Middle Rio Grande Endangered Species Collaborative Program (MRGESCP)
Science & Technical (S&T) Ad Hoc Group Charge
Society for Ecological Restoration Recovery Wheel Ad Hoc

Parent Committee
Science and Adaptive Management Committee

Ad Hoc Group Charge
Develop an ecosystem-level restoration assessment tool based on the Society for Ecological Restoration's (SER) Ecological Recovery Wheel, which visually represents recovery of a target ecosystem compared to a selected reference ecosystem using a 5-star rating scale across a set of attributes. The Recovery Wheel should be customized to the Middle Rio Grande (MRG) river-floodplain ecosystem. The process used to develop this tool should be fully documented to facilitate use and future updates to the wheel.

Membership

A. Criteria for membership

- Knowledge of the structure, function, and spatio-temporal dynamics of the Middle Rio Grande river-floodplain ecosystem;
- Understanding of planning, design, implementation, monitoring, and maintenance practices for ecological restoration in the MRG.

B. Members (Nominees)

_____(Lead),
_____(Member),
_____(Member),
_____(Member),
_____(Member),
…

Iterative Task Development

Background

In February 2023 the SAMC identified the Society for Ecological Restoration's (SER) Ecological Recovery Wheel (Figure 1) as an appropriate and useful tool to assess the success of restoration efforts at the *ecosystem level* in the MRG. The development of this tool, combined with additional restoration monitoring resources and ecosystem-level driving questions, will support an end goal of developing standardized monitoring guidance for the MRG (Figure 2). The Recovery Wheel is part of a set of ecological restoration standards launched in 2016 by SER (McDonald et al. 2016). These standards have been vetted by the international restoration community and applied to a wide variety of restoration work since their inception. While restoration efforts in the MRG are often implemented at the species-specific habitat level, use of the Recovery Wheel tool can place habitat-level projects within the context of ecosystem-scale recovery. This context will help to identify additional benefits that potentially result from restoration projects. The Recovery Wheel is a customizable tool, in which sub-attributes can be modified to suit the MRG ecosystem, and ratings (1-5 stars) represent a scale of progress towards full recovery for each sub-attribute. Over the life of a project, the Recovery Wheel serves as a valuable visual aid for demonstrating progress toward the restoration goals (along individual sub-attributes), as well as helping practitioners determine whether (and when) intervention/maintenance is warranted.

The primary objective of this ad hoc group is to customize the SER Recovery Wheel tool to the MRG ecosystem by: 1) selecting an appropriate reference ecosystem; 2) reviewing attributes (see Table 1) and identifying desired sub-attributes for the MRG; and 3) assigning appropriate levels (see Table 2) to each sub-attribute. Sub-attributes within each attribute should reflect aspects of the MRG ecosystem that are relevant to management of listed species and associated ecological structure and function. Selection of metrics used to quantify sub-attributes should take into account not only the responsiveness of the variable to both management actions and climate change, but also the cost, effort, and feasibility of collecting the data.

The final deliverable (i.e., customized wheel) of this ad hoc group can be subsequently modified through adaptive management and informed by climate futures planning.

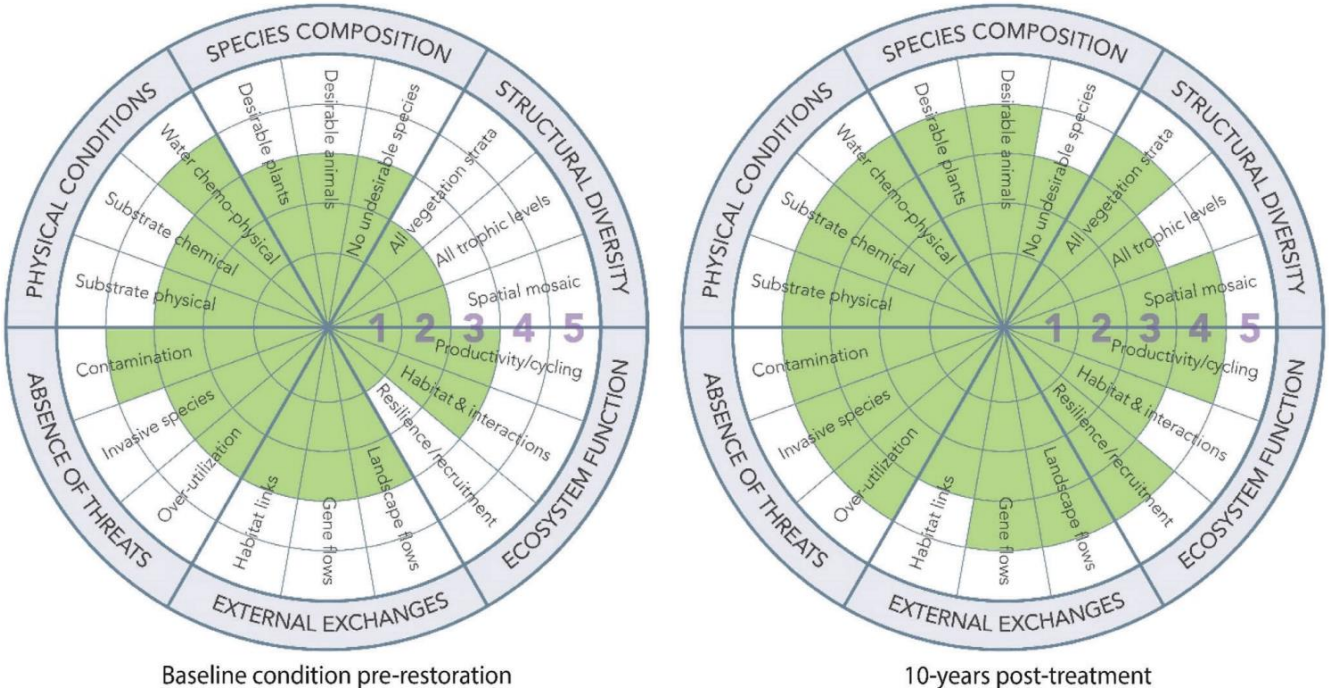


Figure 1. *"The ecological recovery wheel is a tool for conveying progress of recovery of ecosystem attributes compared to those of a reference model. In this example, the first wheel represents the condition of each attribute assessed during the baseline inventory stage of the project. The second wheel depicts a 10-year-old restoration project, where over half its attributes have attained a four-star condition. Practitioners familiar with the project goals, objectives, site-specific indicators, and recovery levels achieved to date can shade the segments for each sub-attribute after formal or informal evaluation. Sub-attribute labels can be added or modified to best represent a particular project. For symmetry of design, three sub-attributes are used in this example, but there may be more, or fewer, needed depending on the project."* (Gann et al. 2019)

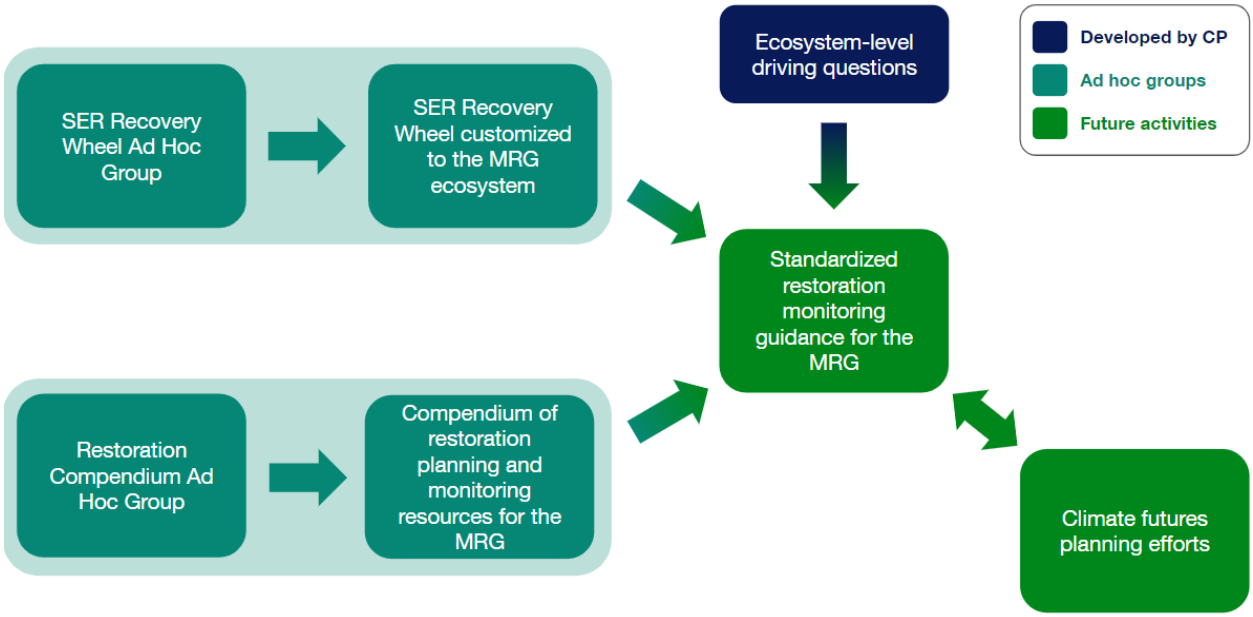


Figure 2. ***Outcomes of this ad hoc group will be combined with restoration monitoring resources and ecosystem-level driving questions to inform the creation of standardized restoration monitoring guidance and other efforts within the MRG.***

Table 1. *"Description of the key ecosystem attributes used to characterize the reference ecosystem, as well as to evaluate baseline condition, set project goals, and monitor degree of recovery at a restoration site."* (Gann et al. 2019)

Attribute	*Description*
Absence of threats	Direct threats to the ecosystem such as overutilization, contamination, or invasive species are absent
Physical conditions	Environmental conditions (including the physical and chemical conditions of soil and water, and topography) required to sustain the target ecosystem are present
Species composition	Native species characteristic of the appropriate reference ecosystem are present, whereas undesirable species are absent
Structural diversity	Appropriate diversity of key structural components, including demographic stages, trophic levels, vegetation strata and spatial habitat diversity are present
Ecosystem function	Appropriate levels of growth and productivity, nutrient cycling, decomposition, species interactions, and rates of disturbance
External exchanges	The ecosystem is appropriately integrated into its larger landscape or aquatic context through abiotic and biotic flows and exchanges

Table 2. *"Sample one- to five-star recovery scale interpreted in the context of the six key ecosystem attributes used to measure progress along a trajectory of recovery. This five-star scale represents a gradient from very low to very high similarity to the reference model. As a generic framework, users must develop indicators and monitoring metrics specific to the ecosystem and sub-attributes they identify."* (Gann et al. 2019)

Attribute	★	★★	★★★	★★★★	★★★★★
Absence of threats	Further deterioration discontinued, and site has tenure and management secured	Threats from adjacent areas beginning to be managed or mitigated	All adjacent threats managed or mitigated to a low extent	All adjacent threats managed or mitigated to an intermediate extent	All threats managed or mitigated to high extent
Physical conditions	Gross physical and chemical problems remediated (e.g. excess nitrogen, altered pH, high salinity, contamination or other damage to soil or water)	Substrate chemical and physical properties on track to stabilize within range of reference ecosystem	Substrate stabilized within range of reference ecosystem and supporting growth of characteristic native biota	Substrate securely maintaining conditions suitable for ongoing growth and recruitment of characteristic native biota	Substrate exhibiting physical and chemical characteristics highly similar to that of the reference ecosystem with evidence they can indefinitely sustain species and processes
Species composition	Some colonizing native species present (e.g. ~2% of species in the reference ecosystem). Moderate onsite threat from nonnative invasive or undesirable species. Regeneration niches available	A small subset of characteristic native species establishing (e.g. ~10% of reference). Low to moderate onsite threat from nonnative invasive or undesirable species	A subset of key native species (e.g. ~25% of reference) establishing over substantial proportions of the site. Very low onsite threat from nonnative invasive or undesirable species	Substantial diversity of characteristic native biota (e.g. ~60% of reference) present across the site and representing a wide diversity of species groups. Very low onsite threat from nonnative invasive or undesirable species	High diversity of characteristic native species present (e.g. >80% of reference), with high similarity to the reference ecosystem; improved potential for colonization of more native species over time. No known onsite threat from undesirable species
Structural diversity	One or fewer biological strata present and no spatial patterning or community trophic complexity relative to reference ecosystem	More strata present but low spatial patterning and trophic complexity, relative to reference ecosystem	Most strata present and some spatial patterning and trophic complexity relative to reference site	All strata present. Spatial patterning evident and substantial trophic complexity developing relative to the reference ecosystem	All strata present and spatial patterning and trophic complexity high. Further complexity and spatial patterning able to self-organize to highly resemble reference ecosystem
Ecosystem function	Substrates and hydrology are at a foundational stage only, capable of future development of functions similar to the reference	Substrates and hydrology show increased potential for a wider range of functions including nutrient cycling, and provision of habitats and resources for other species	Evidence of functions commencing (e.g. nutrient cycling, water filtration, and provision of habitat and resources for a range of species)	Substantial evidence of key functions and processes commencing including reproduction, dispersal, and recruitment of native species	Considerable evidence of functions and processes on a secure trajectory toward that of the reference and evidence of ecosystem resilience, tested by reinstatement of appropriate disturbance regimes
External exchanges	Potential for exchanges (e.g. of species, genes, water, fire) with surrounding landscape or aquatic environment identified	Connectivity for enhanced positive (and minimized negative) exchanges arranged through cooperation with stakeholders. Linkages being reinstated	Positive exchanges between site and external environment becoming evident (e.g. more species, gene flows, etc.)	High level of positive exchanges with other native ecosystems established; control of undesirable species and disturbances	Evidence that external exchanges are highly similar to reference, and long-term integrated management arrangements with broader landscape in place and operative

The SAMC requests that you review the draft tasks, deliverables and schedule below and provide feedback and questions to begin the iterative process of task development.**Tasks and Deliverables**

Step	Objective	Task	Deliverable
1.	**Become familiar with SER 5-Star Recovery Wheel tool**	Review literature on SER Recovery Wheel (Figure 1) • Primary Attributes • Sub-attributes • 5-star Recovery Levels • Customization process	N/A
2.	**Designate a reference ecosystem**	Determine an appropriate reference state for comparison based on desired restoration goals for the MRG, including the scale at which this should take place.	A description of the designated reference ecosystem with a justification of choices based either on scientific literature or expert opinion when appropriate. Please cite sources.
3.	**Customize sub-attributes for the MRG**	Define relevant sub-attributes for the MRG ecosystem. See Table 1 and Figure 3 for descriptions and examples.	A recovery wheel customized to the structure and function of the MRG ecosystem. Please cite sources, where appropriate, and provide rationale.
Interim Peer Review 1: attributes and sub-attributes			
4.	**Customize the sub-attribute recovery levels for the MRG**	Using the customized wheel from Task 3, determine the appropriate recovery levels for each sub-attribute. Consider the question of when/if to maintain or intervene at a restoration site. See Table 2 for an example of how to define levels.	A recovery wheel for the MRG, including sub-attribute levels that inform decisions about site condition and maintenance/ intervention. Please cite sources, where appropriate, and provide rationale.
Interim Peer Review 2: levels and thresholds			
Check-in with SAMC – Summarize progress, issues and findings			
5.	**Recommend next steps**	Using the lessons learned from Steps 2-4, provide recommendations regarding application of the Recovery Wheel to different habitat types within the MRG ecosystem.	An outline documenting the process used to develop a Recovery Wheel customized to the MRG and identifying any lessons learned during the task with recommendations for application and improvement of this tool.

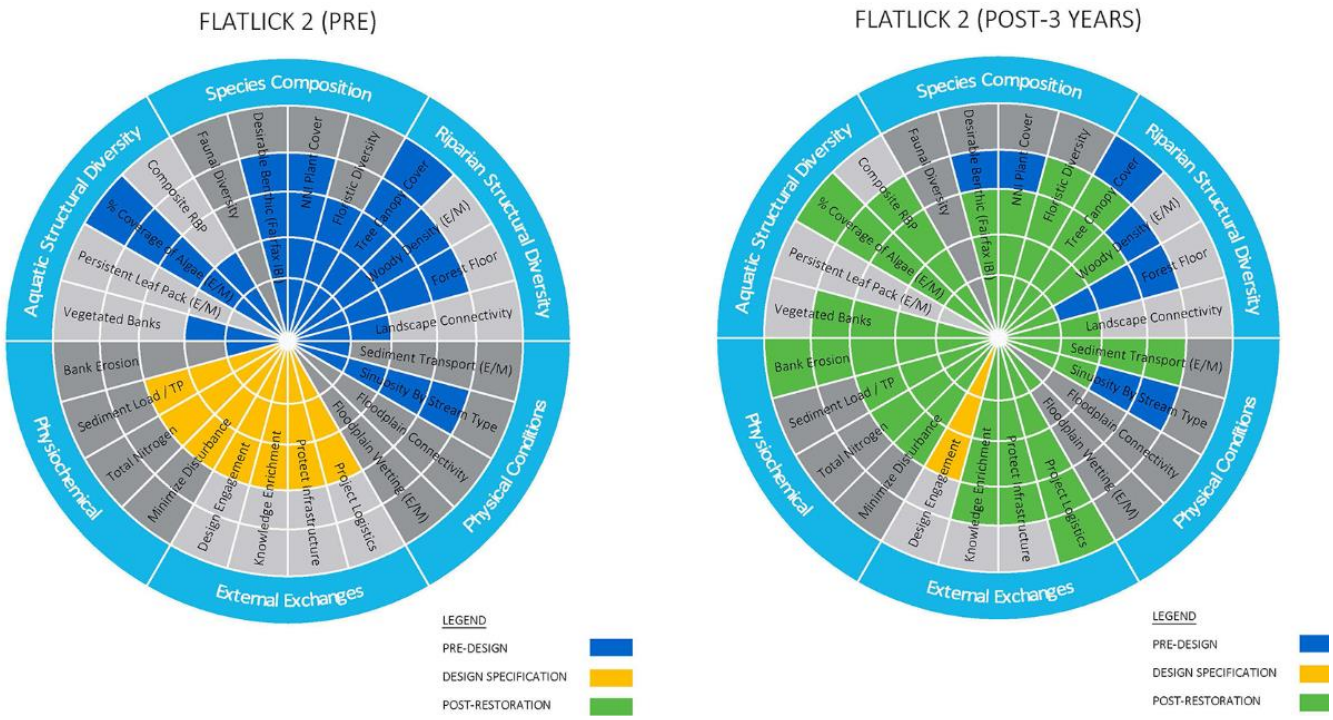
Timeline and Reporting Scheduling

Task	Subtask	Deliverable	To Be Completed By
Step 1	Familiarize with tool	N/A	TBD
Step 2	Design reference ecosystem	A summary of the reference ecosystem constructed with a justification of choices based either on scientific literature or expert opinion when appropriate. Please cite sources.	Time to complete: ~4 weeks
Step 3	Select sub-attributes; Peer Review 1	A recovery wheel customized to the structure and function of the MRG. Please cite sources, where appropriate, and provide rationale.	Time to complete: ~4 weeks (additional 2 weeks for Peer Review)
Step 4	Define sub-attribute recovery levels; Peer Review 2; Check-in with SAMC	A recovery wheel for the MRG, including sub-attribute levels that inform decisions about site condition and maintenance/intervention. Please cite sources, where appropriate, and provide rationale.	Time to complete: ~4 weeks (additional 2 weeks for Peer Review)
Step 5	Recommendations and lessons learned; Presentation to SAMC	An outline documenting the process used to develop a Recovery Wheel customized to the MRG and identifying any lessons learned during the task with recommendations for application and improvement of this tool.	Time to complete: ~2 weeks
		Collaborative Program seminar	TBD

Footnotes

1. "*While every restoration practitioner strives to place his/her site on a secure trajectory to full ecosystem recovery relative to an appropriate reference system, full recovery can often be slow or unrealistic in the short-term. In these cases, and for all restoration projects, practitioners are encouraged to aim and monitor for continuous improvement toward ecosystem recovery… The 5-Star Recovery System tool utilizes a 5-star scale that represents a cumulative gradient from very low to very high similarity to a reference ecosystem. A restoration site can be assigned to one of the five recovery levels (1 to 5 stars) in an overall assessment; or, different ecosystem attributes can be individually assigned recovery levels based on available monitoring data, which provides a more detailed overview of recovery progress, and accounts for the fact that different attributes may have varying rates of recovery. The Recovery Wheel (Figure 1) provides a visual way in which to communicate ecological recovery progress using the 5-star system, and can be shaded in as various sub-attributes of the site achieve greater recovery over time*." (https://www.ser.org/page/SERNews3113)
2. The SER Recovery Wheel was modified and applied to Flatlick Stream (Department of Public Works and Environmental Services, Fairfax County, Virginia), where they created pre-restoration and post-restoration Recovery Wheels for a stream ecosystem (Figure 3). The attributes, sub-attributes, and

levels may be applicable to some MRG ecosystems. More information can be found at the following links:
https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/fairfax_county_restoration_recovery_wheel.pdf



https://www.fairfaxcounty.gov/publicworks/stormwater/plans-projects/fairfax-recovery-wheel

Figure 2. *"Recovery Wheels for the Flatlick II stream restoration, with both a pre-restoration condition and the condition as assessed 3-years post restoration."* https://www.fairfaxcounty.gov/publicworks/stormwater/plans-projects/fairfax-recovery-wheel

References

"Fairfax Recovery Wheel." Fairfax County, https://www.fairfaxcounty.gov/publicworks/stormwater/plans-projects/fairfax-recovery-wheel. Accessed 14 March 2023.

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