The Arizona Riparian Council Newsletter

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CENTER FOR ENVIRONMENTAL STUDIES AND THE CENTRAL ARIZONA - PHOENIX LONG-TERM ECOLOGICAL RESEARCH PROJECT

Cindy D. Zisner, Center for Environmental Studies, Arizona State University

The Center for Environmental Studies at Arizona State University (ASU) has been the Arizona Riparian Council's home since its inception. When the Arizona Riparian Council was formed in 1986, Duncan Patten was the Director of the Center. He was greatly responsible for the formation of our organization and also served as the Council's first President. In 1996, Duncan retired as Director of the Center, and Dr. David Pijawka was Interim Director until January 1997 when Dr. Charles Redman became the new Director.

Dr. Redman received his BA from Harvard University, and his graduate degrees in anthropology from the University of Chicago. He taught at New York University and at State University of New York-Binghamton before coming to ASU in 1983. Since then he has served as Chair for the Department of Anthropology. His interests include archaeological research design, the rise of civilization, human impacts on the environment, and public outreach.

One of the first undertakings as new Director was forming a partnership of ASU faculty and community organizations to apply for funding for a Long-Term Ecological Research (LTER) project from the National Science Foundation. In the fall of 1997, the Center was successful and was awarded one of only two urban LTER grants to study the Phoenix metropolitan area. The other urban LTER was to study Baltimore, Maryland.

CENTRAL ARIZONA - PHOENIX LONG-TERM ECOLOGICAL RESEARCH (CAP LTER) FOCUS

Arizona has been identified as the second fastest-growing state in the nation for the past six years. The Phoenix metropolitan area's growth in population — doubling twice in the past 35 years — and its rapid and continuing expansion into former agricultural and natural settings provides a unique opportunity to monitor human-induced ecological transformations, resulting from rapid land-use transformations.

Historic patterns of growth in the central Arizona - Phoenix region will be reconstructed in the CAP LTER by using maps, planning documents, aerial photographs, and satellite imagery to generate a record of urban change. Computer modeling will be centered on a hierarchical, spatially explicit, patch dynamic approach. Land-use patches include parks, open space, native vegetation, residential, commercial, and industrial categories. At intermediate scales, landscape models will be developed to determine the effects of multiple patches. A regional simulation model of the entire area will be developed to predict and test the ecological consequences of alternative patterns of future development.

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Inside This Issue

PRESIDENT'S MESSAGE

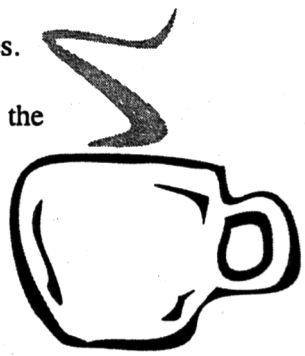
As the season transitions from the cool, breezy days of spring into the hot, sultry days of summer, the Arizona Riparian Council experiences transitions too. At our Twelfth Annual Meeting in Yuma this year we transitioned Presidents. Ruth Valencia passed the torch to me. This is not the first time for me however. I held this position two years ago. Under Ruth's leadership, the Council had several "firsts." One was the conducting a silent auction at our annual meeting (1996 10th Anniversary Meeting in Prescott) to assist in offsetting costs of the meeting. Another was the organizing of the first Riparian Methods Workshop. This workshop was well attended and provided a great service. For all her hard work and dedication, I want to thank Ruth. You did a tremendous job and your efforts are greatly appreciated.

Thanks Ruth!!!

This fall, the Council will have our annual Fall Campout and Get-Together. A location has not been determined yet. We usually have these Get-Togethers in late September or early to mid-October after it has cooled off from the summer. Examples of previous fall meetings include Fossil Creek where we discussed the Federal Energy Regulatory Commission and the relicensing of the hydroelectric operations at Irving and Childs. We explored the riparian system upstream and downstream of the dam diversion. Staff of the Arizona Public Service were our gracious hosts. In 1994, we were hosted by the City of Scottsdale at Planet Ranch where we hiked areas along the Bill Williams River. We talked about such issues as water banking and basin transfers. If you have a suggestion for a location for this fall please call me (602-831-8780) or Cindy Zisner (602-965-2490) and let us know.

Kris Randall, President

Don't know how many of you may remember this, but back in the September 1996 issue of the newsletter we did an article entitled, *The Coffee Connection* by Chuck Hunter. The story was written about shade-grown coffee in the tropical rainforests and how doing so benefited neotropical migrant bird species. At the end of the story Chuck listed some coffee companies who were ECO-OK. Among them was the *Thanksgiving Coffee Co.* Locally, in the Phoenix metropolitan area, the Maricopa Audubon Society has been selling the company's Song Bird Coffee as a fund raiser. It is very good coffee and supports a worthy cause. Jeanine Baker, a member of both the Council and Maricopa Audubon has felt so strongly about the coffee that she has become Arizona's Sales Representative for Song Bird Coffee. If anyone is interested she may be reached at (602) 447-0394 or jayb9@imap1.asu.edu. She has also convinced Arizona Health Foods stores to carry the coffee in their stores in the Phoenix area.



(CAP LTER..Cont. from page 1)

Patch-specific ecological characteristics will be monitored in five core categories: primary production, natural population and community characteristics, storage and dynamics of organic matter, movement of materials (including water), and patterns of disturbance that occur through redevelopment, fire, or flood. Furthermore, patch types will be compared from city center toward the outer fringe, permitting data collection and analysis intended for land-use planning. Eighteen pilot studies have been established to initiate research and to establish baseline information. At the end of each description contact has been provided.

PILOT STUDIES

More than 50 ASU faculty members and community partners have come together to work on the CAP LTER. Faculty members are from various departments on all three (Main, East, and West) ASU campuses.

Establishment of a Pilot GIS Database. A web page (http://caplter.asu.edu/research/data/gisdata.htm) has been created to allow LTER scientists to directly download statewide GIS datasets available from the Arizona Land Resources Information System (ALRIS) division of the Arizona State Land Department. This GIS data is available in a format for scientists working on a PC using standard GIS software (ESRI).

To provide a visual overview of the GIS data available for the LTER project, a separate web page has been created (http://gis1.inre.asu.edu/lterweb/index.html). Providing a visual overview of the data enables scientists to examine it more closely to see if it is useful to them and is intended to inspire questions regarding its relevance to their particular research projects. This web page also includes instructions for scientists working on the UNIX platform and directs them how to obtain data stored on UNIX servers within the lab. The page also points to explicit directions on how to set up a UNIX working environment on a PC. Data available both from Maricopa County Association of Governments and ALRIS are displayed this page.

Also as part of the project, an example of how GIS data may be used has also been created. The goal of the research was to develop a pilot project to demonstrate data integration and analysis capabilities of GIS for LTER scientists. The study consisted of compiling GIS data from several sources and performing some initial analyses on these datasets. Data were collected and compiled from several sources, including lichen data, weather stations from Prism to display wind directions, and air quality data from Maricopa County. A more detailed description of the project objectives, data descriptions, and the results of the analysis can be viewed on the LTER web page (http://gis1.inre.asu.edu/pilot/pilot.html).

The spatial modeling project is aimed to quantify the spatial pattern of the CAP landscape and its changes. The characterization of landscape pattern has important implications for monitoring and assessment of natural resources at regional scales. A series of analyses will be conducted:

(1) Hierarchical analysis of landscape pattern of the CAP urban ecosystem;
(2) Classification of patches according to physical, ecological, and socioeconomic factors; and
(3) Correlation analysis among physical, ecological and social variables of interest.

The results of these analyses will provide essential information for understanding the structure of the CAP urban ecosystem and for developing the hierarchical patch dynamic model to link landscape structure to function. Also, they will help address some important questions concerning the relationship between urbanization and ecological conditions.
Contact: Jana Fry at (602) 965-9709 or JANA.FRY@ASU.Edu.

Using Remote Sensing to Define Patch Typology. This pilot project is utilizing archived 1993 Landsat TM satellite data of the CAP LTER site to derive land-cover classifications. The testing and refinement of classification schemes for urban, desert, and fringe regions of the Phoenix area is the prime focus of the project. Land cover type, the primary product of remote-sensing classification, is a fundamental data set for nearly every aspect of the CAP LTER project. For example, it has been used to derive surface cover, aid in biological surveys, plan future science initiatives, and help define the patch typology of the system. These classes, once accurately defined and field checked will form the basis of the LTER's patch typology and serve as a baseline for the ground cover change inventory of the Phoenix metropolitan area. To examine the temporal effects of urban growth and its impact on the

desert ecology, it is critical to have data extending both into the past as well as the future. In addition to the work with the 1993 Landsat data, the project is exploring the possibilities of acquiring older remote sensing and aerial photographic datasets. These data provide the basis for multithematic, multitemporal, and multispatial scale research. Future data from an array of new airborne and satellite sensors is planned in conjunction with NASA and the Mission to Planet Earth Project. Because urban land-use change monitoring and its effect on population are prime components of NASA's mission statement for terrestrial research, the CAP LTER will serve as an important target for this research. Contact: Mike Ramsey at (602) 965-5507 or ramsey@elwood.la.asu.edu.

Urban Fringe Morphology. The urban fringe morphology project has the following three elements:

1. An analysis of population and employment densities using Maricopa Association of Government data is being conducted to produce 1990-1995 land consumption rates and land absorption coefficients for the 25 local municipalities in the Phoenix metropolitan area. A qualitative inventory of community planning and development policies for the 25 municipalities will also be conducted. The goal is to determine whether differing community land-use policies resulted in varying intensities of land development at the fringe. In other words, were communities with stricter development controls more successful in stimulating higher density development than communities with weaker controls?
2. Beyond the built-up area is a zone that is on the brink of urban development. It is affected by urbanization, but does not yet meet the threshold density for inclusion in the urbanized area. We seek to monitor the changes in this landscape as urbanization unfolds through two methods. First, we are investigating how feasible it is to study this area through land cover changes, watching the turnover from agriculture and open space to built-up area. We also plan to monitor more localized landscape change through fieldwork. The product of this exercise will be a narrative of pre-urban fringe activity. What activities are precursors of fringe development in Phoenix?
3. Also in areas at the cusp of development, we want to monitor land-use change that is invisible to the naked eye. Soon-to-be-developed areas are characterized by a flurry of real estate transactions and by a shift in ownership from private individuals to corporations. The Center for Business Research has data on metropolitan real estate transactions categorized by location and types of owner which will be use. The goal here is to examine land tenure change as the fringe unfolds.

Contact: Elizabeth Burns at (602) 965-7533 or ekburns@asu.edu.

A Hierarchical Patch Dynamic Model of the CAP Urban Ecosystem. A series of computer simulation models are being developed that can be used as experimentation tools to enhance our understanding of how urban development interacts with natural environment. The models will be built at different spatial scales. At the local scale, patch models relate patch characteristics (e.g., size, shape, land cover, disturbance regime) to ecological and socioeconomic variables of interest. The patches may be vegetation remnants, shopping centers, residential areas, and golf courses. These models will provide information that is necessary not only for understanding fine-scale interactions between urbanization and ecology, but also for constructing and parameterizing coarser-scale models. At the landscape level, we will build models for distinctive landscapes: natural vegetation dominated areas, suburban areas, and highly urbanized areas. These landscape models explicitly consider spatial heterogeneity and interactions among patches of different patches. At the regional (CAP) scale, we will build a hierarchically structured, patch dynamic, spatially explicit simulation model, which incorporates the interactions between landscape pattern and ecological and socioeconomic processes at different scales. Contact: Jianguo Wu at (602) 543-6131 or JINGLE@ASU.EDU.

Century-Scale Salt and Gila Rivers' Channel Change. For more than 1,000 years there has been a city on the banks of the Salt and Gila Rivers in the vicinity of what is now Phoenix. The course of natural processes as embodied by the river have interacted with the course of human events as evidenced by the city, each exerting influence on the other. The myriad of tangled connections between the natural and social systems has inevitably altered each of them, so that understanding of one without understanding of the other is incomplete. Within the last 100 years, intensive technological development of the river resources, its space, water, materials, and biotic complements, has radically

altered the natural processes and forms of the river. At the same time, the river has influenced development of the city, sometimes as a resource such as recreational space, and sometimes as a hazard such as flooding. This constantly changing fluvial system, integrating natural and artificial influences, is the foundation for the primary riparian ecosystems of the region.

The research questions of this project are: (1) What has been the nature of change in the geomorphic/riparian system, and how have human and natural factors controlled the distribution and intensity of the change over the past century? (2) Why does the river have its present geomorphic/riparian configuration, and how stable is that arrangement from geomorphic, hydrologic, and geographic perspectives? and (3) How does the river respond to ongoing changes in the spatial arrangement of human activities and attending technological impacts?

This project promises improved understanding of the dynamics of dryland rivers, especially how and why they change under the influence of urban development. The research also promises to provide an integrating factor in the CAP LTER effort, because the river integrates the influences of hydrologic, geomorphic, biotic, and human technological systems. The research will provide a repeatable quantitative approach to assessing the changes in the river and as it continues its millennium-long connection between natural and social systems. Contact: Will Graf at (602) 965-7533 or graf@asu.edu.

Quaternary Geologic and Geomorphic Change. The development of the landscape in the CAP LTER region over the last million years has determined the distribution of materials at the surface and in the shallow subsurface and has controlled the topographic form of the region. These effects define the spatial and temporal context for the ecological relationships that we study. The recent geologic history of the CAP LTER region has been dominated by the activity of the rivers that flow through it. The Gila River and its important tributaries—the Salt, Hassayampa, and Agua Fria Rivers—has existed as a major tributary of the Colorado River for the past 8-9 million years. Alluvial deposits filled the basin floor for much of the early and middle Pleistocene. This was followed in the late Pleistocene and early Holocene by a period of downcutting during which the drainages removed some earlier alluvial material and formed a series of inset terraces. This alternation of aggradation and entrenchment was apparently driven by climatically correlated changes in surface transport rates and sediment supply.

We are gaining an understanding of the development of the landscape by applying traditional and new geological mapping methods to document the distribution of materials and the relative ages of geologic events. That has included generating detailed maps in the area of the White Tank Mountains west of Phoenix and Union Hills and Paradise Valley, and will include investigating the shallow subsurface in the area of the White Tanks using gravimetric methods to attempt a mass balance for the Quaternary sediment production, erosion, transport, and sedimentation in the region. One of the outstanding questions is the timing of landscape development. We have made good progress in our efforts to apply the tool of cosmogenic dating to establish numerical ages for the incision and aggradation events.

Cosmogenic dating is possible because measurable isotopes form in surface matter as a result of cosmic ray bombardment. These isotopes form by a chain of subatomic to nuclear interactions (mostly by the collision of thermal neutrons with parent isotopes) initiated by the penetration of the atmosphere by cosmic rays. Rates of accumulation of these isotopes have been determined experimentally. Thus, the exposure age can be calculated from the amount of isotope measured in a sample by an Accelerator Mass Spectrometer. In reality, the amount of isotope in a sample is not only a function of exposure age, but also erosion rate and inheritance; when making only one isotopic measurement, two of these unknowns must be estimated. However, measuring multiple isotopes produces multiple equations (one for each isotope) that allow simultaneous solution for more than one variable. In addition to exposure age, burial time can be determined by measuring the decay of two isotopes in sediment that is no longer accumulating cosmogenic isotopes as it is shielded by the sediment above. Contact: Ramon Arrowsmith at (602) 965-3541 or ramon.arrowsmith@asu.edu.

Nutrients Data Synthesis, Mass Balance. The goal of this project is to develop preliminary mass balances for nitrogen and salts in the CAP LTER watershed. Nitrogen is important because it is a limiting nutrient for plant growth and because there is widespread nitrate contamination of groundwater in the Phoenix area. Much of the groundwater in the Phoenix area already exceeds the Environmental Protection Agency (EPA) drinking water limit and

many wells have been shut down for this reason. Salts are being studied because a buildup of salts is occurring in the Phoenix ecosystem. Salt buildup in soils or groundwater may eventually reduce plant productivity.

The mass balances include external inputs (surface water, groundwater, atmospheric deposition, fertilizer, food, etc.), outputs (surface and groundwater; human exports, etc.), and accumulation (landfills, surficial soils, vadose zone, groundwater).
Key questions be addressed are: (1) What is the net retention of salts and nitrogen in the Phoenix ecosystem? (2) How much salt and nitrogen is exported from the Phoenix ecosystem via the Gila River? (3) Is downstream export higher than upstream inputs? (4) How have changes in population and land use (e.g., a shift from agricultural production to urban development) affected accumulation rates of these materials? (5) How does accumulation of these materials vary spatially, in relation to land use?

Some very preliminary conclusions are major sources of nitrogen are fertilizer, animal waste, municipal sewage (mostly recycled within system), and atmospheric deposition. Surface and groundwater inputs are small by comparison. Nitrogen retention is probably very high; accumulation occurs in groundwater and probably in the vadose zone. Movement through the vadose zone probably occurs on a time scale of several decades. Contact: Larry Baker at LBaker@asu.edu.

Aquatic Core Monitoring (continuation of NAWQA). The main aim of this project is to answer the following questions: (1) What are the concentrations and amounts of key nutrients, salts, and trace metals being imported to and exported from the CAP LTER urban areas in surface waters (rivers and canals)? (2) How do these terms change over time in response to increasing urbanization and variations in climate? (3) What are the spatial patterns of accumulation and export, and how do these relate to specific land-use patches?

The surface-water quality monitoring sites have been located to meet the following criteria: (a) to characterize the main inputs to and outputs from the CAP LTER study area; (b) to correspond to the sites sampled by the USGS National Water Quality Assessment (NAWQA) program wherever possible; and (c) to be as close as possible to established gauging stations, so that annual or per event loads can be estimated. At several of the sites, CAP LTER sampling will augment between 3 and 40 years of data collection by NAWQA and previous USGS water sampling programs, enabling past changes in materials flow to be compared with current and future data. The LTER core monitoring program consists of seven sites where surface water flow occurs year round. Water sample collection is carried out using the same basic procedure as the NAWQA program. The sample is analyzed for nitrogen (nitrate, ammonium, total N, particulate N), carbon (dissolved organic carbon, particulate carbon, total inorganic carbon), phosphorus (soluble reactive phosphate, total P), salts (calcium, magnesium, sodium, potassium, chloride, sulphate), trace metals (e.g. copper, lead, zinc, iron), suspended solids, conductivity and pH. All analyses are done in triplicate, with the inclusion of quality control samples at regular intervals.

Since almost no data exists on the chemistry of atmospheric deposition in the CAP LTER study area, we intend to establish a network of five wet/dry deposition collectors. These instruments will be located along an urban to desert gradient. Contact: Diane Hope at (602) 965-2887 or di.hope@asu.edu.

Lichen Resurvey with Heavy Metal Analysis . A survey of the presence or absence of different lichen species at 25 sites in Maricopa County that were originally surveyed in 1974. A comparison will be made between the concentration of trace metals in current lichen tissues with those in samples collected in the original survey. Tom Nash at (602) 965-7735 or tom.nash@asu.edu.

Arthropod Sampling. This study is being conducted to characterize differences in the types of arthropod species (e.g., insects, arachnids) inhabiting different types of patches (e.g., desert remnants, agricultural fields, suburban yards, industrial properties) in different locations throughout the Phoenix metropolitan area. Understanding arthropod distributions and how they differ as functions of land use and land cover is important for several reasons. First, arthropods, with their diversity of life strategies are good indicators of an array of features pertaining to habitat quality. Responses to changes in quality take place quickly due to the short life spans and specialized requirements of many species. Second, arthropods provide a key link between what is going on with plant communities (many insects eat plants) and what is going on with vertebrate populations (many birds and lizards eat insects), so characterizing differences in arthropod assemblages as functions of land use and land cover is a key component of understanding the ecology of Phoenix. Contact: Stan Faeth at

(602) 965-4120 or s.faeth@asu.edu.

Plant Survey with Data Synthesis. This project will compile a list of native and exotic plant species for the CAP LTER study area. A resurvey the plants present in areas (especially desert parks) originally surveyed approximately 20 years ago will also be conducted. Contact: Sam Scheiner at (602) 543-6934 or sam.scheiner@asu.edu.

Comparison Among Residential Patch Transition Types—Before and After. The net CO_2 exchange and biomass/biovolumes of selected plant species across a 2 × 2 factorial patch matrix, consisting of three replication of residential xeric and mesic landscapes that were, prior to their development either formerly desert or agricultural sites. Twelve residential sites have been chosen in south Tempe and the Ahwatukee Foothills communities, three undeveloped Sonoran Desert sites in South Mountain Preserve, and three agricultural sites in alfalfa fields in southwest Chandler. Measurement of net above-ground primary production at all these sites. Protocols during the summer 1998 will entail monthly dawn-to-dusk measurements of net photosynthetic capacity on three different plant species at a site. Seasonal measurements of biomass/biovolumes will aos be made. For these measurements, selection of target plant species will be based on differential morphological characters and function types. For example, target plants in a xeric landscape (either formerly desert or agriculture) may include Chilean mesquite (tree; *Prosopis chilensis*) , Texas sage (shrub; *Leucophyllum frutescens*), and lantana (ground cover; *Lantana montevidensis*). Soil gas methodology will include sampling for N_2O and CH_4, as well as CO_2. A soil site characterizaiton will also be conducted. Contact: Thomas Day at (602) 965-8165 or TADDAY@ASU.EDU.

General Model of Urban Fire Ecology. This study will explore ways in which fire as a prominent disturbance in urban ecosystems and a vital element in urban planning and dynamics can be understood in ecological terms. Contact: Stephen Pyne at (602) 543-6013 or IADSJP@ASUVM.INRE.ASU.EDU

Economic Analysis, Open Space. Open-space land, land set aside for public use in its natural state, is an increasingly important part of the urban environment. Open-space land provides recreation and leisure opportunities for local residents and visitors alike, and also is an important source of purely aesthetic enjoyment. In deciding on the quantity of native land to set aside for public use and enjoyment, it is important for policy makers to have some idea of the value consumers derive from the amenities associated with its public use. The purpose of this study is to provide empirical estimates of the economic value of open-space land; that is, the value individuals place on living near and having access to land that has been preserved in its native state for public use. This study focuses on the economic benefits of open-space lands within and around the Phoenix metropolitan area, namely those lands set aside by the government as natural parks that fall within, or border upon, Maricopa County. Since individual valuations underlie all market prices, this study attempts to determine individuals' willingness-to-pay for the amenities associated with open-space areas through an analysis of the primary factors that determine land prices. The main problem that arises in undertaking such an investigation is that it is difficult to determine the value of individual site characteristics, since these characteristics are not separately traded nor are they priced in explicit (i.e. separate) markets. Contact: Michael Ormiston at (602) 965-7350 or Michael.Ormiston@asu.edu.

Historic Records of Climate in the Valley. This study will reconstruct the history of spatial and temporal feedback effects of patch size and distribution on climate. Robert Balling at (602) 965-7533 or robert.balling@asu.edu.

Hohokam Canals as Multiuse Facilities. This study examines archaeologically excavated floral, faunal, and sedimentological data to reconstruct the nature of prehistoric canal habitats and consider past and present relative values of importance of residing close to a canal. Contact: Katherine Spielmann at (602) 965-6213 or atkxs@asuvm.inre.asu.edu.

Bird Survey with Data Synthesis. The goals of this project are (1) to document the changes in avian richness and abundance over time and space and (2) to determine the biotic and abiotic factors that cause these changes to occur. A census protocol has been developmed and bird censuses have been started in four key habitats in the CAP LTER study area. These habitats include older residential neighborhoods, younger residential neighborhoods, remnant desert areas, and golf courses. These sites are located in southern Phoenix, Tempe, Chandler, and Mesa; each site contains a 1 km transect that is sampled three times per month. Eventually, satellite images, high aerial photography, and

vegetative ground surveys will be used to study the effects of landscape structure on avian populations. In addition, volunteers are censusing birds in their respective neighborhoods. These volunteer sites are scattered throughout the valley from Sun City West to Gilbert. Volunteers are not only gathering useful quantitative and qualitative data, but they will be used as "nodes" to disseminate information gained from the LTER project to local neighborhoods. Contact: Mark Hostetler at (602) 965-5841 or hossman@asu.edu.

Student Participation in Plant and/or Bird Survey. The education team has completed preliminary investigations for education program development resulting in an outline of program components and resources, teacher training and workshops, scientist visits to the classroom, focused field trips to resource and research sites (including some of our community partners), and an interactive Web site. These components have been selected after conducting informal teacher interviews and reviewing state science education standards. The full LTER Education team will meet to discuss how our community and institutional partners may be involved. This summer, the LTER will be offering a teacher workshop to small group of elementary, middle school, and high school teachers during which they will help develop classroom approaches to research using LTER protocols. We envision a program that offers K-12 students, teachers, parents, and administrators opportunities to conduct long-term ecological research, using their schoolyards and backyards as research sites. Contact: Fred Staley at (602) 965-3133 or fred.staley@asu.edu.

For more information about the projects and faculty members involved please visit the CAP LTER Web site (http://caplter.asu.edu).

INTERNATIONAL FLAIR HIGHLIGHTS 1998 SPRING MEETING

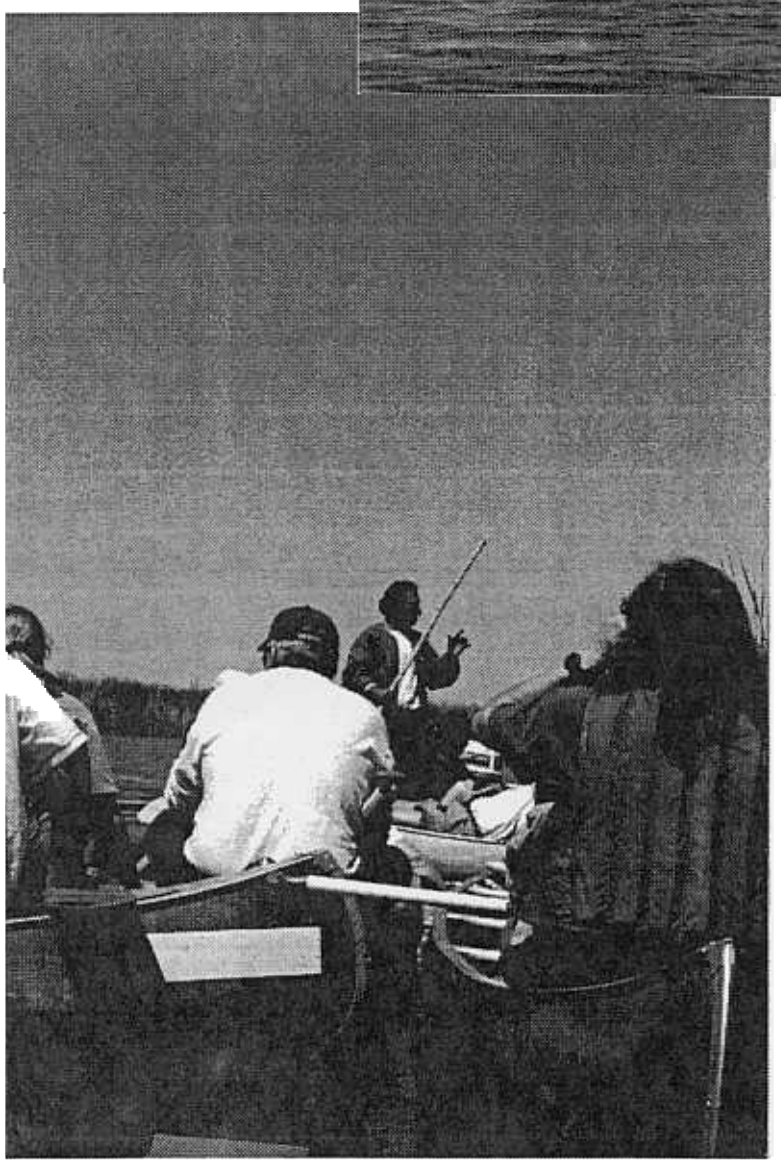
The 1998 meeting, *The Lower Colorado River: Changes Around the Bend,* was held in Yuma. This year's meeting marks the twelfth meeting of the Arizona Riparian Council, and the theme centered on the lower Colorado River.

The morning session featured five speakers who provided interesting information on various topics related to the Colorado River, both in the United States and in Mexico. Chris Harris from the Arizona Department of Water Resources started the session with an historical perspective on the legal and physical operations of the Colorado River. Bill Werner of the Arizona Game and Fish Department gave a brief overview of the Lower Colorado River Multi-Species Conservation Program, which includes a 50-year plan for the conservation of 102 species of fish and wildlife. This presentation was followed by a detailed presentation of the reasonable and prudent alternatives included in the Program by Michael Walker of the U.S. Bureau of Reclamation. Mitch Ellis of the Imperial National Wildlife Refuge, U.S. Fish and Wildlife Service, provided an unique perspective from the lower Colorado River Refuges' point of view. The morning session was concluded by Jose Campoy and Juan Carlos Barrera of the Reserva de la Biosfera Alto Golfo de California. Meeting attendees were very fortunate to receive first-hand knowledge of the operations and future plans for the Cienega de Santa Clara and preserve established by Mexico in upper Gulf of California.

The afternoon session featured concurrent technical presentations. A total of 20 presentations were made on various topics ranging from a riparian species of butterfly to responses of riverine ecosystems to wastewater inputs. Several presentations centered on the Multi-Species Conservation Program and Biological Opinion. In addition, five posters were presented. Copies of the abstracts are available from Cindy Zisner at 602-965-2490 or Cindy.Zisner@asu.edu. Most of those attendees who completed meeting surveys indicated a preference towards concurrent afternoon technical sessions. A catered barbeque dinner was held at the Yuma Crossings State Historical Park after a long day of presentations.

Newly elected board members include Kris Randall, President; Jeff Inwood, Treasurer; and Susan Pierce, Member at Large. Janet Johnson was re-elected Vice President and Matt Chew and Barbara Heslin were re-elected as Members At Large.

Two field trips were conducted on Saturday. A tour of several Lower Colorado River riparian habitats was conducted by Susanna Henry and Bill Werner. Mark Briggs and Ruth Valencia led a large contingent by bus into Mexico to tour the Cienega de Santa Clara and the Colorado River Delta area.



Field trip to the Colorado River Delta

The group that went to Mexico explored the marsh in canoes (thanks to the Colorado River Indian Tribes Ahakhav Preserve) and boats. The dominant vegetation was cattails and several species of birds were seen – Red-winged Blackbird, Ring-billed Gull, Osprey Common Yellowthroats, Long-billed Marsh Wren, American Coot, Yellow-headed Blackbirds, Pied-billed Grebe, Green Heron, White-faced Ibis, and Cattle Egret.

BIOGRAPHIES OF OFFICERS

Kris Randall, President, has been a member of the Council since 1987. Initially she co-chaired the Protection/ Enhancement Committee. She has

formerly served one term as Vice President and two terms as President, and she now serves as co-chair for the Protection/ Enhancement Committee. Kris has her Bachelor of Science in Zoology and Master of Natural Science in Riparian Ecology both from Arizona State University. Her research efforts include studies of riparian revegetation, fluvial geomorphic processes, and the function of riparian vegetation for water quality. She was the Riparian/ Wetland Coordinator for the Arizona Department of Environmental Quality and also Manager of the Surface Water Monitoring Unit dealing with monitoring water chemistry, and innovative techniques to evaluate biological and physical integrity. She currently is employed by EcoPlan.

Janet Johnson, Vice President, has been a member of the Council since 1995 and had held the office of Vice President for one term. She holds a Bachelor of Science in Biology from the University of Nebraska, a Master of Arts in Botany and a Doctorate in Forest Ecology from the University of Montana. Janet has worked as a Riparian Ecologist for the Tonto National Forest for two years. Prior to coming to the Tonto National Forest she held a wide variety of technical advisory and management positions on National Forests in Montana. She was the Bitterroot Forest Ecologist/Botanist from 1991 until 1995, and has worked in the range program on the Lolo National Forest in Montana, focusing on riparian-related issues. On the Beaverhead National Forest she was a Range Conservationist and Resource Assistant, and was a Plant Ecologist with the Northern Region and Intermountain Research Station of the Forest Service in Missoula, Montana. While at the Station there she coordinated the Research Natural Areas Program and developed grassland and riparian vegetation classifications.

Jeff Inwood, Treasurer, has been a member of the Arizona Riparian Council since 1993. He has been Chair of the Water Resource Committee and Co-Editor of the *Arizona Riparian Council Newsletter* since 1995. Also he a member of the Arizona Hydrological Society. Jeff has a Bachelor of Arts degree with majors in geology and business administration from Augustana College in Rock Island, Illinois. Currently, Jeff is an Environmental Scientist for ASL Hydrologic & Environmental Services, a private, full-service environmental consulting firm in Phoenix. Prior to joining ASL, he served as the Executive Director for the Mike Utley Foundation, a non-profit organization that raised money for spinal cord injury research.

Matt Chew, Member-At-Large, has been a member of the Council since 1993 and has served as a Member-at-Large since 1995. He holds a Bachelor of Science in Recreation Resources Management and an Master of Science in Range Science from Colorado State University. While in Colorado, Matt was a member of the Colorado Riparian Association. Matt currently works in the Acquisitions and Planning Unit at Arizona State Parks, where he coordinates the State Natural Areas Program and matters related to natural resources management, ecology, threatened and endangered species and other environmental issues within the State Parks system. He has authored, co-authored, illustrated, and/or edited various papers and publications related to riparian management, and served on several interagency committees devoted to riparian issues.

Barbara Heslin, Member-At-Large, has been a member of the Arizona Riparian Council since 1995 and has fulfilled a vacated Member at Large position for the last two years. She received a Bachelor of Arts degree in Outdoor Education/Biology from Northland College on the shores of Lake Superior (Ashland, Wisconsin), and a Master's degree in Biology from Northern Arizona University. Barbara has worked on the North Kaibab Ranger District, the Mt. Hood National Forest in Oregon, and the Mendocino National Forest in northern California. She returned to Arizona in 1992 to work for the Arizona Game and Fish Depaitment and has held positions in both the Nongame Branch and as a Habitat Specialist in the Mesa Office. Currently, Barbara is employed as a Project Evaluation Specialist in the Habitat Branch at the Arizona Game and Fish Department's Phoenix Office.

Susan Pierce, Member-At-Large, has been a member of the Council since 1996. She received a Bachelor of Science degree in Environmental Resources from the College of Architecture and Environmental Design, Arizona State University. At the Center for Environmental Studies at Arizona State University she was a Field Technician working on effluent-dominated streams. Susan is an Environmental Specialist at Jones & Stokes Associates, a natural resources and environmental planning firm in Phoenix, Arizona. Currently, she is working on a habitat restoration plan for the Town of Superior, Arizona, and the Tres Rios Wetlands Enhancement Project in Phoenix.

Since Jeff Inwood is taking over responsibilities of Treasurer

he has opted to no longer be Co-Editor of the *Arizona Riparian Council Newsletter*. The new *Arizona Riparian Council* Co-Editor is **Dr. Paul C. Marsh** of the Arizona State University, Department of Biology. Paul is an aquatic ecologist who for the past 18 years has specialized in the study of imperiled fishes of the arid Southwest. He has a keen interest in the overall health of regional watersheds, and appreciates the critical structural and functional roles of riparian areas and their contribution to the integrity of the greater ecosystem. Paul been a memberof the ARC since its inception. He is eager to assume his new duties, so please give him a call (602) 965-2977, email at fish.dr@asu.edu, or drop him a note at Department of Biology, Arizona State University, PO Box 871601, Tempe, AZ 85287-1601, provide your ideas, or offer a submission for the *Newsletter*.

ADOT Basin Project Progresses

Douglas Brown, Arizona Department of Transportation
Joelle Don de'Ville, St. Mary's High School

About a year ago, Douglas Brown of the Arizona Department of Transportation (ADOT) contacted the Arizona Riparian Council looking for support for his retention basin project. His idea was to create wetlands utilizing right-of-way runoff, instead of the decomposed granite and eucalyptus tree mudholes that currently are being built. Doug found that wetlands could be constructed for a fraction of the cost now invested in landscaping and maintenance of the existing basins. His proposal has been met with doubters concerned with mosquitos, refuse, and other public health and safety issues. Doug's response has been to initiate an Adopt-A-Basin scheme which would trade equipment and technical support to interested community groups, ecology organizations, or students, for a commitment to an annual basin cleanup.

Thanks to Cindy Zisner, for coordinating a meeting between Doug and Joelle Don de'Ville, the ADOT Hardy Road retention basin, Tempe, has been adopted by six students in Joelle's freshman biology class at St. Mary's High School in Phoenix. This basin is unique in that it has perennial water and supports a stand of willow, cottonwood, and cattail. It also sustains a variety of waterfowl, wading birds, minnows, and amphibians. A partnership in the management and upkeep of this unique basin has been agreed to by Doug and Joelle to provide the students with an outdoor laboratory to develop and test hypotheses pertaining to various aspects of wetland ecology. The students are conducting experiments with vegetation, water quality, fish, and litter accumulation. Doug provides the students with necessary supplies and technical support. In return, Joelle has committed the students to a spring cleanup of the retention basin. This program is the first of what Doug hopes will be many as he tries to persuade ADOT to change its design of retention basins.

The freshman honors, integrated science class of St. Mary's High School is required to design and conduct an experiment that is to be presented at the Central Arizona Regional Science and Engineering Fair held at Arizona State University. Several students had the opportunity to conduct their research at the ADOT retention basin. These projects are the results of professionals who invested their time to educate youth about local natural resources. Such projects also allow students to develop social, cooperative, and organizational skills. Students had the opportunity to learn how to think analytically, while implementing appropriate scientific procedures. Students also were introduced into the unique problems associated with doing field research, e.g., being rained out or having their data lost due to the flooding of the retention basin. The benefits of such projects go beyond fulfilling classroom requirements. These students have been able to build positive attitudes and develop values that will influence the

decisions that their generation will make regarding the environment.

The following are abstracts and comments written by the high school students who participated in the projects.

Paige Finley and **Jovanna Ortega**. The question that our hypothesis orginated from is, "Do plants purify water?" Our hypothesis stated that we believe that if a stream runs through plants, the water will be less polluted at the end after running through the plants, as opposed to before it touched the plants at all. To conduct our experiment, we collected water samples from a retention basin. The first samples were taken before the water touched any plants, the second were in the middle of the stream surrounded by plants, and the third were at the end of the stream after running through willow trees, cottonwood trees, cattails, desert broom, sage, red sprangle top grass, Bermuda grass, Johnson grass, *Polygonum*, *Rumex*, and various types of thistles. After collecting these samples we ran tests on them.

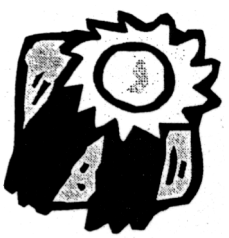
During our visits to the retention basin we learned a valuable lesson about science. We learned that when working in nature, you don't always know what is going to happen, and things you have no control over can affect your experiment and variables. We visited the retention basin three times. At our first visit to the retention basin there was a definite channel of water that ran through the basin. We were able to go down and walk around almost anywhere except the middle of the channel, which was too deep. On our second and third visit the basin was filled with water entirely, forming a lake. There were ducks swimming in the water and frogs around it.

We did not know where all the extra water came from. It had rained two or three times since the first visit, but there was also another source. There was a slight current in the water which meant that there was still more water coming in. We concluded that groundwater must be leaking in from a city well.

The test results showed a minimal amount of change in the different samples. Our observations showed a major change. The water had a strong odor, it was filmy, cloudly, and filled with garbarge. After the water traveled through the plants it no longer had an odor, it was not filmy or cloudy, and there was no garbage. We feel that our hypothesis was supported by our experimental results.

Using the ADOT-owned basin was a great opportunity. We had a chance to study science in a natural environment. Working at a place like the retention basin also gives us a chance to conduct further studies for years to come.

While conducting our experiment, we decided that nonlandscaped retention basins, like the one we worked in, are far better for the environment and for civilization in our city than the landscaped retention basin.



Our merits and hard efforts were rewarded at the 1998 Central Arizona Regional Science and Engineering Fair where we received a Certificate of Achievement from the Arizona Department of Agriculture. We are very grateful for the aid and guidance of Doug Brown, the Arizona Department of Transportation, and the Arizona Riparian Council for donating their time, energy, and materials.

Daniel Mendoza and **Gabe Monlaison**. *Is It Recyclable?* We really enjoyed going to the ADOT retention basin and learning about the preservation of land.

The reason we went to the retention basin was to help clean it up, and to figure out exactly how much of what Americans throw away is recyclable. After cleaning out the retention basin, we figured that 66% of what American throw away is recyclable. I hope that we can go again to further gather data and help cleanup and preserve our wildlife communities.

Kristin Wingate and **Peter Carpenter**. *Plant Diversity—How Does It Affect the Environment?* We had a very interesting experience at the natural retention basin in Tempe. My classmates and I learned a lot about the environment and how people have contributed to the conservation of wildlife in the most natural way possible. We are grateful to Doug Brown from the Arizona Department of Transportation and Cindy Zisner of the Arizona Riparian Council who made it possible for us to work at the basin.

The purpose of our experiment was to compare the biodiversity between a natural and a maintained retention basin. The natural retention basin provided a greater diversity of plant life at a ratio of 12:1 compared to a maintained retention basin.

We concluded that the natural basin is more beneficial to the environment because it provides a better habitat for wildlife at a fraction of the cost than it takes to support a maintained basin.

Thanks again for this wonderful opportunity. We are looking forward to working there again.



SPECIES PROFILE



HUACHUCA WATER UMBEL

Tricia Roller, U.S. Fish and Wildlife Service, Tucson

To the untrained eye, the Huachuca water umbel is difficult to spot. However, it is easy to develop a search image for the plant by looking for its slender, slightly curved, bright green leaves, as compared to the darker green and uncurved leaves of various spikerushes. Its small, onion-like leaves stick up from the water surface along banks and other shallow areas.

Besides adding to the overall biodiversity of the community, the Huachuca water umbel is an important indicator of a stable gradient riparian area or cienega habitat and a wetland ecosystem that remains functional. In addition to protecting the plant to preserve biodiversity within our cienega and riparian systems, it is important to protect this small plant because of the importance of the rapidly disappearing habitats in which it occurs.

The Huachuca water umbel was listed as an endangered species on January 6, 1997. Critical habitat was not designated. The umbel is an herbaceous, semiaquatic perennial plant with slender, erect leaves that grow from creeping rhizomes. The leaves are cylindrical, hollow with no pith, and have septa (thin partitions) at regular intervals. The yellow/green or bright green leaves are generally 0.04-0.12 inches (0.1-0.3 cm) in diameter and often 1 to 2 inches (2.5-5 cm) tall, but can reach up to 8 inches (20 cm) tall under favorable conditions. Three to 10 very small flowers are borne on an umbel that is always shorter than the leaves. The fruits are globose, 0.06-0.08 inches (0.15-0.20 cm) in diameter, and usually slightly longer than wide (Affolter 1985). The species reproduces sexually through flowering and asexually from rhizomes, the latter probably being the primary reproductive mode. An additional dispersal opportunity occurs as a result of the dislodging of clumps of plants, which then may re-root in a different site along aquatic systems.

Huachuca water umbel was first described by A.W. Hill based on the type specimen collected near Tucson in 1881 (Hill 1926). Hill applied the name *Lilaeopsis recurva* to the specimen, and the name prevailed until Affolter (1985) revised the genus. Affolter applied the name *L. schaffneriana* ssp. *recurva* to plants found west of the Continental Divide.

Huachuca water umbel has been documented from 23 sites in Santa Cruz, Cochise, and Pima Counties, Arizona, and in adjacent Sonora, Mexico, west of the Continental Divide (Warren et al. 1989, Saucedo 1990, Warren and Reichenbacher 1991, Warren et al. 1991, U.S. Fish and Wildlife Service files). The plant has been extirpated from 6 of the 23 sites. The 17 extant sites occur in four major watersheds - San Pedro River, Santa Cruz River, Rio Yaqui, and Rio Sonora. All sites are between 3,500-6,500 ft (1,067-1,981 m) elevation.

Huachuca water umbel has an opportunistic strategy that ensures its survival in healthy riverine systems, cienegas, and springs. In upper watersheds that generally do not experience scouring floods, the umbel occurs in microsites where interspecific plant competition is low. At these sites, the umbel occurs on wetted soils interspersed with other plants at low density, along the periphery of the wetted channel, or in small openings in the understory. The upper Santa Cruz River and associated springs in the San Rafael Valley, where a population of Huachuca water umbel occurs, is an example of a site that meets these conditions. The types of microsites required by the umbel were generally lost from the main stems of the San Pedro and Santa Cruz Rivers when channel entrenchment occurred in the late 1800s. Habitat on the upper San Pedro River is recovering, and Huachuca water umbel has recently been found along short reaches of the main channel.

The umbel was found in Empire Gulch in the Empire Cienega allotment in 1996 by Peter Warren. Only a very small patch of Huachuca water umbel was found. During a second visit to the site, Dr. Warren was unable to locate the umbel (P. Warren, pers. comm. 1997). However, potential habitat is widespread along Cienega Creek and Dr. Warren believes (pers. comm. 1997) habitat conditions are improving for the umbel with recent improvements in grazing management. Cattle lightly graze the area where the water umbel occurs in Empire Gulch (Warren, pers. comm. 1997).

In stream and river habitats, Huachuca water umbel can occur

in backwaters, side channels, and nearby springs. After a flood, it can rapidly expand its population and occupy disturbed habitat until interspecific competition exceeds its tolerance. This response was recorded at Sonoita Creek in August 1988, when a scouring flood removed about 95%of the Huachuca water umbel population (Gori et al. 1990). One year later, the umbel had recolonized the stream and again was codominant with watercress, *Rorippa nasturtium-aquaticum* (Warren et al. 1991). The expansion and contraction of Huachuca water umbel populations appears to depend on the presence of "refugia" where the species can escape the effects of scouring floods, a watershed that has an unaltered hydrograph, and a healthy riparian community that stabilizes the channel.

Density of umbel plants and size of populations fluctuate in response to both flood cycles and site characteristics. Some sites, such as Black Draw on the San Bernardino National Wildlife Refuge and Sonora, Mexico, have a few sparsely distributed clones, possibly due to the dense shade of the even-aged overstory of trees, dense nonnative herbaceous layer beneath the canopy, and deeply entrenched channel. The Sonoita Creek population occupies 14.5% of a 5,385 ft^2 (500 m^2) patch of habitat (Gori et al. 1990). Some populations are as small as 11-22 ft^2 (1-2 m^2). The Scotia Canyon population by the Huachuca Mountains, by contrast, has dense mats of leaves. Scotia Canyon contains one of the larger Huachuca water umbel populations, occupying about 57% of the 4,756 ft (1,450 m) perennial reach (Gori et al. 1990; Jim Abbott, Coronado National Forest, Tucson, in litt. 1994).

While the extent of occupied habitat can be estimated, the number of individuals in each population is difficult to determine because of the intermeshing nature of the creeping rhizomes and the predominantly asexual mode of reproduction. A "population" of Huachuca water umbel may be composed of one or many genetically distinct individuals.

Overgrazing, mining, hay harvesting, timber harvest, fire suppression, and other activities in the nineteenth century led to widespread erosion and channel entrenchment in southeastern Arizona streams and cienegas when above-average precipitation and flooding occurred in the late 1800s (Bryan 1925, Hastings and Turner 1965, Martin 1975, Dobyns 1981, Hendrickson and Minckley 1984, Sheridan 1986, Bahre 1991, Webb and Betancourt 1992). These events contributed to long-term or permanent degradation and loss of cienega and riparian habitat throughout southern Arizona and northern Mexico. Much habitat of the Huachuca water umbel and other cienega-dependent species presumably was lost at that time.

Wetland degradation and loss continue today. Human activities such as groundwater overdrafts, surface water diversions, impoundments, channelization, improper livestock grazing, chaining, agriculture, mining, sand and gravel operations, road building, nonnative species introductions, urbanization, wood cutting, and recreation all contribute to riparian and cienega habitat loss and degradation in southern Arizona. The local and regional effects of these activities are expected to increase with the increasing human population.

Dredging extirpated the Huachuca water umbel from House Pond, near the extant population in Black Draw (Warren et al. 1991). The umbel population at Zinn Pond in St. David near the San Pedro River was probably lost when the pond was dredged and deepened. This population was last documented in 1953 (Warren et al. 1991).

Livestock grazing can affect the umbel through trampling and changes in stream hydrology and loss of stream bank stability. However, existence of the umbel appears to be compatible with well-managed livestock grazing (USDI 1997). In overgrazed areas, stream headcutting can threaten cienegas where the umbel occurs. Such headcutting occurs at Black Draw just south of the international boundary and at Los Fresnos, in the San Rafael Valley, Sonora. Groundwater pumping has eliminated habitat in the Santa Cruz River north of Tubac, and threatens habitat in the San Pedro River. Severe recreational impacts in

Drawing from *Handbook of Arizona's Endangered, Threatened, and Candidate Plants: Summer 1992* (Rutman 1992. U.S. Fish and Wildlife Service, Phoenix.).

unmanaged areas can compact soils, destabilize stream banks, and decrease riparian plant density, including densities of the Huachuca water umbel. Populations in Bear Canyon in the Huachuca Mountains have been impacted by trampling and off-highway vehicles.

A suite of nonnative plant species has invaded wetland habitats occupied by the Huachuca water umbel. In some cases their effect on the umbel is unclear. However, in certain microsites, the nonnative Bermuda grass, *Cynodon dactylon*, may directly compete with the umbel. Bermuda grass forms a thick sod in which many native plants are unable to establish. Watercress is another nonnative plant now abundant along perennial streams in Arizona. It is successful in disturbed areas and can form dense monocultures that can outcompete Huachuca water umbel populations.

Limited numbers of populations and the small size of populations makes the Huachuca water umbel vulnerable to extinction as a result of stochastic events that often are exacerbated by habitat disturbance. For instance, the restriction of this taxon to a relatively small area in southeastern Arizona and adjacent Sonora increases the chance that a single environmental catastrophe, such as a severe tropical storm or drought, could eliminate populations or cause extinction. Populations in most cases are isolated, as well, which makes the chance of natural recolonization after extirpation less likely. Small populations are also subject to demographic and genetic stochasticity, which increases the probability of population extirpation (Shafer 1990).

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RIPARIAN LEGISLATION IN REVIEW: MEANDERING THROUGH THE RIPARIAN-RELATED LEGISLATIVE ACTION OF THE 1998 SESSION

The second regular session of the 43rd Arizona Legislature opened on January 12, 1998. As of this writing the session is entering the 100th day, the preferred date of *sine die* (the session is close). But, according to a radio news interview with Sen. Jack Brown, D-Dist. 4, the end is at least three to four weeks off. We know all too well that a good part of those 100 days has been taken up with school finance. What is less apparent from the mainstream media is that a great deal of other business is also being addressed (and it has nothing whatsoever to do with allegations of ethical violations.)

Air quality has captured Arizona lawmakers attention in a way that EPA would like to see us capture our emissions. Although a major topic, air issues are not the only environmental matters on the table. Of the 69 pieces of environmentally related business, nine have at least some tangential connection to riparian habitat, although in general, riparian areas were not the focus, if they were considered at all in drafting these bills. Some of these bills will never see the light of day. Nevertheless, it is instructive to know what is or was out there. After all, legislation usually gets drafted because someone, somewhere, sees a problem that needs to be solved.

Bills originate in one of the two chambers. Of the nine riparian-related bills, five started out in the House and three in the Senate. One is a proposed constitutional amendment and two are memorials—vehicles by which messages are officially delivered from the chamber usually to another government office or official, such as the President of the United States or Congress.

House Concurrent Resolution (HCR) 2019 would have put a constitutional amendment to the voters. The amendment, entitled *Natural Resources Protection*, enumerates the rights of every person to clean and healthful air and water and protection of the natural resources. Infringement of any of those rights is prohibited according to the amendment. This bill, sponsored by three Democrats, was assigned to the Environment, Natural Resources and Agriculture and GRSR committees but saw no action in any of these committees. Obviously, the broad, sweeping language of the bill was fodder for a great deal of controversy. But that discussion will not take place this session.

Each of the Houses passed a Memorial. In the House, HM2003 *American Heritage River Designation*, urged President Clinton and the White House Council on Environmental Quality to abstain from including any of Arizona's rivers, watersheds or river segments in the Initiative launched last year. Of the 126 rivers across the country that have been nominated, the Santa Cruz River is Arizona's only contender for one of 10 spots in the program. Representative Jean McGrath, R-Dist. 17, said that the issue is one of local control. "We couldn't think of what benefits the program offered. We don't need the federal government's control of our waters or watershed, we think we do a good job of that locally," she said. At a meeting last summer Katy McGinity, of the White House Council on Environmental Quality, indicated that a state could simply opt out. The Memorial passed the House and was transmitted to the Secretary of State on April 9, 1998 for conducting Arizona's wish to opt out to the White House. (SIDE NOTE: Among the 10 council members appointed by the President to consider the nominations is William Graf, a Geography Professor with Arizona State University's Department of Geography.)

The Senate contribution in this category is a concurrent memorial, which means that the House is asked to join this message to President Clinton and the United States Congress. SCM 1006; *State's Environmental Standards*, is intended to "remedy the intrusion of [NAFTA's] International Commission for Environmental Cooperation (CEC) into the affairs of the San Pedro Watershed" by urging the refusal of any international treaty ratification or other action that would intrude on the local authority to adopt environmental standards. This bill has passed and been sent to the Secretary of State to forward to the President. As you may recall, the Southwest Center for Biological Diversity recently requested that the CEC report on the environmental impact of grazing, mining and

groundwater pumping on the San Pedro watershed and its wildlife. The Senate passed the bill on a vote of 19 to 9 with 2 abstentions and transmitted it to the House for action on April 14, 1998 where it is assigned to the Natural Resources and Agriculture committee and is awaiting action.

Other House bills of note include a new Aquifer Protection Permit (APP) provision and funding for a flood control project. House Bill 2328 expands the APP's to include "municipal underground water storage facilities with a treatment operation (wetland)." It also allows consideration of site specific conditions for determining best available demonstrated control technology where the facility works via seepage through the bottom. The wetland is still subject to ADEQ performance standards. This is the only instance of allowing site characteristics as a technological consideration for control technology. The bill passed out of both chambers and has been signed by the Governor. House Bill 2660 appropriates $300,000 in FY 1999 to the Department of Emergency and Military Affairs for the state match on the U.S. Army Corps of Engineers Mule Gulch floodway channel near Bisbee in Cochise County. It was transmitted to the Senate for action on April 16, 1998.

A recurring topic of the last couple of sessions is state certification that federal water quality permits will comply with the state's water quality standards. After last year's additions to the statute limiting both the timeframes for the application process and the conditions that ADEQ could place on certification of certain U.S. Army Corps of Engineers dredge and fill permits issued under section 404 of the federal Clean Water Act (CWA), the issue returned to the Senate in SB 1299. As amended in the Natural Resources, Agriculture and Environment Committee, the bill would effectively certify certain CWA section 402 and 404 permits.

This legislation has prompted several environmental groups to call for the Governor to fire the ADEQ Director, Russell Rhoades. The Sierra Club, among others, said that the Director is too quick to acquiesce to the pressures from the business sector. They claim he has effectively given away the farm to the likes of special interests such as the Arizona Rock Products Association (ARPA), the prime mover of this legislation over the last several sessions.

In the bill, the Legislature finds that nonmetallic mineral activities performed within the ordinary high watermark of ephemeral waters are not a threat to surface water quality under specific conditions and certification, therefore, is automatic once ADEQ has received adequate information to make that determination. In the view of the environmentalists this equates to a license to destroy riverbeds. ARPA counters that their operations are environmentally benign.

Other permits that may be automatically certified include remediations pursuant to the UST, WQARF and other hazardous waste programs, and municipal storm water permits with best management practices that achieve maximum reduction of pollutants. The bill went to the House and awaits action on the consent calendar. The original Senate bill died but the provisions were added at the last minute to HB2231, which has passed.

Two other substantive bills have died in the committees, one in each house. House Bill 2514; Endangered Species Investigations; Federal Money would have prohibited the Game and Fish Commission from spending any money passed through from the federal government for the purpose of evaluating wildlife for possible endangered species classification and from compiling lists of species of special concern. Also dead in committee, Senate Bill 1177 purported to expand the definition of grazing lands from the limited ranging of animals uses to include use for conservation purposes. House Bill 2509 passed, which restricts livestock grazing as the only permissible use of grazing lands. These bills apparently respond to the grazing leases controversy that we reported on in the September 1997 issue of this newsletter.

Noteworthy Publications

Michelle M. Oleksyszyn, Department of Plant Biology, Arizona State University

Griffiths, R. P., J. A. Entry, E. R. Ingham, and W. H. Emmingham. 1997. Chemistry and microbial activity of forest and pasture riparian-zone soils along three Pacific Northwest streams. *Plant and Soil* 190:169-178.

This research was in response to current interest that proposes using riparian vegetation to help prevent agricultural runoff from entering the stream. Nitrate present in groundwater can be absorbed in the soil through microbial activity and plant uptake. In general, forests sustain higher levels of nutrients and are more efficient at removing nutrients from groundwater than pasture lands. These authors evaluated the effects of forest and pasture vegetation on soil chemistry and microbial activity. They examined three riparian areas located in Corvallis, OR. The species present in the forest vegetation were oak, rose, douglas fir, and hackberry while the pasture was composed of fescue, clover, and grass. They conducted sampling in January, May, August, and November to quantify seasonal influences. As expected, they found that forest riparian vegetation was more effective at retaining organic carbon, total nitrogen, mineralizable nitrogen, and acid-soluble phosphorus. In addition, both bacterial and fungal biomass was greater in forest soils. Seasonal fluctuation in nutrient levels and microbial activity were believed to be attributed to summer dry conditions.

Wipfli, M. S. 1997. Terrestrial invertebrates as salmonid prey and nitrogen sources in streams: contrasting old-growth and young-growth riparian forests in southeastern Alaska, U.S.A. *The Canadian Journal of Fisheries and Aquatic Sciences* 54:1259-1269.

Riparian areas regulate nutrient inputs into streams and litter from riparian vegetation influences the invertebrate population. At certain times of the year, terrestrial invertebrate input can be more important in salmonid diets than aquatic invertebrates. Six Alaskan streams were studied from April 1993 to October 1994. Three streams were associated with conifer canopies that were never harvested and the second three streams were composed of alder canopies 31 years post clearcutting. The author wanted to identify any potential differences in terrestrial invertebrate inputs between the two types of vegetation as well as the amount of nitrogen and biomass in salmonid diet that was correlated to terrestrial prey. Terrestrial invertebrates composed 30% of the stomach contents of the fish and 50% of the total biomass. Terrestrial input was increasingly important in the latter part of the season and at times of low aquatic invertebrate availability or salmonid stress. The young growth forests (alder) contributed more invertebrate diversity and greater overall inputs. The author stresses the importance of terrestrial invertebrates in salmonid diets and suggests that management decisions regarding riparian vegetation should also consider the associated effects of stream trophic relationships.

Yong, R., and C. S. Crawford. 1997. Ecology of two micro-lepidopteran leaf-rollers in an arid-land riparian forest. *The Southwestern Naturalist* 42(2):155-161.

Leaf-rolling and defoliating insects do not inflict significant damage upon their hosts, yet they contribute nutrients to the soil system and herbivores. These authors examined two species of lepidopteran leaf-rollers (*Archips argyrosphila* and *Anacampis innocuella*) and their distribution, feeding preferences, oviposition, and effects upon associated vegetation. Their study was conducted on a stretch of the middle Rio Grande in New Mexico. Forest vegetation consisted of cottonwood, two species of willow, Russian olive, saltcedar, and sweet clover. Three of the six plant species are non-native to the U.S. (Russian olive, saltcedar, and sweet clover). Both insect species consumed predominantly cottonwood, coyote willow, and saltcedar. Cottonwood was the species most densely populated, most frequently selected for ovipositioning, and most highly consumed. It was concluded that *Archips* may be host-specific to cottonwood, while *Anacampis* may instead have an affinity to the distinctive chemistry of the family Salicaceae—which contains both cottonwood and willow. There is probably little interaction between the two species other than competition for available sites. The authors also state that lepidopteran predation may have an effect on fruit development of cottonwood which may further diminish the already threatened population of cottonwood on this river. They note that similar research on other sites of the river needs to be conducted to determine the true effects the leaf-rollers will have on the riparian area.

The Arizona Riparian Council (ARC) was formed in 1986 as a result of the increasing concern over the alarming rate of loss of Arizona's riparian areas. It is estimated that $<10\%$ of Arizona's original riparian acreage remains in its natural form. These habitats are considered Arizona's most rare natural communities.

The purpose of the Council is to provide for the exchange of information on the status protection, and management of riparian systems in Arizona. The term "riparian" is intended to include vegetation, habitats, or ecosystems that are associated with bodies of water (streams or lakes) or are dependent on the existence of perennial or ephemeral surface or subsurface water drainage. Any person or organization interested in the management, protection, or scientific study of riparian systems, or some related phase of riparian conservation is eligible for membership. Annual dues (January-December) are $15. Additional contributions are gratefully accepted.

This newsletter is published three times a year to communicate current events, issues, problems, and progress involving riparian systems, to inform members about Council business, and to provide a forum for you to express your views or news about riparian topics. The next issue will be mailed in September, the deadline for submittal of articles August 15, 1998. Please call or write with suggestions, publications for review, announcements, articles, and/ or illustrations.

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CALENDAR

Restoring Natural Function Within a Modified Riverine Environment: The Lower Colorado River, July 8-9, 1998. Majorie Barrick Museum of Natural History Auditorium, University of Nevada at Las Vegas. For more information, contact Peter Jenkins, Symposium/Workshop Organizer, Ecological Services Division, U.S. Fish and Wildlife Service, PO Box 1306, Albuquerque, NM 87103-1306; telephone (505) 248-6660; fax (505) 248-6922; email: peter_jenkins@fws.gov.

Arizona Partners In Flight, July 9, 1998. Arizona Game and Fish Department, Roadrunner Room, Phoenix. Planning meeting focusing on freshwater marshes. Contact Magie J. Latta, Arizona Partners In Flight Co-Chair for more information, at (602) 789-3575.

Peaks to Prairies: A Conference on Watershed Stewardship, September 27-30, 1998. Holiday Inn, Rushmore Plaza, Rapid City, South Dakota. For more information contact, Thorne Ecological Instituite, 5398 Manhattan Circle, Suite 120, Boulder CO 80303; telephone (303) 499-3647; fax (303) 499-8340; email: dir@thornecoinst.org.

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