

Lead (Pb) Impacts within Urban Soil Interpretations

Preliminary results from soil
characterization for urban gardens

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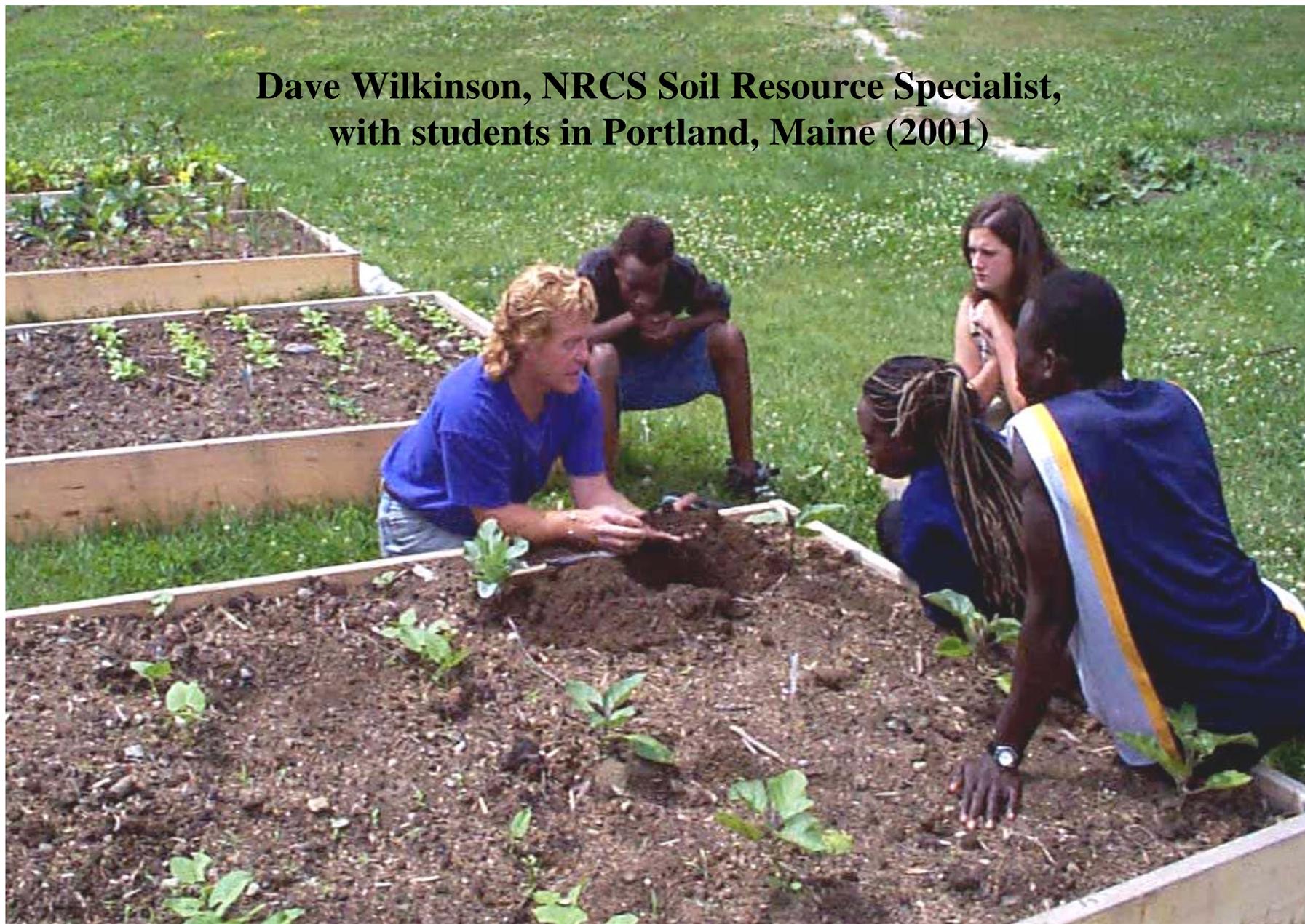
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**Dave Wilkinson, NRCS Soil Resource Specialist,
with students in Portland, Maine (2001)**



EDUCATION IN SOILS

Article published in 2001 (courtesy Wayne Hoar, SSS Maine)

Dave Wilkinson, Soil Resource Specialist in the Lewiston Field Office, gave a soils workshop to young adults participating in the Oikos Project in urban Portland.

This outreach effort is as a result of contacts made through Dave's involvement with the "Urban Soils Working Group" in Portland whose goal is to further understanding of urban and disturbed soils and providing meaningful, useful, and non-traditional soil interpretations to urban soil users.

Brief Description of the Bayside Community in Portland, Maine

This area of Portland has a very culturally diverse population of Sudanese, Ethiopians, Cambodian, Vietnamese and others many of which are recent refugees.

They use the urban soils for small agricultural systems and they are very involved in helping design future development of this area including green spaces, recreational areas, and living spaces.

The Goals of This and Future Sampling

to gather information and provide affordable assistance concerning urban soils in Portland's Bayside neighborhood

to develop interpretations that will be useful in the planning of Bayside's future redevelopment

to expand the current information and database for soil survey including metal contamination related to human health risks

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Urban Soil Characterization Study

This is an effort of the Maine Urban Soils Working Group which is a partnership between NRCS, University of Southern Maine, City of Portland, and several other community and neighborhood action groups.

We are committed to continue with our efforts to assist this culturally diverse neighborhood in tying their vision of their future home to the opportunities and limitations of the soil on which they live, work and play.

Safe Levels of Metals in Soils

We were wondering if you have any publications which give safe levels of heavy metals in soils, average natural background levels, management options for soils with elevated levels of trace elements, or ways that we can interpret the trace element analysis that we just received. We would like to have access to any or all of these kinds of documents or guidelines if they are available. (*Wilkinson*)

I am observing soils in back yards where gardens are grown for food. Does the NSSL run lead samples? Do you have any experience with lead test kits? (*Reed*)

Tour of Human-Disturbed Soils

- 2001 field day for the MAPSS (Maine Association of Professional Soil Scientists)
- 3 profiles were featured at Deering Oaks Park in downtown Portland
- Pedon photo credits: Dave Wilkinson - NRCS - Maine



**Deering Oaks Park #1
Portland, Maine 2001 MAPSS**

Description of Human Disturbed Soil

(MAPSS Tour 2001)

- 0-10" - grvfl surface fill
- 10-19" - sicl fill
- 19-26 - grsil
- 26-44" - grvfl fill of ash, coal, charcoal. Possible debris from the 1860 fire.
- 44-46" - Oa, highly decomposed organic material. This is the original soil surface before the area was used for a landfill.
- 46-47" - E, vfsl, discontinuous. The Albic horizon is showing the podzol development on this soil.
- 47-51" - Bh and Bs, sil, Spodic development
- 51-56"+ - Bc and C, sicl and sic. Marine sediment parent material.



**Deering Oaks Park #2
Portland, Maine 2001 MAPSS**

A photograph of a soil profile in a trench. A black vertical ruler is placed on the left side of the trench, with white markings and numbers at 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, and 44. The soil is dark brown and shows various textures and structures, including roots and some horizontal layering. The top of the trench is covered with grass and soil. The bottom of the trench is also covered with grass and soil.

**Deering Oaks Park #3
Portland, Maine 2001
MAPSS**

14 2:22 PM

Pedon Descriptions for Urban Soils in Portland, Maine.

The "User Site ID / User Pedon ID's" are as follows: If you do a NASIS select under National - select "Sites by User ID" and do an ID match with the following wild card: ME-01* you will get all these pedons. Also our urban pedons end with a "U"

ME-01-3-005-1U, ME-01-3-005-2U

ME-01-8-005-3U, ME-01-8-005-4U

ME-01-11-005-5U, ME-01-11-005-6U, ME-01-11-005-7U

Pilot Project: Laboratory Analysis

- Pilot project: 20 samples for 12 sites in city parks
- S01ME-005-01 through 12 "Parks", project ID **RP01-ME094**
- Soil Descriptions: horizon, depth (cm), color, texture. Other site data included slope, aspect, in-situ temperature, above-ground biomass, and GPS.
- Analyses done at University of Southern Maine: pH, organic carbon, moisture content, particle-size, and bulk density
- Analyses done by NSSL: trace metals especially total lead (Pb)

Urban Soil Characterization and Trace Metals Analysis

- Projects: C2001USME186, R2001USME218, C2002USME052
- Sampled 38 horizons in from a total of 7 pedons vacant lots proposed for development as urban vegetable gardens *S01ME-005-001 to 007*
- Complete field soil description and georeferencing for each pedon
- NSSL analyses:
 - standard physical and chemical characterization
 - total metal content by horizon: lead, arsenic, cadmium, zinc, chromium, nickel, copper, and mercury.

Pb Correlation Analysis (Pearson Correlation Coefficients Prob > |R| under Ho: Rho=0)

	PB	CD	ZN	CD/ZN	pH	WATER	CLAY	CARBON	CEC/CLAY
PB (Total lead)	1.00								
CD (Total cadmium)	0.83**	1.00							
ZN (Total zinc)	0.79**	0.80**	1.00						
CD/ZN (ratio)	-0.00	0.17	-0.27	1.00					
PH (acidity)	0.07	0.20	0.05	0.25	1.00				
WATER (15kPa g/g)	-0.28	-0.24	0.10	-0.60**	-0.10	1.00			
CLAY (<0.002 mm)	-0.33	-0.34	0.05	-0.57**	-0.10	0.94**	1.00		
CARBON (Organic C)	0.56*	0.62**	0.36	0.22	0.11	-0.30	-0.42*	1.00	
CEC/CLAY (ratio)	0.00	0.09	0.28	-0.40	-0.05	0.57*	0.40	-0.11	1.00

** p<0.001, * p< 0.01

Horizons Exceeding USEPA Thresholds for Lead Risk in Urban Soils

(Urban Soil Characterization Study - Portland, ME 2002)

Pedon	Depth from surface	Total Pb
1	8 - 56 cm	1830.23
2	41- 56	965.50
3	0 - 33	2184.54
3	33 - 71	406.86
5	84 - 89	1471.50
5	89 - 140	1083.66

> 400 mg/kg requires site treatment (surface covering)

> 2000 mg/kg requires site remediation (possible soil removal)

Summary of Results for Metal Toxicity

Total lead content exceeds the EPA threshold of 2000 mg/kg for remediation for 3 horizons at two different sites. Across all sites and horizons the lowest Lead levels are high enough for the standard deviation to raise them above the threshold of 400mg/kg requiring site treatment.

[Total soil metal contents for cadmium and zinc are below EPA thresholds for soil remediation (EPA, 2001). The ratio of cadmium to zinc also is consistently below the 0.015 level considered as a dietary risk (Chaney and Ryan, 1992) even using the maximum values for each metal.]

Research and Technology Transfer Needs in Urban Soil Characterization

Urban Soils Working Group - Portland, Maine. Our efforts are continuing in sampling and evaluating disturbed soils in Portland. Our group asked me to find out if we can get a hold of examples of the efforts, products, interpretations that others have developed with regards to efforts in evaluating and interpreting disturbed soils for a wide variety of uses. (Dave Wilkinson, NRCS soil scientist)

Douglas County, NE May 2002
Photo credit : John Handler, MO-10

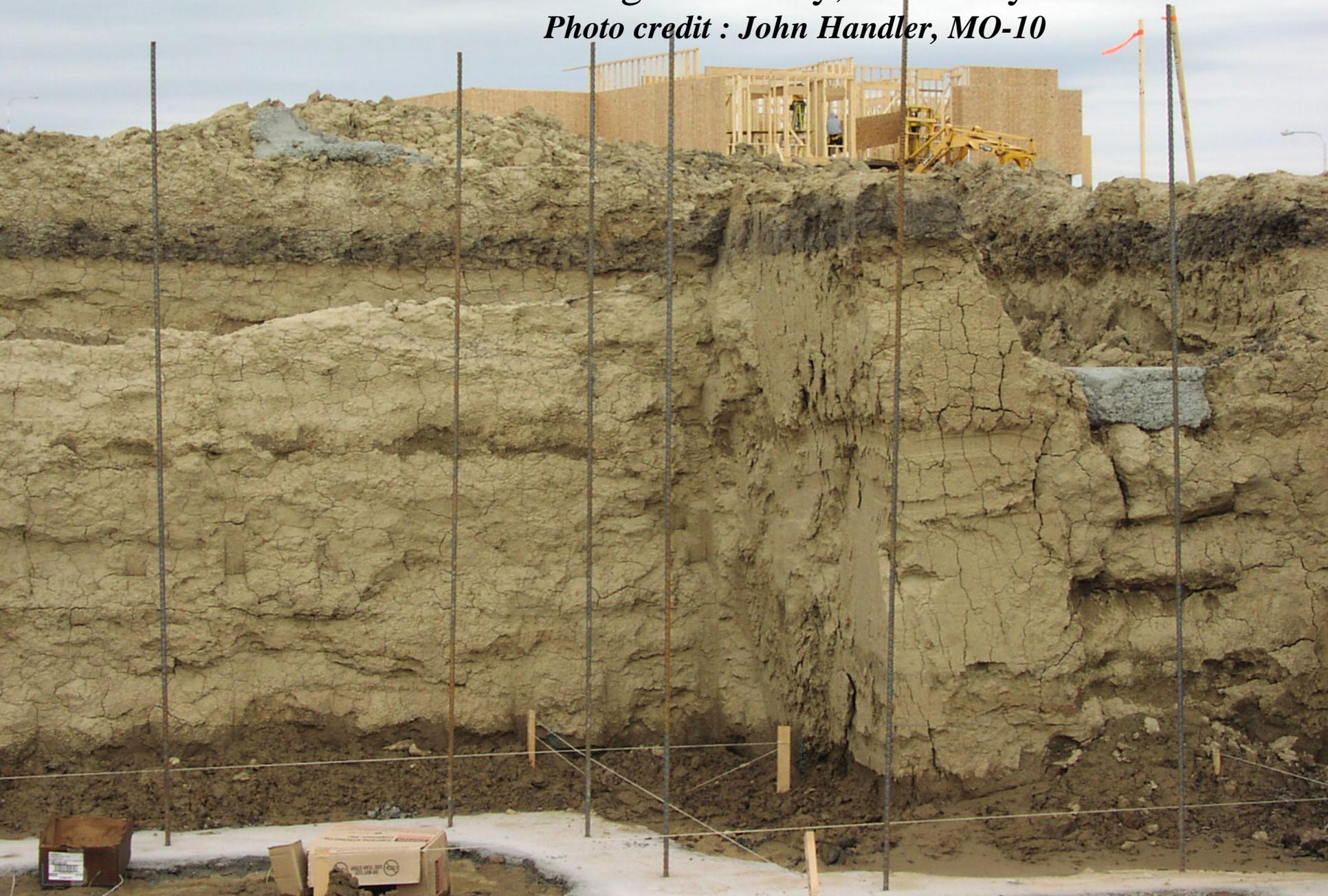


Research and Technology Transfer Needs in Urban Soil Characterization

I am working on a soil survey in the _____ area. I am curious about lead in the soils near the older homes in the older city areas. I am searching for some information from _____ county and the cities but have not found much yet.

I do not anticipate lots of samples for lead testing as most of the development was after about 1955 but the older city houses might be a possibility. There are some large older highway areas that might have some lead in the topsoil, and areas near the superfund sites in the county (all cleaned up except one).

Douglas County, NE May 2002
Photo credit : John Handler, MO-10



Soil Interpretation for Metal Sequestering

Discipline: Urban Soils and Public Health Draft 5/2001

Metal Sequestering Capacity is high (toxicity for human health is low) when:

- .Active microbes and enzymes are present
- .AND Organic carbon is active and present
- .AND aerated
- .AND acidity is in optimal range
- .AND toxins are inactive or absent
- .AND competitive plant uptake is absent

Rules

1. microbes are active
2. organic carbon is active
3. soil is aerated
4. soil is acid
5. toxins absent
6. plant competition absent

Evaluations

temperature
moisture
energy supply
OC present
humic/fulvic active sites open
porosity
pH is low
CaCO₃ absent
metal amounts are low
metals present but not available
competitive plants absent
non-competitive plants present
competitive plants have needs met

Douglas County, NE May 2002
Photo credit : John Handler, MO-10



Collaboration with Local Universities and Agencies

I would be happy to share my data with you.

Unfortunately I do not have any metal data. We don't have the equipment to do heavy metal analysis here, and I don't have the funds to have the samples sent out. We analyze for temp, pH, moisture, microbial activity, particle size, oc, exchangeable cations and salinity. We are also in the process of measuring bulk density. We also have above ground biomass, and exchangeable foliar cations for those sites with trees. I would love to have these samples analyzed for metals, and have saved all the samples from the last 2 years. *(Samantha)*

EDUCATION IN SOILS

Article published in 2001 (courtesy Wayne Hoar, SSS Maine)

Participating in the workshop were three young former refugees from Sudan as well as the program leader and an environmental sciences student from the University of Southern Maine.

The location of the workshop was at Kennedy Park, a low-income housing development where many former refugees have relocated from Sudan, Ethiopia, Cambodia, Thailand, etc.

The ethos of the Oikos Project is youth empowerment and community service and the young adults spend a lot of their time in the community gardens managing crops and outletting the products to the Portland Public Market.

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Through Dave's efforts the group received an overview of

- the nature and properties of soils,
- insight into human activities that negatively impact soil and
- some hands-on info/strategies/perspectives on how they can learn and do more to help.

The students gained an appreciation for soil resources and the importance of them in an urban environment.



Triennial Girl Scout Convention

Kansas City, MO - October 1999

Tom Levermann and Joyce Scheyer

USDA-NRCS