

# MAMMALS OF THE DELTA MARSH, MANITOBA

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### Introduction

Shortly after the senior author became the Curator of Birds and Mammals (1970) at the newly opened Manitoba Museum of Man and Nature in Winnipeg, he initiated a program to survey the mammal fauna in all terrestrial biotic regions of the province — Arctic Tundra, Boreal Coniferous Forest, Eastern Deciduous Forest, and Grassland biomes, plus Aspen Parkland and Taiga transitional zones. The preliminary site of investigation was the Delta Marsh, carried out by the three authors and volunteers. Soper<sup>1</sup> and Tamsitt<sup>2</sup> provided general accounts of mammals collected at Delta, and Hochbaum<sup>3</sup> commented on the presence of the Franklin's Ground Squirrel, Snowshoe Hare, American Mink, and weasels (Ermine, Long-tailed and Least). Certain species have been the focus of other studies as follows: Franklin's Ground Squirrel,<sup>4,5</sup> Muskrat,<sup>6,7</sup> North American Water Shrew,<sup>8</sup> Striped Skunk,<sup>9</sup> and bats.<sup>10</sup> Our research focused on habitat selection and abundance of all historical and recent mammalian species. Additional detail on the ecology of mammals at Delta was provided by Wrigley,<sup>11</sup> shrews by Wrigley, Dubois and Copland,<sup>12</sup> and prairie rodents by Wrigley, Dubois and Copland.<sup>13</sup> Numerous studies of the vegetation, soils, and hydrology have been conducted over the decades, summarized by Shay,<sup>14</sup> who listed 360 plant taxa for the area.

The Delta Marsh, located at the southern end of Lake Manitoba in south-central Manitoba, is one of the most-important wetlands on the Canadian

Prairies. Formed between 4,500 to 2,500 years ago with the drainage of Glacial Lake Agassiz, it consists of 23,000 ha of public and private lands, 8,125 ha of which are protected by the Delta Marsh Manitoba Wildlife Management Area. This area is placed into category IV by the IUCN (World Conservation Union), meaning it is managed mainly for the conservation of habitat and wildlife through management intervention. Named a Ramsar Site (a Canadian Wetland Designated of International Importance) in 1982, it is also recognized as a Manitoba Heritage Marsh and a Canadian Important Bird Area, designated for its ecological significance for waterfowl, wetland birds, and songbirds.<sup>15</sup> With a shoreline of about 31 km, the marsh system varies from 14,600 ha during dry years to double this size during years of heavy precipitation. The marsh generally extends for 8 km from the beach ridge south to farm fields, which were formerly mixed-grass prairie.<sup>3,6</sup>

Delta Marsh has had a long and fascinating history, with a panorama of famous individuals — conservationists, wildlife managers, researchers, artists, business leaders, royalty, movie stars, sports figures, and local characters — drawn mainly by the marsh's exceptional waterfowl-hunting reputation, and as an excellent location to study wetland ecology and environment. Two internationally renowned research facilities have operated at the marsh — the University of Manitoba Field Station (1966 to 2011) and the Delta Waterfowl Research Station/Delta Waterfowl (1938 to current).<sup>1,15</sup> The authors had the opportunity to conduct research at both facilities during this study.

### Methods

Field activities were carried out on 10 trips covering all four seasons, from the autumn of 1970 to the spring of 1974, totaling about 11,000 traps-nights. A crew of enthusiastic volunteers assisted with setting traps, reporting the species



**FIGURE 1:** White-tailed Deer fawn at Delta Marsh. This photo appeared on the cover of *The Canadian Field Naturalist*, Volume 88(1), 1974.<sup>11</sup> The species first invaded southern Manitoba around 1881, following settlement of the region, north of its original range. Photo credit: R. Wrigley.



**FIGURE 2:** A young Franklin's Ground Squirrel searches in the marsh at Delta for grass and herb shoots, roots and seeds, and insects. When reaching larger size, it becomes a significant predator of duck eggs and hatchlings, and other small animals such as nestling mice and frogs. Photo credit: James Hare.

and numbers collected, and in preparing specimens for the Museum's research collection. Our survey incorporated two trapping techniques. The first involved setting Museum-Special mouse and rat traps (Woodstream Corp., Lititz, PA, USA) for mice and squirrels, and pitfall traps (container sunk into the ground) for mice and shrews, in lines of about 50 traps each through all distinctive habitats. These lines attempted to capture the diversity of small mammals in each habitat. The second technique consisted of placing 5-m-wide rows of about 415 traps (5 m apart) within 2-hectare quadrats in the two dominant



plant/animal communities — Deciduous Beach-Ridge Forest, and Grass-Sedge Marsh. These generated quantitative data on species' numbers per hectare.

We also recorded the presence of other species through sightings and signs (i.e., droppings, nests, beds, trails and cuttings). The traps were checked each morning and left active for three days and nights, by which time the local species and the majority of individuals were captured. Several hundred specimens were preserved and entered into the Manitoba Museum's research collection. Detailed lists of traplines, species, and numbers captured each night by habitat were recorded in the senior author's field notebook at the Manitoba Museum.

## Results

While the coastal wetland along the southern shore of Lake Manitoba might appear at first like a monotonous sea of grasses, cattails and ponds, there is in fact a variety of distinct habitats running from the sandy lake shore south to disturbed old-fields and agricultural fields (both formerly mixed-grass prairie), and deciduous-forest woodlots. The following categories list the main habitats (with representative plant species) from the lake shore south to old-field/woodlot, and note the species captured/observed in each (in approximate order of abundance).



**FIGURE 4:** A trail through the beach-ridge forest. Photo credit: R. Wrigley.



**FIGURE 5:** Beach-ridge forest transitioning into grass-sedge marsh and cattail-phragmites marsh. Photo credit: R. Wrigley.



**FIGURE 6:** The marsh in spring, flooded by the melting of an exceptional accumulation of snow. Photo credit: R. Wrigley.



**FIGURE 7:** A spring view of phragmites marsh with an old-field and woodlot in the background. Photo credit: R. Wrigley.



**FIGURE 3:** The shoreline of Lake Manitoba with the sandy beach, rushes, and willow-shrub zones impacted heavily by high water, wind and wave action. Photo credit: R. Wrigley.



**Shoreline Rushes** (*Scirpus* spp., *Eleocharis acicularis*, *Juncus balticus*, *Carex atherodes*)

Eastern Deer Mouse  
Meadow Jumping Mouse  
Eastern Meadow Vole  
Northern Short-tailed Shrew  
Southern Red-backed Vole

**Shoreline Willow Shrubs** (*Salix interior*, *Salix exigua*, *Salix alba*)  
Eastern Deer Mouse  
Meadow Jumping Mouse  
Southern Red-backed Vole  
Northern Short-tailed Shrew  
White-tailed Deer

**Beach-ridge Forest** Sand ridge averaging 90 m in width (*Fraxinus pennsylvanica*, *Acer negundo*, *Populus deltoides*, *Celtis occidentalis*, *Salix amygdaloides*, *Ulmus americana*, *Prunus virginiana*, *Salix interior*, *Cornus sericea*, *Corylus americana*, *Sambucus racemosa*, *Toxicodendron radicans*)  
Southern Red-backed Vole  
Eastern Deer Mouse  
Northern Short-tailed Shrew  
Cinereous Shrew  
Meadow Jumping Mouse  
Franklin's Ground Squirrel  
Eastern Meadow Vole  
Eastern Chipmunk  
Eastern Grey Squirrel  
Red Squirrel  
Northern Flying Squirrel  
Woodchuck  
Northern Raccoon  
Striped Skunk  
Red Fox  
White-tailed Deer  
Eastern Red Bat  
Silver-haired Bat

**Wet Meadow** Seasonally/temporarily flooded (*Scolochloa festucacea*, *Carex atherodes*, *Elymus canadensis*, *Chenopodium rubrum*, *Atriplex patula*)  
Eastern Meadow Vole  
Cinereous Shrew  
Northern Short-tailed Shrew  
Arctic Shrew  
Meadow Jumping Mouse  
Southern Red-backed Vole  
Eastern Deer Mouse  
Franklin's Ground Squirrel  
Richardson's Ground Squirrel  
Woodchuck

Snowshoe Hare  
Striped Skunk  
Ermine  
Eastern Chipmunk (10 m from woods)  
White-tailed Deer

**Marsh** (*Phragmites australis*, *Typha latifolia*, *Mentha canadensis*, *Cirsium arvense*, *Sonchus arvensis*, *Cicuta maculata*, *Urtica dioica*)  
Eastern Meadow Vole  
Cinereous Shrew  
Northern Short-tailed Shrew  
Arctic Shrew  
Meadow Jumping Mouse  
Franklin's Ground Squirrel  
Muskrat

**Salt Flat** (*Hordeum jubatum*, *Salicornia rubra*, *Chenopodium salinum*, *Suaeda calceoliformis*, *Senecio congestus*, *Puccinellia nuttalliana*, *Sonchus arvensis*, *Atriplex patula*)  
Eastern Meadow Vole  
Meadow Jumping Mouse

**Old-Field** (*Bromus inermis*, *Schizachyrium scoparium*, *Cirsium arvense*, *Fallopia convolvulus*)  
Eastern Meadow Vole  
Cinereous Shrew  
Northern Short-tailed Shrew  
Northern Pocket Gopher  
Richardson's Ground Squirrel  
Thirteen-lined Ground Squirrel  
White-tailed Jackrabbit

**Deciduous Forest Woodlot** (*Fraxinus pennsylvanica*, *Acer negundo*, *Populus tremuloides*, *Quercus macrocarpa*, *Cornus sericea*)  
Southern Red-backed Vole  
Northern Short-tailed Shrew  
Eastern Deer Mouse  
Cinereous Shrew  
Eastern Chipmunk  
Eastern Grey Squirrel  
Red Squirrel  
Thirteen-lined Ground Squirrel (grassy edge)  
Richardson's Ground Squirrel (grassy edge)  
Northern Flying Squirrel  
Snowshoe Hare  
White-tailed Deer  
Ermine

## Quadrat Study Results

The Deciduous Beach-Ridge Forest Quadrat (28 August to 2 September, 1972) produced 101 specimens of 11 species: Southern Red-backed Vole (52), Northern Short-tailed Shrew (16), Cinereous Shrew (12), Meadow Jumping Mouse (9), Eastern Deer Mouse (6), Eastern Chipmunk (1), Northern Flying Squirrel (1), Eastern Grey Squirrel (1), Woodchuck (1), Snowshoe Hare (1), Striped Skunk (1).

The Grass-Sedge Marsh Quadrat (29 August to 3 September, 1972) produced 232 specimens of 7 species: Eastern Meadow Vole (192), Cinereous Shrew (19), Arctic Shrew (10), Meadow Jumping Mouse (6), Northern Short-tailed Shrew (3), Eastern Deer Mouse (1), Ermine (1). Many traps were set off from rain, wind-blown grass, and the high population of Leopard Frogs (*Lithobates pipiens*).

## Species Recorded In This Study (26)

Cinereous Shrew (*Sorex cinereus*)  
Arctic Shrew (*Sorex arcticus*)  
Northern Short-tailed Shrew (*Blarina brevicauda*)  
Eastern Chipmunk (*Tamias striatus*)  
Red Squirrel (*Tamiasciurus hudsonicus*)  
Eastern Grey Squirrel (*Sciurus carolinensis*)  
Northern Flying Squirrel (*Glaucomys sabrinus*)  
Richardson's Ground Squirrel (*Urocyon richardsonii*)  
Franklin's Ground Squirrel (*Poliocitellus franklinii*)  
Thirteen-lined Ground Squirrel (*Ictidomys tridecemlineatus*)  
Woodchuck (*Marmota monax*)  
Northern Pocket Gopher (*Thomomys talpoides*)  
Eastern Deer Mouse (*Peromyscus maniculatus*)  
Eastern Meadow Vole (*Microtus pennsylvanicus*)  
Southern Red-backed Vole (*Myodes gapperi*)  
Muskrat (*Ondatra zibethicus*)  
Meadow Jumping Mouse (*Zapus hudsonius*)  
Red Fox (*Vulpes vulpes*)  
Striped Skunk (*Mephitis mephitis*)  
Northern Raccoon (*Procyon lotor*)  
Ermine (*Mustela erminea*)  
White-tailed Deer (*Odocoileus virginianus*)  
Snowshoe Hare (*Lepus americanus*)  
White-tailed Jackrabbit (*Lepus townsendii*)  
Eastern Red Bat (*Lasiurus borealis*)  
Silver-haired Bat (*Lasionycteris noctivagans*)

## Species Unrecorded in This Study, but Whose Distributions include the Delta Area (21)<sup>16</sup>

American Pygmy Shrew (*Sorex hoyi*)  
Prairie Shrew (*Sorex haydeni*)  
North American Water Shrew (*Sorex palustris*)  
North American Porcupine (*Erethizon dorsatum*)  
North American Beaver (*Castor canadensis*)  
Least Chipmunk (*Neotamias minimus*)  
Eastern Fox Squirrel (*Sciurus niger*)  
Eastern Cottontail (*Sylvilagus floridanus*)  
Big Brown Bat (*Eptesicus fuscus*)  
Northern Myotis (*Myotis septentrionalis*)  
Little Brown Bat (*Myotis lucifugus*)  
Hoary Bat (*Lasiurus cinereus*)  
Coyote (*Canis latrans*)  
Canada Lynx (*Felis canadensis*)  
Bobcat (*Felis rufus*)  
Cougar (*Puma concolor*)  
North American Black Bear (*Ursus americanus*)  
American Mink (*Neogale vison*)  
Long-tailed Weasel (*Neogale frenata*)  
Least Weasel (*Mustela nivalis*)  
American Badger (*Taxidea taxus*)

## Species Extirpated (9)

Grey Wolf (*Canis lupus*)  
Brown Bear or Grizzly (*Ursus arctos*)  
American Marten (*Martes americana*)  
Fisher (*Pekania pennanti*)  
Wolverine (*Gulo gulo*)  
Moose (*Alces americanus*)  
Mule Deer (*Odocoileus hemionus*)  
North American Elk (*Cervus elaphus*)  
American Bison (*Bison bison*) (teeth found on the lake shore)

## Discussion

A total of 56 species may be listed as native to the marshland between Delta and St. Ambrose, with 26 species detected in the present study, 21 others that were missed or may occur here occasionally (i.e., Delta Marsh is within the current range maps for these species),<sup>16</sup> and nine species that are considered extirpated (outside current range maps for these species).<sup>16</sup> To this list may be added the introduced House Mouse (*Mus musculus*) and Brown Rat (*Rattus norvegicus*), which exist commensally with people in homes, cottages and farm outbuildings, but may

disperse out into natural habitats during the warm season (authors' data and<sup>16</sup>). In later years, Sealy<sup>8</sup> collected several North American Water Shrews, a species which we failed to detect. The Eastern Cottontail (*Sylvilagus floridanus*) has likely spread to the Delta area in recent times, but we did not record it in the early 1970s.<sup>17</sup> The Fox Squirrel arrived into the Red River Valley of southern Manitoba around 1970 from North Dakota, and rapidly spread throughout the southern parts of the province, but it had not yet reached Delta during our study period.<sup>18</sup> The presence of humans in the region<sup>19,28</sup> may also be added, for a total of 59 species.



**FIGURE 8:** North American Water Shrew (staged). Photo credit: R. Wrigley.

With the rich abundance of small mammals present in the area, avian predators were seen on the hunt, including Bald Eagles (*Haliaeetus leucocephalus*) and Cooper's (*Accipiter cooperii*), Northern Harrier (*Circus hudsonius*), and Red-tailed (*Buteo jamaicensis*) hawks. Sowls<sup>4</sup> found that the Franklin's Ground Squirrel was a significant predator of waterfowl eggs in the Delta Marsh. We observed several Short-tailed Shrews on the beach-ridge road feasting on road-killed Leopard Frogs. Sealy<sup>8</sup> reported finding all four species of local shrews dead along the road by the beach-ridge forest, apparently killed and discarded by mammalian predators (likely due to the shrews' musky scent).

During the winter months of our field work, strong northwesterly winds deposited enormous snow drifts into

the beach-ridge forest from the lake, and as these rose slowly but steadily to a height of up to 5 m into the tree canopy, Snowshoe Hares and White-tailed Jackrabbits were able to browse on ever-higher tree buds and bark. On 24-26 April 1974, spring melt waters flooded the wet meadow and marsh to a depth of over 10 cm, causing a mass movement of Eastern Meadow Voles to higher ground in the beach-ridge forest; shrews were very scarce (possibly drowned or became hypothermic and perished). While the expansive, dense beds of phragmites reeds and cattails were not used by most mammals, nor for waterfowl nesting, we found the abundant presence of the Cinereous, Arctic, and Northern Short-tailed shrews, and the Eastern Meadow Vole. The management of reed/cattail stands and encroachment of woody vegetation in the marsh by fire was studied by Ward.<sup>20,21</sup> In another marsh study in Manitoba, Wrigley<sup>22</sup> found that many species of small mammals can survive a fire and recover their populations by retreating underground to isolated wet sites with some surviving vegetation.

The past five decades since we conducted our studies have seen several human-caused, ecologically deleterious changes in the Delta Marsh, which have no doubt negatively affected aquatic and terrestrial ecosystems, with profound effects on vegetation and waterfowl. Flood/drought fluctuations in prairie marshes are known to be essential in maintaining biotic diversity and productivity through rapid nutrient recycling. Stabilized water levels on Lake Manitoba, introduced by Manitoba Hydro (controlled by the Fairford River dam) since 1961, have prevented these natural fluctuations so regenerative of prairie marshes. A Marsh Ecology Research Program was conducted at Delta to investigate long-term responses of marsh vegetation to water-level stabilization.<sup>23</sup>

The Portage Diversion (funneling excess flood water from the Assiniboine River to Lake Manitoba) has on occasion flooded the marsh and caused the accumulation of undesirable sediment. Excessive nutrients and pollution from farms and towns have also made their way into the marsh, reducing



water quality and occasionally causing algal blooms and surface cover of floating pond weeds, resulting in an impoverished aquatic ecosystem. Catastrophic spring floods of Lake Manitoba in some years (e.g., 1955 and 2011) temporarily submerged most of the marsh's terrestrial habitats (reducing significantly the stands of least-tolerant cattail and whitetop grass), and likely drowned out populations of the local fauna. Variations in water levels in the marsh have ranged up to 1.5 m.<sup>6</sup> Hibernating species, such as the Meadow Jumping Mouse, Woodchuck, and the three species of ground squirrels, would have been most vulnerable to flooding of their hibernacula; a population crash in Franklin Ground Squirrels was reported during overland flooding near Delta in 2001.<sup>5</sup>

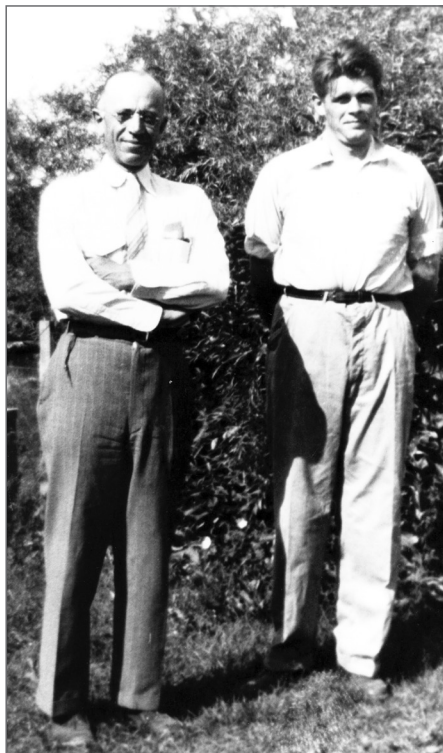
One of the most dramatic negative alterations to marsh ecology due to the above factors was the marked reduction in Muskrat populations, from pre-1950 estimates as high as 100,000 to rarity in the early 1960s, after water-levels were stabilized by Manitoba Hydro.<sup>6,24</sup> In 1955/56, Olsen<sup>6</sup> determined that litter size ranged from 4-11 (average 7.3), with most females bearing one litter per year (range of one to four litters). High water levels not only reduced the population by depleting food resources (i.e., emergent vegetation), but also flooded-out houses, causing mortality of litters. With an average of 20.4 young produced per female (with 2.8 litters) annually, it becomes apparent that the Muskrat population may increase rapidly under favourable water-levels and food resources. Populations in experimental marshes at Delta in 1985 ranged from 0.4/ha in May to 21.3/ha in October, with a high of >30/ha after the second growing season.<sup>7</sup>

The invasion of non-native Carp into the Delta Marsh in the 1950s resulted in great numbers of spawning fish entering the marsh from the lake each spring. Their bottom-grubbing feeding activity created turbid water conditions and release of excessive nutrients from bottom sediment, negatively altering and diminishing the aquatic fauna and flora of the marsh. This in turn has led to the deterioration of Delta's famous

waterfowl- and wetland-bird breeding grounds. The construction of dikes and installation of exclusion screens have been able to limit the entry of most adult carp, leading to a marked improvement in marsh ecology (i.e., water clarity and return of submerged plants and zooplankton), with subsequent increased use of the marsh for breeding and staging by wetland bird life.<sup>25, 26</sup>

The invasion of a European subspecies of the Common Reed, *Phragmites australis*, has largely replaced the native subspecies, *Phragmites australis americanus*, and then the appearance of the aggressive cattail *Typha angustifolia* (possibly introduced from Europe) and its hybrid, *Typha x glauca*, have now outcompeted the original species, *Typha latifolia*, at Delta. Exotic plants have altered the distribution of marsh cover and open water in the marsh, affecting the occurrence of both aquatic and terrestrial faunas. Summaries of these changes were covered by Bossenmaier<sup>27</sup> and more recently in Suggett et al.<sup>28</sup>

Walking along the sandy beach and forested ridge, and through the marsh grass, we felt the former presence




**FIGURE 9:** In 1938, Dr. Aldo Leopold and his graduate student Hans Albert Hochbaum meet to plan the Delta Duck Station, which opened the following year. Peter Ward became the Station's first research assistant. Photo credit: University of Wisconsin—Madison Archives.

of prominent biologists, such as conservation-pioneer Aldo Leopold. We had opportunities to befriend wildlife artist Colleen Nelson, who conducted much of her research (commencing in 1966) at Delta for her remarkable book, "The Downy Waterfowl of North America."<sup>29</sup> She wrote about her experiences at Delta in an article for Manitoba Nature Magazine.<sup>30</sup> We met with botanist Jennifer Shay (founding Director of the University of Manitoba Field Station), artist and author Albert Hochbaum (Director of the Delta Waterfowl Research Station), and Peter Ward (Manager of the latter facility), who prepared articles on marsh fire ecology<sup>20</sup> and for Manitoba Nature Magazine.<sup>21</sup> Sadly, the University of Manitoba Delta Marsh Field Station fell into decline after major flood damage and no longer exists (closed 2011), but the flow of research and visitors continues to flourish at Delta.<sup>31</sup> We hope our efforts in studying the mammalian ecology of the marsh so many years ago prove useful to future researchers, marsh managers, and naturalists drawn to this wonderful prairie marsh.

## Acknowledgements

We thank the dedicated efforts of our volunteers for participating in the field work, sometimes under rather trying conditions. These include Calvin Cuthbert, David Hatch, Allan Miller, Barbara Fisher, Ernie Walker, Pat Stewart, Gordon Stelman, Brian Zawadski, and Bob Ralke. We appreciated being able to conduct our field work on the properties of the University of Manitoba Field Station (Dr. Jennifer Shay), and the Delta Waterfowl Research Station/ Delta Waterfowl (Peter Ward, and Jim Fisher, Director of Conservation Policy), whose cooperation assisted with the efficiency and enjoyment of our research activities. For making available literature on muskrats at Delta, we thank Dean Berezanski (Population Assessment Unit, Fish and Wildlife Branch, Manitoba Natural Resources and Northern Development). We are grateful to Dr. Robert M.R. Barclay for offering improvements to the manuscript, and to Dr. James Hare for providing the photo of the Franklin's Ground Squirrel.

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## RECIPIENT OF THE NATURE SASKATCHEWAN 2022 CLIFF SHAW AWARD: Vladimir Kricsfalusy

Each year, the Editor of *Blue Jay* chooses the recipient of the Cliff Shaw Award. This award acknowledges an article that appeared in the most recent four issues of *Blue Jay* (Fall 2021 to Summer 2022), which merits special recognition for its contribution in any branch of natural history. In 2022, Vladimir Kricsfalusy was chosen to receive the Cliff Shaw Award for his article “Rare Vascular Plants of Redberry Lake Biosphere Reserve”, which appeared in the Winter 2021 (volume 79, no. 4) issue of *Blue Jay*.

Redberry Lake Biosphere Reserve (RLBR) is the only protected area of its kind in Saskatchewan, being designated by UNESCO in 2000 with the purpose to conserve biodiversity and foster sustainable development and capacity building through research, education monitoring and training. There is limited data on biodiversity in this area, and what exists is predominantly focused on birds.

Vladimir's article improves the understanding of biodiversity at a regional scale for different taxonomic groups, and documents the distribution of rare species for conservation planning as they are usually underrepresented in establishing protected areas. He collected rare plant information from literature, databases, herbariums and field studies and his efforts resulted in 18 species being identified as at risk at the global, national and subnational levels.

Through his study, and his paper, Vladimir substantially increased the knowledge and locations of rare plants in RLBR — 10 of 18 were new for the biosphere. He also identified threats to these plants, including successional woody growth, recreational activities and habitat destruction.

Aside from documenting these rare plant species, Vladimir concludes with suggested conservation management actions that are needed, including monitoring to help determine if the species are declining.

The results of Vladimir's study will help to designate priorities for the conservation of rare plants, which are important for raising public awareness and promoting political action. 