Jul 29th, 11:00 AM - 1:30 PM

Geoenvironmental Implications on Food Sovereignty - Meskwaki Settlement, Tama County, Iowa

Lindsey Hubbell
University of Northern Iowa

Chad Heinzel Ph.D.
University of Northern Iowa

See next page for additional authors

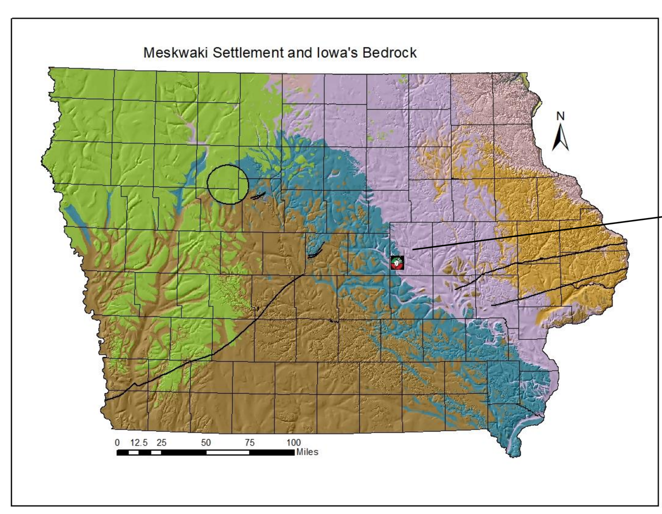
Author
Lindsey Hubbell, Chad Heinzel Ph.D., Christina Blackcloud, Luke Kapayou, and Avis Bear-Bass

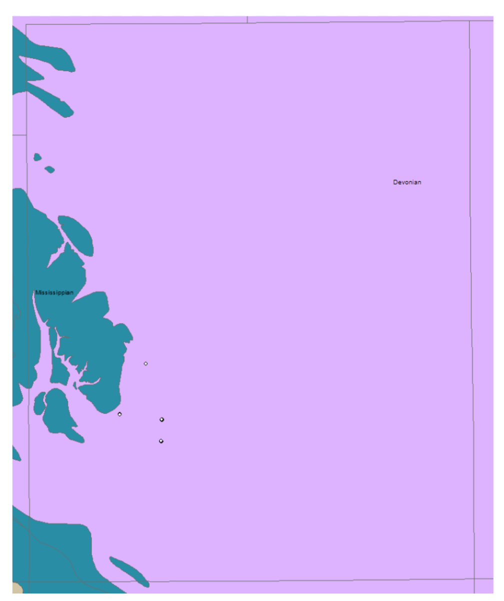
Geoenvironmental Implications on Food Sovereignty Meskwaki Settlement, Tama County, Iowa

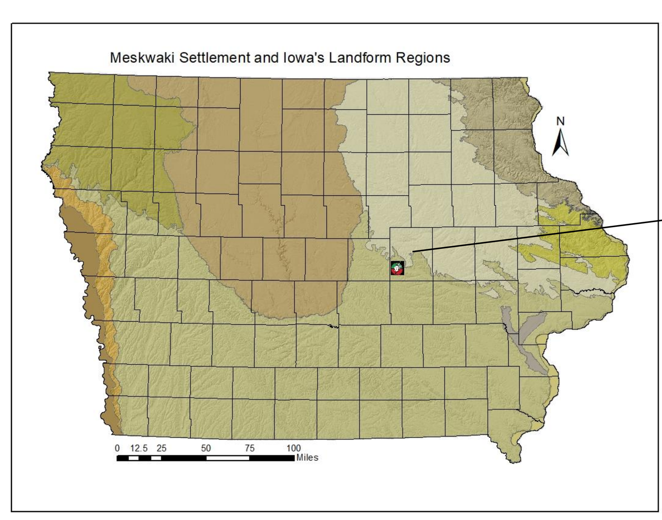
Lindsey Hubbell[a], Chad Heinzel[b], Christina Blackcloud[c], Luke Kapayou[c] and Avis Bear-Bass[c] [a]UNI - Environmental Resource Management, [b]UNI - Dept. of Earth and Environmental Sciences, [c]Meskwaki Food Sovereignty Coordinator, Contact: hubbelaa@uni.edu

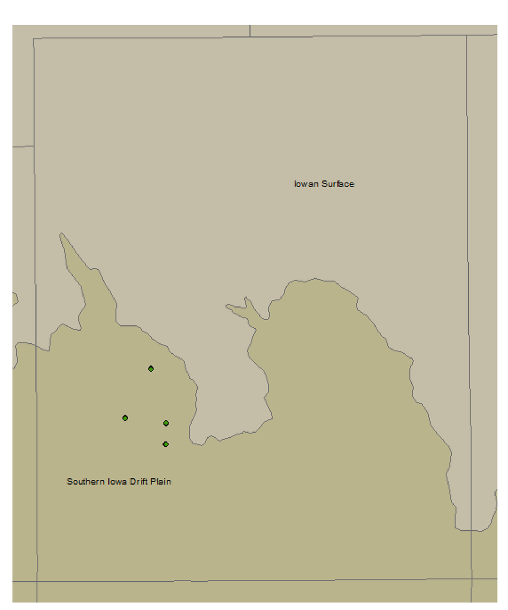
Background

Native American culture demonstrates a spiritual relationship to food, land, and Earth. As opposed to European traditions valuing private property and exploiting the Earth for profit, Native American tradition believes the Earth is owned by no one; food and nourishment from it are a gift for all to take only as needed. The Meskwaki Nation originated around the Great Lakes but was removed to Tama County, Iowa. It is derived from the words "Meskwa" meaning "red" and "aki" meaning "Earth". This Red Earth nation has initiated a Food Sovereignty program to pass along traditional growing and food preparation practices to their youth while defending environmental health. This project studies the Meskwaki Nation's soils in four garden locations to understand how sustainable land management practices could help build environmental/climatic resiliency and maintain healthy soils. Tama County's soil is some of the finest in the state of Iowa, with thick, well-drained topsoil, plentiful organic matter from prairie grasses, and loess deposits from glaciers. Iowa's soil is important to our livelihood and must be protected against erosion and destruction due to human activity.







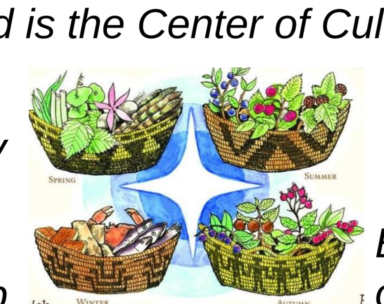


Methods

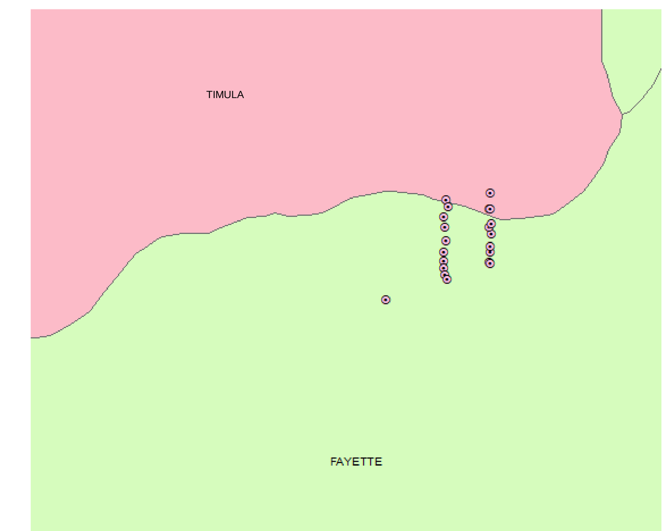
This research has been ongoing since May 2020 and will continue through the fall semester. For collection at the Meskwaki gardens, a soil probe was used to pull samples of topsoil at approximately 20 locations at each garden. Shown here are the locations of each sample collected as well as the soil series present at each garden. A deep core sample was also collected from each site at intervals of 1', 2', 3', and 4' in order to examine the properties of the subsoil. Shown here are the results of the 3' samples. In the geochemistry lab, tests were conducted on all samples to determine pH, nitrogen, potassium, and phosphorus content. An X-Ray fluorescence (XRF) machine was also used to detect elemental compositions, % and ppm, for each sample.

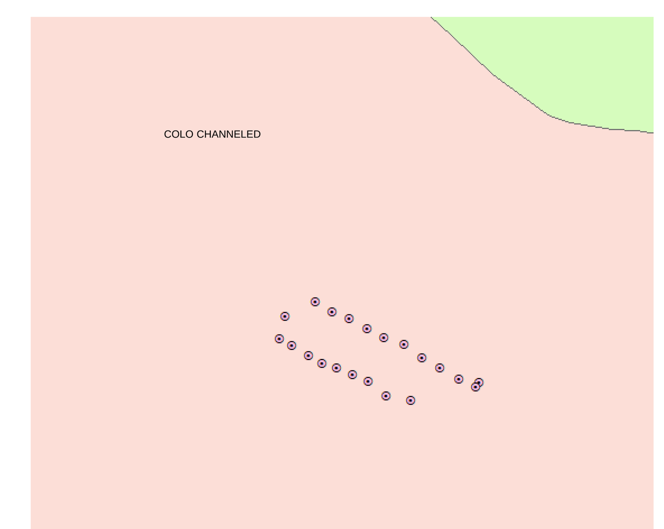
Acknowledgements

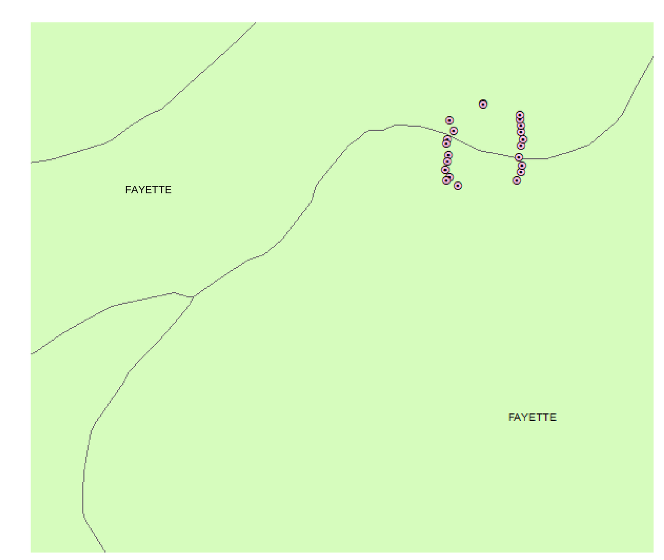
UNI Summer Undergraduate Research Project
Jim and Diane Sass Summer Research Support

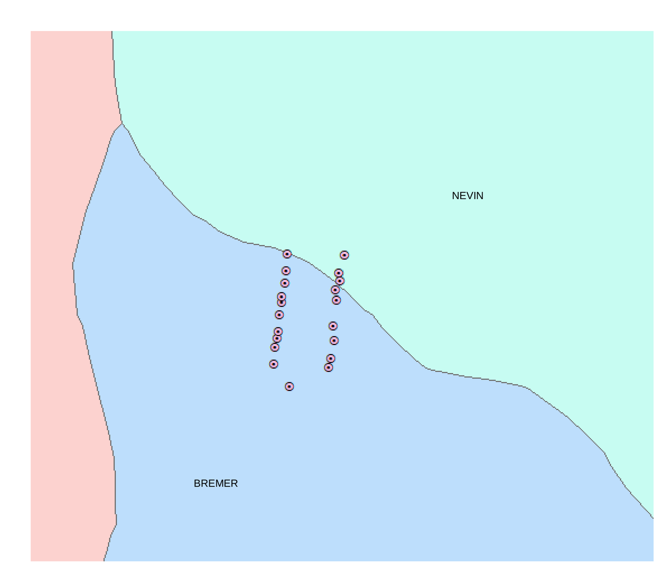


Results









Macronutrients (Averages)

	pH	N	K	P	Landscape	Soil series	Corn yield	Soybean yd
North Plot	5.2	85.3	123.2	81.6	Upland	Fayette	149 BPA	50 BPA
South Plot	5	67	106	122.5	Lowland	Colo Channeled	0 BPA	0 BPA
East Plot	5	80	259	160	Upland	Fayette	140 BPA	47 BPA
West Plot	6.1	71	109	110	Lowland	Bremer	139 BPA	47 BPA

3' Deep Core XRF Samples

North Plot	SiO_2 (%)	TiO_2 (%)	Al_2O_3 (%)	Fe_2O_3(T) (%)	MnO (%)	MgO (%)	CaO (%)	K_2O (%)	Na_2O (%)	P_2O_5 (%)	As (ppm)	Ba (ppm)	Co (ppm)	Cr (ppm)
	66.960	0.890	12.610	7.590	0.124	3.040	1.260	3.020	3.890	0.210	16.162	1341.511	13.694	103.291
	Cu (ppm)	Nb (ppm)	Ni (ppm)	Pb (ppm)	Rb (ppm)	S (ppm)	Sc (ppm)	Se (ppm)	Sr (ppm)	U (ppm)	V (ppm)	Y (ppm)	Zn (ppm)	Zr (ppm)
	38.662	25.186	39.251	25.480	131.252	1189.951	17.440	0.177	198.636	4.261	203.059	43.908	125.115	523.536
South Plot	SiO_2 (%)	TiO_2 (%)	Al_2O_3 (%)	Fe_2O_3(T) (%)	MnO (%)	MgO (%)	CaO (%)	K_2O (%)	Na_2O (%)	P_2O_5 (%)	As (ppm)	Ba (ppm)	Co (ppm)	Cr (ppm)
	69.160	0.870	10.680	6.290	0.220	3.220	1.360	2.870	4.710	0.211	8.915	1226.458	1.459	72.819
	Cu (ppm)	Nb (ppm)	Ni (ppm)	Pb (ppm)	Rb (ppm)	S (ppm)	Sc (ppm)	Se (ppm)	Sr (ppm)	U (ppm)	V (ppm)	Y (ppm)	Zn (ppm)	Zr (ppm)
	21.807	18.637	35.424	20.924	100.400	1477.695	21.602	0.177	192.685	3.390	131.176	41.452	86.046	577.422
East Plot	SiO_2 (%)	TiO_2 (%)	Al_2O_3 (%)	Fe_2O_3(T) (%)	MnO (%)	MgO (%)	CaO (%)	K_2O (%)	Na_2O (%)	P_2O_5 (%)	As (ppm)	Ba (ppm)	Co (ppm)	Cr (ppm)
	66.080	0.910	12.690	8.340	0.199	2.730	1.210	3.140	4.060	0.228	20.008	1329.553	14.851	93.370
	Cu (ppm)	Nb (ppm)	Ni (ppm)	Pb (ppm)	Rb (ppm)	S (ppm)	Sc (ppm)	Se (ppm)	Sr (ppm)	U (ppm)	V (ppm)	Y (ppm)	Zn (ppm)	Zr (ppm)
	34.556	21.924	50.995	25.307	122.424	1242.376	18.564	0.730	210.733	1.868	209.852	47.738	130.762	541.312
West Plot	SiO_2 (%)	TiO_2 (%)	Al_2O_3 (%)	Fe_2O_3(T) (%)	MnO (%)	MgO (%)	CaO (%)	K_2O (%)	Na_2O (%)	P_2O_5 (%)	As (ppm)	Ba (ppm)	Co (ppm)	Cr (ppm)
	68.550	0.910	11.480	6.900	0.149	3.170	1.420	2.840	3.980	0.186	8.961	1349.570	10.069	85.842
	Cu (ppm)	Nb (ppm)	Ni (ppm)	Pb (ppm)	Rb (ppm)	S (ppm)	Sc (ppm)	Se (ppm)	Sr (ppm)	U (ppm)	V (ppm)	Y (ppm)	Zn (ppm)	Zr (ppm)
	28.676	20.275	37.537	23.238	132.386	1390.288	18.165	0.982	196.770	3.687	169.424	43.616	114.875	481.397

Surface XRF Samples (Average per plot)

North Plot	SiO_2 (%)	TiO_2 (%)	Al_2O_3 (%)	Fe_2O_3(T) (%)	MnO (%)	MgO (%)	CaO (%)	K_2O (%)	Na_2O (%)	P_2O_5 (%)	As (ppm)	Ba (ppm)	Co (ppm)	Cr (ppm)
	71.815	0.948	9.895	5.168	0.205	2.713	1.303	3.160	4.148	0.223	11.792	1279.301	3.407	74.344
	Cu (ppm)	Nb (ppm)	Ni (ppm)	Pb (ppm)	Rb (ppm)	S (ppm)	Sc (ppm)	Se (ppm)	Sr (ppm)	U (ppm)	V (ppm)	Y (ppm)	Zn (ppm)	Zr (ppm)
	21.552	22.841	31.470	27.073	134.394	1618.327	18.666	0.832	179.454	4.055	145.256	42.544	91.245	576.609
South Plot	SiO_2 (%)	TiO_2 (%)	Al_2O_3 (%)	Fe_2O_3(T) (%)	MnO (%)	MgO (%)	CaO (%)	K_2O (%)	Na_2O (%)	P_2O_5 (%)	As (ppm)	Ba (ppm)	Co (ppm)	Cr (ppm)
	69.773	0.883	10.135	6.280	0.200	3.118	1.785	2.845	4.305	0.245	10.147	1293.353	4.347	81.978
	Cu (ppm)	Nb (ppm)	Ni (ppm)	Pb (ppm)	Rb (ppm)	S (ppm)	Sc (ppm)	Se (ppm)	Sr (ppm)	U (ppm)	V (ppm)	Y (ppm)	Zn (ppm)	Zr (ppm)
	29.258	22.152	41.298	26.317	127.102	1573.737	19.783	0.644	202.692	3.967	134.107	43.383	119.064	581.356
East Plot	SiO_2 (%)	TiO_2 (%)	Al_2O_3 (%)	Fe_2O_3(T) (%)	MnO (%)	MgO (%)	CaO (%)	K_2O (%)	Na_2O (%)	P_2O_5 (%)	As (ppm)	Ba (ppm)	Co (ppm)	Cr (ppm)
	70.578	0.928	10.078	5.563	0.265	2.863	1.788	3.208	4.078	0.220	11.631	1261.960	3.612	77.495
	Cu (ppm)	Nb (ppm)	Ni (ppm)	Pb (ppm)	Rb (ppm)	S (ppm)	Sc (ppm)	Se (ppm)	Sr (ppm)	U (ppm)	V (ppm)	Y (ppm)	Zn (ppm)	Zr (ppm)
	22.761	23.503	36.870	27.136	132.820	1646.167	18.313	0.535	184.686	3.782	138.762	41.361	102.279	623.125
West Plot	SiO_2 (%)	TiO_2 (%)	Al_2O_3 (%)	Fe_2O_3(T) (%)	MnO (%)	MgO (%)	CaO (%)	K_2O (%)	Na_2O (%)	P_2O_5 (%)	As (ppm)	Ba (ppm)	Co (ppm)	Cr (ppm)
	70.403	0.918	10.295	5.850	0.169	3.058	1.453	2.945	4.255	0.233	9.707	1319.258	3.923	82.996
	Cu (ppm)	Nb (ppm)	Ni (ppm)	Pb (ppm)	Rb (ppm)	S (ppm)	Sc (ppm)	Se (ppm)	Sr (ppm)	U (ppm)	V (ppm)	Y (ppm)	Zn (ppm)	Zr (ppm)
	29.289	23.162	39.793	23.375	139.831	1560.031	18.932	1.056	195.046	3.622	147.152	46.032	116.164	496.642

Discussion & Interpretation

Our world's growing needs for food production puts greater pressure on our soils, so protecting them is of utmost importance. Soil also acts as the world's largest carbon reservoir, so it is important to maintain for carbon sequestration. Sustainable agriculture practices including the following encourage climate resiliency:

- Planting cover crops to protect against wind and rain erosion during off-seasons
- Rotating crops that produce excess nitrogen, like beans, with crops that are in greater need of nitrogen, like corn
- Reducing or eliminating tillage to keep soil structure and pore space intact
- Installing terraces or prairie strips to prevent erosion as well as chemical runoff into groundwater
- Planting a greater diversity of crops to encourage biological resiliency
- Utilizing excess biomass as natural fertilizer, such as clippings and manure
- Adapting crop selections to a warmer climate i.e. tobacco, wild rice

Continued Work

In the fall, we will continue collecting and interpreting data to determine what nutrients Meskwaki's soil may be lacking and possible causes so that we may build a plan for sustainable land management in their gardens. We will also work with them on the food sovereignty side to evaluate what parts of their food system they currently control and what areas they may be able to reclaim control of. Implementing sustainable agricultural practices will help their soil be more productive and resilient so Meskwaki will be able to grow more of their own food and uphold their traditional values.