an informal conversation, so we may ask for a follow up to your thoughts if we need further information.

Project Introduction: We would like to begin by providing information about the broader project that this discussion will inform. The U.S. Geological Survey is partnering with the BLM to support science planning in BLM's National Landscape Conservation System. The project has one primary objective, which is to develop science strategies for individual units of BLM's National Landscape Conservation System. The National Landscape Conservation System was established in 2000 to conserve, protect, and restore nationally significant landscapes. Science strategies are intended to identify and prioritize science needs, promote science efforts, and foster the use of that science in management decisions on the unit. Accordingly, each National Monument and National Conservation Area managed by the BLM is required to develop a science strategy outlining priority management questions and science needs for managing the unit's resources.

Cotoni-Coast Dairies is an onshore unit of the California Coastal National Monument. Near Davenport in Santa Cruz County, Cotoni-Coast Dairies extends from the steep slopes of the Santa Cruz Mountains to the marine coastal terraces overlooking the Pacific Ocean. Vibrant riparian areas follow along stream corridors, with red alder and arroyo willow forests dominating the vegetative community. Beyond supporting riparian and wetland communities, Cotoni-Coast Dairies' waterways provide important habitat for anadromous and freshwater fish as well as water for the city of Santa Cruz and surrounding communities.

Cotoni-Coast Dairies was donated to the BLM in 2014 by The Trust for Public Land. The property is distinguished by broad marine terraces separated by six forested, perennial streams that flow from the Santa Cruz Mountains into the Pacific Ocean. The area supports a wide variety of habitats and wildlife, including coho salmon, steelhead trout, California red-legged frogs, mule deer and mountain lions. A phased approach to recreation development will help protect the property's sensitive biological and cultural resources.

BLM has requested support from USGS in developing their science strategy. BLM is responsible for developing the strategy, but they have asked that we get additional perspectives from their partners on what constitutes a "science need" for the unit.

Interview Objectives: This conversation will help us better understand your perceptions of science in the unit.

Reminder of Consent/Risk: The initial email sent contained information about how we will use and store your responses and the potential risks of participating in this conversation. That document is also attached to this meeting invite if you would like to look through it again. As a reminder, the information collected from your responses will be used as part of pre-planning discussions for the science strategy. All notes and documents that have information that could identify you to your responses will be housed in our secure data folder that only our USGS project team and our IT staff can access. Any information reported in the science strategy will be presented in a way in which it cannot be identified back to you as an individual. Please let me know if you have any questions, and remember that it's okay to withdraw from this conversation at any time.

Record Keeping: We will be taking notes as we move through our discussion. We will share our screen so that you can clarify and confirm our interpretation of your responses as we progress from one question to the next. Are you comfortable with us taking notes?

Interview Process: We will jump right into our science topics questions, and then have a couple of questions on your interest in further engagement in the science planning process. Note that throughout this conversation there are no right or wrong answers, we value responses from folks from all different types of backgrounds and experiences.

Questions:

1. Tell us what science means to you.
2. Based on your response, what kinds of big picture questions do you think we should be asking in this science planning effort for Cotoni-Coast Dairies?
3. Please provide a few examples of what you consider to be relevant information and science products and activities for meeting science needs for Cotoni-Coast Dairies.
4. Are you comfortable with us using a quote from this conversation today within the Science Strategy for Cotoni-Coast Dairies or a related strategy or publication?
5. If so, are you comfortable with us attributing this quote to you or your partner group? How exactly would you like that attribution to read?
6. Would you like to be acknowledged as someone who provided input in this stage of the science planning process for Cotoni Coast-Dairies (e.g., in the Acknowledgements section of the science strategy or a related strategy or publication)?
7. Would you like to be kept appraised on the status of the science planning effort for Cotoni-Coast Dairies (e.g., when we hold a kickoff meeting or ask for public input on draft science needs)?

A.3 Partner Organizations Represented in Conversations, Including Conversation Sample Size

Organizations represented in the partner conversations included the University of California Santa Cruz Department of Ecology and Evolutionary Biology, CalWild, Santa Cruz Museum of Natural History, and the Amah Mutsun Land Trust. Six partners participated in our conversations to inform the science planning process.

A.4 Partner Responses to Questions 4–7

All participants were comfortable with the USGS using quotes from our conversation in the science strategy or a related strategy or publication. All wanted acknowledgment in the science strategy (refer to "Acknowledgments" section), and all wanted to be kept appraised on the status of the science planning effort.

APPENDIX A REFERENCE

BLM (Bureau of Land Management). 2017. BLM Manual 6220, National Monuments, National Conservation Areas, and Similar Designations. U.S. Department of the Interior, Bureau of Land Management, Washington, DC.

Appendix B: Proclamation Establishing the California Coastal National Monument

Proclamation 7264—Establishment of the California Coastal National Monument

January 11, 2000

By the President of the United States of America

A Proclamation

The islands, rocks, and pinnacles of the California Coastal National Monument overwhelm the viewer, as white-capped waves crash into the vertical cliffs or deeply crevassed surge channels and frothy water empties back into the ocean. Amidst that beauty lies irreplaceable scientific values vital to protecting the fragile ecosystems of the California coastline. At land's end, the islands, rocks, exposed reefs, and pinnacles off the coast above mean high tide provide havens for significant populations of sea mammals and birds. They are part of a narrow and important flight lane in the Pacific Flyway, providing essential habitat for feeding, perching, nesting, and shelter.

The California Coastal National Monument is a biological treasure. The thousands of islands, rocks, exposed reefs, and pinnacles are part of the nearshore ocean zone that begins just off shore and ends at the boundary between the continental shelf and continental slope. Waters of this zone are rich in nutrients from upwelling currents and freshwater inflows, supporting a rich array of habitats and organisms. Productive oceanographic factors, such as major ocean currents, stimulate critical biological productivity and diversity in both nearshore and offshore ocean waters.

The monument contains many geologic formations that provide unique habitat for biota. Wave action exerts a strong influence on habitat distribution within the monument. Beaches occur where wave action is light, boulder fields occur in areas of greater wave activity, and rocky outcroppings occur where wave action is greatest. The pounding surf within boulder fields and rocky shores often creates small, but important, habitats known as tidepools, which support creatures uniquely adapted for survival under such extreme physical conditions. Although shoreline habitats may appear distinct from those off shore, they are dependent upon each other, with vital and dynamic exchange of nutrients and organisms being essential to maintaining their healthy ecosystems. As part of California's nearshore ocean zone, the monument is rich in biodiversity and holds many species of scientific interest that can be particularly sensitive to disturbance.

The monument's vegetative character varies greatly. Larger rocks and islands contain diverse growth. Dudleya, Atriplex-Baeria-Rumex, mixed grass-herb, Polypodium, Distichlis, ice plant, Synthyris-Poppy, Eymus, Poa-Baeria, chapparal, and wetlands vegetation are all present. Larger rocks and islands contain a diverse blend of the vegetation types.

The monument provides feeding and nesting habitat for an estimated 200,000 breeding seabirds. Development on the mainland has forced seabirds that once fed and nested in the shoreline

ecosystem to retreat to the areas protected by the monument. Pelagic seabird species inhabit salt or brackish water environments for at least part of their annual cycle and breed on offshore islands and rocks. Gulls, the endangered California least tern, the threatened brown pelican, and the snowy plover, among countless others, all feed on the vegetation and establish their nests in the monument. Both bald eagles and peregrine falcons are found within the monument.

The monument also provides forage and breeding habitat for several mammal species. Pinnipeds are abundant, including the threatened southern sea otter and the Guadalupe fur seal. The monument contains important shelter for male California sea lions in the winter and breeding rookeries for threatened northern (Steller) sea lions in the spring.

Section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431) authorizes the President, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments, and to reserve as a part thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected.

Whereas it appears that it would be in the public interest to reserve such lands as a national monument to be known as the California Coastal National Monument:

Now, Therefore, I, William J. Clinton, President of the United States of America, by the authority vested in me by section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431), do proclaim that there are hereby set apart and reserved as the California Coastal National Monument, for the purpose of protecting the objects identified above, all unappropriated or unreserved lands and interests in lands owned or controlled by the United States in the form of islands, rocks, exposed reefs, and pinnacles above mean high tide within 12 nautical miles of the shoreline of the State of California. The Federal land and interests in land reserved are encompassed in the entire 840 mile Pacific coastline, which is the smallest area compatible with the proper care and management of the objects to be protected.

The establishment of this monument is subject to valid existing rights.

All Federal lands and interests in lands within the boundaries of this monument are hereby appropriated and withdrawn from all forms of entry, location, selection, sale, leasing, or other disposition under the public land laws, including but not limited to withdrawal from location, entry, and patent under the mining laws, and from disposition under all laws relating to mineral and geothermal leasing, other than by exchange that furthers the protective purposes of the monument. Lands and interests in lands within the proposed monument not owned by the United States shall be reserved as a part of the monument upon acquisition of title thereto by the United States.

The Secretary of the Interior shall manage the monument through the Bureau of Land Management, pursuant to applicable legal authorities, to implement the purposes of this proclamation.

Nothing in this proclamation shall be deemed to revoke any existing withdrawal, reservation, or appropriation; however, the national monument shall be the dominant reservation.

Nothing in this proclamation shall enlarge or diminish the jurisdiction or authority of the State of California or the United States over submerged or other lands within the territorial waters off the coast of California.

Nothing in this proclamation shall affect the rights or obligations of any State or Federal oil or gas lessee within the territorial waters off the California coast.

Warning is hereby given to all unauthorized persons not to appropriate, injure, destroy, or remove any feature of this monument and not to locate or settle upon any of the lands thereof.

In Witness Whereof, I have hereunto set my hand this eleventh day of January, in the year of our Lord two thousand, and of the Independence of the United States of America the two hundred and twenty-fourth.

William J. Clinton

Appendix C: Proclamation Enlarging the Boundary of the California Coastal National Monument

Proclamation 9563—Boundary Enlargement of the California Coastal National Monument

January 12, 2017

By the President of the United States of America

A Proclamation

Through Proclamation 7264 of January 11, 2000, President Clinton established the California Coastal National Monument (monument) to protect the biological treasures situated on thousands of unappropriated or unreserved islands, rocks, exposed reefs, and pinnacles owned or controlled by the Government of the United States within 12 nautical miles of the shoreline of the State of California. Presidential Proclamation 9089, issued on March 11, 2014, expanded the monument to include the Point Arena-Stornetta Public Lands, a landscape of coastal bluffs and shelves, tide pools, onshore dunes, coastal prairies, and riverbanks, and the mouth and estuary of the Garcia River. In addition to providing vital habitat for wildlife, these coastal lands were critical for the native peoples who first lived along the California Coast, and they continue to be treasured by modern generations.

Six other spectacular areas along the California Coast contain significant scientific or historic resources that are closely tied to the values of the monument. Like the protections afforded by prior proclamations, protection of Trinidad Head, Waluplh-Lighthouse Ranch, Lost Coast Headlands, Cotoni-Coast Dairies, Piedras Blancas, and Orange County Rocks and Islands would protect and preserve objects of historic or scientific interest on the California Coast.

Trinidad Head

About 30 miles north of Eureka lies the majestic and culturally important promontory known as Trinidad Head. The tip of Trinidad Head encompasses several prominent historic sites along with the rocky ledges that provide their setting, such as the Trinidad Head Light Station, which first operated in 1871 and is still active today. Accompanied by a small wooden bell house, it sits atop sheer cliffs overlooking crashing waves and rugged sea stacks. The importance of this location predated its first use as a lighthouse. Nearly 100 years earlier, on June 9, 1775, representatives of the local Yurok community first made contact with two Spanish ships there. A granite cross installed in 1913 sits in a clearing above the lighthouse, commemorating the spot where the Spanish erected a wooden cross two days later to claim the area for King Charles III. Today, the area is culturally and spiritually significant to the Cher-Ae Heights Indian Community of the Trinidad Rancheria, the Yurok Tribe, and the Tsurai Ancestral Society.

Coastal bluff scrub vegetation, including coyote brush, California wax myrtle, salal, blue blossom, ocean spray, and evergreen huckleberry, surrounds these historic features. Scattered stands of

Sitka spruce, Douglas fir, and red alder stand out among these native shrubs and herbs. Coast Indian paintbrush grows in rocky outcroppings near the bell house, adding splashes of crimson to the landscape. Visitors to Trinidad Head enjoy observing the Trinidad seabird colony, which makes its home on the rocks and islands off the coast of Trinidad Head and contains over 75,000 birds, including several species of cormorant, the common murre, and occasionally tufted puffins.

Waluplh-Lighthouse Ranch

Perched on the edge of Table Bluff, 12 miles south of Eureka, Waluplh-Lighthouse Ranch has spectacular panoramic views of the Pacific Ocean, Eel River Delta, and the south spit of Humboldt Bay. In addition to outstanding scenery, visitors to Waluplh-Lighthouse Ranch can view migratory raptors, songbirds, and the endangered marbled murrelet.

Waluplh-Lighthouse Ranch is part of the ancestral home and current cultural traditions of the Wiyot Tribe, who gave it the name Waluplh. With its expansive views, the area served as a lookout point for the Tribe, as well as a crossroads for trails connecting inland areas with Humboldt Bay to the north and the bottomlands surrounding the mouth of the Eel River to the south. Beginning in the late 1800s, Waluplh-Lighthouse Ranch was developed as a Coast Guard facility, and during World War II, it served as a coastal lookout post and the base for a mounted beach patrol. There are no longer any buildings on the property, so visitors now enjoy its panoramic views surrounded by open space.

Lost Coast Headlands

Thirteen miles south of Waluplh-Lighthouse Ranch, the Lost Coast Headlands present a majestic coastline, encompassing rolling hills and dramatically eroding bluffs, punctuated by freshwater creeks, ponds, and pockets of forests. Underlying the Lost Coast Headlands are layers of highly erodible sedimentary rock known as the Wildcat Group. This geology has weathered over the years, leading to deeply carved and incised bluffs along the beach made up of multi-hued layers of gray clay, golden sandstone, and brown siltstone. The eroding of the bluffs over time exposes fossils of scallops, clams, and snails, providing a glimpse of the marine fauna that lived in the area during the Pleistocene Epoch 2.6 million to 11,700 years ago.

Coastal scrub vegetation and open grasslands blanket the area's rolling hills. Coyote brush and California blackberry dominate, and in the grasslands, small patches of native Pacific reed grass meadow remain. Pockets of Douglas fir, Sitka spruce, and grand fir shadow the eroded draws. These diverse habitats support an array of wildlife species, including black-tailed deer, bobcat, brush rabbit, and Douglas squirrel. While more elusive, gray fox, coyote, and mountain lion also pass through the area, and a careful observer may notice signs of their presence. A variety of small birds dart about its grasslands and scrub, while raptors such as American kestrels, northern harriers, peregrine falcons, and Cooper's hawks scan for prey overhead. Quiet visitors may hear hairy woodpeckers in the forested draws. Foraging shorebirds and gulls, along with the occasional harbor seal, can be observed on the narrow beaches.

Buffered by red alder and willow, Guthrie and Fleener creeks wind their way through the Lost Coast Headlands on their way to the sea. Both perennial streams provide habitat for three-spined stickleback, a small native fish. Sculpin, Pacific lamprey, and the threatened Northern California steelhead have also been observed in Guthrie Creek, and both creeks are potential habitat for the threatened coho salmon. During the summer, the mouth of Guthrie Creek widens into a lagoon that can provide shelter for estuary-dependent fish and invertebrates. The area also features three small, freshwater ponds that provide habitat for the threatened California red-legged frog and a variety of waterfowl, including green-winged teals.

While few signs of it remain, the northernmost point of the Lost Coast Headlands was once the site of the Centerville Beach Naval Facility, established in 1958 to monitor Soviet submarines during the Cold War. For more than 100 years, several families who settled nearby grazed livestock in the area.

Cotoni-Coast Dairies

Near Davenport in Santa Cruz County, Cotoni-Coast Dairies extends from the steep slopes of the Santa Cruz Mountains to the marine coastal terraces overlooking the Pacific Ocean. Sitting atop the soft Santa Cruz Mudstone Formation and the hard, silica-rich Monterey Formation, the area's bedrock supports a diversity of soils and vegetation that have sustained wildlife and people alike for millennia.

Dating back at least 10,000 years, an ancestral group known to archaeologists as the Costanoan or Coastal People (also called the Ohlone) lived in this region, and the Cotoni, a tribelet of this group, lived in the Cotoni-Coast Dairies area. Lithic scatter sites and shell middens demonstrate that inhabitants moved between the coastal ecological zones and upland environments, making use of the landscape's diverse resources. Europeans first made contact with the Cotoni in the 1600s and 1700s. Most of the Costanoan people were converted to Christianity, many forcibly, during California's Mission period in the late 1700s and 1800s, and by the early 1900s, much of the ancient cultural heritage of the Coastal People was left only to memory.

Six perennial streams form the heart of Cotoni-Coast Dairies' ecosystem, flowing from the coastal mountains down to the Pacific Ocean. Molino Creek, Ferrari Creek, San Vicente Creek, Liddell Creek, Yellow Bank Creek, and Laguna Creek have each carved steep canyons on their path to the sea. Vibrant riparian areas follow along the six stream corridors, with red alder and arroyo willow forests dominating the vegetative community. A seventh stream, Scott Creek, flows along a small portion of the area's northern boundary. Most of the area's wetlands can be found within these riparian corridors, though others exist in meadows and floodplains.

Beyond supporting riparian and wetland communities, Cotoni-Coast Dairies' waterways provide important habitat for anadromous and freshwater fish. All of the streams are thought to have historically supported salmon populations. Today, the threatened steelhead and coho salmon can be found on spawning runs in San Vicente Creek, while steelhead are also found in Liddell Creek and Laguna Creek. The endangered tidewater goby may also be found in the tidally influenced portion of Laguna Creek. The threatened California red-legged frog uses many of the waterways and water sources here, along with a wide range of other amphibians and reptiles.

Grasslands, scrublands, woodlands, and forests surround the riparian corridors in Cotoni-Coast Dairies. Purple needlegrass and other native species, such as California oatgrass and blue wildrye, characterize the coastal prairie grassland community. The intermixed wildflowers in the community provide visitors a colorful display in the spring and early summer. Occasional freshwater seeps amid the grasslands support sedges, California buttercup, brown-headed rush, and other species.

California sagebrush and coyote brush scrub communities blanket the area's bluffs and hillside slopes. Native trees, including Douglas fir and coast live oak, dominate forests, which also include stands of coastal trees such as madrone, California bay, Monterey pine, and knobcone pine. Visitors are drawn to stands of coast redwood, which thrive on the north-facing slopes in some watersheds, accompanied by redwood sorrel, elk clover, and other understory species.

The diversity of the uplands vegetation in Cotoni-Coast Dairies supports a rich wildlife community including a vast and varied mammalian population. Among the many species inhabiting Cotoni-Coast Dairies are California voles, dusky-footed woodrats, black-tailed jackrabbits, mule deer, and gray fox. Evidence also suggests that both bobcats and mountain lions hunt here.

Visitors to Cotoni-Coast Dairies may be able to catch a glimpse of a variety of avian species, including black swifts, orange crowned warblers, American kestrels, Cooper's hawks, white-tailed kites, and peregrine falcons. In the riparian areas, one may encounter Wilson's warblers, downy woodpeckers, and tree swallows, among others. Various bat species, including the Townsend's big-eared bat, can be seen darting overhead at dusk.

Piedras Blancas

Only 40 miles north of San Luis Obispo, the large white coastal rocks for which Piedras Blancas was named have served as a landmark for centuries to explorers and traders along the central coast of California. Sitting at a cultural interface between Northern Chumash and Playanos Salinan peoples, Piedras Blancas was and still remains important to Native Americans. The human history of the area stretches back at least 3,000 years, and archaeologists have found stone tools, debris from tool knapping, discrete quarrying locations, and shell midden deposits that help tell that history. Native peoples largely used the area as a source of raw stone and for the manufacture of stone tools.

In 1542, the Spanish explorer Juan Rodriquez Cabrillo noted the value of this area as a maritime guidepost, and the land he sighted from his ship was later claimed by the Spanish, followed by the Governor of Mexico, and subsequently became part of the United States. A lighthouse built in the 1870s still stands today, albeit without the three upper levels that were removed after being damaged by an earthquake in 1948. The lighthouse, with its ornate brick and cast-iron structure, is listed in the National Register of Historic Places along with its surrounding buildings, such as the 1906 fog-signal and oil house. Visitors to Piedras Blancas today are treated to unmatched scenic vistas of the rugged mountain peaks of the Santa Lucia Range and the deep blue waters of the Pacific Ocean. Dramatic geologic features, such as the namesake white rocks, along with the area's characteristic fog, contribute to a dynamic visual landscape.

The bedrock in the area consists of both sedimentary and volcanic rocks of the Franciscan Formation. This Formation represents Jurassic age material from the Pacific Plate that scraped off and attached to the continental margin of North America. Atop the bedrock lie Monterey Formation rocks, topped with marine terrace deposits. Rain percolates through the rock surface and sub-surface and emerges dramatically as ephemeral springs from cliff faces.

California sea lions, harbor seals, and northern elephant seals all spend time on the shores and within the waters of this area. Visitors may observe colonies of massive elephant seals loafing in the sun at Piedras Blancas, where females can be seen nursing their pups, and males occasionally battle for dominance. For decades, scientists have used this land to conduct annual censuses of the threatened southern sea otter and other marine mammals. From the mainland of Piedras Blancas, visitors can also be treated to regular visits by migrating gray and humpback whales, and occasionally blue, minke, and killer whales as well, in addition to bottlenose dolphins.

Marine birds perched on or soaring over the Piedras Blancas rocks include Brandt's cormorants, black oystercatchers, peregrine falcons, and brown pelicans. In a remarkable spring display, Pacific loons can be seen migrating offshore of Piedras Blancas by the tens of thousands. In the rocky intertidal zone found along these shores, scientists have documented mussels, ochre starfish, barnacles, sea anemones, and black and red abalones.

The lighthouse's windswept onshore point is also a sanctuary for plants and wildlife. Over 70 types of native plants, including members from the agave, cashew, sunflower, carnation, morning glory, gourd, iris, and poppy families, establish a foothold in the fine sand and fine sandy loam soils. Together this diversity of vegetation can be characterized as northern coastal bluff scrub. If visitors time their visit, they will be treated to a dazzling array of blooms from species such as seaside poppy, seaside daisy, coastal bush lupine, hedge nettle, dune buckwheat, and compact cobwebby thistle. This native

vegetation supports many wildlife species, including brush rabbits, California voles, dusky-footed woodrats, and bobcats. Black-bellied slender salamanders, threatened red-legged frogs, western terrestrial garter snakes, and other reptiles and amphibians thrive in the Piedras Blancas area.

Orange County Rocks and Islands

This area consists of a series of offshore rocks, pinnacles, exposed reefs, and small islands off the Orange County coastline, where visitors onshore are treated to dramatic crashing waves, unique geology, and an abundance of marine-dependent wildlife. These rocks and islands lie within the current monument boundary but were not previously reserved as part of the monument. These offshore rocks, many in pocket coves, contribute to the rugged beauty of the Orange County coastline and themselves include objects of scientific and historic interest. The features also provide important connectivity from south to north for shore birds and sea birds, as well as for California sea lions and harbor seals.

Cormorants, brown pelicans, gulls, and a variety of other shore birds and sea birds can be seen roosting, resting, and feeding on the jagged rocks and small islands. These rocks and islands are also haul-out areas for marine mammals, including California sea lions, harbor seals, and the occasional northern elephant seal.

Rich in vital nutrients, this offshore zone of swirling currents supports a variety of habitats and organisms. The tide pools around these rocks and islands are home to a diversity of hardy intertidal seaweeds and animal species uniquely adapted for survival within the alternating and equally harsh environs of pounding surf and baking sun.

The protection of Trinidad Head, Waluplh-Lighthouse Ranch, Lost Coast Headlands, Cotoni-Coast Dairies, Piedras Blancas, and Orange County Rocks and Islands as part of the California Coastal National Monument will preserve their cultural, prehistoric, and historic legacy and maintain their diverse array of natural and scientific resources, ensuring that the historic and scientific value of these areas, and their numerous objects of historic or scientific interest, remain for the benefit of all Americans.

Whereas, section 320301 of title 54, United States Code (known as the "Antiquities Act"), authorizes the President, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Federal Government to be national monuments, and to reserve as a part thereof parcels of land, the limits of which in all cases shall be confined to the smallest area compatible with the proper care and management of the objects to be protected;

Whereas, it is in the public interest to preserve the objects of scientific and historic interest on the public lands of Trinidad Head, Waluplh-Lighthouse Ranch, Lost Coast Headlands, Cotoni-Coast Dairies, Piedras Blancas, and Orange County Rocks and Islands;

Now, Therefore, I, Barack Obama, President of the United States of America, by the authority vested in me by section 320301 of title 54, United States Code, hereby proclaim the objects identified above that are situated upon lands and interests in lands owned or controlled by the Federal Government to be part of the California Coastal National Monument and, for the purpose of protecting those objects, reserve as part thereof all lands and interests in lands owned or controlled by the Federal Government within the boundaries described on the accompanying maps, which are attached hereto and form a part of this proclamation. The Orange County Rocks and Islands shall be managed as part of the original offshore area of the monument, and the remainder of the lands shall be known as the Trinidad Head, Waluplh-Lighthouse Ranch, Lost Coast Headlands, Cotoni-Coast Dairies, and Piedras Blancas units of the monument, respectively. These reserved Federal lands and interests in lands encompass

approximately 6,230 acres. The boundaries described on the accompanying maps are confined to the smallest area compatible with the proper care and management of the objects to be protected.

All Federal lands and interests in lands within the boundaries described on the accompanying maps are hereby appropriated and withdrawn from all forms of entry, location, selection, sale, or other disposition under the public land laws, from location, entry, and patent under the mining laws, and from disposition under all laws relating to mineral and geothermal leasing, other than by exchange that furthers the protective purposes of the monument.

The enlargement of the boundary is subject to valid existing rights. If the Federal Government subsequently acquires any lands or interests in lands not owned or controlled by the Federal Government within the boundaries described on the accompanying maps, such lands and interests in lands shall be reserved as a part of the monument, and objects identified above that are situated upon those lands and interests in lands shall be part of the monument, upon acquisition of ownership or control by the Federal Government.

The Secretary of the Interior (Secretary) shall manage the area being added to the monument through the Bureau of Land Management (BLM) as a unit of the National Landscape Conservation System, pursuant to applicable legal authorities, to protect the objects identified above.

The Cotoni-Coast Dairies unit of the monument shall become available for public access upon completion of a management plan by the BLM, consistent with the care and management of the objects identified above.

Consistent with the care and management of the objects identified above, and except for emergency or authorized administrative purposes, motorized vehicle use in areas being added to the monument shall be permitted only on designated roads, and non-motorized mechanized vehicle use shall be permitted only on designated roads and trails.

Nothing in this proclamation shall be construed to interfere with the operation or maintenance, or the replacement or modification within the existing authorization boundary, of existing weather station, navigation, transportation, utility, pipeline, or telecommunications facilities located on the lands added to the monument in a manner consistent with the care and management of the objects to be protected. Other rights-of-way shall be authorized only if they are necessary for the care and management of the objects to be protected.

Nothing in this proclamation shall be deemed to enlarge or diminish the rights or jurisdiction of any Indian tribe. The Secretary shall, to the maximum extent permitted by law and in consultation with Indian tribes, ensure the protection of Indian sacred sites and traditional cultural properties in the monument and provide access by members of Indian tribes for traditional cultural and customary uses, consistent with the American Indian Religious Freedom Act (42 U.S.C. 1996) and Executive Order 13007 of May 24, 1996 (Indian Sacred Sites).

Laws, regulations, and policies followed by the BLM in issuing and administering grazing permits or leases on lands under its jurisdiction shall continue to apply with regard to the lands added to the monument, consistent with the care and management of the objects identified above.

Nothing in this proclamation shall be deemed to enlarge or diminish the jurisdiction of the State of California or the United States over submerged or other lands within the territorial waters off the coast of California, nor shall it otherwise enlarge or diminish the jurisdiction or authority of the State of California, including its jurisdiction and authority with respect to fish and wildlife management.

Nothing in this proclamation shall affect the rights or obligations of any State or Federal oil or gas lessee within the territorial waters off the California Coast.

Nothing in this proclamation shall be construed to alter the authority or responsibility of any party with respect to emergency response activities within the monument, including wildland fire response.

Nothing in this proclamation shall be deemed to revoke any existing withdrawal, reservation, or appropriation; however, the monument shall be the dominant reservation.

Warning is hereby given to all unauthorized persons not to appropriate, injure, destroy, or remove any feature of the monument and not to locate or settle upon any of the lands thereof.

In Witness Whereof, I have hereunto set my hand this twelfth day of January, in the year of our Lord two thousand seventeen, and of the Independence of the United States of America the two hundred and forty-first.

BARACK OBAMA

Appendix D: Additional Information on the Process for Developing the Science Strategy and Identifying and Prioritizing Science Information Needs

D.1 Approach to Developing the Science Strategy

Development of this science strategy was led by a core project team consisting of staff from both the Bureau of Land Management (BLM) and the U.S. Geological Survey (USGS) (Table D1).

The team met frequently throughout the planning process to develop a work plan, identify next steps, solve challenges, and maintain coordination with BLM Central Coast Field Office resource specialists (Table D2). The field manager approved final decisions related to the science planning process and science strategy.

Table D1. Members of the core project team for all or part of the Cotoni-Coast Dairies science planning effort.

Name	Title and Affiliation
Zachary Ormsby	Field Manager, BLM Central Coast Field Office
Benjamin (Ben) Hoke	Assistant Field Manager, BLM Central Coast Field Office
Sarah Carter	Supervisory Research Ecologist, USGS Fort Collins Science Center
Frederick (Fritz) Klasner	National Conservation Lands Science Coordinator, BLM Division of National Conservation Lands
Robin Lewis	National Conservation Lands Specialist (formerly), BLM Division of National Conservation Lands
Sarah Whipple	Biologist, USGS Climate Adaptation Science Centers

Table D2. Additional BLM Central Coast Field Office staff who contributed to the Cotoni-Coast Dairies science planning effort.

Name	Title
Michael Powers	Natural Resource Specialist – Wildlife (Cotoni-Coast Dairies)
Michael Westphal	Ecologist – Wildlife (Field Office Lead)
Ryan O'Dell	Natural Resource Specialist – Botany, Soils, Paleontology
Rebecca Spitzer	Archaeologist – Cultural
Stacey Schmidt	Natural Resource Specialist – Range
Adam Wilde	Outdoor Recreation Planner
Sarcee Somes	Realty Specialist
Sky Murphy	Planning and Environmental Coordinator
Nick Lasher	Chief Law Enforcement Ranger

The team identified goals for the Cotoni-Coast Dairies science strategy and for the planning process itself. As the unit was not yet accessible to the general public during the time period that the science strategy was being developed, the project identified a group of core partners that were very familiar with the unit that would be contacted for input during the process (refer to Appendix A). USGS staff gathered background information about Cotoni-Coast Dairies, including the proclamations for both the establishment of the California Coastal National Monument (refer to Appendix B) and the monument enlargement (refer to Appendix C), resource management plan amendment, other relevant planning documents, and available manager's reports from past years.

D.2 Process for Identifying and Prioritizing Science Needs

Central Coast Field Office resource managers and specialists first identified resources that would be a focus for the effort. Categories of resources considered included: geology; soil resources; water resources; vegetative communities, including grasslands (rangelands), shrublands (scrub, chapparal), forests and woodlands, and riparian and wetlands; fish and wildlife species; special status species; cultural resources; paleontological resources; visual resources; and recreation resources. These categories, and specific resources identified as priorities in each category, provided a framework for the science needs identification process.

USGS project team members met with Central Coast Field Office staff to introduce the project and process for developing a science strategy. The presentation and discussion were intended to help BLM staff begin thinking about potential science needs. USGS project team members introduced a framework derived from Carter et al. (2023) intended to help participants understand four categories of science information for which there might be needs: data about resources of concern, scientific studies relevant to understanding potential effects to those resources, methods for analyzing potential effects to resources, and effective mitigation actions for protecting those resources. Specialists were also asked to consider the purpose of science strategies as laid out in the National Landscape Conservation System 15-year strategy (BLM 2011), issues and management actions in the resource management plan amendment, and science information needs that, if filled, would help to inform their work in the unit, the monument, and for the BLM as a whole. The identified needs are intended to address four core topics required by BLM Manual 6220: (1) investigations of the values for which the National Landscape Conservation System (NLCS) unit was designated; (2) assessment, inventory, and monitoring needs; (3) science that addresses restoration needs; and (4) landscape-level issues.

Individual brainstorming sessions were then held with each staff person (or small groups) to identify and record potential science needs related to unit resources, objects, and values within their area of expertise. Brainstorming sessions were structured by walking through: (1) identified resources, objects, and values across the unit, including the assessment, inventory, monitoring, and restoration of resources, objects, and values; (2) other pressing management issues or concerns on and around the unit; and (3) the role and importance of the unit in the broader landscape. USGS team members developed a reference sheet for use during these brainstorming sessions that is modified from the standard BLM list of resources and actions used in BLM environmental impact analyses (refer to Appendix E).

Draft needs were recorded in real time in a shared document during the brainstorming sessions. If actions or uses authorized in the unit (e.g., livestock grazing) or other management issues or concerns were not addressed in the initial conversation, the expert was asked to consider whether there might be science needs relevant to how the action, issue, or concern might affect the resource of interest. Staff were also asked to consider needs related to how their resource interacts with other resources in the unit and might be affected by changing environmental conditions and land uses. After the meeting, USGS staff clarified and organized needs and combined similar needs or split needs that contained multiple ideas. The resulting list of

potential needs was shared with Central Coast Field Office staff for review and revision.

After the first round of brainstorming sessions, the project team decided on an initial approach for prioritizing science needs that was subsequently revised through input from Central Coast Field Office staff. Needs were considered eligible for high priority if they were tied to public safety or at least one statutory, permitting, or reporting requirement.

Finally, individual science information needs were grouped into broader categories to more clearly communicate the major types and topics of needs. Each need was also classified by the primary resource, action, or topic involved to help sort and present similar needs together. The categories of science needs are included in the main body of the strategy (refer to Table 2).

APPENDIX D REFERENCES

BLM (Bureau of Land Management). 2011. The National Landscape Conservation System 15-Year Strategy, 2010–2025. U.S. Department of the Interior, Bureau of Land Management, Washington, DC. https://www.blm.gov/documents/national-office/public-room/strategic-plan/national-landscape-conservation-system-15-0.

Carter, S.K., T.S. Haby, J.K. Meineke, A.C. Foster, L.E. McCall, L.D. Espy, M.A. Gilbert, J.E. Herrick, and K.L. Prentice. 2023. Prioritizing science efforts to inform decision making on public lands. Frontiers in Ecology and the Environment 21 (10): 453–460.

Appendix E: Resources and Resource Uses/ Activities Considered in Identification of Science Needs

The following lists (Tables E1a and E1b) of resources, issues, concerns, and actions was developed by the project team and shared with resource specialists prior to their initial identification of science needs for Cotoni-Coast Dairies. The lists are based on management actions listed on the Bureau of Land Management's (BLM's) ePlanning website, a list of resources typically considered by the BLM in its National Environmental Policy Act analyses, and other issues or concerns that may be relevant to National Landscape Conservation System units.

Table E1a. Categories of resources, issues, and concerns shared with resource specialists prior to identification of science needs for Cotoni-Coast Dairies.

Categories of Affected Resources, Issues, and Concerns	
Air quality and climate	Water (general or unspecified)
Public health and safety	Water: quality
Wastes (hazardous or solid)	Water: wetlands and riparian zones
Geology	Farmlands (prime or unique)
Paleontology	Livestock grazing and range management
Soils	Wild horses and burros
Topography	Cadastral survey
Law enforcement	Lands and realty (including realty authorizations and rights-of-way)
Recreation	Mineral resources (locatable, leasable, salable)
Social and/or economic values	Noise and light pollution
Visual resources	Transportation (including access)
Plants: invasive, noxious, nonnative species	Fire: ecology and management (including fuels management)
Plants: special status species (which includes threatened and endangered)	Wildlife (general or unspecified)
Plants: vegetation (including forests and woodlands)	Wildlife: aquatic
Plants: woodland products/forest management	Wildlife: aquatic special status species (which includes threatened and endangered)
Special designation: monuments	Wildlife: fish/fisheries
Special designations: areas of critical environmental concern	Wildlife: fish special status species (which includes threatened and endangered)

Table E1a. Continued.

Categories of Affected Resources, Issues, and Concerns	
Special designations: national conservation areas	Wildlife: protected birds (including threatened and endangered and migratory birds)
Special designations: other (e.g., scenic byways)	Wildlife: other birds (including game species)
Special designations: wild and scenic rivers	Wildlife: sage-grouse (including Gunnison and greater sage-grouse)
Special designations: wilderness, wilderness study areas, wilderness characteristics	Wildlife: terrestrial (including big game)
Cultural resources: resources of interest to tribes	Wildlife: terrestrial special status species (which includes threatened and endangered)
Cultural resources: archaeological and historic resources	Wildlife: invasive and nonnative (including fish and aquatic)

Table E1b. Categories of actions shared with resource specialists prior to identification of science needs for Cotoni-Coast Dairies.

Categories of Proposed Actions	
Cave and karst resources	Livestock grazing
Conservation and preservation areas	Mining
Cultural, historical, and Native American resources	Paleontology
Emergency stabilization and rehabilitation	Rangeland management
Facilities management	Recreation and visitor services
Fish and wildlife habitat management	Renewable energy development
Oil and gas development	Riparian and wetlands habitat management
Forestry and timber management	Soil, water, and air quality
Hazard management and resource restoration	Vegetation management
Interpretation and environmental education	Wild horses and burros management
Lands and realty	Wildland fire management
Law enforcement	

Appendix F : Research Permit and Stipulations

Scientific Research and Collection Permit
Cotoni-Coast Dairies,
an Onshore Unit of the California Coastal National Monument

Date: _____

Applicant Name and Address: _____

Phone Number: _____ Email Address: _____

Vehicles: (Make/Model, License Plate) _____

State Permit Number (if applicable): _____

*Federal Permit Number (if applicable): _____

Is the research covered by an assistance agreement with this office and/or other BLM offices?
*If so, attach a copy of the assistance agreement.

Please attach a description of your proposed research including proposed locations for access, projected beginning and ending project timeframe, and provisions for curation of collections (if applicable).

Please contact the Central Coast Field Office science and education coordinator to address questions at any stage of this authorization process.

For Cotoni-Coast Dairies office use only below this line.

☐ Yes	☐ No	Specialist review complete	☐ Yes	☐ No	Science review complete
☐ Yes	☐ No	Permit granted	☐ Yes	☐ No	Curation agreement
☐ Yes	☐ No	Complies w/plan	☐ Yes	☐ No	Permit extension
☐ Yes	☐ No	Special stipulations			

* Date issued: _____ * Expiration: _____

*Area of activity: _____

* Collecting is authorized. Materials to be collected: _____

Authorization. Permission is hereby given to the above-named individual to collect material(s) specified in the approved research proposal, within the guidelines of stipulations outlined below.

Approved by: _____

Central Coast Field Manager Date

I have read and accept the stipulations in this permit:

_____

Permit Holder Date

Standard Stipulations

1. Activities must be in compliance with federal and state regulatory requirements, such as (but not limited to) those under the National Environmental Policy Act, Endangered Species Act, and section 106 of the National Historic Preservation Act.
2. The BLM is responsible for consultation with Indian Tribal Nations on a government-to-government basis in accordance with Executive Order 13175, BLM Manual 1780, and other Department of the Interior policies.
3. This permit may not be assigned to any other organization, group, or individual. Any modifications to the permit must be requested in writing to the field manager or delegated representative.
4. All individuals directly and indirectly involved with research and educational programs at Cotoni-Coast Dairies must adhere to the "Cotoni-Coast Dairies science ethics" included in an initial section of the science strategy for this authorization to be approved and remain valid.
5. This permit is valid only for the period specified. The permit may be suspended or modified at the discretion of the field manager. Fieldwork under this permit may be halted temporarily by either verbal or written notice from the field manager or other authorized officer for violations of permit terms and conditions or for administrative purposes of the BLM.
6. All terms and conditions of this permit shall remain in effect until all permit terms and conditions have been met, regardless of permit expiration date.
7. This permit shall not be exclusive in character, and the Bureau of Land Management reserves the right to authorize other uses of the land during the tenure of this permit. Fieldwork shall be carried out in such a manner as to not impede other legitimate uses of the monument, except when a provision has been made by the field manager or delegated representative.
8. The Department of the Interior, including its bureaus and employees, shall be held blameless for any and all events, deeds, or mishaps, regardless of whether or not they arise from operations under this permit.
9. Unless otherwise agreed, all costs shall be borne by the permittee, including costs of curation.
10. The field manager and/or designated representatives have access to the study area during and after performance of fieldwork and shall have the right to inspect all materials removed.
11. Collections, if authorized, of materials acquired from public lands under the provisions of this permit remain the property of the United States Government and may be recalled at any time for use by the BLM. In certain instances—when samples will be used and destroyed in the analysis process—a designated repository will not be required. This must be discussed and approved in the permit drafting process, before collections are made.
12. Any stakes, flagging, or other temporary materials used to identify localities in the field must be removed upon completion of field activity. No permanent survey monuments or markers shall be disturbed or removed during the course of fieldwork.
13. The Bureau of Land Management, California Coastal National Monument, and Cotoni-Coast Dairies shall be cited in any report, publication, paper, news article, film, television program, or other media, resulting from fieldwork under this permit. Copies of such documents shall be provided to the BLM Central Coast Field Office. To assist in producing the best possible science, you are encouraged to forward manuscripts for review to the Cotoni-Coast Dairies science and education coordinator prior to submitting them for publication.
14. Access to research site(s) is authorized only across BLM-administered lands. Permission to access private lands or lands administered by another agency must be secured separately.

15. Field schedules must be coordinated with the field manager or a designated representative in advance of fieldwork.

16. Per BLM California State Office permit requirements, "b. Permittee shall cease work upon discovering any human remains and shall immediately notify the approving official or bureau field official. Work in the vicinity of the discovery may not resume until the authorized official has given permission."

17. Within 180 days following collection, if authorized, provide field office staff with a complete, annotated list of all specimens collected. Information required for each specimen includes what was collected, collection number, collection location (legal, to nearest ¼ section; latitude/longitude in decimal degrees; or UTM Zone 12), and final curation location of the specimen. If GPS units are used for generating location information, use the NAD 83.

18. Researchers are encouraged to provide an educational outreach component to share the research work they have done with the public. Outreach may include interpretive tours, informative materials such as signs and website information, and educational seminars for local/regional schools. This can be coordinated with the field manager or delegated representative.

19. A copy of this permit must be carried or kept in the fieldwork vehicle onsite by the individual in direct charge of fieldwork during the course of all work conducted under the permit.

Access Authorization Stipulations

1. This signed authorization request and attached stipulations must be in your possession during your visits to the site.

2. It is your responsibility to ensure that all members of your party comply with the stipulations of this authorization. This authorization does not grant exclusive use of the site, nor does it grant permission to conduct any commercial, competitive, or organized event. Such events require issuance of a special recreation permit per 43 CFR 2930.

3. Noncompliance with the stipulations of this authorization may result in issuance of a citation, revocation of the authorization, and/or denial of future requests for authorization.

4. Access to the site must be via existing roads only. If existing access crosses nonfederal lands, it is the authorized individual/team lead's responsibility to get permission to use private property. Vehicular travel is restricted to the main access roads from entry gates.

5. All public land beyond the locked gates is closed to vehicle use except by BLM authorization. Excluded from the "closure, for official business only" are government vehicles, authorized grazing lessees, and other authorized users. If you see or suspect any unauthorized use in the area, please exercise caution and notify this office.

6. If operating during fire season, please adhere to all relevant fire restrictions. All participants must adhere to best fire safety practices. Best practices include, but are not limited to, avoiding parking on or driving over tall vegetation, keeping a fire extinguisher and/or water sprayer with vehicles, cleaning vehicles of all brush and grass debris prior to entering and exiting an area, and alerting local authorities to a fire by calling 911 as soon as safely possible.

7. No soil or vegetation disturbances are permitted. If any surface disturbance is necessary, the work will require advance written permission from the Central Coast Field Office field manager.

8. No refuse shall be allowed on the site. All refuse and debris must be contained in bags or garbage receptacles and removed upon departure from the site.

9. The authorized individual agrees and stipulates that the Federal Government, Department of the Interior, and the Bureau of Land Management and its representative shall not be responsible for damage or injury to persons and property which may occur during the authorized use period or as a result of such use, per 43 CFR 2920.1-2(d).

10. This authorization is not transferable.

11. Use of the access key is limited exclusively to the authorized user(s) solely for the purposes associated with this authorization. Use of the access key or entrance by vehicle for purposes other than those directly associated with this authorization will result in revocation of the authorization and issuance of a citation for being in a vehicle closed area.

12. Duplication or loaning of the access key is not authorized. Either action will result in the revocation of the authorization or denial of future applications. Coordinate with the BLM Central Coast Field Office as needed.

13. Maintain the security of all gates, locks, and keys. Be very careful to relock locks in the same way they were found on all gates and chains onsite to avoid “overlocking” other authorized users out. Please return the key to the Central Coast Field Office when this authorization expires or coordinate as needed.

14. Any violation of the above stipulations will result in immediate cancellation of the authorization.

Appendix G: Projected Future Environmental Conditions for Cotoni-Coast Dairies

This appendix is provided as an abbreviated resource to help Cotoni-Coast Dairies staff and partners consider projected changes in environmental conditions for the unit. This information will be helpful as the needs of the unit and environmental change data both evolve and can be used to inform adaptation and adaptive management efforts.

Three ways in which this appendix can be used:

- As core information on environmental conditions specific to Cotoni-Coast Dairies to inform future planning and environmental analyses and to communicate with partners and the public.
- As a simple tutorial for producing figures, tables, and reports from online climate tools.
- As a resource for further exploring projected environmental conditions for Cotoni-Coast Dairies and other management units.

G.1 Overview and Resources

National Scale

Environmental change and its effects happen at all scales, from local to global. For regional to national trends and big picture efforts to address and adapt to climate change, the Fifth National Climate Assessment is the most recent national assessment for the United States (Jay et al. 2023). In addition to broad-scale information, the chapter on the Southwest United States offers some context and data relevant to Cotoni-Coast Dairies (White et al. 2023). A national-scale point of contact for the Bureau of Land Management (BLM) is the Adaptive Management Program (adapt@blm.gov).

Regional Scale

For a region-specific report of future environmental conditions in the U.S. Southwest, a comprehensive walk-through of climate effects from 2013 is available (Garfin et al. 2013). Additional climate vulnerability assessments are available for California, including assessments that are specific to other onshore units of the monument (EcoAdapt 2021; Thorne et al. 2021).

Technical Guidance

In 2024, the Department of the Interior published technical guidance for agencies like the BLM for use in decision making (Terando et al. 2024). This guide provides best practices for using climate science to inform planning, policy, and regulatory processes.

Partnerships and Contacts

Adapting resource planning and management actions to changing environmental conditions will necessarily include partnerships and robust relationships between researchers and practitioners. Technical experts in climate adaptation working in the region can assist BLM staff and others with an interest in such efforts, including by providing climate information scaled down to the project level.

The Southwest Climate Adaptation Science Center (https://www.swcasc.arizona.edu/) is a resource for climate adaptation with a focus on the U.S. Southwest. Key points of contact at the Southwest Climate Adaptation Science Center can be found on their website under Directory.

G.2 Climate Information Specific to Cotoni-Coast Dairies

Regional Trends

The Fifth National Climate Assessment's chapter on the American Southwest (White et al. 2023) summarizes key coastal management challenges relevant to management of the unit:

> "Large-scale marine heatwaves and harmful algal blooms have caused profound and cascading impacts on marine coastal ecosystems and economies (high confidence). Without implementation of adaptation or emissions-reductions measures, human-caused warming will drive more frequent and longer marine heatwaves (very likely, very high confidence), amplifying negative coastal effects (medium confidence). Sea level rise, along with associated impacts such as flooding and saltwater intrusion, will have severe and disproportionate effects on infrastructure, communities, and natural resources (likely, very high confidence). The California State Government has applied climate science to planning and decision-making for sea level rise, and multiple regions are moving toward climate-informed and adaptive strategies for fisheries (high confidence). However, climate planning and adaptation solutions for aquaculture are less clear (high confidence)" (White et al. 2023).

The management implications of these predictions are complex and vary by landscape position within the unit—the gradient of habitats, from aquatic to riparian to forest, within the unit are all uniquely affected. Readers are encouraged to explore the nuance of projected effects across habitat types in Fleishman et al. 2013 and Garfin et al. 2013.

Local Projections: Methods and Instructions

Beyond climate effects anticipated for the region, some planning and management efforts may benefit from site-specific, forward-looking projections of environmental conditions. Some of this information is provided subsequently, but the information is limited and offered primarily as an example. Note, the figures included in this appendix are copied directly from the source so that readers can use the same resources to create this appendix themselves to explore additional climate information relevant to their planning and management questions (Table G1).

Table G1. Suggested climate tools, including their intended use and specificity, that are available to Department of the Interior staff and the public.

Climate Tool	Use	Link
Climate Mapping for Resilience and Adaptation (CMRA) Assessment Tool	Simplified projections	https://resilience.climate.gov/
National Climate Change Viewer (NCCV)	Detailed projections	https://www.usgs.gov/tools/national-climate-change-viewer-nccv
Climate Toolbox	Nuanced, multivariate information	https://climatetoolbox.org/

The Climate Mapping for Resilience and Adaptation (CMRA) Assessment Tool (https://resilience.climate.gov/) helps people understand local-scale exposure to climate hazards. It is designed for working with people and built infrastructure and may be most useful for understanding how Cotoni-Coast Dairies' partnerships and landscape setting may be affected by environmental change. This appendix contains some example figures pulled directly from the CMRA Assessment Tool (Figures G1 and G2). This tool can be used to generate figures and

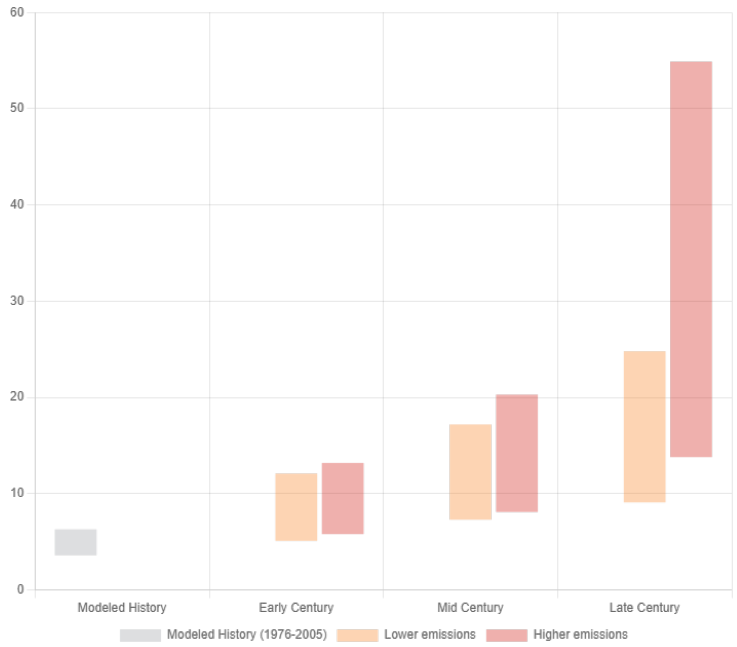


Figure G1. Graph of temperature changes for Santa Cruz County, where Cotoni-Coast Dairies is located, under lower and higher emissions scenarios for early (2015–2044), mid (2035–2064), and late (2070–2099) century timescales. Source: Climate Mapping for Resilience and Adaptation Assessment Tool (https://resilience.climate.gov/), accessed on June 1, 2025.

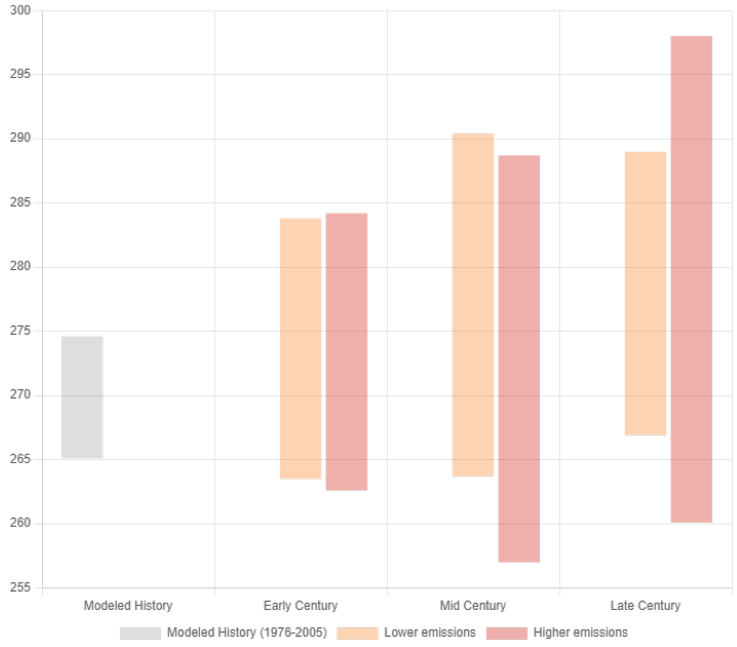


Figure G2. Graph of the predicted number of dry days per year for Santa Cruz County, where Cotoni-Coast Dairies is located, under lower and higher emissions scenarios for early (2015–2044), mid (2035–2064), and late (2070–2099) century timescales. Source: Climate Mapping for Resilience and Adaptation Assessment Tool (https://resilience.climate.gov/), accessed on June 1, 2025.

tables related to temperature change, drought, and wildfire risks.

The National Climate Change Viewer (NCCV) (https://www.usgs.gov/tools/national-climate-change-viewer-nccv) is designed to create straightforward figures and maps of how temperature, precipitation, and monthly water balance variables may change between now and the middle and end of this century (Figures G3 and G4). This tool can display data at the state level or for a watershed, with the San Lorenzo-Soquel watershed as the unit of analysis used for the figures included here. BLM staff may find it useful to generate reports of detailed information from the NCCV. After locating the San Lorenzo-Soquel watershed on the map, users can choose the "Download data" option and easily generate a detailed (approximately 50 page) report of climate information or download time series or spatial data for analyses.

The Climate Toolbox (https://climatetoolbox.org/) is a collection of web tools for exploring location-specific past, present, and projected future climate conditions. The resources offered in the Climate Toolbox are extensive and can be more complex to interact with than the other tools highlighted in this appendix. The tools in the Climate Toolbox may be most helpful when BLM staff or partners need detailed climate or hydrology information for specific analyses (e.g., generating recent climate history for Cotoni-Coast Dairies or developing climate scenarios for planning purposes) (Figures G5, G6, and G7). From the Home Page, users can select individual tools, most of which prompt a brief description of the tool and offer a short tutorial. All figures can be downloaded and used in reports under a Creative Commons 4.0 (CC BY 4.0) license.

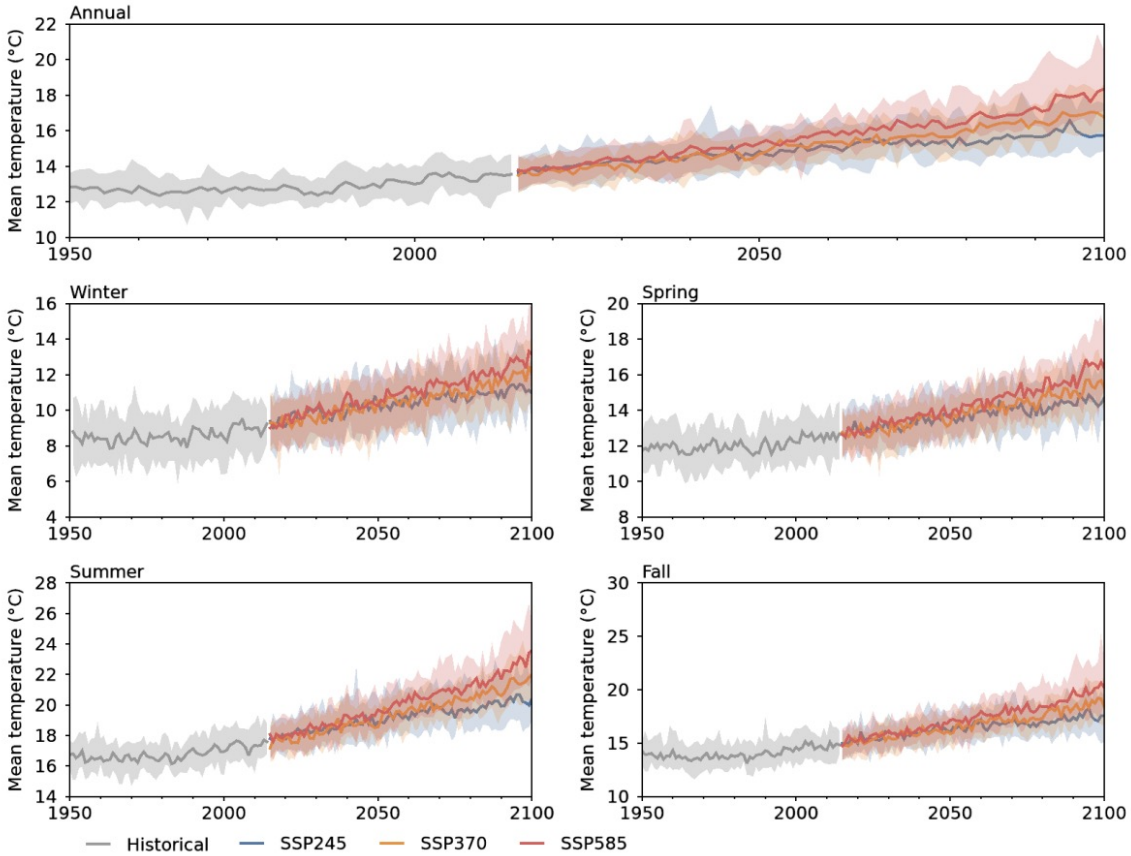
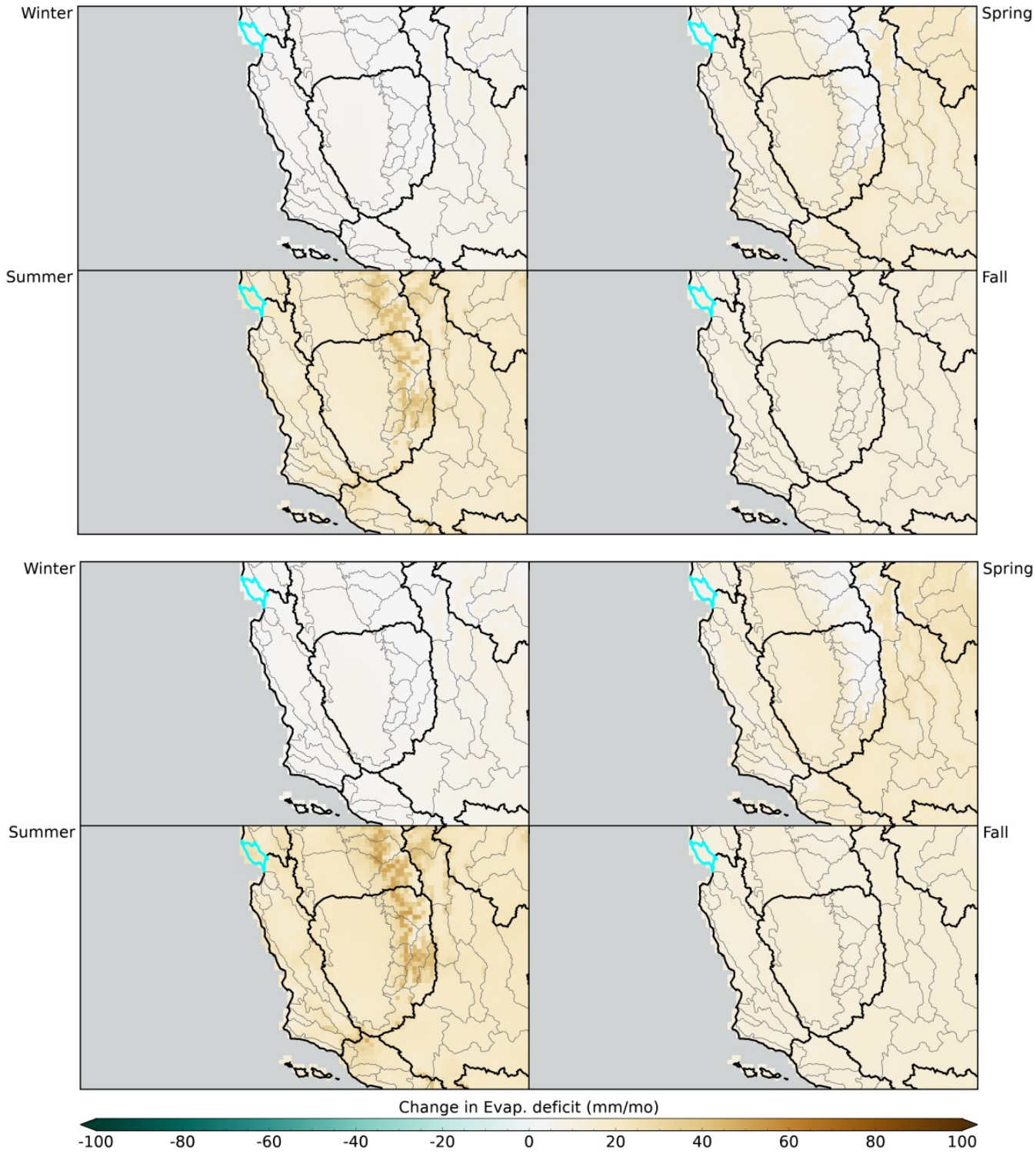


Figure G3. Annual and seasonal time series graphs of mean temperature (°C) for historical (gray, 1950–2014) and different shared socioeconomic pathway (SSP) emissions scenarios (245 (low), 370 (medium), and 585 (high)) up to the year 2100 for the San Lorenzo-Soquel watershed, where Cotoni-Coast Dairies is located. Solid lines indicate the mean of the models used to generate temperature projections, while shaded envelopes indicate the 10th to 90th percentile range of the models. Source: National Climate Change Viewer (https://www.usgs.gov/tools/national-climate-change-viewer-nccv), accessed on June 1, 2025.

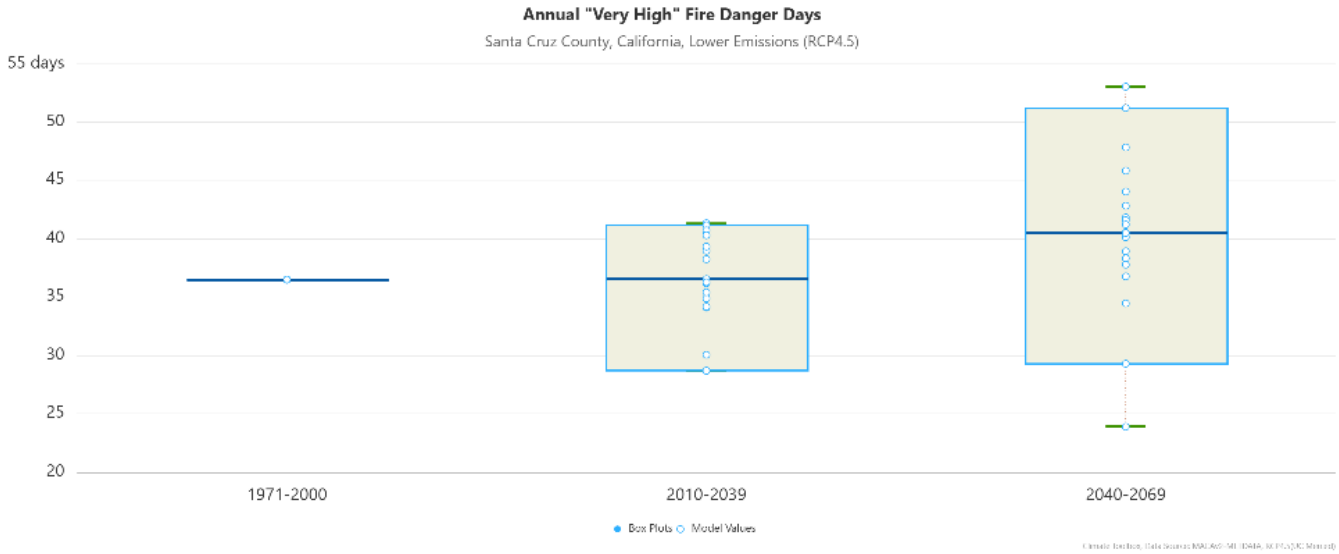


Basemap sources: County of Santa Clara, California State Parks, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USFWS.

Figure G4. Maps of predicted seasonal changes in evaporative deficit under the shared socioeconomic pathway (SSP) 370 (medium, top) and 585 (high, bottom) emissions scenarios for the San Lorenzo-Soquel watershed, where Cotoni-Coast Dairies is located. Predicted changes were calculated by subtracting modern (1981–2010) from predicted (2050–2075) means of climate models. Evaporative deficit is a measure of water stress, calculated as the difference between potential evapotranspiration (PET), which is the amount of evapotranspiration that would occur if unlimited water were available, and actual evapotranspiration (AET), which can be water limited. Source: National Climate Change Viewer (https://www.usgs.gov/tools/national-climate-change-viewer-nccv), accessed on June 1, 2025.

A

Figure G5. Boxplots of annual projected high (A), very high (B), and extreme (C) fire danger days for Santa Cruz County under Representative Concentration Pathways (RCPs) 4.5 (top) and 8.5 (bottom) emissions scenarios and for historic (1971–2000), early (2010–2039) and mid (2040–2069) century time scales. Source: Climate Toolbox (https://climatetoolbox.org/), accessed on June 1, 2025.



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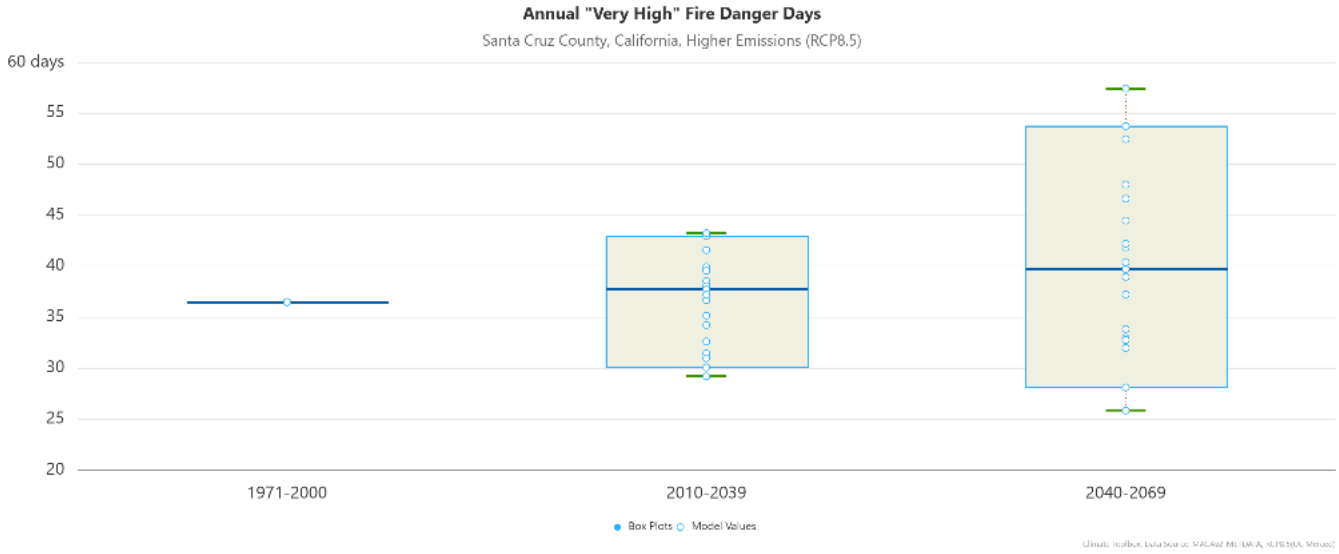
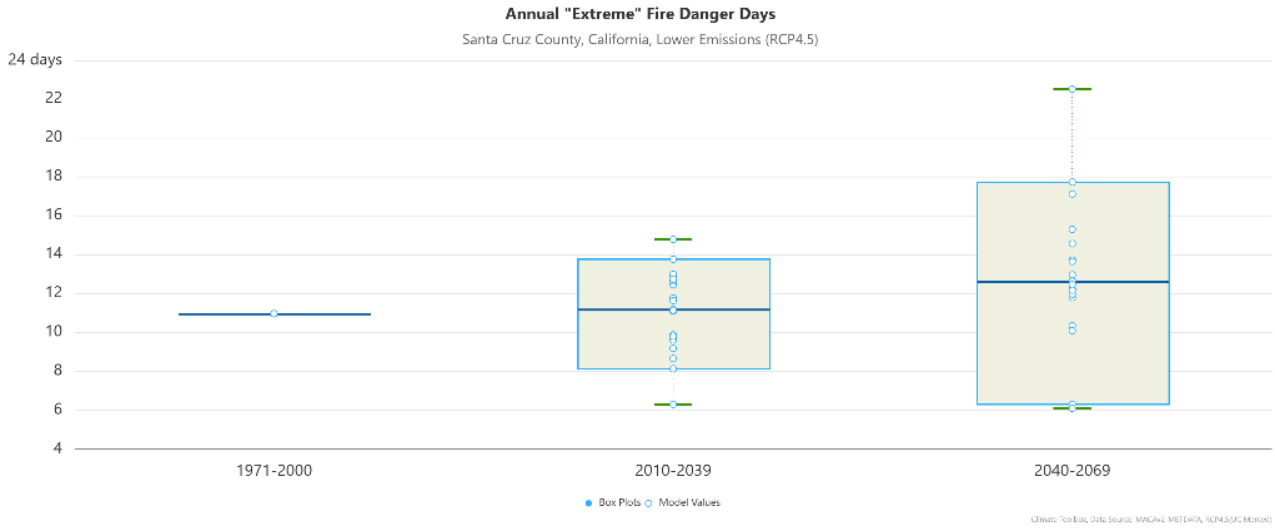


Figure G5. Continued.



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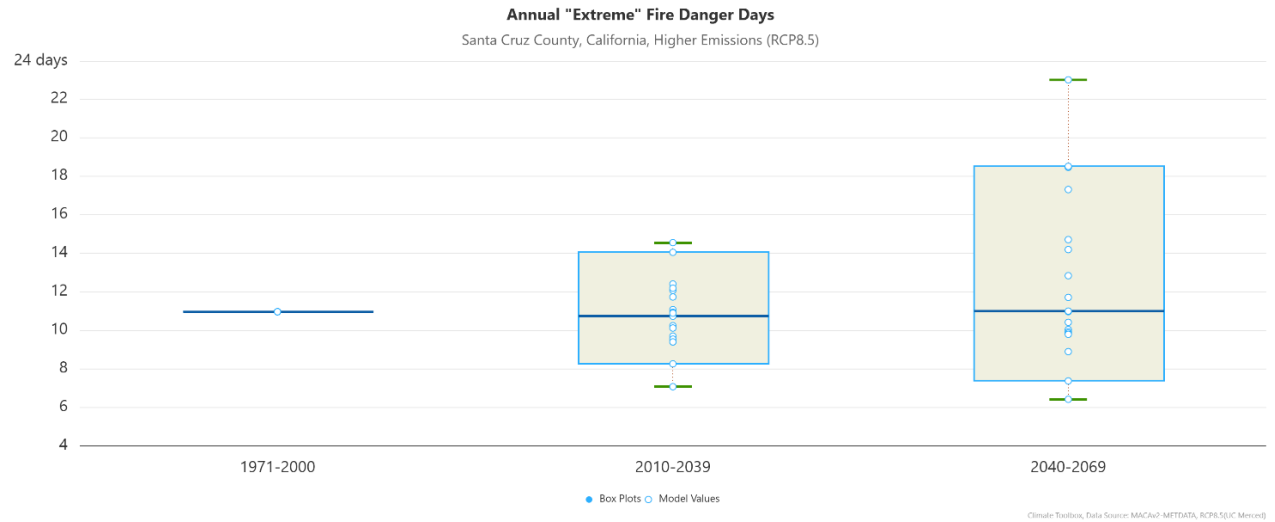

Figure G5. Continued.

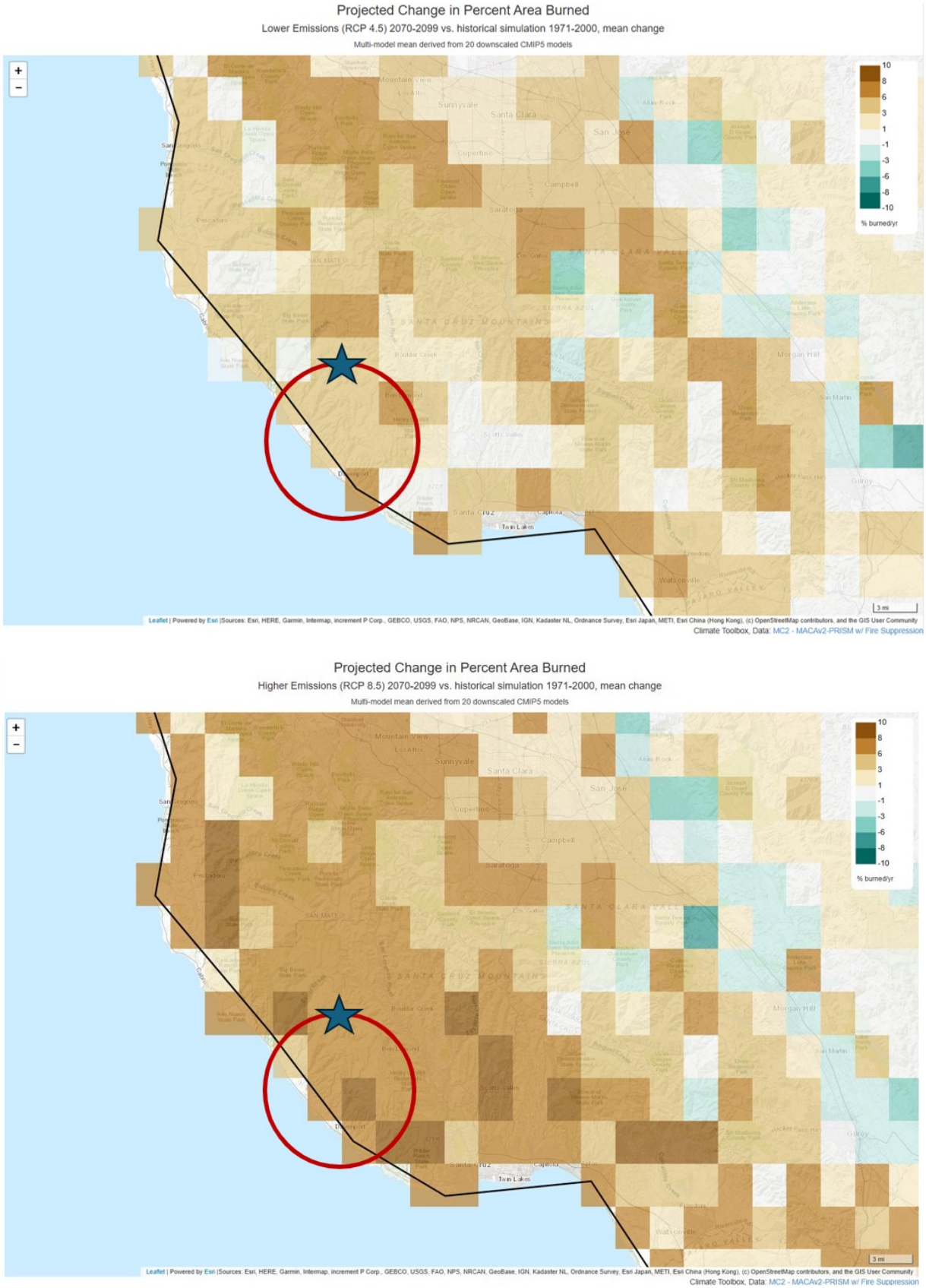

Figure G6. Maps of future vegetation projections (in the form of projected change in percent area burned per year) from 20 global climate models and across Representative Concentration Pathways (RCPs) 4.5 (top) and 8.5 (bottom) emissions scenarios for late century (2070–2099) compared to historic (1971–2000) timescales. The circle with the star indicates the area containing Cotoni-Coast Dairies and Santa Cruz County, California. Source: Climate Toolbox (https://climatetoolbox.org/), accessed on June 1, 2025.

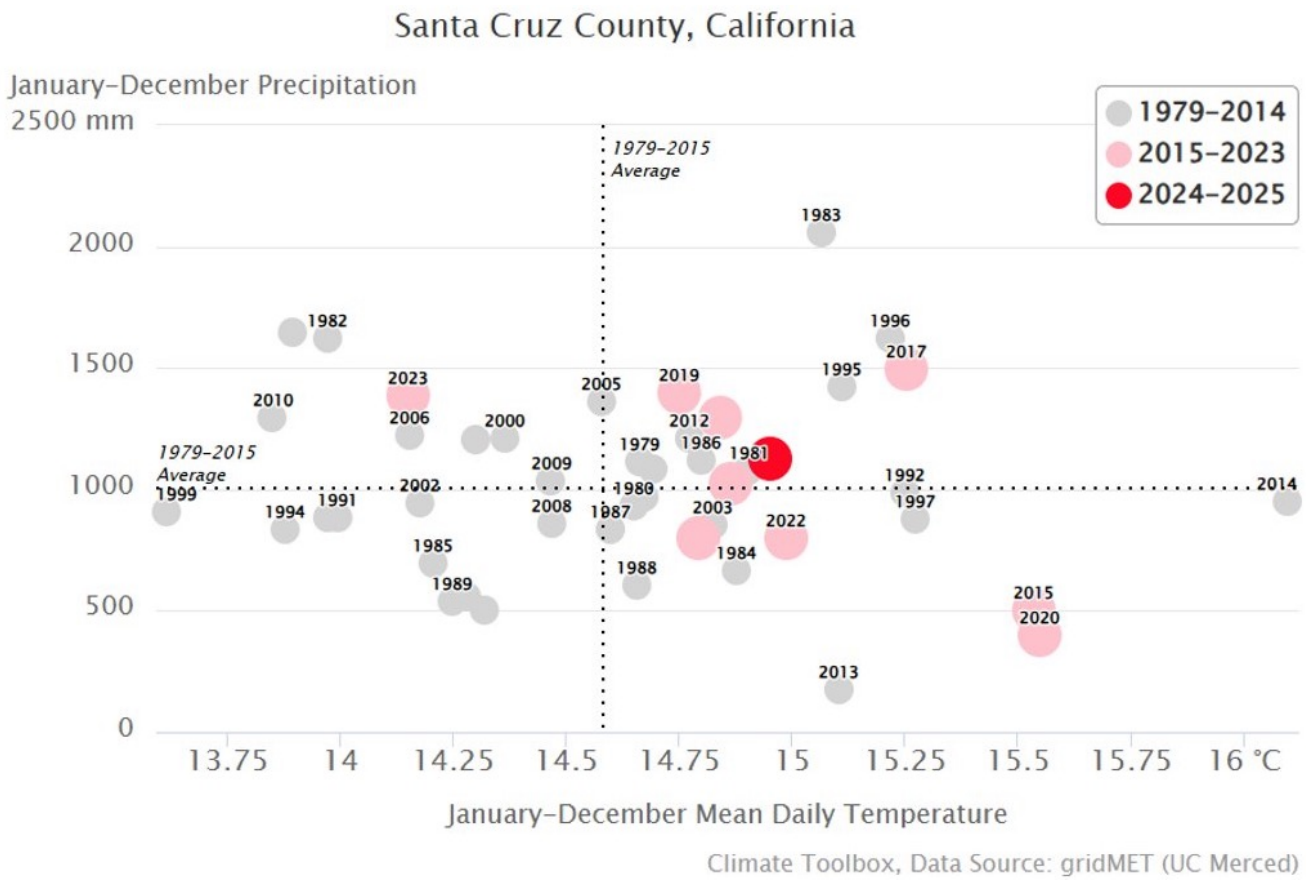

Figure G7. Historical climate scatter plot for Santa Cruz County that compares annual mean temperature (°C) to annual total precipitation (mm). Historical (1979–2014) temperature and precipitation values are represented using gray circles. Historical (1979–2015) average temperature and precipitation are indicated with the dashed vertical and horizontal lines. Recent trends are indicated using pink (2015–2023) and red (2024–2025) circles. Source: Climate Toolbox (https://climatetoolbox.org/), accessed on June 1, 2025.

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