Chicago Soil Survey:

Linking our past, present, and future

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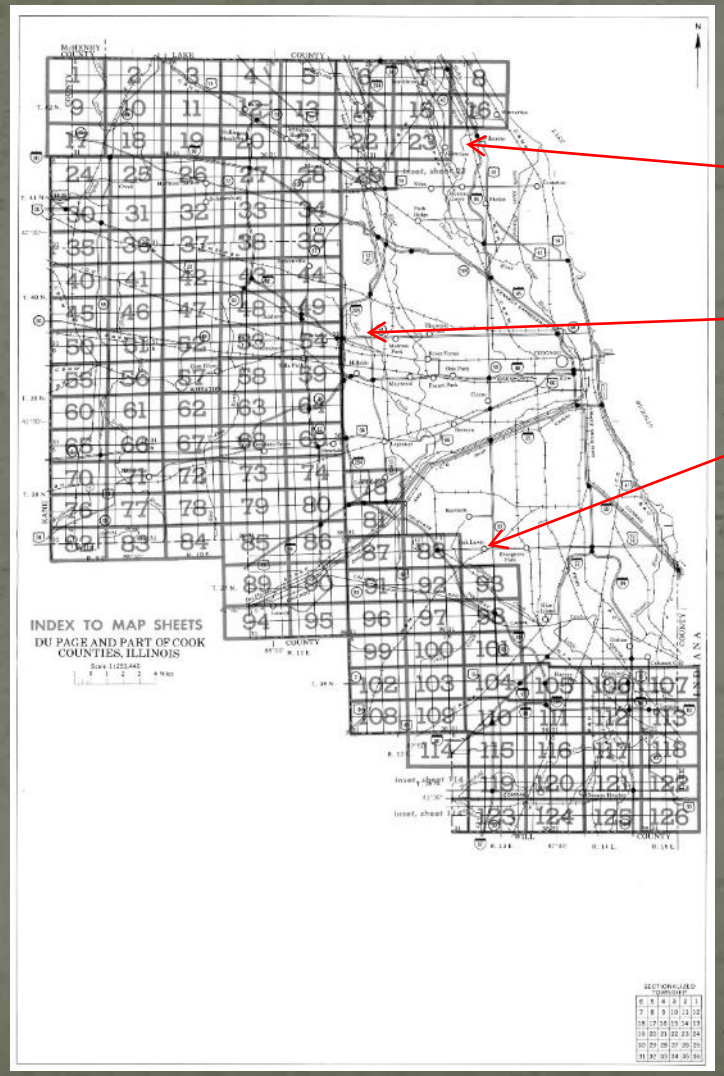
History of Chicago Soil Survey



- "Limit of Detailed Soil Survey"
  - The unmapped portion of Chicago and Cook County ~300,000 acres

Soils Information

Who wants it?

- Engineers
- Land-use planners
- Landscape Architects
- Homeowners*
- Forest Preserve Districts
- Municipality/City Governments
- Botanists
- Ecologists

Why?

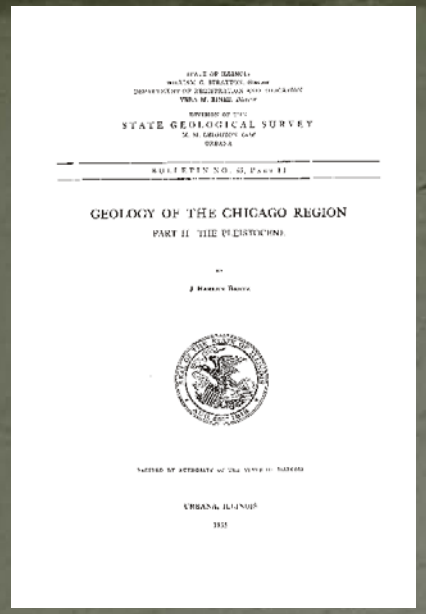
- Key component of land use planning decisions
- Ecological restoration
- Storm water management
- Urban Gardens/Farms

Various Land Uses

Survey Challenges

- Parking and Access Points
- Limited Observation Points*
- Variability of soils
- Mapping by landform*
  - Despite these challenges we have tools to be “history” detectives
  - Historical Records…

Historical Records


STATE GEOLOGICAL SURVEY

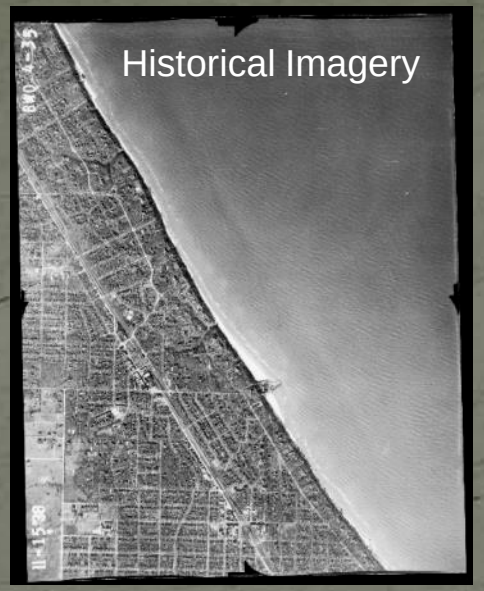
GEOLOGY OF THE CHICAGO REGION

PART II THE PLEISTOCENE

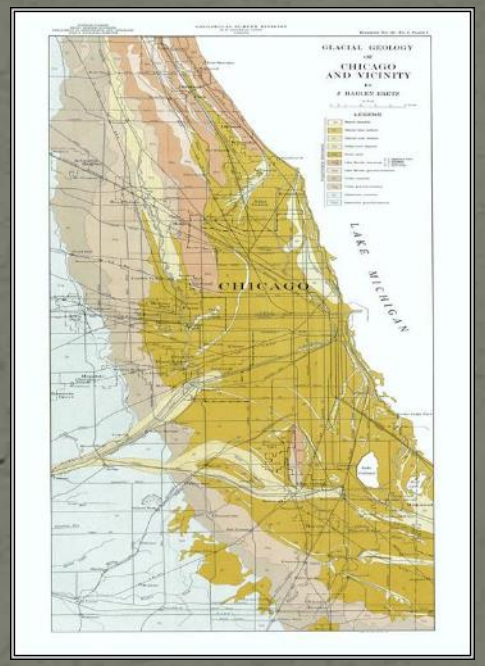
URBANA, ILLINOIS

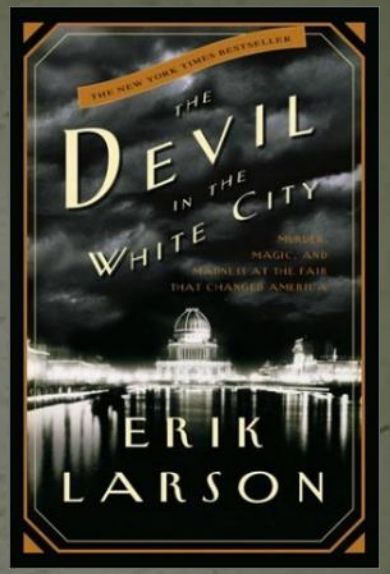
1955

Geological Publications
J. Harlen Bretz (1955)



Surficial Geology Maps
J. Harlen Bretz (1930-1932)



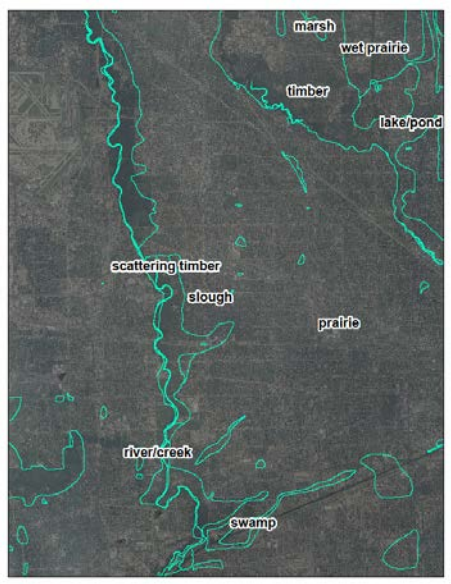


Non-fiction text

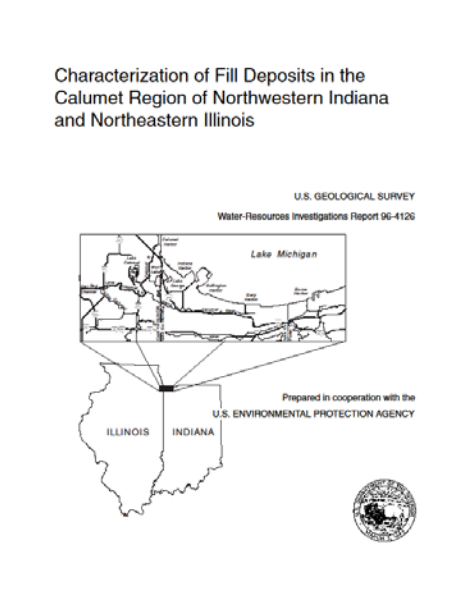
SOIL SURVEY OF
DU PAGE AND PART OF
COOK COUNTIES, ILLINOIS

UNITED STATES DEPARTMENT OF AGRICULTURE,
SOIL CONSERVATION SERVICE,
in cooperation with
ILLINOIS AGRICULTURAL EXPERIMENT STATION

Soil Survey Reports



Pre-settlement Data
(provided by Marlen Bowles, Morton Arboretum)


Characterization of Fill Deposits in the Calumet Region of Northwestern Indiana and Northeastern Illinois

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 96-4126

Lake Michigan

ILLINOIS

INDIANA

Prepared in cooperation with the
U.S. ENVIRONMENTAL PROTECTION AGENCY

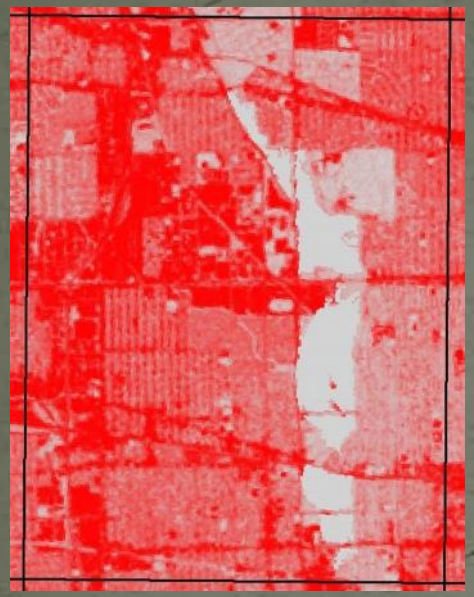
Merging Historical Data with Present Day Tools…

- Historical records
  - Pieces to a puzzle
  - Links our past & present
  - Digital Format
- Important for future planning
- Understand the landscape now and the soil capacity for the future

Historical imagery shows timeline of development

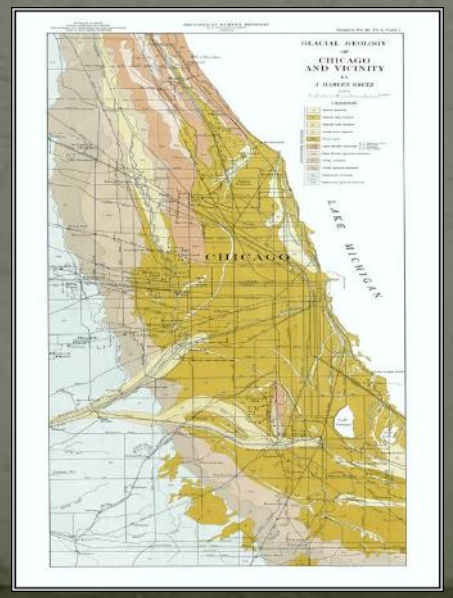
Soil Survey Tools

National Land Cover Database

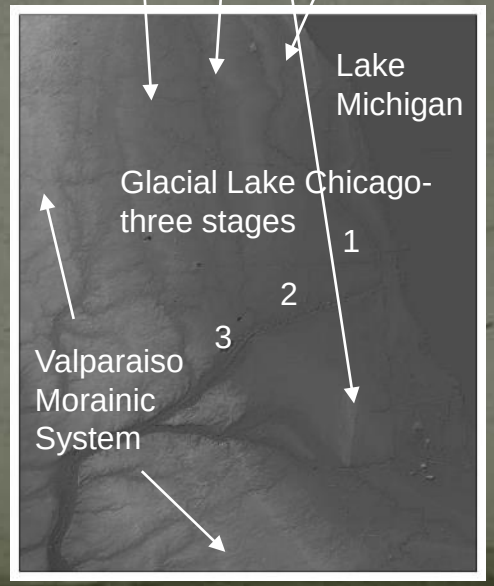


Pre-settlement data

Agriculture fields converted to residential neighborhoods



Surficial geology maps



Hillshade

Landforms

Standing in the glacial lake bottom (Ql) looking at the Park Ridge Moraine (Qbp)

Sears Tower…neat!

Standing on top of the Park Ridge Moraine (Qbp) looking down at the glacial lake bottom (Ql)

Landforms (cont)…

Construction of bleachers into a dune ridge (Qds)

A park in Chicago sitting on a beach ridge (Qb)

Legend Development

- Map unit composition developed through spatial analysis and field observations
- Considered the users and their wants/needs
- In highly urbanized areas parks at least 1 acre in size were investigated
- Age of neighborhood influenced degree of disturbance
- Misconception - everything is disturbed

Future Needs/Vision

- Improve public understanding of soils information to better manage natural resources
  - Stormwater management, recreation, habitat restoration
- NRCS forging new partnerships with local & state agencies, NGOs to address soil-related resource concerns in urban areas
  - Conservation technical assistance
  - Food deserts
- Increase the recognition by NRCS of soil survey opportunities/needs in urban and developing areas
- Exploring applications of the soils database
  - New interpretations for specific needs

Seizing this Opportunity

- Part of the Cook County and Chicago Initial Soil Survey crew (~300,000 acres)
- Planned and led the urban field review for state and regional office staff
- Contacts in the academic sector allow me to give regular soil presentations & more exposure to our agency
- Stayed proactive and sought out opportunities in urban soils
- When asked if I was interested in representing the NRCS I said “yes”. I wanted to show colleagues around the world our expertise

The Process…

- Complete an International Travel Request From (ITRF)
  - Traveler information
  - Explanation of the purpose for trip
  - Dates of travel
  - Estimated cost
  - Reviewed at NHQ; requires approval
- Diplomatic (Official) passport
  - Required; separate from personal
  - Gain clearance from the U.S. embassy
  - Fee is waived
  - This is sent back within 5 business days upon your return and valid for 5 years
- Post-trip Executive Summary
  - Highlights impact of the trip
  - Synopsis, professional connection, impact to you and agency, etc.
- International Programs Division (IPD)
  - Will send an informational packet
  - Can add you to a list for international travel if you wish
- Check state department website for travel and safety tips
- Opportunities for (optional) local tours/travel

- SUITMA Items
  - Enter an abstract to the congress
  - Registration forms
  - 15-20 minute oral and/or poster presentation

Experience/Contacts

- Cultural experiences
- New, international contacts with colleagues doing breakthrough soils research
  - Opportunities for more international work
  - Gives the SSD soil scientists exposure and shows our expertise
- Personal and Professional growth
- New contacts with the NRCS leadership
- Gain a new perspective and new appreciation for current and future work

HUMAN-ALTERED / HUMAN TRANSPORTED SOIL CRITERIA AND CLASSIFICATION.

RECENT UPDATES TO ANTHROPOGENIC SOIL CLASSIFICATION AS RECOGNIZED IN 12TH EDITIONS OF KEYS OF TAXONOMY (2014)

Slides prepared by:

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OVERVIEW

- 12th Edition of Keys to Soil Taxonomy released in 2014
- Major additions to the keys that define, provide criteria, and classify soils with human-altered/human-modified materials
  - Updates to Anthropic Epipedon definition and criteria
  - Human-altered materials & Human-modified materials definition, criteria
    - Anthropogenic landforms, artifacts, manufactured layers
  - Human-altered and Human-modified (HAHT) material class added to Family level
  - Impact of HAHT on control section depths

- United Stated Department of Agriculture – Natural Resources Conservation (NRCS) has recently published urban soil surveys or is actively mapping several major metropolitan areas throughout the United States.
  - New York City
  - Chicago
  - Detroit (on-going)
  - Los Angeles (on-going)
  - among others

- Past versions of Taxonomy did not include specific criteria to accommodate anthropogenic soils
  - Modified materials often fell into two common suborders (arents & orthents)
  - Created issues with diverse soils with common classification for lack of better options

ARTIFACTS

- Materials created, modified, or transported from their source by humans usually for a practical purpose in habitation, manufacturing, excavation, agriculture, or construction activities.
  - Bitumen (asphalt)
  - Brick,
  - Cardboard
  - Carpet
  - Cloth
  - Coal combustion by-products
  - Concrete
  - Glass
  - Metal
  - Paper
  - Plastic
  - Rubber
  - Wood products
  - Mechanically abraded rock fragments
  - Midden

Fine-loamy, pauciartifactic, mixed, superactive, calcareous, thermic, Typic Xerorthents

ANTHROPOGENIC LANDFORMS

- Discrete, artificial landforms that are mappable and identifiable at the Soil Survey mapping scale
  - Constructional Anthropogenic Landforms
    - Composed primarily of Human-transported materials
    - Elevated land by human-activity
  - Destructional Anthropogenic Landforms
    - Commonly associated with Human-altered materials; can also be Human-transported
    - Removal of surface material

CONSTRUCTIONAL LANDFORMS

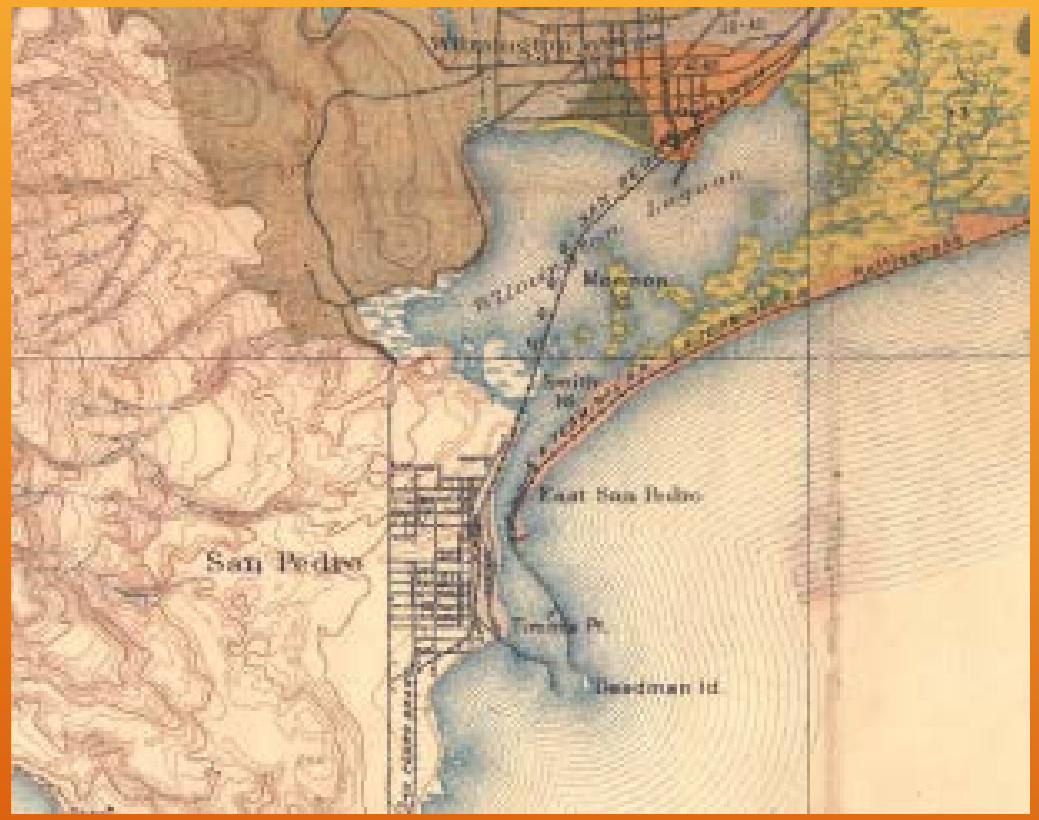
- Artificial Islands
- Artificial levees
- Burial mounds
- Dumps
- Dredge-deposit shoals
- Dredge spoil banks
- Filled Marshland
- Earthworks
- Fill
- Filled Pits
- Filled enclosures
- Irrigationally raised land
- Raised land
- Landfills
- Locally raised landforms
- Middens
- Mounds
- Railroad beds
- Reclaimed lands
- Rice paddies
- Road beds
- Sanitary Landfills
- Spoil banks
- Spoil Piles

Spoil bank adjacent to the interstate in Los Angeles, CA. (Riddle, 2013)

CONSTRUCTIONAL LANDFORMS CNT'D

Raised land, Filled areas. Port of Los Angeles/Long Beach Harbor, San Pedro & Long Beach, CA
Photo – USDA, 2015.

CONSTRUCTIONAL LANDFORMS CNT'D



Raised land, Filled areas. Port of Los Angeles/Long Beach Harbor, San Pedro & Long Beach, CA
Alkali Map, USDA 1903 (Left) & NAIP Imagery, USDA 2010 (Right).

DESTRUCTIONAL LANDFORMS

- Beveled cuts
- Borrow pits
- Canals
- Cuts
- Cutbanks
- Dredged channels
- Earthworks
- Floodways
- Gravel pits
- Leveled land
- Log landings
- Open Pit mines
- Quarries
- Rice Paddies
- Sand Pits
- Scalped area
- Sewage lagoons
- Surface mines

Area of leveled lad in Beverly Hills, CA. Natural areas have small undulations that have been smoothed with construction equipment. Photo: Riddle, USDA (2013)

DESTRUCTIONAL LANDFORMS CNT'D

Cutbank and scalped area on alluvial fan apron at Martingale Middle School in Northeast Los Angeles, CA. Photo – Randy l Riddle, USDA-NRCS, 2012.

ANTHROPOGENIC MICROFEATURES

New construction site installing hillslope terraces (cut & fil) in Rancho Palos Verdes, CA. Localized material with mixed abraded bedrock. Too small to delineate (Riddle, 2015)

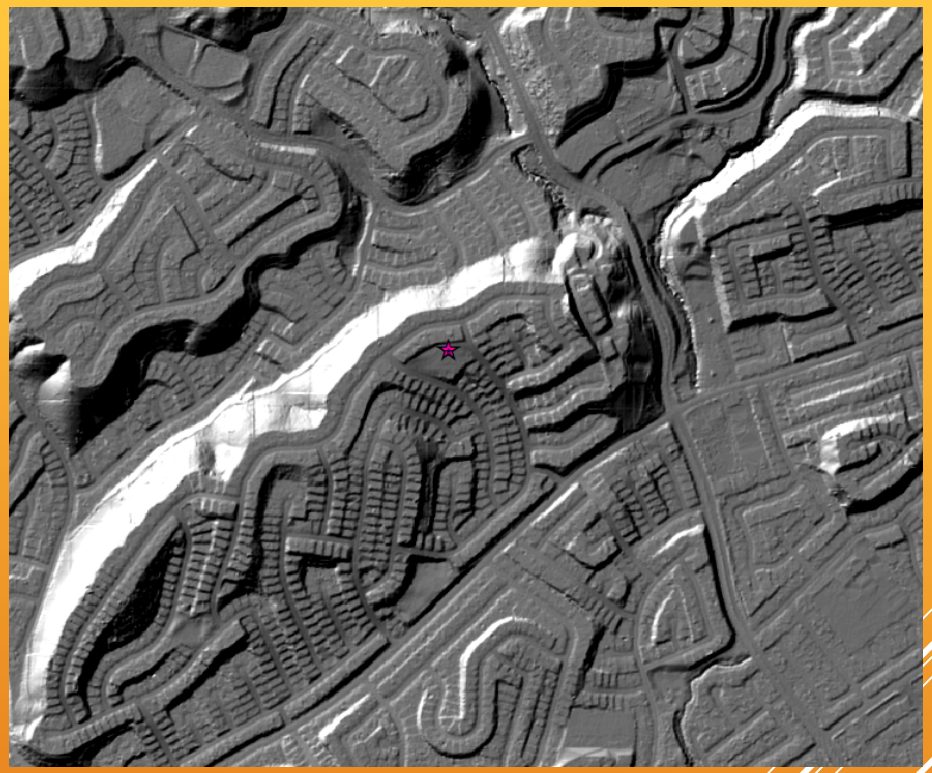
Constructional Microfeatures:

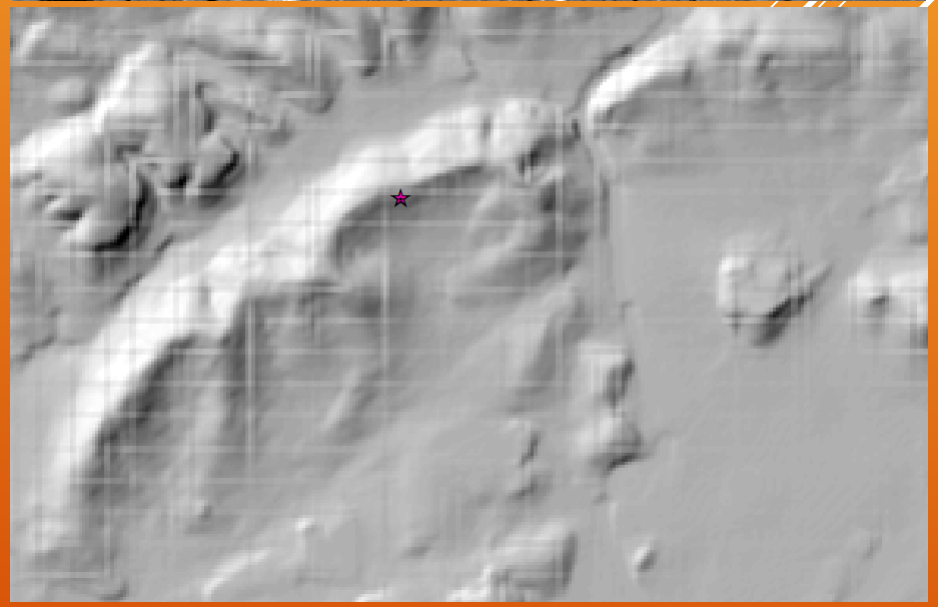
1. Breakwater
2. Burial Mounds
3. Conservation Terraces
4. Dikes
5. Double-bedding mounds
6. Dumps
7. Embankments
8. Fills
9. Hillslope terraces
10. Interfurrows
11. Middens
12. Rivetments
13. Rice paddies
14. Spoil Banks
15. Spoil Piles

Destructional Microfeatures

1. Cutbanks
2. Ditches
3. Furrows
4. Hillslope terraces
5. Impact craters
6. Skid trails
7. Scalped areas

CONSTRUCTIONAL AND/OR DESTRUCTIONAL MICROFEATURES





Above: 2011 USDA-NRCS – A hillslope terrace (constructional and destructional landform) on low lying hills in Walnut, CA.
Top Right: 3mDEM Hillshade displaying extent of hillslope terraces
Bottom Right: 10mDEM hillshade of natural hill shape prior to development

ANTHROPIC EPIPEDON UPDATES

- Definition updated to include soils with human-altered or human-transported materials found on an anthropogenic landform or microfeature.
  - Surface material that shows evidence of purposeful alteration of soil properties by human activity.
  - Extends down to the bottom of the horizon that meets criteria
  - Human-altered or Human-altered materials that are greater than 25cm thick or entirely thickness of the surface if overlying a root-limiting layer
    - Contains one of the following:
      - Artifacts
      - Midden material
      - Anthraquic condition

      OR
      - Directly overlying mine or dredge spoil which has rock structure, root-limiting layer, or non human-altered or hum-transported material (natural material)

HUMAN-ALTERED MATERIALS

- Occurs in soils with deep tilling (>50cm), ponding for agricultural purposes or occurs on a DESTRUCTIONAL anthropogenic landform
- Does not meet criteria for Human-transported materials
- Is purposefully altered by:
  - Contains 3% or more re-oriented remnant pieces of diagnostic horizons
  - 50% or more divergent shaped structure
  - Material overlying internments (human remains)
  - Mechanically abraded rock fragments
  - Indication of past excavation equipment usage
  - Abrupt boundary at edge of excavated material
  - Anthraquic conditions (saturation caused by agricultural practices)
  - Densic contract or 50% or more platy structure from human-induced mechanical compaction

HUMAN-TRANSPORTED MATERIALS

- Material that has been transported from an outside the local area
- Occurs on a CONTRUCTIONAL anthropogenic landform or microfeature or within an excavated DESTRUCTIONAL landform
- Purposeful transportation of soil from outside area of the pedon.

HUMAN-TRANSPORTED MATERIALS CNT'D

- Must contain 1 of the following:
  - Layer 7.5 cm or more thick of transported material that overlies material originating locally from the natural pedon
  - Presence of artifacts
  - Presence of mechanically detached remnant of diagnostic horizons
  - Mechanically abraded rock fragments
  - Fractured rock or pararock fragments with splinters and sharp edges that do not originate from local pedon

Montebello Series: Human-altered materials (leveled land)

Fine-loamy, araric, mixed, superactive, nonacid, thermic, Anthraltic Xerorthents

Counterfeit Soils: Human-transported materials (hillslope terrace)

Fine, spolic, smectitic, calcareous, thermic, Typic Xerorthents

NEW SUBGROUPS ADJECTIVES (EXTRAGRADES)

- Anthraquic – soils with anthraquic conditions
- Anthrodensic – soils with densic contact due to mechanical compaction
- Anthropic – soils with anthropic epipedon
- Plaggic – soils with plaggen epipedon
- Haploplaggic – surface 25 to <50cm thick of material meeting plaggen epipedon requirement
- Anthroportic – 50cm or more of human-transported materials
- Anthraltic – 50cm or more of human-altered materials

NEW HAHT FAMILY CLASS

- Particle-size classes and their substitutes
- **Human-altered and human-transported material classes**
- Mineralogy classes
- Cation-exchange activity classes
- Calcareous and reaction classes
- Soil temperature classes
- Soil depth classes
- Rupture-resistance classes
- Classes of coatings on sands
- Classes of permanent cracks

HAHT FAMILY CLASSES

- Methanogenic
- Asphaltic
- Concretic
- Gypsifactic
- Combustic
- Ashifactic
- Pyrocarbonic
- Artifactic
- Ashifactic
- Pauciartifactic
- Dredgic
- Spolic
- Araric

GENERAL RULES FOR CLASSIFYING HAHT

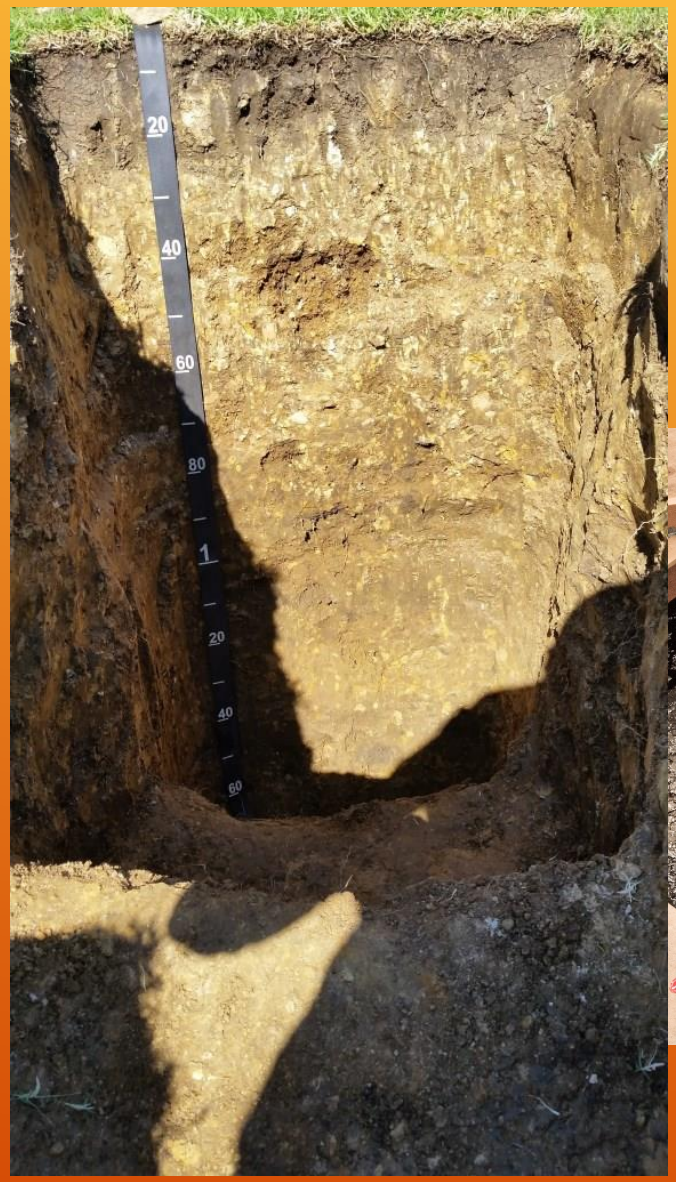
- Generally, there is a 50cm (20 inch) threshold
  - HAHT materials are < 50cm thick
    - Classify the genetic horizons below the HAHT
    - Disregard HAHT
  - HAHT materials are > 50cm thick
    - Classify only HAHT material
    - Restrict control sections to the base of the HAHT
      - E.g. particle-size & mineralogy control sections.
    - Disregard genetic horizons below HAHT

OVERVIEW

- Updates to the Anthropic Epipedon criteria
- Human-altered and Human-transported materials criteria defined
- Criteria that defines “Artifacts”
- New suite of anthropogenic subgroup adjective
- New family class for Human-altered and Human-transported materials class
- Affects of HAHT on control sections

HOW DID I GET THIS OPPORTUNITY?

- Project Leader for the Soil Survey of Los Angeles County, Southeastern Part. (681,000 acre predominantly urban SSA)
- Planned and led an “Urban Soils Tour” for the 2014 SSSA Conference in Long Beach, CA
- Made some great contacts in the urban soils academic community at the SSSA meeting, NRCS leadership, and SUITMA members.
- Stayed proactive and expressed interest in contributing in SUITMA 8 through the Region 2 Director & National Leadership.
- When asked if I was interested in representing the agency, I said yes, I believe I have something to offer from my urban mapping experience.

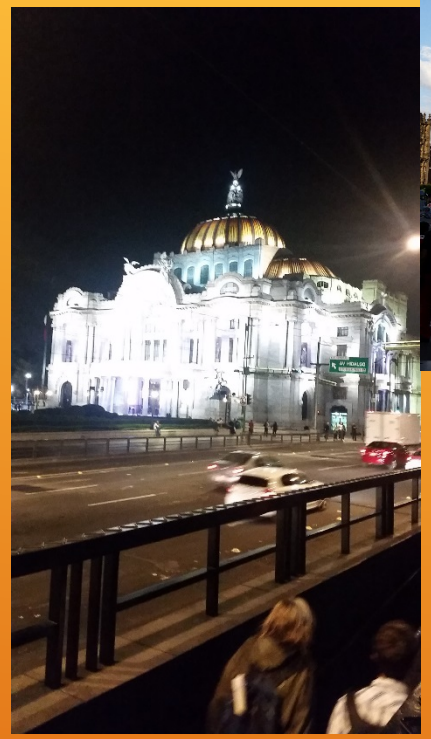


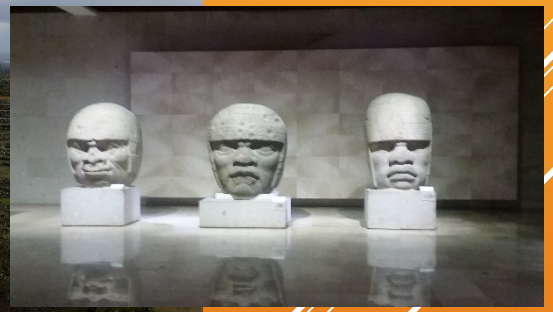
WHAT YOU CAN EXPECT

- Fill out an International Travel Request Form (ITRF) which is reviewed at NHQ
  - Traveler Information
  - Explanation of the purpose for the trip
  - Travel Dates
  - Estimated Costs
- Apply for an OFFICIAL Passport (separate from your personal)
- Post-trip Executive Summary which highlights the impact of the trip.
  - Synopsis of trip, professional connection, impact, etc.

- SUITMA Items
  - Enter Abstract for conference presentation
  - Registration Forms
  - 15-20 Minute oral presentation

Trip Photos





Thank you for your attention…