

**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					<b>FOR NSF USE ONLY</b>	
FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)					<b>NSF PROPOSAL NUMBER</b>	
<b>DEB - Long-Term Ecological Research</b>					<b>0822923</b>	
DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION	
01/31/2008	12	08010000 DEB	1195	173851965	02/04/2008 2:21pm S	
EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)		SHOW PREVIOUS AWARD NO. IF THIS IS <input type="checkbox"/> A RENEWAL <input type="checkbox"/> AN ACCOMPLISHMENT-BASED RENEWAL		IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES <input type="checkbox"/> NO <input type="checkbox"/> IF YES, LIST ACRONYM(S)		
		0618210				
NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE			ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE			
New Mexico State University			New Mexico State University 1620 Standley DR Academic RESH A Las Cruces, NM. 880038001			
AWARDEE ORGANIZATION CODE (IF KNOWN)						
0026575000						
NAME OF PERFORMING ORGANIZATION, IF DIFFERENT FROM ABOVE			ADDRESS OF PERFORMING ORGANIZATION, IF DIFFERENT, INCLUDING 9 DIGIT ZIP CODE			
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IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)		<input type="checkbox"/> SMALL BUSINESS <input type="checkbox"/> FOR-PROFIT ORGANIZATION		<input type="checkbox"/> MINORITY BUSINESS <input type="checkbox"/> WOMAN-OWNED BUSINESS		<input type="checkbox"/> IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE
TITLE OF PROPOSED PROJECT <b>Jornada Basin LTER V: Landscape Linkages in Arid and Semiarid Ecosystems</b>						
REQUESTED AMOUNT \$	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE			
217,457	0 months					
CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW						
<input type="checkbox"/> BEGINNING INVESTIGATOR (GPG I.G.2)		<input type="checkbox"/> HUMAN SUBJECTS (GPG II.D.6) Human Subjects Assurance Number _____				
<input type="checkbox"/> DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C)		Exemption Subsection _____ or IRB App. Date _____				
<input type="checkbox"/> PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)		<input type="checkbox"/> INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)				
<input type="checkbox"/> HISTORIC PLACES (GPG II.C.2.j)		_____				
<input type="checkbox"/> SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.1)		<input type="checkbox"/> HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)				
<input type="checkbox"/> VERTEBRATE ANIMALS (GPG II.D.5) IACUC App. Date _____		_____				
PHS Animal Welfare Assurance Number _____						
PI/PD DEPARTMENT		PI/PD POSTAL ADDRESS				
Jornada Experimental Range		MSC 3JER, Box 30003				
PI/PD FAX NUMBER		Las Cruces, NM 88003				
505-646-5889		United States				
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## 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 disclosed 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 <b>Ancelmo Encinias</b>		<b>Electronic Signature</b>	<b>Jan 31 2008 3:31PM</b>
TELEPHONE NUMBER <b>505-646-2063</b>	ELECTRONIC MAIL ADDRESS <b>aencinia@nmsu.edu</b>	FAX NUMBER <b>505-646-2020</b>	

\*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.

## ***Jornada Basin LTER 2008 SUPPLEMENT***

The Jornada Basin LTER Program investigates the environmental causes and consequences of desertification in semi-arid Chihuahuan Desert ecosystems. Our current research efforts focus on expanding our understanding of the processes that redistribute soil resources in desertifying systems (such as erosion by wind or water, and animal activities) across spatial scales. Our work is aimed at providing a sound basis for management and remediation efforts, and at improving societal understanding of the nature and dynamics of arid and semi-arid systems. This proposal outlines work in several distinct areas that would advance our capabilities significantly as well as improve network-level synthesis. These activities fall into four categories (A-D) with a separate budget for each, and a summary budget.

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- A. Integrated Research and Education (\$72,945)
  - 1. Schoolyard LTER (\$24,000)
  - 2. Research Experience for Undergraduates (\$24,000)
  - 3. Other: Information Management and Cyberinfrastructure (\$24,945)
- B. International (\$19,750)
- C. Social Sciences Network Activities (\$8,187)
- D. EcoTrends (\$116,575)
- E. Summary budget and justification
- F. Supplementary material (Wright CV)

**Total = \$217,457**

## A. Integrated Research and Education (\$72,945)

### 1. Schoolyard Request (\$24,000)

For nearly a decade, the Jornada Basin sLTER 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 > 50,000 K-12 students, and thousands more have been indirectly affected by the > 500 teachers who have participated in one-day, five-day, and two-week teacher professional development workshops.

The key to this volume of outreach continues to be a partnership that was established in 1998 among the Jornada Basin LTER, the USDA-ARS Jornada Experimental Range, and 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 – The heart of the program is a 400-page teacher’s handbook containing 30 inquiry-based activities that are done in the schoolyard and/or classroom. Activities are divided into seven categories that overlap with LTER research: weather, microclimates, soil, water, vegetation, arthropods, and vertebrates. Each activity includes teacher instructions, background information, sample tables and graphs, reproducible student pages in English and Spanish, and alignment with state (New Mexico and Texas) science standards.
- Science investigation kits – Each topic area (e.g., soil) has an associated kit containing all of the equipment and consumable supplies needed to do the activities. Teachers borrow these kits from the Chihuahuan Desert Nature Park for use in their classrooms.
- Teacher workshops – Teachers attend professional development workshops with program scientists to practice the schoolyard activities.
- Field trips – The Jornada Basin sLTER offers opportunities for students to attend day-long field trips to the Jornada Experimental Range and Chihuahuan Desert Nature Park. Students rotate through three to five hands-on activity stations where they learn about the latest research being conducted in the region by LTER scientists.
- Classroom programs – Using part of last year’s supplement, program staff developed one-hour, inquiry-based classroom programs that are delivered by Chihuahuan Desert Nature Park staff. Following the classroom visit, students and teachers continue data collection and analysis using materials and activities provided by the Jornada Basin sLTER program.

### Need

Two years ago, Jornada Basin sLTER staff used an EdEn grant to begin the Real World – Real Science Project, which combines several of the existing components of the sLTER program in a new way. The program was designed to break the pattern of traditional science field trips in this area, where students visit a site, learn a bit about the natural history of the area, and then return to the classroom with little or no follow-up. The Real World - Real Science Project, on the other hand, ensures that students receive a much more in-depth experience.

Participating teachers attend a one-day workshop to learn about field trip topics developed by Jornada Basin sLTER staff. Topics developed for the program’s inaugural year included soil, arthropods, and vertebrates. Each topic includes: (1) pre-field trip activities to introduce students to the topic and prepare them for the field trip, (2) an activity station during the field trip where students collect data and learn about the content as well as the process of science, (3) a kit of supplies to take back to the classroom to extend data collection in the schoolyard, and (4) a post-

field trip visit by Jornada Basin sLTER staff to help students analyze their data and create conclusions.

There was an overwhelmingly positive response from Las Cruces, New Mexico and El Paso, Texas teachers and students who participated in the Real World – Real Science Project in its first full year. Based on this success, the Chihuahuan Desert Nature Park has already applied for outside funding to continue the project. Funding will include money for stipends for teachers, workshop supplies, field trip fees, buses for students, and supplies for existing modules.

We now also have an opportunity to expand this successful program by developing, testing, and adding another module focused on the potential effects of global climate change on desert vegetation. This module will also mirror research being conducted by one of the Jornada Basin LTER scientists, Osvaldo Sala. He is developing rainfall reduction shelters that can be replicated on a smaller scale at the Chihuahuan Desert Nature Park for use during student field trips.

### **Project Plan**

We propose to use sLTER supplement funds this year to (1) continue support for the successful, multifaceted sLTER program we have developed in the last ten years and (2) develop an additional module on global climate change for the Real World – Real Science Project.

Project director Stephanie Bestelmeyer will continue to direct all aspects of the Jornada Basin sLTER program. This will include updating the schoolyard studies activity book, coordinating the restocking of science investigation kits that are loaned to teachers, running teacher workshops (using external funding), and coordinating field trips and class visits for participating students.

In addition to these activities, Dr. Bestelmeyer will meet with Dr. Sala and other Jornada Basin LTER scientists to gather background materials needed to develop the new module on global climate change. The structure of this module will be the same as the existing Real World – Real Science Project modules, including:

- pre-field trip activities to introduce students to some of the vocabulary and concepts,
- a small-scale, long-term rain reduction shelter experiment at the Chihuahuan Desert Nature Park (students will collect data on these plots during field trips),
- post-field trip studies that can be conducted in the classroom and/or in the students' schoolyards,
- a kit of permanent and consumable supplies necessary to do all of the post field-trip, inquiry-based activities.

All activities will be aligned with New Mexico and Texas science and math standards. Activities will be tested in classrooms prior to full implementation. These tests will allow project staff to adjust activities as needed to ensure maximum effectiveness and student learning.

As a result of this addition to the Jornada Basin sLTER program, we expect these outcomes:

- 1) teachers with an increased knowledge of the potential effects of global climate change on the Chihuahuan Desert,
- 2) teachers with increased comfort teaching environmental science using inquiry-based methods and schoolyard data collection activities,
- 3) students with a better understanding of global climate change, and
- 4) students and teachers with decreased stereotypes about who can become an environmental scientist based on their interactions with diverse local scientists.

### **Evaluation**

The Chihuahuan Desert Nature Park, one of the Jornada Basin sLTER partners, has obtained funding to work with an evaluator at the University of Texas at El Paso to develop and pilot test evaluation instruments for field trips, classroom programs, and schoolyard activities during 2008. We will begin using these instruments during the 2008/09 school year (beginning in August 2008) to assess completion of Jornada Basin sLTER objectives.

**Budget and Budget Justification**

*Salaries* – Project director Dr. Stephanie Bestelmeyer will coordinate all aspects of the ongoing sLTER project as well as the creation of the new module for the Real World – Real Science Project. Salary of 0.25 FTE for 10 months (\$1000/month for 10 months) plus 29% for fringe benefits is requested. *Classroom visits* – Funding for 10 classroom programs for 300 middle school students to test the pre-field trip and post-field trip activities in the new global climate change module. *Science kit supplies* – Each kit of supplies for post-field trip activities will include approximately \$800 in materials. We will create five kits to be loaned to participating teachers. \$1000 will be used to restock existing Schoolyard Investigation Kits. *Copier costs* – This will cover copies of the new module for teachers (60 copies x 50 pages x \$0.05/copy = \$150) and students (300 copies x 10 pages x \$0.05/copy = \$150).

Item	Cost
Salaries, Project Coordinator	\$10,000
Fringe Benefits, Staff Salaries @ 29%	\$2,900
<b>TOTAL SALARIES, WAGES, FRINGE</b>	<b>\$12,900</b>
<b>TRAVEL</b>	
Classroom visits, scientists	\$1,000
<b>Total Domestic Travel</b>	<b>\$1,000</b>
<b>OTHER DIRECT COSTS</b>	
Science kit supplies	\$5,000
Total Supplies	\$5,000
Reproduction, Copier Costs	
Student & teacher pre/post activities	\$300
Total Reproduction, Copier Costs	\$300
<b>Total Other Direct Costs</b>	<b>\$5,300</b>
<b>TOTAL DIRECT</b>	<b>\$19,200</b>
<b>TOTAL F&amp;A requested @ 25%</b>	<b>\$4,800</b>
<b>TOTAL DIRECT &amp; INDIRECT</b>	<b>\$24,000</b>

**2. REU Request (\$24,000)**

We request funding for four undergraduate students to be added to our LTER program. Each student will be fully integrated into our research program by working with PIs and collaborators investigating key aspects of multi-scale dynamics in arid landscapes. Jeff Herrick, a Co PI on the Jornada, has served as an ESA SEEDS mentor since 2004. He will work with faculty and graduate students at NMSU and University of Texas at El Paso (both are Hispanic Serving

Institutions) to recruit minorities for these positions. Each student is expected to present a poster at the Annual Jornada Symposium in July 2008.

1. One student will be supported to work with Drs. Rhonda Skaggs and Jack Wright (New Mexico State University), a Co-PI and investigator on the JRN LTER. The student would assist in digitizing and geo-referencing allotment adjudication maps available from the BLM District office in Las Cruces. These maps were prepared in the late 1930s and are the only known copies of the original allotment adjudication maps. The NMSU Department of Geography Geospatial Laboratory is responsible for scanning and digitizing the maps, and for developing the map key. The student would work with the laboratory manager (Quinn Korbolic) to create a usable database for Dona Ana County, the area surrounding the JRN that can potentially influence ecosystem dynamics.

2. We request support for a second undergraduate to work with Dr. Ed Fredrickson (Jornada ARS), a Co-PI on the Jornada. The student will work with a research team to monitor ungulate movements and foraging behaviors within a complex soil-plant matrix, and to provide data to parameterize and test a simulation model of the effects of cattle on long-term vegetation change. In addition, the student will work independently to measure seed consumption, survival and passage rates through ruminant digestive tracts, and seed dispersal and establishment. This research involves some lab work, use of GPS and GIS, and close work with large animals.

3. We request support for two students to work with Dr. Mary Lucero, a collaborator with the Jornada. Funding of undergraduates is a key way for us to involve more collaborators in our project. Dr. Lucero's research on plant-fungal interactions is a promising new avenue for our group. Her recent findings show that fungi associated with seeds can increase establishment of native grasses under laboratory conditions. These responses need to be tested in the field, and the mechanisms for improved remediation success need to be examined. In addition, genetic evidence of endophyte transfer needs to be documented, and the endophytes useful for revegetating arid lands need to be identified. In the laboratory, one student will prepare microbial growth medium, isolate DNA from soil, plant, and microbial samples, isolate culturable fungi from plant and soil samples, and document macroscopic and microscopic characters of fungal isolates. The second student would participate in field work by identifying plant species present within sampling grids, collecting herbarium samples, harvesting seeds, and obtaining soil cores.

**Budget justification (total = \$24,000)**

The majority of the REU funds would be used directly for student stipends (\$19,200), supporting 4 students for 40 hours per week during the summer 2008 and 10-15 hours per week the following fall. NMSU will collect 25% administrative costs on the student stipends (\$4800). Additional materials, supplies, and travel for these students will come from other sources.

<b>REU stipend (4 students * \$4800/student)</b>	<b>\$ 19,200</b>
<b>Administrative costs (25%* \$19,200)</b>	<b>\$ 4,800</b>
<b>Total REU request</b>	<b>\$ 24,000</b>

**3. Other: Information management and cyberinfrastructure (\$24,945)**



We have two requests in this section. The first is to enhance our Information Management System (IMS) with personnel time. The second is for supplies and equipment required to maintain our cyberinfrastructure capabilities.

Student Programmer: We request support for a student computer programmer to complete the administrative web pages needed to manage the JRN LTER website, data catalog, and EML formatted metadata. The student would help implement a secure, searchable web-based interface to allow JRN scientists to quickly access desired aerial photographs from the extensive aerial photograph archive stored on the file server. Salary is estimated as:

Cyberinfrastructure supplies: Power over Ethernet Switch: We request support for a Power Over Ethernet Switch (POE) to interconnect the new firewall and router to the telephone system at the Jornada field station. The POE will allow the wired local area network at the field station to connect to both computers and IP-based telephones. With the recent conversion of the telephone system to IP-based telephones, the new firewall and router cannot be connected directly to the computers and the new telephones without the POE. The installation of the wiring and associated trenching and conduit assembly will be performed by ARS personnel. The POE will be configured by NMSU personnel.

Cyberinfrastructure equipment:File Server: We request support to replace the current file server to allow maximum performance and access to our new storage system. The current server is not capable of taking advantage of the performance gains of this new system. The current server does not support PCI Express expansion slots needed to connect the host bus adapter (HBA) to the storage system using fiber optic cables. There will also be considerable performance gains to scientists and staff when accessing files stored on the server. The current file server is approximately 5 years old, which was its projected life span.

**Budget justification (total = \$24,945)**

Student programmer salary is calculated using \$9.50/hour \* 20 hours/week \* 30 weeks (academic year) + \$9.50/hour \* 40 hours/week \* 12 weeks (summer) for a total of \$10,260 (fringe @ 0.07% = \$72); total salary + fringe = \$10,332). We also request support for a Power Over Switch (\$3824) and server (\$7250) for a total of \$24,945.

**Salary and fringe benefits**

student salary: programmer	\$10,260
fringe (0.07%)	\$72

<b>TOTAL SALARIES, WAGES, FRINGE</b>	<b>\$10,332</b>
<b>supplies (switch)</b>	<b>\$3,824</b>
<b>equipment (server)</b>	<b>\$7,250</b>
<b>TOTAL DIRECT for IDC</b>	<b>\$14,156</b>

<b>TOTAL F&amp;A requested @ 25%</b>	<b>\$3,539</b>
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<b>TOTAL DIRECT &amp; INDIRECT</b>	<b>\$24,945</b>
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## B. International (\$19,750)

We propose an International Supplement Request (Part B) for a cross-site collaboration with Chinese Ecosystem Research Network (CERN)-Inner Mongolia ILTER sites to establish research activities that will increase our understanding of desertification. Specifically, we propose to establish manipulative experiments and correlational studies using GIS and remote sensing to answer the question: *How does the soil-geomorphic template modify climate change and human land use drivers that are causing grassland loss?* More specifically, we will ask: *How can explicit consideration of soil and landscape properties alter analysis and interpretation of long-term datasets on vegetation change?* In order to answer these questions, we propose to use the supplement funding to (1) convene a 2-day workshop in Chengdu, China the 3<sup>rd</sup> week September, 2008 that summarizes the state of knowledge of soil-geomorphic-vegetation relationships in drylands that have experienced or are currently experiencing desertification, and (2) support a visit to prospective research sites in Inner Mongolia after the workshop to assess existing data and design future studies.

This project will be initiated by Dr. Curtis Monger, co-PI at the JRN LTER, who will work with Dr. Guodong Han of the College of Ecology and Environmental Science at the Inner Mongolia Agricultural University and his colleagues with the CERN-ILTER working at the Inner Mongolian grassland sites. Two US students, one graduate student (David Rachal) and one undergraduate student (to be selected), will be part of the research team. The students will participate in the Chengdu workshop and visit the Inner Mongolia research sites. While in Inner Mongolia, the students will attend English language lectures at the university and will interact with Chinese students in ecology and environmental science. They will also gain research experience by being included in the research design and will collect and compare remotely sensed data from the Inner Mongolia and Jornada sites. Curtis Monger will be in charge of organizing the 2-day Chengdu workshop with assistance from Chen-Lu Ping (Univ. of Alaska), Brenda Buck (Univ. of Nevada-Las Vegas), and Xiubin He (Institute of Mountain Hazards and Environment Chinese Academy of Sciences). The workshop will be held after the International Union of Soil Scientist, 13<sup>th</sup> Conference on Soil Micromorphology (<http://icsm.imde.ac.cn>). Because this conference is international, we anticipate attendance by many scientists from the world's dryland regions, which will provide a global perspective on the role of soils and geomorphology on desertification processes. After the workshop, the four team members will travel to the Inner Mongolia Agricultural University where Dr. Monger will give lectures on the interactions between soils, geomorphology, and rangeland ecology. We also request funding for a second US scientist working on desertification. This scientist (to be selected) will also give lectures and establish research collaborations with CERN-ILTER scientists that will involve US students.

This proposed project will provide additional tests of the utility of JRN LTER concepts (particularly the role of spatial linkages in landscapes) for aridlands in general. The specific cross-site collaboration between JRN LTER and CERN-ILTER scientists will build on existing collaborations between the JRN-LTER and Jornada Experimental Range with both Chinese and Mongolian scientists in the arid regions of China and adjacent parts of Mongolia. Finally, the knowledge of our Chinese partners about vegetation dynamics at their sites and the

interpretations that we will generate will add tremendous value to our basic research activities as well as applied research that promotes grassland recovery.

### **Expected Products**

There will be two primary products from this project:

- 1) A journal publication summarizing the key ways soil-geomorphic templates are involved in global desertification processes as identified at the workshop.
- 2) Implementation of soil-geomorphic studies at the Inner Mongolian field experiment sites that match studies at the JRN LTER.

### **Budget justification and budget**

We request airfare (\$2500/person) and per diem (\$1050/person = \$150/day\*7 days) for four people (Monger, David Rachal, undergraduate student, additional US scientist) for a total of \$14,200. We also request \$2000 in participant support costs for workshop expenses, including room rental, copies of handouts, internet connection, etc.

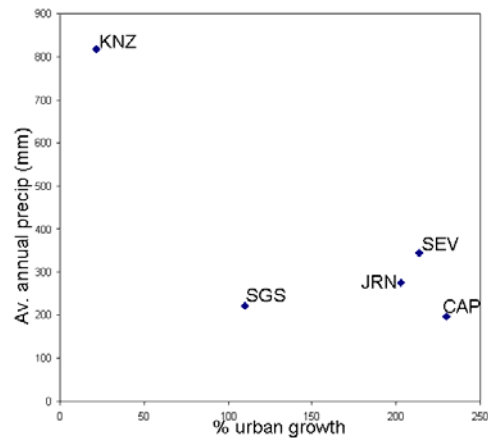
international travel	
airfare	10000
per diem	4200
participant support	2000
total direct costs	16200
total direct for IDC	14200
IDC @25%	3550
total direct + indirect	19750

### C. Social Sciences Network Activities (\$8187) Socioecological Gradients and Land-Use Fragmentation: A Cross-Site Comparative Analysis

In 1970, the United States became a suburban nation. The US Census Bureau recorded in that year that more people lived in suburbs than in central cities. While some growth on the periphery is contiguous, “leap-frog” developments, edge cities, and exurban enclaves have created discontinuous patterns of settlement across the American landscape. Growth on the periphery has been made possible by a number of factors, from federally-insured mortgages to transportation technologies and investments, but little attention has focused on the role of ecosystem services in defining the characteristics of such growth. In this proposal, our goal is to understand how a single but critical ecosystem service – *water provisioning* – in concert with proximate social causes of peripheral growth – *population growth* and *urbanization rates* – is linked to landscape fragmentation. To understand the relative strength of each of these proximate causes of landscape fragmentation, we employ a LTER cross-site analysis along water, population, and urbanization gradients using data from 1970 to the present (figure 1).

#### Theory

Landscape fragmentation affects biodiversity and ecosystem processes as portions of the landscape become isolated without connecting corridors. These changes decrease the ability of species to recover from disturbances (e.g. MacArthur and Wilson 1967; Marzluff and Ewing 2001; O’Neill and Hunsaker 1997) and reduce connectivity that can promote ecosystem processes (Peters et al. 2008, Grimm et al. 2008b). Likewise, landscape fragmentation has important social implications, such as increased costs for public service provision (Camagni et al. 2002), decreased ability to use lands for agricultural (Carjens and van der Knaap) or forest production (Rickenbach and Gobster 2003; Kline et al. 2004; Alig et al. 2002; Wear et al. 1999), and loss of culturally relevant openspaces and natural amenities (Deller et al. 2001;



**Figure 1** Average annual precipitation (92-06) and percent urban population growth (70-00) for case LTER sites.

Rickenbach and Gobster 2003). Development of greenfield sites and conversion of farmland and wildlands to subdivisions, while central city lots and brownfields lie vacant, underscores the inefficiencies that accompanies such growth (Boone and Modarres 2006). Conflict on the urban-rural fringe between farmers, ranchers, and residents can also lead to further fragmentation (Bunce 1994).

Landscape fragmentation may include fragmented land cover and/or land use, while fragmented land ownership is typically conceptualized as a driver of increased land cover/use fragmentation (Mitchell et al. 2002; Gosnell et al. 2006; Stanfield et al. 2002). Some types of land cover may be more affected by land-ownership fragmentation than others; in a study of Colorado ranch-subdivision ownership, fragmentation caused more significant impacts on grasslands than forests (Mitchell et al. 2002). Fragmentation of land cover, use, and ownership all have potentially significant effects on and

feedbacks with the social-ecological system (Redman et al. 2004, Grimm et al. 2008a).

In an effort to outline new directions for research, the LTER community developed a novel conceptual framework that links social and ecological dynamics. Ecosystem services provide the critical linkage between biotic structure and function and human outcomes and behavior. This proposal intends to examine *some* components of that framework by analyzing how ecosystem services bear on social systems to generate land fragmentation. Findings from this research will provide the foundation knowledge for “closing the loop” between social and ecological systems, specifically to examine how the

fragmentation of land impacts biotic structure and function and in turn the ecosystem service of water provisioning.

Our proposal intends to answer the following **research question**: *How does the degree of land fragmentation vary with magnitude and/or rate of change of water provisioning, population growth, and urbanization?* While this question addresses critical *proximate* causes of land fragmentation, we recognize that fragmentation is also a function of availability of technology, institutional change, cultural factors, land use legacies, and economic development pressures (Geist and Lambin 2002, Geist and Lambin 2004). At each site we will investigate the role of these drivers, in addition to our proximate drivers, in the process of land fragmentation. In order to make such an undertaking manageable, we will describe land changes along banded transects at each of the sites, described below.

## Study Design

Our study brings together social scientists at five LTER sites with herbaceous cover (CAP, JRN, KNZ, SEV, and SGS) and where landscape fragmentation is ongoing. The ecosystems at these five sites are all strongly regulated by variations in water resource availability, with four being semi-arid to arid. The study will first evaluate the explanatory power of the magnitude and rates of change of water provisioning, population, and urbanization on the present degree of land fragmentation, defined by land cover, land use, and land ownership. The study will test the following hypotheses:

**-H<sub>0</sub>**: *Sites with higher water provisioning will have greater fragmentation of land cover, use, and ownership.* One of the primary linkages between humans and ecosystems are the ecosystem services that are provided (Daily 1997, Collins et al. 2007); freshwater provisioning (quality and quantity) is perhaps the most important service provided by ecosystems and greatly shapes a landscape's carrying capacity for humans. We hypothesize that water provisioning will partially explain amount and pattern of land fragmentation within the western grasslands context, with more water associated with greater fragmentation. Water provisioning will include precipitation, surface and groundwater (minus evapotranspiration) (Fekete and Vorosmarty 2000), and water delivered by engineered infrastructure (minus measured water loss, typically 20-30%, in the system). Building on methods employed by Jenerette et al. (2006) the analysis of water provisioning will include an assessment of *water supply and demand*, but will extend the analysis to include an assessment of *water rights* as a limiting factor. If time and resources permit, we may also extend the analysis to water pricing.

**-H<sub>1</sub>**: *Sites with greater human populations and growth rates will have greater fragmentation of land cover, use, and ownership.* Larger populations will increase competition for land, decreasing parcel size and increasing fragmentation. Those sites facing greater growth rates, in absolute and in proportional terms, will also have greater fragmentation due to the increased demand for lands, and the inability to respond quickly with comprehensive planning and controls.

**-H<sub>2</sub>**: *Sites with larger urban population and higher rates of urbanization will have higher fragmentation of land cover, use, and ownership.* Dense settlement and intense competition for land in urban areas will amplify the relationship described in **H<sub>1</sub>**. An "urban effect" on land dynamics within and beyond urban areas will be a major driver of fragmentation. Higher magnitudes and rates of urbanization will lead to greater fragmentation throughout the study extents.

**Methods:** Following Stanfield et al. (2002) and Munroe et al. (2005), we will evaluate fragmentation of land cover, use, and ownership at the parcel level. The post-doctoral scholar will work with each site to create banded transects that begin at a point that was agricultural or wildland in 1970 but is currently classified as urban land use (residential, commercial, or industrial) using Anderson Level II specifications. The transect will end at a point that is currently classified as wildland, and each site will determine the length of the transect according to site characteristics and other research considerations (e.g. existing study sites that have appropriate data for this study). As a starting point, we will choose a bandwidth corresponding to the median parcel size of all interesting parcels, and all parcels that intersect the banded transect will be included in the analysis of fragmentation. The bandwidth will be selected using present-day parcels and held constant for historical analysis (1970-present). Where digital boundaries are not available, we will digitize selected parcels and attribute them with ownership, use, and

cover characteristics. Ownership characteristics are available as public records, usually from tax assessor offices. Purchase histories are typically included with present-day attributes, which will allow us to track changes in ownership. If not, these data can be collected from Deeds offices in respective county courthouses. The advantage of using transects is that the number of records will be manageable. Land use data are available from county and city planning departments. To account for different resolutions of classification, we will collapse land use categories from each of the sites into Anderson Level II classes. Land cover will be derived from satellite and aerial imagery and classified using National Land Cover Data definitions (<http://landcover.usgs.gov/classes.php>).

Using the banded transects for each site, we will quantify the degree of fragmentation in a landscape as measured by the number and distribution of patches or distinct (non-adjacent) areas of the same land-cover type, the IJI\_L index (Crossiant et al. 2005; O'Neill and Hunsaker 1997). The IJI\_L index is useful in measuring the degree to which all patch types within a landscape are adjacent or interspersed with each other. It is the observed interspersion divided by the maximum interspersion for the number of patch types, defined as:

$$IJI\_L = \frac{-\sum_{i=1}^{m'} \sum_{k=i+1}^{m'} \left[ \left( \frac{e_{ik}}{E} \right)^{\ln \left( \frac{e_{ik}}{E} \right)} \right]}{\ln(1/2[m'-1])} \quad (100)$$

Where:

$m'$  = Number of patch types or classes present in the landscape, including the landscape border if present  
 $i = 1, \dots, m$  or  $m'$  patch types or classes;  $k = 1, \dots, m$  or  $m'$  patch types or classes;  $e_{ik}$  = Total length (m) of edge in landscape between patch types or classes (distinguished by  $i$  and  $k$ );  $E$  = Total length (m) of edge in landscape

The IJI\_L index provides context for a particular parcel; then we will correlate fragmentation, cover, and use with each other and with our proximate drivers of water provisioning, population size and rate, and urbanization magnitude and rate. In addition, we will correlate our findings with other variables considered in the literature, including distance to urban centers, major highways, natural amenities, parcel size, and county or municipal zoning rules affecting the parcel (Munroe et al. 2005). Previous research has demonstrated a relationship between rural land-cover fragmentation and zoning policies (Croissant and Munroe, 2002) and the urbanization pressure gradient (Wickham et al. 2000). Levia (1998) and LaGro and Degloria (1992) found distance to city center, nearby highways, and parcel size to be related to the probability of conversion to residential use. We will include distance to urban centers as a controlling variable in line with LaGro and DeGloria (1992). We will also include distances to major natural amenities, such as Tuttle Creek Reservoir in Kansas, which are drivers of residential land conversion in the Western United States. We will conduct this analysis at roughly ten year intervals from 1970 to 2000 to correspond with the availability of census data. We will evaluate subdivisions that have occurred during those time periods to assess factors relating to ownership fragmentation and conversion to residential, suburban, or exurban use.

Note: complete references are in Supplementary material.

### **Budget justification and budget (\$8187)**

This is a group request where we request a total of \$100,000 for 5 sites (SEV, SGS, KNZ, CAP, JRN) @ \$20,000/site. We request that \$11,813 of our \$20,000 be allocated to the CAP LTER to support postdoctoral salary and fringe for 1 year to synthesize the water availability data for each site, to facilitate ongoing research on landscape fragmentation at each site, and to travel to the sites. The postdoc will be supervised by Dr. Abby York at ASU who specializes in land-use dynamics and policy.

In our budget, we request support for travel (\$2025) to two workshops: two people to attend a planning workshop at ASU in October 2008 where researchers will refine research tasks and share data and information for the cross-site analyses. A second workshop will be held at the LTER All Scientists meeting in fall 2009 where findings will be discussed and prepared for publication. We request support for one person to attend this meeting; we expect the LNO will provide support for the other person as our social scientist representative. Subsequent meetings will be held quarterly using a Polycom system. We request salary and fringe (\$4524) for an undergraduate to assist in the access and standardization of land cover/land use data for Doña Ana County. Drs. Jack Wright, a collaborator at NMSU (F. Supplementary Material), and Rhonda Skaggs, a JRN Co-PI, will participate in this project. Jack will provide expertise on land use planning and policy, and Rhonda will provide expertise on economic drivers of development.

undergraduate salary	4493
fringe @ 0.7%	31
total salary and fringe	4524
domestic travel	2025
1 person for 2 trips	
1 person for 1 trip	
total direct	6549
IDC @25%	1638
total direct and indirect	8187

## D. EcoTrends (\$116,575)

The goals of the EcoTrends project are to create a platform for synthesis by making long-term data accessible, and to illustrate the utility and application of this platform in addressing within-site and network-level scientific questions. To date, we have collected long-term data sets from all 26 LTER sites, 15 USDA-FS sites, 9 USDA ARS sites, 1 DOE site, 1 USGS site, and 1 site operated by the University of Arizona (Note: a few sites are affiliated with more than one agency). Additional sites will be added as part of our future plans (see details below). Four types of data are being collected for each site: (1) climate and physical variability, including disturbances, (2) human population and economy, (3) biogeochemistry, and (4) biotic structure, including biodiversity. We are generating two products: (1) a book on trends in long-term data within and among sites, and examples that illustrate the value of long-term data in addressing important questions; (2) a web page containing derived data and metadata that are easily accessible for synthetic analyses. The synthesis products are a critical part of the LTER Strategic Plan. This supplemental request was approved by the LTER Executive Board.

The support provided by the 2006 and 2007 LTER Supplements has been invaluable in allowing us to meet our goal of completing the book within a short time period. The EcoTrends Committee will be meeting December 13-14 to finalize content, organization, and layout of the book such that we can submit the final product to a publisher in February. In addition, the web page will be launched at that time (<http://www.ecotrends.info>) that will allow static data (i.e., data collected up to 2007) from the book to be queried and graphed in novel ways to promote new synthesis products. Web page development has been conducted primarily by the LNO with assistance and guidance from EcoTrends personnel. Thus, we have made tremendous progress on this project since its inception in 2004. This progress has been made possible through NSF supplemental support to EcoTrends and the LNO that allowed personnel to devote time to the project. In addition, a close working relationship between EcoTrends and Information Managers and PIs at the individual sites has been critical to project success.

Although the book and initial web page development of static data are nearly done, a considerable amount of work remains before a fully functional web page can be completed. We have been overwhelmed by the positive response by LTER sites in providing data and figures to the EcoTrends project. The book and the initial web page contain a subset of the total number of data sets submitted (ca. 1200). The remaining datasets need to be manipulated and standardized into a derived format, and EML needs to be generated for the derived data (currently ca. 1600 files).

In addition, to make EcoTrends sustainable, the database updates need to be done dynamically, pulling fresh data from participating sites' web pages. The LTER NIS architecture (PASTA) has been identified as the model for this feature because it builds heavily on existing site investments in EML and EcoTrends investment in R scripts plus benefits from a single point of access approach being implemented in the LTER Data Access Server. Finally, to make EcoTrends more useful for synthesis, new web-based applications need to be developed / adopted for increasing the capacity for analysis by increasing the capabilities for graphing, querying, integrating and downloading data.



While all three activities are required before the potential of EcoTrends can be fully realized, making EcoTrends dynamic relies heavily on the participating sites for success and must be coordinated with the development of the Network Information System and other agency information systems. We anticipate that the LNO will lead this development effort as part of their renewal as well as taking on data stewardship for LTER site participants.

Two of these major activities need to be completed in the next year: (1) manipulation of the remaining data sets and (2) the web-based applications development. In this supplement, we request support for the first activity as a supplement to the JRN LTER at NMSU. Currently the only source of support for EcoTrends at NMSU is through an NSF supplement (\$150,000 June 1, 2007-May 31, 2008). Our future plans include obtaining separate funding for this project (see Future plans below) such that additional supplemental support from LTER will not be needed beyond the current request. The LNO will request support independently for the second and third activities.

### Activity 1. Data manipulation

Currently, we have collected ca. 1200 data sets: ca. 85% of these are LTER datasets and ca. 80% have been manipulated for the book; the remaining datasets still need to be worked on. In addition, we anticipate collecting more long-term datasets from each site based on targeted products that have resulted from our work on the book. For example, additional datasets will be requested from the sites as part of our efforts to synthesize data on state changes and on patterns in net primary production. The diversity of datasets in their structure, format, and layout requires that individual attention be given to each dataset. Each dataset needs to be checked for errors, and converted to a standard format and standard units to make it accessible on the EcoTrends web page. Many of the datasets that remain to be manipulated have unique properties that require individual attention before standardization can occur. There will be a number of standard formats depending on the type of data that were collected. In addition, metadata need to be developed for the derived data that characterize EcoTrends. We are writing R scripts to derive the data and to create the book figures. These scripts are also used as documentation of this work. The R scripts will continue to be used over time to derive datasets from newly harvested sources, and may need modification when the format of the source data changes. Perl and PHP scripts, written by LNO staff, are being used to generate EML of derived data and create dynamic plots of the most current data available.

Our major tasks are to:

1. check all submitted datasets for errors in units, formatting, etc.
2. format the data for graphing and analysis; the subset of datasets to be included in the book will have first priority
3. develop R scripts for formatting, graphing, and analysis
4. maintain and expand the EcoTrends database, which keeps track of source data, script, derived data, and book plot files, as well as other information necessary for the generation of EML
5. prepare graphs for the book, and data and metadata for the website
6. continue development of data discovery, plotting and analyses tools for the website

## **Future plans**

We would like to see the EcoTrends project become less reliant on NSF LTER Supplements through time. Although the value of this project to the LTER Network is becoming increasingly clear to many, it's also clear that it's time for the project to secure additional sources of funding as it continues to grow. Our plans include submission of a proposal to the Research Coordinated Networks program at NSF in May 2008 to expand the project in two ways: (1) a focus on synthesis products and coordinated collection of key additional data currently missing from site-based science studies, as identified by initial EcoTrends analyses, and (2) an expansion of the number and types of sites to include additional systems (e.g., shrub steppe, agricultural fields, riparian areas, etc.), networks (e.g., OBFS, LTREB), and agencies (e.g., DOE, USGS). We would also like to add an international aspect to EcoTrends, in the short-term through web links and in the long-term through the incorporation of datasets from international sites. We are building this larger international network of sites in our web portal called P2ERLS (Pole-to-Pole Ecological Research Lattice of Sites, <http://www.p2erls.net>). In the longer-term future, P2ERLS and EcoTrends will be linked dynamically to allow both site and dataset information to be easily accessible for a large number of sites globally. Even as EcoTrends continues to grow, we will maintain our connection with the LTER Network through interactions with the sites and with the LNO as the primary web page developers and through their maintenance of the web site.

## **Budget and justification (total=\$116,575)**

We request salary and fringe benefits for Christine Laney (\$55,000), the EcoTrends project coordinator, to develop the R scripts required for generating standardized, aggregated datasets from our data sources, such that they can be made available to researchers on the EcoTrends website, and sufficiently documenting these data and derivation processes via the EcoTrends database and scripts. She will continue generating content for the book, and providing editorial support. In addition, Christine will continue to integrate new data sources to be made available on the website, and continue coordination of efforts to improve the existing website. To maintain integration of the described activities, Christine will continue to work in close collaboration with Mark Servilla at the LTER Network Office and Information Managers at each site. We request funding for software needed for publishing and final analyses (\$3500). We also request international travel (\$2000) for Christine to attend the 6th International Conference on Ecological Informatics (ISEI6) will be held at Cancun, Mexico, December 2-5, 2008. Bill Michener is convening a special international session on "Ecoinformatics solutions for long term ecological research." This venue will allow us to both promote EcoTrends to the international community, and will allow us to learn about other databases and techniques. We request salary and fringe benefits for a full-time software specialist (\$28,000) to work with Christine by maintaining the EcoTrends database and providing other administrative support to the project. Total request = \$93,260 (direct costs) + 23,315 (IDC @ 25%) = \$116,575.

professional salary*	
Christine Laney	\$42,636
software specialist	\$28,000
total salary	\$70,636
fringe	
*29%	\$12,364
*17%	\$4,760
total salary and fringe	\$87,760
international travel	\$2,000
research supplies	\$3,500
TOTAL DIRECT	\$93,260
IDC (25%)	\$23,315
Total direct + indirect	\$116,575

## **E. SUMMARY BUDGET AND JUSTIFICATION**

### **A. Integrated Research and Education**

#### **1. Schoolyard LTER (\$24,000)**

*Salaries* (\$10,000) – Project director Dr. Stephanie Bestelmeyer will coordinate all aspects of the ongoing sLTER project as well as the creation of the new module for the Real World – Real Science Project. Salary of 0.25 FTE for 10 months (\$1000/month for 10 months) plus 29% for fringe benefits is requested. *Classroom visits* (\$1000) – Funding for travel for 10 classroom programs for 300 middle school students to test the pre-field trip and post-field trip activities in the new global climate change module. *Science kit supplies* (\$5000) – Each kit of supplies for post-field trip activities will include approximately \$800 in materials. We will create five kits to be loaned to participating teachers. \$1000 will be used to restock existing Schoolyard Investigation Kits. *Copier costs* (\$300) – This will cover copies of the new module for teachers (60 copies x 50 pages x \$0.05/copy = \$150) and students (300 copies x 10 pages x \$0.05/copy = \$150).

#### **2. REU Request (\$24,000)**

The majority of the REU funds would be used directly for student stipends (\$19,200), supporting 4 students for 40 hours per week during the summer 2008 and 10-15 hours per week the following fall. NMSU will collect 25% administrative costs on the student stipends (\$4800). Additional materials, supplies, and travel for these students will come from other sources.

#### **3. Other: Information management and cyberinfrastructure (\$24,945)**

Student programmer salary is calculated using  $\$9.50/\text{hour} * 20 \text{ hours/week} * 30 \text{ weeks}$  (academic year) +  $\$9.50/\text{hour} * 40 \text{ hours/week} * 12 \text{ weeks}$  (summer) for a total of \$10,260 (fringe @ 0.07% = \$72); total salary + fringe = \$10,332. We also request support for a Power Over Switch (\$3824) and server (\$7250) for a total of \$24,945.

### **B. International (\$19,750)**

We request airfare (\$2500/person) and per diem (\$1050/person = \$150/day\*7 days) for four people (Monger, graduate student, undergraduate student, additional US scientist) for a total of \$14,200. We also request \$2000 in participant support costs for workshop expenses in Mongolia, including room rental, copies of handouts, internet connection, etc.

### **C. Social Science Network Activities (\$8187)**

This is a group request where we request a total of \$100,000 for 5 sites (SEV, SGS, KNZ, CAP, JRN) @ \$20,000/site. We request that \$11,813 of our \$20,000 be allocated to the CAP LTER to support postdoctoral salary and fringe for 1 year to synthesize the water availability data for each site, to facilitate ongoing research on landscape fragmentation at each site, and to travel to the sites. The postdoc will be supervised by Dr. Abby York at ASU who specializes in land-use dynamics and policy.

In our budget, we request support for travel (\$2025) to two workshops: two people to attend a planning workshop at ASU in October 2008 where researchers will refine research tasks and share data and information for the cross-site analyses. A second workshop will be held at the LTER All Scientists meeting in fall 2009 where findings will be discussed and prepared for publication. We request support for one person to attend this meeting; we expect the LNO will provide support for the other person as our social scientist representative. Subsequent meetings will be held quarterly using a Polycom system. We request salary and fringe (\$4524) for an undergraduate to assist in the access and standardization of land cover/land use data for Doña Ana County. Drs. Jack Wright, a collaborator at NMSU (see attached CV), and Rhonda Skaggs, a JRN Co-PI, will participate in this project. Jack will provide expertise on land use planning and policy, and Rhonda will provide expertise on economic drivers of development.

#### **D. EcoTrends (\$116,575)**

We request salary and fringe benefits for Christine Laney (\$55,000), the EcoTrends project coordinator, to develop the R scripts required for generating standardized, aggregated datasets from our data sources, such that they can be made available to researchers on the EcoTrends website, and sufficiently documenting these data and derivation processes via the EcoTrends database and scripts. She will continue generating content for the book, and providing editorial support. In addition, Christine will continue to integrate new data sources to be made available on the website, and continue coordination of efforts to improve the existing website. To maintain integration of the described activities, Christine will continue to work in close collaboration with Mark Servilla at the LTER Network Office, and the Information Managers and PIs at the sites. We request \$3500 in software supplies for publishing and final analyses. We also request international travel (\$2000) for Christine to attend the 6th International Conference on Ecological Informatics (ISEI6) to be held in Cancun, Mexico, December 2-5, 2008. Bill Michener has invited us to participate in his special international session on "Ecoinformatics solutions for long term ecological research." This venue will allow us to both promote EcoTrends to the international community, and will allow us to learn about other databases and techniques. We request salary and fringe benefits for a full-time software specialist (\$28,000) to work with Christine by maintaining the EcoTrends database and providing other administrative support to the project. Total request = \$93,260 (direct costs) + 23,315 (IDC @ 25%) = \$116,575.

## Budget Summary

Jornada site budget: 2008 supplement  
LTER Budget Detail

### PERSONNEL

#### PI, DEBRA PETERS

##### Salary and fringe benefits

sLTER Project Coordinator*	\$10,000
REU stipend (4 students @ \$4800 each)	\$19,200
student salary: programmer***	\$10,260
student salary: landuse data***	\$4,493
Ecotrends Coordinator (Laney)*	\$42,636
EcoTrends software specialist**	\$28,000
*Fringe Benefits, Staff Salaries @ 29%	\$15,264
**Fringe benefits, temporary @17%	\$4,760
** Fringe Benefits, students @0.07%	\$103

**TOTAL SALARIES, WAGES, FRINGE** **\$134,716**

### TRAVEL

Classroom visits, scientists	\$1,000
social scientists workshops	\$2,025
<b>Total Domestic Travel</b>	<b>\$3,025</b>
<b>International travel (Mongolia)</b>	<b>\$14,200</b>
International travel (EcoTrends)	\$2,000
<b>Total International travel</b>	<b>\$16,200</b>
<b>TOTAL TRAVEL</b>	<b>\$19,225</b>

### OTHER DIRECT COSTS

Supplies	
Science kit supplies	\$5,000
Reproduction, Copier Costs	
Teacher handbooks	\$300
Power Over switch	\$3,824
EcoTrends supplies	\$3,500
Participant support cost	\$2,000
equipment: server	\$7,250
<b>Total Other Direct Costs</b>	<b>\$21,874</b>

**TOTAL DIRECT** **\$175,815**  
 Total Direct for IDC \$166,566  
**TOTAL F&A requested @ 25%** **\$41,642**

**TOTAL DIRECT & INDIRECT** **\$217,457**

## SUPPLEMENTARY MATERIAL

### Biographical Sketch John B. Wright

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Professor and Department Head, Department of Geography, College of Arts & Sciences, New Mexico State University, Las Cruces, NM 88003 Email: [jowright@nmsu.edu](mailto:jowright@nmsu.edu)

#### Education

1973 B.A. Geography, University of Massachusetts-Amherst  
1983 M.A. Geography, University of Montana  
1990 Ph.D. Geography, University of California – Berkeley

#### Appointments

1990-1996 Assistant Professor, Department of Geography, College of Arts & Sciences, NMSU, Las Cruces, NM  
1996-2002 Associate Professor, Department of Geography, College of Arts & Sciences, NMSU, Las Cruces, NM  
2002-present Professor, Department of Geography, College of Arts & Sciences, NMSU, Las Cruces, NM

#### Primary Research Interests

Landscape change, environmental planning, land conservation strategies and implementation, land-use planning, cultural geography, social dynamics modeling at the rural/urban interface.

#### Publications (Five Most Relevant)

Havstad, K.M., D.P.C. Peters, R. Skaggs, J. Brown, B. Bestelmeyer, E. Fredrickson, J. Herrick, and J.B. Wright. 2007. Ecological Services to and from Rangelands of the United States. *Ecological Economics*. Doi:10.1016/j.ecolecon.2006.12.001  
Wright, J.B., Anella, A. 2004. *Saving the Ranch: Conservation Easement Design in the American West*. Island Press, Washington, DC.  
Wright, J.B. 2003. Land Tenure: The Spatial Musculature of the American West, Book Chapter, in *Western Places, American Myths*, Edited by Gary Hausladen. University of Nevada Press, Reno. Pgs. 85-110.  
Wright, J.B. 1998. The Role of Conservation Easement Sites in Biogeographic and Biological Research. *Environmental Conservation* 25(2):95-98.  
Wright, J. B., 1993. *Rocky Mountain Divide: Selling and Saving the West*. University of Texas Press, Austin.

#### Other Relevant Publications

Wright, J.B., and Czerniak, R. 1998. Open Space in New Mexico: An Analysis of Land Trusts and Land-Use Regulations. *Southwestern Geographer* Vol. 2:1-14.  
Wright, J.B. 1994. Designing and Applying Conservation Easements. *Journal of the American Planning Association* 50(3):380-388.

- Wright, J.B. 1994. *Doña Ana County Comprehensive Plan, Agricultural Element*. Doña Ana County Commissioners, Las Cruces, NM.
- Wright, J.B. and Stewart Hilt. 1993. An Overview of Landscape Conservation Efforts in the United States and Canada. *Operational Geographer* 11(3):10-14
- Wright, J.B. 1992. Land Trusts in the USA. *Land Use Policy* 9(2): 82-86, Surrey, England

Synergistic & Interdisciplinary Activities (last 5 years)

- 2007 Land-use consultant, Town of Mesilla, NM.
- 2006-present Co-PI. Social Dynamics Modeling in El Paso, Texas.
- 2005-present Land-use ordinance consultant. Doña Ana County, NM.
- 2002-present Chair, New Mexico Land Conservancy.
- 1999-present President, New Mexico Geographical Society
- 1998-present Chair, Agriculture and Land-Use Committee. Mesilla Valley Econ. Devel. Alliance.

Collaborations & Other Affiliations

*Collaborators:*

- Dr. Robert Czerniak, Dept. of Geography, NMSU
- Dr. Joel R. Brown, USDA Natural Resources Conservation Service, Las Cruces, NM
- Dr. Ed. Fredrickson, Jornada Experimental Range USDA-ARS, Las Cruces, NM
- Dr. Thomas Daniels, City and Regional Planning, U of Pennsylvania
- Dr. Kris M. Havstad, USDA ARS Jornada Experimental Range
- Dr. Jeffrey E. Herrick, USDA ARS Jornada Experimental Range
- Dr. Debra Peters, USDA ARS Jornada Experimental Range
- Dr. Paul Starrs, Dept. of Geography, Univ. of Nevada, Reno

*Graduate and Post-Graduate Advisors:*

- Dr. John M. Crowley, University of Montana Department of Geography
- Dr. James. J. Parsons, UC-Berkeley, Geography (deceased)

*Thesis Advisor (PhD holders only):*

- Dr. Thomas Herman, UC San Diego
- Dr. Mark Miller, National Park Service, Utah



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# SUMMARY PROPOSAL BUDGET

YEAR 1

ORGANIZATION <b>New Mexico State University</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Debra P Peters</b>				AWARD NO.	Proposed	Granted	
				A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)			
				CAL	ACAD	SUMR	
1. <b>Debra P Peters - none</b>				0.00	0.00	0.00	\$ 0 \$
2.							
3.							
4.							
5.							
6. ( 0 ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. ( 1 ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	0.00	0
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( 0 ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. ( 3 ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				12.00	0.00	0.00	80,636
3. ( 0 ) GRADUATE STUDENTS							0
4. ( 3 ) UNDERGRADUATE STUDENTS							33,953
5. ( 0 ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. ( 0 ) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							114,589
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							20,127
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							134,716
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							3,025
2. FOREIGN							16,200
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ _____							0
2. TRAVEL _____							0
3. SUBSISTENCE _____							0
4. OTHER _____							2,000
TOTAL NUMBER OF PARTICIPANTS ( 0 )							
TOTAL PARTICIPANT COSTS							2,000
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							12,324
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							300
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							7,250
TOTAL OTHER DIRECT COSTS							19,874
H. TOTAL DIRECT COSTS (A THROUGH G)							175,815
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
<b>Total Direct Costs excluding equipment and participant costs (Rate: 25.0000, Base: 166566)</b>							
TOTAL INDIRECT COSTS (F&A)							41,642
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							217,457
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 217,457 \$
M. COST SHARING PROPOSED LEVEL \$ 0				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>Debra P Peters</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>Ancelmo Encinias</b>				INDIRECT COST RATE VERIFICATION			
		Date Checked		Date Of Rate Sheet		Initials - ORG	

# SUMMARY PROPOSAL BUDGET Cumulative

ORGANIZATION <b>New Mexico State University</b>				FOR NSF USE ONLY			
				PROPOSAL NO.	DURATION (months)		
PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR <b>Debra P Peters</b>				AWARD NO.	Proposed	Granted	
				A. SENIOR PERSONNEL: PI/PI, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)			
				CAL	ACAD	SUMR	
1. <b>Debra P Peters - none</b>				0.00	0.00	0.00	\$ 0 \$
2.							
3.							
4.							
5.							
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)				0.00	0.00	0.00	0
7. ( <b>1</b> ) TOTAL SENIOR PERSONNEL (1 - 6)				0.00	0.00	0.00	0
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)							
1. ( <b>0</b> ) POST DOCTORAL SCHOLARS				0.00	0.00	0.00	0
2. ( <b>3</b> ) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)				12.00	0.00	0.00	80,636
3. ( <b>0</b> ) GRADUATE STUDENTS							0
4. ( <b>3</b> ) UNDERGRADUATE STUDENTS							33,953
5. ( <b>0</b> ) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)							0
6. ( <b>0</b> ) OTHER							0
TOTAL SALARIES AND WAGES (A + B)							114,589
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)							20,127
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)							134,716
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)							
TOTAL EQUIPMENT							0
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)							3,025
2. FOREIGN							16,200
F. PARTICIPANT SUPPORT COSTS							
1. STIPENDS \$ _____							0
2. TRAVEL _____							0
3. SUBSISTENCE _____							0
4. OTHER _____							2,000
TOTAL NUMBER OF PARTICIPANTS ( <b>0</b> )							
TOTAL PARTICIPANT COSTS							2,000
G. OTHER DIRECT COSTS							
1. MATERIALS AND SUPPLIES							12,324
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION							300
3. CONSULTANT SERVICES							0
4. COMPUTER SERVICES							0
5. SUBAWARDS							0
6. OTHER							7,250
TOTAL OTHER DIRECT COSTS							19,874
H. TOTAL DIRECT COSTS (A THROUGH G)							175,815
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)							
TOTAL INDIRECT COSTS (F&A)							41,642
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)							217,457
K. RESIDUAL FUNDS							0
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)							\$ 217,457 \$
M. COST SHARING PROPOSED LEVEL \$ <b>0</b>				AGREED LEVEL IF DIFFERENT \$			
PI/PI NAME <b>Debra P Peters</b>				FOR NSF USE ONLY			
ORG. REP. NAME* <b>Ancelmo Encinias</b>				INDIRECT COST RATE VERIFICATION			
		Date Checked	Date Of Rate Sheet	Initials - ORG			

C \*ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET

## **E. SUMMARY BUDGET AND JUSTIFICATION**

### **A. Integrated Research and Education**

#### **1. Schoolyard LTER (\$24,000)**

*Salaries* (\$10,000) – Project director Dr. Stephanie Bestelmeyer will coordinate all aspects of the ongoing sLTER project as well as the creation of the new module for the Real World – Real Science Project. Salary of 0.25 FTE for 10 months (\$1000/month for 10 months) plus 29% for fringe benefits is requested. *Classroom visits* (\$1000) – Funding for travel for 10 classroom programs for 300 middle school students to test the pre-field trip and post-field trip activities in the new global climate change module. *Science kit supplies* (\$5000) – Each kit of supplies for post-field trip activities will include approximately \$800 in materials. We will create five kits to be loaned to participating teachers. \$1000 will be used to restock existing Schoolyard Investigation Kits. *Copier costs* (\$300) – This will cover copies of the new module for teachers (60 copies x 50 pages x \$0.05/copy = \$150) and students (300 copies x 10 pages x \$0.05/copy = \$150).

#### **2. REU Request (\$24,000)**

The majority of the REU funds would be used directly for student stipends (\$19,200), supporting 4 students for 40 hours per week during the summer 2008 and 10-15 hours per week the following fall. NMSU will collect 25% administrative costs on the student stipends (\$4800). Additional materials, supplies, and travel for these students will come from other sources.

#### **3. Other: Information management and cyberinfrastructure (\$24,945)**

Student programmer salary is calculated using  $\$9.50/\text{hour} * 20 \text{ hours/week} * 30 \text{ weeks}$  (academic year) +  $\$9.50/\text{hour} * 40 \text{ hours/week} * 12 \text{ weeks}$  (summer) for a total of \$10,260 (fringe @ 0.07% = \$72); total salary + fringe = \$10,332. We also request support for a Power Over Switch (\$3824) and server (\$7250) for a total of \$24,945.

### **B. International (\$19,750)**

We request airfare (\$2500/person) and per diem (\$1050/person = \$150/day\*7 days) for four people (Monger, graduate student, undergraduate student, additional US scientist) for a total of \$14,200. We also request \$2000 in participant support costs for workshop expenses in Mongolia, including room rental, copies of handouts, internet connection, etc.

### **C. Social Science Network Activities (\$8187)**

This is a group request where we request a total of \$100,000 for 5 sites (SEV, SGS, KNZ, CAP, JRN) @ \$20,000/site. We request that \$11,813 of our \$20,000 be allocated to the CAP LTER to support postdoctoral salary and fringe for 1 year to synthesize the water availability data for each site, to facilitate ongoing research on landscape fragmentation at each site, and to travel to the sites. The postdoc will be supervised by Dr. Abby York at ASU who specializes in land-use dynamics and policy.

In our budget, we request support for travel (\$2025) to two workshops: two people to attend a planning workshop at ASU in October 2008 where researchers will refine research tasks and share data and information for the cross-site analyses. A second workshop will be held at the LTER All Scientists meeting in fall 2009 where findings will be discussed and prepared for publication. We request support for one person to attend this meeting; we expect the LNO will provide support for the other person as our social scientist representative. Subsequent meetings will be held quarterly using a Polycom system. We request salary and fringe (\$4524) for an undergraduate to assist in the access and standardization of land cover/land use data for Doña Ana County. Drs. Jack Wright, a collaborator at NMSU (see attached CV), and Rhonda Skaggs, a JRN Co-PI, will participate in this project. Jack will provide expertise on land use planning and policy, and Rhonda will provide expertise on economic drivers of development.

#### **D. EcoTrends (\$116,575)**

We request salary and fringe benefits for Christine Laney (\$55,000), the EcoTrends project coordinator, to develop the R scripts required for generating standardized, aggregated datasets from our data sources, such that they can be made available to researchers on the EcoTrends website, and sufficiently documenting these data and derivation processes via the EcoTrends database and scripts. She will continue generating content for the book, and providing editorial support. In addition, Christine will continue to integrate new data sources to be made available on the website, and continue coordination of efforts to improve the existing website. To maintain integration of the described activities, Christine will continue to work in close collaboration with Mark Servilla at the LTER Network Office, and the Information Managers and PIs at the sites. We request \$3500 in software supplies for publishing and final analyses. We also request international travel (\$2000) for Christine to attend the 6th International Conference on Ecological Informatics (ISEI6) to be held in Cancun, Mexico, December 2-5, 2008. Bill Michener has invited us to participate in his special international session on "Ecoinformatics solutions for long term ecological research." This venue will allow us to both promote EcoTrends to the international community, and will allow us to learn about other databases and techniques. We request salary and fringe benefits for a full-time software specialist (\$28,000) to work with Christine by maintaining the EcoTrends database and providing other administrative support to the project. Total request = \$93,260 (direct costs) + 23,315 (IDC @ 25%) = \$116,575.

## Budget Summary

Jornada site budget: 2008 supplement  
LTER Budget Detail

### PERSONNEL

#### PI, DEBRA PETERS

##### Salary and fringe benefits

sLTER Project Coordinator*	\$10,000
REU stipend (4 students @ \$4800 each)	\$19,200
student salary: programmer***	\$10,260
student salary: landuse data***	\$4,493
Ecotrends Coordinator (Laney)*	\$42,636
EcoTrends software specialist**	\$28,000
*Fringe Benefits, Staff Salaries @ 29%	\$15,264
**Fringe benefits, temporary @17%	\$4,760
** Fringe Benefits, students @0.07%	\$103

**TOTAL SALARIES, WAGES, FRINGE** **\$134,716**

### TRAVEL

Classroom visits, scientists	\$1,000
social scientists workshops	\$2,025
<b>Total Domestic Travel</b>	<b>\$3,025</b>
<b>International travel (Mongolia)</b>	<b>\$14,200</b>
International travel (EcoTrends)	\$2,000
<b>Total International travel</b>	<b>\$16,200</b>
<b>TOTAL TRAVEL</b>	<b>\$19,225</b>

### OTHER DIRECT COSTS

Supplies	
Science kit supplies	\$5,000
Reproduction, Copier Costs	
Teacher handbooks	\$300
Power Over switch	\$3,824
EcoTrends supplies	\$3,500
Participant support cost	\$2,000
equipment: server	\$7,250
<b>Total Other Direct Costs</b>	<b>\$21,874</b>

**TOTAL DIRECT** **\$175,815**  
Total Direct for IDC \$166,566  
**TOTAL F&A requested @ 25%** **\$41,642**

**TOTAL DIRECT & INDIRECT** **\$217,457**