DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, U.S. ARMY CORPS OF ENGINEERS
VENTURA FIELD OFFICE
2151 ALESSANDRO DRIVE, SUITE 110
VENTURA, CALIFORNIA 93001

October 21, 2015

RECEIVED
OCT 26 2015
BY:

Samuel Dea
Special Projects Section
County of Los Angeles, Dept. of Regional Planning
320 West Temple Street
Los Angeles, California
90012

DEPARTMENT OF THE ARMY PERMIT APPLICATION REQUEST

Dear Mr. Dea:

It has come to my attention that Centennial Founders, LLC has plans, distributed for public review, regarding the development of a mixed-use community located north of Quail Lake on 12,323 acres of undeveloped land. The proposed project location lies entirely within the privately-owned Tejon Ranch, Los Angeles County, California. The proposed development project would include the phased construction of 19,333 residential units, 600 acres of business uses, 100 acres of commercial/retail uses, 140 acres of institutional uses (such as schools, medical facilities, transportation facilities, civic government, etc.), 80 acres of recreational facilities, and 180 acres of vital infrastructure. Remaining lands (approximately 47 percent of the proposed development project) would be set aside for resource protection as open space, greenways, and parks.

This activity may require a Department of Army (DA) permit from the U.S. Army Corps of Engineers. A DA permit is required for the discharge of dredged or fill material into, including any redeposit of dredged material other than incidental fallback within, "waters of the United States", including wetlands and adjacent wetlands pursuant to Section 404 of the Clean Water Act of 1972. Examples include, but are not limited to the following activities;

a. creating fills for residential or commercial development, placing bank protection, temporary or permanent stockpiling of excavated material, building road crossings, backfilling for utility line crossings and constructing outfall structures, dams, levees, groins, weirs, or other structures;
b. mechanized land clearing and grading which involve filling low areas or land leveling, ditching, channelizing and other excavation activities that would have the effect of destroying or degrading waters of the U.S.;
c. allowing runoff or overflow from a contained land or water disposal area to re-enter a water of the U.S.; and
d. placing pilings when such placement has or would have the effect of a discharge of fill material.

An application for a DA permit is available on our website: http://www.spl.usace.army.mil/Missions/Regulatory/PermitProcess.aspx. If you have any

questions, please contact Ian Bordenave at 805-585-2151 or via e-mail at Ian.T.Bordenave@usace.army.mil. Please refer to this letter and SPL-2015-00751 in your reply. Please help me to evaluate and improve the regulatory experience for others by completing the customer survey form at http://corpsmapu.usace.army.mil/cm_apex/f?p=regulatory_survey.

Sincerely,

Aaron O. Allen, Ph.D
Chief, North Coast Branch
Regulatory Division

Antelope Valley Air Quality Management District
43301 Division St., Suite 206
Lancaster, CA 93535-4649

661.723.8070
Fax 661.723.3450

Eldon Heaston, Executive Director

In reply, please refer to AV1115/100

November 4, 2015

County of Los Angeles
Department of Regional Planning
Special Projects Section
320 West Temple Street
Los Angeles, CA 90012
Attn: Samuel Dea

Project Title: Centennial Project

Dear Mr. Dea:

The Antelope Valley Air Quality Management District (District) has received the Revised Notice of Preparation (NOP) for the Centennial Project.

The District has reviewed the Revised NOP and concurs with the proposed analysis of air quality impacts associated with the proposed project. District California Environmental Quality Act (CEQA) significance thresholds and be found in the "AVAQMD CEQA and Federal Conformity Guidelines located on our web site at: http://www.avaqmd.ca.gov/Modules/ShowDocument.aspx?documentid=2908Guidelines

Thank you for the opportunity to review this planning document. If you have any questions regarding this letter, please contact me at (661) 723-8070 x2.

Sincerely,

Bret Banks
Deputy Director

BSB/bb

Printed on recycled paper

Clean Cities
Antelope Valley

State of California • Natural Resources Agency
Department of Conservation
Division of Land Resource Protection
801 K Street • MS 18-01
Sacramento, CA 95814
(916) 324-0850 • FAX (916) 327-3430

Edmund G. Brown Jr., *Governor*
John M. Lowrie, *Assistant Director*

November 2, 2015

VIA EMAIL: SPECIALPROJECTS@PLANNING.LACOUNTY.ORG
Mr. Samuel Dea
County of Los Angeles Department of Regional Planning
Special Projects Section
320 West Temple Street
Los Angeles, CA 90012

Dear Mr. Dea:

CENTENNIAL PROJECT; COUNTY PROJECT NO. 02-232, REVISED NOTICE OF PREPARATION FOR AN ENVIRONMENTAL IMPACT REPORT, SCH# 2004031072

The Department of Conservation's (Department) Division of Land Resource Protection (Division) has reviewed the Revised Notice of Preparation (NOP) for an Environmental Impact Report submitted by Los Angeles County (County). The Division monitors farmland conversion on a statewide basis and administers the California Land Conservation (Williamson) Act and other agricultural land conservation programs. We offer the following comments and recommendations with respect to the proposed project's potential impacts on agricultural land and resources.

Project Description

The project includes the development of a master planned community, offering a wide array of housing, business park/office, commercial, schools, parks, natural open space, cultural, and public uses on approximately 12,323 acres of largely undeveloped land located entirely within the privately owned Tejon Ranch and entirely within Los Angeles County. Approximately 19,333 dwelling units will be constructed ranging from estate to small lot single family detached residences, single family and multi-family attached residences, including townhomes, condominiums and apartments. Also planned are commercial, educational and recreation/entertainment facilities; as well as major infrastructure facilities that would serve the entire community.

The project site consists of approximately 12,323 acres and is located in the northwestern portion of the Antelope Valley in unincorporated Los Angeles County. The site is contiguous to the southern boundary of Kern County and is located approximately 5.5 miles east of Ventura County.

Agricultural Impacts

As stated in the NOP, there are approximately 652 acres of farmland located within the project site which are classified as Prime Farmland by the Department of Conservation's Farmland Mapping and Monitoring Program. According to Appendix G of the California Environmental Quality Act (CEQA), conversion of this type of farmland is one of the leading indicators in determining the significants of a project's environmental impact.

Department Comments

The Department recommends the following discussion under the Agricultural Resources section of the DEIR:

- Type, amount, and location of farmland conversion resulting directly and indirectly from implementation of the Centennial Project.
- Impacts on any current and future agricultural operations in the vicinity; e.g., land-use conflicts, increases in land values and taxes, loss of agricultural support infrastructure such as processing facilities, etc.
- incremental impacts leading to cumulative impacts on agricultural land. This would include impacts from the proposed project, as well as impacts from past, current, and likely future projects.

Mitigation Measures

CEQA is the state's main policy tool for agricultural land preservation. If a project is deemed significant, lead agencies are required to adopt feasible mitigation measures to avoid or substantially lessen them. The conversion of agricultural land represents a permanent reduction in the State's agricultural land resources. As such, the Department advises the use of permanent agricultural conservation easements on land of at least equal quality and size as partial compensation for the direct loss of agricultural land. Conservation easements are an available mitigation tool and considered a standard practice in many areas of the State.

Conservation easements will protect a portion of those remaining land resources and lessen project impacts in accordance with CEQA Guideline § 15370. The Department highlights this measure because of its acceptance and use by lead agencies as an appropriate mitigation measure under CEQA and because it follows an established rationale similar to that of wildlife habitat mitigation.

Although direct conversion of agricultural land is often an unavoidable impact under CEQA analysis, mitigation measures must be considered. In some cases, the argument is made that mitigation cannot reduce impacts to below the level of significance because agricultural land will still be converted by the project, and therefore, mitigation is not required. However, reduction to a level below significance is not a criterion for mitigation under CEQA. Rather, the criterion is feasible mitigation that lessens a project's impacts. A Statement of Overriding Considerations is not a substitute for the requirement to prepare findings (CEQA Guidelines § 15091)[1]. CEQA states that the Lead Agency shall describe the specific reasons for rejecting identified mitigation measures. Therefore, all mitigation measures that are potentially feasible should be included in the DEIR. A measure brought to the attention of the Lead Agency should not be left out unless it is infeasible based on its elements. Because agricultural conservation easements are an available mitigation tool they should always be considered.

Mitigation via agricultural conservation easements can be implemented by at least two alternative approaches: the outright purchase of easements or the donation of mitigation fees to a local, regional, or statewide organization or agency whose purpose includes the acquisition and

[1] 2015 CEQA Statute and Guidelines. Palm Desert: Association of Environmental Professionals, 2015. 158-159. Print.

stewardship of agricultural conservation easements. The conversion of agricultural land should be deemed an impact of at least regional significance. Hence, the search for replacement lands should not be limited strictly to lands within the project's surrounding area.

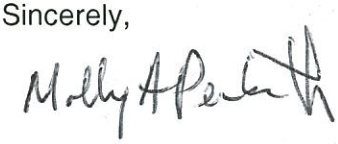
A source that has proven helpful for regional and statewide agricultural mitigation banks is the California Council of Land Trusts. They provide helpful insight into farmland mitigation policies and implementation strategies, including a guidebook with model policies and a model local ordinance. The guidebook can be found at:

http://www.calandtrusts.org/resources/conserving-californias-harvest/

Another source is the Division's California Farmland Conservancy Program (CFCP), which has participated in bringing about conservation easements throughout the State of California involving many California land trusts. Of course, the use of conservation easements is only one form of mitigation that should be considered. Any other feasible mitigation measures should also be considered.

Thank you for giving us the opportunity to comment on the Revised Notice of Preparation for the Centennial Project. Please provide this Department with notices of any future hearing dates as well as any staff reports pertaining to this project. If you have any questions regarding our comments, please contact Farl Grundy, Environmental Planner at (916) 324-7347 or via email at Farl.Grundy@conservation.ca.gov.

Sincerely,



Molly A. Penberth, Manager
Division of Land Resource Protection
Conservation Support Unit

cc: State Clearinghouse

DEPARTMENT OF TRANSPORTATION
DISTRICT 7-OFFICE OF TRANSPORTATION PLANNING
100 S. MAIN STREET, MS 16
LOS ANGELES, CA 90012
PHONE (213) 897-9140
FAX (213) 897-1337
www.dot.ca.gov

Serious drought.
Help save water!

November 2, 2015

Mr. Samuel Dea
County of Los Angeles
Department of Regional Planning
320 West Temple Street
Los Angeles, CA 90012

Re: **Centennial Project**
Notice of Preparation of Draft EIR
SCH#2004031072, IGR No: 151003/EA
Vic: LA / 138 / 0.415 – 4.106; LA / 005/ 82.625

Dear Mr. Dea

The California Department of Transportation (Caltrans) has received a revised Notice of Preparation (NOP) of a Draft Environmental Impact Report (DEIR) for the proposed Centennial project. The Centennial project still involves the development of a master plan community consisting of 19,333 residential units ranging from estates to small lot single-family houses, multi-family townhomes, condominiums, and apartments. The project now includes 19,333 residential units which represents a reduction from the 23,000 units proposed previously. In addition, the project includes approximately 7.371 million square feet of Business Park which includes office, research and development, and warehousing or light manufacturing uses. The project also includes approximately 981,000 square feet of commercial uses, approximately1.55 million square feet Civic/Institutional uses such as schools, medical facilities, transit centers, and library. Approximately, 117 thousand square feet of Recreation/Entertainment uses such as clubhouse, health club, farmers market and child care facilities are also included.

The project site is located adjacent to State Route 138 (SR-138) approximately four miles east of the I-5 and SR-138 junction. Caltrans has reviewed the revised notice of preparation and has the following comments:

Caltrans submitted comments to the original notice of preparation of a Draft EIR back in 2004 and expressed various concerns regarding potential transportation impacts to State highway facilities. Caltrans still has some of the same concerns, so please refer to our comments dated April 21, 2014. We reiterate some the same concerns in the letter:

Traffic Impact Analysis (TIA) and Mitigation Measures

At this time, Caltrans requests the TIA be updated to reflect current conditions and future traffic forecasts. Please instruct traffic engineers for the project to coordinate with Caltrans again to obtain concurrence as

to the assumptions and methodologies of the TIA. Caltrans participation in the TIA is essential as it will be involved in the approval of the different planned connections to State Route 138 (SR-138) and any improvements to SR-138 mainline. Caltrans will be involved in the widening of SR-138 which is likely between the project site and Interstate 5 (I-5).

Please refer traffic engineers to follow the Caltrans Guide for the Preparation of Traffic Impacts Studies, it is accessible online at: http://www.dot.ca.gov/hq/tpp/offices/ocp/igr_ceqa_files/tisguide.pdf

Caltrans will be interested in reaching concurrence as to the study area, methods of analysis, travel forecast modeling, thresholds of significance, vehicle trip generation and internal capture rates, future projection year and cumulative scenarios. The study area should extend into Kern County, and Caltrans District 6. District 6 will also be involved in the development and review of the TIA.

I-5 through the project site is very important for the movement of people and goods across the state and nationally, as such it carries a high volume of heavy duty trucks. The TIA must evaluate potential impacts associated with existing and additional truck traffic from the proposed project and ambient growth. The TIA should pay special attention to the I-5 and SR-138 interchange because of its importance in accommodating future truck through traffic and Centennial truck traffic.

Caltrans over sought the preparation of a Project Study Report (PSR) that identified two alternatives in addition to the no-project alternative for improvements to the segment of SR-138 from I-5 to State Route 138. The TIA should include reference to this document and its findings.

To the extent that vehicle trips are reduced and captured within the project site, less mitigation will be required off-site on State highway facilities. Caltrans recommends a Transportation Management Plan (TMP) to coordinate transit, vanpooling, carpooling, and other transportation options. Employer-sponsored carpools/vanpools or monthly transit passes for employees could be set up. Transportation alternatives for longer-distance travel should be planned for (e.g. express bus to Santa Clarita, Palmdale, and Kern County).

The entire development should be pedestrian and bicycle friendly with bicycle and pedestrian connections to the outside community. Internal circulation of public transit and adequate bike parking should be provided throughout. To provide good connectivity within each community and between communities the grid pattern is preferred over the cul-de-sac design. Park-and-Ride areas should be included and designed to accommodate regional transit. The different communities should be designed to accommodate Neighborhood Electric Vehicles (NEV's).

Land-Use and Project Phasing

It is understood the project will be developed in phases over a twenty-year period. If the residential development occurs prior to the commercial, business, and employment center the typical morning and evening commutes typical of sprawl type development might be established. To avoid this unsustainable scenario, the County as the lead agency should plan the phasing of the development accordingly. Both residential and employment centers should be developed concurrently.

The NOP states that "The Project Applicant has designed an Affordable Housing Program that provides Very Low-, Low-, and Moderate-Income affordable housing opportunities in several housing categories, including for-sale units and/or rental units. The provision of housing affordable for the various income levels is critical to minimize long-distance peak hour commutes. Please pay special attention to the phasing-in of development and housing affordability.

Caltrans understands that the Centennial Project would be developed over time according to market demands and so would the transportation improvements. Transportation facilities necessary to accommodate build-out of the entire Centennial project should be identified at this stage as well as which parts would be implemented by each phase.

Environmental Concerns

In our previous NOP comments, Caltrans expressed concerns involving potential impacts to the environment associated with necessary highway improvements. Mitigation of environmental impacts should consider not only the direct impacts of the proposed development, but those associated with supporting infrastructure improvements as well. Expanding capacity on State routes will not only involve cultural and air quality issues, but also endangered species habitat and wildlife. Native American burial grounds and ancient cultural sites may be an issue within the project site. Development in this area may affect the wildlife corridor crossing of SR-138 and mitigation measures should be planned for.

Conclusion

Caltrans staff is available to work with the project sponsors and its traffic engineers to identify the parameters of traffic impact analysis such as study area, vehicle trip reduction factors, method of analysis, significant criteria, and possible mitigation measures. Caltrans worked with Traffic engineers for the Centennial Project in the past to identify potential transportation impacts and mitigation measures in the TIA. In the Spirit of Mutual Cooperation, Caltrans request the same coordination opportunity this time around.

If you have any questions regarding these comments and wish to schedule a meeting, please feel free to contact me at (213) 897 – 9140 or project coordinator Elmer Alvarez at (213) 897-6696 or electronically at elmer.alvarez@dot.ca.gov.

Sincerely,

Rick Helland for

DIANNA WATSON
IGR/CEQA Branch Chief
Caltrans District 7

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY

EDMUND G. BROWN JR., *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

October 30, 2015

Samuel Dea
Special Projects Section
Department of Regional Planning
County of Los Angeles
320 West Temple Street
Los Angeles, California 90012

Revised Notice of Preparation, Centennial Project, East of the Community of Gorman, North of Quail Lake, Los Angeles County, Southern Field Division, SCH2004031072

Dear Mr. Dea:

Thank you for the opportunity to review and comment on the Revised Notice of Preparation (NOP) of the Centennial Project (Project) located in an unincorporated area north of Quail Lake and south of Tehachapi Afterbay in Los Angeles County. The Project includes development of 12,323-acre master planned community with residential, business park, commercial, civic and institutional, and recreation and entertainment uses within the privately-owned Tejon Ranch. Community infrastructure facilities that will serve the Project include construction of wastewater reclamation facilities, water treatment facility, water bank, and materials recovery facility. A new bridge crossing over the West Branch of the California Aqueduct (Aqueduct) is also proposed in the Project.

The Notice of Preparation of the Project was originally submitted in 2004 and is revised to include reduction in development area and no development in the northwest area of the Project site.

California Department of Water Resources (DWR) has concerns about the Project at the following areas:

Biological Resources

DWR personnel conduct routine maintenance and repairs, and project to increase safety adjacent to the Project. DWR requests impacts to wildlife that cause migration into DWR right-of-way be analyzed as nesting birds and special-status species relocating into DWR right-of-way will impact our ability to maintain and improve State Water Project (SWP) facilities. Nesting birds, including ground nesting raptors, and special status species moving into DWR right-of-way due to loss of habitat would likely require DWR having to consult with wildlife control agencies in order to perform the

routine maintenance and repair. Movement of wildlife into DWR right of way has the potential stop work until take permits are secured whereas prior to development no take permits were required.

Antelope, deer, and badgers are often seen in the area of the Project. Movement of wildlife species into the DWR right-of-way could result in increased accidents with large mammals and road kill. The environmental impact report (EIR) shall address wildlife movement caused by the Project. Page 6 of the NOP states that the Aqueduct is a barrier to wildlife movement; however, many species have been observed finding ways to cross the aqueduct and an increased number of bridges along the Aqueduct could promote crossing used by wildlife.

Hydrology and Water Quality

Two golf courses are planned for each side of the Aqueduct. Golf courses traditionally use fertilizers and pesticides for maintenance. Fertilizers and pesticides could have a major impact on water quality to the California Aqueduct. Impacts to water quality caused by maintenance of the golf courses and project drainage need to be addressed in the EIR. In addition, the project will increase use of fertilizers and pesticides used by residents. Fertilizers and pesticides could have a major impact on water quality to the California Aqueduct. Impacts to water quality caused by residential use need to be addressed as well.

The Project also has the potential to increase the risk of household chemicals and hydrocarbons entering the Aqueduct. Improper disposal of motor oil and household chemicals is a recognized problem in many California communities and may have a significant impact to the Aqueduct as a result of the Project. Impacts to water quality of the Aqueduct shall be addressed.

New bridge developments, and improvements to existing bridges over the Aqueduct, have the potential to impact water quality during construction. Impacts to water quality due to construction shall be addressed.

Drainages need to be designed to avoid the California Aqueduct, and must be specifically discussed in the EIR.

The Project would be located adjacent to the California Aqueduct and Quail Lake. In addition, the western portion of the Project site is located within the watershed of Gorman Creek, which drains to Pyramid Lake. The EIR should evaluate whether the Project would cause erosion and introduce sediment into the Aqueduct or Quail Lake, and whether the Project would cause other pollutants to flow into these waters or

Gorman Creek. Introduction of sediment into the SWP system could reduce the capacity of the SWP water storage and conveyance facilities, damage SWP mechanisms, and/or require DWR to perform additional, unnecessary, and potentially costly maintenance on the SWP facilities. Also, introduction of sediment and other pollutants into the SWP system could impair the quality of the water transported by the SWP.

Geology and Soils

Ground subsidence due to overdraft of ground water is a problem that impacts canals throughout California. Ground subsidence near the Project could cause impacts to the Aqueduct that may result in the need to increase maintenance or call for major repairs. Groundwater use and overdraft prevention shall be addressed in the EIR document.

Some portions of the Project would be built in close proximity to SWP facilities. The EIR should evaluate whether the Project would affect the geology and/or soils in the vicinity of the SWP facilities in a manner that would impair the geological stability of the SWP or the quality of the water flowing through the SWP.

Hazards

The Project would be located near several SWP facilities, most of which are closed to the public for safety and infrastructure security reasons. The Project would substantially increase the number of people living, working, shopping, recreating, and otherwise visiting the Project area and . The EIR should evaluate whether the Project would substantially increase the potential for public safety hazards (e.g., drowning), vandalism, or infrastructure security concerns attributable to the proposed population increase near the SWP. The Project should be designed to discourage and prevent unauthorized access to SWP facilities.

The EIR should also evaluate the potential for the Project to introduce hazardous materials (e.g., construction fuels and chemicals) onto SWP land and into the water carried by the system.

Land Use

The Project would be located adjacent to the California Aqueduct and Quail Lake. The Project should be designed to avoid unauthorized encroachment onto SWP facilities and to not interfere with DWR's ability to access and maintain the SWP. If the Project encroaches onto land owned or managed by DWR (e.g., the proposed access road, bridges, and water pipeline), the Project sponsor should coordinate with DWR during

the early stages of the planning process about securing authorization for the encroachment(s).

Any construction activity in the vicinity of the California Aqueduct may require an encroachment permit issued by DWR. Information regarding regulations and forms for submitting an application for an encroachment permit to DWR can be found at:

http://www.water.ca.gov/engineering/Services/Real_Estate/Encroach_Rel/

Please provide DWR with a copy of any subsequent environmental documentation when it becomes available for public review. Any future correspondence relating to this proposed project shall be sent to:

Leroy Ellinghouse, Chief
SWP Encroachments Section
Division of Operations and Maintenance
Department of Water Resources
1416 Ninth Street, Room 641-2
Sacramento, California 95814

If you have any questions, please contact Leroy Ellinghouse, Chief of the SWP Encroachments Section, at (916) 659-7168 or Jonathan Canuela at (916) 653-5095.

Sincerely,

David M. Samson, Chief
State Water Project Operations Support Office
Division of Operations and Maintenance

cc: State Clearinghouse
Office of Planning and Research
1400 Tenth Street, Room 121
Sacramento, California 95814

CENTER *for* BIOLOGICAL DIVERSITY *Because life is good.*

protecting and restoring natural ecosystems and imperiled species through science, education, policy, and environmental law

11/4/2015

Mr. Samuel Dea
County of Los Angeles Department of Regional Planning,
Special Projects Section,
320 West Temple Street,
Los Angeles, CA 90012
specialprojects@planning.lacounty.gov

RE: Scoping comments on the Revised Notice of Preparation for the Centennial Specific Plan Project Number 02-232, Specific Plan Conditional Use Permits including Oak Tree Permit, Zone Change, Development Agreement and Vesting Tentative Tract Map Numbers 60020, 60021, 60023 and Vesting Tentative Parcel Map Number 60022, State Clearinghouse Number: 2004031072

SUBMITTED ELECTRONICALLY TO specialprojects@planning.lacounty.gov
AND BY USPS POSTMARKED NOVEMBER 4, 2015

Dear Mr. Dea,

The Center for Biological Diversity ("the Center") submits the following comments on the Revised Notice of Preparation for Centennial Specific Plan Project Number 02-232, Specific Plan Conditional Use Permits including Oak Tree Permit, Zone Change, Development Agreement and Vesting Tentative Tract Map Numbers 60020, 60021, 60023 and Vesting Tentative Parcel Map Number 60022, State Clearinghouse Number: 2004031072 (the "Project" or "Centennial Development"). The Center is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has 50,186 members and over 900,000 online activists, including 31,862 members and 111,877 online activists in California. This includes many residents of Los Angeles, Kern, and Ventura counties and other areas that the proposed Project would impact. We submitted scoping comments to the County on the original Centennial Project on April 21, 2004 and those comments are incorporated by reference to these comments. A copy of these comments is attached for your reference (Attachment 1).

As the County is well aware, the Center has filed a legal challenge to the Antelope Valley Area Plan update, which stripped Significant Ecological Area (SEA) designations from the most of the Project area. Therefore, pending the outcome of that court case, we view this Notice of Preparation (NOP) as highly premature, and urge the County to withdraw this notice until the Antelope Valley Area Plan (AVAP) litigation is resolved.

Ileene Anderson, Senior Scientist
8033 Sunset Boulevard, #447 • Los Angeles, CA 90046-2401
tel: (323) 654.5943 *fax:* (323) 650.4620 *email*: ianderson@biologicaldiversity.org
www.BiologicalDiversity.org

The SEA boundaries denote important biological and ecological resources deserving of a higher level of protection. In the NOP, the County claims "No development from the Centennial Project would occur in the SEA within the Project boundary." Prior to the Board of Supervisors adjusting the boundaries of the SEA, the whole of the Project was classified as an SEA. It was only upon an unlawful amendment to the project during the Board meeting at which the AVAP was approved, that this critical change was made. The Center has challenged the Board's removal of lands, including the Project area, from the SEA and the County has acted imprudently in attempting to take action on this project prior to resolution of the AVAP litigation.

The revised NOP indicates that the Project area has increased in size by over 600 acres to a total of 12,323 acres. The Project would develop approximately 6,700 acres into planned communities and approximately 5,600 acres of the Project property would be preserved as "open space" although the management of the "open space" appears to allow degradation of open space values. The Project proposes to construct 19,333 dwelling units on approximately 4,950 acres of land designated for residential/mixed use, plus 700 acres of business, warehouses and commercial space, 500 acres of civic development, and necessary infrastructure facilities – essentially a new city plunked down in one of the key ecological connectivity areas in the state. The Project site is also at the convergence of two largest earthquake faults in California – the San Andreas fault and the Garlock fault.

The Project proposes to sequentially build out this new proposed city over twenty years. This approach is an anathema to smart planning. Over a twenty-year timeframe relevant ecological, political, and social factors will change and planning would be better served to evaluate only the first "phase" of the Project. Even today, this leapfrog type of development – remote from jobs, other housing, and public services – is contrary to contemporary sustainable planning standards.

Despite the passage of a more than a decade, the County has not provided a new Initial Study updating and clarifying the potential significant impacts from the Project. Therefore, the areas of concern from our view remain as presented in our April 21, 2004 scoping comments. In addition, the County needs to provide:

- a robust analysis of greenhouse gas emissions and climate change impacts from all sources associated with the Project using existing conditions as the analytic baseline;
- a robust analysis of the impact from on-going climate change and how that affects the reduced connectivity for plants and animals to move if the Project is built;
- consideration of alternatives involving zero net-energy use by all Project residences and commercial buildings;
- water supply availability and quality analysis incorporating the most recent information on anticipated frequency and severity of long-term drought conditions;
- cumulative impacts from adjacent planned and existing projects;
- a thorough analysis of the status of and potential Project impacts to pronghorn, based on current information, including the attached *Literature Review and Analysis of Pronghorn Populations at Tejon Ranch, California* (Attachment 2);

- full analysis of the status of and potential Project impacts to the Tehachapi white-eared pocket mouse, based on the most recent information available from the U.S. Fish and Wildlife Service, California Department of Fish and Wildlife, and other sources. We attach a 2010 survey results on adjacent Bicentennial and Tricentennial areas by the Endangered Species Recovery Program at the request of the Tejon Conservancy. The report documents successful live-trapping of Tehachapi white-eared pocket mice in both areas;
- analysis of air quality impacts of Project grading on human health, including possible increased risk of valley fever.

A number of biological studies over the years have been prepared for earlier iterations of this Project. These studies were submitted to the County's Significant Ecological Area Technical Advisory Council (SEATAC) for review and discussion. All of those studies need to be included as part of the CEQA analysis going forward.

The environmental effects of developing a new urban sprawl project of over 19,000 houses will include direct and indirect impacts to biological resources, adjacent public lands, air quality, water quantity and quality, and regional urban growth. Evaluation of each of these impacts and analysis of reasonable and prudent alternatives must be included in the EIR.

Thank you for the opportunity to submit comments on this proposed Project. Please do not hesitate to contact the Center with any questions at the number listed above. We look forward to reviewing any further environmental documentation on this project. Please add us to the list for all notices and dissemination of information pertaining to this project.

Sincerely,

April Rose Sommer

April Rose Sommer
Staff Attorney

Ileene Anderson
Senior Scientist

CENTER FOR BIOLOGICAL DIVERSITY

CALIFORNIA AND PACIFIC OFFICE

protecting endangered species and wild places through science, education, policy, and environmental law

VIA FACSIMILE AND FEDERAL EXPRESS OVERNIGHT DELIVERYY

April 21, 2004

Dr. Daryl Koutnik, Ph.D.
County of Los Angeles
Department of Regional Planning
Impact Analysis Section
320 W. Temple St.
Los Angeles, CA 90012-3225
Facsimile: (213) 626-0434

Re: Comments on the Notice of Preparation for Centennial Specific Plan Project Description; Project Number 02-232; Specific Plan; Conditional Use Permits; Oak Tree Permit; Zone Change; Development Agreement; Vesting Tentative Tract Map Numbers 60020, 60021, 60023; Vesting Tentative Parcel Map Number 60022

Dear Dr. Koutnik:

The Center for Biological Diversity ("the Center") and the Center on Race, Poverty, and the Environment ("CRPE") submit the following comments on the Notice of Preparation for Centennial Specific Plan Project Description; Project Number 02-232; Specific Plan; Conditional Use Permits; Oak Tree Permit; Zone Change; Development Agreement; Vesting Tentative Tract Map Numbers 60020, 60021, 60023; Vesting Tentative Parcel Map Number 60022 (hereinafter "the Project" or "Centennial Development"). The Center is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has over 9,000 members throughout California and the western United States, including in Los Angeles, Kern, and Ventura counties and other areas that the Project would impact. CRPE is a non-profit environmental justice advocacy group with offices in Delano, Fresno and San Francisco, California. CRPE represents low-income communities and workers throughout the United States who are fighting environmental hazards. CRPE stresses the need for community-based, community-led organizing and litigation.

The proposed Centennial Development consists of 23,000 residential units and over 14 million square feet of commercial and retail space on over 11,600 acres, rendering it the largest single development project ever proposed in California. The project applicant, listed in the NOP as

Tucson • Phoenix • Silver City • San Diego • Berkeley • Idyllwild

Kassie Siegel, Staff Attorney
PO Box493, Idyllwild, CA 92549
TEL.: (909) 659-6053 x. 302 • FAX: (909) 659-2484
Email: ksiegel@biologicaldiversity.org • www.biologicaldiversity.org

"Centennial Founders, LLC" (NOP at 2) proposes to place a development the size of several mid-size cities in the heart of one of California's most pristine remaining natural areas. The Center and CRPE urge the County of Los Angeles ("County") to give this unprecedented proposal the close scrutiny that it deserves and that is required by law.

The Tejon Ranch, which spreads from the southern end of the San Joaquin Valley from the foothills of the Sierra Nevada, over the Tehachapi Mountains, and into the Antelope Valley, is a unique and irreplaceable piece of California's natural heritage. The 270,000 acres of habitat is a hotspot of biological diversity that lies at the confluence of four major biogeographic regions. It is a haven for rare and endemic species, ancient oak trees, endangered California condors, rare native vegetation communities, and intact watersheds and streams. At least nine plant communities have been identified in this region, as well as hundreds of plant series (some unidentified), including Pleistocene relicts such as Great Basin Sagebrush and Blackbrush scrub.

The Tejon Ranch is surrounded by other public and private protected land, including the Los Padres National Forest and Windwolves Preserve to the southwest, Bitterroot National Wildlife Refuge and Carrizo Plain to the west, and the Sequoia National Forest and Bureau of Land Management Lands to the northeast. The Tejon Ranch is a vital corridor connecting the southern Sierra to the Transverse Ranges and beyond. *See* K. Penrod, C. Cabanero, C. Luke, P. Beier, W. Spencer, and E. Rubin, *South Coast Missing Linkages Project: A Linkage Design for the Tehachapi Connection* (September 2003), Unpublished, South Coast Wildlands Project, Monrovia, CA. The development of the Centennial site would irrevocably and fundamentally alter the California landscape.

While the NOP has provided very little information, the Center and CRPE would like to take this opportunity to emphasize that the County must fully analyze each environmental impact of all phases of the Centennial Development in the EIR. Importantly, the County must address the <u>whole of the action</u> described in the Notice of Preparation ("NOP"). CEQA Guidelines, 14 Cal. Code Regs. ("Guidelines") § 15063. For example, the EIR must describe and analyze all phases of the Project, all road and infrastructure construction and expansion contemplated by the Project, as well as all growth inducement of the Project. The EIR must also carefully evaluate the project's impacts not only in Los Angeles County, where the Project will physically be constructed, but also in Kern County and the San Joaquin Valley, Ventura County, and all other areas affected by the Project's impacts. While the Project is located in the extreme northwestern portion of Los Angeles County, many of the environmental impacts will occur in neighboring counties. If the EIR improperly limits the scope of its analysis, this will invalidate the entire EIR.

Alternatives Analysis. A crucial component of the EIR for this Project will be a full and thorough discussion of alternatives, particularly of alternative locations for the Project with fewer environmental impacts. For example, a close and detailed look at alternative locations for the Project in urban locations with a higher proposed residential density and smaller footprint is required. The alternatives section also should include a comparison of the costs of each alternative to wildlife, air quality, vegetative communities, water quality, aesthetics, and taxpayers.

Air Quality. The EIR must thoroughly analyze and mitigate the Project's direct, indirect, and cumulative impacts on air quality in each air basin that will be impacted by the Project's emissions as well as the impact these emissions will have on human health, wildlife, and native flora. The Project is proposed in an area with the nation's worst air quality. While the Project is physically located in the

the Mojave Desert Air Basin and the Antelope Valley Air Quality Management District, the air pollution emissions from Centennial will impact other air basins and districts, including the San Joaquin Valley Air Quality Control District and the South Coast Air Quality Control District. Impacts to all affected basins and districts must be fully evaluated.

Impacts on vegetation. Native grasslands, wildflower fields, oak and mixed woodlands, and chaparral all exist on site. NOP at 5. The direct, indirect, and cumulative impacts of the Project on vegetation in relation to the environmental baseline must be fully analyzed. In addition, even the relatively more disturbed portions of the Project site (annual grasslands) provide habitat for numerous species in the area, and must not be undervalued. Also, all vegetative resource surveys ever conducted on the Project site must be disclosed to the public.

The Project Applicant is requesting a Conditional Use Permit ("CUP") to develop portions of two areas currently designated Significant Ecological Areas (SEAs). NOP at 7. It is also requesting a CUP to remove oak trees. Id. The Center and CRPE urge the County to reconsider the appropriateness of these actions in light of governing law.

Impacts on biological resources. It is critical that the EIR fully discuss and analyze the direct, indirect, and cumulative impacts of the Project on animal populations and movement. In addition, measures to remove or reduce barriers to movement on the Centennial site must be analyzed and incorporated into the Project as either part of the Project design or required mitigation. NOP at 6 (discussing limitations of existing culverts and roads currently crossing aqueduct). Further, all biological resource surveys previously conducted on the Project site must be disclosed to the public as part of the description of the environmental baseline.

Water quantity and quality. The EIR must fully assess and ensure the availability of an adequate water supply to support the Project. In addition, the EIR must assess the impacts of the Project on surface and groundwater quantity and quality. Riparian and wetland habitats occur in association with drainages, springs, and seeps located on site. NOP at 5.

Traffic impacts. The Project contemplates that the primary access route to the Centennial project site will be SR-138 via I-5. Also planned are 227.4 acres of "internal roads" as well as 470.8 acres of "major roads." NOP at 13. The traffic, air quality, noise, and aesthetic impacts the proposed parkways, major highways, secondary highways, collector streets, local roadways, and improvements to existing routes must be fully analyzed.

Impacts of Sprawl. The EIR must fully disclose the direct, indirect and cumulative impacts of the proposed development and the growth it will induce. Research has identified qualitative and quantitative impacts from sprawl style development, including:

- *Higher rates of driving and vehicle ownership*. The research indicates that in relatively sprawling regions, cars are driven longer distances per person than in places with lower-than-average sprawl. Over an entire region, that adds up to millions of extra miles and tons of additional vehicle emissions.

- *Increased levels of ozone pollution*. The study found that the degree of sprawl is more strongly related to the severity of peak ozone days than per capita income or

employment levels. The difference in ozone peaks appears significant enough to potentially mean the difference between reaching or failing to meet federal health-based standards. Failing to reach the standard not only imperils the health of children and other vulnerable populations, but also subjects regions to a raft of rigorous compliance measures.

- *Greater risk of fatal accidents.* Residents of more sprawling areas are at greater risk of dying in a car crash, the research indicates. In the nation's most sprawling region, Riverside CA, 18 of every 100,000 residents die each year in traffic crashes. The eight least sprawling metro areas all have traffic fatality rates of fewer than 8 deaths per 100,000. The higher death rates in more sprawling areas may be related to higher amounts of driving, or to more driving on high-speed arterials and highways, as opposed to driving on smaller city streets where speeds are lower. Speed is a major factor in the deadliness of automobile crashes.

- *Depressed rates of walking and alternative transport use*. In more sprawling places, people on their way to work are far less likely to take the bus or train or to walk. Twice the proportion of residents take public transit to work in relatively non-sprawling metro areas versus those with below-average scores. Likewise, thousands more residents walk to work in regions that sprawl less.

- *No significant differences in congestion delays*. The research found that sprawling metros exhibited the same levels of congestion delay as other regions. This finding challenges claims that regions can sprawl their way out of congestion.

See R. Ewing, R. Pendall, and D. Chen, Measuring Sprawl and Its Impact, *Smart Growth America Growth* (2002), http://www.smartgrowthamerica.com/.

Other Permits, Authorizations, and Consistency Determinations. The DEIR should provide the public with a list and description of all other permits, authorizations and/or analyses required for the Project, including the statutory basis for the required permit, the date of application (or estimated date) for the permit, the permitting agency, and any opportunity for public comment on each permit. Such permits, authorizations and/or analyses may include Clean Water Act Section 402 National Pollutant Discharge Elimination System permits, federal Endangered Species Act Section 7 consultation documents (including Biological Opinion(s) and any Incidental Take Permits or Statements issued), California Fish and Game Code Sections 1601 and 1603 permits, federal Clean Water Act Section 404 permits, National Environmental Policy Act environmental impacts analysis documents, and air quality permits.

The Proposed Project site, 12,000 acres of the Tejon Ranch, is part of a unique and irreplaceable piece of California's natural heritage, with natural and biological resources of incomparable value. In addition, the region is already suffering from some of the worst impacts of sprawl style growth, including horrendous air quality and traffic congestion. The Center believes that if the true environmental impacts of the Centennial Development are disclosed to the public and decision makers, it will become abundantly clear that the proposed Project should be denied. The Center supports preservation of the entire Tejon Ranch as natural habitat and open space. As Los Angeles County continues processing the application and the CEQA process, we look forward to

reviewing an EIR that addresses each of the issues raised during the scooping process and that complies with CEQA and its implementing regulations as well as all other applicable federal, state, and local laws.

Sincerely,

Kassie Siegel, Staff Attorney, Center for Biological Diversity

Monica Bond, M.S., Staff Biologist, Center for Biological Diversity

A Literature Review and Analysis of Pronghorn Populations at Tejon Ranch, California

TIERRA RESOURCE MANAGEMENT

Photo credit - title page: Pronghorn at Carrizo Plain National Monument (photo Steve Kohlmann)

Suggested citation: Kohlmann, S. G., and J.D. Yoakum. 2009. A literature review and analysis of pronghorn populations at Tejon Ranch, California. Tierra Resource Management, San Ramon, California, USA.

A Literature Review and Analysis of Pronghorn Populations at Tejon Ranch, California

Submitted To:

Center for Biological Diversity
California Field Office
351 California Street, Suite. 600
San Francisco, California 94104

Submitted By:

Tierra Resource Management
440 Hampton Court
San Ramon, California 94546

Authors

Stephan G. Kohlmann, Ph.D. - Lead Author

Stephan (Steve) G. Kohlmann, Ph.D., is a certified wildlife biologist and senior ecologist with many years of professional experience as a population manager and conservation biologist. Steve contributed the chapter on population dynamics and modeling in the book "Pronghorn; Ecology and Management" by Bart W. O'Gara and Jim D. Yoakum. Steve has published over 30 peer-reviewed scientific papers and most of his work has been in population biology and management of large mammals.

James D. Yoakum, Project Leader

James (Jim) D. Yoakum is a certified wildlife biologist. He was the first professional biologist to work for the U.S. Bureau of Land Management, and worked for the federal government 33 years. Jim devoted much of his career to research and management of pronghorn on western rangelands, authoring more than 100 scientific articles in peer reviewed periodicals. Together with another pronghorn researcher, Dr. Bart W. O'Gara, Jim coauthored the book "Pronghorn; Ecology and Management", originally published in 2004.

Table of Contents

Authors **4**

Table of contents **5**

List of figures **7**

List of tables **8**

Acknowledgments **9**

Executive summary **10**

Introduction **14**

1.1 Setting 14
1.2 Proposed action 16
1.3 Purposes of this document 21

Scientific Literature Review **22**

2.1 General biology, life history and ecology 22
2.1.1 Distribution 22
2.1.2 Taxonomy 25
2.1.3 Physical characteristics 26
2.1.4 Behavior 28
2.1.5 Reproduction 31
2.1.6 Population dynamics 33
2.1.7 Diet consumption, food habits and nutrition 38
2.2 Habitat characteristics 42
2.2.1 Topography 42
2.2.2 Vegetation cover 43
2.2.3 Plant composition and structure 44
2.2.4 Plant diversity 44
2.2.5 Habitat suitability 45
2.3 Human impacts 46
2.3.1 Fences 46
2.3.2 Roads 47
2.3.3 Mineral and energy development 48

2.3.4 Housing development and subdivision 48
2.3.5 Disturbance.....49

Population status of pronghorn at Tejon Ranch.....50

3.1 Restoration and historic population development.....50
3.2 Population dynamics 51
3.3 Climatic factors.....53
3.3.1 Habitat suitability.....57
3.3.2 Other factors.....63
3.4 Conclusions.....63

References.....66

List of Figures

Figure 1: Location of Tejon Ranch in Los Angeles County, California. 15
Figure 2: Location and extent of the proposed Tejon Ranch development areas..... 16
Figure 3: Outline of the proposed Centennial development (map from http://www.centennialca.com/aerialmap.html) 17
Figure 4: Significant Ecological Areas in the vicinity of the proposed Tejon Centennial development. 18
Figure 5: Regional ecological linkages and potential wildlife crossings over the aqueduct as identified in the Centennial Specific Plan Biota report (Bonterra Consulting, 2008)..... 19
Figure 6: Vegetation communities for Tejon Centennial proposed development and vicinity..... 20
Figure 7: Original range and habitat occupied in 1997 by pronghorn (source: Yoakum and O'Gara 2000)..... 23
Figure 8: Current distribution of pronghorn in California (map available online at nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=18631). 24
Figure 9: Photograph by Edmend Heller of a captive female pronghorn at Tejon Ranch in 1903; courtesy of David E. Brown and the Smithsonian Institute 25
Figure 10: Survivorship curves for male and female pronghorn at the National Bison Range in Montana (data courtesy John Byers, University of Idaho, pers. comm). Note that this is an unhunted population. 34
Figure 11: Approximate range of pronghorn on Tejon Ranch, California, during 2008..... 51
Figure 12: Number of pronghorn classified during autumn surveys on Tejon Ranch, California, from 1995 through 2008. Data courtesy of California Department of Fish and Game, Bakersfield, CA..... 52
Figure 13: Autumn population composition of the Tejon pronghorn herd from 1995 through 2008. Note the high estimate for fawns and corresponding drop in doe numbers in 2006. Data courtesy of California Department of Fish and Game, Bakersfield, California. 52
Figure 14: Relationship between annual per-capita growth rate and fawn ratios for all data (open circles, dotted trend line) and for reduced data set (value for 2006 excluded; solid circles, solid trend line). None of the trend lines were significant (P>0.05)..... 53
Figure 15: Pronghorn core range at Tejon Ranch and locations of nearest weather stations..... 54
Figure 16: Annual and summer-autum-winter precipitation at Tejon Ranch, measured at Sandberg weather station, Sandberg, CA. 54
Figure 17: Correlation between summer-autumn-winter precipitation (Jul-Dec) two years prior and fall pronghorn fawn ratios observed on Tejon Ranch, 1995-2006.

Weather data are from the nearby Sandberg Weather Station. Solid line represent regression estimate for reduced data set (open circles), dotted line represents the full data (filled circles). 55
Figure 18: Relationship between annual instantaneous growth rates of the female segment of pronghorn population (λF) at Tejon Ranch and wet-season precipitation (Oct-May). 56
Figure 19: Vegetation map showing the Tejon Ranch core pronghorn range and the proposed Centennial development (outlined in red). 58
Figure 20: Native bunchgrass communities of the Centennial project site (Vollmar Consulting 2007) 60
Figure 21: Slope suitability for pronghorn at Tejon Ranch. 61
Figure 22: Location of local roads in and surrounding the core pronghorn range on Tejon Ranch. 62

List of Tables

Table 1: Habitat types and their associated rank of suitability for pronghorn (after Longshore and Lowry, 2008) 57
Table 2: Vegetation types, their ranks for pronghorn habitat suitability and their respective area for the Tejon Ranch pronghorn range. 59

Acknowledgments

The authors wish to thank Adam Keats from the Center of Biological Diversity for his support of this project. We are grateful for the assistance of Curtis Bradley with GIS data layers. Bill Asserson of the California Fish and Game office in Bakersfield and Tony Mathias of the Tejon Ranch shared their knowledge and pronghorn data.

Executive Summary

Founded as a Mexican land grant, the 270,000 acre Tejon Ranch is today one of the largest contiguous expanses of private land in California. The ranch is located in southern California along Interstate 5, approximately 60 miles north of Los Angeles and 30 miles south of Bakersfield. Ecologically, Tejon Ranch is in a key location at the convergence of 5 geomorphic provinces and 4 floristic creating a biodiversity "hotspot" and an irreplaceable linkage among key ecological regions in California. Because of the high concentration of listed and sensitive species, the United States Fish and Wildlife Service Recovery Plan for Upland Species of the San Joaquin Valley identified areas of Tejon Ranch as important for protection.

Tejon Ranch Company has recently announced its plan to build three developments in the western portion of the Ranch along Interstate 5, including a commercial and industrial park on 1,400 acres, a resort-like luxury development, and a master–planned new town named "Centennial" approximately 32 miles north of the City of Santa Clarita, just east of the Interstate 5 (I-5) highway. The Centennial project is the largest housing development ever proposed in California.

There is widespread concern for the potential impact of the Centennial development on the southern-most pronghorn (*Antilocapra americana)* herd in California. Pronghorn were native to most southern California rangelands prior to the early 1800s, but were extirpated during the late 1800s and early 1900s. During the 1980s, translocation by the California Department of Fish and Game resulted in the restoration of a permanent pronghorn population on Tejon Ranch – currently the most southern herd in California.

In addressing the potential impacts of the Centennial development, pronghorn are important because their entire life cycle depends on productive grassland ecosystems. Native grasslands are an integral component of pronghorn habitat requirements. The proposed Centennial development threatens some of the last extensive perennial grasslands in southern California. Most native perennial grasslands in the state have been replaced with invasive annual grasses during the last two hundred years because of various human disturbances. Grasslands produce a mixture of grasses, forbs and shrubs that provide protective cover for fawns and abundant succulent and nutritious forage for sustaining healthy herds.

The purpose of this document is to develop a comprehensive knowledge base regarding pronghorn in southern California, and to address the current status of the herd to better understand the vulnerability of this population to the planned Centennial development on

Tejon Ranch. In addition, this assessment will provide planners, developers and regulatory agencies basic data to explore mitigation strategies which may offset impacts to pronghorn habitats.

Chapter 2 of this report examines the general biology, life history and ecological relationships of pronghorn and their habitats and other species. We discuss behavior, reproduction and dietary needs in regards to the species' requirements in general and as they pertain to southern California. Important differences exist between the behavior and reproduction of pronghorn in northern and southern ranges. These consist mostly of less stable populations, higher variability in ecological conditions, lower reproductive potential and greater demographic vulnerability of pronghorn in southern ranges. Hence, potential human impacts of pronghorn ranges and populations may be exacerbated in southern California.

In Chapter 3, we examine the demographics of the pronghorn herd at Tejon Ranch in relationship to climate and habitat conditions. Pronghorn composition counts conducted on Tejon Ranch are useful as an index to the population's trend, but cannot serve as reliable estimates of population size due to the lack of replication or estimation of precision. Available data suggest that the current population is extremely small (< 50 animals). The population trend has been stable to slightly increasing, but annual fawn production is highly variable. Annual population growth for the Tejon pronghorn herd is not strongly driven by fawn ratios in autumn. This might indicate a weakness of the classification data in representing the true population size.

To evaluate potential rainfall effects on pronghorn population dynamics, we selected long term weather data from KSDB weather station in Sandberg, approximately 1.7 miles (2.7 km) due south of the Centennial project site. We focused our analysis on the amount of rainfall in any given year, because in southern climates it is the main driver of vegetation productivity.

We took a subset of annual precipitation occurring from July through December as a representation of summer,autumn and winter growing conditions. Autumn fawn ratios (fawns/100 does) were significantly correlated with the autumn precipitation two years prior. Furthermore, a significant, positive relationship existed between the annual instantaneous growth of the female segment of the herd and total wet-season precipitation (October-May).

Annual population growth of Tejon Ranch pronghorn thus appears to be driven by a combination of stochastic climatic factors and by fawn recruitment. This indicates density dependent growth characteristics and the importance of pre-winter condition on ensuing fawn production. The delayed response may give managers a possibility to intervene to ameliorate low fawn ratios by changing livestock grazing or other intensive management of food resources, or by reducing mortality factors. Our analysis suggests that when wet-season precipitation drops below 7.7 in. at the Sandberg Weather Station negative population growth is highly likely to follow. Dry years also result in low fawn ratios within 2 years.

The pronounced effect of precipitation of population growth at the Tejon Ranch suggests a strong functional linkage between forage production and pronghorn population dynamics. Currently, all southern pronghorn herds (i.e., Carrizo Plain and surrounding areas, and the Tejon Ranch population) exist in marginal vegetation conditions. Habitat types within the home ranges of the Tejon Ranch pronghorn population are significantly drier and less productive than most pronghorn ranges. In addition, pronghorn forage conditions at Tejon

Ranch appear less productive now than they were a decade ago, possibly because of drought and heavy livestock foraging.

We examined habitat suitability as a function of vegetation type, slope and road density. Suitability ranks for vegetation types for the majority of the pronghorn core area were high: over 90% of the area is ranked 3 or higher in habitat suitability. Herbaceous and grassland vegetation types occupied 34% of the area – this type also occurs in the largest contiguous patches and is the highest-ranking vegetation type for pronghorn. The area has some of the best preserved native perennial grasslands and high-quality bunchgrass communities in southern California. The second and third-best ranked habitats (agricultural, shrub and desert scrub communities) occupied an additional 54%.

Slope is an important indicator of pronghorn habitat suitability. Studies suggest that pronghorn avoid slopes >20% and apparently prefer areas where the slopes are <10%. The average slope of the core pronghorn range was 21 percent (SD=20.3). Slope mapping showed that a large portion of the lowest sloped areas were located within or adjacent the proposed Centennial development. However, the project area also contained a large portion of the lowest slope suitability class.

Road density is highest on private lands outside Tejon Ranch. The effect of roads on pronghorn habitat suitability depends largely on the frequency and speed of vehicular traffic and whether these roads are fenced. Current roads on the Ranch appear to have limited impact on pronghorn populations. The proposed project area is virtually free of any roads, and hence probably has the lowest current disturbance frequency for pronghorn. However, the density of roads on the Centennial Project will be high and pose a negative influence on pronghorn.

Other factors that may affect pronghorn populations on Tejon Ranch are illegal harvest on adjacent private lands, predation by coyotes (most likely dependent on the height and density of vegetation during fawning), livestock grazing, and barbed wire fences built to control cattle.

Our conclusions are as follows:

Wild, free native pronghorn have been restored to suitable habitats on the Tejon Ranch for two decades. This population is the southern-most herd in California. It faces several factors that currently affect its viability to persist in the future:

1. Small population size: Although almost 100 individuals were originally translocated to Tejon Ranch, the population declined to a perilous size of less than 50 animals. This population appears to be critically endangered due to its current population size and its historic trend of remaining small and isolated.

2. Low growth rates: The herd currently has a low potential for sustained growth, with observed maximum per-capita growth rates falling far below the biologically possible value in other ranges. Recently, livestock foraging has been accelerated and standing vegetative biomass has declined to the detriment of pronghorn neonate protective cover, and abundant nutritious forage. This loss is exacerbated by the Centennial Project, for the forage on these rangelands will eventually be lost when the project is completed.

3. Climatic variability: Pronghorn at the Tejon Ranch exist under a highly variable precipitation regime. There is a robust relationship between autumn fawn ratios and the autumn precipitation 2 years prior. Predicted autumn precipitation of 3.4 inches must be achieved for positive population growth (>20 fawns / 100 does in late summer), but was not reached in 35 years out of 61 years of weather data (57%).

4. Habitat quality: The expansive perennial grasslands of a high quality are probably the reason why this population is still marginally persistent. Losing a portion of these grasslands or a persistent degradation by overgrazing could severely impact this highly vulnerable population.

5. Landscape connectivity. Pronghorn at Tejon Ranch are currently isolated from other herds. Given the small population size and stochastic vulnerability of this herd, the establishment of a metapopulation through migration corridors is of critical importance. If Tejon Ranch pronghorn can cross over the crest of the Tehachapi Mountains and Interstate 5, a viable possibility for population linkage may exist.

6. Genetics: Genetic variability is influenced by small founding population, persistently small population size, and isolation by geographic features (e.g., mountain ridges, unsuitable habitat) or human induced barriers (e.g., fences, fragmented landscapes). All these factors are prevalent at the Tejon Ranch pronghorn population. Genetic variation within the Tejon Ranch pronghorn population has not been studied, but can be considered critically in danger of having lost genetic variability.

Chapter 1
Introduction

1.1 Setting

Founded in 1843 as a Mexican land grant, Tejon Ranch is today one of the largest contiguous expanses of private land in California. The ranch is located in southern California along Interstate 5, approximately 60 miles north of Los Angeles and 30 miles south of Bakersfield (Fig. 1). With over 270,000 acres the ranch is larger than the City of Los Angeles. Tejon Ranch is owned by the Tejon Ranch Company, incorporated in 1936 and traded on the New York Stock Exchange (symbol "TRC"). Primary economic activities on the ranch have been agriculture (farming and ranching) and recently real estate development. Mining and oil production activities also occur on the ranch.

Ecologically, Tejon Ranch is in a key location at the convergence of five geomorphic provinces, the Sierra Nevada, the South Coast mountain ranges, the San Joaquin Valley and the high desert. In addition, 4 floristic regions meet at Tejon Ranch, including the California Floristic province, creating a biodiversity "hotspot" and an irreplaceable linkage among key ecological regions in California. The ranch potentially supports as many as 20 state and federally listed plant and animal species and over 60 other rare or sensitive species, including species or subspecies that occur nowhere else on earth (White et al. 2003). More than 30% of the oak species in California are found at Tejon, some reaching the largest size in the state. Up to 23 different vegetation communities have been identified to occur on Tejon Ranch. Rare or under-protected habitat types include grasslands, fir forests, and stands of valley and blue oak woodlands (White et al. 2003). The grasslands, in particular, are important elements in establishing connectivity between the San Joaquin Valley and other conservation areas, such as the Sequoia and Los Padres National Forests and Wind Wolves Preserve, a Wildlands Conservancy project covering 87,000 acres.

Figure 1: Location of Tejon Ranch in Kern and Los Angeles counties, California.
(map from http://www.tejonranch.com/about/maps_1regional.asp#)

Because of the high concentration of listed and sensitive species, the United States Fish and Wildlife Service (USFWS) Recovery Plan for Upland Species of the San Joaquin Valley (USFWS 1998b) identified areas of Tejon Ranch as important for protection. Moreover, Tejon Ranch supports a population of the endangered California condor and therefore a large part of the Ranch has been designated as Critical Habitat for the condor by USFWS. Several threatened or endangered species are known or have the potential to occur on Tejon Ranch including: California jewel-flower (*Caulanthus californicus*, federal and California endangered), Striped adobe lily (*Fritillaria striata*, California threatened), Bakersfield cactus (*Opuntia basila*ris var. *treleasei*, federal and California endangered), Tehachapi slender salamander (*Batrachoseps stebbinsi* , California threatened), California red-legged frog (*Rana draytonii*, federal threatened, California species of concern), Blunt-nosed leopard lizard (*Gambelia sila* , federal and California endangered), California condor (*Gymnogyps californianus*, federal and California endangered), Bald eagle (*Haliaeetus leucocephalus*, federal threatened, California species of concern), California spotted owl (*Strix occidentalis*, federal threatened, California species of concern), Southwestern willow flycatcher (*Empidonax traillii extimus* , federal and California endangered), San Joaquin antelope squirrel (*Ammospermophilus nelsoni*, California threatened, federal species of concern), San Joaquin Valley kit fox (*Vulpes macrotis mutica*, federal endangered, California threatened).

1.2 Proposed action

Tejon Ranch Company has recently announced that it is planning to build three developments (Fig. 2) in the western portion of the Ranch along existing Interstate 5. Tejon Industrial Complex is a business park located near the junction of Highway 99 and Interstate 5, offering commercial and industrial space on 1,400 acres. Tejon Mountain Village is a resort-like luxury development, offering estate homes, resort hotels, golf courses and other recreational facilities. The third development is a master–planned new town named "Centennial". The project area of Centennial is located in the northwest area of the Antelope Valley in Los Angeles County and covers approximately 11,680 acres (Fig. 3).

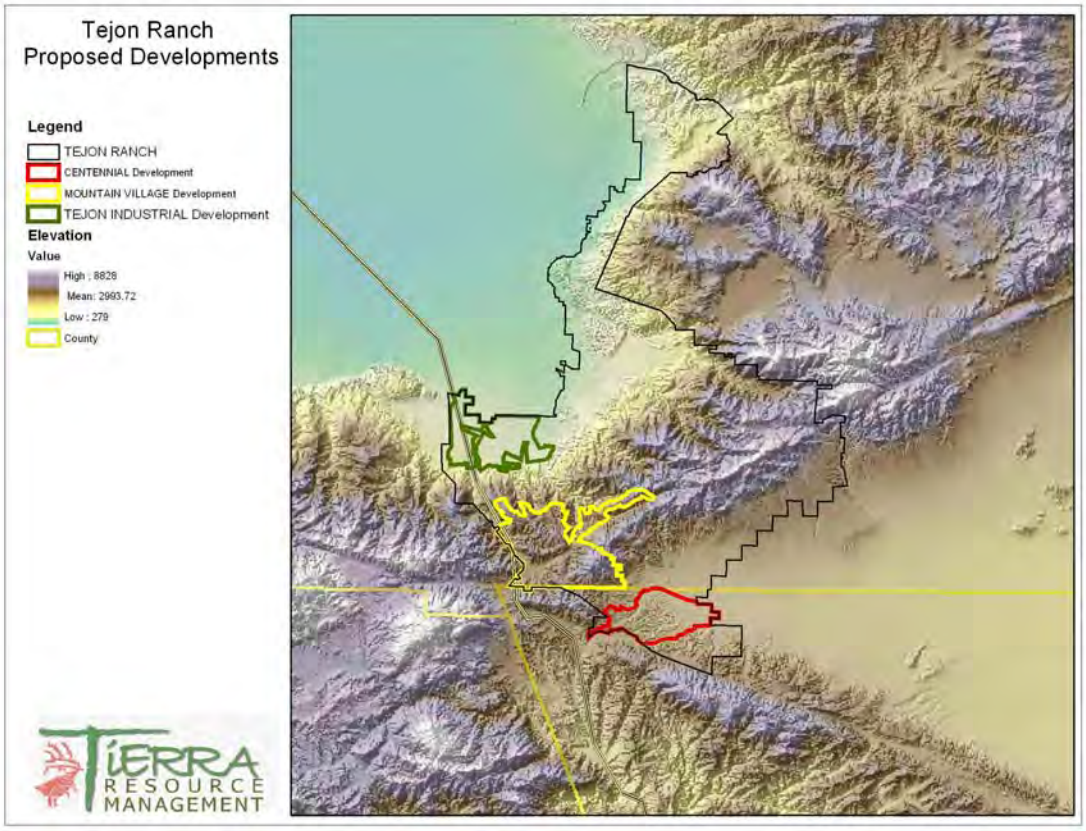


Figure 2: Location and extent of the proposed Tejon Ranch development areas.

The Centennial site is approximately 32 miles north of the City of Santa Clarita, just east of the Interstate 5 (I-5) highway. The proposed development includes 22,998 residential units, 2,020,915 sq.ft. (46.3 acres) of commercial floor area, and 12,484,730 sq.ft. (286 acres) of office space, allowing an estimated build-out population of 64,000 persons. The Centennial project is the largest housing development ever proposed in California (Center for Biological Diversity 2008).

Figure 3: Outline of the proposed Centennial development (map from http://www.centennialca.com/aerialmap.html)

Los Angeles County's General Plan has designated Significant Ecological Areas (SEAs) characterized by unique biological and ecological resources (http://planning.lacounty.gov/assets/upl/data/ord_gp-update-seas-rpc.pdf). Two of these SEAs include or are adjacent to portions of the planned Centennial site (Fig. 4):

1) SEA 59, "Tehachapi Foothills" includes large expanses of grasslands and unique wildflower stands. The area is located primarily to the west of Centennial.

2) SEA 58, "Portal Ridge / Liebre Mountains" is located on the southeastern perimeter of the Centennial project site. SEA 58 is characterized by unique and varied vegetation that reflects the transition between the Mojave Desert, Coastal Ranges, and the Tehachapi Mountains ecosystems.

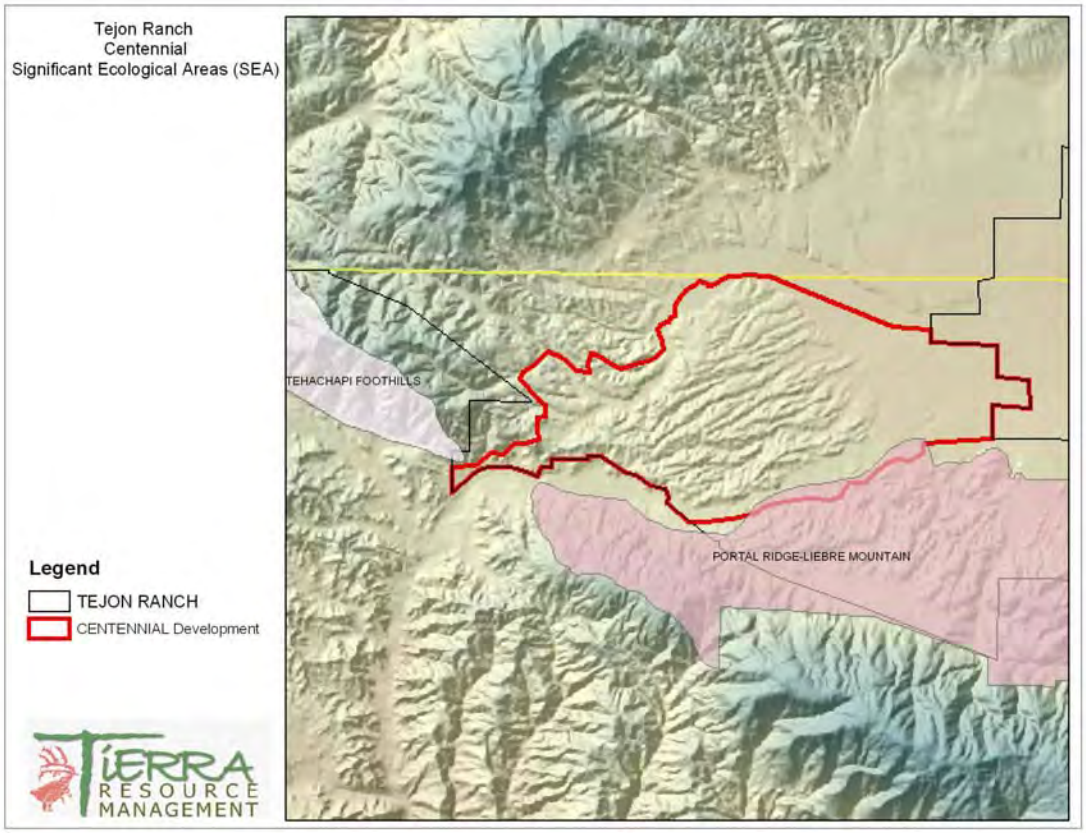


Figure 4: Significant Ecological Areas in the vicinity of the proposed Tejon Centennial development.

Proposed developments in SEAs must undergo review by SEATAC, a panel composed of scientists, to ensure that the integrity of SEAs is maintained. SEATAC has determined that Centennial would severely curtail the effectiveness of wildlife corridors and regional linkages (Fig. 5):

> *"Wildlife corridors exist in nature and are naturally-occurring functions of the land developed over hundreds to thousands of years. Centennial project studies should have been conducted to locate existing corridors for large and small wildlife and plan the project around them, not suggest new directions for wildlife to travel after build out. One cannot, for convenience, move the wildlife corridors to peripheral areas around the project. There is probably some movement of wildlife in an N-S direction across the grasslands between the Tehachapis and Liebre Mountain. Corridors may be a network rather than singlestrand, linear. The biological reports need to present studies that investigate the current, natural, unimpeded wildlife movement across the project site, between the mountain ranges. The report should provide a map clearly indicating where the movement now occurs."* (SEATAC 2008).

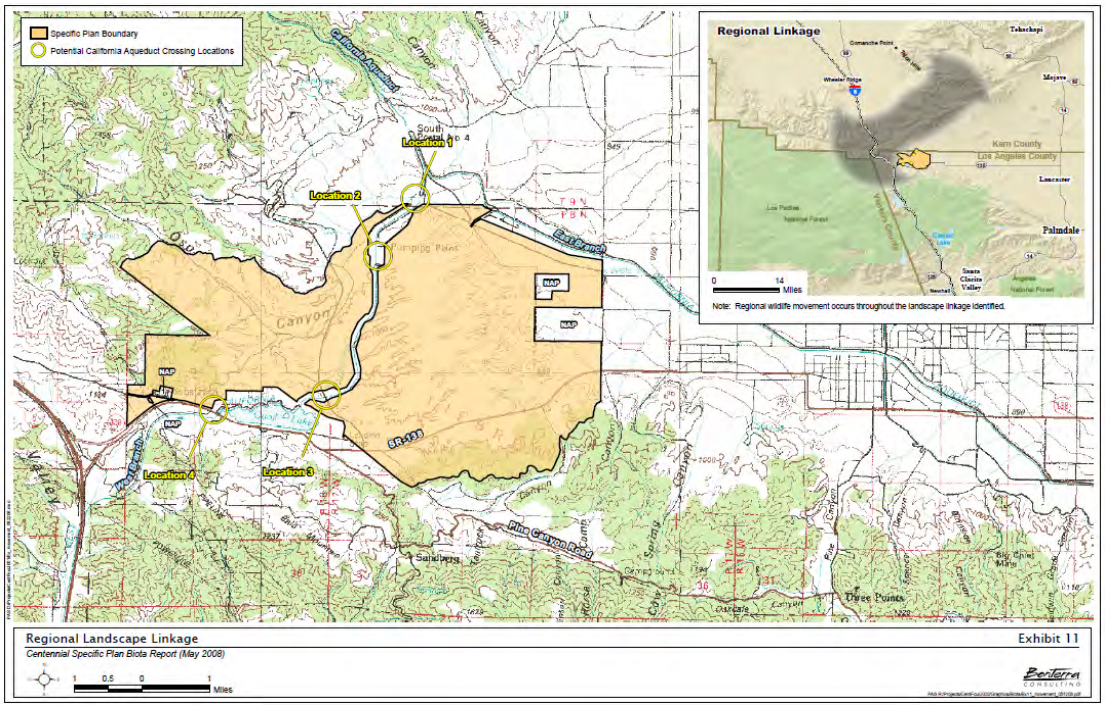


Figure 5: Regional ecological linkages and potential wildlife crossings over the aqueduct as identified in the Centennial Specific Plan Biota report (Bonterra Consulting, 2008).

Pronghorn were native to most southern California rangelands prior to the early 1800s, but were extirpated during the late 1800s and early 1900s. Then, during the 1980s, the California Department of Fish and Game financed repeated translocation projects resulting in the restoration of a permanent pronghorn population on Tejon Ranch – currently the most southern herd in California (Koch and Yoakum 2002). These management endeavors were successful, providing recreational hunting and wildlife observation opportunities for the public. It is now once again possible to drive Highway 138 to see the fastest land mammal in California and the western hemisphere.

The eastern portion of Tejon Ranch retains some of the last extensive perennial grasslands in southern California (Fig. 6). Native grasslands are an integral component of pronghorn habitat requirements. They produce a mixture of grasses, forbs and shrubs that provide protective cover for fawns and abundant succulent and nutritious forage for sustaining healthy herds. Most native perennial grasslands in the state have been replaced with invasive annual grasses during the last two hundred years because of various human disturbances. Modern conservation practices advocate enhancing existing native perennial grasslands as decreasing or eliminating invasive species.

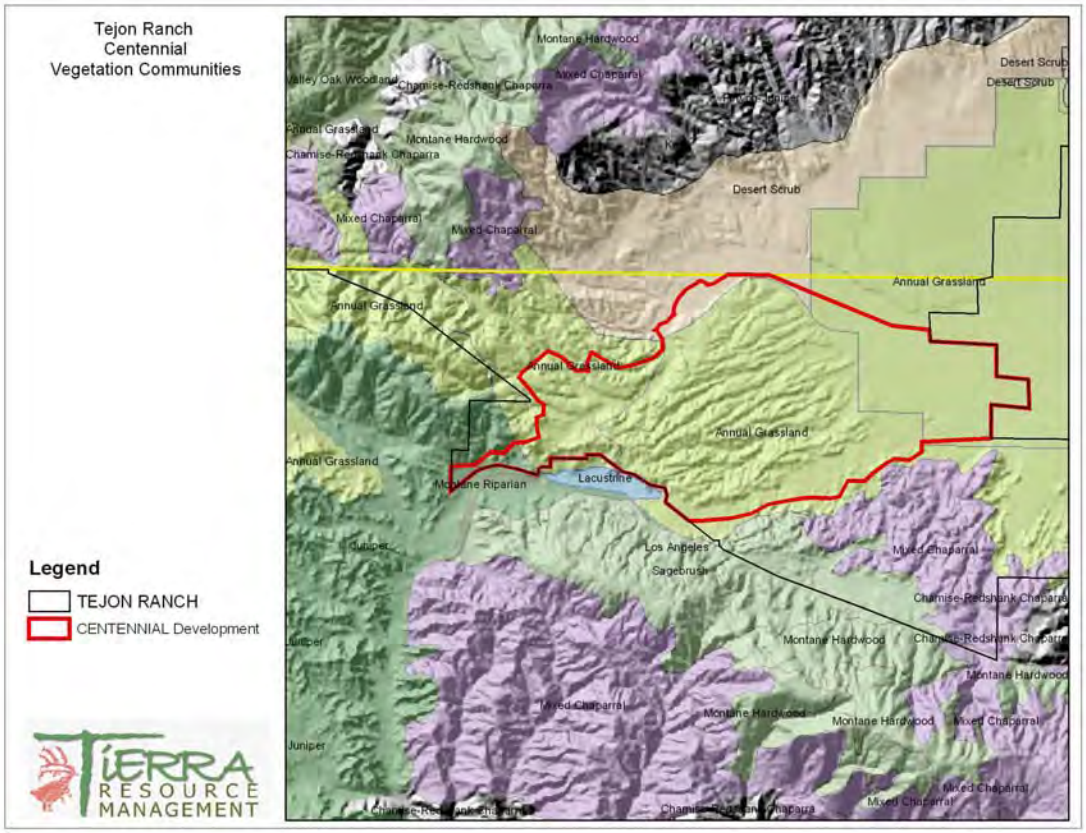


Figure 6: Vegetation communities for Tejon Centennial proposed development and vicinity.

In addressing the potential impacts of the Centennial development, pronghorn are important because their life cycle depends on productive grassland ecosystems. The vast majority of the perennial grasslands on the eastern portion of Tejon Ranch will be impacted by the Centennial development project, reducing the suitability of the remaining habitat to a considerable extent. There is widespread concern for the potential impact of the Centennial development on this important population of pronghorn (the most southern herd in California). According to published minutes (SEATAC 2008) SEATAC is:

> "*very interested in preserving the habitat use by the Pronghorn which are regularly seen in the area, an example of charismatic megafauna of biological and general public interest*" (SEATAC 2008)

Pronghorn are frequently observed on the southern slopes of the Tehachapi Mountains on Tejon Ranch. In addition, SEATAC members and biologists have observed pronghorn:

> "*on all sides of the CA Aqueduct, including the E and W sides of the proposed Centennial area, which indicates that all parts of the proposed Centennial area are habitat for the pronghorn*" (SEATAC 2008)

In 2001, Yoakum (pers. comm.) observed the majority of about 30-40 pronghorn on native grasslands near the existing cement plant, which is located outside the Centennial project

boundary, approximately 2000 m to the northwest straddling the county line of Los Angeles and Kern counties. It is currently unclear if and where pronghorn may be able to negotiate the fenced California Aqueduct, but most likely they will occasionally use bridges over the aqueduct when vehicular traffic is low (Fig. 5).

1.3 Purposes of this document

The purpose of this document is to develop a comprehensive knowledge base regarding pronghorn in southern California, and to address the current status of the herd to better understand the vulnerability of this population to the planned Centennial development on Tejon Ranch. In addition, this assessment will provide planners, developers and regulatory agencies basic data to explore mitigation strategies which may offset impacts to pronghorn habitats.

The report is structured to serve four major goals:

(a) a detailed review of the current scientific literature, that includes general biology, life history and ecology of pronghorn and characteristics of pronghorn habitat, a review of published scientific observations on impacts and effects of human development on certain pronghorn populations in California and elsewhere in the United States;

(b) a historical perspective of pronghorn in southern California and the project area;

(c) an assessment of the current status of pronghorn in the project area; and

(d) an evaluation of potential impacts of the proposed Centennial project on the resident population.

Chapter 2
Scientific Literature Review

Photo: Jim Yoakum

2.1 General biology, life history and ecology

Pronghorn were first called "antelope" by Lewis and Clark during their epic journey in the early 1800s. The term has been accepted by the public and is used commonly today. However, the term clashes with various species of "true" antelope from Africa that have been introduced to private and public lands in North America. Scientists differentiate between antelope of North America and Africa and placed them into completely different taxonomic groups. Hence, for the purposes of this report we have chosen to use the scientifically accepted common name of "pronghorn".

2.1.1 Distribution

Pronghorn were once a widespread element of the grassland and desert fauna of North America numbering up to 60 million (Nelson 1925). It is estimated that there were about 30,000 left in 1923 (Nelson 1925). By 2000, the population of pronghorn in North America was estimated at almost 800,000 (Krausman et al., 2005). The historic distribution of pronghorn (Fig. 7) included Alberta, Saskatchewan and Manitoba in Canada, all western states of the US except perhaps Washington, and south to northern Sonora and Chihuahua the States of Durango, Zatecas and San Luis Potosi in Mexico (Seton 1929). There are small, contiguous populations in extreme western Oklahoma and Nebraska (Sundstrom et al. 1973) and small, isolated populations in Kansas and Baja California (Yoakum and O'Gara 2000).

In California, the earliest survey of pronghorn was conducted by the California Academy of Sciences in 1922. It reported a total of 434 pronghorn for the State. A second, more comprehensive survey was conducted by the Academy in 1924 resulted in an estimate of 1,007 animals, of which 982 existed in Siskiyou, Modoc, and Lassen Counties, 14 in Fresno County , and 11 in Kern County (McAllister 1924). Pingle (1938) reported the last sighting of a pronghorn in southern California near Los Banos in 1938. Today, pronghorn are found primarily in northeastern California and in Mono County (Fig. 8). Since 1960, the entire California pronghorn population averaged approximately 7,000 animals. In northeastern California, there were nearly 6,000 in 1978 (Pyshora 1978, Salwasser and Shimamoto 1979) and about 8,000 in 1992 (California Department of Fish and Game 2000a).

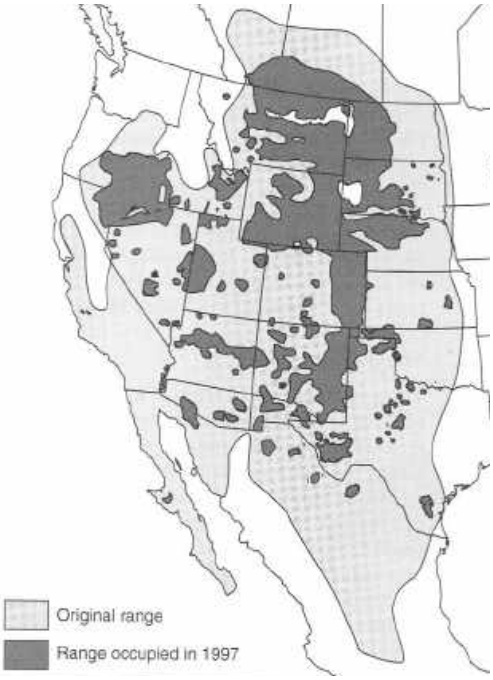


Figure 7: Original range and habitat occupied in 1997 by pronghorn (source: Yoakum and O'Gara 2000).

Figure 8: Current distribution of pronghorn in California (map available online at *nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=18631).*

Pronghorn were once abundant in the project area and surrounding Tejon Ranch. In his "Catalogue of mammals collected by E. Heller in southern California", Elliot (1904) describes two pronghorn collected in Antelope Valley near the eastern base of Tehachapi Mountains and depicts the photograph of a captive female pronghorn on Tejon Ranch (Fig. 9). The report also contains reference to 30 pronghorn in the western edge of the Mohave Desert near the eastern base of the Tehachapi Mountains in Kern County, 7 "on the open plains" of the San Joaquin side of Tehachapi Pass, another 7 or so farther west near Buena Vista Lake in Kern County, and another herd on the Carrizo Plains on the western side of the San Joaquin Valley. This report is also the first to identify pronghorn movement corridors between the Mohave Desert and the San Joaquin Valley.

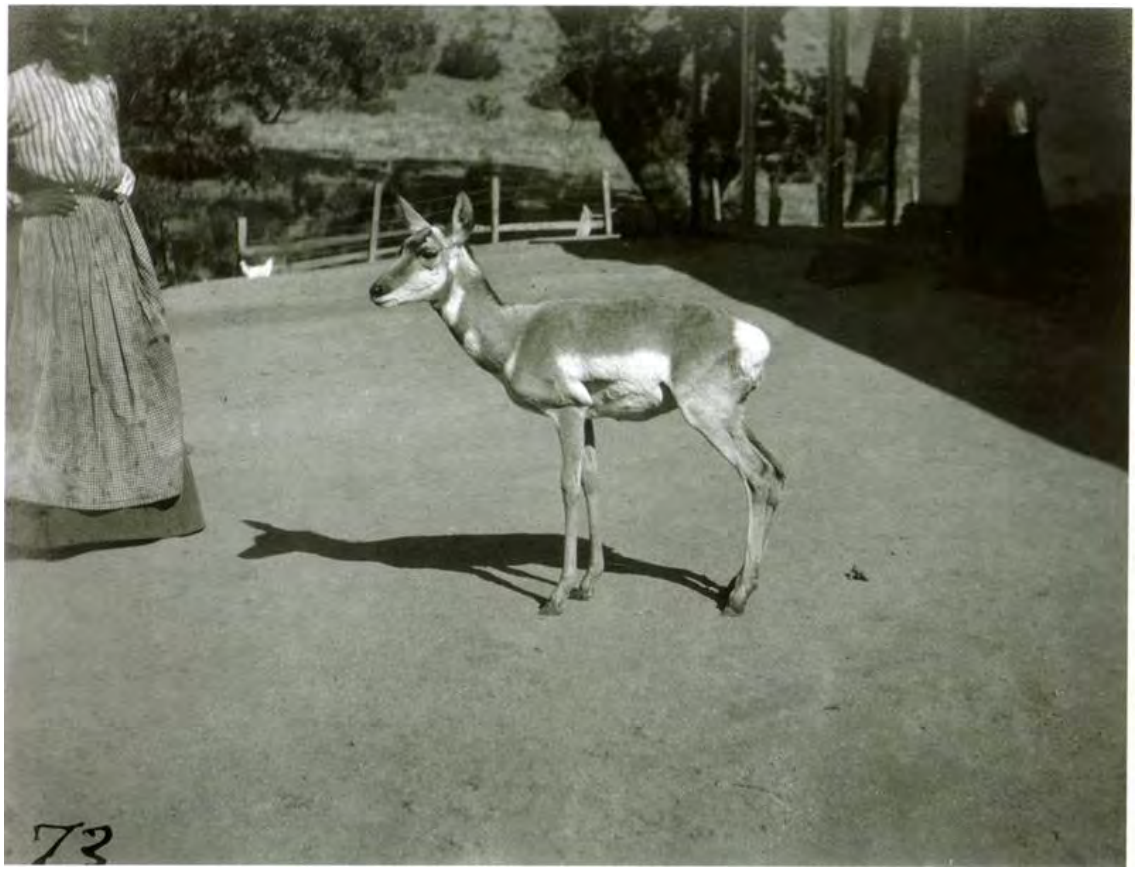


Figure 9: Photograph by Edmend Heller of a captive female pronghorn at Tejon Ranch in 1903; courtesy of David E. Brown and the Smithsonian Institute.

2.1.2 Taxonomy

There is considerable debate about the taxonomic relationship between pronghorn (*Antilocapra americana*) and other ruminants. Recent studies (Janis and Scott 1987; Cronin et al. 1996) suggest that Antilocapridae form their own legitimate family and are probably unrelated to bovids, although they share many characteristics.

Pronghorn occupy a large and diverse land area and exist under a variety ecological conditions which suggest ecological clines as a result of regional adaptations (O'Gara and Janis 2004). In the past, anatomical and distributional characteristics have been used to establish five recognized subspecies (Bailey 1932, Goldman 1945, Paradiso and Nowak 1971, O'Gara and Janis 2004):

1. *Antilocapra americana americana* originally occurred from Alberta, Canada to the Gulf coast of Texas (Simpson and Leftwich 1978) through central New Mexico and into Arizona and the Colorado Desert of California (Miller and Kellog 1955). *A.a. americana* may also have extended into Mexico (Goldman 1945).

2. *Antilocapra americana mexicana* formerly ranged from southeastern Arizona and southwestern New Mexico through western Texas, Chihuahua, Coahuila to northeastern Durango in Mexico (Miller and Kellog 1955). The subspecies has been confirmed by genetic analyses (Lee 1992). It is the most abundant and widely distributed subspecies in Mexico.

3. The peninsular pronghorn (*Antilocapra americana peninsularis*) is an endangered species endemic to Mexico. The population in the Vizcaino desert is estimated at 200 (Cancino et al. 2004). The subspecies formerly occupied the peninsula of Baja California and is now restricted to the Vizcaino Biosphere Reserve (Cancino et al. 2004).

4. *Antilocapra americana sonoriensis* is the smallest subspecies of pronghorn and similar to *A. a. mexicana* (Goldman 1945). It is estimated that there are fewer than 300 individuals of the Sonoran Pronghorn in the United States and 200-500 individuals in Sonora, Mexico (U.S. Fish and Wildlife Service 1998a). Sonoran and Mexican pronghorn may intergrade genetically (US Fish and Wildlife Service 1998a, Lee 1992).

5. *Antilocapra americana oregona* may be the least distinct of the subspecies (Lee 1992). Its distribution overlaps with that of *A.a. americana* and has been suggested to occur primarily in Oregon.

It is noteworthy that all biologists involved in naming pronghorn subspecies were either C. Hart Merriam or his associates. Merriam was a notorious taxonomic "splitter" (Brown 2006). California was reported to once have perhaps the greatest diversity among pronghorn subspecies and presents perhaps the strongest argument for a comprehensive taxonomic study of all pronghorn subspecies. Pronghorn populations located in different regions of California were formerly classified as *A. a. americana, A. a. oregana, A. a. sonoranensis*, and *A. a. peninsularis*; however, today all populations are classified as *A. a. americana* (O'Gara and Janis 2004). The original descriptions of these subspecies may have been based on arbitrary criteria and small sample sizes. Genetic analyses conducted by Lou (1998), Rhodes et al. (1999) and Amor et al. (2001) did not reveal any discrete genetic differences between the original subspecies. Hence, pronghorn populations probably represent a genetic cline.

2.1.3 Physical Characteristics

The pronghorn is a unique mammal found only in North America (O'Gara and Yoakum 2004). It is a medium-sized ungulate, and its body mass is relatively low compared to body size. Sexual dimorphism in body mass is slight. Adult males are 51-59 in (130–150 cm) long from nose to tail, stand 34 – 41 in (87–104 cm) high at the shoulder (O'Gara 1978), and weigh 89-133 lbs (40–60 kg). The females average slightly less, 89-110 lb (40–50 kg). Neck circumference is larger in males than in females, especially in late summer and during the rut. The tail is short (average 5.3 in, or 13.5 cm). The pelage color of adults is brown or tan, with a white rump and belly and two white stripes on the throat. A short dark mane grows on top of the neck. Males have a characteristic black face and black patches on the sides of the cheek. The white rump patch becomes enlarged and highly conspicuous when pronghorn are alarmed or excited.

Pronghorn evolved in expansive, level or rolling rangelands with low shrub or herbaceous cover. They are uniquely adapted to run at great speeds over rough rocky terrain. The pronghorn's top speed is up to 62 miles/h (100 km/h), and therefore it is the fastest terrestrial mammal in North America. The animal has an extraordinary capacity to consume and process oxygen to sustain long-distance running at high speeds (Lindstedt 1991). Compared with similar-sized ruminants, pronghorn have an unusually large lung volume, larger hearts, larger blood volume, higher hemoglobin levels, higher buffering capacity of the blood, and larger tracheal diameters (Lindstedt 1991, McKean and Walker 1974, O'Gara 2004a). The feet have two pointed, black hooves, with cartilaginous padding and no dewclaws (O'Gara 2004a). Kitchen (1974) suggested that pronghorn coloration and their tendency to visually enlarge their rump patch by piloerection may confuse pursuing predators. These characteristics support the hypothesis that pronghorn may have evolved with fast-running pleistocene predators, and that speed and mobility is a vestigial reminder of these "Ghosts of Predators Past" (Byers 1997).

The pronghorn has legendary eyesight, facilitated by large protruding eyes, and it is capable of detecting movement at great distances (O'Gara, 2004a). The orbits (eye sockets) are prominent and sit high on the skull; there is no antorbital pit. Its sense of smell is equally developed, as evidenced by a large amount of olfactory epithelium in their noses. Adult pronghorn rely on a variety of olfactory messages to distinguish among individuals within a group or herd, and to mark territories (O'Gara 2004a). The pronghorn is the only ruminant with branched horns (i.e., a sheath of compressed, cornified epithelial cells over a bony core), which is shed annually. Each sheath has a forward pointing tine. The horns of males can exceed 40 cm in length; in females, they are either small, misshapen, or absent. Approximately 70% of all females have horns (O'Gara 2004a).

Pronghorn regulate their body temperature by piloerection during cold weather, and by opening their mouths when hot. The hair of the winter coat is hollow, brittle and hard. Large air-cells within each hair (Murie 1870) allow the animal maintain body heat to a lower critical body temperature of -23° C (Wesley et al. 1973). Pronghorn begin to molt in late winter and by August the molt is usually complete (O'Gara 2004a, Byers 2003).

In addition, the carotid and orbital retia may add in keeping the brain cooler than the body temperature (Carlton and McKean 1977). Hebert et al. (2008) measured temperatures in the brain, carotid artery, jugular vein and abdominal cavity of pronghorn to determine their winter body temperature and to investigate whether the carotid rete has a survival role. Their findings suggest that in winter the effects of the carotid rete are reduced, which eliminates selective brain cooling but may induce depression of metabolism, with the survival advantage of conservation of energy. Their findings suggest that the carotid rete has wider thermoregulatory effects than its traditional selective brain cooling function.

Like other ungulates, pronghorn have no upper incisors or canines, biting off individual food items between the lower incisors and a hard gum plate in the upper jaw. The teeth are hypsodont, and the dental formula is I 0/3, C 0/1, P 3/3, M 3/3 x 2 = 32. Mastication of forage is facilitated by well-developed molars and pre-molars. Pronghorns are ruminants, with a typical four-chambered stomach, each of which is tasked with a particular aspect of the digestion of plant materials. A gall bladder is present (O'Gara 2004a).

Comparison of diets among 4 species of ruminants indicated that pronghorn selected the highest quality diet, followed in order by domestic sheep, cattle, and then bison (Schwartz et al. 1977). The digestive system of the pronghorn is typical of a intermediate, mixed feeder (Hoffman 1989). Pronghorn rumens are about half the size of domestic sheep stomachs, which are primarily grazers. In addition, a small omasal and abomasal capacity suggest that pronghorn are adapted and limited to use of highly digestible forage. In feeding experiments, pronghorn consumed only 58% of the forage amount eaten by sheep (Severson et al. 1968). The pronghorn's digestive system is somewhat inefficient in digesting low-quality, high fiber forage. Most nutritional studies of pronghorn indicate that they select plants containing 10-22% protein, although individuals can survive seasonally on forages of 7-9% protein. Forage digestibility is normally high, often ranging from 65-75% total digestible nutrients (Yoakum 2004b).

2.1.4 Behavior

Grouping and dominance

Pronghorns are social animals, gathering in herds for most of the year, except during parturition and when males are solitary or form small groups during spring. In the north pronghorn are known for their tendency to form large herds during winter. Nearest-neighbor distances and the rate of social interactions tend to decrease with increasing group size (Byers 1997) on winter rangeland, thereby preventing additional foraging costs during times of energetic stress. In these herds, animals of both sexes and all ages can be seen feeding and bedding in close association with minimal social conflicts and may number up to several hundred individuals. Groups of 600 have been sighted in northern California (Pyshora 1977). At the Carrizo Plain National Monument in southern California, October herd size averaged 45 individuals, compared with less than 5 during April and May (Clausen 1999). In spring, herds break up into smaller units. Young bucks aggregate in bachelor bands of 2-40, and females may be found in groups of 5-20. By mid-summer, most does will be observed in doe-fawn groups, and non-territorial bucks still remaining in bachelor bands (Prenzlow et al. 1968, Kitchen 1974, Autenrieth and Fichter 1975). Sexes may remain segregated in areas experiencing mild winters (O'Gara 2004b). Females generally tend to tolerate other pronghorn in closer proximity than males (Byers 1997).

Pronghorn group composition appears to be dynamic, and no matrilineal or other social bonds exist. Although group composition changes frequently, the dominance status of individuals remains surprisingly constant. Social dominance among pronghorn females is prominent (Byers 1997, Fairbanks 1994) and pronghorn females show more aggressive behavior than most other female ungulates (Byers 1997, Fournier and Festa-Bianchet 1995). An individual's social rank is not related to age (Fairbanks 1994, Kitchen 1974), agonistic interaction rate (Byers 1997, Fairbanks 1994), body mass (Byers 1997), or horn size (Byers 1997) but seems to be established as a juvenile and persists throughout her entire life (Byers 1997). High-ranking, young females may dominate low-ranking, older females. Female pronghorn start to establish social rank at neonatal ages (less than one month old). Linear hierarchies are established within fawn social-groups by their third month of life (Byers 1997). At the National Bison Range in Montana diet quality was found to be related to

dominance rank. High-ranked and low-ranked females showed higher levels of nutrition than middle-ranked females (Dennehy 2001).

Spatial behavior

Home ranges are extremely variable, depending on habitat, year, and location. Bryant and Canon (2006) determined home ranges of pronghorn in the Trans-Pecos region of Texas. Male pronghorn consistently had smaller home ranges than females; males averaged 9.73 + 1.72 (SD) square miles (25.1 + 4.5 km^2) and females 16.4 + 3.9 (SD) square miles (42.4 + 10.1 km^2). Drought conditions influenced home ranges of females, particularly during the post-fawning period. In southeastern Idaho, Reynolds (1984) reported home range sizes of 4.6 square miles + 0.8 (SD) (11.9 km^2 + 2.1(SD)) and Hoskinson and Tester (1980) estimated pronghorn home ranges in southeastern Idaho and southwestern Montana to range from 0.37 to 0.58 square miles (0.97 to 1.5 km^2). In Arizona, large (15.8 to 468.3 square miles; 41 to 1,213 km^2) home ranges of Sonoran pronghorn were attributed to limited forage availability (Wright and deVos 1986).

Pronghorn rely on daily and seasonal movements, often across long distances, to meet their energetic and nutritional requirements (Van Riper and Ockenfels 1998, Yoakum 2004b). Most pronghorn herds exhibit seasonal movements (Einarsen 1948, Yoakum 1978) between summer and winter ranges. However, some populations may migrate one year and not the next (Ryder and Irwin 1987, White et al. 2007). Pronghorn are often described as opportunistic (Bruns 1977, Amstrup 1978, Hoskinson and Tester 1980), and according to Ryder (1983), can assess forage supplies and densities of other pronghorn in preferred habitats. Generally, changes in climatic and vegetative conditions trigger the onset and length of seasonal movements. During dry seasons, southern pronghorn may move great distances in search of forage and water (Buechner 1950, Hailey 1979). Yoakum (1978) reported daily movements of 0.06-0.5 mi (0.1-0.8 km) in spring and summer, and 1.9-5.8 mi (3.2-9.7 km) in autumn and winter. The greater the winter severity, the farther individuals and herds travel to areas with less snow (Creek 1967, Yoakum 1978, Guenzel 1986, Raper et al. 1989, Sawyer and Lindzey 2000) to avoid mortality that is often associated with snow depths exceeding 16 in (40 cm, Yoakum et al. 1996). Rouse (1954) found pronghorn migrations in Wyoming occurred in response to storms, forage supplies, and availability of water.

GPS telemetry has shown that maximum distance of an individual pronghorn from winter to fawning range was 278 miles (445 km; Gates et al. 2006). In the northern parts of their range, pronghorn can routinely move up to 200 miles (320 km) in response to deep snow or to reach available winter forage (Riddle 1990). In Wyoming, pronghorn migrated 72.5 – 161 mi (116–258 km) between seasonal ranges (Sawyer et al. 2005). Yellowstone pronghorn were partially migratory, with >70% of the pronghorn population migrating 9.3-31.2 mi (15–50 km) to 4 contiguous summering areas and <30% remaining year-round on the winter range (White et al. 2007). All migrant pronghorn traveled 6.25 mi (10 km) over a topographic bottleneck (Mt. Everts) separating the winter and summer ranges, primarily using grassland–sagebrush pathways through conifer forest. Movements of up to 93 mi (150 km) have been reported for pronghorn in California (California Department of Fish and Game 2000a). Timing of spring migrations in Idaho and south-central Wyoming was dependent on snow, not temperature (Hoskinson and Tester 1980, Guenzel 1986). During spring migration among the Grand Teton National Park and Gros Ventre River Drainage pronghorn, Sawyer and

Lindzey (2000) noticed pronghorn "appeared to push the snowline north, moving as quickly as snow conditions allowed." This is supported by Bruns (1977), who reported that pronghorn in southeastern Alberta and northern Montana prefer areas of reduced snow accumulation and reduced snow hardness. Conversely, fall migrations in Idaho appeared to not be influenced by snowpack but instead were stimulated by percent moisture in vegetation (Hoskinson and Tester 1980). Among pronghorn in western and southwestern Wyoming, fall migrations were also unrelated to snow and described as unpredictable in timing (Raper et al. 1989, Sawyer and Lindzey 2000).

Jumping ability

Pronghorn evolved in open landscapes without vertical barriers. Consequently, pronghorn seem unable to go through fences or to jump them. Instead, pronghorn have learned to negotiate certain barbed-wire fences by crawling underneath them. Caton (1877) reported that 4-foot (1.2 m) wire fences can restrict pronghorn movements. Buechner (1950) observed that most pronghorn seem unaware of their ability to jump and rather crawl under fences than jump them. Fences often severely impede pronghorn movements (Spillet et al. 1967, Oakley and Riddle 1974, Mitchell 1980, Barrett 1982, Pyrah 1987) and net-wire fences are particularly obstructive to pronghorn (Hailey 1979). During trapping operations, adult pronghorn have been observed to jump over 94 in (2.4 m) high fences (Spillet et al. 1967) and 82 in (2.1 m) horizontal structures (Mapston 1968). However, Spillett et al. (1967) reported that 31.5 in (80 cm) seems to be the maximum fence height pronghorn would readily jump. Experiments with different fence designs in pronghorn range have been conducted by Bear (1969) and Gross et al. (1983).

Activity and vigilance

Pronghorn conserve energy during inclement weather through selection of microhabitats with lower wind velocities, reducing daily travel, traveling single file, and reducing activity levels and foraging time. During periods of high winds, pronghorn may lay down in compact groups with their heads curled back along their bodies (Bruns 1977). Pronghorn may be active day or night, but crepuscular activity can increase especially during hot weather. Peak feeding time is shortly after sunrise and shortly before sunset (Kitchen 1974, Kitchen and O'Gara 1982). Pronghorn rumination is the second most important activity after feeding – it serves to break down plant material and speed passage rate.

Goldsmith (1990) studied pronghorn in the Adobe Valley of California, and found that they were significantly more vigilant (in terms of scanning frequency and duration) in shrublands (desert scrub, sage, etc) with poor visibility than in meadow habitat with open visibility. Thus, while pronghorn demonstrate an ability to compensate for restricted visibility by increasing vigilance, greater amounts of time spent in vigilance may conflict with other activities such as foraging and thus reduce the suitability of habitats with low visibility (Goldsmith 1990).

2.1.5 Reproduction

Although pronghorn fawns occasionally may be able to reproduce (Wright and Dow 1962, Mitchell 1967), does usually breed the first time when 16-17 months of age (O'Gara 2004b). Males generally do not mate until they are 3 years of age because of their inability to hold a territory. Most northern pronghorn breed during a short period from mid-September to early October (O'Gara 1968), but animals in more southern areas may breed from July through October (Lehman and Davis 1942, Buechner 1950). Pronghorn are polygamous. Males tend to harems of 7 to 10 does, which they defend from other bucks (Yoakum 1978). Dominant males often hold widely spaced territories of about 0.06-2.0 mi^2 (0.2-5.2 km^2) (Kitchen 1974, O'Gara 1978), but there is considerable plasticity in the breeding system of pronghorn males: bucks may be territorial during breeding season, and may have harems and/or territories. For example, a predominantly non-territorial breeding system was described by Clausen (1999) for a low-density population of pronghorn at Carrizo Plain National Monument in southern California. In this herd, male home ranges overlapped on average by 45%, which contrasts with Bromley's (1968) findings of 0% overlap in Montana pronghorn. Reasons for this plasticity in breeding behavior may be the uniform resource distribution over a large area, and a relatively young male age distribution (Clausen 1999). Variability in the breeding system may occur both among and within populations and may represent a frequency-dependent mating strategy of males (Min 1997).

Mating occurs after a prolonged courtship ritual and female mate selection is apparent (Byers 1997). The presence of mature, territorial bucks ensures that bachelor bucks do not compete with pregnant and lactating does for forage on the best rangelands (Gilbert 1973). The most vigorous bucks do most of the breeding in either a territorial or harem breeding strategy (Byers 1997). Unlike some other ungulates, younger bucks < 5 years of age possess the largest horns (Brown et al. 2002).

Superovulation (ovulation of 4-7 ova at the time of mating) is common in pronghorn and is thought as an insurance against loss of fetuses (O'Gara 2004b). The number of embryos is reduced subsequently to two (or less often, three) viable fetuses. The mean number of fetuses per doe in 6 studies involving 209 does was 1.94 (O'Gara 2004b). A study of pronghorn litter size in California revealed an average of 1.94 fetuses per doe *in utero* (Chattin and Lassen 1950). Mid-summer fawn-ratios (fawns per 100 does) often are used as an index of recruitment.

There is considerable debate among pronghorn managers about the "break-even" fawn ratio. This is the point where recruitment is balanced with mortality. In Arizona, the breakeven point is "most likely to be in the range of 20 to 35 fawns per 100 does" (AZDGF 2006). In other regions, fawn ratios are considerably higher (e.g. 38-69 for northern California (Salwasser and Shimamoto 1979). Caughley (1974) was the first to caution that age ratios cannot be interpreted "even in a general way" without additional information on the population's rate of increase. This finding is echoed in various studies of other ungulates (McCullough 1994, Bonenfant et al. 2005, Harris et al. 2008). However, empirically derived values for a given population may be valid "rules-of-thumb" as long as environmental conditions do not deviate greatly.

Pronghorn have an exceptionally high level of maternal investment (Byers and Moodie 1990): fawns represent a higher percentage of maternal body weight (15.5%) than in any

other ungulate in North America. Only the saiga antelope (*Saiga tatarica*), another grassland antelope, exceeds the maternal investment of pronghorn with fawn birth weights averaging 16.9% of maternal body mass (Robbins and Robbins 1979). Similarly, the pronghorn's gestation period, on average 245-255 days, is long compared to similar-sized ruminants (Hepworth and Blunt 1966). Pronghorn females can extend their gestation period after a drought summer, compared to wet summers (Byers and Hogg 1995, Byers 1997).

Pronghorn fawning coincides with a peak of forb production on most rangelands, which allows females to rapidly increase fetal weight during the last month of pregnancy. Intensive studies in Oregon by Einarsen (1948), Hansen (1955), Yoakum (1957), and Trainer et al. (1983) showed most parturition occurred between 14 May and 2 June. This period is probably appropriate for other northern populations (Idaho, Wyoming, Colorado, etc.); however, for southern herds, Lehman and Davis (1942) and Buechner (1950) reported fawns born from February through April, and pronghorn in the Sonoran Desert typically give birth in February and early March (Murphey 1917).

Births are highly synchronous, often occurring within a 3-week parturition season (Autenrieth and Fichtner 1975, O'Gara 2004b). Birth synchrony in pronghorn is thought to be a response to predation on neonates ("predator swamping", Gregg et al. 2001, O'Gara 2004b). The simultaneous birth of many pronghorn limits the number which predators can attack before the neonates develop sufficient strength to outrun them. At birth, fawns are well camouflaged, resembling dried bison dung with their grayish brown coats (Bromley 1977). Birth weights of fawns range from 7 to 9 pounds (O'Gara 2004b). Although fawns are typical "hiders" they can outrun a human when 4 days old (Lent 1974). The pure hiding strategy lasts for the first 10 days of the fawn's age. After each suckling bout, the fawn moves away from the doe and selects a hiding place that offers vegetative cover and reclines. The fawn will remain at this location motionless for several hours until the doe returns for another suckling bout. As fawns grow older, they increase their activity until about 20 days old, when fawns start joining maternal bands. Doe and fawn behavior apparently minimize the information a predator can obtain (Byers and Byers 1983). Young pronghorn are precocial, and weaning occurs during the rut. At this time, small herds of fawns may be observed.

Adequate cover is a crucial component of fawn bed site selection (Autenrieth 1976, 1984) and is a major factor affecting fawn survival (Bromley 1978, Barrett 1981, O'Gara et al. 1986, VanSchmus 1990). In south-central Wyoming fawns selected dense shrub cover but avoided high-density sagebrush-steppe communities (Alldredge et al. 1991). Several studies suggest that density and height of vegetation affect fawn survival (Tucker and Garner 1983, Canon and Bryant 1997, Bromley 1978). Smith and Beale (1980) surmised that bed site selection was affected more by opportunities for visual detection of predators, rather than concealment. Habitat diversity provided by sagebrush, small depressions, and stands of grasses or forbs 10 in. (25 cm) tall contributed to above-average survival of fawns in Alberta (Barrett 1981). Fawn bed sites in South Dakota (Jacques et al. 2006) contained more grass and less forbs than random sites throughout Wind Cave National Park, South Dakota.

2.1.6 Population dynamics

Population growth

Pronghorn population dynamics are characterized by a combination of high fecundity and delayed density dependence. These are basic prerequisites for population irruptions, when forage and weather conditions become favorable. Pronghorn irruptions have been observed in Yellowstone pronghorn (White et al. 2007) and also may explain the rapid growth of pronghorn populations elsewhere (e.g. Hart Mountain, Yoakum 2008). However, a population's ability to respond to changes in habitat quality may be limited in areas where the quantity and quality of the winter range has diminished or where migration routes to historic wintering habitat have been fragmented by development, fencing, and other land-use practices (Singer and Renkin 1995, Caslick 1998, Scott 2004, Wagner 2006).

Population growth rates of pronghorn can be surprisingly high. In North Dakota, maximum per capita growth rates for pronghorn populations in habitats of different quality ranged from 0.54 (primary range) to 0.71 (tertiary range) (Kohlmann 2004). Density dependence is an important factor to consider in management. Density dependence has been detected in pronghorn populations in Colorado (Shenk 1995) and Oregon (Kohlmann et al. 1998). In Utah, density dependence was suggested to limit pronghorn population growth and fawn production on the Deseret Land and Livestock ranch (Danvir 2000). Hess (1999) confirmed density-dependent summer fawn survival for the interstate pronghorn herd of Oregon, California and Nevada.

Survival

Wild pronghorn probably do not live frequently beyond 9 years of age (Einarsen 1948, Hepworth 1965), although Trainer et al. (1983) reported 16 year-old does as determined by tooth sectioning. Others have reported pronghorn longevity up to 18 years for does (O'Gara 2004a) and bucks up to 14 years. Fawn mortality is the most significant mortality in pronghorn populations, and fawns can suffer in excess of 90% mortality. Once pronghorn have reached yearling age, mortality is reduced greatly, but annual survival rates may as low as 0.55 have been reported (Mitchell 1980). Pronghorn survivorship curves (Fig. 10) are essentially flat for adult ages until females reach 10-12 years of age (7 years for males).

Pronghorn have been reported to succumb to a multitude of mortality agents. Hunting often is a significant source of male mortality, but it is generally strictly regulated (O'Gara and Morrison 2004). However, only 3 factors are considered limiting factors: Climate events, predation on neonates and forage conditions (Hansen et al. 2001, Aoude and Danvir 2002, Canon and Bryant 1992, Ockenfels 1994, and O'Gara 2004a, 2004b).

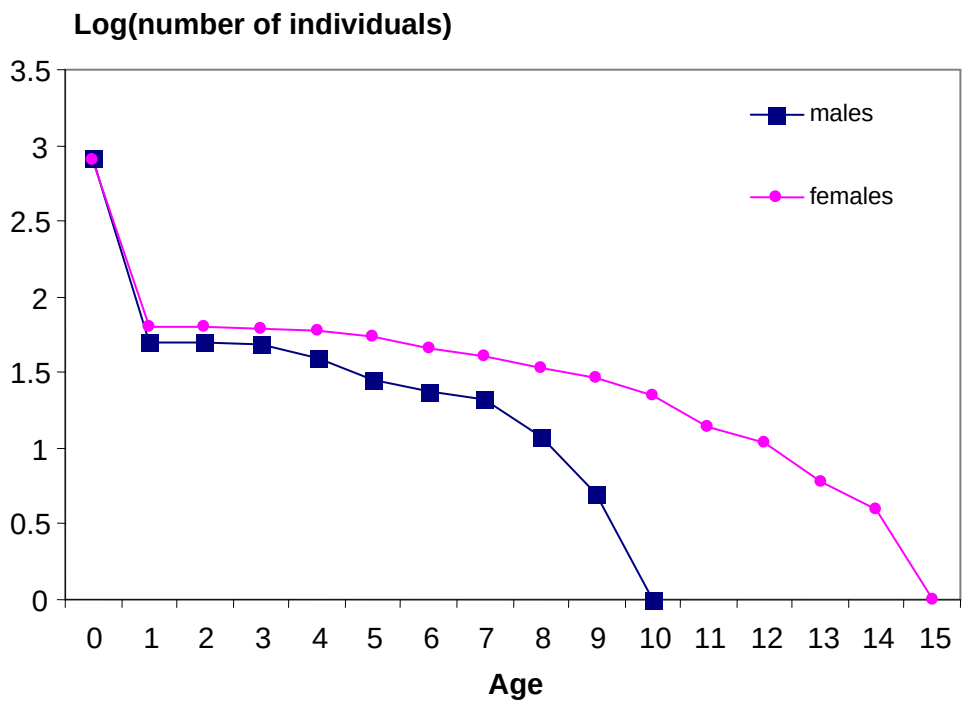


Figure 10: Survivorship curves for male and female pronghorn at the National Bison Range in Montana (data courtesy John Byers, University of Idaho, pers. comm). Note that this is an unhunted population.

Survival is age-specific and most of the annual mortality occurs in neonates less than 45 days old. Survivorship curves of pronghorn have been developed for at least two populations (Sundstrom et al. 1973, Byers 1997, Fig. 10). They both show a rapid decline in numbers during the first year, with mortality rated subsequently leveling off until age 7 for males and age 10 for females. According to these studies, males have a higher natural mortality rate than females. In unhunted populations, this is probably related to male combat and rut-related exhaustion. Grogan and Lindzey (2007) studied the annual survival of adult female pronghorn in two hunted populations within Wyoming. Annual survival estimates including harvested animals averaged 81% for the Medicine Bow Herd and 75% for the Sublette Herd. Mean annual survival estimates excluding harvested animals were 85% and 83% for the Medicine Bow and Sublette Herds, respectively.

Predation is one of the primary source of juvenile mortality in most pronghorn populations with most fawns killed before they are 1 month old (O'Gara and Shaw 2004). Predation is not considered a primary factor in adult survival. Thus, adult pronghorn generally have a high probability of living a relatively long life, except in long-term drought situations. Such droughts can result in large losses in isolated pronghorn herds (Buechner 1950, Hailey 1979) and can be detrimental where net-wire fences do not allow free movement (O'Gara and Shaw 2004).

Average mortality of fawns in 18 telemetry studies (O'Gara and Shaw 2004) showed a mean mortality rate of 71% in fawns, of which 76% was predator-caused. The yearly fawn mortality at the National Bison Range in Montana was nearly 90% (Byers 1997), yet the

population was stable. The primary predator of pronghorn fawns is the coyote (*Canis latrans*). However, bobcats (*Felis rufus*), Golden Eagles (*Aquila chrysaetos*), domestic dogs (*Canis familiaris*) and other species may occasionally kill pronghorn fawns (O'Gara and Shaw 2004). Mountain lions *(Puma concolor)* may take adults and fawns in rugged terrain in Arizona (Ockenfels 1994a, b) or in northern ranges (Barnowe-Meyer et al. 2009). Despite the apparent heavy mortality caused by coyotes, the two species co-evolved over millennia, creating the characteristic neonatal anti-predator strategy of the pronghorn.

Removing coyotes to benefit ungulate populations is controversial and may be effective only in limited circumstances. Cases where coyote population reduction appeared to have reduced fawn mortality have been documented in Wyoming (Knowlton 1968), in Arizona (Arrington and Edwards 1951, Neff 1977, Neff and Woolsey 1979), in Utah (Udy 1953), in Oregon (Oregon State Game Commission 1971) and Texas (Jones 1949, Hailey 1979, Reed 1980). Phillips and White (2003) employed simulation models to estimate pronghorn population trends at Hart Mountain National Antelope Refuge and found that long-term benefits to pronghorn populations could result from coyote control even if fawn-doe ratios declined after coyote control is stopped. Likewise, in a study of 7 sites in Colorado and Utah, Harrington and Conover (2007) suggested that control effort (no. of hr spent aerial gunning for coyotes) and success (no. of coyotes taken) were positively correlated with numbers of mule deer and pronghorn observed per kilometer of transect. Seidler (2009) monitored pronghorn fawns and coyote territorial maintenance and survival before and after surgical sterilization of resident coyote pairs. Survival of fawns captured in sterile coyote home ranges was higher than survival of fawns captured in intact home ranges, suggesting that surgical sterilization may be effective in reducing fawn mortality by coyotes. Unfortunately, many studies of neonate predation in pronghorn have concentrated on predation and predator control, and have not assessed concurrent other ecological factors that may have contributed to responding changes in population numbers.

Recently, an 11-year research project of predation effects on pronghorn neonates was concluded at Hart Mountain National Antelope Refuge, Oregon (Yoakum et al. 2004). To our knowledge, this is the only long-term (more than 5 years) predator/pronghorn neonate research project to date. Findings indicated that predation rates varied among years with a long-term average annual rate of approximately 50 percent. At the same time, the pronghorn population increased. During the study period vegetation conditions changed, which may have increased forage quality and quantity. This study emphasizes that predator/pronghorn studies may be most effectively accomplished when various ecological factors affecting carrying capacity are concurrently studied.

Under natural conditions, the presence of wolves (*Canis lupus*) may limit the predation by coyotes. Studies of survival rates of pronghorn neonates in wolf-free and wolf-occupied ranges in Wyoming found that coyote predation was the primary cause of mortality at all sites, but mortality due to coyotes was 34% lower in areas utilized by wolves. Wolf presence apparently shifted the population growth rates of pronghorn from a declining to an increasing trend (Murray-Berger and Conner 2008). Barnowe-Meyer et al. (2009) documented cause-specific mortality of adults and fawns for pronghorn in Yellowstone National Park. In this study, coyotes accounted for 56% of adult predation and up to 79% of fawn predation. Additional predators of adults included cougars and wolves, while cougars, black bears (*Ursus americanus*), and Golden Eagles occasionally killed fawns. These results suggest that even where multiple predator species occur, coyote predation on fawns is predominant.

Other mortality factors include illegal harvest, crippling from hunting, road kills, toxic poisoning (Hailey et al. 1966), fence entanglement, parturition complications (Canon and Byrant 1992), starvation, disease, drought, and accidents (Einarsen 1948).

Pronghorn are rarely affected by extensive epizootics (O'Gara 2004d). Some 33 species of roundworms, 21 genera of bacteria, 14 viral diseases, 8 species of protozoa, 5 species of tapeworms, and 4 species of ticks, one fluke, and a louse fly have been reported in or on pronghorn (Lance and Pojar 1984), but their impact on free-ranging populations appears limited as a population controlling factor. Epizootic hemorrhagic disease, caused by bluetongue viruses (BTV/EHDV) is the most serious known disease affecting pronghorn. In 1976, at least 3,200 pronghorn died from this disease in eastern Wyoming, and an estimated 600 to 1,000 pronghorn died in northeastern Wyoming during 1984 (Thorne et al., 1988). Examining 139 blood samples of pronghorn in Arizona, Dubay et al. (2006) found antibodies to parainfluenza virus type 3 (PI3) in 33% of the samples, and antibody against BTV/EHDV in 77% of samples.

In northern populations, pronghorn may experience frequent winter-kill (Einarsen 1948); this is rare in more southern ranges, but can be catastrophic when it does occur (White 1969). However, indirect climate effects on vegetation growth and productivity are far more important for most pronghorn populations. Highest pronghorn densities occur in ecosystems where mean annual precipitation ranges from 8 to 15 inches (20-38 cm). Populations in precipitation belts above or below these parameters have lower survival rates and densities (Yoakum 2004a, Sundstrom et al. 1973).

Late winter and early spring precipitation is often the driving factor affecting the production of forbs and standing biomass and thus appears to be more important to pronghorn recruitment and survival than summer precipitation. Low forb abundance and quality may reduce maternal nutrition during lactation, thus affecting fawn viability. In addition, low standing biomass may poorly conceal fawns during the hiding phased and render them more vulnerable to predation. Malnutrition may pre-dispose fawns to succumb to a variety of mortality factors, such as severe winters, droughts, entrapment in fenced pastures, predation, and others (Martinka 1966, Compton 1970, Ellis 1970, Riddles and Oakley 1973, Barrett 1974, Pyrah 1978). However, pronghorn mortality due to inadequate quality and quantity of nutritious forge is often difficult to detect in the field. Dunbar et al. (1999) found no apparent nutritional or health-related factors that predisposed pronghorn fawns to mortality including those killed by coyotes. Loss of up to 30 percent of body weight has been found in Wyoming's Red Desert females that survived a particularly harsh winter (Creek 1967).

Rainfall effects

Previous research has suggested strong relationships between pronghorn and precipitation (Buechner 1950, Hailey et al. 1966, O'Gara and Yoakum 1992). Studies in the Southwest have shown that pronghorn populations require a minimum of 2 inches (50 mm) of precipitation during the period October through March for herd maintenance (Brown et al. 2002). In southern New Mexico, Brown et al. (2002) found a significant correlation between precipitation (October through March) and pronghorn fawn survival the following August and a less robust but still significant relationships between winter precipitations and

subsequent fawn survival rates. They postulate that forb production, as affected by rainfall, is more important than grass production and hiding cover in determining fawn survival in semi-desert grassland habitats. Their study also suggests that fawn survival rates following winters having less than 2 to 3 inches (50 to 80 mm) of precipitation are insufficient to maintain pronghorn population levels. McDonald (2005) working in northern Arizona found no correlation between fawn recruitment and precipitation during winter or spring, but detected a positive correlation between annual precipitation and fawn recruitment.

Bright and Hervert (2005) suggested that Sonoran pronghorn fawn mortality was correlated with the amount and timing of rainfall and that drought may be a major factor in the survival of adults and fawns. They reported that lack of nutritious forage and water led to high fawn mortality and affected adult mortality by causing animals to use areas where predators are more successful. In the Trans-Pecos region of Texas, pronghorn abundance was positively correlated with precipitation indices (Simpson et al. 2007). The study suggested that fawn production may be more closely related to immediate moisture conditions, whereas pronghorn abundance was more influenced by long-term population trends.

In Arizona, recruitment of pronghorn through late summer was positively correlated with precipitation during the previous October–April during 1983–2002 (McKinney et al. 2008). Brown et al. (2006) found that the number of does seen on summer surveys in 3 areas in the Southwest was related to midsummer drought indices, and that annual variations in doe mortality might be more important in determining population levels in dry years than fawn recruitment. In Texas, droughts were associated with decreased pronghorn productivity (Hailey 1979). Global warming is considered to be a great threat due to the predicted xerification of pronghorn habitat that will further reduce forb abundance and productivity (Cohn 2007) and which may reduce landscape linkages for pronghorn (Packard and Cook 1995).

Population genetics

Genetic variability within animal populations is known to be influenced by a small number of founders or significant reductions in population size. In addition, isolation by geographic features (e.g., mountain ridges, unsuitable habitat) or human induced barriers (e.g., fences, fragmented landscapes) can prevent genetic exchange with other populations and can reduce genetic variability. Genetic characteristics of pronghorn populations have been documented for several populations (Lee et al. 1989, Lee et al. 1994, Honeycutt 2000, Carling et al. 2003). Pronghorn were once widespread in western North America numbering up to 60 million; by 1920, probably less than 30,000 were left (Nelson 1925). Existing populations of pronghorn have reduced variation in mitochondrial DNA when compared with other mammalian populations (Lee et al. 1994). This loss of genetic variation is of great concern in reintroduced and translocated populations where founder populations are often small. However, studies have shown that pronghorn have maintained relatively high levels of heterozygosity following the potential bottleneck event of the early 1900's (Honeycutt 2000).

Lee et al. (1989) studied six pronghorn populations in western Texas and recommended that translocations into isolated populations be conducted only if genetic information collected revealed that both populations were similar. Similar to pronghorn in the US, Mexican pronghorn populations declined drastically in the last century as a result of habitat

fragmentation and loss, predation and illegal hunting. Amor et al. (2001) compared genetic variation between Mexican and USA populations using mitochondrial molecular markers. They found 29 haplotypes indicating high levels of genetic variation but a low level of genetic differentiation between the populations. Mitochondrial DNA sequence data and 5 microsatellite loci from 2 small populations of the endangered Sonoran pronghorn (1 in Arizona and 1 in Mexico) suggest a history of recent isolation of Sonoran pronghorn populations from those in Arizona, New Mexico, and Texas. Loss of genetic diversity due to bottlenecks and drift has been severe in both populations of the Sonoran pronghorn, but is most pronounced in the Arizona population (Stephen et al. 2005a).

Stephen et al. (2005b) studied the genetic diversity of pronghorn at the Umatilla Army Base in Oregon, which resulted from the reintroduction of 17 pronghorn with no subsequent translocations or immigration into this fully enclosed area. They found a sharply lower genetic diversity compared to its source populations, despite its rapid increase in population size following the initial founding event. They also reported significant haplotypic and genotypic differentiation between the reintroduced population and its source and a notably high frequency of 2 rare alleles.

Studies documenting effects of inbreeding, which include decreased fitness, lower resistance to diseases, and lower ability to adapt to changing environmental conditions, have been conducted largely on captive populations (Lacy 1997). Less is known about how inbreeding influences wild pronghorn populations. A study of genetics in small ($N \approx 30$) population at Wind Cave National Park in South Dakota found that levels of multi-loci heterozygosity (0.473 to 0.594) and inbreeding coefficients (-0.168 to 0.037) were similar to other populations in western South Dakota (Jenks et al. 2006) .

2.1.7 Diet Consumption, Food Habits and Nutrition

Daily food consumption

Adult pronghorns require an average of 2.5-3.0 lbs (1.1-1.4 kg) of air-dry forage per day, and consume less than 1% of the forage produced on western rangelands (Wagner 1978). Messenger (1978) found that yearling male pronghorn require 3 oz (86 g) water and 55 kcal/lb (123 kcal/kg) of energy per unit body mass. Pronghorn seldom seem to be affected by eating toxic plants and, at times, apparently favor them (Yoakum and O'Gara 1990). Pronghorn may have a specialized liver that can detoxify the chemicals in these plants. Broom snakeweed, known to cause abortion in cattle, made up 7% and 5% of the diet in winter and spring in the Trans Pecos (Hailey 1979) and 10-14% of the diet in New Mexico (Russell 1964). The combination of paperflower (*Psilostrophe tagetina*, *P. gnaphaloides*, which can cause emaciation and death in sheep), groundsel (*Senecio riddellii*; can cause permanent liver damage in cattle and horses), goathead (*Tribulus terrestris*; can cause photosensitization in sheep and probably in cattle) and broom snakeweed (*Gutierrezia sarothrae*) made up 23% of the annual pronghorn diet in Texas (Buechner 1950). Buechner (1950) suggested that toxic plants (locoweed, *Astragalus* spp.) may have caused sickness and death for pronghorn.

Minerals

Although pronghorn often visit salt and mineral blocks, their mineral requirements and use remain unstudied (Yoakum 2004b). Pronghorn in Arizona have been diagnosed as deficient in selenium and copper, perhaps due to decreased quality or availability of preferred forage species (Heffelfinger et al. 1999). Pronghorn are apparently less susceptible to high consumption of selenium (Raisbeck et al. 1996). A presumptive copper deficiency was diagnosed in hand-reared captive pronghorn at the Los Angeles Zoo (Miller et al. 2001). Fox et al. (2000) determined the mineral content of forage species available for Sonoran pronghorn on the Cabeza Prieta National Wildlife Refuge (CPNWR) in southwestern Arizona. Diets consumed by pronghorn using plants available on the CPNWR were deficient in sodium, phosphorus, copper, zinc, and selenium. Jones (1991) suggested that pronghorn in the Cholame area of southern California were phosphorous-deficient, based on a comparison of observed diet selection with standards for white-tailed deer (*Odocoileus virginainus*) and domestic sheep (*Ovis aries*).

Food habits

Rouse (1941) was first to quantify diet composition, and since then over 250 studies of pronghorn food habits have been conducted (Yoakum 2004b). Pronghorn are selective feeders (Byers 1997, Schwartz 1977, Schwartz and Ellis 1981, Courtney 1989). Food habits vary greatly because pronghorn occur in three biomes—grasslands, shrub-steppes, and deserts. Yoakum (2004b) reviewed 200 diet selection studies conducted during the last 50 years and stated that forbs are the predominately preferred forage class followed by shrubs, with grasses as the least preferred species. Preference ratings calculated from 21 studies were 4.7 for forbs, 1.5 for shrubs, and 0.2 for grasses. Pronghorn have even been recorded to consume lichens (Thomas and Rosentreter 1993). Pronghorn dietary patterns can shift dramatically depending on forage availability and quality. Mitchell (1980) suggested that high grass and shrub consumption in pronghorn diets indicate scarcity of the preferred forb species. Dirschl (1963) identified a positive correlation between plant protein content and the degree of consumption by pronghorn, suggesting that plants with protein contents above 10% were the most preferred. A study of feeding ecology of pronghorn in the Cholame area of southern California (Jones 1991) suggested that pronghorn in that area were "receiving suboptimal amounts of protein, energy and phosphorous in the summer. Summer and early fall conditions in the Cholame area will determine the carrying capacity for antelope [sic] in these ranges". This result may also be valid for other existing southern pronghorn herds in California.

Due to their nutrient and energy content (Ellis 1970, Smith and Beale 1980, Hervert et al. 2000), forbs are of paramount nutritional importance (Buechner 1950, Pyrah 1978), especially during spring, when fetal growth is greatest during the third trimester, and during peak lactation in early summer. Forbs contain large amounts of protein, are highly digestible and provide preformed water (Ellis 1970, Smith and Beale 1980, Hervert et al. 2000). Numerous studies of pronghorn feeding habits throughout their range confirm that nutritious forbs are the most selected forage items for pronghorn when available (Beale and Smith 1970, Yoakum 2004b). Hansen et al. (2001) reported pronghorn consumed large quantities of perennial forbs during a mild winter with little snow covering small herbaceous plants.

Byers (2003) concluded that rangelands with abundant nutritious forbs in the autumn-winter generally produce larger fawns and high fawn survival rates during summer. Forbs are consumed whenever available. In south-central Arizona (McDonald 2005), forbs comprised 60-69 percent of pronghorn diets during gestation and lactation, while grasses were eaten in small quantities and browse consumption increased as forbs dried up during summer. Forbs and shrubs make up the majority of Sonoran pronghorn diets (Hervert et al. 2000).

Wheat was a major constant (74%) of the November through April diet of pronghorn near green wheat fields in Colorado (Hoover 1966), but pronghorns abandoned winter wheat fields in mid-late spring apparently at a time when nutritional value of native forages was increasing and that of wheat was decreasing (Torbit et al. 1993). At least 60% of the pronghorn diet in Kansas from October through March was wheat (Sexton et al. 1981), declining to 1.7% by April. Pronghorn may concentrate in cropland during severe winter weather (Mitchell 1980), but may not prefer areas with more than 25% of the land area in cultivation. Sexton et al. (1981) found that in Kansas pronghorn distribution included up to 30% agricultural land, but the use of grain fields may depend on proximity to native rangelands (Cole and Wilkins 1958). Grain fields in Montana less than 0.8 km (0.5 mi) from native rangelands received greater use by pronghorn during all seasons of the year than did fields more than 0.8 km from rangelands. Use of alfalfa and other cultivated plants in California has been low, but may be increasing (Salwasser and Shimamoto 1979).

In the Cholame area of southern California pronghorn selected areas with the highest diversity of forb species. Filaree (*Erodium spp*), black mustard (*Brassica nigra*) and fiddleneck (*Amsinckia spp*) made up more than 80% of the cover and biomass of the vegetation during summer and were deemed important forage plants in this area (Jones 1991).

Grasses are consumed in small quantities, and most intensively during emergence, when fresh growth are highly nutritious (O'Gara 1978, Kitchen and O'Gara 1982). Also, fine-textured bunch grasses are preferred over large coarse bunch grasses. Ferrel and Leach (1952) identified less than 2% grasses in pronghorn rumen contents from California. In the Cholame area of southern California, pronghorn consumed grasses predominantly during spring (Jones 1991). Although grasses appear the least desired forage item in most pronghorn populations, Semprebon and Rivals (2007) suggest that the extreme hypsodonty of modern pronghorn may be related to a heavier reliance on grasses during the evolutionary past.

Shrubs, like forbs, are often consumed each month of the year, however, they are browsed in greater quantities during autumn and winter. Consumption of skunk brush (*Rhus aromatica*) and apache plume (*Fallugia paradoxa*) increased greatly from gestation to lactation likely as a result of drying of forb forage during early summer in Arizona (McDonald 2005). Shrub consumption is often important when climatic conditions render forbs unavailable during autumn and winter (Ferrel and Leach 1952, Pyshora 1977). Shrubs have been reported to be high in fat content (Hughes and Smith 1990, Fox 1997), but also often contain secondary compounds that deter herbivory and, when ingested interfere with digestion and nutrient absorption (Freeland and Janzen 1974). Shrubs often have greater concentrations of nutrients during the autumn-winter than spring-summer. Some of the lesser preferred shrubs are consumed in greater quantities during severe winters and droughts because the total for nutritional forage is scarce.

In northern ranges, including northern California, several species of sagebrush (*Artemisia* spp.) are the most important browse shrub, followed by bitterbrush (*Purshia tridentata*) and other shrubs (Pyshora 1977). Although sagebrush is often high in secondary plant compounds, it has been identified as a major food item in pronghorn diets (Mason 1952, Mitchell and Smoliak 1971, Messenger and Schitoskey 1980). Bitterbrush is one of the most important palatable native shrubs in the western United States, providing high quality, important spring and winter browse. In northwestern South Dakota, pronghorn consumed at least 32 different plant species (Messenger 1978), with big sagebrush (*Artemisia tridentata*) and silver sage (*A. cana*) being the major shrub species consumed. Annual diets of pronghorn in a grass-dominated ecosystem in South Dakota (Jacques at al. 2006) favored shrubs: Pronghorn consumed 41.5 % grasses, 31.1 % shrubs, and 27.4 % forbs when total forage production was primarily grass (72 %) and forbs (23 %). In Arizona, diet of Sonoran pronghorn consisted of forbs, (69%), shrubs (22%), cacti (7%), and grasses (0.4%) (Edwards and Ohmert 1981).

In contrast to northern pronghorn ranges, animals in southern California are rarely seen consuming shrubs. Jones (1991) reported that pronghorn in the Cholame area were never seen foraging in the vicinity of shrubs. This may be due to these southern ranges not offering *Artemisia* or other palatable shrub species and that black mustard offered a highly palatable and protein-rich food source.

Livestock Interactions

Livestock most commonly found on western rangelands include domestic and feral cattle, sheep, horses and burros. Comparison of diets among 4 species of ruminants indicated that pronghorn selected the highest quality diet, followed in order by domestic sheep, cattle, and then bison (Schwartz et al. 1977). Pronghorn generally select diets containing higher levels of crude protein (CP) and lower levels of acid-detergent fiber (ADF) than horses or cattle, and hence show little dietary overlap with these species (McInnes and Vavra 1987). The animal unit per month (AUM) equivalent of an adult pronghorn (40-60 kg BM) is 0.163 to 0.22, based on the ratios of metabolic body weight (Heady and Child 1994). This means that the daily dry matter forage consumption of a pronghorn is roughly between 16- 22% of that of a 1000 lbs domestic cow with calf. Various methods of calculating exchange ratios (animal unit equivalents, AUE) have been used, but none has been completely satisfactory (Buechner 1950, Hoover et al. 1959, Severson et al. 1968, Taylor 1972, Kniesel 1988, Yoakum and O'Gara 1990). Anderson and Denton (1980) compared quantities of forage consumed per day by pronghorn and cattle in Idaho. Their results suggest that 14.8 pronghorn consume the equivalent dry matter of one AUM, but when taking dietary overlap ratios into effect, 59.2 pronghorn equaled one AUM.

Liverstock removal is often suggested as an effective way to increase pronghorn habitat quality. Several studies (Howard et al. 1990; Ockenfels et al. 1992; Yoakum 1994) have addressed the hypothesized negative effects of cattle-grazing on pronghorn fawn bed-site quality and amount of available cover. In shrub-steppe habitats, fawn bed sites were associated with greater shrub and overall vegetation cover (Autenrieth 1976; Alldredge et al. 1991), whereas studies in open, arid grasslands showed that shrub cover was negatively associated with bed-site selection (Barrett 1984; Canon and Bryant 1997). A study of forage conditions on the Anderson mesa in Arizona following cattle removal suggested that

curtailing or removing cattle is unlikely, by itself, to lead to rapid improvements in the hiding cover or forb availability for pronghorn on similar rangelands in northern Arizona Loeser et al. 2005)

Water

Pronghorn will drink water daily if it is available (Einarsen 1948). Body size, sex, health, lactation demands, and physical activity, and the succulence of the forage, as well as humidity and ambient temperatures are all factor affecting water consumption by pronghorn. Beale and Smith (1970) reported that pronghorn were not observed drinking although water was readily available when forbs were abundant and their moisture content was 75% or greater. Dew and the water content of cacti and forage plants may be sufficient to provide necessary water requirements for adult survival, but may not meet lactation needs (Fox 1997). Cutler (1996) studied vertebrate use of 2 artificial water developments on the Cabeza Prieta National Wildlife Refuge in southwestern Arizona, but Sonoran pronghorn were not detected in remote camera photos. Likewise Hughes (1991) never observed Sonoran pronghorn drinking.

Pronghorn consume less free-standing water at lower temperatures. In Wyoming, lacking snow or free water during winter appeared to stress pronghorn (Cook et al. 1984, Guenzel et al. 1982). Based on laboratory experiments, water requirements for an adult pronghorn in summer are 0.95 gal/day/100 lb animal (3.6 l/day/45 kg) (Whisler 1984). Sundstrom (1968) measured water consumption under field conditions and found daily consumption rates per adult pronghorn to range from 0.09 gal/day (0.34 l/day) in May to 1.19 gal/day (4.5 l/day) in August. During winter, pronghorn need approximately 25% of their summer water consumption rates when free water (including snow) is unavailable (Sundstrom 1968).

Many studies suggest that there is a close relationship between pronghorn distribution and water locations. For example, in Wyoming 95% of 12,465 pronghorn surveyed from the air were within 4 miles (6.4 km) of a water source (Sundstrom 1968). Most pronghorn in Arizona and New Mexico are usually found within two miles (3.2 km) of water (Ockenfels et al. 1994, Clemente et al. 1995). The maximum distance from pronghorn kidding sites in Alberta to open water was less than 2.5 mi (4.0 km) (Barrett 1981), but the mean distance was only 640 yards (586 m). Autenrieth (1978) suggested that pronghorn use most livestock watering sources, but pronghorn in Colorado were reluctant to drink from cement stock tanks (Hoover et al. 1959). Pronghorn in Arizona avoided the first 400 yards (365 m) from water sources, possibly reducing the threat of predation (Ockenfels et al. 1994). The dispersion of pronghorn populations is often related to water developments (Beale and Smith 1970), and water developments may encourage pronghorn dispersal. Baker (1953) found that pronghorn in Wyoming sometimes died while trying to get through fences to reach water.

2.2 Habitat characteristics

2.2.1 Topography

Pronghorn occur in open landscapes with a gentle topography and high diversity of vegetation communities, as opposed to monotypic communities (Yoakum 2004a). Soils may be clay, gravel or sand. Elevations range from sea level to over 11,000 ft; however, the

greatest pronghorn densities occur between 4000 and 6000 ft (1300 – 1900 m) (Yoakum 2004a). Slope is an indicator of pronghorn habitat suitability. In studies conducted in Arizona, Ockenfels (1994b) and Lee et al. (1998) reported that pronghorn avoid slopes >20% and apparently prefer areas where the slopes are <10%, while research conducted by Bright and van Riper III (1999) at Wupatki National Monument in Arizona showed variable selection of slope by season and sex; with both sexes avoiding slopes > 19%. Use of rugged landscapes may negatively affect survival because mountain lions (*Felis concolor*) are often found in such sites (Ockenfels 1994a, b). Furthermore, greater slopes and pronounced topographic relief may reduce visibility and escape routes from perceived danger.

Natural barriers can hinder pronghorn from moving to different areas and may even exclude the occupancy of otherwise suitable habitats. Such barriers include abrupt escarpments or mountain ranges, deep canyons, thick copses of shrubs or trees, and densely wooded areas. In Arizona, steep-walled canyons effectively separate pronghorn populations into distinct herds (Ockenfels et al. 1994). Einarsen (1948) cited two examples of such barriers in Oregon, the Columbia River and a forested region, where pronghorn did not move into suitable but isolated habitats nearby.

2.2.2 Vegetation cover

Pronghorn population densities are related to the quality and quantity of grasses/forbs/shrubs for various ecosystems (Ellis 1970). The health and growth potential of pronghorn populations is a direct effect of vegetation and forage condition (Ellis 1970, Salwasser 1980, Yoakum 2004a, Autenrieth et al. 2006). Pronghorn depend on adequate vegetation composition and structure for two major reasons: (1) as security cover during the neonatal hiding period and (2) as a source of digestible and palatable foods during their entire life. Ground cover in grasslands is about 60-80% live plants, with 20-40% of the ground being bare. In shrub steppes and semiarid grasslands, the amount of bare ground may increase to 50% (Yoakum 2004a, Brown 1994). In shrub steppe habitats, the composition of the vegetation is 5-15% grasses, 5-10% forbs, and 10-35% shrubs, and in grasslands the typical composition is 50-80% grasses 10-20% forbs and less that 5% shrubs (Yoakum 2004a). Ockenfels et al. (1994b) reported that in semi-arid grasslands in Arizona, grass cover was approximately 15%, and shrub cover averages 10%, and forbs ranges from 2-10%. Desert populations of pronghorn may exist in areas with less than 10% shrub cover and grasses and forbs comprising less than 2% of ground cover.

Pronghorn tend to avoid tree cover, but may seek shade during hot weather (Ockenfels 1994b). Tree density in Arizona pronghorn ranges is generally less than 2 trees/acre (5/ha) (Alexander and Ockenfels 1994). Pronghorn seem to avoid areas with dense stands of vegetation > 2.5 ft (0.75 cm) tall. Apparently, the reduced visibility or reduced mobility may affect pronghorn survival by increasing predation rates (Goldsmith 1990) and decreasing vegetative biomass in the understory (Yoakum 2004a).

Pronghorn fawns during the hiding phase of their life depend on security cover to conceal them from hunting predators. Adequate cover is a crucial component of fawn bed site selection (Autenrieth 1984) and is a major factor affecting fawn survival (Bromley 1978, Barrett 1981, O'Gara et al. 1986, VanSchmus 1990). Cover for neonates exist in clumps or patches of vegetation of at least 12 to 15 inches (30-38 cm) high. In south-central Wyoming fawns selected dense shrub cover but avoided high-density sagebrush-steppe communities

(Alldredge et al. 1991). Several studies suggest that density and height of vegetation affect fawn survival (Tucker and Garner 1983, Canon and Bryant 1997, Bromley 1978). Smith and Beale (1980) surmised that bed site selection was affected more by opportunities for visual detection of predators, rather than concealment. Habitat diversity provided by sagebrush, small depressions, and stands of grasses or forbs 25 cm tall contributed to above-average survival of fawns in Alberta (Barrett 1981). Fawn bed sites in Wind Cave National Park, South Dakota, contained more grass and less forbs than random sites (Jacques et al. 2006).

OBrien et al. (2005) used observed habitat selection by Sonoran pronghorn to develop a landscape-level Classification and Regression Tree (CART) and logistic regression models of potential Sonoran pronghorn habitat in southwestern Arizona. A predictive GIS map of Sonoran pronghorn habitat identified >12,000 km^2 of potential habitat for Sonoran pronghorn on the evaluation area that might aid in the selection of potential reintroduction sites.

2.2.3 Plant composition and structure

Throughout the pronghorn's range, an estimated 53% of populations occur in grasslands, 47% in shrub steppes, and < 1% in deserts (Yoakum 2004a). Of particular importance in sustaining pronghorn populations is a strong forb component in the vegetative mix (Yoakum 2004a). The presence of succulent forbs is essential to lactating does and thus fawn survival during the spring and early summer (Ellis and Travis 1975, Howard et al. 1990). High quality browse, protruding above snow level, is especially critical to winter survival of pronghorn in northern climates (Yoakum 2004a). Generally, composition of vegetation is 5-15% grasses, 5-10% forbs, and 10-35% shrubs on shrubsteppes; in grasslands, the typical composition is 50-80% grasses, 10-20% forbs, and less than 5% shrubs (Yoakum 2004a). In semi-desert grasslands in Arizona, grass cover averaged 15%, shrub cover averaged approximately 10%, and forbs cover fluctuated between two and 10% (Ockenfels et al. 1994). Arid lands used by pronghorn may have <10% shrub cover with annual grasses and forbs composing less than two percent of the ground cover. The use of semi-desert and desert habitats with tree cover is usually low, but increases during hot, dry periods when pronghorn use scattered trees or other structural cover for shade (Ockenfels 1994b).

Pronghorn appear to prefer low vegetation height averaging 10-18 inches (25-46 cm), while vegetation over 25 inches (63 cm) is typically avoided. Pronghorn may use areas having high shrubs while traveling to or from preferred habitats. However, reduced visibility or decreased mobility due to tall vegetation, are important factors in pronghorn survival (Goldsmith 1990). Pronghorn in the Southwest often use savannas if canopy cover averages less than 20% and other vegetation is less than 24 inches (61 cm) (Ockenfels et al. 1994). Better visibility and higher availability of preferred foods (forbs) were suggested to explain the higher numbers of pronghorn in Chihuahuan Desert rangelands in New Mexico, where late-seral ecological conditions provide better habitat for pronghorn than those in lower seral stages (Clemente et al. 2005). Other special southwest habitats include dunes in the Vizcáino area of the Sonoran Desert and "cholla forests" in northwest Sonora and southwest Arizona (Cancino et al. 2001, Hervert et al. 2005).

2.2.4 Plant diversity

Plant diversity of pronghorn ranges is generally high, with 5-20 grass species, 20-70 forb species, and 5-10 shrub species ((Lee et al. 1998, Yoakum 2004a). On grasslands, the averages are 10-20 grasses, 20-60 forbs, and 5-10 shrubs. Although semidesert grassland habitats exhibit similar diversity, most desert habitats possess less than five species of grass, five forbs, and one or two shrubs with some of the grasses and forbs being annuals. As a consequence, plant species richness may vary by month, with the greatest variety usually being in spring (Ockenfels et al. 1994). Trees are often absent or scarce in grasslands and shrubsteppes. When present, tree species richness is usually two or less except in the Sonoran Desert where up to five species of trees may be present (Brown 1994). Pronghorn also forage and often congregate in areas of recent wildfires as these “burns” typically produce new grass growth and a flush of succulent forbs (Deming 1963, Yoakum 1980, Courtney 1989). Key vegetative components are those areas necessary to sustain a pronghorn population during critical periods (e.g., severe winters, droughts, etc.). The use of such areas may or may not be seasonal, and often depends on environmental conditions. Vegetative requirements for pronghorn vary widely in relation to land management practices, geographic location, climate, soils, and habitat types. Examples of key rangelands used by pronghorn include: spring feeding areas (Becker 1972), winter range (Compton 1970, McKenzie 1970, West 1970, Taylor 1975); seasonal movement routes, areas having water (Sundstrom 1968, Beale and Holmgren 1975), and fawning areas (Einarsen 1948, Pyrah 1974, Autenrieth 1976).

2.2.5 Habitat suitability

Over the last 40 years, habitat suitability (Allen et al. 1984) modeling has been conducted in an attempt to identify those areas of pronghorn range that are critical for survival. Determining suitable habitat for pronghorn is related to the right amount and juxtaposition of all habitat characteristics meeting the species' biological requirements. Knowledge of these habitat requirements is the ecological foundation for accurate model predictions and management decisions (Yoakum 2004a). Early attempts to characterize habitat suitability were mainly related to the identification of release and translocation sites. Hoover et al. (1959) developed a form recommended for completion prior to release on grasslands in Colorado. Yoakum (1980) adapted the form for shrubsteppes.

Habitat suitability criteria have not been established for all habitats. Transferability of habitat suitability criteria among ecosystems is generally low. Suitability values for bare ground, percent forbs or vegetation height can vary between regions and ecological conditions. Values for the habitat suitability index range from 0 to 1, and are unitless. It is important to note that habitat suitability does not represent habitat quality, which would require including some measure of survivability or reproductive success. Quantitative rating systems have been developed to assess: winter rangelands (Allen and Armbruster 1982), translocation sites (McCarthy and Yoakum 1984, Arizona Game and Fish Department 1993), suitable year-round habitat in Nevada (U.S. Bureau of Land Management 1980, U.S. Soil Conservation Service 1989), effects of wildfires on vegetation (U.S. Bureau of Land Management 1980), and the compatibility of domestic sheep to pronghorn (Howard et al. 1990). O’Brien et al. (2005) developed landscape-level Classification and Regression Tree (CART) and logistic regression models of potential Sonoran pronghorn habitat in southwestern Arizona and created a predictive Geographic Information System (GIS) map of Sonoran pronghorn habitat.

In California, habitat suitability rating was used as the main criterion for evaluating five potential shrubsteppe translocation sites in Mono County, California (McCarthy and Yoakum 1984). At the Carrizo Plain National Monument, pronghorn habitat suitability has been modeled using primarily vegetation characteristics, road density and slope as primary factors (Longshore and Lowry 2008). In addition, a conservation assessment for the Cuyama Valley in southern California (Andersen et al. 2009) included an analysis of habitat connectivity for pronghorn moving to and from the Carrizo Plain.

2.3 Human impacts

Human developments remove hundreds of thousands of acres of pronghorn habitat each year. Pronghorn habitats can be lost or compromised by virtually all human activities on the landscape. The major impact of human development entail either direct habitat loss (destruction or alteration of existing, accessible habitat) or habitat fragmentation by reducing patch sizes of resource area and reducing accessibility to existing patches. Because pronghorn range widely to access the most succulent forage available at different locations at various times of the year, and often return to specific fawning grounds, they are considered to be a landscape-connectivity dependent species (Clark 2006), i.e., they are dependent on the ability to move freely between resource patches across large landscapes. Highways and railroads, substandard fences, tree and shrub encroachment, and human developments result in habitat loss and fragmentation (Ockenfels et al. 2006a, van Riper and Ockenfels 1998, Ockenfels et al. 2007).

2.3.1 Fences

Fences influence pronghorn movement patterns by either reducing or eliminating previously used travel routes across highways, roads and railroads (Buechner 1950, Sundstrom 1967, Ward et al. 1976, Ward et al. 1980, Guenzel 1986). This also may affect the carrying capacity of some rangelands (Yoakum 1978). In Wyoming, pronghorn selected winter home ranges with significantly lower total fence densities than available in the study area (Sheldon 2005). The design, construction, and location of the fence determine the impact that it has on pronghorn populations (Hailey and DeArment 1972, O'Gara and Yoakum 1992). Pronghorn have been known to sometimes injuring themselves or dying due to entanglement in fences (Spillett et al. 1967, Bear 1969, Oakley and Riddle 1974). An especially notorious example of pronghorn mortality associated with fences occurred in south-central Wyoming in the 1980s, when a rancher erected a 28-mile (45 km) fence, made of 5 ft (152 cm) tall mesh, in an area called Red Rim. The Red Rim fence enclosed public land along with the ranch's private land, and it kept thousands of pronghorn from reaching winter rangelands, causing an estimated 700 pronghorn to die in the winter of 1983. Eventually, a federal judge ordered that the fence be partially removed and modified so pronghorn could pass through (Oakley and Riddle 1974).

Fences constructed adjacent to roadways are often a barrier to pronghorn, and the inability of pronghorn to negotiate woven-wire fences and barbed-wire fences with low (< 16") bottom wires is well-documented (Yoakum 2004c). Pronghorn rarely jump over fences but can successfully negotiate barbed wire fences with a minimum 16" of space between the ground

and the bottom strand (Yoakum 2004c). However, most fences constructed on western rangelands have bottom wires approximately 10” off the ground (Yoakum 2004a). Consequently, fencing is considered a major source of habitat fragmentation for pronghorn populations. Ockenfels et al. (1997) and Ticer et al. (1999) found that pronghorn home ranges were bound by fences in Arizona.

2.3.2 Roads

In southwestern Wyoming (Sheldon 2005) and in Arizona (van Riper et al. 2001) unfenced roads appeared not to be a barrier to pronghorn movement, but the combination of heavy traffic volume (Buechner 1950) and fences along roads can be considerable barriers to movement and fragment habitat. Transportation corridors in Arizona are significantly fragmenting pronghorn habitat and isolating populations in Arizona (Ockenfels et al. 2007). Crossings of 2-lane, paved highways by pronghorn have been documented, but only when right-of-way fences were set back from the highway or where fences were in disrepair and traffic volume was low (Ockenfels et al. 2007). For relatively narrow (= 3 lanes) undivided roadways with low or moderated traffic volume (i.e., < 2000 Average Annual Daily Traffic, AADT), fence modification or removal may allow pronghorn to move across. As these narrow, single-lane roadways are widened into multi- lane roads with high traffic volumes, the ability for pronghorn to cross will possibly be eliminated. Divided highways, interstates, and other high-volume (i.e., > 2000 AADT) roadways are usually fenced to keep wildlife off the roadway and minimize wildlife-vehicle collisions.

Pronghorn reactions to roads usually vary in response to traffic volume. Pronghorns showed higher vigilance and lower foraging times along high traffic roads during the spring season compared with lower traffic levels, suggesting that risk perception is related to traffic level (Gavin and Komers 2006). Moreover, individuals within close proximity to roads regardless of traffic level exhibited higher vigilance levels, indicating that there is an overall risk perceived towards roads. Gavin and Komers (2006) also suggest that individuals in herds with young are more risk averse than other social groupings and individuals in larger groups perceive less risk.

Pronghorn movements across fenced roadways are restricted to designated crossing structures, typically underpasses in the form of bridges or culverts. Plumb et al. (2003) documented 70 pronghorn in group sizes ranging from 1 to 57 moving through a concrete box underpass (20’ wide and 60’ long) along a two-lane highway in western Wyoming. They also noted 19 other pronghorn that approached the structure, but did not pass. These unsuccessful movement events by pronghorn were not attributed to traffic; rather they appeared to be due to pronghorn reluctance to enter the structure. Yoakum (2004c) speculated that pronghorn behavior may negatively influence the use of under and overpasses of high-volume highways. Not surprisingly, the habitat and landscape attributes associated with underpasses affect their effectiveness for wildlife movements (Putman 1997, Clevenger and Waltho 2000). Natural habitat surrounding the underpass increases the likelihood of it being used by the species of interest. Obviously habitat surroundings are species specific, and what may be suitable for carnivores or elk or deer, may not be suitable for pronghorn and vice versa. Open-span bridges built in flat prairie or shrubland habitat may prove effective for allowing pronghorn movements underneath roadways (Sawyer and Rudd 2005). The potential influence of human activity may be especially important for species like pronghorn

that rely on open spaces and high visibility to detect predators. Although it is common for crossing structures to serve multiple uses (e.g., roads, machinery, livestock, watercourses, trails, etc.), a structure designed for pronghorn would be most effective if multiple use and the associated human activity were restricted. In California, construction of a pronghorn overpass along US 46 was proposed (Hacker 2002) but these plans were modified to include underpasses only because anecdotal evidence suggests pronghorn already cross underneath existing bridges in the area (D. Hacker, pers. comm., cited in Sawyer and Rudd 2005).

2.3.3 Mineral and energy development

The recent expansion of energy development in the West has the potential to have serious impacts to pronghorn and their habitat. Although few final studies exist on the effects of energy development on pronghorn exist, some preliminary results are available. Berger et al. (2006) showed that some pronghorn continued to use areas that were heavily developed, whereas other animals showed strong avoidance to such areas. The same study suggests that migrating pronghorn avoid more densely developed areas.

An ongoing study of pronghorn (Berger et al. 2006) in the Upper Green River Basin in southwestern Wyoming reported that natural gas development (gas fields, roads and associated human infrastructure) may alter the suitability of habitat for wildlife. Energy development resulted in avoidance of heavily developed areas by pronghorn and the total abandonment of the Jonah Field, which had previously been important winter transition range. The study documented reduced use and abandonment of habitat parcels that were less than approximately 600 acres (242 ha) in size. Pronghorn did not change their 24-hour activity pattern to forage in the habitat near well pads, even at night when human disturbance was reduced. Areas within 100m of gas wells were also consistently avoided.

Sawyer et al. (2002) suggested that energy development could sever migrations corridors for pronghorn and could influence the winter distribution of pronghorn on winter ranges. The changes in distribution could change the capacity of those ranges to support pronghorn. In many pronghorn ranges throughout the West, intensive energy development is occurring. Well densities are often at 1 well per 40-acres (16 ha), or up to 16 wells per section. The direct loss of habitat in those areas is approximately 4 acres per well or about 10% of each section. In addition to the direct habitat loss, there are indirect impacts from increased traffic, increased human presence, spread of invasive weed species, poaching, and other disturbances that could lead to pronghorn avoiding areas with intense development and a reduction in pronghorn carrying capacity. Primary effects of oil development and well-site access roads may come with associated fences and the resulting hindrance of pronghorn movements (Riddle and Oakley 1973). Those impacts, both direct and indirect, will likely be compounded during times of drought. Deer and pronghorn are frequently seen foraging near oil and gas facilities, and even use habitats in the middle of oil fields. This indicates they can become accustomed to and may not be affected by such activities.

2.3.4 Housing development and subdivision

Sawyer et al. (2005) tracked pronghorn moving along a 150 km corridor, migrating from summer ranges within the Grand Teton National Park to traditional winter ranges in Wyoming. They identified a number of bottlenecks along this migration route. Historically, the Trapper's Point bottleneck point was 2000 m (1.2 miles) wide, tightly constrained by the flow of two rivers. However, recent residential developments have reduced the effective width of this bottleneck to <0.8 km (0.5 miles). An estimated 1,500–2,000 pronghorn move through the bottleneck twice a year during spring and autumn migrations and the decreasing width of the bottleneck has been cited as a major management concern (Sawyer et al. 2005).

Pronghorn populations in Yavapai County, Arizona are threatened by loss and degradation of available habitat to urban development associated with a rapidly expanding human population (Arizona Department of Game and Fish, 2007). The town of Prescott Valley is among the fastest-growing incorporated areas in the state, and much of this growth has occurred in high-quality pronghorn habitat. The Willow Lake herd is a declining subpopulation of <50 pronghorn that persists within the Prescott city limits and occupies habitat that is being rapidly converted to a residential housing-golf course development. Historical dispersal or migration from this area likely influenced the number of pronghorn in the area. However, construction of two roads (and associated fencing) more than 30 years ago created the first major barrier to movement on the northern border of the area. Continued urban development has reduced habitat from 10 mi^2 (25 km^2) in 1990 to less than 2 mi^2 (5 km^2) in 2000.

2.3.5 Disturbance

Pronghorn are sensitive to noise created by various human activities. Avoidance distances reported for pronghorn range from 0.25 mi (0.4 km, Autenrieth 1983) to 0.6 mi (0.96 km, Easterly et al. 1991) from sources of disturbance. Landon et al. (2003) documented that in southwestern Arizona noise produced by military aircraft apparently affected habitat used by pronghorn. Pronghorn used areas with low noise (<45 decibels [dB]) significantly more than expected and appeared to avoid areas with higher noise levels (≥55 dB). Johnson et al. (2000) found the density of pronghorn at the Foote Creek Rim windfarm in Wyoming were not lower in number than control sites outside of the windfarm area. In most cases, even very mild forms of human activities, such as recreational hiking can affect pronghorn. Pronghorn on Antelope Island State Park in Utah retreated further from trails once they were opened for recreational use (Tullous and Fairbanks 2002). Copeland (1980) suggested that hunting may affect social organization of pronghorn. Segerstrom (1982) reported avoidance of human activity by pronghorn regardless of the visibility of the activity to pronghorn. Pronghorn tend to keep human activity in view when in close proximity to such activities. Unpredictable, erratic movements of light vehicles and humans on foot tend to cause greater avoidance reactions than predictable and repetitious activities. Jones (1991) reported that unhunted pronghorn in the Cholame area of southern California were “extremely skittish” and usually could not be approached closer than ½ mile (800 m).

Chapter 3
Population status of pronghorn at Tejon Ranch

Photo: Ed Ruth

3.1 Restoration and historic population development

In California, pronghorn were first reintroduced to historic range lands in Mono County (north of Mono Lake and at Adobe Valley), beginning in 1947 (Pyshora 1977). Since 1987, translocations by the California Department of Fish and Game established pronghorn populations to Kern, San Luis Obispo, and Los Angeles counties, where small populations have become established (Koch and Yoakum 2002). These isolated herds are presently found in the California Valley and the Carrizo Plain National Monument, on several private ranches near Cholame and at the eastern reaches of Tejon Ranch. The best-known and perhaps the most successful re-establishment of pronghorn in southern California occurred at Carrizo Plain National Monument (Koch and Yoakum 2002), where a series of releases of animals from northeastern California occurred in 1987, 1988 and 1990. This population has expanded its range, however, its size remains critically small (< 150 animals).

In 1985 and 1987, a total of 93 pronghorn were released on the eastern foothills of the Tehachapi Mountains on Tejon Ranch. The historic release site was located within the foothills of the Tehachapi Mountains in the Fish Creek drainage. Originally, transplant animals were held in a temporary pen for 2-3 days and then released. Initial dispersal within 2-3 years of the release was significant; observations of pronghorn as far as the Poppy Reserve probably result from such dispersal.

Current distribution of pronghorn include 4 distinct groups, plus at least three animals that appear to have crossed the aqueduct and are now frequently seen on the eastern portion of the proposed centennial site (T. Matthias, pers. comm.). Currently, the main groups include 2 groups in the Oso Canyon area (each containing 1 buck and several does) 1 group in the Fish

Creek area (approximately 10 individuals) and 1 group near 190th and 170th Street area on the Northrup site. The entire herd range measures approximately 48,000 acres or 195 km^2 (Fig.11).

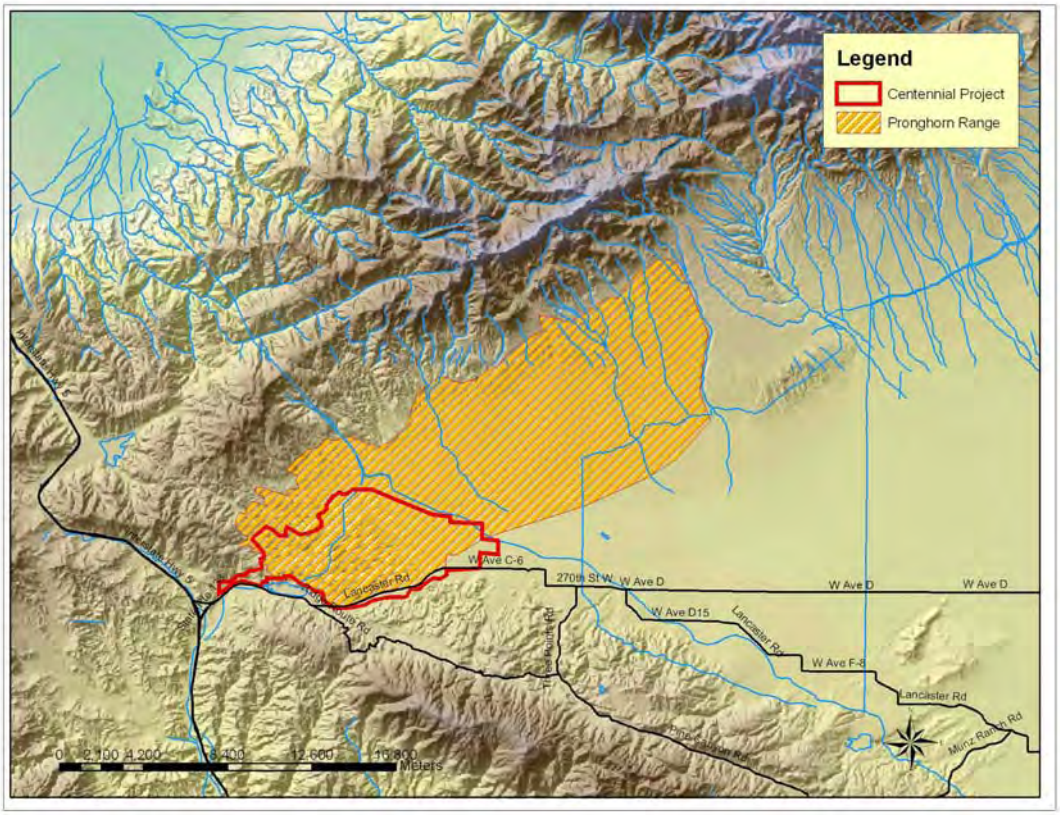


Figure 11: Approximate range of pronghorn on Tejon Ranch, California, during 2008.

3.2 Population dynamics

The Tejon Ranch pronghorn population was surveyed each year during autumn from 1995 until present (Bill Asserson, CDFG, Bakersfield, pers. comm). Total number of classified animals varied among years, but remained rather stable over the 14 years of data collection (Fig. 12).

Pronghorn composition counts conducted on Tejon Ranch are useful as an index to the population's trend, but cannot serve as reliable estimates of population size due to the lack of replication or estimation of precision. They represent a minimum population estimate, also often referred to as a "Minimum Known Alive" (MKA) estimate. However, assuming that bias related to missed and misclassified animals is constant among years (e.g., similarly experienced observers, sighting conditions etc), some important conclusions can be drawn from these data.

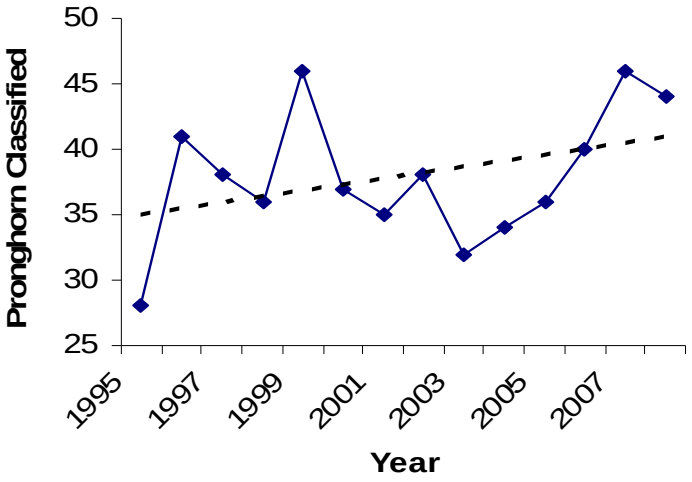
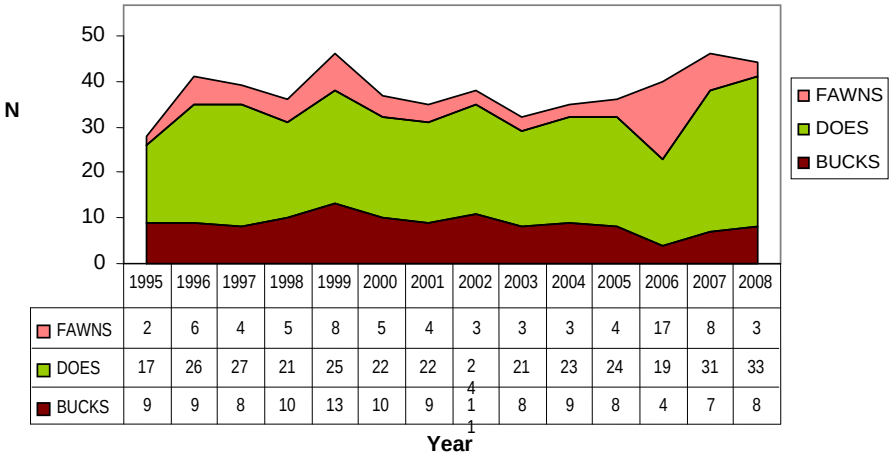


Figure 12: Number of pronghorn classified during autumn surveys on Tejon Ranch, California, from 1995 through 2008. Data courtesy of California Department of Fish and Game, Bakersfield, CA.

First and foremost, the data suggest that the current population is extremely small (< 50 animals). The population trend has been stable to slightly increasing, but annual fawn recruitment is highly variable (Fig. 13). The estimate of 2006 is especially noteworthy, because an unusually high number of fawns classified coincided with fewer than normally observed doe numbers. This may indicate a misclassification problem. Thus, to assess the sensitivity of analyses to this presumed outlier, we examined the annual per-capita growth rates and fawn ratios for the full set of data (complete time series) and for the reduced data set (i.e., where the value for 2006 was removed).



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
FAWNS	2	6	4	5	8	5	4	3	3	3	4	17	8	3
DOES	17	26	27	21	25	22	22	24	21	23	24	19	31	33
BUCKS	9	9	8	10	13	10	9	11	8	9	8	4	7	8

Figure 13: Autumn population composition of the Tejon pronghorn herd from 1995 through 2008. Note the high estimate for fawns and corresponding drop in doe numbers in 2006. Data courtesy of California Department of Fish and Game, Bakersfield, California.

Annual population growth for the Tejon Ranch pronghorn herd did not strongly follow fawn recruitment in autumn, for both the full and the reduced data set. We calculated the instantaneous growth rate of the population for each year as $\lambda = N_{t+1}/N_t$ and evaluated the relationship between the per capita growth rate (ln (λ) and fawn ratios. The tendency was statistically not significant (Fig. 14) for both and might indicate a weakness of the classification data in representing the true population size.

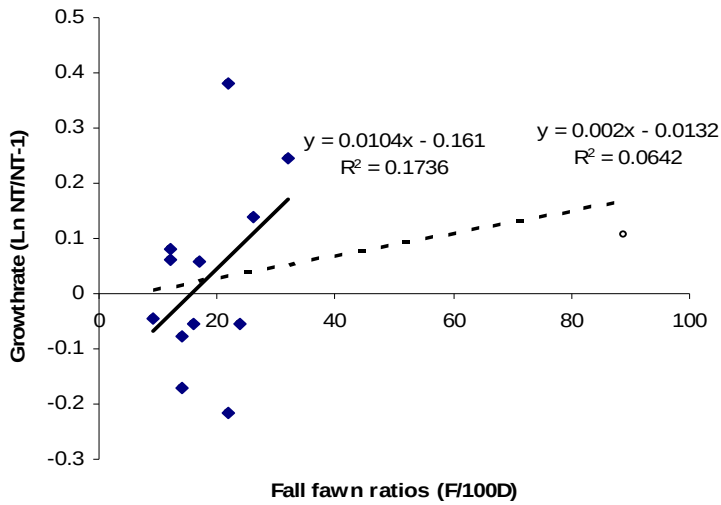


Figure 14: Relationship between annual per-capita growth rate and age ratios for all data (open circles, dotted trend line) and for reduced data set (value for 2006 excluded; solid circles, solid trend line). None of the trend lines were significant (P>0.05).

3.3 Climatic factors

Nutritional quality of vegetation for most currently occupied southern pronghorn habitat appears markedly lower than that of comparable habitats in northern ranges. This is especially true in California, where rainfall patterns and vegetation types vary markedly between northern ranges (Great Basin Desert regime) and southern ranges (Mojave Desert and annual grasslands). Pronghorn in the monsoonal climate regions of Arizona and New Mexico usually experience a second green-up during the August monsoons, but this bimodal precipitation pattern is absent in the arid regions of southern California and western Mexico. These populations occur in some of the driest of all pronghorn ranges. The frequency of low precipitation, coupled with marginal forage conditions may be the reason why California's southern pronghorn herds occur at comparatively low densities, compared to populations in northern California.

The Tejon Ranch pronghorn population is located at the far western edge of the Mojave Desert, where rainfall patterns can vary substantially. To evaluate potential rainfall effects on pronghorn population dynamics, we selected long term weather data from KSDB (72383) in Sandberg, located at Lat- 34° 44' 36" N Long 118° 43' 31" W, at an elevation of 4509 feet (1374 m). The weather station is approximately 1.7 miles (2.7 km) due south of the Centennial project site and the Lancaster Highway (Fig. 15).

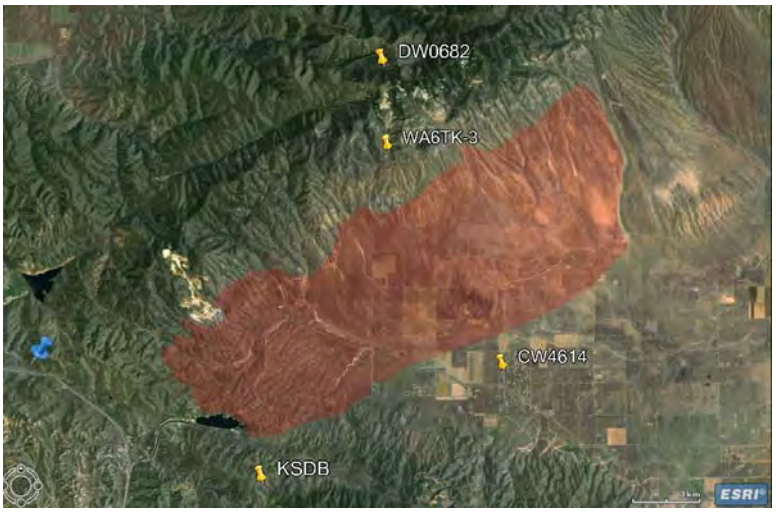


Figure 15: Pronghorn core range at Tejon Ranch and locations of nearest weather stations.

Weather data were available from this station for the past 61 years (Fig. 16). We focused our analysis on the amount of rainfall in any given year, because in southern climates it is the main driver of vegetation productivity. We took a subset of annual precipitation occurring from July through December as a representation of summer-autumn-winter (SAW) growing conditions.

Fawn ratios (fawns/100 does) were significantly correlated (R^2=0 .7847, F=40.1, 12 df, P< 0.005,) with the SAW precipitation two years prior (Sandberg Weather Station; Fig. 15). Correlations were highly significant for both data sets (full and reduced), but the fit was slightly better for the reduced data set (Fig 17).

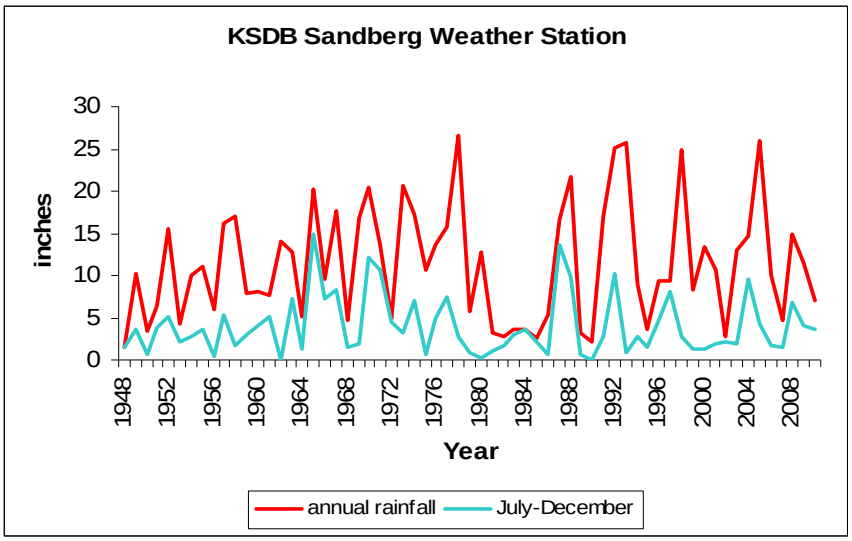


Figure 16: Annual and summer-autum-winter precipitation at Tejon Ranch, measured at Sandberg weather station, Sandberg, CA.

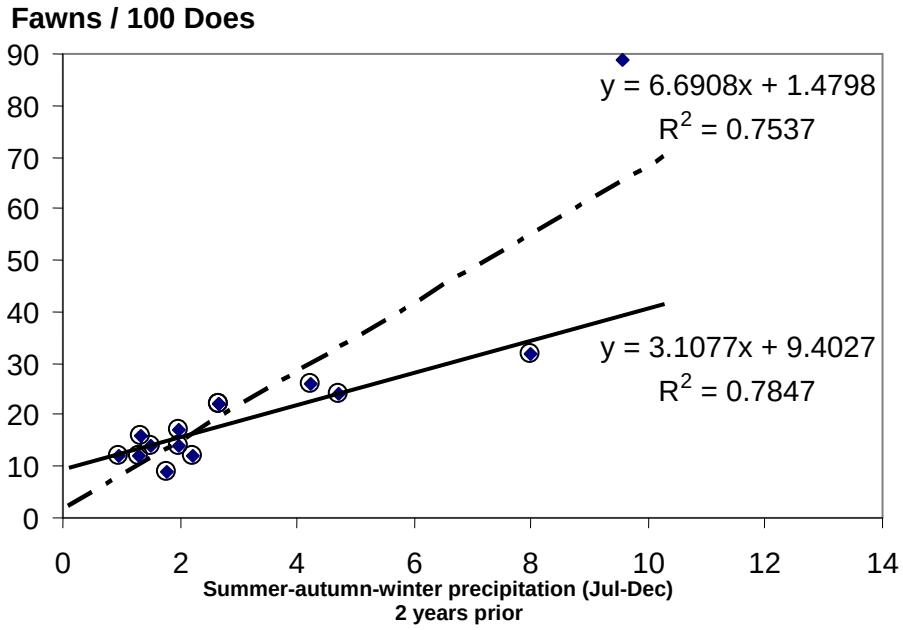


Figure 17: Correlation between summer-autumn-winter precipitation (Jul-Dec) two years prior and fall pronghorn fawn ratios observed on Tejon Ranch, 1995-2006. Weather data are from the nearby Sandberg Weather Station. Solid line represent regression estimate for reduced data set (open circles), dotted line represents the full data (filled circles).

In addition, we examined the correlation between fawn ratios and weather data for the Lebec weather station, approximately 7 miles (11.2 km) west of the core pronghorn area. A similar strong correlation between fawn ratios and SAW precipitation 2 years prior was found (R^2= 0.6228, F=18.14, P<0.001, 12 df.). Fawn ratios and various subsets of precipitation data (Oct-Mar, Jan-Jun, Total) showed a positive relationship with fawn ratios, but only the correlation of fawn ratios with October-March precipitation was significant (R^2=0.4229, F= 8.06, p=0.016, 12 df).

There is a pronounced 2-year time lag between the observed autumn precipitation and the observed autumn fawn recruitment rate. Time lags of 1 or more years often indicate trophic or habitat relationships such as reliance on certain forage or vegetation conditions following rainfall. This delayed response may give managers a possibility to intervene to ameliorate low fawn ratios by changing livestock grazing or other intensive management of food resources, or by reducing mortality factors.

These results suggest that there is a robust relationship between fawn ratios and the SAW precipitation 2 years prior. Annual population growth of Tejon Ranch pronghorn appears to be driven by a combination of stochastic factors and by fawn recruitment, which in return was highly dependent on precipitation with a 2-year time lag. A similar result was reported for 44 herd units in Wyoming by Smyser et al. (2006), who identified positive relationships between fawn:doe ratios and previous growing season precipitation, autumn precipitation, and previous season's population growth potential. This model indicated pronghorn populations demonstrate density dependent growth characteristics and highlighted the importance of pre-winter condition on ensuing fawn production.

We furthermore evaluated if there is a definable "break-even point" in precipitation above which population growth rates become positive. We used the instantaneous growth rate of the female segment of the herd (λ_F) as an index of the reproductive potential of the population, and examined if this was related to weather variables. A significant, positive relationship (R^2= 0.434, F= 8.4584, P=0.0142, 12 df) existed between λ_F and total wet-season precipitation (October-May; Fig 18).

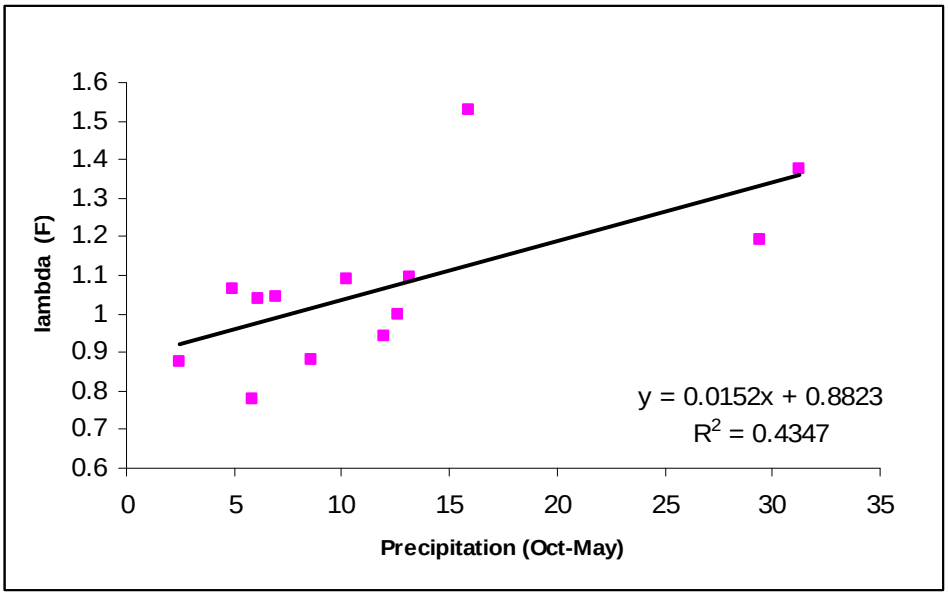


Figure 18: Relationship between annual instantaneous growth rates of the female segment of pronghorn population (λF) at Tejon Ranch and wet-season precipitation (Oct-May).

Using the above correlation coefficients, a precipitation threshold can be identified at which population growth can be expected to become negative. Thus, annual wet-season precipitation of at least 7.72 in (196 mm) of precipitation at the Sandberg Weather Station is likely to be followed by positive population growth.

The average wet-season precipitation (Oct-May) at the Sandberg Weather Station is 11.93 in (288 mm), and the variability is large (SD=89.3 in; 198 mm). Over the last 60 years, the average dry period (number of sequential years with autumn precipitation below 7.72 in (196 mm) is shorter (1.7 years) as the average length of wet periods (2.9 years). On average, 63% of years had a wet-season precipitation above 7.72 in, compared to 37% of "dry" years. If the above estimate is robust, we can expect that the population should, on average continue to grow, albeit at a very low rate.

It is however important to recognize that due to limitations of the current data set, with its lack of precision and unknown bias, statistical analyses are of limited value. A stochastic simulation and population viability analysis may give a more comprehensive view of the apparent limiting factors and the risk of extinction and may facilitate making probabilistic predictions.

3.3.1 Habitat suitability

The pronounced effect of precipitation of population growth at the Tejon Ranch suggests a strong functional linkage between forage production and pronghorn population dynamics. Currently, all southern pronghorn herds (i.e., Carrizo Plain and surrounding areas, and the Tejon Ranch population) exist in habitat conditions that may be defined as "poor vegetation quality" (Yoakum 2009, pers. comm.). Habitat types within the home ranges of the Tejon Ranch pronghorn population are significantly drier and less productive than pronghorn ranges in higher-density ecosystems. In addition, pronghorn forage conditions at Tejon Ranch appear poorer now than they were a decade ago, possibly because of drought and heavy livestock foraging (Koch and Yoakum 2002, Yoakum 2009, pers. comm.).

We designated a "core pronghorn range" based on observations and anecdotal information of where pronghorn are most often observed on Tejon Ranch (T. Mattias, pers. comm.). We then examined the habitat suitability of this core range via data layers that are frequently evaluated for estimating habitat suitability, and which were recently used on other California pronghorn ranges (Longshore and Lowry 2008, Andersen et al. 2009, Koch and Yoakum 2002). In absence of a peer-reviewed algorithm that links these suitability layers, we present habitat suitability as two independent layers: vegetation and slope, because these are most often cited as the predominant suitability drivers. In addition, we also considered road density as a third factor affecting habitat suitability, however the degree of disturbance and habitat fragmentation associated with these roads, which are predominantly on private lands, could not be assessed due to lack of specific data.

Vegetation

Vegetation information for the mapped pronghorn range on Tejon Ranch was obtained from GIS layers that are publicly available. We used the western Mojave vegetation layer (Fig. 19, online http://projects.atlas.ca.gov/frs/?group_id=42&release_id=229) and, following Longshore and Lowry (2008), assigned the following rank values to the individual vegetation types:

Table 1: Habitat types and their associated rank of suitability for pronghorn (after Longshore and Lowry, 2008)

Vegetation type	Suitability rank (1=best, 10=least)
Agriculture	2
Conifer Woodland	10
Desert Shrub	3
Desert Woodland	6
Hardwood Forest	9
Herbaceous	1
Shrub	3
Urban	10
Water	5

Suitability ranks for vegetation for the majority of the area were high: over 90% of the area is ranked 3 or higher in habitat suitability (Table 2). Herbaceous (including grassland vegetation types) occupied 34% of the area – this type also occurs in the largest contiguous patches and is the highest-ranking vegetation type for pronghorn. The area has some of the best preserved native perennial grasslands and high-quality bunchgrass communities in southern California. Vollmar Consulting was hired by the project proponents to characterize the vegetation communities of the project site in 2003 and 2004. They "discovered one of the largest intact stands of native perennial bunchgrasses known in the state." (Vollmar Consulting 2007, Fig. 20). Unfortunately, these vegetation data layers could not be obtained for a more detailed analysis. The second and third-best ranked habitats (agricultural, shrub and desert scrub communities) occupied an additional 54%.

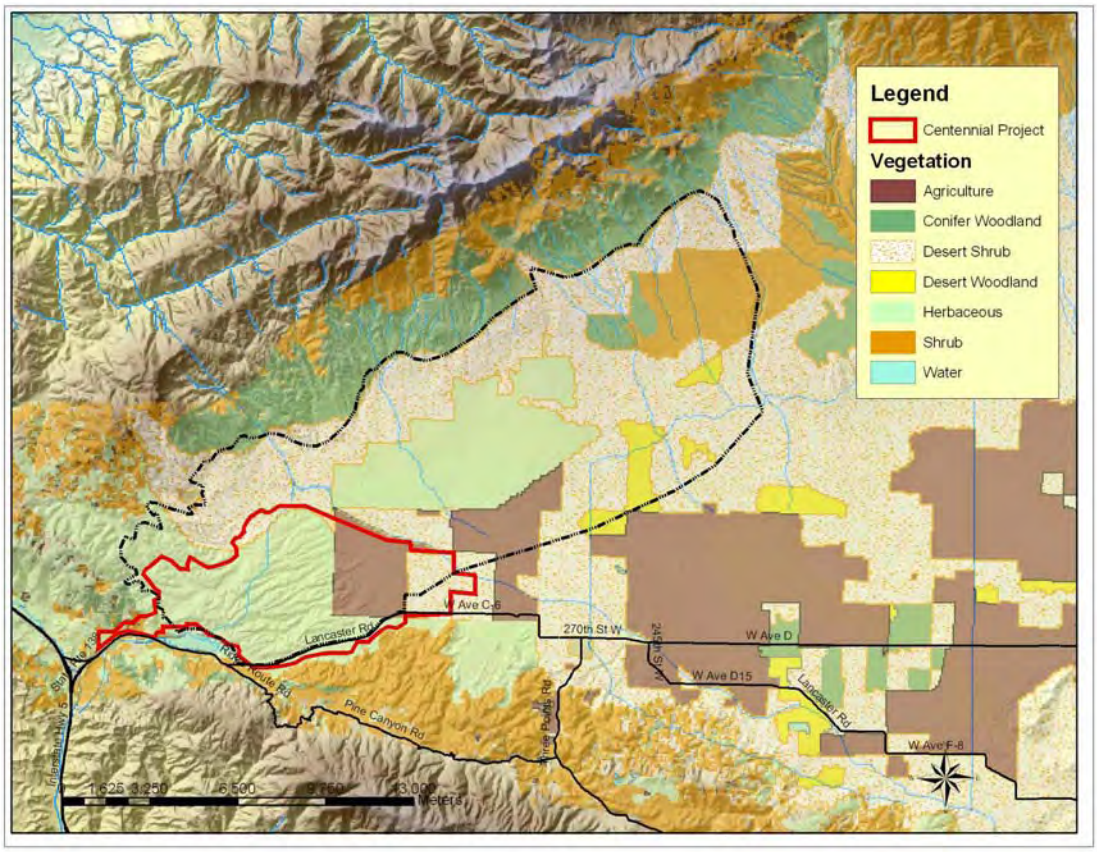


Figure 19: Vegetation map showing the Tejon Ranch core pronghorn range and the proposed Centennial development (outlined in red).

Table 2: Vegetation types, their ranks for pronghorn habitat suitability and their respective area for the Tejon Ranch pronghorn range.

Habitat	Rank	acres	hectares	% of area
Grassland/herbaceous	1	15,555	6,295	33%
Agriculture	2	4227	1,711	9%
Desert Shrub	3	21,396	8,659	45%
Shrub	3	3,315	1,342	7%
Water	5	3	1	0%
Desert Woodland	6	1,387	561	3%
Hardwood Forest	9	5	2	0%
Conifer Woodland	10	1,201	486	3%
Urban	10	4	2	0%
	TOTAL	47,094	19,058	100%

Slope

Slope is an important indicator of pronghorn habitat suitability. Studies suggest that pronghorn avoid slopes >20% and apparently prefer areas where the slopes are <10% (Yoakum 2004a, Longshore and Lowry 2008). Thus we determined the topography suitability by evaluating the slope of the area based on a digital elevation model (DEM) in GIS. The average slope of the core pronghorn range was 21 percent (SD=20.3). Because of the high variability of slopes within the core pronghorn range, we mapped slope suitability based on the following ranking: 0-10% = high, 10-20% = medium, > 20% = low. The resulting map showed that a large portion of the lowest sloped areas were located within or adjacent the proposed Centennial development (Fig. 21). However, the project area also contained a large portion of the lowest slope suitability class.

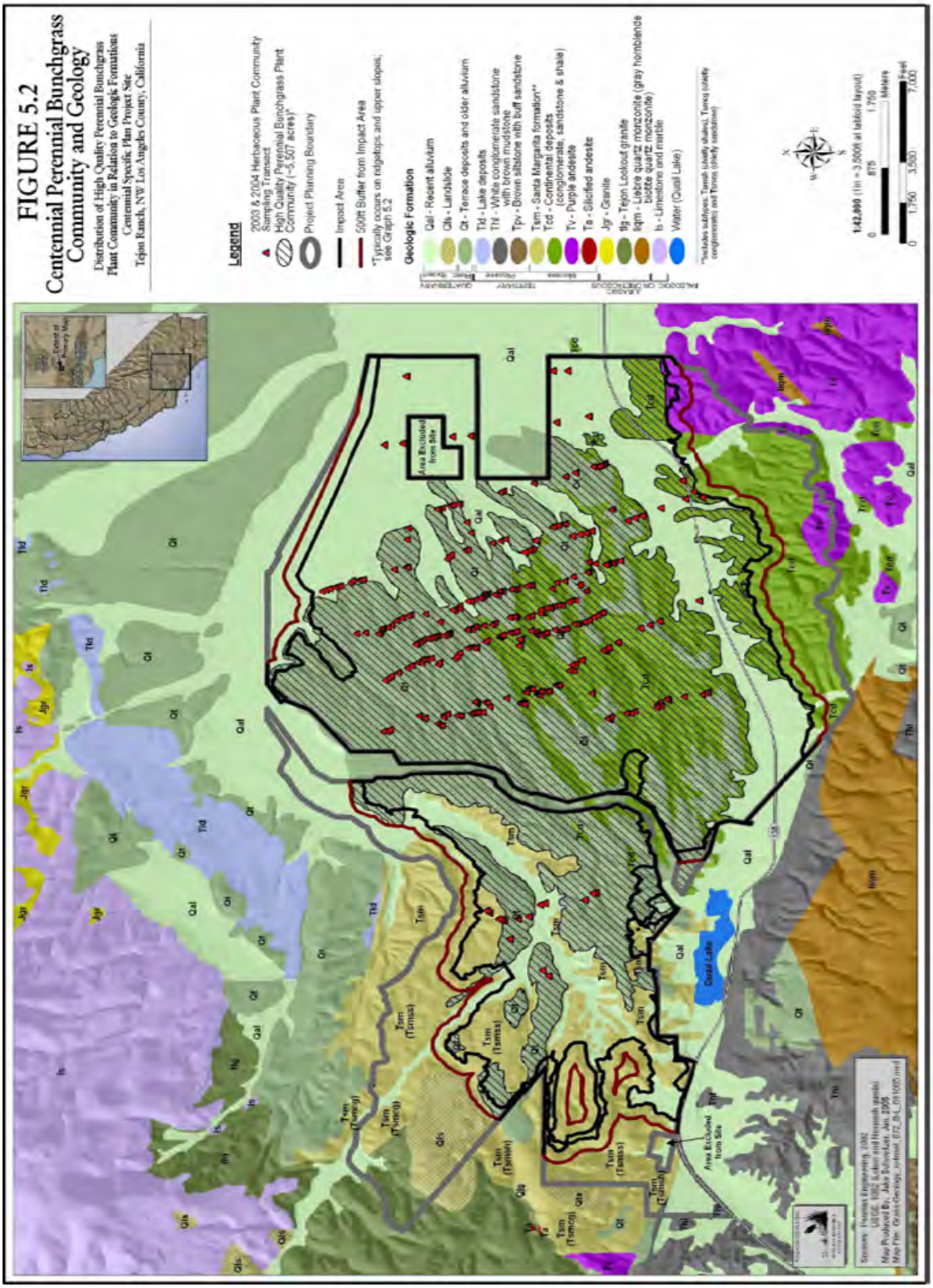


Figure 20: Native bunchgrass communities of the Centennial project site (Vollmar Consulting 2007)

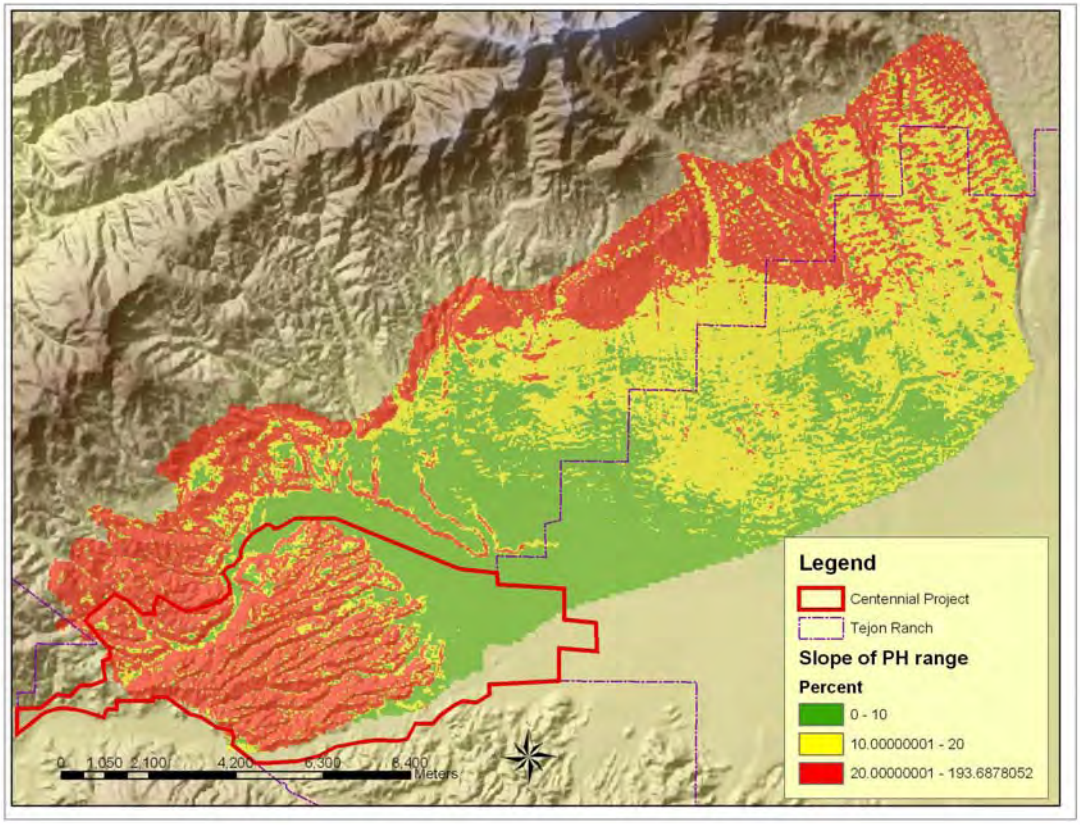


Figure 21: Slope suitability for pronghorn at Tejon Ranch.

Roads

Road density is highest on private lands outside Tejon Ranch (Fig. 22). The effect of roads on pronghorn habitat suitability depends largely on the frequency and speed of vehicular traffic and whether these roads are fenced. Based on our observations while traveling the pronghorn core area, it was noted that few roads exist and these were generally not fenced, most were dirt, and numerous locks on gates limited public access (the road to the cement factor being an exception). This implies that current roads on the Ranch appear to have limited impact on pronghorn populations. Noteworthy in this context is the fact that the proposed project area is virtually free of any roads, and hence probably has the lowest current disturbance frequency for pronghorn. However, the density of roads on the Centennial Project will be high and pose a negative influence on pronghorn. Also, roads in the southeastern part of the range not on Tejon Ranch have abundant small housing developments and agriculture fields, resulting in higher road densities. Pronghorn currently appear to use these lands infrequently.

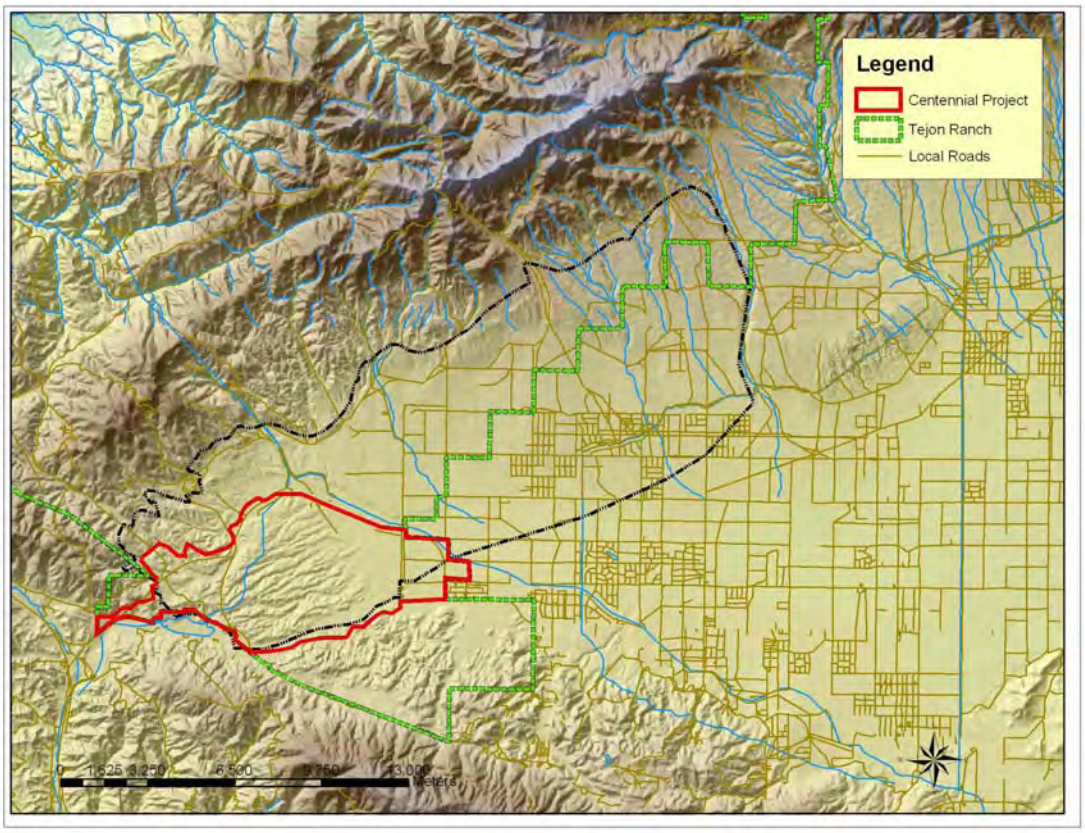


Figure 22: Location of local roads in and surrounding the core pronghorn range on Tejon Ranch.

3.3.2 Other factors

Illegal kills on private lands are apparently an issue affecting mortality of adult pronghorn (T. Mattias, pers. comm.). Commercial hunting of male pronghorn has occurred at low intensity during the past years on Tejon Ranch.

Predation by coyotes is currently unknown and most likely related to the height and density of vegetation during fawning. The strong rainfall effect may also be related to predation: in years following sufficient rainfall, vegetation is probably higher and denser and thus conceals fawns better, resulting in higher fawn survival.

Livestock grazing (sheep and cattle) occurs on the majority of Tejon Ranch rangelands. Sheep are occasionally grazed on the eastern part of the Ranch within the proposed project area. Numerous fences, watering systems, corrals, and other grazing related improvements are located throughout the core pronghorn area (T. Mathias, pers. comm.). Water development installed for livestock are generally beneficial for pronghorn. In addition there are many small streams providing drinking water for livestock and wildlife. Barbed wire fences built to control cattle, do not meet "pronghorn friendly" specifications identified in Autenrieth et al. 2006; however, pronghorn in the past seem to have negotiated these structures. These fences are now deteriorating and provide sites where the bottom wire is high enough for pronghorn to pass under without difficulty. Woven-wire fences appear rare on the pronghorn core area, likely because sheep are usually attended by herders. This is a major asset to pronghorn as woven-wire fences seriously impact the seasonal movements of pronghorn herds on other western rangelands.

3.4 Conclusions

Wild, free native pronghorn have been restored by the California Department of Fish and Game on the Tejon Ranch for two decades. These herds are the most southern in California and reminiscent of the thousands that historically roamed the rangelands of the Golden State. However, this population faces several factors that currently affect its viability to persist in the future.

1. Small population size: The long-term viability of small, isolated populations is often threatened by stochasticity and bottlenecks. Although almost 100 individuals were originally translocated to Tejon Ranch, the population has subsequently declined to a perilous size of less than 50 animals. This population appears to be critically endangered due to its current population size and its historic trend of remaining small and isolated. Pending a comprehensive Population Viability Analysis for southern California pronghorn, inferences maybe drawn from similarly small populations. For example, Hosack et al. (2002) used Population Viability Analysis for a small population of Sonoran pronghorn in Arizona currently numbering between 130 and 160 animals. Sonoran pronghorn population growth is most sensitive to low fawn survival rates, but adult survival rates were also strongly correlated with the likelihood of population survival. Modeling results indicated that Sonoran pronghorn have a 1% probability of extinction within the next 25 years, a 9% probability of

extinction within the next 50 years, and a 23% probability of extinction within 100 years. The analysis furthermore suggested that if the population size falls below approximately 100 individuals, the probability of extinction increases markedly. Dunn and Byers (2008) described a demographic bottleneck following a drought at the National Bison Range in Montana. Their results emphasize the need to maintain genetic variation and limit inbreeding in small, isolated populations, and to account for stochasticity in population viability assessments and long-term management planning.

2. Low population growth rates: The herd currently has a low potential for sustained growth, with observed maximum per-capita growth rates (r= 0.38) falling far below the biologically possible value in other ranges (r=0.70, Kohlmann 2004). The low growth of the herd is probably a function of its small population size, where even small losses of adults or fawns affect the overall population significantly. Vegetation and habitat analysis data (Koch and Yoakum 2002) indicated that the habitat was in relatively good condition. However, since these surveys, livestock foraging has been apparently intense and standing biomass has declined to the detriment of pronghorn neonate protective cover, and abundant nutritious forage. Apparently, livestock management has greatly changed during the last decade on certain Tejon Ranch rangelands. This loss will be exacerbated by the Centennial Project, for the forage on these rangelands will eventually be lost when the project is completed.

3. Climatic variability: Pronghorn at the Tejon Ranch exist under a highly variable precipitation regime. There is a robust relationship between autumn fawn ratios and the autumn precipitation two years prior and between the wet season precipitation and instantaneous growth rates. Based on this relationship, a predicted wet season precipitation of 7.2 inches must be achieved for positive population growth.

4. Vegetation quality: The expansive perennial grasslands of a high quality are probably the reason why this population is still marginally persistent. Losing only a portion of these grasslands or a persistent degradation by livestock grazing could severely impact this highly vulnerable population.

5. Landscape connectivity. Pronghorn at Tejon Ranch are currently isolated from other herds. Given the small population size and stochastic vulnerability of this herd, the establishment of a meta-population through migration corridors is of critical importance. This would allow animals to shift among seasonal ranges and to exchange genetic material. Currently, little is known if and where pronghorn might migrate across the Tehachapi Mountains to connect with other herds. Pronghorn from Carrizo Plain have moved as far east as the Tejon Industrial Complex and Windwolves Preserve near Grapevine.

6. Genetics: Genetic variability is influenced by small founding population, persistently small population size, and isolation by geographic features (e.g., mountain ridges, unsuitable habitat) or human induced barriers (e.g., fences, fragmented landscapes). All these factors are prevalent at the Tejon Ranch pronghorn population. However, genetic variation within the Tejon Ranch pronghorn population has not been studied. In absence of genetic data, the "50/500" rule of thumb initially proposed by Franklin (1980) and Soule (1980) may be used to assess the population's risk of experiencing deleterious genetic processes. The rule recommends a short-term effective population size (N_e) of 50 adults to prevent inbreeding, and a long-term N_e of 500 adults to maintain overall genetic variability. The pronghorn

population at Tejon Ranch falls short of both goals and hence is critically in danger of having lost genetic variability.

Chapter 4
References

Alexander, A. and R. A. Ockenfels. 1994. Juniper densities relative to pronghorn use in central Arizona. Proceedings Pronghorn Antelope Workshop 16:75-85.

Alldredge, A. W., Deblinger, R. D., and J. Peterson. 1991. Birth and fawn bed site selection by pronghorns in a sagebrush-steppe community. Journal Wildlife Management 55:222-227.

Allen, A. W. and M. J. Armbruster. 1982. Preliminary evaluation of habitat suitability model for the pronghorn. Proceedings Pronghorn Antelope Workshop 10:93-105.

Allen, A. W., Cook, J. G., and M. J. Armbruster. 1984. Habitat suitability index models: Pronghorn. FWS/OBS-82/10.65. U.S. Department of the Interior. Fish and Wildlife Service. Washington, D.C., USA.

Amor, C. D., O. A. Ryder, R. Romey, and R. A. Medellin. 2001. Genetic variation among pronghorn populations using mitochondrial DNA control region as a molecular marker. Proceedings Pronghorn Antelope Workshop 19: 106.

Amstrup, S. C. 1978. Activities and habitat use patterns of pronghorns on Montana-Wyoming coal lands. Proceedings Pronghorn Antelope Workshop 8:270-304.

Andersen, C., B. Dobrowski, M. Harris, E. Moreno, and P. Roehrdanz. 2009. Conservation assessment for the Cuyama Valley: Current conditions and planning scenarios. Group project final report, Donald Bren School of Environmental Science & Management, University of California, Santa Barbara, 82 pp. accessed online May 29, 2009 at http://www2.bren.ucsb.edu/~tnc2/CuyamaGP_FinalReport_2009.pdf.

Anderson, L. D. and J. W. Denton. 1980. Adjustable wire fences for facilitating big game movement. Technical Note 343. U.S. Bureau Land Management Service Center, Denver, Colorado, USA.

Aoude, A., and R. E. Danvir. 2004. Using range manipulations to increase pronghorn carrying capacity. Proceedings Pronghorn Antelope Workshop 20:124-135.

Arizona Game and Fish Department. 1993. Game management program. Appendix 8: Prioritizing antelope transplant sites. Arizona Game and Fish Department, Phoenix, Arizona, USA.

Arizona Department of Game and Fish. 2006. Arizona Statewide Pronghorn Operational Plan. Available online at http://www.azgfd.gov/h_f/documents /PronghornOperationalPlan050327.pdf

Arizona Department of Game and Fish. 2007. Pronghorn management plan. Available online at http://www.azgfd.gov/pdfs/h_f/guidelines/pronghorn %20management%20plan%20december%207%202007%20-%20final.pdf.

Arrington, O. N., and A. E. Edwards. 1951. Predator control as a factor in antelope management. Transactions North American Wildlife and Natural Resources Conference 16:179–193.

Autenrieth, R. E. 1976. A study of birth sites selected by pronghorn does and the bed sites of fawns. Proceedings Pronghorn Antelope Workshop 7:127-134.

Autenrieth, R. E. 1978. Antelope fawning and bedding site vegetation analysis. Pages 32-37 *in* Greenley, J. C. Antelope ecology. Idaho Department of Fish and Game. Boise, Idaho, USA.

Autenrieth, R. E. 1978. Guidelines for the management of pronghorn antelope. Proceedings Pronghorn Antelope Workshop 8:472-526

Autenrieth, R. E. 1984. Little lost pronghorn fawn study - condition, habitat use and mortality. Proceedings Pronghorn Antelope Workshop 11:49-70.

Autenrieth, R. E. and E. Fichter. 1975. On the behavior and socialization of pronghorn fawns. Wildlife Monographs 42:1–111.

Autenrieth, R. E, D. E. Brown, J. Cancino, R. M. Lee, R. A. Ockenfels, B. W. O'Gara, T. M. Pojar, and J. D. Yoakum. 2006. Pronghorn Management Guide. Proceedings Pronghorn Workshop 21. Available online at http://gf.nd.gov/multimedia/pubs/prong-mgmt-guide-pdf-ndx.html.

Bailey, V. 1932. The Oregon antelope. Proceedings Biological Society of Washington 45:45-46.

Baker, T. C. 1953. Antelope movement and migration studies. Wyoming Wildlife 17(10):31-36.

Barrett. M. W. 1974. Importance, utilization, and quality of *Artemisia cana* on pronghorn winter ranges in Alberta. Proceedings Pronghorn Antelope Workshop 6:26-56.

Barrett, M. W. 1978. Pronghorn fawn mortality in Alberta. Proceedings Pronghorn Antelope Workshop 8:429-444.

Barrett, M. W. 1981. Environmental characteristics and functional significance of pronghorn fawn bedding sites in Alberta. Journal Wildlife Management 45:120-131.

Barrett, M. W. 1982. Distribution, behavior, and mortality of pronghorns during a severe winter in Alberta. Journal Wildlife Management 46:991–1002.

Barrett, M. W. 1984. Movements, habitat use, and predation on pronghorn fawns in Alberta. Journal of Wildlife Management 48:542–550.

Barnowe-Meyer, K. K., P. J. White, T. L. Davis, and J. A. Byers 2009. Predator-specific mortality of pronghorn on Yellowstone's Northern Range. Western North American Naturalist 69:186–194.

Bayless, S. R. 1969. Winter food habits, range use, and home range of antelope in central Montana. Journal Wildlife Management 33:538-550.

Bayless, S. R. 1971. Relationships between big game and sagebrush. Proceedings Annual Meeting of the Northwest Section of the Wildlife Society, Bozeman Montana, USA.

Beale, D. M., and A. D. Smith. 1970. Forage use, water consumption, and productivity of pronghorn antelope in western Utah. Journal Wildlife Management. 34(3): 570-582.

Beale, D. M. and R. C. Holmgren. 1975. Water requirements for pronghorn antelope survival and growth. Utah Division Wildlife Resources, Salt Lake City, Utah, USA.

Bear, G. D. 1969. Antelope and net wire fences. Proceedings Western Association State Game and Fish Commissioners 49:265-271.

Becker, B. W. 1972. Pronghorn—cattle range use and food habits relationships in an enclosed sagebrush control area. Thesis, Montana State University, Bozeman, Montana, USA.

Berger, J., K. Berger and J. Beckman. 2006. Wildlife and energy development: Pronghorn of the Upper Green River Basin – Year 1 Summary. The Wildlife Conservation Society. Jackson, Wyoming. Summary online at http://www.ourpubliclands.org/ resources/BergerSummary.

Berger, J., S. L. Cain and K. Murray Berger. 2006. Connecting the dots: An invariant migration corridor links the holocene to the present. Biology Letters 2:528-531.

Bright, J. L. and C. van Riper III. 2000. Habitat selection by pronghorn antelope at Wupatki National Monument, Arizona. proceddings pronghorn Workshop 17:77-85.

Bright, J. L. and J. J. Hervert. 2005. Adult and fawn mortality of Sonoran pronghorn. Wildlife Society Bulletin 33:43–50.

Britt, T. L. 1980. Reestablishment of pronghorn antelope on the Arizona Strip. Proceedings Pronghorn Antelope Workshop 9:226-245.

Bromley, P. T. 1968. Territoriality in pronghorn bucks on the National Bison Range, Moiese, MT. Journal Mammalogy 50:81-89.

Bromley, P. T. 1977. Aspects of the behavioral ecology and sociobiology of the pronghorn (*Antilocapra americana*). Dissertation, University of Calgary, Edmonton, Alberta, Canada.

Bromley, P. T. 1978. Ultimate factors, behavior, and fawn recruitment. Proceedings Pronghorn Antelope Workshop 8:449-471.

Brown, D. E. 1994. Grasslands. Part 4. Pages 106-141 *in* D. Brown, editor. Biotic communities. Southwestern United States and northwestern Mexico. University Utah Press, Salt Lake City, Utah, USA.

Brown, D. E. 2006. An evolutionary history of pronghorn habitat and its effect on taxonomic differentiation. Proceedings Pronghorn Antelope Workshop 22: 97-124.

Brown, D. E, D. Warnecke, and T. McKinney. 2006. Effects of midsummer drought on mortality of doe pronghorn (*Antilocapra americana*). Southwestern Naturalist 51(2):220-225.

Brown, D. E., W. F. Fagon, R. Lee, H. G. Shaw and R. B. Turner. 2002. Winter precipitation and pronghorn fawn survival in the Southwest. Proceedings Pronghorn Antelope Workshop 20:115-122.

Bruns, E. H. 1977. Winter behavior of pronghorns in relation to habitat. Journal Wildlife Management 41:560-571.

Bryant, F. C. and S. K. Canon. 2006. Home range and survival of pronghorn in the Trans-Pecos region of Texas. Pages 23-39 in K .A. Cearley and S. Nelle, Pronghorn Symposium 2006. Texas Cooperative Extension, College Station, Texas, USA.

Bonenfant, C., J. Gaillard, F. Klein, and J. Hamann. 2005. Can we use the young:female ratio to infer ungulate population dynamics? An empirical test using red deer *Cervus elaphus* as a model. Journal of Applied Ecology 42:361–370.

BonTerra Consulting, 2008. Biota Report For the Centennial Specific Plan In Northwestern Antelope Valley Los Angeles County, California. Project Number 02-232. Online at http://www.cuddyvalley.org/projects/centennial/biota_may_08/Biota%20Report%20Text.pdf

Buechner, H. K. 1950. Life history, ecology, and range use of the pronghorn antelope in Trans-Pecos Texas. American Midland Naturalist. 43(2): 257-354.

Byers J. A, and J. D. Moodie 1990. Sex-specific maternal investment in pronghorn, and the question of a limit on differential provisioning in ungulates. Behavioral Ecology and Sociobiology 26:157–164.

Byers, J. A. 2003. Pronghorn (*Antilocapra americana*). *In*: G. Feldhammer, B. Thompson, and J. Chapman, Wild Mammals of North America. Johns Hopkins University Press, Baltimore, Maryland, USA.

Byers, J. A. and J. T. Hogg. 1995. Environmental effects on prenatal growth rate in pronghorn and bighorn: further evidence for energy constraint on sex-biased maternal expenditure. Behavioral Ecology 6:451–457.

Byers, J. A. and K. Z. Byers. 1983. Do pronghorn mothers reveal the locations of their hidden fawns? Behavioral Ecology and Sociobiology 13:147–156.

Byers, J. A., and D. W. Kitchen. 1988. Mating system shift in a pronghorn population. Behavioral Ecology and Sociobiology 22:355-360.

Byers, J. A. 1997. American pronghorn. Social adaptations and the ghosts of predators past. University of Chicago Press, Chicago, Illinois, USA.

California Department of Fish and Game. 2000a. California Wildlife Habitat Relationship Database System, Version 7.0. Computer database and program. California Department of Fish and Game, Sacramento, California, USA

California Department of Fish and Game. 2000b. Life history account for pronghorn. Available online at http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=17936.

Campbell, R. B. 1972. Pronghorn, sheep and cattle range relationships in southeastern Montana. Proceedings Pronghorn Antelope Workshop 5:103-105.

Cancino, J., Castellanos, J. Holland, F. Ramirez, and V. Sánchez. 2004. The peninsular pronghorn recovery plan: 20 years. Proceedings Pronghorn Antelope Workshop 21:96-101

Canon, S. K, and F. C. Bryant. 1990. Fawn survival and bed site characteristics of Trans Pecos pronghorn. *In:* Webster, D. B., and H. L. Schramm, Jr., Research highlights: Noxious brush and weed control, range and wildlife management. 21:21-22, Texas Tech University, Lubbock, Texas, USA.

Canon, S. K., and F. C. Bryant. 1992. Survival of Trans-Pecos pronghorn. Proceedings Pronghorn Antelope Workshop 15: 67-77.

Canon, S. K., and F. C. Bryant. 1997. Bed-site characteristics of pronghorn fawns. Journal Wildlife Management 61:1134-1141.

Carling, M. D., C. Passavant, and J. A. Byers. 2003. DNA microsatellites of pronghorn (*Antilocapra americana*). Molecular Ecology Notes 3:10-11.

Carlton, C. and T. McKean. 1977. The carotid and orbital retia of the pronghorn, deer, and elk. Anatomical Records 189:91-108.

Caslick, J. 1998. Yellowstone pronghorns: relict herd in a shrinking habitat. Yellowstone Science 6:20–24.

Caton, J. D. 1877. The antelope and deer of America. Hurd and Houghton, New York, New York, USA.

Center for Biological Diversity, 2008. Key county panel rejects Tejon's enormous centennial project. E-wire press release, online at http://www.ewire.com/display.cfm/ Wire_ID/4993.

Chattin, J. E., and R. W. Lassen. 1950. California antelope reproductive potentials. Calif. Fish and Game 36:328-329.

Clark, M. J. 2006. Landscape-Level modeling for pronghorn habitat restoration planning on Anderson Mesa, Arizona, Thesis, Northern Arizona University, Flagstaff, Arizona, USA.

Clary, W. P., and D. M. Beale. 1983. Pronghorn reactions to winter sheep grazing, plant communities, and topography in the Great Basin. Journal Range Management. 36:749-752.

Clausen, A. 1999. Behavioral correlates of fawning, territorial and breeding activities in a pronghorn antelope (*Antilocapra americana*) population on the Carrizo Plains, California. Thesis, California Polytechnic State University, San Luis Obispo, California, USA.

Clemente, F., R. Valdez, J. L. Holechek, P. J. Zwank and M. Cardenas 1995. Pronghorn home range relative to permanent water in southern New Mexico. Southwestern Naturalist 40:38-41.

Clemente F., R. Valdez and J. Holechek. 2006. Pronghorn numbers on late and mid seral Chihuahuan Desert rangelands. Pages 53-58 *in* K.A. Cearley and S. Nelle, Pronghorn Symposium 2006. Texas Cooperative Extension, College Station, Texas, USA.

Clevenger, A. P. and N. Waltho. 2003. Longterm, year-round monitoring of wildlife crossing structures and the importance of temporal and spatial variability in performance studies. Proceedings of the International Conference on Ecology and Transportation (ICOET), pp.293-302.

Cohn, J. P. 2007. Return of the pronghorn. Bioscience 57(4):317-320.

Cole, G. F. and B. T Wilkins. 1958. The pronghorn antelope, its range use and food habits in central Montana with special reference to wheat. Technical Bulletin 2, Montana Fish and Game Department, Helena, Montana, USA.

Compton, H. O. 1970. Southeastern Montana antelope population trends in relation to severe winters. Proceedings Pronghorn Antelope Workshop 4:50-54.

Cook, J. G., L. L. Irwin, A .W. Allen, and M. J. Armbruster. 1984. A field test of a winter pronghorn suitability index model. Proceedings Pronghorn Antelope Workshop 11:207-211.

Copeland, G. L. 1980. Antelope buck breeding behavior, habitat selection and hunting impact. Wildlife Bulletin 8. Idaho Fish and Game Department, Boise, Idaho, USA.

Courtney, R. F. 1989. Pronghorn use of recently burned mixed prairie in Alberta. Journal Wildlife Management. 53(2): 302-305.

Creek, D. E. 1967. A summary of pronghorn antelope investigations. Wyoming Game and Fish zdepartment, Cheyenne, Wyoming, USA.

Cronin, M. A., R. Stuart, B. J. Pierson, and J. C. Patton. 1996. K-casein gene phylogeny of higher ruminants (Pecora, Artiodactyla). Molecular Phylogenetics and Evolution 6:295-311.

Cutler, P. L. 1996. Wildlife use of two artificial water developments on the Cabeza Prieta National Wildlife Refuge, Southwestern Arizona. Thesis, University of Arizona, Tucson, Arizona, USA.

Danvir, R. E. 2000. Environmental and density-dependent effects on a northern Utah pronghorn population. Proceedings Pronghorn Antelope Workshop 17:36-41.

Deming, O. V. 1963. Antelope and sagebrush. Pages 55-60. Transactions Interstate Antelope Conference, 4:55-60

Dennehy, J. J. 2001. Influence of social dominance rank on diet quality of pronghorn females. Behavioral Ecology 12:177-181.

Dirschl, H. J. 1963. Food habits of the pronghorn in Saskatchewan. Journal Wildlife Management 27:81-93.

Dubay, S. A., T. H. Noon, J. C. deVos, Jr. and R. A. Ockenfels. 2006. Serologic survey for pathogens potentially affecting pronghorn (*Antilocapra americana*) Fawn recruitment in Arizona, USA. Journal Wildlife Diseases 42: 844-848.

Dunbar. M. R., R. Velarde, M.A. Gregg, and M. Bray. 1999. Health evaluation of a pronghorn antelope population in Oregon. Journal Wildlife Diseases 35:496-510.

Dunn, S. J. and J. A. Byers. 2008. Determinants of survival and fecundity through a population bottleneck in pronghorn (*Antilocapra americana*). Journal Mammalogy 89:1124-1129.

Easterly, T. A. Wood, and T. Litchfield. 1991. Responses of pronghorn and mule deer to petroleum development on crucial winter range in the Rattlesnake Hills. Unpublished completion report, Wyoming Game & Fish Department. Cheyenne, Wyoming, USA.

Edwards, C. L., and R. D. Ohmart. 1981. Food habits of the Sonoran pronghorn. 1981. Pages 34-44 *in* Anonymous. The Sonoran pronghorn. Special Report 10. Arizona Game and Fish Department, Phoenix, Arizona, USA.

Einarsen, A. S. 1948. The pronghorn antelope and its management. Monument printing, Baltimore, Maryland, USA.

Elliot, D. G. 1907. A catalogue of the collection of mammals in the Field Columbian Museum. Field Columbian Museum Zoological Series 115:1-694.

Ellis, J. E. 1970. A computer analysis of fawn survival in the pronghorn antelope. Dissertation, University California, Davis, Califonia, USA.

Ellis, J. E., and M. Travis. 1975. Comparative aspects of foraging behavior of pronghorn antelope and cattle. Journal Applied Ecology 12:411–420.

Fairbanks, W. S. 1994. Dominance, age, and aggression among female pronghorn, *Antilocapra americana* (Family: Antilocapridae). Ethology 97:278-293.

Ferrel, C. M., and H. R. Leach. 1952. The pronghorn antelope of California with special reference to food habits. California Fish and Game 53:285-293.

Fichter, E. 1972. On the bedding behavior of pronghorn. Proceedings Pronghorn Antelope Workshop 5: 255-257.

Fournier, F. and M. Festa-Bianchet. 1995. Social dominance relationships in adult female mountain goats. Animal Behaviour 49: 1449-1459.

Fox, L. M. 1997. Nutritional content of forage in Sonoran pronghorn habitat, Arizona. Thesis, University of Arizona, Tucson, USA.

Fox, L. M., P. R. Krausman, M. L. Morrison, and T. H. Noon. 2000. Mineral content of Sonoran pronghorn forage. California Fish and Game 86: 159-174.

Franklin, J.R. 1980. Evolutionary change in small populations. In: Soulé, M.E. and B. A. Wilcox. Conservation biology. An evolutionary-ecological perspective. Sinauer, Sunderland, pp. 135–149.

Freeland, W. J., and D. H. Janzen. 1974. Strategies in herbivory by mammals: The role of plant secondary compounds. American Naturalist 108:269-286.

Gates, C., P. Jones , D. Eslinger, K. Sheriff, M. Grue , D. Bender, M. Suitor , T. Seagel, P. Knaga, K. Morton, K. Kunkel, and P. Gogan, 2006. Pronghorn as a focal species for conservation planning in the Northern Great Plains. Proceedings Pronghorn Workshop 22: 197.

Gavin, S. D. and P. E. Komers. 2006. Do pronghorn (*Antilocapra americana*) perceive roads as a predation risk? Canadian Journal of Zoology 84:1775–1780.

Gilbert, B. K. 1973. Scent marking and territoriality in pronghorn (*Antilocapra americana*) in Yellowstone National Park. Mammalia 37:25-33.

Gilpin, M. E., and M. E. Soule. 1986. Minimum viable populations: Processes of species extinction. Pages 19-34 *in* M. E. Soule. Conservation biology: The science of scarcity and diversity. Sinauer Associates, Sunderland, Maryland, USA.

Goldman, E. A. 1945. A new pronghorn antelope from Sonora. Proceedings Biological Society of Washington 58:3-4.

Goldsmith, A. E. 1988. History and research on reintroduction of pronghorn in California. Pages 288-297 *in:* Neilson, L., Brown, R. D., Translocation of wild animals. Wisconsin Humane Society, Wisconsin, USA.

Goldsmith, A. E. 1990. Vigilance behavior of pronghorn in different habitats. Journal Mammalogy 71:460-462.

Goodwin, G. A. 1976. Golden eagle predation on pronghorn antelope. Auk 94: 789-790.

Gregg, M. A., M. Bray, K. M. Kilbride, and M. R. Dunbar. 2001. Birth synchrony and survival of pronghorn fawns. Journal Wildlife Management 65:19-24.

Grogan, R. and F. Lindzey. 2007. Pronghorn Survival in Wyoming. Final Report Prepared for Wyoming Game and Fish Department, Laramie, Wyoming, USA. online at http://www.uwyo.edu/wycoopunitsupport/docs/Pronghorn%20Survival%20Final%20Report%202007.pdf.

Gross, B. D., J. L. Holechek, D. Hallford and R. D. Pieper. 1983. Effectiveness of antelope pass structures in restriction of livestock. Journal Range Management. 36:22-24.

Guenzel, R. J. 1986. Pronghorn ecology in southcentral Wyoming. Thesis, University of Wyoming, Laramie, Wyoming.

Guenzel, R.J., L. L. Irwin and T. J. Ryder. 1982. A comparison of pronghorn movements and distributions during a normal and a mild winter in the Red Rim area, Wyoming. Proceedings Pronghorn Antelope Workshop 10:156-172.

Hacker, D. G. 2002. Pronghorn and a California highway: potential impacts and mitigation. Proceedings Pronghorn Antelope Workshop 20:143-152.

Hailey, T. L. 1979. A handbook for pronghorn antelope management in Texas. Texas Parks and Wildlife Department, Austin, Texas, USA.

Hailey, T. L. and R. DeArment. 1972. Droughts and fences restrict pronghorns. Proceedings Pronghorn Antelope Workshop 5:22-24.

Hailey, T. L., J. W. Thomas, and R. M. Robinson. 1966. Pronghorn die-off in Trans-Pecos. Journal Wildlife Management 30: 448-496.

Hansen, E. L. 1955. Survival of pronghorn antelope in south-central Oregon during 1953 and 1954. Thesis. Oregon State College, Corvallis, Oregon, USA.

Hansen, M. C., J. D. Yoakum, W. H. Pyle, and R. G. Anthony. 2001. New strategies for pronghorn food habit studies. Proceedings Pronghorn Antelope Workshop 19:71-94.

Harrington, J. L., and M. R. Conover. 2007. Does removing coyotes for livestock protection benefit free-ranging ungulates? Journal Wildlife Management. 71:1555–1560.

Harris, N. C, M. J. Kauffman and L. S. Mills 2008. Inferences about ungulate population dynamics derived from age ratios. Journal of Wildlife Management 72(5):1143-1151.

Heady, H. F. and R. D. Child. 1994. Rangeland ecology and management. Westview Press, San Francisco, California, USA.

Hebert, J., A. Lust, A. Fuller, S. K. Maloney, D. Mitchell and G. Mitchell. 2008. Thermoregulation in pronghorn antelope (*Antilocapra americana*, Ord) in winter. Journal Experimental Biology 211:749-756.

Heffelfinger, J. R., R. J. Olding, T. H. Noon, M. R. Shupe, And D. P. Betzer. 1999. Copper/Selenium levels and occurrence of bluetongue virus in Arizona pronghorn. Proceedings Pronghorn Antelope Workshop 18:32–42.

Hepworth, W.G. 1965. Investigations of pronghorn antelope in Wyoming. Proceedings Pronghorn Antelope Workshop 1:1-12.

Hepworth, W.G. and F. Blunt. 1966. Research findings on Wyoming antelope. Special Antelope Issue. Wyoming Wildlife 30(6):24-29.

Hervert, J. J., J .L. Bright, M. T. Brown, L. A. Priest and R. S. Henry. 2000. Sonoran pronghorn monitoring: 1994-1998. Nongame and Endangered Species Program Technical Report 16. Arizona Game and Fish Department, Phoenix, Arizona, USA.

Hervert, J. J., J. L. Bright, R. S. Henry, L. A. Priest, and M. T. Brown. 2005. Home range and habitat use patterns of Sonoran pronghorn in Arizona. Wildlife Society Bulletin 33:8–15.

Hess, M. L. 1999. Density dependent summer pronghorn survival rates in the northwestern Great Basin-revisited. Proceedings Pronghorn Antelope Workshop 18:107.

Hofmann, R. R. 1989. Evolutionary steps of ecophysiological adaptation and diversification of ruminants: A comparative view of their digestive system. Oecologia 78:443-457.

Honeycutt, R. L. 2000. Genetic applications for large mammals. Pp. 233-259 in S. Demarais and P. R. Krausman. Ecology and management of large mammals in North America. Prentice Hall, Upper Saddle River, New Jersey, USA.

Hoover, R. L., C. E. Till, and S. Ogilvie. 1959. The antelope of Colorado. Technical Bulletin 4, Colorado Department of Fish and Game, Denver, Colorado, USA.

Hoover, R. L. 1966. Antelope food habits and range relationships in Colorado. Proceedings Pronghorn Antelope Workshop 2:75-85.

Hosack, D. A., P. S. Miller, J. J. Hervert, and R. C. Lacy. 2002. A population viability analysis for the endangered Sonoran pronghorn, *Antilocapra americana sonoriensis*. Mammalia 66:207–229.

Hoskinson, R. L. and J. R. Tester. 1980. Migration behavior of pronghorn in southeastern Idaho. Journal Wildlife Management 44:132–144.

Howard, V. W., J. L. Holechek, R. D. Pieper, K. Green-Hammond, M. Cardenas, and S. L. Beasom. 1990. Habitat requirements for pronghorn on rangelands impacted by livestock and net wire in east-central New Mexico, Bulletin 750. Agricultural Experiment Station, New Mexico State University, Las Cruces, New Mexico, USA.

Hughes, K. S. 1991. Sonoran pronghorn use of habitat in southwest Arizona. Thesis, University of Arizona, Tucson, Arizona, USA.

Hughes, K. S. and N. S. Smith. 1990. Sonoran pronghorn use of habitat in southwest Arizona. Final Report 14–16–009–1564 RWO #6. Arizona Cooperative Fish and Wildlife Research Unit, Tucson, Arizona, USA.

Jacques, C. N., J. D. Sievers, J. A. Jenks, C. L. Sexton, and D. E. Roddy. 2006. Evaluating diet composition of pronghorn in Wind Cave National Park, South Dakota. The Prairie Naturalist 38: 239-250.

Janis, C. M. and K. M. Scott. 1987. The origin of the higher ruminant families with special reference to the origin of Cervoidea and relationships within the Cervoidea. American Museum Novitates 2893:1-85.

Jenks J. A., C. N. Jacques, J D. Sievers, R. W. Klaver, R. T. Bowyer, and D. E. Roddy. 2006. Evaluating genetic viability of pronghorn in Wind Cave National Park. The Prairie Naturalist 38:155-164.

Johnson, G. D., D. P. Young, W. P. Erickson, C. E. Derby, M. D. Strickland and R. E. Good. 2000. Final report, wildlife monitoring studies, SeaWest Windpower Project, Carbon County, Wyoming, 1995-1999. Western Ecosystems Technology, Inc., Cheyenne, Wyoming, USA.

Jones, P. V. 1949. Antelope management, Texas Game and Fish 7:4-5, 18-20, 24-25, 28-29.

Jones, K. S. 1991. Feeding study of pronghorn antelope in San Luis Obispo County. Thesis, California Polytechnic State University, San Luis Obispo, California USA.

Kindschy, R., C. Sundstrom, and J. Yoakum. 1978. Range/wildlife interrelationships-pronghorn antelope. Proceedings Pronghorn Antelope Workshop 8:216-262.

Kitchen, D. W. 1974. Social behavior and ecology of the pronghorn. Wildlife Monographs 38: 1-96.

Kitchen, D. W., and B. W. O'Gara. 1982. Pronghorn *(Antilocapra americana*). Pp 960- 971 *in*: J. A. Chapman and G. A. Feldhamer. Wild mammals of North America. Johns Hopkins Univ. Press, Baltimore, Maryland, USA.

Kniesel, M. 1988. AUM equivalence and its use in rangeland planning. Proceedings Pronghorn Antelope Workshop 13:83-87.

Knowlton, F. F. 1968. Coyote predation as a factor in management of antelope in fenced pastures. Proceedings Pronghorn Antelope Workshop 3:65-74.

Koch, A. J. and J. D. Yoakum. 2002. Reintroduction and status of pronghorn on the Carrizo Plain National Monument and surrounding areas in southern California. Proceedings Pronghorn Workshop 20:25–41.

Kohlmann, S. G. 2004. Population dynamics and modeling. Chapter 19 in O'Gara, B. W. and J. D. Yoakum, Pronghorn; ecology and management. Colorado University Press, Boulder, Colorado, USA.

Kohlmann, S. G., D. G. Whittaker, M-J. Hedrick. 1998. Density dependence in Great Basin pronghorn: Implications for adaptive harvest management. Proceedings Pronghorn Antelope Workshop 18:103.

Krausman, P. R., J. R. Morgart, L. K. Harris, C. S. O'Brien, J. W. Cain III, and S. S. Rosenstock. 2005. Sonoran pronghorn literature: an annotated bibliography. Technical Bulletin, United States Geological Survey, Tucson, Arizona, USA.

Lacy, R. C. 1997. Importance of genetic variation to the viability of mammalian populations. Journal Mammalogy 78:320-335.

Lance, W. R., and T. M. Pojar. 1984. Diseases and parasites of pronghorn: a review. Special Report 57, Colorado Division of Wildlife, Denver, Colorado, USA.

Landon, D., P. R. Krausman, K. G. Koenen, and L. K. Harris. 2003. Pronghorn use of areas with varying sound pressure levels. The Southwestern Naturalist 48:725-728.

Lee, R. N., J. D. Yoakum, B. W. O'Gara, T. M. Pojar, and R. A. Ockenfels. 1998. Pronghorn management guides. Pronghorn Antelope Workshop, Arizona Antelope Foundation, Prescott and Phoenix, Arizona, USA.

Lee, Jr. T. R., J. N. Derr, J. W. Bickham, and T. L. Clark. 1989. Genetic variation in pronghorn from West Texas. Journal Wildlife Management 53:890-896.

Lee Jr., T. E. 1992. Mitochondrial DNA and allozyme analysis of pronghorn populations in North America. Dissertation, Texas A&M University, College Station, Texas, USA.

Lee, Jr. T. E., J. W. Bickham, and M. D. Scott. 1994. Mitochondrial DNA and allozyme analysis of North American pronghorn populations. Journal Wildlife Management. 58:307-318.

Leftwich, T. J., and C. D. Simpson. 1978. The impact of domestic livestock and farming on Texas pronghorn. Proceedings Pronghorn Antelope Workshop 8:307-320.

Lehman, V. W., and J. B. Davis. 1942. Experimental wildlife management in the south Texas chaparral. P-R Quart. Rept. 1-R CI, Texas Game, Fish and Oyster Commission, Austin, Texas, USA.

Lent, P. C. 1974. Mother–infant relationships in ungulates. Pp. 14–55 in: Geist, V. and F. R. Walther. The behaviour of ungulates and its relationship to management. International Union for the Conservation of Nature and Natural Resources, Morges, Switzerland.

Lindstedt, S. L. 1991. Running energetic in pronghorn antelope. Nature 353:748-750.

Loeser, M. R., S. D. Mezulis, T. D. Sisk and T. C. Theimer. 2005. Vegetation cover and forb responses to cattle exclusion: implications for pronghorn. Rangeland Ecology and Management 58:234-238

Longshore, K. and C. Lowrey. 2008. Habitat suitability and food habits of pronghorn antelope in the Carrizo Plains National Monument, California. Western Ecological Research Center, USGS, las vegas, Nevada, USA.

Lou, Y. 1998. Genetic variation of pronghorn (*Antilocapra americana*) populations in North America. Dissertation, Texas A&M University, College Station, Texas, USA.

Lovaas, A. L. 1972. Preliminary studies of pronghorn antelope - blacktail prairie dog relations in Wind Cave National Park. Proceedings Pronghorn Antelope Workshop 5:115-156.

Lyman, R. L. 2007. The holocene history of pronghorn (*Antilocapra americana*) in Eastern Washington State. Northwest Science 81(2):104-111.

Mackie, N. W. 1929. Life history notes – Antelope in Kern County. Calif. Fish and Game 15(3):285

Maher, C. R. 1991. Activity budgets and mating system of male pronghorn antelope at Sheldon National Wildlife Refuge, Nevada. Journal Mammalogy 72(4): 739-744.

Malone, C. L., J. C. deVos, Jr., J. R. Heffelfinger, and O. E. Rhodes, Jr. 2004. Genetic distinction of the Sonoran pronghorn. Proceedings Pronghorn Antelope Workshop 20:72-83.

Mapston, R.D. 1968. The use of structures to facilitate antelope movement through sheep-tight fences. Thesis, University Arizona, Tucson, Arizona, USA.

Mason, E. 1952. Food habits and measurements of Hart Mountain antelope. Journal Wildlife Management 16:387-389.

Martinka, C. 1966. The international antelope herd. Montana Wildlife. July: 28-30.

McAllister, H. M. 1924. Census of California's big game. Calif. Fish and Game 10(2):76-77.

McCarthy, C., and J. Yoakum. 1984. An interagency approach to evaluating pronghorn transplant sites in Mono County, California. Proceedings Pronghorn Antelope Workshop 11:134-143.

McCarty, R. S., Jr. 1982. Little Lost/Birch Creek antelope habitat management plan. Proceedings Pronghorn Antelope Workshop 10:229-245.

McCullough, D. R. 1994. What do herd composition counts tell us. Wildlife Society Bulletin 22:295–300.

McDonald, D. T. 2005. Factors affecting pronghorn fawn recruitment in central Arizona. Thesis, Texas Tech University, Lubbock, Texas, USA.

McInnis, M. L. and M. Vavra, 1987. Dietary relationships among feral horses, cattle, and pronghorn in southeastern Oregon. Journal Range Management. 40(1): 60-66.

McKean, T. and B. Walker. 1974. Comparison of selected cardiopulmonary parameters between the pronghorn and the goat. Respiratory Physiology. 21(3):365-370.

McKenzie, J. V. 1970. Two “killer winters” 1964—1965 and 1968-1969 in North Dakota. Proceedings Antelope States Workshop 4:36-40.

McKinney, T., D. Brown, and L. Allison. 2008. Winter precipitation and recruitment of pronghorns in Arizona. The Southwestern Naturalist 53(3):319-325.

McNay, M. E. 1980. Causes of low pronghorn fawn:doe ratios on the Sheldon National Wildlife Refuge, Nevada. Thesis University of Montana, Missoula, Montana, USA.

Messenger, N. C. 1978. Diet and nutrition of the pronghorn antelope. Thesis , South Dakota State University, Brookings, South Dakota, USA.

Messenger, N. C. and F. Schitoskey. 1980. Components and digestibility of pronghorn diets. South Dakota Academy of Science 59:194–204.

Miller, G. S., and R. Kellogg. 1955. List of North American recent mammals. Bulletin of the United States National Museum 205: 817

Miller, M., S. Amsel, J. Boehm, and B. Gonzales 2001. Presumptive copper deficiency in hand-reared captive pronghorn (*Antilocapra americana*) fawns. Journal Zoo and Wildlife Medicine 32:373–378.

Min S. E. 1997. Variation in sexually dimorphic traits of male pronghorns. Journal Mammalogy 78:31-47.

Mitchell, G. J. 1967. Minimum breeding age of female antelope. Journal Mammalogy 48(3):489-490.

Mitchell, G. J. 1980. The pronghorn antelope in Alberta. Thesis, Univ. Regina, Regina Saskatchewan, Canada. 165 pp.

Mitchell, G. J., and S. Smoliak. 1971. Pronghorn antelope range characteristics and food habits in Alberta. Journal Wildlife Management 35:238-250.

Murie, J. 1870. Notes on the anatomy of the prongbuck, Antilocapra americana. Proc. Zool. Soc. London, pp 334-368.

Murphey, R.C. 1917. Natural history observations from the Mexican portion of the Colorado Desert. Proceedings Linnean Society, New York 28:43-101.

Murray-Berger, K. and M. M. Conner. 2008. Recolonizing wolves and mesopredator suppression of coyotes: impacts on pronghorn population dynamics. Ecological Applications 18:599-612.

Neff, D. J. 1977. The coyote and the antelope on Anderson Mesa, Arizona Game & Fish Department Wildlife Views 20(8):1-3.

Neff, D. J. and N. G. Woolsey. 1979. Effect of predation by coyotes on survival of antelope fawns on Anderson Mesa, Special Report No. 8, Arizona Game and Fish Department, Phoenix, Arizona, USA.

Nelson, F. W. 1925. Status of pronghorn antelope, 1922–1924. United States Department of Agriculture Bulletin 1346. Washington, D. C., USA.

Oakley, C. and P. Riddle, 1974. The impact of a severe winter and fences on antelope mortality in south-central Wyoming. Proceedings Pronghorn Antelope Workshop 6:155-173.

O'Brien, C., S. S. Rosenstock, J. J. Hervert, J. L. Bright, and S. R. Bol. 2005. Landscape-level models of potential habitat for Sonoran pronghorn. Wildlife Society Bulletin 33: 24-34.

Ockenfels, R. A. 1994b. Factors affecting adult pronghorn mortality rates in central Arizona. Wildlife Digest 16. Arizona Game and Fish Department, Phoenix, Arizona, USA.

Ockenfels, R. A. 1994a. Mountain lion predation on pronghorn in central Arizona. Southwest Naturalist 39:305-306.

Ockenfels, R. A., A. Alexander, C. L. Dorothy Ticer, and W. K. Carrel. 1994. Home ranges, movement patterns, and habitat selection of pronghorn in central Arizona. Technical report 13. Arizona Game and Fish Department, Phoenix, Arizona, USA.

Ockenfels, R.A, C. L. Ticer, A. Alexander, and J. A. Wennerlund. 1996a. A landscape level pronghorn habitat evaluation model for Arizona. Arizona Game and Fish Department Technical Report 19, Phoenix, Arizona, USA.

Ockenfels, R. A, C. L. Ticer, A. Alexander, and J. A. Wennerlund. 1996b. Statewide evaluation of pronghorn habitat in Arizona. Arizona Game and Fish Department Federal Aid Final Report, Phoenix, USA.

Ockenfels, R., J. Devos, and J. Hervert Jr. 2006. Transportation corridors and pronghorn: What do we know and what can we do about it. P 85 *in*: K.A. Cearley and S. Nelle. Pronghorn Symposium 2006. Texas Cooperative Extension, College Station, Texas, USA.

Ockenfels, R. A., J. C. deVos, J. J. Hervert 2007. Transportation corridors in Arizona and Mexico and pronghorn: Case studies. Road Ecology Center eScholarship Repository, John Muir Institute of the Environment, University California, Davis, California, accessed online at http://repositories.cdlib.org/cgi/viewcontent.cgi?article=1417 &context=jmie/roadeco, July 2009.

O'Gara, B. W. 1968. A study of the reproductive cycle of the female pronghorn (*Antilocapra americana* Ord.). Dissertation, University of Montana, Missoula, Montana.

O'Gara, B. W. 1978. Antilocapra americana. Mammalian Species. No. 90: 1-7.

O'Gara, B. W., M. E. McNay, and W. A. Bodie. 1986. Effects of fawn activity and bedding cover on susceptibility to predation. Proceedings Pronghorn Antelope Workshop 12:58-66.

O'Gara, B. W., and J. D. Yoakum. 1992. Pronghorn management guides. Pronghorn Antelope Workshop, Rock Springs, Wyoming, USA.

O'Gara, B. W. and J. D. Yoakum, 2004. Pronghorn: Ecology and management. Colorado University Press, Boulder, Colorado, USA.

O'Gara, B.W. 2004a. Physical characteristics. Pages 109-143 *in* B.W. O'Gara and J.D. Yoakum. Pronghorn: Ecology and management. University Press Colorado, Boulder, Colorado, USA.

O'Gara, B. W. 2004b. Reproduction. Pages 275-298 *in* B. W. O'Gara and J. D. Yoakum, . Pronghorn: Ecology and management. University Press Colorado, Boulder, Colorado, USA.

O'Gara, B. W. 2004c. Mortality Factors. Pages 379-407 *in* B. W. O'Gara and J. D. Yoakum, . Pronghorn: Ecology and management. University Press Colorado, Boulder, Colorado, USA..

O'Gara, B. W. 2004d. Diseases and Parasites. Pages 299-336. *in* B. W. O'Gara and J. D. Yoakum. Pronghorn: Ecology and management. University Press Colorado, Boulder, Colorado, USA.

O'Gara, B. W., and H. G. Shaw. 2004. Predation. Pages 337-377 *in* B. W. O'Gara and J. D. Yoakum. Pronghorn: Ecology and management. University Press Colorado, Boulder, Colorado, USA.

O'Gara, B. W. and C. M. Janis. 2004. Scientific classification. Pages 3–25. *in* O'Gara, B. W., and J. D. Yoakum Pronghorn: Ecology and management. University Press Colorado, Boulder, Colorado, USA.

O'Gara, B. W., and B. Morrison. 2004. Managing the harvest. Pages 673-704 *in* B.W. O'Gara and J. D. Yoakum, Pronghorn: Ecology and management. Colorado University Press, Boulder, Colorado, USA.

Oregon State Game Commission. 1971. Effects of coyote control on antelope survival, Umatilla Army Depot, Ordnance, Oregon, *in*: Predator Control and Related Problems, Hearings before the Subcommittee on Agriculture, Environmental and Consumer Protection, Committee on Appropriations, U.S. Senate, Ninety-Second Congress, Second Session, pp 570-571.

Packard, J.M and T. L. Cook. 1995. Effects of climate change on biodiversity and landscape linkages in Texas. Pages 322-336 *in* Norwine, J., J. R. Giardino, G. R. North, and J. B. Valdés, The changing climate of Texas: Predictability and implications for the future. GeoBooks, College Station, Texas, USA.

Paradiso, J. L. and R. M. Nowak. 1971. Taxonomic status of the Sonoran pronghorn. Journal Mammalogy 52:855–858.

Phillips, G. E. and G. C. White. 2003. Pronghorn population response to coyote control: modeling and management. Wildlife Society Bulletin 31:1162–1175.

Pingle, H. L. 1938. Secretary, West Side Sportsman's Assoc. Los Banos, California. Letter to California Fish Game Commission, June 3 1938, cited in Goldsmith (1988).

Plumb, R. E., K. M. Gordon, and S. H. Anderson. 2003. Pronghorn use of a wildlife underpass. Wildlife Society Bulletin 31:1244-1245.

Prenzlow, E. J., Gilbert, D. L., and F. A Glover. 1968. Some behavior patterns of the pronghorn. Special Report No. 17. GFP-R-S 17. Colorado Department of Game, Fish and Parks, Denver, Colorado, USA.

Putman, R. J. 1997. Deer and road traffic accidents: Options for management. Journal Environmental Management 51:43-57.

Pyrah, D. 1974. Antelope fawn bedding cover selection in central Montana. Proceedings Antelope States Workshop 6:113-120.

Pyrah, D.B. 1978. American pronghorn antelope in the Yellow Water Triangle, Montana. Montana Department Fish, Wildlife and Parks, Helena, Montana, USA.

Pyshora, L. 1977. The pronghorn antelope in northeastern California. Administrative Report Number 77-2, California Department Fish and Game, Sacramento, California USA.

Raisbeck, M. F, D. O'Toole, R. A. Schamber, E. L. Belden, and L. J. Robinson. 1996. Toxicologic evaluation of a high-selenium hay diet in captive pronghorn antelope (*Antilocapra americana*). Journal Wildlife Diseases 32:9-16.

Raper, E., T. Christiansen, and B. Petch. 1989. Sublette antelope study: Final report. Pages 124-169 *in*: Wyoming Game and Fish Department, Annual Big Game Herd Unit Report, Cheyenne, Wyoming, USA.

Reed, J. 1980. Conservation for future generations, Texas Game Warden, Fall 4-8.

Reichel, J. D. 1991. Relationships among coyote food habits, prey populations, and habitat use. Northwest Science 65:133-137.

Reynolds, T. D. 1984. Daily summer movements, activity patterns, and home range of pronghorn. Northwest Science 58:300-311.

Rhodes, O. E. Jr., R. N. Williams, J. R. Heffelfinger, L. K. Page, E. P. Reat, and J. C. deVos, Jr. 1999. Genetic variation in pronghorn antelope from Arizona. Proceedings Pronghorn Antelope Workshop 18:53-60.

Riddle, P. 1990. Wyoming antelope status report -1990. Proceedings Pronghorn Antelope Workshop 14:24.

Riddle, P. and C. Oakley. 1973. The impact of severe winters and fences on antelope mortality in south-central Wyoming. Proceedings Western Association State Fish and Game Commissioners 53:174-188.

Robbins C. T, and B. L. Robbins. 1979. Fetal and neonatal growth-patterns and maternal reproductive effort in ungulates and sub-ungulates. American Naturalist 114:101–116.

Rouse, C.H. 1941. Notes on winter foraging habits of antelopes in Oklahoma. Journal Mammalogy 22:57-60.

Rouse, C.H. 1954. Antelope and sheep fences: Preliminary report. U.S. Bureau Land Management, Washington, D.C., USA.

Russell, T. P. 1964. Antelope of New Mexico. New Mexico Department Game and Fish, Santa Fe, New Mexico, USA.

Ryder, T. J. 1983. Winter habitat selection of pronghorn in south-central Wyoming. Thesis. University of Wyoming, Laramie, Wyoming, USA.

Ryder, T. J. and L. L. Irwin. 1987. Winter habitat relationships of pronghorns in southcentral Wyoming. Journal Wildlife Management 51:79–85.

Salwasser, H., and K. Shimamoto. 1979. Some aspects of pronghorn ecology and management in northeastern California. Cal-Neva Wildlife 14:1-10.

Salwasser, H. 1980. Pronghorn antelope population and habitat management in the northwestern great basin environments. Interstate Antelope Conference , Alturas, California, USA.

Sawyer, H., and F. Lindzey. 2000. Jackson Hole pronghorn study: Final report. Wyoming Cooperative Fish and Wildlife Research Unit, University of Wyoming, Laramie, Wyoming, USA.

Sawyer, H., F. Lindzey, and D. McWhirter. 2005. Mule deer and pronghorn migration in western Wyoming. Wildlife Society Bulletin 33:1266-1273.

Sawyer, H., F. Lindzey, D. McWhirter and K. Andrews. 2002. Potential effects of oil and gas development on mule deer and pronghorn populations in western Wyoming. Transactions North American Wildlife and Natural Resource Conference 67:350-365.

Sawyer, H. and W. Rudd. 2005. Pronghorn roadway crossings: A review of available information and potential options. Online at http://gf.state.wy.us/downloads/pdf/pronghorn_report_final.pdf.

Schwartz, C.C. 1977. Pronghorn grazing strategies on the short-grass prairies. Dissertation, Colorado State University, Fort Collins, Colorado, USA.

Schwartz, C. C., J. G. Nagy, and R. W. Rice. 1977. Pronghorn dietary quality relative to forage availability and other ruminants in Colorado. Journal Wildlife Management 41:161-168.

Schwartz, C. C., and J. E. Ellis. 1981. Feeding ecology and niche separation in some native and domestic ungulates on the shortgrass prairie. Journal Applied Ecology 18:343-353.

Scott, M. D. 2004. History of pronghorns translocated from Yellowstone National Park. Proceedings Pronghorn Antelope Workshop 21:114–133.

SEATAC 2008. SEATAC agenda, Appendix: Centennial SEATAC Discussion Topics, available at http://planning.lacounty.gov/assets/upl/agenda/sea_20080908-agenda.pdf

Segerstrom, T. 1982. Effects of an operational coal strip mine on pronghorn antelope. Proceedings Pronghorn Antelope Workshop 10:174-208.

Seidler, R. 2009. Surgical sterilization of coyotes to reduce predation on pronghorn fawns. Thesis, Utah State University, Logan, Utah, USA.

Semprebon, G. M. and F. Rivals. 2007. Was grass more prevalent in the pronghorn past? An assessment of the dietary adaptations of Miocene to Recent Antilocapridae (Mammalia: Artiodactyla). Palaeogeography, Palaeoclimatology, Palaeoecology 253:332-347.

Seton, E. T. 1929. The common prongbuck prong-horn, antelope or prong-horned antelope of America, Cabrit or Cabrie, pied goat of the plains. Pages 413-467 *in* Lives of game animals. Volume 3 - Part 2 hoofed animals. Doubleday, Doran and Company, Garden City, New York, USA.

Severson, K., M. May, and W. Hepworth. 1968. Food preferences, carrying capacities, and forage competition between antelope and domestic sheep in Wyoming's Red Desert. Science Monograph 10. Agricultural Experiment Station, University of Wyoming, Laramie. Wyoming, USA.

Sexton, M. L., J. R. Choate, and R. A. Nicholson. 1981. Diet of pronghorn in western Kansas. Journal Range Management 34:489-493.

Sheldon, D. P. 2005. Movement and distribution patterns of pronghorn in relation to roads and fences in southwestern Wyoming. Thesis. University of Wyoming, Laramie, Wyoming, USA.

Shenk, T. M. 1995. Pronghorn investigations: detecting density dependence in natural populations. Project CO W-153-R-7. Colorado Division of Wildlife, Denver, Colorado, USA.

Simpson, C. D. and T. J. Leftwich. 1978. Historic range change in the Texas pronghorn. Proceedings Pronghorn Antelope Workshop 8:121-146.

Simpson D, L. Harveson, C. Brewer, R. Walser, and A. Sides. 2007. Influence of precipitation on pronghorn demography in Texas. Journal Wildlife Management 71:906-910.

Singer, F. J. and R. A. Renkin. 1995. Effects of browsing by native ungulates on the shrubs in big sagebrush communities in Yellowstone National Park. Great Basin Naturalist 55:201–212.

Smith, A. D., and D. M. Beale. 1980. Pronghorn antelope in Utah: some research and observations. Resources Publication 80-13, Utah Division of Wildlife Salt Lake City, Utah. USA.

Smyser, T. J., A. F. Reeve, and E. O. Garton. 2006. Evaluation of pronghorn population productivity relative to broad-scale habitat variables in Wyoming (1978-2003). Proceedings Pronghorn Antelope Workshop 22.

Spillett, J. J., J. B. Low, and D. Sill. 1967. Livestock fences-how they influence pronghorn antelope movements. Bulletin 470, Agriculture Experiment Station. Utah State University, Logan, Utah, USA.

Stephen C. L., J. C. Devos, T. E. Lee, J. W. Bickham, J. R. Heffelfinger, and O. E. Rhodes. 2005a. Population genetic analysis of sonoran pronghorn (*Antilocapra americana sonoriensis*). Journal Mammalogy 86:782-792.

Stephen, C. L., D. G. Whittaker, G. Gillis, L. L. Cox and O. E. Rhodes. 2005b. Genetic consequences of reintroductions: an example from pronghorn antelope in Oregon. Journal Wildlife Management 69:1463-1474.

Soulé, M.E. 1980: Threshold for survival. Maintaining fitness and evolutionary potential. P. 151–169 in: Soulé, M.E. and B. A. Wilcox, B.A. Conservation biology- an evolutionary-ecological perspective. Sinauer, Sunderland.

Sundstrom, C. 1967. Effects of livestock fencing on antelope. Federal Aid Report, FW-3-R-14. Wyoming Game and Fish Commission. Cheyenne, Wyoming, USA.

Sundstrom, C. 1968. Water consumption by pronghorn antelope and distribution related to water in Wyoming's Red Desert. Proceedings Pronghorn Antelope Workshop 3:39-47.

Sundstrom, C., Hepworth, W. G., Diem, K. L. 1973. Abundance, distribution and food habits of the pronghorn: A partial characterization of the optimum pronghorn habitat. Bulletin No. 12, Wyoming Game and Fish Department, Cheyenne, Wyoming, USA.

Taylor, E. R. 1972. Food habits and feeding behavior of pronghorn antelope in the Red Desert of Wyoming. Proceedings Pronghorn Antelope Workshop 5:211-221.

Taylor, E. R. 1975. Pronghorn carrying capacity of Wyoming's Red Desert. Wildlife Technical Bulletin 3. Wyoming Game and Fish Department, Cheyenne, Wyoming, USA.

Thomas, A. E., and R. Rosentreter. 1993. Utilization of lichens by pronghorn antelope in three valleys in east-central Idaho. Technical Bulletin Number 92-3, U.S. Department of the Interior, Bureau of Land Management, Boise, Idaho. USA.

Thomas, C. D. 1990. What do real population dynamics tell us about minimum viable population sizes? Conservation Biology 4:324-327.

Thorne, E. T., E. 5. Williams, T. R. Spraker, W. Helms, and T. Segerstrom, 1988. Bluetongue in free-ranging pronghorn antelope (*Antilocapra americana*) in Wyoming: 1976 and 1984. Journal Wildlife Diseases 24:113-119.

Ticer, C. L., S. R. Boe, R. A. Ockenfels, and J. C. deVos Jr. 1999. Factors affecting home ranges and movements of pronghorn on a shortgrass prairie of northern Arizona. Proceedings Pronghorn Antelope Workshop 18:84–90.

Torbit, S. C, R. B. Gill, A. W. Alldredge, and J. C Liewer 1993. Impacts of pronghorn grazing on winter wheat in Colorado. Journal Wildlife Management 57:173-181.

Trainer, C. E., M. J. Willis, G. P. Keister, and D. P Sheehy. 1983. Fawn mortality and habitat use among pronghorn during spring and summer in southeastern Oregon, 1981-1982. Wildlife Research Report No. 12. Oregon Department of Fish and Wildlife, Portland, Oregon, USA.

Tucker, R. D., and G. W. Garner. 1983. Habitat selection and vegetational characteristics of antelope fawn bed sites in western Texas. Journal Range Management 36:110-113.

Tullous, R. and W. S. Fairbanks. 2002. Distribution of pronghorn before and after development of recreational trails in Antelope Island State Park, Utah. Proceedings Pronghorn Workshop 20:136.

U.S. Bureau Land Management. 1980. Manual supplement 6630-Big game studies: Guidelines for the evaluation of pronghorn antelope habitats. U.S. Bureau Land Management, Reno, Nevada, USA.

U.S. Fish and Wildlife Service. 1998a. Final revised Sonoran pronghorn recovery plan. Albuquerque, New Mexico, USA.

U.S. Fish and Wildlife Service. 1998b. Recovery plan for upland species of the San Joaquin Valley, California . Portland, Oregon, USA.

U.S. Soil Conservation Service. 1989. Wildlife habitat evaluation guides for antelope in Arizona. U.S. Soil Conservation Service, Phoenix, Arizona, USA.

Udy, J. R. 1953. Effects of predator control on antelope populations. Publication 5. Utah Department of Fish and Game, Salt Lake City, Utah, USA.

Van Riper III, C., and R. A. Ockenfels. 1998. The influence of transportation corridors on the movement of pronghorn antelope over a fragmented landscape in northern Arizona. Pp 241-248, *in*: Proceedings 2nd International Conference Transportation and Wildlife Ecology, Ft. Meyers, Florida, USA.

Van Riper III, C., J. Hart and J. Bright. 2001. Effect of fenced transportation corridors on pronghorn antelope movements in Petrified Forest National Park, Arizona. Pages 71-74 *in* D. Harmon, editor. Crossing Boundaries in Park Management: Proceedings of the 11th Conference on Research and Resource Management in Parks and on Public Lands, George Wright Society, Hancock, Michigan, USA.

VanSchmus, D. R. 1990. Bedsite selection by pronghorn antelope fawns in Grand County, Colorado. Proceedings Pronghorn Antelope Workshop 14:35-40.

Vollmar Consulting 2007. Statement of Qualification. online at http://www.vollmarconsulting.com/_lib/pdf/FINAL_Vollmar-Consulting_SOQ_w_Graphics_091007jv_printable.pdf

Wagner, F. H. 2006. Yellowstone's destabilized ecosystem: Elk effects, science, and policy conflict. Oxford University Press, New York.

Wagner, F. H. 1978. Livestock grazing and the livestock industry. Pages 121-145 *in* H.P. Brokaw, editor. Wildlife and America. U.S. Government Printing Office, Washington, D.C., USA.

Ward, A. L., J. J. Cupal, G. A. Goodwin and H. D. Morris. 1976. Effects of highway construction and use on big game populations. Rept. FHW-ARD- 76-174. U.S. Federal Highway Administration, Washington, D.C., USA.

Ward, A. L., N. E. Fornwalt, S. E Henry, and R. A. Hodorff. 1980. Effects of highway operation practices and facilities on elk, mule deer, and pronghorn antelope. Rept. FHW-ARD- 79-143. U.S. Federal Highway Administration, Washington, D.C, USA.

Wesley, D. E., K. L. Knox, and J. G. Nagy. 1973. Energy flux and water kinetics in young pronghorn antelope. Journal Wildlife Management 34:563-572.

West, D. R. 1970. Effects of prolonged deep snow and cold winters on pronghorn mortality and reproduction in South Dakota. Proceedings Pronghorn Antelope Workshop 4:41-49.

Whisler, S. 1984. Seasonal adaptations of pronghorn antelope to water deprivation. Dissertation, University of Wyoming, Laramie, Wyoming, USA.

White, R. W. 1969. Antelope winter kill, Arizona style. Proceedings Western Association State Game and Fish Commissioners 49:251-254.

White, M. D., J. A. Stallcup, W. D. Spencer, J. R. Strittholt, and G. E. Heilman. 2003. Conservation significance of Tejon Ranch: a biogeographic crossroads. Unpublished report prepared by the Conservation Biology Institute, available online at http://www.savetejonranch.org/doclibrary/20030930-tejon-rpt1.pdf.

White, P. J., J. E. Bruggeman, and R. A. Garrott. 2007. Irruptive population dynamics in Yellowstone pronghorn. Ecological Applications 17:1598–1606.

White, P. J., T. L. Davis, K. K. Barnowe-Meyer, R. L. Crabtree, and R. A. Garrott. 2007. Partial migration and philopatry of Yellowstone pronghorn. Biological Conservation 135:502-510.

Wright, P. L., and S. A. Dow, Jr. 1962. Minimum breeding age in pronghorn antelope. Journal of Wildlife Management 26:100-101.

Wright, R. L. and J. C. deVos Jr. 1986. Final report on Sonoran pronghorn status in Arizona. Arizona Game and Fish Department, Phoenix, Arizona, USA.

Yoakum, J. D. 1957. Factors affecting the mortality of pronghorn antelope in Oregon. Thesis, Oregon State College, Corvallis, Oregon, USA.

Yoakum, J. D. 1972. Antelope-vegetative relationships. Proceedings Pronghorn Antelope Workshop 5: 171-177.

Yoakum, J. D. 1978. Managing rangelands for the American pronghorn antelope. Proceedings Pronghorn Antelope Workshop 8:321-336.

Yoakum, J. D. 1979. Managing rangelands for pronghorns. Rangelands 1:146-148.

Yoakum, J. D. 1980. Habitat management guides for the American pronghorn antelope. Technical Note 347. U.S. Department of the Interior, Bureau of Land Management, Denver, Colorado, USA.

Yoakum, J. D 1982. Managing vegetation and waters for pronghorn. Western Association of Fish and Wildlife Agencies 62:153-158.

Yoakum, J. D. 1994. Water requirements for pronghorn. Proceedings Pronghorn Antelope Workshop 16:143–157.

Yoakum, J. D. 2004a Habitat characteristic and requirements. Pages 75-105 *in* B.W. O'Gara and J. D. Yoakum, Pronghorn: Ecology and Management. Colorado University Press, Boulder, Colorado, USA.

Yoakum, J. D. 2004b. Foraging ecology, diet studies and nutrient values. Pages 447-502 *in* O'Gara B.W. and J. D. Yoakum. Pronghorn: Ecology and Management. Colorado University Press, Boulder, Colorado, USA.

Yoakum, J. D. 2004c. Habitat Conservation. Pages 571-630 *in* O'Gara B.W. and J.D. Yoakum. Pronghorn: Ecology and Management. Colorado University Press, Boulder, Colorado, USA.

Yoakum, J. D. 2008. Pronghorn and habitat management on the Hart Mountain National Antelope Refuge – a review and assessment. Proceedings Pronghorn Antelope Workshop 23:153.

Yoakum, J. D., and B. W. O'Gara. 1990. Pronghorn/livestock relationships. Transactions North American Wildlife and Natural Resources Conference 55:475-487.

Yoakum, J. D., B.W. O'Gara, and V. W. Howard. 1996. Pronghorn on western rangelands. Pages 211-226 *in:* Krausman, P. R.. Rangeland wildlife. Society Range Management, Denver, Colorado, USA.

Yoakum, J. D., and B. W O'Gara. 2000. Pronghorn. Pages 559-577 *in*: Demarais S. and P. Krausmann, Ecology and management of large mammals in North America. Prentice Hall, Upper Saddle River, New Jersey, USA.

MAMMALIAN SPECIES SURVEYS IN THE ACQUISITION AREAS ON THE TEJON RANCH, CALIFORNIA

PREPARED FOR THE TEJON RANCH CONSERVANCY

Prepared by:
Brian L. Cypher, Christine L. Van Horn Job, Erin N. Tennant, and Scott E. Phillips

California State University, Stanislaus
Endangered Species Recovery Program
One University Circle
Turlock, CA 95382

August 16, 2010

esrp_2010_TejonRanchsurvey.doc

MAMMALIAN SPECIES SURVEYS IN THE ACQUISITION AREAS ON THE TEJON RANCH, CALIFORNIA

TABLE OF CONTENTS

Introduction 1

Study Areas 3

Methods 4

- Target Special Status Species 4
- Camera Station Surveys 4
- Live-Trapping 5
- Spotlight Surveys 5
- Opportunistic Observations 5

Results 6

- Camera Station Surveys 6
- Live-Trapping 7
- Spotlight Surveys 8
- Opportunistic Observations 8

Discussion 9

- San Joaquin Kit Fox 10
- Tehachapi Pocket Mouse 12
- Other Species 13

Conclusions and Recommendations 15

- Recommendations 16

Literature Cited 18

Appendix A. Locations of Camera Stations and Small Mammal Trap Lines on Tejon Ranch Acquisition Areas 19

Appendix B. Mammalian Species Detected on Tejon Ranch Acquisition Areas 22

LIST OF TABLES

Table 1. Acquisition areas on the Tejon Ranch, California, available for preservation through the purchase of conservation easements. 3

Table 2. Special status mammal species potentially occurring on the acquisition areas of Tejon Ranch, California. 4

Table 3. Wildlife species detected at automated digital camera stations on the acquisition areas of Tejon Ranch, California. 6

Table 4. Small mammals captured during live-trapping on the acquisition areas of Tejon Ranch, California. 8

Table 5. Species observed during spotlight surveys on the acquisition areas of Tejon Ranch, California. 9

LIST OF FIGURES

Figure 1. Location of Tejon Ranch in central California. 1
Figure 2. Locations of the 5 acquisition areas on the Tejon Ranch, California (figure courtesy of Tejon Ranch Conservancy). 2
Figure 3. San Joaquin kit fox images from automated digital camera stations on the White Wolf acquisition area, Tejon Ranch, California, December 2009. 7
Figure 4. Tehachapi pocket mice captured in the Bi-Centennial and Tri-Centennial acquisition areas, Tejon Ranch, California, April 2010. 7
Figure 5. Kit fox scat and track from the White Wolf acquisition area, Tejon Ranch, California, November 2009. 9
Figure 6. Locations of kit fox observations and sign on the White Wolf and Old Headquarters acquisition areas, Tejon Ranch, California, 2009. 10
Figure 7. Locations of Tehachapi pocket mouse captures on the Bi-Centennial and Tri-Centennial acquisition areas, Tejon Ranch, California, April 2010. 13
Figure 8. Example habitats where Tehachapi pocket mice were captured on the Tri-Centennial and Bi-Centennial acquisition areas, Tejon Ranch, California, April 2010. 13
Figure 9. Red fox image from an automated digital camera station on the Old Headquarters acquisition area, Tejon Ranch, California, December 2009. 15

ACKNOWLEDGMENTS

Funding for this project was provided by the Tejon Ranch Conservancy. We thank Allie Madrid and Tory Westall for their dedicated assistance with field work. We thank Mike White, Tom Maloney, Jennifer Browne, and Ginnie Day for logistical and administrative support.

EXECUTIVE SUMMARY

During autumn 2009 and spring 2010, surveys were conducted for mammal species in 4 areas on Tejon Ranch in central California. These "acquisition areas" are available for possible conservation and include the White Wolf, Old Headquarters, Bi-Centennial, and Tri-Centennial areas. Survey methods included automated digital camera stations, live-trapping, spotlighting, and opportunistic observations. Despite the relatively short-term nature of the surveys, 28 mammal species were documented on the acquisition areas: 12 on White Wolf, 17 on Old Headquarters, 12 on Bi-Centennial, and 13 on Tri-Centennial. Included among those detected were 3 special status species: San Joaquin kit fox, Tehachapi pocket mouse, and badger. Kit foxes were confirmed on the White Wolf area from camera station images, spotlight observations, tracks, and scats. Kit fox scats also were collected on the Old Headquarters area, and an individual and a potential den were observed by other field biologists. Five individual Tehachapi pocket mice were captured during live-trapping: 2 on the Bi-Centennial area and 3 on the Tri-Centennial area. Badger diggings were observed in the White Wolf area, although this species likely is wide-spread on Tejon Ranch. The Ranch clearly supports a diversity of mammal species and because of its size, habitat diversity, and habitat quality, the Tejon Ranch can contribute significantly to the conservation of special status mammal species as well as regional biological diversity. Recommendations include (1) conducting additional surveys for additional special status species, (2) conserving habitat in the White Wolf and Old Headquarters areas for San Joaquin kit foxes, (3) managing and enhancing habitat for kit foxes through vegetation management and artificial den installation, (4) gathering demographic and ecological data on kit foxes on the Ranch to further conservation of this species, (5) conserving habitat in the Bi-Centennial and Tri-Centennial areas for Tehachapi pocket mice, and (6) gathering demographic and ecological data on Tehachapi pocket mice to further conservation of this species.

INTRODUCTION

The privately owned Tejon Ranch comprises 109,571 ha (270,750 ac) of contiguous land in Kern and Los Angeles Counties in Central California (Figure 1). The Ranch is situated at the convergence of the Sierra Nevada, Coast Ranges, Mojave Desert, and San Joaquin Valley, and therefore encompasses an immense diversity of habitats, animals, and plants (White et al. 2006). Because of its considerable size, diversity of biological resources, habitat quality, and location, Tejon Ranch is of considerable importance to the conservation of regional biodiversity and ecosystem connectivity.

Figure 1. Location of Tejon Ranch in central California.

Under the Tejon Ranch Conservation and Land Use Agreement adopted in 2008 (Tejon Ranch Company 2008), approximately 72,035 ha (178,000 ac) of the Ranch will be permanently preserved through conservation easements. Furthermore, another approximately 25,090 ha (62,000 ac), referred to as acquisition areas, were made available for preservation, contingent upon externally raised funds to purchase conservation easements on these lands. The acquisition lands consist of 5 areas

(Table 1), with 2 areas occurring on the northern side of the Ranch in the San Joaquin Valley and the other 3 areas occurring on the south side (Figure 2).

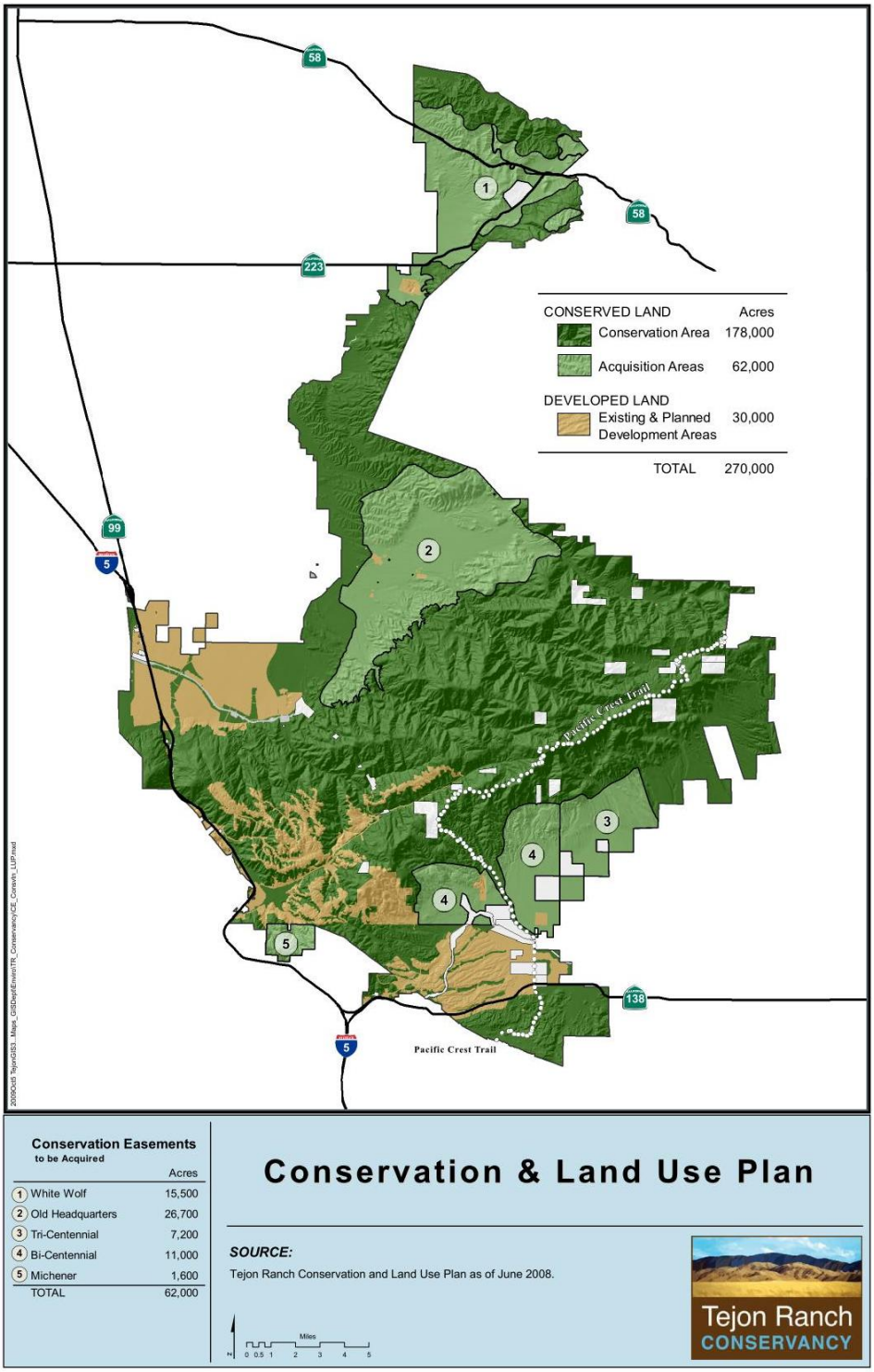


Figure 2. Locations of the 5 acquisition areas on the Tejon Ranch, California (figure courtesy of Tejon Ranch Conservancy).

Table 1. Acquisition areas on the Tejon Ranch, California, available for preservation through the purchase of conservation easements.

Acquisition Areas	Hectares (Acres)
White Wolf	6,475 (16,000)
Old Headquarters	10,725 (26,500)
Tri-Centennial	2,914 (7,200)
Bi-Centennial	4,330 (10,700)
Michener Ranch	648 (1,600)
Total	25,090 (62,000)

A further action under the Tejon Ranch Conservation and Land Use Agreement was the establishment of the Tejon Ranch Conservancy. The Conservancy was charged with stewardship of the conserved lands on the Ranch, including the eventual preparation of a conservation/management plan for these lands. In order to more effectively maintain, enhance, and restore the conservation values of these lands, the Conservancy is coordinating systematic surveys to document the natural resources on these lands, particularly the occurrence of any rare species.

The Conservancy contracted with the California State University-Stanislaus, Endangered Species Recovery Program (ESRP) to conduct surveys for mammal species on the acquisition lands. Objectives of these surveys were to (1) document the occurrence of all mammal species detected in the acquisition areas, (2) conduct more focused efforts to detect the presence of rare species (federal or state listed species and species of special concern), and (3) provide any recommendations for the long-term conservation of mammal species occurring in the acquisition areas and elsewhere on the ranch. Surveys only were conducted for terrestrial species and therefore did not include bats.

STUDY AREAS

Surveys were conducted on the 4 largest acquisition areas: White Wolf, Old Headquarters, Tri-Centennial, and Bi-Centennial. The White Wolf and Old Headquarters acquisition areas are located on the San Joaquin Valley side of Tejon Ranch (Figure 2). Grasslands comprising a diversity of native and non-native grasses and forbs are the dominant habitat in these areas. Oak (*Quercus spp*.) woodlands are present, mostly at the slightly higher eastern margins of the areas. Limited riparian communities occur along some of the major creek drainages.

The Tri-Centennial and Bi-Centennial acquisition areas are located on the Antelope Valley side of the Ranch (Figure 2). These 2 areas are contiguous with pronounced north-south and east-west habitat gradients. Grasslands comprising a diversity of native and non-native grasses and forbs dominate the southern portions, which are lower in elevation. The northern portions of the areas are higher in elevation and support oak woodlands, juniper woodlands, and chaparral habitats. The eastern portion of the 2 areas is markedly more arid with a trend toward more mesic conditions in the western portion.

Notably, Joshua tree (*Yucca brevifolia*) woodlands cover considerable areas in the eastern portion. Riparian communities occur along the major creek drainages.

Almost all of the lands within the acquisition areas are grazed by cattle. Cattle production historically and currently is a primary source of revenue for Tejon Ranch. Some game harvests are conducted within the acquisition areas during the appropriate seasons. Otherwise, public access to the Ranch is highly restricted.

METHODS

TARGET SPECIAL STATUS SPECIES

The purpose of the surveys was to document mammal species occurring on the acquisition areas (except for bats), but particular effort was directed toward detecting special status species that might occur on the areas (Table 2).

Table 2. Special status mammal species potentially occurring on the acquisition areas of Tejon Ranch, California.

Common name	Scientific name	Federal status[1]	California status[2]	Notes
San Joaquin kit fox	*Vulpes macrotis mutica*	Endangered	Threatened	Potential habitat on White Wolf and Old Headquarters
Badger	*Taxidea taxus*	-	Species of Special Concern	Potential habitat on all areas
Ringtail	*Bassariscus astutus*	-	Fully protected species	Potential habitat in upper elevations of all areas
Giant kangaroo rat	*Dipodomys ingens*	Endangered	Endangered	Potential habitat on White Wolf and Old Headquarters
Short-nosed kangaroo rat	*Dipodomys nitratoides brevinasus*	Species of Concern	Species of Special Concern	Potential habitat on White Wolf and Old Headquarters
San Joaquin antelope squirrel	*Ammospermophilus nelsoni*	Species of Concern	Threatened	Potential habitat on White Wolf and Old Headquarters
Tehachapi pocket mouse	*Perognathus alticolus inexpectatus*	Species of Concern	Species of Special Concern	Potential Habitat on Tri-Centennial, Bi-Centennial, and Michener
Tulare grasshopper mouse	*Onychomys torridus tularensis*	Species of Concern	Species of Special Concern	Potential habitat on White Wolf and Old Headquarters
Buena Vista Lake Shrew	*Sorex ornatus relictus*	Endangered	Species of Special Concern	Potential Habitat on Tri-Centennial, Bi-Centennial, and Michener

1 From U.S. Fish and Wildlife Service 1998.

2 From California Department of Fish and Game 2009.

CAMERA STATION SURVEYS

Automated digital field cameras (Stealth Cam 3.0 MP Digital Scouting Cameras, Stealth Cam LLC, Bedford, TX; Cuddeback 3.0 MP Digital Scouting Camera, Non Typical, Park Falls, WI) were deployed in an effort to detect the presence and relative abundance of

medium to large sized mammals. The cameras were secured to 1.2-m (4-ft) U-posts with zip-ties. A can of cat food was staked to the ground approximately 2 m in front of each camera using tent stakes. Camera stations were distributed throughout the acquisition areas (Appendix A), and each station was left in place for approximately 2-4 weeks. On the San Joaquin Valley acquisition areas, camera stations were established in locations that that appeared to comprise suitable habitat for San Joaquin kit foxes and badgers. On the Antelope Valley acquisition areas, stations were established in locations that appeared to comprise suitable habitat for badgers or ringtails. We measured camera success as the total number of visits by distinct individuals (as tallied on a per-night basis) divided by the number of camera-nights (one camera operational for one night = one camera-night).

LIVE-TRAPPING

Live-trapping was conducted to assess the presence and abundance of small mammals on the acquisition areas (Appendix A). We used aluminum Sherman box traps (7.5 x 9.5 x 30 cm) modified to avoid injury to long-tailed animals such as kangaroo rats. Traps were deployed along transects and were spaced approximately 10-m apart. The traps were opened in the evening, baited with white millet seed, and provisioned with synthetic batting to provide insulation. All animals captured were identified to species, aged, sexed, belly-marked with a felt-tipped non-toxic marker, and released at the capture site.

On the White Wolf and Old Headquarters areas, 4 pairs of trapping transects were established with each transect consisting of 25 traps. Thus, a total of 200 traps was set on each area and trapping was conducted for 3 nights. Locations for transects were chosen to sample a diversity of habitats, but also to increase the probability of detecting short-nosed kangaroo rats.

A different approach was employed on the Tri-Centennial and Bi-Centennial areas so that more areas could be sampled. On the Tri-Centennial area, 8 pairs of transects were established with each transect consisting of 10 traps. Due to inclement weather, trapping was only conducted for 2 nights. On the Bi-Centennial area, 8 pairs of transects were established, but trapping was conducted for 3 nights on 6 transects, 2 nights on the 7th transect, and 1 night on the 8th transect. On the Tri-Centennial and Bi-Centennial areas, locations for transects were chosen to sample a diversity of habitats, but also to increase the probability of detecting Tehachapi pocket mice.

SPOTLIGHT SURVEYS

Spotlight surveys were conducted by driving slowly (10-15 km/hr) along roads throughout the acquisition areas while the driver and a passenger shined 2-million-candlepower spotlights out opposite sides of the vehicle. Upon observing an animal or its eye-shine, the vehicle was stopped while the observer attempted to identify the species using binoculars. Surveys were conducted for approximately 2 hours and routes varied nightly. Generally, survey routes covered 15-25 km.

OPPORTUNISTIC OBSERVATIONS

Opportunistic observations of mammal species occurring on the acquisition areas also were recorded. Such observations were recorded during reconnaissance visits and during the conduct of the survey and trapping efforts described above. These observations

included direct observations of species and also of diagnostic sign associated with a given species (e.g., scats, tracks, burrows, etc.). GPS coordinates were recorded for locations of any special status species observed.

RESULTS

CAMERA STATION SURVEYS

Camera stations were deployed from 22 December 2009 to 14 January 2010 on the White Wolf area, 24 November to 17 December 2010 on the Old Headquarters area, and 12-28 April 2010 on the Bi-Centennial and Tri-Centennial areas. By far, most images recorded by the cameras were of cows. Coyotes, striped skunks, and feral pigs were the wildlife species most commonly detected by the cameras (Table 3). San Joaquin kit fox was detected on 2 nights in the White Wolf area (Figure 3). Five species were detected on White Wolf, 9 species on Old Headquarters, 3 species on Bi-Centennial, and 7 species on Tri-Centennial.

Table 3. Wildlife species detected at automated digital camera stations on the acquisition areas of Tejon Ranch, California.

	Acquisition Area							
	White Wolf (138 nights)		Old Headquarters (138 nights)		Bi-Centennial (104 nights)		Tri-Centennial (90 nights)	
Species[1]	No. Obs.	No. per night	No. Obs.	No. per night	No. Obs.	No. per night	No. Obs.	No. per night
Coyote	7	0.05	20	0.14	2	0.02	10	0.11
Kit fox	2	0.01	-	-	-	-	-	-
Gray fox	-	-	8	0.06	1	0.01	-	-
Red fox	-	-	1	0.01	-	-	-	-
Bobcat	-	-	2	0.01	-	-	1	0.01
Striped skunk	9	0.07	12	0.09	-	-	-	-
Spotted skunk	-	-	1	0.01	-	-	-	-
Raccoon	3	0.02	4	0.03	-	-	-	-
Unidentified canid	1	0.01	-	-	-	-	-	-
Antelope squirrel	-	-	-	-	-	-	7	0.08
Ground squirrel	-	-	-	-	3	0.03	1	0.01
Kangaroo rat	-	-	-	-	-	-	1	0.01
Jackrabbit	2	0.01	2	0.01	-	-	5	0.06
Feral pig	-	-	11	0.08	-	-	-	-
Bird	-	-	-	-	-	-	2	0.02

1 Coyote – Canis latrans; Kit fox (San Joaquin) – *Vulpes macrotis mutica*; Gray fox – *Urocyon cinereoargenteus*; Red fox – *Vulpes vulpes*; Bobcat – *Lynx rufus*; Striped skunk – *Mephitis mephitis*; Spotted skunk – *Spilogale gracilis*; Raccoon – *Procyon lotor*; Antelope squirrel (white-tailed) – *Ammospermophilus leucurus*; Ground squirrel (California) – *Spermophilus beechyi*; Jackrabbit – *Lepus californicus*; Feral pit – *Sus scrofa*; Birds were California quail (*Callipepla californica*) and unidentified sparrow.

2 One night = 1 camera-station deployed and operational for 1 night.

Figure 3. San Joaquin kit fox images from automated digital camera stations on the White Wolf acquisition area, Tejon Ranch, California, December 2009.

LIVE-TRAPPING

Live-trapping for small mammals was conducted during 2-4 December 2009 on the White Wolf area, 4-6 November 2009 on the Old Headquarters area, 27-29 April 2010 on the Bi-Centennial area, and 14-15 April 2010 on the Tri-Centennial area. Across all areas, 12 different rodent species were captured with 3 caught on White Wolf, 4 on Old Headquarters, 5 on Bi-Centennial, and 7 on Tri-Centennial (Table 4). Heermann's kangaroo rats (*Dipodomys heermanni*) were the most frequently captured species on the White Wolf and Old Headquarters areas, while deer mice (*Peromyscus maniculatus*) were the most frequent on Bi-Centennial and Panamint kangaroo rats (*Dipodomys panamintinus*) were the most frequent on Tri-Centennial. Five individuals of one sensitive species, the Tehachapi pocket mouse (*Perognathus alticolus inexpectatus*), were captured on the Bi-Centennial and Tri-Centennial areas (Figure 4).

Figure 4. Tehachapi pocket mice captured in the Bi-Centennial and Tri-Centennial acquisition areas, Tejon Ranch, California, April 2010.

Table 4. Small mammals captured during live-trapping on the acquisition areas of Tejon Ranch, California.

	Acquisition Area							
	White Wolf (600 trapnights)		Old Headquarters (600 trapnights)		Bi-Centennial (318 trapnights)		Tri-Centennial (419 trapnights)	
Species[1]	No.	No. per 100 TN	No.	No. per 100 TN	No.	No. per 100 TN	No.	No. per 100 TN
Heermann's kangaroo rat	40	6.7	9	1.5	-	-	-	-
Panamint kangaroo rat	-	-	-	-	14	4.4	52	12.4
San Joaquin pocket mouse	2	0.3	3	0.5	-	-	-	-
Little pocket mouse	-	-	-	-	-	-	1	0.2
Tehachapi pocket mouse	-	-	-	-	2	0.6	3	0.7
California pocket mouse	-	-	3	0.5	-	-	-	-
Deer mouse	5	0.8	3	0.5	31	9.7	41	9.8
Brush mouse	-	-	-	-	-	-	1	0.2
Grasshopper mouse	-	-	-	-	1	0.3	-	-
White-tailed antelope squirrel	-	-	-	-	-	-	1	0.2
Desert woodrat	-	-	-	-	-	-	2	0.5
Dusky-footed woodrat	-	-	-	-	1	0.3	-	-
Total	47		18		49		101	
Total per 100 TN	7.8		3.0		15.4		24.1	

1 Heermann's kangaroo rat – *Dipodomys heermanni*; Panamint kangaroo rat – *Dipodomys panamintinus*; San Joaquin pocket mouse – *Perognathus inornatus*; Little pocket mouse – *Perognathus longimembris*; Tehachapi pocket mouse – *Perognathus alticolus inexpectatus*; California pocket mouse – *Chaetodipus californicus*; Deer mouse – *Peromyscus maniculatus*; Brush mouse – *Peromyscus boylii*; Grasshopper mouse – *Onychomys torridus*; White-tailed antelope squirrel – *Ammospermophilus leucurus*; Desert woodrat – *Neotoma bryanti*; Dusky-footed woodrat – *Neotoma macrotis*..

SPOTLIGHT SURVEYS

Three spotlight surveys were conducted on the White Wolf and Old Headquarters areas, and 1 was conducted on the Tri-Centennial area. None were conducted on the Bi-Centennial area. Spotlight survey efforts were limited on the Bi-Centennial and Tri-Centennial areas because the probability of observing special status species was considered low. Instead, efforts were redirected to deploying additional camera stations and additional small mammal trap lines.

During spotlight surveys, 9 species were observed (Table 5). Of particular note, 2 kit foxes were observed on the White Wolf area.

OPPORTUNISTIC OBSERVATIONS

The presence of a number of other species was recorded through opportunistic observations of animals or their sign. In general, most of these observations were of species considered to be common. However, several observations of kit fox scats and tracks (Figure 5) on the White Wolf and Old Headquarters areas helped to confirm the presence of this species in those areas. Also, badger diggings were observed in the White Wolf area. A list of all mammalian species detected on the acquisition areas by any means is provided in Appendix B.

Table 5. Species observed during spotlight surveys on the acquisition areas of Tejon Ranch, California.

	Acquisition Area		
Species[1]	**White Wolf (3 surveys)**	**Old Headquarters (3 surveys)**	**Tri-Centennial (1 survey)**
Coyote	3	1	-
Kit fox	2	-	-
Unidentified canid	1	-	-
Bobcat	2	-	-
Striped skunk	2	-	-
Raccoon	-	1	-
Jackrabbit	9	1	5
Feral pig	-	28	-
Burrowing owl	2	-	-
Long-eared owl	2	-	1
Unidentified owl	4	-	-

1 Coyote – *Canis latrans*; Kit fox (San Joaquin) – *Vulpes macrotis mutica*; Bobcat – *Lynx rufus*; Striped skunk – *Mephitis mephitis*; Raccoon – *Procyon lotor*; Jackrabbit – *Lepus californicus*; Feral pit – *Sus scrofa*; Burrowing owl – *Athene cunicularia*; Long-eared owl - *Asio otus*.

Figure 5. Kit fox scat and track from the White Wolf acquisition area, Tejon Ranch, California, November 2009.

DISCUSSION

The surveys conducted by ESRP were essentially "rapid assessment" in nature. Thus, all mammal species present in the acquisition areas were not likely detected, and the lists of species presented in this report should not be considered exhaustive. Further survey efforts will undoubtedly detect additional species. Despite the relatively short-term nature of the surveys, 28 mammal species were documented on the acquisition areas (Appendix B): 12 on White Wolf, 17 on Old Headquarters, 12 on Bi-Centennial, and 13 on Tri-Centennial. Most species were known or suspected to occur in the acquisition areas. Included among those detected were 3 special status species: San Joaquin kit fox, Tehachapi pocket mouse, and badger.

San Joaquin Kit Fox

Detections of San Joaquin kit foxes (i.e., spotlight observations and tracks) were relatively common in the White Wolf area (Figure 6), particularly in the northwest portion of this area where the vegetation structure is shorter with areas of exposed ground and where kangaroo rats appear to be abundant. Kit foxes are adapted to arid environments and a relatively short, open vegetation structure facilitates mobility and predator detection. Furthermore, kangaroo rats, which also are adapted to arid environments, are a preferred prey item for kit foxes, and fox abundance generally is positively related to kangaroo rat abundance (Grinnell et al. 1937, McGrew 1979, Cypher 2003). Other portions of the White Wolf area are characterized by tall, relatively dense grass, and therefore are less optimal for kit foxes. For example, the 2 southern-most small mammal traplines in this area (Appendix A) were in dense grassland, and no kangaroo rats were captured on these lines and no kit fox sign was detected near these lines. Kit foxes may still use these less optimal areas, but probably more intermittently or for dispersal. Based on current habitat conditions, 2 to 5 kit fox pairs might be using the White Wolf area.

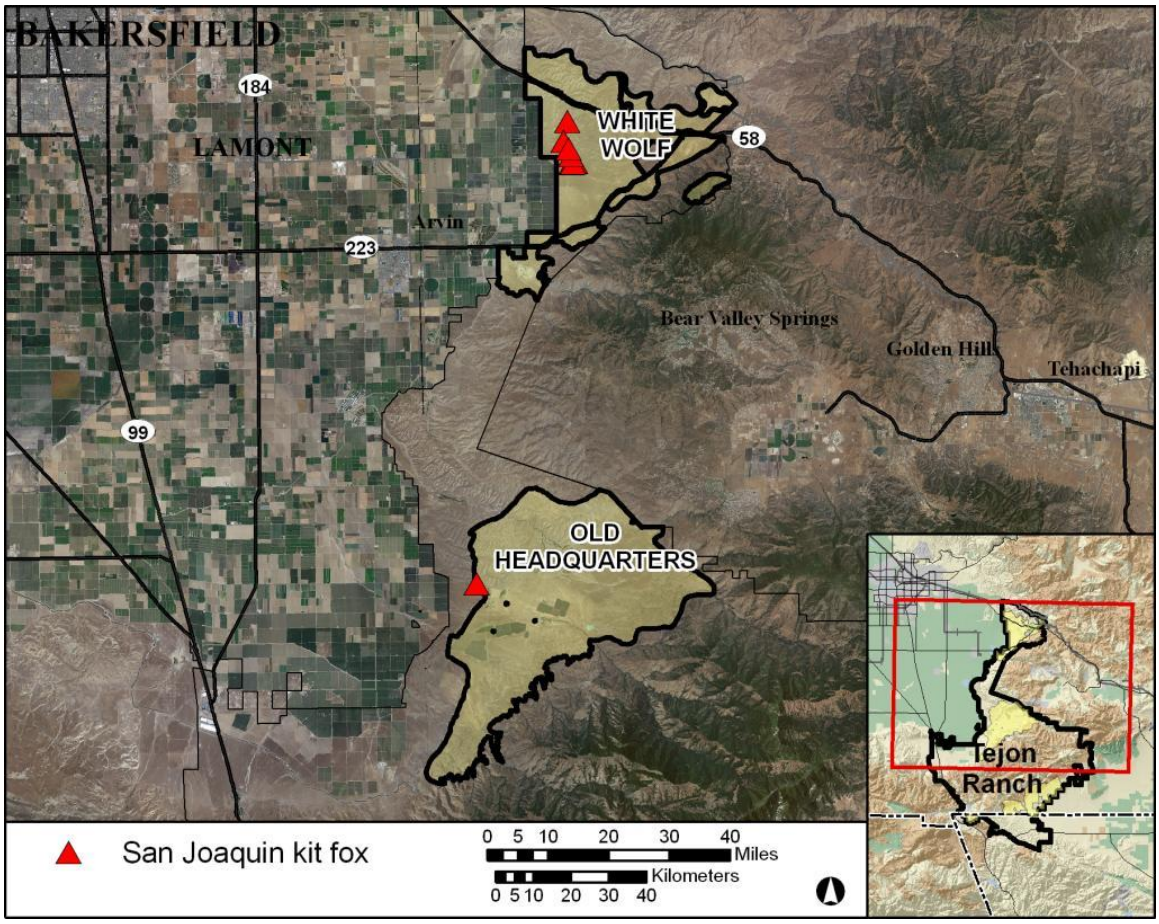


Figure 6. Locations of kit fox observations and sign on the White Wolf and Old Headquarters acquisition areas, Tejon Ranch, California, 2009.

Kit foxes also appear to be present in the Old Headquarters area. Two kit fox scats were found during small mammal trapping efforts (Figure 6). Also, a potential kit fox den and a possible sighting of a kit fox both were reported in this area during the past year (M.

White, Tejon Ranch Conservancy, personal communication). The kit fox scats and the possible sighting all were located in the vicinity of the Tejon Hills in the northwest portion of the Old Headquarters area. The Tejon Hills are characterized by a relatively low, open vegetation structure, and kangaroo rats are abundant in this area based on small mammal trapping efforts. Thus, habitat suitability for kit foxes is good. Much of the rest of the Old Headquarters area is characterized by tall, relatively dense grass and may be less suitable. As in the White Wolf area, kit foxes might still use this less optimal habitat, but probably more intermittently or for dispersal.

The frequency of kit fox detections in the White Wolf area indicates that foxes likely are resident there and not just transient. Foxes also may be resident in the Tejon Hills portion of the Old Headquarters area. Based on current habitat conditions, 2 to 5 kit fox pairs potentially might be using each area. If so, then these areas may support small "satellite" populations of kit foxes, which could contribute significantly to range-wide conservation and recovery. Such populations increase the size of the overall metapopulation thereby further buffering the species against catastrophic or stochastic declines and reducing extinction risk. Thus, conservation of both areas to benefit San Joaquin kit foxes is warranted. Also, conserving these areas would contribute to Recovery Task 2.2.20 in the recovery plan for kit foxes which specifically calls for protecting habitat in the Comanche Point and Tejon Hills areas for kit foxes (U.S. Fish and Wildlife Service 1998). The Tejon Ranch has already committed to conserving the Comanche Point area (Tejon Ranch Company 2008).

Furthermore, kit foxes also appear to be present in the Comanche Point area of Tejon Ranch, which is located between the White Wolf and Old Headquarters acquisition areas (K. Babcock, DUDEK, personal communication) and is an extension of the Tejon Hills. The presence of kit foxes in these 3 areas is significant from the perspective of region habitat connectivity for this species. Recovery Task 5.3.8 in the recovery plan for kit foxes (U.S. Fish and Wildlife Service 1998) calls for maintaining a linkage area for kit foxes and other species along the southern edge of the San Joaquin Valley from McKittrick over to the Kern River. The presence of kit foxes on the White Wolf, Comanche Point, and Old Headquarters areas indicates that Tejon Ranch lands currently constitute a viable linkage along the southeastern edge of the San Joaquin Valley, and maintaining this linkage through conservation of these areas will contribute to recovery efforts for this species.

The presence of San Joaquin kit foxes on Tejon Ranch constitutes a positive situation that could benefit the range-wide conservation of the species, as described above. Habitat management and enhancement potentially could increase the security and persistence of kit foxes on the Ranch, and could facilitate the expansion of suitable habitat for foxes possibly resulting in an increase in abundance. Currently, some portions of the acquisition areas and other areas on the Ranch have suitable terrain for kit foxes (e.g., flat to gently rolling), but have a relatively tall, dense vegetation structure. Commonly, this structure is a product of community invasion by non-native grasses (e.g., *Avena* spp., *Bromus* spp.). Management strategies that reduce the vegetation height and density to produce a shorter, sparser structure could increase predator detection and prey availability (e.g., kangaroo rats) thereby improving habitat suitability for kit foxes. Grazing is probably the most practical and effective strategy for managing vegetation on the Ranch. A grazing program and infrastructure are already in place on most Ranch lands. Improvements in habitat suitability might be achieved simply by altering the timing and

intensity of grazing to further reduce vegetation density. Furthermore, improving habitat suitability for kit foxes also would benefit other special status species that share similar habitat requirements, such as blunt-nosed leopard lizards (*Gambelia sila*), San Joaquin antelope squirrels, short-nosed kangaroo rats, and Tulare grasshopper mice.

Habitat suitability for kit foxes also might be enhanced through the installation of artificial dens. Kit foxes are critically dependent on dens for avoiding predators, avoiding temperature extremes, conserving moisture, daytime resting, and rearing young. On average, each kit fox annually uses approximately 11 different dens, which are scattered around its home range (Koopman et al. 1998). Den availability may be a limiting factor in areas that are used intermittently by foxes or that are used primarily for movement (e.g., dispersal). The installation of artificial dens can provide additional refugia that could facilitate use of or movement through an area by kit foxes. Artificial den materials are relatively inexpensive (<$100 per den), easy to install, and readily used by kit foxes (B. Cypher, CSUS ESRP, unpublished data).

TEHACHAPI POCKET MOUSE

Five individual Tehachapi pocket mice were captured in the Bi-Centennial and Tri-Centennial areas in just 5 nights of live-trapping. These 5 individuals were captured in 4 locations (Figure 7). All 4 locations were in arid shrub communities on slopes (Fig. 8). On the Bi-Centennial area where 2 individuals were captured, one site was dominated by manzanita (*Arctostaphylos* spp.) and the other site was dominated by Joshua tree, California buckwheat (*Eriogonum fasiculatum*), and cheesebush (*Hymenoclea salsola*). The 2 sites on Tri-Centennial where 3 individuals were captured were dominated by California buckwheat and goldenbush (*Ericameria* spp.) with sparse juniper (*Juniperus* spp.). Tehachapi pocket mice are reported to occur in arid forest, shrub, and grassland communities (Best 1994). They apparently have even been found in rangeland dominated by non-native grasses and anthropogenically altered habitats such as fallow grain fields dominated by tumbleweed (*Salsola* spp.) (Williams 1986). On Tejon Ranch and elsewhere, Tehachapi pocket mice occur in areas subject to moderate grazing indicating that this is probably a compatible land use for this species.

In addition to the 5 individuals captured during this survey, a pocket mouse was captured in Bronco Canyon in the Bi-Centennial area in 2001 (J. Patton, University of California-Berkeley, personal communication), and another was captured just west of the Bi-Centennial area in 2003 (CNDDB 2010). The distribution of capture locations and the frequency of captures indicate that Tehachapi pocket mice probably are widely distributed throughout the Bi-Centennial and Tri-Centennial areas. The total range for the Tehachapi pocket mouse is comparatively restricted. The known range extends from the mountains just each of Tehachapi across the Transverse Ranges to about Mt. Pinos, and along the north slope of the nearby San Gabriel Mountains from about the Interstate 5 corridor eastward to about Lake Elizabeth (Williams et al. 1993). Thus, Tejon Ranch and the Bi-Centennial and Tri-Centennial acquisition areas appear to encompass a large portion of this range, and preserving habitat in these areas clearly would contribute significantly to the conservation of this species.

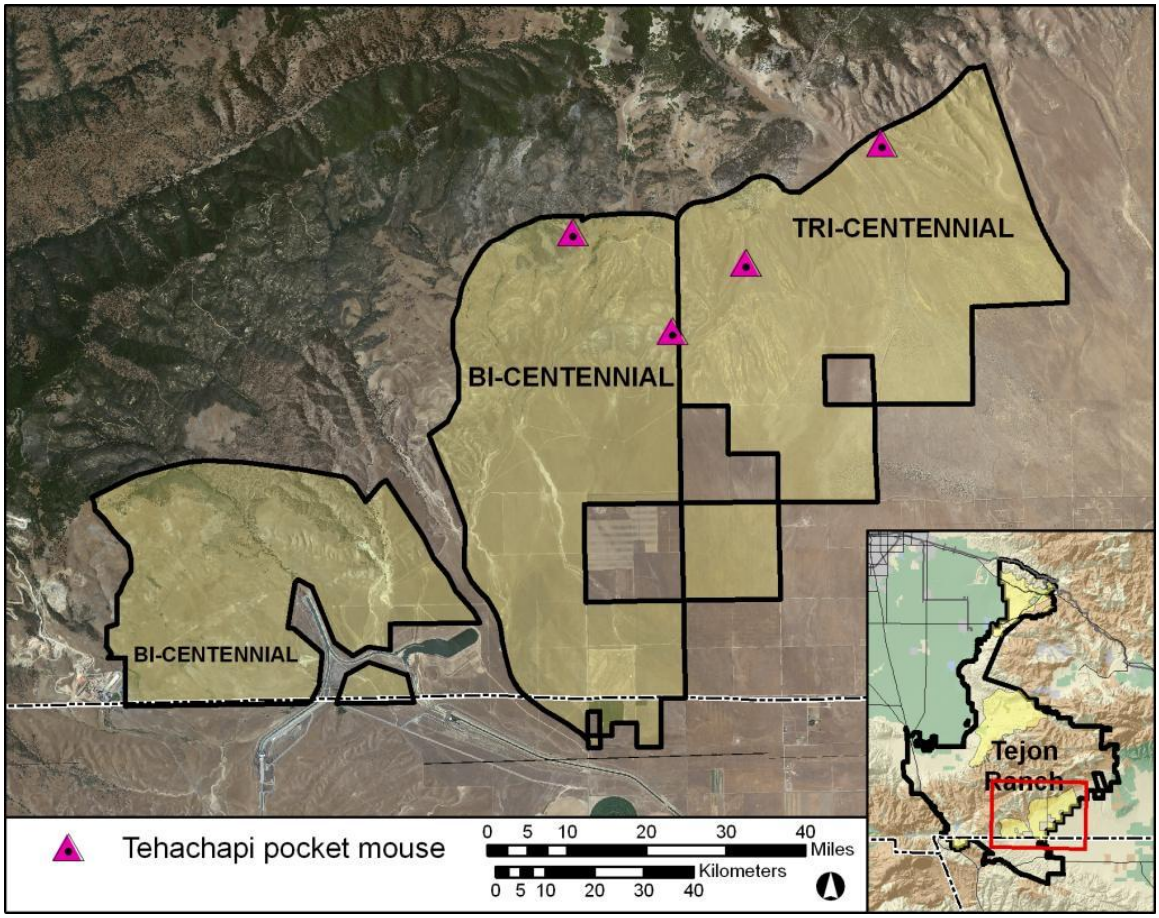


Figure 7. Locations of Tehachapi pocket mouse captures on the Bi-Centennial and Tri-Centennial acquisition areas, Tejon Ranch, California, April 2010.

Figure 8. Example habitats where Tehachapi pocket mice were captured on the Tri-Centennial and Bi-Centennial acquisition areas, Tejon Ranch, California, April 2010.

OTHER SPECIES

Badger was the only other special status species detected during the surveys. Badgers have been observed in many locations on Tejon Ranch and appear to be relatively widespread. This species probably occurs on all of the acquisition areas. Despite being a

California species of special concern, badgers apparently are occasionally legally harvested on the Ranch.

Ringtails were not detected during the surveys. However, ringtails characteristically occur at low densities and are difficult to detect, particularly during short-duration surveys. Also, the relatively open habitats prevalent throughout much of the acquisition areas are less optimal for this species. Ringtails generally favor dense brushy or forested cover in proximity to water (Orloff 1988). Ringtails probably occur on Tejon Ranch and potentially could occur on the acquisition areas, particularly in riparian areas, rocky canyons, and chaparral habitat. Accordingly, the greatest potential for this species may be in the Bi-Centennial and Tri-Centennial areas.

Giant kangaroo rats, short-nosed kangaroo rats, and San Joaquin antelope squirrels generally prefer more arid conditions than are present in the White Wolf and Old Headquarters areas. The highest potential for these species in the acquisition areas may be the northwest portion of the White Wolf area. On Tejon Ranch, the highest potential for these species probably is in the Comanche Point area where a population of blunt-nosed leopard lizards is known to occur. Blunt-nosed leopard lizards typically occur in habitat conditions favored by giant kangaroo rats, short-nosed kangaroo rats, and San Joaquin antelope squirrels (U.S. Fish and Wildlife Service 1998).

The probability of occurrence of Tulare grasshopper mice on the White Wolf and Old Headquarters areas is high. This species typically occurs in very low densities and is difficult to detect. The highest potential for this species is probably in the more sparsely vegetated Tejon Hills of the Old Headquarters area and northwest portion of the White Wolf area.

The methods employed during the surveys were not appropriate for detecting Buena Vista Lake shrew. The distribution and habitat requirements of this species are poorly defined. However, the shrews generally are found in perennial wetland and riparian areas where soil stays moist, even if surface water is not always present. Focused surveys for shrews could be conducted in locations with appropriate habitat conditions in the White Wolf and Old Headquarters areas. However, it should be noted that the taxonomic relationships of ornate shrews in the San Joaquin Valley are unresolved and it is possible that any ornate shrews occurring on Tejon Ranch might not be Buena Vista Lake shrews. Thus, any shrews captured on the Ranch should be genetically sampled and tested to verify identification.

Despite the relatively short duration of the survey effort, 28 species were detected, including a diversity of rodents (14 species) and carnivores (9 species). As expected, many non-special status species were detected. Among these were 2 non-native species, red foxes (Figure 9) and feral pigs. Red foxes have been increasing in the San Joaquin Valley in the past 2 decades (B. Cypher, personal observation). The effects of this species on native wildlife are unknown. Of potential concern are impacts to endangered kit foxes through interference and exploitation competition (Cypher et al. 2001, Clark et al. 2005). However, there is no evidence to suggest that red foxes are displacing kit foxes. In an interesting ecological dynamic, coyotes appear to effectively limit or even exclude red foxes in natural habitats (Cypher et al. 2001). Thus, red foxes in the San Joaquin Valley are mostly relegated to anthropogenic habitats such as agricultural and urban areas. Indeed, the red fox detected in the Old Headquarters area was captured on a

camera located approximately 1.5 km south of the nut orchards and vineyards along Chiminez Road.

Figure 9. Red fox image from an automated digital camera station on the Old Headquarters acquisition area, Tejon Ranch, California, December 2009.

Feral pigs also were commonly observed during the surveys. The pigs have been present on the Ranch for over a decade. The impacts of feral pigs on native fauna and flora are abundantly documented. Feral pigs are heavily harvested on Tejon Ranch through a hunting program, and this may help reduce numbers. However, control of feral pig populations is difficult to achieve.

CONCLUSIONS AND RECOMMENDATIONS

The mammal surveys conducted by ESRP helped further document the immense biodiversity on Tejon Ranch, with particular emphasis on the White Wolf, Old Headquarters, Bi-Centennial, and Tri-Centennial acquisition areas. These surveys also contributed significantly to Recovery Task 3.2.23 in the *Recovery Plan for Upland Species of the San Joaquin Valley*, California (U.S. Fish and Wildlife Service 1998). This task calls for surveys to be conducted for special status animals along the southeastern and southern edge of the San Joaquin Valley. During the surveys, 28 mammal species were detected. The surveys also helped to further document the presence and distribution of 3 special status species: San Joaquin kit fox, Tehachapi pocket mouse, and badger.

RECOMMENDATIONS

Based on the results of this project, the following recommendations are offered:

1. Conduct additional surveys for special status mammal species

The surveys conducted by ESRP were of limited scope and duration. Additional survey efforts may detect additional special status species as well as provide additional distribution and abundance information on previously detected special status species (i.e., San Joaquin kit fox, Tehachapi pocket mouse, badger).

2. Conserve habitat in the White Wolf and Old Headquarters areas for San Joaquin kit foxes

Small populations of San Joaquin kit foxes may be present in the White Wolf and Old Headquarters acquisition areas. Conserving habitat in these areas would facilitate population security and persistence. Particularly important habitat occurs in the northwest portion of the White Wolf area and the Tejon Hills portion of the Old Headquarters area. Conserving habitat in these acquisition areas also would help maintain habitat connectivity and movement corridors through the southeastern edge of the San Joaquin Valley. Conserving existing populations and maintaining connectivity both would contribute significantly to range-wide conservation and recovery of San Joaquin kit foxes.

3. Manage and enhance habitat for kit foxes

Habitat management and enhancement could increase kit fox population security and persistence, and even could facilitate population increase and expansion. In particular, maintaining a relatively low, open vegetation structure would increase predator detection and possibly prey abundance for kit foxes. Vegetation management would probably best be achieved through grazing. A grazing plan that aims to increase and maintain habitat suitability for kit foxes should be developed and implemented, at least in areas considered important for kit foxes as described above. Tejon Ranch may already be considering preparing such a plan (K. Babcock, DUDEK, personal communication). Habitat for kit foxes could be further enhanced through the installation of artificial dens. Artificial dens would increase kit fox capacity for occupying and moving through areas.

4. Gather information on San Joaquin kit foxes

Few data are available on satellite populations of kit foxes (i.e., those populations outside of the Carrizo Plain, western Kern County, and Ciervo-Panoche core areas), and virtually nothing is known about kit fox populations on Tejon Ranch. Gathering data on kit foxes on the Ranch through scientific research and monitoring would provide critical information necessary for conserving fox populations on the Ranch as well as elsewhere. Particularly important data would include distribution, abundance, population trends, demographic patterns (e.g., survival, mortality sources, reproductive rates, dispersal patterns), and ecological parameters (e.g., food habits, space use, den use patterns, interspecific interactions). Also of importance is determining whether Tejon Ranch kit

fox populations are isolated or whether exchange is occurring with neighboring populations. This could be assessed through telemetry methods or genetic analysis.

5. Conserve habitat in the Bi-Centennial and Tri-Centennial areas for Tehachapi pocket mice

Tehachapi pocket mice appear to be relatively widespread and abundant in the Bi-Centennial and Tri-Centennial acquisition areas. These areas and Tejon Ranch in general encompass a substantial portion of the entire range of the Tehachapi pocket mouse. Thus, conserving the habitat in these areas would contribute significantly to the conservation of this species. Current uses and activities in these areas appear to be compatible with this species and thus would not be affected.

6. Gather information on Tehachapi pocket mice

Virtually nothing is known about Tehachapi pocket mice other than its taxonomic relationship to related species. Gathering data on this species through scientific research and monitoring would provide critical information necessary for conserving Tehachapi pocket mouse populations on Tejon Ranch as well as elsewhere. Particularly important data would include distribution, abundance, population trends, demographic patterns (e.g., survival rates, reproductive rates), and ecological parameters (e.g., preferred habitat types and attributes, space use, burrow attributes and use patterns, interspecific interactions).

LITERATURE CITED

Best, T. L. 1994. *Perognathus alticolus*. Mammalian Species 463:1-4.

California Department of Fish and Game. 2009. Special Animals. http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/spanimals.pdf. Accessed October 2009.

California Natural Diversity Database (CNDDB). 2010. http://www.dfg.ca.gov/biogeodata/cnddb/. Accessed June 2010.

Clark, H. O., Jr., G. D. Warrick, B. L. Cypher, P. A. Kelly, D. F. Williams, and D. E. Grubbs. 2005. Competitive interactions between endangered kit foxes and nonnative red foxes. Western North American Naturalist 65:153-163.

Cypher, B. L. 2003. Foxes. Pages 511-546 in G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, editors. Wild Mammals of North America: Biology, Management, and Conservation. Second edition. The Johns Hopkins University Press, Baltimore, Maryland.

Cypher, B. L., H. O. Clark, Jr., P. A. Kelly, C. Van Horn Job, G. W. Warrick, and D. F. Williams. 2001. Interspecific interactions among mammalian predators: implications for the conservation of endangered San Joaquin kit foxes. Endangered Species UPDATE 18:171-174.

Grinnell, J., D. S. Dixon, and J. M. Linsdale. 1937. Fur-bearing mammals of California. Volume 2. University of California Press, Berkeley, California.

Koopman, M. E., J. H. Scrivner, and T. T. Kato. 1998. Patterns of den use by San Joaquin kit foxes. Journal of Wildlife Management 62:373-379.

McGrew, J. C. 1979. *Vulpes macrotis*. Mammalian Species 123:1-4.

Orloff, S. 1988. Present distribution of ringtails in California. California Fish and Game 74:196-202.

Patton, J. L., D. G. Huckaby, and S. T. Alvarez-Casteneda. 2007. Evolutionary history and systematic revision of woodrats of the Neotoma lepida group. University of California Publications in Zoology, Volume 135, University of California Press, Berkeley.

Tejon Ranch Company. 2008. Tejon Ranch conservation and land use agreement. http://tejonranchconservancy.org/images/uploads/rwa_exec.pdf. Accessed June 2010.

U.S. Fish and Wildlife Service (USFWS). 1998. Recovery plan for vernal pool ecosystems of California and Oregon. U.S. Fish and Wildlife Service, Region 1, Portland, Oregon.

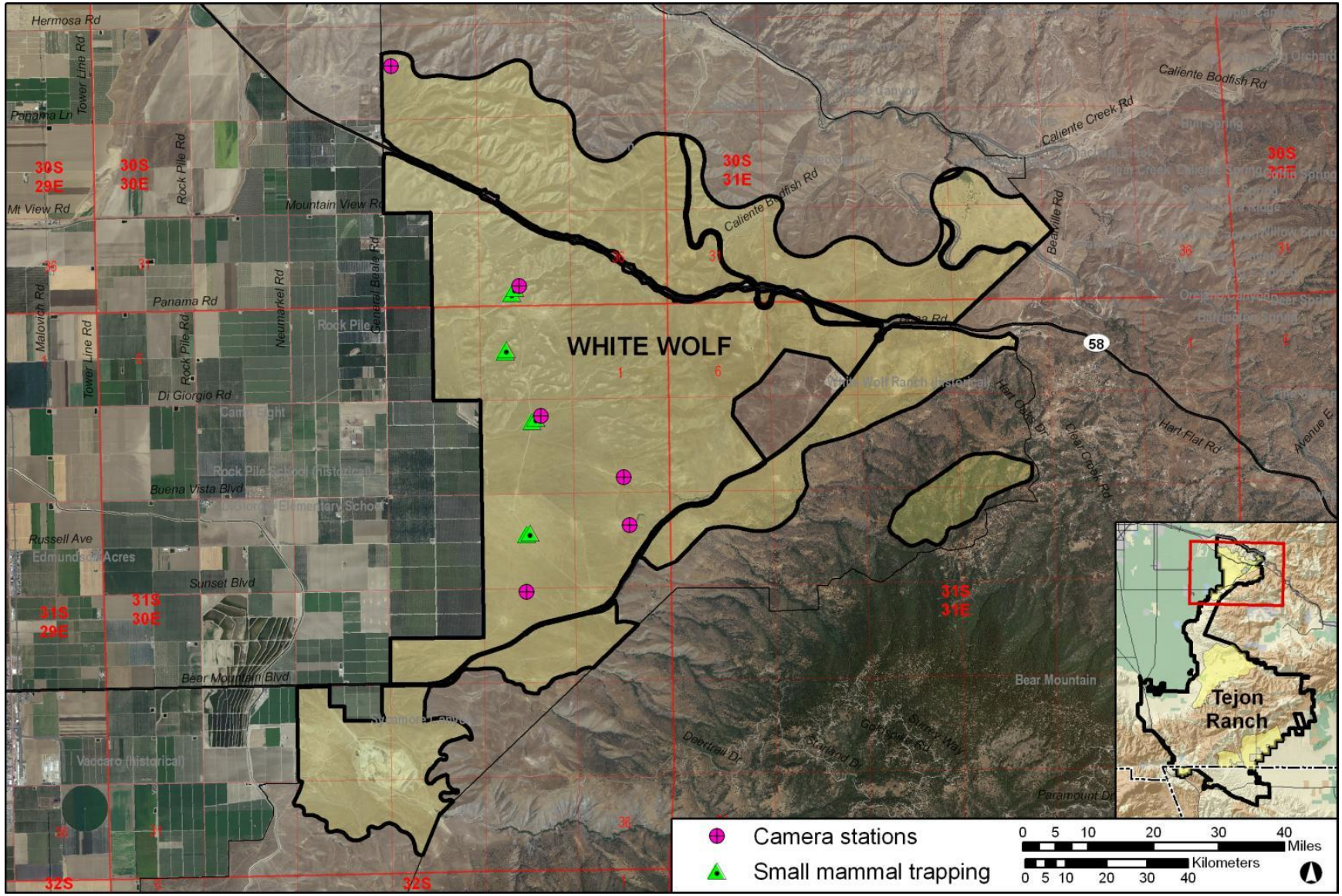
White, M. D., J. A. Stallcup, C. R. Cabañero, and K. L. Penrod. 2006. Proposed reserve design for Tejon Ranch: a threatened California legacy. Conservation Biology Institute and South Coast Wildlands, Corvallis, OR.

Williams, D. F. 1986. Mammalian species of special concern *in* California. California Department of Fish and Game, Wildlife Management Division Administrative Report 86-1, Sacramento.

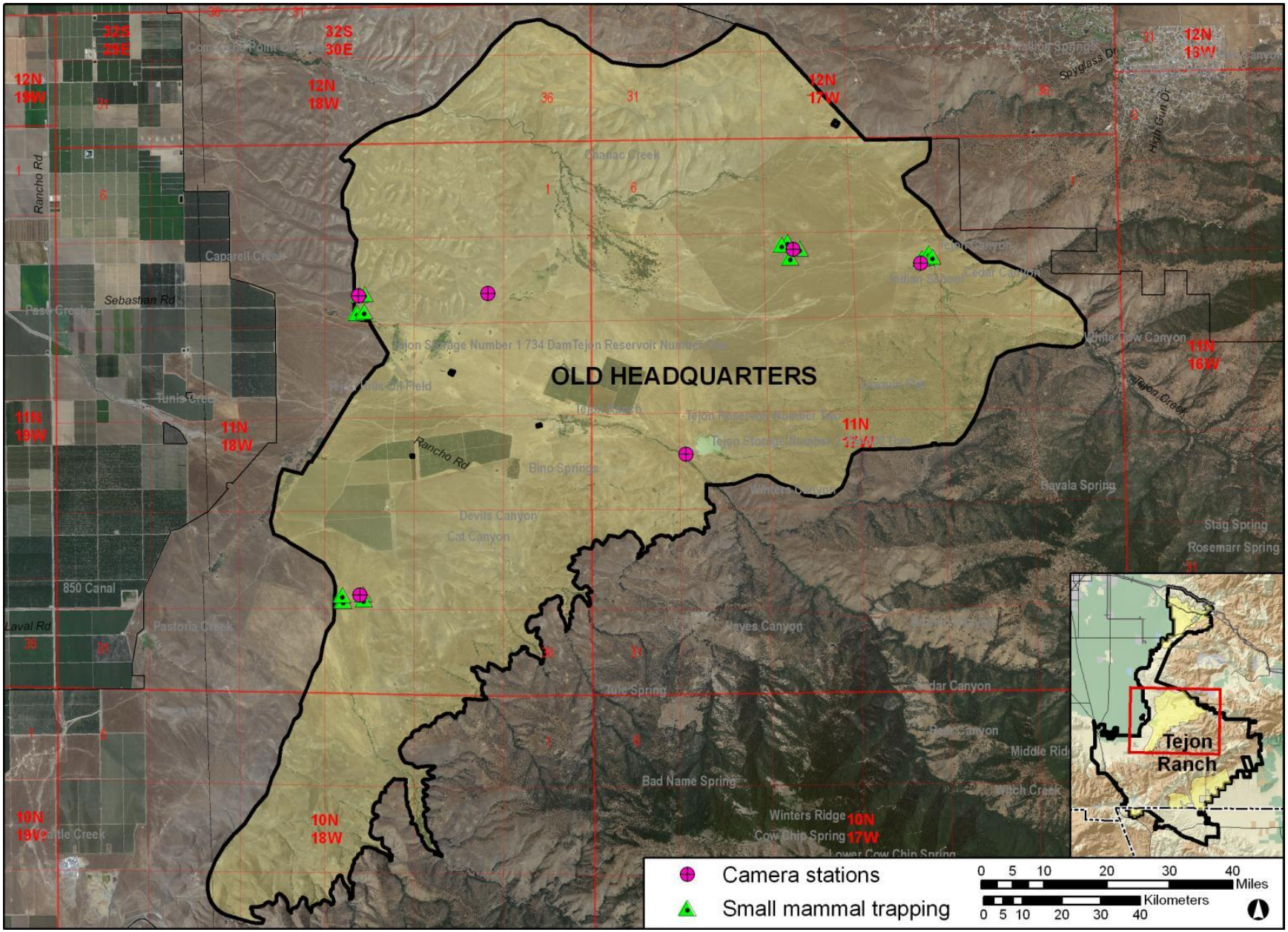
Williams, D. F., H. H. Genoways, and J. K. Braun. 1993. Taxonomy. Pages 36-196 in H. H. Genoways and J. H. Brown, editors. Biology of the Heteromyidae. The American Society of Mammalogists, Special Publication 10.

Wilson, D. E., and D. M. Reeder, editors. 2005. Mammal species of the world: a taxonomic and geographic reference. Third edition. Johns Hopkins University Press, Baltimore, MD.

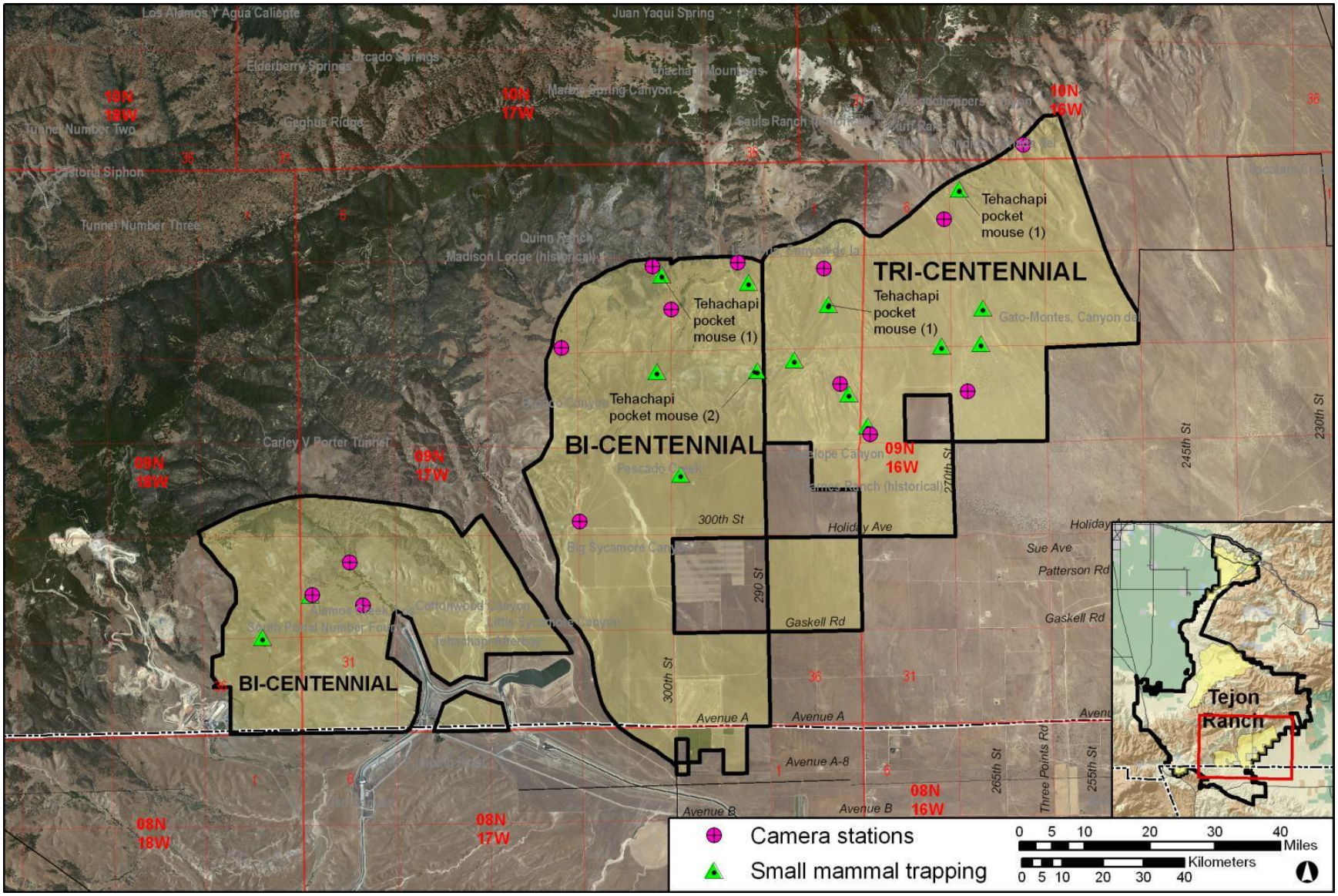
APPENDIX A. LOCATIONS OF CAMERA STATIONS AND SMALL MAMMAL TRAP LINES ON TEJON RANCH ACQUISITION AREAS



Camera stations and small mammal trap lines on the White Wolf acquisition area of Tejon Ranch.



Camera stations and small mammal trap lines on the Old Headquarters acquisition area of Tejon Ranch.



Camera stations and small mammal trap lines on the Bi-Centennial and Tri-Centennial acquisition area of Tejon Ranch.

APPENDIX B. MAMMALIAN SPECIES DETECTED ON TEJON RANCH ACQUISITION AREAS

The table below includes a list of all mammalian species detected on the White Wolf, Old Headquarters, Bi-Centennial, and Tri-Centennial acquisition areas of Tejon Ranch, California, during surveys conducted by the California State University-Stanislaus, Endangered Species Recovery Program during 2009-2010. Detection codes are as follows: C = Camera station image, S = Spotlight observation, L = Live-trapped, O = Opportunistic observation of animal, F = Scat (fecal) observation, T = Track observation, B = Burrow observation.

Species				**Acquisition Area**			
Order	**Family**	**Genus species**	**Common name**	**White Wolf**	**Old Headquarters**	**Bi-Centennial**	**Tri-Centennial**
Lagomorpha	Leporidae	*Lepus californicus*	Black-tailed jackrabbit	C, S	C, S		C, S
		Sylvilagus audubonii	Desert cottontail	O	O		
Rodentia	Sciuridae	*Ammospermophilus leucurus*	White-tailed antelope squirrel				C, L, O
		Spermophilus beechyi	California ground squirrel	O, B	O, B	C, O, B	C, O, B
	Heteromyidae	*Dipodomys heermanni*	Heermann's kangaroo rat	L	L		
		Dipodomys panamintinus	Panamint kangaroo rat			L	C, L
		Chaetodipus californicus	California pocket mouse		L		
		Perognathus alticolus inexpectatus[2]	Tehachapi pocket mouse			L	L
		Perognathus inornatus	San Joaquin pocket mouse	L	L		
		Perognathus longimembris	Little pocket mouse				L
	Geomyidae	*Thomomys bottae*	Bottae's pocket gopher	B	B	B	B
	Cricetidae	*Neotoma bryanti*	Desert woodrat				L, B
		Neotoma macrotis	Dusky-footed woodrat			L, B	
		Onychomys torridus	Southern grasshopper mouse			L	
		Peromysus boylii	Brush mouse				L
		Peromyscus maniculatus	Deer mouse	L	L	L	L
Carnivora	Felidae	*Lynx rufus*	Bobcat	S, O	C		C
	Canidae	*Canis latrans*	Coyote	C, S, F, T	C, S, F, T	C, O, F, T	C, O, F, T
		Urocyon cinereoargenteus	Gray fox		C	C	
		Vulpes macrotis mutica[3]	San Joaquin kit fox	C, S, F, T	F		
		Vulpes vulpes[4]	Red fox		C		
	Mustelidae	*Taxidea taxus*[2]	Badger	B			
	Mephitidae	*Mephitis mephitis*	Striped skunk	C, S	C		
		Spilogale gracilis	Spotted skunk		C		
	Procyonidae	*Procyon lotor*	Raccoon		S		T
Artiodactyla	Suidae	*Sus scrofa*[4]	Feral pig		C, S	O	
	Cervidae	*Odocoileus hemionus*	Black-tailed deer			F	
	Antilocapridae	*Antilocapra americana*	Pronghorn			O	

1 Taxonomy follows Wilson and Reeder 2005 except for Neotoma species, which follow Patton et al. 2007.
2 Federal Species of Concern, California Species of Special Concern
3 Federal Endangered, California Threatened
4 Non-native

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Central Region
1234 East Shaw Avenue
Fresno, California 93710
(559) 243-4005
www.wildlife.ca.gov

EDMUND G. BROWN, JR., Governor
CHARLTON H. BONHAM, Director

October 29, 2015

Samuel Dea
County of Los Angeles Department of Regional Planning
Special Projects Section
320 West Temple Street
Los Angeles, California 90012
Fax (213) 626-0434
Email: specialprojects@planning.lacounty.gov

Subject: Revised Notice of Preparation (RNOP) of a Draft Environmental Impact Report (DEIR) for the Centennial Project (State Clearinghouse number 2004031072).

Dear Mr. Dea:

The California Department of Fish and Wildlife (CDFW) have reviewed the RNOP submitted by Los Angeles County (Lead Agency) for the proposed Centennial Project (Project). The RNOP is being distributed by the Lead Agency due to a change in the Centennial Project description and the approval of a revised Antelope Valley Area Plan for the Project area in 2015. The 12,323-acre Project site is located in the northwestern portion of the Antelope Valley in an unincorporated portion of Los Angeles County and is contiguous to the southern boundary of Kern County. The Project site's western boundary is approximately one mile east of Interstate 5 (I-5). State Route 138 (SR-138) bisects the southern portion of the Project site. The Project site is located approximately 50 miles south of Bakersfield, 5 miles east of Gorman, 36 miles west of Lancaster, and 35 miles north of Santa Clarita.

The Project includes: the development of 19,333 dwelling units on approximately 4,950 acres of land designated for residential/mixed use; Business Park uses (office, research and development, and warehousing or light manufacturing uses) on approximately 600 acres; Commercial uses on approximately 100 acres; Civic/Institutional uses (schools for higher education, medical facilities, library, and other civic uses) on approximately 110 acres; and Recreation/Entertainment (such as clubhouse, farmers market, childcare facilities, health clubs) on approximately 80 acres. Proposed sites for major infrastructure facilities (e.g., wastewater reclamation facilities, water treatment facility, water bank, materials recovery facility, etc.) encompass 180 acres and K-12 schools will be located on approximately 140 acres. Approximately 5,800 acres (47 percent) of the 12,323-acre Project site is proposed for active and passive recreational use or natural resource protection in the form of parks, greenways, and open space. The Project would also include the operation of three (3) fire stations

for the Los Angeles County Fire Department, a public library, and one station for the Los Angeles County Sheriff's Department.

The current land use on the Project site is listed as a mixture of undeveloped annual grassland grazing, agriculture, and developed features include the National Cement Plant Road and a residence used to support the grazing, hunting, and caretaking operations. The West Branch of the California Aqueduct, which bisects the Project site from north to south, and the SR-138, which bisects the Project site from east to west, are excluded from the Project site boundaries. There are several local drainages on the Project site including drainages within Oso Canyon and Tentrock Canyon. Los Angeles County San Andreas Significant Ecological Area (SEA) No. 17 is located on the northwestern portion of the Project site as well as areas to the south of the SR-138. The Project proposes to preserve lands with the SEA designation.

Vegetation communities supported on the Project site described in the NOP include perennial native grasslands, wildflower fields, oak and mixed woodlands and chaparral. Nonnative annual grasslands are the dominant plant community. Riparian and wetland habitats also occur in association with the drainages, springs, and seeps, located on the site. The RNOP states the Environmental Impact Report (EIR) will analyze the potential for adverse effects to candidate, sensitive, or special status species, wetlands and riparian habitats or other sensitive natural communities, wildlife movement corridors, and oak resources.

At this time, CDFW has not been presented with recent data from biological surveys performed on the Project site. However, beginning in 1999 our staff have conducted several site visits and reviewed results from prior wildlife and botanical surveys conducted on the Project site and the surrounding Tejon Ranch lands. Based upon this information and from communicating several times over the intervening years with the Lead Agency and the Applicant on the previous Centennial Project proposal, we understand enough about species habitat suitability in the Project area to say that the Project site supports a diverse assemblage of special status species and the habitat necessary to sustain them.

Special status species known to occur within or adjacent to the Project site, include but are not limited to: State and federally endangered Least Bell's vireo (*Vireo bellii pusillus);* State and federally endangered Southwestern willow flycatcher (*Empidonax traillii extimus);* State threatened Swainson's hawk (*Buteo swainsoni*); State fully protected golden eagle (*Aquila chrysaetos)*; State Endangered Bakersfield cactus (*Opuntia basilaris* var. *treleasei*) CNPS List 1B.1 Paiute Mountain pincushionplant/naverretia (*Navarretia setiloba*) and round leaved filaree (*California macrophylum*); CNPS List 1B.2 Palmer's mariposa lily (*Calochortus palmeri var. palmeri*); and the following State Species of Special Concern: yellow-blotched ensatina (*Ensatina eshscholtzii croceator*); silvery legless lizard (*Anniella pulchra pulchra*); coastal whiptail (*Aspidoscelis tigris*); two-striped gartersnake (*Thamnophis hammondii*); Western pond turtle (*Emys marorata*); Tri-colored Blackbird (*Agelaius tricolor*);

Burrowing Owl (*Athene cunicularia*); Northern Harrier (*Circus cyaneus*); Short-eared Owl (*Asio flammeus*), Loggerhead Shrike (*Lanius ludovicianus);* Mountain Plover (*Charadrius montanus*); Grasshopper Sparrow (*Ammodramus savannarum*); California Horned Lark (*Eremophila alpestris actia*); Yellow Warbler (*Setophaga petechial*); California Gnatcatcher (*Polioptila californica californicas*); coast horned lizard (*Phrynosoma blainvillii*); American badger (*Taxidea taxus*), Tehachapi pocket mouse (*Perognathus alticolus inexpectatus)*, and the locally rare pronghorn antelope (*Antilocapra americana*). There is evidence to suggest that portions of the riparian habitat on site provide suitable nesting habitat for the State endangered and federally threatened Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*).

The Project site is also one of the largest perennial and annual grassland habitat areas remaining in Los Angeles County and is located within an area of evolutionary flux for wildlife and plant groups because of the meeting of habitats in the Centennial area. The Project appears to present the potential to significantly impact these species and degrade this core habitat area. Preservation of habitat for biological diversity and evolutionary processes to continue in the natural open spaces should be very closely examined in the DEIR.

In this letter, we describe several minimum survey recommendations for special status species that are known to occur on and in habitat that is contiguous with the Project site. Because the surveys are intended to provide a baseline for the County's California Environmental Quality Act (CEQA) analysis, we recommend completing the surveys prior to circulating a draft CEQA document so that the project design, impact analysis, and mitigation measures are based on an understanding of the species' abundance and distribution on the Project site. Such surveys would also be necessary to inform the analysis required for CDFW to issue Incidental Take Permits (ITPs) pursuant to the California Endangered Species Act (CESA).

CDFW Jurisdiction

Trustee Agency Authority: CDFW is a Trustee Agency with the responsibility under CEQA for commenting on projects that could impact plant, fish and wildlife resources. Pursuant to Fish and Game Code section 1802, CDFW has jurisdiction over the conservation, protection and management of fish, wildlife, native plants and habitat necessary for biologically sustainable populations of those species. As a Trustee Agency for plant, fish and wildlife resources, CDFW is responsible for providing, as available, biological expertise to review and comment on environmental documents and impacts arising from project activities, as those terms are used under CEQA.

Responsible Agency Authority: CDFW has regulatory authority over projects that could result in take of any species listed or is a candidate for listing by the State (State-listed) as threatened or endangered, pursuant to CESA. For this or any other project which impacts listed species, an ITP is the mechanism for providing take authorization under CESA. CEQA requires a Mandatory Finding of Significance if a

project is likely to substantially impact threatened or endangered species (§§ 21001{c}, 21083, Guidelines §§ 15380, 15064, 15065). Impacts must be avoided or mitigated to less than significant levels unless the CEQA Lead Agency makes and supports a Statement of Overriding Consideration (SOC). A CEQA Lead Agency's SOC would not preclude the Project proponent's obligation to comply with CESA.

Native Plant Protection Act (NPPA): Fish and Game Code section 1900 *et seq.* The NPPA prohibits the take[1] of state-listed rare plants unless authorized by CDFW or in certain limited circumstances. Take of state-listed rare plants that may occur as a result of a project may only be permitted through an incidental take permit or other authorization issued by CDFW pursuant to California Code of Regulations, title 14, section 786.0 subdivision (b).

Lake and Streambed Alteration Notification: CDFW has regulatory authority with regard to activities occurring in streams and/or lakes that could adversely affect any fish or wildlife resource, pursuant to Fish and Game Code sections 1600 *et seq.* Section 1602(a) of the Fish and Game Code requires an entity to notify CDFW before engaging in activities that would substantially change the bed, channel, or bank of a stream or substantially divert or obstruct the natural flow of a stream. If Project activities are proposed that will involve work within the bed, bank, or channel of any stream, a Lake and Streambed Alteration Agreement (LSA Agreement) may be necessary. CDFW recommends the Project applicant submit a Lake and Streambed Alteration Notification to CDFW for the Project. CDFW is required to comply with CEQA before issuing an LSA Agreement. Therefore, for efficiency in environmental compliance, we recommend that any stream disturbance be described and mitigation for the disturbance be developed as part of the environmental review process. This will reduce the need for CDFW to require extensive additional environmental review for an LSA Agreement for the Project in the future.

Other Rare Species: Species of plants and animals need not be listed as Endangered, Rare or Threatened (E, R or T) pursuant to CESA and/or the Federal Endangered Species Act (ESA) to be considered E, R or T under CEQA. If a species can be shown to meet the criteria for a listing as E, R or T under CESA and/or ESA as specified in the CEQA Guidelines (California Code of Regulations [CCR], Title 14, Chapter 3, § 15380), it should be fully considered in the environmental analysis for the Project.

Fully Protected Species: CDFW has jurisdiction over fully protected species of birds, mammals, amphibians, reptiles, and fish, pursuant to Fish and Game Code sections 3511, 4700, 5050, and 5515. Take of any fully protected species is prohibited, and CDFW cannot authorize their take except under the provisions of a Natural Communities Conservation Plan (NCCP), pursuant to Section 2081.7(d) of the Fish and

---

[1] Take is defined in Section 86 of the Fish and Game Code as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill."

Game Code, or a Memorandum of Understanding for scientific purposes. Absent the Project obtaining incidental take coverage under an NCCP in accordance with Section 2081.7(d), it is advised the DEIR evaluate and address potential Project-related impacts to fully protected species and include appropriate avoidance measures to ensure that take of fully protected species is prevented. Additional comments on potential Project-related impacts to are provided below.

Bird Protection: CDFW has jurisdiction over actions that may result in the disturbance or destruction of active nest sites or the unauthorized take of birds. Sections of the Fish and Game Code that protect birds, their eggs and nest include sections 3503 (regarding unlawful take, possession or needless destruction of the nest or eggs of any bird), 3503.5 (regarding the take, possession or destruction of any birds-of-prey or their nests or eggs), and 3513 (regarding unlawful take of any migratory nongame bird).

Potential Impacts and Recommendations

Biological Surveys: It appears that the Lead Agency's NOP and Initial Study is utilizing biological surveys that are now several years old (dating back between 1999-2009). CDFW recommends that current botanical and wildlife surveys be conducted to update biological impact assessments, and determine suitable avoidance, minimization, and mitigation measures in the DEIR. This is especially relevant if site conditions have changed following the most previous surveys such as the occurrence of wildfire, changes in grazing patterns, rainfall availability, recently discovered sensitive species occurrences, etc. The DEIR should also discuss the effects of the prolonged drought on any negative results and what the likelihood is of a species to occur on-site during optimal conditions of rainfall.

Special Status Wildlife: The Project has the potential to impact several wildlife special status species. All the species listed above are known to occur or could potentially occur on the proposed Project site and in the Project vicinity. Given the importance of the Project area for special status species, CDFW recommends that the DEIR's biological impact analysis include a robust assessment of the proposed Project's potential to substantially reduce and adversely modify habitat for special status species, reduce and potentially seriously impair the viability of populations of special status species, and reduce the number and range of special status species while taking into account the likelihood that special status species on adjacent and nearby natural lands rely upon the habitat that occurs on the proposed Project site. For each State-listed species that may be potentially impacted by the Project, CDFW recommends the Lead Agency demonstrate in the DEIR that Project-related impacts would be fully mitigated as required by CESA. In addition, given the location of this Project and the degree to which habitat for the suite of special status species in the regional vicinity is being affected by a variety of land uses, we recommend a detailed cumulative effects analysis be conducted to address the impacts of this Project in relation to other projects and their effect on sensitive species. The analysis should also thoroughly describe the specific measures that would be undertaken through Project actions and other mechanisms to

ensure that the effects of this Project would not contribute to the declining viability or extirpation of sensitive species populations.

Full mitigation for this Project would include offsetting take and the loss of carrying capacity by protection of suitable and comparable habitat in perpetuity and enhancing the capacity of this habitat to support higher densities of CESA listed species. CDFW recommends that any proposal to fully mitigate any CESA listed species impacts from this Project include the specific location, habitat quality, and acreage of proposed mitigation lands. If the DEIR does not specify conservation of specific areas, identification of the larger area within which mitigation lands could be acquired (including the amount of proposed mitigation lands) may suffice. We further recommend the DEIR impact analysis and mitigation proposal demonstrate how the acreage, location, and management of mitigation lands would increase the number of CESA listed species on those lands in perpetuity at a rate which fully offsets the Project's individual and cumulative impacts to that species population, including the direct and indirect effects discussed above.

Swainson's Hawk: The Project site occurs within the Antelope Valley which supports a breeding population of Swainson's hawk (SWHA). Based on previous survey data for the Project site, SHWA has been observed on the Project site. Because of the known site fidelity (repeated use of the same nest site annually) demonstrated by SWHA, CDFW considers any documented SWHA nest to be active unless it is demonstrated by protocol-level surveys conducted during the nesting season (January 1 through September 15) to be unoccupied. Annual grasslands, alfalfa, fallow fields, dry-land and irrigated pasture, cereal grain crops (including corn after harvest), as well as beet, tomato and other low-growing row or field crops are all considered SWHA foraging habitat (CDFG 1994). To help identify potential Project-related impacts to SWHA, CDFW recommends the Lead Agency require surveys for nesting SWHA be conducted within a 0.5-mile buffer around the Project site, before starting any Project-related activities, following the survey methodology developed by the SWHA Technical Advisory Committee (SWHA TAC 2000). In the event that SWHA is detected, consultation with CDFW is recommended to discuss how to implement the Project and avoid take (e.g., minimize impacts). If take cannot be avoided, acquisition of an ITP would be warranted in advance of Project implementation for Project-related incidental take of SWHA. To facilitate the application of an ITP, CDFW recommends the Lead Agency disclose potential impacts to SWHAs and their nest sites in the CEQA document; thereby enabling CDFW to use the CEQA document to issue an ITP.

Burrowing Owl: The Project site is located within an area of the Antelope Valley that supports the last remaining breeding populations of burrowing owl in Los Angeles County. Burrowing owl (BUOW) were observed during previous survey efforts on the Project site which supports abundant suitable habitat for the species. To establish the status of BUOWs on the Project site and to provide for a CEQA baseline, CDFW recommends following the *Staff Report on Burrowing Owl Mitigation* dated March 7, 2012. The staff report can be found on our website at

www.dfg.ca.gov/wildlife/nongame/docs/BUOWStaffReport.pdf. If the Project site contains potential BUOW burrows, CDFW recommends that a qualified biologist conduct a survey no more than 30 days before the onset of any Project activities. Per CDFW staff report, if Project activities are delayed or suspended for more than 30 days, the area should be resurveyed.

Pronghorn (Antelope): Pronghorn have been observed on the Project site and should be accommodated in the design of the Project with all actions to ensure continued use of the Project site by this species detailed in the DEIR. Pronghorn are known as animals typical of grassland, and their use of the Centennial grassland needs to be facilitated and managed accordingly to enable their persistence. The California Aqueduct should be spanned with vegetative bridges for the pronghorn as part of an overall effort to safeguard movement corridors for pronghorn and other animals and plants through the Project site.

Furthermore, due to pronghorns' historical extirpation and successful return to Los Angeles County, the Centennial area herd is now the only herd present within Southern California. As such, CDFW believes it is imperative to conduct detailed field studies of their use of the Tejon Ranch and surrounding areas in order to fully understand the times of year when this herd is using the Project site and vicinity and typical movement patterns between and within suitable habitats. This data can then be used to support and develop the Project design as well as appropriate minimization and mitigation measures.

Raptors and Migratory Birds: For the protection of raptors and migratory song birds and to assist in avoiding take of avian species as required by Fish and Game Code sections 3503, 3503.5 and 3513, if Project-related activities will occur during the breeding season (January through mid-September), CDFW recommends the Lead Agency require surveys be conducted by a qualified biologist no more than 14 days prior to the beginning of any Project-related activity likely to impact raptors and migratory song birds, for the entire Project site. If Project activities are delayed or suspended for more than 14 days during the breeding season, CDFW recommends the surveys be repeated. If nesting raptors and migratory song birds are identified, CDFW recommends the Lead Agency require the active nest be continuously monitored by a qualified biologist for the first 24 hours prior to any construction-related activities to establish a behavioral baseline. Once work commences, all nests should be continuously monitored to detect any behavioral changes as a result of the Project. If behavioral changes are observed, the work causing that change should cease and CDFW consulted for additional avoidance and minimization measures.

If continuous monitoring of identified nests by a qualified biologist is not feasible, the following minimum no-disturbance buffers are advised to be implemented:

1. 250 feet around active passerine (perching birds and songbirds) nests;

2. 500 feet around active non-listed (pursuant to CESA or federal Endangered Species Act) raptor nests; and 0.5 mile around active listed bird nests.

These buffers should be maintained until the breeding season has ended or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival. Variance from these no-disturbance buffers may be implemented when the Project area would be concealed from a nest by topography. Any variance from these buffers is advised to be supported by a qualified biologist and it is recommended CDFW be notified in advance of implementation of a no-disturbance buffer.

General Wildlife Mortality: The DEIR should discuss how general take of wildlife will be avoided or reduced. For example CDFW recommends that any grading/grubbing be done in phases to push wildlife of higher mobility towards adjacent habitat in which to escape equipment. Islands of habitat should not be created during site disturbance where wildlife will enter and then be subject to mortality when these areas are grubbed or graded. Attempts to salvage species of low mobility should be made prior to ground disturbance activities. Salvaged species should be salvaged out of harm's way onto adjacent suitable habitat not disturbed by the Project.

The DEIR should discuss ways to minimize adverse impacts to wildlife from fencing. Where feasible, fence placement and design should facilitate wildlife movement and all fencing should avoid creating a wildlife injury hazard. Fencing can adversely impact wildlife by restricting or eliminating movement through a project and access to onsite and offsite habitats. Birds and reptiles seek out hollow metal fence posts in which to reside and can become trapped, resulting in mortality. Raptor's talons can become entrapped within the bolt holes of metal fence stakes resulting in mortality (see http://kern.audubon.org/death_pipes.htm.) Fences with sharp protruding edges can also pose a wildlife hazard and should be avoided. To reduce fencing hazards to wildlife, CDFW recommends that hollow fence posts be capped and fence stakes be plugged with bolts or other plugging materials. All fencing materials should also avoid sharp edges to reduce injury and mortality to wildlife. Pronghorn friendly fencing practices should be used in areas where this species occurs or will likely occur in the future.

Special Status Plants and Natural Communities: To assess the presence of rare, threatened, and endangered plants and natural communities on the Project site, botanical surveys following the guidelines developed by CDFW (CDFW 2009) and the United States Fish and Wildlife Service (USFWS) (USFWS 1996) are recommended. CDFW recommends botanical surveys cover the entire area of direct and indirect Project affects and be timed appropriately to detect all species which may occur on the property before CEQA analysis occurs. Use of reference sites is recommended for species which are known to occur in the vicinity or which otherwise have a high potential of occurring on-site.

Special status plant species documented on the Project site that are recommended to be evaluated in the DEIR should include but not be limited to the round-leaved filaree (*California macrophylum*) and Piute Mountains navarretia (*Navarretia setiloba)* both considered Rare 1B.1 listed plants. The California Endangered Bakersfield cactus (*Opuntia basilaris var. treleasei*) has recently been confirmed by Los Angeles County Department of Regional Planning on a hillside slope within grazed pastureland approximately one mile west of the Project site and should also be included in focused botanical surveys and the Project impact analysis.

CDFW recommends special status plant species are avoided whenever possible by delineation and observing a no-disturbance buffer of at least 50-feet from the outer edge of the plant population(s) or specific habitat type. Be advised that a 50-foot buffer is considered a minimum standard buffer distance and a larger buffer distance may be warranted depending upon the situation, species, or habitat type. If buffers cannot be maintained, then consultation with CDFW would be warranted to determine appropriate minimization and mitigation measures for impacts to special status plant species. Should a State- or federally listed plant species be identified during botanical surveys then consultation with CDFW is necessary and take authorization may be warranted prior to commencing ground-disturbing activities.

CDFW also recommends that natural communities on the Project site, such as but not limited to native grassland, riparian, oak woodland and wildflower fields, be classified according to the *List of Natural Communities Recognized by the California Natural Diversity Database* (CDFG 2010) and the *List of California Vegetation Alliances* (CDFG 2007). CDFW considers those natural communities noted with an asterisk in CDFG 2010, or with a State rank of S1-S3 in CDFG 2007, to be of conservation concern and recommends the CEQA analysis consider these communities as sensitive.

Riparian Resources: The NOP identifies several local drainages on the Project site and describes Project construction and flood control measures that may adversely impact riparian resources. The NOP describes that all developed areas on the Project site would be connected by a trail system that would link the parks to the residential areas through the open space drainages. Any Project activity that would substantially change the bed, channel, or bank of a stream and associated riparian vegetation or substantially divert or obstruct the natural flow of a stream may require further consultation with CDFW and require an LSA Agreement. Maintenance activities within storm water facilities described in the NOP such as debris basins, water quality basins, infiltration and retention/detention basins, and flood-control structures may also require an LSA Maintenance Agreement pursuant to Fish and Game Code sections 1600 *et seq*. CDFW recommends early consultation regarding the Project's drainage concept, as significant modification to a Project and mitigation measures may be required in order to obtain an LSA Agreement.

Wildlife Movement: Oso Canyon has been identified as an important wildlife corridor by CDFW, and by the Lead Agency as defined in the San Andreas SEA. The DEIR

should analyze how the proposed project will impact wildlife movement to and through Oso Canyon through the Project site in general and onto adjacent suitable off-site habitats. The DEIR is advised to include data from actual field studies of animal movement on and adjacent to Centennial lands including the Project site. Movement data derived from radio telemetry studies, tracking, and camera stations provides a robust approach to determine where movement corridors are essential to maintain and where infrastructure and other Project elements are best positioned. CDFW believes that there is movement and dispersal opportunity for wildlife and botanical resources over the grassland within the Project site and that design of any natural open space in the Project and wildlife corridors provides opportunity to allow for this. For example as stated for pronghorn antelope above, the DEIR can propose ways to enhance biological resource movement across the California Aqueduct, which poses a partial wildlife movement barrier through the Project site and adjacent off-site areas, to supplement permeability across the landscape. At present, the major avenues for wildlife movement from the Tehachapi Mountains south to the Angeles National Forest is to move west under Interstate 5, travel south and then move east under Interstate 5 once again. This passage is less than optimal and discourages north south movement. A north-south passage directly from the Tehachapi Mountains, across the Project site and other Tejon Ranch lands and into the Angeles National Forest is the most direct route and one that can be accomplished with Aqueduct crossing opportunities and strategic habitat restoration to encourage use. Facilitating movement across the Aqueduct utilizing vegetated bridges would enhance habitat value to any open space dedicated on the Project site for biological resource value and further reduce Project impacts to biological resources.

The NOP proposes utility and/or drainage infrastructure improvements, extensions, and/or easements within SR-138 (i.e., Caltrans) right-of-way, Gorman Post Road, and 300th Street West in addition to additional roadways and lane widening at SR-138 that will facilitate traffic circulation onto and throughout the Project. Whenever possible, CDFW recommends incorporating biota movement opportunities across any movement impediments that restrict biota movement from and on to the Project site. The widening of SR-138 will create further wildlife movement impediments and mortality if adequate undercrossings or overcrossings are not installed during the construction phase by Caltrans in coordination with the Project. It may be more cost effective to install structural movement opportunities at this time in a cooperative effort with Caltrans rather than postponing until when these types of structures may be decided as a priority in the future.

Open Space Areas and Trail System: While CDFW is typically supportive of Open space, parks, and passive uses, these land uses often do not meet the habitat needs of fish and wildlife resources. The DEIR should include measures and instruments proposed to preserve and manage in perpetuity any areas to be preserved for biological resource value, especially areas within designated SEAs and areas dedicated as mitigation for impacts to biological resources. CDFW recommends placement of preservation areas into conservation easements managed by a land conservancy to

assist in maintaining biological resources. It is also recommended the Applicant consult with CDFW to identify open space locations and land uses compatible with preserving the integrity of the State's natural resources.

Please provide a key for Figure 3 of the 2004 NOP which appears to show green open space or landscape areas within the Project planning areas. The Draft EIR should detail all areas of potential public access, and passive recreation to allow for an analysis of the potential impact those land uses would have on biological resources.

Several of these greenways appear to "dead end". Linear habitat areas that do not connect to other areas of habitat may encourage wildlife use and increase wildlife human conflict if these areas end at developed areas where wildlife may enter neighborhoods. All Open space conservation lands should be large blocks of habitat contiguous with and of logical extension of existing protected habitat resources. As currently depicted in Figure 3 and 4, the conservation areas may be too patchily distributed to provide effective habitat and be too onerous to manage for the remaining biological resources. CDFW recommends that the DEIR include ways to move wildlife safely through landscaped open space areas to avoid future wildlife/human conflicts.

A biological resources management plan (Plan) for conservation areas is advised to be created. The plan should include detailed conservation principles, goals success criteria, implementation schedules, monitoring, and have contingency plans for each of those details. If fire management needs to impact more open space or biological resource conservation areas, this impact is advised to be clearly analyzed and addressed in the DEIR and plan. If the Project includes continued cattle grazing, the DEIR and plan should discuss how cattle will continue to be used on dedicated conservation lands on the Project site and describe how this practice will facilitate the perpetuation and enhancement of biological diversity. Measures to control feral pig (*Sus scrofa*) are recommended to also be included in the Plan. Guidelines and enforcement provisions will need to be addressed in advance. For example, guidelines on pets, feral animal management, trespass, how wildlife take will be managed, and payment of enforcement staff (rangers) would be a key items and described in detail in the plan. The plan should include a funding source in perpetuity as an important component for plan implantation and success. Because the impacts to biological and botanical resources are so substantial in the execution and full buildout of the Project, CDFW requests the detailed plan be part of the DEIR and available for review and consideration by interested parties, the public, stakeholders, and trustee agencies.

The NOP describes that developed areas on the Project site would be connected by a trail system that would link the parks to the residential areas through the open space drainages. CDFW recommends that trails are located outside of open space conservation areas and outside of drainages whenever feasible. If trails must be placed within open space conservation areas, the DEIR should analyze the associated impacts on biological resources avoidance and mitigation measures. Mitigation measures may include keeping trails to a minimal width; utilizing natural much materials for trail

surfaces; prohibiting artificial night lighting; providing trash receptacles that cannot be opened by bears and other scavengers; instituting and enforcing a "no pet" or "pets only on leash" policy when appropriate. Trail uses within drainages may require a lake and streambed alteration agreement for the installation and maintenance of these trails.

Cumulative Impacts: Cumulative impacts are changes in the environment that result from the incremental impact of the Project when added to other closely related past, present, and reasonably foreseeable, probable future impacts. CDFW recommends that the DEIR prepared for the Project adequately address and quantify cumulative impacts to special status species included but not limited to those mentioned above. Cumulative impacts from development and other land use changes in the Antelope Valley and projects such as the Tejon Ranch Commerce Center, and Tejon Mountain Village are advised to be included in this analysis. We recommend that the cumulative impacts analysis also consider that the species discussed above are rapidly losing habitat in the same region as undisturbed lands are converted to agricultural, industrial, and commercial developments, including renewable energy projects.

Federally Listed Species: CDFW also recommends consulting with the USFWS on potential impacts to federally listed species. Take under ESA is more broadly defined than CESA; take under ESA also includes significant habitat modification or degradation that could result in death or injury to a listed species by interfering with essential behavioral patterns such as breeding, foraging, or nesting. Consultation with the USFWS in order to comply with ESA is advised well in advance of Project implementation.

Thank you for the opportunity to comment on the Grapevine Specific and Community Plan NOP. If you have any questions regarding these comments, please contact Lori Bono, Senior Environmental Scientist (Specialist), at (559) 243-4014, extension 350, or lori.bono@wildlife.ca.gov.

Sincerely,

Julie A. Vance
Regional Manager

cc: Thomas Leeman
United States Fish and Wildlife Service
2800 Cottage Way, Room W-2805
Sacramento, California 95825-1846

ec: See Page Thirteen

Literature Cited

CDFG. 1994. Staff Report Regarding Mitigation for Impacts to Swainson's Hawks (*Buteo swainsoni*) in the Central Valley of California. California Department of Fish and Game.

CDFG. 2007. List of California Vegetation Alliances. California Department of Fish and Game Biogeographic Data Branch.
9
CDFG. 2009. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. California Department of Fish and Game.

CDFG. 2010. List of Natural Communities Recognized by the California Natural Diversity Database. California Department of Fish and Game, Sacramento, California.

CDFG. 2012. Staff Report on Burrowing Owl Mitigation. California Department of Fish and Game. Report available at:
www.dfg.ca.gov/wildlife/nongame/docs/BUOWStaffReport.pdf

SWHA TAC. 2000. Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley. Swainson's Hawk Technical Advisory Committee.

USFWS. 1996. Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants. United States Fish and Wildlife Service, Sacramento, California.

Lorelei H. Oviatt, AICP, Director
2700 "M" Street, Suite 100
Bakersfield, CA 93301-2323
Phone: (661) 862-8600
Fax: (661) 862-8601 TTY Relay 1-800-735-2929
Email: planning@co.kern.ca.us
Web Address: http://pcd.kerndsa.com/

PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT

Planning
Community Development
Administrative Operations

November 6, 2015

File: Centennial Project NOP

County of Los Angeles
Department of Regional Planning
Special Projects Section
Attn: Mr. Samuel Dea
320 West Temple Street,
Los Angeles, CA 90012

RE: Centennial Project (SCH# 2004031072) Revised Notice of Preparation

Dear Mr. Dea:

The Kern County Planning & Community Development Department appreciates the opportunity to provide comments on the Revised Notice of Preparation (NOP) for the Centennial Project by Centennial Founders LLC. This department previously commented on this project in a letter dated April 20, 2004.

The revised Centennial Project is a 12,323 acre master planned community located in the northwestern portion of the Antelope Valley region of unincorporated Los Angeles County. The Project is contiguous to the southern boundary of Kern County. At buildout, the Project would include several village areas containing approximately 19,333 dwelling units, 7,371,000 square feet (s/f) of business park uses, 981,000 s/f of commercial uses, and 1,551,000 s/f of civic/institutional uses.

The Environmental Impact Report (EIR) should include an analysis of the following potentially significant impacts on Kern County:

Air Quality

The Project is located within the jurisdiction of the Antelope Valley Air Quality Management District (AQMD). This Antelope Valley AQMD is located south of and adjacent to the Kern County portion of the Mojave Desert Air Basin under the administration of the Eastern Kern County Air Pollution Control District (EKAPCD) formerly the Kern County Air Pollution Control District (KCAPCD). This portion of Kern County is affected by transport of air emissions from both the San Joaquin Valley and the Antelope Valley basins. The KCAPCD Rate of Progress report, dated November 15, 2000, for the Ozone Air Quality Attainment Plan showed that in absence of transport, the area would be in attainment for ozone standards. The current Plan has demonstrated attainment of the standards for PM_{10} and ozone, but it did not anticipate a project of the size of the Centennial Project. The Project's contribution to the air basin should also be assessed in regards to the potential for significantly increasing the amount of transport from the Antelope Valley AQMD to the Mojave Air Basin.

Additionally, potential impacts on the San Joaquin Valley Air Basin should be assessed from the potential for increased traffic travelling on Interstate 5 from:

1. Truck traffic from the commercial portion of the Project, and
2. Traffic from the residential portion of the Project travelling to central and northern California destinations.

Transportation/Traffic

Interstate 5 is a major highway corridor through Kern County. State Highway 138 (Avenue D) connects to State Highway 14, which is the major transportation corridor for eastern Kern County. The analysis of traffic impacts should include, but not be limited to, the following areas of concern:

1. increased temporary use of the Frazier Park/Lebec interchange for travel to Bakersfield from the Project's new residents;
2. increased congestion on State Highway 14 as the Project's residents commute to jobs, or use it as an alternate to Interstate 5;
3. increased truck traffic on Interstate 5 from the commercial portion of the Project;
4. transport of students by bus to existing schools before construction of the onsite schools; and
5. increase of transit/bus trips to Frazier Park/Lebec, Bakersfield, and other destinations north of the Project.

Additionally, the EIR should include analysis of the traffic for the community of Tejon Mountain Village, which is a fully entitled project that is expected to begin construction in 2016; the community of Grapevine which is currently in seeking entitlements for a master planned community containing between 12,000 and 14,000 dwelling units, and a maximum of 5,100,000 s/f of commercial/light industrial uses; and the Tejon Indian Tribe casino project for which the Bureau of Indian Affars (BIA) has initiated the preparation of an Environmental Impact Statement (EIS).

Water

The Project proposed to use some combination of groundwater and surface water available from local groundwater, recycled water, Antelope Valley East Kern Water District (AVEK) water, banked water, return flows and other purchased water supplies from outside the AVEK service area. The projected use of supplemental water from AVEK is a feature of the following approved specific plans in eastern Kern County: 1) Mojave Specific Plan; 2) Rosamond Specific Plan; and 3) Willow Springs Specific Plan. At buildout these specific plans provide for approximately 89,000 dwelling units, 4,700,000 s/f of commercial, and 10,000,000 s/f of industrial uses. This is in addition to the growing areas of Lancaster, Palmdale, and Edwards Air Force Base which may also utilize AVEK water. Analysis of the realistic availability of water over the next 20 years on a cumulative basis should be included in the EIR. A full analysis of the water supply as required by Senate Bill (SB) 610 (Costa) included potential water transfers, existing condition of the hydrologic basin, and conservation measures should occur.

Emergency and Medical Services

The Project Description refers to facilities for fire and sheriff services, but not for emergency and other medical services. There is no major hospital within immediate transport of the Project site. A detailed plan for the provision of emergency services, including a trauma hospital, should be included in the Centennial Specific Plan and discussed in the EIR. Accidents on Interstate 5, as well as icy roads on State

Highway 138 could make access to off-site hospital facilities difficult or impossible. Additionally, the impacts on Kern County public services such as fire, ambulance, paramedics and medi-vac, which provide backup emergency services, should be discussed in the EIR.

Public Facilities

The phasing of the Project could result in new residents living without a wide range of public facilities. This lack of public services could result in impacts to the following Kern County facilities at Frazier Park/Lebec: 1) libraries, 2) parks, and 3) fire. As these facilities are already negatively impacted by budgetary constraints, the EIR should discuss the impacts and assess appropriate mitigation for impacts to Kern County facilities.

The Revised NOP indicated that prior to the construction of the high school, all students would be housed in the first constructed K-8 school. However, Page 9 of the original NOP noted that until enough students warrant the construction of a high school, that grades 9-12 would be transported to the existing high school in Frazier Park. If students will end up being sent to the high school in Frazier Park, which is part of the El Tejon School District, the EIR should assess the fiscal impacts to the El Tejon School District and clarify the issue of which district will receive the payment of statutory school fees.

Cumulative Impacts Analysis

As required by CEQA, a complete list of past, present and reasonably foreseeable future projects is required for discussion of cumulative impacts. Please contact the Kern County Planning Department to discuss the scope of projects along Interstate 5 and Avenue A that should be included in the cumulative impact discussion.

The Kern County Planning and Community Development Department appreciates the opportunity to provide consultation and cooperate with Los Angeles County on this proposed Project on our southern border. Please contact me at (661) 862-8739, or by emailing me at MurphyC@co.kern.ca.us to discuss any question or concerns, or if I can help provide guidance in your research for the preparation of the Draft EIR.

Sincerely,

Craig M. Murphy, Division Chief
Planning & Community Development Dept.

California Water Boards

Edmund G. Brown Jr., Governor

Matthew Rodriquez, Secretary for Environmental Protection

Lahontan Regional Water Quality Control Board

November 4, 2015

File: Environmental Doc Review
Los Angeles County

Samuel Dea
County of Los Angeles Planning Department
320 West Temple St.
Los Angeles, CA 90012
Email: specialprojects@planning.lacounty.gov

Comments on the Notice of Preparation of a Draft Environmental Impact Report for the Centennial Development Project, Los Angeles County, State Clearinghouse Number 2004031072

The Notice of Preparation of a Draft Environmental Impact Report (DEIR) for the above-referenced project (Project) was prepared by the County of Los Angeles Planning Department (County) and circulated for public comment in compliance with provisions of the California Environmental Quality Act (CEQA). As a responsible agency, the California Regional Water Quality Control Board, Lahontan Region (Water Board) is providing these comments to specify the scope and content of the environmental information germane to our statutory responsibilities pursuant to CEQA Guidelines, California Code of Regulations, title 14, section 15096. Based on our review of the proposed Project, we recommend that several issues be considered in the preparation of the Notice of Preparation (NOP), particularly: 1) established numerical and narrative water quality objectives and standards should be used when evaluating thresholds of significance for Project impacts; (2) post-construction best management practices (BMPs) for stormwater control are an essential part of project planning and should be discussed in the DEIR; and 3) all potential downstream impacts to hydrology and water quality must be evaluated as a result of Project implementation. Our comments on the Project are outlined below.

Project Overview

The Centennial Project is a large residential-commercial development that will include 19,333 dwelling units on an area of a total of 12,323 acres in western Antelope Valley, 36 miles west of Lancaster. Approximately 6,700 acres of land will be developed into a series of communities over a 20 year period, and approximately 5,600 acres of land will be preserved for open space for drainages and conservation. New infrastructure facilities including shopping centers, water treatment facilities, water banking facilities will be built on approximately 180 acres, while approximately 140 acres will be set aside for K-12 schools. Commercial buildings will occupy approximately 100 acres, hospitals, medical facilities, and higher education buildings will occupy approximately 110 acres, and recreational and entertainment facilities will occupy approximately 80 acres.

Water Board's Authority

All groundwater and surface waters are considered waters of the State. Surface waters include streams, lakes, ponds, and wetlands, and may be ephemeral, intermittent, or perennial. All waters of the State are protected under California law. State law assigns responsibility for protection of water quality in the Lahontan Region to the Lahontan Water Board. Some waters of the State are also waters of the U.S. The Federal Clean Water Act (CWA) provides additional protection for those waters of the State that are also waters of the U.S.

The *Water Quality Control Plan for the Lahontan Region* (Basin Plan) contains policies that the Water Board uses with other laws and regulations to protect the quality of waters of the State within the Lahontan Region. The Basin Plan sets forth water quality standards for surface water and groundwater of the Region, which include designated beneficial uses as well as narrative and numerical objectives which must be maintained or attained to protect those uses. The Basin Plan can be accessed via the Water Board's web site at http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.shtml.

Specific Issues to be Considered in the NOP

Based on our review of the information provided, we recommend that the following issues be considered in preparation of the DEIR.

1. The DEIR should identify all the applicable water quality standards that pertain to this project and identify which standards could potentially be violated by Project alternatives and use these standards when evaluating thresholds of significance for impacts. Water quality objectives and standards, both numerical and narrative, for <u>all</u> waters of the State within the Lahontan Region, including surface waters and groundwater, are outlined in Chapter 3 of the Basin Plan. Water quality objectives and standards are intended to protect the public health and welfare, and to maintain or enhance water quality in relation to the existing and/or potential beneficial uses of the water.

2. The Project area is located within the Neenach Hydrologic Area of the Antelope Hydrologic Unit, 626.00. The Project area lies over the Antelope Valley groundwater basin (Department of Water Resources unit 6-44). We note that the NOP in section 3.e. does not include the Basin Plan in its list of relevant plans. The beneficial uses of minor surface waters and wetlands are listed in Chapter 2 of the Basin Plan. The DEIR should identify and list all the beneficial uses of the surface water and groundwater resources within the Project area, and include an analysis of the potential impacts to water quality and hydrology with respect to those beneficial uses.

3. Healthy watersheds are sustainable. Watersheds supply drinking water, provide for recreational uses, and support ecosystems. Watershed processes include the movement of water (i.e. infiltration and surface runoff), the transport of sediment, and the delivery of organic material to surface waters. These processes create and sustain the streams, lakes, wetlands, and other receiving waters of the Antelope Hydrologic Unit, including groundwater. The DEIR should discuss the project components and their potential impacts to watersheds on the project area.

4. The DEIR should describe a proposed long-term maintenance and monitoring plan that will be implemented to evaluate and maintain the established baseline conditions. Specific routine and non-routine activities should be identified, such as dredging/excavation and re-contouring, and the thresholds that will trigger when maintenance activities are warranted.

5. The DEIR should describe the long-term post-construction best management practices (BMPs) maintenance plan. It is understood that routine sediment removal is necessary to maintain the function of a basin, and the removal of accumulated sediments in the bottom of a basin would completely remove any vegetation that may have been present. However, we also recognize the benefits of vegetation for water quality by filtering sediments and constituents of concerns from water. We *strongly recommend* that the County proponent include in their long term maintenance plan provisions for mowing rather than eradication, so that vegetation can more easily reestablish itself post-maintenance. Maintaining healthy deep-rooted vegetation is crucial to soil stabilization. Re-contouring and vegetation grubbing should only be done on an as-needed basis.

6. The DEIR should describe the project design standards used for sizing and constructing hydraulic features. Surface waters support a variety of beneficial uses including municipal and agricultural uses, groundwater and fresh water recharge, habitat, flood attenuation, and water quality enhancement. To ensure that no net loss of function and value will occur as a result of Project implementation, we request that culverts be designed to (1) pass storm flows without impoundment upstream, (2) with sufficient energy dissipation provided at the outlet to reduce flow velocities to pre-Project conditions, and (3) sufficiently sized to allow for habitat connectivity across/beneath the roadway.

7. All rock slope protection and energy dissipation rip-rap placed within stream channels should be **ungrouted** and the minimum amount necessary to provide scour protection and energy dissipation to prevent erosion. The DEIR should describe channel design and energy dissipation to prevent erosion. The DEIR should describe channel design criteria.

8. Construction and post-construction storm water management must be considered a significant Project component, and BMPs that effectively treat storm water runoff should be included as part of the Project. The DEIR should specify those temporary and permanent long-term sediment and erosion control BMPs that will be implemented to mitigate potential water quality impacts related to stormwater. The temporary BMPs need to be implemented for the Project until such time that vegetation has been restored to pre-Project conditions. We request that vegetation clearing be kept to a minimum and, where feasible, existing vegetation be mowed so that vegetation could more readily reestablish post-construction. A long-term BMP maintenance plan should be included in the DEIR.

9. The DEIR should identify all impacts to water resources and describe how impacts were avoided, minimized, or proposed to be mitigated. The Water Board requires that impacts to water resources be avoided where feasible and minimized to the extent practical. Compensatory mitigation will be required for all unavoidable permanent impacts to surface water resources. Water Board staff coordinate all mitigation requirements with staff from other federal and state regulatory agencies,

including the USACE and the California Department of Fish and Wildlife. In determining appropriate mitigation ratios for impacts to waters of the State, Water Board staff considers Basin Plan requirements (minimum 1.5:1 mitigation ratio for impacts to wetlands) and utilizes *12501-SPD Regulatory Program Standard Operating Procedure for Determination of Mitigation Ratios*, published December 2012 by the USACE, South Pacific Division.

10. All temporary impacts to water resource and upland areas should be restored (recontoured and revegetated) to match pre-Project conditions. A Restoration and Revegetation Monitoring Plan should be prepared and described in the DEIR that requires monitoring for some period of time (usually no less than 3 years), outlines a schedule with performance measures to be met in order for the restoration/revegetation to be deemed successful, and contains adaptive management criteria in the event performance measures are not being met.

11. Equipment staging areas, excavated soil stockpiles, and hazardous materials (i.e. oils and fuels) should be sited in upland areas outside surface waters and adjacent flood plain areas. We recommend that a comprehensive Spill Prevention and Response Plan be prepared and described in the DEIR that outlines the site-specific monitoring requirements and lists the BMPs necessary to prevent hazardous material spills or to contain and cleanup a hazardous material spill, should one occur.

12. Buffer areas should be identified and exclusion fencing used to protect water resources and to prevent unauthorized vehicles or equipment from entering or otherwise disturbing the surface waters. Equipment should use existing roadways to the extent feasible. These features should be described in the DEIR.

13. The project plans to construct and operate a domestic wastewater treatment plant. The plant will produce recycled water for use within the project area. Onsite disposal of treated wastewater must not cause pollution and minimize degradation. Denitrification should be included in the plant design. The DEIR should fully describe the following.

    a. Treatment plant and disposal pond locations,
    b. Treatment plant design criteria,
    c. Storage and disposal pond design criteria,
    d. Expected wastewater quality,
    e. Receiving groundwater quality,
    f. Expected receiving groundwater degradation (nature and extent) resulting from the discharge according to State Board Resolution 68-16,
    g. Background receiving groundwater quality and direction of flow established from a statistically significant data set,
    h. Location and well construction design of monitoring wells installed to evaluate groundwater quality,
    i. Lift station locations and design,
    j. Backup power features,
    k. Recycled water storage, delivery, and use area design standards, and
    l. Entity responsible for owning and operating the treatment plant and recycled water infrastructure.

Permitting Requirements

A number of activities associated with the proposed Project have the potential to impact waters of the State and, therefore, may require permits issued by either the State Water Resources Control Board (State Water Board) or Lahontan Water Board. The required permits may include the following.

14. Streambed alteration and/or discharge of fill material to a surface water may require a CWA, section 401 water quality certification for impacts to federal waters (waters of the U.S.), or dredge and fill waste discharge requirements for impacts to non-federal waters, both issued by the Lahontan Water Board.

15. Land disturbance of more than 1 acre may require a CWA, section 402(p) storm water permit, including a National Pollutant Discharge Elimination System (NPDES) General Construction Storm Water Permit, Water Quality Order (WQO) 2009-0009-DWQ, obtained from the State Water Board, or individual storm water permit obtained from the Lahontan Water Board if water of the United States are affected. The DEIR should identify where waters of the United States are present with in the project area. The Water Board may establish individual waste discharge requirements to address stormwater impacts to state only waters.

16. New industrial operations may require coverage under the Industrial General Stormwater Permit (2014-0057-DWQ) if waters of the United States are affected. Information on the Industrial General Stormwater Permit is available on the State Water Board's web site at http://www.swrcb.ca.gov/water_issues/programs/stormwater/industrial.shtml. These permits must be obtained from the Lahontan Water Board.

17. Disposal from wastewater treatment facilities will require a waste discharge requirements which must be obtained from the Lahontan Water Board. Information on what information is needed in a report of waste discharge is available on the State Water Board's web site at http://www.waterboards.ca.gov/water_issues/programs/land_disposal/waste_discharge_requirements.shtml

18. Water diversion and/or dewatering activities may be subject to discharge and monitoring requirements under either NPDES General Permit, Limited Threat Discharges to Surface Waters, Board Order R6T-2014-0049, or General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality, WQO-2003-0003, both issued by the Lahontan Water Board. The DEIR should identify any and all proposed diversion or dewatering actions.

19. Recycled water uses are subject to water reclamation and waste discharge requirements issued by the Water Board. An Engineering Report must be submitted to the Water Board and State Division of Drinking Water, which also must approve the Engineering Report.

Please be advised of the permits that may be required for the proposed Project, as outlined above. The specific Project activities that may trigger these permitting actions should be identified in the appropriate sections of the NOP. The Project proponent should consult with Water Board staff early on should Project implementation result in activities that trigger

these permitting actions. Information regarding these permits, including application forms, can be downloaded from our web site at http://www.waterboards.ca.gov/lahontan/.

Thank you for the opportunity to comment on the NOP. If you have any questions regarding this letter, please contact me at (760) 241-7391 thomas.browne@waterboards.ca.gov or Jehiel Cass, Senior Water Resource Control Engineer, at (760) 241-2434 jehiel.cass@waterboards.ca.gov.

Please send all future correspondence regarding this Project to the Water Board's email address at Lahontan@waterboards.ca.gov and be sure to include the State Clearinghouse Number, when available, and Project name in the subject line.

for Jehiel W. Cass P.E.

Tom Browne, PhD, PE
Water Resource Control Engineer

cc: USEPA Wetlands Regulatory Office, Region 9 (R9-WTR8-Mailbox@epa.gov)
Daniel Swenson, USACE (Daniel.P.Swenson@usace.army.mil)
CA Dept. of Fish and Wildlife (askR5@wildlife.ca.gov)
Shu-Fang Orr, Division of Drinking Water (shu-fang.orr@waterboards.ca.gov)

R:\RB6\RB6Victorville\Shared\Units\Jays Unit\Tom\CEQA Review\Centennial Project\final Centennial Project_NOP-EIR.docx

Three Points-Liebre Mountain Town Council
P. O. Box 76
Lake Hughes, CA 93532
3pointsliebremountain@gmail.com

4 November 2015

SENT VIA EMAIL

Los Angeles County Regional Planning
Mr. Samuel Dea
Special Projects Section
320 West Temple Street
Los Angeles, CA 90012
213.974.4876
specialprojects@planning.lacounty.gov

Dear Mr. Dea,

RE: Specific Plan, Centennial Project No. 02-0232

Our town council appreciates the opportunity to participate in the Notice of Preparation (NOP) comment period for the Centennial Project (Project). We requested Special Projects Section provide the Initial Study Checklist (Checklist) and were unable to attain the document to assist us in the compilation of our letter. The Checklist would be helpful in understanding what Regional Planning believes to be the level of impact of various components of the Project and guide us in adequately addressing what impacts are potentially significant, significant, or less than significant with mitigation. Neither the NOP 2004, nor the NOP 2015 establishes the impact thresholds at which each item is determined to require mitigation, only that the Environmental Impact Review will evaluate and determine substantial adverse effects on Aesthetics, Agricultural Resources, Air Quality, Biological Resources, etc. The Check List usually determines impacts that are then addressed in the Environmental Impact Review (EIR) along with mitigation strategies. These NOP documents are primarily "Project Descriptions," in which we are told the EIR will determine if there is "substantial adverse effect," and whose items are merely read off the list, but not evaluated. This requires that we must question the ability of ourselves and others to "divine" impacts, and determine on our own what needs review and what level of review. We would also ask if an earlier analysis will be used for this plan and, request, if affirmative, that you publish the earlier reviews and documents on the Project webpages.

We have done our best to itemize our requests for what we believe should be considered in the EIR; please see the list below:

<u>Aesthetics</u>

- Expansive views in the project area will be change to one highly developed, including industrial zones, where nothing but open space currently exists. The area is situated among some of the best wildflower viewing in California, and is a "California Floristic Province" of great importance and

continuing loss. Explain how the project will preserve viewshed. Consider preservation, two acres replaced to one acre lost.

- Determine cumulative impacts to viewshed in surrounding areas as well, since development will undoubtedly result in continuing "sprawl" encouraged by this specific plan.
- Explain effects to night sky views, and consider lighting similar to that of areas interested in preserving darkness near observatories. Downward shielding of lighting as required by the County's Rural Lighting Ordinance—streetlights as well as commercial, private, interior and exterior lighting will not be adequate in reducing or preventing night sky glow, and will permanently affect the dark nights we enjoy now.
- Ridge Route Road and portions of Highway 138, and Gorman Post Road are listed as county scenic highways. Explain how the project will preserve viewshed from these areas.

AGRICULTURE

- Conversion of farmland to non-agricultural use will affect the historic use of the Tejon Ranch, affecting the cultural significance of the project area. How will the loss of grasslands and grazing affect supplies of locally grown livestock? While grazing has changed most lands in the California Floristic Province, preservation of grazing and grasslands and associated habitats have been able to maintain some beneficial qualities that would otherwise disappear with heavy commercial agriculture and urban/commercial/suburban housing development.
- Review effects of specially designated farmland loss. Consider preservation of valuable agricultural land and the opportunity to truly make the Centennial Project self-sustaining in food production.

FOREST

- Detail the effects of the project on the Angeles and Los Padres National Forests. Without doubt, the increase in visitors to an already overworked and underfunded forest system that will be stretched to the limits.
- Tell us how the project will protect forests from overuse and illegal uses—including marijuana grows and all that entails, unauthorized off-road use, increased threat of fire on local communities, all wildlife, endangered, special status, protected by law, or otherwise. The Angeles Forest Land Management Plan admits that 90% of fires are human caused. Increased population and forest use will place nearby communities at risk.
- The forests provide watershed protection; how would fires affect the ability for those watersheds to recharge local water supplies and the aquifer beyond?
- Will the project require additional powerlines to traverse the forests? Studies have shown the largest fires in California have occurred as a result of high wind events and/or downed powerlines.
- Possible loss of vegetation combined with heavy rain produces mudflows, flash flooding, debris flows and the like, with power to destroy properties adjacent to the project.
- Describe mitigations that would protect forests, their habitats and species, springs, streams, and aquifers, as well as private properties from the very adverse results of fire and overuse from a potential population of 80,000 or more.

AIR QUALITY

- Despite the county line dividing Kern and Los Angeles Counties' air quality districts, pollutants do cross jurisdictional lines. The National Cement Plant already emits serious pollutants into the air,

along with auto and industrial pollutants from the adjacent Interstate 5, and coastal and urban areas, which are usually distributed eastward into the the Mojave Air Basin by prevailing westerly winds. The Antelope Valley is already in non-compliance with the Environmental Protection Agency (EPA) and local air quality standards for particulates.

- We request that further investigation into whether the project will require review by the EPA and whether it will comply with both national and local air quality standards through out the building process.
- Best Management Practices (BMP) for particulates and dust control have proven ineffective at preventing deposition of fugitive dust into the air from past BMP "approved" projects. This is a crucial issue, from the first phases of the project to the last, since Valley Fever is a matter of public health importance. Not only that, but particulates will affect sensitive receptors with ailments like asthma, pulmonary and cardiac disorders. Require multiple samples for soil testing for cocci diodes *immitus,* with disclosure to residents of the project, and to the public. New Residents and those of surrounding communities need to know the risk of living in endemic areas like the Antelope Valley, and that construction is correlated with increased risk of infection. It is known that the spores of the cocci fungus can travel on the wind for up to seventy-five miles.
- There is no project control regarding the sale, lease, or rental of industrial space planned for the south side of Highway 138, that may produce objectionable odors or exhaust pollutants from manufacturing. Residents of our rural area expect an absence of unnatural odors from the results of the project.
- Evaluate increases in all potential dangerous air pollutants on persons, water, and all biological resources.
- Prohibit the sale/lease/rental to businesses that will produce objectionable odors or other pollution that will drift to adjoining properties as well as SEAs adjacent to the project industrial/manufacturing areas.

BIOLOGICAL RESOURCES

Tejon Ranch and the California Floristic Province

- As one of only five areas with a Mediterranean-type climate in the world--all of which are on the hotspot list--the California Floristic Province is characterized by hot, dry summers and cool, wet winters. The region contains a wide variety of ecosystems, including sagebrush steppe, prickly pear shrubland, coastal sage scrub, chaparral, juniper-pine woodland, upper montane-subalpine forest, alpine forest, riparian forest, cypress forests, mixed evergreen forests, Douglas fir forests, sequoia forests, redwood forests, coastal dunes, and salt marshes. Today, only about 80,000 square kilometers or 24.7 percent of the original vegetation, remains in more or less pristine condition. The California Floristic Province is a zone of Mediterranean-type climate and has the high levels of plant endemism characteristic of these regions. The hotspot is home to the giant sequoia, the planet's largest living organism and its taller but less massive relative, the coastal redwood. This region also holds a number of threatened endemic species--like the last individuals of the Critically Endangered California condor which can still be found here on the Tejon Ranch. In fact, the province is the largest avian breeding ground in the United States. Wilderness destruction caused by commercial farming is a major threat for the region as the California Floristic Province generates half of all the agricultural products used by U.S. consumers. The hotspot is also heavily threatened by the expansion of urban areas, pollution, and road construction. The issues that are causing the most threats to this province include but are not limited to population pressures, loss of habitat, unsustainable resource use, and introduced non-native species.

- Please explain the lasting effects of urbanization and sprawl development on the Province. Explain also how the project will preserve and improve this area of critical importance in Southern California. Conservation lands set aside should number twice the amount of project development, so as to preserve qualities of the Province—and experience no net loss.
- Explore rangeland conservation in the Province and its links to biodiversity conservation, as well as links to continuation of private ranching landscapes sustainably managed through resource conservation practices before stating the Tejon Ranch-Centennial development area is "degraded farmland" and valued only for development.
- Determine the loss of annual and native grasslands to invasive species that will undoubtedly introduce non-native plants to conservation areas and adjoining Significant Ecological Areas (SEA), and devise a plan to organize and fund the resources necessary for the eradication of non-natives and protection of those natural areas, on and off-site.
- How will loss of project grasslands affect future populations of perennial and annual grasslands?
- Explain the effects of invasive plant species on surrounding preserved grassland and forest areas.
- Require ongoing support and maintenance through non-chemical control of invasive plant species; require a native plant palette for all areas requiring landscaping, and control of invasive species in conservation areas.
- Detail overall effects to federal and state listed special status species including California Condors and their critical habitat area, Tri-colored blackbirds and their breeding and foraging sites at and around Quail Lake and Holiday Lake. Evaluate historic and current Condor movements in the project area and surrounding areas as well.
- How will avian life be protected according to the migratory bird treaty act and the Bald and Golden Eagle Protection Act? What about the loss of grassland for raptor foraging habitat? What are the projected declines in raptor populations?
- Describe how much breeding bird habitat will be displaced or destroyed by the project.
- Provide discussion on the effects to the Audubon designated Globally Important Bird Area encompassing the project. How will the project affect populations of migratory passerines, raptors, and waterfowl? What reductions in numbers can be predicted?
- How will the project preserve wildflower viewing areas?
- Evaluate the "urban heat island effect" on the average temperatures before, during, and after buildout, and their effects on wildlife. Determine the need for transitional habitat as global and local (project) temperatures increase and does the project include that as a conservation goal?
- How will the EIR adjust for changes to the environment over the last twelve years?
- This area is a well known convergence of the San Gabriel, Transverse, and Tehachapi Ranges and is described as an important wildlife corridor. The project appears to bisect the San Andreas SEA. How will building in this "Economic Opportunity Area" (EOA) inserted into planning documents, overriding the recommended expansion of this SEA, preserve and improve the corridor?
- Mitigation might suggest the building of animal crossings, if it is proved an adequate alternative to just letting wildlife cross highways and roads wherever they can.
- Please include in the EIR, all historical, archived recommendations made by the Significant Ecological Area Technical Advisory Committee to the project, and address each item and how the project will assure the continued health and improvement of the conserved SEA areas.
- Explain the effects of the project to United States Geological Survey's identification of part of the project area as an "Evolutionary Biological Hotspot and how the project will protect this important designated area.

- Describe how conservation lands will be protected from habitat loss associated with climate change and require continuing evaluation of conservation lands to assure they meet conservation goals, understanding the role of such lands as providing a safe haven for species whose distributions are projected to shift within reserves due to climate change and decline beyond those borders from land use changes. Use predictive mapping methods to determine effects of the project (creating its own warming) on surrounding forests and SEA areas near the project.
- Explain why water and wastewater treatment facilities must be placed in SEAs. None of the maps provided show the locations of such infrastructure.
- Describe the effects of recycled water use on native vegetation.
- List effects of urban run-off on preserved open-space drainages, wetlands, riparian areas, and properties nearby.
- Identify effects of residual pharmaceuticals in treated wastewater on drainages, wetlands, riparian areas, and properties nearby.
- Identify location and number of oak trees protected by the county's Oak Tree Ordinance and explain why they must be removed. Plan development to avoid destruction of oak trees and eliminate injury to disappearing California oak woodland.
- Detail increased use of Quail Lake on migratory waterfowl, raptors, and passerines who rely on the lake as a stop-over point or winter home.
- Explain effects of development to the Pacific Flyway—through the presence of people, destruction of habitat, water sources, etc.

CULTURAL RESOURCES

- Detail protection of important Native American Historical or archeologically important sites on project and in areas nearby. Preserve and protect these areas from development that will prevent access for study or Native American ceremonial activities.
- Ridge Route Road enjoys a listing on the National Register of Historic Places, as well as listing as a Los Angeles County Historic Place. Will increased population pressures cause illegal use or change the alignment from Highway 138 where Ridge Route Road begins its southern path?

GEOLOGY AND SOILS

- Explain how the project will protect residents from earthquake along the San Andreas and Garlock faults that essentially surround the project area to the south and west. The Antelope Valley Area Plan (AVAP) asserts that these zones would limit land use density in hazard areas exemplified by the project area, which appears to conflict with the high density designations in the "West Economic Opportunity Area." Common sense would dictate lower density development than what is offered in the AVAP.
- Soil erosion as a result of creating impervious surface run-off—how does the project plan to protect soils and erosion?
- Provide a complete soils analysis, including the ability of soils to accommodate waste water treatment. Explain how waste water and sewage will be accommodated in the early phases of development when one assumes there will be no sewage treatment plant. Indicate the population density at which sewage treatment will be built. How will septic systems accommodate waste from industrial and commercial uses, and how will this affect local surface and groundwater, i.e., local sensitive wetlands, seeps, springs, drainages, and other riparian areas until such time a treatment plant is built?

GREENHOUSE GAS EMISSIONS

- How will the project decrease greenhouse gas emissions (GHG) in general, and explain specifically. The grasslands that exist in the project area now represent a huge carbon sink. Please describe the loss of this carbon sink in relation to creating more GHG throughout the construction process and through the additional traffic generated by truck deliveries and residents' automobile usage.
- There are no regional public transportation systems or services in place, and the transportation plans appear to address only internal transportation to and from the planned industrial areas. There is no guarantee of project residents actually working in the area; this is evidenced by other master-planned communities like Santa Clarita, suburban cities like Palmdale/Lancaster and their large commuter populations. At what population point is regional transportation planning incurred? The project could possibly see build-out and never be required to contribute to regional transportation.
- The expansion of the Northwestern Highway 138 has been justified by the project, yet we do not know how much GHG will be contributed by "commuter" driven development, and how much more will be produced by increased traffic in the area and by those passing through.

HAZARDS AND HAZARDOUS MATERIALS

- Determine the potential for industrial and municipal waste transport to and from the project area to release hazardous materials in proximity to the proposed expanded Highway 138, exacerbated by increasing truck transport encouraged by said highway expansion. How will hazardous waste be transported, disposed of, and how will enforcement of proper disposal be addressed? It is not unusual for trucks to dump hazardous loads in rural areas of the Antelope Valley; the project may increase the probability.
- Hazardous materials are involved in water treatment, solid waste, storm water run-off, use of industrial/manufacturing materials, electrical generation, and hazardous materials storage.
- How does the plan propose to protect surrounding communities from hazards incurred from development in special hazard class (fire, earthquake, flood) and special management areas, and how does this comport with the rural preservation strategy indicating low density development in hazard areas?

HYDROLOGY

- There is the potential for the project to substantially deplete groundwater supplies, not only on the project area, but surrounding private properties. Discuss contingency plans for the possibility of at least a ten year drought in the Antelope Valley, much like the period of 1894 to 1904, which devastated businesses in the area. The current drought has brought required cuts in usage of 35%. How can the project be justified in supplying approximately 80,000 people, plus industrial/manufacturing uses? Indicate build-out pumped water usage, and guarantee water supply in perpetuity, especially to property owners whose wells may become useless when providing water to a large population in times of drought. Rural communities are often used for their resources in supporting larger populations.
- Despite storm water drainage plans, increases in impermeable surfaces will cause huge effects to natural drainages and stream flows. How do you prevent off-site flooding and polluted run-off?

- We have seen recent news reports of substantial flash floods, mud and debris flows in mountain communities and areas of the Antelope Valley, that historically do not see flooding. Fire denuded hillsides during the Powerhouse Fire, causing life-threatening floods, destruction to private properties and businesses. What is the plan for preventing and reducing destruction from fire and subsequent weather events?
- Explain the source of water for the two golf courses planned. If it is treated water, explore the effects to natural areas nearby from the use of fertilizers, herbicides, rodenticides, and other chemicals that can cause harm to water sources, wildlife, and humans.

LAND USE AND PLANNING

- Please explain the conflict between the county's rural preservation strategy and its designation of high densities in the West EOA, as well as usually recommended reduced densities in special management areas, high fire hazard areas, flood zones and earthquake zones.

NOISE

- Describe how the project proposes disclosure to its developers and subsequent tenants regarding the explosive blasting performed at the National Cement mining areas. This is known to disturb existing residents nearby and has cracked window glass.
- Besides blasting, permanent increases in ambient noise levels starting with construction and continuing with increased traffic, business, and manufacturing noise. There are known health hazards to humans. How will the project mitigate this impact? How will noise affect the existence of wildlife? Evaluate the effects of noise on nearby conservation and open-space areas, and determine if the conservation values match those necessary for the goals of providing "safe haven" habitat and wildlife corridors.

RECREATION

- See previous comments under the FOREST heading. How will so much recreational use change forest habitats, affect endangered, special status species? Recreation is not limited to project area parks and other facilities.
- There are few regional parks already in the area. What about increased use on Quail Lake—a popular destination for fishermen, and a
- How can the project justify the use of water for golf courses?

TRAFFIC

- Explain how the project will affect traffic patterns if traffic signal lighting is proposed on Highway 138? What is the financial responsibility of the project to contribute to infrastructure costs that its development will cause?
- The Highway 138 alignment through the Quail Lake area is problematic. How does the project propose to solve traffic problems that will result, if the highway is narrowed or its current state maintained?

- This project will cause major increases in traffic on the 138, Interstate 5. The project appears to be automobile oriented, since the expansion of the 138 is based on the project proceeding to buildout.

- Provide details on mitigation to local communities when traffic increases on roads not intended for large amounts of traffic are affected. High traffic volumes on the I-5 and 138 will predictably divert drivers to secondary roads through our small communities.

UTILITIES AND SERVICE SYSTEMS

- Consider relocating water and wastewater treatment systems, substations and the like, outside of SEAs, especially if modifications and expansion is anticipated. Expansions in SEAs or adjacent areas could be seriously impacted. Any project utilities should be placed beyond viewshed areas visible from 138, and Ridge Route Road.

The Three Points-Liebre Mountain Town Council area faces the potential of tremendous negative effects from this project. While we have recommended some mitigations, please do not take this as our approval of this project. Our council has historically been opposed to such massive development and all the effects this will bring to our rural community, since our mission is to preserve the wonderful aspects of our environment. Our enjoyment of the Tejon Ranch in its present state is one reason many of us live here. Its proposed urbanization and subsequent production of sprawl in an almost completely undeveloped area is saddening.

On behalf of our town council,

Susan Zahnter
Vice President

CC: Field Deputy Christine Borzaga, Assistant Deputy Richard Grooms, 5th District Planning Deputy Edel Vizcarra, Supervisor and Mayor Michael D. Antonovich

From: Ewart, Ronald J CIV NAVFAC SW, ESWD
To: DRP Special Projects
Subject: FW: Centennial Project
Date: Monday, October 19, 2015 8:29:12 AM

Dear Mr. Dea,

Hello, I was given your contact information by the front desk. I need to put together a brief summary by the end of today on what's up with this project, namely the recent changes. Also I have some specific questions. If I could get a response when you have a chance I'd really appreciate it. Thanks!

Very Respectfully,

Ron Ewart
U.S. Navy SW Regional Encroachment Office
Community Plans and Liaison Officer
1220 Pacific Hwy, San Diego, CA 92132
(619) 532-3504
ronald.ewart@navy.mil

-----Original Message-----
From: Ewart, Ronald J CIV NAVFAC SW, ESWD
Sent: Thursday, October 15, 2015 10:11 AM
To: 'zoningldcc@planning.lacounty.gov'
Subject: Centennial Project

Dear LA County Department of Regional Planning,

Hello, I just have a few questions in regards to the above. We did receive the Revised NOP which is fairly descriptive but I do have some specific questions. Please know that I am brand new to learning about this project but I have to report up some basic but factual information. Also forgive me that I'm missing things due to my unfamiliarity but I have some important questions at this time:

Firstly, could I please get a breakdown of all the changes between the 2004 proposal and the 2015 proposal? Information is peppered here and there but a side by side comparison would be great. In the introduction it states , "The Project development area has been reduced in size when compared to the 2004 proposal. " On page 5/10 it states that the revised area includes 12,323 acres and the original NOP had set forth 11,680 acres. Would this not be an increase in area and not a reduction? Do you have a site plan for each (the 2004 and 2015), showing locations of development, land use types, streets, etc.? What area(s) were added or taken out?

Why is a new EIR being required? Was an EIR done during/ after the 2004 proposal timeframe?

What is the significance of the 2 LUP document updates- the General Plan and the AVAP? Page 5/10 states the Project is consistent with and implements the requirements of both. What is meant by the last line in that paragraph- "As such, some of the land use entitlement actions previously requested in the 2004 NOP are no longer applicable."?

What are the next steps- understanding the review of the RNOP is 10/5 to 11/4 2015. When will the EIR commence and be finished? When would the BOS vote on the project? (Did they vote on and approve the 2004 proposal?) If all is approved, when is the earliest groundbreaking could take place? Assume it is still a 20-year buildout.

If I could get these answers by noon Monday, October 19 I would be very grateful as I have a deadline on that day. Please feel free to call or e-mail.

Very Respectfully,

Ron Ewart
U.S. Navy SW Regional Encroachment Office
Community Plans and Liaison Officer
1220 Pacific Hwy, San Diego, CA 92132
(619) 532-3504
ronald.ewart@navy.mil

From: Ian Pari
To: DRP Special Projects
Subject: Comments on Revised NOP for Centennial Project
Date: Tuesday, November 03, 2015 11:05:33 AM

Dear Mr. Dea,

Thank you for the opportunity to comment on the Revised Notice of Preparation for the proposed Centennial Project. In reviewing the project description and potential traffic/circulation impacts, the City of Santa Clarita requests that the following intersections and roadway links be included as part of the traffic/access section of the EIR.

1) Interstate 5, between State Route 138 and State Route 14
2) Newhall Ranch Road/SR-126 interchange at Interstate 5
3) Magic Mountain Parkway interchange at Interstate 5

Please contact me if you have any questions.

_____

Ian Pari
Senior Traffic Engineer
City of Santa Clarita

Phone: (661) 284-1402
Email: IPARI@santa-clarita.com
Web: http://www.santa-clarita.com

SOUTHERN CALIFORNIA
ASSOCIATION of GOVERNMENTS

Main Office

818 West 7th Street
12th Floor
Los Angeles, California
90017-3435

t (213) 236-1800
f (213) 236-1825

www.scag.ca.gov

Officers

President
Cheryl Viegas-Walker, El Centro

First Vice President
Michele Martinez, Santa Ana

Second Vice President
Margaret Finlay, Duarte

Immediate Past President
Carl Morehouse, San Buenaventura

Executive/Administration Committee Chair

Cheryl Viegas-Walker, El Centro

Policy Committee Chairs

Community, Economic and Human Development
Bill Jahn, Big Bear Lake

Energy & Environment
Deborah Robertson, Rialto

Transportation
Alan Wapner, San Bernardino Associated Governments

November 4, 2015

Mr. Samuel Dea
County of Los Angeles of Regional Planning, Special Projects Section
320 West Temple Street
Los Angeles, California 90012
Phone: (213) 974-4876
E-mail: specialprojects@planning.lacounty.gov

RE: SCAG Comments on the Revised Notice of Preparation of a Draft Environmental Impact Report for the Centennial Project [SCAG NO. IGR3107]

Dear Mr. Dea,

Thank you for submitting the Revised Notice of Preparation of a Draft Environmental Impact Report for the Centennial Project ("proposed project") to the Southern California Association of Governments (SCAG) for review and comment. SCAG is the authorized regional agency for Inter-Governmental Review (IGR) of programs proposed for federal financial assistance and direct development activities, pursuant to Presidential Executive Order 12372. Additionally, SCAG reviews the Environmental Impact Reports of projects of regional significance for consistency with regional plans pursuant to the California Environmental Quality Act (CEQA) and CEQA Guidelines.

SCAG is also the designated Regional Transportation Planning Agency under state law, and is responsible for preparation of the Regional Transportation Plan (RTP) including its Sustainable Communities Strategy (SCS) component pursuant to SB 375. As the clearinghouse for regionally significant projects per Executive Order 12372, SCAG reviews the consistency of local plans, projects, and programs with regional plans.[1] Guidance provided by these reviews is intended to assist local agencies and project sponsors to take actions that contribute to the attainment of the regional goals and policies in the RTP/SCS.

SCAG staff has reviewed the Revised Notice of Preparation of a Draft Environmental Impact Report for the Centennial Project in the Los Angeles County. The proposed project is a master planned community for 19,333 residential units on approximately 4,950 acres of land designated for residential/mixed use development. The proposed project also includes business park uses, commercial uses, civic/institutional uses, and recreation/entertainment uses.

When available, please send environmental documentation to SCAG's *office in Los Angeles or by email to sunl@scag.ca.gov* providing, at a minimum, the full public comment period for review. If you have any questions regarding the attached comments, please contact the Inter-Governmental Review (IGR) Program, attn.: Lijin Sun, Esq., Senior Regional Planner, at (213) 236-1882 or sunl@scag.ca.gov. Thank you.

Sincerely,

Ping Chang

Ping Chang
Program Manager II, Land Use and Environmental Planning

---

[1] SB 375 amends CEQA to add Chapter 4.2 Implementation of the Sustainable Communities Strategy, which allows for certain CEQA streamlining for projects consistent with the RTP/SCS. Lead agencies (including local jurisdictions) maintain the discretion and will be solely responsible for determining "consistency" of any future project with the SCS. Any "consistency" finding by SCAG pursuant to the IGR process should not be construed as a finding of consistency under SB 375 for purposes of CEQA streamlining.

COMMENTS ON THE REVISED NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT FOR THE CENTENNIAL PROJECT [SCAG NO. IGR3107]

CONSISTENCY WITH RTP/SCS

SCAG reviews environmental documents for regionally significant projects for their consistency with the adopted RTP/SCS.

2012 RTP/SCS GOALS

The SCAG Regional Council adopted the 2012 RTP/SCS in April 2012. The 2012 RTP/SCS links the goal of sustaining mobility with the goals of fostering economic development, enhancing the environment, reducing energy consumption, promoting transportation-friendly development patterns, and encouraging fair and equitable access to residents affected by socio-economic, geographic and commercial limitations (see http://rtpscs.scag.ca.gov). The goals included in the 2012 RTP/SCS may be pertinent to the proposed project. These goals are meant to provide guidance for considering the proposed project within the context of regional goals and policies. Among the relevant goals of the 2012 RTP/SCS are the following:

SCAG 2012 RTP/SCS GOALS	
RTP/SCS G1:	*Align the plan investments and policies with improving regional economic development and competitiveness*
RTP/SCS G2:	*Maximize mobility and accessibility for all people and goods in the region*
RTP/SCS G3:	*Ensure travel safety and reliability for all people and goods in the region*
RTP/SCS G4:	*Preserve and ensure a sustainable regional transportation system*
RTP/SCS G5:	*Maximize the productivity of our transportation system*
RTP/SCS G6:	*Protect the environment and health for our residents by improving air quality and encouraging active transportation (non-motorized transportation, such as bicycling and walking)*
RTP/SCS G7:	*Actively encourage and create incentives for energy efficiency, where possible*
RTP/SCS G8:	*Encourage land use and growth patterns that facilitate transit and non-motorized transportation*
RTP/SCS G9:	*Maximize the security of the regional transportation system through improved system monitoring, rapid recovery planning, and coordination with other security agencies*

For ease of review, we encourage the use of a side-by-side comparison of SCAG goals with discussions of the consistency, non-consistency or non-applicability of the policy and supportive analysis in a table format. Suggested format is as follows:

SCAG 2012 RTP/SCS GOALS		
	Goal	Analysis
RTP/SCS G1:	*Align the plan investments and policies with improving regional economic development and competitiveness*	*Consistent: Statement as to why;* *Not-Consistent: Statement as to why;* *Or* *Not Applicable: Statement as to why; DEIR page number reference*
RTP/SCS G2:	*Maximize mobility and accessibility for all people and goods in the region*	*Consistent: Statement as to why;* *Not-Consistent: Statement as to why;* *Or* *Not Applicable: Statement as to why; DEIR page number reference*
etc.		etc.

RTP/SCS STRATEGIES

To achieve the goals of the 2012 RTP/SCS, a wide range of strategies are included in SCS Chapter (starting on page 152) of the RTP/SCS focusing on four key areas: 1) Land Use Actions and Strategies; 2) Transportation Network Actions and Strategies; 3) Transportation Demand Management (TDM) Actions and Strategies and; 4) Transportation System Management (TSM) Actions and Strategies. If applicable to the proposed project, please refer to these strategies as guidance for considering the proposed project within the context of regional goals and policies. To access a listing of the strategies, please visit http://rtpscs.scag.ca.gov/Documents/2012/final/f2012RTPSCS.pdf (Tables 4.3 – 4.7, beginning on page 152).

REGIONAL GROWTH FORECASTS

At the time of this letter, the most recently adopted SCAG forecasts, at the jurisdictional level, consists of the 2020 and 2035 RTP/SCS population, household and employment forecasts. To view them, please visit http://scag.ca.gov/Documents/2012AdoptedGrowthForecastPDF.pdf. The forecasts for the region and applicable jurisdictions are below.

	Adopted SCAG Region Wide Forecasts		Adopted County of Los Angeles Forecasts	
	Year 2020	**Year 2035**	**Year 2020**	**Year 2035**
Population	19,663,000	22,091,000	10,404,000	11,353,000
Households	6,458,000	7,325,000	3,513,000	3,852,000
Employment	8,414,000	9,441,000	4,558,000	4,827,000

MITIGATION

SCAG staff recommends that you review the SCAG 2012 RTP/SCS Final Program EIR Mitigation Measures for guidance, as appropriate. See Chapter 6 (beginning on page 143) at:
http://rtpscs.scag.ca.gov/Documents/peir/2012/final/Final2012PEIR.pdf

As referenced in Chapter 6, a comprehensive list of example mitigation measures that may be considered as appropriate is included in Appendix G: *Examples of Measures that Could Reduce Impacts from Planning, Development and Transportation Projects.* Appendix G can be accessed at:
http://rtpscs.scag.ca.gov/Documents/peir/2012/final/2012fPEIR_AppendixG_ExampleMeasures.pdf

South Coast
Air Quality Management District
21865 Copley Drive, Diamond Bar, CA 91765-4178
(909) 396-2000 • www.aqmd.gov

October 8, 2015

Samuel Dea
County of Los Angeles Department of Regional Planning
Special Projects Section
320 West Temple Street
Los Angeles, CA 90012

Revised Notice of Preparation of a CEQA Document for the
Centennial Project

The South Coast Air Quality Management District (SCAQMD) staff appreciates the opportunity to comment on the above-mentioned document. The SCAQMD staff's comments are recommendations regarding the analysis of potential air quality impacts from the proposed project that should be included in the draft CEQA document. Please send the SCAQMD a copy of the CEQA document upon its completion. Note that copies of the Draft EIR that are submitted to the State Clearinghouse are not forwarded to the SCAQMD. Please forward a copy of the Draft EIR directly to SCAQMD at the address in our letterhead. **In addition, please send with the draft EIR all appendices or technical documents related to the air quality and greenhouse gas analyses and electronic versions of all air quality modeling and health risk assessment files. These include original emission calculation spreadsheets and modeling files (not Adobe PDF files). Without all files and supporting air quality documentation, the SCAQMD will be unable to complete its review of the air quality analysis in a timely manner. Any delays in providing all supporting air quality documentation will require additional time for review beyond the end of the comment period.**

Air Quality Analysis

The SCAQMD adopted its California Environmental Quality Act (CEQA) Air Quality Handbook in 1993 to assist other public agencies with the preparation of air quality analyses. The SCAQMD recommends that the Lead Agency use this Handbook as guidance when preparing its air quality analysis. Copies of the Handbook are available from the SCAQMD's Subscription Services Department by calling (909) 396-3720. More recent guidance developed since this Handbook was published is also available on SCAQMD's website here: http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/ceqa-air-quality-handbook-(1993). SCAQMD staff also recommends that the lead agency use the CalEEMod land use emissions software. This software has recently been updated to incorporate up-to-date state and locally approved emission factors and methodologies for estimating pollutant emissions from typical land use development. CalEEMod is the only software model maintained by the California Air Pollution Control Officers Association (CAPCOA) and replaces the now outdated URBEMIS. This model is available free of charge at: www.caleemod.com.

The Lead Agency should identify any potential adverse air quality impacts that could occur from all phases of the project and all air pollutant sources related to the project. Air quality impacts from both construction (including demolition, if any) and operations should be calculated. Construction-related air quality impacts typically include, but are not limited to, emissions from the use of heavy-duty equipment from grading, earth-loading/unloading, paving, architectural coatings, off-road mobile sources (e.g., heavy-duty construction equipment) and on-road mobile sources (e.g., construction worker vehicle trips, material transport trips). Operation-related air quality impacts may include, but are not limited to, emissions from stationary sources (e.g., boilers), area sources (e.g., solvents and coatings), and vehicular trips (e.g., on- and off-road tailpipe emissions and entrained dust). Air quality impacts from indirect sources, that is, sources that generate or attract vehicular trips should be included in the analysis.

The SCAQMD has also developed both regional and localized significance thresholds. The SCAQMD staff requests that the lead agency quantify criteria pollutant emissions and compare the results to the recommended regional significance thresholds found here: http://www.aqmd.gov/docs/default-source/ceqa/handbook/scaqmd-air-quality-significance-thresholds.pdf?sfvrsn=2. In addition to analyzing regional air quality impacts, the SCAQMD staff recommends calculating localized air quality impacts and comparing the results to localized significance thresholds (LSTs). LSTs can be used in addition to the recommended regional significance thresholds as a second indication of air quality impacts

when preparing a CEQA document. Therefore, when preparing the air quality analysis for the proposed project, it is recommended that the lead agency perform a localized analysis by either using the LSTs developed by the SCAQMD or performing dispersion modeling as necessary. Guidance for performing a localized air quality analysis can be found at: http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/localized-significance-thresholds.

In the event that the proposed project generates or attracts vehicular trips, especially heavy-duty diesel-fueled vehicles, it is recommended that the lead agency perform a mobile source health risk assessment. Guidance for performing a mobile source health risk assessment ("*Health Risk Assessment Guidance for Analyzing Cancer Risk from Mobile Source Diesel Idling Emissions for CEQA Air Quality Analysis*") can be found at: http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/mobile-source-toxics-analysis. An analysis of all toxic air contaminant impacts due to the use of equipment potentially generating such air pollutants should also be included.

In addition, guidance on siting incompatible land uses (such as placing homes near freeways) can be found in the California Air Resources Board's *Air Quality and Land Use Handbook: A Community Perspective*, which can be found at the following internet address: http://www.arb.ca.gov/ch/handbook.pdf. CARB's Land Use Handbook is a general reference guide for evaluating and reducing air pollution impacts associated with new projects that go through the land use decision-making process.

Mitigation Measures

In the event that the project generates significant adverse air quality impacts, CEQA requires that all feasible mitigation measures that go beyond what is required by law be utilized during project construction and operation to minimize or eliminate these impacts. Pursuant to CEQA Guidelines §15126.4 (a)(1)(D), any impacts resulting from mitigation measures must also be discussed. Several resources are available to assist the Lead Agency with identifying possible mitigation measures for the project, including:

- Chapter 11 of the SCAQMD *CEQA Air Quality Handbook*
- SCAQMD's CEQA web pages at: http://www.aqmd.gov/home/regulations/ceqa/air-quality-analysis-handbook/mitigation-measures-and-control-efficiencies.
- CAPCOA's *Quantifying Greenhouse Gas Mitigation Measures* available here: http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf.
- SCAQMD's Rule 403 – Fugitive Dust, and the Implementation Handbook for controlling construction-related emissions
- Other measures to reduce air quality impacts from land use projects can be found in the SCAQMD's Guidance Document for Addressing Air Quality Issues in General Plans and Local Planning. This document can be found at the following internet address: http://www.aqmd.gov/docs/default-source/planning/air-quality-guidance/complete-guidance-document.pdf?sfvrsn=4.

Data Sources

SCAQMD rules and relevant air quality reports and data are available by calling the SCAQMD's Public Information Center at (909) 396-2039. Much of the information available through the Public Information Center is also available via the SCAQMD's webpage (http://www.aqmd.gov).

The SCAQMD staff is available to work with the Lead Agency to ensure that project emissions are accurately evaluated and mitigated where feasible. If you have any questions regarding this letter, please contact me at Jwong1@aqmd.gov or call me at (909) 396-3176.

RECEIVED
OCT 15 2015
BY:_____

Sincerely,

Jillian Wong

Jillian Wong, Ph.D.
Program Supervisor
Planning, Rule Development & Area Sources

LAC151001-10
Control Number

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

David A. Ford
Local Public Affairs
1000 Potrero Grande Dr.
Monterey Park, CA 91754

November 4, 2015

Samuel Dea
County of Los Angeles Department of Regional Planning
Special Projects Section
320 West Temple Street
Los Angeles, CA 90012
specialprojects@planning.lacounty.gov

RE: Centennial Project (NOP)

Dear Mr. Dea:

Southern California Edison (SCE) appreciates the opportunity to review and provide comments on the Notice of Preparation of a Draft Environmental Impact Report (DEIR) for the proposed Centennial Project. The Project is a master planned community for 19,333 residential units, business park/office, commercial, schools, parks, natural open space, cultural, and public uses.

SCE provides electric service to the County of Los Angeles and maintains electrical transmission and distribution facilities, as well as substations and supporting appurtenances in the County. Attached is a map of the Project area and SCE's existing 66 kilovolt (kV) subtransmission lines illustrated as bold green lines and 220 kV transmission lines illustrated as bold blue lines.

Potential Impacts to SCE's Facilities
SCE is concerned that the proposed Centennial Project may impact SCE's existing transmission lines. The developer for the Centennial Project should contact George Perez of SCE's Transmission Project Delivery Department to discuss the relocation of the existing 66 kV subtransmission lines and identification of necessary on- and off-site electrical facilities required to service the proposed Project. He may be contacted at George.Perez@sce.com or (805) 559-9913.

Encroachment of SCE's Right-of-Way and Access Roads
The proposed project should not impose constraints on SCE's ability to access, maintain, and operate its current and future facilities. Additionally, if bike lanes and landscaping are planned within SCE's corridors an agreement between the developer and SCE is required. Any parkways or pathways (either by foot, bicycles, or other means) that invite the public onto SCE's right-of-way will require the installation of fencing and/or Climbing Discouragers on each transmission line tower at the customer's expense.

SCE's rights-of-way and fee-owned properties are purchased for the exclusive use of SCE to operate and maintain its present and future facilities. SCE will review any proposed use on a case-by-case basis. Approvals or denials will be in writing based upon review of the maps provided by the developer and compatibility with SCE right-of-way constraints and rights. Please forward five (5) sets of plans depicting SCE's facilities and associated land rights to the following location:

Real Properties Department
Southern California Edison Company
2131 Walnut Grove Avenue, G.O.3 – Second Floor
Rosemead, CA 91770

General Order 131-D

The construction, modification, and relocation of transmission lines, or electrical facilities that are designed to operate at or above 50 kilovolts (kV) may be subject to the California Public Utilities Commission's (CPUC) General Order 131-D[1]. If the construction, modification, or relocation of transmission lines results in significant environmental impacts, they should be identified and discussed in the Draft EIR. If not, SCE may be required to pursue a separate, mandatory CEQA review through the CPUC, which could delay approval of the SCE transmission line portion of the project for two years or longer.

If you have any questions regarding this letter, please contact me at David.A.Ford@sce.com or (323) 720-5290.

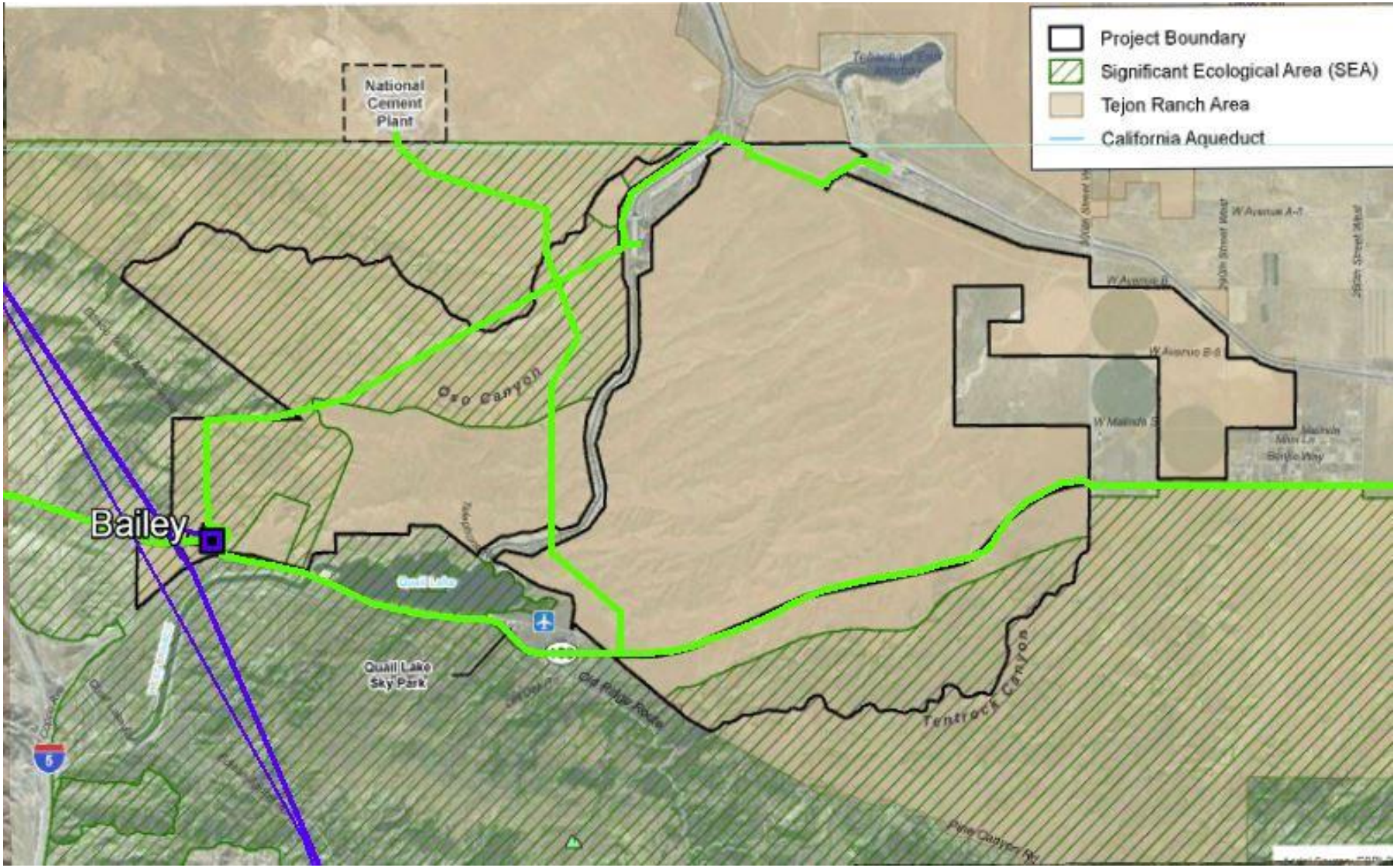
Regards,

David A. Ford
Local Public Affairs, Governmental Affairs Representative
Southern California Edison Company

cc: George Perez, SCE
Karen Cadavona, SCE

[1] http://docs.cpuc.ca.gov/PUBLISHED/Graphics/589.PDF

SCE FACILITIES IN PROJECT AREA



Rudy Ortega Jr.
Tribal President

Fernandeño Tataviam Band of Mission Indians
Tribal Historic & Cultural Preservation

Tribal Historic & Cultural Preservation Committee
Steve Ortega
Chairman
David Ortega

October 12, 2015

Sam Dea, Supervising Regional Planner
Special Projects Section
County of Los Angeles Regional Planning
320 West Temple Street
Los Angeles, CA 90012

RE: Formal Request for Tribal Consultation Pursuant to the California Environmental Quality Act (CEQA), Public Resources Code section 21080.3.1, subds. (b), (d) and (e) for Centennial Project (Project No. 02-232).

Dear Mr. Dea,

This letter constitutes a formal request for tribal consultation under the provisions of the California Environmental Quality Act (CEQA) (Public Resources Code section 21080.3.1 subdivisions (b), (d) and (e)) for the mitigation of potential project impacts to tribal cultural resource for the above referenced project. The Fernandeño Tataviam Band of Mission Indians requested formal notice and information for all projects within your agency's geographical jurisdiction on July 1, 2015 and received notification on 10/05/2015 regarding the above referenced project.

The Fernandeño Tataviam Band of Mission Indians requests consultation on the following topics below, which shall be included in consultation if requested (Public Resources Code section 21080.3.2, subd. (a)):

- Alternatives to the project
- Recommended mitigation measures
- Potentially significant effects of the project

Fernandeño Tataviam Band of Mission Indians also requests consultation on the following discretionary topics below (Public Resources Code section 21080.3.2), subd. (a):

- Type of environmental review necessary
- Significance of tribal cultural resources, including any regulations, policies or standards used by both your agency and the Fernandeño Tataviam Band of Mission Indians to determine significance of tribal cultural resources
- Significance of the project's impacts on tribal cultural resources
- Project alternatives and/or appropriate measures for preservation or mitigation that we may recommend, including, but not limited to:

    (1) Avoidance and preservation of the resources in place, pursuant to Public Resources Code section 21084.3, including, but not limited to, planning and construction to avoid the resources and protect the cultural and natural context, or planning greenspace, parks or other open space, to incorporate the resources with culturally appropriate protection and management criteria;
    (2) Treating the resources with culturally appropriate dignity taking into account the tribal cultural values and meaning of the resources, including but not limited to the following:

a. Protecting the cultural character and integrity of the resource;
b. Protection the traditional use of the resource; and
c. Protecting the confidentiality of the resource.

(3) Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.
(4) Protecting the resource.

Additionally, Fernandeño Tataviam Band of Mission Indians would like to receive any cultural resources assessments or other assessments that have been completed on all or part of the project's potential "area of project effect" (APE), including, but not limited to:

1) The results of any record search(es) conducted at an archaeological information center of the California Historical Resources Information System (CHRIS), including, but not limited to:
   (a) Any known cultural resources that have already been recorded on or adjacent to the potential APE;
   (b) Whether the probability is low, moderate or high that cultural resources are located in the potential APE; and
   (c) If a survey is required to determine whether previously unrecorded cultural resources are present in the potential APE.
2) The results of any archaeological inventory survey that was conducted of all or part of the potential APE, including, but not limited to:
   (a) Any report that may contain site forms, site significance, and suggested mitigation measures.
3) The results of any Sacred Lands File searches conducted through the Native American Heritage Commission for all or part of the potential APE;
4) Any ethnographic studies conducted for any area including all or part of the potential APE; and
5) Any geotechnical reports regarding all or part of the potential APE.

We would like to remind your agency that CEQA Guidelines section 15126.4, subdivision (b)(3) states that preservation in place is the preferred manner of mitigating impacts to archaeological sites. Section 15126.4, subd. (b)(3) of the CEQA Guidelines has been interpreted by the California Court of Appeal to mean that "feasible preservation in place must be adopted to mitigate impacts to historical resources of an archaeological nature unless the lead agency determines that another form of mitigation is available and provides superior mitigation of impacts." *Madera Oversight Coalition v. County of Madera* (2011) 199 Cal.App.4th 48, disapproved on other grounds, *Neighbors for Smart Rail v. Exposition Metro Line Construction Authority* (2013) 57 Cal.4th 439.

Fernandeño Tataviam Band of Mission Indians expects to begin consultation within 30 days of your receipt of this letter. Via email, please contact the Caitlin Gulley at the email address below.

Sincerely,

Caitlin Gulley, Director
Tribal Historic and Cultural Preservation Department
cgulley@tataviam-nsn.us

cc: Native American Heritage Commission