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Stewardship in Action

A New Tool for Assessing Restoration Potential and Monitoring Restoration Success in Tallgrass Prairies: The Natural Community Health Index

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ABSTRACT

There is a need for natural area managers to better quantify the results of management actions and the potential of sites for restoration. Detailed botanical and zoological surveys and monitoring are the most valuable scientifically but require significant cost and expertise that often are not practical to accomplish at scale. To bridge this gap between rigorous monitoring and assessment, and relying on very subjective judgements of natural community condition, we developed a natural community health index model for natural tallgrass prairie communities in the unglaciated ecoregions of Missouri. Here we relate the development of this index, its field application, and its strengths and limitations.

Index terms: ecological integrity; natural community inventory; natural community monitoring; vegetation monitoring

INTRODUCTION

Natural resource managers need tools to rapidly assess natural community conditions that go beyond just gut instincts. Increasingly state and federal natural resource agencies are asked to monitor the effectiveness of restoration efforts. Land managers are being asked to report on the acreage being managed, but also to describe the efficacy of the management effort.

The concepts and methods of ecological integrity assessment have been in development by conservation biologists for over a decade now (Faber-Langendoen et al. 2019) with most recent efforts including developing metrics to track the restoration of southern open pine ecosystems (Nordman and White 2018). While monitoring is a critical component of strategic habitat conservation it often does not occur because intensive, plot-based monitoring is costly and time-consuming. Detailed vegetation monitoring also requires a high degree of botanical skill, which is in increasingly shorter supply.

In 2014 we began developing terrestrial natural community health indices as a tool to both assess restoration potential of natural areas and more importantly to gauge restoration and management success. Informed by the work of ecological integrity assessments developed by NatureServe staff (Faber-Langendoen et al. 2016) and the Minnesota wetland rapid floristic quality assessment tool (Bourdaghs 2014), we created community health index (CHI) models with input from a variety of Missouri Conservation Department (MDC) staff and members of the inter-agency Missouri Natural Areas Committee. In this report we document the methods, analyses, and results of CHI surveys for natural tallgrass prairie communities in the unglaciated ecoregions of Missouri conducted from 2018 to 2020.

METHODS

Developing a Community Health Index (CHI)

There are four primary components to ecological integrity (Tierney et al. 2009; Faber-Langendoen et al. 2016; Rocchio et al. 2020): landscape context and size of the natural community, plant and animal species composition, vegetation structure, and negative disturbances such as invasive species (Box 1). We developed metrics to account for these factors based on expert peer review and field testing for multiple prairie natural community types. Below we outline the steps taken in the development of a tallgrass prairie CHI and its implementation protocols.

We utilized the *Terrestrial Natural Communities of Missouri* (Nelson 2010) as the basis for identifying and classifying the prairie natural communities to evaluate with CHIs and as a primary source of data on characteristic species and vegetation structure to set as target conditions for restored communities. Missouri's natural tallgrass prairie communities differ substantially between those that occur in the glaciated versus the unglaciated ecoregions of the state. The CHI developed here is

Box 1. Components of Ecological Integrity

- Landscape Context – 10 maximum possible points
- Vegetation Characteristics – 80 points
- Animal Species Factors – 10 points
- Disturbance Factors – negative points, up to 11 points of the total possible score can be detracted.

Box 2. Section 1 – Landscape Context Scoring

- % of surrounding landscape (1.6 km radius – from the edge of the community boundaries) in native vegetation:
  0–25% – 0.5 points (pts); 26–50% – 1 pts; 51–75% – 1.5 pts; >75% – 2.5 pts
- Size of the prairie community (ha):
  <2 – 0 pts; 2–6.1 – 0.5 pts; 6.2–10.1 – 1 pts; 10.2–16.2 – 2 pts; 16.3–32.4 – 3 pts; 32.5–40.5 – 4 pts; 40.6–60.7 – 5 pts; >60.7 – 6 pts
- Distance to associated community types (typically bottomland prairie, claypan prairie, and savannas and woodlands):
  >1.6 km – 0.25 pts; 1–1.6 km – 0.5 pts; 0.4–0.9 km – 0.75 pts; <0.4 km – 1 pts
- Presence of prairie swales and headwater drainages embedded within the upland prairie community: yes – 0.25 pts; yes, but swales or drainages are incised/downcut – 0.2 pts; no – 0 pts
- Presence of mima mounds: yes – 0.25 pts; no – 0 pts

Total Possible Points = 10

specifically developed for the unglaciated ecoregions and is most applicable to tallgrass prairie remnants in west-central and southwest Missouri, southeast Kansas, northeast Oklahoma, and northwest Arkansas (i.e., the Osage Plains ecological section and Springfield Plain and Plateau subsections; Cleland et al. 2007). We are in the process of developing CHIs for glaciated tallgrass prairies and other natural community types that occur here in Missouri and adjacent states.

The above information was then added to and refined based on field experience and reports from other sources of data on unglaciated tallgrass prairies in Missouri (e.g., Thomas 2019, Missouri River Bird Observatory 2020). Target plant and animal species and ranges of desired vegetation structure by physiognomic group (e.g., native grass cover) were incorporated into the tallgrass prairie CHI based on these published sources as well as review and input from field ecologists familiar with these prairies. The CHI is modular and consists of four sections and their respective total point values possible are outlined in Box 1.

Note that vegetation structure and composition account for the bulk of the score. This is because the vegetative community influences most ecosystem functions (Kimmins 1997) and provides habitat for other taxonomic groups (Fryxell et al. 2014) while being the primary vector of energy flow through an ecosystem (Grossman et al. 1998). Strong correlations exist between vegetation and soils (Binkley and Fisher 2020) and plants are the most easily and practically measured variables of natural communities (White and Madany 1978). Vegetation integrates spatially and temporally variable natural and management induced disturbances (Oliver and Larson 1990) and vegetation and insect diversity are correlated to some degree (Panzer and Schwartz 1998; Wilhelm and Rericha 2017).

Box 3. Section 2 – Vegetation Characteristics Scoring

- Native tree cover (%): <5% – 3 pts; 5–10% – 1 pts; 11–20% – –3 pts; >20% – –5 pts
- Native shrub cover (%) excluding *Amorpha canescens* Pursh, *Ceanothus* species, *Salix humilis* Marshall, and *Quercus prinoides* Willd. Includes species such as *Rhus copallinum* L., *Rhus glabra* L., and *Rubus* species: 0–5% – 3 pts; 6–15% – 1 pts; 16–25% – 0 pts; 26–50% – –3 pts, >50% – –5 pts
- Cover (%) of native species in the Poaceae, Cyperaceae, and Juncaceae families: 0–25% – 2 pts; 26–50% – 6 pts; 51–75% – 7 pts; >75% – 5 pts
- Native forb cover (%): 0–25% – 2 pts; 26–50% – 6 pts; 51–75% – 7 pts; >75% – 5 pts
- Number of characteristic matrix plant species present (see Table 1 for list): each species recorded is worth 0.21 pts (round up) up to 12 possible pts.
- Estimated frequency of occurrence of characteristic matrix plant species noted taken as a whole group across the site?
  - Very frequently observed (>50% of the site) – 12 pts
  - Frequently or commonly observed (31–50% of the site) – 8 pts
  - Occasional or infrequently observed (11–30% of the site) – 6 pts
  - Rarely observed (<11 % of the site) – 3 pts
  - Not present – 0 pts
- Number of conservative plant species present (see Table 2 for list): each species recorded is worth 0.46 pts (round up) up to 18 possible pts.
- Estimated frequency of occurrence of conservative plant species noted taken as a whole group across the site?
  - Very frequently observed (>50% of the site) – 18 pts
  - Frequently or commonly observed (31–50% of the site) – 16 pts
  - Occasional or infrequently observed (11–30% of the site) – 12 pts
  - Rarely observed (<11 % of the site) – 5 pts
  - Not present – 0 pts

Total Possible Points = 80

The specific metrics and point spreads for the tallgrass prairie CHI are outlined below. In addition, an Excel file that contains the metrics and embedded formulas for scoring is accessible for downloading from the MDC website (Missouri Department of Conservation 2021). The first module of the CHI (Box 2) relates to the landscape context of the site and includes components that are measured in both the office via GIS and in the field.

Within the vegetation module (Box 3), the abundance and diversity of characteristic matrix and conservative plant species

Box 4. Section 3 – Animal Species Factors

- Number of reptile and amphibian species that have been observed on the site within the past 5 years: 0 – 0 pts; 1 – 0.5 pts; 2 – 1 pts; 3 – 1.5 pts; ≥4 – 2 pts
- Number of characteristic reptile and amphibian species (see Table 3 for list) observed on the site within the past 5 years. Each species recorded is worth 0.07 pts (round up) up to 1 pts total possible.
- Observation of the regal fritillary (*Argynnis idalia* Drury) on the site within the past 5 years? Yes – 1 pts; No – 0 pts
- Observation of the prairie mole cricket (*Gryllotalpa major* Saussure) on the site within the past 5 years? Yes – 1 pts; No – 0 pts
- Assign point values as follows for each of the characteristic bird species (see Table 4) observed on the site within the past 5 years (during the breeding bird season dates): 0 – 0 pts; 1–3 species – 1 pts; 4–6 species – 3 pts; 7–10 species – 5 pts

Total Possible Points = 10

are weighted heavily, contributing to 60 of the 80 total possible points. We utilize the concepts of floristic quality analysis (Spyreas 2019) and more heavily weight the presence of remnant-dependent, high conservation value species (termed "conservative" species) such as downy gentian (*Gentiana puberulenta* J. Pringle). These conservative species are assigned a coefficient of conservatism (C value) of 7–10 on a 10-point scale (Taft et al. 1997). Matrix species (C values 4–6) are the backbone of the tallgrass prairie community and include species such as little bluestem (*Schizachyrium scoparium* [Michx.] Nash).

We selected remnant-dependent plant species for the matrix and conservative species lists that are relatively easy to recognize vegetatively, without extensive keying, throughout large portions of the growing season. This also allows the CHI to be conducted by a larger cadre of biologists, with appropriate training and translates into greater monitoring coverage.

Animal species (Box 4), while an important component of natural communities, do pose challenges for rapid evaluation. Bird species are more readily surveyed for in prairies than herptiles and insects, which require much larger inputs of time and expertise. Because of the cryptic nature of herptiles in tallgrass prairies and the time of day and season constraints of bird sampling the animal module is often done separately or not completed. However, the CHI can be completed with just its three core components: the landscape context, vegetation characteristics, and disturbance factors (Box 5) modules. Completing these three modules can yield a total possible point value of 90 points. Scores can then be relativized based on a 90-point total possible. For example, a practitioner might evaluate a site and score it as 8 points for landscape context, 65 points for vegetation characteristics, and –3 points for disturbance factors yielding a total score for the site of 70 out of 90 possible points or 78%.

Box 5. Section 4 – Disturbance Factors

- Cover (%) of aggressive non-native plant species (see Table 5 for typical species in the region): 0% – 0 pts; 1–2% – –0.25 pts; 3–10% – –1 pts; 11–15% – –3 pts; 16–25% – –5 pts; 26–50% – –8 pts; >50% – –10 pts
- Evidence of past cropping or soil grading (e.g., terraces, erosion gullies)? Yes – 1 pts; No – 0 pts

Total Possible Points = 0 to –11

Implementation of a CHI

To conduct a CHI, first map the sampling units. CHI sampling units are defined based on the natural community type and management history. Unit boundaries are defined using aerial imagery, topographic maps, natural community maps, and land management maps. Sampling units should be based on natural community types first and then management history second. For example, if a burn unit boundary straddles two natural community types it is recommended to split the units into two rather than lump two disparate ecological units into one sampling unit because they both had the same management treatment. Likewise, if an ecological unit has two very different management regimes it is recommended that the unit be split into two sampling units. In our study of unglaciated prairies in southwest Missouri sampling units varied in size from 8 to 32 hectares. After mapping the sampling units, proceed to filling out the metrics for the first module, landscape context (Box 2). Sample units can then be uploaded onto devices for use in the field.

With CHI sample units loaded on devices and either paper or electronic CHI forms and field maps, head to the field. Once at the sampling unit, conduct a timed meander crossing a representative swath of the unit. Aim to spend under 1 min and 30 sec per half-hectare. The times listed here are ideal, depending on individual skillset and training. While walking you will be looking for the matrix and conservative plant species as well as making mental notes on the different vegetation and disturbance metrics. During the CHI, collection of animal data is preferred but optional. Because of the modular nature of the CHI and the difficulty in sampling animal species concurrently with the vegetation, the landscape context, vegetation characteristics, and negative disturbance factors are often sampled independently of the animal species module.

If you are planning on collecting animal data (Box 4), there are some additional considerations. First, to collect the bird data, you need to traverse the site during the breeding bird season safe dates (USGS 2020), generally between mid-May and late June in Missouri observed from sunrise to around 10:00 AM. Birds are not difficult to measure but these constraints for breeding bird data limit the timeframe for collecting these data. Unfortunately, collection of herptile data is difficult in most communities without more intensive sampling techniques (e.g., cover boards, drift fences, multiple visits). Most herptile data collected are often anecdotal observations. However, these

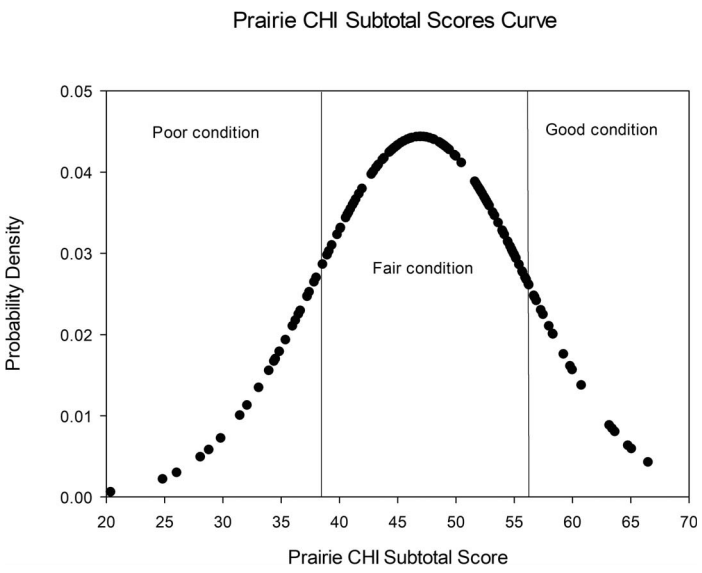

Figure 1.—Prairie CHI Subtotal Scores Curve. The *x*-axis contains the range of CHI subtotal scores (0–90 points possible in this case, excluding the animal module) and the *y*-axis contains CHI subtotal scores fitted to a probability density function.

can be utilized. Any animal records observed within the sampling unit as per the metrics within the past 5 years can be utilized in filling out the CHI animal module. The 5-year cutoff was determined based on input from the Missouri state herpetologist and ornithologist as the longest time period acceptable for similar suitable habitat to be available, on average, for the target species.

We utilized the above CHI to survey sites consisting of remnant unglaciated tallgrass prairies and prairie reconstruction plantings owned by MDC, the Missouri Prairie Foundation (MPF), and The Nature Conservancy (TNC). The tallgrass prairie remnants sampled in this study ranged in their natural quality from low ("grade D") to high ("grade A") following the grading system of the Missouri Natural Heritage Program (2020). In this study, prairies were divided into sampling units based on the size of the prairie, management units (e.g., prescribed fire units), and landform features. Sampling units averaged 23 ha in size and ranged from 6 to 57 ha. Sampling was conducted primarily by MPF contractors and staff and MDC staff. Between 2018 and 2020 plant communities were sampled at 145 remnant prairie sampling units (3355 ha) and 2 prairie reconstruction planting sampling units (23 ha) at 33 total sites. Landscape factors were determined from remote sensing data and field surveys. This was a robust sample of 20% of the remnant tallgrass prairie acreage remaining in the unglaciated ecoregions of Missouri (Missouri Natural Heritage Database 2021). Because of the uneven sampling of the herptile communities across sites we chose to just analyze the results of the landscape context, vegetation characteristics, and disturbance factors components of the CHI and leave out the animal module. These modules were combined for each sampling unit into a CHI subtotal score (with a total possible score of 90 points).

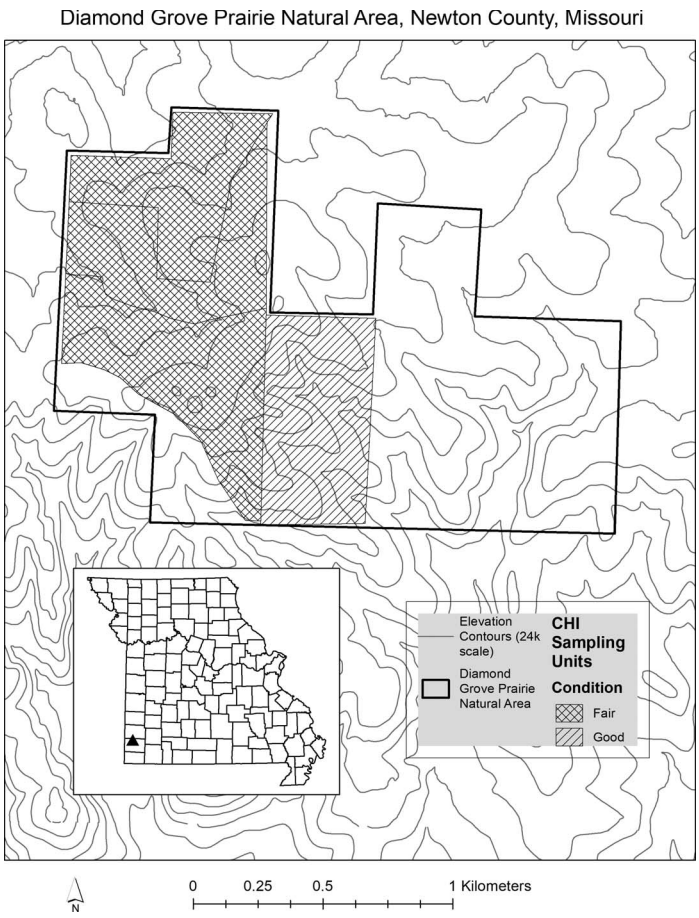

Figure 2.—Diamond Grove Prairie Natural Area CHI Units. This map shows the units sampled on the natural area by their CHI subtotal score condition class.

RESULTS AND DISCUSSION

The mean CHI subtotal unit score was 47 ± 0.7 (± SE). Scores ranged from 20 to 66 points out of 90 total possible. Low scoring units were either prairie plantings or remnant prairies with a history of past heavy livestock grazing, herbicide spraying of native forbs, and/or overseeding of nonnative tall fescue (*Festuca arundinacea* Schreb.). These units also had higher levels of invasive tree and shrub cover and or infestations of sericea lespedeza (*Lespedeza cuneata* [Dum. Cours.] G. Don)—one of the most aggressive nonnative species in the region. The higher scoring units had element occurrence ranks of A-B in the Missouri Natural Heritage Database. CHI subtotal scores for each sampling unit were fitted to a normal probability distribution function to determine the subjective condition classes of "good, fair, and poor" (Figure 1).

We defined units to be in fair condition if they ranged from 38 to 56, which was the mean ± one standard deviation (47 ± 9). Good condition units were >56 (mean + 2 SD) and poor condition units were <38 (mean − 2 SD). Because we had sampled a range of sites varying in their natural quality from high to low as identified by the Missouri Natural Heritage Program, the distribution shown represents a real range of habitat quality. Twelve percent of the units were in good

Table 1.—Characteristic matrix plant species.

C Value	Scientific name	Authority
5	*Andropogon gerardii*	Vitman
4	*Asclepias hirtella*	Pennell
5	*Asclepias tuberosa*	L.
5	*Asclepias viridis*	Walter
6	*Baptisia alba*	(L.) Vent.
6	*Camassia scilloides*	(Raf.) Cory
6	*Castilleja coccinea*	(L.) Spreng.
6	*Coreopsis grandiflora*	Hogg ex Sweet
5	*Desmodium sessilifolium*	(Torr.) Torr. & A. Gray
4	*Euthamia gymnospermoides*	Greene
6	*Helianthus mollis*	Lam.
5	*Helianthus pauciflorus*	Nutt.
5	*Heliopsis helianthoides*	(L.) Sweet
6	*Heuchera richardsonii*	R. Br.
6	*Hieracium longipilum*	Torr.
5	*Hypoxis hirsuta*	(L.) Coville
6	*Koeleria macrantha*	(Ledeb.) Schult.
6	*Lespedeza capitata*	Michx.
5	*Lespedeza virginica*	(L.) Britton
6	*Liatris aspera*	Michx.
6	*Liatris pycnostachya*	Michx.
6	*Liatris squarrosa*	(L.) Michx.
6	*Lithospermum canescens*	(Michx.) Lehm.
6	*Mimosa quadrivalvis*	L.
5	*Oligoneuron rigidum*	(L.) Small
6	*Orbexilum pedunculatum*	(Mill.) Rydb.
6	*Packera plattensis*	Nutt.
6	*Parthenium integrifolium*	L.
5	*Pedicularis canadensis*	L.
6	*Penstemon tubaeflorus*	Nutt.
6	*Phlox pilosa*	L.
6	*Physostegia angustifolia*	Fernald
5	*Physostegia virginiana*	(L.) Benth.
6	*Platanthera lacera*	(Michx.) G. Don
4	*Polygala sanguinea*	L.
5	*Pycnanthemum pilosum*	Nutt.
4	*Pycnanthemum tenuifolium*	Nutt.
4	*Ratibida pinnata*	(Vent.) Barnhart
5	*Rosa arkansana*	Porter
4	*Rosa carolina*	L.
5	*Rudbeckia subtomentosa*	Pursh
4	*Salvia azurea*	Michx. ex Lam.
5	*Schizachyrium scoparium*	(Michx.) Nash
4	*Silphium integrifolium*	Michx.
6	*Silphium laciniatum*	L.
5	*Sisyrinchium campestre*	E.P. Bicknell
6	*Solidago missouriensis*	Nutt.
6	*Solidago radula*	Nutt.
4	*Sorghastrum nutans*	(L.) Nash
6	*Sporobolus heterolepis*	(A. Gray) A. Gray
5	*Symphyotrichum ericoides*	(L.) G.L. Nesom
6	*Symphyotrichum praealtum*	(Poir.) G.L. Nesom
5	*Tephrosia virginiana*	(L.) Pers. var. glabra Nutt.
5	*Verbesina helianthoides*	Michx.
5	*Viola pedata*	L.
6	*Viola sagittata*	Aiton
5	*Zizia aurea*	(L.) W.D.J. Koch

condition, 73% were in fair condition, and 15% were in poor condition (Figure 1).

For further information on these remnant prairies and prairie plantings in terms of location, specific prairie community types, and history consult the *Public Prairies of Missouri Interactive Story Map* (Missouri Department of Conservation and Missouri Prairie Foundation 2020).

Table 2.—Characteristic conservative plant species.

C Value	Scientific name	Authority
10	*Agalinis auriculata*	(Michx.) S.F. Blake
8	*Amorpha canescens*	Pursh
8	*Arnoglossum plantagineum*	Raf.
10	*Asclepias meadii*	Torr. ex A. Gray
8	*Asclepias sullivantii*	Engelm. ex A. Gray
7	*Asclepias viridiflora*	Raf.
7	*Baptisia bracteata*	Muhl. ex Elliott
10	*Buchnera americana*	L.
8	*Callirhoe digitata*	Nutt.
10	*Calopogon oklahomensis*	D.H. Goldman
10	*Camassia angusta*	(Engelm. & A. Gray) Blank.
7	*Ceanothus americanus*	L.
8	*Ceanothus herbaceus*	Raf.
7	*Comandra umbellata*	(L.) Nutt.
7	*Coreopsis palmata*	Nutt.
8	*Dalea candida*	Michx. ex Willd.
8	*Dalea purpurea*	Vent.
7	*Delphinium carolinianum*	Walter
7	*Echinacea pallida*	(Nutt.) Nutt.
8	*Eryngium yuccifolium*	Michx.
9	*Eurybia hemispherica*	(Alexander) G.L. Nesom
9	*Gentiana puberulenta*	J. Pringle
9	*Marshallia caespitosa*	Nutt. ex DC.
9	*Oligoneuron album*	(Nutt.) G.L. Nesom
10	*Pediomelum esculentum*	(Pursh) Rydb.
8	*Pediomelum tenuiflorum*	Rydb.
8	*Polygala incarnata*	L.
8	*Polytaenia nuttallii*	DC.
7	*Prenanthes aspera*	Michx.
7	*Primula meadia*	(L.) A.R.Mast & Reveal
7	*Salix humilis*	Marshall
9	*Silene regia*	Sims
7	*Solidago speciosa*	Nutt.
8	*Spiranthes vernalis*	Engelm. & A. Gray
8	*Stipa spartea*	Trin.
7	*Symphyotrichum oolentangiense*	(Riddell) G.L. Nesom
7	*Vernonia arkansana*	DC.
10	*Viola pedatifida*	G. Don
7	*Zizia aptera*	(A. Gray) Fernald

CHI unit maps were constructed in ArcGIS (Figure 2 is an example for Diamond Grove Prairie Natural Area, a state-designated natural area) for easy visual analysis of prairie condition by the prairie's area manager. This allows the area manager to rapidly see which management units require attention and what their spatial context is to other resource management data layers (e.g., prescribed fire lines and invasive species infestations).

We also compared CHI subtotal scores from the same five units sampled by different survey crews in 2018 and 2020. Encouragingly the scores were similar with an average difference of just 3.2 $\pm$ 0.9 (SEM) points between samples conducted in 2018 and 2020 by different people. This demonstrates the repeatability of the surveys given trained crews.

Most of the prairie units sampled were in fair condition, which is a broad condition class. It is encouraging that most CHI

Table 3.—Characteristic reptile and amphibian species.

Accepted common name	Scientific name	Authority
Boreal chorus frog	*Pseudacris maculata*	Agassiz
Bullsnake	*Pituophis catenifer sayi*	Schlegel
Eastern tiger salamander	*Ambystoma tigrinum*	Green
Eastern yellow-bellied racer	*Coluber constrictor flaviventris*	Say
Great Plains skink	*Plestiodon obsoletus*	Baird and Girard
Lined snake	*Tropidoclonion lineatum*	Hallowell
Northern crawfish frog	*Lithobates areolatus circulosus*	Rice and Davis
Plains box turtle	*Terrapene ornata ornata*	Agassiz
Plains leopard frog	*Lithobates blairi*	Mecham, Littlejohn, Oldham, Brown, and Brown
Prairie kingsnake	*Lampropeltis calligaster calligaster*	Harlan
Prairie ring-necked snake	*Diadophis punctatus arnyi*	Baird and Girard
Small-mouthed salamander	*Ambystoma texanum*	Matthes
Southern prairie skink	*Plestiodon septentrionalis obtusirostris*	Bocourt
Western slender glass lizard	*Ophisaurus attenuatus* |*attenuatus*	Cope

Table 4.—Characteristic bird species.

Accepted common name	Scientific name	Authority
Bell's vireo	*Vireo bellii*	Audubon
Blue grosbeak	*Passerina caerulea*	L.
Dickcissel	*Spiza americana*	Gmelin, JF
Eastern meadowlark	*Sturnella magna magna*	L.
Grasshopper sparrow	*Ammodramus savannarum*	Gmelin, JF
Greater prairie-chicken	*Tympanuchus cupido*	L.
Henslow's sparrow	*Centronyx henslowii*	L.
Northern bobwhite	*Colinus virginianus*	L.
Northern harrier	*Circus hudsonius*	L.
Upland sandpiper	*Bartramia longicauda*	Bechstein

Table 5.—Typical aggressive nonnative plant species in the region.

Scientific name	Authority
Bothriochloa bladhii	(Retz.) S.T. Blake
Bothriochloa ischaeum	(L.) Keng
Centaurea stoebe	L.
Dipsacus fullonum	L.
Dipsacus laciniatus	L.
Elaeagnus umbellata	Thunb.
Festuca arundinacea	Schreb.
Lespedeza cuneata	(Dum. Cours.) G. Don

units are in fair to good condition. These data provide a baseline on which to evaluate future restoration efforts.

The next step in refining and improving the tallgrass prairie CHI is to calibrate it with full plant species inventories of quadrats. CHIs conducted on prairies with arrays of vegetation quadrats will allow us to compare floristic quality metrics with CHI scores. The hypothesis is that CHI scores and the total mean coefficient of conservatism (Total Mean C) for the quadrat data will be positively correlated. Future work plans include conducting more CHIs on sites with detailed vegetation quadrat data to allow for a correlation analysis (Zar 1999).

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Jennifer Buchanan was an assistant natural history biologist with the Missouri Department of Conservation. She is currently a herpetology contractor with the Wisconsin Department of Natural Resources.

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