

33RD ANNUAL
**NATURAL AREAS
CONFERENCE**



*Stewards of the Old
and New West*

SEPTEMBER 20-23, 2006 • FLAGSTAFF, ARIZONA

33rd Annual Natural Areas Conference: Stewards of the Old and New West
September 20-23, 2006
du Bois Center, Northern Arizona University
Flagstaff, Arizona

Hosted by the Natural Areas Association and the National Park Service



Overview of Schedule

Registration

Tuesday – September 19

5:00 - 8:00 p.m. First-floor hallway, du Bois Center

Wednesday & Thursday – September 20 & 21

7:30 a.m. - 4:00 p.m. First-floor hallway, du Bois Center

Program

Wednesday – September 20

9:00 a.m. - 12:00 p.m. Conference Opening, Plenary Address, & Keynote Address, Ballroom

12:00 - 4:00 p.m. National Association of Exotic Pest Plant Councils Membership Meeting, Humphreys Room

1:30 - 5:20 p.m. Concurrent Sessions

6:30 - 9:00 p.m. Opening Reception, Pine Mountain Amphitheater, Fort Tuthill Fairgrounds. Transportation provided.

Thursday – September 21

9:00 a.m. - 12:10 p.m. Concurrent Sessions

1:30 - 5:00 p.m. Concurrent Sessions

6:00 - 7:30 p.m. National Park Service Director's Natural Resource Awards Ceremony, Museum of Northern Arizona. Transportation provided.

7:00 - 9:00 p.m. Poster Session and Mixer, Ballroom

Friday – September 22

8:00 a.m. - 5:00 p.m. Mid-Conference Field Trips, du Bois Center

8:00 - 11:30 a.m. State Natural Areas Roundtable, Agassiz Room

8:00 - 11:30 a.m. Federal Natural Areas Roundtable, Southwest Room

11:30 a.m. - 5:00 p.m. State and Federal Natural Areas Field Trip

5:30 p.m. Auction items available for viewing and bidding, Ballroom

6:00 p.m. Pre-Banquet Mixer, Ballroom

6:30 p.m. Banquet and Live and Silent Auctions, Ballroom

Saturday – September 23

7:30 - 8:45 a.m. Natural Areas Association Membership Meeting and Breakfast, Ballroom

9:00 - 10:15 a.m. Comments & Plenary Address, Ballroom

10:40 a.m. - 12:40 p.m. Concurrent Sessions

12:40 p.m. End of Conference

33rd Annual Natural Areas Conference

Stewards of the Old and New West

September 20-23, 2006

du Bois Center, Northern Arizona University
Flagstaff, Arizona

We wish to thank the following organizations for their generous support of this conference:

Hosts

Natural Areas Association
National Park Service

Underwriters (\$5,000 to \$10,000)

Bureau of Land Management
Arizona State Parks
U.S. Forest Service
U.S. Geological Survey, Southwest Biological Science Center

Sponsors (\$1,000 to \$4,999)

Center for Sustainable Environments, Northern Arizona University
Northern Arizona University
Rocky Mountain Research Station, U.S. Forest Service
SWCA Environmental Consultants
Museum of Northern Arizona
Western National Parks Association
Ecological Monitoring and Assessment Program at Northern Arizona University
Grand Canyon Association
Grand Canyon Trust
Master of Liberal Studies and College of Engineering and Natural Sciences at
Northern Arizona University

Supporter (\$500 to \$999)

Ecological Restoration Institute at Northern Arizona University

Partner (\$100 to \$499)

Grand Canyon Wildlands Council
Ecopsatial Analysts, Inc

Conference Planning Team

Ron Hiebert (Conference Chair), National Park Service
John Vankat (Program Chair), National Park Service and Miami University
Mark Daniels, Northern Arizona University
Julye Evans, Northern Arizona University
Angie Evenden, National Park Service
Deb Kraus, Natural Areas Association
Dan Shein, Arizona State Parks
Judy Springer, Northern Arizona University
Deb Kraus, Natural Areas Association

Session Organizers

Steven Carothers, SWCA Environmental Consultants
Kenneth L. Cole, U.S. Geological Survey
Linda Drees, National Park Service
Trinkle Jones, National Park Service; Gary Nabhan, Northern Arizona University
Paul Keim, Gery Allan, and Dave Wagner, Northern Arizona University
Christian B. Luginbuhl, U.S. Naval Observatory
Meghan Maloney, University of Arizona
Daniel A. Sarr, National Park Service
Karen Shelly, NAA Program Assistance Chair
Karen Smith, Arkansas Natural Heritage Commission
Steve Shelly, U.S. Forest Service
John R. Spence, National Park Service
Kathryn Thomas (Poster Session), U.S. Geological Survey
Lisa Thomas and Chris Lauver, National Park Service
Wendy Vanasselt, The Wilderness Society

Field Trip Leaders

Carl Bowman, Cole Crocker-Bedford, Lori Makarick, Don Bertolette, Dean Reese,
Carmen Sipe, Colleen Hyde, and Michael Quinn, National Park Service
Neil Cobb, Northern Arizona University
Rebecca Garrett, The Nature Conservancy; Charlie Denton, Northern Arizona
University
Allen Haden, Northern Arizona University
Richard Holm, Northern Arizona University
Red Rock State Park Naturalists, Arizona State Parks
John Rihs, National Park Service and Larry Stevens, Grand Canyon Wildlands
Council
Charles Schelz, National Park Service
Tom Sisk and George Koch, Northern Arizona University
John Spence, National Park Service
John Vankat, National Park Service and Miami University
Patty West and Susie Smith, Northern Arizona University; Elaine Leslie, National
Park Service
Catherine Wightman, Arizona Game and Fish Department

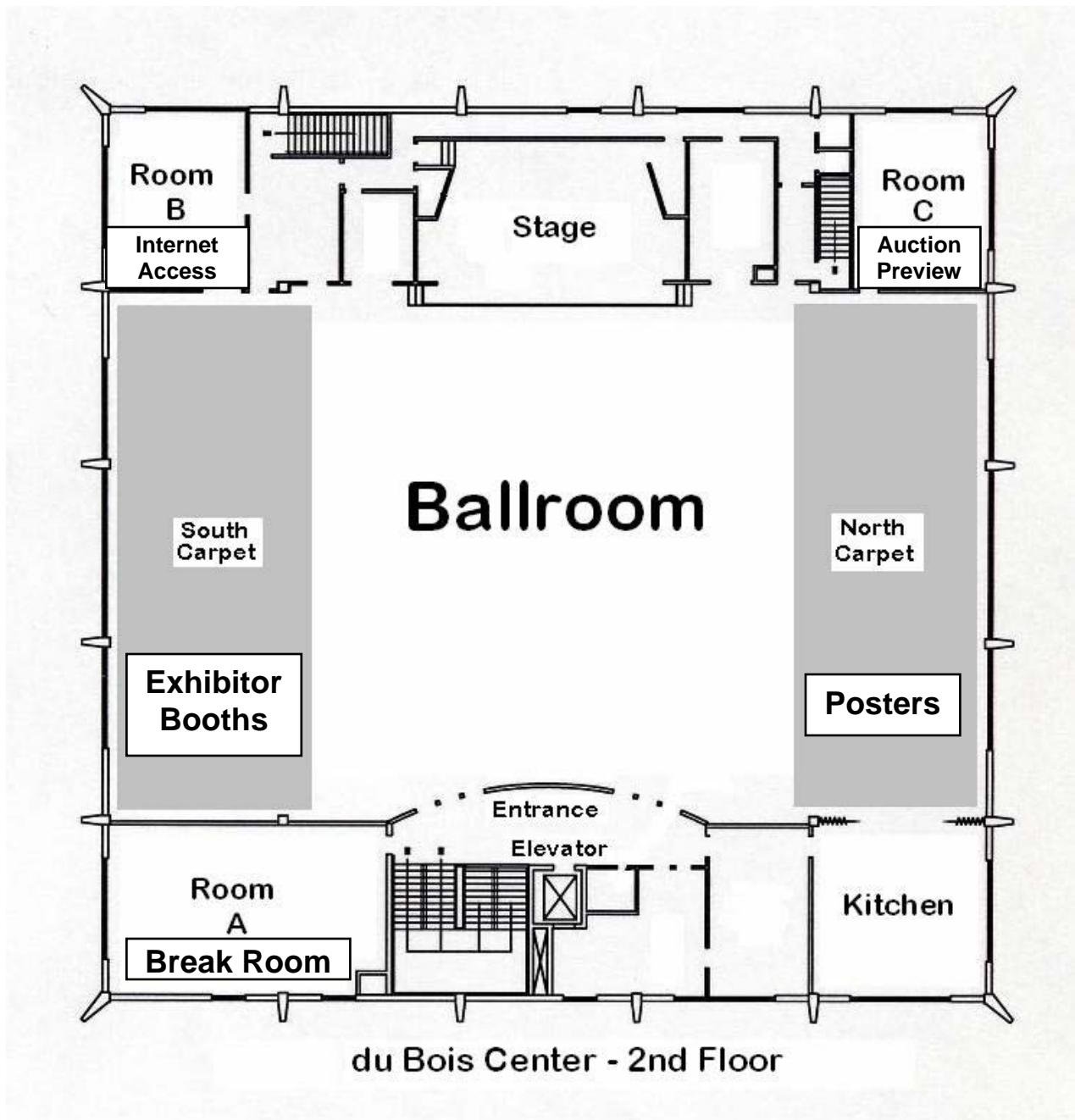
Welcome

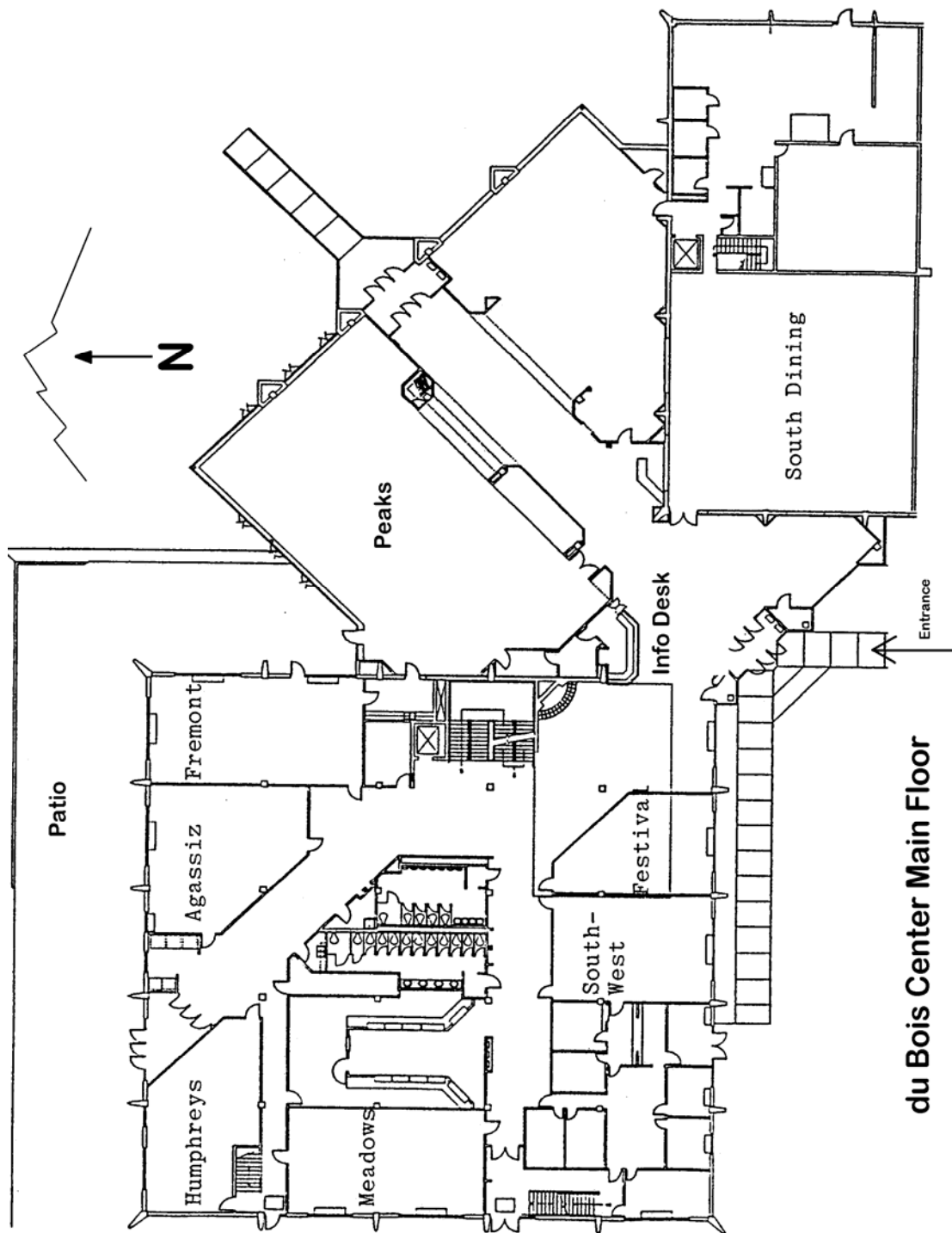
On behalf of the Natural Areas Association and the National Park Service, we welcome you to the 33rd Annual Natural Areas Conference on the mountain campus of Northern Arizona University in beautiful Flagstaff, Arizona.

Our conference theme, “Stewards of the Old and New West”, reflects the stewardship role of members of the Natural Areas Association and the challenge in the western United States and elsewhere of reconciling land use and natural area protection. The plenary and keynote speakers, banquet presenter, and many paper and poster presentations and discussions explore issues embedded in the conference theme.

We hope you find the conference interesting, thought-provoking, and useful in pursuing your work in natural areas.

Du Bois Center Maps





du Bois Center Main Floor

General Information

Conference Headquarters/Registration Table

The conference headquarters/registration table is located in the first-floor hallway of the du Bois Center. Feel free to ask questions there, or of individuals wearing name badges with a "Committee" ribbon.

Name Badges

Please remember that name badges are required to attend all conference events through Friday. Please recycle your used name badge holder at the registration table at the end of the conference.

Messages

Messages will be posted on a board near the registration table.

Driving or Walking to the du Bois Center

The du Bois Center is located on Northern Arizona University's South Campus, less than one mile from the south end of S. Milton Road, the major north-south street in Flagstaff. The directions from S. Milton Road are the same for walking or driving:

Starting from the traffic light at the intersection of S. Milton Road and W. Forest Meadows Street,

1. Go west on W. Forest Meadows - about 500 feet
2. Turn left on S. Beulah Boulevard - about 600 feet
3. Turn left on McConnell Drive - about 2,000 feet
4. Turn right into parking lot P40 (see below for parking information)
5. Follow signs to the du Bois Center - about 600 feet

Starting from the traffic light at the intersection of Butler Avenue and San Francisco Street,

1. Go south on San Francisco Street – you will take San Francisco Street all the way south (past McConnell Drive) to Pine Knoll Drive.
2. Turn right (west) on Pine Knoll Drive – you will pass the duBois Center on your right (but no parking is available in the lot south of duBois). Pine Knoll Drive will then curve north.
3. Turn right (east) on McConnell Drive
4. Turn right into parking lot P40 (see below for parking information)
5. Follow signs to the du Bois Center – about 600 feet

If parking lot P40 is full, then:

4. Continue on McConnell Drive to the stop sign at San Francisco Street. Turn right.
5. Turn right into parking lot P66
6. The du Bois Center is west from P66.

Parking

Follow the signs to Natural Areas Conference parking. Conference participants can use Lot P40 north of the du Bois Center, or Lot P66 east of the du Bois Center (refer to the Campus map in the registration packet). Permits are not necessary to park in these two lots; however, where there are parking meters, the meters must be fed and parking limitations adhered to. Cars parked in other areas (e.g., handicapped spaces and other lots) will be ticketed.

Shuttle Service

Shuttle Service to and from the conference will be provided from two hotel hubs. The first is LaQuinta Inn and Suites at 2015 S. Beulah Blvd. The second hotel hub is the Econo Lodge at 2480 East Lucky Lane. The shuttle schedule is listed below. Shuttle sign-ups will be at the registration table. We ask people to sign up if they would like to utilize the shuttle. In our continuing effort to be green, the shuttles will NOT run if people are not signed up for them.

Wednesday Shuttle Schedule:

Morning: The shuttles will arrive at the hotel hubs at 8:00 a.m., 8:20 a.m. and 8:40 a.m. to transport people to the conference.

Lunch: The shuttles will leave the du Bois Center at 11:45 a.m. to transport people to the hotels. The shuttles will arrive at the hotels at 12:55 p.m. and 1:15 p.m. to return people to the hotel hubs.

End of Day: The shuttles will leave the du Bois Center at 4:45 p.m., 5:05 p.m., and 5:25 p.m. to return people to the hotel hubs.

Opening Reception: The shuttles will arrive at the hotel hubs at 5:45 p.m. and 6:00 p.m. to shuttle people to the du Bois Center parking lot where the busses will leave to take people to the reception. After the reception, the shuttles will return people to the hotel hubs.

Thursday Shuttle Schedule:

Morning, Lunch and End of Day: same as Wednesday.

NPS Awards Ceremony: The shuttles will arrive at the hotel hubs at 5:15 p.m. and 5:35 p.m. to take people to the du Bois Center where there will be a bus to take people to the ceremony at the Museum of Northern Arizona

Poster Session: The shuttles will arrive at the hotel hubs at 6:30 p.m. and 6:50 p.m. to take people to the du Bois Center. The shuttles will leave the du Bois center at 8:45 and 9:05 to take people back to the hotel hubs.

Friday Shuttle Schedule:

Field Trips: Due to the staggered departure times of the field trips, please sign up for your shuttle at the registration table. Shuttle service will return people to the hotel hubs after the trips return.

Banquet: Shuttles will arrive at the hotel hubs at 5:20 p.m., 5:40 p.m., 6:00 p.m., and 6:10 p.m. Shuttles will return people to the hotel hubs after the banquet.

Saturday Shuttle Schedule:

Morning: The shuttles will arrive at the hotel hubs at 8:00 a.m., 8:20 a.m. and 8:40 a.m. to transport people to the conference. No further shuttles to the hotels will be offered.

Dining

Conference attendees are responsible for all meals, except the box lunch provided on full-day Friday field trips, the banquet Friday evening, and the membership meeting and breakfast Saturday morning. Several dining choices are available on the bottom floor of the du Bois Center, open Wednesday and Thursday 7:00 AM to 8:00 PM, Friday 7:00 AM to 7:00 PM, and Saturday 10:30 AM to 7:00 PM. For off-campus alternatives, see the list of restaurants provided in your registration packet.

Break Room

Beverages and foods are available in Room A, near the southeast corner of the Ballroom. Make a left at the top of the stairs before the Ballroom to avoid entering through the door in the Ballroom.

Speaker Ready Room

A computer with PowerPoint software is available in Room B near the southwest corner of the Ballroom for last-minute review and editing of your presentation. Room B is accessible by the back stairwell (or through the Ballroom).

Internet Access

Internet access is available to conference attendees in Room B near the southwest corner of the Ballroom. Please limit your use of the computers when others are waiting. Room B is accessed by the back stairwell (or through the Ballroom).

Auctions

The Natural Areas Conference tradition of live and silent auctions continues. With donated items ranging from books to T-shirts to the notorious Prairie Fire, there are auction items of interest to everyone. Auction items will be available to view and bid on in the Ballroom by 5:30 p.m. on Friday. Bid early and often, because all proceeds support the work of the Natural Areas Association. Winners pay for their items after the bidding closes on Friday evening (credit cards are accepted).

Donation of Auction Items

If you have items to donate to the auction, please drop them off at the conference headquarters/registration table in the first-floor hallway of the du Bois Center.

Exhibitor Booths

Exhibitor booths are along the south side of the Ballroom. Exhibitors include:

Natural Areas Association
Arizona State Parks and Natural Areas
Center for Sustainable Environments, Northern Arizona University
Ecological Monitoring and Assessment Program, Northern Arizona University
Grand Canyon Association
Grand Canyon Trust
Island Press
National Park Service
SWCA Environmental Consultants
University of Arizona Press
U.S. Geological Survey
Western National Parks Association

Natural Areas Association Booth

Visit the Natural Areas Association booth located in the exhibitor's area of the Ballroom to learn the latest news about NAA activities and to purchase your Natural Areas Conference 2006 souvenir T-shirt (while supplies last).

Photography Exhibit

America's newest system of public lands – the National Landscape Conservation System – encompasses the Bureau of Land Management's National Monuments, National Conservation Areas, Wild and Scenic Rivers, Scenic and Historic Trails, Wilderness, and Wilderness Study Areas. Some of the most famous parts of the System include Utah's Grand Staircase-Escalante National Monument and Arizona's Sonoran Desert National Monument, but most of the System's wild lands, waters, and cultural sites are truly "the hidden treasures of the American West."

To help Americans learn about this innovative collection of public lands, a coalition of more than 50 conservation and historic preservation groups sponsored a photo contest in 2005. Winning photographs captured the diversity of the National Landscape Conservation System. Images include archaeological sites, unique campsites, mountains, canyons, biodiversity, and spectacular vistas. The 12 winning photos and information about the National Landscape Conservation System are displayed at the rear of the Ballroom.

Self-Guided Tours

We have prepared information for many self-guided tours in the Flagstaff area. Visit the conference headquarters/registration table to see the list and pick up a handout for the tours you might be interested in.

Free Admission to Arizona State Parks

Conference attendees who present their conference name badge will receive free admission to all Arizona State Parks during the week of the conference.

Flagstaff

Riordan Mansion State Historic Park (tour reservations: 779-4395)

Flagstaff Region

Dead Horse Ranch State Park / Verde River Greenway (south, near Cottonwood)

Fort Verde State Historic Park (south, near Camp Verde)

Homolovi Ruins State Park (east, near Winslow)

Jerome State Historic Park (south, in Jerome)

Red Rock (south, near Sedona)

Slide Rock State Park (south, near Sedona)

For more information on Arizona State Parks, see <http://www.pr.state.az.us/>

CONFERENCE PROGRAM

Wednesday – September 20

Welcome and Plenary Session (Ballroom, 2nd Floor)

9:00 a.m. Welcome and Opening Remarks

Ron Hiebert, Conference Chair, 2006 Natural Areas Conference
Laura Huenneke, Dean, College of Engineering & Natural Sciences,
Northern Arizona University
Kim Herman, President, Natural Areas Association
Mike Soukup, Associate Director for Natural Resource Stewardship
and Science, National Park Service
Abigail Rome, Chair, International Program, Natural Areas Association

Plenary Address

9:30 a.m. Thriving Paradox – Life and Beauty on the Colorado Plateau
Thomas Sisk, Professor of Ecology, Northern Arizona University

Keynote Address

11:00 a.m. How to be Stewards of the Land in Revolutionary Times
Ed Marston, Publisher Emeritus, *High Country News*

Concurrent Sessions

1:30 - 3:10 p.m. Conservation Biology & Genetic Analysis – I
Ecological Monitoring & Assessment – I
Roles of Corporations in Natural Areas Protection – I
Conservation Planning – Setting Priorities
Invasive Species – I

3:40 - 5:20 p.m. Conservation Biology & Genetic Analysis – II
Ecological Monitoring & Assessment – II
Roles of Corporations in Natural Areas Protection – II
Conservation Planning – Partnering
Invasive Species – II

Opening Reception (Pine Mountain Amphitheater, Fort Tuthill Fairgrounds)

6:30 - 9:00 p.m. Enjoy meeting old and new friends at northern Arizona's newest outdoor venue. Transportation, cash bar, finger food, and entertainment.

WEDNESDAY - SEPTEMBER 20

	Ballroom				
9:00	Welcome				
9:30	Plenary Address: Thriving Paradox – Life and Beauty on the Colorado Plateau Tom Sisk				
10:30	Break				
11:00	Keynote Address: How to be Stewards of the Land in Revolutionary Times Ed Marston				
12:00	Lunch				
	Ballroom	Fremont	Meadows	Agassiz	Southwest
	Conservation Biology & Genetic Analysis - I <i>moderator: Dave Wagner</i>	Ecological Monitoring & Assessment - I <i>moderators: Lisa Thomas and Chris Lauver</i>	Roles of Corporations in Natural Areas Protection - I <i>moderator: Steven Carothers</i>	Conservation Planning – Setting Priorities: Contributed Papers <i>moderator: Patricia Koleff</i>	Invasive Species: Contributed Papers - I <i>moderator: Glenn Matlack</i>
1:30	Recent developments in conservation genetics: examples from endangered topminnows, wolves, and Florida panthers. <i>PHIL HEDRICK</i>	What is a healthy forest? An example from Canada's National Parks. <i>DONALD S. MCLENNAN</i>	Endangered species conservation banking: Hickory Pass Ranch and golden-cheeked warblers in central Texas. <i>ALAN M. GLEN</i>	Overview of the Grand Canyon Ecoregion Wildlands Network design. <i>KIM CRUMBO</i>	Medusahead (<i>Taeniatherum caput-medusae</i>) control with flaming, native plant seeding, and straw. <i>STEVEN O. LINK, Bill Mast, Betsy Kaiser, Vicky Erickson, Jean Wood, and Sally Simmons</i>
1:50		Developing scorecards for reporting the condition of natural resources. <i>Don Faber-Langendoen, Geri Tierney, BRIAN R. MITCHELL, and Greg Shriver</i>	Regaining inertia in land protection – picking up where the federal government left off: a case study from the Great Salt Lake ecosystem, Utah. <i>C. MARK RAMING and Heidi M. Hoven</i>	Conservation priorities for Mexican ecoregions. <i>CÉSAR CANTÚ, Patricia Koleff, Marcia Tambutti, Michael Scott, Rocío Esquivel, and Antonio Moreno</i>	Evaluation of restoration methods to minimize Canada thistle (<i>Cirsium arvense</i>) infestation. <i>DIANE L. LARSON and Jennifer L. Larson</i>
2:10	Conservation genetics of North American bison: a tale of two recoveries? <i>Natalie Halbert, Joe Templeton, and JAMES DERR</i>	An integrated framework for assessment, monitoring, and management of grassland, shrubland, and savanna ecosystems. <i>JEFFREY E. HERRICK, Brandon T. Bestelmeyer, Steven Archer, Arlene J. Tugel, Joel R. Brown, James P. Ward, Al Rango, and Kris M. Havstad</i>	Lavaca River Ranch Mitigation Area: a conservation bank project in Texas. <i>JAMES O. JONES</i>	Mexican Gap Analysis: an integrated approach. <i>PATRICIA KOLEFF, Marcia Tambutti, Ignacio March, Rocío Esquivel, César Cantú, Diana Hernández, Melanie Kolb, Verónica Aguilar, and Elizabeth Moreno</i>	Mechanisms of invasion of Japanese stilt grass (<i>Microstegium vimineum</i>), a nonnative annual grass threatening deciduous forests. <i>Nathaniel Miller and GLENN MATLACK</i>

WEDNESDAY - SEPTEMBER 20

	Ballroom	Fremont	Meadows	Agassiz	Southwest
2:30	Community heritability measures the evolutionary consequences of indirect genetic effects on community structure. <i>STEPHEN M. SHUSTER, Eric V. Lonsdorf, Gina M. Wimp, Joseph K. Bailey, and Thomas G. Whitham</i>	Field-based evaluations of sampling methods for long-term monitoring of upland ecosystems on the Colorado Plateau. <i>DANA L. WITWICKI, Mark E. Miller, and Rebecca K. Mann</i>	Jonah Natural Gas Field, Wyoming: innovative approaches to mitigating impacts. <i>KEVIN THOMPSON and Rob Mathes</i>	Quantifying the value of instream flow in the desert Southwest. <i>MATTHEW A. WEBER, Steven Stewart, and Robert Berrens</i>	<i>Phragmites</i> management to optimize biodiversity and ecosystem services. <i>ERIK KIVIAT</i>
2:50	Conservation genetics and coalescence in the Hawaiian genus <i>Argyroxiphium</i> (Asteraceae). <i>ELIZABETH A. FRIAR and Robert H. Robichaux</i>	Ecological assessment of piñon-juniper mortality (2002-2005) in Mesa Verde: a case study linking research to monitoring. <i>LISA M. FLOYD, William Romme, and David Hanna</i>	A habitat conservation plan for endangered karst invertebrates, Bexar County, Texas. <i>STEVEN W. CAROTHERS and Kemble White</i>		Georgia Invasive Species Taskforce: implementation of control and prevention strategies for managing cogongrass (<i>Imperata cylindrica</i>) on a state-wide scale. <i>DAVID J. MOORHEAD, Christopher W. Evans, Charles T. Barger, and G. Keith Douce</i>
3:10	Break				
	Conservation Biology & Genetic Analysis - II <i>moderator: Gery Allan</i>	Ecological Monitoring & Assessment - II <i>moderators: Lisa Thomas and Chris Lauver</i>	Roles of Corporations in Natural Areas Protection –II <i>moderator: Steven Carothers</i>	Conservation Planning – Partnering: Contributed Papers <i>moderator: Drew Vankat</i>	Invasive Species: Contributed Papers - II <i>moderator: Mary McFadden</i>
3:40	Climate change, the ultimate conservation challenge? An evolutionary perspective. <i>J. L. HAMRICK</i>	Ecological system and natural community integrity specifications as a tool for conservation planning and monitoring. <i>RENEE RONDEAU, Joe Rocchio, and Pat Comer</i>	Molecular taxonomy and a phylogeographic approach to targeting acquisition sites for the protection of cryptic species. <i>KEMBLE WHITE and Pierre Paquin</i>	Effective conservation of biodiversity in Hawaii through private/public watershed partnerships. <i>RANDY W. KENNEDY</i>	A tongue-in-cheek look at the exotic plants and animals in the land of the weird & bizarre – south Florida. <i>BILL HELFFERICH</i>
4:00		Implementation of a multi-scale ecosystem monitoring program for Sonoran Desert Network Parks. <i>J. ANDY HUBBARD AND CHERYL MCINTYRE</i>	Creation of refugia for threatened and endangered fishes. <i>KENNETH P. FERJANCIC</i>	An innovative federal and tribal partnership – Kasha-Katuwe Tent Rocks National Monument, New Mexico. <i>EDWIN SINGLETON AND DONALD SUINA</i>	Changes in understory vegetation on a large-scale ponderosa pine forest restoration project in Arizona: from sparse understory to abundant natives to cheatgrass invasion. <i>CHRISTOPHER M. MCGLONE, Judith D. Springer, and W. Wallace Covington</i>

WEDNESDAY - SEPTEMBER 20

	Ballroom	Fremont	Meadows	Agassiz	Southwest
4:20	Conservation implications of community & ecosystem phenotypes of foundation plant species. <i>THOMAS G. WHITHAM, Randy Bangert, Jennifer A. Schweitzer, Gery J. Allan, Stephen M. Shuster, Joseph K. Bailey, Gina M. Wimp, and Catherine A. Gehring</i>	Approaches for effectively delivering natural resource information to natural area managers, planners, and interpreters. <i>STEVEN G. FANCY</i>	Endangered fish conservation in the American Southwest: the increasing role of environmental consultants. <i>RICHARD A. VALDEZ</i>	Preserving natural areas by integrated community-based natural resource management practices in South Africa. <i>FRANCIS STEYN</i>	Viability of non-native plant seeds passing through horse digestive systems in selected National Park Service units of California. <i>Lauren Quinn, Bonnie Davis, Mietek Kolipinski, and SIBDAS GHOSH</i>
4:40	Panel Discussion	Panel Discussion	Native fish habitat restoration in selected tributaries of the Grand Canyon, Arizona: a potential recovery effort for native fishes. <i>WILLIAM C. LEIBFRIED</i>	Conservation and the private sector: the establishment of a biodiversity corridor within the Cape Floristic Region, South Africa. <i>PAMELA BOOTH</i>	Understanding and assessing plant invasions: an online workshop for wildland weed managers. <i>MARY MCFADZEN</i>
5:00				Nature conservation within an urban setting: the city of Cape Town, South Africa. <i>ADELE PRETORIUS</i>	Coral bleaching and disease combine to cause extensive mortality on reefs in U.S. Virgin Islands. <i>JEFF MILLER, Erinn Muller, Rob Waara, and Caroline Rogers</i>
	Pine Mountain Amphitheater, Fort Tuthill Fairgrounds (transportation provided)				
6:30-9:00	Conference Opening Reception				

Thursday – September 21

Concurrent Sessions

- 9:00 - 10:20 a.m. Invasive Species: Emerging Issues in Management – I
Federal Natural Areas Programs
Rare & Endemic Plants of the Colorado Plateau and
Adjacent Areas: Biodiversity, Management, & Conservation
Conservation Planning – Assessment and Acquisition
Genetics & Conservation
- 10:50 - 12:10 p.m. Invasive Species: Emerging Issues in Management – II
State Natural Areas Programs
Light & Noise Pollution of Natural Areas
Humans in Nature
Vegetation Classification & Ecology
- 1:30 - 3:10 p.m. Invasive Species: Early Detection & Monitoring in Natural
Areas – I
Bureau of Land Management's National Landscape
Conservation System: the New Face of Preservation in the
West
Climate Change & Natural Areas Management – I
Public Involvement & Education
Grasslands
- 3:40 - 5:00 p.m. Invasive Species: Early Detection & Monitoring in Natural
Areas – II
Role of Cooperative Extension in Natural Resource
Management
Climate Change & Natural Areas Management – II
Human Management Issues
Fire Ecology
- 6:00 - 7:30 p.m. National Park Service Awards Ceremony, Museum of
Northern Arizona. Transportation, snacks and beverages
provided

Poster Session & Mixer (Ballroom)

- 7:00 - 9:00 p.m. Posters will be available for viewing, and authors will be
present for questions and discussion. Finger foods.

THURSDAY - SEPTEMBER 21

	Ballroom	Fremont	Meadows	Agassiz	Southwest
	Invasive Species: Emerging Issues in Management - I <i>moderator: Linda Drees</i>	Federal Natural Areas Programs <i>moderator: Steve Shelly</i>	Rare & Endemic Plants of the Colorado Plateau and Adjacent Areas: Biodiversity, Management, & Conservation <i>moderator: John R. Spence</i>	Conservation Planning – Assessment and Acquisition: Contributed Papers <i>moderator: W. Chris Colclasure</i>	Genetics & Conservation: Contributed Papers <i>moderator: Thomas Meyer</i>
9:00	Disposable pets, unwanted giants: pythons in Everglades National Park, Florida. <i>SKIP SNOW, Lori Oberhofer, and Tony Pernas</i>	Research Natural Areas of the Southwest. <i>CAROLYN SIEG and Charles B. McDonald</i>	Interagency rare plant work in the Waterpocket Fold and San Rafael Swell of south-central Utah. <i>TOM O. CLARK and Deborah J. Clark</i>	Evaluating the status of the Missouri Natural Areas System. <i>TIMOTHY A. NIGH and Karen Shelly</i>	Morphologically cryptic host race formation in the poplar bud gall mite <i>Aceria parapopuli</i> : evidence from the internal transcribed spacer region of nuclear ribosomal DNA and implications for conservation biology. <i>LUKE EVANS, Gery Allan, and Thomas Whitham</i>
9:20	Ecosystem threats of non-native mosquitofish (<i>Gambusia affinis</i>) and their parasites to natural areas in San Francisco Bay area of California. <i>MIETEK KOLIPINSKI, Anindo Choudhury, Jim Cunningham, and Sibdas Ghosh</i>	Selection of “Special Areas” on the Cimarron and Comanche National Grasslands, Kansas and Colorado. <i>STEVEN OLSON</i>	Status and management of three rare plants from the western edge of the Colorado Plateau: dwarf bear poppy, Holmgren milkvetch, and Shivwits milkvetch. <i>RENEE VAN BUREN</i>	Publication of a report card on the ecological health of the Chicago Wilderness region. <i>LAUREL ROSS, Christopher Mulvaney, and Dan Gooch</i>	Population genetic analysis of <i>Populus fremontii</i> , an ecologically important forest tree: implications for population and conservation biology of natural riparian areas. <i>BARBARA HONCHAK, Gery Allan, Thomas Whitham, and Paul Keim</i>
9:40	Invaders of the National Parks – using the broadcast media to inform on complicated resource issues. <i>CURT DEUSER, Mike Whateley, Elizabeth Smith, and Linda Drees</i>	Garnering support for Federal Natural Areas programs: lessons learned in the National Natural Landmarks Program. <i>MARGARET A. BROOKS</i>	Four Corners flora project: lessons from intensive field surveys. <i>KENNETH D. HEIL, Steve L. O’Kane, Jr., Linda M. Reeves, and Arnold Clifford</i>	Developing a natural areas land acquisition program by the Parks and Recreation Commission of Washtenaw County, Michigan. <i>TOM A. FREEMAN and Sylvia Taylor</i>	Genetic diversity in Ponderosae: challenges to management on mountain islands in the Southwest. <i>JASON S. KILGORE, Frank W. Telewski, and Bryan K. Epperson</i>
10:00	Helping natural area managers respond to new invasions from cactus moth to tamarisk – new tools for new threats. <i>SHARON K. GROSS</i>	Baseline and stewardship monitoring on Sawtooth National Forest Research Natural Areas, Idaho. <i>KIM PIERSON, Steven K. Rust, and Jennifer J. Miller</i>	Status and management of rare species on the Navajo Nation, including management of two federally listed species. <i>DANIELA ROTH</i>	Land acquisition techniques utilized by the Arkansas Natural Heritage Commission to accomplish land protection objectives. <i>W. CHRIS COLCLASURE</i>	Association mapping and introgression of community level traits in naturally occurring cottonwood (<i>Populus</i>) hybrid zones. <i>MATTHEW ZINKGRAF, Scott Woolbright, Gery Allan, and Thomas Whitham</i>

THURSDAY - SEPTEMBER 21

10:20	Break				
	Ballroom	Fremont	Meadows	Agassiz	Southwest
	Invasive Species: Emerging Issues in Management - II <i>moderator: Linda Drees</i>	State Natural Areas Programs <i>moderators: Karen Shelly and Karen Smith</i>	Light & Noise Pollution of Natural Areas (to 12:30) <i>moderator: Christian B. Luginbuhl</i>	Humans in Nature: Contributed Papers <i>moderator: Bill Clemente</i>	Vegetation Classification & Ecology: Contributed Papers <i>moderator: Anne Cully</i>
10:50	Invaders: citizen scientists combat invasive species. <i>DAMON E. WAITT and Tani Hubbard</i>	Panel Discussion: State Natural Areas Program reports. <i>MIKE LEAHY, KAREN SMITH, THOMAS MEYER, NANCY STRAYER, BRIAN BOWEN, and RANDY HEIDORN</i>	Determination and restoration of the natural soundscape at Grand Canyon National Park, Arizona. <i>KEN. G. MCMULLEN</i>	Fences, gates, and views of the world. <i>JONATHAN LONG and Mae Burnette</i>	Vegetation communities of southern Colorado Plateau National Parks. <i>MONICA HANSEN and Kathryn Thomas</i>
11:10	Avian influenza – wild migratory bird surveillance in Arizona. <i>LISA A. SHENDER</i>		Losing the night – documenting the extent and severity of artificial light pollution. <i>CHAD MOORE and Dan Duriscoe</i>	Evolution and development of a land ethic on the Babbitt Ranches, northern Arizona. <i>WILLIAM C. CORDASCO and Karan English</i>	Pine health in the Ashland Research Natural Area, Oregon. <i>Donald J. Goheen, Katy M. Mallams, and DIANE E. WHITE</i>
11:30	<i>Stop Aquatic Hitchhikers!</i> and the 100 TH Meridian Initiative – using social marketing for the benefit of conservation. <i>BOB PITMAN and Joe Starinchak</i>		The meaning and value of natural quiet and dark. <i>PAUL BOGARD</i>	Carl Hiaasen’s hilarious wetland <i>Skinny Dip</i> with a serious ecological <i>Hoot</i> . <i>BILL CLEMENTE</i>	Minnesota’s native plant community classification: forests, woodlands, and prairies. <i>CARMEN K. CONVERSE and Michael D. Lee</i>
11:50	Preventing zebra mussel (<i>Dreissena</i> sp.) infestation at Lake Powell, Arizona and Utah. <i>MARK ANDERSON</i>		Biological and ecological consequences of night lighting. <i>Travis Longcore, Catherine Rich, and CHRISTIAN B. LUGINBUHL</i> Panel Discussion (to approximately 12:30)	A proposal to determine how much local participation is needed for the successful development and implementation of nature-based tourism policies in Peru. <i>H. A. DE LA CRUZ-NOVEY</i>	Stand dynamics of an old-growth hemlock-hardwood forest in the central Appalachian Mountains. <i>NATHAN R. BEANE, Eric Heitzman, and Thomas M. Schuler</i>
12:10	Lunch				

THURSDAY - SEPTEMBER 21

	Ballroom	Fremont	Meadows	Agassiz	Southwest
	Invasive Species: Early Detection & Monitoring in Natural Areas - I <i>moderator: Daniel A. Sarr</i>	Bureau of Land Management's National Landscape Conservation System: the New Face of Preservation in the West <i>moderator: Wendy Vanasselt</i>	Climate Change & Natural Areas Management - I <i>moderator: Kenneth L. Cole</i>	Public Involvement & Education : Contributed Papers <i>moderator: Jim Brett</i>	Grasslands: Contributed Papers <i>moderator: Gary Wilson</i>
1:30	Early detection protocol development in the National Parks: integrating all the pieces. <i>PENELOPE LATHAM, Daniel Sarr, and Bradley A. Welch</i>	Bureau of Land Management's National Landscape Conservation System: ambitious mission, essential partnerships. <i>ELENA C. DALY</i>	The latest perspective on climate variability and change in the Southwest. <i>MELANIE LENART, Gregg Garfin, and Ben Crawford</i>	Research, inventory, and monitoring volunteers – opportunities for professionals and paraprofessionals. <i>JOANNE M. ROBERTS, Kenneth J. Kingsley, and Amy J. Gaiennie</i>	Structure and composition of tallgrass prairie plant communities along east-to-west and north-to-south gradients within the central United States, <i>JILL E. CRAIG and John Harrington</i>
1:50	A thousand points of blight: plants invading parks, preserves, and other natural areas. <i>JIL M. SWEARINGEN</i>	The National Landscape Conservation System and the new economic reality of the West. <i>REBECCA CARTER, Ray Rasker, Ben Alexander, Jeff Van den Noort, and Erin Mock</i>	The post-Younger Dryas warming, an analog for the present and future from 11,600 years ago. <i>KENNETH L. COLE</i>	Growing prairie: a preserve manager's tale of success working with volunteer stewards. <i>BILL KLEIMAN</i>	Examining current patterns and heterogeneity In remnant prairies of southern Wisconsin. <i>CARRIE E. READ and John Harrington</i>
2:10	Modeling invasive plant species in Big Bend National Park, Texas. <i>SCOTT T. SCHRADER, Kendal E. Young, Gary Roemer, and Colleen Caldwell</i>	Cultural resources in Bureau of Land Management's National Landscape Conservation System: a needs analysis. <i>MICHAEL SMITH</i>	Community and evolutionary consequences of record drought in the Southwest. <i>THOMAS G. WHITHAM, Adrian Stone, Crescent M. Scudder, Alicyn R. Gitlin, Christopher M. Sthultz, R. Talbot Trotter III, Nashelly Meneses, and Catherine A. Gehring</i>	Restoration of a canyon landscape – building a sustainable and local workforce in Canyon de Chelly National Monument, Arizona. <i>ELAINE LESLIE</i>	Prairies found and prairies lost: inventory work in northeast Kansas. <i>KELLY KINDSCHER</i>
2:30	A framework for predicting invasive plants in National Parks: proof of concept using <i>Verbascum thapsus</i> in Lava Beds National Monument, California. <i>THOMAS C. EDWARDS, D. Richard Cutler, Karen H. Beard, Jacob R. Gibson, and Daniel Sarr</i>	Protecting rivers in the western landscape. <i>QUINN MCKEW</i>	Drought consequences for soil fungi and how they feed back to affect dominant trees. <i>CATHERINE A. GEHRING, Kristin E. Haskins, Rebecca C. Mueller, and Thomas G. Whitham</i>	A re-emergence of field-based natural history education. <i>JIM BRETT and Michele Richards</i>	Vegetation of the Bayou Meto-Grand Prairie area, Arkansas. <i>THOMAS FOTI</i>

THURSDAY - SEPTEMBER 21

	Ballroom	Fremont	Meadows	Agassiz	Southwest
2:50	Detecting and monitoring aquatic invaders in the context of comprehensive ecoregional monitoring. <i>DAVID E. BUSCH and Paul Heimowitz</i>	Panel Discussion: The National Landscape Conservation System: lessons learned and future concerns.	Modeling current and future plant species distributions in the southwestern U.S. <i>KIRSTEN E. IRONSIDE, Kenneth L. Cole, Jimmie D. Chew Neil S. Cobb, Philip B. Duffy, and John D. Shaw</i>	Interpreting Denali's landcover types with fabric (quilt). <i>LUCY E. TYRRELL and Jon Paynter</i>	
3:10	Break				
	Invasive Species: Early Detection & Monitoring in Natural Areas II <i>moderator: Daniel A. Sarr</i>	Role of Cooperative Extension in Natural Resource Management <i>moderator: Meghan Maloney</i>	Climate Change & Natural Areas Management - II <i>moderator: Kenneth L. Cole</i>	Human Management Issues: Contributed Papers <i>moderator: Marty Lee</i>	Fire Ecology: Contributed Papers <i>moderator: Paul P. Drewa</i>
3:40	The SE-EPPC volunteer mapping project: aiding early detection and rapid response using the state EPPCs. <i>CHRISTOPHER W. EVANS, Charles T. Barger, G. Keith Douce, and David J. Moorhead</i>	Interactive Panel Discussion: Building a bridge of dialogue between the Old & New West: an interactive panel discussion on the role of Cooperative Extension in natural resource management efforts. <i>ROBERT EMANUEL, BARRON ORR, MEGHAN MALONEY, WADE ALBRECHT, KERRY SCHWARTZ, CORI DOLAN, JEFF SCHALAU, and TRENT TEEGERSTROM</i>	Potential effects of climatic change on terrestrial ecosystem processes in the Southwest. <i>STEPHEN C. HART and Bruce A. Hungate</i>	Characterizing natural sounds in Grand Canyon National Park, Arizona. <i>SARAH FALZARANO and Skip Ambrose</i>	Landscape heterogeneity and fire history control the distribution and population structure of two dominant shrubs of a national park in a temperate savanna, Argentina. <i>FERNANDO BIGANZOLI and William Batista</i>
4:00	Panel Discussion		Challenge of conservation in a changing climate: experiences and perspective from The Nature Conservancy. <i>BARRY BAKER</i>	Impacts of mountain biking on wildlife and people – a review of the literature. <i>MICHAEL J. VANDEMAN</i>	Wildland fire use effects on forest structure over an elevational gradient, Grand Canyon National Park. <i>PETER Z. FULÉ and Daniel C. Laughlin</i>
4:20			Upland free water and wildlife: past, present, and future on the Colorado Plateau. <i>BRANDON HOLTON, Jan Hart, and David Mattson</i>	Benefits of land use for sustaining native diversity. <i>JONATHAN LONG and Alvin J. Medina</i>	Plant community stability following wildfires in old-growth fire-adapted forests in Grand Canyon National Park, Arizona. <i>DANIEL C. LAUGHLIN and Peter Z. Fulé</i>
4:40				Managing the environmental and social impacts of trail-based recreation. <i>DREW VANKAT</i>	Are precipitation patterns important when using fire as a management tool in Chihuahuan Desert Grasslands? <i>PAUL B. DREWA, Debra P.C. Peters, and Kris M. Havstad</i>

THURSDAY - SEPTEMBER 21

	Museum of Northern Arizona
6:00-7:30	National Park Service Awards Ceremony
	Ballroom
7:00-9:00	Poster Session and Mixer

Notes

Poster Session

1. BATES, BRYAN C. Astronomy of the ancestral Puebloans of the southwestern United States
2. CONN, DAVID BRUCE. Land-based education, research, and resource management on America's largest college campus
3. CRUMBO, KIM. Safe havens, safe passages: the Grand Canyon Ecoregion Wildlands Network design
4. DEFEX, TULIA I., William E. Grant, Roel Lopez, and Dusty Perkins. Monitoring urbanization and ecological succession to project future landscape changes
5. DREES, LINDA. National Park Service Exotic Plant Management Teams – using a team approach to manage invasive plants
6. EVANS, CHRISTOPHER W., Charles T. Barger, David J. Moorhead, G. Keith Douce, and Richard Reardon. *Invasive Plants of the United States: Identification and Control* CD-ROM
7. FAULKNER, PATRICIA L., Christopher S. Reid, Michael H. MacRoberts, Barbara H. MacRoberts, and Judy J. Jones. Characteristics of a saline prairie – woodlands natural area complex in northwest Louisiana
8. GRAHAM, TIM B. Riparian invertebrate communities of Salt Creek, Canyonlands National Park, Utah: variability and finding indicator taxa
9. GRAHAM, TIM B. Vehicles in streams: effects of driving through pools on *Bufo Woodhousii* (Woodhouse toad) egg survival in Canyonlands National Park, Utah
10. HAINES, DUSTIN F., Diane Larson, and Ron Hiebert. Development of the Restoration Rapid Assessment Tool
11. HAUSER, CHRISTOPHER and Drew Ullberg. Large-scale seed harvest for Midwestern tallgrass ecosystems
12. HUBER, PATRICK R., Nathaniel Roth, Mike McCoy, and Rod Meade. San Joaquin Valley conservation opportunities: a collaborative regional planning effort in California
13. JAMES, MICHELE A., Peter Friederici, Karen Underhill, and Sandra Lubarsky. Using oral histories as a tool in exploring ecological change
14. JINI, ANTOINETTE. Re-Introduction of Klipspringer (*Oreotragus oreotragus*) into Table Mountain National Park, South Africa
15. LESLIE, ELAINE F., Hank Hayou, and Arthur Benally. Wildlife habitat inventory, restoration, and preservation at Canyon de Chelly National Monument, Arizona
16. LYNN, JANET C., Karan English, and Michele James. Northern Arizona University's San Juan Science and Recreation Program: a unique partnership with the Bureau of Land Management

17. MADDOX, VICTOR, John Madsen, Richard Brown, Clifton Abbott, Randy Westbrooks, Joel Floyd, and Annie Simpson. Collaborative effort to protect native southwestern pricklypear (*Opuntia* P. Mill.) from the invasive cactus moth (*Cactoblastis cactorum* Berg.)
18. MASI, SUSANNE and Emily Kapler. Long-term rare plant monitoring at Midewin National Tallgrass Prairie (Illinois)
19. MCLEOD, MARY ANNE and Thomas J. Koronkiewicz. Characteristics of southwestern willow flycatcher (*Empidonax traillii extimus*) habitat along the Lower Colorado River – applied restoration science
20. MOSTAFAVI, G., F. Salimpour, and F. Sharifnia. Survey of taxonomic differences between *Trifolium radicosum* and other species of the Section *Lotoidea* in Iran
21. MOSTAFAVI, G., E. Zarifi, F. Salimpour, and F. Sharifnia. Karyological study of *Trifolium* species in Section *Lotoidea* in Iran
22. MULVANEY, CHRISTOPHER, Laurel Ross, and Dan Gooch. Status and trends of biodiversity in the Chicago wilderness region: results from an ecological report card
23. NILON, CHARLES, Caroline Broun, Robert Pierce, and Ginny Wallace. Missouri Master Naturalists: volunteers applying ecological concepts and approaches in community-based conservation programs
24. PECH, LOUIS L. and Tim B. Graham. Use of flight-interception traps to monitor beetle diversity in Salt Creek Canyon, Canyonlands National Park, Utah
25. ROCCAFORTE, JOHN PAUL, Peter Z. Fulé, and W. Wallace Covington. Landscape-scale changes in canopy fuels and potential fire behavior following ponderosa pine restoration treatments at Mt. Trumbull, Arizona
26. ROTHROCK, PAUL, John Bacone, Gerould Wilhelm, and Thomas Post. Hoosier Prairie oak savanna, Lake County, Indiana: current status and change during 27 years of prescribed burns
27. SEILER, JENNY. Student Conservation Association: providing assistance to natural, cultural, and historical resource managers for nearly 50 years
28. STUDD, S. E. and T. Mau-Crimmins. Development of plant field identification cards for the Arizona Wildlands Invasive Plant Working Group Species List
29. THOMAS, KATHRYN and Patty Guertin. Grid sampling: a novel sampling design for invasive non-native plant surveys
30. WAITT, DAMON E. and Linda Drees. *Be Plantwise and Garden Smart*, an educational program designed for the gardener to prevent plant invasions
31. WARRINER, MICHAEL D. The Arkansas Bumblebee Survey: a citizen-science effort

Friday – September 22

Field Trip Check In (parking areas of du Bois Center)

6:45 - 9:15 a.m. Field trip participants need to check in at least 15 minutes prior to departure. Field trips will take place regardless of weather. Bring water bottle(s), sunscreen, hat, and other items specified in online description of field trip (see <http://cpcesu.nau.edu/NAC2006/fieldtrips.htm>).

Field Trip Departures (parking areas of du Bois Center)

7:00 - 9:30 a.m. Field trips depart.

- 7:00 a.m. Fossil Creek Stream Restoration Project
- 7:00 a.m. Grand Canyon National Park – South Rim – Option 1 – Hike to Dripping Springs
- 8:00 a.m. Colorado River Float Trip to Lees Ferry
- 8:00 a.m. Grand Canyon National Park – South Rim – Option 2 – Discussions near the Rim
- 8:00 a.m. Oak Creek and Sedona Area Parks
- 8:00 a.m. Volcanoes, lava flows, and landscapes on the southern Colorado Plateau
- 8:30 a.m. Pinyon-Juniper Woodlands: Impacts of Drought and Climate Change
- 8:30 a.m. San Francisco Peaks & Merriam's Life Zones
- 9:30 a.m. TNC Hart Prairie Preserve/Hochderffer Fire

State Natural Areas Roundtable (pre-registration required)

8:00 - 11:30a.m. Roundtable discussions for state natural area and natural heritage programs. Agassiz Room.

Federal Natural Areas Roundtable (pre-registration required)

8:00 - 11:30 a.m. Roundtable discussions for federal natural area programs. Southwest Room

State and Federal Natural Areas joint Field Trip (pre-registration required)

11:30 - 5:00 p.m. Verde River Greenway State Natural Area and Tuzigoot National Monument.

Evening Festivities (Ballroom)

Don't forget to bring your admission ticket for the evening. It was provided in your registration packet.

5:30 p.m. Auction items available for viewing and bidding. Browse through the auction items and enter your bids on items in the silent auction. Prepare your bidding strategy for the live auction. Remember, all proceeds support the work of the Natural Areas Association. Winning bidders pay for their items after the close of bidding.

6:00 p.m. Pre-Banquet Mixer. Greet old and new friends and colleagues and size up your competition for the silent and live auctions.

6:30 p.m. Banquet.

Master of Ceremonies, Kim Herman

Announcement of the 2007 Natural Areas Conference, Renee Boronka

Presentation of Natural Areas Association's Student Awards, Lisa Smith

Presentation of Natural Areas Association's Carl N. Becker Stewardship Awards and George B. Fell Award, Mike Scott

Introduction of banquet presentation, John Vankat

Presentation by Tom Brownold, Photographer

Conclusion of silent auction

Live auction, Randy Nyboer, Natural Areas Association

Saturday – September 23

Natural Areas Association Annual Membership Meeting and Breakfast (Ballroom)

7:30 - 8:45 a.m. Enjoy a light breakfast while participating in the annual meeting.

Remarks and Plenary Session (Ballroom) – Open to Public

9:00 a.m. Remarks

Ron Hiebert, Conference Chair, 2006 Natural Areas Conference
Kim Herman, President, Natural Areas Association

9:15 a.m. Plenary Address

Respecting the Wildness in the Rivers of the West: Reforming the
19th-Century Policies, Laws, and Ideas that Rule Western Water

Charles Wilkinson, Distinguished Professor, School of Law,
University of Colorado

Concurrent Sessions

10:40-12:40 p.m. Cultural Landscapes & Protected Areas

10:40-12:00 p.m. Pinyon-Juniper Ecology
Restoration Ecology

10:40-12:20 p.m. Ecological Inventory & Monitoring
Wildlife

End of Conference

Thank you for joining us! We hope to see you in Cleveland, OH in 2007.

SATURDAY - SEPTEMBER 23

	Ballroom				
7:30	Natural Areas Association Annual Membership Meeting and Breakfast				
9:00	Comments: <i>Ron Hiebert</i>				
9:15	Plenary Address: Respecting the Wildness in the Rivers of the West: Reforming the 19th-Century Policies, Laws, and Ideas that Rule Western Water <i>Charles Wilkinson</i>				
10:15	Break				
	Ballroom	Fremont	Meadows	Agassiz	Southwest
	Cultural Landscapes & Protected Areas <i>moderators: Trinkle Jones and Gary Nabhan</i>	Pinyon-Juniper Ecology: Contributed Papers <i>moderator: Neil Cobb</i>	Restoration Ecology: Contributed Papers <i>moderator: Tom O. Moody</i>	Ecological Inventory & Monitoring: Contributed Papers <i>moderator: Kathryn Thomas</i>	Wildlife: Contributed papers <i>moderator: Stephen Dewhurst</i>
10:40	Cultural landscapes and traditional ecological knowledge: integrating them into protected areas. <i>GARY P. NABHAN</i>	Initial understory response to restoration treatments and slash arrangements in the pinyon-juniper woodlands of northern Arizona. <i>MARIA R. IRWIN, Alex Finkral, and John Bailey</i>	Wilderness Areas and fire restoration: federal agency interpretations and challenges. <i>David Ostergren and MEGAN TRIPLETT</i>	Shorebird and habitat monitoring at Shell Key Preserve in west-central Florida. <i>DON STILLWAUGH, Kristen Sommers, Steve Harper, and Catherine S. Flegel</i>	Habitat characteristics of Henslow's Sparrow wintering in saline soil barrens of southern Arkansas. <i>WILLIAM C. HOLIMON, C. Theo Witsell, William H. Baltosser, and Catherine W. Rideout</i>
11:00	Proposed National Heritage Areas and Globally Important Ingenious Agricultural Heritage Sites for cultural landscapes on the Colorado Plateau. <i>PATTY WEST</i>	Slash additions retain soil resources and increase rates of graminoid seedling establishment in a pinyon-juniper woodland. <i>MICHAEL T. STODDARD, David Huffman, and Thomas Alcoze</i>	Making sense of rivers: guiding principles for the arid Southwest. <i>Tom O. Moody and ELIZABETH J. RUTHER</i>	The border impacts program at Organ Pipe Cactus National Monument, Arizona. <i>ANTHONY POVILITIS, Beth Fallon, Mary Kralovec, Ami Pate, Sue Rutman, and Ben Zank</i>	Role of bison in Native American culture and history, then and now. <i>DALE ENGQUIST, Sibdas Ghosh, Arthur Scott, and Mietek Kolipinski</i>
11:20	Historic orchards and heirloom fruits in protected areas: their conservation and restoration. <i>KANIN ROUTSON</i>	Stand characteristics of pinyon-juniper woodlands after a major drought event. <i>MICHAEL CLIFFORD, Neil S. Cobb, Robert Delph, and Paulette L. Ford</i>	Taking bankfull to the bank: useful channel patterns in the arid Southwest. <i>TOM O. MOODY and Elizabeth J. Ruther</i>	Monitoring vegetation change in Great Lakes region National Parks. <i>SARAH E. JOHNSON, Erika L. Mudrak, and Donald M. Waller</i>	The Florida Ecological Greenways Network: protecting a statewide Florida black bear (<i>Ursus americanus floridanus</i>) metapopulation and Florida's biodiversity. <i>TOM S. HOCTOR</i>

SATURDAY - SEPTEMBER 23

	Ballroom	Fremont	Meadows	Agassiz	Southwest
11:40	The Kino Fruit Trees Project: replanting historically and horticulturally appropriate fruit trees in Tumacácori National Historical Park, southeast Arizona. <i>JESUS M. GARCIA and ROBERT M. EMANUEL</i>	Impact of drought and bark beetle outbreak on ground-dwelling arthropod dynamics in pinyon-juniper woodlands in the Middle Rio Grande Basin. <i>ROBERT J. DELPH, Mike Clifford, Neil Cobb, and Paulette Ford</i>	Derivation of a formula for determining area of pits used for water catchment in ecological restoration. <i>T. H. KARIM and K. K. Sharif</i>	Invasive plant inventory: observations from a novel sampling design at Petrified Forest National Park, Arizona. <i>KATHRYN THOMAS and Patty Guertin</i>	Bureaucratic sabotage of large carnivore conservation in the American Southwest. <i>C. DUSTIN BECKER and Anthony Povilitis</i>
12:00	Integrating intermingled federal, state, and private lands for natural area management in northern Arizona. <i>MANDY ROBERTS METZGER</i>			Regional cave ecological inventory and new species discoveries, Grand Canyon-Parashant National Monument, Arizona. <i>J. JUDSON WYNNE, Kyle D. Voyles, and Charles A. Drost</i>	Landscape-level modeling for pronghorn habitat restoration planning in central and northern Arizona. <i>MATTHEW J. CLARK and Stephen Dewhurst</i>
12:20	Discussion: new perspectives on cultural landscapes. <i>MICAH LOMOAMVAYA AND SHELLEY SILBERT</i>				
	End of Conference				

Notes

What You May Not Know about the Natural Areas Association

The Natural Areas Association (NAA) does much than publish the *Natural Areas Journal* and host the annual Natural Areas Conference. NAA also actively and continually works to provide on-the-ground programs and services to our members and the natural areas community. All natural area activities (some shown below) are developed, fielded and managed by dedicated NAA committee members, which are composed of NAA members, plus the Board of Directors.

Please join us! Some of the areas you can become involved in are:

Board of Directors: Due to term limits, we are currently looking for new Board members who share the NAA vision and care about natural areas. Check our website (www.naturalarea.org) or the inside cover of the *Journal* to view the current NAA board members and their affiliations. The ideal board has a diverse make-up of NGO, government agency, and nonprofit members. Consider what you would bring to the Board if you were to become a member of, or advisor to, the Board.

The Committee Corner: NAA committees offer another opportunity to work with your peers, network, and utilize your skills and creativity while working on projects of special interest to you – all while serving the Natural Areas Association and community. See the Committee Corner in the latest issue of the *Natural Area News* to learn about the specific committees that bring NAA programs to life.

Current program plans:

- **2007-2008 Status of State Natural Areas Programs report (SSNAPs).** This report includes a national evaluation and summary of state-based natural area and nature preserve, programs, and systems. Included is a directory of the key contacts for each state, plus contact information. The NAA is constantly compiling updated information on state natural area and natural heritage programs. We invite you to contribute to the official update to the 2005 SSNAPs report, either financially and/or by volunteering your time and expertise.
- **Partnerships** with Land Trust Alliance (LTA) and other national conservation organizations to spearhead workshops and support for land stewardship programs. NAA will be presenting: Stewardship on Fee Lands - Habitat Restoration at the national LTA conference this October. This seminar will cover the importance of fee land stewardship and how to implement effective, science-based land management strategies.

- **International Workshops.** For 10 years the NAA has featured exciting guided trips to directly experience and study international protected areas and diverse conservation strategies. Trip participants meet with international conservation colleagues to discuss their programs, successes, and challenges. Participants also contribute to local conservation by sharing their own knowledge and experience and by developing lasting conservation alliances. Details on the 2007 Guatemala Workshop are on the NAA website.
- **New Fire Management Compendium** CD-ROM, to include fire-related papers from over 24 volumes of the *Natural Areas Journal*. This project is pending, based on securing the funding to compile and produce it.

State and Federal Natural Area Roundtables: Natural areas managers and staff (along with heritage program managers and ecologists from those states that do not have natural area programs) gather to share their different perspectives and experiences, hold discussions, and present information on the condition of their state natural areas program to enable learning by example and sharing first-hand experiences. The 2006 Natural Areas Conference provides, for the first time, special sessions that cover topics and issues such as:

- Status of natural area programs across the country
- How and why natural area programs have changed from their inception
- Criteria for measuring progress in establishing and maintaining natural area and heritage programs
- Successes in building partnerships within and outside state government
- Building and strengthening networks

The Roundtables, spearheaded by the NAA Program Assistance committee, will be followed with ongoing written reports, online natural area program updates, and plans for future forums in order to sustain this vital outreach program. If you have not been involved in the Roundtables to date, you are welcome to join this consortium.

We invite you to get involved now...

Please consider donating your time and/or financial support to those specific programs and activities that are most important to you. The vitality of these programs depends on NAA members' support. The NAA is a membership organization and therefore you are the NAA. Your fellow members and your Board welcome your ideas and suggestions and greatly appreciate your support. You can contact NAA Director Deb Kraus or any NAA Board member or committee chair at mail@naturalarea.org

Abstracts

Alphabetized by name of the first author.

Name of presenter is capitalized.

Oral Presentation

PREVENTING ZEBRA MUSSEL (*DREISSENA* SP.) INFESTATION AT LAKE POWELL, ARIZONA AND UTAH

ANDERSON, MARK

Glen Canyon National Recreation Area, PO Box 1507, Page, AZ 86040; mark_anderson@nps.gov

Lake Powell is one of the most likely points of entry for zebra mussels (*Dreissena* sp.) into the Colorado River System. Glen Canyon National Recreation Area has operated a Zebra Mussel Infestation Prevention Program on the lake since 2001. The program includes monitoring for early detection of infestation and screening vessels for risk of introduction, through targeted questions. Visitors with vessels that pose a risk of spreading zebra mussels are required to receive a free professional boat washing. Details of the program, its evolution, and results are discussed. Through this program over 100 boats have been washed, and Lake Powell remains zebra mussel free.

Oral Presentation

CHALLENGE OF CONSERVATION IN A CHANGING CLIMATE: EXPERIENCES AND PERSPECTIVE FROM THE NATURE CONSERVANCY

BAKER, BARRY

The Nature Conservancy, 2424 Spruce St., Suite 100 Boulder, CO 80302; bbaker@tnc.org

Threats to the conservation of species and natural communities have traditionally been viewed as the effects from the loss or fragmentation of habitat, invasive alien species, over-harvesting, and pollution. However, the fingerprints of global climate change are already evident and have begun to alter many biological systems thus presenting new challenges for the conservation of biodiversity. Recognizing this challenge, The Nature Conservancy (TNC) is working to promote cost-effective policies and standards to reduce greenhouse gas emissions as well as conducting applied research to assess the impacts of climate change on species and ecological systems. Methodologies are presented that demonstrate how TNC has begun to incorporate projected impacts of climate change into national, ecoregional, and landscape-level conservation planning.

Poster Presentation

ASTRONOMY OF THE ANCESTRAL PUEBLOANS OF THE SOUTHWESTERN UNITED STATES

BATES, BRYAN C.

Science Faculty, Coconino Community College, 2800 Lone Tree Road, Flagstaff, AZ 86001;
bryan.bates@coconino.edu

Humankind has consistently attempted to understand the passage of the skies, ascribing to the sun, moon, planets, and stars mythologies which reflect the bioregion of their particular civilization. The ancestral Puebloan people were extremely adept at not only marking the commonly observed celestial indicators of seasonal change (such as solstices, equinoxes, and cross-quarter dates), but also of calendaring their survival and ceremonial events to correspond with changes in the celestial vault. Research reflects that agriculturalist tend to use sun-moon-stellar horizon associations, whereas hunters & gathers tend to use constellations as predictors of seasonal change. Using photographic and schematic documentation of archaeoastronomy, I examine how ancestral science of the skies reflects knowledge of the seasonal changes in biota and climate that lead to effective land management by the ancient Puebloans.

Oral Presentation

STAND DYNAMICS OF AN OLD-GROWTH HEMLOCK-HARDWOOD FOREST IN THE CENTRAL APPALACHIAN MOUNTAINS

BEANE, NATHAN R.¹, Eric Heitzman¹, and Thomas M. Schuler²

¹Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV 26506-6125; nbeane@mix.wvu.edu; eric.heitzman@mail.wvu.edu

²Timber and Watershed Laboratory, U.S. Forest Service, Parsons, WV 26287; tschuler@fs.fed.us

Hemlock woolly adelgid (*Adelges tsugae*) is an exotic insect threatening eastern hemlock (*Tsuga canadensis*) forests in the eastern United States. One area at risk is Cathedral State Park (CSP), a 53-ha old-growth hemlock-hardwood forest in the central Appalachian Mountains of West Virginia. CSP represents perhaps the finest example of old-growth hemlock; trees larger than 100 cm in diameter and 35 m tall are not uncommon. In 2006, we remeasured field plots established six years ago in CSP to describe adelgid-induced changes in forest structure and species composition. We discuss current efforts to control adelgid populations using insecticides and predatory beetles. We also measured the herbaceous plant community in CSP during the 2006 growing season, and describe how this ground flora has changed since it was originally surveyed in 1965. Finally, the volume of coarse woody debris in CSP is quantified and compared with other old-growth forests in the eastern United States.

Oral Presentation

BUREAUCRATIC SABOTAGE OF LARGE CARNIVORE CONSERVATION IN THE AMERICAN SOUTHWEST

BECKER, C. DUSTIN and Anthony Povilitis

Life Net, PO Box 1220, Lukeville, AZ 85341; dustizuni@yahoo.com; a_povilitis@yahoo.com

Historically, public agencies in the Southwest persecuted large carnivores under anti-predator campaigns to benefit the livestock industry and other interest groups. Contemporary wildlife agencies in deference to these same economic and ideological interests fail in their responsibilities under law to recover the endangered Mexican wolf and jaguar. The Mexican wolf program is burdened with management constraints so severe that an experimental wolf population cannot be maintained without continued release of captive bred wolves, and no plans exist to reestablish the subspecies within its natural geographic range in the U.S. In the case of the jaguar, there is no federal recovery program or team, and a state-lead program created in lieu of federal action has failed after a decade of stonewalling to implement promised habitat conservation. To recover these species, agency professionals must advance regional and trans-border conservation planning, promote primacy or co-equal status for carnivores on public lands, avoid goal substitutions for habitat conservation, ensure truthful reporting of program status, reject behind-the-scenes political pressure to thwart recovery efforts, and protect themselves against bureaucratic retaliations through political and organizational channels that support professional integrity and ethics. Private conservationists can help end bureaucratic sabotage of recovery efforts by establishing carnivore recovery oversight groups (CROGS) to publicly expose agency misdoings, campaign for landscape-scale conservation, and sponsor independent, scientifically based recovery plans that would stand as alternatives to current failed programs.

Oral Presentation

LANDSCAPE HETEROGENEITY AND FIRE HISTORY CONTROL THE DISTRIBUTION AND POPULATION STRUCTURE OF TWO DOMINANT SHRUBS OF A NATIONAL PARK IN A TEMPERATE SAVANNA, ARGENTINA

BIGANZOLI, FERNANDO and William Batista

Agronomy School, Buenos Aires University, Av. San Martín 4453, C1417DSE Buenos Aires, Argentina; biganzol@agro.uba.ar; batista@agro.uba.ar

Establishment of protected areas in landscapes previously used for cattle production often triggers changes in vegetation composition and physiognomy. Interpretation of such changes is crucial for the management of protected areas. In 1965 a National Park was established in Argentina to protect a tract of temperate palm savanna in an area previously used for cattle grazing. Fire suppression and exclusion of livestock grazing from the protected area resulted in massive encroachment of shrubs. As the first step to understanding the dynamics of this process, we characterized the landscape distribution and heterogeneity of local populations of two native dominant species, *Baccharis dracunculifolia* and *Eupatorium buniifolium*. Based on shrub censuses, we constructed statistical models to evaluate possible controls of presence, abundance, and local population structure of these species within the National Park. *Baccharis* was ubiquitous, but its density was higher in recently burned sites with low palm and tree cover. Unburned sites supported senescent populations. In contrast, populations of *Eupatorium* were restricted to palm savannas and shrublands on sandy loam soils, but were absent from sandy outcrops and dense, unburned palm savannas. Density of *Eupatorium* was higher in recently burned sites with low palm cover. Moreover, populations were older in sites unburned or with high tree cover and bare soil. Our results indicated that the structure and dynamics of local populations of the two dominant shrubs in the savanna are mainly controlled by fire history. Therefore, understanding the natural fire regime appears to be essential for management of this protected area.

Oral Presentation

THE MEANING AND VALUE OF NATURAL QUIET AND DARK

BOGARD, PAUL

University of Nevada – Reno, 535 Toiyabe St., Reno, NV 89509; PBOGARD@UNR.EDU

The night we know is no longer what it was. Astronomers say that because of artificial night lighting fully 80% of people in Western Europe and North America no longer experience “real night,” that is, real darkness. The cost is high: the loss of a beautiful night sky that generations upon generations before us have watched with wonder. But the light pollution blocking our view of the stars is only the most obvious result of artificial night lighting. Our lack of attention to the spread of artificial night lighting mirrors a lack of appreciation for night’s ancient gifts of peace, time to be with those we love, and quiet. And, perhaps most seriously, as we’ve diluted the darkness, so have we negatively affected ecosystems in ways we’re only beginning to understand. I discuss the value of real darkness and real quiet, calling attention to what we’re losing as we’re losing night.

Oral Presentation

CONSERVATION AND THE PRIVATE SECTOR: THE ESTABLISHMENT OF A BIODIVERSITY CORRIDOR WITHIN THE CAPE FLORISTIC REGION, SOUTH AFRICA

BOOTH, PAMELA

Eden to Addo Corridor Initiative, PO Box 56, Sedgefield, 6573, South Africa;
papio@edentoaddo.co.za

The Cape Floristic Kingdom is the smallest of the six floristic kingdoms and the only one found within the boundaries of one country – South Africa. While 70% of the plants within the Cape Floristic Kingdom are found nowhere else, 80% of the region is in private hands. This poses a unique problem: how to get the private sector to willingly protect an important biodiversity asset? Due to the natural beauty of the region, enormous pressure is placed on landowners to sell to developers who often pay more than the going agricultural rate. As a result, the landscape is fragmented and formally protected areas are fast becoming islands. In response to this, a group of individuals met in 2003 and, after raising sufficient funds through the Critical Ecosystem Partnership Fund, The Eden to Addo Conservation Corridor was launched. As a private sector initiative, Eden to Addo works in partnership with conservation authorities to integrate livelihoods with biodiversity conservation in a mutually beneficial manner. In contrast to the current trend of offering incentives, Eden to Addo promotes conservation as a lifestyle that yields benefits outweighing the monetary returns offered by developers. The initiative has used current trends and thinking in conservation in a way that appeals to the young, dynamic landowners in the region who can relate to the “Eden to Addo Lifestyle” and who willingly take on stewardship responsibilities. One of the marketing and fundraising tools used was the establishment of an Eden to Addo Epic Hike of approximately 400 km traversing the length of the corridor. Landowners, potential financial supporters, and the public were invited to experience the “Living Corridor” first hand, thereby contributing financially toward the removal of invasive alien species and other management costs of the new trail and the corridor.

Oral Presentation

A RE-EMERGENCE OF FIELD-BASED NATURAL HISTORY EDUCATION

BRETT, JIM and Michele Richards

Pennsylvania Institute for Conservation Education, 1-D Teaberry Road, Bloomsburg, PA 17815;
jimbrett@naturecorp.com; naturecorp@enter.net

The deinstitutionalization of natural history looms as one of the biggest scientific mistakes of our time, perpetrated by the very scientists and institutions that depend on natural history for their well-being. We created the Pennsylvania Institute for Conservation Education (PICE) in 2002 because it was becoming eminently obvious that knowledge of natural history was being lost throughout the educational system across the broad spectrum of curricular structure. PICE was founded based on what appeared to be the impending extinction of natural history. We became increasingly aware that students on all levels were not being taught the very basics of natural science. PICE is dedicated to advancing awareness, knowledge, and skills of natural history and conservation by building an ecologically literate and engaged public. Natural history enables the professional ecologist to see functional relationships in nature, to uncover the broader patterns necessary for managing wildlife and their habitats. In a few short years PICE has become an important voice in the re-emergence of field-based natural history. It has recently been chosen by the Rocky Mountain Elk Foundation to design the conservation education program for its new visitor center in Pennsylvania. Significant funding has been received from the Richard King Mellon Foundation to develop a wildlife leadership school for upper level high school students beginning in 2007. Bucknell University has partnered with PICE to develop natural history programs for high school and undergraduate college students in the Roaring Creek Watershed, a newly acquired 9,000 acres in central Pennsylvania. PICE encourages hands-on discovery of watersheds and ecosystems of Pennsylvania while instilling stewardship of the Commonwealth's natural resources. It serves all ages and regions by providing adult seminars and retreats, teacher education, conservation internships, youth and school programs, and custom programs for organized groups.

Oral Presentation

GARNERING SUPPORT FOR FEDERAL NATURAL AREAS PROGRAMS: LESSONS LEARNED IN THE NATIONAL NATURAL LANDMARKS PROGRAM

BROOKS, MARGARET A.

National Park Service, 255 N. Commerce Park Loop, Tucson AZ 85745; margi_brooks@nps.gov

After establishment of the National Natural Landmarks (NNL) Program in 1962, nearly 600 NNLs were designated by 1988. These designations were made to herald and protect features that are considered nationally significant for their geological or biological resources, regardless of ownership. Designations were made on state, federal, tribal, and municipal lands, and have recognized a wide variety of resource areas in 48 states and the U.S. territories, including volcanic features, coastal resource areas, rare plant communities, caves, and impact craters, to name only a few. Challenges to the program by private property rights groups brought a halt to new designations in 1989. Ten years later the moratorium on program activity was lifted, but the stigma remained. The NNL program continued to be very "unpopular", especially in some agency offices that had been contacted by groups opposing the program many years before. However, a new NNL was designated in 2006, the first in over 18 years, and support continues to grow for the program and new designations. Favorable attitudes and agency support didn't just happen; it was developed by parties within and outside of the NPS who championed the NNL program, marketed it to a responsive constituency, and took every opportunity to herald the achievements of the

program at local sites. While attitudes can always change again, the NNL program appears to be out of its dark period and is once again recognizing and supporting conservation at outstanding natural areas.

Oral Presentation

DETECTING AND MONITORING AQUATIC INVADERS IN THE CONTEXT OF COMPREHENSIVE ECOREGIONAL MONITORING

BUSCH, DAVID E.¹ and Paul Heimowitz²

¹U.S. Geological Survey, Western Region – Biological Resources, Regional Ecosystem Office, Portland, OR 97208; dave_busch@usgs.gov

²U.S. Fish and Wildlife Service, Pacific Regional Office. Portland, OR 97232; paul_heimowitz@fws.gov

Implementation of most prominent ecoregional initiatives includes substantial effort to monitor ecosystems and habitats, track biotic communities or target species, and conduct data management, analyses, and reporting to support adaptive management. Monitoring invasive species is inherent to understanding and characterizing ecosystems. Because of this, programs to detect invasive species usually coexist in landscapes where more general ecoregional monitoring occurs. A comprehensive inquiry into aquatic invasive species (AIS) detection and monitoring programs in the Pacific Northwest shows that they are taxonomically, systematically, and geographically comprehensive, and contain many of the same elements as other ecoregional initiative monitoring programs. However, no one entity manages the breadth of environmental monitoring in aquatic and riparian systems of the region. Thus, it is unclear to what degree targeted AIS monitoring might duplicate or complement other forms of ecoregional monitoring and vice versa. Differences in priorities and approach appear to exist with respect to handling numeric data, taxonomic emphases, trend determination, and the need for spatially-explicit real time reporting. Despite such differences, there is great potential for increasing AIS monitoring efficiency and productivity through greater communication, collaboration, and reporting among those conducting monitoring in aquatic and riparian systems.

Oral Presentation

CONSERVATION PRIORITIES FOR MEXICAN ECOREGIONS

CANTÚ, CÉSAR¹, Patricia Koleff², Marcia Tambutti², Michael Scott³, Rocío Esquivel⁴, and Antonio Moreno⁵

¹Facultad de Ciencias Forestales, UANL, Ap. Post 41 CP 67700, Linares, N.L. Mexico; ccantu@fcf.uanl.mx

²CONABIO, Ave. Liga Periférico Insurgentes Sur #4903, Col. Parques del Pedregal CP 14010 Mexico, D.F.; pkoleff@xolo.conabio.gob.mx; mtambutti@xolo.conabio.gob.mx

³College of Natural Resources, University of Idaho, PO Box 441142, Moscow, ID 83844; mscott@uidaho.edu

⁴CONANP-SEMARNAT, Camino al Ajusco #200, Col. Jardines en la Montaña, Del. Tlalpan, Mexico, D.F. CP 14210; resquive@conanp.gob.mx

⁵Facultad de Ciencias Biológicas, UANL. Cd. Universitaria, Ave. Alfonso Reyes San Nicolás de los Garza., N.L.; ecocart@prodigy.net.mx

Mexico has been recognized as a megadiverse country because of its exceptional biodiversity in number of species, endemics, habitats, landscapes, and ecosystems. To identify priority areas for protecting its high biological diversity, we considered 75 terrestrial ecoregions, which represent contrasting environmental conditions. Currently, Mexico has 405 nature reserves (155 federal and 250 state) covering 11% of its territory, but these are unevenly distributed across the country and might not protect representative samples of the national biodiversity. In order to determine how effectively nature reserves may protect biodiversity in terms of representing the Mexican ecoregions, we developed a conservation prioritization index for the ecoregions based on seven weighted variables: percentage of Mexican territory, percentage of land in nature reserves, number of nature reserves, number of secondary vegetation types, number of primary vegetation types, vegetation heterogeneity (total vegetation types), and elevation heterogeneity. Index values ranked in ascending importance from 2 to 100. Ecoregions that exhibited the highest prioritization values are located in the western region, mainly on the Pacific Coast of the country, and are characterized by dry forests, xerophytic vegetation, and oak and pine forest. This study provides a quantitative methodology to show ecoregion gaps for strengthening conservation activities.

Oral Presentation

A HABITAT CONSERVATION PLAN FOR ENDANGERED KARST INVERTEBRATES, BEXAR COUNTY, TEXAS

CAROTHERS, STEVEN W.¹ and Kemble White²

¹SWCA Environmental Consultants, 114 N. San Francisco Street, Flagstaff, AZ 86001; scarothers@swca.com

²SWCA Environmental Consultants, 4407 Monterey Oaks Boulevard, Building 1, Suite 110, Austin, TX 78749; kwhite@swca.com

Nine species of cave invertebrates presently known only from karst topography in north and northwest Bexar County, Texas, were listed as endangered on 26 December 2000. Critical habitat for these species was designated on 8 April 2003. Species include two troglobitic ground beetles, *Rhadine exilis* and *R. infernalis*; a mold beetle, *Batrissodes ventyivi*; an eyeless harvestman, *Texella cokendolpheri*; and five eyeless spiders, *Cicurina baronia*, *C. madla*, *C. venii*, *C. vespera*, and *Neoleptoneta microps*. A local landowner, with three small caves, all occupied by one or two of the listed species, applied for and received an Endangered Species Act section 10(a)(1)(B) incidental take permit to close one of the caves and preserve in perpetuity each of the other two caves in small (1-acre) preserves. The applicant and the authors worked with the U.S. Fish and Wildlife Service (Austin, Texas, Ecological Services Field Office) to establish guidelines for evaluating the specifics of incidental take for the project, as well as establishing mitigation criteria and long-term protection guidelines for designated mitigation preserves. The preserves that have been established include nine caves on 179 acres, each occupied by two to five of the listed species. This presentation provides details of preserve establishment, maintenance, and monitoring, and comments on the distribution and demographic characteristics of some of the listed species.

Oral Presentation

THE NATIONAL LANDSCAPE CONSERVATION SYSTEM AND THE NEW ECONOMIC REALITY OF THE WEST

CARTER, REBECCA¹, Ray Rasker², Ben Alexander², Jeff Van den Noort², and Erin Mock³

¹Sonoran Institute, 7650 E. Broadway Blvd., Suite 109, Tucson, AZ 85710; rebecca@sonoran.org

²Headwaters Economics, PO Box 7059, Bozeman MT 59771; ray@headwaterseconomics.org; ben@headwaterseconomics.org; jeff@headwaterseconomics.org

³Sonoran Institute, Northwest Office, 201 S. Wallace, Suite B3C, Bozeman, MT 59715; emock@sonoran.org

The economy of the West has changed a great deal over the past decade – and so have the towns and counties near and in which National Landscape Conservation System (NLCS) areas are located. This presentation highlights research conducted by the Sonoran Institute over the past several years on the effects of NLCS and other types of protected areas on local economies. We examine case studies of counties before and after NLCS designation and explore economic change in the context of regional, national, and global trends. We also discuss additional factors that must be in place for communities to prosper in the changing economy. This presentation draws from research reports by the authors and colleagues, including *Prosperity in the 21st Century West: The Role of Protected Public Lands* (2004), *Public Lands Conservation and Economic Well-Being* (2004), *The National Landscape Conservation System's Contribution to Healthy Local Economies* (2005), and *The Potential Economic Impacts of Wilderness in Doña Ana County, New Mexico* (2006).

Oral Presentation

LANDSCAPE-LEVEL MODELING FOR PRONGHORN HABITAT RESTORATION PLANNING IN CENTRAL AND NORTHERN ARIZONA

CLARK, MATTHEW J.¹ and Stephen Dewhurst²

¹4780 South House Rock Trail, Flagstaff, AZ 86001; mjc93@nau.edu

²PO Box 15018, Flagstaff, AZ 86011; Stephen.Dewhurst@nau.edu

Woodland encroachment is a widespread phenomenon that has negatively affected extensive tracts of grasslands in northern Arizona and the Intermountain West. Pronghorn (*Antilocapra americana*) is a native-grassland ungulate and Management Indicator Species that stands to benefit from grassland restoration. Mechanical overstory removal is a capital-intensive first-step towards achieving restoration in areas affected by encroachment. Managers have expressed a desire to identify future restoration areas with high potential for successfully enhancing pronghorn habitat. Using GIS, we implemented a zoning process to develop landscape-level models that incorporate biophysical factors important to pronghorn together with special management areas identified by managers. These static models are designed such that users can query or set targets for key criteria and indicators to develop spatially-explicit scenarios that identify potential restoration areas meriting further investigation. We collaborated with land and wildlife managers from Prescott National Forest, Arizona Game and Fish Department, and Coconino National Forest to develop GIS-based decision support tools to create tactical management strategies for mechanical overstory removal. Recently, we used this approach to generate management scenarios for a 440,000 acre landscape encompassing the greater Anderson Mesa area, which contains both summer and winter range for a stressed pronghorn herd that has declined 58% since 1985. Information derived from pronghorn telemetry, slope, canopy cover, soil types, historical reference conditions, policy documents, expert knowledge, and manager-defined operational constraints defined the primary zones of management interest, while pronghorn ecology, operational strategies and goals, landscape ecology, and conservation biology principles informed the location and configuration of potential restoration areas. Results indicate that our zoning approach is an effective method to integrate complex spatial resource inventory information along with expert knowledge. Potential restoration areas identified via ArcGIS queries or optimization modeling can be evaluated using economics, indicator targets, and spatial statistics.

Oral Presentation

INTERAGENCY RARE PLANT WORK IN THE WATERPOCKET FOLD AND SAN RAFAEL
SWELL OF SOUTH-CENTRAL UTAH

CLARK, TOM O.¹ and Deborah J. Clark²

¹National Park Service, Capitol Reef National Park, Torrey, UT 84775; Tom_O_Clark@nps.gov

²Bureau of Land Management, Richfield District, Richfield, UT 84775

In south-central Utah, lands within and adjacent to Capitol Reef National Park contain populations of over 40 rare and endemic plant species. The geologic strata and elevational gradient in this area have created very specific microhabitats and niches of temperature, soil, minerals, moisture, and substrate that have allowed unique plant species to evolve with very restricted ranges. The Forest Service, Bureau of Land Management, and Capitol Reef National Park became partners in an Interagency Program to inventory and monitor threatened, endangered, and sensitive plant species shared by these agencies. From 1999 to 2005, the Interagency Rare Plant Team surveyed and recorded over 500 new locations for 32 of these plant species by covering more than 90,000 acres of federally managed lands. Knowledge gained about these species and their habitat requirements has helped determine which species are truly rare and in need of additional conservation actions. In addition, results from this project help determine which species and populations should be monitored to find out if specific human activities are affecting them and will enable federal land managers to ensure that those plants are protected.

Oral Presentation

CARL HIAASEN'S HILARIOUS WETLAND *SKINNY DIP* WITH A SERIOUS ECOLOGICAL *HOOT*

CLEMENTE, BILL

Department of English, Peru State College, Peru, NE 68421; bclemente@mac.com

This presentation takes its title from two novels by Carl Hiaasen, the very popular writer of madcap, dark, and often hilarious works that address both his love of Florida and his horror at the ecological destruction greed continues to cause. Hiaasen has written more than ten novels, and the tone of the narratives has become increasingly darker since his first novel, *Double Whammy*, with respect especially to the wetlands areas; the increasingly angry pitch echoes, for example, in the recurring character Skink, who reappears in *Skinny Dip*. This novel concerns in the main the ecological turmoil of the Everglades and features a wetlands biologist as the comic villain, a marine scientist who does not know which direction the Gulf Stream flows. The comedy of this book and *Hoot* underscore significant issues; *Hoot*, while presenting a similar message, however, presents Hiaasen's recurrent pleas for ecological sanity in a very different register: A Newberry Honor Book, *Hoot* is an adolescent novel. Both novels suggest why Hiaasen's popular novels merit serious attention; they have the power to turn a skinny dip into an activist agenda. Michael Grunwald's recently published *The Swamp: The Everglades, Florida, and the Politics of Paradise* provides an excellent foundation for my analysis as does *Paradise Screwed*, a collection of Carl Hiaasen's columns written for the *Miami Herald*, where he has worked for years as a reporter. And his *Team Rodent: How Disney Devours the World* provides an excellent metaphor for the powerful forces of deceit his dark humor seeks to expose.

Oral Presentation

STAND CHARACTERISTICS OF PINYON-JUNIPER WOODLANDS AFTER A MAJOR DROUGHT EVENT

CLIFFORD, MICHAEL¹, Neil S. Cobb¹, Robert Delph¹, and Paulette L. Ford²

¹Merriam-Powell Center for Environmental Research and Department of Biological Sciences, Northern Arizona University, Peterson Hall PO Box 5640, Flagstaff, AZ 86011; mjc235@nau.edu; Neil.Cobb@nau.edu; Robert.Delph@nau.edu

²Rocky Mountain Research Station, 333 Broadway SE, Suite 115, Albuquerque, NM 87102; plford@fs.fed.us

Over the last decade the southwestern US has experienced drought conditions nearly every year, causing region-wide vegetation changes due to large-scale death of pinyon pine (*Pinus edulis*) trees throughout the pinyon-juniper (P-J) woodlands. Drought stressed pinyons became susceptible to insect herbivores such as the pinyon ips (*Ips confusus*). Throughout the Middle Rio Grande Basin (MRGB), New Mexico P-J woodlands have experienced high pinyon mortality (~50-65%), while one-seeded juniper (*Juniperus monosperma*) mortality remained low (~5-10%). With increasing mortality, stand characteristics have changed from previous conditions, thus altering ecosystem dynamics. Through the use of random vegetation plots throughout the MRGB, we determined stand characteristics of P-J woodlands. With these data we were able to determine changes in stand density, understory vegetation, invasive species, and fuel loads.

Oral Presentation

LAND ACQUISITION TECHNIQUES UTILIZED BY THE ARKANSAS NATURAL HERITAGE COMMISSION TO ACCOMPLISH LAND PROTECTION OBJECTIVES

COLCLASURE, W. CHRIS

Arkansas Natural Heritage Commission, 1500 Tower Building, 323 Center Street, Little Rock, AR 72201; chrisc@arkansasheritage.org

The Arkansas Natural Heritage Commission, a state agency, is charged with establishing and protecting a system of natural areas. Land acquisition is an intricate function utilized in accomplishing this mission. Land acquisition targets are strategically identified using available data and site conservation plans. Targeted properties are researched to identify landowners. Landowners are contacted to initiate negotiations. Negotiations are based on an appraisal completed by a state-certified appraiser. After successful negotiations, purchase agreements and/or options are drafted that detail the terms of the acquisition. The standard terms of purchase include: authority to sell, clear title, purchase price, closing costs, tax proration, closing date, and access. Upon the satisfaction of all purchasing terms, the acquisition is finalized and the deed or easement is recorded in the county of purchase. Once acquired, these lands are formally dedicated and added to the Arkansas System of Natural Areas, to be managed and protected in perpetuity.

Oral Presentation

THE POST-YOUNGER DRYAS WARMING, AN ANALOG FOR THE PRESENT AND FUTURE FROM 11,600 YEARS AGO.

COLE, KENNETH L.

USGS Southwest Biological Science Center, Box 5614, Flagstaff, AZ 86011;
Kenneth.Cole@nau.edu

Past climates are being investigated to understand the consequences of on-going and future climate shifts. Unfortunately, the multitude of different climate variables, usually changing at different rates and frequencies, guarantees that no climate period can be a perfect analog for any other. But during the last 20,000 years, two periods stand out as potential analogs for future greenhouse climates: the middle Holocene and the post-Younger Dryas warming. The middle Holocene was a time of warmer climates bringing substantial drought stress to the Colorado Plateau, with enhanced evaporation and/or lessened precipitation. This period had been thought of as a potential guide to environmental effects of 2 X CO₂ climates, but its temperatures are often estimated to have been on the order of 1°C warmer than the 20th century. It may be a better analog for the eventual consequences of the current decade's climate than for the future. In contrast, the post-Younger Dryas warming is not an analog for specific conditions at any one place, but instead an example of the ecological consequences of rapid climate warming. During this period, separating the Pleistocene from the Holocene, the climates of the southwestern United States rapidly warmed at least 4°C over less than 150 years. The most detailed stratigraphic records from ice and sea cores outside the southwestern U.S. suggest that this warming was even more rapid, possibly occurring over a few decades. This is the only climate warming that rivals the future projected climate changes in both magnitude and rate. Plant records from fossil packrat middens and fossil pollen from just after this period suggest that in mountainous areas species moved upslope rapidly, but their latitudinal migrations in response to the warming were far slower. Species assemblages reorganized as different plant species migrated in different directions and at different rates.

Poster Presentation

LAND-BASED EDUCATION, RESEARCH, AND RESOURCE MANAGEMENT ON AMERICA'S LARGEST COLLEGE CAMPUS

CONN, DAVID BRUCE

School of Mathematical and Natural Sciences, Berry College, Mount Berry, GA 30149-5036;
bconn@berry.edu

Situated in the Appalachian foothills of northwest Georgia, Berry College is a private coeducational college, with properties comprising 28,000 acres of contiguous land. Habitats include pasturelands, river frontage, several lakes and ponds, mixed mesophytic forests, baldcypress and other wetlands, and other natural areas. Much of the land encompasses a wildlife management area through cooperation with the state. Since 1902, the land was used primarily for forestry and mining, while the actual college campus was restricted to less than 3,000 acres, including more than 1,000 acres of farmlands supporting agriculture education. In 1997, the college began an aggressive program to convert the entire 28,000 acres into an active center for land-based education and research across all academic disciplines, while maintaining forestry and mining operations that are integrated into educational opportunities for students, faculty, and visiting scholars. The program began in the natural sciences and has extended into the schools of humanities and social sciences, education, and business. Courses in biology, geology, astronomy,

animal science, archaeology, art, and others make extensive use of the land. Outreach programs to K-12 schools and adult education in environmental sciences have been implemented. Wildlife research includes investigations of coyotes (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), eastern bluebirds (*Sialis sialis*), bobwhite quail (*Colinus virginianus*), Canada geese (*Branta canadensis*), reptiles, and amphibians. Entomological research with beetles (Coleoptera), wasps (Hymenoptera), and dragonflies (Odonata), as well as forestry and botanical research with longleaf pine (*Pinus palustris*) and American chestnut (*Castanea dentata*) restoration are ongoing. A major new archaeological research initiative spans periods from 8,000 BCA through the Civil War to the mid 20th Century. These and other programs are now supported by grants from the National Science Foundation, the Getty Foundation, and many others. Visiting scientists from the U.S. and Europe are now conducting research on the campus.

Oral Presentation

MINNESOTA'S NATIVE PLANT COMMUNITY CLASSIFICATION: FORESTS, WOODLANDS, AND PRAIRIES

CONVERSE, CARMEN K.¹ and Michael D. Lee²

¹Minnesota Department of Natural Resources, 500 Lafayette Road, St. Paul, MN 55155; carmen.converse@dnr.state.mn.us

²Minnesota Department of Natural Resources, 940 Industrial Drive S. #103, Sauk Rapids, MN 56379; michael.lee@dnr.state.mn.us

Minnesota Department of Natural Resources (MN DNR) plant ecologists have completed publication of a three-volume series of field guides presenting a new statewide classification of Minnesota's terrestrial native plant communities organized by the state's four ecological provinces: Laurentian Mixed Forest Province, Eastern Broadleaf Forest Province, Prairie Parkland Province, and Tallgrass Aspen Parklands Province. The field guides include keys and other tools to enable field workers to apply the classification. The classification is based on multivariate analysis of vascular plant data from more than 5,200 plot samples from across the state, informed by landform, soils, and hydrology data. It is hierarchical, incorporating MN DNR's Ecological Land Classification System at higher levels and classifying existing vegetation into Native Plant Community Types and Subtypes at the lowest levels. Types are grouped into Classes, which are considered analogous to habitat types in many other classifications. Classes are grouped into Ecological Systems, based on major ecological processes. The classification provides a framework for forest, prairie, and wetland management and biodiversity protection. For example, the MN DNR is currently developing recommendations for management of native habitats at the level of the Native Plant Community Class. This presentation illustrates how this classification has been used for conservation planning and management.

Oral Presentation

EVOLUTION AND DEVELOPMENT OF A LAND ETHIC ON THE BABBITT RANCHES, NORTHERN ARIZONA

CORDASCO, WILLIAM C.¹ and Karan English²

¹Babbitt Ranches, P.O. Box 521, Flagstaff, AZ 86002; cobar@babbitranches.com

²Ecological Monitoring & Assessment Program and Foundation, Northern Arizona University, P.O. Box 5845, Flagstaff, AZ, 86011; Karan.English@nau.edu

Babbitt Ranches in northern Arizona cover 704,000 acres (270,000 privately held) on the Coconino Plateau, stretching from Cataract Canyon to the Little Colorado River. Babbitt Ranches supports native grasslands and provide habitat many wildlife species including pronghorn (*Antilocapra americana*), Gunnison's prairie dog (*Cynomys gunnisoni*), golden eagle (*Aquila chrysaetos*), and northern goshawk (*Accipiter gentilis*). Babbitt Ranches has a progressive land management philosophy inspired by Aldo Leopold's "Land Ethic." This ethic stresses the need to understand the natural landscape, and, as Leopold believed, the private landowner has an ethical obligation to be responsible for the health of the land. Babbitt Ranches takes Leopold's philosophy one step further in that they believe that humans are an active participant in the environmental process. Babbitt Ranches implements what they call a "land use ethic" and base management decisions on this ethic. A tangible example of this ethic is the donation of the Cataract Canyon Conservation Easement to The Nature Conservancy in 2000. This conservation easement protects 34,480 acres of ranchland from the threat of subdivision and preserves native grasslands and open spaces in an area that comprises an important watershed for Cataract Canyon, Havasu Canyon, and the Colorado River. In addition, Babbitt Ranches has developed long-term relationships with the Native American community through landscape-level planning, sharing of knowledge, and development of cooperative agreements. Babbitt Ranches also believes in the importance of education to the residents of northern Arizona. Babbitt Ranches co-founded the Ecological Monitoring and Assessment (EMA) Program and Foundation at Northern Arizona University. EMA provides a university-based framework for advancing the understanding of social, economic, and ecological factors affecting lands of the Southwest. Babbitt Ranches donated a 24-acre parcel of land to EMA where the Wild Bill Ecological Center will be built and also granted EMA research rights within the Babbitt Ranches' boundaries.

Oral Presentation

STRUCTURE AND COMPOSITION OF TALLGRASS PRAIRIE PLANT COMMUNITIES ALONG EAST-TO-WEST AND NORTH-TO-SOUTH GRADIENTS WITHIN THE CENTRAL UNITED STATES

CRAIG, JILL E. and John Harrington

Department of Landscape Architecture, University of Wisconsin, Madison, WI 53705, USA;
 jecraig@wisc.edu; jaharrin@wisc.edu

Studies exploring the distribution of plant species within the tallgrass prairie show a strong relationship to ecological gradients within relatively small distances encompassed by state boundaries. A broad-scale study by Diamond and Smeins considered the composition of 63 prairies spanning south-to-north from Texas to Canada. Based on the frequency of 42 perennial graminoids, sites ordinated along gradients of temperature and precipitation decreases, soil organic matter increases, and, less significantly, on gradients relating to soil pH and percent clay. Our study explores similar broad-scale relationships of plant community composition along ecological gradients from north-to-south and east-to-west in the upper Midwest. In 2005, 19 upland (dry-mesic to mesic) prairie remnants were sampled for plant community composition from Norman County, Minnesota to Riley County, Nebraska and from Dickinson County, Iowa to Jefferson County, Wisconsin. Sites were ordinated based on the frequency of select graminoids and forbs using Non-metric Multidimensional Scaling. Climatic conditions, soil texture, latitude, longitude, site size, and management practices were examined to identify relationships to plant community composition. Analyses to date show precipitation and temperature had the strongest correlation to the site ordination. Graminoids that had a strong influence on ordination values were: *Andropogon gerardii*, *Sorghastrum nutans*, *Schizachyrium scoparium*, *Poa pratensis*, and *Elymus trachycaulus*. Of these influential graminoids, frequencies of *A. gerardii*, *S. scoparium*, and *P. pratensis* were significantly different between the geographically distinct regions sampled. Additional sampling

and analyses are planned. We present information on grass and forb distributions in relation to site variables through maps and ordination.

Oral Presentation

OVERVIEW OF THE GRAND CANYON ECOREGION WILDLANDS NETWORK DESIGN

CRUMBO, KIM

Canyon Wildlands Council, 316 East Birch, PO Box 1594, Flagstaff, AZ 86023; kcrumbo@grand-canyon.az.us

The Grand Canyon Wildlands Council and collaborators recently completed a draft Wildlands Network Vision, a document that conceptually outlines an integration of science and management to protect and heal wild nature in the Grand Canyon ecoregion – from the High Plateaus of Utah, to the headwaters of the Little Colorado River in Arizona. Current federal land management planning affords land managers and conservationists a decadal opportunity to debate and implement the Vision's recommended management goals and objectives, a Vision that transcends political boundaries to protect and restore native biodiversity on an ecoregional scale. The Wildlands Network provides an inspirational landscape of safe havens (protected core regions) and safe passages (wildlife linkages) for all of the region's native wild biota. Our goal is not to capture a static vignette of a bygone era, but to "re-wild" the ecoregion, that is, to restore the promise and natural complexity of self-willed, naturally evolving wildlands. Land conservation in the past has taken the form of designating relatively small, protected areas. These are becoming islands of protected habitat in a sea of increasingly degraded lands, managed for static sets of characteristics and isolating natural components and processes in space and time. Just as real, isolated islands may lose native diversity, national parks like Grand Canyon continue to lose native species. Part of the solution requires designating additional, larger safe havens, such as wilderness and wildlife conservation areas, and other supplemental efforts are needed as well. Many native species inhabiting core areas require additional natural connections and dynamics that can be provided only through connectivity. Safe passages, connected landscapes allowing native plant and animal dispersal and evolution, are critical. A Wildlands Network provides most native species the possibility to flourish in a changing world of urbanization and climatic change. Other, complementary information is in a poster presentation.

Poster Presentation

SAFE HAVENS, SAFE PASSAGES: THE GRAND CANYON ECOREGION WILDLANDS NETWORK DESIGN

CRUMBO, KIM

Canyon Wildlands Council, 316 East Birch, PO Box 1594, Flagstaff, AZ 86023; kcrumbo@grand-canyon.az.us

This presentation provides details for the overview given in an oral presentation. The Grand Canyon Wildlands Council and collaborators recently completed a draft Wildlands Network Vision, a document that conceptually outlines an integration of science and management to protect and heal wild nature in the Grand Canyon ecoregion – from the High Plateaus of Utah, to the headwaters of the Little Colorado River in Arizona. Current federal land management planning affords land managers and conservationists a decadal opportunity to debate and implement the Vision's recommended management goals and objectives, a Vision that transcends political

boundaries to protect and restore native biodiversity on an ecoregional scale. The Wildlands Network provides an inspirational landscape of safe havens (protected core regions) and safe passages (wildlife linkages) for all of the region's native wild biota. Our goal is not to capture a static vignette of a bygone era, but to "re-wild" the ecoregion, that is, to restore the promise and natural complexity of self-willed, naturally evolving wildlands. Land conservation in the past has taken the form of designating relatively small, protected areas. These are becoming islands of protected habitat in a sea of increasingly degraded lands, managed for static sets of characteristics and isolating natural components and processes in space and time. Just as real, isolated islands may lose native diversity, national parks like Grand Canyon continue to lose native species. Part of the solution requires designating additional, larger safe havens, such as wilderness and wildlife conservation areas, and other supplemental efforts are needed as well. Many native species inhabiting core areas require additional natural connections and dynamics that can be provided only through connectivity. Safe passages, connected landscapes allowing native plant and animal dispersal and evolution, are critical. A Wildlands Network provides most native species the possibility to flourish in a changing world of urbanization and climatic change.

Oral Presentation

**BUREAU OF LAND MANAGEMENT'S NATIONAL LANDSCAPE CONSERVATION SYSTEM:
AMBITIOUS MISSION, ESSENTIAL PARTNERSHIPS**

DALY, ELENA C.

National Landscape Conservation System, Bureau of Land Management, Room 5618, 1849 C Street NW, Washington, DC 20240; elena_daly@blm.gov

The National Landscape Conservation System (NLCS) of the Bureau of Land Management (BLM) was created in June 2000 and encompasses 26 million acres of unique landscapes and public lands resources. The NLCS includes more than 800 federally designated areas with a variety of ecosystems, from cactus deserts and redwood groves to coastal zones and arctic tundra. The NLCS boasts thousands of rare plants and animals and encapsulates the cultural heritage of the West. The lands range from National Monuments, such as Arizona's Grand Canyon-Parashant and Vermilion Cliffs, to the ancient redwoods of California's Headwaters Forest and more. The mission of the NLCS is to conserve, protect, and restore these nationally significant landscapes recognized for their outstanding cultural, ecological, and scientific values. The NLCS aims to sustain local cultures, heritage, and resources through cooperation with local communities and stakeholders. The cooperative process furthers the spirit of the "Preserve America" initiative that directs Federal agencies to advance the protection, enhancement, and contemporary use of historic properties, particularly by seeking public-private partnerships to promote the use of such properties as a stimulus to local economic development. To achieve its ambitious mission for the NLCS, the BLM is pursuing innovative partnerships and, particularly, a community-based focus that involves citizen stakeholders and government partners who care about the cultural resources found on the public lands.

Oral Presentation

**A PROPOSAL TO DETERMINE HOW MUCH LOCAL PARTICIPATION IS NEEDED FOR THE
SUCCESSFUL DEVELOPMENT AND IMPLEMENTATION OF NATURE-BASED TOURISM
POLICIES IN PERU**

DE LA CRUZ-NOVEY, H. A.

University of Idaho, P.O. Box 441139, Moscow, ID 83844-1139; dela6098@uidaho.edu

Peru is the third largest country in South America and is recognized as one of the world's twelve megadiverse countries with its high degree of biodiversity. The government has established 61 protected areas. In the last 14 years, tourism activity has been identified as a tool for sustainable development and conservation for protected areas in Peru. In addition, the policies and regulations of the Peruvian protected area system have the goal of contributing to the improvement of the quality of life of local communities while promoting the sustainable use of the ecosystems. The purpose of this future study is to document and describe the tourism policymaking process, explore its implementation at the community level, and determine and compare the tourism benefits perceived by local communities and policymakers.

Poster Presentation

MONITORING URBANIZATION AND ECOLOGICAL SUCCESSION TO PROJECT FUTURE LANDSCAPE CHANGES

DEFEX, TULIA I.¹, William E. Grant¹, Roel Lopez¹, and Dusty Perkins²

¹Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX 77843-2258; tulidefex@tamu.edu; wegrant@tamu.edu; roel@tamu.edu

²Southern Plains Inventory and Monitoring Network, National Park Service, PO Box 329, 100 Ladybird Lane, Johnson City, TX 78636; Dustin_W_Perkins@nps.gov

Two major issues threatening the ecological integrity of national parks are 1) land-use practices of neighboring lands and 2) encroaching urbanization. As part of Phase III of the Inventory and Monitoring program for the National Park Service's Southern Plains Network (SOPN), protocols must be developed to monitor ecological indicators (vital signs) of ecological integrity. We used geo-referenced data on vegetative cover (VC) and urban growth to develop a methodology for representing the influence of urbanization and vegetative succession on changes in landscape structure in and around national parks. We calculated an urban influence index (UI) for each cell in a grid superimposed on the landscape of interest (LOI) based on the distances from cell centers to centers of all nearby towns and the population sizes of these towns (a) currently and (b) historically. We then correlated changes in VC in the LOI with changes in UI. Independently, we assigned probabilities of ecological succession (ES) from each vegetation type in the LOI to each other vegetation type, assuming no urban influence; these probabilities were based on expert opinion informed by historical trends. We then projected future changes in the LOI under several management scenarios with a spatially-explicit simulation model parameterized based on VC-UI correlations and ES. This methodology should be applicable to any landscape that currently is threatened with urbanization and/or disruption of ecological succession.

Oral Presentation

IMPACT OF DROUGHT AND BARK BEETLE OUTBREAK ON GROUND-DWELLING ARTHROPOD DYNAMICS IN PINYON-JUNIPER WOODLANDS IN THE MIDDLE RIO GRANDE BASIN

DELPH, ROBERT J.¹, Mike Clifford², Neil Cobb², and Paulette Ford³

¹Colorado Plateau Museum of Arthropod Biodiversity, Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ 86011; robert.delph@nau.edu

²Merriam-Powell Center, Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ 86011; mjc235@nau.edu; neil.cobb@nau.edu

³Rocky Mountain Research Station, 333 Broadway SE, Suite 115, Albuquerque, NM; plford@fs.fed.us

The purpose of this study was to document the impacts of bark beetle induced pinyon pine (*Pinus edulis*) mortality on ground-dwelling arthropod dynamics in response to severe drought in the pinyon-juniper woodlands of the Middle Rio Grande Basin (MRGB) in north-central New Mexico. At least four objectives of monitoring ground-dwelling arthropods were addressed: 1) to determine if there were any differences in species composition and relative abundances of ground dwelling-arthropods associated with environments experiencing high pinyon mortality and low pinyon mortality, 2) to find out how fine-scaled ground-dwelling arthropod dynamics are being affected by high levels of pinyon mortality, 3) to develop a synoptic reference collection of arthropod species occurring in the MRGB pinyon-juniper woodlands, and 4) to provide ecological information on the associated ground-dwelling arthropod community composition of the MRGB and how its impacts to vegetation changes through drought can be used as a model to assess impacts of drought in other ecosystems. Pitfall traps were used to quantify ground-dwelling arthropod dynamics in response to pinyon die-off. This tested the hypothesis that with the die-off of a co-dominant tree species, arthropod abundance, species richness, and dynamics changed. Due to the increased complexity of micro-habitats from fallen debris and dead pinyon pines, ground-dwelling arthropod abundance and species richness will increase. Analysis of arthropod abundance and species richness between high and low pinyon mortality environments showed no significant differences. Further analysis of individual arthropod taxa showed at least five indicator species, three that favored low pinyon mortality environments and two that favored high pinyon mortality environments. By understanding how arthropods are affected by drought we can use them as a model for determining how global climate change will affect species at higher trophic levels.

Oral Presentation

INVADERS OF THE NATIONAL PARKS – USING THE BROADCAST MEDIA TO INFORM ON COMPLICATED RESOURCE ISSUES

DEUSER, CURT¹, Mike Whateley², Elizabeth Smith³, and Linda Drees²

¹Lake Mead Recreation Area, NPS, 601 Nevada Hwy., Boulder City, NV 89005; Curt_Deuser@nps.gov

²Natural Resource Program Center, NPS, 1200 Oakridge Dr., Fort Collins, CO 80525; Mike_Whateley@nps.gov; Linda_Drees@nps.gov

³WorkinSyn Productions, 7391 Buffalo Ave., Takoma Park, MD 20912; workinsync@hotmail.com

The National Park Service (NPS) has created an Office of Education and Outreach within the Natural Resource Program Center. The goal of the office is to educate park staff and the public on a vast array of often complicated resource issues. A variety of mediums are used to inform audiences including workshops, radio spots, DVDs, interactive computer programs, and even messages printed on seed packets. This presentation highlights one of the products: a DVD entitled *Invaders of the National Parks*. This movie describes the impacts of tamarisk (*Tamarix* spp.) to the Southwest and an NPS resource management response, the Exotic Plant Management Team. The issue of invasive species control and Exotic Plant Management Team action is illustrated through a deployment of plant control experts at Arches National Park, Utah. This DVD was developed through a partnership of Montana State University M.F.A. Program in Science and Natural History Filmmaking and the NPS.

Poster Presentation

NATIONAL PARK SERVICE EXOTIC PLANT MANAGEMENT TEAMS – USING A TEAM APPROACH TO MANAGE INVASIVE PLANTS

DREES, LINDA

Natural Resource Program Center, NPS, 1200 Oakridge Dr, Fort Collins, CO 80525;
Linda_Drees@nps.gov

The National Park Service (NPS) Exotic Plant Management Teams (EPMT's) were created in 2000 as a new resource management tool, modeled after the approach to fight wildfires. The 16 NPS EPMT's are serving over 209 parks, controlling harmful invasive species that threaten natural and cultural resources. EPMT's have identified, treated, or monitored close to a quarter of a million acres and eradicated six species of exotic plants from parklands. EPMT's are also building capacity to meet the growing demand for information and technical resources to manage exotic plants. Other land management agencies are now considering adoption of the NPS model. This free-standing, professionally developed display describes program design, implementation, contracting, partnerships, and new technical capabilities such as the Alien Control Plant Management Database (APCAM).

Oral Presentation

ARE PRECIPITATION PATTERNS IMPORTANT WHEN USING FIRE AS A MANAGEMENT TOOL IN CHIHUAHUAN DESERT GRASSLANDS?

DREWA, PAUL B.^{1,2}, Debra P.C. Peters¹, and Kris M. Havstad¹

¹Jornada Experimental Range, USDA-Agricultural Research Service, Box 30003, New Mexico State University, Las Cruces, NM 88011; debpeter@nmsu.edu, khavstad@nmsu.edu

²Present address: Department of Biology, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106; paul.drewa@case.edu

Fire is more commonly employed as a management tool in shortgrass steppe of the American Southwest than in Chihuahuan Desert grasslands, where the natural fire regime is not entirely understood and fire is often assumed to delay perennial grass recovery. In July 1998, a lightning-initiated fire burned the eastern edge of MacKenzie Flats on the Sevilleta National Wildlife Refuge in central New Mexico and afforded an opportunity to evaluate plant community responses in a transition zone between shortgrass steppe and Chihuahuan Desert grassland. Five 64-100 m² plots were randomly established in both burned and unburned areas in each of two sites that were 1.5 km apart and dominated by the perennial grasses, black grama (*Bouteloua eriopoda*) and blue grama (*Bouteloua gracilis*). Plant species abundance was evaluated in plots in July 1998 and September-October 2001. Aerial cover of black and blue grama was initially greater in unburned than in burned areas, but this difference was not detected in 2001. Basal cover of black and blue grama was not affected by fire. Over time, aerial cover of perennial forbs decreased regardless of fire, while aerial cover of annuals increased as much as 5%, especially in unburned areas. From 1998-2001, growing season precipitation was 81-148% of the long-term average, and the amount of precipitation for either July or August exceeded monthly averages in each of the four years following fire. Our past research also demonstrates that rapid perennial grass recovery corresponds with copious amounts of precipitation immediately after prescribed fire in southern New Mexico. By contrast, when fire was prescribed during drought, perennial grass recovery has remained delayed. Thus, we advocate manipulative experiments that directly examine how precipitation patterns influence perennial grass recovery in the immediate post-fire environment. Results from such studies will refine burn prescriptions for Chihuahuan Desert grasslands.

Oral Presentation

A FRAMEWORK FOR PREDICTING INVASIVE PLANTS IN NATIONAL PARKS: PROOF OF CONCEPT USING *VERBASCUM THAPSUS* IN LAVA BEDS NATIONAL MONUMENT, CALIFORNIA

EDWARDS, THOMAS C.¹, D. Richard Cutler², Karen H. Beard³, Jacob R. Gibson³, and Daniel Sarr⁴

¹USGS Utah Cooperative Research Unit, College of Natural Resources, Utah State University, Logan, UT 4322-5290; tce@nr.usu.edu

²Department of Mathematics and Statistics, Utah State University, Logan, UT 84322-3900; Richard.cutler@usu.edu

³Department of Wildland Resources and Ecology Center, Utah State University, Logan, UT 84322-5230; kbeard@cc.usu.edu

⁴National Park Service, Klamath Network, 1250 Siskiyou Blvd, Ashland, OR, 97520-5011; dan_sarr@nps.gov

We developed a strategy for modeling the likelihood of invasive plant species occurrence in national parks using mullein (*Verbascum thapsus*) in Lava Beds National Monument in northern California as an example. The strategy was designed to meet four basic objectives: (1) develop models for extrapolating to unsampled regions the likely locations of invasive plant species, (2) examine the adequacy of the models for predicting the likelihood of occurrence of invasives using cross-validation methodologies, (3) develop a sampling strategy to assess the ability of the model(s) to accurately predict the locations of invasives, and (4) assess the validity of the models with an independent data set. Training data from Lava Beds were modeled using CART and translated into a spatially explicit depiction of occurrence likelihoods throughout the Monument. Model accuracies based on cross-validation of the training data were good, with estimates of 83% percent correctly classified, 51% specificity, 95% sensitivity, and 0.79 AUC. The resultant prediction map was next used to develop a stratified random sampling scheme for model validation. Strata included access (<250 m from roads, >250 m), and 4 likelihood of occurrence bins (0-25%, 26-50%, 51-75%, 76-100%). Points were censored by Lava Beds National Monument for safety and archeological concerns prior to field assessment. A total of 160 points were targeted for evaluation.

Oral Presentations

BUILDING A BRIDGE OF DIALOGUE BETWEEN THE OLD & NEW WEST: AN INTERACTIVE PANEL DISCUSSION ON THE ROLE OF COOPERATIVE EXTENSION IN NATURAL RESOURCE MANAGEMENT EFFORTS

EMANUEL, ROBERT¹, BARRON ORR², MEGHAN MALONEY¹, WADE ALBRECHT³, KERRY SCHWARTZ⁴, CORI DOLAN⁵, JEFF SCHALAU⁶, and TRENT TEEGERSTROM⁷

¹University of Arizona, PO Box 210036, Tucson, AZ 85721-0036; emanuel@ag.arizona.edu; maloneym@email.arizona.edu

²University of Arizona, Office of Arid Lands, 1955 E. 6th Street, Tucson, AZ 85721; barron@email.arizona.edu

³Coconino Co. Cooperative Extension, 2304 N. 3rd Street, Flagstaff, AZ 86004; walbrech@ag.arizona.edu

⁴Water Resources Research Center, University of Arizona, 350 N. Campbell Avenue, Tucson, AZ 85719; kschwartz@Ag.arizona.edu

⁵1311 E. 4th Street, Biological Sciences East Rm. 125, University of Arizona, Tucson, AZ 85721; cdolan@ag.arizona.edu

⁶Cooperative Extension, Yavapai County, 840 Rodeo Dr. #C, Prescott, AZ 86305;
jschalau@Ag.arizona.edu

⁷Department of Agricultural & Resource Economics, University of Arizona, PO Box 210023,
Tucson, AZ 85721-0023; tteegers@ag.arizona.edu

The Inter-mountain West is experiencing some of the most dramatic population growth and land development in the nation. From 1982 to 1997, developed land in the region grew by 2 million acres, or about half an acre per person, through conversion of agricultural land, forest, and natural open space. Urban and “exurban” population growth has an impact on natural resources, local landscapes, lifestyles, economies, and the local social fabric. The transition from a landscape that directly supports a livelihood to one that offers a lifestyle results in more landscape fragmentation and divergent management objectives that combine to threaten any kind of “sustainable” future. Demographic change often is accompanied by new issues and associated educational needs related directly and indirectly to land management. Education programs such as those conducted by Cooperative Extension are well-established in rural settings. In open spaces of the West, the traditional model of providing educational services that support profitable and sustainable agriculture is now being complemented by programs that promote successful stewardship and are related more to lifestyles rather than livelihoods in urban, suburban, and exurban populations. Some of the new educational topics include wildland fire, invasive species, water resources, small-scale livestock, wildlife, and recreation management. However, reaching this new clientele has proven challenging. This panel discussion provides an opportunity to share the preliminary findings of a small University of Arizona Extension research project focused on this challenge, as well as updates on related activities in other organizations. Using what has been learned to date combined with your experiences, our objective is to develop ideas for what ultimately could become regional strategy to extend the reach of natural resource education programs more explicitly into the urban and exurban market. We explicitly invite and encourage dialogue and active participation.

Oral Presentation

ROLE OF BISON IN NATIVE AMERICAN CULTURE AND HISTORY, THEN AND NOW

ENGQUIST, DALE¹, Sibdas Ghosh², Arthur Scott², and Mietek Kolipinski³

¹Indiana Dunes National Lakeshore, 1100 N. Mineral Springs Road, Porter, IN 46304;
dale_engquist@nps.gov

²Dominican University of California, Department of Natural Sciences and Mathematics, 50 Acacia Avenue, San Rafael, CA 9490; sghosh@dominican.edu

³National Park Service, Pacific West Regional Office, Oakland, CA 94607;
mietek_kolipinski@nps.gov

At one time, 40-70 million bison (*Bison bison*) roamed freely across America. It was from these herds that Native Americans derived their food, clothing, shelter, weapons, and countless other daily necessities. Above all else the bison was a highly venerated spiritual symbol representing abundance and transcendence. Once Europeans arrived and Americans moved westward under the umbrella of Manifest Destiny, the numbers of bison began to decline dramatically to the point of near extinction. The demise of the bison flowed from the War Department's conscious effort to drive the Native Americans off the plains by destroying the bison. European bison (*Bison bonasus*) was destroyed in the wild after World War I and saved from extinction in Poland. Dominican University of California is developing the U.S. portion of an international traveling bison exhibit in collaboration with the National Park Service, the Polish National Parks, and other partners. An exhibit will tour major museums and National Parks in both countries. Themes of the exhibit will include evolution of bison, the wide-ranging historic importance of bison as noble species and as symbols of conservation in the Northern hemisphere, restoration and conservation of bison

populations, current threats, diseases, and genetics. As a model/example for the rest of the exhibit, authors will present the story-line and graphics for the key topic: history and culture of Native Americans related to bison. Native Americans are consultants and participants in planning this project to capture their perspective and to assure a factual and dynamic product. A marketing effort has started to raise \$750,000 from partners to complete and support the exhibit which will be housed in a large traveling tent.

Oral Presentation

THE SE-EPPC VOLUNTEER MAPPING PROJECT: AIDING EARLY DETECTION AND RAPID RESPONSE USING THE STATE EPPCS

EVANS, CHRISTOPHER W.¹, Charles T. Barger¹, G. Keith Douce², and David J. Moorhead³

¹The Bugwood Network, University of Georgia, PO Box 748, Tifton, GA 31793; cevans@uga.edu; cbargero@uga.edu

²The University of Georgia, Department of Entomology, PO Box 748, Tifton, GA 31793; kdouce@uga.edu

³The University of Georgia, Warnell School of Forestry and Natural Resources, PO Box 748, Tifton, GA 31793; moorhead@uga.edu

Early detection of new invasive species allows for management activities to be implemented while infestations are small and eradication or suppression is more feasible. Land managers, biologists, amateur botanists, and private landowners all have the ability to identify these species, but may not know if they are new to that area and who to contact to report infestations. The Southeast Exotic Plant Pest Council's (SE-EPPC) mapping project provides a location for users to view and submit data on the distribution of invasive plant species throughout the Southeast United States. This project compiles the current distribution data from a variety of sources and uses volunteers from the state EPPCs to collect distribution data on common and new invasive species throughout the Southeast. All data collected are compliant with mapping standards of the North American Weed Management Area (NAWMA) and can be shared with most major mapping projects. Descriptive features of the infestation, such as habitat, infested area, and abundance, are included within the data. To ensure data validity, herbarium vouchers for recorded infestations are encouraged for submission to a local herbarium. Additionally, identification-level images can be uploaded with the infestation distribution data. The data can be viewed via an online mapping program available at www.se-eppc.org/mapping. This mapping program can show the distribution data either as point-data or county-level maps. The Google Maps web service is being used to allow users to overlay the point data with road maps, satellite images, and topographic maps. With the cooperation of the state EPPCs, this project can provide a reporting location for new infestations, help fill in the gaps in the distribution data, and provide users with an easy to operate method of retrieving the data.

Poster Presentation

INVASIVE PLANTS OF THE UNITED STATES: IDENTIFICATION AND CONTROL CD-ROM

EVANS, CHRISTOPHER W.¹, Charles T. Barger¹, David J. Moorhead², G. Keith Douce³, and Richard Reardon⁴

¹The Bugwood Network, University of Georgia, PO Box 748, Tifton, GA 31793; cevans@uga.edu; cbargero@uga.edu

²The University of Georgia, Warnell School of Forestry and Natural Resources, PO Box 748, Tifton, GA 31793; moorhead@uga.edu

³The University of Georgia, Department of Entomology, PO Box 748, Tifton, GA 31793; kdouce@uga.edu

⁴Forest Health Technology Enterprise Team, U.S. Forest Service, 180 Canfield Street Treatment Technology, Morgantown, WV 26505; rreardon@fs.fed.us

In 2003, the Bugwood Network, in cooperation with the U.S. Forest Service Forest Health Technology Enterprise Team (USFS-FHTET), developed the *Invasive Plants of the Eastern United States: Identification and Control* CD-ROM (FHTET-2003-08). Over 28,000 copies of this CD-ROM have been pressed and distributed free by USFS-FHTET. The CD has proven to be a useful tool for land managers, educators, researchers, private citizens, and others dealing with the issue of invasive weed species. The success of that project has encouraged the authors to develop the new CD-ROM project, *Invasive Plants of the United States: Identification and Control*. The project includes over 150 species of concern in the entire United States. The focus of this new CD-ROM will be providing identification, ecology, and control information for the worst invasive plants in the United States. This product compiles information in recent publications from leaders in invasive species management in the United States, such as U.S. Forest Service, U.S. Department of Agriculture Animal and Plant Health Inspection Service – Plant Protection and Quarantine, The Nature Conservancy, The Plant Conservation Alliance, The Southeast Exotic Pest Plant Council, and the Invasive Plant Atlas of New England. It will be available through the USFS-FHTET at no cost. For more information on this product, go to www.invasive.org.

Oral Presentation

MORPHOLOGICALLY CRYPTIC HOST RACE FORMATION IN THE POPLAR BUD GALL MITE *ACERIA PARAPOPULI*: EVIDENCE FROM THE INTERNAL TRANSCRIBED SPACER REGION OF NUCLEAR RIBOSOMAL DNA AND IMPLICATIONS FOR CONSERVATION BIOLOGY

EVANS, LUKE, Gery Allan, and Thomas Whitham

Department of Biological Sciences, Box 5640, Northern Arizona University, Flagstaff, AZ 86001; lme36@dana.ucc.nau.edu; gery.allan@nau.edu; thomas.whitham@nau.edu

Host race formation is a critical prerequisite to speciation and diversification and is of fundamental interest to ecologists and evolutionary biologists. Our study investigates morphologically cryptic host race formation in a common herbivore, *Aceria parapopuli*, which colonizes poplars (*Populus*: cottonwoods, aspen and poplars) throughout North America. Surveys of *A. parapopuli* within a *Populus* common garden demonstrate that mite colonization is strongly linked to host plant genetics. Molecular studies demonstrate genetic differentiation of mites among *P. fremontii*, *P. angustifolia*, their hybrids, and *P. tremuloides* in the wild. Thirteen variable nucleotide sites within the Internal Transcribed Spacer (ITS)1 region (nrDNA) of *A. parapopuli* show distinct genetic lineages. Mites from the same host species are genetically similar, even when separated by hundreds of kilometers, but mites from different host species are genetically distinct, even when separated by less distance. *Aceria parapopuli* found on *P. fremontii* x *P. angustifolia* hybrids had the greatest genetic variation and were distinct from those found on either pure species. To test if genetic lineages of *A. parapopuli* are locally adapted to specific *Populus* hosts, we are initiating reciprocal transplant studies in a greenhouse environment. If these studies show differential survival and reproduction on different hosts and their hybrids, our hypothesis of morphologically cryptic host race formation will be supported. Several conclusions would follow: 1) *Aceria parapopuli* represents a species complex, with cryptic species on different *Populus* hosts, 2) *Populus* diversification is linked to *A. parapopuli* diversification via synchronous speciation or radiation through host switching among *Populus*, and 3) Host plant genetic differentiation drives speciation in a dependent herbivore. If confirmed, our results will demonstrate a close ecological and evolutionary connection between a dominant tree species and a dependent herbivore, and

underscore the need to conserve ecologically important tree species as key drivers of species diversity.

Oral Presentation

DEVELOPING SCORECARDS FOR REPORTING THE CONDITION OF NATURAL RESOURCES

Faber-Langendoen, Don¹, Geri Tierney², BRIAN R. MITCHELL³, and Greg Shriver⁴

¹NatureServe, 3467 Amber Road, Syracuse, NY 13215; don_faber-langendoen@natureserve.org

²Department of Environmental and Forest Biology, SUNY College of Environmental Science & Forestry, 1 Forestry Drive, Syracuse, NY 13210; gtierney@esf.edu

³Northeast Temperate Network, National Park Service, 54 Elm Street, Woodstock, VT 05091; brian_r_mitchell@nps.gov

⁴University of Delaware, 257 Townsend Hall, Newark, DE 19716-2160; gshriver@udel.edu

NatureServe, the State University of New York (SUNY-ESF), and the National Park Service (NPS) are collaborating on a project to develop scorecards suitable for reporting the condition (ecological integrity) of natural resources at parks of the NPS Northeast Temperate Network (NETN).

Assessing current condition of an ecosystem requires selecting indicators and metrics of the structure, function, and composition of an ecosystem as compared to reference or benchmark sites operating within the bounds of natural or historic disturbance regimes. We have selected a suite of metrics and developed thresholds for each metric that will document forest condition during long-term ecological monitoring, and we will develop similar thresholds for the upcoming NETN freshwater wetland monitoring program. Field values for each metric are rated, and the individual ratings are aggregated into an overall rating of Good, Caution, or Poor based on rules provided in the scorecard. The condition thresholds will be built into monitoring databases, allowing automated reporting of resource condition immediately after data entry and QA/QC. Thresholds and the relative importance of different metrics will change over time, as new information becomes available. The databases will track changes to thresholds and allow for the preparation of revised scorecards that reflect this new knowledge. These scorecards provide a transparent and adaptive link between raw data and summary reports of resource condition that will be valuable to park managers and other interested constituencies.

Oral Presentation

CHARACTERIZING NATURAL SOUNDS IN GRAND CANYON NATIONAL PARK, ARIZONA

FALZARANO, SARAH¹ and Skip Ambrose²

¹Grand Canyon National Park, 823 N San Francisco St, Flagstaff, AZ 86001; Sarah_Falzarano@nps.gov

²Sandhill Company, 393 Castle Creek Ln, Castle Valley, UT 84532; skipambrose@frontiernet.net

Natural ambient sounds are important to wildlife survival, visitor experience, and as a resource itself in our National Parks. These sounds are increasingly masked or altered by human-generated noise. Grand Canyon National Park has numerous air-tour flights over backcountry areas and has been mandated by the 1987 National Parks Overflights Act to restore natural quiet in the Park. Natural sounds vary by time of day, season, weather, vegetation type, and other factors. Sound levels in summer in four main vegetation types were very low, often near the noise floor of the instruments (about 15 dBA). Daytime L90 values (the sound level exceeded for 90% of the measurement period) were between 17.0 dBA and 25.5 dBA, indicating that measured sound

levels were being influenced by the noise floor of the instruments, and actual sound levels were lower than recorded during this study. More sensitive equipment should be used in future studies. On average, human-generated sounds were audible to humans 34% of the time; most of these sounds were aircraft.

Oral Presentation

APPROACHES FOR EFFECTIVELY DELIVERING NATURAL RESOURCE INFORMATION TO NATURAL AREA MANAGERS, PLANNERS, AND INTERPRETERS

FANCY, STEVEN G.

National Park Service, Natural Resource Program Center, 1201 Oak Ridge Dr., Suite 150, Fort Collins, CO 80525; steven_fancy@nps.gov

National Park managers across the country are confronted with increasingly complex and challenging issues that require a broad-based understanding of the status and trends of the park's natural resources as a basis for making decisions, working with other agencies, and communicating with the public to protect natural systems and native species. As part of the National Park Service's efforts to "improve park management through greater reliance on scientific knowledge", the Inventory and Monitoring Program has implemented a major effort in partnership with other programs and agencies to collect, organize, and make available natural resource data and to facilitate the transformation of data into information through analysis, synthesis, and modeling. Recent approaches for making scientific data more available and useful for park managers, planners, interpreters, the scientific community, and the general public are described.

Poster Presentation

CHARACTERISTICS OF A SALINE PRAIRIE – WOODLANDS NATURAL AREA COMPLEX IN NORTHWEST LOUISIANA

FAULKNER, PATRICIA L.¹, Christopher S. Reid¹, Michael H. MacRoberts², Barbara H. MacRoberts², and Judy J. Jones¹

¹Louisiana Natural Heritage Program, Louisiana Department of Wildlife and Fisheries, P.O. Box 98000, Baton Rouge, LA 70898; pfaulkner@wlf.louisiana.gov; creid@wlf.louisiana.gov; jjones@wlf.louisiana.gov

²Herbarium, Museum of Life Sciences, Louisiana State University-Shreveport, Shreveport, LA 71115; MMacRoberts@lsus.edu

Surveys of a recently discovered natural area complex of saline prairies and woodlands in northern Desoto Parish in northwestern Louisiana have revealed a rich flora, including 16 state-listed rare plant species. This site was identified using the parish soil survey and aerial photographs. The saline prairie component in the complex totals 51 ha, the largest area of saline prairies currently documented from Louisiana. Little is known about Louisiana saline prairies and adjacent woodlands, with only six sites previously recognized and surveyed by Louisiana's Natural Heritage Program. All six sites have been altered and are threatened by competing landuse. Large portions of the newly identified complex are in pristine condition. This high-quality site provides an excellent opportunity to advance the characterization of saline prairies and woodlands of the Upper West Gulf Coastal Plain. The prairie openings contain broad grassy expanses with scattered pimple mounds, shallow depressions, and barren "salt licks". Woodlands surrounding the prairie are dominated by *Quercus similus* and *Ulmus crassifolia*, with codominants *Fraxinus pennsylvanica*

and *Gleditsia triacanthos*. Hawthorns, including *Crataegus brachycantha*, *C. marshallii*, *C. spathulata*, and *C. viridis*, are conspicuous in the understory and become more dominant at the woodland/prairie interface. State-rare *Forestiera ligustrina* is locally common in the woodlands. Sloughs containing *Taxodium distichum*, *Planera aquatica*, and *Cephalanthus occidentalis* are scattered in the woodlands, occurring in isolated depressions and along streams. The entire site is in non-industrial private ownership, and interactions with landowners have been very positive.

Oral Presentation

CREATION OF REFUGIA FOR THREATENED AND ENDANGERED FISHES

FERJANCIC, KENNETH P.

HDR|FishPro, 2 North Chamisa Drive, Suite J, Santa Fe, NM 87508; ken.ferjancic@hdrinc.com

State and federal agencies are required to protect dwindling populations of fish from extirpation by attempting to increase the populations to a level where delisting of the species is a goal. Traditional hatchery facilities have come under scrutiny in recent years for producing fish that may not be as fit phenotypically or genotypically as their wild counterparts. This presentation describes three rearing facilities custom-designed by HDR|FishPro to assist in the conservation of specific endangered fish species. Research into modifying conventional fish-rearing facilities has been conducted by federal and state agencies to determine the impacts of rearing fish in non-natural environments. HDR|FishPro incorporated these studies into a Spring/Summer Chinook (*Oncorhynchus tshawytscha*) rearing facility for the Nez Perce Tribe on the Clearwater River, Idaho, mimicking the natural environment for spawning, incubation, and fry and fingerling life stages. Another facility, built under contract to the New Mexico Interstate Stream Commission for the City of Albuquerque, is intended to benefit the endangered Rio Grande silvery minnow (*Hybognathus amarus*). It was designed to mimic as many natural conditions as feasible within the constraints of limited water, suitable land, and construction budget. These conditions included varying currents, velocity, depth, turbidity, streambed forms, coloration, and substrate. A second facility (under construction) has been designed with very different site constraints but with the same objective. The Minnow Sanctuary, funded by the Bureau of Reclamation, has similar traits but is constructed as a 1,400-foot long river. In a third project, the U.S. Fish and Wildlife Service, National Park Service, and Nevada Department of Wildlife are working with HDR|FishPro on the design of a naturalized refugium for the Devils Hole pupfish (*Cyprinodon diabolis*). This aboveground "hole" will recreate a set of conditions unique to the Devils Hole environment located in the Ash Meadows National Wildlife Refuge, Nevada.

Oral Presentation

ECOLOGICAL ASSESSMENT OF PIÑON-JUNIPER MORTALITY (2002-2005) IN MESA VERDE, COLORADO: A CASE STUDY LINKING RESEARCH TO MONITORING

FLOYD, M. LISA¹, William Romme², and David Hanna¹

¹Prescott College, 220 Grove Ave, Prescott, AZ 81301; lfloyd-hanna@prescott.edu; dhanna@prescott.edu

²Colorado State University, Ft. Collins, CO 80523; romme@warnercnr.colostate.edu

Ecological studies in the past four decades in Mesa Verde National Park (MVNP) focused on *Pinus edulis-Juniperus osteosperma* woodlands and may contribute fundamental information to NPS long-term monitoring programs. Floristic studies have been carried out by J. Erdman in the 1960's,

annually or intermittently by Park resource management, and by researchers during vegetation mapping projects (1991-1993, 2004) and post-fire assessments (1997-1999, 2002). For example, we documented expansion of cheatgrass (*Bromus tectorum*) after fires since 1989. We also investigated fire history using age and size structures of 24 woodlands. In 2004, the availability of these data allowed us to evaluate some of the long-term consequences of the recent piñon pine (*Pinus edulis*) die off caused by drought, rising temperatures, and *Ips confusus* infestations. By returning to established fire history plots, we found that an average 36% of the piñons and 11% of the junipers (*Juniperus oostersperma*) died during 2002-2004, with the largest size classes most heavily affected and a wide range in severity (0% to 86% mortality). Cover of native and invasive understory plant species suggests that succession in undisturbed soils under dead crowns favors native grasses, but there was no significant difference in cheatgrass cover under dead and live canopies and intercanopy spaces (Wilks Lambda=.778, F=21.6, p<.05). We are now determining patterns of reproduction and establishment in surviving piñons which produced mast seed crops in 2005. Germination and establishment is discussed relative to trends known from long-term monitoring in the region. Concerns surrounding current condition of woodland (e.g., piñon die-off, air pollution effects, and loss of native biodiversity) can potentially be addressed using a baseline of past assessments. Thus, MVNP provides a "case study" in which data collected for somewhat disparate ecological assessments might be unified into a benchmark for long-term monitoring of ecosystem conditions.

Oral Presentation

VEGETATION OF THE BAYOU METO-GRAND PRAIRIE AREA, ARKANSAS

FOTI, THOMAS

Arkansas Natural Heritage Commission, Suite 1500, Tower Bldg., 323 Center St., Little Rock AR 72201; tom@arkansasheritage.org

Maps of geomorphology, soils, and flood frequency, in combination with existing and historic vegetation data, were used to develop a predictive map of existing and potential vegetation in an area of approximately 3,000 km². The study area is within the Mississippi Alluvial Plain (MAP), an ecoregion that encompasses parts of Arkansas, Louisiana, Mississippi, Tennessee, Kentucky, Illinois, and Missouri. Landscapes in the MAP have been formed by rivers, with predominant substrates comprised of alluvial material deposited within the last 6,000-8,000 years. Much of the area is within floodplains of rivers and was originally covered with bottomland hardwood forests. However, large areas of the MAP, particularly in Arkansas, are mantled with glacial outwash deposits on terraces older than 12,000 years that are above current floodplains, are drier, and often originally supported open woodlands or prairies. Prairies and woodlands became established within the last 5,000 to 8,000 years and were maintained by frequent fire set by lightning and people. The Grand Prairie was the largest prairie in the region, including over 1,500 km² of prairie along with savannas and woodlands, bottomland forests, upland forests, and flatwoods forests (that have a combination of upland and bottomland species). Most forests have been cleared and streams have been leveed and/or channelized. Agriculture is the dominant land use. Groundwater use for irrigation is heavy and aquifers are declining. The study area encompasses two Corps of Engineers projects, the Bayou Meto project and the Grand Prairie project, that will increase surface water storage and water conservation and will also divert water from the White and Arkansas Rivers to augment rainfall and groundwater. The Bayou Meto project includes restoration of both bottomland hardwood and prairie wetlands, and this study was done to help develop protection and restoration priorities.

Oral Presentation

DEVELOPING A NATURAL AREAS LAND ACQUISITION PROGRAM
BY THE PARKS AND RECREATION COMMISSION OF WASHTENAW COUNTY, MICHIGAN

FREEMAN, TOM A.¹ and Sylvia Taylor²

¹Washtenaw County Parks and Recreation, 2230 Platt Rd., Ann Arbor, MI 48107;
freemat@ewashtenaw.org

²10353 Judd Rd., Willis, MI 48191; smtaylor@umich.edu

The Washtenaw County Natural Areas Preservation Program has been acquiring land in Washtenaw County since 2003. Initiated by the Washtenaw County Board of Commissioners through the passage of Natural Areas Ordinance #128, the Natural Areas Preservation Program protects unique natural areas which have aesthetic and practical benefits. The Washtenaw County Parks and Recreation Commission (WCPARC) administers the program and is advised by the Natural Areas Technical Advisory Committee (NATAC) which identifies land representing the natural ecological diversity/heritage of Washtenaw County. Properties nominated for consideration are reviewed by Parks staff and NATAC. Highly rated properties are also reviewed by the Washtenaw County Planning Advisory Board and the local unit of government. If the Parks and Recreation Commission elects to acquire a property, it has the authority to make the landowner a purchase offer equal to the fair market value of the land. Land purchased is maintained by WCPARC as nature preserves, with development limited to improvements facilitating access and passive uses. To date 780 acres of land have been protected, comprising 8 properties. This has been accomplished through fee simple acquisition and purchase of a conservation easement. Efforts are underway to foster collaboration between the Washtenaw County Natural Areas Preservation Program and other local preservation programs. A schedule of regular meetings of these organizations has been established. This has resulted in an agreement to share information among organizations on nominated properties and negotiations are underway on a “three-party” purchase of a property, involving the County and two communities.

Oral Presentation

CONSERVATION GENETICS AND COALESCENCE IN THE HAWAIIAN GENUS
ARGYROXIPHUM (ASTERACEAE)

FRIAR, ELIZABETH A.¹ and Robert H. Robichaux²

¹Rancho Santa Ana Botanic Garden, 1500 N. College Ave., Claremont, CA 91711;
Elizabeth.friar@cgu.edu

²Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, AZ 85721;
robichau@u.arizona.edu

The genus *Argyroxiphium* in the Hawaiian silversword alliance encompasses the “true silverswords”, with three species with basal rosettes of silvery-gray dagger-shaped leaves, plus the greensword (*A. grayanum*), which lacks the silvery hairs of the rest of the species. *Argyroxiphium kauense* is currently Federally listed as endangered, as is *A. sandwicense* subsp. *sandwicense*. *Argyroxiphium sandwicense* subsp. *macrocephalum* is currently listed as threatened. All of the species are restricted to high alpine areas of Maui and Hawaii. None of the species are known from more than three locations. Extensive genetically-informed reintroduction plans are in place for both endangered species. We discuss the recent genetic data on the diversity within and relationships among populations and species. We also describe the reintroduction programs for both species.

Oral Presentation

WILDLAND FIRE USE EFFECTS ON FOREST STRUCTURE OVER AN ELEVATIONAL GRADIENT, GRAND CANYON NATIONAL PARK, ARIZONA

FULÉ, PETER Z. and Daniel C. Laughlin

Ecological Restoration Institute and School of Forestry, Northern Arizona University, P.O. Box 15018, Flagstaff, AZ 86011; Pete.Fule@nau.edu; Daniel.Laughlin@nau.edu

We studied four fires that burned over approximately 7,865 ha on an elevational gradient in Grand Canyon National Park in 2003. The fires met criteria for Wildland Fire Use for Resource Benefits, the current U.S. policy for allowing the restoration of fire's ecological role in forest landscapes. We remeasured 82 permanent pre-established plots burned by the fires plus 43 additional plots on unburned companion sites. At the low-elevation pine-oak site, tree density declined, but basal area was unchanged. At the middle-elevation mixed-conifer site and the high-elevation spruce/fir/aspen site, where fire intensity (measured by maximum bole char) and severity (basal area mortality) were greater, both density and basal area declined. The thinning effect of fire was concentrated on smaller, shorter, and fire-susceptible trees. Small-diameter trees (<20 cm diameter) made up 79%-95% of all tree mortality. Shade-tolerant conifers experienced disproportionate mortality (31%-82% basal area decline), unlike fire-resistant ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) (2%-8% decline). This study showed that even after an unusually long fire-free period (1880-2003) had occurred at the middle- and high-elevation burned sites, fire effects were consistent with restoration of historical reference conditions. Fires simultaneously reduced the living, dead, and ladder fuels that made the forest vulnerable to uncharacteristically severe fire. These changes help make the forests more resistant to the expected increases in fire size and severity under future climate conditions.

Oral Presentation

THE KINO FRUIT TREES PROJECT: REPLANTING HISTORICALLY AND HORTICULTURALLY APPROPRIATE FRUIT TREES IN TUMACÁCORI NATIONAL HISTORICAL PARK, SOUTHEAST ARIZONA

GARCIA, JESUS M.¹ and ROBERT M. EMANUEL²

¹Arizona-Sonora Desert Museum, 2021 N. Kinney Rd., Tucson, AZ 85743-8918; jgarcia@desertmuseum.org

²Arizona Master Watershed Steward Program, University of Arizona, Forbes, Room 301, Tucson, AZ 85721-0036; emanuel@Ag.arizona.edu

In 2004, Tumacácori National Historical Park—an important mission site in southeastern Arizona—completed the acquisition of an original 5-acre mission orchard and a significant portion of its original agricultural area. It was on these lands in the late 17th and early 18th centuries that Jesuit missionaries such as Father Eusebio Francisco Kino and later Franciscans introduced European fruit trees to this portion of the New World catalyzing a watershed agricultural transformation for the region's peoples. The goal of the Kino Fruit Trees Project is to assist the National Park Service in replanting historically and horticulturally appropriate varieties of those fruit trees on this land. This has involved the project's team in an exciting blend of archival, ethnohistorical, ethnobotanical and horticultural methods, experiments, and adventures. We introduce the broad outlines of the project, discuss the results of a first year of work, and talk about new directions.

Oral Presentation

DROUGHT CONSEQUENCES FOR SOIL FUNGI AND HOW THEY FEED BACK TO AFFECT DOMINANT TREES IN THE SOUTHWESTERN U.S.

GEHRING, CATHERINE A., Kristin E. Haskins, Rebecca C. Mueller, and Thomas G. Whitham

Department of Biological Sciences & the Merriam-Powell Center for Environmental Research, Northern Arizona University, Flagstaff, AZ 86011; Catherine.Gehring@nau.edu, Kristin.Haskins@nau.edu, Rebecca.Mueller@nau.edu, Thomas.Whitham@nau.edu

Recent drought in the southwestern U.S. has had obvious impacts on the landscape through massive tree mortality. However, the belowground consequences of drought are less readily observed, although they may be important predictors of the responses of ecosystems to climate change. For example, the recent drought in the southwestern U.S. has significantly impacted belowground mycorrhizal fungi. Mycorrhizal fungi are widespread mutualists associated with plant roots that provide plants with increased access to soil nutrients and water in exchange for energy from photosynthesis. The abundance and species composition of these fungi can influence the distribution of plants and vice versa. In pinyon pine (*Pinus edulis*), a plant species heavily impacted by drought, the abundance and species diversity of mycorrhizal fungi has declined by approximately 50%, likely due to a combination of direct effects of drought on the fungi and indirect effects due to host plant mortality. Increases in herbivory as a consequence of drought also contribute to changes in mycorrhizal communities across the landscape. Studies in which tree stress is reduced through watering or competitor removal suggest that mycorrhizal fungal communities can rebound, but the capacity for this may be reduced as the drought continues and resistant propagules in the soil are diminished. In areas where pinyons are rare, pinyon seedlings are unlikely to be colonized by mycorrhizal fungi, resulting in decreased survival and growth. Our studies suggest that lack of suitable belowground mutualists may limit the ability of plants to recolonize areas of high plant mortality and suggest that an understanding of belowground-aboveground linkages is important in basic ecology, land management, and restoration.

Oral Presentation

ENDANGERED SPECIES CONSERVATION BANKING: HICKORY PASS RANCH AND GOLDEN-CHEEKED WARBLERS IN CENTRAL TEXAS

GLEN, ALAN M.

Smith|Robertson LLP, 221 W. Sixth St., Suite 1100, Austin, TX 78701; aglen@smith-robertson.com

There is an increasing trend across the country towards the establishment of conservation banks focused on federally listed endangered and threatened species. Indeed, in 2003 the U.S. Fish and Wildlife Service issued specific guidance on the creation of species conservation banks. Such banks can be a valuable tool in resource conservation, as they tend to promote an orderly approach to balancing and planning for species impacts and mitigation across regional landscapes. Most species banks generate mitigation or conservation credits by preserving, managing, and monitoring important endangered species habitats. These credits can then be sold to third-parties needing to mitigate for species impacts occurring within a "service area" prescribed for the bank. The process for creating a species conservation bank is relatively straightforward and culminates in the execution of a bank agreement between the banker and the Service. Nongovernmental organizations are sometimes involved in order to provide monitoring and/or enforcement assurances. Smith|Robertson and SWCA Environmental Consultants assisted in the creation of the Hickory Pass Ranch Conservation Bank for the endangered golden-cheeked warbler (*Dendroica chrysoparia*) in central Texas. Hickory Pass is a 3,000-acre ranch containing high

value warbler habitat. The Service favorably cited Hickory Pass in its announcement of the conservation bank guidance. The bank is notable not only for its significant habitat conservation, but also for its early financial success.

Oral Presentation

PINE HEALTH IN THE ASHLAND RESEARCH NATURAL AREA, OREGON

Goheen, Donald J.¹, Katy M. Mallams¹, and DIANE E. WHITE²

¹Southwest Oregon Forest Insect and Disease Service Center, 2606 Old Stage Road, Central Point, OR 97502; dgoheen@fs.fed.us; kmallams@fs.fed.us

²Rogue River-Siskiyou National Forest, 333 W. 8th Street, Medford, OR 97501; dewwhite01@fs.fed.us

The Ashland Research Natural Area was established in 1970 to provide examples of the “Pacific” ponderosa pine and ponderosa pine-Douglas-fir forests found west of the Cascade Range in southern Oregon. Considerable concern has developed in recent years about the condition of stands in the RNA and surrounding areas, especially as regards the health of their pine components. We stratified the RNA by Plant Association Group (PAG), overlaid the 570 ha area with a systematic 73 point grid, randomly chose 37 grid points weighted to sample PAGs proportional to area covered by each, and established permanently monumented plots at each sample point. Within plots we collected data on stocking by tree species, size, and condition and also measured amount of down wood to characterize potential fuel loading. We found that: 1) pines in the RNA are declining as evidenced by high levels of mortality, poor health of remaining live trees, and lack of regeneration, 2) shade tolerant tree species, especially Douglas-fir (*Pseudotsuga menziesii*) and white fir (*Abies concolor*), are proliferating and causing high levels of competition with the remaining pines, and 3) fuel loads are very high. Ponderosa Pine stands in southwest Oregon normally developed on burned sites and were maintained over time by rather frequent light to moderate intensity wildfires. Fire has been excluded from the Ashland RNA since 1910, and the current condition of the RNA reflects the result of its protracted absence.

Poster Presentation

RIPARIAN INVERTEBRATE COMMUNITIES OF SALT CREEK, CANYONLANDS NATIONAL PARK, UTAH: VARIABILITY AND FINDING INDICATOR TAXA

GRAHAM, TIM B.

USGS BRD, Southwest Biological Science Center, Canyonlands Research Station, 2290 West Resource Blvd, Moab, UT 84532; tim_graham@usgs.gov

Invertebrates represent all trophic levels above primary producers, perform many ecosystem functions, and thus provide a large pool of potential indicator taxa to monitor ecosystem condition. Before they can be used, we must know which taxa are present, what functions they perform, and how they respond to natural and anthropogenic disturbances. The road in Salt Creek in Canyonlands National Park was closed in 1998, providing an opportunity to document riparian ecosystem response to elimination of vehicles. Since the closure, Canyonlands has received significantly less precipitation than normal, overlaying the natural stress of drought on potential recovery from anthropogenic disturbance. Different invertebrate-trapping methods were used to sample a variety of taxa, looking for those taxa that could function as indicators of riparian condition. Open-road and lower cañon closed-road communities are more similar, and show

similar fluctuation patterns, while the no-road site communities resemble those of the upper end of the closed-road. Relative abundance of each order and fluctuations in abundance over time differ between upper and lower cañon sites. Differences associated with road closure have been difficult to discern given the pervasive influence of drought across the landscape, but some taxa show promise as indicators of recovery in the closed-road sites. Most specimens have only been identified to order at this point, but beetles and flies from some collection periods have been identified to families and ants have been identified to genus. There are qualitative and quantitative differences among the sites for these taxa at the family or genus level. As the samples are processed and specimens identified, taxa and trapping methods that appear to track changes among the management zones will be targeted for monitoring condition of the Salt Creek riparian ecosystems.

Poster Presentation

VEHICLES IN STREAMS: EFFECTS OF DRIVING THROUGH POOLS ON *BUFO WOODHOUSII* (WOODHOUSE TOAD) EGG SURVIVAL IN CANYONLANDS NATIONAL PARK, UTAH

GRAHAM, TIM B.

USGS Canyonlands Field Station, 2290 West Resource Blvd, Moab, Utah 84532;
tim_graham@usgs.gov

Effects of roads on species are varied, ranging from fragmentation and destruction of habitat, to providing corridors for invasive species. Roads in desert streams and riparian zones may have greater impacts since most desert organisms use riparian ecosystems for at least part of their lives. Off-road vehicle use is increasing on the Colorado Plateau; land managers face difficult decisions in balancing recreation demands with protection of sensitive habitats. Salt Creek in Canyonlands National Park contains the most extensive riparian ecosystem in the park besides the Colorado and Green River corridors. It was used extensively by livestock prior to 1964, with a four-wheel-drive road from at least the late 1940's; the upper end was gradually closed, only 20 km were still open in 1998. In July 1998, the upper 14 km of road were closed; approximately 6 km of the cañon remain open to vehicle use. The road crosses Salt Creek >60 times, and frequently the stream channel is the road. Since 2000, studies of amphibian population trends and arthropod community structure have been conducted in Salt Creek, with sites in the open-, closed-, and no-road segments. Known numbers of *Bufo woodhousii* eggs were placed in pools in road crossings of the open road. A vehicle was driven through the pool once at low speed and the number of eggs remaining in the pool was counted. A single pass through a pool significantly reduced the number of eggs recovered from the pool immediately after the pass. Breeding pools outside the roadbed provide some refugia, but allowing vehicles to drive through desert streams during amphibian breeding periods could alter the long-term sustainability of a population and its resistance to other perturbations, both natural and anthropogenic.

Oral Presentation

HELPING NATURAL AREA MANAGERS RESPOND TO NEW INVASIONS FROM CACTUS MOTH TO TAMARISK – NEW TOOLS FOR NEW THREATS

GROSS, SHARON K.

Invasive Species Program, USGS, 12201 Sunrise Valley Drive, MS 301, Reston, VA 20192;
sgross@usgs.gov

Hundreds of new non-native species from other countries are introduced intentionally or unintentionally into the U.S. every year. Many of these non-native species become invasive, posing risks to native species, valued ecosystems, and human and wildlife health. The increasing threat of new invasions intensifies the need for scientists, managers, and stakeholders to collaboratively build better systems to quickly detect and respond to new invaders; track, control, and manage/eradicate established invaders; and restore habitat damaged by invaders. The U. S. Geological Survey (USGS) has been developing tools and methods to assist in the early detection and assessment of invasive species. This presentation provides an overview of several of these efforts and includes a discussion on: an early warning system for aquatic invasive species developed through the USGS Nonindigenous Aquatic Species database in Gainesville, Florida, a cooperative effort between the USGS and Mississippi State University to develop and maintain a Cactus Moth Detection and Monitoring Network (CMDMN), the development of guided field surveys (or “smart surveys”) and predictive spatial modeling capabilities to provide information for targeted searches of invasive species on National Wildlife Refuges, and tools that are being developed to be used by managers to identify sites dominated by invasive species that have the highest likelihood of success for both control and restoration efforts (tamarisk, *Tamarix* spp., and leafy spurge, *Euphorbia esula*, are examples).

Poster Presentation

DEVELOPMENT OF THE RESTORATION RAPID ASSESSMENT TOOL

HAINES, DUSTIN F.¹, Diane Larson², and Ron Hiebert³

¹Department of Ecology, Evolution and Behavior, University of Minnesota, 100 Ecology Building, 1987 Upper Buford Circle, St. Paul, MN 55108; hain0072@umn.edu

²USGS Northern Prairie Wildlife Research Center, 100 Ecology Building, 1987 Upper Buford Circle, St. Paul, Minnesota 55108; dlarson@usgs.gov

³National Park Service, Northern Arizona University, PO Box 5765, Flagstaff, AZ 86011-5765; Ron.Hiebert@nau.edu

Land managers face considerable challenges in designing and implementing habitat restoration projects. First, the methods used to assess site conditions are highly variable, from brief visual surveys without data collection, to in-depth, multi-disciplinary assessments over the course of several years. When professional assessments of restoration experts are not available, decisions may be inappropriate or left to instinct. There is rarely adequate funding and time to address all restoration needs within a given park or jurisdiction. Finally, records of the decision-making process are irregularly or never kept, hindering informed decision making for future projects. We have initiated development of a computer-based decision support tool for restoration projects within National Parks for rapidly assessing site conditions, standardizing the way that decisions are made, prioritizing areas for restoration, and documenting the process. The Restoration Rapid Assessment Tool (RRAT) relies on visual indicators that can be rapidly scored in the field, as well as factors such as stressors and intrinsic values of the sites. We focused on riparian restorations for developing the prototype of the RRAT, as riparian areas are among the most impacted in National Parks. Multiple riparian, stream, and river restoration ecologists and practitioners were interviewed to determine the information and logic they use to make restoration decisions. We then developed a computer expert system based upon these interviews and published restoration literature, using the program Corvid by EXSYS Inc. We present a model appropriate for most riparian areas of the contiguous United States.

Oral Presentation

CONSERVATION GENETICS OF NORTH AMERICAN BISON: A TALE OF TWO RECOVERIES?

Halbert, Natalie, Joe Templeton, and JAMES DERR

Department of Veterinary Pathobiology, College of Veterinary Medicine, Texas A&M University, College Station, TX 77843-4467; nhalbert@cvm.tamu.edu; jtempleton@cvm.tamu.edu; jderr@cvm.tamu.edu

Conservation biology is sometimes viewed as a “crisis discipline” because most species of interest are critically threatened in some way. However, the recovery of North American bison (*Bison bison*) is one of the best documented success stories in all of conservation biology. Bison suffered an infamous population bottleneck that lasted from the early to mid-1800s to about 1905 when animal numbers were reduced from millions to less than a few hundred distributed across North America in small and severely fragmented populations. It is fashionable to blame the disappearance of free-ranging bison on “buffalo” hunters, but clearly a more complex series of events devastated the bison herds. For example, extreme and unusually harsh weather conditions for nearly a decade in the 1870s, exotic livestock diseases imported from Europe and Africa, and competition for resources with increasing numbers of imported domestic grazers clearly had a major impact on the decline of the great bison herds. Regardless of these issues, most modern bison populations appear to be relatively free of fitness-related problems usually associated with severe population bottlenecks and, for the last 50 years, their recovery has seemed assured. However, the recent discovery that most bison populations contain evidence of domestic cattle genetics has led to an increased concern for the long-term conservation of this species. In fact, a second recovery of bison appears to be underway that is centered on the genetic history and lineage of specific populations. In possibly the most comprehensive genetic evaluation of any wildlife species, we have recently completed studies using modern technologies to examine genetic diversity and evaluate the genetic integrity of major bison populations across North America. These studies focusing on the genetic recovery and long-term conservation of bison germplasm should serve as a model in the rescue of other threatened wildlife species.

Oral Presentation

CLIMATE CHANGE, THE ULTIMATE CONSERVATION CHALLENGE? AN EVOLUTIONARY PERSPECTIVE.

HAMRICK, J. L.

Departments of Plant Biology and Genetics, University of Georgia, 2512 Plant Science, Athens, GA 30609; hamrick@plantbio.uga.edu

Plant species have experienced climatic fluctuations throughout their evolutionary history. Some historical climatic changes have been gradual while others have apparently been quite abrupt. The paleo-ecological record has shown that such rapid climatic changes have caused dramatic geographic shifts in plant communities. Such region-wide climatic changes also may adversely affect the geographic distribution and population sizes of plant species, leading perhaps to their extinction. Predictions made in response to current global warming indicate that the ranges of many dominant tree species will be displaced northward. Concern has been expressed that species may be unable to disperse to locations with suitable habitats and/or adapt to the rapidly changing environment and as a result, will go extinct. I argue that the results of more than 80 years of plant evolution studies have shown that it is likely that common plant species should survive the expected climatic changes. The combination of geographically associated adaptive variation and their adaptation to microhabitat conditions (e.g., slope aspect and poor soils) should provide adequate standing genetic variation for species to respond to the expected climatic changes. Locally distributed, habitat specialists may experience more drastic effects with some

species being unable to disperse to patchily distributed, suitable habitats. Other locally distributed species may significantly expand their ranges in response to the predicted climatic changes. We have a very poor ecological and evolutionary understanding of what allows some species to increase their ranges while other, apparently very similar, congeners have limited distributions.

Oral Presentation

VEGETATION OF SOUTHERN COLORADO PLATEAU NATIONAL PARKS

HANSEN, MONICA¹ and Kathryn Thomas²

¹US Geological Survey, Southwest Biological Science Center, P.O. Box 5614, Northern Arizona University, Flagstaff, AZ 86011; mlhansen@usgs.gov

² US Geological Survey, Southwest Biological Science Center, 125 Biological Sciences East, Bldg. 43, University of Arizona, Tucson, AZ 85721; kathryn_a_thomas@usgs.gov

The United States Geological Survey (USGS) Colorado Plateau Research Station and Sonoran Desert Research Station are collaborating with the National Park Service (NPS) Southern Colorado Plateau Network Inventory and Monitoring Program (SCPN) to classify and describe the vegetation of Canyon de Chelly National Monument, Mesa Verde National Park, Petrified Forest National Park, Sunset Crater National Monument, Walnut Canyon National Monument, and Wupatki National Monument. Vegetation samples were collected in the parks during 1999-2004 and were combined with existing datasets to conduct a vegetation community analysis. Plant communities were described, in collaboration with NatureServe, using the evolving National Vegetation Classification System (NVC) and include barren, sparse, grassland, shrubland, dwarf-shrubland, steppe, woodland, and forest cover types. Seventy-five NVC alliances, 106 associations, and 24 park special vegetation types were described and mapped using 153 map labels. These are some of the first of the 19 parks in the SCPN to be mapped using the NVC standards for describing vegetation. We discuss the community analysis, vegetation community composition for each of the NPS units, and the implication of vegetation classification for vegetation mapping on the Colorado Plateau. We will also compare trends in vegetation communities within and among SCPN NPS units.

Oral Presentation

POTENTIAL EFFECTS OF CLIMATIC CHANGE ON TERRESTRIAL ECOSYSTEM PROCESSES IN THE SOUTHWEST

HART, STEPHEN C.^{1,3} and Bruce A. Hungate^{2,3}

¹School of Forestry, Northern Arizona University, Flagstaff, AZ 86011; steve.hart@nau.edu

²Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ 86011; bruce.hungate@nau.edu

³Merriam-Powell Center for Environmental Research, Northern Arizona University, Flagstaff, AZ 86011

The hypothesized increase in global mean annual temperatures of 1.5-4.5 °C over the next 50-100 years due to the production of greenhouse gases is likely to dramatically impact terrestrial ecosystems of the southwestern U.S. This is because of the strong temperature dependence of most biological and chemical processes, including organic matter decomposition, soil nutrient transformations, and plant nutrient uptake. The emission rate of greenhouse gases from soils is also influenced by temperature, potentially resulting in positive feedbacks to climatic change.

However, it is less clear whether or not increases in precipitation will accompany increases in air temperature as the concentration of greenhouse gases rise in the atmosphere. In the arid to semi-arid regions of the Southwest, where water availability is a major driver of terrestrial ecosystem processes, understanding how precipitation patterns are altered by climatic change is paramount for predicting the structural and functional responses of ecosystems to a future climate. In this presentation, we discuss results from completed and ongoing climatic change studies in the Southwest that evaluate experimentally how future increases in temperature and changes in water dynamics may impact terrestrial ecosystem processes in the Southwest.

Poster Presentation

LARGE-SCALE SEED HARVEST FOR MIDWESTERN TALLGRASS ECOSYSTEMS

HAUSER, CHRISTOPHER and Drew Ullberg

Forest Preserve District of Kane County, 719 Batavia Avenue, Geneva, IL 60134;
hauserchristopher@co.kane.il.us; ullbergdrew@co.kane.il.us

Large restoration projects in Midwestern tallgrass ecosystems rely on a large volume of native seed representing hundreds of plant species. Here we present techniques for economically harvesting and processing native seed on a large scale. Various harvest techniques include modified agricultural combines, smaller specialized seed strippers, and hand harvesting using volunteer labor. Once the plant material is harvested and dried, it must be processed to remove seed from the dried pods and heads. Traditionally, seed was "cleaned" by hand, but larger restoration projects require mechanization. To process large volumes of plant material, we recommend using a hammermill attached to a cyclonic vacuum. Processed material can be screened to partially purify the seed and reduce bulk, but this is not necessary. Using these techniques, a small crew of staff and volunteers can harvest thousands of pounds of seed representing a diversity of several hundred native species.

Oral Presentation

RECENT DEVELOPMENTS IN CONSERVATION GENETICS: EXAMPLES FROM ENDANGERED TOPMINNOWS, WOLVES, AND FLORIDA PANTHERS

HEDRICK, PHIL

School of Life Sciences, Arizona State University, Tempe, AZ 85287; philip.hedrick@asu.edu

Genetic variation may be divided into neutral, detrimental, and adaptive components, and I discuss examples for detrimental variants from Florida panthers (*Puma concolor coryi*) and Mexican wolves (*Canis lupis baileyi*). Understanding both population structure and effective population size are fundamental to conservation genetics. I illustrate various aspects of these concepts by application of neutral markers and simple theoretical considerations. (1) Measuring population structure using highly variable markers, such as microsatellites, may give values that are smaller than for markers with less variation. I discuss a new standardized measure that is appropriate for different types of genetic markers and different species. (2) Often the past population size of endangered species is not known or difficult to estimate. Using museum samples from around 1890, the bottleneck size of Florida panthers was estimated as around two individuals for two consecutive generations.

Oral Presentation

FOUR CORNERS FLORA PROJECT: LESSONS FROM INTENSIVE FIELD SURVEYS

HEIL, KENNETH D.¹, Steve L. O’Kane, Jr.², Linda M. Reeves¹, and Arnold Clifford¹

¹Department of Math and Science, San Juan College, Farmington, NM 87402

²Department of Biology, University of Northern Iowa, Cedar Falls, IA 50614

The Four Corners region, encompassing portions of Arizona, Colorado, New Mexico, and Utah, is one of the most floristically diverse regions of the Colorado Plateau. A flora project for the San Juan River Basin, ongoing for more than 15 years through San Juan College, is nearing completion and should be published in 2007. The inception, history, and goals of this flora project are presented. Many species new to science and to the region have been documented, some of which are rare and potentially threatened by development. An overview of the geology, plant communities, new and interesting species, and the flora is provided, concentrating on rare species and novel plant communities. As field and herbarium studies elsewhere in the western U.S. have shown, the pace of discovery of newly described species and new range extensions remains high.

Oral Presentation

A TONGUE-IN-CHEEK LOOK AT THE EXOTIC PLANTS AND ANIMALS IN THE LAND OF THE WEIRD & BIZARRE – SOUTH FLORIDA

HELFFERICH, BILL

South Florida Water Management District, 3301 Gun Club Rd., West Palm Beach, FL 33406;
whelffer@sfwmd.gov

It seems that the world’s strangest and worst exotic species have come to south Florida. Everyone with access to the Internet has seen the photo of the Burmese python whose eyes were bigger than its stomach and exploded after eating an alligator. Thanks to unwitting (or half-witted) animal lovers who decided it was more humane to release their one-year old, nine foot long python than kill it, we now have a breeding population in Everglades National Park, as well as downtown Miami. Twenty years ago we thought south Florida’s natural areas would be overrun with *Melaleuca*. Today control of it is almost an afterthought when compared to Old-World climbing fern that completely engulfs Everglades tree islands, cypress domes, and pine flatwoods with equal disregard, or shoe button ardisia, which grows in the understory of Brazilian pepper so thick that bulldozers have to clear paths so exotic treatment crews can work. The U.S. Fish & Wildlife Service is trying to contain the Gambian pouch rat (), which grows to 10 pounds, to the Florida Keys. Thanks to Ponce de Leon, the Spaniards brought the domestic pig to Florida in 1521, which quickly became feral and has been raising hell ever since. Flocks of parrots and parakeets are found in our urban parks, snakefish burrow long tunnels into the mud to survive the dry season, walking catfish flop and wiggle across suburban lawns and roads, the beautiful but highly venomous red lionfish is now found swimming on offshore reefs not only in Florida but along the entire eastern seaboard, and there are unconfirmed reports of anacondas and cobras. Sound like a great place to live? Come on down, everyone else is.

Oral Presentation

AN INTEGRATED FRAMEWORK FOR ASSESSMENT, MONITORING, AND MANAGEMENT OF GRASSLAND, SHRUBLAND, AND SAVANNA ECOSYSTEMS

HERRICK, JEFFREY E.¹, Brandon T. Bestelmeyer¹, Steven Archer², Arlene J. Tugel³, Joel R. Brown³, James P. Ward¹, Al Rango¹, and Kris M. Havstad¹

¹USDA ARS, Jornada Experimental Range, Las Cruces, NM 88003; jherrick@nmsu.edu; bbestelm@nmsu.edu; jameswar@nmsu.edu; alrango@nmsu.edu; khavstad@nmsu.edu

²School of Natural Resources, University of Arizona, Tucson, AZ 85721; sarcher@ag.arizona.edu

³USDA NRCS, Jornada Experimental Range, Las Cruces, NM 88003; atugel@nmsu.edu; joelbrow@nmsu.edu

We describe an integrated framework for organizing, synthesizing, and applying our growing understanding of grassland, shrubland and savanna ecosystems using a flexible, multi-objective assessment, monitoring, and management approach. The framework is dual-purpose: (1) to coordinate the use of existing tools, resources, and diffuse knowledge and (2) to facilitate the integration and application of new knowledge as it is developed. In particular, this framework must facilitate the integration of new knowledge about linkages among landscape units across scales. The framework includes five elements: (1) an ecological site-based approach for categorizing land based on soils and climate, (2) a repository for organizing existing data and knowledge about each ecological site, (3) conceptual models that organize information on the impacts of management and climate variability, and protocols for (4) assessing and (5) monitoring key ecosystem attributes fundamental to a variety of management objectives. Within this framework, basic and applied research are explicitly linked to management of arid and semiarid ecosystems to more effectively articulate research questions and set research priorities. This general approach is currently being applied throughout the western United States. Elements are being independently adapted for application in Canada, Mexico, China and Mongolia. We present specific examples, including one from the National Park Service Chihuahuan Desert Network, and discuss how it can be adapted to address multiple objectives in diverse ecosystems. We also briefly discuss the potential use of small, remotely piloted airplanes (UAVs) for landscape-scale assessment and monitoring programs.

Oral Presentation

THE FLORIDA ECOLOGICAL GREENWAYS NETWORK: PROTECTING A STATEWIDE FLORIDA BLACK BEAR (*URSUS AMERICANUS FLORIDANUS*) METAPOPULATION AND FLORIDA'S BIODIVERSITY

HOCTOR, TOM S.

GeoPlan Center, Department of Landscape Architecture, University of Florida, Gainesville, FL 32611; tomh@geoplan.ufl.edu

Work on a statewide Florida greenways network began in the early 1990s. This resulted in the creation of the Florida Greenways Program, which is administered by the Office of Greenway and Trails in the Florida Department of Environmental Protection. The Florida Ecological Greenways Network (FEGN) is the ecological component of the program and identifies the best opportunities for protecting large, connected landscapes across the state. In the last five years the FEGN has been prioritized, updated, and reprioritized in 2005. Most of the highest priorities in the FEGN, called Critical Linkages, are extremely important for maintaining or restoring connections among Florida black bear populations. These projects, including the Ocala National Forest-Osceola National Forest-Okefenokee National Wildlife Refuge reserve network and the Northwest Florida

Greenway project, are discussed. If protection of these large landscape linkages is successful, there is still a great opportunity to protect a statewide bear metapopulation that will better maintain genetic diversity and overall population viability. As a flagship and umbrella species, protecting large landscapes for the Florida black bear will greatly benefit overall biodiversity conservation efforts. However, development and loss of habitat are rapidly occurring and efforts to expand land acquisition programs and sound growth management planning will be essential for accomplishing these goals. Initiatives include extending the current state land acquisition program beyond 2010 and significantly increasing funding levels, modifying growth management to decrease sprawl and protect important landscapes, protecting road frontage from development within critical wildlife corridors, and encouraging expansion of local land acquisition programs.

Oral Presentation

HABITAT CHARACTERISTICS OF HENSLOW'S SPARROW WINTERING IN SALINE SOIL BARRENS OF SOUTHERN ARKANSAS

HOLIMON, WILLIAM C.¹, C. Theo Witsell¹, William H. Baltosser², and Catherine W. Rideout³

¹Arkansas Natural Heritage Commission, 1500 Tower Building, 323 Center Street, Little Rock, AR 72201; billh@arkansasheritage.org; theo@arkansasheritage.org

²University of Arkansas at Little Rock, 2801 S. University Drive, Little Rock, AR 72204; whbaltosser@ualr.edu

³Arkansas Game and Fish Commission, #2 Natural Resources Drive, Little Rock, AR 72205; cwrdeout@agfc.state.ar.us

Henslow's Sparrow (*Ammodramus henslowii*) is a grassland bird that has declined dramatically over the past half-century following high rates of conversion of grassland habitat to other land uses and interruption of disturbance processes. Though breeding habitat requirements are well documented, few studies of their winter habitat requirements have been completed. Studies to date on winter habitat associations have focused on estimating density of Henslow's Sparrow and characterizing their vegetation preferences in longleaf pine (*Pinus palustris*) savanna and pitcher plant (*Sarracenia* spp.) bogs within the longleaf pine ecosystem of the southeastern United States. We investigated density of Henslow's Sparrow and their habitat preferences in saline soil barrens that occur within loblolly pine (*P. taeda*) and shortleaf pine (*P. echinata*)-oak (*Quercus* spp.) forest and flatwoods in the South Central Plains of southern Arkansas. This species was only recently described as regularly wintering as far north as southern Arkansas. Surveys for wintering Henslow's Sparrow were conducted throughout all saline soil barrens at Warren Prairie Natural Area to estimate density. We estimated habitat characteristics by sampling vegetation in circular plots of 5-m radius centered where the first 30 Henslow's Sparrow were first flushed. We also sampled vegetation in 30 plots randomly located throughout the saline soil barrens. The number and density of Henslow's Sparrows observed and their habitat preferences are discussed.

Oral Presentation

UPLAND FREE WATER AND WILDLIFE: PAST, PRESENT, AND FUTURE ON THE COLORADO PLATEAU

HOLTON, BRANDON¹, Jan Hart², and David Mattson³

¹Center for Environmental Sciences and Education, P.O. Box 5694, Northern Arizona University, Flagstaff, AZ 86011; pbh5@nau.edu

²Colorado Plateau Research Station, P.O. Box 5614, Northern Arizona University, Flagstaff, AZ 86011; Jan.Hart@nau.edu

³USGS Southwest Biological Science Center, Colorado Plateau Research Station, P.O. Box 5614, Northern Arizona University, Flagstaff, AZ 86011; David_Mattson@usgs.gov

Humans dramatically altered the temporal and spatial availability of free water during the past century in uplands of the Colorado Plateau. With the exception of National Park Service (NPS) jurisdictions, livestock producers and wildlife and public land managers installed numerous catchments, wells, troughs, and tanks to disperse livestock and provision both livestock and water-dependent wildlife with water. In contrast to times before European settlement, when naturally occurring free water was rare and irregularly distributed, there are currently few areas beyond range of free water for mobile wildlife, even in NPS units. Recent work in the Flagstaff area has confirmed that human-made devices substantially prolong and more uniformly distribute free water. Moreover, heavy use by elk and ravens is consistent with speculations that the presence of both species, considered to be faunal resources by the NPS, depends on artificial waters in the Flagstaff uplands. Perhaps more surprising, carnivores and birds are nearly the sole users of natural waters in NPS units, whereas herbivores more heavily use artificial waters on flatter open sites in adjacent non-NPS jurisdictions, presumably to reduce risk of predation and raising the prospect that human-made watering devices have modified predator-prey dynamics. The future probable drying and more certain warming of the Colorado Plateau raises questions about other effects of artificial upland waters on NPS resources – effects undoubtedly expressed at multiple scales and encompassing vegetation, soils, and hydrology. Artificial upland waters pose yet another conundrum regarding how we reconcile conservation of valued resources with policy-based prescriptions of “naturalness”, especially when facing the impacts of human-driven climate change.

Oral Presentation

POPULATION GENETIC ANALYSIS OF *POPULUS FREMONTII*, AN ECOLOGICALLY IMPORTANT FOREST TREE: IMPLICATIONS FOR POPULATION AND CONSERVATION BIOLOGY OF NATURAL RIPARIAN AREAS

HONCHAK, BARBARA¹, Gery Allan¹, Thomas Whitham¹, and Paul Keim^{1,2}

¹Department of Biological Sciences and the Environmental Genetics and Genomics Laboratory, Northern Arizona University, PO Box 5640, Flagstaff, AZ 86011-5640; Barbara.Honchak@nau.edu; Gery.Allan@nau.edu; Thomas.Whitham@nau.edu

²The Center for Microbial Genetics and Genomics, Northern Arizona University, PO Box 5640, Flagstaff, AZ 86011-5640; Paul.Keim@nau.edu

The genus *Populus* is rapidly becoming a model for molecular genetics and genomics research and is the first forest tree genome to be sequenced. Despite this advancement there is very little information about the population genetic structure of individual *Populus* species. *Populus fremontii* is found throughout the southwestern United States and is an ecologically important foundation species in natural riparian areas including those in national parks, national monuments, and national wildlife reserves. In this study, we examine how genetic variation is distributed both within and among populations of *P. fremontii* using Amplified Fragment Length Polymorphisms (AFLPs). The AFLP method is a rapid genetic screening technique that allows assessment of genome-wide variability and population structure. In particular, we ask the following questions: 1) how genetically distinct are different populations of *P. fremontii*, 2) are different genotypes of *P. fremontii* geographically structured, and 3) how extensive is gene flow across populations in the Southwest. Answers to these questions will yield: 1) a better understanding of how genetic variation in dominant trees is partitioned across broad geographic areas, 2) critical genetic information for conservation biologists seeking to understand how to best manage dominant tree species within natural riparian areas, and 3) a yardstick for ecologists interested in measuring the relationship

between genetic diversity in dominant tree species and the biodiversity of riparian environments. Thus, we expect information obtained from this study to be of use to land managers, conservationists, ecologists, and researchers studying the genetics and genomics of *Populus*.

Oral Presentation

IMPLEMENTATION OF A MULTI-SCALE ECOSYSTEM MONITORING PROGRAM FOR SONORAN DESERT NETWORK PARKS

HUBBARD, J. ANDY¹ and CHERYL MCINTYRE²

¹Sonoran Desert Network, 7660 E. Broadway Blvd, Suite 303, Tucson, AZ 85710; Andy_Hubbard@nps.gov

²Sonoran Institute, 7650 E. Broadway Blvd., Suite 203, Tucson, AZ 85710; cmcintyre@sonoran.org

Increasingly, land management agencies are charged with developing and implementing comprehensive long-term ecosystem monitoring programs with multiple and often competing objectives. High-quality ecological information on a subset of key ecosystem parameters or “vital signs” can provide critical and timely information for decision makers at local scales. From regional and national perspectives, generalized results for topics and parameters of broad interest provide an assessment in aggregate of the state of resources across large areas with varying land management goals and practices. Initiated in 2001, the Sonoran Desert Network is a recent example of a monitoring program mandated to meet multiple objectives. Comprised of 11 National Park Service units totaling nearly half a million acres, the network has recently completed an exhaustive planning effort and is currently implementing the monitoring program. The Sonoran Desert Network works with many partners to accomplish planning and implementation. An integral collaborator with the network is the Sonoran Institute. The Sonoran Institute’s Adaptive Management Program works with a wide range of partners to develop a collaborative, regional approach to ecosystem monitoring that will facilitate consistent data collection, information sharing, and adaptive management throughout the Sonoran Desert region. A multiple-agency Regional Monitoring Partnership, facilitated by the Sonoran Institute, focuses on the Huachuca Mountain Valley Grassland Complex in southern Arizona and provides an opportunity for collaboration among agencies on priority issues. The Regional Monitoring Partnership serves as proof of concept area for monitoring and assessment on an ecoregional scale.

Poster Presentation

SAN JOAQUIN VALLEY CONSERVATION OPPORTUNITIES: A COLLABORATIVE REGIONAL PLANNING EFFORT IN CALIFORNIA

HUBER, PATRICK R.¹, Nathaniel Roth¹, Mike McCoy¹, and Rod Meade²

¹Information Center for the Environment (ICE), University of California Davis, One Shields Ave., Davis, CA 95616; prhuber@ucdavis.edu; neroth@ucdavis.edu; mcmcoy@ucdavis.edu

²R. J. Meade Consulting, 7910 Ivanhoe Ave., No. 40, La Jolla, CA, 92037; rjmeade@san.rr.com

The San Joaquin Valley of central California is a complex landscape that currently is dominated by agricultural uses but is projected add 4 million new residents by the year 2050. The California Partnership for the San Joaquin Valley was created by the Governor’s Executive Order in 2005 in order to bring together state and local agencies and representatives of the public from this eight county region for the purpose of providing recommendations to the Governor for creating a sustainable landscape that will accommodate this population growth while providing for the social

and economic well-being and quality of life of the residents. One facet of this effort is the identification of high value open space and conservation opportunities within the Valley and opportunities for maintaining/establishing connectivity between them. Representatives of participating organizations and agencies provided suggested conservation priorities that were arranged into 13 conservation categories. These categories were then represented as GIS data layers that were then super-imposed to reveal those areas displaying multiple conservation features. Locations with higher occurrences of these features were designated High Value Conservation Opportunities. A non-species specific connectivity cost surface was assembled by aggregating several variables: existing vegetation, urban density, natural areas density, road density, waterway density, and current land management status. Potential least-cost paths linking the Opportunity areas were designated using this cost surface. The resulting potential conservation network could provide guidance for future local government coordinated conservation and restoration decisions in this complex and urbanizing landscape.

Oral Presentation

MODELING CURRENT AND FUTURE PLANT SPECIES DISTRIBUTIONS IN THE SOUTHWESTERN U.S.

IRONSIDE, KIRSTEN E.¹, Kenneth L. Cole², Jimmie D. Chew³, Neil S. Cobb¹, Philip B. Duffy⁴, and John D. Shaw⁵

¹Merriam-Powell Center for Environmental Research, Northern Arizona University, PO Box 6077, Flagstaff, AZ 86011; Kirsten.Ironside@nau.edu; Neil.Cobb@nau.edu

²U.S. Geological Survey, Southwest Biological Science Center, Colorado Plateau Research Station, Northern Arizona University, PO Box 5614, Flagstaff, AZ 86011; Kenneth.Cole@nau.edu

³USDA Forest Service Rocky Mountain Research Station, Forestry Sciences Laboratory, 800 E. Beckwith, Missoula, MT 59801; jchew@fs.fed.us

⁴Lawrence Livermore National Laboratory, PO Box 808, 7000 East Avenue Livermore, CA 94550; pduffy@llnl.gov

⁵USDA Forest Service Rocky Mountain Research Station, Forest Inventory and Analysis, 507 25th Street, Ogden, UT 84401; jdshaw@fs.fed.us

Changes in climate alter the distribution and abundance of species, resulting in species migration, adaptation to new climates, and local to regional extinctions. Climate change impact studies have taken two general approaches: 1) modeling changes in the future location of potential habitat for individual species and 2) modeling ecosystem processes using vegetation units. Method 1 has been criticized for not including important ecosystem processes, and Method 2 has been criticized for not taking into account species-specific responses to change. Paleoecological evidence shows vegetation associations have rarely responded as a unit; instead, past associations have been re-arranged through species-specific responses to major climate changes. We are integrating the two methods by using conceptual models, predicting species-specific responses to climate change, and using statistical modeling to help understand ecological processes to integrate into a landscape process model. We present pilot work and planned future work for a project titled Regional Dynamic Vegetation Model for the Colorado Plateau: A Species-Specific Approach, where we plan to predict distributional changes in plant species in response to climate change in the western U.S. (a sub-continental scale >2,000,000 km²) by modeling species-specific relationships to climate. These models will be incorporated into a regional scale (15,000 km²) landscape process model to make landscape-level predictions of disturbance events and processes influencing species distributions, abundance, and size classes. For this modeling we have selected 26 dominant plant species occurring along the 3,000 m elevation gradient from low desert to alpine tundra in northern Arizona. We hypothesize future changes in climate will cause dominant plant species to independently shift distributions, resulting in a reshuffling of plant associations. We also hypothesize many future disturbance processes influenced by climate, such as bark beetle

outbreaks, drought mortality, wildfire frequency, and exotic species spread, can be simulated using climate model results.

Oral Presentation

INITIAL UNDERSTORY RESPONSE TO RESTORATION TREATMENTS AND SLASH ARRANGEMENTS IN THE PINYON-JUNIPER WOODLANDS OF NORTHERN ARIZONA

IRWIN, MARIA R.¹, Alex Finkral¹, and John Bailey²

¹Northern Arizona University, School of Forestry, Flagstaff, AZ 86001-5018; mri4@nau.edu; Alex.Finkral@nau.edu

²Oregon State University, Department of Forest Resources, Corvallis, OR 97331; John.Bailey@oregonstate.edu

Pinyon-Juniper woodlands have been increasing in density across the West. Land managers are concerned about the resulting decrease in understory abundance and diversity and are engaging in extensive juniper removal or thinning projects. This study tests methods of dealing with slash created by thinning and the effects of common restoration treatments on the understory plant community. Twenty three hectares of Pinyon Pine (*Pinus edulis*) and Utah Juniper (*Juniperus osteosperma*) were thinned to 1860 age structure and density. The resulting slash was used to determine which slash arrangement and treatment encouraged the greatest understory response. Slash was arranged as a pile, broadcast, or clustered. Each of these arrangements received one of four treatments: prescribed fire, seeding, prescribed fire and seeding, or no treatment. The abundance and diversity of understory plants was measured before thinning and then again after treatments and slash arrangements. These plots will continue to be measured in five and ten years, providing a longer term picture of understory response to various slash arrangements and treatments. This study will help land managers decide how to handle slash created by thinning in pinyon-juniper woodlands.

Poster Presentation

USING ORAL HISTORIES AS A TOOL IN EXPLORING ECOLOGICAL CHANGE

JAMES, MICHELE A.¹, Peter Friederici², Karen Underhill³, and Sandra Lubarsky⁴

¹Ecological Monitoring and Assessment Program and Foundation, Northern Arizona University, PO Box 5845, Flagstaff, AZ 86011; Michele.James@NAU.EDU

²Northern Arizona University, School of Communication, PO Box 5619, Flagstaff, AZ 86011; Peter.Friederici@NAU.EDU

³Northern Arizona University, Cline Library, PO Box 6022, Flagstaff, AZ 86011; Karen.Underhill@NAU.EDU

⁴Northern Arizona University, Master of Liberal Studies Program, PO Box 6031, Flagstaff, AZ 86011; Sandra.Lubarsky@NAU.EDU

Oral histories constitute a valuable but underutilized resource for exploring ecological change over time. In 2005, the Ecological Monitoring and Assessment (EMA) Foundation Science Advisory Panel identified conducting oral histories with residents of the Colorado Plateau as a high priority. To meet this need, the Northern Arizona University (NAU) Master of Liberal Studies Program, with the assistance of NAU's Cline Library, offered a course to graduate students in fall 2005 entitled "Ecological Oral Histories". The course trained a cadre of students in this intensive and culturally sensitive method of gathering information. This class combined training in oral history theory and

methodology, an overview of regional ecological knowledge, and an intensive writing workshop. This effort allowed EMA and NAU to gather significant ecological history from the perspective of those who have lived and worked on the land – a perspective that has rarely, if ever, been given formal systematic attention. The resultant information will assist land managers and owners in the region in making land-use decisions and help researchers determine baseline ecological conditions on the Colorado Plateau. The 13 oral histories collected include observations from a diverse group of Native Americans, ranchers, foresters, wildlife biologists, and others. The interviews yielded an abundance of useful information on issues such as forest and grassland health and management, changes in wildlife populations, spread of invasive plants, land productivity and its relationship to climate, climate change patterns, changes brought by tourism and population growth, and changes to springs and agricultural land uses. These interviews, as well as additional interviews conducted in 2006, will be published in a print collection and are available in electronic form via Cline Library's Colorado Plateau Digital Archives (www.nau.edu/library/speccoll).

Poster Presentation

RE-INTRODUCTION OF KLIPSPRINGER (*OREOTRAGUS OREOTRAGUS*) INTO TABLE MOUNTAIN NATIONAL PARK, SOUTH AFRICA

JINI, ANTOINETTE

South African National Parks, PO 37 Constantia, 7848, South Africa; antoinettej@sanparks.org

Klipspringers were hunted to extinction on the Cape Peninsula around 1930. Table Mountain National Park has been working on a re-introduction program following the removal of the Himalayan Tahr, a goat-like ungulate. In 1999, 2000, and 2004, a total of 59 klipspringers were released. A monitoring program and a master's research study are underway to determine the success of the release, determine other suitable habitat on the Peninsula, and to monitor natural recruitment. Preliminary results from the monitoring and future introductions are discussed.

Oral Presentation

MONITORING VEGETATION CHANGE IN GREAT LAKES REGION NATIONAL PARKS

JOHNSON, SARAH E., Erika L. Mudrak, and Donald M. Waller

University of Wisconsin – Madison, Botany Department, 430 Lincoln Drive, Madison, WI 53706; sejohnson7@wisc.edu; mudrak@wisc.edu; dmwaller@wisc.edu

Long-term ecological monitoring is essential to understanding how natural systems change over time and to determine if current patterns fall within the natural range of historic variability. The Great Lakes Inventory and Monitoring Network (GLKN) of National Parks has identified terrestrial vegetation as a high priority 'Vital Sign' and is developing protocols to monitor plant species dynamics, community composition, and community structure. Sustained monitoring of vegetation within this region demands a sampling method that efficiently and reliably characterizes vegetation and is sensitive to various kinds of ecological change within and among parks. The widely established Forest Inventory and Analysis (FIA) method is being considered for use by the GLKN. To assist the Network in this decision, we have compared the FIA method with more intensive methods including that used 50 years ago by the University of Wisconsin Plant Ecology Laboratory (PEL) and a newly designed 'Hybrid' method. FIA is less time-intensive and covers less area within a stand. The PEL and Hybrid methods detect more total species, but the number of species observed per given area is similar. The FIA protocol places more emphasis on the overstory than on the more diverse understory, contrary to GLKN objectives. Power analyses show that FIA does

not meet the GLKN's objective of $\geq 80\%$ power to detect a 10% change in given metrics. FIA was comparable to PEL and Hybrid at detecting a 20% change in tree density, but the more intensive methods outperformed FIA in detecting 20% changes in the abundance of understory vegetation. Augmenting the FIA method to include a walk-through vegetation survey provides $>90\%$ power to detect a 20% change in understory species richness. For the proposed sample size and method, our analyses support using composite rather than specific indicators of change. We also show the effectiveness of multivariate approaches for detecting shifts in community composition.

Oral Presentation

LAVACA RIVER RANCH MITIGATION AREA: A CONSERVATION BANK PROJECT IN TEXAS

JONES, JAMES O.

SWCA Environmental Consultants, 4407 Monterey Oaks Boulevard, Building 1, Suite 110, Austin, TX 78749; jjones@swca.com

SWCA Environmental Consultants, working with our client, has developed a 1,000-acre wetland conservation area on the Lavaca River in Jackson County, Texas. The property is unique in that it contains an unusually wide diversity of wetland and upland habitat types that range from freshwater to estuarine. Habitat types include a large, well-preserved riparian corridor along the Lavaca River, freshwater ponds and habitats, brackish-water habitats, and intertidal estuarine areas. The project is unique in that it falls on the boundary of the north and south units of the U.S. Army Corps of Engineers regulatory office as well as within various state and federal resource agency jurisdictions. This provides the project with an unusually large market area. The Lavaca River Ranch Mitigation Area fronts the Lavaca River and occupies approximately 1,000 acres within a 1,500-acre ranch. The project is situated at the convergence of inland riverine systems and coastal estuarine systems, approximately 11 miles upstream from where the Lavaca River flows into Lavaca Bay. Lavaca Bay is an arm of the Matagorda Bay system that connects with the Gulf of Mexico. The project offers over a mile of untouched riparian corridor where oak trees with trunk diameters at breast height in excess of 30 inches are common. The project also contains a very large and well-developed tidal bay system teeming with estuarine species. The project has been developed as a habitat conservation bank to service primarily permittees in the Corps' permitting process that are in need of wetland mitigation credits. However, the bank is also suited for use with other regulatory and compliance programs. Credits will be sold to preserve units within the mitigation area on an as-needed basis. Units sold will be protected by perpetual conservation easements with the Legacy Land Trust based in Houston, Texas.

Oral Presentation

DERIVATION OF A FORMULA FOR DETERMINING AREA OF PITS USED FOR WATER CATCHMENT IN ECOLOGICAL RESTORATION

KARIM, T. H.¹ and K. K. Sharif²

¹Department. of Soil and Water Science, College of Agriculture, University of Salahaddin, Iraqi Kurdistan Region; solavtariq@yahoo.com

²Department of Soil Science, College of Agriculture, University of Sulaimani, Sulaimani, Iraqi Kurdistan Region

Catchment of water at the bases of plants can facilitate ecological restoration. Although sizes of water catchment pits and their spacing are determined by a trade-off between cost and effectiveness, they are issues to be resolved. We derived a formula to determine the catchment

$$S = \sqrt{\frac{a K i}{(I - f_b) \cos \varphi}}$$

area which feeds a single pit with runoff water without overtopping [, where S = pit spacing (m), a = pit area (m²), I = rainfall intensity (cmh⁻¹), f_b = basic infiltration rate (cm h⁻¹), K = saturated hydraulic conductivity (cmh⁻¹), i = hydraulic gradient (m m⁻¹), and φ = slope angle]. The derivation was based on equating the runoff rate from overland flow and the flow rate leaving

$$S = \sqrt{\frac{a f_b}{(I - f_b)}}$$

the pit in steady state condition. A simplified form of the above formula is [, based on i = 1, K = f_b, and cos φ ≅ 1 for gentle slopes]. A numerical example is presented. We suggest using a special inverted tank to measure *in situ* I and filling pits with rocks to increase their effectiveness and sustainability.

Oral Presentation

EFFECTIVE CONSERVATION OF BIODIVERSITY IN HAWAII THROUGH PRIVATE/PUBLIC WATERSHED PARTNERSHIPS

KENNEDY, RANDY W.

Hawaii DLNR/Natural Area Reserve System, 1151 Punchbowl Street, Rm. 325, Honolulu HI 96744; randall.w.kennedy@hawaii.gov

Watershed Partnerships are voluntary alliances of public and private landowners committed to the common value of protecting large areas of land for water recharge and other values. Although resource quality and management goals differ among partnerships, all share the common threat of non-native invasive species. A significant portion of watershed partnership activities would not be possible without the partnerships' fundraising abilities or collaboration between landowners. These unique partnerships have grown to include nine independent partnerships totaling more than 1,000,000 acres of both public and private land and create a much needed contiguous front on which to address control of feral ungulates, alien plants, and non-native predators. The resultant healthy forests are important for human health, improved supply of water in quality and quantity, erosion control, rare and endangered species habitat, recreation, and intrinsic values.

Oral presentation

GENETIC DIVERSITY IN PONDEROSAE: CHALLENGES TO MANAGEMENT ON MOUNTAIN ISLANDS IN THE SOUTHWEST

KILGORE, JASON S.¹, Frank W. Telewski¹, and Bryan K. Epperson²

¹W.J. Beal Botanical Garden and Department of Plant Biology, 166 Plant Biology Laboratory, Michigan State University, East Lansing, MI 48824; kilgorej@msu.edu; telewski@cpa.msu.edu

²Department of Forestry, 114 Natural Resources, Michigan State University, East Lansing, MI 48824; epperson@msu.edu

The mountain islands of the American Southwest represent unique pools of genetic diversity and thus challenges for conservation and management. In this study, we report on diversity and distribution in the Ponderosae, specifically within the Santa Catalina range, with implications for the Madrean Archipelago. The current population distributions are, in part, the result of past climatic change driving plant migration. Anthropogenic pressures, including altered fire regime and frequency, development, and recreation, have the potential to impact distribution of vegetation. Catastrophic fires, such as the Bullock (2002) and Aspen (2003) fires in the Santa Catalina Mountains, provide opportunities for massive regeneration events and thus changes in forest structure and composition. Introduction of genetic material not native to the mountain system could alter the genetic composition, and subsequent fitness, of the locally adapted populations through either hybridization or resource competition. In areas not scheduled for artificial reforestation (e.g., wilderness areas), prevailing environmental conditions mediate the redistribution of populations. Any reforestation and management plans should include considerations for genetic differences in populations from mountain islands of the Southwest.

Oral Presentation

PRAIRIES FOUND AND PRAIRIES LOST: INVENTORY WORK IN NORTHEAST KANSAS

KINDSCHER, KELLY

Kansas Biological Survey, 2021 Constant Ave., University of Kansas, Lawrence, KS 66047;
Kindscher@KU.edu

During 2004 and 2005, staff at the Kansas Biological Survey identified and visited the remaining high-quality prairies and forests in Douglas, Johnson, Leavenworth, Miami, and Wyandotte Counties in the greater Kansas City area of northeastern Kansas. We found 126 high-quality tallgrass prairies >5 acres each and 24 high-quality forest sites, most of which were >10 acres each. These findings, added to previous documentation, result in a total of 166 high-quality prairie sites and 38 high-quality forests that are documented in the Kansas National Heritage Inventory database for the five-county area. We also found regal fritillary butterflies (*Speyeria idalia*) at 76 of the prairie sites. In addition, we found 29 previously unknown populations of Mead's milkweed (*Asclepias meadii*) at the prairie sites, a federally protected plant species that is listed as threatened. These findings, added to previous documentation, result in a total of 87 populations of Mead's milkweed that are documented in the Kansas Natural Heritage Inventory database for the five-county area (about half of all globally known populations). Of significant concern and due to data collected from sites in 1988, we are able to document that Douglas County (with Lawrence, Kansas – a rapidly growing college town and county seat) has lost 29% of its high-quality tallgrass prairie remnants (native hay meadows) during the last 17 years. In addition, 39% of their total acreage has been lost due to land-use changes (primarily till agriculture and development).

Oral Presentation

PHRAGMITES MANAGEMENT TO OPTIMIZE BIODIVERSITY AND ECOSYSTEM SERVICES

KIVIAT, ERIK

Hudsonia Ltd., P.O. Box 5000, Annandale, NY 12504; kiviatt@bard.edu

Phragmites australis (common reed) is an invasive marsh plant spreading in many wetlands. It is composed of native and introduced genotypes. *Phragmites* is often considered a pest with low value to wildlife and a threat to rare plants, although scientific documentation is ambivalent. Much

research, mostly in the eastern states, has been conducted in the past decade. Some organisms are favored by *Phragmites* invasion and some are not. *Phragmites* is valuable for water quality amelioration, immobilization of contaminants, soil stabilization, and carbon storage. Ecological functions of *Phragmites* vary greatly depending on site and stand factors, including depth and duration of flooding, salinity, soil organic content, microtopography, presence of shrubs, trees, or vines, stand size, interspersation with other plant communities, and *Phragmites* height, density, dominance, and prevalence of inflorescences. *Phragmites* is often encouraged by, and a symptom of, underlying problems, such as siltation, nutrient loading, and hydrological alteration, yet *Phragmites* does not necessarily indicate poor habitat quality. Many restoration and management projects seek to remove *Phragmites* despite sparse information on its ecology, nontarget impacts of removal, correction of underlying problems, and sustainability of alternate native vegetation. Depending on management goals, site and stand factors, the surrounding landscape, and local biota, it may be appropriate to remove a *Phragmites* stand, take no action, or alter the stand to modify its habitat functions and ecosystem services. An explicit and documented decision-making process should be used to justify management actions, and data should be collected on management outcomes that can inform decision-making elsewhere. In addition to ecological functions, *Phragmites* management must consider use of *Phragmites* for wastewater treatment, products, and Native American economies.

Oral presentation

GROWING PRAIRIE: A PRESERVE MANAGER'S TALE OF SUCCESS WORKING WITH VOLUNTEER STEWARDS

KLEIMAN, BILL, The Nature Conservancy, 8772 S. Lowden Rd., Franklin Grove, IL 61031; bkleiman@tnc.org

Would you drive for two hours, each way, every Saturday to do volunteer stewardship? Al Meier does. Have you ever seen a prairie planting that was so diverse that it looked like remnant prairie? Volunteer Steward Jay Stacy has created three. For over 20 years, volunteers have been an integral part of restoration activities at Nachusa Grasslands, a 2,500-acre preserve owned and managed by The Nature Conservancy in north-central Illinois. At Nachusa, volunteer stewards are relied upon to carry out much of the stewardship of the site. This program has flourished because volunteer stewards are treated as colleagues and members of a conservation community and because they are empowered to make important decisions for the areas they steward. I describe the Volunteer Stewardship program and some of the participants.

Oral Presentation

MEXICAN GAP ANALYSIS: AN INTEGRATED APPROACH

KOLEFF, PATRICIA¹, Marcia Tambutti¹, Ignacio March², Rocío Esquivel³, César Cantú⁴, Diana Hernández¹, Melanie Kolb¹, Verónica Aguilar¹, and Elizabeth Moreno¹

¹National Commission for the Knowledge and Use of Biodiversity (CONABIO) Liga Periférico – Insurgentes Sur 4903 Col. Parques del Pedregal, 14010 México, D.F.; pkoleff@xolo.conabio.gob.mx; mtambutti@xolo.conabio.gob.mx; dhernand@xolo.conabio.gob.mx; mkolb@xolo.conabio.gob.mx; vaguilar@xolo.conabio.gob.mx; emoreno@xolo.conabio.gob.mx

²The Nature Conservancy, Manuel M. Ponce No. 322-2 piso, Colonia Guadalupe Inn, 01020 Mexico, D.F.; imarch@tnc.org

³National Commission for Protected Areas (Conanp-Semarnat), Camino al Ajusco 200, Col. Jardines en la Montaña, 14210, México D.F.; requivel@conanp.gob.mx

⁴Facultad de Ciencias Forestales, UANL. Km. 145 Carr. Nacional 85
Linares, N.L. Ap. Post 41 CP 67700 Mexico; ccantu@fcf.uanl.mx

Mexico is one of the megadiverse countries, because the large number of species and endemics that inhabit it, as well as the variety of landscapes, vegetation types, and terrestrial and marine ecosystems. Most gap analyses in the literature are focused on some species groups within ecoregions, other units, or environments. To integrate all of these efforts into a National perspective, the National Commission for the Knowledge and Use of Biodiversity (CONABIO), the National Commission for Protected Areas (CONANP), and several institutions and specialists developed an integrated approach to consider different results for marine and terrestrial priority areas, as well as key sites for endemic, rare, and threatened species. We propose a conceptual model that has five steps: (1) Determine critical ecoregions for conservation through ecoregional and taxa approaches, (2) Identify terrestrial and marine sites and regions of high priority to conservation, (3) Identify gaps in the Natural Protected Area System, (4) Identify important areas for connectivity and ecological resilience, and (5) Develop a first approach to an interface between terrestrial and marine priority areas for conservation.

Oral Presentation

ECOSYSTEM THREATS OF NON-NATIVE MOSQUITOFISH (*GAMBUSIA AFFINIS*) AND THEIR PARASITES TO NATURAL AREAS IN SAN FRANCISCO BAY AREA OF CALIFORNIA

KOLIPINSKI, MIETEK^{1,3}, Anindo Choudhury², Jim Cunningham³, and Sibdas Ghosh³

¹National Park Service, Pacific West Regional Office, 1111 Jackson Street, Oakland, CA 94607-4807; Mietek_Kolipinski@nps.gov

²St. Norbert College, Division of Natural Sciences, 100 Grant Street, De Pere, Wisconsin 54115; anindo.choudhury@snc.edu

³Dominican University of California, Department of Natural Sciences and Mathematics, 50 Acacia Avenue, San Rafael, CA 94901-2298; JCunningham@dominican.edu; sghosh@dominican.edu

Since the 1920s non-native mosquitofish, *Gambusia affinis*, have been introduced to the San Francisco Bay Area in efforts to control mosquito larvae. Adult mosquitoes are pests and vectors of infectious diseases, including West Nile Virus. Our aim was to determine whether native and/or non-native parasites are present in mosquitofish. Undergraduate research scholars from Dominican University of California examined 301 mosquitofish for possible presence of parasitic helminths and other macroscopic parasites. One mosquitofish collection site was in Point Reyes National Seashore (PORE). However, most mosquitofish originated from ponds of a mosquito and vector control agency located north of San Francisco. Dissections of the 301 fish revealed that 8 had a total of 13 internal parasites. The small sample of 25 mosquitofish collected from PORE was parasite free. Parasites were stained, mounted, and identified using standard taxonomic techniques. Three taxa of parasitic helminths were found. Two were larval stages (metacercariae) of trematode flukes belonging to the family Clinostomatidae, one of which is of the genus *Clinostomum* (species not yet determined) and the other remains to be identified. The third taxon was an acanthocephalan, *Octospiniferoides chandleri* (adult form). It was likely introduced within mosquitofish when they were transplanted into California, as this acanthocephalan appears to be non-native to California. The other two clinostomatid taxa may or may not have been introduced with the mosquitofish. Clinostomatids are widely distributed and common in some fish-eating birds. Possibly mosquitofish acquired these parasites in California, providing one more intermediate host for parasitic life cycles. Mosquitofish near or within national parks can serve as reservoirs for parasites that have potential to alter biological populations and natural processes in aquatic as well as terrestrial ecosystems. The parasites identified have complex life cycles that can involve certain invertebrates, other species of fish, amphibians, and birds.

Oral Presentation

EVALUATION OF RESTORATION METHODS TO MINIMIZE CANADA THISTLE (*CIRCIUM ARVENSE*) INFESTATION

LARSON, DIANE L.¹ and Jennifer L. Larson²

¹USGS Northern Prairie Wildlife Research Center, Minnesota Field Station, 100 Ecology Bldg, 1987 Upper Buford Circle, St. Paul, MN 55108; dlarson@usgs.gov

²University of Minnesota, 100 Ecology Building, 1987 Upper Buford Circle, St. Paul, MN 55108; jl Larson@umn.edu

The National Wildlife Refuge System has an active habitat restoration program and annually seeds thousands of acres to native plant species. In FY2003 alone, Region 3 restored 26,690 wetland acres and 7,394 upland acres. The noxious weed, Canada thistle, plagues these restorations. This study evaluates planting methodology and seed mixes with the goal of recommending optimal methods to reduce infestation of noxious weeds, especially Canada thistle, in new restorations. Three planting methods (dormant season broadcast, spring broadcast, and spring drill) were fully crossed with three levels of seed diversity (10, 20, and 34 species) in a completely randomized design replicated on nine fields in Minnesota and Iowa. The Canada thistle propagule bank was evaluated at each field. Planting occurred in winter 2004 and spring 2005. Here we report on results from summer 2005. Native species richness varied significantly ($p < 0.05$) among fields and by seeding method and diversity in a 3-way interaction. Dormant-seeded plots tended to have higher native richness than spring-seeded plots, but the high-diversity seed mixes did not always produce greater expressed richness than the medium-diversity mixes. Non-native species richness was unrelated to seed mix diversity, but varied with field and planting method. Four of the nine fields had higher non-native richness in the dormant-broadcast plots; one had higher non-native richness in the spring-broadcast and drill plots. Both cover and stem counts of Canada thistle varied with field and planting method, but were unrelated to seed-mix diversity. Canada thistle was more often detected, and cover was higher, on dormant broadcast plots. However, site preparation for the spring seedings included herbicide application prior to seeding, so results from 2006 will be a better test of effects on thistle. In the short term, planting method plays a substantial role in these restorations.

Oral Presentation

EARLY DETECTION PROTOCOL DEVELOPMENT IN THE NATIONAL PARKS: INTEGRATING ALL THE PIECES

LATHAM, PENELOPE¹, Daniel Sarr², and Bradley A. Welch³

¹National Park Service, Inventory and Monitoring Program, Pacific West Regional Office, Seattle, WA 98104; Penny_Latham@nps.gov

²National Park Service, Klamath Network Inventory and Monitoring Program, Ashland, OR 97520; Dan_Sarr@nps.gov

³National Park Service, Washington Office Inventory and Monitoring Program and the Invasive Species Branch (remotely participating from Wales); shoshin21@yahoo.com

Invasive plant species management is a national priority for the National Park Service (NPS). With limited resources available to NPS and other land management agencies, efforts to anticipate occurrence and prevent establishment of invasive species are critical. Control efforts must be initiated while economically and logistically feasible. At this early stage, predictive capabilities and monitoring strategies that efficiently cover large areas are needed as well as efficient strategies to survey smaller parks and conservation lands. Natural resource managers require prioritization

tools for species and habitats, spatially-explicit models, non-spatial models, risk analyses, adaptive sampling designs, and incidental reporting to accomplish these tasks. Many of these components have been developed and applied in other contexts or exist in isolation, but no effort has been made to combine these components into a comprehensive protocol for early detection of invasive plants. We discuss NPS-U.S. Geological Survey collaborative efforts to integrate these diverse approaches. Our goal is to produce a tool for natural resource managers that has broad application, yet is sufficiently detailed to be practical. An overview of the conceptual approach and project status is discussed. We encourage dialogue regarding our conceptual approach, gaps in knowledge most urgently in need of filling, potential for interagency cooperation, and coordination of rapid response.

Oral Presentation

PLANT COMMUNITY STABILITY FOLLOWING WILDFIRES IN OLD-GROWTH FIRE-ADAPTED FORESTS IN GRAND CANYON NATIONAL PARK, ARIZONA

LAUGHLIN, DANIEL C. and Peter Z. Fulé

Ecological Restoration Institute and School of Forestry, Northern Arizona University, P.O. Box 15018, Flagstaff, AZ 86011; Daniel.Laughlin@nau.edu; Pete.Fule@nau.edu

Wildland fire use is the management of naturally ignited wildland fires to meet resource objectives in fire-adapted ecosystems. Assessing the stability of forested ecosystems following fire use is necessary to inform adaptive management. Understory plant community stability likely varies among ecosystems that exhibit different disturbance regimes. We tested the hypothesis that communities adapted to frequent surface fires would exhibit greater stability following fire than communities adapted to infrequent crown fires by examining surface fire effects in old-growth montane ponderosa pine forests and mixed-severity fire effects in old-growth subalpine forests on the North Rim of Grand Canyon National Park. In montane pine forests, species richness and plant cover increased slightly two years after the fire. Community composition in the montane forests shifted slightly toward greater occurrence of native annual forbs and the non-native annual cheatgrass (*Bromus tectorum*). In subalpine forests, plant cover and richness were reduced one year after the mixed-severity fire. After two years, plant cover and richness were similar in burned and unburned forests but community composition shifted dramatically toward greater occurrence of native annual forbs. Species loss increased with fire severity, although the loss was short-lived. The stability of plant community composition in both forest types was positively related to pre-fire species richness. Results suggest that old-growth ponderosa pine forest understory plant communities exhibited functional stability following low-severity surface fire. Old-growth subalpine forest understory plant communities exhibited functional resilience yet were compositionally unstable after two years. Lightning-initiated fire is a native ecosystem process that regulates the structure, composition, and function of ponderosa pine and subalpine forests. Therefore, we recommend the continued use and monitoring of wildland fire in these old-growth forests where natural processes can still operate at landscape scales.

Oral Presentations

STATE NATURAL AREAS PROGRAM REPORTS

LEAHY, MIKE¹, KAREN SMITH², THOMAS MEYER³, NANCY STRAYER⁴, BRIAN BOWEN⁵, and RANDY HEIDORN⁶

¹Missouri Department of Conservation, 2901 W. Truman Blvd., Jefferson City, MO 65109; Michael.Leahy@mdc.mo.gov

²Arkansas Natural Heritage Commission, 1500 Tower Bldg., 323 Center St., Little Rock, AR 72201; karen@arkansasheritage.org

³Wisconsin Department of Natural Resources, 101 S. Webster St., PO Box 7921, Madison, WI 53707-7921; Thomas.Meyer@dnr.state.wi.us

⁴Ohio Department of Natural Resources, Division of Natural Areas & Preserves, 2045 Morse Road F-1, Columbus, OH 43229-6693; Nancy.Strayer@dnr.state.oh.us

⁵Tennessee Department of Environment and Conservation, Division of Natural Areas, 7th Floor, L&C Annex, 410 Church St., Nashville, TN 37243-0447; brian.bowen@state.tn.us

⁶Illinois Nature Preserves Commission, One Natural Resources Way, Springfield, IL 62702-1271; Randy.Heidorn@illinois.gov

This session will highlight the structure, operations, and accomplishments of natural areas programs from the states of Missouri, Arkansas, Wisconsin, Ohio, Tennessee, and Illinois. This familiarization of several programs will help participants in the State Natural Areas Roundtable (scheduled for Friday morning) understand the complexity and diversity of methods used in natural area protection throughout the nation. The format of each state natural area report is:

State Program Name:

Program Manager or Coordinator:

- Organizational structure within state government
- Budgets: state funding, federal funding, other fund raising efforts
- Staffing: organizational chart and number of positions, organizational structure
- Acquisitions approach: site assessments/inventories, site conservation plans, prioritizing acquisition
- Stewardship approach: management plans, on-the-ground management techniques
- Public Relations: recent efforts to build support within state government and the general public
- Natural Areas: slides of 3-4 Natural Areas in the state, brief description to represent the range of the state's biodiversity

Oral Presentation

NATIVE FISH HABITAT RESTORATION IN SELECTED TRIBUTARIES OF THE GRAND CANYON, ARIZONA: A POTENTIAL RECOVERY EFFORT FOR NATIVE FISHES

LEIBFRIED, WILLIAM C.

SWCA Environmental Consultants, 114 N. San Francisco Street, Flagstaff, AZ 86001; bleibfried@swca.com

Grand Canyon National Park, Arizona has initiated a project to restore native fish habitat in tributaries of the Colorado River within the Park's boundaries. SWCA Environmental Consultants was chosen to conduct this effort based on their long history with Grand Canyon resource management and technical fishery expertise. The removal of non-native fishes from these streams will create the opportunity for native fishes to utilize these open habitats. The ultimate goal of this effort is to reduce non-native fish populations from selected streams to restore the habitats and enhance native fish populations. This project will contribute to the protection and enhancement of native Park resources by restoring habitats occupied by non-native species. Native fishes that would benefit from this project include the humpback chub (*Gila cypha*; endangered), flannelmouth sucker (*Catostomus latipinnis*), bluehead sucker (*Catostomus discobolus*), and speckled dace (*Rhinichthys osculus*). In 2004 and 2005, four field efforts were conducted to sample fish

populations in Shinumo, Tapeats, and Kanab Creeks to determine which streams would be the most feasible for non-native fish removal efforts and native fish restoration. Fish abundance estimates and non-native fish removal data from these efforts were analyzed, and Shinumo Creek was selected for further study. Significant declines in rainbow trout (*Oncorhynchus mykiss*) abundance and significant increased abundance for speckled dace were observed during our 2005 field efforts. Our results indicate that non-native salmonids can be effectively removed from Shinumo Creek. Due to these efforts, the potential for repatriation of humpback chub into Shinumo Creek is currently under consideration by federal agencies.

Oral Presentation

THE LATEST PERSPECTIVE ON CLIMATE VARIABILITY AND CHANGE IN THE SOUTHWEST

LENART, MELANIE, Gregg Garfin, and Ben Crawford

Climate Assessment for the Southwest, University of Arizona, 715 N. Park Ave., 2nd Fl., Tucson, AZ 85721-0156; mlenart@email.arizona.edu; gmgarfin@email.arizona.edu; bercrawf@email.arizona.edu

The winter of 2006 was one of the driest in 111 years of instrumental records in the Southwest. Characterized by exceedingly low snowpack in the lower Colorado River Basin and generally above-average temperatures throughout the Southwest, 2006 re-established the long-term drought that was merely interrupted by the wet winter of 2004-2005 in the upper Colorado River Basin and northern Arizona. The ongoing drought is beginning to rival the most severe droughts in the instrumental and tree-ring records. Moreover, increasing temperatures, recorded by instruments and tree-rings, threaten to change the nature of drought – with impacts on snow hydroclimatology, soil moisture, water supply, and ecosystem health. We review precipitation and temperature records, in order to put the ongoing drought into historical perspective. We then explore climate change projections for the region, from published papers and from a subset of Intergovernmental Panel on Climate Change – Global Climate Model runs, and discuss implications for watersheds and ecosystems.

Oral Presentation

RESTORATION OF A CANYON LANDSCAPE – BUILDING A SUSTAINABLE AND LOCAL WORKFORCE IN CANYON DE CHELLY NATIONAL MONUMENT, ARIZONA

LESLIE, ELAINE F.

Canyon de Chelly National Monument, POB 588, Chinle, AZ 86503; elaine_leslie@nps.gov

Aggressive infestation by tamarisk (*Tamarix ramosissima*, *T. chinensis*) and Russian olive (*Elaeagnus angustifolia*), in combination with intensive historic grazing and tour operations within the riparian corridors of Canyon de Chelly National Monument, have created the need for an integrated and collaborative approach to managing cultural and natural resources within the canyons and their associated watersheds. Natural biological diversity has been significantly reduced along the riparian corridor. Restoration and preservation of this diversity is important for maintaining the natural ecology of the canyons and for sustaining traditional and ethnological uses by the Navajo peoples residing within the canyon bottoms. These changes have dramatically altered and seriously threaten valuable and irreplaceable archeological resources, cultural landscapes, at-risk species, and traditional lifeways. The park is addressing these issues by

developing, training, and funding a local and sustainable Canyon Conservation Corp – one of the first Native American Restoration Teams in the National Park Service.

Poster Presentation

WILDLIFE HABITAT INVENTORY, RESTORATION, AND PRESERVATION AT CANYON DE CHELLY NATIONAL MONUMENT, ARIZONA

LESLIE, ELAINE F., Hank Hayou and Arthur Benally

Canyon de Chelly National Monument, POB 588, Chinle, AZ 86503; elaine_leslie@nps.gov; hank_hayou@nps.gov; arthur_benally@nps.gov

Aggressive infestation by tamarisk (*Tamarix ramosissima*, *T. chinensis*) and Russian olive (*Elaeagnus angustifolia*), in combination with intensive historic grazing and tour operations within the riparian corridors of Canyon de Chelly Monument, have significantly reduced native habitat and species diversity. Restoration and preservation of this diversity is important for maintaining the natural ecology of the canyons and for sustaining traditional and ethnological uses by the Navajo peoples residing within the canyon bottoms. The park has undertaken a landscape-level restoration project to reduce and contain exotic species. A critical component of this project is to collect baseline data on avifaunal and mammalian species and establish a long-term monitoring regime. This poster explores the implications on species diversity and associated ecological response to exotic plant removal.

Oral Presentation

MEDUSAHEAD (*TAENIATHERUM CAPUT-MEDUSAE*) CONTROL WITH FLAMING, NATIVE PLANT SEEDING, AND STRAW

LINK, STEVEN O.¹, Bill Mast², Betsy Kaiser³, Vicky Erickson⁴, Jean Wood⁵, and Sally Simmons¹

¹Washington State University Tri-Cities, 2710 University Drive, Richland, WA 99354; slink@wsu.edu, ssimmons@tricity.wsu.edu

²Wildlands, Inc., 1941 Saint, Richland, WA 99354; wildland@verizon.net

³USDA Forest Service, Walla Walla Ranger District, Umatilla National Forest, 1415 Rose Street, Walla Walla, WA 99362; bkaiser@fs.fed.us

⁴USDA Forest Service, Umatilla, Wallowa-Whitman and Malheur National Forests, 2517 SW Hailey Ave., Pendleton, OR 97801; verickson@fs.fed.us

⁵USDA Forest Service, Umatilla National Forest, 2517 SW Hailey Ave., Pendleton, OR 97801; jwood@fs.fed.us

Invasive alien annuals are increasing their cover in the canyons of Umatilla National Forest, Washington and Oregon, leading to increased fire risk. Medusahead is prominent in the study area. An experiment was conducted to test hypotheses about reducing cover of the alien species and re-establishing competitive native species in their place. Treatments included controls, burning, burning+seeding, and burning+seeding+application of straw mulch. Species composition, cover, richness, and frequency were determined. The mulch treatment was the best because it reduced the frequency and cover of the invasive species while creating conditions that were most favorable for establishment of bluebunch wheatgrass (*Pseudoroegneria spicata*). Density of seeded bluebunch wheatgrass was 19.3 ± 6.6 plants m^{-2} in the mulch treatment.

Oral Presentation

FENCES, GATES, AND VIEWS OF THE WORLD

LONG, JONATHAN¹ and Mae Burnette²

¹Rocky Mountain Research Station, US Forest Service, 2500 S. Pine Knoll Dr., Flagstaff, AZ 86001; jonathanwlong@juno.com

²Watershed Program, White Mountain Apache Tribe, P.O. Box 2109 Whiteriver, AZ 85941; mburnette@wmat.nsn.us

Fencing is a common and important practice for restoring and managing natural areas in the Southwest. Construction of fences to exclude particular sites from use by people, wildlife, and livestock is frequently a contentious activity. Although environmental studies frequently monitor the physical impacts of a fence, the symbolic impacts of fencing typically receive scant attention. We reviewed a host of stream and wetland conservation and restoration projects implemented by the White Mountain Apache Tribal Watershed Program on the White Mountain Apache Reservation in east-central Arizona. We identified each project in which fencing was used, evaluated whether the fences had remained intact or not, and identified fences that had been purposefully rendered ineffective, presumably by community members or recreational users. Through interviews with project managers and other tribal members who were involved in project planning, we compiled comments made by various individuals concerning fencing projects. We analyzed these comments to evaluate how people viewed the fencing of particular sites. Our approach was not intended to survey the tribal community, but merely to identify and evaluate prominent concerns about fencing that should be considered in future fencing projects. We found that particular explanations of the purpose of fencing projects and modifications to fencing design helped to alleviate concerns among many tribal members. These strategies and a greater awareness of potential conflicts over fencing projects should help to improve restoration planning and suggest topics for more in-depth consideration in conservation research.

Oral Presentation

BENEFITS OF LAND USE FOR SUSTAINING NATIVE DIVERSITY

LONG, JONATHAN and Alvin, J. Medina

Rocky Mountain Research Station, US Forest Service, 2500 S. Pine Knoll Dr., Flagstaff, AZ 86001; jonathanwlong@juno; almedina@fs.fed.us

“Naturalness” is a problematic concept when considering how to sustain ecosystems that humans have occupied for many generations. Advocates of biodiversity conservation have emphasized negative effects of human influence on ecosystems. We review several cases on wetland ecosystems in which human influences were initially assumed to have negative impacts on biodiversity, when in fact they appeared to have facilitated conservation of biodiversity. One of these cases involves our long-term research on dynamics of the upper Verde River, Arizona. These cases have involved species that depend on maintaining patches of early successional habitat by removing biomass and increasing access to water and sunlight. Beneficial effects have been demonstrated for ecosystems that are both artificial and natural, lentic and lotic, as well as for various plants, birds, and amphibians. Despite these examples, conservationists and ecologists have advocated policies based on assumptions that traditional land management activities need to be halted or sharply curtailed to conserve biodiversity. Nevertheless, attitudes toward some traditional land management practices, such as “light-burning” forests, have shifted from overwhelming negative to largely positive over the past century. A similar attitude shift toward adaptive livestock grazing is unfolding in many places. Such shifts reflect several factors, including

1) change in the scale and intensity of land-use practices; 2) change in the ecosystems due to the effects of climatic shifts, spread of invasive species, and legacies of past land use; and 3) abandonment of simplistic arguments and models in favor of ones that account for ecological dynamics and interactions. Because of these factors, conservation strategies need to demonstrate flexibility toward changing circumstances, while being especially cautious about disrupting land-management traditions that have been in place for many years. Those practices may serve to sustain biological diversity particularly in the face of climate change and the spread of invasive species.

Oral Presentation

BIOLOGICAL AND ECOLOGICAL CONSEQUENCES OF NIGHT LIGHTING

Longcore, Travis¹, Catherine Rich¹, and CHRISTIAN B. LUGINBUHL²

¹The Urban Wildlands Group, PO Box 24020, Los Angeles, CA 90024;
longcore@urbanwildlands.org

²U.S. Naval Observatory Flagstaff Station, 10391 West Naval Observatory Road
Flagstaff, AZ 86001; cbl@nobs.navy.mil

For more than three billion years, life on Earth has evolved under a natural day and night cycle. The introduction of artificial light in just the last 150 years, especially the last 50 years, fundamentally alters the natural night, adding light with spectral, temporal, and intensity characteristics heretofore unexperienced by living systems. The effect of this intrusion on biological systems, including human, is only just beginning to be investigated. We briefly summarize highlights of recent research in this area.

Poster Presentation

NORTHERN ARIZONA UNIVERSITY'S SAN JUAN SCIENCE AND RECREATION PROGRAM: A UNIQUE PARTNERSHIP WITH THE BUREAU OF LAND MANAGEMENT

LYNN, JANET C., Karan English, and Michele James

Ecological Monitoring & Assessment Program & Foundation, Northern Arizona University, PO Box 5845, Flagstaff, AZ 86011-5845; Janet.Lynn@nau.edu; Karan.English@nau.edu; Michele.James@nau.edu.

Biologically diverse and geologically and culturally rich, the San Juan River was recently designated by the Bureau of Land Management (BLM) as a potential Area of Critical Environmental Concern (ACEC) with the highest diversity of relevant and important values (scenic, cultural, wildlife, and natural systems) for the region. In 2005, The Ecological Monitoring & Assessment Program (EMA) and Northern Arizona University (NAU) Outdoors received a San Juan River permit from Arizona Raft Adventures. Since then, the San Juan River permit has been a catalyst that has generated a variety of environmental research, education, and recreation programs and opportunities for the students and faculty at NAU, and local and regional community members and organizations. Through the formation of a collaborative partnership with BLM, NAU and EMA developed the San Juan Science and Recreation Program. The goals of the Program are to 1) cultivate cooperation and partnerships between resource managers at the BLM and NAU; 2) enhance the environmental and cultural student programs at NAU that contribute to the sustainability, diversity, and quality of recreational experiences and ecosystem health along the San Juan River corridor and surrounding area; 3) create hands-on research opportunities for

students; 4) provide research data and information that will assist BLM resource managers to make informed decisions and manage more efficiently and effectively for multiple uses; and 5) develop a programmatic model for university collaboration with selected BLM operations to enhance the Bureau's specific goals and stimulate the development of new professional talent in the discipline of resource management. Our main focuses for the Program in 2006 are the inventory of invasive Camelthorn (*Alhagi pseudoalhagi*) along the river corridor, and recreational impacts at Indian Creek Climbing Area in southeastern Utah.

Poster Presentation

COLLABORATIVE EFFORT TO PROTECT NATIVE SOUTHWESTERN PRICKLYPEAR (*OPUNTIA* P. MILL.) FROM THE INVASIVE CACTUS MOTH (*CACTOBLASTIS CACTORUM* BERG.)

MADDOX, VICTOR¹, John Madsen¹, Richard Brown², Clifton Abbott¹, Randy Westbrooks³, Joel Floyd⁴, and Annie Simpson⁵

¹Mississippi State University, GeoResources Institute, Box 9627, Mississippi State, MS 39762; vmaddox@pss.msstate.edu; jmadsen@gri.msstate.edu; abbott@gri.msstate.edu

²Mississippi State University, Department of Entomology and Plant Pathology, Box 9775, Mississippi State, MS 39762; moth@ra.msstate.edu

³U.S. Geological Survey – Biological Resources Discipline, 233 Border Belt Drive, Whiteville, NC 28472; rwestbrooks@usgs.gov

⁴Pest Detection and Management Programs, USDA, APHIS, PPQ, Riverdale, MD 20737; Joel.P.Floyd@aphis.usda.gov

⁵National Biological Information Infrastructure, Invasive Species Information Node, U.S. Geological Survey, Reston, VA; asimpson@usgs.gov

Pricklypear cacti (*Opuntia* spp.) are important components of several southwestern ecosystems, and several species and varieties are endangered. Pricklypear cacti are threatened by the accidental introduction of the cactus moth (*Cactoblastis cactorum*) into Florida. Cactus moth was a widely used biological control agent of pricklypear cacti in Australia and South Africa. It appeared in the Florida Keys in 1989 and expanded its range to Dauphin Island on the Gulf Coast and Charleston, South Carolina on the Atlantic Coast. The caterpillars of this native to Argentina can destroy entire plants and stands of cacti. This exotic pest is expected to have a catastrophic effect on landscapes of Western states and Mexico, if its range expands beyond Louisiana. Collaborative efforts between the U.S. Geological Survey, Mississippi State University's GeoResources Institute, U.S. Department of Agriculture's Animal and Plant Health Inspection Service (USDA-APHIS), and volunteers with the Fish & Wildlife Service, and other organizations are underway. A national database, the National Cactus Moth Detection and Monitoring Network (www.gri.msstate.edu/cactus_moth), has been built to monitor and track pricklypear and the cactus moth. This web-based database is a project of the National Biological Information Infrastructure (NBII) Invasive Species Information Node (ISIN), which is composed of numerous databases and information sources on invasive species. To date, active mapping of the host pricklypear has been conducted in 11 southern states. Three types of surveys are being collected and stored: cactus moth trap data, cactus moth visual observation data, and pricklypear data. Species associated with pricklypear are also recorded to assist ongoing modeling efforts. In addition, sentinel sites have been established along the leading edges of cactus moth range expansion in the Carolinas and Mississippi. Data on the location of pricklypear cacti and cactus moth will be used by USDA-APHIS for management efforts to prevent the spread of cactus moth.

Poster Presentation

LONG-TERM RARE PLANT MONITORING AT MIDEWIN NATIONAL TALLGRASS PRAIRIE (ILLINOIS)

MASI, SUSANNE and Emily Kapler

Institute for Plant Conservation, Chicago Botanic Garden, 1000 Lake Cook Road, Glencoe, IL 60022; smasi@chicagobotanic.org; ekapler@chicagobotanic.org

The Chicago Botanic Garden has conducted rare plant monitoring at Midewin National Tallgrass Prairie since 2001 through the Garden's Plants of Concern (POC) program. POC is a regional rare plant monitoring project that utilizes standardized protocols developed by an advisory group of land managers and scientists. It works with trained volunteers coordinated by professional staff. *Carex crawei*, *Isoetes butleri*, *Malvastrum hispidum*, *Minuartia patula*, and *Rudbeckia fulgida* var. *sullivantii* were monitored 2003-2005; *Tomanthera auriculata* was monitored 2001-2005. *Cirsium hillii*, *Cypripedium candidum*, and *Trifolium reflexum* are monitored at nearby sites. Several of these taxa are regionally endemic to the rare dolomite prairie system that occurs at and near Midewin. Monitoring methods include a census and status assessment of the populations: plant numbers and area covered are recorded as well as impacts of invasive species and other threats. Some populations are further monitored in permanent plots using demographic or sampling methods. Monitoring data are related to management practices occurring at each location to determine the management impact on population change and to guide further management. Resulting trends from this long-term monitoring are still tentative after three to five years of data, although data about threats such as deer browse, cattle grazing, and brush encroachment suggest these threats negatively impact several populations. The poster presents the scope of the monitoring program, species monitored, examples of the types of data being gathered, and volunteer involvement. Two species are used as examples to demonstrate how data are being analyzed by the program.

Oral Presentation

UNDERSTANDING AND ASSESSING PLANT INVASIONS: AN ONLINE WORKSHOP FOR WILDLAND WEED MANAGERS

MCFADZEN, MARY

Center for Invasive Plant Management, PO Box 173120, Dept. LRES, Montana State University, Bozeman, MT 59771; mmcfadzen@montana.edu

To support effective and sustainable wildland weed management efforts, the Center for Invasive Plant Management offers an online workshop to land managers on ecologically-based weed management. The goals of the workshop are to provide the participants with an understanding of ecological principles and processes to better assess weed populations, and to assist them in developing and prioritizing weed management strategies in conjunction with their land management goals using an adaptive management framework. Five weed ecologists from three western universities facilitate the eight-week workshop. Module content covers adaptive management, the invasion process, risk assessment, monitoring, management options and actions (integrated tools), and the influences of spatial and temporal scales on management. Opportunities for dialogue and information exchange among participants, and between participants and instructors, occur via asynchronous discussions, real-time chats, and a web conference. By the end of the workshop, participants complete a draft ecologically-based weed management plan for an area they manage. This presentation describes the online workshop in more detail and includes results of participants' evaluation of the January 2006 workshop.

Oral Presentation

CHANGES IN UNDERSTORY VEGETATION ON A LARGE-SCALE PONDEROSA PINE FOREST RESTORATION PROJECT IN ARIZONA: FROM SPARSE UNDERSTORY TO ABUNDANT NATIVES TO CHEATGRASS INVASION

MCGLONE, CHRISTOPHER M., Judith D. Springer, and W. Wallace Covington

Ecological Restoration Institute, Northern Arizona University, P.O. Box 15017, Flagstaff, AZ 86011; chris.mcglone@nau.edu; Judith.Springer@nau.edu; Wally.Covington@nau.edu

The understory vegetation in modern southwestern ponderosa pine forests is believed to be depauperate, especially when compared to historical conditions. The use of ecological restoration practices such as the thinning of small diameter trees and the reintroduction of fire has been advocated as a method for reinvigorating the understory vegetative community. Little is known about the effectiveness of these practices on a whole-forest scale. In 1995, a large-scale ecological restoration project was initiated in the Uinkaret Mountains in northern Arizona. Trees were thinned to mimic pre-1870 densities and distribution. Thereafter, the treated areas were broadcast burned and seeded with native perennial grasses and forbs. By 2001, the treated areas contained a more abundant and species-rich understory. When we remeasured the area in 2003, however, the nonnative annual cheatgrass (*Bromus tectorum*) had heavily invaded the treated areas, becoming the dominant understory species in many areas. The native plant community was still more robust in the treated plots than in the control plots, which is consistent with the objectives of the ecological restoration project. However, the high levels of invasion by cheatgrass pose a serious challenge to the health of the ecosystem. The authors recommend that land managers incorporate the threat of invasion by nonnative species into their future ecological restoration projects.

Oral Presentation

PROTECTING RIVERS IN THE WESTERN LANDSCAPE

MCKEW, QUINN

American Rivers, 1101 14th Street NW, Washington, DC 20005; qmckew@americanrivers.org

The Bureau of Land Management (BLM) manages 38 Wild and Scenic Rivers (WSR) as part of the National Landscape Conservation System (NLCS), protecting over one million acres of land in corridors along 2,060 miles of river. Some of these rivers, like the Missouri and the Rio Grande, echo through tales of the American western experience, and many of the BLM's river corridors include historic and archaeological sites. Americans exploring these waterways experience the West as it was discovered by the first European explorers – remote, wild, and rugged. The WSR Act and the rivers in the NLCS offer a variety of ways to pursue a modern conservation vision – one in which communities, species, and recreation all can benefit. With over 18% of the river miles in the nation's WSR system, the BLM plays an important role in managing these rivers. In addition, the BLM manages thousands of other river segments that truly are wild and scenic, despite not having the formal title. Most of the rivers currently considered to have potential as additions to the WSR system are found on BLM land.

Oral Presentation

WHAT IS A HEALTHY FOREST? AN EXAMPLE FROM CANADA'S NATIONAL PARKS

MCLENNAN, DONALD S.

Parks Canada Agency, National Parks Directorate, 25 rue Eddy, 4th floor (25-4-S) Hull, Quebec, CANADA K1A0M5; donald.mclennan@pc.gc.ca

Parks Canada Agency is developing coordinated and systematic ecological integrity monitoring and reporting over all 42 parks in Canada's national park system to meet agency deadlines for 2008. A major challenge for this program is to select the most parsimonious suite of measures ('indicators') that together can be assessed and communicated to report to Canadians any significant changes in the ecological integrity of national parks. The program mission is to develop park monitoring systems that are useful (to park managers and partners), comprehensive (i.e., include measures from all major park ecosystems), and sustainable (within park human and financial resource capabilities). As an example of how Parks Canada is proceeding, this talk focuses on an approach for measuring and assessing forest ecological integrity, including 1) conceptual ecosystem models to frame the monitoring; 2) selecting and sampling a suite of ecological integrity measures ('indicators') in long-term sample sites (annual decomposition proxy, forest songbirds, forest salamanders, forest composition and structure, site tree productivity) to assess local scale change; 3) selecting and sampling a suite of ecological integrity measures ('indicators') from forest landscape analysis, e.g., fragmentation-connectivity, forest community representation, and forest productivity; 4) development of the concept of a 'desired condition' for park forests; 5) integration and assessment of measures; and 6) reporting and communicating the monitoring results in State of the Park reports to be produced every 5 years by each park in the system. We view park forests as an ecological continuum with forests adjacent to the park. Thus a key to conservation success at the park level is to successfully engage park neighbors in forest management and monitoring, and examples of successful and ongoing partnerships from are provided.

Poster Presentation

CHARACTERISTICS OF SOUTHWESTERN WILLOW FLYCATCHER (*EMPIDONAX TRILLII* *EXTIMUS*) HABITAT ALONG THE LOWER COLORADO RIVER – APPLIED RESTORATION SCIENCE

MCLEOD, MARY ANNE and Thomas J. Koronkiewicz

SWCA Environmental Consultants, 114 N. San Francisco St, Flagstaff, AZ 86001; mmcleod@swca.com; tkoronkiewicz@swca.com

As a major component of the Lower Colorado River (LCR) Multi-Species Conservation Program (MSCP), 5,940 acres of cottonwood-willow riparian habitat will be restored along the LCR to provide habitat for the endangered Southwestern Willow Flycatcher and other riparian species. SWCA Environmental Consultants has been contracted by the U.S. Bureau of Reclamation under the MSCP to design and conduct vegetation, microclimate, and hydrology studies at unoccupied and occupied willow flycatcher sites along the LCR and its tributaries in Nevada and Arizona to quantify physical characteristics of willow flycatcher habitat. Over three years, our studies indicated that flycatchers placed their nests in habitats that were cooler, exhibited smaller temperature fluctuations, were more humid, and had higher soil moisture than unoccupied sites. Habitat structure at flycatcher nest sites differed from unoccupied sites, with occupied sites having greater canopy closure and taller canopy height than unoccupied sites. Foliage density was also greatest at and immediately above mean nest height. Designing MSCP cottonwood-willow restoration sites to replicate the physical habitat characteristics of occupied willow flycatcher habitat

may facilitate colonization of sites and provide a more suitable microclimate for willow flycatchers to raise offspring.

Oral Presentation

DETERMINATION AND RESTORATION OF THE NATURAL SOUNDSCAPE AT GRAND CANYON NATIONAL PARK, ARIZONA

MCMULLEN, KEN G.

Grand Canyon National Park Science Center, 823 N San Francisco St., Suite B, Flagstaff, AZ 86001; ken_mcmullen@nps.gov

Efforts to restore the natural soundscape at Grand Canyon National Park (GCNP) have struggled for 30 years to characterize the “natural” sound conditions of the park. Examples of human noise intrusions into the backcountry are provided, along with an assessment of trends. The potential for shaping park management direction in the protection and management of the natural soundscape of GCNP, while addressing a range of socio-economic concerns and pressure for recreational use, is discussed. Determining the current condition of five representative acoustic zones and applying that information to management of the park lands has been difficult. Obstacles to management implementation have come from interested public and business interests that question the scientific accuracy of methods and data and the potential impacts of proposed actions. The potential to substantially restore the “natural” soundscape at GCNP and to overcome an array of issues from diverse interests and conflicting Federal agency policies is discussed.

Oral Presentation

INTEGRATING INTERMINGLED FEDERAL, STATE, AND PRIVATE LANDS FOR NATURAL AREA MANAGEMENT IN NORTHERN ARIZONA

METZGER, MANDY ROBERTS

Diablo Trust, PO Box 31239, Flagstaff, AZ 86003; mandyrmetzger@viawest.net

Participants in the Diablo Trust have probably kicked as much dirt as any organization. Going to the land has always proven to be constructive when challenged with land management issues. And, for the most part, Diablo Trust has stayed together as a team, welcoming new dirt-kickers on a regular basis. Designated a National Government Reinventing Laboratory, Diablo Trust is a non-profit land management team dedicated to the conservation of 665 square miles of intermingled federal, state, and private lands. Located in northern Arizona and home to two historic ranches, this natural area gem is also frequented by the public for recreation and hunting. It provides a place of solace and inspiration to some, opportunities for adventure and research to others. The Trust, formed in 1993 at a kitchen table, is now headquartered in the Center for Sustainable Environments at Northern Arizona University. Participants include environmentalists, agency specialists, ranchers, students, and university faculty. However, all is not quiet in this seemingly idyllic home on the range. Challenged by shifting economics, weather patterns, populations, and government regulations, the Diablo Trust strives to find innovative ways to provide a “hands on proving ground” for new land management ideas. Towards this goal, the Trust has started an 80,000-acre project, which includes grasslands restoration, historic spring restoration, and wildlife habitat improvements. To help ensure the future long-term protection of this natural area, the Trust created the Diablo Canyon Rural Planning area – authorized under state statute, it is the first planning area of its kind in Arizona. The Trust is caretaker of, and case study for, a holistic

monitoring program that measures biological, social, and economic indicators, both on the ranches and in the community, and measures effectiveness of collaborative processes as well.

Oral Presentation

CORAL BLEACHING AND DISEASE COMBINE TO CAUSE EXTENSIVE MORTALITY ON REEFS IN U.S. VIRGIN ISLANDS

MILLER, JEFF¹, Erinn Muller², Rob Waara³, and Caroline Rogers²

¹Virgin Islands National Park, 1300 Cruz Bay Creek, St. John, VI 00830; William_J_Miller@nps.gov

²U.S. Geological Survey, 1300 Cruz Bay Creek, St. John, VI 00830; Emuller@usgs.gov, Caroline_Rogers@usgs.gov

³National Park Service, South Florida/Caribbean Inventory and Monitoring Network, 18001 Old Cutler Road, Suite 419, Palmetto Bay, FL 33157; Rob_Waara@nps.gov

Historically warm *in-situ* water temperature and calm seas during summer-autumn 2005 created extensive coral bleaching in the U.S. Virgin Islands. Episodic monitoring at five study reefs revealed >90% coral cover bleached (n = 20 permanent video transects per site). Corals began regaining color in October 2005 as water temperatures decreased, and minimal coral mortality was detected. Continued monitoring at these sites from November 2005 through July 2006 revealed significant coral mortality following distinct White Plague disease signs resulting in 48.7% mean loss of coral cover at the six monitoring sites in Virgin Islands National Park (VIIS), and Buck Island Reef National Monument. Tektite Reef (VIIS) showed a 48% coral cover decline in only 6 months and 54% loss in 10 months. Chronic mortality from this disease has occurred monthly at the Tektite monitoring site since 1997, but with prevalence rates not related to elevated temperatures or previous bleaching events; however, levels of mortality from disease at all sites increased approximately 4-80 times that of pre-bleaching levels and is strongly suggestive of a connection between bleaching and disease mortality. While coral mortality from bleaching events has been well documented, this study shows that only with frequent monitoring would the post-bleaching mortality patterns and presence of pathogenic disease be detected.

Oral Presentation

MECHANISMS OF INVASION OF JAPANESE STILT GRASS (*MICROSTEGIUM VIMINEUM*), A NONNATIVE ANNUAL GRASS THREATENING DECIDUOUS FORESTS

Miller, Nathaniel and GLENN MATLACK

Environmental and Plant Biology, Porter Hall, Ohio University, Athens, OH 45701; nm177505@ohio.edu; matlack@ohio.edu

Japanese stilt grass is a shade-tolerant annual grass rapidly spreading through forest ecosystems of the eastern United States although it has no obvious dispersal vector. To understand its mechanism and pattern of spread we have established long-term monitoring of patches in forests of southeastern Ohio. Distribution of patches strongly corresponds to microenvironmental gradients of light, soil moisture, and exposed soil. Expansion of populations along a variety of traffic corridors suggests dispersal by deer, water movement, pedestrian traffic, and off-road vehicles, with expansion rates approaching 100m per year in the latter. Away from traffic corridors, a seed-sowing experiment suggests that stilt grass is both habitat- and dispersal-limited. We conclude that vehicle movement presents the greatest threat of stilt grass spread, but that any

human activities creating disturbed microsites under an open canopy may promote expansion in local areas.

Oral Presentation

MAKING SENSE OF RIVERS: GUIDING PRINCIPLES FOR THE ARID SOUTHWEST

Moody, Tom O. and ELIZABETH J. RUTHER

Natural Channel Design, Inc., 3410 S. Cocopah Drive, Flagstaff, AZ 86001;
tom@naturalchanneldesign.com; liz@naturalchanneldesign.com

Over several years of enhancement and restoration design for alluvial stream systems across the Southwest, patterns have emerged illuminating 'Guiding Principles' that have helped our restoration efforts become highly successful in this dynamic region. These Guiding Principles are intuitive but are critical to consider when designing, enhancing, or restoring stream channels. Each is discussed and a case study of Natural Channel Design's work on the Santa Clara River in southern Utah is used to illustrate each principle.

Oral Presentation

TAKING BANKFULL TO THE BANK: USEFUL CHANNEL PATTERNS IN THE ARID SOUTHWEST

MOODY, TOM O. and Elizabeth J. Ruther

Natural Channel Design, Inc., 3410 S. Cocopah Drive, Flagstaff, AZ 86001;
tom@naturalchanneldesign.com; liz@naturalchanneldesign.com

The geomorphic approach to stream restoration is based on a thorough understanding of patterns of channel morphology of natural stream systems. A common point of reference, called bankfull stage, is used to understand stream flow and channel characteristics. Research over the past decade has identified geomorphic patterns common to stream channels in the arid Southwest. These patterns can be invaluable for assessment and design of stream projects. We discuss these patterns in context of Natural Channel Design's restoration work and share preliminary findings regarding our measurements of bankfull stage in arid regions.

Oral Presentation

LOSING THE NIGHT – DOCUMENTING THE EXTENT AND SEVERITY OF ARTIFICIAL LIGHT POLLUTION

MOORE, CHAD and Dan Duriscoe

National Park Service Night Sky Team, Bryce Canyon National Park, PO Box 640201, Bryce, UT 84764; Chad_Moore@nps.gov; Dan_Duriscoe@nps.gov

The U.S. National Park Service has developed a system to measure the night sky brightness and the degree to which starry skies are degraded by light pollution. Results from approximately 40 parks and natural areas show that many areas have substantial degradation, with remarkably few

pristine areas remaining. This causes a substantial impact on the scenic qualities of the night, and is also an ecological impact that merits much greater study and alarm. Starry night skies are a significant element in what the public expects from their natural areas, a growing source of ecotourism, a component of our heritage, a wilderness character, and a fundamental side of our planet.

Oral Presentation

GEORGIA INVASIVE SPECIES TASKFORCE: IMPLEMENTATION OF CONTROL AND PREVENTION STRATEGIES FOR MANAGING COGONGRASS (*IMPERATA CYLINDRICA*) ON A STATE-WIDE SCALE

MOORHEAD, DAVID J.¹, Christopher W. Evans², Charles T. Barger², and G. Keith Douce³

¹The University of Georgia, Warnell School of Forestry and Natural Resources, PO Box 748, Tifton, GA 31793; moorhead@uga.edu

²The Bugwood Network, University of Georgia, PO Box 748, Tifton, GA 31793; cevans@uga.edu; cbarger@uga.edu

³The University of Georgia, Department of Entomology, PO Box 748, Tifton, GA 31793; kdouce@uga.edu

With only 43 known infestations, cogongrass is an emerging invasive species in Georgia. To facilitate cooperation in all areas of management, both of cogongrass and other invasive species, state and federal agencies, university personnel, and Exotic Plant Pest Council (EPPC) members have combined to form the Georgia Invasive Species Task Force. The task force has adopted a four-fold approach to managing cogongrass in Georgia: 1) management of known infestations, 2) discovery of any existing but unknown infestations, 3) reduction of pathways of spread, and 4) preparation for new infestations. Control efforts on known infestations are currently being administered by U.S. Department of Agriculture Animal and Plant Health Inspection Service – Plant Protection and Quarantine (APHIS-PPQ) or Georgia Forestry Commission personnel. University of Georgia faculty and staff are maintaining a database of known infestations and have created an online mapping program showing locations. Plans are underway to implement on-the-ground and remote sensing surveys to aid in discovering new infestations. Workshops, educational materials, and press releases are all being used to inform and educate the public on this new threat. To prepare for the inevitable increase in new infestations, the Georgia Invasive Species Task Force is developing protocols for handling new finds, initiating a land-owners assistance program, and training agency and university personnel on identification, management, and control of cogongrass.

Poster Presentation

SURVEY OF TAXONOMIC DIFFERENCES BETWEEN *TRIFOLIUM RADICOSUM* AND OTHER SPECIES OF THE SECTION *LOTOIDEA* IN IRAN

MOSTAFAVI, G., F. Salimpour, and F. Sharifnia

Department of Biology, Faculty of Science, Islamic Azad University, North Tehran Branch, PO Box 19585-935, Tehran, Iran; golaleh_m@hotmail.com

Clover is a valuable forage plant in Iran. Section *Lotoidea* of the clover genus consists of seven annual and perennial herbaceous species. *Trifolium radicosum* of this section is the only species endemic to Iran; it is reported from Tehran (Tochal Mountain). This species is perennial and is morphologically separated from the rest of the section by its purple corolla, oblong standard, and

elliptical seed shape. Phenetic study was done with the use of NTSYS software. Cluster analysis, factor analysis, and principal component analysis confirmed differences with other species of this section. Palynological study by scanning electronic microscope determined that *T. radicosum* had the smallest polar length (P) and equatorial width (E) and a P/E ratio of 0.1, unique among species in this section. Its reticular pollen surface ornamentation is also unique. Seeds of *T. radicosum* are markedly different in general shape, length, width, and surface ornamentation. The species is diploid with $2n=2x=16$. The shape and length of chromosome is different from other species in this section. We recommend additional techniques for separating this species from others in the section.

Poster Presentation

KARYOLOGICAL STUDY OF *TRIFOLIUM* SPECIES IN SECTION *LOTOIDEA* IN IRAN

MOSTAFAVI, G.¹, E. Zarifi², F. Salimpour¹, and F. Sharifnia¹

¹Department of Biology, Faculty of Science, Islamic Azad University, North Tehran Branch, PO Box 19585-935, Tehran, Iran; golaleh_m@hotmail.com

²Genetics and Genetic Resources Research Department, Seed and Plant Improvement Institute, PO Box 4119, Karaj 31585, Iran; Ezarifi@yahoo.com

The genus *Trifolium* (Fabaceae) includes 52 species of annual and perennial herbs that are widely distributed in different ecological conditions in Iran. Many of these species are valuable sources of forage for both wild and domestic animals. Some of the species are cultivated. Chromosomal data has long been a valuable tool for cytogeneticists and breeders. Chromosome studies are often useful in suggesting taxonomic and phylogenetic relationships among species and in identifying subspecies. We carried out karyological studies on seven *Trifolium* species of the *Lotoidea* section, collected from different ecological regions of Iran. Root tip meristems obtained from germinated seeds in Petri dishes were pretreated with a saturated solution of α -bromonaphthalene at 4°C for 2.5 h. The fixed root tips in 3:1 solution were hydrolyzed in 1N HCL and stained in aceto-iron- hematoxylin. Cytogenetical studies showed that all the species in section *Lotoidea* have the same basic chromosomal number of eight ($x=8$); three species are diploids and four are tetraploids. All species have satellited chromosomes equal to ploidy level, which could be used as chromosome markers. The chromosome number for two species, *T. montanum* and *T. nigrescens* $2n=32$, was determined for the first time for Iran. Morphometry of chromosomes was analyzed.

Poster Presentation

STATUS AND TRENDS OF BIODIVERSITY IN THE CHICAGO WILDERNESS REGION: RESULTS FROM AN ECOLOGICAL REPORT CARD

MULVANEY, CHRISTOPHER¹, Laurel Ross², and Dan Gooch³

¹Chicago Wilderness, 1000 Lake Cook Rd., Glencoe, IL 60022; cmulvaney@chicagowilderness.org

²The Field Museum, 1400 South Lake Shore Dr., Chicago, IL 60605; lross@fieldmuseum.org

³Illinois Endangered Species Protection Board, 16w284 97th Street, Burr Ridge, IL 60527; rdangooch@aol.com

On April 10, 2006, the Chicago Wilderness (CW) consortium, an alliance of over 190 public and private organizations working together to protect, restore, study, and manage the natural ecosystems of the Chicago metropolitan region, released *The State of Our Chicago Wilderness: A Report Card on the Health of the Region's Ecosystems*. This document, existing in both a

summary format for the general public and a more comprehensive technical document for CW member organizations, describes the first assessment of the status of the natural ecosystems in the CW region since the completion of the CW *Biodiversity Recovery Plan* in 1999. As part of this process, natural areas experts familiar with the region's biodiversity were brought together during two all-day workshops to rank the region's natural communities and animal assemblages and to identify sources of data. Using a four-point scale, experts provided a condition ranking for each community type and species assemblage. Despite the presence of numerous high-quality sites, most communities and assemblages ranked at the lower end of the scale, indicating that much of the region's biodiversity remains threatened and in a state of decline. In this poster, we present the major results from the report card and examine them in context with the *Biodiversity Recovery Plan* assessments, completed several years earlier, to learn of any identifiable trends in the health of the region's ecosystems.

Oral Presentation

CULTURAL LANDSCAPES AND TRADITIONAL ECOLOGICAL KNOWLEDGE: INTEGRATING THEM INTO PROTECTED AREAS

NABHAN, GARY P.

Center for Sustainable Environments, Northern Arizona University, Box 5765, Flagstaff, AZ 86011; gary.nabhan@nau.edu

Since its inception, the Center for Sustainable Environments at Northern Arizona University has assisted Native Americans in the U.S. and Mexico with establishing their involvement in the management and restoration of cultural landscapes in protected areas. In most cases, these indigenous communities have had long relationships of conservation and use with the plants, animals, minerals, water, and landscapes in these areas, but these have sometimes been disrupted by formal land management agencies. I argue that the long-accumulated traditional ecological knowledge still imbedded in these communities is not antithetical but complementary to Western scientific management of these areas and their resources. Where national parks, private land trusts and conservancy areas have sometimes engaged indigenous communities in co-management, our Sacred Lands Toolkit suggests additional means and structures for indigenous participation. Among the emerging means and structures are National Heritage Areas, Globally Ingenious Agricultural Heritage Sites, Community-Based Protected Areas for Conservation and Traditional Use, and Tribally-Designated Cultural Parks and Gathering Grounds.

Oral Presentation

EVALUATING THE STATUS OF THE MISSOURI NATURAL AREAS SYSTEM

NIGH, TIMOTHY A.¹ and Karen Shelly²

¹Missouri Department of Conservation, Resource Science Division, 1110 College Ave, Columbia, MO 65201; Timothy.Nigh@mdc.mo.gov

²8718 Mashie Lane, Missoula, MT 59808; kshelly@bigsky.net

Publication of the revised Terrestrial Natural Communities of Missouri and the Atlas of Missouri Ecoregions has provided a new framework for evaluating the Missouri Natural Areas system. Using the new classification, the Heritage database, and the ecological subsections, we developed a database that allows us to examine how well natural communities are represented in the ecological subsections they occur by the existing designated Natural Areas. We also identified

Candidate Natural Areas for those communities poorly represented in the system. The evaluation summarizes the extent that potential natural communities in each subsection are represented and provides a list of candidates by region, subsection, and community type generated from our best available information in the Heritage database. These results will help guide future nominations, as well as natural community inventory needs.

Poster Presentation

MISSOURI MASTER NATURALISTS: VOLUNTEERS APPLYING ECOLOGICAL CONCEPTS AND APPROACHES IN COMMUNITY-BASED CONSERVATION PROGRAMS

NILON, CHARLES¹, Caroline Broun¹, Robert Pierce¹, and Ginny Wallace²

¹Department of Fisheries and Wildlife Sciences, University of Missouri-Columbia, 302 ABNR, Columbia, MO 65211-7240; nilonc@missouri.edu; piercer@missouri.edu; cbkt3@mizzou.edu

²Missouri Department of Conservation, PO Box 180, Jefferson City, MO 65102; Ginny.Wallace@mdc.mo.gov

The Missouri Master Naturalist Program has been developed as an educational program directed at developing a corps of master volunteers to provide education, outreach, and service that promotes the integration of science-based ecological concepts into the management of natural resources within their respective community. The program combines education and volunteer service at the community level to empower citizens to become involved in natural resource management and education. In addition, participants must complete an advanced training program that emphasizes ecological applications and natural history and conduct volunteer service projects within their community through the organization of a local Master Naturalist Chapter. The Master Naturalist Program has been successfully piloted in three locations in the state and is now being implemented statewide. Results from the pilot chapters indicate that participants described themselves as more knowledgeable about basic ecological concepts and conservation issues and are better prepared to organize and lead conservation education programs within their communities. Survey results from four Master Naturalist chapters indicate that participants also retain knowledge gained and are likely to apply that knowledge towards the beneficial management of natural resources within their community.

Oral Presentation

SELECTION OF "SPECIAL AREAS" ON THE CIMARRON AND COMANCHE NATIONAL GRASSLANDS, KANSAS AND COLORADO

OLSON, STEVEN

Pike-San Isabel National Forest and Cimarron-Comanche National Grasslands, 2840 Kachina Drive, Pueblo, CO 81008; solson01@fs.fed.us

The Cimarron-Comanche National Grassland (CCNG) is revising its land management plan using the 2005 National Forest Management Act Planning Rule, which guides plan revision on National Forests and Grasslands. The CCNG is the first National Forest System unit to complete a draft plan using the new rule. Under the rule, "Special Areas" represent one of five required plan components. Special areas are designated for their unique or special characteristics. Resource specialists for the Grasslands, including those working in archaeology, paleontology, botany, and wildlife, provided lists of sites that have such features. Several areas had recommendations from more than one discipline. Eight sites were carried forward as special areas in the land

management plan. Two were kept based on recommendations of a single resource area, while the other six represented multiple resources.

Oral Presentation

WILDERNESS AREAS AND FIRE RESTORATION: FEDERAL AGENCY INTERPRETATIONS AND CHALLENGES

Ostergren, David¹ and MEGAN TRIPLETT²

¹School of Forestry and the Center for Environmental Sciences and Education, Northern Arizona University, Flagstaff, AZ 86011; david.ostergren@nau.edu

²School of Forestry, Northern Arizona University, Flagstaff, AZ 86011; megan.triplett@nau.edu

The U.S. Forest Service, Bureau of Land Management, and National Park Service manage wilderness areas in northern Arizona that are dominated by ponderosa pine ecosystems. Agencies, researchers, and NGOs acknowledge that these ecosystems are out of their natural range of variability and need restoration of composition, structure, and function. Across the Southwest, the most significant process that has been excluded is fire. Wilderness may be one of the most important places to reintroduce fire. The foci of this analysis are the differences in how three federal agencies interpret what may be acceptable to reintroduce fire in Wilderness Areas. The debate of what is an acceptable action in Wilderness has evolved over four decades and engaged agency personnel, researchers, and non-government organizations. Management standards are supposed to protect the wilderness character of an area, to maximize natural and untrammelled conditions. Utilizing case study methodology this analysis identifies and analyzes the policy changes and challenges to restoring designated Wilderness Areas in northern Arizona reflecting policy across the United States. Findings indicate that policy options include 1) letting wild fire burn regardless of the outcome, 2) single entry prescriptions with hand tools or chainsaws and then letting all fires run their course, 3) a strategy that includes light thinning for fire lines and regular-interval prescribed burns planned for the foreseeable future. Any option in Wilderness is bound to require extensive documentation, deliberation, collaboration, and strong, creative leadership.

Poster Presentation

USE OF FLIGHT-INTERCEPTION TRAPS TO MONITOR BEETLE DIVERSITY IN SALT CREEK CANYON, CANYONLANDS NATIONAL PARK, UTAH

PECH, LOUIS L.¹ and Tim B. Graham²

¹Department of Biological Sciences, University of Wisconsin-Marathon County, 518 South 7th Avenue, Wausau, WI 54401; lou.pech@uwc.edu

²Canyonlands Research Station, Southwest Biological Science Center, USGS, 2290 West Resource Blvd, Moab, UT 84532; tim_graham@usgs.gov

Salt Creek Canyon in Canyonlands National Park (CANY) is one of few perennial or semi-perennial riparian environments in CANY. Historically, Salt Creek has been used as a road by off-road vehicles. Portions of the canyon have been closed recently, thus dividing Salt Creek Canyon into three sections: an upper No Road (NR) section where vehicle use ended in 1964, a middle Closed Road (CL) section where vehicle use ended in 1998, and a lower Road Open (RO) section where vehicle use continues. Since 2000, we have been surveying the invertebrate community of Salt Creek Canyon in order to establish monitoring methods to evaluate the effects of vehicle

disturbance and response to road closure on the Salt Creek ecosystem. Flight interception traps are relatively simple to transport to field sites, easy to set up, and do not require digging into fragile biological soil crusts. Thus we were interested in evaluating flight interception traps for use in Salt Creek Canyon. While this study is ongoing, here we focus on the beetles collected using these traps in June 2005. The 2,384 specimens collected were distributed among 32 morphospecies from 20 families. The proportions of each morphospecies at each trapping site were compared. Most showed no obvious trends. However, one nitidulid and one buprestid decreased proportionally from lower RO section through the CL section to the upper NR section of the canyon. In contrast, one scarab, one staphylinid, and one mordellid increased proportionally from the lower to the upper reaches of the canyon. While preliminary, these results suggest that some beetle taxa may be useful indicators of riparian system condition, and that flight interception traps may be a useful, simple, and relatively low impact method for monitoring trends in beetle diversity along an ecological gradient in Salt Creek Canyon.

Oral Presentation

BASELINE AND STEWARDSHIP MONITORING ON SAWTOOTH NATIONAL FOREST RESEARCH NATURAL AREAS, IDAHO

PIERSON, KIM¹, Steven K. Rust², and Jennifer J. Miller²

¹Sawtooth National Forest, 2647 Kimberly Road East, Twin Falls, ID 83301; kpierson@fs.fed.us

²Idaho Conservation Data Center, Idaho Department of Fish and Game, PO Box 25, Boise, ID 83707; srust@idfg.idaho.gov; jmiller@idfg.idaho.gov

Research Natural Areas (RNAs) are part of a national network of ecological areas designated in perpetuity for research and education, and to maintain biological diversity on National Forest System lands. Stewardship monitoring is needed within the RNAs to assure attainment of long-term management goals and to provide baseline reference data for evaluating more intensively managed lands. Seven RNAs occur on the Sawtooth National Forest. These natural areas were established in the late 1980s and early 1990s to provide representation of a diverse range of biological and physical components ranging from cool, montane peatlands to dry sagebrush steppe and juniper woodlands, and include unique examples of glacial deposition and globally rare plant species. Baseline and stewardship monitoring efforts in these RNAs began in 2002 with the assistance of the Idaho Conservation Data Center. Annual sampling has continued. We report a summary of all biodiversity data collected to date. Additionally, we present information on current threats, uses, and management needs. We make recommendations for future research needs, mitigations for threat reduction, and changes in management to continue the protection and/or restoration of natural ecological communities, species, and processes, which the RNAs were designated to represent and protect.

Oral Presentation

STOP AQUATIC HITCHHIKERS! AND THE 100TH MERIDIAN INITIATIVE – USING SOCIAL MARKETING FOR THE BENEFIT OF CONSERVATION

PITMAN, BOB¹ and Joe Starinchak²

¹U.S. Fish and Wildlife Service, Southwest Regional Office, 500 Gold Ave. SW, Albuquerque, NM 87102; Bob_Pitman@fws.gov

²U.S. Fish and Wildlife Service and National Aquatic Nuisance Species Task Force, Washington Office, 4401 N. Fairfax Drive, Rm. 322, Arlington, VA 22203; Joe_Starinchak@fws.gov

Globally, aquatic nuisance species (ANS) are increasingly viewed as an environmental challenge with significant ecological and economic impacts. Introduced into “new” habitats, these species can cause economic harm, degrade ecosystems, and negatively affect human health and lifestyles. Over the past 15 years, the U.S. resource management community has developed and refined a comprehensive approach for dealing with this complex issue. A key component is public outreach and education. However, little has been done nationally or regionally to legitimize outreach as a viable part of the equation in addressing this complex issue. Under the leadership of the national Aquatic Nuisance Species Task Force and the U.S. Fish and Wildlife Service (USFWS), the public education and outreach issues are finally beginning to be addressed on both a national and regional level through two public awareness campaigns. While the ANS issue originally became elevated through the zebra mussel invasion of the Great Lakes in the late eighties, the public awareness component of the government’s response did not truly take shape until the development of the regional, western-focused *100th Meridian Initiative* in the late nineties. This has been complemented by the national *Stop Aquatic Hitchhikers!*TM campaign. This presentation describes how these campaigns are being evaluated and how they have served as a catalyst for better internal coordination between state and federal conservation agencies and nonprofit and private sectors, for enhancing strategic communications among multiple agencies, for generating partnerships with stakeholders and constituent groups, and for developing greater statewide public support for expanding the agency invasive species funding and authorities.

Oral Presentation

THE BORDER IMPACTS PROGRAM AT ORGAN PIPE CACTUS NATIONAL MONUMENT, ARIZONA

POVILITIS, ANTHONY, Beth Fallon, Mary Kralovec, Ami Pate, Sue Rutman, and Ben Zank

Resource Management Division, Organ Pipe Cactus National Monument, 10 Organ Pipe Drive,
Ajo, AZ 85321; Anthony_Povilitis@nps.gov;

Human migration, drug smuggling, and related law enforcement efforts have increased greatly in recent years across the Sonoran Desert of Organ Pipe Cactus National Monument (OPCNM). The National Park Service monitors the extent, spatial patterns, and trends of resulting land surface disturbances, seeking to evaluate ecological impacts and mitigate natural and cultural resource damage. Monitoring includes backcountry transects to document foot trails, vehicle routes, and dispersed trash on designated wilderness lands. Road surveys record off-road excursions (exit/entry points) originating from public and administrative roads, and vehicle-related roadside impacts. Law enforcement officials provide additional data on off-road travel. Satellite imagery is useful in some areas for detecting major trails and vehicle routes. A Rapid Assessment Tool is employed for mapping foot trails and vehicle routes while providing information on ground-level impacts. Site specific damage is further documented through photography and written descriptions. The program evaluates the vulnerability of species and natural communities to disturbance and recommends field research to better document impacts. A study of how border activities affect soils and vegetation is underway in cooperation with the Sonoran Institute. Preventative measures include a vehicle barrier along the international border and a protocol for law enforcement personnel on how to minimize impacts. Signs posted along roads emphasizing wilderness boundaries and the need to stay on established roads, drive slowly, and avoid road-kills help reinforce this. Masking or raking out vehicle tracks and use of physical barriers to discourage off-road use are being tested. Trash removal is underway and rehabilitation options for selected disturbed sites are being considered. While there is nothing that resource managers can do to stop illegal travel through OPCNM, heightened law enforcement and surveillance activity in areas of particular ecological or cultural concern may help abate certain impacts.

Oral Presentation

NATURE CONSERVATION WITHIN AN URBAN SETTING: THE CITY OF CAPE TOWN, SOUTH AFRICA

PRETORIUS, ADELE

Cape Town Nature Conservation, City of Cape Town Municipality South Africa, 5 11th Ave, Melkbosstrand, Cape Town, South Africa, 7441; bca@sybaweb.co.za

The Cape Floristic Kingdom (CFK) was recently declared a World Heritage site. This recognizes the uniqueness of the smallest floristic kingdom and the only one to be found entirely within a single country. The CFK comprises an area of less than 90,000 km² and has approximately 9,600 plant species, of which 70% are endemic. Cape Town Nature Conservation reserves are located within the City of Cape Town (which is located entirely within the CFK) and therefore are surrounded by urban environment. The Cape Peninsula, an area smaller than the size of London, has 2285 plant species of which 160 species are endemic and 141 are threatened with extinction. The presentation focuses on highlighting conservation of biodiversity in an urban context and showcases possible solutions to common problems that challenge nature conservators today.

Oral Presentation

VIABILITY OF NON-NATIVE PLANT SEEDS PASSING THROUGH HORSE DIGESTIVE SYSTEMS IN SELECTED NATIONAL PARK SERVICE UNITS OF CALIFORNIA

Quinn, Lauren¹, Bonnie Davis², Mietek Kolipinski³, and SIBDAS GHOSH¹

¹Dominican University of California, Department of Natural Sciences and Mathematics, 50 Acacia Avenue, San Rafael, CA 94901-2298; lquinn@dominican.edu; sghosh@dominican.edu

²Independent Project Consultant, PO Box 14130, Fremont, CA 94539; horsecamping@comcast.net

³National Park Service, Pacific West Regional Office, 1111 Jackson Street, Oakland, CA 94607-4807; Mietek_Kolipinski@nps.gov

Invasive plants cause widespread damage to California's native ecosystems. We are investigating the role horse manure may have on introduction and spread of non-native, invasive plants in California's natural areas. Undergraduate research scholars from Dominican University of California are assisting in this work. Seven of eight species of plants that emerged from manure collected in San Francisco Bay and other central California areas were non-native. Two (*Hirschfeldia incana* and *Lolium multiflorum*) are listed as having "moderate" impact and one (*Medicago polymorpha*) as "limited" impact in the revised invasive plant species list by the California Invasive Plant Council (Cal-IPC), which reflects severity of ecological impact in terms of breadth of distribution and potential for spread. The remaining four (*Gnaphalium luteoalbum*, *Malva niceaeensis*, *Polygonum aviculare*, and *Portulaca oleracea*) are not listed. Nineteen of 27 species germinated from manure samples collected in several National Parks in northern California were not native to California. Of these, six (*Hordeum marinum*, *Lolium perenne*, *Mentha pulegium*, *Rumex acetosella*, *Trifolium hirtum*, and *Vulpia myuros*) are on the Cal-IPC list as having "moderate" impact, and four (*Hypochaeris glabra*, *Lythrum hyssopifolium*, *Medicago polymorpha*, and *Poa pratensis*) as "limited" impact. The remaining nine non-native species are not on the list. An intensive public educational program regarding (1) spread of invasive species via contaminated hay and (2) potential benefits of using certified weed-free feed may possibly avoid barring access of horses into California wildlands. Federal and state agencies have been developing multi-pronged strategies to decrease spread of non-native plants, and adding preventive programs could decrease further invasions. Weed-free feed could be a small yet significant part of the solution.

Oral Presentation

REGAINING INERTIA IN LAND PROTECTION – PICKING UP WHERE THE FEDERAL GOVERNMENT LEFT OFF: A CASE STUDY FROM THE GREAT SALT LAKE ECOSYSTEM, UTAH

RAMING, C. MARK and Heidi M. Hoven

SWCA, Environmental Consultants, 257 East 200 South, Suite 200, Salt Lake City, UT 84111; mraming@swca.com; hhoven@swca.com

In 1928, Congress acted to create the Bear River Migratory Bird Refuge on the north shore of Great Salt Lake, Utah. That event established federal ownership and management of 71,000 acres of refuge for migratory waterfowl. Along with state and private sector acquisition and management of lake-associated wetlands for duck hunting, this constituted the extent of ecosystem conservation on the Great Salt Lake until the 1980s. By 1990, the opinion of environmental interest groups and regional wildlife resource managers was that the Lake's environmental resources were barely protected by existing programs and that more needed to be done to maintain the critical function of the Lake as a hemispheric resource for migratory waterbirds. By 1991, resource managers on the Lake developed a concept referred to as the South Shore Ecological Reserve (SSER). The intent of the reserve was to renew the protection of critical environmental resources particularly in the lakeshore areas affected by rapid urbanization along the Wasatch Front. When the concept of the SSER was introduced, its attainability in terms of funding and leadership was unclear. Today, however, the SSER has gone a long way toward realization. The cornerstone of SSER implementation was initiated by private industry, specifically, a 2,500-acre shorebird reserve created as mitigation for impacts to wetlands from a Kennecott Utah Copper tailings impoundment. This initial, significant effort created inertia for fundraising and conservation efforts by non-profit organizations and state, city, and county governments. Today, thousands of acres of additional land have been added to a nearly contiguous web of conservation properties on the Lake, and additional planning processes towards the protection of wetlands and wildlife habitat is being developed by county and city governments around the lake.

Oral Presentation

EXAMINING CURRENT PATTERNS AND HETEROGENEITY IN REMNANT PRAIRIES OF SOUTHERN WISCONSIN

READ, CARRIE E. and John Harrington

Department of Landscape Architecture, University of Wisconsin-Madison, 1 Agriculture Hall, 1450 Linden Drive, Madison, WI 53706; cread@wisc.edu; jaharrin@wisc.edu

The Military Ridge Prairie Heritage Area, a 50,000 acre agricultural landscape in south-central Wisconsin, has been identified by conservation and natural resource agencies as having the highest priority for landscape-scale grassland protection and management in the state and represents one of the best opportunities in the Midwest to protect prairie remnants and grassland-dependant species. This study documents the present spatial patterns and distributions of prairie remnants in relation to environmental variables to better understand the spatial dynamics associated with remnant prairies and to aid in predicting unknown remnant locations, leading to more effective conservation and management decisions. Historically, prairies occurred on a variety of soil and slope conditions ranging from well- to poorly-drained. However, human land use and settlement patterns have greatly altered the observed spatial patterns and distribution of this ecosystem. To identify current spatial patterns and the relationship between remnant locations and environmental variables, we assembled available spatial data for more than 90 remnant locations

into a geographic information system (GIS). Locations were identified through remote sensing and ground-truthing. Remnants range in size from <1 to >100 acres and have a positive association with slope gradients greater than 12%, stony and rocky soils, and silt loam soils with low fertility. Significant association was found between prairie remnants and northern, southwestern, western, and northwestern aspects while southern aspects had a significant negative association. Remnants were positively associated with adjacency to grassland while agriculture land uses were negatively associated with adjacency to remnants.

Oral Presentation

RESEARCH, INVENTORY, AND MONITORING VOLUNTEERS – OPPORTUNITIES FOR PROFESSIONALS AND PARAPROFESSIONALS

ROBERTS, JOANNE M.¹, Kenneth J. Kingsley², and Amy J. Gaiennie²

¹Arizona State Parks, Natural Areas Program Advisory Committee, PO Box 1849; 2980 Highway 90, Benson, AZ 85602; jmroberts@pr.state.az.us

²Verde River Greenway, 2011B Kestrel Road, Cottonwood, AZ 86326; kenandamy@escapees.com

In 2003, Arizona State Parks Board (ASPB) provided staff with a shift in emphasis to science-informed decision management vision. ASPB stressed the need to expand staff and consultants ecological knowledge base through the development and implementation of the Parks' Asset Management System (PAMS). In 2004, Arizona State Parks' Director announced the new vision and direction to staff, "to be recognized locally and nationally as an outstanding resource management organization". There likely never has been and never will be sufficient funding to support all the natural resource research, inventory, and monitoring needs of all Natural Areas using paid professionals. However, many natural resource professionals are at or nearing retirement, and Natural Areas provide a potential opportunity for them to contribute their skills, doing the type of work they love, and making important contributions to the Natural Areas program. Arizona State Parks has piloted a program of working with a team of volunteers, a retired professional ecologist and a paraprofessional. In exchange for a campsite in a State Park, the volunteers have conducted Important Bird Area surveys, surveys for endangered species, vegetation and photo-points monitoring, invasive species mapping and monitoring, and have contributed to interpretive programs. This presentation reviews the range of services that could be provided by volunteers, the requirements to attract and hold such volunteers, and the contributions of this pilot team to the State Natural Areas Program. We make suggestions on how to begin or expand a program of using professionals and paraprofessionals, and recount the various challenges, pitfalls, and obstacles to developing a program.

Poster Presentation

LANDSCAPE-SCALE CHANGES IN CANOPY FUELS AND POTENTIAL FIRE BEHAVIOR FOLLOWING PONDEROSA PINE RESTORATION TREATMENTS AT MT. TRUMBULL, ARIZONA

ROCCA FORTE, JOHN PAUL, Peter Z. Fulé, and W. Wallace Covington

Ecological Restoration Institute, Northern Arizona University, PO Box 15017, Flagstaff, AZ 86011-5017; John.Roccaforte@nau.edu; Pete.Fule@nau.edu; W.Wallace.Covington@nau.edu

We evaluated canopy fuels and potential fire behavior changes following landscape-scale restoration treatments in a ponderosa pine forest at Mt. Trumbull, Arizona. The goal of the project was to restore historical forest structure by thinning and burning, thereby reducing canopy fuels and minimizing the potential for active crown fire. We measured 117 permanent plots before (1996/97) and after (2003) treatments. The plots were evenly distributed across the landscape and represented an area of approximately 1200 ha, about half of which was an untreated control. We compared canopy fuel estimates using three different methods to assess whether fire behavior modeling outputs were sensitive to the choice of canopy fuel equation. Basal area and tree density were decreased significantly from 32.6 to 18.9 m² and from 784.6 to 399.2 trees/ha, respectively, in the treated area between 1996 and 2003 while the control did not change significantly over the same time period. Restoration treatments decreased canopy fuel load from 7.7-18.3 to 4.4-9.1 Mg/ha (the range of values reflects three different canopy fuel equations) and decreased canopy bulk density from 0.038-0.172 to 0.022-0.67 kg/m³ in the treated area, while slight increases occurred in the control. We applied two simulation models to estimate potential fire behavior: FlamMap and Nexus. These models differ in several important features but predicted outcomes were consistent; under extreme drought and wind conditions, the proportion of the landscape susceptible to active crown fire and the mean patch size of these areas were both reduced in the treated area. In contrast, the models show little change in active crown fire susceptibility in the control over the same time period. We conclude that the restoration treatments have successfully addressed the project goals of reducing canopy fuels and the potential for active crown fire.

Oral Presentation

ECOLOGICAL SYSTEM AND NATURAL COMMUNITY INTEGRITY SPECIFICATIONS AS A TOOL FOR CONSERVATION PLANNING AND MONITORING

RONDEAU, RENEE¹, Joe Rocchio¹, and Pat Comer²

¹Colorado Natural Heritage Program, Colorado State University, Campus Mail 8002, Fort Collins, CO 80523-8002; rjr@lamar.colostate.edu; jroccchio@lamar.colostate.edu

²NatureServe, 1101 Wilson Blvd., 15th Floor, Arlington, VA 22209; pat_comer@natureserve.com

How well are we doing at protecting functioning ecological systems and conserving biodiversity? The Colorado Natural Heritage Program and NatureServe have been developing integrity specifications for ecological systems and natural communities that can assist conservation planners, land managers, and ecologists in long-term monitoring and assessment. We have taken a "scorecard" approach that provides a means for measuring function and trends at different scales, i.e., from landscape to site-specific. At the landscape level we score ecological systems on their abundance, quality, and threats, while at the site-specific level we score them for size, condition, and landscape context. Our general approach in 2005 and 2006 was to test this method by using a subset of Colorado's ecological systems. We chose several small-patch wetland ecological systems to test the applicability of site-specific level monitoring and all of Colorado's matrix ecological systems to test the applicability of landscape-level monitoring. Subscores were developed at multiple levels and can be combined into a final score. This partitioning allows managers to assess trends of multiple attributes, thus assisting future management actions. For example, one might be able to see that over time, size remained the same while the condition decreased; therefore, management needs to address condition but not size. We present examples of site-specific integrity specifications for several wetland ecological systems that support on-the-ground monitoring. In addition, we present the results of a GIS analysis for Colorado matrix ecological systems that will provide an example of a landscape-level analysis. These tools can be used to conduct long-term monitoring as well as guide conservation action.

Oral Presentation

PUBLICATION OF A REPORT CARD ON THE ECOLOGICAL HEALTH OF THE CHICAGO WILDERNESS REGION

ROSS, LAUREL¹, Christopher Mulvaney², and Dan Gooch³

¹The Field Museum, 1400 South Lake Shore Dr., Chicago, IL 60605; lross@fieldmuseum.org

²Chicago Wilderness, 1000 Lake Cook Rd., Glencoe, IL 60022; cmulvaney@chicagowilderness.org

³Illinois Endangered Species Protection Board, 16w284 97th Street, Burr Ridge, IL 60527; rdangooch@aol.com

The Chicago Wilderness consortium (CW) is an alliance of over 190 public and private organizations working together to protect, restore, study, and manage the natural ecosystems of the Chicago metropolitan area. In April 2006, CW released *The State of Our Chicago Wilderness: A Report Card on the Health of the Region's Ecosystems*. This publication, existing in both a summary format for the general public and a more comprehensive technical document for CW member organizations, describes the first assessment of the status of the natural ecosystems in the CW region since the completion of the *Biodiversity Recovery Plan* in 1999. As part of this process, natural areas experts familiar with the region's biodiversity were brought together during two all-day workshops to rank the region's natural communities and animal assemblages and to identify sources of data. Using a four-point scale, experts provided a condition ranking for each community type and species assemblage. Despite the presence of numerous high-quality sites, most communities and assemblages ranked at the lower end of the scale, indicating that much of the region's biodiversity remains threatened and in a state of decline. Follow-up efforts will be directed at refining the process to provide for more quantitative assessments in future report cards, allowing the Chicago Wilderness consortium to better track and respond to changes in the region's ecological health. In this presentation, we report on the motivations behind the creation of the report card and the challenges encountered in its development, describe the organizational structure of the document, and discuss some of the major findings and what they are telling us about the state of our ecosystems in the Chicago region.

Oral Presentation

STATUS AND MANAGEMENT OF RARE SPECIES ON THE NAVAJO NATION, INCLUDING MANAGEMENT OF TWO FEDERALLY LISTED SPECIES

ROTH, DANIELA

Navajo Natural Heritage Program, Navajo Department of Fish & Wildlife, Window Rock, AZ 86515; droth@navajofishandwildlife.org

The Navajo Nation is located on the Colorado Plateau and covers over 25,000 square miles in northeast Arizona, northwest New Mexico, and southeast Utah. The Navajo Natural Heritage Program (NNHP) is the Navajo Nation's rare, threatened, and endangered species office. NNHP's purpose is to collect, manage, and disseminate biological and ecological information for land-use planning to promote the conservation of biological diversity on the Navajo Nation. The NNHP responds to requests for data on rare and protected species from land use planners, developers, and researchers. We also review and update the Navajo Endangered Species List. Currently there are 31 plants of concern listed on the Navajo Endangered Species List, eight of which are also listed under the federal Endangered Species Act. This presentation highlights current conservation projects of the Navajo Nation, the protection of two species of federally and tribally listed rare cacti.

Poster Presentation

HOOSIER PRAIRIE OAK SAVANNA, LAKE COUNTY, INDIANA: CURRENT STATUS AND CHANGE DURING 27 YEARS OF PRESCRIBED BURNS

ROTHROCK, PAUL¹, John Bacone², Gerould Wilhelm³, and Thomas Post⁴

¹Department of Earth and Environmental Science, Taylor University, 236 W. Reade Avenue, Upland, IN 46989; plothro@tayloru.edu

²Division of Nature Preserves, Indiana Department of Natural Resources, 402 W Washington Street, Indianapolis, IN 46204; jbacone@dnr.in.gov

³Conservation Design Forum, 375 W First Street, Elmhurst, IL 60126; gwilhelm@cdfinc.com

⁴Division of Nature Preserves, Jasper-Pulaski Fish and Wildlife Area, 5822 Fish and Wildlife Lane, Medaryville, IN 47957; twpost@home.ffni.com

Hoosier Prairie Nature Preserve, located in northwestern Indiana, protects a rare and unusually high quality example of a Midwestern oak savanna. Although many savannas in the region have been lost to agriculture, urbanization, and fire suppression, parts of the 178 ha preserve never lost the historic community structure. A program of prescribed burning was initiated in 1978 and two 10 x 10 m sample areas (Blocks) were established. Preliminary results of 27 years of monitoring of species composition and floristic quality of the understory are reported. Throughout the observation period each Block retained a distinct understory composition while experiencing notable, individualistic changes from their original species composition. Throughout the observation period the sites supported a remarkably high diversity of xeric and mesic forbs ranging from 34-58 species per Block and as high as 17 species per 0.67 m² quadrat. Floristic Assessment metrics indicate that species quality of the contemporary Hoosier Prairie is comparable (mean C >= 4.9) to that expected in regional pre-settlement oak savanna communities.

Oral Presentation

HISTORIC ORCHARDS AND HEIRLOOM FRUITS IN PROTECTED AREAS: THEIR CONSERVATION AND RESTORATION

ROUTSON, KANIN

Center for Sustainable Environments, Northern Arizona University, Box 5765, Flagstaff, AZ 86011; kaninroutson@yahoo.com

Historic orchards persist in one third of all U.S. National Parks and Monuments surveyed, and perhaps in an even larger percentage of TNC (The Nature Conservancy) areas, state parks, and land trusts. Nevertheless, their maintenance is seldom given much funding or priority among management objectives, even though they are important reservoirs of agrobiodiversity and offer interpretative opportunities for living history. Two case studies, one from the Fruita Historic District in Capitol Reef National Park and one from Slide Rock State Park in Sedona, will illustrate the potential for restoring orchards for multiple benefits in protected areas.

Oral Presentation

MODELING INVASIVE PLANT SPECIES IN BIG BEND NATIONAL PARK, TEXAS

SCHRADER, SCOTT, T.¹, Kendal E. Young¹, Gary Roemer², and Colleen Caldwell³

¹New Mexico Cooperative Fish and Wildlife Research Unit, Department of Fishery and Wildlife Sciences, New Mexico State University, Las Cruces, NM 88003; schrader@nmsu.edu; kyoung@nmsu.edu

²Department of Fishery and Wildlife Sciences, New Mexico State University, Las Cruces, NM 88003; groemer@nmsu.edu

³U.S. Geological Survey, New Mexico Cooperative Fish and Wildlife Research Unit, New Mexico State University, Las Cruces, NM 88003; ccaldwel@nmsu.edu

Big Bend National Park (BBNP) in southwestern Texas hosts approximately 324,153 ha of Chihuahuan Desert shrubland, grassland, high elevation woodland, and over 300 springs. The Rio Grande River forms the Park's southern boundary, providing 190 km of riparian and wetland habitats. These resources are potentially threatened by over 300 invasive plants and animals. Ecologists have acknowledged the problems caused by invasion of non-native species into communities and the associated negative effects on biodiversity. Some invasive species have the ability to displace native plants and animals (including threatened and endangered species), disrupt nutrient and fire cycles, and alter the character of the community by enhancing additional invasions. We modeled the potential distribution of eight invasive plant species in BBNP using GIS and remotely sensed data. These models provide a method to identify invasive species populations and prioritize sites for ground visits. We also modeled distributional pathways and conducted risk analyses that provide a framework for developing conservation strategies to restrict or eradicate invasive plant species. This research provided information to help in understanding the introduction, spread, and distribution of non-native species and their effects on native habitats in BBNP and in the northern Chihuahuan Desert.

Poster Presentation

STUDENT CONSERVATION ASSOCIATION: PROVIDING ASSISTANCE TO NATURAL, CULTURAL, AND HISTORICAL RESOURCE MANAGERS FOR NEARLY 50 YEARS

SEILER, JENNY

SCA California/Southwest Regional Office, 655 13th Street, Suite 100, Oakland, CA 94612; JSeiler@theSCA.org

Student Conservation Association (SCA) is a nationwide conservation force of college and high school volunteers who protect and restore America's parks, forests, urban green spaces, and other public lands. For nearly 50 years, SCA's active, hands-on approach to conservation has helped to develop a new generation of conservation leaders, inspire lifelong stewardship, and preserve America's great green treasures. SCA members contribute 1.6 million hours – 200,000 days – of service each year in a multitude of natural and cultural resource areas including backcountry and wilderness patrol, GIS/GPS mapping, invasive species eradication, inventory and monitoring, trail maintenance and restoration, visitor services and interpretation, and wildlife and fisheries management.

Oral Presentation

AVIAN INFLUENZA – WILD MIGRATORY BIRD SURVEILLANCE IN ARIZONA

SHENDER, LISA A.

Arizona Game and Fish Department, 2221 W. Greenway Rd., Phoenix, AZ 85023;
lshender@azgfd.gov

With the ever-increasing international attention paid to the highly pathogenic H5N1 Asian strain of avian influenza (AI), concerned U.S. citizens undoubtedly have questions regarding the nation's surveillance program for this disease, which at this time has not yet been detected anywhere in the Western Hemisphere. Although the role of migratory wild birds in the transmission of avian influenza is not clear, a document titled *An Early Detection System for Highly Pathogenic H5N1 Avian Influenza in Wild Migratory Birds, a U.S. Strategic Plan* was published in March 2006 by a United States Interagency Work Group. This plan addresses specific surveillance methods and identifies target species for the detection of highly pathogenic H5N1 Asian strain of avian influenza. Arizona target species are those whose fall migration brings them from Eurasia through Alaska to Arizona, or who intermingle with Eurasian bird populations in Alaska. The Arizona target species are northern pintail (*Anas acuta*), mallard (*A. platyrhynchos*), American wigeon (*A. americana*), American green-winged teal (*A. crecca*), northern shoveler (*A. clypeata*), lesser snow goose (*Chen caerulescens caerulescens*), and the lesser sandhill crane (*Grus canadensis canadensis*). The Arizona Game and Fish Department (AGFD) has been charged with the responsibility of collecting 500 AI samples, the majority of which will be collected via hunter harvested surveillance, in addition to the investigation of reported morbidity and mortality events. This presentation provides background information on AI and further explains the role of the AGFD, other state agencies, and the general public in state-wide sampling for this disease.

Oral Presentation

COMMUNITY HERITABILITY MEASURES THE EVOLUTIONARY CONSEQUENCES OF INDIRECT GENETIC EFFECTS ON COMMUNITY STRUCTURE

SHUSTER, STEPHEN M.^{1,2,3}, Eric V. Lonsdorf^{1,2,3}, Gina M. Wimp^{1,2,4}, Joseph K. Bailey^{1,2,5}, and Thomas G. Whitham^{1,2}

¹Department of Biological Sciences, Northern Arizona University, Flagstaff, AZ 86011

²Merriam-Powell Center for Environmental Research, Northern Arizona University, Flagstaff, AZ 86011; stephen.shuster@nau.edu; thomas.whitham.nau.edu

³Conservation and Science Department, Lincoln Park Zoo, Chicago, IL 60616; ericlonsdorf@lpzoo.org

⁴Department of Entomology, University of Maryland, College Park, MD 20742; gwimp@umd.edu

⁵Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN 37996; jkb22@dana.ucc.nau.edu

The evolutionary analysis of community organization is a major frontier in biology. Nevertheless, current explanations for community structure exclude the effects of genes and selection at levels above the individual. We demonstrate a genetic basis for community structure, arising from the fitness consequences of genetic interactions among species (i.e., interspecific indirect genetic effects or IIGEs). Using simulated and natural communities of arthropods inhabiting North American cottonwoods (*Populus*), we show that when species comprising ecological communities are summarized using non-metric multidimensional scaling (NMDS), the resulting univariate scores can be analyzed using standard techniques for estimating the heritability of quantitative traits. Our estimates of the broad sense heritability of arthropod communities on known genotypes of

cottonwood trees in common gardens explained 56-63% of the total variation in community phenotype. We also modeled synthetic communities in which the number, intensity, and fitness consequences of the genetic interactions among species comprising the community were known. Results from the model suggest that our empirical estimates of broad sense community heritability arise from heritable variation in a host tree trait and the fitness consequences of IGEs that extend from tree trait to arthropods. When arthropod traits are heritable, interspecific IGEs cause species interactions to change, and community evolution occurs. Our results have implications for establishing the genetic foundations of communities and ecosystems, for quantifying the impacts of genetically modified organisms on communities, and for making informed environmental policy decisions. In particular, because extended phenotypes are heritable, the loss of genetic diversity in a dominant or keystone species could cascade, to negatively affect the diversity of the entire dependent community. Thus, contrary to current conservation practices emphasizing the preservation of genetic diversity within threatened and endangered species, the long-term benefits of genetic conservation may be greater for dominant species than for species that are rare.

Oral Presentation

RESEARCH NATURAL AREAS OF THE SOUTHWEST

SIEG, CAROLYN HULL¹ and Charles B. McDonald²

¹U.S. Forest Service, Rocky Mountain Research Station, 2500 S. Pine Knoll Dr., Flagstaff, AZ 86004; csieg@fs.fed.us

²U.S. Forest Service, Southwestern Region, 333 Broadway Blvd., SE, Rm. 209, Albuquerque, NM 87102; cbmcdonald@fs.fed.us

The Southwestern Region of the U.S. Forest Service, which includes Arizona and New Mexico, has 18 designated Research Natural Areas (RNAs) encompassing a total of 17,873 acres. These areas are permanently protected to conserve biological diversity and conduct non-manipulative research. RNAs in this region range in elevation from 2,000 to 12,100 feet and represent several southwestern plant communities. The Santa Catalina RNA on the Coronado National Forest, established in 1927, was the nation's first RNA. Bush Highway RNA occurs at 2,000 feet and is characterized as Sonoran Desert grassland. RNAs characterized as grama-tobosa grass shrub steppe grading into oak savanna occur at elevations between 2,450 and 5,100 feet. Three RNAs support diverse riparian habitat, including species such as bigtooth maple (*Acer grandidentatum*) and Arizona sycamore (*Platanus wrightii*). The Bernalillo Watershed RNA supports pinyon-juniper grassland, and the Mesito de las Madrones RNA is a one-seed juniper grassland on the top of a sandstone butte. Portions of some RNAs are characterized as Madrean oak communities and chaparral. Pole Bridge Canyon RNA supports populations of Arizona pines, including Apache pine (*Pinus engelmannii*), southwestern white pine (*P. strobiformis*), border pinyon (*P. discolor*), and Arizona pine (*P. arizonica*). Goudy Canyon RNA, ranging in elevation from 7,500 to 10,000 feet, is mostly mixed-conifer forest. Phelps Cabin RNA, at 9,200 to 9,500 feet, encompasses wet meadows and Engelmann spruce-subalpine fir forest. The San Francisco Peaks RNA ranges in elevation from 9,300 to 12,100 feet, and supports bristlecone pine (*P. aristata*) and spruce-fir forest, and is one of only two locations in Arizona where alpine tundra occurs. Wildfires and invasion by non-native plant species have impacted a number of these RNAs. Efforts to remove overly dense post-settlement trees to restore old-growth character in RNAs dominated by ponderosa pine have been underway in both Monument Canyon and Gus Pearson RNAs.

Oral Presentation

AN INNOVATIVE FEDERAL AND TRIBAL PARTNERSHIP – KASHA-KATUWE TENT ROCKS NATIONAL MONUMENT, NEW MEXICO

SINGLETON, EDWIN¹ and DONALD SUINA²

¹Bureau of Land Management, Albuquerque District Office, 435 Montano NE, Albuquerque, NM 87107; edwin_singleton@blm.gov

²Pueblo de Cochiti, P.O. Box 70, Cochiti Pueblo, NM 87072

The Bureau of Land Management forged a successful partnership with the Pueblo de Cochiti, resulting in the designation of Kasha-Katuwe Tent Rocks National Monument. The Pueblo de Cochiti serves as the gateway community to these unique formations of wind- and water-eroded volcanic tuff sculptures. The Monument is located between Albuquerque and Santa Fe, attracting over 50,000 visitors a year. Beginning at the grass-roots level in 1997, the Bureau of Land Management and the Pueblo de Cochiti signed a Cooperative Management Agreement to provide for joint management of Tent Rocks Area of Critical Environmental Concern, ensure access to the public, preserve the tranquility of the Pueblo community, and protect the geologic values of the site. In preparation for Monument designation, a unique Inter-Governmental Cooperative Agreement was signed in 2000 to provide benefits for natural resource program coordination, public and Pueblo land-use planning, economic benefit, and ongoing protection of culturally sensitive areas. The Pueblo de Cochiti based the agreements with the Bureau of Land Management on a viable demonstrated relationship and a shared vision. Today, the Monument is an outstanding model of an innovative, nation-to-nation partnership and epitomizes community-based conservation.

Oral Presentation

CULTURAL RESOURCES IN BUREAU OF LAND MANAGEMENT'S NATIONAL LANDSCAPE CONSERVATION SYSTEM: A NEEDS ANALYSIS

SMITH, MICHAEL

National Trust for Historic Preservation, 1785 Massachusetts Ave. NW, Washington, DC 20036; mike_smith@nthp.org

More than 263,000 cultural properties, from Native American sacred sites to remnants of the pioneer era, have been discovered on Bureau of Land Management (BLM) lands. BLM's recently established National Landscape Conservation System (NLCS), consisting of about 10 percent of all lands under the BLM, includes many of the best cultural and natural resource sites. The new NLCS offers the agency a major opportunity to showcase its cultural resource management capabilities. This presentation will discuss how the NLCS represents a unique experience for the public to enjoy cultural resources and for archaeologists to study cultural resources, as well as examine why these resources in the NLCS are threatened. This presentation draws on 2006 research by the National Trust for Historic Preservation and offers recommendations to help protect these unique and irreplaceable resources.

Oral Presentation

DISPOSABLE PETS, UNWANTED GIANTS: PYTHONS IN EVERGLADES NATIONAL PARK, FLORIDA

SNOW, SKIP¹, Lori Oberhofer¹, and Tony Pernas²

¹Everglades National Park, 40001 State Road 9336, Homestead, FL 33034; Skip_Snow@nps.gov; Lori_Oberhofer@nps.gov

²South Florida Ecosystem Office, 950 North Krome Avenue, 1st Floor, Homestead, FL 33030-4443; tony_ernas@nps.gov

Exotic snakes in Everglades National Park (ENP) include Burmese pythons (*Python molurus bivittatus*), as a result of unwanted, intentionally, and perhaps accidentally, released exotic pets. The Burmese python, a native to Southeast Asia that can reach a length >600 cm, is a long-lived (15-25 years) behavioral, habitat, and dietary generalist that produces large clutches of eggs (8-107). Pythons have been observed in many areas of ENP. Their diet includes many mammals and birds. Sources of mortality include motor vehicles, mowing equipment, fire, and alligators. As *P. molurus* is known to eat birds, and also known to frequent wading bird colonies in their native range, the proximity of python sightings to wood stork (*Mycteria americana*) rookeries is troubling. In recent years more than 156 pythons have been removed from the park or adjacent lands. Multiple observations of individuals of different size-classes support the establishment of breeding populations in ENP. The length of snakes recovered is 65-427 cm and includes hatchling sized animals. Pythons have the potential to occupy the entire footprint of the Comprehensive Everglades Restoration Project, adversely impacting valued resources. Burmese pythons are widely bred in Florida and still imported from Southeast Asia as pets. Proposed management and control actions must include strategies for preventing their intentional release. Participants in an Invasive Snake/Reptile Management and Response Workshop in July 2005 recommended: (1) python control, (2) rapid response to invasive amphibians and reptiles, and (3) public outreach and education. Action plans are being drafted.

Oral Presentation

PRESERVING NATURAL AREAS BY INTEGRATED COMMUNITY-BASED NATURAL RESOURCE MANAGEMENT PRACTICES IN SOUTH AFRICA

STEYN, FRANCIS

Department of Agriculture, Western Cape, Private Bag X1, Elsenburg 7607, South Africa; franciss@elsenburg.com

This presentation highlights successes obtained by applying the LandCare Areawide methodology at Bredasdorp on the southern tip of Africa for the preservation of natural areas. Planning must be conducted at a scale larger than an individual farm to effectively address many natural resource issues, such as preservation of endangered critical natural systems, control of alien invasive species, stewardship of the natural areas, awareness, and youth education. To meet this need, the Department of Agriculture has adopted the LandCare Areawide Planning methodology for larger-scale planning in which local people identify and address the concerns of their community while striving to improve or preserve the health of the land. This methodology blends the actions of individuals with those of their neighbours and their community to solve common problems, using the Integrated Development Planning (local governance according to the South African Constitution) as the vehicle to achieve these goals. This methodology was developed and refined with Australian and U.S. Department of Agriculture support to South Africa and even displayed during a tour in Northam after the 2003 LandCare conference in Darwin, Australia. The

Bredasdorp integrated centre is a partnership of various agencies and farmers that have a common goal and have crafted a desired future condition of their area. This successful project will change the lifestyles, livelihoods, and futures of the inhabitants of this community and especially the way resources are managed due to the change in land use. This presentation highlights these issues and how they directly impact the preservation of the southern tip of Africa.

Oral Presentation

SHOREBIRD AND HABITAT MONITORING AT SHELL KEY PRESERVE IN WEST-CENTRAL FLORIDA

STILLWAUGH, DON, Kristen Sommers, Steve Harper, and Catherine S. Flegel

Pinellas County Environmental Lands Division, Brooker Creek Preserve, 3620 Fletch Haven Drive, Tarpon Springs, FL 34688; dstillwa@pinellascounty.org; ksommers@pinellascounty.org; sharper@pinellascounty.org; cflegel@pinellascounty.org

Shell Key Preserve is a 1,755 acre preserve that includes a 180 acre barrier island known as Shell Key. Habitats within this dynamic ecosystem are monitored annually through extensive mapping efforts and with photopoints. It is designated as an Important Bird Area, providing an essential stop-over point for migratory birds as well as critical habitat for nesting shorebirds. Nesting success of three state-listed species, the American oystercatcher (*Haematopus palliatus*), black skimmer (*Rynchops niger*), and least tern (*Sterna antillarum*), were monitored during 2000-2006. Results indicate considerable variation in nesting success among years, with nest failure attributed to disturbance by humans, dogs, and storms, as well as to predation by raccoons, fish crows, gulls, and possibly other birds. Land management utilizing raccoon removal, delineation and posting of a Bird Protection Area, and educational programs have been initiated to increase future nesting success. Balancing the habitat needs of the flora and fauna with the desires of the recreational public is an ongoing and difficult task.

Oral Presentation

SLASH ADDITIONS RETAIN SOIL RESOURCES AND INCREASE RATES OF GRAMINOID SEEDLING ESTABLISHMENT IN A PINYON-JUNIPER WOODLAND

STODDARD, MICHAEL, T.¹, David Huffman^{1,2}, and Thomas Alcoze²

¹Ecological Restoration Institute, Northern Arizona University, PO Box 15017, Flagstaff, AZ 86011-5017; mike.stoddard@nau.edu; david.huffman@nau.edu

²School of Forestry, Northern Arizona University, Flagstaff, AZ 86011-5017; thom.alcoze@nau.edu

Trees in pinyon-juniper woodlands are encroaching into adjacent intercanopy spaces, developing a continuous canopy structure with high fuel loads and a decline in herbaceous production and species richness. An increase in tree density has contributed to the depletion of essential soil nutrients and moisture from nearby intercanopy spaces, thereby affecting the establishment of perennial grasses and forbs within these interspaces. We established a 2 X 2 full factorial experiment with two levels of seeding and two levels of slash additions within the interspaces of pinyon (*Pinus edulis*) and juniper (*Juniperus osteosperma*) tree canopies to examine the effects of slash additions on soil stability, soil biota, and graminoid establishment. The study site was at Mt. Trumbull in Grand Canyon-Parashant National Monument, northern Arizona, and sites represented both cinder and sedimentary soil types. Our goal was to create favorable microsites or "islands" of

elevated soil fertility for graminoid seed establishment. Slash additions increased residual woody and litter debris, which seem to have affected rates of soil loss. Arbuscular mycorrhizal fungi and microbial carbon biomass increased significantly in slash treatments compared to non-slash treatments. Graminoid cover increased over 200% with slash and seed additions compared to seed-only treatments. In the second year, 42% of the slash and seed plots contained at least one reproductively active, seeded graminoid species. Nineteen percent of the total cover (14.3 %) was comprised of the seeded graminoid species. These results suggest that slash treatments create favorable microsites for graminoid emergence and establishment, thereby contributing to an increase in understory production within pinyon-juniper interspaces.

Poster presentation

DEVELOPMENT OF PLANT FIELD IDENTIFICATION CARDS FOR THE ARIZONA WILDLANDS INVASIVE PLANT WORKING GROUP SPECIES LIST

STUDD, S. E.¹ and T. Mau-Crimmins²

¹Sonoran Institute, 7650 E. Broadway, Suite 203, Tucson, AZ 85710;
sarah_studd@partner.nps.gov.

²National Park Service, Sonoran Desert Network Office, 7660 E. Broadway, Suite 303, Tucson AZ 85710; theresa_mau-crimmins@nps.gov

Early detection of invasive exotic species is imperative for control efforts to be successful. Proper identification of these species is the first step preceding any management efforts and is an equally important aspect of control. To aid in the identification of the 74 invasive non-native plant species on the list compiled by the Arizona Wildlands Invasive Plant Working Group (AZ-WIPWG), we have created field identification cards. Cards measure 5 x 8 inches and are laminated, making them both durable and easy to carry. Information was gathered on each species' key identifying characteristics, ecology, impact on ecosystems, and both known and potential distributions. This information is presented on the cards in relaxed botanical terms to reach a wide audience. Each card also has several color photos from various stages of plant development to aid identification, a colored border that reflects flower color, and symbols representing the life form, the impact risk level (from AZ-WIPWG), and elevation range. Additional information includes Integrated Taxonomic Information System (ITIS) codes, common names, and other pertinent information. These cards were developed for in-house use by the National Park Service, Sonoran Desert Network and the Sonoran Institute, but have been formalized and will soon be available for use by other interested parties.

Oral Presentation

A THOUSAND POINTS OF BLIGHT: PLANTS INVADING PARKS, PRESERVES, AND OTHER NATURAL AREAS

SWEARINGEN, JIL M.

National Park Service, National Capital Region, Center for Urban Ecology, Washington DC 20007;
jil_swearingen@nps.gov

According to the WeedUS Database, developed by the National Park Service (NPS) and the Plant Conservation Alliance, about 1,035 invasive plant species have been reported to be impacting and threatening natural resources, natural areas, and ecosystems in the United States, including Hawaii. The database is a compilation of published data from federal and state government

agencies, non-governmental organizations such as The Nature Conservancy, Exotic Pest Plant Councils and related groups, scientific publications, and other reliable sources. About two-thirds (650 species) of the identified perpetrators occur on national parks and are causing ecological damage including the loss of native plants and animals and destruction and alteration of natural habitats. Management of these species costs the NPS millions of dollars annually. The WeedUS Database is now available online at <http://www.nps.gov/plants/alien> and can be easily queried.

Poster Presentation

GRID SAMPLING: A NOVEL SAMPLING DESIGN FOR INVASIVE NON-NATIVE PLANT SURVEYS

THOMAS, KATHRYN and Patty Guertin

US Geological Survey, Southwest Biological Science Center, Sonoran Desert Research Station,
125 Biological Sciences East, University of Arizona, Tucson, AZ 85721;
Kathryn_A_Thomas@usgs.gov; pguertin@nexus.srn.arizona.edu

We conducted an invasive, non-native plant survey at Petrified Forest National Park in northeastern Arizona from 2002 through 2005 using a unique sampling design. Rather than target just areas of known disturbance or high traffic, we also sampled in natural areas with low human impacts. Our sampling unit consisted of contiguous 100 x 100 m sampling units, 2,730 total among three different areas of interest in the Park. Each sampling unit was oriented to the cardinal directions and had a center with predetermined geographical coordinates. We documented invasive plant infestations within each sampling unit by species and cover category. The grid sampling method allowed for systematic sampling of the entire area of interest, provided for effective data documentation, and served as a repeatable framework for comparisons of infestations over time. We show the design and layout of the grid sample at Petrified Forest National Park, the protocols for sampling unit measurement and data documentation, and some of the additional advantages and disadvantages we anticipate in applying this method to other landscapes.

Oral Presentation

INVASIVE PLANT INVENTORY: OBSERVATIONS FROM A NOVEL SAMPLING DESIGN AT PETRIFIED FOREST NATIONAL PARK, ARIZONA

THOMAS, KATHRYN and Patty Guertin

US Geological Survey, Southwest Biological Science Center, Sonoran Desert Research Station,
125 Biological Sciences East, University of Arizona, Tucson, AZ 85721;
Kathryn_A_Thomas@usgs.gov; pguertin@nexus.srn.arizona.edu

Few land managers have the resources and time to exhaustively field sample for the occurrence of invasive, non-native plants (invasive plants). Yet the potential for ecological degradation is high if harmful invasive plants are not detected and managed effectively and early in their infestation. We surveyed the presence of invasive plants at three locations in Petrified Forest National Park in northeastern Arizona yearly between 2002 and 2005, using a systematic grid of contiguous 100 x 100 m sampling units. Our sampling method allows for evaluation of the potential value of different sub-sampling designs. We present the preliminary results of these comparisons and their implications for the inventory and monitoring of invasive plants.

Oral Presentation

JONAH NATURAL GAS FIELD, WYOMING: INNOVATIVE APPROACHES TO MITIGATING IMPACTS

THOMPSON, KEVIN¹ and Rob Mathes²

¹SWCA Environmental Consultants, 295 Interlocken Blvd, Suite 300, Broomfield, CO 80021; kthompson@swca.com

²Bjork, Lindley & Little PC, 1600 Stout Street, Suite 1400, Denver, CO 80220-3110; rmathes@bjorklindley.com

Western Wyoming is the location of extensive natural gas fields that currently are being developed in response to increasing demand and the desire to utilize domestic energy sources. The Jonah Field is a prolific natural gas reservoir located on public land administered by the Bureau of Land Management, Pinedale Field Office. As part of the National Environmental Policy Act (NEPA) process prior to the infill development at Jonah Field, SWCA successfully completed an Environmental Impact Statement that called for some innovative approaches to mitigating impacts. As part of their proposal to increase development in Jonah Field, the Operators agreed to fund a range of off-site mitigation measures and creative reclamation projects. We review the impact analysis of the NEPA process and provide details of on- and off-site mitigation.

Oral Presentation

INTERPRETING DENALI'S LANDCOVER TYPES WITH FABRIC (QUILT)

TYRRELL, Lucy E. and Jon Paynter

Denali National Park and Preserve, PO Box 9, Denali Park, AK 99755; lucy_tyrrell@nps.gov; jon_paynter@nps.gov

Over the last five years, Denali Quilters created a quilt (approximately 3.3 m square) to interpret Denali National Park and Preserve's landcover types at large and small scales. The quilt will be available to foster learning by students and the general public about such ecological themes as natural areas, landcover types, vegetation, wildlife habitat, natural history, GIS technology, satellite imagery, maps, and scale. The central portion of the quilt is a map based on a satellite image of the Park's 2.5 million ha, in which 23 landcover types are shown as different colored pixels. The fabrics match colors that Park staff selected when previously classifying the composite image. The map contains 13,600 pixels (each is ~2 cm on a side representing ~1.8 km on the ground). We selected pixel size to be small enough to clearly show map features like the Alaska Range, yet large enough to be practical to sew. Twenty-two blocks surround the map, each depicting a close-up view of selected plants and animals (e.g., nose and curl of horn of Dall sheep among mountain avens and rock) of a cover type (e.g., Dwarf Shrub – Rock). Each block is bordered by the same fabric (color) as the pixels that represent that landcover type in the map, so the border blocks become an illustrated legend for the map. The machine quilting outlines the park's boundary and highlights major river and stream drainages and topographic lines (contour interval of ~1,000 m).

Oral Presentation

ENDANGERED FISH CONSERVATION IN THE AMERICAN SOUTHWEST: THE INCREASING ROLE OF ENVIRONMENTAL CONSULTANTS

VALDEZ, RICHARD A.

SWCA Environmental Consultants, 172 West 1275 South, Logan UT 84321; valdezra@aol.com

Desert fishes of the American Southwest are among the most imperiled species in North America. Many cling to an existence in rivers, lakes, and streams aggressively claimed by a burgeoning human population in an already parched land. Dramatic cutbacks in federal Endangered Species Act (ESA) programs have left the primary federal agency, the U.S. Fish and Wildlife Service (USFWS), overburdened with biological opinions, recovery plans, species listings, critical habitat designations, and litigations with little time and money for ongoing management and recovery of listed species. To fill the gap and comply with ESA requirements, project participants, including state and federal agencies, industry, and private landowners, who lack the internal expertise, are turning increasingly to environmental consultants to assist as scientists, liaisons, and mediators. SWCA Environmental Consultants is currently involved in programs that affect 11 threatened and endangered fish species in several western lakes and river systems, including Utah Lake, the Rio Grande drainage, the Colorado River Basin, the Canadian and Cimarron Rivers, the Little Colorado River, and the Gila River. SWCA is conducting independent research to clarify species life histories, interrelationships of species to project impacts, and development of conservation strategies. SWCA is also instrumental in forging partnerships and contributions of funds, in-kind services, and available resources (e.g., land and water) by project proponents for species conservation. SWCA has demonstrated that environmental consultants can transcend their role of technical assistants to project proponents by also helping the USFWS to author recovery plans and serve as members of recovery teams. This involvement is not without challenges, however, because environmental consultants are sometimes viewed as paid advocates with agendas favorable to their clients. Consultants and project proponents need to understand the importance of maintaining objectivity and scientific credibility for continued involvement by environmental consultants in resolving issues dealing with species conservation.

Oral Presentation

STATUS AND MANAGEMENT OF THREE RARE PLANTS FROM THE WESTERN EDGE OF THE COLORADO PLATEAU: DWARF BEAR POPPY, HOLMGREN MILKVETCH, AND SHIVWITS MILKVETCH

VAN BUREN, RENEE

Department of Biology, Utah Valley State College, Orem, Utah 84058; vanburre@uvsc.edu

Long-term monitoring studies have been ongoing for over 15 years for three federally listed plant species endemic to southwestern Utah. The habitat for these three rare perennial species, dwarf bear poppy (*Arctomecon humilis*), Holmgren milkvetch (*Astragalus holmgreniorum*), and Shivwits milkvetch (*Astragalus ampullarioides*), is currently under intense pressure from development and recreational activities that threaten their survival. Each of these species occupy unique habitat that greatly limits their range and distribution. Recent land development and major highway construction plans have created an interesting opportunity for possible protection and preservation of these species through partnerships that include BLM, The Nature Conservancy, Utah Department of Transportation, State Trust Lands of Utah, Zion National Park, Tribal officers, and city and county officials. We report work concerning the most current biology of these species

including population demographics, survey results, preliminary seedbank studies, and the status of projects that presently impact conservation efforts.

Oral Presentation

IMPACTS OF MOUNTAIN BIKING ON WILDLIFE AND PEOPLE – A REVIEW OF THE LITERATURE

VANDEMAN, MICHAEL J.

2600 Camino Ramon # 2E950I, San Ramon, CA 94583-5000; mjvande@pacbell.net

The sport of mountain biking is expanding rapidly, fueled partly by the mountain bike and tourism industries, the Olympics, and other competitive events (recently, e.g., "adventure racing"). It is putting intense pressure on wildlife habitat, worldwide, as well as inhibiting efforts to protect additional lands. It is important, therefore, to assess its impacts on wildlife, people, and the environment. I reviewed available studies, focusing primarily on physics and conservation biology. All of these studies on mountain biking that attempted to compare the impacts of hiking and mountain biking (which addressed primarily erosion, but also intimidation of wildlife, horses, and other trail users) concluded that their impacts are essentially the same. However, their research designs all have serious flaws: they ignore speed and distance traveled, and nearly all ignore impacts on wildlife; they also make no attempt to test mountain biking under realistic conditions (e.g., normal speeds). A more accurate conclusion from the data presented would be that the impacts of mountain biking are actually from two to six times those of hiking, due in part to the greater speed and distance traveled by mountain bikers. This is important, because some land managers have used this research as justification for opening trails to bikes.

Oral Presentation

MANAGING THE ENVIRONMENTAL AND SOCIAL IMPACTS OF TRAIL-BASED RECREATION

VANKAT, DREW

International Mountain Bicycling Association, PO Box 7578, Boulder, CO 80306; drew@imba.com

Land managers face a variety of questions when designing and designating shared-use trail systems. Often the most pressing is how to manage the potential social and environmental impacts of trail users. Fortunately, a growing body of science is addressing these topics by providing concrete, objective information. This presentation highlights current methodologies and a summary of new research on trail impacts. It also covers lessons learned from the International Mountain Bicycling Association's (IMBA) trail design, construction, and maintenance projects around the world. IMBA is the recipient of a Lifetime Achievement Award for Sustainable Trail Design and Construction by the Professional Trail Builders Association, as well as the Award for Excellence for Sustainable Practices from a consortium of federal land management agencies. The second half of the presentation addresses aspects of successful land manager partnerships and their role in fostering active, collaborative trails communities. The lessons and practices focus primarily on IMBA's formal relationships with federal land managers, but are transferable to a variety of non-profit organizations. IMBA's 2005 General Agreement with the National Park Service (NPS) and our work with interested NPS units to design appropriate mountain bicycling experiences is discussed. Examples also come from IMBA's formal partnerships with the NPS Rivers, Trails, and Conservation Assistance Program, U.S. Forest Service, U.S. Army Corps of Engineers, Bureau of Land Management, and numerous state agencies across the country.

Poster Presentation

BE PLANTWISE AND GARDEN SMART, AN EDUCATIONAL PROGRAM DESIGNED FOR THE GARDENER TO PREVENT PLANT INVASIONS

WAITT, DAMON E.¹ and Linda Drees²

¹Lady Bird Johnson Wildflower Center, 4801 La Crosse Ave, Austin, TX 78739;
dwaitt@wildflower.org

²Natural Resource Program Center, National Park Service, 1200 Oakridge Dr, Fort Collins, CO 80525; Linda_Drees@nps.gov

Be PlantWise is a partnership between the National Park Service, Lady Bird Johnson Wildflower Center, Garden Clubs of America, Student Conservation Association, the Center for Plant Conservation, and many others to educate the public and communities about best management practices to control harmful invasive plants from invading parklands and natural areas. Education is a critical mechanism for changing behaviors and creating an environment where the public takes responsibility for managing plants in their homes and communities. Invasive plant management, like litter control or fire proofing homes, is an issue that can best be addressed by public education. The development of a web-accessed, community education program on invasive plant management, such as the successful *Firewise* (www.firewise.org) or litter prevention campaigns, will help communities, agencies, and nongovernmental organizations manage their invasive plant problems by providing them with a standard set of educational materials. The standardized materials outline the problem of invasive species and how homeowners and landowners can prevent introductions, manage their landscapes in the presence of introductions, and use native plants or non-invasive plants as an alternative. The poster will provide conference participants with sample brochures and the 10 best management practices for being *PlantWise*. These materials can be used by natural area managers to educate their staff and public and private partners. The materials give hands-on advice on what we all can do to prevent invasion into natural areas.

Oral Presentation

INVADERS: CITIZEN SCIENTISTS COMBAT INVASIVE SPECIES

WAITT, DAMON E.¹ and Tani Hubbard²

¹Lady Bird Johnson Wildflower Center, 4801 La Crosse Ave., Austin, TX 78739;
dwaitt@wildflower.org

²Arizona-Sonora Desert Museum, 2021 N. Kinney Rd., Tucson, AZ 85743;
thubbard@desertmuseum.org

Those of us who care deeply about native plants and habitats understand how important they are to our sense of place. But even as we are working to protect our plant heritage from land development and other pressures, native flora across the country – in our backyards, along our roadways, on our farms and ranches, and in our parks and natural areas – are facing a less obvious but equally serious threat from invasive species. The Wildflower Center has joined with The Arizona-Sonora Desert Museum to lead a consortium of museums participating in a national early detection program entitled *INVADERS: Citizen Scientists Combat Invasive Species*. The *INVADERS* program involves recruiting, training, and providing materials to volunteers who detect and report invasive species in their communities. These volunteers find, track, describe, photograph, and collect samples of invasive species and report occurrences to their affiliated institution. The early detection data are validated by experts before being delivered to the U.S. Geological Survey National Institute of Invasive Species Science website for data hosting, analysis, and mapping. The anticipated outcomes of this program include a national network of volunteers

contributing scientific data on the distribution and abundance of invasive species, increased public awareness of the dangers imposed by invasive species and what steps citizens can take when they encounter them, and reduced spread of invasive species through more timely control and eradication responses from regulatory agencies.

Poster Presentation

THE ARKANSAS BUMBLEBEE SURVEY: A CITIZEN-SCIENCE EFFORT

WARRINER, MICHAEL D.

Arkansas Natural Heritage Commission, 1500 Tower Building, 323 Center Street, Little Rock, AR 72201; michaelw@arkansasheritage.org

In Arkansas, bumblebees (*Bombus* spp.) are vital pollinators of several native plants, some tracked as species of special concern. From an agricultural perspective, bumblebees are the most effective pollinators of such crops as blueberries, raspberries, tomatoes, and melons. Without the pollination services of bees, many native plants would become extinct and crop yields could be significantly reduced. To assess how bumblebees are faring in Arkansas, the Arkansas Natural Heritage Commission launched the Arkansas Bumblebee Survey. The Arkansas Bumblebee Survey is a citizen-science project aimed at mapping the distribution of bumblebees across the state. This project marks the first effort by any state in the southeastern U.S. to map their bumblebee fauna.

Oral Presentation

QUANTIFYING THE VALUE OF INSTREAM FLOW IN THE DESERT SOUTHWEST

WEBER, MATTHEW A.¹, Steven Stewart¹, and Robert Berrens²

¹Department of Hydrology and Water Resources, SAHRA, Marshall Bldg 5th Floor, The University of Arizona, PO Box 210158, Tucson AZ, 85775-2102; maweber@hwr.arizona.edu; sstewart@hwr.arizona.edu

²Department of Economics, MSC 05 3060, 1 University of New Mexico, Albuquerque, NM 87131-0001; rberrens@unm.edu

Water resources management faces the complex challenge of maintaining environmental amenities amidst diverse and increasing pressures. In the southwestern United States, riparian areas are ribbons of green swirling through a sparse landscape, hosting a concentration of plant and animal life in extreme contrast to adjacent chaparral. Environmental economics offers methodologies to quantify values associated with these instream flows. Riparian protection and restoration is more informed through data collection and analysis regarding such benefits. We examine two case studies. The first employs the Zonal Travel Cost Method for Aravaipa Creek Wilderness in Arizona to estimate the recreation use value of the Wilderness, one component of total resource value. Consumer surplus estimates per visitor-day were \$25.06 and \$17.31 for two separate access points, the discrepancy implying a premium for remote recreation. This work offers management information for the Wilderness as well as benefit transfer potential for recreation value of other surface water sites in the Southwest. The second case study concerns river restoration of the Albuquerque reach of the Rio Grande River. A mail survey conducted in 2006 explores visitation statistics and potential recreation improvements. Restoration valuation focuses on four key restoration attributes identified by focus groups: fish and wildlife habitat, vegetation density, tree type, and natural river processes. A choice model is used to decompose

the value of these restoration attributes in both a relative and absolute (dollar) sense. Results are applicable to other southwestern riparian areas with qualifications for site-specific factors. Restoration decisions have much to gain from improved information; funding is strong with more than \$10 billion spent nationally on over 35,000 such projects (NRRSS, 2005). The long-range goal associated with this work is to address data needs for a dynamic simulation model of Total Riparian Value, itself a component of a larger watershed decision support tool.

Oral Presentation

PROPOSED NATIONAL HERITAGE AREAS AND GLOBALLY IMPORTANT INGENIOUS AGRICULTURAL HERITAGE SITES FOR CULTURAL LANDSCAPES ON THE COLORADO PLATEAU

WEST, PATTY

Center for Sustainable Environments, Northern Arizona University, Box 5765, Flagstaff, AZ 86011; patty.west@nau.edu

The Little Colorado River watershed is being proposed both as a National Heritage Area and Globally Important Ingenious Agricultural Heritage Site. Within these proposed conterminous protected areas, several agricultural landscapes offer insights into the oldest agricultural traditions in North America and the opportunity to market place-based heritage foods and agri-tourism experiences that will financially benefit indigenous and rural communities and foster watershed restoration and maintenance of cultural traditions. These opportunities are being explored through ERDENE (Northern Arizona University's Environmental Research, Development and Education for the New Economy) funded research, education, training, and promotion.

Oral Presentation

MOLECULAR TAXONOMY AND A PHYLOGEOGRAPHIC APPROACH TO TARGETING ACQUISITION SITES FOR THE PROTECTION OF CRYPTIC SPECIES

WHITE, KEMBLE¹ and Pierre Paquin²

¹SWCA Environmental Consultants, 4407 Monterey Oaks Boulevard, Building 1, Suite 110, Austin, TX 78749; kwhite@swca.com

²Biology Department, Portland State University, Portland OR 92182; pdx02141@pdx.edu

In Central Texas, 16 species of endemic cave-adapted invertebrates have been added to the federal endangered species list because their entire range is threatened by rapid urbanization along the Interstate 35 corridor. The pace of development is rapidly outstripping the pace of study of this unique biodiversity, and potential preserve land is disappearing. Of the hundreds of caves on private land potentially providing habitat for these species, fewer than 10 percent have been thoroughly sampled for biota. The range and true rarity of many taxa remain unknown due to taxonomic impediments and the slow pace of traditional survey methods. SWCA Environmental Consultants played a leading role in developing the first genetic and phylogeographic studies of these species, which have provided a shortcut to traditional techniques. The range of the endangered spider *Cicurina madla* has been mapped with relative accuracy, and other more vulnerable taxa have been identified. Molecular taxonomy has increased the number of known populations of *C. madla* in existing management areas and has facilitated the acquisition of new preserve land.

Oral Presentation

CONSERVATION IMPLICATIONS OF COMMUNITY AND ECOSYSTEM PHENOTYPES OF FOUNDATION PLANT SPECIES

WHITHAM, THOMAS G.¹, Randy Bangert¹, Jennifer A. Schweitzer², Gery J. Allan¹, Stephen M. Shuster¹, Joseph K. Bailey², Gina M. Wimp³, and Catherine A. Gehring¹

¹Department of Biological Sciences & the Merriam-Powell Center for Environmental Research, Northern Arizona University, Flagstaff, AZ 86011; Thomas.Whitham@nau.edu; Randy.Bangert@nau.edu; Stephen.Shuster@nau.edu; Gery.Allan@nau.edu; Catherine.Gehring@nau.edu

²Department of Ecology and Evolution, University of Tennessee, Knoxville TN 37996; Jennifer.Schweitzer@NAU.EDU; jkb22@dana.ucc.nau.edu

³Department of Entomology, University of Maryland, 4144 Plant Sciences Building, College Park, MD 20742; gwimp@umd.edu

Our studies of cottonwoods (*Populus* spp.), a foundation tree species that characterizes many riparian habitats throughout the northern hemisphere, show that diverse species from microbes to vertebrates are sensitive to individual plant genotypes. Because different tree genotypes support different communities of arthropods and microbes and determine different ecosystem processes such as decomposition and nutrient cycling, these predictable effects are termed “community and ecosystem” phenotypes. Common garden studies show that these phenotypes exhibit broad-sense heritability. The existence of these phenotypes has several important conservation implications. First, genetic diversity in cottonwoods positively affects biodiversity. For example, the genetic diversity in stands of cottonwoods explains ~60% of the variation in the diversity of an arthropod community composed of 207 arthropod species. Thus, the loss of genetic diversity in cottonwoods could result in the loss of species dependent upon those genotypes for their survival. Second, there is a genetic component to ecosystem services. Because the field of ecosystem science is largely genetics free, it is important to understand how plant genetics affects carbon storage and other ecosystem services, which are important to the climate change debate. Third, the effects of climate change on the genetic structure of foundation species are likely to alter their community and ecosystem phenotypes to affect a much larger community of organisms. Our studies with climate-sensitive, insect resistant and susceptible pinyon pines (*Pinus edulis*) suggest that 1,000 species from microbes to vertebrates have been affected by the recent record drought in the Southwest. Fourth, because the phenotypes of genetically modified organisms are likely to have extended community and ecosystem phenotypes, it is important to evaluate these higher order phenotypes before their release is approved. These findings argue that the development of the emerging field of community and ecosystem genetics might have important implications for conservation biology and genetics.

Oral Presentation

COMMUNITY AND EVOLUTIONARY CONSEQUENCES OF RECORD DROUGHT IN THE SOUTHWEST

WHITHAM, THOMAS G.¹, Adrian Stone¹, Crescent M. Scudder¹, Alicyn R. Gitlin¹, Christopher M. Sthultz¹, R. Talbot Trotter III^{1,2}, Nashelly Meneses¹, and Catherine A. Gehring¹

¹Department of Biological Sciences & the Merriam-Powell Center for Environmental Research, Northern Arizona University, Flagstaff, AZ 86011; Thomas.Whitham@nau.edu; acs47@dana.ucc.nau.edu; cms8@dana.ucc.nau.edu; arg24@dana.ucc.nau.edu; cms79@dana.ucc.nau.edu; nm49@dana.ucc.nau.edu; Catherine.Gehring@nau.edu

²Northeastern Center for Forest Health Research, USDA Forest Service, Northeastern Research Station, 51 Mill Pond Road, Hamden CT 06514; rttrotter@fs.fed.us

With the record drought that the Southwest has been experiencing since 1996, dominant plant species from low to high elevations have suffered local mortality approaching 100% and landscape-level mortality as high as 41%. Not all dominants suffer the same levels of mortality (e.g., pinyon pine = 41% and juniper = 3% mortality). Because these dominants are community drivers, as they go, so goes the rest of the community. On pinyon pine (*Pinus edulis*), about 1,000 species are affected including microbes, insects, birds, and mammals, which results in an overall loss in biodiversity. Supplemental watering experiments confirm our observational studies by demonstrating a reversal of these negative effects. Relatively rare riparian habitats are likely to be most affected, and it is important for land managers to adopt strategies that protect water resources so that the removal of water during droughts doesn't effectively turn a 100 year drought into a millennium level drought. There are also important gene x environment interactions that result in unexpected outcomes that could affect management decisions and reforestation. For example, insect-susceptible trees are 3x more likely to survive the drought than insect-resistant genotypes. Because drought appears to affect the genetic makeup of the surviving population, this drought event is not only a major ecological event, it is also likely to be an evolutionary event. These findings have important implications for understanding the ecological, evolutionary, and conservation consequences of climate change.

Oral Presentation

FIELD-BASED EVALUATIONS OF SAMPLING METHODS FOR LONG-TERM MONITORING OF UPLAND ECOSYSTEMS ON THE COLORADO PLATEAU

WITWICKI, DANA L.¹, Mark E. Miller², and Rebecca K. Mann²

¹ U.S. Geological Survey, Southwest Biological Science Center, 2290 Resource Blvd., Moab, UT, 84532; dwitwicki@usgs.gov

² U.S. Geological Survey, Southwest Biological Science Center, 190 E. Center Street, Kanab, UT 84741; mark_miller@usgs.gov; rmann@usgs.gov

To inform planning for long-term ecological monitoring, we sampled vegetation and soil-surface attributes across a range of terrestrial ecosystems in seven National Park Service (NPS) units on the Colorado Plateau. Objectives were to (1) evaluate a suite of sampling methods according to measures of repeatability, efficiency, and impacts on plot conditions and (2) characterize within- and among-plot variability in monitoring measures. This work was designed to support NPS staff in selecting the combination of methods which best meets their monitoring objectives and resource constraints. We found no differences among cover-estimation techniques in terms of observer repeatability (measurement precision). Cover estimates for total live understory vegetation, individual species, and soil-surface features were highly repeatable between observers for 10-m² quadrats, 1-m² quadrats, and line-point intercept sampling methods. At 10 of 11 ecological sites, sampling with 10-m² quadrats was the most efficient cover estimation technique with respect to within-plot variability in cover estimates and numbers of subsamples required to estimate plot-level cover with 20% precision. But the line-point technique was most efficient at 8 of 11 ecological sites in terms of the amount of time required to estimate total plot-level cover with 20% precision, and there was no statistical difference among methods with respect to median subsampling times for 20% precision. There also was no difference among methods with respect to mean and median measures of among-plot variability in total live understory cover. Among-plot variability was least for the line-point technique at 7 of 11 ecological sites. Sampling activities had greatest impacts on plot conditions at macroplots where there was a high degree of cover by biological and physical soil crusts.

Oral Presentation

REGIONAL CAVE ECOLOGICAL INVENTORY AND NEW SPECIES DISCOVERIES, GRAND CANYON-PARASHANT NATIONAL MONUMENT, ARIZONA

WYNNE, J. JUDSON^{1,2}, Kyle D. Voyles³, and Charles A. Drost¹

¹USGS-Southwest Biological Science Center, Colorado Plateau Research Station, 2255 North Gemini Dr, Flagstaff, AZ 86001; Jut.Wynne@NAU.EDU; charles_drost@usgs.gov

²Corps of Discovery International, 265 East Kiowa, Flagstaff, AZ 86011

³National Park Service, Grand Canyon-Parashant National Monument, 345 East Riverside Dr, St. George, UT 84790; Kyle_Voyles@nps.gov

Prior to this study, the cave ecology of Grand Canyon-Parashant National Monument was unknown. We surveyed the 24 known caves on the Monument for wildlife presence and use, and sampled for invertebrates. Many of the 24 caves were used by porcupines (*Erethizon dorsatum*) and bats (including *Myotis* sp. and *Corynorhinus townsendii*). New invertebrate species discoveries include four species of cave cricket (Family Rhaphidophoridae), one Psocopteran species, and one Coleopteran species; however, additional new species discoveries are likely. This research represents Arizona's first regional cave ecology inventory using systematic sampling techniques. Our data are useful in targeting caves for future research, as well as identifying caves of high conservation priority.

Oral presentation

ASSOCIATION MAPPING AND INTROGRESSION OF COMMUNITY-LEVEL TRAITS IN NATURALLY OCCURRING COTTONWOOD (*POPULUS*) HYBRID ZONES

ZINKGRAF, MATTHEW, Scott Woolbright, Gery Allan, and Thomas Whitham

Biological Sciences Department and the Environmental Genetics and Genomics Laboratory, Northern Arizona University, PO Box 5640, Flagstaff, AZ 86011; msz2@nau.edu; scott.woolbright@nau.edu; gery.allan@nau.edu; thomas.whitham@nau.edu

The role that genes play in determining community-level trait variation is poorly understood in most ecological systems. One system that provides unparalleled opportunities for defining the interactions between genes and ecology is the cottonwood system, which consists of extensive hybrid zones formed between two or more cottonwood tree species. In this system, we have identified strong correlations between host plant genetics and community-level traits including arthropod community composition and plant chemical defense. To better understand the genetic variation that underlies community-level trait variation, we looked at 1) how genetic variation in cottonwood hybrids (*Populus fremontii* x *P. angustifolia*) affects the survival of the aphid *Pemphigus betae* and 2) how introgression of molecular markers associated with quantitative trait loci (QTL) for plant chemistry are distributed across a cottonwood hybridizing complex in the Weber River, Utah. Using genome-wide association mapping techniques and amplified fragment length polymorphisms (AFLP) markers, we have identified cottonwood AFLP markers that significantly ($p < 0.001$) contribute to *P. betae* survival on cottonwoods ($n=94$). In addition *P. fremontii* AFLP molecular markers associated with QTLs for salicortin and HCH-salicortin are selectively introgressing out of the hybrid zone and into the *P. angustifolia* zone ($n=282$). These data suggest that specific cottonwood genes may contribute to community-level trait variation and that introgression of genes associated with plant foliar chemistry may be adaptive and provide an evolutionary mechanism for generating new chemical defenses.



The Natural Areas Association

Preserving Nature's Diversity

The Natural Areas Association (NAA), founded in 1980, is a national organization providing support and information services to persons and institutions concerned with the protection and stewardship of natural areas. NAA is a vital resource for those involved in planning, development and/or management of natural area and natural heritage policies and programs. The goal of NAA is to collect the varied expertise of its members and apply it toward protecting natural areas and creating, sustaining, or improving natural area programs in every state. The NAA is funded primarily through membership dues, individual donations, conferences, grants, and other NAA-sponsored events. Individual and agency donations are especially integral to the services and programs that we provide.

As a forum for those committed to natural area conservation, the Natural Areas Association:

- Publishes the *Natural Areas Journal*
- Hosts the annual Natural Areas Conference
- Publishes the Natural Area News
- Develops special reports such as the Status of State Natural Area Programs
- Facilitates special sessions such as the State and Federal Natural Area Roundtables at this Conference
- Hosts international workshops – guided trips focused on natural areas conservation
- Serves as a primary portal – a centralized resource for natural areas information and services

Learn more about the Natural Areas Association by visiting:

WWW.NATURALAREA.ORG

2007 Natural Areas Conference

Some Assembly Required: Preserving Nature in a Fragmented Landscape

October 9-12, 2007

Cleveland Marriott at Key Center
Cleveland, Ohio

The typical schedule used for past Natural Areas Conferences has been changed by moving all standard events up one day. Registration will begin on Tuesday, October 9. Plenary and keynote addresses will take place that afternoon. Wednesday, October 10 will be a full day of symposia and contributed paper sessions. On Thursday, October 11, we will hold field trips throughout northeast Ohio and our annual banquet at The Cleveland Museum of Natural History. Friday, October 12, will be the conference's final day. After a full day of symposia and contributed paper sessions, the conference will adjourn at 4 PM.

