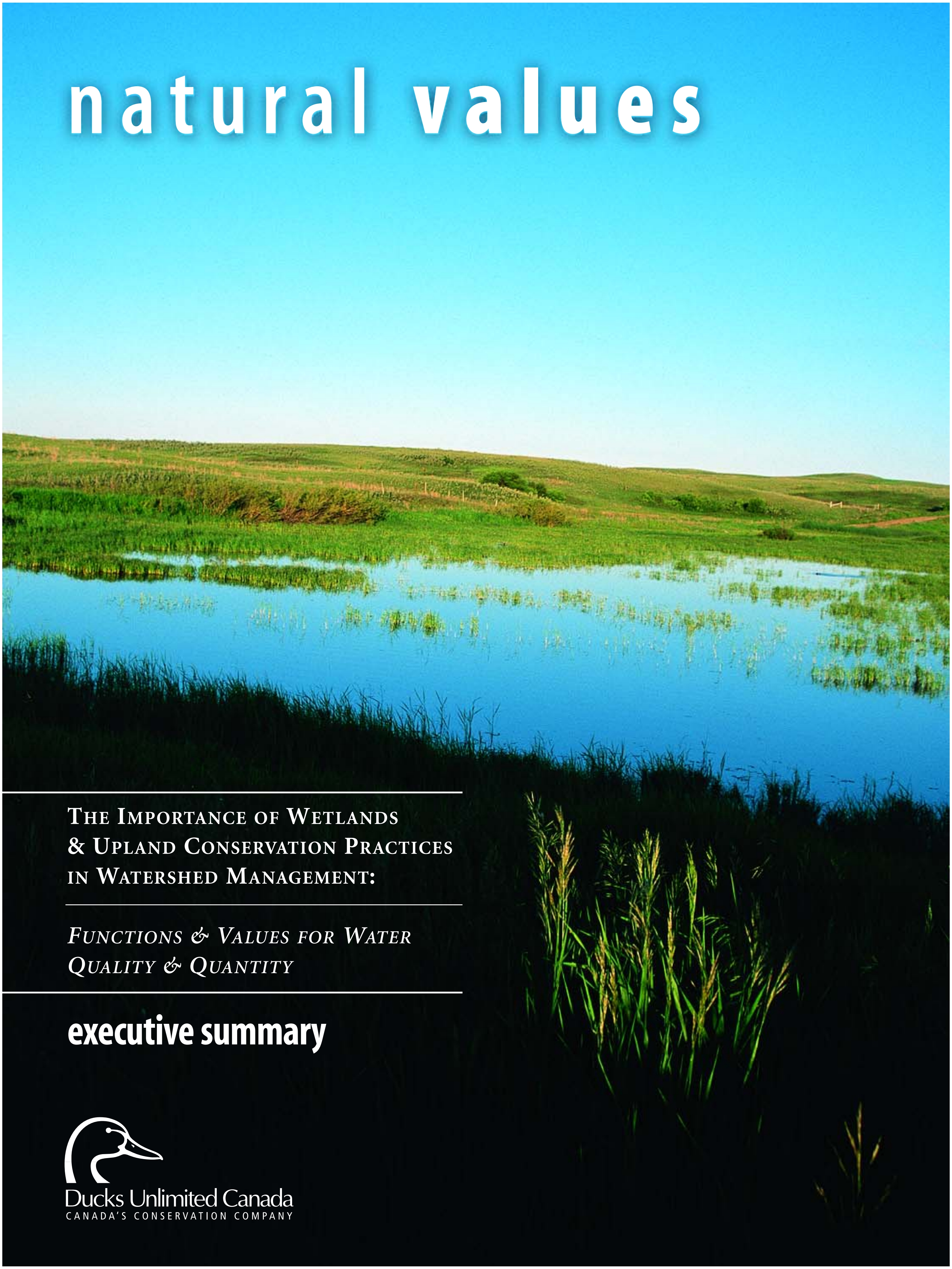

natural values

The Importance of Wetlands & Upland Conservation Practices in Watershed Management:

Functions & Values for Water Quality & Quantity

executive summary

Ducks Unlimited Canada
CANADA'S CONSERVATION COMPANY

executive summary

natural values

Fresh water is a vital resource for human society. To ensure the long-term sustainability of water resources, we must protect and enhance landscape features that ensure water quantity and quality in the future. Wetlands and riparian areas are natural watershed features that are critical for sustainable water resource management.

This paper focuses on the function and value of wetlands, riparian areas, and permanent cover within watersheds. An overview of watershed management is presented including Integrated Watershed Management (IWM) planning and implications of land use for water quality.

Watersheds

A watershed is an ecosystem with complex interacting natural components. Upland plant communities, wetlands, riparian areas, rivers, lakes, and streams are critical natural features that affect surface and ground water quality and quantity within a watershed.

Land use, terrestrial landscape features, and modifications to water regimes have a direct influence on not only surface water bodies but also groundwater. Water quality and quantity in a watershed are inexorably linked to processes that are inherent in the landscape, involving surface water, ground water, biogeochemistry, biota, atmospheric deposition, and sedimentation.

IWM planning is a comprehensive multi-resource management planning process involving all stakeholders within the watershed, who, together as a group, cooperatively work toward identifying the watershed's resource issues and concerns, as well as develop and implement a watershed plan with solutions that are environmentally, socially and economically sustainable. Watershed planning is a cyclical, iterative process involving the following key components: evaluation, planning, implementation, and monitoring.

Given the relationships and interdependencies that exist, a comprehensive, all-inclusive approach to considering the factors affecting water resources within a watershed must be clearly understood and considered.

Wetlands

The hydrological functions of wetlands include storage and eventual release of surface water, recharge of local and regional groundwater supplies, reduction in peak floodwater flows, de-synchronization of flood peaks, and erosion prevention. Position in the landscape, location of the water table, soil permeability, slope, and moisture conditions all influence the ability of wetlands to attenuate floodwaters. Wetland drainage reduces the capability of a watershed to attenuate runoff during flood conditions.

Maintaining and restoring wetlands on the landscape reduces overland flow rates and therefore potential flooding.

Recharge of groundwater is an extremely important function of some wetlands; water percolates slowly from wetlands to aquifers. Interactions between wetlands and local or regional groundwater supplies are complex and site-specific and affected by the position of the wetland with respect to groundwater flow systems, geologic characteristics of the substrate, and climate.

Wetlands are extremely complex systems and several characteristics contribute to their roles as nutrient sinks. They retain nutrients in buried sediments, convert inorganic nutrients to organic biomass, and their shallow water depth maximizes water-soil contact and therefore microbial processing of nutrients and other material in the overlying waters. Wetlands can be effective nitrate sinks in agricultural landscapes (over 80% removal). Phosphorus retention in wetlands can also be significant (up to 94%) and is accomplished through adsorption onto particles, precipitation with metals and incorporation into living biomass.

Wetlands can reduce the impacts of sedimentation on water quality within watersheds. Hydrology is a primary determinant of the sediment-retention capacity of a wetland and controls the source, amount, and spatial and temporal distribution of sediment inputs. Percent of wetland area and position are important for reducing sediment loads of water passing through the system.

Little information exists on the effects of the ability of natural wetlands to reduce microbial populations in water. The effectiveness of constructed wetlands to reduce pathogenic organisms from wastewater is high (up to 99% for coliforms). Natural wetlands are dominated by microbes (bacteria, fungi and algae) and plant life that are important for reducing pathogens.

High levels of biological productivity in wetlands result in dissipation of pesticides due to profuse submersed and emergent plant growth that increases the availability of surface area for pesticide adsorption, plant sequestration, microbial degradation, and exposure from wetlands, primarily due to adsorption to organic matter in sediments and decomposing litter.

Riparian Areas

Vegetated buffer strips can effectively control erosion by forming a physical barrier that slows the surface flow of sediment and debris, by stabilizing wetland edges and stream banks, and by promoting infiltration. The required width of a buffer size is determined by the type of vegetation present; the extent and impact of the adjacent land use; and the functional value of the receiving wetland. Studies have found the bulk of sediment removal occurs in the first few meters of the buffer zone; sediment removal can be 75-97%.

Buffer strips can effectively remove nutrients from surface water flow. The main mechanisms of nitrate removal are by vegetation uptake in the roots and anaerobic microbial denitrification in the saturated zone of the soil. Relatively narrow buffers seem to be very (35-96%) effective in reducing nitrogen.

Phosphorus retention can be effective (27-97%) in buffer strips that contain both woody and herbaceous vegetation, grasses and cropped buffer systems. Buffer strips can trap a significant proportion of pathogens (up to 74% of fecal coliforms); however, remaining levels often exceed minimum drinking water standards. Low soil moisture and high soil temperature substantially decrease survival of total and fecal coliform bacteria. The key process for pesticide retention in buffer strips is infiltration. Grass buffer strips can reduce pesticides by 8-100%.

Upland Cover

Upland conservation programs, such as no-till and permanent perennial cover, slow surface runoff, trap sediments and promote infiltration, consequently reducing the amount of sediments, nutrients and pesticides that enter the watershed.

The most beneficial outcome from implementing practices such as conservation tillage and permanent perennial cover is erosion reduction. Erosion from wind, rain and runoff can be reduced up to 99%

because of greater site stability, infiltration and protection as a result of surface crop residue and perennial vegetation.

Upland cover has shown to be effective in reducing the amounts of nitrogen (up to 90%), phosphorus (up to 91%) and pesticides (up to 100%) in runoff but there is potential for increased leaching through the soil profile to groundwater. Although conservation tillage has not always reduced nutrient and pesticide leaching, this practice is recommended because the benefits outweigh the potential drawbacks. With respect to perennial upland cover, this land has been removed from production, resulting in fewer pesticides and fertilizer nutrients applied and subsequently released. Currently there is insufficient information regarding upland conservation practices and pathogen movement.

Wetlands, riparian buffers and uplands are vital components of watersheds and freshwater resource sustainability in North America. If we desire to understand the role of wetlands, uplands and riparian buffers in maintaining both the quantity and quality of water supplies, we must approach policy, management, and research from a holistic viewpoint, incorporating all components of the watershed.