QUICK GUIDE SERIES FM 2015-1

Cottonwood Management:

Ecology, Rehabilitation, Wildfire and Other Considerations

Colorado State Forest Service

Adapted to thrive on Colorado's Eastern Plains, in mountain valleys and along riparian areas throughout the state, cottonwoods represent the largest native broadleaf trees in the state, and the most pervasive deciduous trees found at lower elevations. Colorado cottonwoods can grow to more than 80 feet in height, flourishing in wetter soils near rivers, lakes, irrigation ditches and other lowland areas. Managing these natives can help ensure numerous benefits that include wildlife habitat, recreation, stream bank stabilization and stormwater uptake.

Figure 1. Cottonwoods near the South Platte River. *Photo: William M. Ciesla (WMC)*

Cottonwood Ecology

Groves of cottonwood trees, or bosques, are located in riparian zones – areas adjacent to rivers and streams – in Colorado and throughout the western United States. These ecosystems are usually a patchy mosaic of plains cottonwood trees (*Populus deltoides*), narrowleaf cottonwood trees (*Populus angustifolia*) and/or Rio Grande cottonwood trees (*Populus deltoides* ssp. *wislizenii*) that grow in conjunction with shrubs, such as willows, and various grasses and forbs. Narrowleaf cottonwoods grow at the highest elevations, between 5,000 and 8,000 feet, while plains cottonwoods grow from approximately 3,500 to 6,500 feet. Rio Grande cottonwoods grow on the West Slope of the Continental Divide between 4,000 and 6,000 feet.

In the riparian zones where cottonwoods are found, the vegetation is influenced by shallow groundwater and is different from the vegetation found in adjacent, more arid upland zones. Typical riparian zones are very diverse in species and many plants within them require a consistent supply of water to survive. These zones provide high-quality fish and wildlife habitat, offer shade to lower water and soil temperatures and have vegetation that absorbs flood waters and improves water quality by filtering out pollutants.

Modern watershed management has reduced occurrences of seasonal floods, while variables such as drought and changes in land use have left many riparian forest floors littered with large amounts of dead branches, logs and leaf layers. Historically, cottonwood groves present in floodplains relied on periodic flooding to wash away debris and promote tree regeneration. A lack of naturally occurring, regular flooding thus reduces cottonwood reproductive success.

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When dry, the accumulation of debris in these areas also can become hazardous fuel for wildfire, lacking flooding events that can bury flammable forest floor debris with sediment and make it less likely to carry fire.

Many cottonwoods located in riparian areas with altered stream flows are mature and/or in decline. Due to changing factors in these ecosystems, including drought, water management and extensive wildlife browsing or overgrazing by livestock, cottonwoods are not surviving in some areas where they historically thrived.

Benefits of Cottonwoods and Riparian Vegetation

Riparian ecosystems associated with cottonwood groves contain numerous smaller native shrub and tree species. These species vary depending on elevation, with higher-elevation species that include coyote willow, black willow, red osier dogwood, river birch, rocky mountain maple and thin leaf alder; and lower-elevation species that include boxelder, silver buffaloberry, hoptree, skunkbush sumac, woods' rose, fourwing saltbush and golden currant. Benefits of cottonwoods and other riparian trees/shrubs include:

- reducing erosion, with roots that hold soil in place;
- capturing and filtering sediment;
- providing wildlife habitat;
- slowing floodwater runoff; and
- increasing water infiltration.

Figure 2. A CSFS volunteer sawyer removes a Russian-olive in Barr Lake State Park. *Photo: CSFS*

Competition from Invasive Species

In the past, many tree species were introduced to the western United States. While most of these species were beneficial for erosion control and thrived under irrigation, a few escaped cultivation and became invasive. Trees are considered invasive if they are exotic or non-indigenous species that grow aggressively and replace native vegetation in environments in which they did not evolve. Invasive plants often have no natural enemies to limit their reproduction (e.g., insects that feed on them), and thus displace native vegetation and can cause environmental damage. In Colorado, the most prominent invasive tree species in riparian areas are Russian-olive and tamarisk.

Russian-olive, a medium-sized tree native to portions of Europe and Asia, was introduced into North America as a shelterbelt and windbreak tree during the late 1800s. Russian-olives have silvery-green foliage and tiny yellow flowers in spring, and produce olive-like fruit in late summer or early fall. This tree proved to be especially suitable for the harsh growing conditions of the Great Plains, and ultimately escaped cultivation. Russian-olive has invaded riparian areas, fields and open areas, where it competes with and displaces native vegetation, including cottonwoods. Due to extensive historical

planting and the dispersion of seed by birds, this invasive tree has become widely distributed across Colorado and other Western states, and is now on the noxious plant list for Colorado.

Tamarisk, or salt cedar, is a species of small- to medium-sized trees native to southern Europe, northern Africa and central Asia. Like Russian-olive, tamarisk was originally introduced to North America during the late 1800s as an ornamental tree and for use in shelterbelts, windbreaks and stream-bank stabilization. Tamarisk readily adapted to the semi-arid climate of the West, invaded riparian areas – especially in the Great Plains and Great Basin regions – and displaced native forests of cottonwood and willow. Tamarisk thickets alter the ecology and hydrology of riparian areas. These trees have a high evapotranspiration rate, creating excess water loss. Sites invaded by tamarisk can potentially dry out over time, resulting in reduced stream flows.

Figure 3. A riparian ecosystem infested with tamarisk. *Photo: Shelly Simmons, CSFS*

When considering any treatment for invasive tree or shrub species, including Russian-olive and tamarisk, choose an option that best meets individual management objectives. Options may include tree removal, use of chemical treatments and replanting native species. Chemical treatments such as herbicides can be effective if product directions are carefully followed, but they can be time-consuming and costly, may not be practical or effective for all situations, and may be of concern if used near bodies of water. It is essential to research the best possible treatments for a specific area before taking action, and assess the site's potential for native re-vegetation. If adequate stands of native vegetation already exist on a site, it may not be necessary to actively re-vegetate.

Figure 4. A healthy riparian ecosystem along Chacuaco Creek in southeast Colorado. *Photo: Shelly Simmons, CSFS*

Role of Wildfire in Riparian Zones

Historically, flooding was the major natural disturbance in riparian zones. With human-structured flood controls that allow for the build-up of vegetative fuels, wildland fire is becoming much more prevalent as another form of disturbance in these ecosystems, which evolved with very little fire influence.

Cottonwood trees are not a highly fire-resistant species. They can survive low-intensity wildfires, but moderate- to high-intensity fires have the potential to kill cottonwood trees. Yet in many cottonwood-dominated riparian ecosystems, wildfires have replaced periodic flooding as the main disturbance. Although after a wildland fire severely burned cottonwoods sprout new suckers from the root system that could become next-generation trees; these suckers often lack hardiness and do not survive. As a result, Colorado cottonwood stands are being replaced by ecosystems dominated by non-native, invasive shrubs.

The accumulation of branches and leaf litter in these invasive-dominated systems creates large amounts of hazardous fuels. Woody invasive plants, such as tamarisk and Russian-olive, reproduce prolifically from roots following fire, and thrive with repeated fires on the landscape. As excess fuels from shrubs in riparian areas increase, so do the frequency and intensity of riparian wildfires, creating a spiraling condition that is increasingly hostile to native cottonwoods. Woody invasive plants also add ladder fuels, or lower fuels beneath larger trees that allow fire to spread to the upper tree canopy, which increases the chance of a high-intensity fire.

Fuels Management Recommendations to Reduce Fire Risk in Cottonwood Groves

1. Create defensible space around structures, such as homes, bridges, diversion sloughs or designated recreation access areas. See the CSFS Quick Guide *Protecting Your Home from Wildfire: Creating Wildfire-Defensible Zones (FIRE 2012-1)*, available online at www.csfs.colostate.edu.
2. Do not stack branches or woody material under trees or large shrubs. This increases wildfire intensity near the trees, which can damage or kill them.
3. Remove invasive woody plants from underneath cottonwoods. These can be non-native plants, such as tamarisk or Russian-olive, or drier upland shrubs, such as juniper or fourwing saltbush, that have become invasive in the absence of regular flood conditions. (Note: Native cottonwood shrub communities should be preserved where the understory is New Mexico olive, buffaloberry or willow. These species are critical for wildlife.)
4. Remove ladder fuels by pruning off tree branches from ground level up to a height of 10 feet above ground, or up to one-third the height of the tree, whichever is less. Consult with a forester to determine the best pruning practices for different tree species.
5. Remove dead branches from shrubs annually and excess leaf litter buildup underneath trees as needed.
6. Move dead and downed woody debris in the cottonwood groves to beyond the farthest reaching branches of the trees, or to a minimum of 10 feet away from desirable trees.
7. Thin less-desirable trees to decrease competition and increase vigor of remaining trees in the stand. Groups or clumps of desirable trees may be left standing, but retain 30 feet of spacing between clumps and surrounding trees.
8. Leave enough young cottonwood growth for habitat and tree regeneration.
9. Create a mosaic of open areas, such as fuelbreaks interspersed with denser stands of trees, to simulate areas historically created by floods.

Figure 5. Defensible space around structures can help prevent a wildfire from traveling toward a structure. *Photo: CSFS*

Figure 6. Dead and down debris can offer fuel for a wildfire. *Photo: CSFS*

Figure 7. Dead branches can act as ladder fuels, which would help a wildfire travel into tree canopies. *Photo: CSFS*

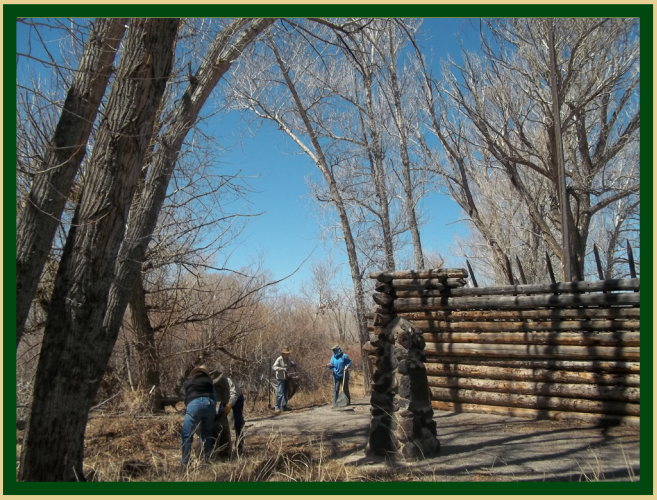

Figure 8. Volunteers removing hazardous cottonwood debris. *Photo: Adam Moore, CSFS*

Livestock Grazing Considerations

Overgrazing of livestock in a riparian area can negatively impact the survival and reproduction of vegetation. It also can have other negative effects, such as soil compaction, reduced water infiltration, and increased runoff and erosion. And livestock can introduce seeds of invasive species into riparian areas.

If livestock are present in a riparian area, consider a controlled grazing plan, which includes providing rested areas in order to allow adequate regeneration of tree seedlings. Also, offer an alternative drinking water system for the livestock. Fencing off areas of cottonwood regeneration will protect them from livestock and browsing wildlife.

Figure 9. The fenced area protects regeneration from browsing wildlife and livestock. *Photo: U.S. Fish and Wildlife Service*

Wildlife Management Considerations

Riparian zones provide critical habitat for wildlife because they offer food, water and shelter. This is especially true in the arid Southwest, where rivers and streams may be the only sources of water. To maintain critical riparian wildlife habitat, consider the following recommendations:

- Logs diverting the flow of water into the streambank and accelerating erosion should be removed. However, other downed logs on the riverbank and in the water should not be removed.
- Unless wildfire fuel loading is extreme, downed cottonwood and willow logs larger than 6 inches in diameter should not be removed. Keep these larger logs and relocate additional dead and down debris to a minimum of 10 feet from one another.
- Standing dead trees can provide homes for cavity-nesting birds and squirrels. Retain trees with existing cavities.
- When thinning trees, leave two to five stumps per acre. These provide posts for raptor feeding and lookouts for small rodents. For safety reasons, cut stumps should be between 12 and 30 inches in height.
- Check for listings of endangered species that live in riparian habitats. For example, the Southwestern willow flycatcher depends on riparian areas to forage, and is listed on the federal and state endangered species lists.

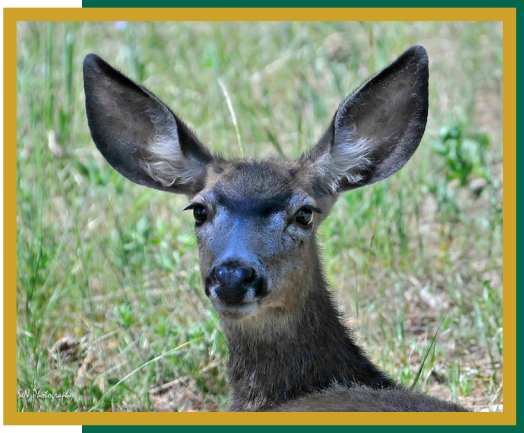

Figure 10. Wildlife is an important component to riparian ecosystem management. *Photo: CSFS*

Cottonwood Regeneration and Streambank Stabilization Recommendations

To restore a cottonwood grove to a healthy, more natural state, the CSFS recommends the following management actions:

- Leave a buffer strip of grass and shrubs along the river/stream for bank stabilization.
- Retain pockets of dense native vegetation, including cottonwoods and shrubs, for forest regeneration and wildlife habitat.
    - Remove dead and down trees next to these pockets to reduce the

risk of wildfires spreading in either direction.

  - Fence off an area as tall as the tallest trees in the pocket to encourage regeneration.
  - Remove dense pockets of trees and shrubs near bridges or other critical infrastructure, as they pose wildfire concerns.
  - Fence off regeneration for protection from browsing game and livestock.

- Promote narrowleaf cottonwood regeneration by cutting down one healthy cottonwood tree. The intact root system will sprout suckers. Dying or dead cottonwoods will not have the healthy root systems to sprout new trees.
- Create or retain occasional small brush piles for wildlife habitat. These also will encourage seedling regeneration.
  - Be sure to locate these piles outside of defensible spaces around structures.
- Check for management restrictions if the area is located in a U.S. Army Corps of Engineers-delineated wetland.

Figure 11. Russian-olive trees in Larimer County. *Photo: WMC*

Site Rehabilitation Planning Checklist

Prior to the implementation of a cottonwood-focused rehabilitation project, property owners/managers should create a strategy for the site that will result in a range of long-lasting benefits. Use the following checklist prior to the implementation of a cottonwood rehabilitation project to help ensure that the project is well-planned and will make the best use of available resources.

Gather baseline resource data for the site.

This will be key to inform project implementation strategies, so know the site and conditions as well as possible. Speak to neighboring property owners, the local resource conservation district, and/or the local CSFS district office to try to assemble a history of the property. Other data that could be valuable prior to implementing a cottonwood stand rehabilitation project include:

- **Soil testing.** This is critical for making initial re-vegetation plant selections and for choosing plants that will survive local soil conditions.
- **Climate conditions.** By knowing annual precipitation, soil moisture, humidity and other climatic data averages, land managers are able to choose appropriate plants.
- **Depth to ground water, and seasonal depth fluctuations.** These data are crucial for successfully establishing and sustaining woody natives as pole plantings or as long-pot planted stock.
- **Site inventory of native and nonnative plants.** What natives are growing on the site and doing well?
- **Water availability.** Is there the possibility to water new plants if necessary?
- **Feasibility of providing protection from wildlife.** Is it realistic to obtain and provide animal protection for new plants, if necessary?

Evaluate site goals and generate a project strategy.

Common project goals could include:

- Reducing wildfire risk
- Improving growing conditions for cottonwood trees
- Improving wetland habitat
- Establishing native plant cover and removing invasive species

Create a detailed budget for the project.

How much funding is available for the total rehabilitation project? Is there a particular area that requires a higher level of funding? Create a detailed budget including labor, materials and any other necessary expenditures.

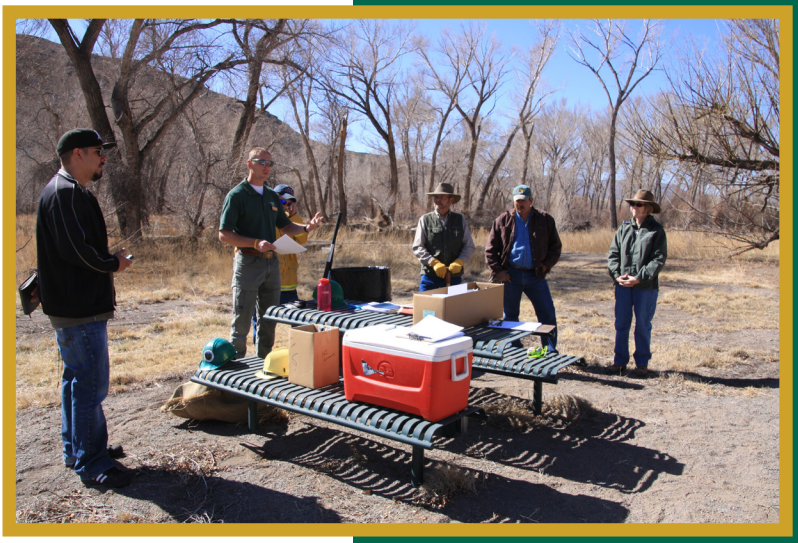

Figure 12. Consult a forester or other professional when planning a riparian management project. *Photo: CSFS*

Plan priority treatment areas.

Identify the priority treatment areas and why they are designated as such, and develop a comprehensive strategy to address these areas first. Often, it makes the most sense to choose the areas that will provide the highest return on investment – not necessarily the areas that are the most infested with invasive species.

For More Information

For more information on cottonwood management, contact a local Colorado State Forest Service district office or visit the CSFS website at www.csfs.colostate.edu.

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Figure 13. Rio Grande cottonwood trees are found on the West Slope of Colorado between 4,000 and 6,000 feet. *Photo: Vince Urbina, CSFS*

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Figure 14. A tamarisk infestation in the riparian area along the Chacuaco Creek in southeastern Colorado. *Photo: Shelly Simmons, CSFS*

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