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CHANGES IN THE BUTTERFLIES (LEPIDOPTERA) OF WINNESHIEK COUNTY, IOWA AFTER 90 YEARS

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ABSTRACT

In 1908, Bert Porter reported the presence of 73 species of butterflies in the Decorah, Iowa area. Since then, no systematic surveys of the butterflies in the Decorah area have been completed despite extensive habitat changes and degradation of native prairie and timber that have occurred over the past 90 years. In 1998, an extensive survey of the butterflies of Winneshiek County confirmed the presence of 55 species of butterflies. Our findings generated a checklist of the butterflies currently found in Winneshiek County, and were compared to Porter's original list. Unfortunately, the regal fritillary, *Speyeria idalia*, and several other butterfly species found in 1908 apparently no longer occur in the Decorah area.

Porter (1908) previously reported the presence of 73 species of butterflies in the Decorah, Iowa area, although no habitat, locality, or abundance data other than "near Decorah" were provided. Since then, no systematic survey of the butterflies in the Decorah area has been completed, despite extensive land use and habitat changes that have occurred in the county over the past 100 or so years (USDA 1994). Although some of the species reported on Porter's list were inaccurate, the majority of the list is a useful tool to assess changes which may be occurring in the diversity of the butterfly fauna in the Decorah area. For example, the regal fritillary, *Speyeria idalia* (Drury), found on Porter's 1908 list, is a category 2 species and possible candidate for listing as threatened by the U.S. Fish & Wildlife Service (Federal Register 1994). This butterfly, once a common resident of Winneshiek County, was last documented in Winneshiek County at Chipera Prairie in 1994 (KJL., pers. obs.) and its populations are known to be declining dramatically throughout Iowa (Debinski and Kelly 1998).

This study involved a systematic survey of the butterflies of Winneshiek County from early June until early September of 1998. Our methodology was similar to quantitative surveys of butterflies performed by Pollard et al. (1975), Pollard (1977), and Thomas (1983). Our first objective was to produce a checklist of the butterflies currently found in Winneshiek County. Our second objective was to obtain baseline data on the flight times and relative abundance of these butterfly species, so that future monitoring efforts can assess whether or not individual species are increasing or declining in abundance.

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MATERIALS AND METHODS

Eight sites (Table 1) representing a diversity of habitat types in Winneshiek County, Iowa (Figure 1) were monitored on an every other week basis for butterflies beginning the second week of June through the first week in September of 1998. At each site, a transect between 1.6–3.1 km long was established through as many different types of habitats as possible. The survey involved walking the same route at each site at a steady pace every other week during both a mid-morning or late-morning visit and an afternoon visit on different days, counting and identifying all butterflies observed. The order in which sites were checked and scheduling of morning or afternoon visits was randomized every two weeks. To ensure good flight activity, all surveys occurred between 0900 and 1800 h CDT at temperatures between 21C and 35C, and with wind speeds less than 24 kph. Cloud coverage was less than 90% (i.e. some blue sky was visible). Weather conditions, time spent walking the transect, and numbers of each species of butterfly seen in a 5–m wide band in front of the observer were recorded.

Any butterflies not identified "on the wing" were collected in a butterfly net, identified and released, or stored in glassine butterfly envelopes, and returned to the laboratory for identification and vouchering. References for butterfly identification included Opler and Malikul (1992), Pyle et al. (1981), Scott (1986), and Opler and Krizek (1984). Scientific and common names were standardized using Cassie et al. (1995). Voucher specimens for each species are housed in the Hoslett Museum of Natural History at Luther College (Decorah, IA).

Our analysis included generating a checklist of the butterflies observed throughout the survey and comparing this list with Porter's (1908) list. We quantified butterfly abundance, and calculated overall species richness, community diversity (Shannon's H'), and evenness (Pielou's J') at each site. These indices were calculated and Euclidean cluster analysis was performed using percent similarity data with Ecological Analysis™ statistical software (Eckblad 1996).

RESULTS

1908 butterfly list. Nine of the species on Porter's (1908) list were merely morphological forms of other butterflies on the list, rather than different species. There were four species on Porter's list not found in this part of the United States, and most likely were misidentified. These included *Zerene euridice* (Boisduval), the California dogface, *Eurema euterpe* Menetries, a Caribbean species, and *Polites vibex* (Geyer) and *Pyrgus oileus* (Linnaeus), strays from the extreme southeastern United States (Glassberg 1999). This reduced the number of likely butterfly records on Porter's (1908) list to 60 species (D. Schlicht, pers. comm.)

1998 butterfly records. We observed or collected 4,305 butterflies representing 52 different species on the transects in 1998 (Table 2), as compared to the 60 species listed by Porter in 1908. Three additional species found in Winneshiek County in 1998 but observed outside of the survey transects included *Satyrodes eurodice* (Johansson), *Atalopedes campestris* (Boisduval) and *Hylephila phyleus* (Drury), bringing our total for 1998 Winneshiek County records to 55 species. We were unable to document the presence of 16 of the 60 species on Porter's list (1908) during the summer of 1998 (Table 2). These "missing" species included *Pontia occidentalis* (Reakirt), *Colias cesonia* (Stoll), *Eurema nicippe* (Cramer), *Euptoieta claudia* (Cramer), *Speyeria*

Table 1. Sites in Winneshiek County, Iowa monitored for butterflies on a biweekly basis throughout the summer of 1998.

Site Name	Township	Mgmt.*	Habitats	Transect Length(m)
1. Cardinal Marsh	Lincoln	IA DNR	woods, agricultural fields	2400
2. Falcon Springs	Bluffton	IA DNR	woods, agricultural fields	2450
3. Malanaphy Springs	Canoe	IA DNR	riparian woods	1600
4. Anderson Prairie	Decorah	LC	dry reconstructed prairie, woods	2875
5. VanPeenan Park and Woods	Decorah	DPR	reconstructed prairie, old field, woods	3100
6. South Bear Creek	Highland	IA DNR	riparian old fields	1900
7. Coon Creek	Glenwood	IA DNR	agricultural fields, old fields, riparian woods	3000
8. Chipera Prairie	Jackson	WCC	wet, original prairie, old field	2600

*Management Agencies: IA DNR = Iowa Department of Natural Resoures, WCC = Winneshiek County Conservation, LC = Luther College, DPR = Decorah Parks and Recreation.

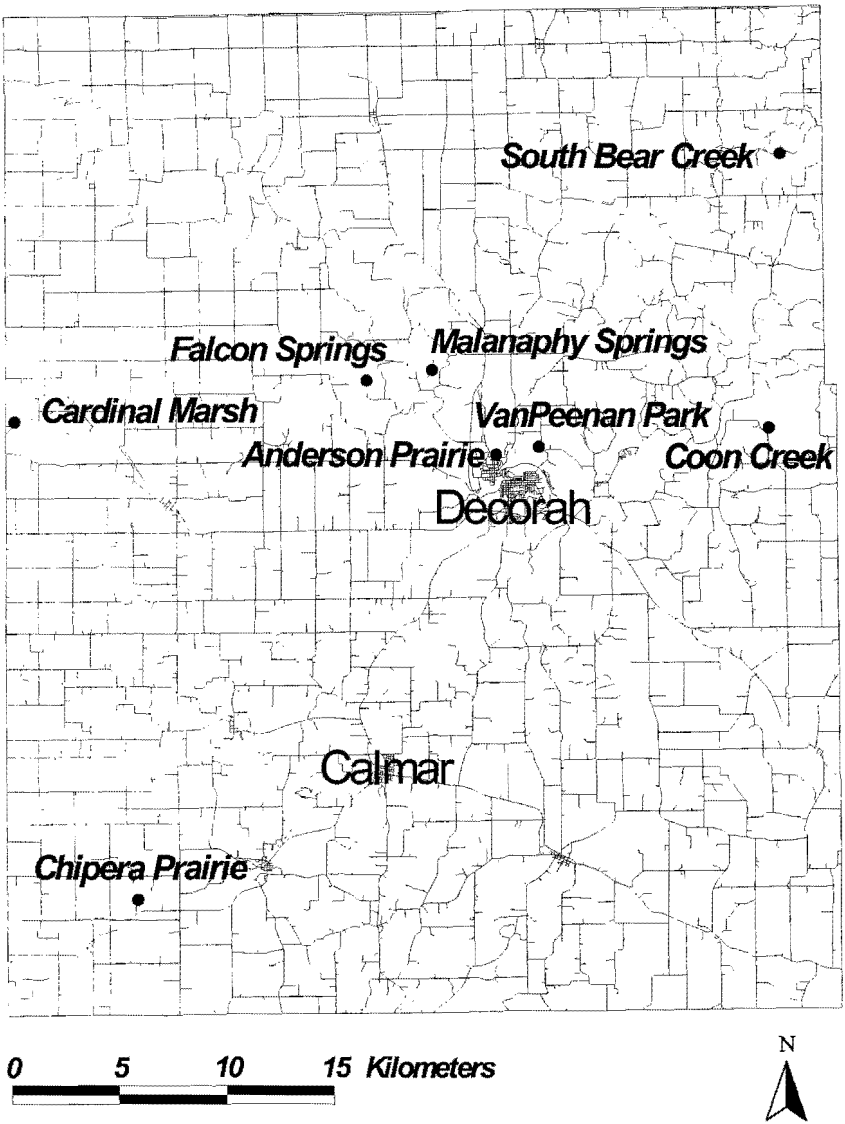

Figure 1. Winneshiek County, Iowa, with the eight sites surveyed for butterflies during the summer of 1998.

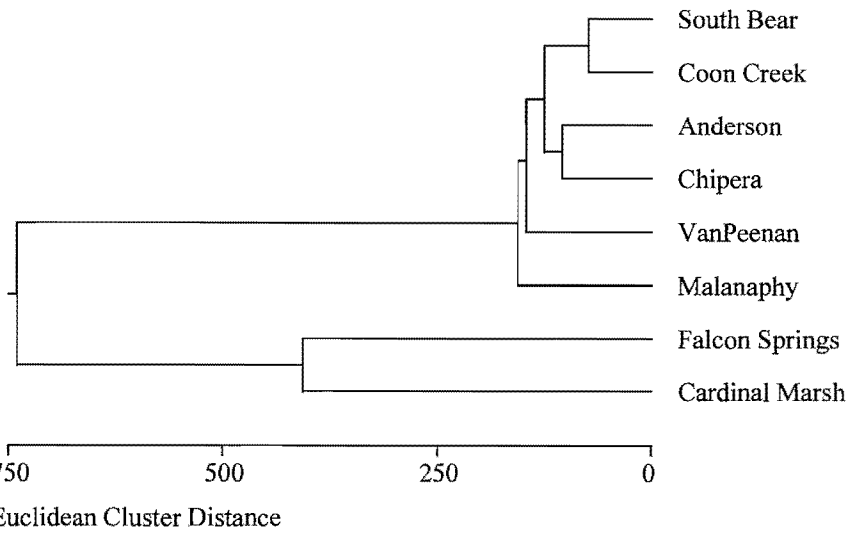

Figure 2. Euclidean cluster analysis showing similarity of butterfly assemblages among eight sites in Winneshiek County, Iowa, during the summer of 1998.

idalia (Drury), *Chlosyne gorgone* (Hubner), *Nymphalis vau-album* (Denis & Schiffermuller), *Vanessa cardui* (Linnaeus), *Phyciodes campestris* (Behr), *Satyrium calanus* (Hubner), *Harkenclenus titus* (Fabricius), *Feniseca tarquinius* (Fabricius), *Lycaena phlaeas* (Linnaeus), *Pompeius verna* (Edwards), *Erynnis brizo* (Boisduval & LeConte), and *Pyrgus communis* (Grote). Ten species not listed by Porter (1908), yet found in 1998 included *Phyciodes tharos* (Drury), *Nymphalis milberti* (Godart), *Fixsenia ontario* (Edwards), *Callophrys gryneus* (Hubner), *Ancyloxypha numitor* (Fabricius), *Polites mystic* (Edwards), *Thymelicus lineola* (Ochsenheimer), *Wallengrenia egeremet* (Scudder), *Euphyes bimacula* (Grote & Robinson) and *Erynnis martialis* (Scudder).

We found an average of 31.5 species of butterflies at each of these eight sites over the field season during 1998. The highest species richness occurred at Coon Creek (36 species), with diverse habitats of agricultural fields, CRP old fields, and riparian woods. The lowest species richness (15 species) occurred at Malanaphy Spring (Table 3). Abundance during the survey varied greatly by site, from a maximum of 1,363 butterflies at Falcon Springs, mostly consisting of *Colias philodice* Godart, *Pieris rapae* (Linnaeus), and *Danaus plexippus* (Linnaeus), to a minimum of 42 butterflies at Malanaphy Springs (Table 3). Shannon's index of diversity showed the greatest species diversity at Coon Creek and lowest at Cardinal Marsh (Table 3). Pielou's index of evenness was greatest at Malanaphy Spring and lowest at Cardinal Marsh (Table 3).

Euclidean cluster analysis, comparing the similarity of butterfly assemblages among the different survey sites (Figure 2) reveals the South Bear and Coon Creek sites had the most similar assemblages of butterflies. Anderson Prairie and Chipera Prairie also had very similar butterfly assemblages.

Table 2. Checklist of butterflies (Lepidoptera) reported in the Decorah, Iowa area by Porter (1908), and those recorded at either the eight transect sites in Winneshiek County, Iowa or observed outside of the transects in 1998. Current scientific and common names from Cassie et al. (1995).

Current Scientific Name	Common Name	Notes	Scientific Name (Porter 1908)	1908	1998	Observed Flight Periods	Abundance
SWALLOWTAILS, FAMILY: PAPILIONIDAE							
Subfamily: Papilioninae							
Papilio polyxenes Fabricius	Eastern Black Swallowtail		*Papilio polyxenes*	X	X	Jul, Aug, Sep	C
Papilio cresphontes (Cramer)	Giant Swallowtail		*Papilio thaos*	X	X	Jul, Aug	U
Papilio glaucus (Linnaeus)	Tiger Swallowtail		*Papilio turnus*	X	X	Jun, Jul, Aug	C
WHITES AND SULFERS, FAMILY: PIERIDAE							
Whites, Subfamily: Pierinae							
Pontia protodice (Boisduval & LeConte)	Checkered White		*Pontia protodice*	X			na
Pontia occidentalis (Reakirt)	Western White		*Pontia occidentalis*	X			na
Pieris rapae (Linnaeus)	Cabbage White		*Pontia rapae*	X	X	Jun, Jul, Aug, Sep	A
Sulfers, Subfamily: Coliadinae							
Colias philodice Godart	Clouded Sulphur		*Eurymus philodice*	X	X	Jul, Aug, Sep	A
		a	*Eurymus eriphyle*	X			
Colias eurytheme Boisduval	Orange Sulphur/Alfalfa		*Eurymus eurytheme*	X	X	Jul, Aug, Sep	C
		b	*Eurymus albino*	X			
		b	*Eurymus ariadne*	X			
Zerene eurydice (Boisduval)	California Dogface	c	*Zerene eurydice*	X			na
Colias cesonia (Stoll)	Southern Dogface		*Zerene caesonia*	X			na
		d	*Zerene rosa*	X			
Eurema lisa (Boisduval & LeConte)	Little Yellow		*Eurema alba*	X	X	Jul, Aug, Sep	U
Eurema nicippe (Cramer)	Sleepy Orange		*Eurema nicippe*	X			na
		e	*Eurema euterpe*	X			
GOSSAMER-WING BUTTERFLIES, FAMILY: LYCAENIDAE							
Harvesters, Subfamily: Miletinae							
Feniseca tarquinius (Fabricius)	Harvester		*Feniseca tarquinius*	X			na
Coppers, Subfamily: Lycaeninae							
Lycaena dione (Scudder)	Dione Copper		*Gaeides dione*	X	X	Jul	R
Lycaena hyllus (Cramer)	Bronze Copper		*Chrysophanus thoe*	X	X	Jun, Aug	U
Lycaena phlaeas (Linnaeus)	Small Copper		*Heodes hypophleas*	X			na

Hairstreaks, Subfamily: Theclinae							
Fixsenia ontario (Edwards)	Northern Hairstreak	f			X	Jun, Jul	U
Callophrys gryneus (Hubner)	Olive Hairstreak	f			X	Jun, Jul	U
Satyrium calanus (Hubner)	Banded Hairstreak		*Thecla calanus*	X			na
Harkenclenus titus (Fabricius)	Coral Hairstreak		*Strymon titus*	X			na
Blues, Subfamily: Polyommatinae							
Everes comyntas (Godart)	Eastern Tailed Blue		*Everes comyntas*	X	X	Jun, Jul, Aug, Sep	C
Celestrina ladon (Cramer)	Spring Azure		*Cyaniris ladon*	X	X	Jun	C
		g	*Cyaniris marginata*	X			
BRUSH-FOOTED BUTTERFLIES, FAMILY: NYMPHALIDAE							
Snouts, Subfamily: Libytheinae							
Libytheana carinenta (Cramer)	American Snout		*Hypatus bachmani*	X	X	Jul, Aug	U
Fritillaries, Subfamily: Heliconiinae							
Euptoieta claudia (Cramer)	Variegated Fritillary		*Euptoieta claudia*	X			na
Speyeria cybele (Fabricius)	Great Spangled Fritillary		*Argynnis cybele*	X	X	Jun, Jul, Aug, Sep	A
Speyeria aphrodite (Fabricius)	Aphrodite Fritillary		*Argynnis aphrodite*	X	X	Jul, Aug, Sep	C
		h	*Argynnis alcestis*	X			
Speyeria idalia (Drury)	Regal Fritillary		*Speyeria idalia*	X		Jun	na
Speyeria atlantis (Edwards)	Atlantis Fritillary		*Argynnis atlantis*	X	X	Jul, Aug	C
Boloria selene (Denis & Schiffermuller)	Silver Bordered Fritillary		*Brenthis myrina*	X	X	Jul	U
Boloria bellona (Fabricius)	Meadow Fritillary		*Brenthis bellona*	X	X	Jun, Jul, Aug, Sep	C
True Brush-foots, Subfamily: Nymphalinae							
Chlosyne gorgone (Hubner)	Gorgone Checkerspot		*Charidryas ismeria*	X			na
Chlosyne nycteis (Doubleday & Hewitson)	Silvery Checkerspot		*Charidryas nycteis*	X	X	Jun, Jul, Aug	U
Phyciodes tharos (Drury)	Pearly Crescentspot		*Phyciodes tharos*	X	X	Jun, Jul, Aug, Sep	C
Phyciodes selenis (Kirby)	Northern Crescent	f			X	Jun, Jul, Aug, Sep	C
Phyciodes campestris (Behr)	Field Crescentspot		*Hylephila campestris*	X			na
Polygonia interrogationis (Fabricius)	Question Mark		*Polygonia interrogationis*	X	X	Jun, Jul, Aug, Sep	U
		i	*Polygonia umbrosia*	X			
Polygonia comma (Harris)	Eastern Comma		*Polygonia comma*	X	X	Jun, Jul, Aug, Sep	C
		j	*Polygonia dryas*	X			
Polygonia faunus (Edwards)	Green Comma		*Polygonia faunus*	X	X	Jun, Jul, Aug, Sep	U
Polygnia progne (Cramer)	Gray Comma		*Polygonia progne*	X	X	Jul, Aug, Sep	U
Nymphalis vau-album (Denis & Schiffermuller)	Compton Tortoise Shell		*Eugonia j-album*	X			na

(Continued)

Table 2. (Continued)

Current Scientific Name	Common Name	Notes	Scientific Name (Porter 1908)	1908	1998	Observed Flight Periods	Abundance
Nymphalis antiopa (Linnaeus)	Mourning Cloak		*Euvanessa antiopa*	X	X	Mar, Jun, Jul	U
Nymphalis milberti (Godart)	Milbert's Tortoise Shell	f			X	Jun, Jul, Aug	C
Vanessa virginiensis (Drury)	American Lady		*Vanessa huntera*	X	X	Jun, Jul	R
Vanessa cardui (Linnaeus)	Painted Lady		*Vanessa cardui*	X		May, Aug, Oct	C
Vanessa atalanta (Linnaeus)	Red Admiral		*Vanessa atalanta*	X	X	Jun, Jul, Aug	C
Junonia coenia (Hubner)	Common Buckeye		*Junonia coenia*	X	X	Aug, Sep	U
Admirals and Relatives, Subfamily: Limenitidinae							
Limenitus arthemis (Drury)	Red-Spotted Purple		*Basilarchia arthemis*	X	X	Jun, Aug	C
		k	*Basilarchia astyanax*	X			
Limenitus archippus (Cramer)	Viceroy		*Basilarchia archippus*	X	X	Jun, Jul, Aug, Sep	U
Emperors, Subfamily: Apaturinae							
Asterocampa celtis (Boisduval & LeConte)	Hackbury Emperor		*Chlorippe celtis*	X	X	Jun, Jul, Aug, Sep	C
Asterocampa clyton (Boisduval & LeConte)	Tawny Emperor		*Chlorippe clyton*	X	X	Jun, Jul	U
SATYRS, FAMILY: SATYRIDAE							
Subfamily: Satyrinae							
Enodia portlandia (Fabricius)	Northern Pearly Eye		*Enodia portlandia*	X	X	Jun, Jul	C
Satyrodes eurodice (Johansson)	Eyed Brown	l			X	Jun	na
Megisto cymela (Cramer)	Little Wood Satyr		*Cissia eurytus*	X	X	Jun, Jul	C
Cercyonis pegala (Fabricius)	Common Wood Nymph		*Cercyonis alope*	X	X	Jul, Aug	C
		m	*Cercyonis nephele*	X			
MILKWEED BUTTERFLIES, FAMILY: DANAIDAE							
Monarchs, Subfamily: Danainae							
Danaus plexippus (Linnaeus)	Monarch		*Anosia plexippus*	X	X	Jun, Jul, Aug, Sep	A
SKIPPERS, FAMILY: HESPERIIDAE							
Spread-wing Skippers, Subfamily: Pyrginae							
Epargyreus clarus (Cramer)	Silver-Spotted Skipper		*Epargyreus tityrus*	X	X	Jun, Jul	C
Thorybes pylades (Scudder)	Northern Cloudywing		*Thorbes pylades*	X	X	Jul	R
Erynnis brizo (Boisduval & LeConte)	Sleepy Duskywing		*Thanaos brizo*	X			na
Erynnis juvenalis (Fabricius)	Juvenal's Duskywing		*Thanaos juvenalis*	X	X	Jun, Jul	U
Erynnis martialis (Scudder)	Mottled Duskywing	f			X	Jul, Aug	U
Pyrgus communis (Grote)	Checkered Skipper		*Hesperia tessellata*	X			na

Pyrgus oileus (Linnaeus)	Tropical Checkered Skipper	n	*Hesperia montivagus*	X			na
Pholisora catullus (Fabricius)	Common Sootywing		*Pholisora catullus*	X	X	Jul	U
Grass Skippers, Subfamily: Hesperiinae							
Ancyloxypha numitor (Fabricius)	Least Skipper	f			X	Jun, Aug, Sep	C
Thymelicus lineola (Ochsenheimer)	European Skipper	f			X	Jul	C
Hylephila phyleus (Drury)	Fiery Skipper	f, l			X	Sep	na
Polites peckius (Kirby)	Peck's Skipper		*Polites peckius*	X	X	Jun	U
Polites themistocles (Latreille)	Tawny-Edged Skipper		*Thymelicus cernes*	X	X	Jul	R
Polites mystic (Edwards)	Long Dash	f			X	Jun	R
Polites vibex (Geyer)	Whirlabout	o	*Thymelicus brettus*	X			na
Wallengrenia egeremet (Scudder)	Northern Broken-Dash	f			X	Jul	R
Pompeius verna (Edwards)	Little Glassywing		*Euphyes verna*	X			na
Atalopedes campestris (Boisduval)	Sachem	f, l			X	Jun, Aug, Sep	na
Poanes hobomok (Harris)	Hobomok Skipper		*Atrytone hobomok*	X	X	Jun	C
Euphyes bimacula (Grote & Robinson)	Two-Spotted Skipper	f			X	Jul	R

Notes:

a form of *C. philodice*
b form of *C. eurytheme*
c found in Northern California south to Baja
d rose colored form of *C. cesonia*
e not a US species, Caribbean
f not on Porter's 1908 list
g form of *C. ladon*
h form of *S. aphrodite*
i form of *P. interrogationis*
j form of *P. comma*
k form of *L. arthemis*
l found in 1998, but not on transects
m form of *C. pegala*
n found in extreme southern US
o stray from SE United States

Abundance based on # of butterflies observed per 100 m of transect:
A = abundant (>10/km)
C = common (1–10/km)
U = uncommon (0.1–1/km)
R = rare (<0.1/km)
na = abundance data not available

Table 3. Number of butterflies observed, species richness, Shannon's diversity index (H'), and Pielou's evenness (J') values for butterfly assemblages found at eight sites in Winneshiek County, Iowa, in 1998.

Site Name	Number of Butterflies	Species Richness	Shannon's Diversity Index (H')	Pielou's Evenness (J')
1. Cardinal Marsh	713	34	2.763	0.543
2. Falcon Springs	1363	34	2.977	0.585
3. Malanaphy Springs	42	15	3.623	0.927
4. Anderson Prairie	389	32	3.799	0.759
5. VanPeenan Park and Woods	473	35	4.000	0.779
6. South Bear Creek	418	34	3.725	0.732
7. Coon Creek	362	36	4.132	0.799
8. Chipera Prairie	545	32	3.889	0.778

Van Peenan Park and Malanaphy Spring did not share as many of the same species as the first four sites, but they were more similar to those sites than to Falcon Springs or Cardinal Marsh. These last two sites were more similar to each other in terms of the butterflies present than to any of the other sites in the survey, but were still quite distinct from one another. Geographic position of the different sites had no apparent influence on the similarity of butterfly assemblages among the sites.

The number of butterflies observed per hour increased as the summer progressed. By 10 August, high numbers of sulfur butterflies (*C. philodice* and *C. eurytheme* Boisduval) dominated the counts and accounted for 46.7% of all butterflies observed. As temperature increased, we also noticed an increase in the number of butterflies observed per hour ($r^2 = 0.448$, $P > 0.05$), although this trend was not significant.

DISCUSSION

In 1998, we observed a number of butterfly species that were not on Porter's (1908) list that are apparently new to Winneshiek County. One of these butterflies found on the transects in 1998 was the European skipper, *T. lineola*. This butterfly was imported from Europe to Ontario, Canada in 1910, and has a very wide range which is still expanding (Glassberg 1999). Although not native to NE Iowa, *T. lineola* is now one of the most common skippers throughout North America (Glassberg 1999). Another new resident, but observed outside our transects, was the Sachem, *Atalopedes campestris* (Boisduval). This butterfly is widespread, and can be very abundant. It prefers open, disturbed areas such as landfills, lawns, pastures and roadsides (Glassberg 1999).

A number of the butterflies reported by Porter (1908) were not observed during our survey. One of the most notable was the regal fritillary, *S. idalia*. This butterfly is listed as a species of special concern in Iowa, and its populations are known to be declining (Debinski and Kelly 1998, Orwig and Schlicht 1999). The decline of *S. idalia* and other native species is likely due to the change in land use from native tallgrass prairie to more urbanized and agricultural habitats. In Iowa, forest and wetland acreage has been reduced to 5% of its presettlement area (Smith 1998). Even more dramatic, tallgrass prairie and savanna, which used to make up over 80% of the presettlement area has been reduced to less than one hundredth of one percent (Smith

1998, Orwig and Schlicht 1999). In Winneshiek County, prairie covered 45.6% (201,193 acres) of the county in 1859, but had virtually disappeared by 1992, remaining on only 0.02% of the land. Simultaneously, tilled cropland and grass agricultural areas in the county increased from 0.22% in 1859 to 85.7% by 1992 (USDA 1994). This decline in natural habitats affects host plants that individual butterfly species need to survive. It is clear the natural habitats of the regal fritillary have been destroyed at an alarming rate, and this species may eventually be listed as a threatened or endangered species (Federal Register 1994). Its last documented observation in Winneshiek County was at Chipera Prairie in 1994 (KJL, pers. obs.). Native sites that do remain in their original form are much more isolated, functioning as islands in a sea of corn and soybeans. This makes it difficult, if not impossible for a species to re-colonize an isolated site after a disturbance such as hail, drought, plowing, or fire.

There are many physical and geographical factors that may be contributing to the large differences in butterflies among the sites. Malanaphy Spring was the most unique site in the survey, in that it consists exclusively of heavily shaded riparian woods. This site is located on the west side of a bluff along the Upper Iowa River, and does not receive direct sunlight until mid-afternoon. These environmental factors likely contributed to the reduced abundance and species richness of butterflies observed at this site. South Bear and Coon Creek sites both contain old field habitats and riparian areas. Anderson Prairie consists of a dry reconstructed prairie, while Chipera Prairie is an original moist to dry prairie that has been heavily grazed and mowed, although both prairie sites are burned, at least in part, on three year cycles. Falcon Springs and Cardinal Marsh both contain large corn and alfalfa fields adjacent to standing timber, but had very different butterfly assemblages likely due to the presence of standing water at Cardinal Marsh. Van Peenan Park includes dry reconstructed prairie, old field, and wooded habitats, and is several kilometers from any streams or rivers.

Another possible explanation for these historic changes in butterfly assemblages in Winneshiek County may be due to the introduction of pest species, such as the European skipper (*Thymelicus lineola*), which may outcompete native species. Recently arrived pest species may feed on some of the same host plants as native species, and pests often adapt much more readily to changing environmental conditions. With these pest species increasing, there could be competition for resources which may ultimately lead to a decline in the abundance and possible extirpation of native species.

In conclusion, there is much work that still needs to be done to get a more complete understanding of the status of the butterfly fauna in Winneshiek County, Iowa. In our 1998 survey, we covered only eight sites throughout the county. It is possible that we may have missed some of the species on Porter's 1908 list simply because they were present at other sites or were not active during the periods we performed our surveys. Similarly, it is possible that some of the butterflies we found in 1998 were in the Decorah area in 1908, but Porter also may have missed them. Obtaining a clear picture of what is happening in the environment takes a significant amount of time. There are many climatic factors such as global warming or El Nĩno events that we may not be able to detect, and these may affect the butterflies in a given year. For example, during the summer of 1999, unusually high populations of giant swallowtails, American snouts, and buckeyes were observed in Winneshiek County (KJL, pers. obs.). Overall, an ongoing monitoring program would be the best way to get a more complete understanding of the causes of the ongoing changes to the butterfly diversity of Winneshiek County, Iowa.

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