ABSTRACT

Let's Talk About Soil!

(A study conducted using procedures in the GLOBE soil protocols to analyze soil from north & south slopes)
Ella K. Curry - 5th grade
Alpena Middle School, Alpena, AR

Is there a difference in the soil properties of north-facing verses south facing slopes? It was predicted that wooded northern-facing slopes would have the best soil properties. I was also predicted that open northern-facing slopes would have the second-best soil properties.

North and south facing slopes were located and a GPS was used to record coordinates. A digital 3-way analyzer was put directly into soil to determine fertility and ground temperature. Results were recorded. Soil samples were collected and placed in Ziploc bags. Test kits for phosphorus, potash, nitrogen, and pH were used to analyze the samples.

The pH average levels for North and South slope were both 7.0. Nitrogen, Potash, and Phosphorus levels are as follows: 0=depleted, 1=deficient, 2=adequate, 3=sufficient, 4=surplus. North slope average for nitrogen = 1, south slope averaged 1.2. North slope averaged a potash level of 1, south slope averaged a potash level of 0.8. North slope averaged a phosphorus level of 1.2, south slope averaged 1. The digital 3-way analyzer showed a fertility level of 0.8 as the average for the north slope and 0.6 for the south slope. Fertility levels range from 0–10.

The hypothesis was minimally supported by the data. The north-wooded slope had the highest pH and phosphorus average. The south-wooded slope and north-wooded slope average for Potash were both 1.5 which was the highest recorded. The highest nitrogen content was from the south-wooded slope.
Neither the north or south slope had sufficient levels of nitrogen, potash, or phosphorus.

Let's Talk About Soil!

A study conducted using GLOBE protocols to analyze soil from north & south slopes

Ella Curry - 5th grade
Alpena Elementary/Middle School
Alpena, AR
Teacher: Roger G. Rose
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INTRODUCTION

In the Northern hemisphere, north-facing slopes retain more moisture than south-facing slopes. Because south-facing slopes receive more sunlight, they tend to dry out quicker. Old timers have always stated that north-facing slopes are better for growing things so I wanted to see if they were correct or if it's just a myth. I based my project around the GLOBE protocols for collecting soil samples and documenting test locations.

QUESTION

Is there a significant difference in the soil properties of north-facing verses south facing slopes?

HYPOTHESIS

It was predicted that wooded northern-facing slopes would have the best soil properties. It was also predicted that open northern-facing slopes would have the second-best soil properties.

METHODS & MATERIALS:

PROCEDURE

The researcher located north and south facing slopes and used GPS to record coordinates according to the GLOBE soil protocols. A digital 3-way analyzer was put directly into soil to determine fertility and ground temperature. Results were recorded. Using a small trowel to dig, soil samples were collected and placed in Ziploc bags and labeled. The soil samples were then put into individual cups and water was added to dilute the soil. After the soil settled, a dropper was used to extract the sample from the cup and the sample was placed in 4 separate test kits (phosphorus, potash, nitrogen, and pH). Color changer tablets were added by the researcher under adult supervision. The results were recorded and was analyzed with the use of charts and graphs.

MATERIALS

Soil Samples
Small trowel
Ziploc bags
Smartphone (for GPS coordinates)
Digital 3-way analyzer
Soil test kit
Droppers
Distilled Water
Plastic Cup

DATA SUMMARY:

The pH average levels for North and South slope were both 7.0 (neutral). According to the soil test kit, Nitrogen, Potash, and Phosphorus levels are as follows: 0 = depleted, 1 = deficient, 2 = adequate,
3 = sufficient, 4 = surplus. The north slope averaged a nitrogen level of 1 and the south slope averaged 1.2. The north slope averaged a potash level of 1 and the south slope averaged a potash level of 0.8. The north slope averaged a phosphorus level of 1.2 while the south slope averaged 1. Neither the north or south slope had sufficient levels of nitrogen, potash, or phosphorus. The digital 3-way analyzer showed a fertility level of 0.8 as the average for the north slope and 0.6 for the south slope. Fertility levels range from 0 – 10 with this test.

Location #1 : open, south facing, coordinates 36.371958, -93.324912, Test: fertility 2, temperature 64 degrees, p1, k1, n1, ph 7.0 neutral

Location#2 : wooded, south facing, coordinates 36.372191, -93.323790, Test: fertility 0, temperature 51 degrees, p1, k2, n2, ph 7.0 neutral

Location#3 : open, north facing, coordinates 36.372977, -93.323939, Test: fertility 0, temperature 51 degrees, p1, k1, n1, ph 6.5 slight acid

Location#4 : wooded, north facing, coordinates 36.372596, -93.323187, Test: fertility 1, temperature 46 degrees, p1, k1, n1, ph 7.5 alkaline

Location#5 : open, south facing, coordinates 36.365071, -93335609, Test: fertility 0, temperature 58 degrees, p1, k0, n1, ph 7.0 neutral

Location#6 : open, south facing, coordinates 36.366184, -93.335609, Test: fertility 1, temperature 58 degrees, p1, k0, n1, ph 7.0 neutral

Location#7 : open, north facing, coordinates 36.366176, -93.332054, Test: fertility 1, temperature 53 degrees, p1, k1, n1, ph 7.0 neutral

Location#8 : wooded, south facing, coordinates 36.371280, -93.327018
Test: fertility 0, temperature 54 degrees, p1, k1, n1, ph 7.0 neutral

Location#9 : open, north facing, coordinates 36.376010, -93.322397
Test: fertility 1, temperature 55 degrees, p1, k0, n1, ph 7.0 neutral

Location#10 : wooded, north facing, coordinates 36.378423, -93.323165
Test: fertility 1, temperature 55 degrees, p2, k2, n1, ph 7.0 neutral

RESULTS:

The pH average levels for North and South slope were both 7.0. Nitrogen, Potash, and Phosphorus levels are as follows: 0=depleted, 1=deficient, 2=adequate, 3=sufficient, 4=surplus. North slope average for nitrogen = 1, south slope averaged 1.2. North slope averaged a potash level of 1, south slope averaged a potash level of 0.8. North slope averaged a phosphorus level of 1.2, south slope averaged 1. The digital 3-way analyzer showed a fertility level of 0.8 as the average for the north slope and 0.6 for the south slope. Fertility levels range from 0–10.

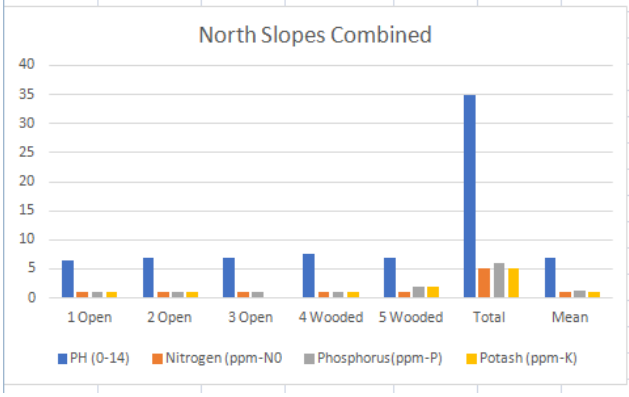
Soil Test Results for North Slopes and South Slopes								
	North Slopes				South Slopes			
Location	pH (0-14)	Nitrogen (ppm-N)	Phosphorus (ppm-P)	Potash (ppm-K)	pH (0-14)	Nitrogen (ppm-N)	Phosphorus (ppm-P)	Potash (ppm-K)
1 open	6.5	1	1	1	7.0	1	1	1
2 Open	7.0	1	1	1	7.0	1	1	0
3 open	7.0	1	1	0	7.0	1	1	0
Total	20.5	3	3	2	21.0	3	3	1
Mean	$6.8\overline{3}$	1	1	$0.6\overline{6}$	7.0	1	1	$0.3\overline{3}$
4 wooded	7.5	1	1	1	7.0	2	1	2
5 wooded	7.0	1	2	2	7.0	1	1	1
Total	14.5	2	3	3	14.0	3	2	3
Mean	7.25	1	1.5	1.5	7.0	1.5	1	1.5

Soil Test Results for North Slopes and South Slopes

	North Slopes				South Slopes			
Location	pH (0-14)	Nitrogen (ppm-N)	Phosphorus (ppm-P)	Potash (ppm-K)	pH (0-14)	Nitrogen (ppm-N)	Phosphorus (ppm-P)	Potash (ppm-K)
1 open	6.5	1	1	1	7.0	1	1	1
2 Open	7.0	1	1	1	7.0	1	1	0
3 open	7.0	1	1	0	7.0	1	1	0
4 wooded	7.5	1	1	1	7.0	2	1	2
5 wooded	7.0	1	2	2	7.0	1	1	1
Total	35.0	5	6	5	35.0	6	5	4
Mean	7.0	1	1.2	1	7.0	1.2	1	0.8

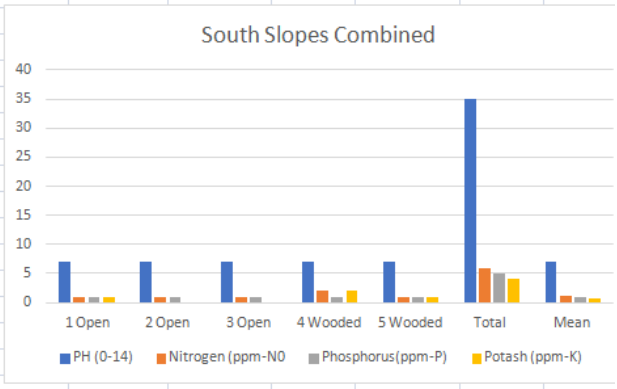
North Slopes

Location	PH (0-14)	Nitrogen (ppm-N0	Phosphorus(ppm-P)	Potash (ppm-K)
1 Open	6.5	1	1	1
2 Open	7	1	1	1
3 Open	7	1	1	0
4 Wooded	7.5	1	1	1
5 Wooded	7	1	2	2
Total	35	5	6	5
Mean	7	1	1.2	1



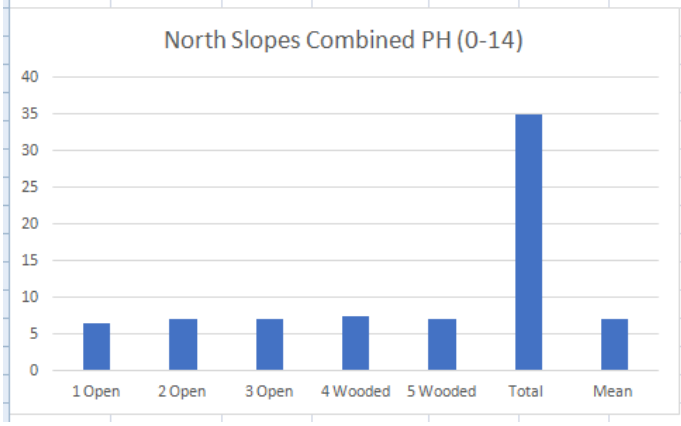
South Slopes

Location	PH (0-14)	Nitrogen (ppm-N0	Phosphorus (ppm-P)	Potash (ppm-K)
1 Open	7	1	1	1
2 Open	7	1	1	0
3 Open	7	1	1	0
4 Wooded	7	2	1	2
5 Wooded	7	1	1	1
Total	35	6	5	4
Mean	7	1.2	1	0.8



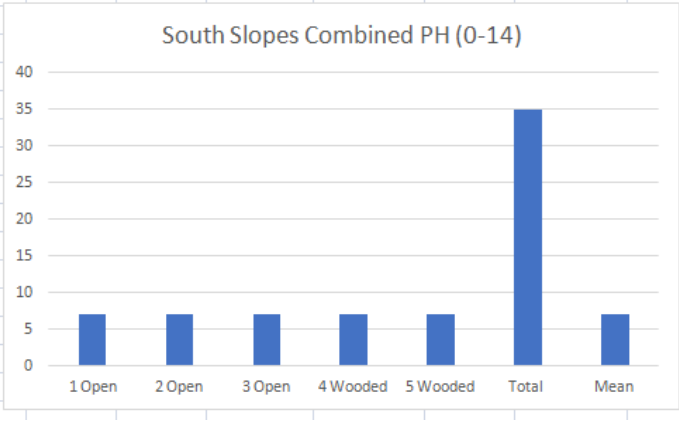
North Slopes

Location	PH (0-14)
1 Open	6.5
2 Open	7
3 Open	7
4 Wooded	7.5
5 Wooded	7
Total	35
Mean	7



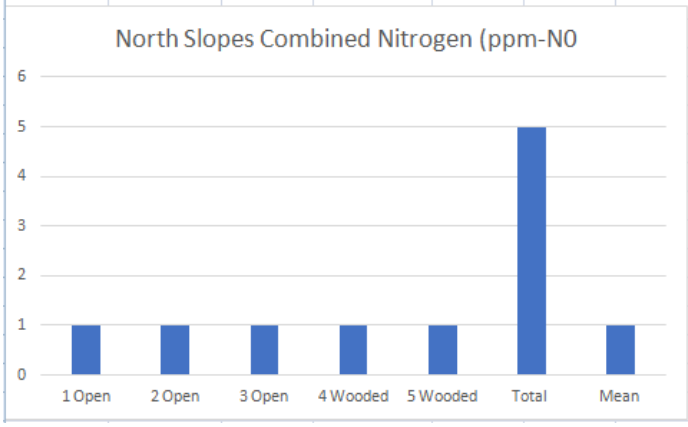
South Slopes

Location	PH (0-14)
1 Open	7
2 Open	7
3 Open	7
4 Wooded	7
5 Wooded	7
Total	35
Mean	7



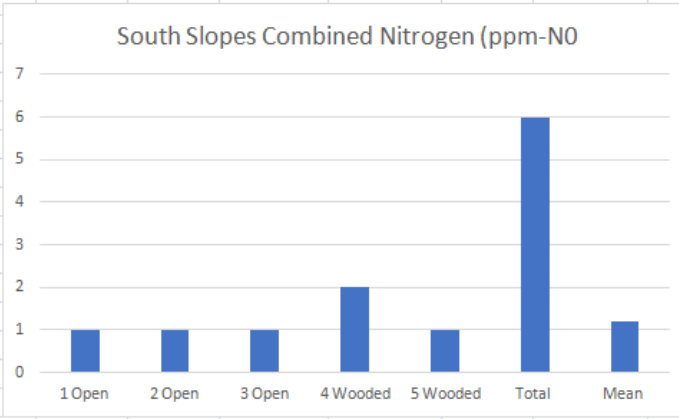
North Slopes

Location	Nitrogen (ppm-N0
1 Open	1
2 Open	1
3 Open	1
4 Wooded	1
5 Wooded	1
Total	5
Mean	1



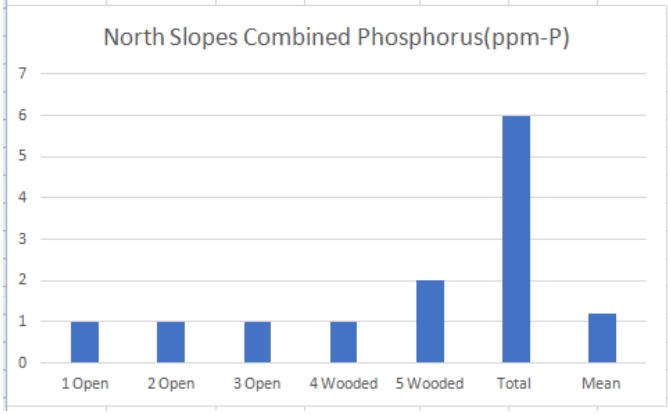
South Slopes

Location	Nitrogen (ppm-N0
1 Open	1
2 Open	1
3 Open	1
4 Wooded	2
5 Wooded	1
Total	6
Mean	1.2



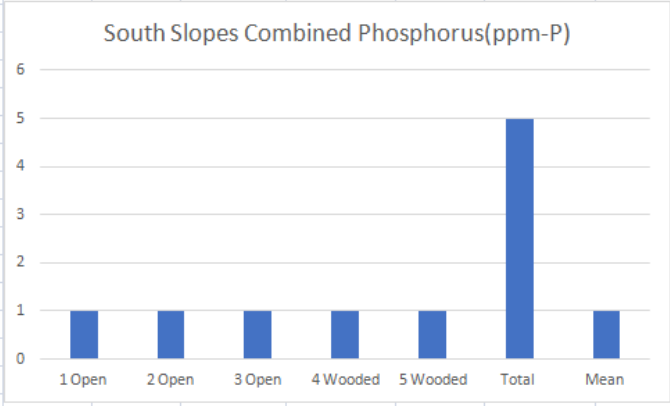
North Slopes

Location	Phosphorus (ppm-P)
1 Open	1
2 Open	1
3 Open	1
4 Wooded	1
5 Wooded	2
Total	6
Mean	1.2



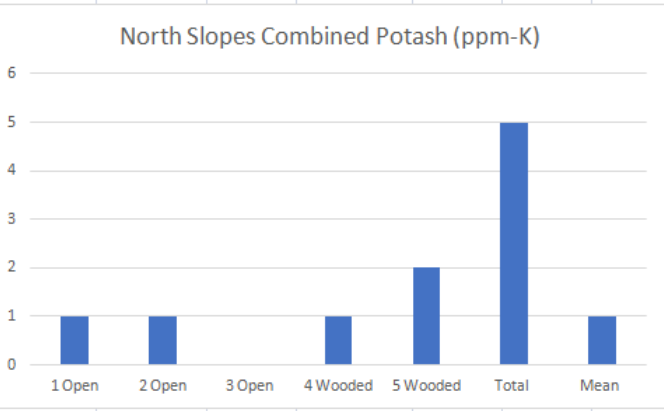
South Slopes

Location	Phosphorus (ppm-P)
1 Open	1
2 Open	1
3 Open	1
4 Wooded	1
5 Wooded	1
Total	5
Mean	1



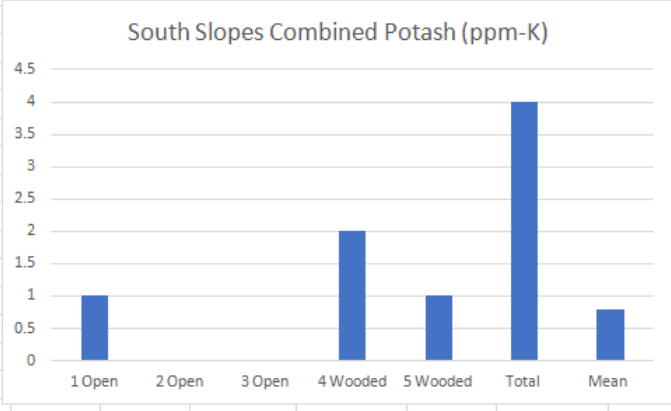
North Slopes

Location	Potash (ppm-K)
1 Open	1
2 Open	1
3 Open	0
4 Wooded	1
5 Wooded	2
Total	5
Mean	1



South Slopes

Location	Potash (ppm-K)
1 Open	1
2 Open	0
3 Open	0
4 Wooded	2
5 Wooded	1
Total	4
Mean	0.8



CONCLUSION:

The hypothesis was minimally supported by the data. The north-wooded slope had the highest pH and phosphorus average. The south-wooded slope and north-wooded slope average for Potash were both 1.5 which was the highest recorded. The highest nitrogen content was from the south-wooded slope. Neither the north or south slope had sufficient levels of nitrogen, potash, or phosphorus.

DISCUSSION:

The soil sample analysis showed little to no variation between north and south slopes. The researcher wonders if there is not a discrepancy between north and south slope soil content due to the fact that there is not much topsoil left on hillsides because of run-off. Additionally, the land is treated each year with *Grazon* to control the weed population. It would be interesting to collect soil samples from bottom land between two slopes to determine if the soil content is the same or different. Another possible experiment would be to test slopes that have been treated with chemicals and slopes that have not been treated with chemicals.

ACKNOWLEDGEMENT:

The researcher was assisted in her project by her parents who took her around to collect the soil samples and monitored as she conducted the chemical testing of the samples. The researcher's teacher, Mr. Rose, instructed the student in using the GLOBE protocols and how to use the test kits for testing the soil samples.

REFERENCES/BIBLIOGRAPHY:

Anderson, Jonathan Michael, and J. S. I. Ingram, eds. *Tropical soil biology and fertility*. Wallingford: CAB international, 1989.

Beasley, R. Scott, and Alfredo B. Granillo. "Soil protection by natural vegetation on clearcut forest land in Arkansas." *Journal of Soil and Water Conservation* 40.4 (1985): 379-382.

Brye, K. R., C. P. West, and E. E. Gbur. "Soil quality differences under native tallgrass prairie across a climosequence in Arkansas." *The American midland naturalist* 152.2 (2004): 214-230.

Kerby, Norma (2016, March 30) *Sunny Slopes and Garden Growth: Approaching your crops from a new angle* Retrieved from http://northword.ca/features/sunny-slopes-and-garden-growth-approaching-your-crops-from-a-new-angle/

Legg, Joseph Ogden, and R. L. Beacher. "The Potassium Supplying Power of Representative Arkansas Soils 1." *Soil Science Society of America Journal* 16.2 (1952): 210-214.

McCauley, Ann, Clain Jones, and Jeff Jacobsen. "Soil pH and organic matter." *Nutrient management module* 8 (2009): 1-12.

Mitchell, James Kenneth, and Kenichi Soga. *Fundamentals of soil behavior*. Vol. 3. New York: John Wiley & Sons, 2005.

Olk, D. C., et al. "Chemical stabilization of soil organic nitrogen by phenolic lignin residues in anaerobic agroecosystems." *Soil Biology and Biochemistry* 38.11 (2006): 3303-3312.

Read, Ralph A. "Tree species occurrence as influenced by geology and soil on an Ozark north slope." *Ecology* 33.2 (1952): 239-246.

Rodriguez, Amy. (n.d.) *"How Can a Slope Affect the Soil in an Area?" Home Guides | SF Gate.* Retrieved from http://homeguides.sfgate.com/can-slope-affect-soil-area-39386.html.

Sharpley, Andrew, et al. "Determining environmentally sound soil phosphorus levels." *Journal of soil and water conservation* 51.2 (1996): 160-166.

Shreve, Forrest. "Soil temperature as influenced by altitude and slope exposure." *Ecology* 5.2 (1924): 128-136.

Slaton, Nathan A., et al. "Nutrient input and removal trends for agricultural soils in nine geographic regions in Arkansas." *Journal of environmental quality* 33.5 (2004): 1606-1615.

Williams, Dianna K. (2017, April 27) *Differences Between North- and South-Facing Slopes* Retrieved from https://sciencing.com/differences-between-north-southfacing-slopes-8568075.html