Strip-Mine Impoundments for the Birds

Richard A. Olson and William T. Barker

Natural wetlands of the glaciated prairie pothole region, in the eastern portion of the Northern Great Plains, are one of the most productive ecosystems of the world. These rangeland ecosystems are especially important for producing waterfowl and other wildlife, as well as providing water for livestock, irrigation, and various recreational activities.

A major factor contributing to high waterfowl production on these natural wetlands is the presence of well-developed wet meadow, emergent, and submerged wetland plant communities which serve as attractive waterfowl habitat. Extensive development of wetland plant communities provides nesting cover, protective cover, brood rearing cover, and food sources to both resident and migrating waterfowl.

Compared to the glaciated prairie pothole region, natural wetlands are rare in the unglaciated rangelands west of the Missouri River in North and South Dakota, eastern Wyoming, and eastern Montana. However, thousands of rangeland water impoundments are prevalent in the form of stockdams, dugouts, and coal strip-mine ponds. Their principal function is for livestock watering. A management plan for the wetland vegetation of these unique rangeland ecosystems, however, can provide additional assets in the form of improved wildlife habitat and enhanced recreational opportunities such as hunting, trapping, and bird watching.

Developing Management Plans

There is a growing demand to develop management schemes for the wetland vegetation on these rangelands impoundments, especially strip-mine ponds. As strip mining for lignite and sub-bituminous coal increases to meet future energy requirements, more rangeland water impoundments will emerge. Ecological information must be collected on these little-known rangeland ecosystems before management plans for wetland vegetation can be developed.

In response to the need for devising management guidelines, the Rocky Mountain Forest and Range Experiment Station, U.S. Forest Service, Rapid City, S. Dak., and North Dakota State University, Fargo, jointly combined efforts to collect ecological information on the wetland plant communities of rangeland strip-mine ponds and stockdams. Wetland plant communities on strip-mine ponds and stockdams were studied at Beulah and Bowman, N. Dak.; Colony and Sheridan, Wyo; and Firesteel, S. Dak., during the summers of 1976, 1977, and 1978.

The objectives were to determine the wetland plant communities of rangeland impoundments, their characteristic and structure, their relationship to various physical, chemical, and biological factors, and to develop guidelines for managing wetland vegetation.

Plant Community Characteristics

Several differences in wetland plant community development are apparent between strip-mine ponds and stockdams. First, strip-mine ponds lack wet meadow and shallow marsh plant communities such as foxtail barley (*Hordeum jubatum*), prairie cordgrass (*Spartina pectinata*), sedges (*Carex* spp.), and rushes (*Juncus* spp.). All stockdams display these outermost wetland plant communities around the basin margin. This is especially significant for waterfowl since sedges and rushes are preferred nesting cover.

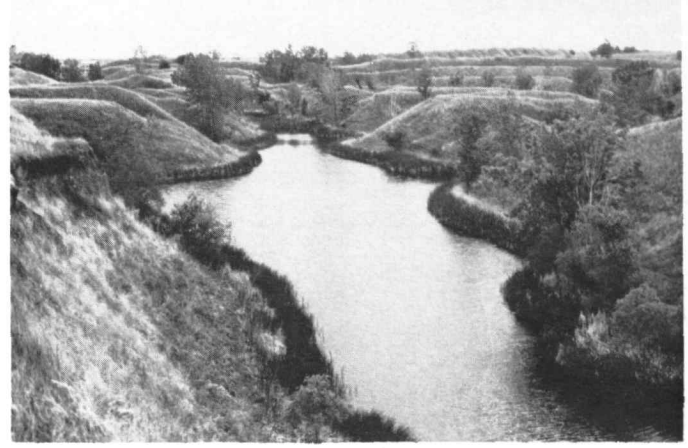
Second, strip-mine ponds have extremely narrow bands of emergent vegetation such as cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.) compared to broad, extensive zones of emergent vegetation on stockdams. Retarded development of emergent vegetation reduces the amount of escape and brood rearing cover essential for superior waterfowl habitat.

Third, submerged plant communities such as the pondweeds (*Potamogeton* spp.) and water milfoil (*Myriophyllum exalbescens*) are restricted to a narrow band close to shore on strip-mine ponds. In contrast, submerged plant communities of stockdams are more extensively developed. Restricted development of submerged vegetation limits the amount of food sources available to waterfowl both directly and indirectly. Tubers, the underground stems of pondweeds, are preferred waterfowl foods. Also, reduced area of submerged vegetation limits the production of plant dependent aquatic invertebrates, a highly preferred high-protein food required by ducklings for growth.

Finally, strip-mine ponds exhibit fewer wetland plant communities, fewer plant species within each community, and a more concentric pattern of community development around the pond margin. Stockdams, in comparison, have many more visually detectable communities in a complex, mosaic pattern. Reduced variability of wetland vegetation may be less attractive to waterfowl, as reflected by lower waterfowl utilization on strip mine ponds.

Environmental Explanations

The expression of any plant community is governed by a host of complex, interacting environmental variables. Resource managers must identify and manipulate these major variables in managing wetland vegetation of rangeland impoundments.



Steep basin slopes on rangeland strip-mine ponds and natural fluctuating water levels are major factors causing the absence of wet meadow plant communities.

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Gradually sloped basins of stockdams, coupled with a fluctuating water regime, promote extensive development of wetland plant communities and waterfowl habitat.

A common factor inhibiting wetland plant development on strip-mine impoundments in the east is highly acidic basin water resulting from oxidation and subsequent leaching of toxic spoil material from anthracite and bituminous coal fields. The water in Northern Great Plains strip-mine impoundments is more alkaline, probably due to less acidic overburden overlying the younger lignite and sub-bituminous coals. In most cases, acidity is low enough and does not inhibit wetland plant growth.

However, a major factor governing the development of wetland vegetation on Northern Great Plains strip-mine ponds is basin slope. Interacting with naturally fluctuating water levels, basin slope influences wetland plant development by regulating water depth and permanence within zones of wetland vegetation.

Basin slopes are normally extremely steep on strip-mine ponds compared to stockdams. Since wetland plant development is closely linked with moisture conditions, extreme basin slope limits the amount of shoreline area having favorable moisture conditions under fluctuating water levels. This results in narrower emergent communities, restricted submerged zones, and lack of wet meadow communities.

In the case of submerged vegetation, deep water near shore due to extreme basin slope limits the amount of light penetration reaching submerged plants. As a consequence, photosynthesis is severely restricted with increasing depths, limiting community development to narrow bands near shore.

Also, seasonal water level fluctuations are of lesser magnitude on strip-mine ponds compared to stockdams. This stability limits wetland plant development since smaller areas of shoreline are exposed or inundated during extreme water level ranges.

Three factors probably account for subdued water level fluctuation on strip-mine ponds. First, unlike stockdams, underground springs feeding strip-mine ponds buffer the loss of basin water from evaporation and transpiration. Second, greater water depth and smaller surface area of strip-mine ponds may suppress water surface areas. Finally, the rate of water loss from a wetland basin varies directly with the length of shoreline per unit area and inversely with basin slope, since most water loss occurs through transpiration by marginal emergent vegetation and evaporation from exposed shoreline soil surfaces.

Natural summer drawdowns, resulting in mudflat exposure, offer several advantages for improving waterfowl habitat. Exposed mudflats encourage the establishment of many wetland plant species from seed. Once germination and establishment occur on a mudflat, many wetland plant species continue to grow and reproduce by root sprouting, even under flooded conditions. Cattails and bulrushes often colonize new wetland areas in this manner.

Mudflats exposed from a natural drawdown quickly develop more favorable growing conditions for wetland plants compared to submerged soils. Decomposition of residual plant materials proceeds rapidly under the aerobic conditions of exposed mudflats, quickly releasing essential growth nutrients for future plant utilization. Under submerged conditions decomposition of plant material is much slower, resulting in a build-up of organic residues. Fluctuating water regimes prevent an accumulation of organic debris while contributing to higher soil fertility.

Fluctuating water regimes also create a variety of environmental conditions favorable to a wider number of wetland plant species. This condition is a major reason for the mosaic pattern of wetland plant community distribution on gradually sloped stockdams. A greater number of wetland plant species attract a greater number of waterfowl by providing more diversified habitat.

Another inherent problem limiting the development of wetland vegetation on steep-sloped basins is erosion. Spoil banks are commonly void of terrestrial vegetation or at most only sparsely vegetated. As a result, erosion of unstable soils is rapid on steep basin slopes. A fast rate of sediment deposition into the basin causes a constantly shifting substrate to which wetland plants anchor. Continual disturbance of the substrate by sediment loads hinders the development of wetland plant communities.

Suggestions For Improvement

Correcting basin slope and manipulating water levels are the major factors to consider in managing wetland vegetation on rangeland impoundments. Both factors interact to determine habitat favorable to wetland plant development.

Plans for the construction of future rangeland impoundments should include provisions for gradually sloping the surrounding shoreline. Future strip mining activities should include plans for setting aside top soil for overburden material until after contouring has been completed. This may reduce the amount of toxins leached into a basin from the oxidation of spoil materials.

On existing rangeland impoundments, particularly strip-mine ponds, shoreline contouring is recommended to encourage enhanced wetland plant development. Installation of weirs or other water control devices on present and future impoundments will permit deliberate manipulation of water levels to create artificially induced mudflats.

Summary

Development of wetland vegetation on strip-mine ponds and stockdams is governed by a host of complex, interacting environmental variables. However, basin slope plays a major role in the expression of wetland vegetation on rangeland impoundments by determining the area of shoreline exposed under natural summer drawdowns; water depth and permanence within zones of wetland vegetation; and the rate of sediment deposition on the substrate occupied by wetland plants.

We must realize the additional potential assets offered from managing wetland vegetation on these rangeland impoundments. Contouring basin slopes and manipulating water levels will enhance the development of wetland vegetation, permitting greater multiple uses on rangeland impoundments. With proper management, strip-mine ponds can be converted into more productive ecosystems for all interests. ●