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**Developing a multi-metric habitat index
for wadeable streams in Illinois.**

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and John Epifanio

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Institute of Natural Resource Sustainability
Division of Illinois Natural History Survey

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ILLINOIS
NATURAL
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SURVEY

INHS • 1816 S. Oak St. • Champaign, IL 61820 <http://www.inhs.uiuc.edu>

**University of Illinois Urbana-Champaign
Institute of Natural Resource Sustainability
Illinois Natural History Survey**

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wadeable streams in Illinois**

(May 1, 2008 - April 30, 2009)

Leon C. Hinz Jr., Laura L. Sass,
and John Epifanio

Submitted to

Illinois Department of Natural Resources
One Natural Resources Way
Springfield, Illinois 62702

University of Illinois Urbana-Champaign
Institute of Natural Resource Sustainability
Illinois Natural History Survey

1816 South Oak Street
Champaign, Illinois 61820

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Illinois Natural History Survey Technical Report 2009/17

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Annual Project Report 2009

Project: T-25-P-001

1 May 2008 to 30 April 2009

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University of Illinois Urbana-Champaign
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1816 South Oak Street
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15 June 2009

Dr. John Epifanio,
Project Coordinator
Illinois Natural History Survey

Dr. Brian Anderson,
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PROJECT TITLE: Developing a multi-metric habitat index for wadeable streams in Illinois.

Summary:

This project was initiated to describe key aquatic habitat characteristics and their association to anthropogenic disturbance by developing a field based, rapid assessment method for qualitatively monitoring instream conditions using a multi-metric habitat index. We have developed and applied a method for rating disturbance in wadeable streams throughout Illinois and collected information on physical habitat at 474 sites statewide. Index development and outreach will be the focus of our efforts for the remainder of the project. Presentations at three scientific meetings (Midwest Fish & Wildlife 2008, Illinois American Fisheries Society 2009, Emiquon Science Symposium 2009) based on project information were given. A seven month no cost extension was requested and granted during this reporting period (APPENDIX A). This report summaries progress for the period beginning 1 May 2008 and ending 30 April 2009.

JOB 1. Sample metrics at chosen sample sites.

1.1 Investigate utility of using existing disturbance ratings developed by Smogor 2000.

Assessment of the Smogor (2000) ratings suggested that an alternative approach would better meet the needs of our study by removing factors that influence fish directly but may not alter the physical structure of the stream channel (e.g., sewage outflows or hazardous waste locations) and by localizing the landscape summaries to the sites. **This job has been completed.**

1.2 Develop alternative disturbance rating scheme if needed.

We have developed a disturbance rating based on arc (stream confluence to confluence) local watershed, upstream catchment, and riparian zone perturbations. We used five metrics to assess stream segment watersheds at the local and upstream catchment level (over 50,000 arcs state wide): 1. proportion of disturbed land in the upstream catchment, 2. maximum volume of impounded water in the upstream catchment, 3. proportion of strip-mined land in the local watershed, 4. proportion of undisturbed land in the local riparian zone (150 m buffer centered on the stream), and 5. density of road crossings in the local watershed. An equally weighted sum of the standardized values for each metric was used as an index of disturbance. This method was used to apply disturbance ratings to stream arcs throughout Illinois (Figure 1). **This job has been completed.**

1.3 Select sites with range of disturbance for sampling.

Potential sites were based on station codes developed by Illinois EPA and each was assigned the disturbance rating of their corresponding stream arc. Because they offer a broad and relatively detailed coverage of the state we used the fish IBI regions developed by Smogor (2000) as a starting point for site selection. We selected a minimum of 30 sites to visit from each Fish IBI region (10 least disturbed, 10 most disturbed and 10 moderately disturbed). Locations with existing biological or physical/chemical data were given priority over sites without associated historical data. **This job has been completed.**

JOB 2. Identify potential metrics.

2.1 Identify a list of candidate metrics by reviewing existing indices and the literature.

While reviewing the literature, it became apparent that several common methods of habitat characterization might be appropriate for use in this project. However, these methods required detailed physical measurements that did not allow for a rapid assessment method (e.g., point transect method) or they lost potentially important information by broadly summarizing throughout the reach (e.g., SHAP [IEPA 1994]). To address these issues we collected and summarized data from each site at two scales: (1) the entire reach, and (2) individual channel units (Table 1). **This job has been completed.**

2.2 Develop sampling techniques for each candidate metric.

Sampling techniques were fine-tuned during the 2006 field season and procedures were developed to facilitate data collection. Characteristics for substrate type and instream cover were defined based on existing methods (IEPA 1994). Metrics and data sheets were finalized before the beginning of the field season in 2007 and used for the remainder of the project (Figures 2A & 2B). **This job has been completed.**

2.3 Sample metrics at chosen sample sites.

During the 2008 field season we focused on areas of the state that have been under sampled and on least disturbed sites to ensure sufficient data for index development. We have sampled candidate metrics at 474 unique locations (Figure 3) during the three field seasons (71 in 2006, 233 sites in 2007, and 163 in 2008). In addition several sites were sampled multiple times to evaluate consistencies between crews and years. Each year water levels precluded some sites from being sampled either due to flooding or when they became pooled or dry by late summer. **This job has been completed.**

JOB 3. Determine Regions

3.1 Identify possible regionalization schemes (e.g., watersheds, natural divisions).

Regionalizations used in Illinois have been based on Natural Divisions (Schwegman 1973), Ecoregions (Woods et al. 2006) or some modification of these (Smogor 2000). We examined Fish IBI regions, Natural Divisions, and Freshwater Ecoregions (TNC) as possible regions for index development (Table 2). In addition, we have typed stream segments using a method developed by colleagues in Michigan (Brenden et al. [2006, 2008]). This method uses stream segments based on confluence to confluence reaches as the basic unit (1:100,000). Each stream segment has been attributed with information from GIS summaries of landcover, geology, and physiography of the watershed and stream network. Stream typing for this project is based on size (link number), underlying geology (bedrock), and local channel gradient (valley slope). We are currently investigating the use of these stream types for regionalizing our habitat index.

3.2 Identify degree to which metrics sampled at least-disturbed sites differ among regions.

We have begun to examine the relationships between sampled metrics, defined statewide regions (see above), and our statewide stream typing. These stream types have been defined as having similar physical characteristics, rather than being defined on spatial proximity. They are being used to examine relationships between sampled metrics at least-disturbed sites rather than using geographical regions. This work is ongoing.

3.3 Select final regions.

Final selection will be based on the outcome of our analysis in 3.2 above. Work on this job has been rescheduled as per the approved no-cost extension.

JOB 4. Select Final Metrics.

4.1 Select final metrics based on those that reflect levels of disturbance in each region.

We have reviewed over 250 potential metrics (Table 3) and their relationship with our statewide disturbance ratings. We are currently assessing the relationships between those that showed statewide signals and the potential regionalizations. Final metric selection for the habitat index will be based on the outcome of this analysis. This work is ongoing and has been rescheduled as per the approved no-cost extension.

JOB 5. Develop scoring criteria for each region.

5.1 Establish regional scoring criteria for each metric.

Establishment of scoring criteria requires the completion of 4.1 above. This work is ongoing and has been rescheduled as per the approved no-cost extension.

JOB 6. Prepare Final Report.

6.1 Prepare final report including a “how to” manual.

Work on this job has been rescheduled for June-December of 2009 as per the approved no-cost extension.

6.2 Conduct a training workshop.

Work on this job has been rescheduled for June-October of 2009 as per the approved no-cost extension.

Literature Cited

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- Schwegman, J. E. 1973. Comprehensive plan for the Illinois nature preserves system part 2: the natural divisions of Illinois. Illinois Nature Preserves Commission. Springfield, IL 31pp.
- Woods, A. J., J. M. Omernik, C. L. Perderson, and B. C. Moran. 2006. Level III and IV ecoregions of Illinois. EPA/600/R-06/104 Illinois Environmental Protection Agency. Springfield, IL 23pp.

Presentations Given during this reporting period:

- Sass, L.L., A. M. Holtrop, L. Hinz, and J. Epifanio. 2009. Developing a multimetric habitat index for wadeable streams in Illinois. Emiquon Science 2009, Dickson Mounds Museum, Lewistown, Illinois (12 March).
- Sass, L.L., A. M. Holtrop, L. Hinz, and J. Epifanio. 2009. Developing a multimetric habitat index for wadeable streams in Illinois. 47th Annual Meeting of the Illinois Chapter of the American Fisheries Society, Moline, Illinois (24 February).
- Sass, L. L., A. M. Holtrop, L. Hinz, and J. Epifanio. 2008. Developing a multimetric habitat index for wadeable streams in Illinois. 69th Midwest Fish and Wildlife Conference, Madison, WI. (15-16 December).

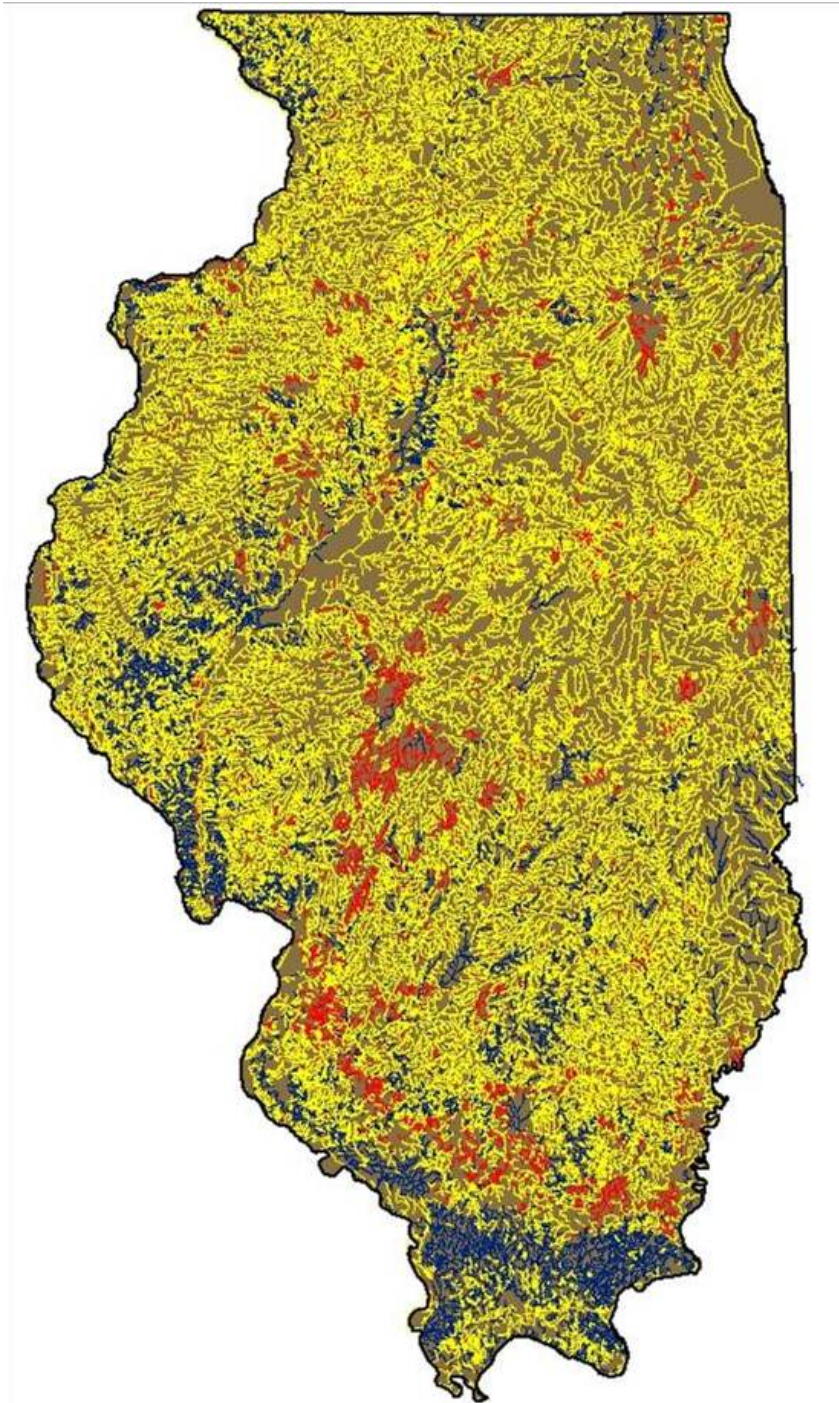


Figure 1. Disturbance ratings for Illinois streams (based on 1:100,000 NHD). Ratings were developed to reflect anthropogenic disturbance throughout the watershed and in riparian areas that could potentially affect stream habitat. Red streams are most disturbed, yellow streams are moderately disturbed, and blue streams are the least disturbed.

HABITAT EVALUATION FORM

Station Code: _____	Stream: _____	Location (include road crossing): _____
Date: _____	Scorer(s): _____	Gaz pg: _____

Page 1 of

REACH CHARACTERISTICS
Check one box per bank. River right looking upstream.

Buffer Width (Top of Bank)	Riparian Type	Stream Bank Vegetation	Predominant Channel Type																																												
<table border="0" style="width: 100%;"> <tr> <th style="text-align: left;">L</th> <th style="text-align: left;">R (Per Bank)</th> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table> <p style="font-size: small;">L _____ R _____</p>	L	R (Per Bank)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<table border="0" style="width: 100%;"> <tr> <th style="text-align: left;">L</th> <th style="text-align: left;">R (Predominant Per Bank)</th> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table>	L	R (Predominant Per Bank)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<table border="0" style="width: 100%;"> <tr> <th style="text-align: left;">Left</th> <th style="text-align: left;">Right</th> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table> <p style="font-size: x-small;">1=Sparse, 2=Intermediate, 3=Abundant</p>	Left	Right	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<table border="0" style="width: 100%;"> <tr> <td><input type="checkbox"/></td> <td>Pool</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Riffle</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Run</td> </tr> </table> <p>Total # of Channel Units: _____</p>	<input type="checkbox"/>	Pool	<input type="checkbox"/>	Riffle	<input type="checkbox"/>	Run
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Predominant Substrate in Reach
(1=Predominant, 2=Next Dominant)

<input type="checkbox"/> Boulder (>256 mm)	<input type="checkbox"/> Sand
<input type="checkbox"/> Slab Boulder (>256 mm)	<input type="checkbox"/> Hardpan
<input type="checkbox"/> Cobble (64-256 mm)	<input type="checkbox"/> Silt
<input type="checkbox"/> Gravel (8-64mm)	<input type="checkbox"/> Bedrock
<input type="checkbox"/> Fine Gravel (2-8 mm)	

Predominant Flow in Reach
Check one

Fast
 Moderate
 Slow
 No detectable flow

Shading of Water Surface

Water surface completely shaded
 Water mostly shaded with some sunlight
 Half water surface shaded, half full sunlight
 Most water surface receiving sunlight
 Lack of canopy; full sunlight reaching water

Thalweg Depths in Reach

1	_____	m
2	_____	m
3	_____	m
4	_____	m
5	_____	m
6	_____	m
7	_____	m
8	_____	m
9	_____	m
10	_____	m

Comments: _____

CHANNEL EVOLUTION STAGE

I - STABLE

II - INCISION

III - WIDENING

IV - STABILIZING

V - STABLE

h=streambank height; hc = critical streambank height (slope failure is imminent depending on the strength of the soils in the bank)

Predominant Channel Stage: _____

ADDITIONAL STREAM INFORMATION

<p>Water Level</p> <p><input type="checkbox"/> Rising</p> <p><input type="checkbox"/> Normal/Base Flow</p> <p><input type="checkbox"/> Decreasing</p> <p><input type="checkbox"/> Pooled</p>	<p>Stream Modifications Check all that apply</p> <p><input type="checkbox"/> Outfalls/pipes</p> <p><input type="checkbox"/> Canopy Removal</p> <p><input type="checkbox"/> Dredging</p> <p><input type="checkbox"/> Artificial cover/substrate</p> <p><input type="checkbox"/> Impoundments</p>	<p>Wetted Width</p> <p>DS _____ m</p> <p>MID _____ m</p> <p>UP _____ m</p> <p>Mean _____ m</p>	<p>Thalweg Depth</p> <p>_____ m</p> <p>_____ m</p> <p>_____ m</p> <p>_____ m</p>
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GPS Location (NAD83)
Latitude: _____
Longitude: _____

Reach Length: _____ m

Photos Taken: Yes # Taken _____ No

Comments: _____
Reach starts _____ m upstream/downstream from bridge.

Figure 2A. Example field sheets including information collected at each site (reach scale).

Unit #:	CHANNEL UNIT (Circle One):	Lateral Pool	Mid-Channel Pool	Riffle	Run	Transitional
Substrate Type (1=Predominant, 2=Next Dominant)		COVER (0=None, 1=Sparse, 2=Intermediate, 3=Abundant)				
<input type="checkbox"/> Boulder (>256 mm)	<input type="checkbox"/> Sand	0 1 2 3 Undercut Bank		0 1 2 3 Aquatic Macrophytes		
<input type="checkbox"/> Slab Boulder (>256 mm)	<input type="checkbox"/> Hardpan	0 1 2 3 Overhanging Vegetation		0 1 2 3 Logs or Woody Debris		
<input type="checkbox"/> Cobble (64-256 mm)	<input type="checkbox"/> Silt	0 1 2 3 Rootwads		0 1 2 3 Aggregate LWD		
<input type="checkbox"/> Gravel (8-64mm)	<input type="checkbox"/> Bedrock	0 1 2 3 Boulder		0 1 2 3 Rootmats		
<input type="checkbox"/> Fine Gravel (2-8 mm)				0 1 2 3 Other _____		
Substrate Embeddedness (1° substrate) Applies when 1° substrate is ≥ fine gravel		Depth of Fines as Bottom Cover		Cross Section Depths (Pools Only) Measure from LAB to RAB		
<input type="checkbox"/> Not Embedded	<input type="checkbox"/> Pool (N/A)	<input type="checkbox"/> None		1 _____ m	Predominant Flow (Circle One) Fast Moderate Slow No Detectable Flow	
<input type="checkbox"/> 0-25% Embedded	<input type="checkbox"/> 1° substrate is fine (N/A)	<input type="checkbox"/> 1-25 mm		2 _____ m		
<input type="checkbox"/> 25-50% Embedded		<input type="checkbox"/> 25-50 mm		3 _____ m		
<input type="checkbox"/> 50-75% Embedded		<input type="checkbox"/> 50-75 mm		4 _____ m		
<input type="checkbox"/> 75-100% Embedded		<input type="checkbox"/> > 75 mm		5 _____ m		
				6 _____ m		
				7 _____ m		
				8 _____ m		
Comments:				Max Depth: _____ m		

Unit #:	CHANNEL UNIT (Circle One):	Lateral Pool	Mid-Channel Pool	Riffle	Run	Transitional
Substrate Type (1=Predominant, 2=Next Dominant)		COVER (0=None, 1=Sparse, 2=Intermediate, 3=Abundant)				
<input type="checkbox"/> Boulder (>256 mm)	<input type="checkbox"/> Sand	0 1 2 3 Undercut Bank		0 1 2 3 Aquatic Macrophytes		
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<input type="checkbox"/> Fine Gravel (2-8 mm)				0 1 2 3 Other _____		
Substrate Embeddedness (1° substrate) Applies when 1° substrate is ≥ fine gravel		Depth of Fines as Bottom Cover		Cross Section Depths (Pools Only) Measure from LAB to RAB		
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<input type="checkbox"/> 0-25% Embedded	<input type="checkbox"/> 1° substrate is fine (N/A)	<input type="checkbox"/> 1-25 mm		2 _____ m		
<input type="checkbox"/> 25-50% Embedded		<input type="checkbox"/> 25-50 mm		3 _____ m		
<input type="checkbox"/> 50-75% Embedded		<input type="checkbox"/> 50-75 mm		4 _____ m		
<input type="checkbox"/> 75-100% Embedded		<input type="checkbox"/> > 75 mm		5 _____ m		
				6 _____ m		
				7 _____ m		
				8 _____ m		
Comments:				Max Depth: _____ m		

Unit #:	CHANNEL UNIT (Circle One):	Lateral Pool	Mid-Channel Pool	Riffle	Run	Transitional
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<input type="checkbox"/> Fine Gravel (2-8 mm)				0 1 2 3 Other _____		
Substrate Embeddedness (1° substrate) Applies when 1° substrate is ≥ fine gravel		Depth of Fines as Bottom Cover		Cross Section Depths (Pools Only) Measure from LAB to RAB		
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<input type="checkbox"/> 50-75% Embedded		<input type="checkbox"/> 50-75 mm		4 _____ m		
<input type="checkbox"/> 75-100% Embedded		<input type="checkbox"/> > 75 mm		5 _____ m		
				6 _____ m		
				7 _____ m		
				8 _____ m		
Comments:				Max Depth: _____ m		

Figure 2B. Example field sheets including information collected at each site (unit scale).

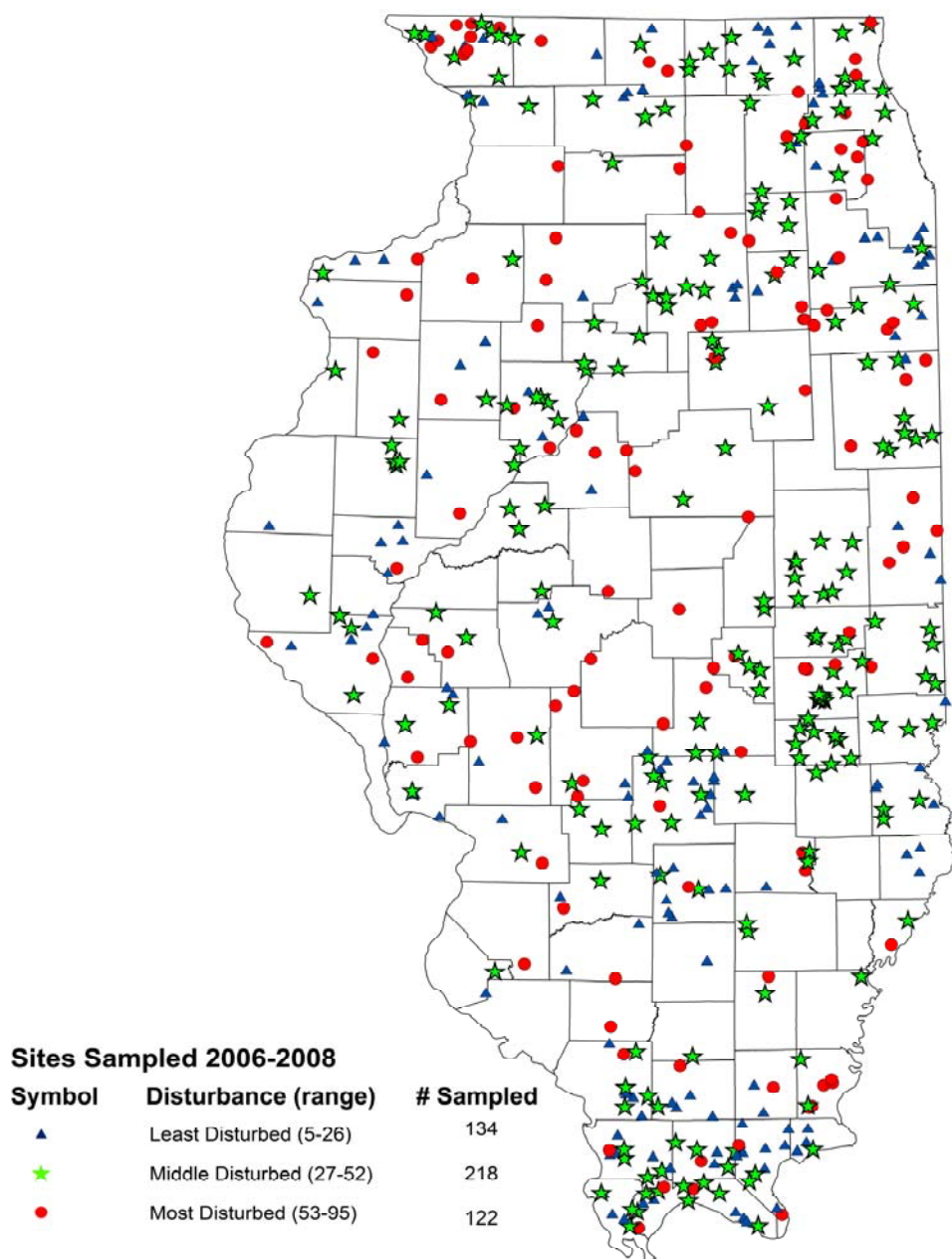


Figure 3. Location of sites at which candidate metrics were sampled between 2006-2008. Sites are coded according to the respective disturbance level (red circles are most disturbed, green stars are moderately disturbed, and blue triangles are least disturbed sites).

Table 1. Candidate metrics collected by field staff. Scale refers to whether the metric is determined for each channel unit, for the entire sampling reach, or both.

Metric	Definition	Scale
Buffer Width	Width of the undeveloped buffer on each side of the stream	Reach
Riparian Type	Type of vegetation growing in the buffer zone	Reach
Stream Bank Vegetation	Type of vegetation growing on the stream banks	Reach
Predominant Channel Type	Pool, riffle, or run	Reach
Predominant Substrate	Most abundant type of substrate	Both
Predominant Flow	Fast, moderate, slow, or no detectable flow	Both
Shading of Water Surface	Completely, mostly, half, most light, all light	Reach
Thalweg Depths	10 approximately equidistant depths taken	Reach
Channel Evolution	Per Schumm et al. 1984	Reach
Water Level	Rising, base flow, decreasing or pooled	Reach
Stream Modifications	Any human alterations are noted	Reach
Wetted Width	Taken at the downstream, mid and upstream points	Reach
Thalweg Depth	Taken at the downstream, mid and upstream points	Reach
Channel Unit Type	Lateral pool, mid-channel pool, riffle, run or transitional	Unit
Cover	Abundance of cover for 9 types (see Figure 2b)	Unit
Substrate embeddedness	Only applied to substrates fine gravel and larger	Unit
Depth of fines as bottom cover	None, 1-25mm, 25-50, 50-75, and >75mm	Unit
Cross section depths	Eight depths are taken across pools	Unit
Max depth	Deepest water in a unit	Unit

Table 2. Total number of sites sampled within potential regionalizations by disturbance class.

Fish IBI Region	Disturbance Class			
	Least	Middle	Most	Total
1	6	9	8	23
2	10	17	10	37
3	10	12	10	32
4	9	15	10	34
5	7	15	11	33
6	6	32	10	48
7	11	19	13	43
8	11	12	11	34
9	12	23	8	43
10	12	9	12	33
11	11	26	9	46
12	18	16	6	40
13	11	13	4	28

Natural Division	Disturbance Class			
	Least	Middle	Most	Total
Coastal Plain	13	18	7	38
Grand Prairie	13	75	47	135
Illinois River/ Miss R. Sand Areas	2	1	0	3
Lower Mississippi R. Bottomlands	5	3	1	9
Middle Mississippi R. Border	1	3	2	6
Northeastern Morainal	20	23	13	56
Rock River Hill Country	5	5	2	12
Shawnee Hills	9	3	0	12
Southern Till Plain	28	34	14	76
Upper Miss./ Illinois R Bottomlands	11	18	10	39
Wabash River Border	12	17	13	42
Western Forest-Prairie	10	15	8	33
Wisconsin Driftless	5	3	5	13

Freshwater Ecoregion	Disturbance Class			
	Least	Middle	Most	Total
Laurentian Great Lakes	0	0	1	1
Lower Mississippi	13	14	4	31
Teays – Old Ohio	26	57	22	105
Upper Mississippi	95	147	95	337

Total Sampled	134	218	122	474
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Table 3. Candidate metrics examined for statewide signals related to androgenic disturbance. Metrics in **bold** show the best relationships and are being further examined within the potential regionalization methods.

Substrate Type

Proportion Of Clay
 Proportion Of Silt
 Proportion Of Sand
 Proportion Of Fine Gravel
 Proportion Of Gravel
 Proportion Of Gravels
 Proportion Of Cobble
 Proportion Of Slab Boulder
 Proportion Of Boulder
 Proportion Of Boulder-Cobble Substrate
 Proportion Of Hardpan
 Proportion Of Bedrock
 Predominant Substrate In The Units
 Predominant Substrate For The Reach
 Substrate Calculated With QHEI Methods
 Predominant Substrate QHEI
 Next Predominant Substrate QHEI
 Predominant Substrate For Predominant Unit Type

Substrate Quality

Substrate Class
 Proportion Soft Substrate
 Proportion Coarse Substrate
 Deepest Fine
 Deepest Fine In The Runs
 Deepest Fine In The Riffles
 Deepest Fine In The Pools
 Proportion Of Pools With Predominant Silt
 Proportion Of All Pools
 Proportion Of Units With Predominant Silt
 Number Of Units That Are Not Embedded
 Proportion Of Units Not Embedded
 Proportion Of Units With Macrophytes
 Average Of Deepest Fines
 Average Of Embeddedness
 Average Of Percent Embeddedness
Substrate Stability
 Predominant Substrate Size
 Next Predominant Substrate Size
 Average Of Predominant Substrate Size
 Average Of Next Predominant Substrate Size
 Average Substrate Size
 Proportion Of Boulder-Cobble-Gravel

Instream Cover Type

Number Cover Types Reach
 Number Cover Types Runs
 Number Cover Types Pools
 Proportion Of Units With “Other”
 Proportion Of Junk
 Proportion Of Undercut Banks
 Proportion Of Overhanging Cover
 Proportion Of Rootwad
 Proportion Of Boulder
Proportion Of Large Woody Debris
 Proportion Of Rootmat
 Proportion Of Overhang-Rootmats
Proportion Of Wood
 Proportion Of Under Cut-Over Hanging
Proportion Of Aquatic Macrophyte Cover
 Number Pools>70 Cm Deep
 Number Pools>50 Cm Deep
 Proportion Of Pools>70 Cm Deep
 Proportion Of Pools>50 Cm Deep
 Number Runs>70 Cm Deep
 Number Runs>50 Cm Deep
 Proportion Of Runs>70 Cm Deep
 Proportion Of Runs>50 Cm Deep
 Number Units>70 Cm Deep
 Number Units>50 Cm Deep
 Proportion Of Units>70 Cm Deep
 Proportion Of Units>50 Cm Deep

Instream Cover Amount

Proportion Of Units With No Cover
 Proportion Of Units With Some Cover
 Proportion Of 0s For Cover
 Proportion Of 1s For Cover
 Proportion Of 2s For Cover
 Proportion Of 3s For Cover
 Proportion Of Overhang-Rootmat In Pools
Proportion Of Wood In Pools
 Proportion Of Overhang-Rootmat In Runs
 Proportion Of Wood In Runs
 Proportion Of Overhang-Rootmats In Riffles
 Proportion Of Wood In Riffles
 Proportion Of Total Cover
Count Of Cover Types
 Cover Calculated Similarly To QHEI

Table 3. Continued

Pool/Riffle Quality

Proportion Of Riffles

Proportion Of Riffles >10 Cm Deep
 Number Lateral Pools
 Number Mid-Channel Pools
 Total Number Of Pools
 Total Number Of Riffles
 Pool Max Depth To Mean Depth Ratio
 Pool Min Depth To Mean Depth Ratio
 Pool Mean Depth Mean Depth Ratio
 Variance Max Pool Depth
 Variance In Mean Pool Depth
 Count Units That Are Not Pools
 Proportion Of Units That Are Pools
 Proportion Of Units That Are Mid-Channel Pools
 Proportion Of Units That Are Lateral Pools
 Pool Variability Score
 Mean Range Of Pool Cross Sections
 Average Of The Max Depth In Riffles
 Proportion Riffles With Coarse Substrate
 Number Of Riffles With Embeddedness
 Proportion Of Riffles With Embeddedness
 Variation In Riffle Substrate
 Pool To Riffle Ratio
 Pool Substrate Characterization
 Average Of Pool Depth Variance

Pool Quality Score

Deepest Fines Depth In Pools
 Max Of Max Depth Across Pools
 Proportion Of Pools >70 Cm Deep
 Proportion Of Pools >50 Cm Deep
 Deepest Fines In Pools
 Average Fines In Pools
 Average Substrate Size In Pools
 Proportion Of Cover In Pools

Misc. Data

Flood Plain Quality
 Air Temp
 Water Temp
 Hydro Diversity

Riparian Quality /Erosion

Minimum Buffer Width
 Maximum Buffer Width
Average Buffer Width
Buffer Riparian Score
 Adjacent Land Use
 Bank Erosion
 Bank Stability
Cover Structure
Average Riparian Type
 Bank Erosion Ranked
 Bank Stability Ranked
Riparian Similar To QHEI
Average Buffer Width Ranked

Channel Quality/Stability

Channel Evolution
 Channel Evolution Class
 Width To Depth Ratio
 Shading
Percent Shade*
 Sinuosity
 Channelized (Yes/No)
 Stream Modifications
 Channel Alteration

Other Units

Number Of Lateral Pools
 Number Of Mid-Channel Pools
 Number Of Pools
 Number Of Runs
 Number Of Riffles
 Number Of Transitional Units
 Proportion Of Lateral Pools
 Proportion Of Mid-Channel Pools
 Proportion Of Pools
Proportion Of Runs
Proportion Of Riffles
 Proportion Of Transitional Units
 Number Unit Types
 Most Common Unit
 Total Number Of Units
 Predominant Channel Type
Max Of Max Depth Unit

Table 3. Continued

Thalweg

Thalweg Minimum Depth
Thalweg Maximum Depth
Thalweg Mean Depth
Thalweg Max Depth To Min Depth Ratio
Thalweg Mean Depth To Max Depth Ratio
Thalweg Range Of Depths
Thalweg Variance Across Depths
Variance Of Max Depth In Runs
Thalweg Max To Mean Depth Ratio In Runs

Flow

Predominant Flow In The Reach
Predominant Flow In The Units
Proportion Of No Flow Units
Proportion Of Slow Flow Units
Proportion Of Moderate Flow Units
Proportion Of Fast Flow Units
Number Flow Types
Proportion Of Slow & No-F Low Units
Proportion Of Moderate & Fast Flow Units
Ratio Of Slow To Fast Flow Units
Mean Velocity
Water Level

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Institute of Natural Resource Sustainability
Illinois Natural History Survey

1816 South Oak Street
Champaign, Illinois 61820



November 26, 2008

Ann Holtrop
Illinois Department of Natural Resources
One Natural Resources Way
Springfield, IL 62702-1271

Dear Ms. Holtrop:

This letter is a request for an extension of time, without supplemental funds, for completion of the Grant between the Illinois Department of Natural Resources and the University of Illinois for Developing a multi-metric habitat index for wadeable streams in Illinois, (T-25-P-001). A seven month extension of time is requested, which will result in December 31, 2009 as the new date for project completion.

A new schedule is necessary because fiscal obligations required that we execute this grant approximately four months earlier than full time staff were available to begin work. In addition we have experienced two extreme weather years (dry in 2006 and wet in 2007) limiting our access to field sites. Generally, water levels in Illinois do not reach base flow until early June. Therefore, effective training of interested user groups (Job 6) would also best be conducted in the summer (June-October). An extension will allow us to conduct field training in the appropriate season and revise the field manual after additional input from the field staff.

Please contact me if additional information is required. To indicate your approval of this request, please sign in the indicated space below, acquire additional approvals necessary within your agency (if any), and please return the approved request to Sandra Moulton, Associate Director, Post Award Administration, University of Illinois, 1901 South First Street, Suite A; Champaign, IL 61820.

Sincerely,

John Epifanio
Principal Investigator

Approved:

Ann Holtrop, Project Manager
Illinois Department of
Natural Resources

Kay L. Williams, Director
PostAwards, Grants & Contracts Office
University of Illinois

Michael E. Douglas, Division Director
Illinois Natural History Survey

Brian Anderson, Director
Illinois Natural History Survey