Title: Monitoring natural regeneration, habitat condition and wildlife use in narrowleaf cottonwood (*Populus angustifolia*) forests of the Middle Madison River, Montana

Date: November 11, 2024

Project 2188 License Article: The proposed monitoring project provides, under Article 2188, direct benefits for fisheries and wildlife populations and habitat within the main stem of the Madison River (Priority 1) and on adjacent lands to the Madison River (Priority 2) and provides results and protection, mitigation and enhancement benefits to Madison-Missouri River fisheries, wildlife populations and habitat (Priority 3).

Five Year Wildlife Plan Article 423 Wildlife Habitat Monitoring and Enhancement Plan:

The project will improve knowledge of or assist in recovery of wildlife populations along the Middle Madison River and enhance knowledge of the condition and reproductive status of critical riverine floodplain wildlife habitat on lands and waters associated with the project.

Sponsor: Rocky Mountain Botany (Tara Luna)

Location: Middle Madison River (Granger Ranch Section-Lower O'Dell Floodplain to Ennis, MT)

Geocode: 45 18`53 N/ 111 44` 43W (1523 meters avg. elevation)

TAC Share Cost Share Requested: $ 10,000.00

1.**Introduction**

Narrowleaf cottonwood (*Populus angustifolia*) riparian forests are crucial wildlife corridors and habitat for the entire range of resident and migratory wildlife found in southwestern Montana. Natural regeneration of cottonwood stands has been a restoration focus and priority for both regulated and unregulated rivers in semi-arid regions of the Rocky Mountains, Great Plains and Intermountain regions of western North America. Although natural regeneration of mixed stands of cottonwood have been examined in the central Rocky Mountains and Canadian Rocky Mountain foothills and plains (Amlin and Rood; D'Amico 1997, Gom and Rood 1999; Rood et al 2003; Rood et al 2007; Rood et al 2008; Wilding et al 2014), there is no information available on the condition and regenerative processes of narrowleaf cottonwood from the Madison River Valley of southwestern Montana.

Narrowleaf cottonwood found on river floodplains subjected to annual ice and flood disturbance at more northern latitudes, typically contain mostly clonal individuals. This species differs from eastern cottonwood in several life history characteristics and may be more readily adaptable to more variable frequency of flooding and reduced flows (Wildling et al 2014), especially when compared with broadleaf cottonwood (*P. deltoides, P. fremontii*).

Cottonwood seedlings that reach maturity are usually less common and often restricted to points of exposed sediment deposits that are not repeatedly disturbed by prolonged inundation and ice sheer. Minimum seed bearing age of narrowleaf cottonwood is unknown, although other western

Populus species typically reach reproductive maturity at 10 to 15 years (Wycoff and Zasada 2008). Young clonal trees derived from re-sprouts, root suckering or adventitious rooting of buried stems reach reproductive age and seed bearing status when relatively young (<5 years). Reproductively mature trees, whether clonal or seedling derived, can flower and produce seeds 1 to 2 years after top damage or removal.

Trees are dioecious, with individuals producing either all male or female flowers, however, gender ratios among natural stands of *Populus* are not well documented (Wycoff and Zasada 2008). Rivers subjected to regular disturbance may exhibit disproportionate gender ratios if most stands are of clonal origin. Stand regeneration (clonal vs. seedlings), community structure and condition in repeatedly disturbed sites can determine the degree or extent of reproductive success in these highly dynamic riverine environments.

Cottonwood seeds usually mature in June and early July in Montana, 3 to 4 weeks after fertilization, and can develop to seed release stage under variable temperatures. Seeds are dispersed by wind and can be water-transported great distances from upstream stands. Seeds remain viable for only short periods (7-10 days) after landing on soils, however water transported seeds can potentially remain viable for longer periods and can germinate during later summer months, following water pulses and exposure of suitable sediments. Upstream stands that release seeds later (late June to mid-July) may contribute to mid to late summer seedling recruitment downstream, potentially extending the season of recruitment or improving odds of seedling establishment that coincide with pulse flows.

Native cottonwood stands in good ecological condition at valley locations are relatively uncommon in many areas of the Rocky Mountains. Determining the distribution, regenerative or mature structure and composition of these communities can provide reference data for restoration projects elsewhere in the region and provide important habitat condition data for wildlife. Establishing a baseline of wildlife observations in the river corridor of the Middle Madison River will assist with future wildlife conservation projects in the area and provide observation data to the State Heritage Program and university researchers.

2.**Objectives**

Data and observations of narrowleaf cottonwood are needed along the Middle Madison River to determine reproductive, regenerative and successional status of these riparian forests. Plots will be established in sections of the Middle Madison River (Granger Ranch section) that are regularly disturbed by ice jams and flooding. The objectives of this study will include:

~Determine mode (clonal vs. seedling) distribution and frequency of *Populus angustifolia* regeneration along sections of the Middle Madison river and meanders;

~Record physical parameters (elevation, topographic landforms, distance to river channel, soil type, soil moisture, water table depth, sun exposure) in sampled stands and where regeneration is found

~Collect data on flowering and seed release phenology of stands and determine gender ratios in examined stands;

~ Record total average number of clonal re-sprouts and seedlings in monitoring plots and assess seed producing maturity of younger stands;

~Develop stand diagrams showing height/dbh classes, gender ratios and community distribution;

~Inspect suitable sites for current year seedling recruitment following seed release;

~Examine community composition, structure and condition of stand classes and determine community types present;

~ Provide management recommendations for narrowleaf cottonwood riparian habitat based on natural stand data, including restoration methods of propagation, planting densities and establishment timing;

~Record wildlife observations and activity during field work including any protected or species of concern.

3.**Methods**

Non-permanent transects will be subjectively placed in sampled stands to capture representative stand classes, age and composition of stands. Transects will be located in river sections on the Granger Ranch that have not been grazed by livestock for a minimum of 3 to 5 years. Plots will be compared with river sections that are currently grazed by livestock on other landownerships. Photo-points and GPS points will be taken at each site.

Transects will be placed perpendicular to the river channel. Each transect will be examined for indicators of physical disturbance (drift, flotsam, ice sheer) on the Madison River between Varney Bridge and Ennis, MT. Gender ratios is each sampled site will be determined during peak anthesis during spring months. Seed release timing will be recorded in each sampled site and at an upstream location (above and below Hebgen Dam) to determine the full time range of seed release along the Madison River.

Composition and stand structure (height and dbh) will be measured in each sampled stand. Physical parameters (soils, soil moisture, water table depth, sun exposure, land form), elevation and distance from river channel will be measured in each plot. Height/dbh class of overstory and regenerating *Populus angustifolia* will be determined by measuring a minimum of ten representative individuals per sampled point. Young saplings or seedlings will be measured using an electronic digital caliper (basal stem area).

Stand composition will be determined for each strata (herb, shrub, tree) by assigning absolute canopy cover values. Any Plant Species of Concern encountered during sampling work will be counted, recorded and mapped. Data will be analyzed to determine community types present, regeneration stages and stand classes present in sampled sites. Willow (*Salix* species) communities will also be determined and mapped on these sites.

Additional plots will be established to measure and record regeneration mode (clonal sprouts vs. seedlings) in each sampled site. Physical parameters, landform, elevation and distance from river channel will be recorded where seedlings or clonal sprouts are found. Reproductive mode will be

determined by visual indicators (exposed lateral roots, linear and basal sprouting) or by carefully inspecting evidence for taproots of seedlings or by inspecting buried, severed branches. Any surface soils that are disturbed will be immediately replaced to ensure seedling/sprout survival.

Seed release timing across the course of the growing season will be plotted with current seasons precipitation data and timing of pulse flows. At the end of the growing season, any sites that have been located with current season seedling recruitment will be measured for total number of seedlings, average seedling height and rooting depth.

Experimental plantings and seedings of narrowleaf cottonwood will be placed on suitable sites. Dormant pole cuttings will be placed along a hydrological gradient to measure first year survival. Experimental seedings will be placed in several plots to first year measure germination and establishment (from June to August) and to compare with natural seedling germination and recruitment, where found. Initial results from experimental plantings will be used to develop specific restoration management recommendations for narrowleaf cottonwood floodplain forests.

During each site visit (4 total), wildlife observations will be recorded in each sampling site in cottonwood/willow river habitat. Each site will be specifically searched for any evidence or activity of MT Wildlife Species of Concern or Protected Species. Wildlife observation type and activity (nesting, brood rearing, feeding, resting) will be recorded with GPS points or photos in each sampling site during each site visit. Results will be shared with landowner and compiled in the annual N.W.E.-TAC report.

4.**Schedule**

Field work for this project will begin in mid-May and be completed by late August 2025. Specific activities performed during each site visit and completion of deliverables are shown below:

Measurements/Observations Recorded	**Month**	**Location**
Anthesis, Clonal vs seedling distribution, gender ratios, stand distribution and height (age) classes; develop stand diagrams; Expt plantings; wildlife observations	May	Middle Madison
Seed release timing, community composition; youngest seed bearing height classes; Expt seedings, wildlife observations	June	Middle Madison
Upstream seed release timing; wildlife observations (Middle Madison only); experimental seedings; wildlife observations	July	Upstream stands (Hebgen, Quake Lake area) and Middle Madison
Examine plots for natural current year seedling recruits; finalize all vegetation and experimental planting data collection, wildlife observations	August	Middle Madison
Analyze data, develop stand diagrams/maps and complete monitoring report	Sept-October	--------

5.**Personnel**

Rocky Mountain Botany will provide all labor, personnel and deliverables associated with the project proposal.

6.**Project Costs**

Project Item	**Estimated Cost**	**Description**
Travel	800.00	4 sites visits (May to August)
Labor	8,400.00	est. 240 labor hours
Materials	0.00	will supply all equipment
Other Direct Expenses	800.00	insurance
Direct Overhead	0.00	------
Cost Share Amounts (in-kind contributions)	0.00	-------
TOTAL	$ 10,000.00	

7.**Deliverables**

Floodplain cottonwood forests are critical habitats and migratory travel corridors for wildlife including many protected and species of conservation concern. A full report, including all data and results, recorded during the course of this project will be delivered to N.W.E during September or October 2025.

Project results will also be shared with the landowner and Species of Concern observations will be shared with State Heritage Program, with the landowner's permission. Bird observations will be shared with U.M. Avian Science Center.

The proposed project will help determine the extent, success, type (clonal vs. seedlings) and distribution of cottonwood regeneration and the condition and composition of mature stands along sections of the Middle Madison River (O'Dell Creek floodplain to Ennis, MT), following 3-5year livestock grazing removal.

1. *Montana State Restoration Guidelines (Biological Restoration)*

Monitoring results of natural stands can be used as a reference to develop future state biological restoration guidelines for narrowleaf cottonwood floodplain forests, where applicable.

2. *Montana State Restoration Guidelines (Restoration Management Techniques)*

Results will be used to develop management recommendations in the Madison River area to sustain, enhance and improve narrowleaf cottonwood forest regeneration and condition and to develop restoration recommendations specifically for riparian floodplain forests dominated by this species.

Restoration management recommendations will include: 1) determine timing, density, methods of restoration plantings for narrowleaf cottonwood on other sites; 2) determine the correct hydrological gradient or zone and substrate/soil type for all dominant woody species present to

improve out-planting survival and establishment 3) determine optimum seed capture timing and methods for augmentation seeding of narrowleaf cottonwood. First year experimental pole cutting plantings and seedings will be established on suitable sites.

8.**Cultural Resources**

No ground disturbing activities and soil movement is associated with this project. Some minor soil surface movement will occur when examining identified seedlings and young clonal re-sprouts within plots (approximately 7.5 sq. cm from basal stems sampled). All surface soil will be immediately replaced to protect seedling/sprout viability and to minimize site disturbance.

9.**Water Rights**

The proposed monitoring project will comply with all State (MT) water rights, laws and policy guidelines and does not involve water rights.

10. **References**

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D'Amico, D. 1997. Regeneration of plains and narrowleaf cottonwood on south Boulder Creek, Boulder, Co. Report prepared for the City of Boulder, CO.

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Rood,S. et al.2003. Branch propagation permits disperse clonal reproduction of riparian cottonwoods. Forest Ecology and Management. 18 (6): 227-244

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Wycoff, G.W. and Zasada J.C.2008. The genus *Populus.* In: Bonner, F.T. and Karrfalt, R.P. (editors). The Woody Plant Seed Manual. U.S. Department of Agriculture. Forest Service. Agricultural Handbook 727. Washington, D.C. pp. 856-871.