Corrected : 03/20/2008

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 08-1

NSF 05-550 **03/07/08**

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

DBI - Biological Field Stations & Marine Labs

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

0829470

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EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)

856000401

SHOW PREVIOUS AWARD NO. IF THIS IS
☐ A RENEWAL
☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

New Mexico State University

AWARDEE ORGANIZATION CODE (IF KNOWN)

0026575000

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

New Mexico State University
1620 Standley DR Academic RESH A
Las Cruces, NM. 880038001

NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE

PERFORMING ORGANIZATION CODE (IF KNOWN)

ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING 9 DIGIT ZIP CODE

IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☐ SMALL BUSINESS ☐ MINORITY BUSINESS
☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS

☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **Construction of a Multi-user Facility at the Jornada Experimental Range Field Station**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **238,000**	**24** months	**10/01/08**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☐ BEGINNING INVESTIGATOR (GPG I.G.2)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.5) IACUC App. Date _____
PHS Animal Welfare Assurance Number _____

☐ HUMAN SUBJECTS (GPG II.D.6) Human Subjects Assurance Number _____
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)
_____
☐ HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)

PI/PD DEPARTMENT
NM Agricultural Experiment Station

PI/PD FAX NUMBER
575-646-2816

PI/PD POSTAL ADDRESS
PO Box 30003
MSC 3BF
Las Cruces, NM 88003
United States

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
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CO-PI/PD				
CO-PI/PD				

Electronic Signature

CERTIFICATION PAGE

Certification for Authorized Organizational Representative or Individual Applicant:

By signing and submitting this proposal, the Authorized Organizational Representative or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding debarment and suspension, drug-free workplace, and lobbying activities (see below), nondiscrimination, and flood hazard insurance (when applicable) as set forth in the NSF Proposal & Award Policies & Procedures Guide, Part I: the Grant Proposal Guide (GPG) (NSF 08-1). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U. S. Code, Title 18, Section 1001).

Conflict of Interest Certification

In addition, if the applicant institution employs more than fifty persons, by electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative of the applicant institution is certifying that the institution has implemented a written and enforced conflict of interest policy that is consistent with the provisions of the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.A; that to the best of his/her knowledge, all financial disclosures required by that conflict of interest policy have been made; and that all identified conflicts of interest will have been satisfactorily managed, reduced or eliminated prior to the institution's expenditure of any funds under the award, in accordance with the institution's conflict of interest policy. Conflicts which cannot be satisfactorily managed, reduced or eliminated must be dislosed to NSF.

Drug Free Work Place Certification

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency? Yes ☐ No ☒

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Grant Proposal Guide.

Certification Regarding Lobbying

The following certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding $100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding $150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure of Lobbying Activities,'' in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Certification Regarding Nondiscrimination

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative is providing the Certification Regarding Nondiscrimination contained in Exhibit II-6 of the Grant Proposal Guide.

Certification Regarding Flood Hazard Insurance

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:

(1) community in which that area is located participates in the national flood insurance program; and
(2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the NSF Proposal Cover Sheet, the Authorized Organizational Representative or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:

(1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
(2) for other NSF Grants when more than $25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Ancelmo Encinias**	**Electronic Signature**	**Mar 7 2008 4:06PM**

TELEPHONE NUMBER	ELECTRONIC MAIL ADDRESS	FAX NUMBER
505-646-2063	**aencinia@nmsu.edu**	**505-646-2020**

*SUBMISSION OF SOCIAL SECURITY NUMBERS IS VOLUNTARY AND WILL NOT AFFECT THE ORGANIZATION'S ELIGIBILITY FOR AN AWARD. HOWEVER, THEY ARE AN INTEGRAL PART OF THE INFORMATION SYSTEM AND ASSIST IN PROCESSING THE PROPOSAL. SSN SOLICITED UNDER NSF ACT OF 1950, AS AMENDED.

Directorate for Biological Sciences
Division of Biological Infrastructure
Biological Field Stations & Marine Labs

Proposal Classification Form
PI: Daugherty, LeRoy / Proposal Number: 0829470

CATEGORY I: INVESTIGATOR STATUS (Select ONE)

- ☐ Beginning Investigator - No previous Federal support as PI or Co-PI, excluding fellowships, dissertations, planning grants, etc.
- ☐ Prior Federal support only
- ☐ Current Federal support only
- ☑ Current & prior Federal support

CATEGORY II: FIELDS OF SCIENCE OTHER THAN BIOLOGY INVOLVED IN THIS RESEARCH (Select 1 to 3)

- ☐ Astronomy
- ☐ Chemistry
- ☐ Computer Science
- ☑ Earth Science
- ☐ Engineering
- ☐ Mathematics
- ☐ Physics
- ☐ Psychology
- ☐ Social Sciences
- ☐ None of the Above

CATEGORY III: SUBSTANTIVE AREA (Select 1 to 4)

- ☐ BIOMATERIALS
- ☐ BIOTECHNOLOGY
  - ☐ Animal Biotechnology
  - ☐ Plant Biotechnology
  - ☐ Environmental Biotechnology
  - ☐ Marine Biotechnology
  - ☐ Metabolic Engineering
- ☐ CHROMOSOME STUDIES
- ☑ COMMUNITY ECOLOGY
- ☐ COMPUTATIONAL BIOLOGY
- ☐ CONSERVATION & RESTORATION BIOLOGY
- ☐ CORAL REEFS
- ☐ CURATION
- ☐ DATABASES
- ☑ ECOSYSTEMS LEVEL
- ☐ GENOMICS (Genome sequence, organization, function)
  - ☐ Viral
  - ☐ Microbial
  - ☐ Fungal
  - ☐ Plant
  - ☐ Animal
- ☐ INFORMATICS
- ☐ MARINE MAMMALS
- ☐ Molecular Evolution
- ☐ Methodology/Theory
- ☐ Gene/Genome Mapping
- ☐ Natural Products
- ☐ NANOSCIENCE
- ☐ PHOTOSYNTHESIS
- ☑ PLANT BIOLOGY
  - ☐ Arabidopsis-Related Plant Research
- ☑ POPULATION DYNAMICS & LIFE HISTORY
- ☐ POPULATION GENETICS & BREEDING SYSTEMS
- ☐ REPRODUCTIVE ANIMAL BIOLOGY
- ☐ Plant Pathology
- ☐ Coevolution
- ☐ Biological Control
- ☐ STATISTICS & MODELING
  - ☐ Methods/ Instrumentation/ Software
  - ☐ Modeling (general)
    - ☐ Modeling of Biological or Molecular Systems
    - ☐ Computational Modeling
  - ☐ Statistics (general)
- ☐ STRUCTURAL BIOLOGY
- ☐ SYSTEMATICS
- ☐ Phenetics/Cladistics/ Numerical Taxonomy
- ☐ NONE OF THE ABOVE

CATEGORY IV: INFRASTRUCTURE (Select 1 to 3)

- ☐ COLLECTIONS/STOCK CULTURES
  - ☐ Collection Enhancement
  - ☐ Collection Refurbishment
  - ☐ Living Organism Stock Cultures
  - ☐ Natural History Collections
  - ☐ DATABASES
    - ☐ Database Initiation
    - ☐ Database Enhancement
    - ☐ Database Maintenance & Curation
    - ☐ Database Methods
- FACILITIES
  - ☐ Controlled Environment Facilities
  - ☑ Field Stations
    - ☑ Field Facility Structure
    - ☐ Field Facility Equipment
  - ☑ LTER Site
  - ☐ GENOME SEQUENCING
    - ☐ Other Plant Genome Sequencing
  - ☐ INDUSTRY PARTICIPATION
  - ☐ INSTRUMENTATION
    - ☐ Instrument Development

☐ Instrument Acquisition	☐ Technique Development	☐ Multi-, Cross-, Interdisciplinary Training
☐ Computational Hardware Development/Acquisition	TRACKING SYSTEMS	☐ Undergraduate Training
☐ TOOLS DEVELOPMENT	☐ Geographic Information Systems	☐ Predoctoral Training
☐ Analytical Algorithm Development	☐ Remote Sensing	☐ Postdoctoral Training
☐ Other Software Development	☐ TRAINING	☐ NONE OF THE ABOVE
☐ Informatics Tool Development		

CATEGORY V: HABITAT (No selection required)

CATEGORY VI: GEOGRAPHIC AREA OF THE RESEARCH (No selection required)

CATEGORY VII: CLASSIFICATION OF ORGANISMS (Select 1 to 4)

☐ VIRUSES	☐ PLANTS	☐ Chondrichthyes (Cartilaginous Fishes) (Sharks, Rays, Ratfish)
☐ Bacterial	☐ N0N-VASCULAR PLANTS	☐ Osteichthyes (Bony Fishes)
☐ Plant	☐ VASCULAR PLANTS	☐ AMPHIBIA
☐ Animal	☐ GYMNOSPERMS	☐ REPTILIA
☐ PROKARYOTES	☑ ANGIOSPERMS	☐ AVES (Birds)
☐ Archaebacteria	☐ Monocots	☐ MAMMALIA
☐ Cyanobacteria	☐ Dicots	☐ Primates
☐ Eubacteria	☐ ANIMALS	☐ Humans
☐ PROTISTA (PROTOZOA)	☑ INVERTEBRATES	☐ Rodentia
☐ FUNGI	☐ ARTHROPODA	☐ Marine Mammals (Seals, Walrus, Whales, Otters, Dolphins, Porpoises)
☐ LICHENS	☐ Hexapoda (Insecta) (Insects)	☐ TRANSGENIC ORGANISMS
☐ SLIME MOLDS	☑ VERTEBRATES	☐ NO ORGANISMS
☐ ALGAE	☐ FISHES	

CATEGORY VIII: MODEL ORGANISM (Select ONE)

☑ NO MODEL ORGANISM	FUNGAL	☐ Fruitfly (Drosophila melanogaster)
MODEL ORGANISM (Choose from the list or input up to 9 characters)	PLANT	[Enter your own model organism - up to 9 characters]
☐ Escherichia coli	☐ Mouse-Ear Cress (Arabidopsis thaliana)	

1. Project Summary

This proposal is a request for funds to construct a 2000 ft^2 multi-user facility to provide needed support space to the dozens of scientists and technical staff actively using the Jornada Experimental Range (JER) as a field station. This proposed facility was the #1 priority for infrastructure development identified as a result of a Division of Biological Infrastructure planning grant (award #0330667) awarded in 2003. This facility will be a key component in maintaining the Jornada Experimental Range as a premier arid land field station for both research and training for scientists, students, land managers, and the general public.

The Jornada Experimental Range (JER) in southern New Mexico is an historical research station that continues to be one of the most significant scientific arid land field facilities in the nation and the world. Established in 1912, the contributions of scientists working at this station for nearly a century have resulted in one of the longest records of ecological data and resulting publications in existence for desert landscapes. Operated by the United States Department of Agriculture, Agricultural Research Service (ARS), the Jornada Range has transcended categorization as an agricultural research facility. The involvement of this facility in a broad array of important national science programs, including as one of the original cohorts of Long Term Ecological Research sites and now a proposed relocatable site within the National Ecological Observation Network, has elevated the Jornada into a unique status as a multi-agency, multi-dimensional, and international scientific facility of major importance for arid lands, their conservation, and their management. The Jornada has also served as a key site for training of land managers in new knowledge and technologies germane to both public and private rangelands that comprise nearly 50% of the land area of the US. Locally, the Jornada has also provided sites for education programs for over 10,000 students and teachers per year in collaboration with the Asombro Institute for Science Education; a non-profit organization that partners with the JER in K-12 science education activities. The Asombro Institute is one of the nation's leading programs in reaching out to underrepresented minority students, and has documented the effectiveness of its programs through increased science test scores of participating students.

The involvement of the ARS as the administering agency provides a consistent and adequate level of both funding and staffing support for this field station. In addition, the ARS research mission of protecting and enhancing the nation's natural resource base with a special emphasis on the nation's rangeland environments provides a broad scientific framework that can accommodate the diverse research programs operating at the Jornada. Jornada scientists have published nearly 2000 scientific papers over the years with the majority of these papers published in the last quarter century. This knowledge base has been a major contribution to our understanding of not only key ecological processes and properties of the Chihuahuan Desert, but an understanding of ecological principles that have application to the 1/3rd of the world's land surface that is arid rangeland. In 2008, scientists from over 50 agencies, institutions, non-government organizations, and universities from 4 continents are actively collaborating with the research program based at the Jornada. The JER has developed infrastructure but not the necessary facilities to support these collaborations.

The JER headquarters is located 30 mi (50 km) from high quality support facilities, including laboratories and offices, on the campus of New Mexico State University (NMSU). The JER field station lacks a central building to support research planning, sample preparations, data management, or routine discussions of scientific activities that are needed in the field to fully augment the facilities available on the NMSU campus. These deficits seriously constrain the on-site use of this field station by collaborating scientists, staff and students. This proposal requests the funds needed to construct this multi-user facility. The funds required to design, equip, furnish and maintain this facility are known, but not requested in this proposal..

TABLE OF CONTENTS

For font size and page formatting specifications, see GPG section II.C.

*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

2. Project Description

A. Basic Description

This proposal is a request for funds to construct a 2000 ft^2 multi-user facility to support on-site research activities at the Jornada Experimental Range (JER) field station. The request is for $238,000 for construction costs. Costs of facility architectural and engineering design, all initial furnishings and equipment, and subsequent maintenance and repair are known, but not requested in this proposal. This multi-user facility was identified as the #1 priority in a master plan for this field station developed through a planning grant from the NSF Division of Biological Infrastructure (Award # 0330667) received in 2003. The proposed facility will provide needed on-site space to support research planning activities, data management, field logistics, and off-site communications for all research personnel utilizing this station. This multi-user facility is a key next step in developing a fully functional field station.

The Jornada Experimental Range located near Las Cruces, New Mexico, in Dona Ana County, is a United States Department of Agriculture (USDA) research station operated through the Agricultural Research Service (ARS), the principle in-house science agency of the USDA. However, this site can not be simply regarded as an agricultural station. With its 96 year history of research, the JER has developed into a field station servicing a number of important national and international scientific and biological programs. The most important of these programs are: inclusion of the site within the NSF Long-Term Ecological Research Network (LTER; http://jornada-www.nmsu.edu/), an institutional member site of the Association of Ecosystem Research Centers (http://www.ecosystemresearch.org/), one of the original Man and Biosphere Reserves (1976) (www.unesco.org/mabdb/br/brdir/directory/biores.asp?mode=all&code=USA+14), and a member institution and a candidate relocatable site within the Southwest Domain of the proposed National Ecological Observation Network (NEON; http://www.neoninc.org/neon-membership/neon-member-institutions.html). The JER is an active field station supporting numerous important research programs around the nation and the world (see: http://usda-ars.nmsu.edu and http://www-jornada.nmsu.edu).

Site History: The JER was established in 1912 by Presidential Executive Order. Originally named the Jornada Range Reserve, this 192,000 ac (78,000 ha) facility was established within the Bureau of Plant Industry of the USDA, but transferred to the US Forest Service (USFS) in 1915. The USFS quickly established a research program to address the principle objectives cited in the 1912 Executive Order including: 1) quantifying carrying capacity of native rangeland for livestock use, 2) establishing a system of forage utilization consistent with growth requirements of desert forage plants, and 3) examining the possibility of rangeland improvements by introductory of new plants, seed planting, and conservation of runoff. These objectives were seen as critical to addressing the wide spread problems of rangeland degradation that had been documented across the American southwest at the end of the 19th Century.

In 1952 the JER was transferred to the then newly created ARS, the principle intramural research agency of the USDA. The ARS has been able to expand the research program from its more narrow beginnings to one with national and international significance now in place. The history of research during the 20th Century is effectively categorized into 6 principle themes: ecology, ecosystem sciences, rangeland management, interdisciplinary sciences, rangeland improvements, and animal husbandry (Havstad and Schlesinger 1996). The resulting productivity of approximately 2000 papers published in the peer-reviewed literature has been a significant contribution to a global understanding of arid ecosystems, their key ecological processes and

properties, predictions for future dynamics, and important principles for the management of these landscapes (see searchable bibliography at: http://jornada-www.nmsu.edu/ris/).

Staffing: The JER research program staff are housed in a modern 29,000 ft^2 facility (Wooton Hall) constructed in 2002 based on the campus of New Mexico State University (NMSU). The construction of this ARS facility at NMSU was the first phase of our current facilities plan for the development of the JER as a national and international research program for arid land ecology and management. This building contains modern laboratory, office and conference facilities that support both ARS and LTER programs based at the JER. There are 20 scientist FTEs officed within this campus based facility.

These LTER, NMSU and ARS scientists are supported by 35 FTE technical staff. In addition, 5 FTE technical staff are assigned to the JER field station in support of maintenance, repair, and field research assistance activities. The JER field station headquarters (HQ) is located 30 mi. (50 km) from the NMSU and Wooton Hall. These field station staff are housed at the JER HQ on a daily basis and they provide technical and logistic support for field station activities of all collaborating scientists, staff and students.

In total, the JER has a resident staff of 70-75 scientists, technicians, office and administrative professionals, graduate and undergraduate students.

Facility Administration: The JER field station is operated within long term collaborative agreements among LTER, NMSU, and ARS programs. The formal cooperative agreements that serve as the basis of this collaboration have been in place for decades. An ARS senior scientist serves as location coordinator responsible for all overall administrative and scientific functions and operations of the JER research unit and its cooperative research activities (Fig. 1). A Lead Scientist serves as Principle Investigator for both ARS and the LTER research programs based at the JER. A Station Superintendent is assigned to the JER field station facility and directs staff, repair and maintenance (R&M) activities and field support functions on site. A Site Superintendent coordinates and directs field campaigns associated with LTER, NMSU and ARS activities. Individual technical staff handles specific research projects and field campaigns.

Research Program: The two main components of the research program at the JER are the 1) NSF LTER-based project "Landscape Linkages in Arid and Semi-Arid Ecosystems" (2007-2012; DEB # 0618210), and the 2) ARS based project "Management Technologies for Arid Rangelands" (2008-2012, USDA ARS Program # 6235-11210-006-00D).

The LTER program addresses identification of key processes which redistribute resources across spatial scales. Expanding our understanding of these processes will have direct application to both the management and restoration of arid rangeland systems in the US, throughout North America, and around the world. The ARS project is conceptually linked to the LTER project in that key hypotheses have application to the LTER research objectives. The ARS project contributes directly to the USDA ARS National Research Program in Rangelands, Pasture, and Forages. The JER is the largest single research unit operating solely within this National Program and its base project has four research objectives of 1) developing assessment and monitoring approaches for multi-scale evaluations, 2) identifying key ecological processes that influence potential for restoring degraded landscapes, 3) developing adaptive management strategies with application for desert environments, and 4) predicting system responses to both management dependent and independent drivers. Both ARS and LTER projects build intensively and extensively upon the 96 year research history at the JER (see Section 2D).

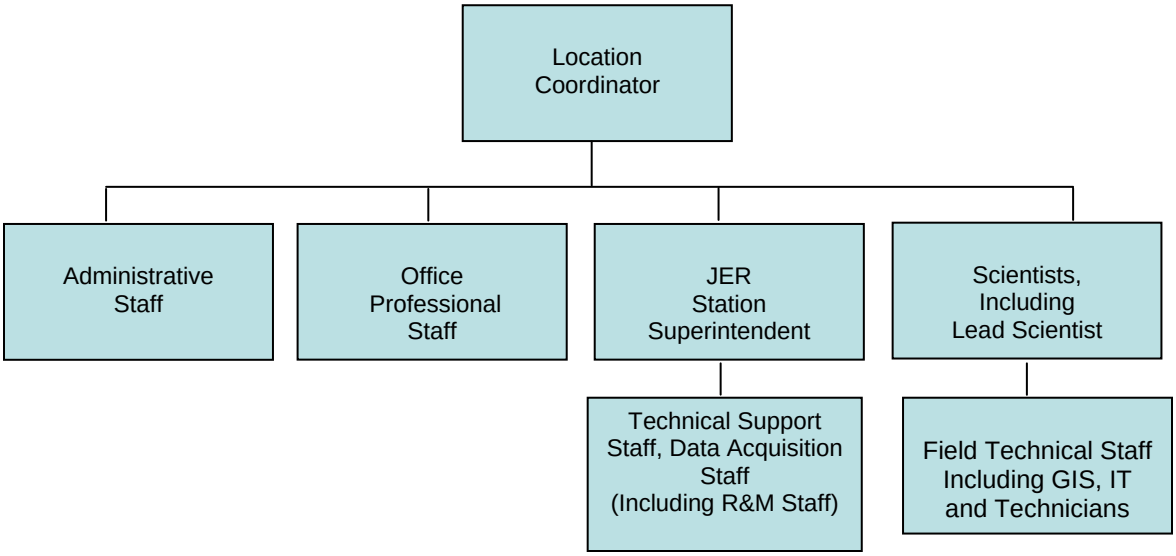

Fig. 1. Facility Administration of the collaborative research program based at the Jornada experimental Range

Headquarters Site: The JER HQ is located in the geographic center of the field station and is approximately 30 mi (50 km) from the campus of NMSU in Las Cruces. This location provides direct access to hundreds of field sites currently in operation across the JER. On-site housing (mobile homes) provides accommodations for up to 20 visiting scientists, students and field staff. A motor pool is based and maintained at the HQ to provide staff and visitor transportation needs. A fully equipped 4000 ft^2 shop area provides space for all basic equipment fabrication, repair and maintenance needs. Four additional shop areas of 500-750 ft^2 each provide specific space for wood, metal, mechanical and miscellaneous construction projects.

With the construction of Wooton Hall on the campus of NMSU in 2002 we completed the first phase of our facility development plan for the overall JER program. With modern laboratories and adequate office space on campus, our most pressing need for the improvement of the JER was development of field facilities at the JER field station. The DBI planning grant awarded in 2003 allowed us to develop the next phase of this facility improvement. During the course of identifying the priorities for needed new facility construction (detailed in Section 2B), we were able to use LTER, NMSU and ARS funding support to dramatically improve the infrastructure at the JER HQ. Currently, at the JER HQ the existing infrastructure includes:

- modern telecommunications services,
- modern electrical systems and distribution lines,
- an integrated network of 3 domestic water wells providing 50,000g of water storage and a modernized delivery system,
- a newly installed fire abatement system with appropriately distributed hydrants,
- a newly installed T1 fiber optics system providing high speed data communications and wireless internet access service to the HQ and subsequent nodes across the field station.

This 30 ac (12 ha) HQ area has adequate space for expansion of needed facilities.

Information Technology/Data Acquisition System: The Jornada Information Management System includes acquisitions and management of spatial data and provision of network and computing systems (see Fig. 2). This system is staffed by 6 full-time personnel jointly supported by ARS, NMSU, and LTER programs. These positions include an overall systems manager, 2 GIS specialists, a computer systems manager, and 2 network and data system support personnel. The Information Management System (IMS) is integrated with a Geographic Information System and is composed of a relational database management system and metadata repository. All metadata can be searched and accessed through the JER data web access points. Data acquisition systems on the JER are within two general categories; 1) long term studies, and 2) sensor networks (Fig. 3). Data associated with long-term studies are accessible through http://jornada-www.nmsu.edu/longtermdatasets.php?withJS=true&with_JS=true. The sensor networks include both local (for example, dust collector network) and national (for example, climate reference network, U/V network) networks. In addition, the JER is a site within the Southwest Climate Domain proposed for inclusion within the forthcoming National Ecological Observation Network. Data acquisitions within the JER are facilitated by a T1 fiber optic system based at the JER headquarters (HQ) and associated wireless network data access nodes across the range, a radio based data transmission system for transfer of data from remote instruments to JER HQ, and direct line connections back to the Wooton Hall facility on the NMSU campus with subsequent relay to other hosts.

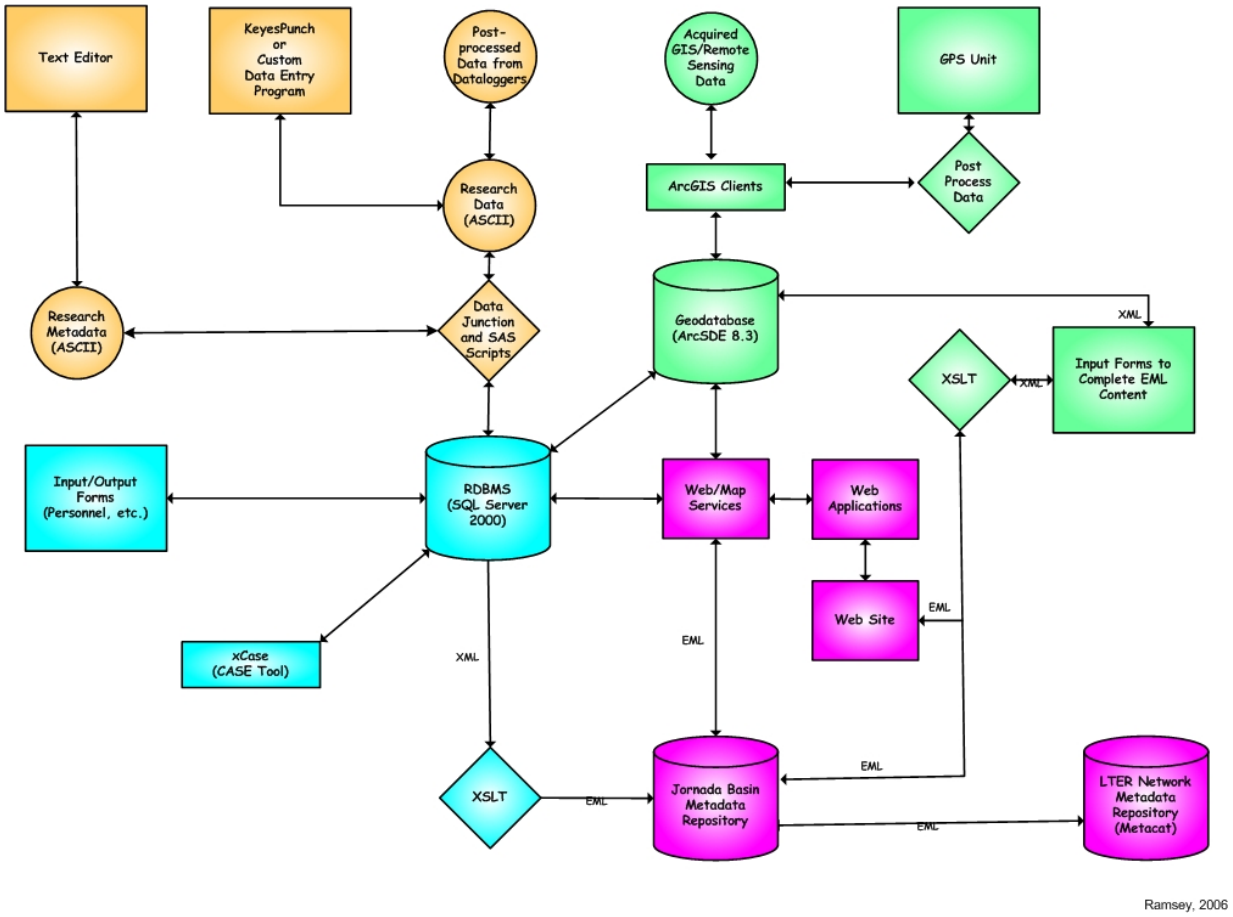

Fig. 2. Jornada Information Management System designed and managed by Jornada Experimental Range staff.

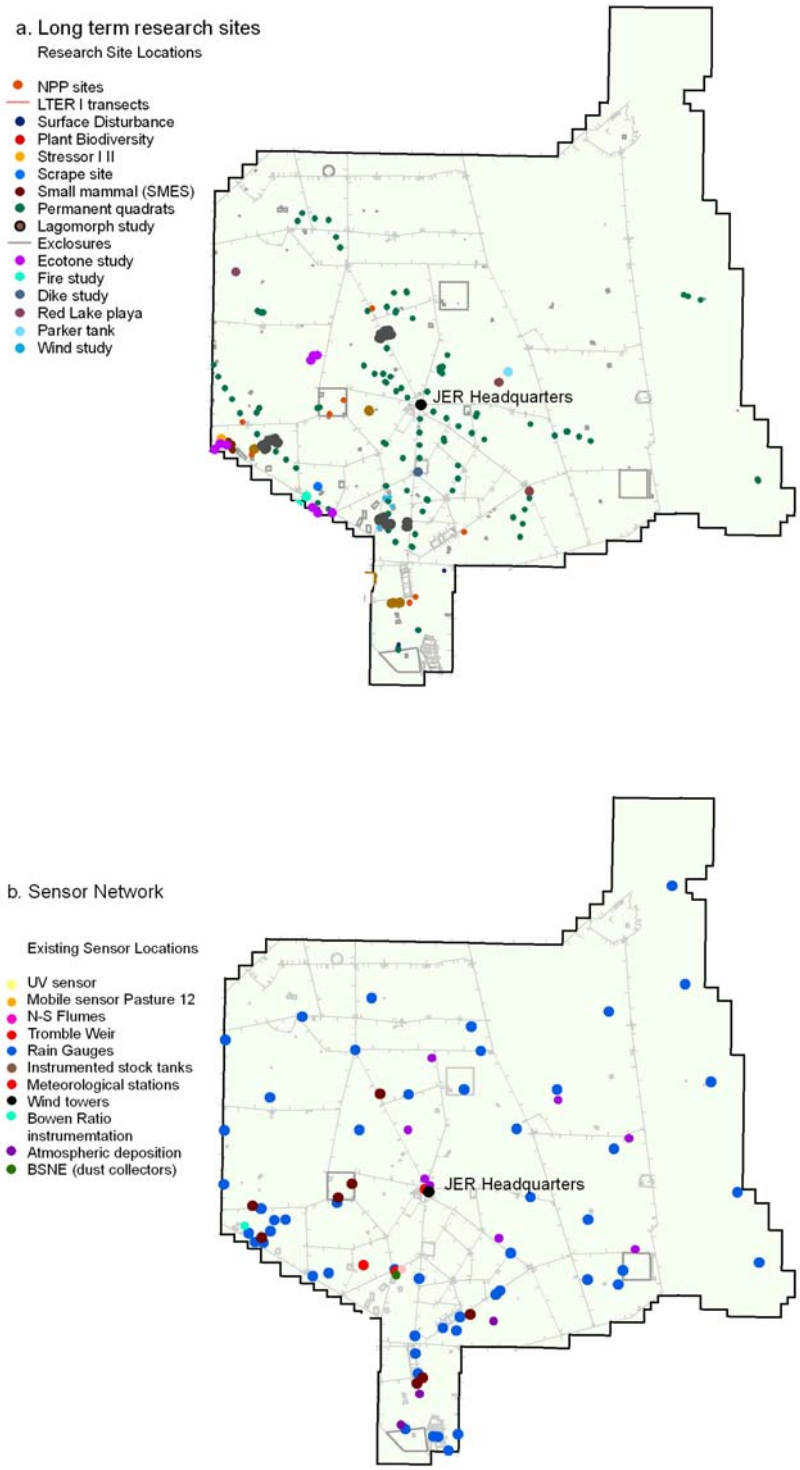

Fig. 3. (a) Selected long term core studies and (b) existing sensor locations distributed across the 192,000 ac Jornada Experimental Range.

Data Management: As one of the original six LTER sites established in 1981, the JER has adopted the data management policies established by NSF for the LTER network. The Jornada Basin Information Management System provides protocol and services for data collection, verification, organization archives and distribution in accordance with LTER guidelines, (see: http://jornada-www.nmsu.edu/jrndmpol.php?withJS=true). All data collected within the JER, including through LTER, USDA, or other funding sources, complies with these data management policies. Associated with data management policies is a data access policy that all data are made publicly available no later than 2 years after submission of the original data, unless a specific extension to this time limit is granted to a PI for a specific reason. Initial documentation for any data set is required of all scientists, collaborators, and their students and field personnel within 90 days of initiation of data collection. All data forms, access requests, and documentation forms are available on-line from http://jornada-www.nmsu.edu.

Unique Elements: Approximately ½ of the world's land area is classified as rangeland. This is a land type characterized by low yet highly variable productivity, low fertility soils unsuited to cultivation, a native flora dominated by herbaceous and/or shrubby species, and often with a history, either recent or in the past or both, of degradation. Common images of these landscapes are savannas of southern Africa, shrublands of western Australia, steppe grasslands of northeastern Asia, and the hot deserts of the southwestern United States. Not only do these landscapes occur on all continents, over 1.5 billion people, nearly 1/4th of the world's human population, lives on or immediately adjacent to this land type (Grice and Hodgkinson 2002).

Approximately ½ of the United States' land area is rangeland, primarily in the western US. Nearly 100 million people in the US live on or adjacent to this land type, and this population is expected to increase by at least 20% in the next 20 years. This land type has historically provided a variety of goods and services, with provisioning services of food and fiber from grazing livestock dominating throughout the 20th century. A shift to a more diverse array of goods and services is being requested from US rangelands in support of a rapidly growing and increasingly urban population. These goods and services include regulating, cultural, and supporting services. The ability of these rangelands to supply these services requires fundamental ecological knowledge of these ecosystems, and ecologically based principles for land management (Havstad et al. 2007). The JER is the one of the oldest, largest and most scientifically active field stations in the western US. As such, it is uniquely positioned to conduct the long term research required to provide the ecologically based knowledge and principles required for management of these arid land resources (Havstad et al. 2006).

In addition, the JER is within the northern portion of the Chihuahuan Desert. The Chihuahuan Desert is the largest desert in North America. This desert covers nearly 1.69 m mi^2 (650,000 km^2) and is one of the most biologically diverse deserts in the world. For example, the Chihuahuan Desert includes nearly 1/3 of the world's cacti species, over 180 species of reptiles, and more than 3,000 species of plants. The only North American desert east of the Continental Divide, the region is a mosaic of enclosed basins and isolated mountain ranges that creates an extremely heterogeneous landscape that has both terrestrial and freshwater environments (Wauer and Riskind 1977). The JER is a unique subset of the biological diversity that characterizes this region. Within the boundaries of the JER, there are over 500 plant species, and a particularly rich biota of animals. For example, approximately one-tenth of North American ant species are found within the Jornada Basin (Whitford and Bestelmeyer 2006). Fortunately, many of the floral and fauna are well documented due to the history of long-term research within this basin (Havstad et al., 2006).

B. Proposed Improvements

One of the objectives of the 2003 DBI planning grant (award # 0330667) was to develop a master plan and identify priorities for infrastructure investment (objective 5 of this prior award). During the past five years, through both USDA intramural sources and supplemental grants to both DEB # 0080412 and DEB # 0618210, the necessary infrastructure required to support facilities identified in the master plan have been installed and are operational. These services are described in Section 2A, and include a modern domestic water supply storage and delivery system, T1 cable providing modern telecommunication services, high speed internet service with wireless access at the JER HQ, a fire abatement system including dispersed hydrants, and fully staffed facilities providing repair and maintenance services for field equipment, communications and motor vehicles.

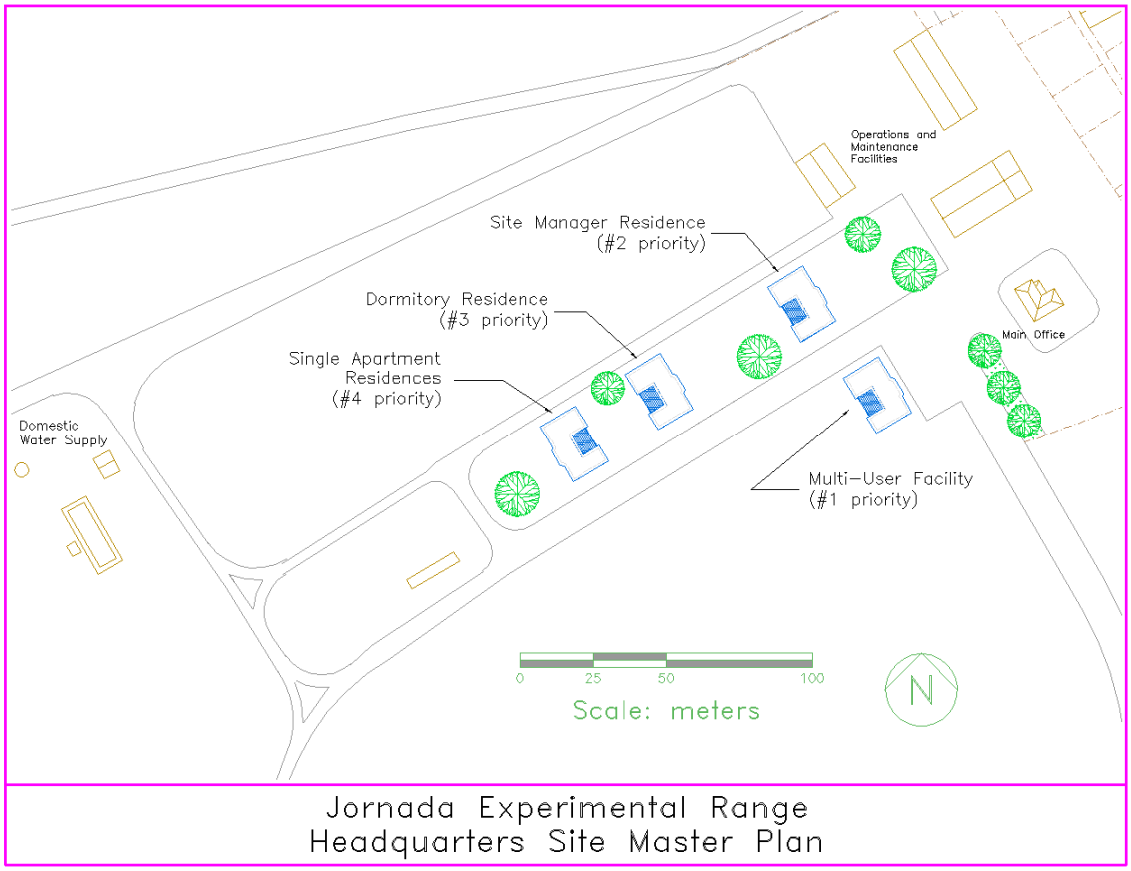

Fig. 4. Jornada Experimental Range (JER) Headquarter Site Master Plan

Needed Facilities: The master plan identifies 4 facilities needed to complete the field station in order to fully support existing, projected and proposed activities (Fig. 4). These facilities are, in order of priority:

1. A 2000 ft^2 multi-user facility to support on-site research activities including planning, data collection, data management, and both on-site and off-site communications.
2. A 2000 ft^2 on-site manager residence. This facility will replace a 35-year old mobile home currently on site and used as this residence.
3. A 2000 ft^2 dormitory for student guests with 4 large sleeping areas, a commons area, kitchen facilities, and restrooms and shower/bath areas.

4. A 2000 ft^2 facility with 8 single bedroom apartments for visiting scientists, a commons area, and kitchen facilities

This proposal requests construction funds for priority #1, a multi-use facility to support on-site research activities. A facility of this type is not currently present at this field station, yet is needed because there is no existing space on-site to properly support field campaigns of visiting scientists, staff and students.

The other three priority facilities (#2 - #4 above) are being provided through temporary structures. These structures are either antiquated or of insufficient size or both, but are providing needed housing at this time. Subsequent proposals will be developed in the coming years to construct these other facilities as identified in our field station master plan.

Proposed Construction: The proposed construction is a 2000 ft^2 multi-user facility. General design, elevation, and floor plan features are shown in Fig 5. The facility includes an 800 ft^2 work area/meeting room/conference area. This area will support multiple activities as an open floor space where work area, tables and chairs can be arranged to support sample preparations for transportation to off-site laboratories, planning sessions, group discussions, seminars, and conferences of ~50 people. The facility will also include 600 ft^2 for three offices for both on-site technical staff and visiting scientists. These offices will provide work space for visitors residing in on-site housing during field campaigns. The facility will also include 600 ft^2 of entry, restrooms, display, and storage areas. Design sketches for both the open work area and for offices are included in Section 6B of this proposal.

Construction estimates are \$119/ft^2, or \$238,000. This construction cost per ft^2 estimate is the current figure (2008) used by the USDA for field station facilities in the southwestern US that do not include special use facilities, such as laboratories.

Costs for design, initial furniture, equipment, and annual repair and maintenance are known, but are not requested in this proposal.

All property is owned by the USDA, and all required utilities are available directly at the site. In addition, the construction site is a prior building location. A Certification of Flood Zone document from Dona Ana County is attached (see Section 6A). There are no environmental or archeological issues on this site, but all needed clearances will be obtained through USDA processes.

Facility Use and Maintenance Plan: The facility will be scheduled for use through the Station Superintendent. As with other user requests for research access, the scheduling of this facility will make every attempt to accommodate all requests. Priority will be give to visiting scientists, students, and technicians working at the JER. Public use associated with educational programs linked to the JER research programs will be accommodated as available. A simple on-line request form for facility use will allow for a relatively stream-lined and simple process. No fees will be assessed for facility use by any user.

Maintenance of the facility will be assigned to the Repair and Maintenance (R&M) staff position at the JER directed by the Station Superintendent. The R&M staff is a full-time position staffed by a qualified professional. At least 4% of the JER annual operating budget (~\$176,100) is allocated to R&M activities directed towards station facilities. This budget allocation includes both force account labor. These staff resources will be adequate to address this facility's R&M

needs. Janitorial services currently contracted for JER HQ facilities are available to service the proposed facility.

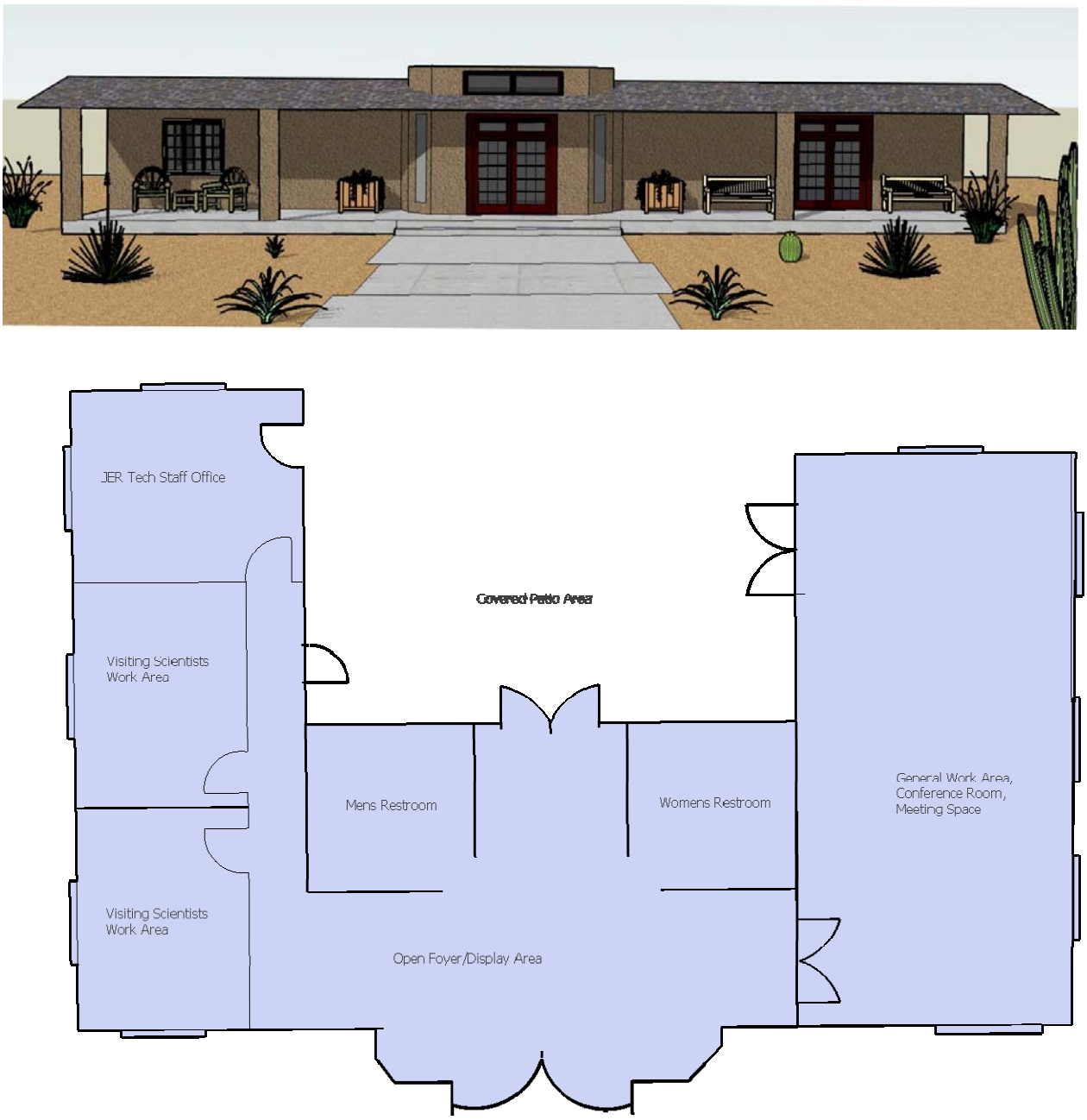

Fig. 5. Elevation (top) and floor plan (bottom) for proposed 2000 ft^2 multi user facility.

C. Research and Training Use of the Facility, Last 5 Years

Research and Training Use: The use of the facility is documented in annual reports on file for the Jornada Basin LTER program (see: http://jornada-www.nmsu.edu/site/pubs/reppro.php?withJS=true; annual report # is 0080412, and these documented activities include ARS based activities). Over the last 5 years, on average,

approximately 140 scientific personnel from various institutions use the field station in a variety of regular, scheduled capacities each year. This use includes approximately 40 scientists accessing field sites and/or long term data sets originating from JER research, 10 post doctoral research associates conducting research activities in support of either ARS or LTER programs, 25 technical staff directing field research activities, 30 graduate students from several institutions (including NMSU, Brown, UCLA, and several foreign Universities), 30 undergraduates providing support to field campaigns, and 5 undergraduates involved in Research Experience for Undergraduate programs.

In addition, there are numerous uses of the field station on a less routine or less scheduled basis each year. For example, in 2007 university students from several institutions, including West Texas State, NMSU, the University of Chihuahua, and the University of Guelph, accessed the field station for several days or several weeks at a time in support of field courses or field experiments that took advantage of the JER research history, associated research programs, and its accommodations. Each year approximately 30-100 students and faculty access the JER in this manner.

Approximately ¼ of these scientific personnel are non local residents and are either residing in housing provided on site, in local hotels, or with local colleagues. These collaborators require on-site facilities that provide the services that would be available through this proposed multi-user facility.

As a land base withdrawn from the public domain and devoted to long term research, the JER is closed to unescorted public access according to federal policies. However, JER staff routinely escort public groups requesting access in support of specific interests. Each year the JER is a site for 10-20 local field trips organized by various civic groups, including local chapters of the Sierra Club, the Audubon Society, Soil and Water Conservation Districts, and the Native Plant Society. The JER staff also conducts 2-6 workshops each year for land management agency personnel, including the Bureau of Land Management and the Natural Resource Conservation Service. These workshops are typically 3-4 days each with a mixture of field and meeting room activities. These civic and agency groups would be able to utilize this facility to support their local meetings and workshops, and associated on-site field activities.

K-12 Schoolyard Program: For nearly a decade, the Jornada program has provided quality, inquiry-based science education opportunities to K-12 students and teachers throughout southern New Mexico and west Texas. Over this time period, program staff have directly worked with >500 teachers who have participated in one-day, five-day and two-week teacher professional development workshops. These workshops are specifically directed towards development of science based curriculum that can be used by these teachers in their classroom programs. These curricula have been developed through the Asombro Institute for Science Education, and specifically address state board of education outcomes for science education in New Mexico.

The key to this volume of outreach continues to be a partnership that was established in 1998 among the LTER, the ARS, and the Asombro Institute for Science Education (formerly the Chihuahuan Desert Nature Park), a nonprofit science education organization. Using the combined expertise of these partners, we deliver a multifaceted K-12 education program which includes schoolyard studies, science investigation kits, teacher workshops, field trips, and classroom programs. Over the past 5 years, over 50,000 students have been involved in these programs. Approximately 20% of these students participate in field activities conducted on-site at the JER as part of their education activities. Annually, JER staff devotes over 500 hours of time in support of these field programs at the JER. Not only would this proposed facility provide

needed restroom facilities for these school children, the work area would provide classroom space for some curricula activities.

D. Summary of Most Signification Research, Last 5 Years

The majority of the research based at the JER works towards a general goal of determining how biological, soil and geomorphological processes interact across multiple spatial and temporal scales to affect soil development, soil stability, nutrient and water retention and acquisition, and plant establishment and survival. Our overall hypothesis is that temporal and spatial variation in ecosystem dynamics is a result of the interactions of vegetation patch structure with both transport vectors (wind, water, and animals) and environmental drivers. These interactions influence resource redistribution which in turn feeds back to patch structure and dynamics with cascading effects on goods and services provided by these arid systems (Peters et al. 2004, Peters et al. 2006, Fig. 6). Important modifiers of these relationships are historical legacies and geomorphic templates across these landscapes. One of the more significant outcomes has been the development of a conceptual framework regarding ecosystem services that synthesizes our observations within the context of what has been learned from nearly a century of research at this field station (Havstad et al. 2007, Fig. 7). This framework is guiding our future research directions. A few of the important results from this research program are summarized within the context of this goal and overall hypothesis in the following text.

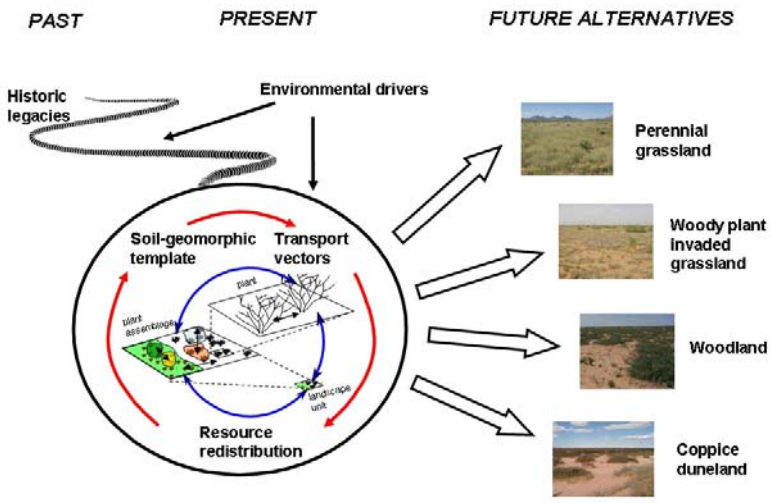

Fig. 6. Landscape linkages conceptual framework containing five key elements (legacies, drivers, soil-geomorphic template, transport vectors, resource redistribution) that interact to lead to cascading events and nonlinear dynamics in future stares (Peters et al 2004, Peters et al 2006).

Vegetation Dynamics: The extensive history of research at the JER has allowed us to recently reassess dynamics of vegetation at both broad (>10 ha) and fine (1 m^2) scales over lengthy time periods. The JER was dominated by perennial grasses communities in 1858, but dominated by shrub communities by 1998 (Gibbens et al. 2005). However, there is tremendous spatial and temporal variation in perennial grass cover that is best explained, for key grass species, by spatial variation in important transport process, specifically seed transport and the redistribution of water

(Yao et al. 2006). Vegetation changes are nonlinear, and likely reflect thresholds in dominant processes (Peters et al. 2004).

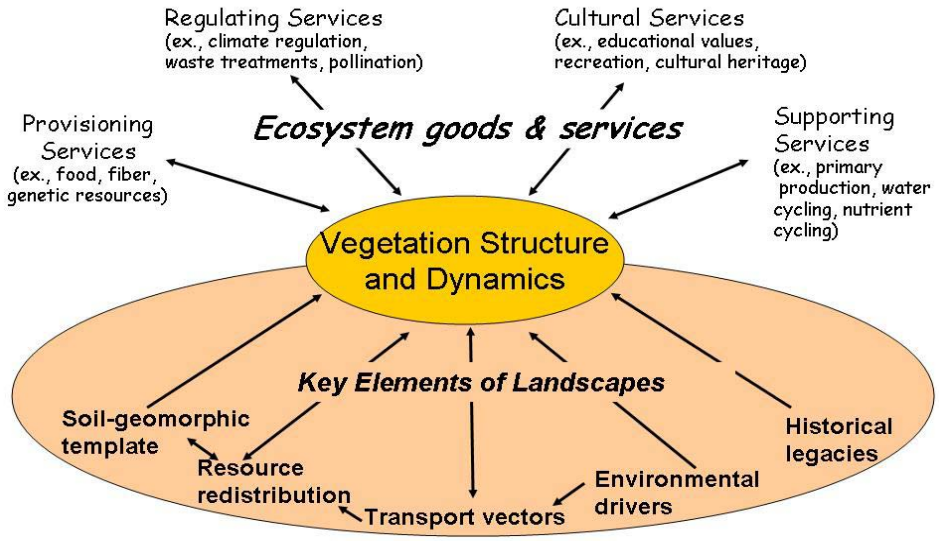

Fig 7. Five key elements of rangeland landscapes interact to determine vegetation structure and dynamics with resulting effects on ecosystem goods and services: (1) historical legacies of past climate, disturbances, and human activities, (2) environmental drivers, (3) transport vectors, such as the run-on and run-off of water during extreme rain events, (4) redistribution of resources, such as soil, nutrients, and seeds, and (5) the soil-geomorphic template (after Peters et al. 2006, Havstad et al. 2007).

Aeolian Dynamics: Of all of the different geomorphic units present within these arid landscapes, the sandy loam surfaces dominated by mesquite are, by far, the sites most susceptible to wind erosion, and the sites that are the primary sources of dust emissions from this desert (Gillette and Pitchford 2004). These are the units that need to be revegetated in order to reduce particulate emissions and significantly improve air quality in this region.

Carbon Patterns and Dynamics: Highly developed petrocalcic horizons in the JER basin contain up to 223 kg C/m^2 (Gile et al. 2003). However, these petrocalcic horizons are not a significant source of atmospheric CO_2 (Duniway et al. 2007). In addition, the spatial variation in parent materials, landforms, and soil texture in this region are the result of long term soil forming processes (Monger et al. 2006).

Disturbances: Prior long term studies at the JER have shown that vegetation responses to disturbances may be extremely slow to develop, in some cases responses were not evident until a half century later (Havstad et al. 1999). More recent analyses of these slow responses have shown strong influences of landscape position on subsequent responses. For example, a primary perennial grass in the region is black grama, and black grama can be extremely slow to respond to disturbance. However, responses can be relatively quicker in more favorable landscape positions, such as within arroyos that receive additional soil moisture, or on northern aspects that receive less solar radiation (Peters et al. 2006).

Hydrologic Studies: Field studies along grass-shrub ecotones have illustrated significant differences in runoff nutrient content as a function of the timing of runoff events. High loads of ammonia are characteristic of early monsoonal storms, with reduced loads later in the monsoon

season. These flux dynamics are strongly influenced by both vegetation structure and landscape position (Müller 2004).

E. Broader Impacts of the Proposed Project

The overall program at the JER is based on integration of our research objectives into a broad set of collaborative research agreements with numerous institutions, agencies and non-profit organizations devoted to application of information and technologies resulting from our research to natural resource management. These partnerships include US government agencies with responsibilities for managing over 400 m ac (160 million ha) of public rangelands (both the Bureau of Land Management and the National Park Service), or providing technical support for hundreds of millions of ac of private rangelands across the US (the Natural Resource Conservation Service). These cooperative agreements also include groups interested in conservation of biodiversity (the Nature Conservancy and the Malpai Borderlands Group) and proper land management practices for degraded regions on other continents (the Agricultural University of Inner Mongolia and the Mongolian Institute for Animal Research). The JER has over 20 active agreements with many different organizations that result in research positively affecting both national policies and management of landscapes throughout the western US and on other continents.

New Mexico State University is the main cooperating institution with the JER. NMSU is one of the nation's largest Hispanic serving institutions, and the JER typically supports 12-20 NMSU students either through undergraduate research experience programs or graduate research assistantships.

A key broader impact of this research program has been the contributions of JER staff to K-12 educational programs coordinated through the Asombro Institute for Science Education, a non-profit partner with the JER in bringing science education into classrooms across the region (see: http://asombro.org). The Asombro Institute, supported by over 500 hours each year of volunteer staff time from JER personnel, reach over 12,000 students and over 600 teachers and adults each year. This association, supported in part by the USDA, is one the nation's best K-12 science education programs. Of significance is that in this region the majority of students are from underrepresented minorities, primarily Hispanic.

F. Results from Prior NSF Support

Peters, D.P.C., B.T. Bestelmeyer, K.M. Havstad, J.E. Herrick, and H.C. Monger. Jornada Basin LTER V: Linkages in semi-arid landscapes. 2006-2012. $4,920,000 (DEB 06-18210)

The Jornada Basin LTER program has been funded continuously since 1982 with a long-term focus on desertification, encompassing both mechanics and consequences. Through the first three funding cycles, the focus was on the redistribution of soil resources at the plant-interplant scale – the Jornada desertification model. Under Peters' leadership starting in 2003, a new framework was developed for LTER IV that aimed at a better understanding of the multi-scale consequences (and interactions with other agents of global change) of desertification, and of integrating approaches to better understand redistribution processes at multiple scales. Two major conceptual papers were published by Peters describing these ideas (Peters et al. 2004, Peters et al. 2006). Starting in 2006 with LTER V, furthering understanding of the multi-scale processes that lead to cross-scale interactions has been the focus. In particular, experiments, observations, and modeling are being used to determine the degree to which redistribution of resources (soil, nutrients, water) and propagules forms the basis of linkages among spatial units across a range of scales, and

explains spatial and temporal variation in patterns and dynamics across the Jornada Basin and throughout the hot deserts of North America. Peters' role is in the LTER is twofold: to lead and synthesize efforts and ideas among 17 scientists and to lead the simulation modeling part of the project. As part of her leadership responsibilities, Peters coordinated a special issue of seven papers ("Cross scale interactions and spatial heterogeneity: consequences for system dynamics") published in *Ecosystems* in 2007 that extends the Jornada cross-scale framework to other sites and systems. In addition, Peters is leading a special issue of six papers to be published in 2008 in *Frontiers in Ecology and the Environment* that expands these ideas to the continental scale. Finally, Peters has been leading the EcoTrends Project since its inception in 2004; this project has been funded by an NSF supplement to the Jornada for the past two years. EcoTrends currently includes ca. 1200 long-term data (> 10 year record) from all 26 LTER sites and an additional 20 sites supported by other agencies (USDA-FS, USDA-ARS, DOE, USGS). The book, Our Changing World, will be submitted for publication in early 2008, and the fully functional web page (http://www.ecotrends.info) will be released at the time of publication. Since 2006, the Jornada LTER has published 38 papers of which Peters was an author or co-author on six.

Havstad's role is to lead long term data set syntheses, and to provide overall supervision to the JER field station facilities in support of all collaborative research programs. Havstad was the lead editor and contributor to 5 of the 18 chapters in the Jornada's synthesis volume for the LTER network series published through Oxford Press (Havstad et al. 2006). In 2007 he was the lead author of a synthesis paper in *Ecological Economics* that described the conceptual framework for this research program and its applications to sustaining ecological services from desert environments. Since 2006, Havstad has been an author or co-author on 17 of the journal articles, book chapters or books published by the Jornada LTER.

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