Appendix C

Habitat Potential Index (HPI) Parameters for Derivation of Land Cover-Based Ecological Quality Values

September 19, 2013

** = some or all information can be imported from other Fieldprint Calculator metrics*

(HPI-0) Farm location*

Please enter the following information for your farm (defined as a single contiguous tract or parcel):

Farm location options
State
County
Ecoregion
Do you rent or own?
(Rent only) Does your lease arrangement limit or specify your management options? Y/N

Location information may be Fieldprint Calculator input

(HPI-1) Land cover

Do you have the following land cover on your farm? What type? What size?
("Farm" refers to a single contiguous tract or parcel)

Options (selected options determine which subsequent questions are asked):

Land Cover	Options (Land Cover Type)	Size (per option)
Cultivated land	Corn, Soybeans, Rice, Cotton, Potatoes, Wheat, Alfalfa/Hay, Other crop(s)	Area (acres)
Edge features/buffers	Edge features (Buffer strips, Grass waterways, Terraces, Filter strips, Field borders, Pivot corners (non-cultivated), Pollinator habitat, Hedge rows, Tree rows, Wind breaks, Headlands), Riparian buffer	Area (acres)
Forest	Conifer Plantation, Deciduous Forest, Evergreen Forest, Mixed Forest	Area (acres)
Grasslands/Savanna	Native (ungrazed), Native (grazed), Non-native (ungrazed), Non-native (grazed)	Area (acres)
Wetlands	Natural or Restored wetland, Artificial wetland	Area (acres)
Surface waters	River, Stream, Pond (natural), Pond (artificial), Lake (natural), Lake (artificial)	Length * constant[1], or Area (acres)

Land cover types are assigned an "eco-weight" (Table 2, Report) based on their general capacity to support biodiversity; this value is also influenced by urban development pressure (see Report Section 3.3.2.

[1] It is suggested to represent stream/river area using the length plus a given constant (ex. 100 ft) to account for varying stream/river sizes and seasonal variability in "wetted width".

(HPI-2) Land cover change

Was any of this land cover converted from another land cover type in the past 5 years? If yes, select the predominant previous land cover type (most recent) and the amount of acres converted.

Options (per land cover type; does not include crop-to-crop changes):

Option	Size
From "*Previous land cover*"	Area (acres)

Land use change impacts on habitat potential can be directly evaluated from two perspectives, 1) a measure of recent loss of ecological value in the case of conversion of a land cover from a higher ecological weighting value to a lower value (i.e., conversion of a natural wetland to cultivated land), or 2) a measure of how established a given land cover is in the case of conversion of a land cover from a lower ecological weighting value to a higher value (i.e., conversion of crop production to grassland), which can provide an estimate of functionality such as soil quality.

For each land cover present at the farm-scale, the user will identify the predominant land cover change within the past 5 years (if any) from a selection menu (ex. "*From Deciduous Forest*", or "*None*", if no land cover change), as well as the number of acres comprising the land cover change. From this input, the algorithm determining the score for land use change is as follows:

Land use change score = $1 - ((A_C/A_T) * (ABS(E_C - E_P))/4)$

Where A_C = # changed acres of land cover

A_T = # total acres of land cover

E_C = Ecological weighting value for current land cover

E_P = Ecological weighting value for previous land cover

High scores correspond with an established land cover (i.e., past 5 years). This is the case for both land cover types that have declined in ecological weight (ex., a wetland that was recently converted to cultivated land), as well as those which have increased in ecological value (ex., forest that has been recently restored from pasture). In both cases, land cover types that are established earn a higher score than the same land cover type that is "new". This parameter is just one component of the eco-quality score for a given land cover, and should not be confused with the eco-weighting factors used to relatively rank the land covers. For example, a recently restored wetland will have a lower score for this specific parameter compared with an established forest; however the wetland will still have a higher eco-weight than the forest).

Cultivated Land HPI Inputs

User first selects crop type(s), size and previous land use (See HPI-1and HPI-2):

Cultivated land
(Specify crop type)

(Photo from NRCS)

Corn
Soybeans
Rice
Cotton
Wheat
Potatoes
Alfalfa/Hay
Other crop(s)

Cultivated land cover includes seven crop types specified by Field to Market, as well as a category for "Other crop(s)" encompassing any other cultivated land on the farm. The subsequent cultivated land HPI questions were designed for the specified (7) crops and may not be applicable to other types of crops, and/or may be difficult to generalize answers across multiple "other" crop types. Therefore, the current recommendation is to include the acreage from "Other crop(s)" in the overall HPI calculation for the whole farm, but not prompt users to answer survey questions for this "Other" category. Instead, a proxy eco-quality score for the "Other crop(s)" category will be assigned based on the average eco-quality score derived from the specified (7) crop types present on the farm. If the "Other crop(s)" category comprises 25% or more of the total cultivated land on the farm, the user will be alerted (by means such as a pop-up box) to the introduced uncertainty due to this assumption.

(HPI-3) Residue Cover (per crop)*

What is the predominant tillage practice used?

Options:

Option	Score
> 30% residue (No-till, strip till, conservation tillage)	1
15-30% residue (Reduced tillage)	0.5
< 15% residue (Conventional or intensive tillage)	0

Tillage practices (and associated residue cover) have a significant impact on soil organic matter, soil erosion, and soil compaction (NRCS, 1996).

This parameter is weighted by the Environmental Benefit Score for residue and tillage management (value of 35, NRCS Practice Code 329, Conservation Program Activity list, 2013).

(HPI-4) Crop rotation (per crop)*

What is the predominant crop rotation practice used?

Options:

Option	Score
Crop to fallow	1
Conventional rotation	0.5
Continuous single crop	0

This parameter evaluates the use of crop rotation for each crop type. While crop rotation practices can vary from simple rotations of two crop types to highly complex sequences of cropping patterns (NRCS 1996), this parameter is provided as a simple response based on the predominant practice for a crop type.

This parameter is weighted by the Environmental Benefit Score for conservation crop rotation (value of 31, NRCS Practice Code 328, Conservation Program Activity list, 2013).

(HPI-5) Cover crop (per crop)*

Do you use a cover crop, either native or planted?

Options:

Option	Score
Use on most of crop	1
Use on approximately half of crop	0.5
Generally do not use	0

The establishment of a cover crop in between seasonal cropping cycles provides a number of habitat benefits related to maintaining soil quality on cultivated acreage, including reduced erosion, increased organic matter, retained soil moisture and enhanced local nutrient cycling, and promotes biodiversity of both soil biota and other organisms by providing habitat and a food source outside the regular growing season (NRCS Practice Standard Code 340).

This parameter is weighted by the Environmental Benefit Score for conservation crop rotation (value of 42, NRCS Practice Standard Code 340, Conservation Program Activity list, 2013).

(HPI-6) Nutrient management (per crop)

Are you implementing an approved Nutrient Management Plan and/or do you apply nutrients according to the "4 R's" of nutrient stewardship (see options below)?

Options: (scores will be added to a maximum value of 1)

Option	Score
Implement nutrient management plan	1
Right source	0.25
Right rate	0.25
Right time	0.25
Right place	0.25
None	0

This parameter provides an indicator for nutrient management activities based on whether the respondent is implementing an approved nutrient management plan (nutrient management that meets the standards of NRCS Practice Standard 590 for "Managing the amount, source, placement, form and timing of the application of nutrients and soil amendments", and/or whether the respondent is practicing any of the "4 R's" of nutrient management stewardship.

The principles of the "4 R's", as described by the 4-R Nutrient Stewardship Initiative: http://www.nutrientstewardship.com/what-are-4rs/ are:

"… *Right Source- Ensure a balanced supply of essential nutrients, considering both natural available sources and the characteristics of specific products, in plant-available forms.*

Right Rate- Assess and make decisions based on soil nutrient supply and plant demand

Right Time- Assess and make decisions based on the dynamics of crop uptake, soil supply, nutrient loss risks, and field operation logistics

Right place- Address root-soil dynamics and nutrient movement, and manage spatial variability within the field to meet site-specific crop needs and limit potential losses from the field…"

This parameter is weighted by the Environmental Benefit Score for "plant tissue tests and analysis to improve the management of nitrogen", representing a basic component of a nutrient management plan (value of 19, NRCS Practice Standard Code WQL04, Conservation Program Activity list, 2013).

(HPI-7) Pest management (per crop)*

What is the predominant pest management practice used?

Options: (identical to Water Quality Index in the Fieldprint Calculator)

Option	Score
IPM strategies used to manage pests primarily without the use of chemical control	1
. IPM strategies used to manage pest including chemical control	0. 75
Pest managed primarily using chemical control and additional site-specific techniques	0.5
Pest managed solely using chemical control	0

This parameter identifies the management practice in place for pest management, equivalent to the options used in the Water Quality Index in the Fieldprint Calculator.

Additional text will be included from the WQI Index in the Fieldprint Calculator.

This parameter is weighted by the Environmental Benefit Score for "High-level Integrated Pest Management" (value of 31, NRCS Practice Standard Code WQL13, Conservation Program Activity list, 2013).

(HPI-8) Water Conservation (per crop)*

If you irrigate, what is your water source?

Options: Score dependent upon farm location in "water scarce" region (see notes)

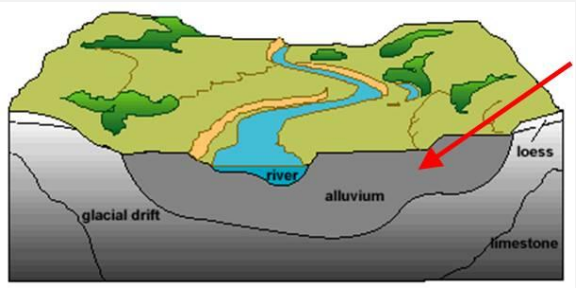
Option	Score
Crop not irrigated	1
Surface water or alluvial groundwater source (see notes)	(see below)
Groundwater or other source not connected to surface water	1

For "Surface water or alluvial groundwater source," select from the additional options below:

Do you use water conservation methods (*see notes for examples*)?

Option	Score
Yes, water conservation methods used	0.5 – 0.75 (see notes)
No, water conservation methods not used	0 – 0.25 (see notes)

This parameter identifies how a grower is managing surface water consumption. An alluvial groundwater source is groundwater that is hydraulically connected to a surface water body (an alluvial aquifer, see figure below).



Cross-section of alluvial aquifer; arrow added to Prior (1991) image, http://ia.water.usgs.gov)

Water conservation includes methods such as irrigation scheduling, tailwater recovery, and drainage water management.

Parameter scoring is dependent upon whether the farm is located in a "water-scarce" watershed (computed in the background based on the "Water Supply Stress Index" ("WASSI"; USDA, http://www.wassiweb.sgcp.ncsu.edu/). Farms located in watersheds within the top 25% of nationwide WASSI values will be classified as "water-scarce".

Option	Score
No irrigation or Irrigation with non-surface water source	1
Irrigation with water conservation (not in water scarce watershed)	0.75
Irrigation with water conservation (water scarce watershed)	0.5
Irrigation, no water conservation (not in water scarce watershed)	0.25
Irrigation, no water conservation (water scarce watershed)	0

The parameter is weighted by the Environmental Benefit Score for "Decrease Irrigation Water Quantity or Conversion to non-irrigated crop" (value of 44, NRCS Practice Standard Code WQLT08, Conservation Program Activity list, 2013).

(HPI-9) Drainage Water Management (per crop, excluding cotton)*

Do you use tile drainage? If so, are you implementing an approved drainage water management plan?

Options: Local soil condition (soil drainage) determines the lowest score (see notes)

Option	Score
No tile drainage (natural drainage or other drainage water management)	1
Tile drainage with drainage water management	1
Tile drainage without drainage water management	0 – 0.5 (see notes)

Tile drainage systems can reduce the amount of surface run-off (and associated erosion) generated by a cultivated field; however, this practice can also significantly increase the loading of nitrates into receiving waters which can negatively impact aquatic life (for example by causing periodic depletion of available oxygen). Due to the both positive and negative potential impacts of tile drainage on habitat potential, this parameter is scored based on whether tile drainage is implemented with or without drainage water management. Drainage water management (adhering to a plan that meets the NRCS Standard 554, also see NRCS Drainage Water Management Ad Hoc Action Team Final Report, 2011) can reduce the negative impacts of tile drainage. If drainage water management is used, the parameter is assigned the maximum value of 1 (same as no tile drainage).

The need for tile drainage is considered in the scoring in order to account for regional/local differences in soil condition (soil drainage). Growers using tile drainage without drainage water management in poorly-drained soils are scored higher than growers using tile drainage without drainage water management in well-drained soils. Soil drainage condition (e.g., well-drained vs. poorly drained) can be imported in the background of the tool based on the soil condition information in the WQI ("moist" or "dry/well-drained").

Option	Score
No tile drainage (natural drainage or other drainage water management)	1
Tile drainage with drainage water management	1
Tile drainage without drainage water management (poorly-drained soil)	0.5
Tile drainage without drainage water management (well-drained soil)	0

This parameter is weighted by the Environmental Benefit Score for "Drainage Water Management for Nutrient, Pathogen, or Pesticide Reduction" (value of 26, NRCS Standard Practice Code WQL27, Conservation Program Activity list, 2013).

(HPI-10) Wildlife habitat enhancements on cultivated land

Do you practice any seasonal habitat enhancements?

Options: assigned a score of 1 if any of the below are practiced, or 0 if "None"

Option	Score
Seasonal flooding *(option for rice only)*	1 and increase eco-weight to artificial wetland status (2-4 based on ecoregion)
Provide foraging habitat	1
Provide breeding and/or nesting habitat	1
None	0

This parameter identifies wildlife enhancements on cropland that provide seasonal habitat for foraging, breeding and nesting habitat. Examples include providing waterfowl habitat (winter wheat), vegetative cover, supplemental crop, and/or not harvesting part of the crop.

For weighting, this parameter does not have one clear corresponding NRCS Standard Practice, but is weighted by a representative (most relevant) Environmental Benefit Score for "Enhance Wildlife Habitat on Acres with Perennial Vegetation Managed as Hayland" (value of 87, NRCS Practice Standard Code WQLT08, Conservation Program Activity list, 2013). If seasonal flooding of rice fields is used, the weighting of this parameter will be doubled to 174, to recognize the importance of this habitat enhancement in providing surrogate wetland habitat for migratory birds (The State of the Birds 2013 Report on Private Land (http://www.stateofthebirds.org/).

Edge Feature and Riparian Buffer Land Cover HPI Inputs

User first selects edge/riparian type(s), size and previous land use (See HPI-1and HPI-2):

Edge-of-field Features

Riparian buffer

(Photos from NRCS)

Edge-of-field features include natural and semi-natural land cover on the farm associated with adjacent cultivated fields including features such as buffer strips, grass waterways, terraces, filter strips, field borders, pivot corners (non-cultivated), ditches, hedge rows, tree rows, wind breaks, and headlands.

Riparian buffer is non-cultivated land comprised of grasses, shrubs and/or trees that is adjacent to a surface water.

(HPI-11) Edge Feature/Riparian Vegetation

How much of the edge feature/riparian buffer is vegetated and how much is native?

Options:

Option	Score
All vegetated, all native	1
All vegetated, some native	0.85
All vegetated, no native	0.7
Some vegetated, all native	0.55
Some vegetated, some native	0.4
Some vegetated, no native	0.25
No vegetation (bare soil)	0

This parameter provides a general estimate of how much native vegetation is present in the edge-of-field or riparian buffer features on a farm.

(HPI-12) Management of Edge/Riparian Features

Do you manage the edge/riparian features for habitat, and if so how?

Options: Select all that apply; sum all selections not to exceed a total value of 1

Option	Score
Remove/discourage spread of invasive species	0.25
No grazing or grazing management (ex. conservation grazing)	0.25
Prescribed burn or mowing	0.25
Wildlife habitat enhancements (e.g., edge feathering)	0.25
Add plant diversity (native and/or recommended by Extension/NRCS/other expert)	0.25
Extend field border	0.25
Integrated Pest Management (IPM) strategy	0.25
Limit or avoid ditch cleaning	0.25
None of the above	0

This parameter determines if any management practices are being implemented that can improve habitat potential. Implementation of at least four (4) of the above practices yields a maximum score of 1. NRCS Practice Codes relevant to edge-of-field and riparian management include Prescribed Burning (338), Biological Suppression and Other Non-Chemical Techniques to Manage Brush, Weeds and Invasive Species (WQL01), Upland Wildlife Management (645), Establishment of Pollinator Habitat (PLT15), Riparian forest buffers (ANM05, ANM33, 390, 391), Extending filter strips or herbaceous riparian cover (ANM32), Filter strips (393), Establishment of windbreak/shelterbelt (PLT06, 380, 650), Incorporation of native grasses (ANM03), and Field border (ANM07 and 386).

Forest Land Cover HPI Inputs

User first selects forest type(s), size and previous land use (See HPI-1and HPI-2):

Deciduous Forest

Mixed Forest

Evergreen Forest

Conifer plantation

(Photos from NRCS)

For natural forest types, the definitions provided with the National Land Cover Dataset (MRLC 2001, http://www.epa.gov/mrlc/definitions.html) can be used as guidance:

"…Deciduous Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.

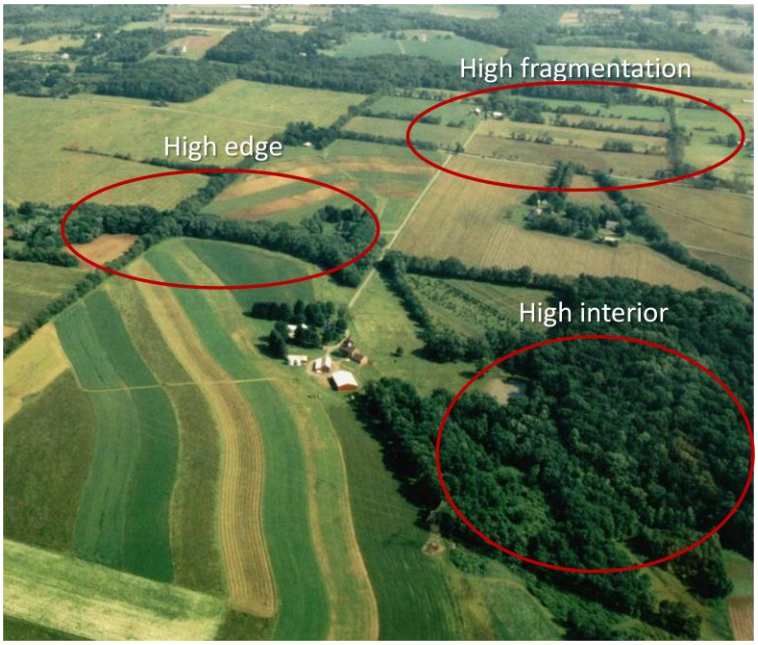
Evergreen Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.

Mixed Forest - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover…"

(HPI-13) Arrangement/Fragmentation

What is the predominant arrangement/configuration of your forested land?

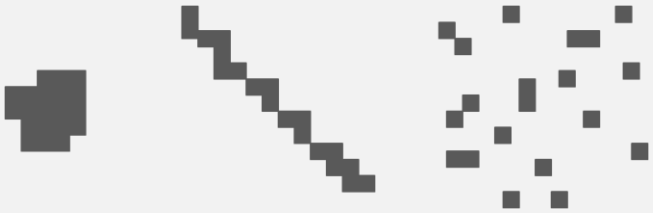
Options: Select image that best represents the arrangement of your forest:



(Photo from NRCS with labels added)

Option	Score
High forest interior (single large forest cluster)	1
High forest edge (narrow line of trees)	0.5
High forest fragmentation (small clusters of trees scattered throughout farm)	0.25

This parameter describes the spatial configuration of the forest land on a farm. Forest with high interior provides the greatest habitat potential for wildlife, while high amounts of edge and fragmentation limit habitat potential. It is recognized that some wildlife species prefer edge habitat, however, overall habitat potential appears more highly influenced by the availability of larger intact forest parcels. In a past study, a forest interior distance of <100m is associated with disturbance related to edge effects (Broadbent et al. 2008). Below is a graphical representation of the three forest configuration types based on the same number of blocks (ex. acres) of forest:



High interior *High edge* *High fragmentation*

(HPI-14) Forest habitat management

Do you manage the forest land for habitat, and if so how?

Options: Select all that apply; sum all selections not to exceed a total value of 1

Option	Score
Selective harvesting of timber for age diversity	0.25
Retain special features beneficial to wildlife	0.25
Manage understory	0.25
Manage forest edge	0.25
Long-term conservation easement	0.25
Wildlife corridor (see illustration in notes)	0.25
None of the above	0

This parameter identifies a variety of forest management practices that can improve habitat potential. Example NRCS Practice Codes relevant to forest management include Enhance Wildlife Habitat on Forestland (ANM36), Patch Burning to Enhance Wildlife (ANM11), Biological Suppression and Other Non-Chemical Techniques to Manage Brush, Weeds and Invasive Species (WQL01), Upland Wildlife Management (645), and Establishment of Pollinator Habitat (PLT15).

Example, wildlife corridor (Photo from NRCS with arrow added)

Grassland/Savanna Land Cover HPI Inputs

User first selects grassland type(s), size and previous land use (See HPI-1and HPI-2):

Non-native, grazed Grassland/Savanna

Non-native, non-grazed Grassland/Savanna

Native, grazed Grassland/Savanna

Native, non-grazed Grassland/Savanna

(Photos from NRCS)

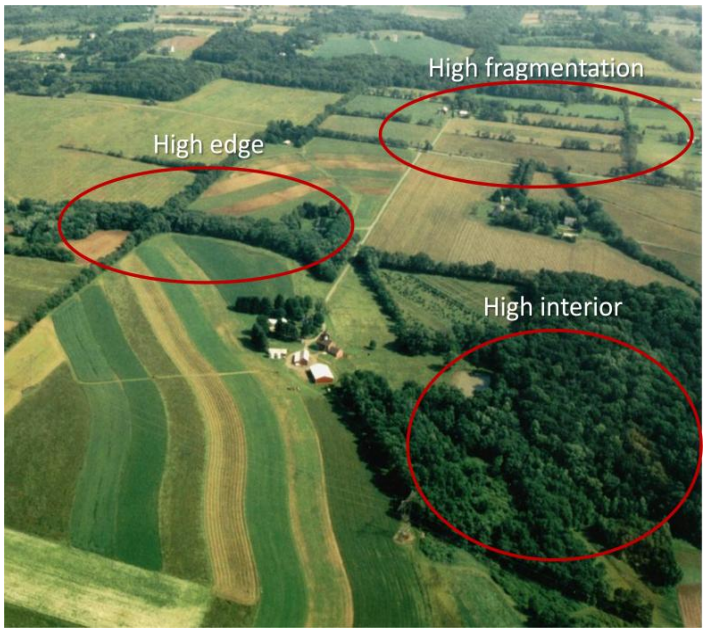
Grassland/savanna is defined as land dominated by grasses, forbs, shrubland or savanna conditions on which the predominant land use is grazing (permanent pasture or rangeland) and/or wildlife habitat. Non-native grassland/savanna indicates that the vegetation present is introduced, while native grassland/savanna is land historically having vegetation characteristic of a native grassland or savanna ecosystem.

(HPI-15) Arrangement/Fragmentation

What is the predominant arrangement/configuration of your grassland/savanna?

Options: Select image that best represents the arrangement of your grassland/savanna:

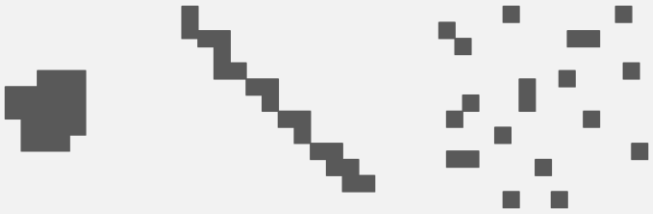
(PLACEHOLDER GRAPHIC)



Option	Score
High interior grassland/savanna (single large cluster)	1
High edge grassland/savanna (narrow line)	0.5
High fragmentation grassland/savanna (small clusters scattered throughout farm)	0.25

This parameter describes the spatial configuration of the grassland/savanna on a farm. Grassland/savanna with high interior provides the greatest habitat potential for wildlife, while high amounts of edge and fragmentation limit habitat potential.

Below is a graphical representation of the three grassland/savanna configuration types based on the same number of blocks (ex. acres) grassland/savanna:



High interior *High edge* *High fragmentation*

(HPI-16) Grazing intensity

What is the relative level of grazing intensity on the grassland/savanna?

Options: Select all that apply; sum all selections, not to exceed a total value of 1

Option	Score
Low or no grazing	1
Moderate	0.5
High	0
Practice rotational or conservation grazing	Add 0.5 to score (up to max of 1)

This parameter identifies the intensity of grazing activity on the grassland and whether grazing management is implemented. Grazing intensity varies by region (climatic zone), therefore the grower is asked to provide a relative qualitative estimate of grazing intensity. Grazing intensity may be defined as stocking intensity (ex. livestock units per acre), or in terms of the % biomass remaining at the end of the growing season. A regional example in a past study of the Northern tallgrass prairie defined heavy grazing as ≤ 10% biomass remaining (Biondini et al. 1998).

NRCS Practice Codes relevant to grazing management include Grazing Management to Improve Wildlife Habitat (ANM09), Prescribed Grazing (528), Intensive rotational grazing (PLT16).

For grazed grassland/savanna with both the "Low or no grazing" and the "Practice rotational or conservation grazing" options selected, the eco-weight will be adjusted to be consistent with the "un-grazed" grassland value due to relatively comparable ecological benefits of low-intensity rangeland (Reidsma et al. 2006).

(HPI-17) Grassland/savanna habitat management

Do you manage your grassland/savanna land for habitat, and if so how?

Options: Select all that apply; sum all selections not to exceed a total value of 1

Option	Score
Conservation easement (ex. NRCS Grasslands Reserve Program)	1
Remove/discourage spread of invasive species	0.25
Manage for native woody encroachment (e.g. prescribed burn)	0.25
Prescribed fire for grassland maintenance	0.25
Providing residual cover for wildlife	0.25
Adding plant diversity (inter-seed legumes and native forbs)	0.25
Integrated Pest Management (IPM) strategy or no chemical use	0.25
None of the above	0

This parameter identifies grassland/savanna management practices that can improve habitat potential. Grassland/savanna protected by a conservation easement and/or implementing at least four (4) of the above management practices yields the maximum score of "1", while the individual; practices provide opportunity for partial credit (0.25 each). Examples of NRCS codes relevant to grassland management practices include Prescribed Burning (338), Biological Suppression and Other Non-Chemical Techniques to Manage Brush, Weeds and Invasive Species (WQL01), Upland Wildlife Management (645), and Establishment of Pollinator Habitat (PLT15).

Wetland Land Cover HPI Inputs

User first selects wetland type(s), size and previous land use (See HPI-1and HPI-2):

Artificial wetland

Natural or restored wetland

(Photos from NRCS)

Natural wetland (as defined in NRCS Natural Resources Inventory, 2007): *"…Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes* [aquatic plants]*; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year (Cowardin et al. 1979)…"*

A comprehensive listing of region-specific wetland vegetation is provided at: http://rsgisias.crrel.usace.army.mil/NWPL/.

Restored wetland (as defined in NRCS General Manual): *"…the return of a wetland and its functions to a close approximation of its original condition as it existed prior to disturbance on a former or degraded wetland site..."*

Artificial wetland (as defined in NRCS General Manual): *"…land that was formerly non-wetland under natural conditions but now exhibits wetland characteristics because of the influence of human activities..."*

(HPI-18) Water regime (natural/restored wetlands only)

What type(s) of water regime(s) are present in the wetland(s) on your farm?

Options: Select all that apply; scores will be added up to a max value of 1

Option	Score
Seasonally flooded	0.75
Temporarily flooded	0.5
Semi-permanently flooded	0.5
Permanently flooded	0.25
Saturated	0.25

This parameter identifies the water regime(s) present in the wetlands on a farm, generally based on the Cowardin et al. (1979) non-tidal water regime modifiers, as follows:

Temporarily flooded: surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface for most of the season.

Seasonally flooded: surface water is present for extended periods especially early in the growing season, but is absent by the end of the season in most years.

Semi-permanently flooded: surface water persists throughout the growing season in most years.

Permanently flooded: water covers the land surface throughout the year in all years.

Saturated: the substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present

Different water regimes offer different aspects of habitat potential and associated benefits supporting biodiversity, For example, seasonally flooded wetlands provide an important breeding habitat for waterfowl, while temporarily flooded wetlands can be colonized by a variety of invertebrate populations. The presence of more than one wetland type (water regime) significantly increases the potential for habitat provided by wetlands on the farm. The more wetland types on the farm, the higher the parameter score (up to a max of 1).

(HPI-19) Water level management (artificial wetlands only)

Do you use water control structures to manage wetland water levels (i.e., periodic drawdowns)?

Options:

Option	Score
Yes	1
No	0

This parameter identifies whether a grower has the capability to manipulate water levels to implement periodic drawdowns (drainage) of the artificial wetland. Periodic drawdowns simulate the natural wet and dry cycles of a wetland, enhancing plant productivity and overall habitat potential (Ducks Unlimited Wetland Habitat Management Guide for Landowners, 2005). Water control structures include flashboard and full-round risers, as well as screwgate structures. Timing, rate and frequency of drawdowns are important to approximate a natural water regime. For example, in the Great Lakes region, drawdown should typically coincide with the local growing season length, be implemented at a relatively slow rate (2-3 weeks), and optimally be scheduled to occur every 3-5 years (Ducks Unlimited 2005).

(HPI-20) Wetland habitat management

Do you manage your wetland for habitat, and if so how?

Options: Select all that apply; scores will be added up to a max value of 1

Option	Score
Conservation easement (ex. NRCS Wetlands Reserve Program)	1
Manage for nutrients, sediment and/or habitat enhancements (see notes)	0.5
Remove/discourage spread of invasive species	0.5
None	0

This parameter identifies whether the grower is implementing wetland management practices that can improve habitat potential. Examples of management of nutrients and habitat includes limiting/restricting nutrient run-off from livestock or pesticide run-off from cultivated acreages (for example the inclusion of a vegetative buffer zone), and adding physical habitat features such as logs or artificial nesting structures for wildlife (NRCS Practice "Wetland Wildlife Habitat Management", code 644). A perfect score of 1 is attained through implementation of both management options listed, or protection of the wetland under a conservation easement.

Surface Water Land Cover HPI Inputs

User first selects surface water type(s) and size (See HPI-1and HPI-2):

Stream

River

Pond
(Specify Natural or Artificial)

Lake
(Specify Natural or Artificial)

(Photos from NRCS)

Surface water land covers include four classifications: rivers, (wadeable) streams, lakes and ponds. For user selection of surface water type, rivers and streams can be differentiated by average depth- wadeable streams are typically defined as less than 1.5 m depth (Missouri Dept. of Natural Resources, 2002). While characteristics of lakes and ponds overlap, lakes are generally larger and deeper inland water bodies, while ponds are smaller and shallower inland water bodies.

(HPI-21) Riparian buffer

What is the estimated percent of the surface water edge that has a riparian buffer? (See notes for specifications)

Options: Enter % estimate

Option	Score
> 75%	1
51 to 75%	0.5
25 – 50%	0.25
< 25%	0

A riparian zone buffer is defined as a non-cultivated area (comprised of grasses, shrubs or trees) that has a width of at least **35 feet**, or **at least 2.5 times** the width of the surface water (NRCS Conservation Practice Standard 390).

(Photo from NRCS)

A riparian buffer provides benefits to water quality and provides habitat and food resources for aquatic communities and other wildlife (NRCS Conservation Practice Standard document, CPS 390). All riparian-related questions (HPI-21, HPI-22, HPI-23) are assigned half the weight for ponds/lakes as streams/rivers.

(HPI-22) Vegetative Cover, Riparian Zone

What is the % of vegetative cover of the riparian zone (land adjacent to surface water)?

Options: Enter % estimate (from 0% to 100%)

Option	Score
Optimal > 90%	1
Suboptimal 70 to 90%	0.5
Marginal 50 – 69%	0.25
Poor < 50%	0

This parameter provides a relative estimate of protective plant cover (grasses, shrubs, and/or trees) within the riparian zone, with high vegetative cover having the greatest benefit to aquatic life. The parameter options are based on those used in the U.S. EPA Rapid Bioassessment Protocol metric for bank vegetative protection (Barbour et al. 1999).

Example images below from Barbour et al. 1999 (U.S. EPA) for low and high-gradient streams:

9a. Bank Vegetative Protection—High Gradient

Optimal Range
(arrow pointing to streambank with high level of vegetative cover)

Poor Range
(arrow pointing to streambank with almost no vegetative cover)

9b. Bank Vegetative Protection—Low Gradient

Optimal Range *(Peggy Morgan, FL DEP)*

Poor Range *(MD Save Our Streams)*
(arrow pointing to channelized streambank with no vegetative cover)

(HPI-23) Riparian Management

How are you managing the riparian zone (land adjacent to surface water)?

Options (enter the % of riparian zone falling within each management option (adds up to 100%):

Option	Percent of Riparian Zone	Score
Conservation easement or undisturbed wildlife habitat	Enter %	1
Limited cattle access for grazing/watering	Enter %	0.5
Unlimited cattle access for grazing/watering	Enter %	0
Crop production	Enter %	0
Roads or other disturbances/ constructed features	Enter %	0

This management parameter provides information about livestock access and other potential disturbances within the riparian zone that can affect water quality, habitat and wildlife food sources. A weighted average of the scores will be computed based on the total riparian zone (100%). This approach allows growers to get some credit for any undisturbed wildlife habitat that may be present in the riparian zone.

(HPI-24) Bank Stability (Erosion)

What is the condition and management for the majority of the surface water banks?

Options (select bank stability level and if a management plan is in place):

Option	Score
Banks highly stable (little to no erosion)	1
Banks moderately stable (infrequent erosion)	0.50
Banks moderately unstable (high erosion during floods)	0.25
Banks unstable (obvious erosion over majority of banks)	0
Implementing bank restoration with guided design	Add 0.50 to score (up to 1)

The bank stability classifications in this parameter are based on those used in the U.S. EPA Rapid Bioassessment Protocol metric for bank stability (Barbour et al. 1999). Additionally, implementation of a bank restoration plan can enhance the score for this parameter (ex. an approved plan designed to meet the NRCS Conservation Practice Standard for stream habitat improvement and management (NRCS Practice Standard 395).

Example images below from Barbour et al. 1999 (U.S. EPA) for low and high-gradient streams:

8a. Bank Stability (condition of banks)—High Gradient

Optimal Range
(arrow pointing to stable streambanks)

Poor Range *(MD Save Our Streams)*
(arrow highlighting unstable streambanks)

8b. Bank Stability (condition of banks)—Low Gradient

Optimal Range *(Peggy Morgan, FL DEP)*

Poor Range
(arrow highlighting unstable streambanks)

(HPI-25) Channel modifications (river and streams only)

What is the extent of modifications to the river/stream channel (on the farm)?

Options: (select predominant channelization extent and if levee(s) or dam(s) are present):

Option	Score
Channel is managed by another authority	Question will be omitted from HPI score
Channelization absent or minimal	1
Some channelization, mostly historical	0.5
Extensive channelization	0.25
Completely altered channel, artificial banks	0
Levee(s) or dam(s) present	Subtract 0.25 from channel score >0

The channelization options are generally based on the U.S. EPA Rapid Bioassessment Protocol metric for channel stabilization (Barbour et al. 1999). Presence of levees and/or dams also indicate disturbance in the natural flow regime and physical habitat of the surface waterbody. This parameter does not apply if the channel is managed by another authority.

Example images below from Barbour et al. 1999 (U.S. EPA) for low and high-gradient streams:

6a. Channel Alteration—High Gradient

Optimal Range

Poor Range
(arrows emphasizing large-scale channel alterations)

6b. Channel Alteration—Low Gradient

Optimal Range

Poor Range *(John Maxted, DE DNREC)*

(HPI-26) In-stream disturbance (river and streams only)

How are you managing the in-stream habitat of the river/stream?

Options (check all that apply; scores added up to maximum value of 1):

Option	Score
No in-stream disturbance	1
Disturbance only related to adding fish habitat	1
Unmaintained stream crossings	0.5
Flow modifications (elevated culverts, diversion structures)	0
Dredging, gravel mining, maintenance of stream crossings	0

This parameter provides information about what disturbances occur within the in-stream habitat of the river or stream that can affect water quality as well as physical habitat and food sources for aquatic communities.

(HPI-27) Predominant use of pond/lake (pond and lakes only)

What is the *predominant* use for the pond/lake?

Options (select one):

Option	Score
Wildlife habitat	1
Aesthetics/recreation (includes fishing)	0.75
Cattle watering using external trough or other external system	0.75
Aquaculture	0.25
Cattle watering into pond using partial fencing	0.25
Flooding or erosion control	0.25
Irrigation	0.25
Cattle watering into pond with unlimited access	0

Scoring for this parameter decreases as the predominant use becomes more intensive in its potential for habitat disturbance.

(HPI-28) Pond/lake depth (pond and lakes only)

What is the average depth of the pond/lake?

Options: enter average depth (ft), which is scored as a range from 0 to 1 based on increasing depth up to 10 ft.

Option (range, min/max shown below)	Score
≥ 10 ft (optimal)	1
9 ft	0.9
8 ft	0.8
7 ft	0.7
6 ft	0.6
5 ft	0.5
4 ft	0.4
3 ft	0.3
2 ft	0.2
1 ft	0.1
< 1 ft	0

The farm pond management literature (ex., University of Arkansas Pine Bluff Extension; Austin et al. 1996) identifies a range of 10 – 12 feet in depth as desirable to minimize oxygen depletion and winterkill. Therefore, for this parameter a value of 10 ft. is used as the optimal score (1), and the score will decrease with decreasing depth from 10 ft. (ex. 5 ft depth = score of 0.5).

(HPI-29) Management of pond/lake (pond and lakes only)

How are you managing the pond/lake?

Options: (check all that apply; scores are added up to value of 1):

Option	Score
Surrounding land is under conservation easement	1
Habitat structures	0.75
Species stocking (native)	0.75
Aquatic vegetation management	0.5
None of the above	0

Implementing a conservation easement is assumed to provide the greatest opportunity to preserve, protect, and enhance habitat quality and associated wildlife diversity of the pond or lake at the farm scale (sore = 1). Alternatively, adding physical habitat structures to a lake or pond can significantly increase productivity and diversity (Score =0.75). Certain species of fish and wildlife might be stocked to increase diversity (Score =0.75). Management of aquatic vegetation provides benefit to ponds/lakes by controlling excessive growth of aquatic weeds (Score =0.5).