How to evaluate ravine vegetation? Testing a new meander-based protocol and comparing to plot-based data for Schenck Ravine.

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Introduction

Illinois has 47 ravines along the north shore of Lake Michigan that are home to species of concern. Disturbance and degradation have resulted from erosion caused by high volume, high velocity storm water runoff, invasion by exotic species, construction near and inside ravines, lack of buffers, and trash dumping. A greater understanding of conditions within ravines will enable the development of conservation management strategies for these unique natural areas. Since 2000, the Chicago Botanic Garden's (CBG) Plants of Concern (POC) program has collected data on rare species in the Chicago region including those in ravine communities. With the help of trained citizen scientists, POC collects data and delivers it to land managers and state agencies, contributing to rare plant conservation. POC has also contributed to ravine conservation projects. In 2013, Plants of Concern assisted with development of a plot-based protocol (RRA) to determine the quality of ravine vegetation. This protocol was time consuming to use. The goal of this project was to develop a rapid method of sampling that would allow determination of the vegetation quality in the ravines, and to compare that protocol to the RRA. We developed and tested a meander-based sampling method (RFQA), based on the Rapid Minnesota Floral Quality Assessment, and compared results from both sampling methods to known information about the ravines we sampled.

Study Site

Openlands Lakeshore Preserve (OLP) in Highwood, Illinois is the southern part of what was once Fort Sheridan. Of three ravines at OLP, Schenck Ravine was chosen as our study site. Ravines are the result of the erosion created by streams cutting through glacial moraines to flow into Lake Michigan. This down-cutting has occurred since glaciers retreated from the area 15,000 years ago. These V-shaped valleys create a cool microclimate able to support unique flora and fauna. Each ravine has two facing slopes: south and north, and these slopes support slightly different vegetation due the amount of sun exposure. The streams in ravines are generally intermittent.

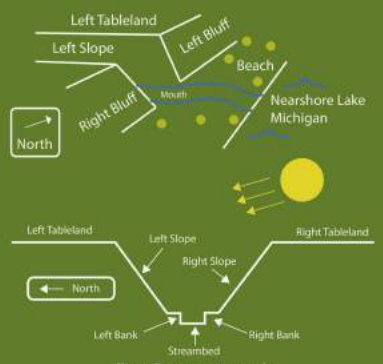

Fig.1 Ravine topography

Fig.2 Schenck Ravine

Questions and Hypothesis

Q: Is meander-based sampling effective at rapidly evaluating the composition of the plant community in Schenck Ravine?

H1: Meander-based Rapid FQA sampling will provide accurate data about the vegetation community of Schenck ravine in a short time frame (one sampling day).

Methods

We compared two protocols for assessing ravine vegetation. The ravine was divided into three communities – table, slope, and bluff – which we sampled on the north- and south-facing sides of the ravine in both protocols.

RRA (Plot-based sampling)

Surveyors walked a transect across ravine communities and sampled at least 15 plots on each table and mid-slope on both sides of the ravine. Three plots were sampled on the bluff for a total of 66 plots per ravine. Plots had 20' diameters and were evenly distributed across the ravine. Surveyors recorded the cover of all species within each plot in canopy, shrub and vine, and herbaceous layers.

RFQA (Meander-based sampling)

Surveyors meandered the ravine recording species for a specified amount of time. Table and slope were sampled together with a 1 hour base time, and for the bluff a 20 minute base time. Species presence and cover across the ravine were recorded.

Calculated metrics:

$$\text{Average } C = \frac{\sum C}{R}$$

$$\text{Weighted Average } (wC) = \sum pC$$

Where R=Richness (# species sampled), C = coefficient of conservativism, and p = proportional abundance

Protocol comparison

Protocols were compared using Average C and R. We could not use wC to compare protocols since different cover classes were used. A 'true' value for Average C and R, compiled from other studies of this ravine, was a baseline that we compared the two protocols against. Analysis of the vegetation community was done using NMDS (Non-metric multidimensional scaling) in DECODA.

Results

Fig.3 RRA Map: demonstrates the locality of the plots, the richness according to the size and the community according to the colors.

Fig. 4 RFQA Map: meander sampling and boundaries between slopes and table along the ravine.

		Plot Results			Meander Results		
	Area	Richness	N-Richness	Average C	Richness	N-Richness	Average C
Table	North facing	32	25	3.78	10	8	3.40
	South facing	47	35	3.17	16	12	2.63
Slope	North facing	47	38	3.66	37	32	4.84
	South facing	53	29	3.30	41	34	4.61
Bluff	North facing	20	13	2.45	13	9	3.15
	South facing	15	11	2.40	16	11	2.63

Table 1. RRA and RFQA Richness, native richness (N) and average coefficient of conservatism value (C)

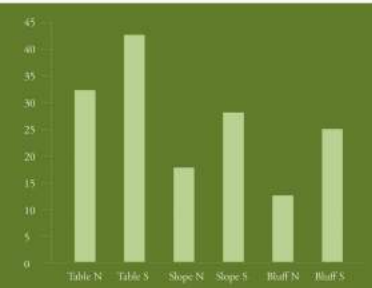

Fig. 5 Weighted C scores for the meander-based RFQA

Fig: 6. Vegetation analysis using NMDS. Legend codes refer to the protocol used and the community sampled (MS=Meander Schenck, PS=Plot Schenck, TS= True Schenck, B=bluff, T= table, S=slope, N= north-facing, S=south facing) Past data collected by POC was used to create a master species list and our true values.

Discusion

The plot-based RRA map illustrates that richness distribution is not uniform (Fig.3). RFQA sampling did not address this heterogeneity, though the surveyor's meanders did cover much of the ravine (Fig.4). At Schenck Ravine, the narrow table and small ravine-associated bluff resulted in more time spent on the slope. In both protocols, the north-facing side of the ravine had the highest average C for table, bluff and slope. Difference in table and bluff richness between protocols was dramatic because many of the common species found in these areas were not included on the RFQA species list. Highest total and native richness was found on ravine slopes using both protocols and the rarest plants in the ravine occurred on the slopes according to the average C (Table 1). In contrast, the south-facing table had the highest wC as determined in RFQA. Since wC incorporates relative abundance, it produces different patterns that provide critical information about these communities (Fig. 5).

Community analysis showed that vegetation communities on the slopes as sampled with both protocols aligned with previous data ('true value') for the slope and the whole ravine. In contrast, the table and bluff communities sampled with different protocols were less similar to each other and to the 'true value' (Fig. 6). Historic disturbance and the relatively small size of table and bluff communities could have resulted in this variation in sampling results.

Both protocols accurately determined the vegetation community in Schenck Ravine, with a high degree of accuracy on the slopes. However the protocols are useful for different purposes; the meander-based RFQA evaluates the composition of vegetation communities in a small amount of time, while the plot-based RRA quantitatively evaluates the spatial distribution of vegetation in ravines, but is not rapid. The RFQA was effective in Schenck Ravine, but should be tested in different conditions to evaluate its efficacy and adaptability.

References:

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Data Source:
Plants of Concern, Chicago Botanic Garden (2014) www.plantsofconcern.org

Acknowledgments:
The Chicago Botanic Garden, Anna Braum, Sam Fiek, Clare Milsted, Margaret Isagson, Jessie Pink & The National Science Foundation REU program.