



## MONITORING AND EVALUATION

Future management of Seedskadee NWR should include regular monitoring and directed studies to determine how ecosystem structure and function are changing, regardless of whether restoration and management options identified in this report are undertaken. Ultimately, the success in restoring and sustaining communities and ecosystem functions/values at Seedskadee NWR will depend on how well the physical and hydrological integrity of the Green River Valley is protected and how key ecological processes and events, especially pulsed late-spring and early-summer flooding, can be restored or emulated by management actions. Uncertainty exists about the ability to make some system changes because of constraints of Fontenelle Reservoir management, water rights and historical uses, and land uses in the larger Green River watershed, including the Big Sandy River drainage. Also, techniques for controlling or reducing introduced plant species and restoring cottonwood are not entirely known.

Whatever future management actions occur on Seedskadee NWR, activities should be done in an adaptive management framework where: 1) predictions about community response and water issues are made (e.g., improved distribution and vigor of seasonal wetland communities in floodplain swales) relative to specific management actions (e.g., restoring floodplain connectivity at discharge levels of 8-10,000 cfs) and then 2) follow-up monitoring is conducted to evaluate ecosystem responses to the action.

The availability of geospatial (e.g., LIDAR) and hydrological data (e.g., flow dynamics) for the Green River system greatly enhanced the ability of this HGM evaluation to identify potential management options for Seedskadee NWR. Further, past research and monitoring studies of certain communities, especially riparian woodlands, and attributes

(such as groundwater dynamics) have been critically important in advancing the understanding of the Seedskadee NWR ecosystem. Other important data needed to more precisely understand HGM relationships and management options are not available, however. The most important of these missing data are: 1) precise stage-discharge relationships for the Green River at various locations on the refuge, 2) detailed contemporary soils data and maps, and 3) historical photographs that identify pre-Fontenelle Dam features and flood events in the Green River floodplain. If these data, maps, and photographs become available, the HGM relationships, maps, and recommendations provided in this report likely can be refined.

Especially critical information and monitoring needs for Seedskadee NWR are identified below:

### KEY BASELINE ECOSYSTEM DATA

Important site- and regionally-specific data that are needed for the Seedskadee NWR region include:

- Detailed soils mapping and description, especially within the alluvial floodplain areas.
- Comprehensive inventory and mapping of all vegetation, including invasive and noxious species.
- Comprehensive surveys of key animal species that represent major taxa, species of concern or management emphasis, and primary trophic levels.
- Presence, depth, and duration of water levels in off-channel floodplain areas associated with various river stage levels.

## RESTORING NATURAL WATER REGIMES AND WATER FLOW PATTERNS

This report suggests several physical and management changes to help restore some more natural topography, water flow, and flooding dynamics in floodplain habitats. Most changes involve restoring at least some more natural water flow through natural drainages and tributaries and across floodplain meadows in a sheetflow manner and to manage depressions and impounded sites for more seasonally- and annually-dynamic flooding and drying regimes. The following monitoring will be important to understand effects of these changes if implemented:

- Annual monitoring of water use for refuge areas including source, delivery mechanism or infrastructure, extent and duration of flooding/drying, and relationships with non-refuge water and land uses. These data will also document how existing water rights are used and maintained.
- Documentation of how water moves across floodplain areas at various river stage levels, especially during flow events > 8,000 cfs.
- Evaluation of surface and groundwater interactions and flow across and through alluvial fans and terraces onto floodplain areas and eventual discharge into the Green River.
- Periodic monitoring of water quality in all drainage and floodplain areas.
- Refinement of topographic, roughness, and hydraulic data used in the HEC-RAS models

(discussed earlier in the Historical Climate and Hydrology section).

## LONG TERM CHANGES IN VEGETATION AND ANIMAL COMMUNITIES

As previously stated, comprehensive baseline data on historic, and even current, plant and animal communities for Seedskaelee NWR is sparse. In addition to determining current distribution and dynamics of species, long term survey/monitoring programs are needed to understand changes over time and in relation to management activities (e.g., USFWS 2007). Important survey/monitoring programs are needed for:

- Distribution and composition of major plant communities including expansion or contraction rates of introduced and invasive species.
- Survival, growth, and regeneration rates of willow and cottonwood in riparian woodland corridors.
- Abundance, chronology of use, survival, and reproduction of key waterbird and Neotropical migrant songbirds such as dabbling ducks, trumpeter swan, American bittern, etc.
- Occurrence and abundance of ungulates.
- Occurrence and abundance of amphibians, reptiles, and fish.



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