ALL GRASSLAND HABITATS NARRATIVE

This habitat narrative is the results of the aggregated data for all grassland sub-habitat types.

Habitat description

Open area dominated by grass species, for example, prairies or reclaimed minelands.

Problems affecting species and habitats

Species threats

Respondents ranked the following threats to wildlife in all grassland habitats in Indiana:

Rank	Threats to wildlife in all grassland habitats
1	Habitat loss (breeding range)
2	Habitat loss (feeding/foraging areas)
3	Invasive/non-native species
4	Predators (native or domesticated)
5	Dependence on irregular resources (cyclical annual variations) (e.g., food, water, habitat limited due to annual variations in availability)
6	Degradation of movement/migration routes (overwintering habitats, nesting and staging sites)
7	Bioaccumulation of contaminants
8	Unintentional take/ direct mortality (e.g., vehicle collisions, power line collisions, by-catch, harvesting equipment, land preparation machinery)
9	Viable reproductive population size or availability
10	Small native range (high endemism)
11	High sensitivity to pollution
12	Diseases/parasites (of the species itself)
13	Specialized reproductive behavior or low reproductive rates
14	Large home range requirements
15	Near limits of natural geographic range
16	Dependence on other species (mutualism, pollinators)
17	Regulated hunting/fishing pressure (too much)
18	Unregulated collection pressure

Appendix F-48: Aggregated Grasslands

Respondents offered additional threats to wildlife in all grassland habitats in Indiana (not ranked):

- Changes in burrowing crayfish or rodent populations that would impact the availability of burrows
- Introduction of fish into formally fishless breeding waters
- Development of barriers between the crayfish frog's burrow and breeding waters
- Cold wet weather when first litters appear (late March and early April)
- Cottontail rabbits
  - Agricultural policy, i.e., production without supply side considerations, influence availability of the habitats
  - Cottontails are a game species and utilized heavily as a recreational resource, and therefore a luxury. The tradeoff is that the American public wants beef, corn and related foodstuffs at a low cost. The cottontail will not prevail here as being necessary under those societal needs
  - Habitat loss to natural succession is a critical threat to cottontail populations in Indiana
- Impacts of herbicides and pesticides drifting over from nearby agricultural lands is unknown
- Mowing in June, July and August
- Early harvesting of hay crops
- Fire suppression is a major threat to many, many species in the state. Savannah habitats are seriously degraded because fire suppression has allowed shade tolerant species to dominate the understory, changing the open savannah structure into a dense forest with an impenetrable understory. Fire keeps the structure open and results in a varied mosaic of habitats, including fire killed trees that provide both food and shelter

Respondents listed top threats to wildlife in all grassland habitats in Indiana (not ranked):

- Habitat loss, degradation, fragmentation
  - Land use changes or other factors that impact the availability and persistence of suitable burrows
  - Loss of habitat, plus people trying to remove them from their lawns and gardens
  - Loss of grasslands, and grassland ground squirrel populations
  - Habitat loss to uncontrolled vegetative succession is a serious threat
  - Habitat loss due to agricultural practices
  - Short-tailed shrew: Habitat loss in this relatively specialized habitat is the primary threat to the short-tailed shrew. Early successional grassland habitats provide marginal habitat requirements for this specialized species. The short-tailed shrew is an insectivore/vermivore. Early successional grassland habitat occurs in abandoned land associated with either agricultural, industrial or urban land uses. Only in isolated situations do grasslands develop as a dominant habitat type in Indiana. Most grasslands will eventually be dominated by shrub or tree cover. By definition early successional grassland habitat is a temporary habitat type
  - Loss of quality nesting and brood habitat
  - Lack of large areas in native grass
  - Habitat loss due to fire suppression

  - Redheaded woodpecker: This species is more of an obligate to open areas with scattered dead trees than most Indiana species. Outright loss of this habitat configuration is probably the leading threat

- Crayfish frog
  - Introduction of fish into formally fishless breeding waters
  - Development of barriers between the crayfish frog's burrow and breeding waters

- Agricultural policy/loss of farm programs
  - Bobwhite quail
    - The primary threat is the loss of these farm programs
    - An additional threat would be the loss or shortening of the primary nesting season dates established by USDA

- Farm practices
  - Habitat loss due to agricultural practices
  - Bobwhite quail: Mowing or haying during the quail nesting season would be allowed on enrolled acreage if these dates were eliminated or shortened.
  - Timing and frequency of haying, as well as the cover type (alfalfa) can negatively affect nest success and limit productivity
  - Mowing grasslands
  - Invasive/non-native vegetative species such as fescue do not provide cover, nutrition and are thought to be toxic
  - Fire suppression

- Domestic predators
  - Habitat loss and fragmentation create small, isolated patches where nest predation and brood parasitism tend to increase

- Specialized habitat
  - Short-tailed shrew: Habitat loss in this relatively specialized habitat is the primary threat to the short-tailed shrew. Early successional grassland habitats provide marginal habitat requirements for this specialized species

- Disease
  - Redheaded woodpecker: West Nile Virus is probably currently the second greatest threat

- Small population size and low reproductive rate
  - Most known populations seem to occur at such low densities that mating seems a remote possibility. All problems associated with small population size and low reproductive rate seem likely to plague the Ornate box turtle. Most populations seem likely to be in a slow-motion death spiral at the moment

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the threats to wildlife in all grasslands habitats. Their responses included:

- The greatest threat to grassland birds nesting in Indiana would be losing these reclaimed mineland grasslands to housing developments, golf courses and industrial development.

Habitat threats

Appendix F-48: Aggregated Grasslands

Respondents ranked threats to all grassland habitats in Indiana:

Rank	Threats to all grassland habitats
1 (tie)	Habitat degradation
2	Successional change
3	Agricultural/forestry practices
4	Commercial or residential development (sprawl)
5	Habitat fragmentation
6	Counterproductive financial incentives or regulations
7	Invasive/non-native species
8	Residual contamination (persistent toxins)
9	Mining/acidification
10	Point source pollution (continuing)
11	Climate change
12	Nonpoint source pollution (sedimentation and nutrients)
13	Drainage practices (stormwater runoff)
14	Diseases (of plants that create habitat)
15	Stream channelization
16	Impoundment of water/flow regulation

Respondents noted additional threats to all grassland habitats in Indiana (not ranked):

- Badgers: Mowing or burning for aesthetic purposes such that badger prey population or badger cover are diminished
- No financial incentive to develop/maintain/manage these habitats
- Bobwhite quail: If the farm bill programs (e.g. CRP) were to be eliminated the negative effects on Indiana's northern bobwhite population would be substantial
- Red-headed woodpecker: Loss of disturbance regimes that maintained the open structure of savannahs and swamp forests where the red-headed woodpecker resides
- Fire suppression is the major threat. Lack of fire also results in an increase of shade-tolerant invasive species like garlic mustard and Asian bush honeysuckle, further degrading the savannah habitat

Respondents listed top threats to all grassland habitats in Indiana (not ranked):

- Agricultural practices
  - Cattle grazing, farming, and development activities that affect the persistence of burrows in formally flooded or moist grasslands
  - Invasion of early successional grasslands by tall fescue

  - Another threat is early mowing or haying during the primary nesting season. These activities are not currently allowed until after July 15 but mowing during late July and early August still destroys some nests and young
  - Conversion of hayfields to row crop

- Habitat loss and fragmentation
  - Draining of breeding ponds, ditches; introducing fish into breeding waters
  - Loss of grasslands, and grassland ground squirrel populations
  - Due to agricultural practices
  - Due to urban sprawl/conversion to urban cover types
  - Conversion of savannah to development uses
  - Fragmentation and small habitat size – most habitats are small remnants of native grassland, surrounded by either agriculture of fire-suppressed oak savannah. Habitat size needs to be expanded at sites which support seemingly salvageable populations of the Ornate box turtle

- Successional change/fire suppression
  - Results in habitat degradation as grasslands are invaded by woody vegetation
  - Fire suppression is resulting in successional change to more shade-tolerant forests. Forestry practices are not emphasizing the need for fire in savannah areas enough

- Exotic/invasive species
  - Fescue invasion
  - Much potentially suitable habitat has been lost though succession to exotic species and oak woodland. This turtle requires expansive open grassland. Lack of habitat management, or in the case of invasive species, because of the purposeful introduction of invasive shrubs, has resulted in open native grassland being lost to shrub land and oak woodland

- Agricultural policy

- Competing products (food)

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the threats to all grasslands habitats. There were no responses.

Additional research and survey efforts

Current body of research

Species research

Thirty-three percent respondents stated that the current body of science is adequate for wildlife in all grassland habitats in Indiana; sixty-seven percent stated that it is inadequate or nonexistent.

Respondents identified the following citations (title, author, date, publisher) that would give the best overview of wildlife in ALL Grassland habitats in Indiana.

Title = Amphibians and reptiles of Indiana;
Author = Sherman A. Minton, Jr.;
Date = 2001;

Publisher = Indiana Academy of Sciences

Author = www.natureserve.org/explorer

Title = Mamm. IN;
Author = M & W 1982

Title = Mammals of the Eastern United States;
Author = J.O. Whitaker, Jr. and W. J. Hamilton, Jr.;
Date = 1998;
Publisher = Cornell University Press

Author = www.natureserve.org/explorer

Title = Mammals of Indiana;
Author = Mumford;
Date = ?;
Publisher = ?

Title = Mammals of the Great Lake States;
Author = ?;
Date = ?;
Publisher = ?

Title = Mammals of IN;
Author = Russel Mumford & John Whitaker Jr;
Date = 1982;
Publisher = IN Universty Press

Title = Reduction in the Eastern Limit of the Range of the Franklin's Ground Squirrel;
Author = Scott Johnson and Jane Choromanski-Norris;
Date = 1992;
Publisher = American Midland Naturalist 128:325-331.

Title = Franklin's Ground Squirrel in Illinois: A Declining Prairie Mammal?;
Author = Jason Martin, Edward Heske, Joyce Hofman;
Date = 2003;
Publisher = American Midland Naturalist 150:130-138.

Title = A 14-year study of BLARINA BREVICAUDA in east-central Illinois.;
Author = Getz, L. L.;
Date = 1989;
Publisher = J. Mammalogy 70:58-66.

Title = Blarina bravicauda;
Author = George,S. B., J. R. Choate, and H. H. Genoways;
Date = 1986;
Publisher = Mammalian Species 261:1-9

Title = Population Ecology and Harvest of the Cottontail Rabbit;
Author = Heraold A.Demaree, Jr;
Date = 1978;

Title = Population ecology and harvest of the cottontail rabbit on the Pigeon River fish and wildlife area, 1962-1970;

Author = Harold Demaree Jr.;
Date = 1978;
Publisher = Indiana Division of Fish and Wildlife

Title = HESPS in mine land MS Thesis;
Author = Travis Devault;
Date = 2000;
Publisher = Indiana State Univ

Title = Forest and Grassland Bird Productivity;
Author = Robb et. al.;
Date = 1998;
Publisher = USFWS internal report

Title = Atlas of Breeding Birds of Indiana;
Author = J.S. Castrale, E.M. Hopkins, & C.E. Keller;
Date = 1998;
Publisher = IDNR

Title = Effects of management practices on grassland birds: Bobolink;
Author = Dechant, J.A., M.L. Sondreal, D.H. Johnson, L.D. Igl, C.M. Goldade, A.L. Zimmerman and B.R. Euliss;
Date = 2001;
Publisher = Northern Prairie Wildlife Research Center

Title = Atlas of Breeding Birds of Indiana;
Author = Castrale, JS, E Hopkins, C Keller;
Date = 1988;
Publisher = IDNR

Title = BNA Account - Savannah;
Author = Wheelwright and Rising;
Date = 1993;
Publisher = American Ornithologists' Union

Title = Red-headed Woodpecker (Melanerpes erythrocephalus). In The Birds of North America, No. 518;
Author = Smith, K. G., J. H. Withgott, and P. G. Rodewald.;
Date = 2000;
Publisher = The Birds of North America, Inc., Philadelphia, PA.

Title = 1998. Atlas of Breeding Birds of Indiana Atlas of Breeding Birds of Indiana;
Author = Castrale, John S., Edward M. Hopkins, and Charles E. Keller.;
Date = 1998;
Publisher = Indiana Department of Natural Resources

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the current body of science for wildlife in all grasslands habitats. Their responses included:

- Also, see list of literature references pertaining to reclaimed minelands, habitat fragmentation and brown-headed cowbird parasitism.

Habitat research

Forty-two percent of respondents stated that the current body of science is adequate for all grassland habitats in Indiana; fifty-four percent stated that it is inadequate or nonexistent.

Respondents identified the following citations (title, author, date, publisher) that would give the best overview of ALL Grassland habitats in Indiana.

Title = Mammals of Indiana;
Author = Mumford/Whitaker;
Date = 1982;
Publisher = IU Press

Title = A4-year study study of BLARINA BREVICAUDA un east-central Illinois;
Author = Getz, L. L.;
Date = 1989;
Publisher = J. Mammalogy 70:58-66.

Title = Strip mine grassland birds;
Author = Travis Devault;
Date = 2000;
Publisher = Indiana State Univ.

Title = Vegetation management practices on conservation reserve program fields to improve northern bobwhite habitat quality;
Author = Greenfield, K. C.; W. B. Burger Jr.; M. J. Chamberlain, E. W. Kurzejeski;
Date = 2002;
Publisher = Wildlife Society Bulletin

Title = Surviving where ecosystems meet: ecotonal animal communities of midwestern oak savannas and woodlands;
Author = Temple, Stanley A.;
Date = 1998;
Publisher = Transactions of the Wisconsin Academy of Sciences, Arts and Letters 86:206-222

Title = Savannas, barrens, and rock outcrop plant communities of North America;
Author = Anderson, Roger C., Fralish, James S. , and Baskin, Jerry M.;
Date = 1999;
Publisher = Cambridge University Press

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the current body of science for all grasslands habitats. There were no responses.

Research needs

Species research

Respondents ranked research needs for wildlife in all grassland habitats in Indiana:

Rank	Research needs for wildlife in all grassland habitats
1	Limiting factors (food, shelter, water, breeding sites)

2	Threats (predators/competition, contamination)
3	Relationship/dependence on specific habitats
4	Population health (genetic and physical)
5	Distribution and abundance
6	Life cycle

Respondents noted additional research needs for wildlife in all grassland habitats in Indiana (not ranked):

- Some wildlife species are in great need of study on all aspects of its ecology
- We need more information on the reproduction of some wildlife species in various habitats
- Badgers: The relationship between badgers and land use and soil type, especially soil types that support borrows both for the badger and its prey
- Cottontail rabbits: Determine what affect feral cats have on a local cottontail population
- I would like to see some research to determine the extent to which mowing and haying negatively impact production following the end of the primary nesting season (as defined by the USDA). Following July 15 in Indiana landowners can mow or hay there enrolled lands. I believe a substantial proportion of bobwhites are still nesting at that time
- How to reduce clean farming and increasing field size
- Detailed demographic data need to be gathered and the effects of habitat structure and fragmentation on those demographic parameters understood

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the research needs for wildlife in all grasslands habitats. There were no responses.

Habitat research

Respondents ranked research needs for all grassland habitats in Indiana:

Rank	Research needs for all grassland habitats
1	Distribution and abundance (fragmentation)
2	Threats (land use change/competition, contamination/global warming)
3	Successional changes
4	Relationship/dependence on specific site conditions

5	Growth and development of individual components of the habitat

Respondents noted additional research needs for all grassland habitats in Indiana (not ranked):

- Crawfish frogs: Habitat needs to be adequately described
- Additional information on all phases of the biology of some wildlife species would be helpful. However, some are in no current danger
- Badgers: The difference between native, warm-season-grass/native for grasslands; planted, non-native, cool-season grasslands and CRP grasslands relative to suitability for badgers
- Seeding mixtures and mid-contract management activities currently utilized on Farm Bill lands need to be evaluated to determine their value to bobwhite nesting and brood rearing
- How to create and maintain quality grassland habitat on a permanent basis
- Timing and frequency of haying and other agricultural disturbances
- Relationship of fire to habitat structure needs to be better elucidated

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the research needs for all grasslands habitats. There were no responses.

Conservation actions necessary

Species actions

Respondents ranked conservation efforts by how well they address threats to wildlife in all grassland habitats in Indiana:

Rank	Conservation efforts for wildlife in grassland habitats
1	Population management (hunting, trapping)
2	Public education to reduce human disturbance
3	Exotic/invasive species control
4	Protection of migration routes
5 (tie)	Food plots
5 (tie)	Threats reduction
6	Habitat protection
7 (tie)	Regulation of collecting
7 (tie)	Native predator control
7 (tie)	Limiting contact with pollutants/contaminants

Respondents noted other current conservation practices for wildlife in all grassland habitats in Indiana (not ranked):

- Crawfish frog: Study burrow-making crayfish and their burrows
- Saving grassland (and woodland) will help this animal
- Vegetative succession control/fire management
- Cottontail rabbits: Provide additional habitats through programs, agricultural and other. Rabbits are a byproduct of the economy. The more human needs placed on the landscape the less amount of by products will be produced. If we select for beef and corn there will be less rabbits. By selecting for, you simultaneously select against something else
- Restoration of native grasslands, and increased enrollment in Conservation Reserve Program provide refuges from agricultural disturbances (provided the proper vegetation structure is maintained)
- Water level management in swamp forests

Respondents recommended these practices for more effective conservation of wildlife in all grassland habitats in Indiana (not ranked):

- Crawfish frog: Promote non-disturbance in known crawfish frog habitat
- Identify breeding sites and protect the sites from disturbance and the introduction of fish
- Conservation and restoration of ground squirrel and pocket gopher populations
- Limit human access to all parts of large grasslands
- Protect, conserve and restore early successional habitat
  - Promote early succession associated with structure similar to L. japonica
  - The best strategy would be to protect as much early successional habitat as possible but that habitat must be manipulated periodically to set back natural succession
  - Manage lands for early successional grassland habitat - would require land use change every three to five years
  - Long-term fire management of existing savannah sites
  - Restoration of grassland habitats adjacent to known population sites would be a great start. Restoration could involve creation of native grassland system from adjacent agricultural fields, wit the restoration designed to create habitat specifically for this and other species
  - Restoration of oak savannah at known sites would involve opening the canopy in oak woodlands to ~50 percent cover and control of invasive exotic shrubs. This would restore connectivity between potentially occupied habitat patches at larger public lands, and expand potential habitat
- Require mid-contract management (e.g. discing or burning) between three to five years after establishment on all Farm Bill acreage planted to grasses

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the conservation of wildlife in all grasslands habitats. Their responses included:

- Non-native vegetation including tall fescue, smooth brome, orchard grass and Japanese brome was used successfully for nesting. The size of the reclaimed minelands and isolation from forested habitat apparently accounted for a reduced level of brown-headed cowbird parasitism and high nesting use and success.

Habitat actions

Respondents ranked conservation efforts by how well they address threats to all grassland habitats in Indiana:

Rank	Conservation efforts for all grassland habitats
1	Habitat restoration incentives (financial)
2	Habitat protection on public lands
3	Cooperative land management agreements (conservation easements)
4	Habitat restoration on public lands
5	Selective use of functionally equivalent exotic species in place of extirpated natives
6	Corridor development/protection
7	Land use planning
8	Restrict public access and disturbance
9	Habitat restoration through regulation
9 (tie)	Technical assistance
10	Habitat protection incentives (financial)
11	Habitat protection through regulation
12	Succession control (fire, mowing)
13 (tie)	Protection of adjacent buffer zone
13 (tie)	Artificial habitat creation (artificial reefs, nesting platforms)
13 (tie)	Managing water regimes
13 (tie)	Pollution reduction

Respondents listed other current conservation practices for all grassland habitats in Indiana (not ranked):

- Strip spraying/interseeding
- Preventing early mowing and haying of CRP land or other habitat

Respondents recommended the following practices for more effective conservation of all grassland habitats in Indiana (not ranked):

- Crawfish frog: Public ownership (purchase) of known crawfish frog habitat and maintenance of the hydrology of the site and associated breeding waters

- Prescribed burning/manage for early successional habitats
    - Grasslands often have to be maintained by fire. Control-burns are becoming more difficult to conduct due to lack of trained personnel, restricted burn windows, and encroaching development. Grassland management difficulties need to be addressed
    - Prescribed burning, because it is useful in controlling vegetative succession. Uncontrolled vegetative succession eventually excludes rabbits and makes future management difficult due to concerns for the Indiana Bat. (Stribling, H.L. and Speake, D. W. 1991. Responses of Bobwhite Quail and Eastern Cottontail Rabbit Populations to Prescribed Burning, Cover Enhancement and Food Plots. Alabama Game & Fish Division/Auburn University
    - To maintain cottontail rabbit habitat
    - Early successional grassland habitat maintenance would require restart succession is areas. Disturbance of a magnitude to create bare ground, such as a complete burn, plowing, etc. would be required to accomplish this goal

- Making mid-contract management mandatory on enrolled acreage

- Control invasives: Get rid of the invasive species degrading savannah habitats, including those invasive species deliberately plant by wildlife agencies

- Prevent early mowing/haying
    - Provide incentives to prevent landowners from haying or grazing during the breeding season

- Landowner education and outreach
    - Educate landowners about the importance of their land to the persistence of the species

- Purchase remnant savannahs, restore savannahs that have undergone succession to forest or have been farmed

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the conservation for all grasslands habitats. Their responses included:

- Purchase of fee title or easement rights by the State is the last hope to preserve significant grassland habitat for grassland and savanna nesting birds.

Partner agencies/organizations

The following organizations indicated that they work in Grassland habitats.

Organization	Percent of time spent in Grassland habitats
Blue Heron Ministries, Inc.	40
Merry Lea Environmental Learning Center of Goshen College	35
Red-tail Conservancy, Inc.	33

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Big Oaks National Wildlife Refuge, USFWS	30
DNR Division of Nature Preserves	30
Dunes-Calumet Audubon Chapter	30
Indiana Grand Kankakee Marsh Restoration Project	30
Indiana Native Plant and Wildflower Society	30
Indiana Quail Unlimited	30
U.S. Fish and Wildlife Service - Indiana Private Lands Office	30
NICHES Land Trust	25
Northern Indiana Public Service Company (NIPSCO) a Subsidiary of NiSource	25
Pheasants Forever Inc.	25
Sassafras Audubon Society	25
Trillium Land Conservancy, Inc.	25
Indiana Dunes National Lakeshore	20
Lincoln Hills RC&D	20
Patoka River National Wildlife Refuge & Management Area	20
Summit Lake State Park	20
The Nature Conservancy	20
Cinergy Corp.	15
Ducks Unlimited, Inc.	15
Mason & Hanger Corp. Newport Chemical Depot	15
South Bend-Elkhart Audubon Society	10-15
Earth Source, Inc.	10
Indiana Association of Soil and Water Conservation Districts	10
JFNew and Associates	10
MWH Americas, Inc.	10
Northwestern Indiana Regional Planning Commission (NIRPC)	10
Save the Dunes Conservation Fund	10
Sycamore Land Trust	10
The Indiana Audubon Society	10
U.S. Department of Agriculture, Forest Service Hoosier National Forest	10
Wawasee Area Conservancy Foundation, Inc.	10
Imdian Deer Hunters Association	10
St. Joseph River Watershed Initiative	7
Division of Fish and Wildlife	6
ACRES, Inc.	5
Central Indiana Land Trust	5
Ducks Unlimited	5
Hoosier Environmental Council	5
IDNR- Division of Forestry- Cooperative Forest Management Section (Private Lands)	5
Indiana state trappers assoc	5
Lost River Conservation Association	5

Robert Cooper Audubon Society	5
Sierra Club Hoosier Chapter	5
US Fish and Wildlife Service Ecological Services (does not include national wildlife refuges)	5
Veolia Water Indianapolis, LLC	5
Whitewater Valley Land Trust, Inc.	5
St. Joseph County Soil & Water Conservation District (SWCD)	4
Indiana Division of the Izaak Walton League of America	3
Indiana Department of Natural Resources Division of Forestry, Properties Section (State Forests)	1
Federal Highway Administration (FHWA)	?
American Society of Landscape Architects, Indiana Chapter	
Central Hardwoods Joint Venture/American Bird Conservancy	
Crooked Creek Conservation & Gun Club, Inc.	
Fur Takers of America	
Indiana Beef Cattle Association	
Law Enforcement Division, Indiana Department of Natural Resources	
National Audubon Society - Indiana Important Bird Areas Program (IBA)	
USDA Natural Resources Conservation Service	

Proposed plans for monitoring

Current monitoring

Species monitoring

Respondents were aware of the following monitoring efforts by state agencies for wildlife in all grassland habitats in Indiana (not ranked):

- Statewide year-round monitoring
- Statewide once-a-year monitoring
- Periodic statewide (less than once a year but still regularly scheduled) monitoring
- Occasional statewide (less than once a year and not regularly scheduled) monitoring
- Regional or local year-round monitoring
- Regional or local once-a-year monitoring
- Periodic regional or local (less than once a year but still regularly scheduled) monitoring
- Occasional regional or local (less than once a year and not regularly scheduled) monitoring

Respondents were aware of the following monitoring efforts by other organizations for wildlife in all grassland habitats in Indiana (not ranked):

- Statewide once-a-year monitoring
- Periodic statewide (less than once a year but still regularly scheduled) monitoring
- Occasional statewide (less than once a year and not regularly scheduled) monitoring
- Regional or local year-round monitoring
- Regional or local once-a-year monitoring

- Periodic regional or local (less than once a year but still regularly scheduled) monitoring
- Occasional regional or local (less than once a year and not regularly scheduled) monitoring

Respondents ranked monitoring efforts by state agencies based on their importance for conservation of wildlife in all grassland habitats in Indiana:

Rank	Monitoring efforts by state agencies for conservation of wildlife in grassland habitats
1	Statewide once-a-year monitoring
2	Occasional statewide (less than once a year and not regularly scheduled) monitoring
3	Periodic statewide (less than once a year but still regularly scheduled) monitoring
4	Occasional regional or local (less than once a year and not regularly scheduled) monitoring
5	Regional or local once-a-year monitoring
6	Statewide year-round monitoring
7	Periodic regional or local (less than once a year but still regularly scheduled) monitoring
8	Regional or local year-round monitoring

Respondents ranked monitoring efforts by other organizations based on their importance for conservation of wildlife in all grassland habitats in Indiana:

Rank	Monitoring efforts by other organizations for conservation of wildlife in grassland habitats
1	Statewide once-a-year monitoring
2	Occasional regional or local (less than once a year and not regularly scheduled) monitoring
3	Regional or local once-a-year monitoring
4 (tie)	Periodic statewide (less than once a year but still regularly scheduled) monitoring
4 (tie)	Occasional statewide (less than once a year and not regularly scheduled) monitoring
5	Periodic regional or local (less than once a year but still regularly scheduled) monitoring
6	Regional or local year-round monitoring
7	Statewide year-round monitoring

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Respondents listed regional or local monitoring by state agencies for wildlife in all grassland habitats in Indiana (not ranked):

- Crawfish frogs: Statewide within the range of crawfish frogs: Indiana Amphibian Monitoring Program (IAMP) part of the North American Amphibian Monitoring Program and Frog Watch are conducted annually during the crawfish frog breeding season. The data can be analyzed regionally

- Badgers: Indiana Division of Fish and Wildlife and the Division of Nature Preserves maintain data on the occurrence location of road-kill, accidentally trapped or other verified human encounters with badgers

- Cottontail rabbits: Indiana Division of Fish and Wildlife logged rabbit sightings during quail whistle counts in the past

- DNR property harvest data

- Annual small game survey of licensed hunters

- Indiana Division of Fish and Wildlife conducts a biennial mailing survey to small game hunters to estimate harvest. Additionally, the division conducts and annual spring whistle counts to provide an index to the spring breeding population. However, neither of these methods focus directly on Farm Bill habitats

- Interlake Property, Division of Outdoor Recreation ownership

- Surveys on state properties and through efforts such as the Breeding Bird Atlas project

- IDNR's Nongame and Endangered Species Program

Respondents listed regional or local monitoring by other organizations for wildlife in all grassland habitats in Indiana (not ranked):

- The Breeding Bird Atlas survey
    - Is conducted by the National Audubon Society and observers counts the number of bobwhites seen along with other bird species. This survey is not directly focuses on Farm Bill habitats
    - BBS routes and work done on strip-mined lands in southwest Indiana, and Big Oaks National Wildlife Refuge
    - BBS routes are scattered throughout the state depending on volunteer participation
    - Includes routes that incorporate sites occupied by the redheaded woodpecker. This annual survey will therefore potentially count redheaded woodpeckers at a few sites yearly

- Local intensive surveys, nest monitoring or mark-recapture studies

- May Day Bird Counts and Summer Bird Counts

Respondents listed organizations that monitor wildlife in all grassland habitats in Indiana (not ranked):

- Cottontail rabbits: The biennial small game harvest survey is the only method currently being used by the Division of Fish and Wildlife to monitor the statewide rabbit population

- Breeding Bird Survey
  - Conducted by National Audubon Society
  - Conducted by U.S. Geological Survey Bird Banding Lab
- USDA Forest Service
- Indiana Division of Fish and Wildlife
- The Nature Conservancy
- U.S. Fish and Wildlife Service
- Indiana Academy of Science
- National Audubon Society/local chapters
- Universities such as Purdue University conduct local-level research projects
- U.S. Geological Survey
  - In Porter, Indiana has conducted studies of oak savannah birds, including the Red-headed Woodpecker
  - Breeding Bird Survey
- Birding organizations

Respondents considered monitoring techniques for wildlife in all grassland habitats in Indiana:

Monitoring techniques for wildlife in grassland habitats	Used	Not used but possible with existing technology and data	Not economically feasible
Radio telemetry and tracking	--	X	X
Modeling	X	X	X
Coverboard routes	X	X	--
Spot mapping	X	X	X
Driving a survey route	X	X	X
Reporting from harvest, depredation, or unintentional take (road kill, by-catch)	X	X	--
Mark and recapture	X	X	X
Professional survey/census	X	X	X

Volunteer survey/census	X	X	X
Trapping (by any technique)	X	X	X
Representative sites	X	X	X
Probabilistic sites	X	X	--

Respondents noted other monitoring techniques for wildlife in all grassland habitats in Indiana (not ranked):

- Sampling for eggs or larva
- Nest monitoring
- Distance sampling

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the monitoring techniques for wildlife in all grasslands habitats. Their responses included:

- Merry Lea Environmetnal Learnig Center of Goshen College is a bird banding station in support of the nationwide MAPS program. (Monitoring Avian Productivity and Survivorship)

Habitat inventory and assessment

Respondents were aware of the following inventory and assessment efforts by state agencies for all grassland habitats in Indiana (not ranked):

- Statewide annual inventory and assessment
- Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment
- Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment
- Regional or local year-round inventory and assessment
- Regional or local once-a-year inventory and assessment
- Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment
- Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment

Respondents were aware of the following inventory and assessment efforts by other organizations for all grassland habitats in Indiana (not ranked):

- Statewide annual inventory and assessment
- Statewide once-a-year inventory and assessment
- Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment
- Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment
- Regional or local year-round inventory and assessment
- Regional or local once-a-year inventory and assessment
- Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment

- Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment

Respondents ranked inventory and assessment efforts by state agencies based on their importance for conservation of all grassland habitats in Indiana:

Rank	Inventory and assessment by state agencies for conservation of all grassland habitats
1	Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment
2	Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment
3	Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment
4	Statewide annual inventory and assessment
5	Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment
6	Statewide once-a-year inventory and assessment
7 (tie)	Regional or local year-round inventory and assessment
7 (tie)	Regional or local once-a-year inventory and assessment

Respondents ranked inventory and assessment efforts by other organizations based on their importance for conservation of all grassland habitats in Indiana:

Rank	Inventory and assessment by other organizations for conservation of all grassland habitats
1	Occasional statewide (less than once a year and not regularly scheduled) inventory and assessment
2 (tie)	Periodic statewide (less than once a year but still regularly scheduled) inventory and assessment
2 (tie)	Occasional regional or local (less than once a year and not regularly scheduled) inventory and assessment
3 (tie)	Statewide annual inventory and assessment

3 (tie)	Statewide once-a-year inventory and assessment
4	Periodic regional or local (less than once a year but still regularly scheduled) inventory and assessment
5	Regional or local once-a-year inventory and assessment
6	Regional or local year-round inventory and assessment

Respondents listed regional or local inventory and assessment by state agencies for all grassland habitats in Indiana (not ranked):

- Crawfish frogs: Habitat is not well understood and is not currently being inventoried to my knowledge. Grasslands may be monitored by not all grasslands are crawfish frog habitat
- Badgers
  - Purdue University and NRCS keep track of grasslands created as part of the Farm Bill programs. There are also occasional statewide assessments of grassland as part of remote-sensing, GIS based studies such as the GAP Analysis
  - Division of Nature Preserves keeps track of good examples of remnant native grassland. I am not sure any of these agencies collect the grassland habitat data specifically for badgers but other agencies applied the information to badgers
- DNR property evaluations
- Interlake Property
- Habitats on state areas are occasionally surveyed for quality and quantity
- Annual and 5-year-census, county-level reports of acreage planted to various hay cover types and acreage harvested
- Indiana Division of Nature Preserves has inventoried habitats across the state over the past three decades. Savannas mainly occur in the northern third of the state

Respondents listed regional or local inventory and assessment by other organizations agencies for all grassland habitats in Indiana (not ranked):

- Farm Bill/CRP type inventories but none specifically for cottontail rabbits
- Farm Service Agency keeps track of the location and acreage associated with each contract
- USFWS, USFWS, TNC, Indiana State University have surveyed quality and quantity of habitats for HESP's
- Statewide aerial imagery of habitats, land uses
- In the northern third of the state

Respondents listed organizations that monitor all grassland habitats in Indiana (not ranked):

- I am not aware of any scheduled monitoring of early successional habitat in Indiana. I would suspect that one of the universities has remotely sensed data but their objective probably isn't specifically to monitor early successional habitat

- Bobwhite quail
    - Indiana Division of Fish and Wildlife will initiate some type of bobwhite monitoring program to determine the success of the newest continuous CRP practice (CP33)
    - Farm Service Agency monitors acreage and location of tracts enrolled in each USDA program
    - Natural Resource Conservation Service provides technical support or administers most farm programs and I believe they conduct regular inspections

- IDNR, USDA, USFS, TNC, Indiana State University

- USDA National Agricultural Statistics Service for Indiana http://www.nass.usda.gov/in/

Respondents considered inventory and assessment techniques for all grassland habitats in Indiana:

Inventory and assessment techniques for all grassland habitats	Used	Not used but possible with existing technology and data	Not economically feasible
GIS mapping	X	X	--
Aerial photography and analysis	X	X	--
Systematic sampling	X	X	--
Property tax estimates	--	X	X
State revenue data	--	X	X
Regulatory information	X	X	X
Participation in land use programs	X	X	X
Modeling	X	X	X
Voluntary landowner reporting	X	X	X

Respondents listed additional inventory and assessment techniques for all grassland habitats in Indiana (not ranked):

- Bobwhite quail: I recently correlated the number of acres enrolled in USDA programs with our annual bobwhite whistle indices on a statewide scale. I am planning on modeling regional bobwhite indices and USDA idled acreage

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the inventory and assessment techniques for all grasslands habitats. There were no responses.

Recommended monitoring

Species monitoring

Respondents recommended the following monitoring techniques for effective conservation of wildlife in all grassland habitats in Indiana (not ranked):

- Crawfish frogs: More intensive call surveys and larva surveys, especially to determine how far the adults are traveling to deposit their eggs

- If we wanted to survey some wildlife species, I would develop a system counting hills

- Badgers: Continue to monitor road-kills, accidental captures and other verified sightings. Review this data and, if warranted, (a number of verified sightings near grassland habitat) attempt a telemetry and tracking study

- Trapping and visual surveys
    - Cottontail rabbits
        - McWheter, Gary Randolph, 1991, Estimating Abundance of Cottontail Rabbits using live trapping and visual surveys, Master's thesis, University of Tennessee
        - An analysis of vegetative structure by specie or species group in early successional habitats and then correlated with selected early successional species would be relevant
        - I would like to see a rural mail carrier survey initiated that would be useful for monitoring rabbits and several other wildlife species. Another method to monitor rabbit populations would be to include rabbit observations on the division's annual bobwhite whistle counts

- Bobwhite quail
    - To monitor bobwhite populations specifically in Farm Bill habitats
        - A random sample of contracts and conducting flushing transects
        - Have hunters complete "report cards" when hunting on Farm Bill acreage
        - Request that landowners conduct whistle counts on their enrolled lands each spring
    - Fall Covey counts

- Professional and volunteer survey and census

- Point counts
    - During breeding season
    - Conduct point counts on private lands. If possible estimate nest success too
    - Point counts in potential habitats using distance sampling. This technique is relatively simple to implement and provides density information rather than an index. Observers count birds from points randomly located in the studied habitat and measure or estimate distance to observed birds. Calculation of density from the data, however, does require some technical expertise (Buckland, S. T., D. R. Anderson, et al (2001). Introduction to distance sampling. Oxford, UK, Oxford University Press)

- Establish more Breeding Bird Survey routes http://www.pwrc.usgs.gov/bbs/

- Roadside surveys; spot-mapping on smaller areas

- I'm not sure if a salvageable population exists in the State of Indiana. It would be critical to survey know populations to determine population structure, density and potential for recruitment. This information could then be used to plan and implement a conservation effort geared towards this species

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the monitoring techniques for effective conservation of wildlife for all grasslands habitats. There were no responses.

Habitat inventory and assessment

Respondents recommended the following inventory and assessment techniques for effective conservation of all grassland habitats in Indiana (not ranked):

- Crawfish frog habitat: May be described by a combination of hydrology, soil type, proximity to breeding waters and vegetation. These factors should be investigated to develop a model for crawfish frog habitat

- Monitoring larger grasslands in Indiana (both native and man-made) such as grassland created by strip mining

- Cottontail rabbits: Are a mid to late early successional habitat resident. We do not know the amount of structure required to maintain optimum populations. We don't know what an optimum population is! We do know that it cycles but we don't know why

- The best habitat inventory technique would be creating a GIS with Landsat data from different time periods

- Flush counts or more intensive whistle counts on farm program lands would be a useful method of evaluating their quality when compared to the same indices on non-Farm Bill lands

- Grassland mapping by major plant species type

- GIS mapping and participation in land use programs (CRP)

- Survey of hay harvest dates and frequencies each year

- Aerial imagery couple with modeling

Technical experts and conservation organizations reviewed the above results and were asked if these were a reasonable representation of the monitoring techniques for effective conservation of all grasslands habitats. There were no responses.

Technical experts and conservation organizations offered the following additional comments:

- Make sure "savanna" (no "h") is spelled correctly in any official publicstions
- No comments were received on reclaimed mine lands, even though they represent the largest remaining grasslands in the state, and have been shown through recent research to be highly important to many grassland birds. They also represent the best chance in Indiana to protect and manage large blocks of grassland habitat, and many are being parceled out and sold as small tracts. This is a significant omission in the conservation plan for grassland habitats for Indiana.

Appendix F-48: Aggregated Grasslands