



## PROTECTING RIPARIAN HABITATS

### THE BIG PICTURE

The term “riparian,” derived from the Latin word “ripa,” or riverbank, refers to the land on either side of any body of water. The “green strips” of vegetation that follow the paths of rivers and streams are perhaps the best examples of what scientists, land managers, and foresters call riparian habitats.

They are environmentally important because they link water ecosystems to adjoining forests and grasslands; they facilitate the movement of nutrients, yet at the same time slow the transfer of materials such as sediment between water and the land; they are the principle source of the woody debris that helps stabilize stream channels; and they provide protective habitats for aquatic invertebrates and fish.

Because of the intimate relationship between water and land, riparian habitats are also sensitive indicators of natural and man-made disturbances, allowing the Forest Service to use them as indicators of entire watershed conditions.

Following are a few of the many examples of riparian research underway throughout the Rocky Mountain Research Station’s

(RMRS) territory. Findings are helping assure that managers and planners have the best science available for long-term sustainability of these critical ecosystems. More detailed examples are available on the RMRS website at <http://www.fs.fed.us/rmrs/docs//riparian->

climate change patterns and the spectrum of biological and physical factors that influence stream processes and, over the long-term, determine stream and riparian ecosystem sustainability. Studies show that during the early to mid-Holocene (11,500 to 5,500 years ago) the total number of plant



*Riparian habitats link water ecosystems to adjoining forests and grasslands. (By permission: Janet Yagoda Shagam, Rhizotech)*

### **Climate Change, Riparian Sustainability, and the Great Basin Ecosystem Management Project**

The Great Basin Ecosystem Management Project for Restoring and Maintaining Sustainable Riparian Ecosystems, initiated in 1993 and managed by the RMRS, is revealing the complex relationship between long-term

species found in woodrat middens (nests) remained constant. Later, the cool and wet climate associated with the Neoglacial period (4,500 to 2,500 years ago) caused a reduction in arid plants and, in mid-to-low elevations, an increase in trees. A severe drought (2,500 to 1,300 years ago) decreased the number of plant species by more than 50 percent, caused a regional decline in woodland trees

and, not unexpectedly, increased the predominance of desert shrub vegetation. A look at the effects of comparatively recent climate change events on plant diversity reveals similar patterns. The most recent period, the past 150 years, shows the plant diversity changes expected with trends toward an increasingly dry climate and the impacts of European settlers on the region.

Correlating the climate-driven changes in Great Basin riparian plant communities to climate-related watershed geomorphic changes provides clues that help understand the processes that drive long-term riparian sustainability. The variability in watershed responses to disturbance and the magnitude of the resulting riparian habitat changes indicate the need to base riparian management and restoration practices on an understanding of current biological and physical processes rather than historical conditions.

The practical outcome of this work is a broadly-applicable assessment tool that will help environmental professionals design site-specific and lasting, rather than stop-gap, riparian management and restoration strategies.

### **For Further Reading:**

- Great Basin Riparian Ecosystems: Ecology, Management and Restoration. 2004. Edited by Chambers, J.C., and J.A. Miller. Island Press, Washington, D.C.
- Chambers, J.C. 2000. "Great Basin Research and Management Project: Restoring and Maintaining Riparian Ecosystem Integrity." USDA Forest Service Proceeding, RMRS-P-17.

## **Research at Bosque del Apache**

Since 2000, Station scientists have examined the effects of reducing exotic plants such as saltcedar, tamarisk and Russian olive on bird species diversity and their abundance in the middle Rio Grande Valley (NM). Studies show that increases in the amount of combustible wood associated with these exotics has increased risk for riparian fires along the bosque (riverbank forests).

Investigations are underway at locations ranging from urban to rural. Each area contains a control site where the bosque receives no treatment and invasive species continue to grow, a controlled burn site, a mulched site, and a fourth site replanted with native vegetation.

Researchers found that fewer mid-story nesting bird species – those that use shrubs for nesting – such as Spotted Towhees and Blue Grosbeaks – remained in the cleared areas. In contrast, clearing did not affect canopy nesters such as Summer Tanagers, Western Wood

Pewees, and Cooper's Hawks. A preliminary conclusion of their study is that exotic shrub removal may reduce the risk, severity, and frequency of wildfires in the bosque and thus improve the chances for successful regeneration of cottonwoods and willows. Researchers say that once they complete the study, they will be able to recommend how best to clear invasive plants and have the least negative effect on wildlife.

In related work, biologists expect that four out of six lizard species will become more abundant or present in the cleared areas. Open habitat is generally available in riparian areas not overrun by non-natives and it may simply be that the lizards studied prefer habitats with areas open to some sunlight. Biologists can use lizards as indicators of changes in their riparian habitats. By understanding how restoration activities affect wildlife, land managers can balance management objectives, like removing non-native plants, with other considerations, such as providing important wildlife habitat.



*Firefighters battle a fire in the bosque near Albuquerque.*

Scientists are also investigating mortality rates and seed production of cottonwoods and saltcedar to determine the effects of wildfire on their populations in the bosque. Their research indicated that saltcedar is better adapted to survive wildfire than cottonwood. Ultimately, wildfire could promote the spread of the non-native saltcedar in the bosque while reducing the cover of the native cottonwood. Managers can use these results to understand site differences in saltcedar and cottonwood responses after wildfire, the rapidity of saltcedar succession, and the need, at some burn sites, to take action promptly to prevent saltcedar from returning or invading the site after fire. This information will also help understand the need to proactively restore sites through fuel reduction to prevent fires from occurring in the first place.

### **Early Warning Detection for Western Rivers**

In 2005, congressional action created two environmental threat assessment centers (ETACs) – the Western Wildland Environmental Threat Assessment Center (WWETAC) in Prineville, Oregon (Pacific Northwest Research Station), and the Eastern Forest Environmental Threat Assessment Center (EFETAC) located in Asheville, North Carolina (Southern Research Station). ETACs provide researchers, policymakers, and the public with tools to support well-founded land protection, remediation, and restoration decisions.

The Rocky Mountain Research Station is taking an active role in developing the riparian portion of the Western Wildland Threats Assessment Program. Scientists and collaborators are constructing an interactive riparian threats assessment map, and assembling an extensive annotated bibliography. Using a variety of geospatial resources, researchers are compiling and mapping a spectrum of landcover features that includes satellite views of roads, dams, and other man-made objects, and landscape features, such as mountains and valley floors, that might affect riparian zones adjacent to and influenced by streams and rivers. The end product will be an interactive map of the western United States where users can discover the spectrum of local and distant threats affecting a particular riparian area. They can then use the annotated bibliography to learn about specific riparian problems. A draft version is already available on the RMRS website at <http://www.rmrs.nau.edu/awa/riphreatbib/>. Here, site visitors can view over 400 references, alphabetized by author, and an accompanying abstract.

You can find preliminary information about the Western Riparian Threats Assessment at <http://www.nrel.colostate.edu/~davet/wrta.html>.

### **For Further Reading:**

- Obedzinski, R.A., C.G. Shaw, and D.G. Neary. 2001. "Declining Woody Vegetation in Riparian Ecosystems of the Western United States." *Western Journal of Applied Forestry*, Vol. 16 (4), pp. 169-181.

- Poff, N.L., J.D. Oldem, D.M. Merritt, and D.M. Pepin. April, 3, 2007. "Homogenization of Regional River Dynamics by Dams and Global Biodiversity Implications." *Proceedings of the National Academy of Science*, Vol. 104 (14) pp. 5732-5737.
- Theobald, D.M. 2007. *GIS Concepts and ArcGIS Methods (v9.2)*. Conservation Planning Technologies, <http://www.consplan.com>.

### **Watershed Restoration and Post-fire Regrowth**

When the western portion of the Little Granite Creek watershed in western Wyoming burned in 2000, the fire provided an opportunity to study stream and riparian post-fire recovery processes. Although fire is an important natural disturbance in many ecosystems, scientists have a limited understanding of the behavior properties and history of fire in many riparian areas of the western United States, including how riparian vegetation responds to a burn.

Along riparian transects, researchers tallied every shrub and measured their height and width. They found good regrowth on some of the shrubs. While general knowledge is that riparian vegetation comes back strong after fire, researchers don't know the rates of recovery or the responses of individual species.

Following the 2000 burn, most shrubs re-sprouted within one to three years and grew quickly, partly because they received plenty of sunlight. However, shrubs in the most severely burned portions of the watershed were either killed or did not resprout for another four to five years. Research results

show that severe fire, which burns hot enough to kill root crowns and other subsurface regenerative tissue, can hinder or delay the regrowth of woody vegetation. Findings also indicate that grazing on grasses and browsing on shrubs and trees by native ungulates (hoofed animals such as elk) and livestock impacts the recovery of post-fire riparian vegetation. To promote the recovery of streams and riparian areas following wildfire, scientists suggest managers consider excluding livestock from recently burned areas until riparian shrub species have reached a target height or volume. Knowledge of post-fire recovery rates for key riparian shrubs also helps managers decide where to focus restoration and rehabilitation efforts along streams.

## **Cicadas and the Middle Rio Grande Bosque: Timing is Everything**

The cicada's (*Tibicen dealbatus*) music is a good reminder of the fundamental role these insects play in shaping the ecological character of the Rio Grande (NM) riparian habitat. The middle Rio Grande region extends approximately 50 miles north and 50 miles south of Albuquerque. For the past 80 years, there have been ongoing efforts to reduce the flooding that results from spring snowmelts and summer rains in this developed and urbanized stretch of the river. While an improvement for the people who live or farm near the Rio Grande, the loss of cyclic flooding has profound consequences for a riparian ecosystem long adapted to a regime of seasonal flooding.



*Cicadas play an important role in shaping the Rio Grande riparian habitats. (By permission: Max Smith, Oklahoma Biological Survey, University of Oklahoma)*

Reductions in water flow and soil saturation have killed many mature cottonwoods, reduced cottonwood reseeded, and produced ecological changes that encourage the growth of drought- and fire-tolerant invasive plant species.

Scientists and their collaborators are studying the long-term effects of wildfires on riparian habitats by looking at the relationship between riparian wildfires, cottonwood tree density, and the mid-summer emergence of cicadas.

Each year, nymphs, after living three to five years underground, emerge from the soil, transform into winged adults, reproduce, and die a few weeks later. This emergence transports water and nitrogen to aboveground communities and supplies food to secondary consumers such as breeding birds. Research indicates that some riparian birds select

their breeding sites based on characteristics associated with large numbers of cicadas.

Studies correlate the emergence of cicadas in burned and unburned areas to such factors as soil temperature and vegetation. Expecting that fire might “cook” underground cicada nymphs, researchers were surprised to find that cicadas did emerge from burned sites - earlier in the summer than those living in unburned plots.

This few weeks' difference in timing means that nymph emergence no longer coincides with the nesting of Yellow-billed Cuckoos and other riparian birds. Researchers speculate that this change in emergence timing, by affecting the availability of food, may ultimately affect the success of riparian nesting birds.

These results translate into recommendations for successful bosque land management. In the most general sense, preventing wildfires helps preserve the native riparian habitat and thereby ensures that cicadas emerge at times and densities that benefit the birds and other animals that eat them. When wildfires do occur, scientists say it is essential to restore the cottonwood canopy lost to fire by encouraging the growth of cottonwood resprouts.

### For Further Reading:

- Albuquerque Bosque Restoration Projects: <http://www.bosquerevive.com/>
- Middle Rio Grande Bosque Initiative: <http://www.fws.gov/southwest/mrgbi/>
- Middle Rio Grande Conservancy District: <http://www.mrgcd.com>
- Smith, D.M., J.F. Kelly, and D.M. Finch. 2006. "Cicada Emergence in Southwestern Riparian Forest: Influences of Wildfire and Vegetation Composition." *Ecological Applications*, Vol. 16(4), pp. 1608-1618.

### Invasive Plants vs. Research

In riparian habitats, exotic plants reduce the diversity of plant and animal communities, consume large amounts of water, contribute to increasing soil salinity, and produce the fuel that, in combination with the effects of climate change, helps increase fire frequency and intensity. These changes also reduce the economic value of riparian habitats by making them less attractive for recreational activities.

The Rocky Mountain Research Station is taking an active role in both preventing the spread of invasive plants to riparian habitats, and managing invasive plants in areas of established growth. Scientists and their cooperators are using GIS mapping to locate areas that contain invasives. This information helps determine how these plants spread, as well as identify locations that require remediation.

A lack of natural enemies is one of many factors that help invasive plants overrun new habitats. Researchers are investigating the ability of black and brown flea beetles – imported natural enemies – to control the spread of leafy spurge in the Great Northern Plains.

Salt cedar, prevalent throughout Rocky Mountain riparian habitats, is a notable problem along the Rio Grande (NM) where dams prevent seasonal flooding. These trees, in addition to consuming large amounts of water, increase soil salinity and fuel intense fires. Management practices include treating tree stumps with herbicides, aerial herbicide treatments, and bulldozing. However, managing the spread of salt cedar comes with an interesting complication – the endangered Southwestern Flycatcher, a riparian bird that now breeds in salt cedar dominated sites.

Many government agencies, including the Forest Service, are working on salt cedar management while also taking into consideration the Southwestern Willow Flycatcher. A recently published Forest Service proceedings describes a successful project involving monotypic salt cedar infestations along the Rio Grande in New Mexico. Using helicopters equipped with GPS units, the Socorro Soil and Water Conservation District made a quarter-mile buffer zone around Southwestern Willow Flycatcher nesting sites. This strategy enabled them to remove salt cedar from nearly 8,000 acres while also preserving Southwestern Willow Flycatcher nesting sites.



You can learn more about riparian-related studies at the Rocky Mountain Research Station in the *Rocky Mountain Riparian Digest*, located at <http://www.fs.fed.us/rmrs/docs/riparian-digest/riparian-digest.pdf>.

For more information about research programs at the Rocky Mountain Research Station, visit our website at <http://www.fs.fed.us/rmrs>.

If you would like to be added (or removed) from the *RMRScience* mailing list, contact us at the address on the back page, or e-mail: [rfletcher@fs.fed.us](mailto:rfletcher@fs.fed.us).



**RMRS**cience  
**USDA Forest Service**  
**Rocky Mountain Research Station**  
240 West Prospect Road  
Fort Collins, CO 80526 USA

**FIRST CLASS MAIL**

**Postage & Fees Paid**

**USDA-FS**

**Permit No. G-40**

OFFICIAL BUSINESS

Penalty for Private Use \$300

The USDA Forest Service's Rocky Mountain Research Station is one of seven units nationwide that make up the most extensive natural resource research organization in the world. Headquartered at the foot of the Rockies in Fort Collins, CO, the Station maintains 12 laboratories within a 14-state territory (see map). Scientists conduct studies nationwide, with emphasis on the Rocky Mountains, Great Basin, Great Plains, and Southwest. Research serves the Forest Service, as well as other federal and state agencies, international organizations, private groups and individuals. For more information, visit [www.fs.fed.us/rmrs](http://www.fs.fed.us/rmrs).



The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. Persons with disabilities who require alternative means for communication of program information should contact USDA's TARGET Center at 202-720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call 800-795-3272 (voice) or 202-720-6382 (TDD). USDA is an equal opportunity provider and employer.