The Importance of Shallow Wetlands in Cropland to Wildlife in the Prairie Pothole Region of Minnesota and Iowa

By Rex Johnson

Before Europeans settled the region and began plowing and draining the wet prairie, there were nearly two and a half million shallow wetlands in the Prairie Pothole Region of western and southern Minnesota and north-central Iowa (Johnson, in prep). One hundred and fifty years of increasingly intense farming and wetland drainage has eliminated over 80% of these wetlands in the Minnesota prairies and 99% of wetlands throughout Iowa. Most remaining wetlands in the region are threatened directly by active drainage installation or by the installing of drainage tile around (but not within) a wetland, effectively drying the soil so that runoff is intercepted before it reaches the wetland.

Shallow wetlands with a temporary or seasonal water regime are at greatest risk of wetland drainage due to their small size, relative ease of drainage, and likelihood of being embedded within agricultural fields. Temporary wetlands hold water for <14 days during the growing season and are usually covered by grass. Seasonal wetlands usually are ponded for < 30 days during the growing season and tend to be full of cattail unless disturbed. The most common form of disturbance is farming through these wetlands, often initiated in the fall when they are dry and in many cases this disturbance actually benefits wildlife. However, the benefits of farmed wetlands depend greatly on the hydrology and agricultural practices being implemented.

Most people look at these small wetlands and do not recognize them as an essential part of the regional wetland community or know how critical they are to wildlife. The reasons are simple – 95% are smaller than 2 acres; most of the time they are dry, especially by early summer; and duck hunters, the members of the public that tend to be most intimately involved with wetlands seldom hunt them because they are dry in the fall in most years. Although small wetlands may not appear to provide significant values when assessed individually at a single snapshot in time, they are critically important collectively as dynamic elements of natural prairie-wetland landscapes (Trochlell and Bernhall 1998).

There were once about 1.9 million temporary and seasonal wetlands in the prairies of Minnesota and Iowa. The other historic wetlands were deeper semi-permanent wetlands or “duck sloughs” and lakes. Today there are about 230,000 temporary and seasonal wetlands left in the Prairie Pothole Region of Iowa and Minnesota and 57% of these are embedded within cropland (hereafter cropped wetland). Many of these cropped wetlands were completely or partially drained in the past, yet regularly over time their drainage systems have become decrepit. Thus they may provide significant wetland functions for now but they remain at particularly high risk of drainage because established drainage systems can in some cases be easily restored to their original function, which results in direct wetland loss and may also enhance the surrounding drainage network. Often these partially drained wetlands in cropland provide much of the wetland wildlife value that Minnesota and Iowa still retain.

What are the wildlife values of cropped wetlands that conservationists are so determined to conserve? To understand their value, it's important to understand what these wetlands look like in the spring when they tend to be most valuable for wildlife. If we stood in the middle of a cropped wetland in April, we could normally wear a pair of calf-high rubber boots and still keep our feet dry. Looking around, we would see surface water extending out in a rough circle for no more than 50 yards. Looking down into the water, we would see the residue of last year's crop and if we looked very closely we would see that the wetland teemed with snails, aquatic insect larva and adults and even smaller crustaceans called zooplankton. The type and abundance of these tiny animals depends mainly on the type of crop planted and how much residue was left in the field after fall tillage (Johnson and Hubbard 1998). Generally, wetlands in pastures, road ditches and small grain fields like wheat hold the most invertebrates, while "clean" crops like sunflowers and soybeans have few to none. As we stand in the wetland, if we can see a nearby deeper semi permanent wetland or a lake, it is still covered with ice and may be for another month or more—meaning we are standing on one of the only food sources available during this critical time of year for birds and many other wetland-associated species that are preparing to breed. In fact, Kantrud and Stewart (1977) reported that 60% of the dabbling ducks they observed in the early spring were on seasonal wetlands which routinely make up about 33% of the wetlands in a glaciated prairie landscape like western or southern Minnesota or north central Iowa (Johnson and Higgins 1997).

Because they are shallow, cropped wetlands are the first to warm up and provide open water and food for wildlife and this is their main value to wildlife. Migratory birds are most often associated with cropped wetlands. Ducks that are still migrating feed heavily on waste grain, full of energy-rich carbohydrates and fat. Shorebirds headed farther north and ducks that have completed migration feed on snails, insects, worms and other invertebrates which are rich in protein and calcium essential for egg production. Swanson and Meyer (1977) reported that 99% of the volume of foods of laying hen ducks consisted of animal materials, mainly snails and insects. Migrating shorebirds that fly short distances between migration stops may actually double their body weight in a few days feeding on these invertebrate, and if they fail to put on the required weight they may not breed successfully or even survive migration, literally falling dead out of the sky (Swanson and Meyer 1977).

The four most important factors in the attractiveness of cropped wetlands to ducks and shorebirds are depth, food abundance, residual vegetation left over from the last growing season, and the density of other shallow wetlands in the surrounding landscape (Johnson and Hubbard 1998). Repeated surveys of nearly 1,500 cropped wetlands found ducks on 96% of sampled wetlands one or more times, and shorebirds on 57% of wetlands.

The importance of depth of the cropped wetland is easy to understand. Most of the ducks that arrive early and use cropped wetlands are called dabbling ducks due to their habit of tipping up with their feet kicking at the surface of the water while then feeding on seeds or invertebrates on the bottom of the wetland. Dabbling ducks will normally only feed in water two-thirds or less than the length of their body. Shorebird relation to depth is equally easy to understand. Most shorebirds wade in the deepest water they can. This is one way that they avoid competition for food with other shorebird species. Larger, or just plain longer legged species, feed in deeper water, while the smallest shorebirds feed along the mud-water interface. This means the location and overall availability of quality food sources for particular species is dynamic throughout the spring and early summer, and between years, as precipitation and soil moisture vary over time.

The importance of food abundance is equally easy to understand, but what determines abundance is more subtle. Invertebrate abundance is directly related to the surface area of leaves of growing submersed plants or crop residue. Thus, grass (pasture) small grain stubble and corn generally have higher densities of food than beans or sunflowers that have a bottom substrate that is mostly mud.

Except for snipe, shorebirds have an aversion to abundant tall vegetation which is one reason why a number of species are closely associated with cropped wetlands where the crop stubble is short or has been disked down (Johnson and Hubbard 1998). Ducks use wetlands with tall emergent plants like cattails but it seems that, particularly during spring migration and the early breeding season, duck pairs are especially wary. An open “viewscape” in which the ducks can see long distances around them appears to be very attractive. The behavior of using cropped wetlands and other wetlands in flat, open areas has yet to be adequately explained.

Lastly, it is well known that duck abundance and shorebird dispersion on the landscape are both affected by the density of shallow wetlands in the surrounding landscape. Krapu et al. (1997) estimated that 93% of the variation in annual wetland density was attributable to the number of ponded temporary and seasonal wetlands. Ducks are gregarious at a landscape scale, seeking out areas with other ducks, particularly of the same species; however, pairs of ducks in late migration arriving on the breeding grounds or at the beginning of the breeding season seek isolation from other members of the same species too. That is, they will not tolerate sharing the same wetland with other pairs or lone males of the same species. Landscapes with a lot of alternative shallow wetlands enable them to be near others of the same species, perhaps for information exchange about habitat quality, without being crowded. Johnson and Hubbard (1998) and Fairbairn and Dinsmore (2001) reported that the smallest cropped or grazed wetlands had the highest density of ducks and shorebirds during migration and early breeding simply because they are small (Fig. 1). Thus conserving these wetlands is an efficient strategy of sustaining populations on the fewest possible total acres of wetlands.

Cropped wetlands are at the highest possible risk of being drained despite state and federal legislation and farm bill rules passed between 1980-85 that constrained drainage. Oslund et al. (2010) estimated that over 4% of wetlands in the Minnesota prairie pothole region had been drained between 1980 and 2010. At least 72% of these wetlands were in croplands that have drainage histories that underscore the environmental importance of drainage maintenance. The primary protection for cropped wetlands is the farm bill's "Swampbuster" provision, whereby a landowner that drains or fills a prohibited wetland may lose a portion of their farming subsidies. Since participation in the farm program is voluntary, high commodity prices have recently made the program less attractive and more and more landowners are opting out and draining or enhancing drainage of cropped wetlands. Johnson et al. (1996) estimated that the Swampbuster exclusion of wetlands that are less than 1 ac in size and frequently farmed would potentially make over 77% of temporary and seasonal wetlands in eastern South Dakota eligible for drainage. The Wildlife Management Institute (1995) estimated that exempting cropped wetlands that are 1 ac and smaller in the prairie pothole region would reduce regional duck production by 50% and reduce the continental fall flight by 9% in the short term.

High crop prices make drainage system installation and repair more appealing and affordable, but the loss of wetlands means increased fragmentation of the landscape for species that have limited mobility. Gibbs (1993) found that the density of small wetlands was correlated with the abundance of turtles and small mammals. Lehtinen et al. (1999) found that amphibian species richness was lower in more isolated wetlands. Their findings make intuitive sense since upland habitats, particularly cropland, are hostile to amphibians because it makes them more susceptible to predation, desiccation, and pesticide exposure. Populations of species like wood frogs may be different in two wetlands as close as 800 m apart indicating that they are highly susceptible to loss of wetlands and habitat fragmentation.

Despite their value to wildlife and other ecological services like water quality improvement and ground water recharge, cropped wetlands continue to be lost. When losses are unavoidable, mitigation of shallow wetlands and grass-dominated uplands is critical. Strategically siting these mitigation landscapes or "banks" represents a primary biological and socio-economic planning challenge for the near future.

Literature Cited:

Fairbairn, S.E. and J.J. Dinsmore. 2001. Local and landscape-level influences on wetland bird communities of the prairie pothole region of Iowa, USA. Wetlands 21(1):41-47.

Gibbs, J.P. 1993. Importance of small wetlands for the persistence of local populations of wetland-associated animals. Wetlands 13(1):25-31.

Johnson, R.R., D.E. Naugle, M.E. Estey, and K.F. Higgins. 1996. Characteristics of eastern South Dakota wetland basins and implications of changes in jurisdictional wetland definitions. Trans. 61rst No. Am. Wildl. and Natur. Resour. Conf.: 127-136.

Johnson, R.R. and K.F. Higgins. 1997. Wetland resources of eastern South Dakota. South Dakota State University, Brookings. 102pp.

Johnson, R.R. and D.E. Hubbard. 1998. Landscape and habitat factors affecting use of temporary and seasonal prairie wetlands by migrating ducks and shorebirds. South Dakota State University, Brookings, File Copy. 32 pp.

Kantrud, H.A. and R. E. Stewart. 1977. Use of natural basin wetlands by breeding waterfowl in North Dakota. J. Wildl. Manage. 41(2):243-253.

Krapu, G. L., R.J. Greenwood, C.P Dwyer, K.M. Kraft, and L.M. Cowardin. 1997. Wetland use, settling patterns and recruitment in mallards. J. Wildl. Manage. 61(3):736-746.

Lehtinen, R.M., S.M. Galatowitsch, and J.R. Tester. Consequence of habitat loss and fragmentation for wetland amphibian assemblages. Wetlands 19(1):1-12.

Oslund, F.T., R. R. Johnson, and D. R. Hertel. 2010. Assessing wetland changes in the prairie pothole region of Minnesota from 1980 to 2007. J. Fish Wildl. Manage. 1(2):131-135.

Swanson, G.A. and M.I. Meyer. 1977. Impact of fluctuating water levels on feeding ecology of breeding blue-winged teal. J. Wildl. Manage. 41(3):426-433.

Trochlell, P. and T. Bernthal. 1998. Small wetlands and the cumulative impacts of small wetland losses: A synopsis of the literature. WI DNR Res. Publ. FH226-98.

Wildlife Management Institute. 1995. More threats to wetlands, now in ag bills. Wildl. Manage. Instit. Outdoor News Bull. 49(9):2-3.

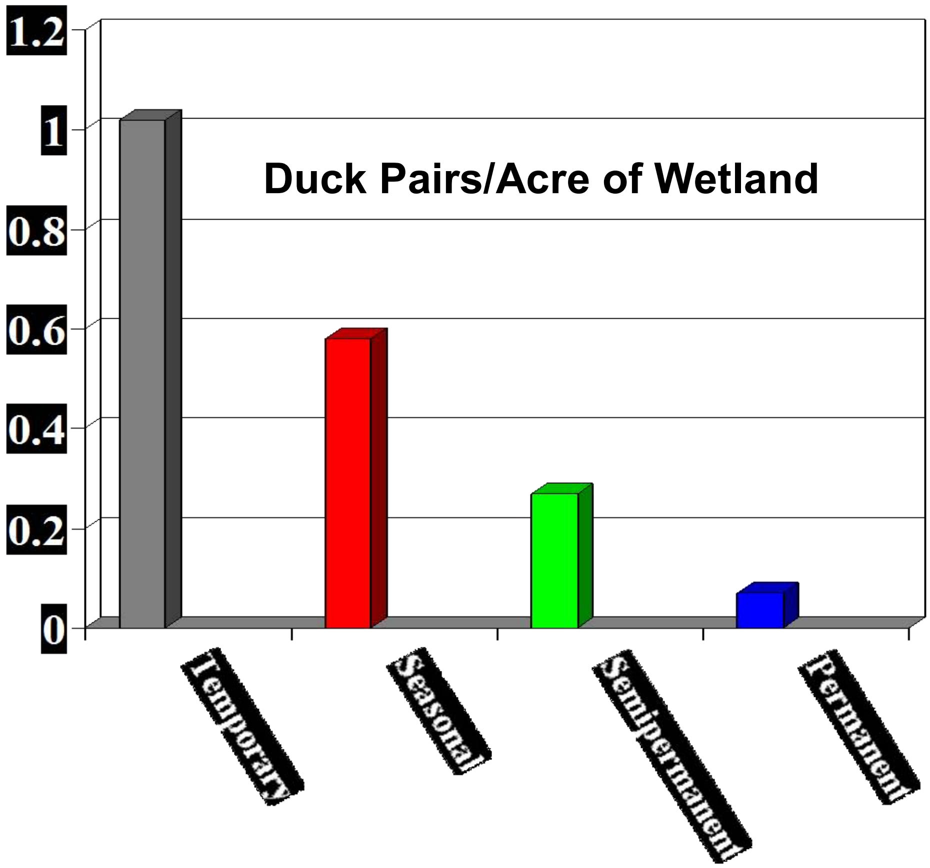

Figure 1. The density of ducks in the spring is inversely related to wetland size suggesting that an efficient conservation strategy is the preservation of small, shallow wetlands with temporary or seasonal water regime (Johnson and Hubbard 1998).