

**The Wapsipinicon:
A Gentle Refuge**

Rare Plants In Her Realm



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"There's always been a strangeness hovering over all this land . . . there are layers and layers of history here, like a chair with 10 coats of enamel. And . . . some of those layers were peeling off, floating in the air, waiting to be breathed in, soaked up like sunshine." — W.P. Kinsella, *The Iowa Baseball Confederacy*

IOWA contains the least amount of native land of any state in the U.S.—and probably the entire Western Hemisphere—with less than five percent of the surface (and likely less than one percent) being covered with relatively undisturbed examples of original presettlement plant and animal communities. It has always astounded me that within such a sea of corn, beans, bluegrass and concrete, much of the original biological diversity still hangs on tenaciously. Of the approximately 1,900 plant species that have been recorded from the state, perhaps only 25-30 may now no longer occur here. Of the 150 or so native butterflies that have been collected in Iowa, only four have not been seen in recent years, and these losses are due solely to mismanagement of sites by conservation agencies. Our natural heritage miraculously persists, hidden away in the edges of woods, on the side of steep banks and in unplowed corners of fields.

These natural habitat remnants have not been equally distributed throughout the state, being usually found in places where the hills were a bit too steep to be farmed, the soils a bit too thin, rocky, or lean to be plowed, and the settlers a bit less motivated by profits and more motivated by the sound of geese on a cold November night drifting in from the back 40. People like me, who spend most of our summers rambling around the back roads of Iowa searching for these fragments of our natural history, come to know these regions

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well, for this is where our most exciting discoveries are to be made. Because of the untillable land present, it is probably not too surprising that the northeastern Paleozoic Plateau region with its many steep, rocky woods and slopes, the rugged Loess Hills of the western counties, the region about the Iowa Great Lakes in the northwest and the sandy ground along the Mississippi and Cedar Rivers near Muscatine have been recognized as the most important places to find native habitats and rare species in Iowa.

But another must be added: the Wapsipinicon River basin. Throughout its length from its headwaters near McIntire on the Minnesota border to its confluence with the Mississippi just south of Camanche, the Wapsipinicon cradles a rich and varied collection of native habitats, perhaps unmatched in the state. In particular, the small stretch between Quasqueton and Olin may contain more threatened and endangered species for its area than any other area in Iowa, a surprising statement when this stretch is compared to the rugged and spectacular landscapes associated with Iowa's other diversity centers. The reasons why the Wapsi's gentle, placid valley should harbor more endangered plants than the forested canyons leading back from the Mississippi or the complex hilly land along the Altamont moraine at Lake Okoboji are many and varied and point to the way in which subtle contingencies can conspire to enrich diversity of species and habitats.

TO BEGIN the explanation for the biological richness of the Wapsi valley, it is necessary to go back 440 million years, when what we now know as Iowa was part of a vast shallow, tropical, southern hemisphere sea. In these clear, shallow waters life forms took calcium and carbon dioxide from the water and converted them into the mineral calcite. The limy mud which rained down upon the ocean floor, made up of the dead bodies of countless billions of small creatures that incorporated lime into their cell walls for protection,

became over a few hundred million years the rock we term limestone. The remains of larger creatures living within these seas would become entombed within this limy mud and were often also preserved as fossils. Throughout the Wapsi valley it is not uncommon to find pieces of coral, brachiopod shells or stems from crinoids which once flourished in these seas. The lime-rich bedrock comes in two major types: limestones are made of calcium carbonate, while dolomite has had half of its calcium atoms replaced by magnesium. The older Silurian rock along the Wapsi tends to be dolomite, while the younger, Devonian rock tends to be limestone. This difference becomes important when their strength is compared: dolomites in the Wapsi basin are somewhat more resistant to erosion. The effect of this slight change in bedrock chemistry is most striking as one travels from Troy Mills to Paris (where it flows over Devonian limestone) past Central City through Waubeek, Matsell Bridge and Stone City (where it begins traveling over Silurian dolomites). The shallow limestone ledges occasionally found around Troy Mills quickly change just south of Central City into taller dolomite cliffs within a deeper, more rugged valley.

Following bedrock formation, the next important geological event to shape the Wapsi valley began some 2.5 million years ago when the first of the great continental glaciers pushed south of out of the Laurentian Shield and Hudson's Bay to herald the start of the Ice Age. The record left in their remaining deposits makes clear that over this period the area was covered by multiple glacial advances. The last ice sheet to visit the Wapsi melted away almost a half-million years ago, with the last continental ice sheets having missed the region entirely. The glacier left behind a complex assortment of sediments ranging from silty pebbly clay, known as glacial till, to large rounded boulders—some the size of a small truck—called glacial erratics. Where water ran out from the ice, outwash sand and gravel deposits accumulated. The intervening years have smoothed and rearranged the contours of this landscape, removing the obvious signs of glaciation that are still present in younger landscapes. But it

could not remove the many different substrates below.

The fact that the Wapsi basin has been exposed to erosion for hundreds of thousands of years, but not directly to the ravages of glacial ice, is essential to an understanding of the diversity of habitats. Although missed by the last two glacial advances, the area was still impacted by their frigid climates. From the available data, it is apparent that 23,000-16,000 years ago, the whole of northeastern Iowa was covered by what would now be considered arctic tundra, with the ground locked in permafrost, just as is true today for northern Canada and Alaska. In fact, the landscapes seen along the Dalton Highway as it passes north of the Brooks Range toward Prudhoe Bay in Alaska were eerily reminiscent of the Wapsi basin because of this permafrost-driven (periglacial) erosion. The repeated seasonal thawing in summer of the top few feet of the permafrost combined with its freezing again in the winter created ground that was continually churned, with large rocks being "floated" to the surface, wedges of sand being deposited in fissures and hillsides being eroded a bit more steeply than one would otherwise expect. In places, enough of the underlying glacial till was removed to expose bedrock. While the summer thaw and subsequent soil erosion was effective at keeping thick wind-blown silt (loess) from accumulating, sand—sourced from local glacial till and outwash from the great ice sheet to the north and west—did collect. The lack of uniform loess mantle across the Wapsi basin allowed the great diversity of underlying sediments to be exposed. In other areas of the state where loess accumulations were not so thoroughly removed, there is a decreased diversity of soils and thus fewer habitats available for both plants and animals to live.

Erosion rates were not uniform across the Wapsi basin. For instance in northeastern Mitchell County only a few feet of glacial till remain resting over the bedrock, while in Linn, Jones and Clinton Counties to the south, till deposits over 60 feet thick are not uncommon. The amount of residual loess left in the landscape also changes; in the north, it is completely absent, while in the south it covers many ridge crests

along the river. Sand washed into the Wapsipinicon was lifted from the floodplain during the great windstorms created from the air pressure differential between the ice sheet to the north and the exposed land to the south. Some ridges next to the river acted like snow fences and eventually became covered by thick layers of fine sand which were then sculpted into dune fields.

This complex interaction of various earth materials, affected by late glacial-age changes in climate and erosional history is characteristic of a large region of northeastern Iowa which has been termed by geologists as the Iowan Erosional Surface. The Wapsi stands as an integral part of this region.

THE PERIGLACIAL erosion of glacial till and bedrock, plus irregular accumulations of loess and sand during the height of the last ice age combined with the modern erosional and depositional history of the Wapsipinicon River itself has created an intriguing assortment of habitats for native species to colonize. To begin this discussion, we must first consider the typical habitats which covered the largest extent of the Wapsipinicon basin: the tallgrass prairie, the deciduous forest and the riparian forest.

Tallgrass prairie was found throughout the gently undulating uplands away from the river where the soils were deep and rich and neither too wet nor too dry. How these prairies must have appeared can only be imagined, as they were the first to be systematically destroyed by European settlers. The ease of plowing and richness of the soil guaranteed the almost total extinction of this community. Within the entire Wapsi basin, perhaps no more than a few dozen acres of this once dominant habitat may now exist, tucked away along railroad rights-of-way, settlers' cemeteries and the corners of fields.

The two forest communities have fared somewhat better, thanks to their somewhat less agriculturally productive soils. From Central City south through Anamosa, dense deciduous

forests of oak, maple, basswood, hickory and ash are still found in the shallow soil on the slopes above the river. In more than a few places the hillsides are covered with Wild Ginger, Spring Beauties, Dutchman's Breeches, Bellworts, Shooting Stars and Virginia Bluebells. It is also possible, with a little perseverance, and luck, to find some of the rarer woodland flowers such as Yellow Lady's Slippers, and Puttyroot, Three-birds and Rattlesnake Plantain Orchids. Sadly these relatively undisturbed woodlands are becoming increasingly endangered from grazing and logging.

Riparian forests encompass the many thousands of acres of River Birch, Silver Maple, Black Ash, Box Elder and Black Walnut in the bottom lands and along the stagnant backwater of the river. They exist in considerable acreage at Troy Mills, Paris and Matsell Bridge. While not very diverse, they none-the-less represent the only habitat within the region for such plants as the Green Dragon and the Cardinal Flower.

A number of much rarer habitats were also present, and it is their existence that has contributed so much to Wapsi basin biodiversity. The most important of these near the stretch of river between Quasqueton and Olin are limestone glades, limestone cliffs, sand prairies, sand ponds, vernal pools and fens. In large part these unique habitats owe their presence to the combination of geological processes and surface materials that occur in the region.

Limestone glades occur in those areas where erosion removed the old glacial till, exposing the underlying limestone (or dolomite) bedrock at the surface. They are places exposed to the heat of summer as well as the cold of winter and represent some of the driest prairies in the state. In a limestone glade, xeric prairie plants grow out of cracks in the exposed limestone or in the few inches of soil which may have developed in the limestone rubble on the surface. Unlike typical tallgrass prairie vegetation, growth is reduced; most grasses and other flowering plants may grow no higher than one to two feet. Not surprisingly, the usual species found in them are more frequent in the west; many, like Pasqueflower, Serrate Evening-primrose, Silky Aster, Upland White Aster and

Ground Plum are more typical of the Loess Hill prairie along Iowa's western border.

Limestone cliffs are found in the regions of Silurian dolomite outcrop between Central City and Anamosa along both the Wapsi and Buffalo Creek. On cool, moist, north-facing exposures, a unique flora may be found that is much more typical of the Paleozoic Plateau region to the northeast. Along Buffalo Creek east of Central City, for example, is one of the few Paper Birch groves in Iowa outside of the northeastern counties. A bit upstream, on another north-facing limestone bluff, grows the only Witch Hazel population on the Iowan Erosional Surface.

Three of the special habitats of the Wapsi basin are associated with upland sand deposits. Sand prairies lie in the driest places, and often the prevailing winds have reworked the surface into dunes. Such places are frightfully dry and hot in the summer; rainfall quickly runs out of the sterile sand, leaving the ground surface to bake in 120°F heat during sunny days. Plant growth is often stunted, sometimes being no more than a few inches tall. In other places, it is too dry for even these plants to grow, leaving only the bare, yellow sand to cover the ground. It is from these places that the only native cactus species are situated, as well as a number of other western plants such as Green Milkweed, Eye-brow Grass Pinweed and Wild Flax.

Sand ponds are found in low spots between dunes or where a small stream was blocked at some time in the past by shifting sands. The shallow water of these ponds is frequently covered by dense growth of aquatic plants, including Duckweeds, Pondweeds, Pickerelweeds and carnivorous Bladderworts. Because sand ponds form where infiltrating rainwater contacts impermeable glacial till, their water levels fluctuate greatly from year to year, being prone to complete drying during droughts. Sand ponds are not common, with only a half dozen or so occurring within the Quasqueton-Olin stretch. However, they represent the only natural still water bodies in the uplands. Perhaps the best developed example is found just north of Central City along Highway 13. Over a half-

dozen endangered plants, including Huckleberry and Water Shield have been found there.

Vernal pools are always associated with sand prairies, but may or may not be associated with sand ponds. These are places that may be under a foot or two of water in the spring but by mid-summer will be bone-dry. Usually they are found at the base of sand prairie dunes, where snow melt runoff and spring rains briefly accumulate or on the shallow margins of sand ponds where any yearly water fluctuations may be expressed. This fluctuating water table makes for a difficult environment, being too wet during some of the year for dry-loving plants and too dry the rest of the year for wet-loving species. Only a very few plants can tolerate such extremes. Compounding this harsh water regime is their pure sand soils containing few nutrients to aid plant growth. Most characteristic vernal pool species are not typically of the Midwest; rather, they normally live from Cape Cod to Florida and Louisiana along the Atlantic Coastal Plain. Most of the plants restricted to vernal pools are very small, often no more than six inches tall. The ground surface is usually covered with clumps of Jade Green Haircap Moss, with plants such as Lance-leaved Violet and Purple Gerardia being scattered among the mosses. These include some of the rarest plants in the state, with many being known from fewer than six locations and some from single populations only. Supporting over 20 state-endangered plants, vernal pools rank among the most important habitats in Iowa for conservation of rare species.

For almost 100 years, fens were believed to be restricted in Iowa to the area surrounding Lake Okoboji in northwestern Iowa. In 1984 I was shown an intriguing wetland habitat along the banks of the Little Wapsi near Sumner and in 1985 an almost identical site on the western side of Rowley. These two places shared saturated, peaty soils fed by ground water. After later seeing the fens of northwestern Iowa, it became clear that these eastern Iowa places were also fens. By fall, 1991, I had located over 170 fens throughout the northeastern quarter of the state; of these, some of the finest examples are found within the Wapsipinicon basin.

Fens are areas of peat soil fed by mineral-rich underground water sources. Because of their unique hydrology, guaranteeing a constant source of water, they are fairly well buffered from the vagaries of short-term weather patterns. During the drought of 1988, for instance, there was little change in water influx into Iowa fens, and the species living within them did not suffer. The constant temperature of the water is also important, as it helps buffer fen soils from the greatly varying Iowa climate. Even on the hottest days of summer, the soil temperature in a typical Iowa fen, 20 cm below the surface, will rarely exceed 65F. In the winter, when frigid arctic wind freezes the soil two to three feet deep in other places, only the very upper few inches will freeze in a fen.

Fens form where underground aquifers or perched water tables have been exposed through erosion. In the central Wapsi basin, this almost exclusively occurs where periglacial erosion 20,000 years ago ate into a sand and gravel deposit left over from the last glacier. The frequency of fens in the Wapsi basin and the Iowan Erosional surface as a whole, is due to the lack of loess cover. If present it would have acted as a bottlecap, keeping the water sealed within the ground. Because the water-bearing gravel deposits are frequently exposed on hillsides, fens in eastern Iowa are often elevated above surrounding drier soils as either mounds or terraces. Those that have developed into conical 5-20 foot tall peat mounds were termed "mound springs" by original settlers. Many of these sites are still termed mound springs by their owners. To say the least, walking *uphill* onto a peat bed so wet that waves of earth are generated with each step is a singular experience.

What makes fens particularly interesting to people like me is that they support a number of Iowa's rarest species. Until their discovery in eastern Iowa in 1984, many of these were considered either extinct or among the rarest in the state. A decade later many are now known not to be so endangered, but all require these unique and special conditions to live. In all, some 50 threatened or endangered Iowa plants, 12 rare

butterflies or skippers and a number of very rare mosses and snails have been observed in these sites.

HAVING BEEN introduced to the "why" and "what" of our story, it seems high time to discuss the "who"—the rare species themselves. At latest count, approximately 60 rare or endangered Iowa plants have been located between Quasqueton and Olin. If the entire Wapsi basin were to be considered, this number likely could be doubled. Let's start with some of the rare wildflowers.

Grass-of-Parnassis (*Parnassia glauca*) is a lovely late summer wildflower of fens. It sends single one-inch diameter flowers on long, narrow, leafless stems from a cluster of green shiny, almost succulent basal leaves. A single clump may produce 30 to 40 blooms over a two-week period, converting their fens into a sea of white, bobbing blooms. This wonderful plant was feared extinct from eastern Iowa as they had not been recorded by botanists from the region since 1912. Since 1985, I have seen this species in three fens along the Wapsi. And it is often found with another legendary wildflower, the Fringed Gentian (*Gentiana crinita*). Blooming in September, Fringed Gentians open their almost impossibly azure blue flowers only on sunny days. To see a wet, peaty spot emblazoned by the blue and white of Fringed Gentians and Grass-of-Parnassis in the late summer sun is to see one of the most breathtaking sights in the state. Also feared near extinction in Iowa in the late 1970's, Fringed Gentians have also proven to be frequent within fen communities and occur in at least eight fens along the central Wapsi.

The Milkworts represent a showy, but fairly unknown group of wildflowers. The Sand Milkwort (*Polygala polygama* var. *obtusata*), a small, six-inch plant with two-inch spikes of pink, orchid-like flowers, is known from only six populations in the state; all but two are found within the Wapsipinicon basin. It occurs in dry, open dunes on sand prairies and

also on the dry margins of vernal pools. The largest population in the state, with well over a thousand individuals, is found northwest of Walker. The Pink Milkwort (*Polygala incarnata*) is an oddity, being an annual plant with a photosynthetic stem and no leaves. Its spike of tubular, pink flowers begin blooming in July and continue until frost. Restricted to perhaps no more than three populations within the state, one of these occurs on dry sand prairie in the Matsell Bridge area. The Cross-leaved Milkwort (*Polygala cruciata*) is the rarest Milkwort in the state. It had not been seen alive for over 90 years when rediscovered in an acidic fen and adjacent vernal pool near Walker in 1987. It too is an Atlantic Coastal Plain species, restricted here to such habitats.

The Orange Pinweed (*Hypericum gentianoides*) was long considered extinct from Iowa—the last time recorded alive was in Clinton County in 1932. In 1987, however, a large population was discovered in the open, dry sand of a vernal pool habitat in southern Buchanan County northwest of Walker. Like the Pink Milkwort it is an annual wildflower which has no leaves—only a photosynthetic stem. In bloom, this plant reminds me of a small (two to three inch) wire brush with orange flowers. Like other vernal pool species, this one also is more usually associated with the Atlantic Coastal Plain.

Another rare vernal pool wildflower is the Yellow-eyed Grass (*Xyris torta*). It is a difficult plant to observe when not in bloom. The leaves resemble grass, and the flowering head is nothing more than a small woody ball at the end of a narrow, thread-like, twisted stem. When in bloom, however, one-half inch, three-petaled lemon-yellow flowers emerge from the woody tips. Like the Orange Pinweed, this Atlantic Coastal Plain species was also recently considered extinct from the state, having last been collected in the 1950's from Cedar County. In 1983, on the margin of a sand pond just west of Troy Mills, I discovered a population of approximately 50 Yellow-eyed Grass plants. They were growing amid clumps of Haircap Moss on the edge of a sand pond. Since 1983, I have located two additional populations in the vernal pools west of Walker. One of these is very large, and literally

tens of thousands of plants are present. In mid-July during the peak of the bloom, the bottoms of the vernal pools at this location become covered in a sea of yellow blooms.

Two species of native cactus have been found in the sand prairies bordering the central Wapsi, the Fragile Prickly-pear (*Opuntia fragilis*) and the Large-rooted Prickly-Pear (*Opuntia macrorhiza*). The Fragile Prickly-Pear is found in barren, dry, open dunes on a single sand ridge along the Buchanan-Benton county line west of Walker. Until its discovery in the spring of 1985, this western species was believed restricted in Iowa to a single population 300 miles to the northwest. This species is characterized by the small size of its pads and by the weakness of the joints holding them together. Walking through a colony of this cactus is very much like walking through a field of very large sandburs, with cactus pieces hitching a ride and covering your lower pant legs. The Big-rooted Prickly-pear was not known to occur in Iowa at all until I found it near Camp Hitaga near Walker in 1982. A species typical of Colorado and the western Great Plains, it has found the open dunes of this sand prairie a tolerable home within the relatively wet Iowa climate.

The Prairie Bush Clover (*Lespedeza leptostachya*), known from only 40 or so populations in the world, has been listed by the federal government as a threatened species. It is a one to two foot tall legume, with spikes of small pink and white pea-like flowers coming into bloom in late August. Its narrow, three-parted leaves are covered by a silky-gray pubescence, while the stem is rather coarse and very flexible. It is known only from Iowa, southern Minnesota, southwestern Wisconsin and northern Illinois. In the summer of 1991, I discovered a population near Troy Mills on a xeric limestone glade, where it was found with other more common prairie plants like Pasqueflower, Silky Aster and Lead Plant.

Not to be left out of this discussion are the wild orchids. There are approximately 34 native orchid taxa found in Iowa; a dozen or so of these have been recently observed along the Wapsi. The Small White Lady's Slipper (*Cypripedium candidum*), is a miniature variety of the more common Yellow

Lady's Slipper, being only six inches tall, with a tiny, white, one-inch diameter flower. Once common in wet prairies, this species is now restricted in the Wapsi basin to a single fen. The Pale-green Orchid (*Habenaria flava* var. *herbiola*) is only known from five populations in the state. One of the largest of these is found on the wet, sandy margin of a fen near Waubeek, where 50 plants may be seen in good years. The rarest of the native orchids, the Club-spur Orchid (*Habenaria clavellata*) is known from a single population in the state. Found in a vernal pool near Walker in the summer of 1991 with Green's Rush, Field Sedge, Yellow-eyed Grass and Sand Milkwort, this species had last been seen alive in Iowa in 1894. Only a single clump of eight plants was observed blooming, although another 10 non-blooming plants were observed in the surrounding habitat.

A number of the rare plants don't feature spectacular flowers. This includes some of the rare woody plants in the Wapsipinicon basin. This is true for the Huckleberry (*Gaylussacia baccata*), which is currently known from only five populations in the state. One of these is found in the moist, acidic soil along the margin of a sand pond north of Central City. At this site, Huckleberry occurs as a few small clumps on the margin of the pond. Sage Willow (*Salix candida*) is known from six locations along the central Wapsi basin. It's a small shrub, growing no more than two feet tall, with leaves dark green above and pure white and fuzzy below. It is found only in the cold, wet peaty soils of fens. Sage Willow reaches the southern limit of its range along the Wapsi; it is more typical of peat bogs and fens north of the Canadian border, ranging as far north as Alaska and Labrador. Until the early 1980's this willow was thought to be extinct in the state. A related species, Bog Willow (*Salix pedicellaris*), has also been rarely found in fens along the central Wapsi. Like Sage Willow, Bog Willow is a dwarf, northern shrub which is restricted to the cold, wet soil of fens. Unlike Sage Willow, Bog Willow has completely smooth, hairless leaves which have a reddish-blue cast. It was thought to be limited to one site in the state; it is now known from seven northeastern Iowa counties.

A number of rare sedges have been found within the Wapsipinicon basin. Even the most charitable botanist would agree that they are nondescript, with their small, modified flowers looking something like grasses. However unassuming, sedges also represent one of the state's most diverse plant groups and include many rare Iowa species. One of the more interesting rare sedges found within the central Wapsi basin is the Deep Green Sedge (*Carex tonsa*), which is restricted to open, bare dunes within sand prairies. Until 1988 this species was thought to occur only in two or three sand prairies along the Mississippi in Lousisa and Allamakee counties. I have found this on five sand prairies along the Wapsi. Another rare Iowa sedge is the Slender Sedge (*Carex leptalea*), which was believed to be limited to a single fen northwest of Cedar Falls in Black Hawk County. In August, 1991, I was fortunate to find it at two additional sites, both fens, within the Wapsipinicon basin in Benton and Jones Counties. A third rare sedge I have found in the Wapsi valley is the Field Sedge (*Carex conoidea*), which was believed as late as 1986 to be extinct from the state. Since 1988, I have located it from three vernal pool groups near Walker and Troy Mills.

Richardson's Sedge (*Carex richardsonii*) had been known from only four Iowa collections (three collected in the 1880's) when I first found it in 1991 in Allamakee County. Since that time I have seen it on dozens of bedrock glades across the northeastern third of the state, including at least six in the central Wapsi basin. Richardson's Sedge is quite pretty, as sedges go, with waxy dark green tufts of leaves surrounded by the straw-yellow dead leaves from the previous year. From these emerge its leafless flowering flower spike, with alternating dark purple and green bands with purple and yellowish-green seed heads. It blooms in early spring about the same time as Pasqueflowers, with which it often appears, and it drops its seeds by early June. Like a number of limestone glade species, it seems to prefer slightly more mesic north-facing slopes, but it is always limited to areas where plant growth is less than eight inches tall. It is rather amazing that it went so long without being recorded in Iowa.

Two species of Cotton-grass occur within the central Wapsipinicon basin, the Tall Cotton-grass (*Eriophorum angustifolium*) and Tawny Cotton-grass (*Eriophorum virginicum*). Both are characterized by their cottony seed heads which rise above the sedges and grasses on fens. Tall Cotton-grass blooms in the early summer and displays pure white heads. Tawny Cotton-grass features heads the color of untreated wool; it blooms in mid-to-late August. The former was considered in the late 1970's to be limited to fewer than a half-dozen sites in the state. It has subsequently been seen in more than 50 fens throughout northeastern Iowa where it is one of the most characteristic fen plants. In the central Wapsipinicon basin, the Tall Cotton-grass occurs in at least 10 fens. The Tawny Cotton-grass is one of Iowa's rarest plants, being limited to a single population of less than a dozen individuals in a single fen west of Walker in Buchanan County. Until found in late summer of 1991, it was not even known to occur in the state. The nearest known populations were thought to occur in the cranberry bogs of central Wisconsin. The Walker population is found in an unusually acidic fen whose water seeps out of sterile sand and has Sphagnum Moss covering its surface.

The rushes constitute another group of nondescript, grass-like plants. Two of the rarest in Iowa have been found along the Wapsi. The Large Path Rush (*Juncus tenuis* var. *antheratus*) had previously been reported only from the banks of the Wapsi north of the Quad Cities in Scott County. I have since found it at three additional sites, all vernal pools, along the stretch of river between Walker and Olin. Greene's Rush (*Juncus greenei*) was believed restricted to two sites in the state as recently as 1988. Since then I have found this typical Atlantic Coastal Plain species from five vernal pool and sand prairie communities along the central Wapsi basin.

A true grass which is very rare in the state is the Northern Panic Grass (*Panicum boreale*), which was previously known only from a small fen in Black Hawk County and an old collection near Edgewood in Clayton County. I have located two populations in Wapsi basin fens. In both cases, this di-

minutive grass was found growing in rather acidic soil with Sphagnum Moss hummocks.

A number of rare ferns have also been found along the Wapsi. These include Adder's Tongue Fern (*Ophioglossum pusillum*), Least Grape Fern (*Botrychium simplex*), Leather Grape Fern (*Botrychium multifidum*) and the Royal Fern (*Osmunda regalis*). Perhaps the rarest plant in the state is a fern called the Bog Clubmoss (*Lycopodium inundatum*). Until I discovered it in 1987 northwest of Walker it had never been seen within 150 miles of Iowa, its nearest population being in central Wisconsin. This tiny fern sends its pale green prostrate stems along the sandy soil on the margins of vernal pools. Perhaps only five plants exist in its single location within the state. And it may have gone extinct in the severe 1988 drought, as it has not been seen at this site since. I live in hope, though, that some spores survived to germinate a new colony during wetter periods.

The Woodland Horsetail (*Equisetum sylvaticum*) is another very rare Iowa fern. It is not found in woodland habitats, but rather in mesic and wet-sandy prairies. Once considered restricted to a single Iowa site, it has been found at two locations along the Wapsi. This species may be the most attractive horsetail in Iowa. Its recurved, many-forked side branches make it look like a foot-tall spruce tree.

The Prairie Moonwort (*Botrychium campestre*), was originally discovered and named to science from populations in the western Iowa Loess Hills. I subsequently found it in a dozen limestone glades across northeastern Iowa, including four within the Wapsi basin. This one-inch tall fern remains hidden under dead grass and emerges for only a few weeks in the spring—about the same time as morel mushrooms. Of interest is the fact that these plants only grow in close proximity to Little Bluestem grass clumps, and it seems likely that they share the same soil fungi associates.

While this discussion has only dealt with rare plants, many other endangered creatures call the Wapsi valley home. Consider land snails, for instance. About 100 species are known from Iowa, where they live in all terrestrial habitats. Well

over 80 percent of them are about the size of Lincoln's nose on a penny and are hidden away in leaf litter where they eat fungus. Because of their tiny size and cryptic habit, thousands can be living within a square yard and yet be totally invisible to all but those who are specifically looking for them. About two-thirds of Iowa's fauna has been recorded in the Wapsi basin. Limestone cliffs, limestone glades and fens support the most interesting species. And individual limestone cliff sites—such as those along Buffalo Creek east of Central City—will support over 30 snail species, including *Vertigo meramecensis* which was once thought restricted to the northern Ozarks and northeastern Iowa (it actually ranges east into the Shenandoah Valley of Virginia) and whose nearest cousins live in sky island forests of the southern Rockies. Such sites also harbor *Vallonia perspectiva*, which is more characteristic of juniper parklands of New Mexico and Arizona and dry aspen forests of North Dakota. While limestone glades support a fauna characteristic of the high plains, they also include such endemic species as *Gastrocopta rogersensis* which was named new to science in 2001 from populations ranging from the Ozarks north to the hill prairies along the Mississippi River bluffs of southeastern Minnesota and adjacent Wisconsin. One of the few known Iowa sites is on a south-facing limestone glade near Stone City. Fens support upward of 3,000 snails per square yard of habitat. A number of these, like *Vertigo ventricosa*, are normally found in the taiga of the far north and are able to live as far south as Iowa due to the cold, moist fen soils. Some, like *Strobilops affinis* are largely restricted to the midwestern fen habitat. One is a species just described new to science: *Euconulus frestii*, named after Terry Frest, the first scientist to notice it in Wapsi fens. Found in almost every fen in the Wapsi basin, the large population located on a fen near Martelle was selected as the one that scientifically describes this species.

A number of rare butterflies and skippers have also been observed along the Wapsi. This includes one of Iowa's rarest species, the Baltimore Checkerspot (*Euphydryas phaeton* var. *phaeton*), which is known from only six communities in the

state. Buffalo Creek has also been identified as harboring one of the most diverse assemblages of fresh water clams to be found within Iowa's interior streams.

"Yet there remains the river, in a few spots hardly changed since Paul Bunyon's day; at early dawn, before the motor boats awaken, one can still hear it singing in the wilderness." Aldo Leopold, *A Sand County Almanac*

FOR MANY groups of species the Wapsi basin serves as an important last refuge for survival. The collection sand prairies, limestone glades, vernal pools, fens and sand ponds found within its watershed represents a rich and varied collection of native habitats. The number of endangered, threatened and rare species which call these places home is almost without precedent. The rare species found here include some of the most uncommon in the entire state. While the natural heritage of other regions has been almost completely destroyed, a significant proportion of the natural diversity of the Wapsi remains, sequestered away in the nooks and crannies of our agricultural landscape.

The legacy of geological and biological interactions has endowed the Wapsi basin's gentle land a place of importance for biological diversity in Iowa, just as is true for the Loess Hills, the recently glaciated terrain of the Des Moines lobe and the northeastern Paleozoic Plateau. It is important that the Wapsi not only be recognized for its important contribution to Iowa's biological diversity, but that like these other more well known centers, a comprehensive effort be made to protect its natural heritage. Luckily, we humans have discovered the existence of this diversity before destroying it. Now the burden is upon us to not undo the work of over 400 million years of natural history. We must ensure that the generations which follow be allowed to enjoy the wonders of the Wapsi, and that all species that call this river home be given

the opportunity to exist with us along its placid banks and broad vistas.

I WROTE this piece almost 30 years ago while finishing my PhD in Ecology at the University of North Carolina. I was a bit reluctant to read what I had written: was it embarrassing? (My skill as a writer was, at best, in its nascent stage then). Did it capture what I knew of the Wapsi? (Yes! Emphatically!) As I read it I was shocked to see that much still rings true, with only some bits being utter rubbish—like the previously composed land snail section. I deleted this and replaced it with text based on my field and lab research.

But the general message remains the same: the Wapsi is one of the most important and underappreciated biodiversity hotspots in Iowa and for the exact reasons reported here.

Sadly, my plea for protection of these last few small precious jewels has gone mostly unheeded.

Yes, the Hitaga Sand Ridge with the Big-rooted Prickly Pear Cactus was bought by the Linn County Conservation Commission, and for that I am forever grateful. But most of these sites remain in private hands, which is not a bad thing when the owners appreciate these treasures. But what happens when owners change, or a younger generation takes over or financial troubles arrive and whisper that that "worthless" bit of swamp in the back 40 could be earning its keep if converted into more cropland? (as if the world really needs more bushels of corn. But I digress . . .)

I now live and work in the Czech Republic and have not visited these sites in over a decade. But by viewing Google Earth I can witness the mounting losses: the sand pond with the vernal pool edge supporting the first Yellow-eyed Grass population I ever found vanished under tile and plow in 2013. The White Lady's Slipper population west of Rowley was plowed under maybe 20 years ago. The last time I was there they were still trying to emerge through the grass. Are they still? I'm not hopeful.

However, it appears the sand hill and vernal pool complex

supporting the Club Spur Orchid is still there, and the little fen with the Slender Sedge on the Benton County line and the amazing vernal pool / acid fen / sand prairie complex on the Buchanan County border northwest of Walker were present as of 2019. But for how much longer?

If you read this and it inspires you, all I ask is that like the Lorax in the classic Dr. Seuss story you speak for those that have no tongues. That you adopt one of these places. Get to know the owners. Talk to them. Take them out to see the beautiful flowers. Help them understand that the wealth of their special place is not measured in dollars but in life. Help the next generation understand how important these places are. And to love them. And also help keep the land healthy and clear out any invading trees if necessary. (That Club Spur Orchid site really needs it based on the Google Earth views!) But please, not with fire. That does more harm than good.

Become a steward and a champion of these tiny, precious bits of wild Iowa. And, maybe with your help these places and the shy neighbors living in them will be able to continue to call the Wapsi their home for another century or more.

Endangered, Threatened and Rare Plants Of The Wapsipinicon River Basin From Quasqueton To Olin

Three-seeded Mercury (*Acalypha gracilens*)
 Puttyroot Orchid (*Aplectrum hyemale*)
 Sullivant's Milkweed (*Asclepias sullivantii*)
 Paper Birch (*Betula papyrifera*)
 Prairie Moonwort (*Botrychium campestre*)
 Leathery Grape-fern (*Botrychium multifidum*)
 Least Grapefern (*Botrychium simplex*)
 Watershield, a Sedge (*Brasenia schreberi*)
 Hair Sedge (*Bulbostylis capillaris*)
 Water Starwort (*Callitriche heterophylla*)
 Field Sedge (*Carex conoidea*)
 Slender or Bristle-stalked Sedge (*Carex leptalea*)
 Fen or Prairie Sedge (*Carex prairea*)
 Richardson's Sedge (*Carex richardsonii*)
 Deep Green or Shaved Sedge (*Carex tonsa*)
 White Lady's Slipper (*Cypripedium candidum*)
 Greater Yellow Lady's Slipper
 (*Cypripedium parviflorum* var. *pubescens*)
 Water Horsetail (*Equisetum fluvatile*)
 Meadow Horsetail (*Equisetum pratense*)
 Woodland Horsetail (*Equisetum sylvaticum*)
 Tall Cotton Grass (*Eriophorum angustifolium*)
 Tawny Cotton Grass (*Eriophorum virginicum*)
 Slender Fimbristylis (*Fimbristylis autumnalis*)
 Cottonweed (*Froelichia gracilis*)
 Black Huckleberry (*Gaylussacia baccata*)
 Fringed Gentian (*Gentiana crinita*)
 Rattlesnake Plantain (*Goodyera pubescens*)
 Club-spur Orchid (*Habenaria clavellata*)
 Pale Green Orchid (*Habenaria flava* var. *herbiola*)
 Witch Hazel (*Hamamelis virginica*)
 Northern St. Johnswort (*Hypericum boreale*)
 Orange Pinweed (*Hypericum gentianoides*)
 Canadian St. Johnswort (*Hypericum majus*)
 False Pennyroyal (*Isanthus brachiatus*)

(Continued, next page)

Greene's Rush (*Juncus greenei*)
 Large Path Rush (*Juncus tenuis* var. *anthelatus*)
 Prairie Bushclover (*Lespedeza leptostachya*)
 Bog Clubmoss (*Lycopodium inundatum*)
 Prairie Rush Grass or Mat Muhly
 (*Muhlenbergia Richardsonis*)
 Adder's Tongue Fern (*Ophioglossum pusillum*)
 Fragile Prickly-pear (*Opuntia fragilis*)
 Large-rooted Prickly-pear (*Opuntia macrorhiza*)
 Royal Fern (*Osmunda regalis*)
 Northern Panic Grass (*Panicum boreale*)
 Grass-Of-Parnassia (*Parnassia glauca*)
 Large-flowered Penstemon (*Penstemon grandiflorus*)
 Cross-leaved Milkwort (*Polygala cruciata*)
 Pink Milkwort (*Polygala incarnata*)
 Sand Milkwort (*Polygala polygama* var. *obtusata*)
 Vasey's Pondweed (*Potamogeton vaseyi*)
 Dwarf Raspberry (*Rubus pubescens*)
 Sage Willow (*Salix candida*)
 Bog Willow (*Salix pedicellaris*)
 Clark's Willow (*Salix X clarkei*)
 Red Willow (*Salix X rubella*)
 Spike Moss (*Selaginella rupestris*)
 Skunk Cabbage (*Symplocarpus foetidus*)
 Marsh St. Johnswort (*Triadenum fraseri*)
 Three-birds Orchid (*Triphora trianthophora*)
 Valerian (*Valeriana edulis*)
 Lanceolate-leaved Violet (*Viola lanceolata*)
 Primrose Violet (*Viola primulaefolia*)
 Yellow-eyed Grass (*Xyris torta*)

Random Gems



Sullivant's Milkweed
 (*Asclepias sullivantii*)
 —Peter Dziuk—



Cross-leaved Milkwort
 (*Polygala cruciata*)
 —Peter Dziuk—

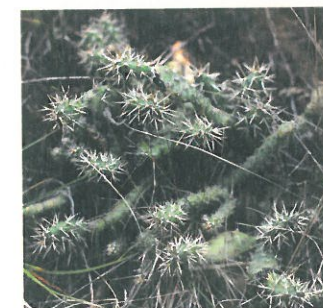


Yellow-eyed Grass
 (*Xyris torta*)
 —Katy Chayka—



Water Horsetail
 (*Equisetum fluvatile*)
 —Peter Dziuk—

Fragile Prickly Pear
 (*Opuntia fragilis*)
 —Dennis Schlict—





Puttyroot Orchid
(*Aplectrum hyemale*)
—Michele Olson—



Sage Willow
(*Salix candida*)
—Dennis Schlicht—



White Lady's Slipper Orchid
(*Cypripedium candidum*)
—Michele Olson—



Yellow Lady's Slipper Orchid
(*Cypripedium pubescens*)
—Frank Olsen—



Skunk Cabbage
(*Symplocarpus foetidus*)
—Frank Olsen—



Royal Fern
(*Osmunda regalis*)
—Peter Dziuk—



Rattlesnake Plantain
(*Goodyera pubescens*)
—Peter Dziuk—



Limestone Glade in Bloom
Near Buffalo Creek
—Timothy Fay—



Bog Willow
(*Salix pedicellaris*)
—Timothy Fay—



Woodland Horsetail
(*Equisetum pratense*)
—Dennis Schlicht—



Fringed Gentian
(*Gentiana crinita*)
—Frank Olsen—



Prairie Moonwort
(*Botrychium campestre*)
—Dennis Schlicht—



Bearbower Sand Prairie near Rowley, Iowa
—Timothy Fay—



Large-flowered Penstemon
(*Penstemon grandiflorus*)
—Katy Chayka—

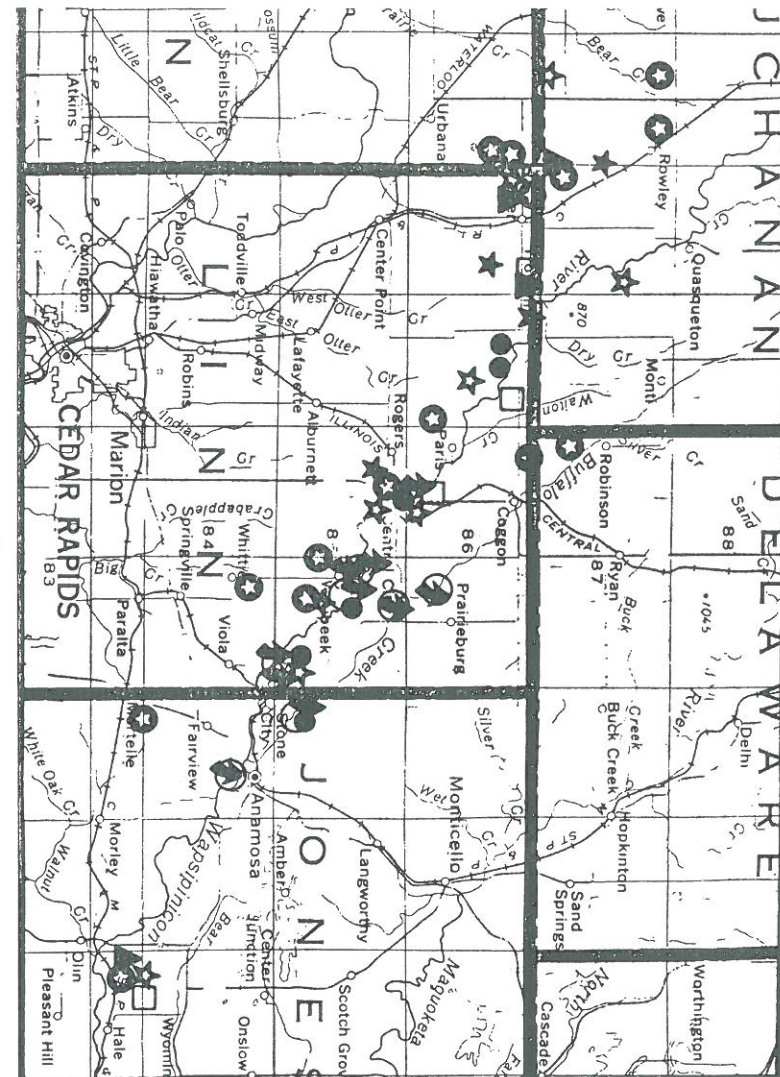


Marsh St. Johnswort
(*Triadenum fraseri*)
—Katy Chayka—



Millard Sand Pond Preserve near Central City, Iowa
—Timothy Fay—

Four-County Wapsi Basin Map



- | | |
|---------------------|---------------------|
| ● = Limestone Glade | ○ = Limestone Cliff |
| ★ = Sand Prairie | □ = Sand Pond |
| ▲ = Vernal Pool | ⊙ = Fen |
| ◆ = Woodland | ★ = Prairie |

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— *Dennis Schlict* is a retired high school science teacher living in Center Point, Iowa. Dennis co-authored *The Butterflies of Iowa* with John Downey and Mr. Nekola (University of Iowa Press, 2007).

— *Frank Olsen* is a plant and butterfly enthusiast who lives in Cedar Rapids.

— *Michele Olson* works as the Jones County, Iowa, naturalist at Central Park near Center Junction.

— *Minnesota Wildflowers* features a wonderful web site at [minnesotawildflowers.info]. Its founder, Katy Chayka, has generously allowed the Route 3 Press to use several of its photographs for this publication. Katy describes herself as a “born again nature lover.” She and Peter Dziuk, a former Minnesota Department of Agriculture employee, took the photos represented here. Certain Iowans in the know highly recommend this web site.

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