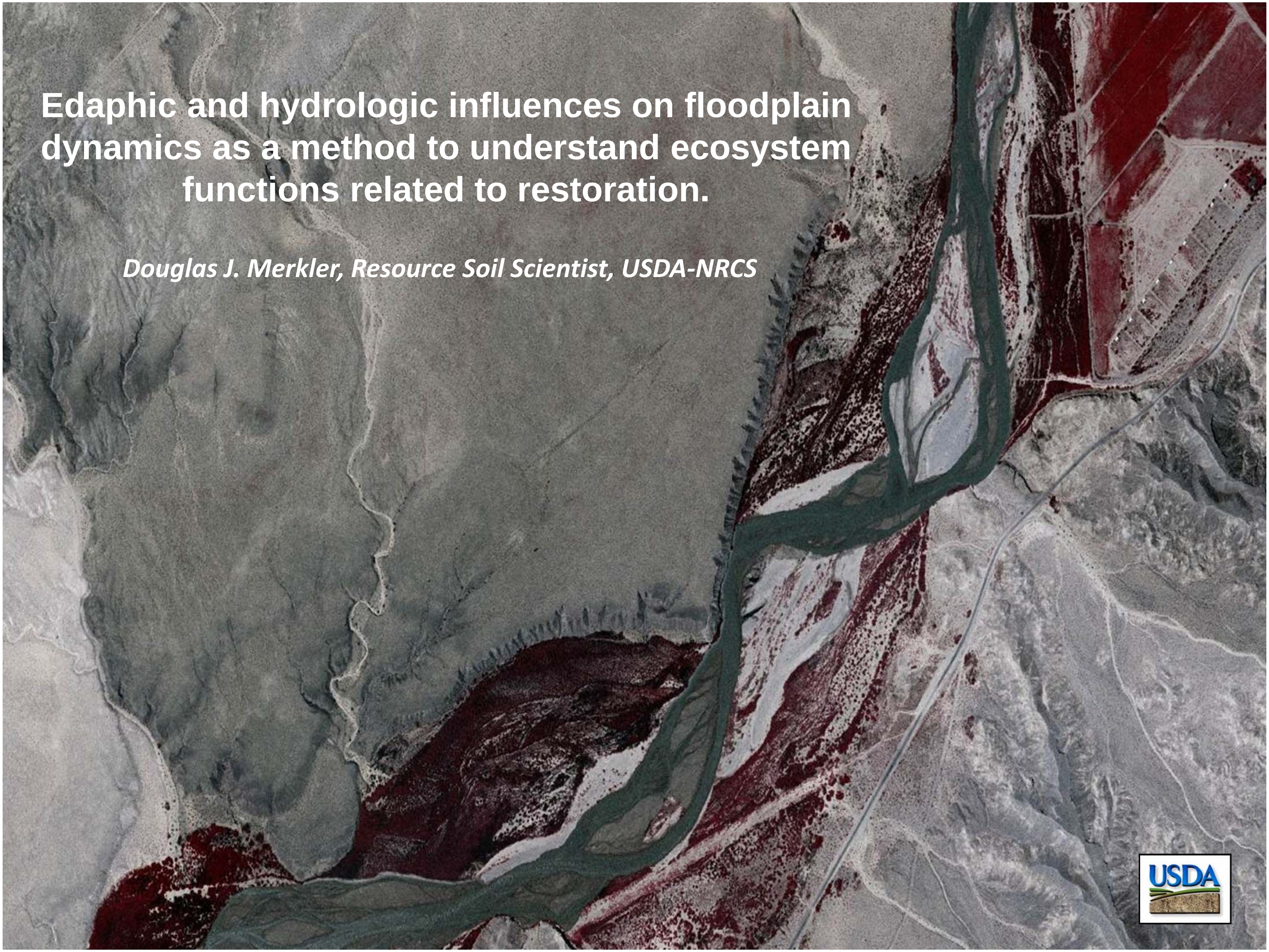
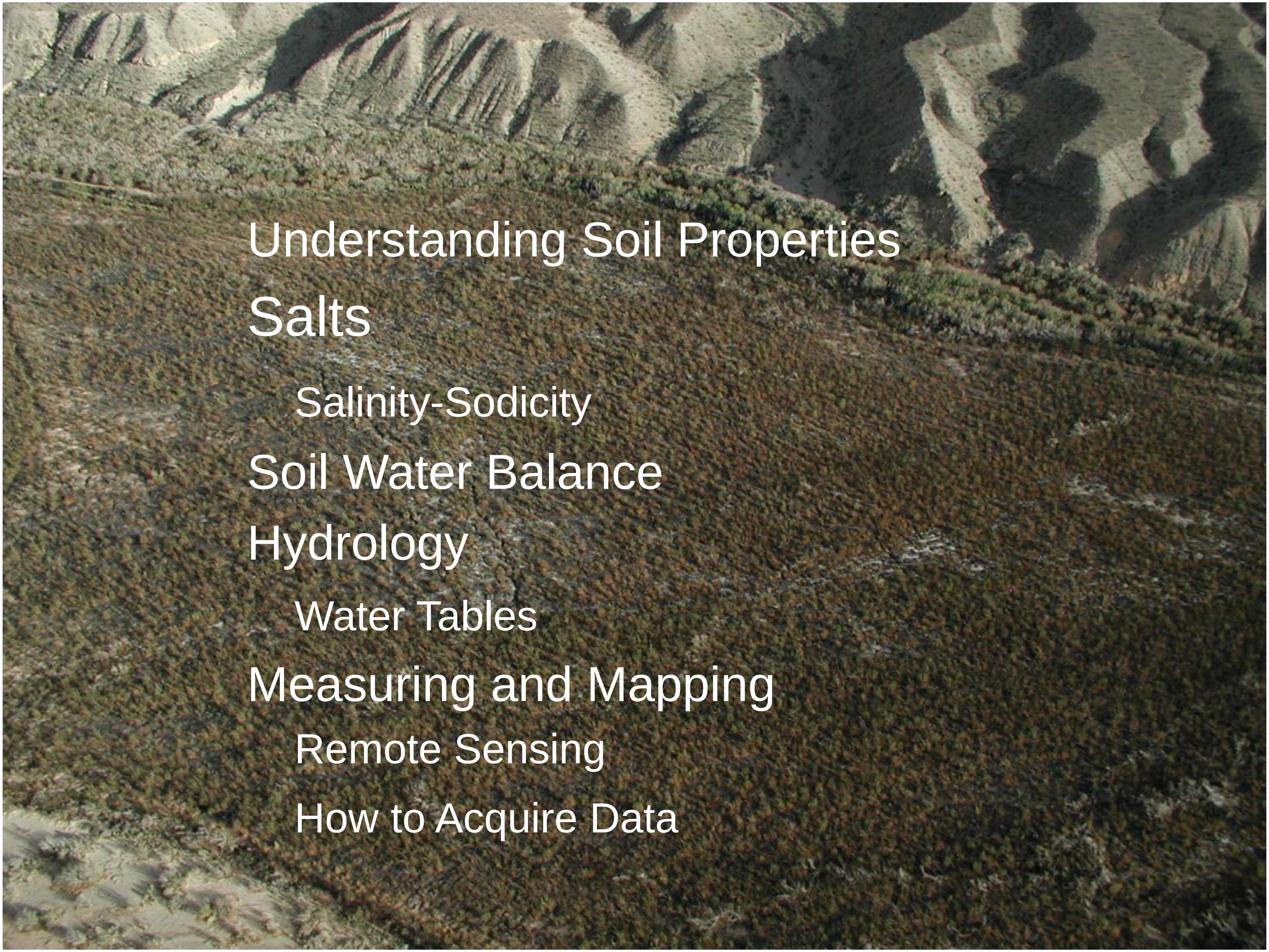
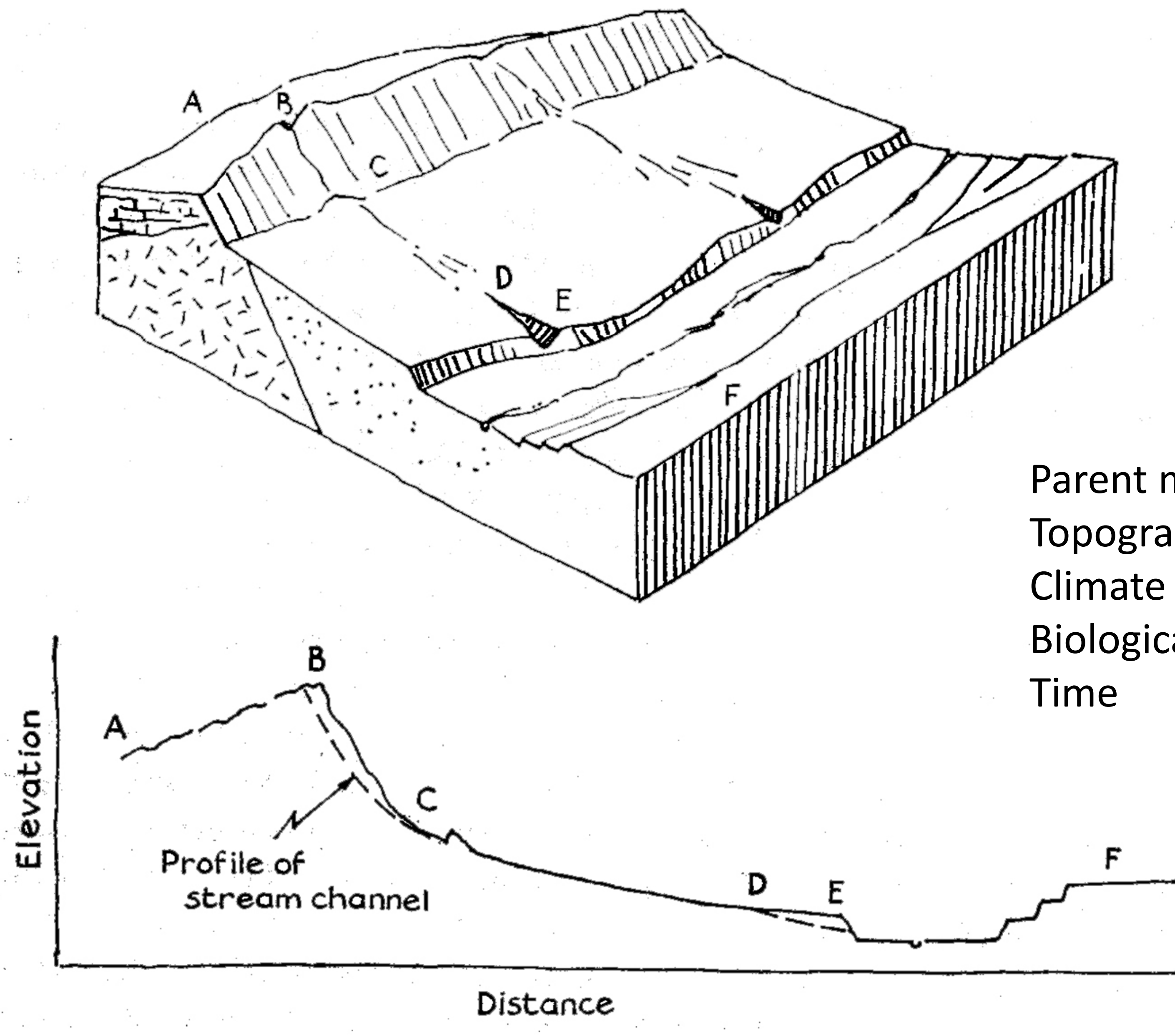


Edaphic and hydrologic influences on floodplain dynamics as a method to understand ecosystem functions related to restoration.

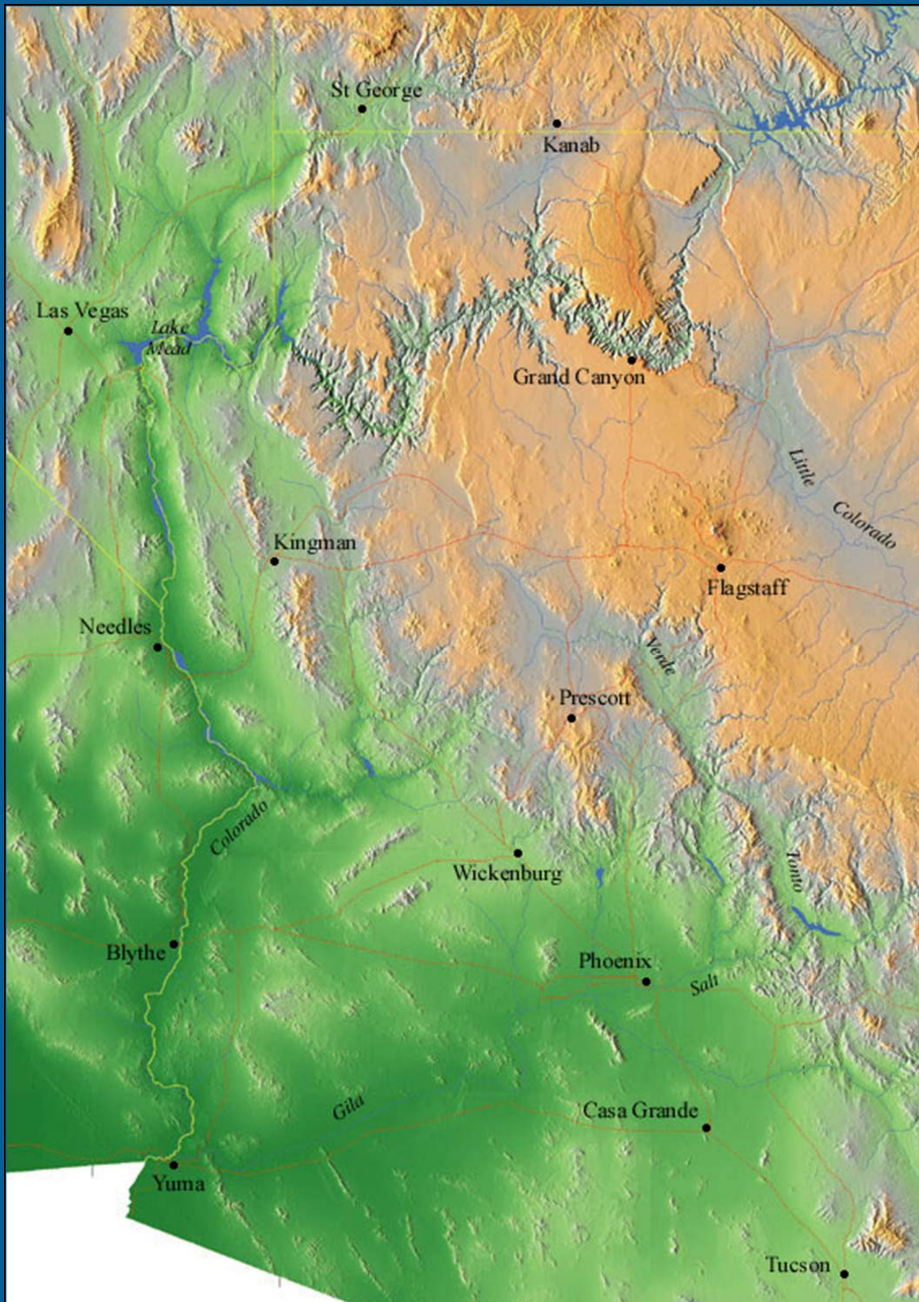
Douglas J. Merkler, Resource Soil Scientist, USDA-NRCS


Understanding Soil Properties
Salts
Salinity-Sodicity
Soil Water Balance
Hydrology
Water Tables
Measuring and Mapping
Remote Sensing
How to Acquire Data



Parent material
Topography
Climate
Biological
Time

Merkler 2012



Lake Bidahochi fills as upper Colorado Drainage extends to south (~6-7 Ma)

Lake overtops 'Coconino' divide and spills down proto-Grand Canyon

Sequential filling of lakes in Western Lake Mead Area (6-5.6 Ma)

Lake overtops 'Black Canyon' divide and spills into Cottonwood Basin (6-5.6 Ma)

Lake overtops 'Pyramid' divide and fills Mohave and Cottonwood Valleys (~5.6 Ma)

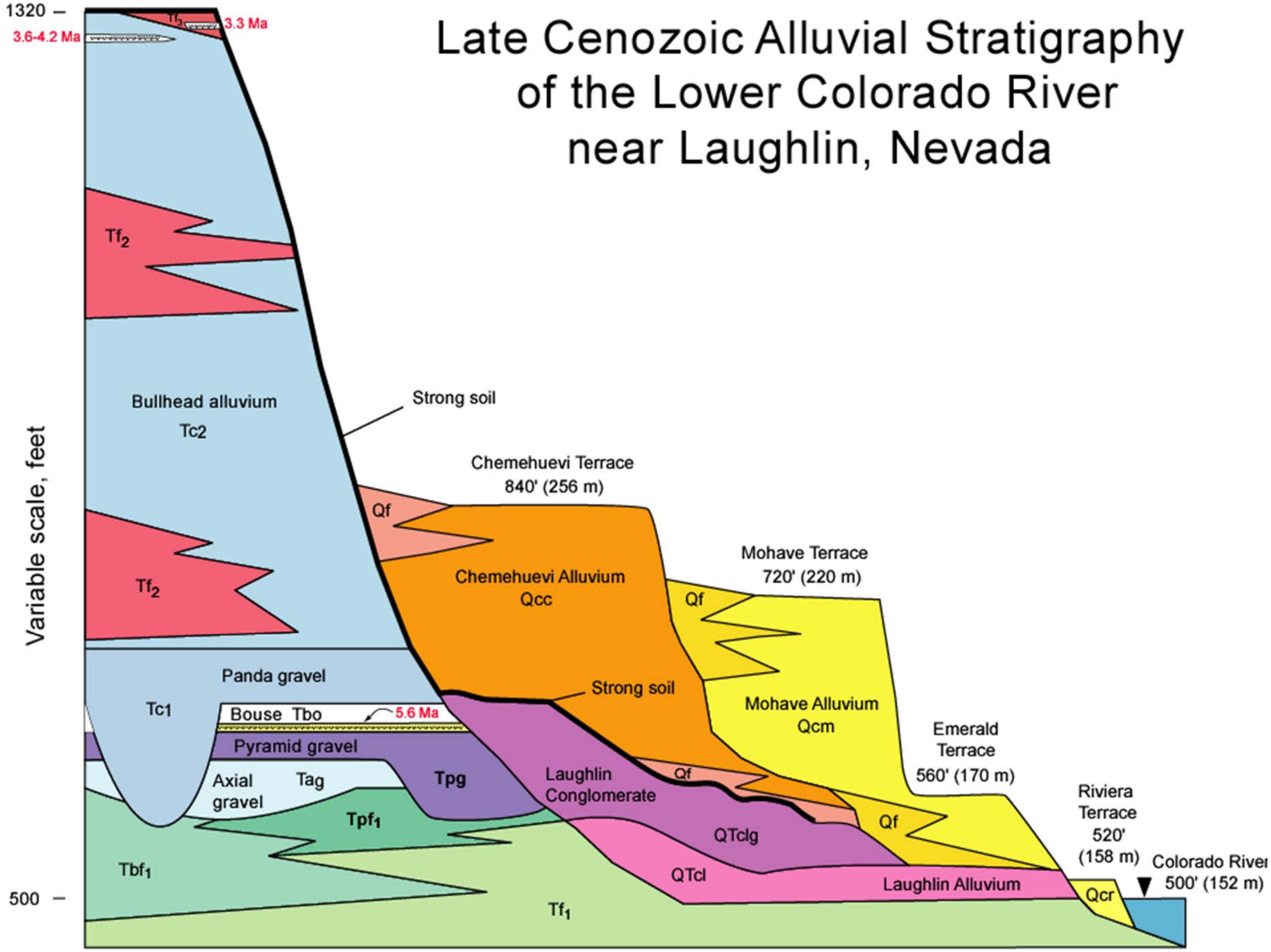
Lake overtops 'Topock' divide and fills Chemehuevi Valley

Lake overtops 'Buckskin' divide and fills Parker-Cibola Valley

Lake overtops 'Chocolate' divide and LCR reaches developing Gulf of California

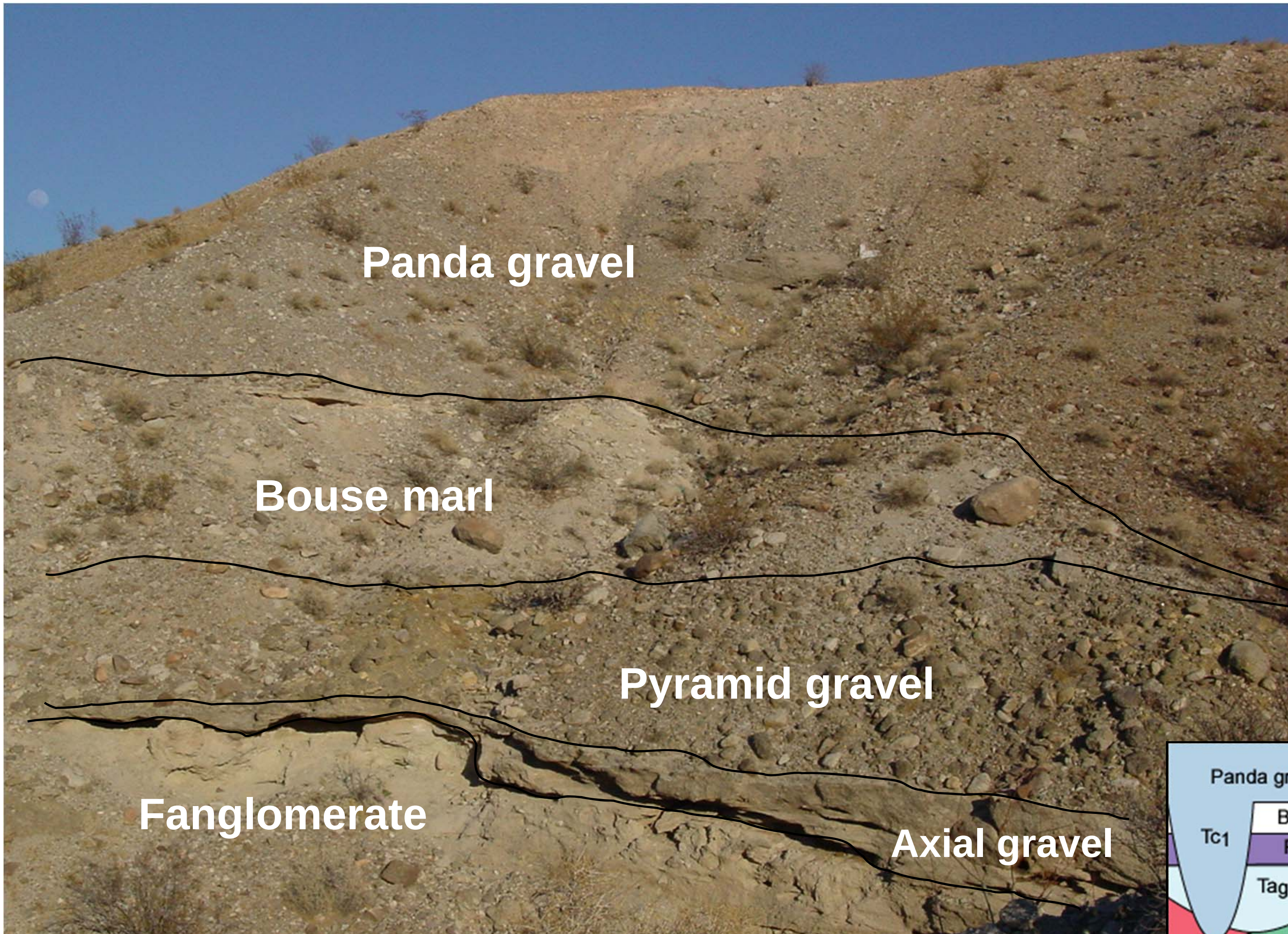
Kyle House, 2002

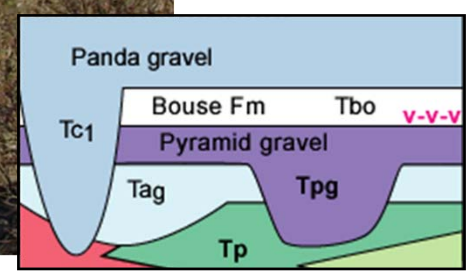
Late Cenozoic Alluvial Stratigraphy of the Lower Colorado River near Laughlin, Nevada



Kyle House, 2002

Late Tertiary Transitional Stratigraphy—The Laughlin Bluffs



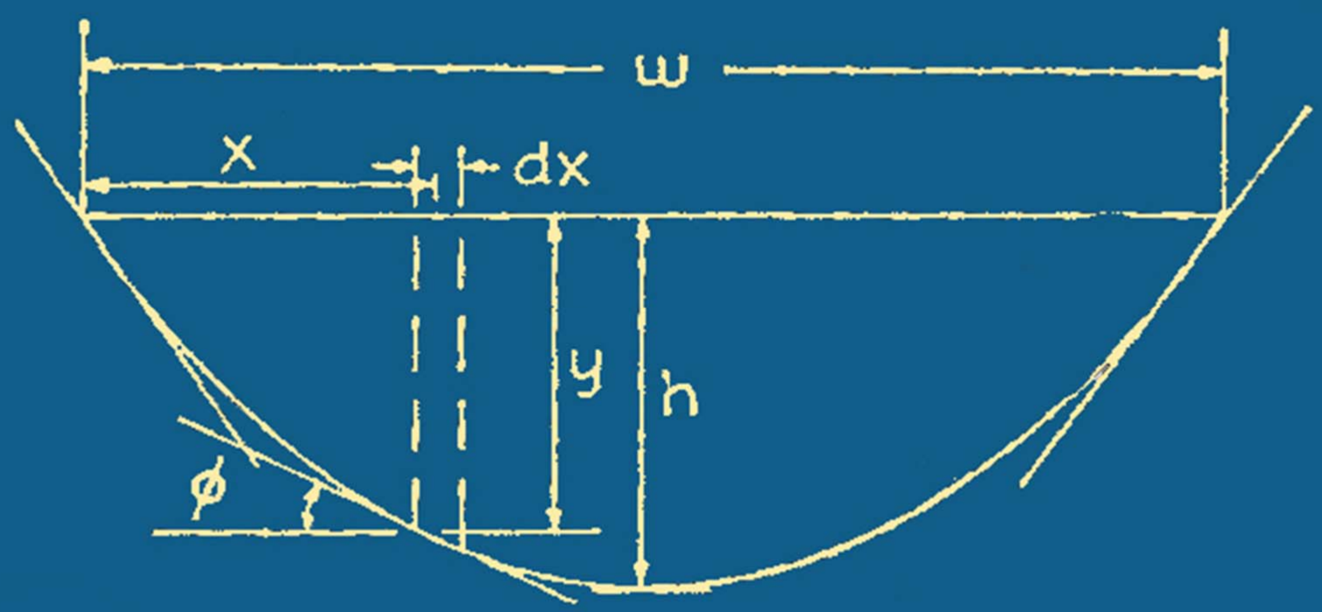


Base of axial gravel at 600’; Modern river at 500’

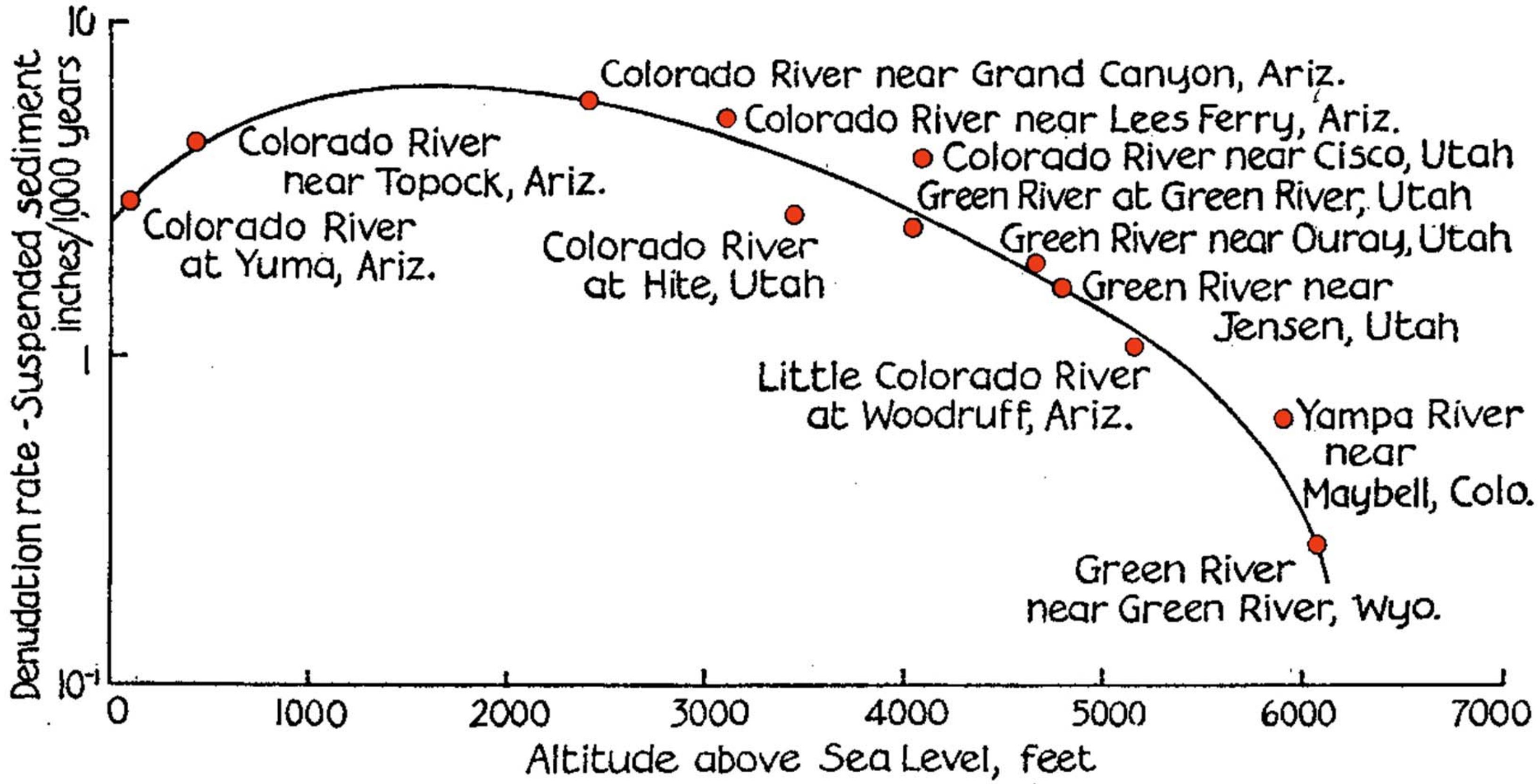
Kyle House, 2002

"Rain added to a river that is rank
Perforce will force it overflow its bank"

SHAKESPEARE
Venus and Adonis

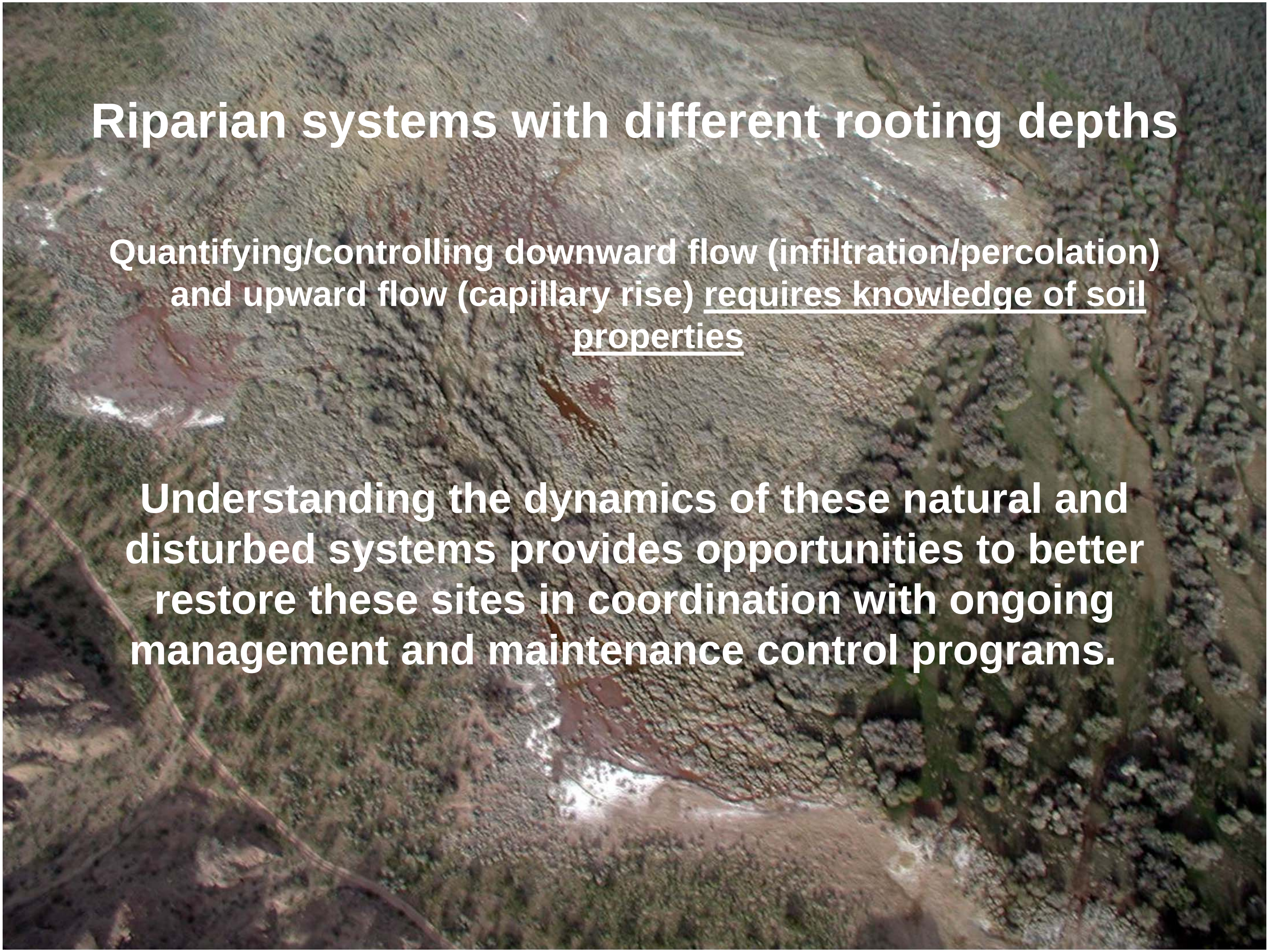


phology


10
1
10⁻¹
Denudation rate - Suspended sediment inches/1000 years
0
1000
2000
3000
4000
5000
6000
7000
Altitude above Sea Level, feet
Colorado River near Grand Canyon, Ariz.
Colorado River near Lees Ferry, Ariz.
Colorado River near Cisco, Utah
Green River at Green River, Utah
Green River near Ouray, Utah
Green River near Jensen, Utah
Colorado River near Topock, Ariz.
Colorado River at Yuma, Ariz.
Colorado River at Hite, Utah
Little Colorado River at Woodruff, Ariz.
Yampa River near Maybell, Colo.
Green River near Green River, Wyo.

Microtopography, hydrology, soil texture, salt content and chemical redox state are interrelated in floodplains.

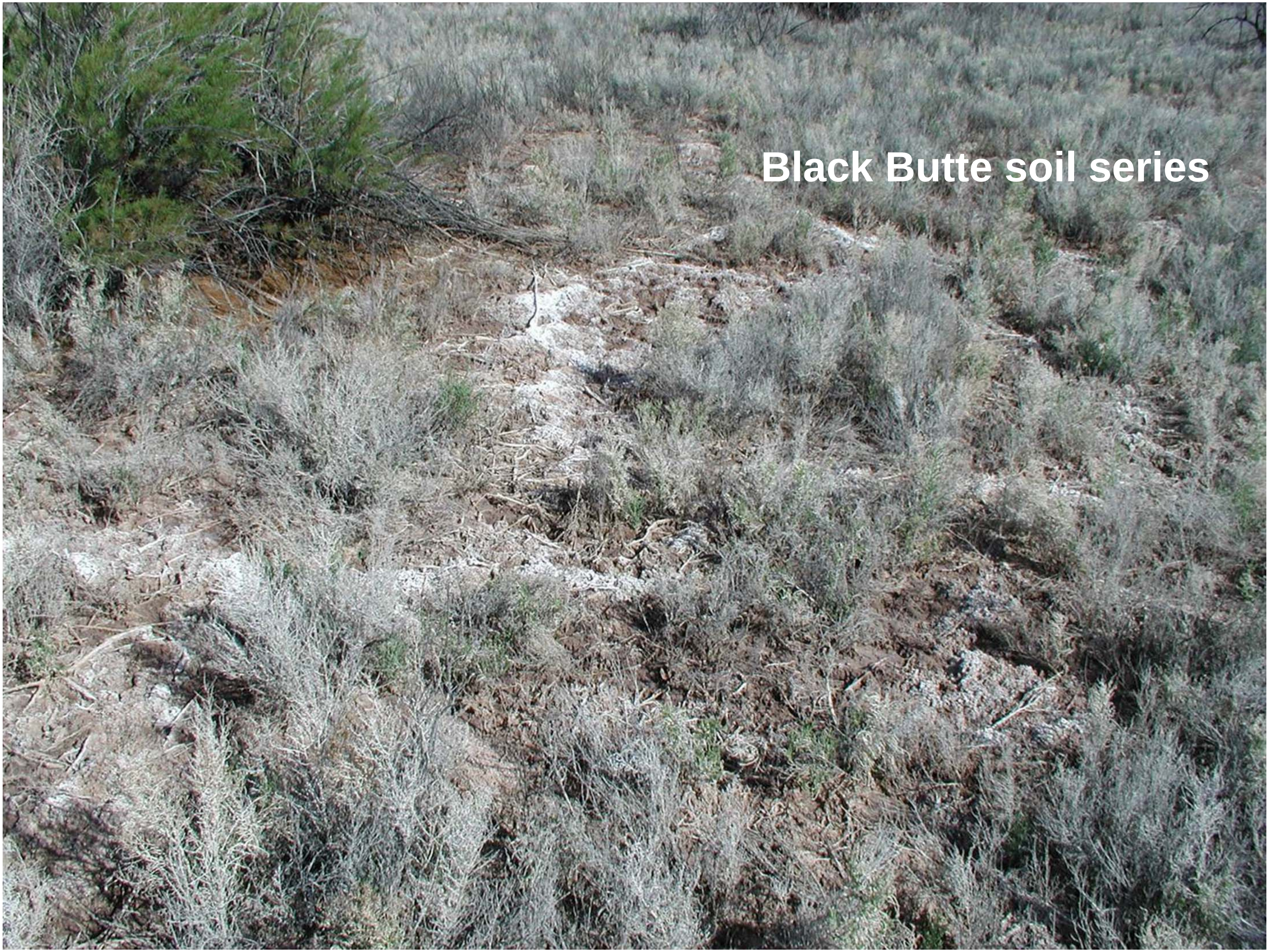
These edaphic properties result in a pattern of mutually dependent plant and microbial communities on geomorphic landscapes which relate to the function of the floodplain ecosystems.

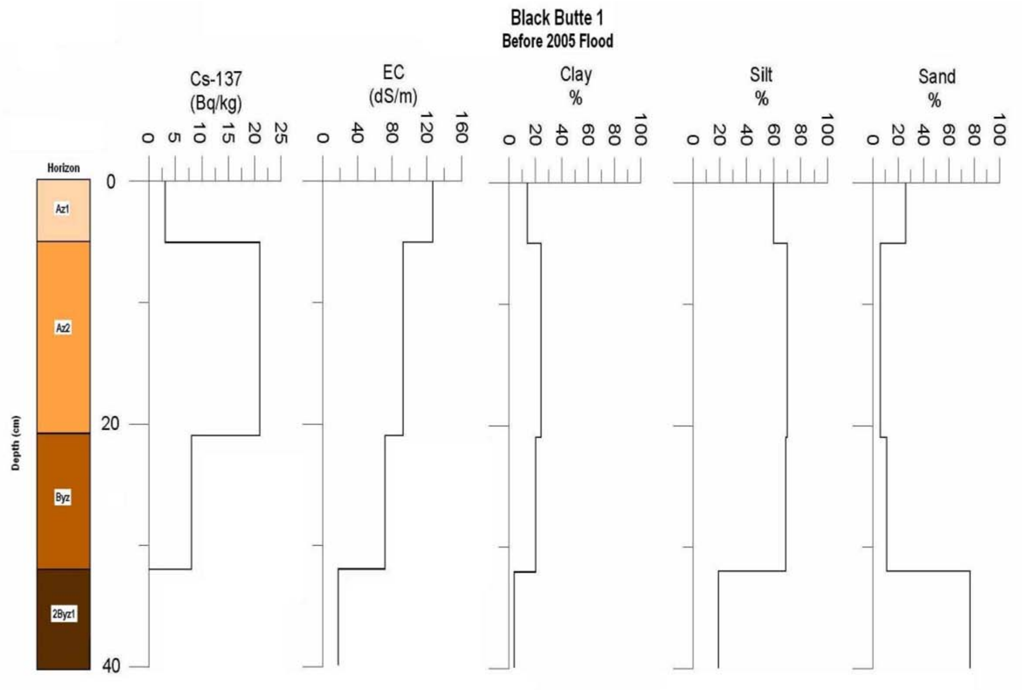


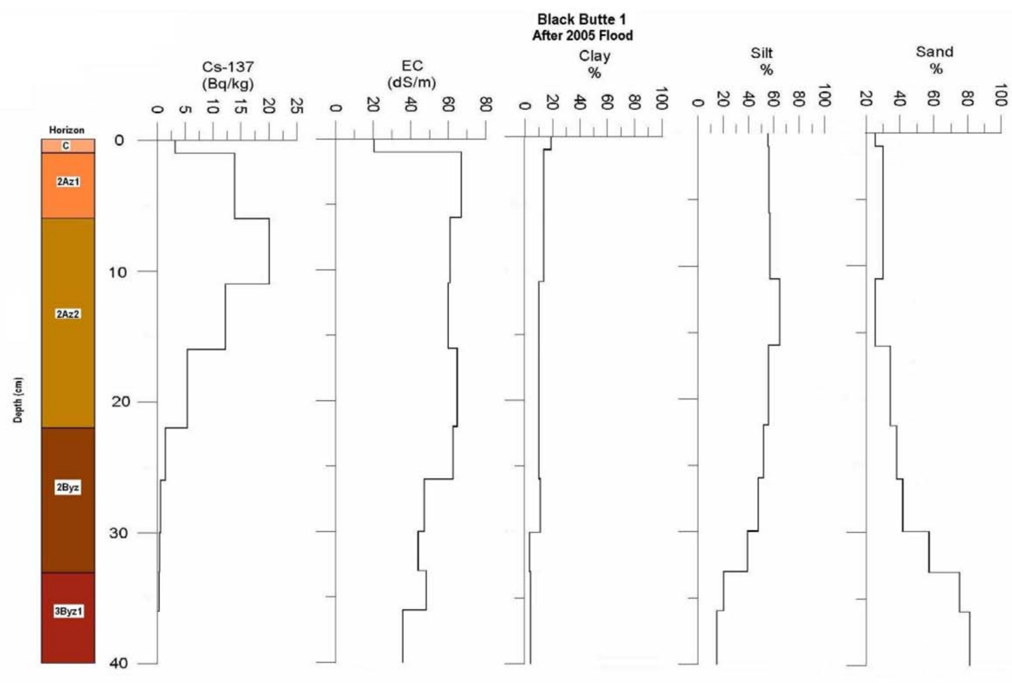
Riparian systems with different rooting depths

Quantifying/controlling downward flow (infiltration/percolation) and upward flow (capillary rise) <u>requires knowledge of soil properties</u>

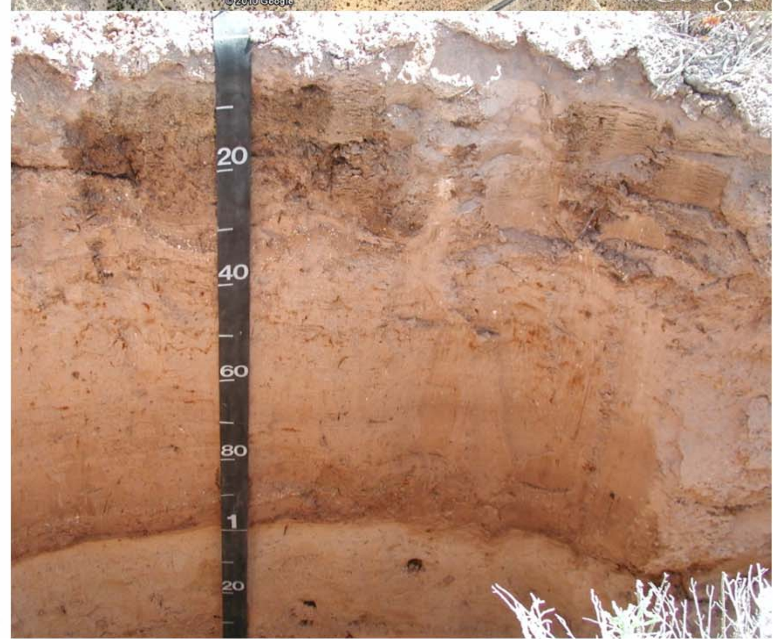
Understanding the dynamics of these natural and disturbed systems provides opportunities to better restore these sites in coordination with ongoing management and maintenance control programs.

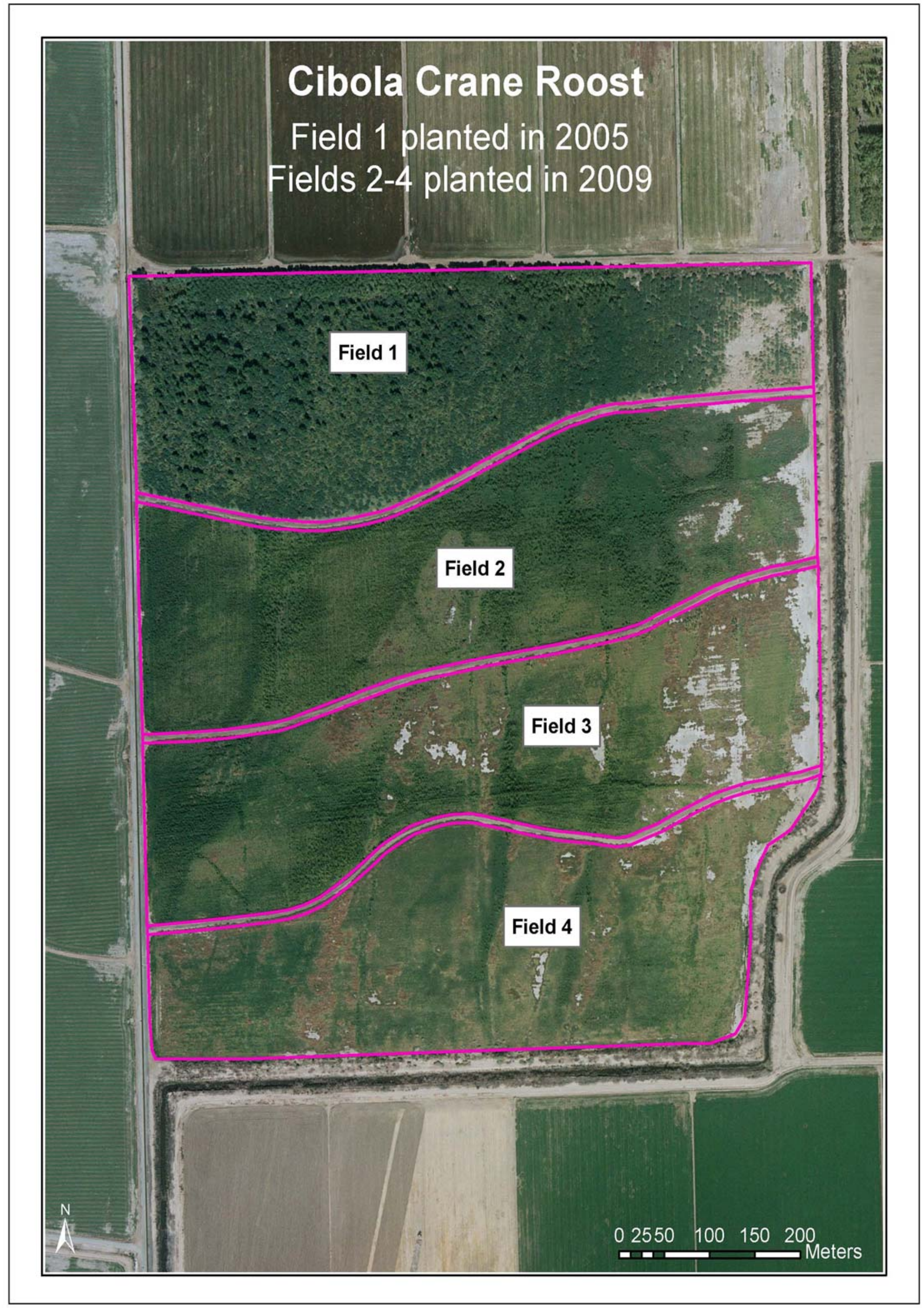

Black Butte soil series

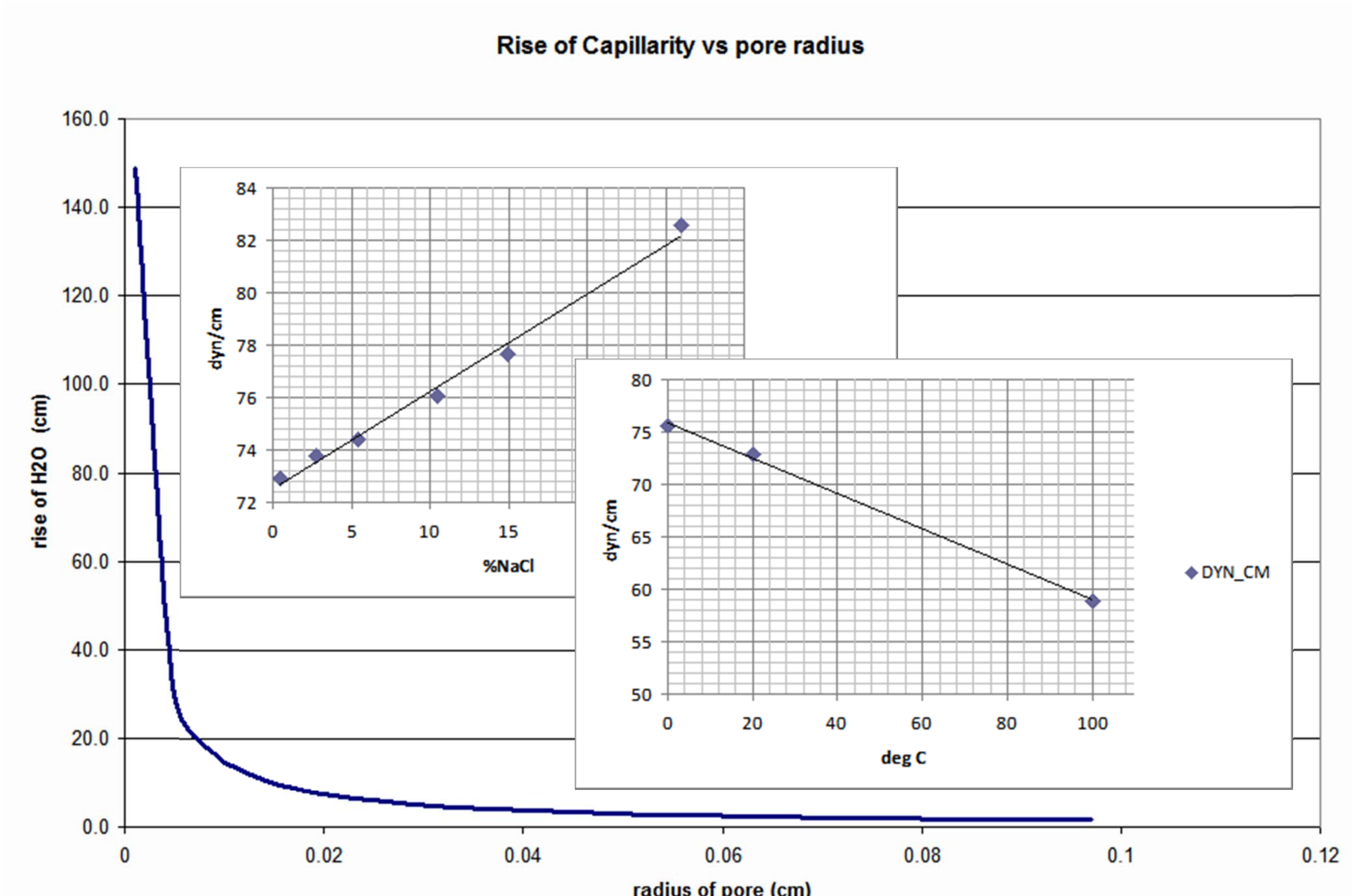

Black Butte 1
Before 2005 Flood
Cs-137
(Bq/kg)
EC
(dS/m)
Clay
%
Silt
%
Sand
%
Horizon
Az1
Az2
Byz
2Byz1
Depth (cm)
0
20
40


Black Butte 1
After 2005 Flood
Cs-137
(Bq/kg)
EC
(dS/m)
Clay
%
Silt
%
Sand
%
Horizon
C
2Az1
2Az2
2Byz
3Byz1
Depth (cm)
0
10
20
30
40


Black Butte soil series
Google

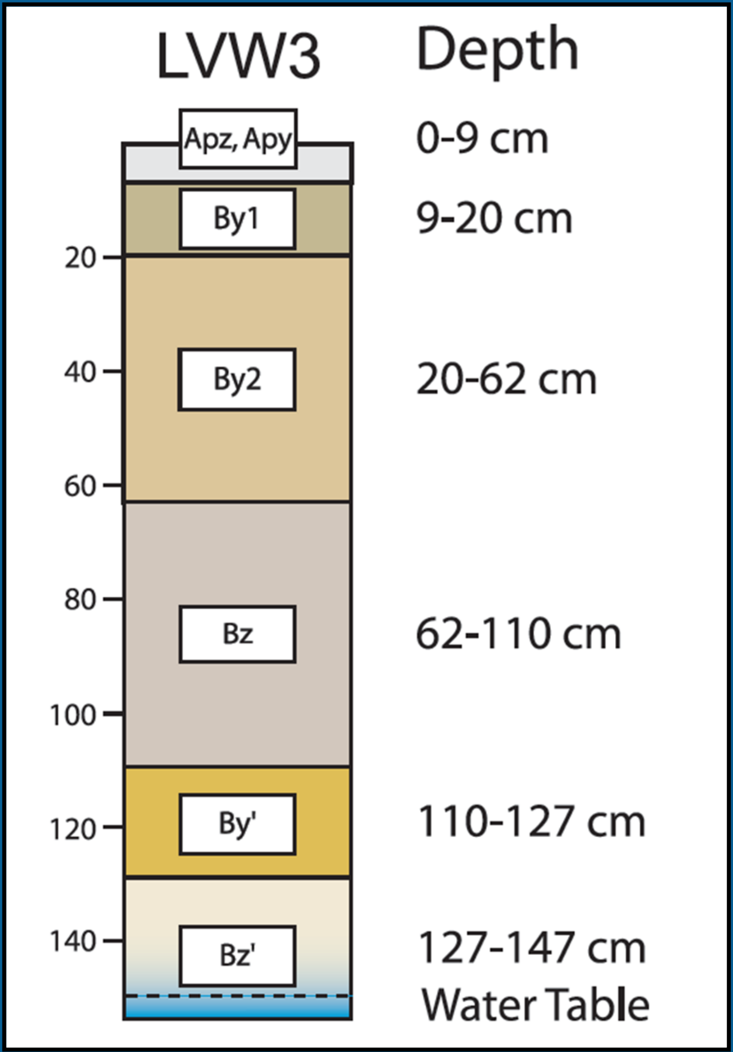



Cibola Crane Roost
Field 1 planted in 2005
Fields 2-4 planted in 2009
Field 1
Field 2
Field 3
Field 4
N
0 25 50 100 150 200
Meters



height in cm = 2y / rdg

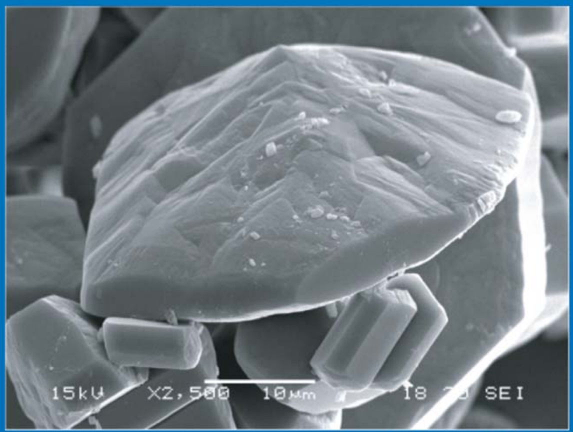
Duck Creek, Las Vegas Wash



Buck et al., 2006, SSSAJ

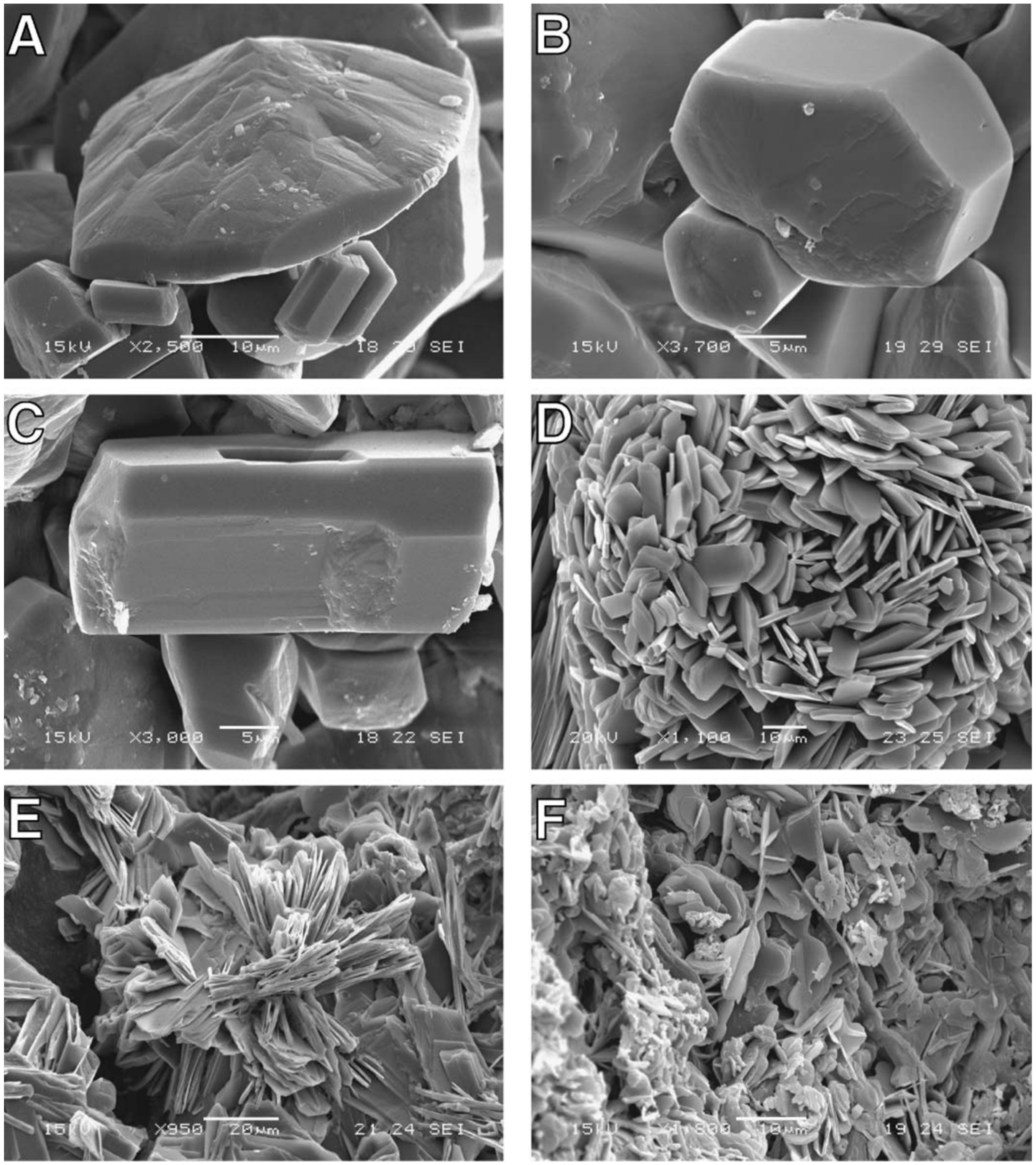
Na+…

Halite NaCl



Gypsum $CaSO_4 \cdot 2H_2O$

SEM images from Las Vegas Wash



(A) lenticular gypsum from By2 horizon (61–98 cm)

(B) tabular pseudo-hexagonal gypsum By3 horizon (98–140 cm)

(C) lath gypsum from By2 horizon (61–98 cm)

(D) euhedral, tabular pseudo-hexagonal bloedite from surface salt crust (0–1 cm)

(E) euhedral bladed bloedite from Azn horizon (0–2 cm)

(F) twinned bladed bloedite from Azn horizon (0–2 cm)

Salt Mineralogy of Las Vegas Wash, Nevada: Morphology and Subsurface Evaporation

Brenda J. Buck, Katherine Wolff, Douglas J. Merkler, and Nancy J. McMillan*

Published in Soil Sci. Soc. Am. J. 70:1639–1651 (2006).
Soil Mineralogy and Urban Soils
doi:10.2136/sssaj2005.0276

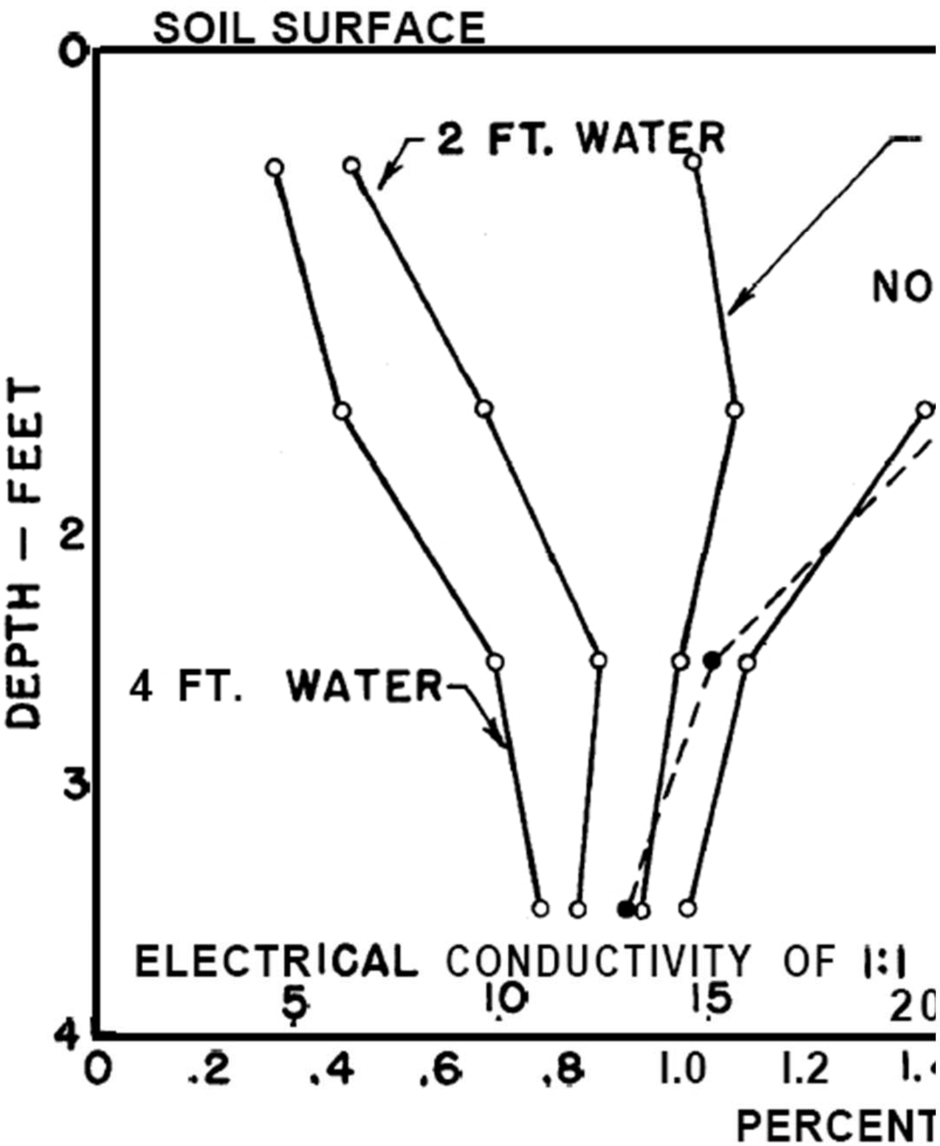


Table 7. LVW2 crystal habits.

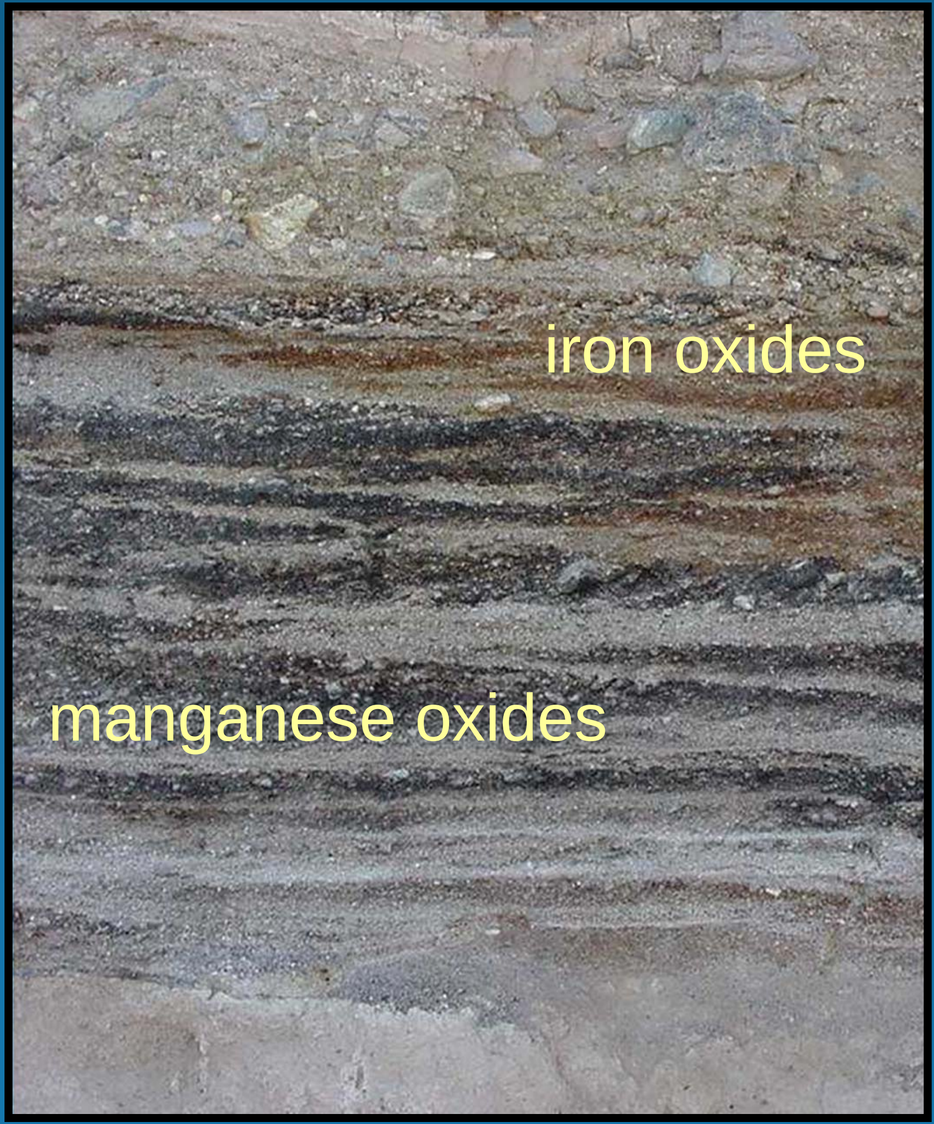
Horizon	Mineral	Crystal habit	Percent†
Azn 0–1 cm	bloedite	anhedral massive	100
	eugsterite	tabular rhomboidal	19
	hexahydrite	bladed	15
	halite	anhedral massive	13
	gypsum	columnar	7
	thenardite	hollow triangle	6
	kainite	foliated	3
		lath	3
		tabular hexagonal	2
		acicular	100
		tabular pseudo-hexagonal	33
		anhedral massive	67
		anhedral massive	100
		tabular pseudo-hexagonal	100
		anhedral massive	100
		tabular pseudo-hexagonal	32
Ayzn 1–9 cm	gypsum	tabular pseudo-hexagonal	57
		tablular hexagonal	29
		lenticular	14
Byzn1 9–20 cm	gypsum	tablular hexagonal	50
		tabular pseudo-hexagonal	25
		lenticular	25
Byzn2 20–62 cm	gypsum	lenticular	50
		lath	38
		tabular pseudo-hexagonal	12
2Byzn3 62–110 cm	halite	anhedral massive	73
	hexahydrite	hopper	23
	bloedite	cubic	4
	gypsum	anhedral massive	91
		tabular pseudo-hexagonal	9
		tabular pseudo-hexagonal	86
		bladed	14
		tabular pseudo-hexagonal	100
2Byzn4 110–127 cm	gypsum	lenticular	60
		lath	28
		tabular pseudo-hexagonal	12
2Byzn5 127–150 cm	hexahydrite	anhedral massive	92
	bloedite	tabular pseudo-hexagonal	8
	halite	tabular pseudo-hexagonal	50
	gypsum	bladed	33
		lenticular	17
		anhedral massive	100
		tabular pseudo-hexagonal	100

† Percentage determined by frequency of occurrence within the total SEM images analyzed.

Interesting issues with hydric soils in hypersaline environments.

Classical indicators (iron oxides and manganese oxides - mottles) will not form in soils with pH's higher than 9.

Will affect formal wetland determinations.



Interesting issues with hydric soils in hypersaline environments.

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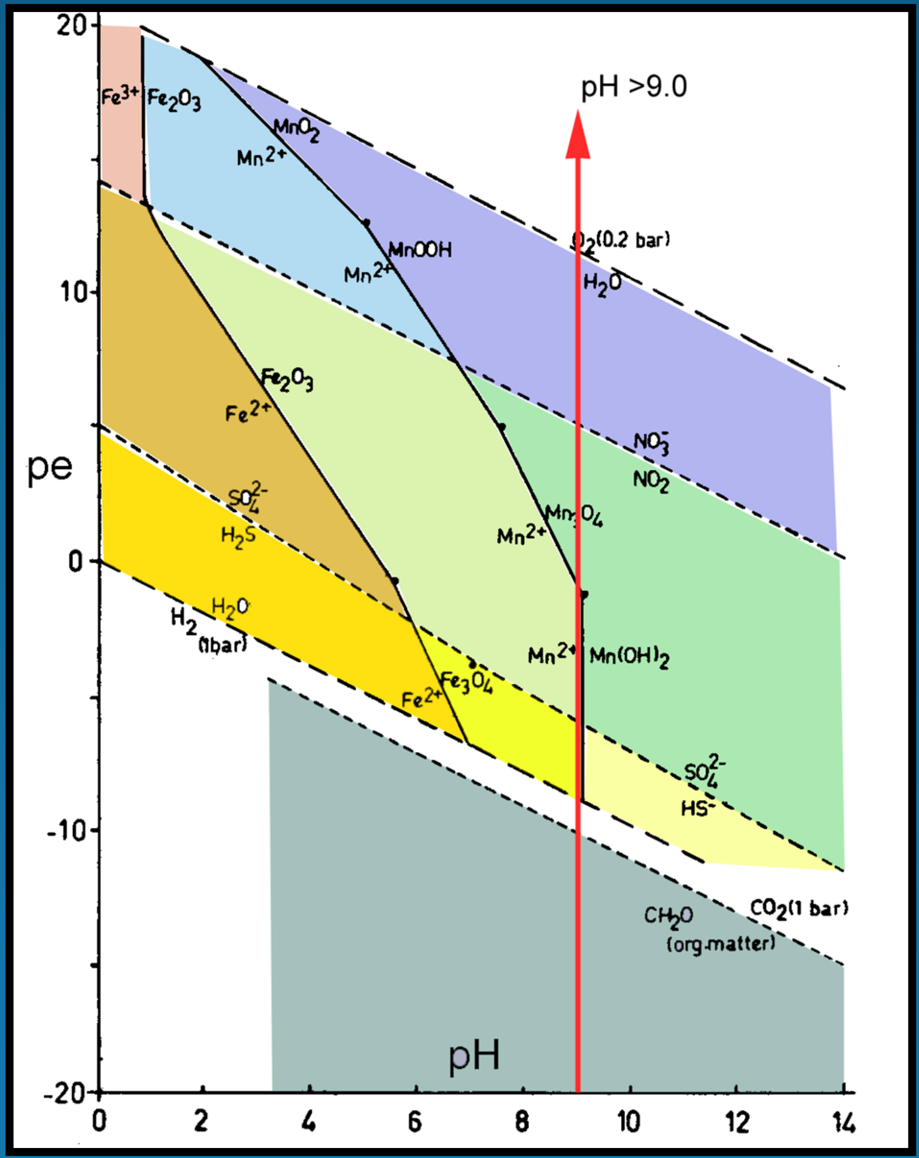
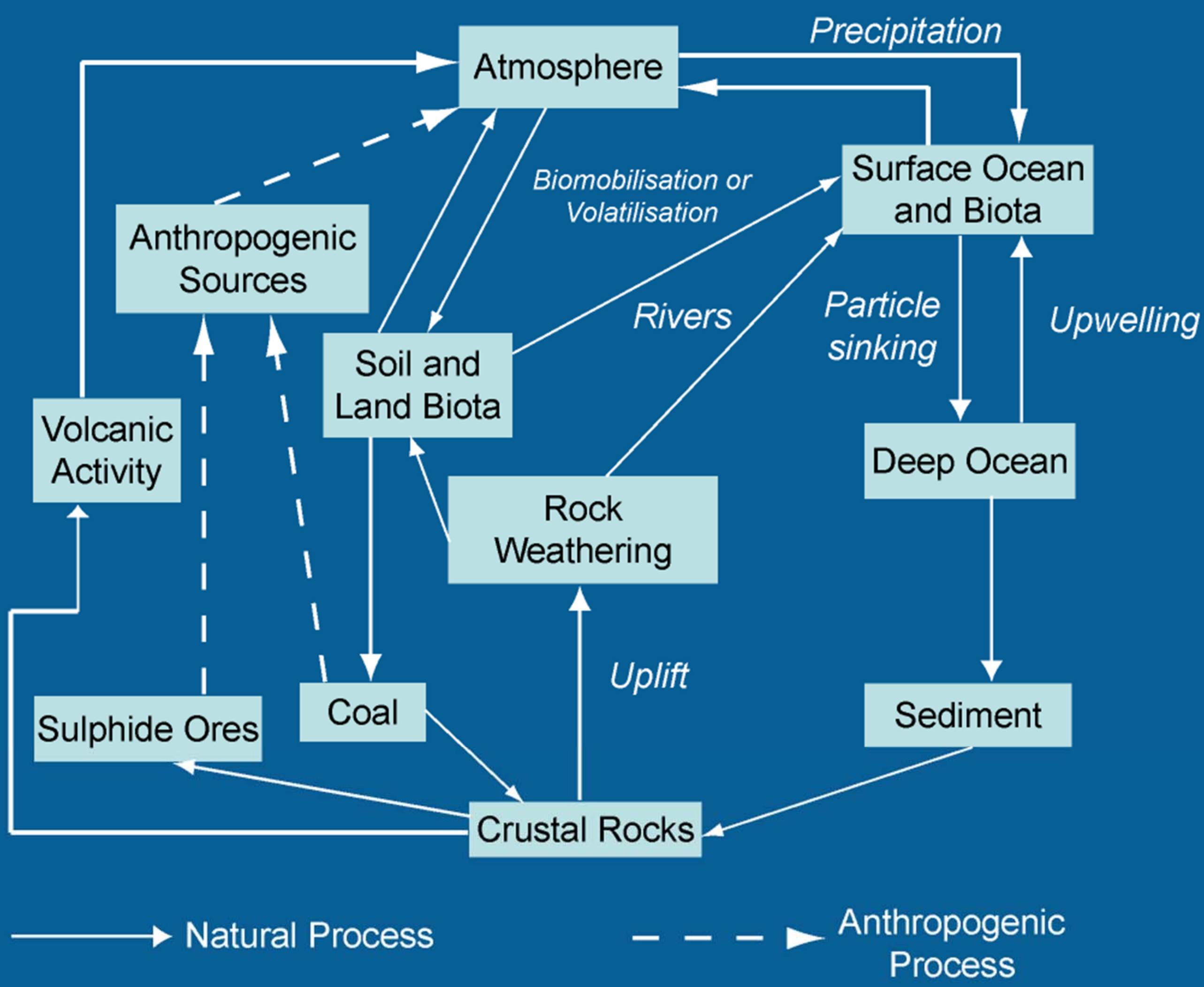
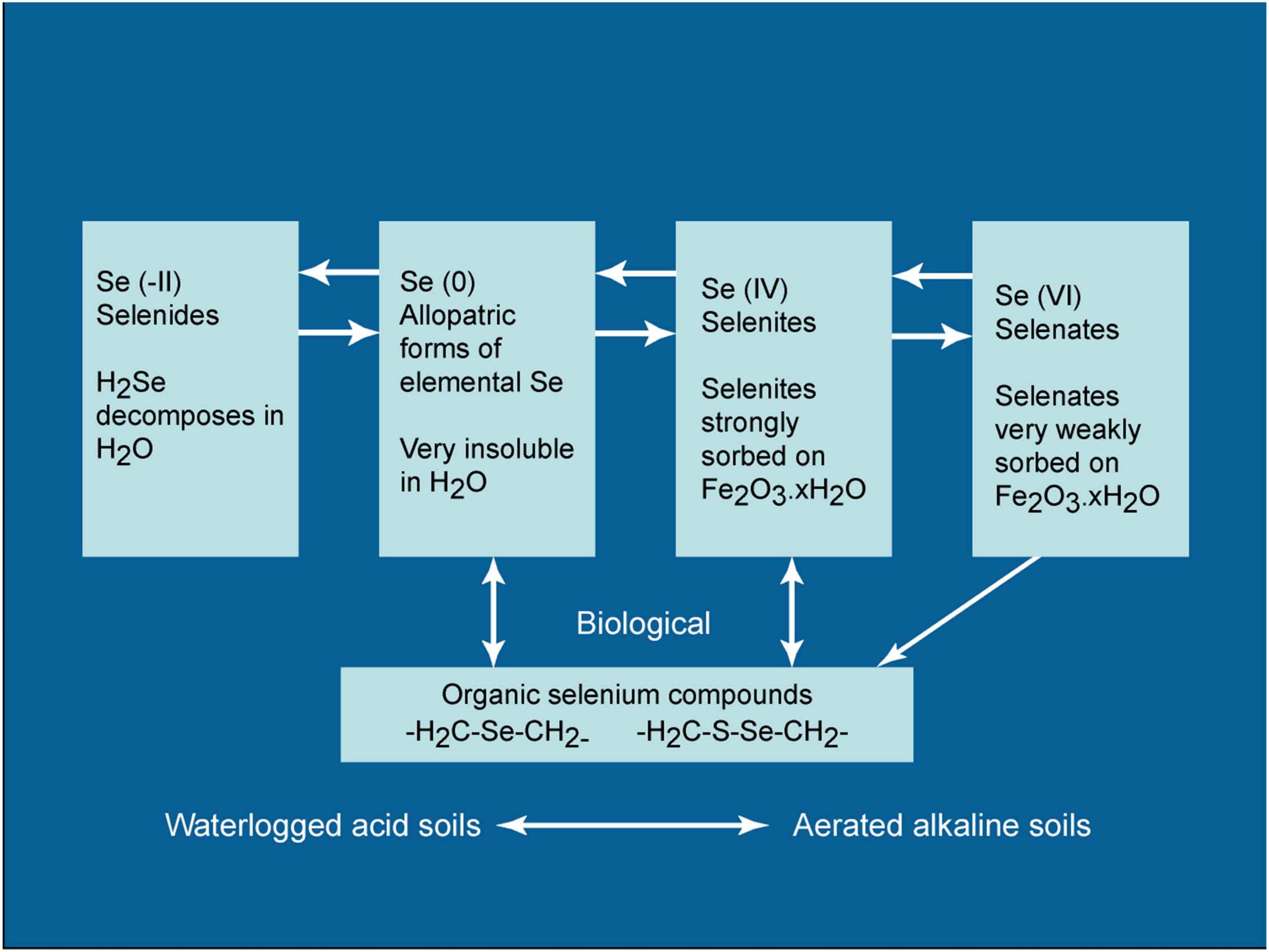
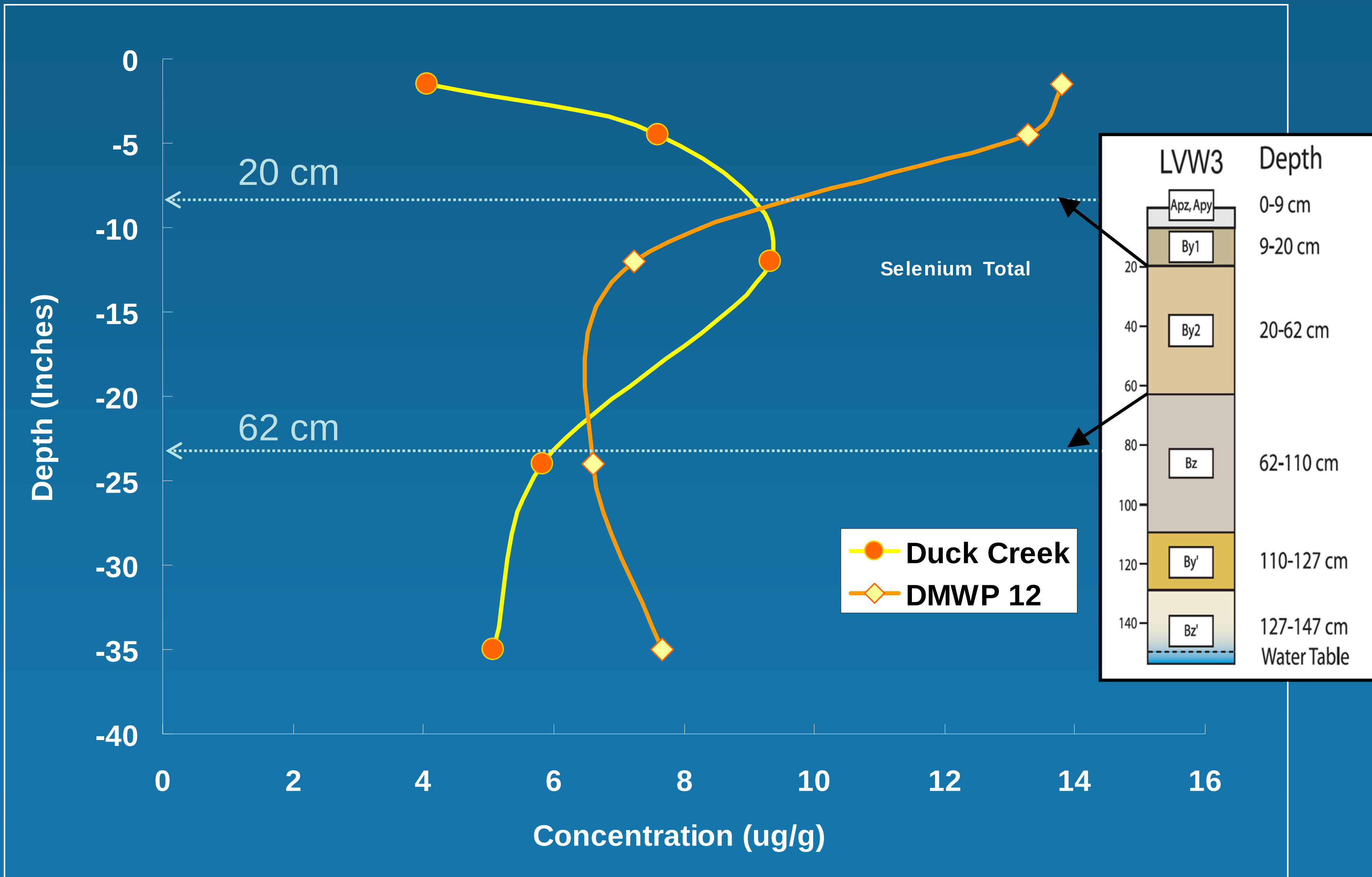


Selenium cycle




Se (-II)
Selenides
H2Se decomposes in H2O
Se (0)
Allopatric forms of elemental Se
Very insoluble in H2O
Se (IV)
Selenites
Selenites strongly sorbed on Fe2O3.xH2O
Se (VI)
Selenates
Selenates very weakly sorbed on Fe2O3.xH2O
Biological
Organic selenium compounds
-H2C-Se-CH2-
-H2C-S-Se-CH2-
Waterlogged acid soils
Aerated alkaline soils

Se concentration with depth



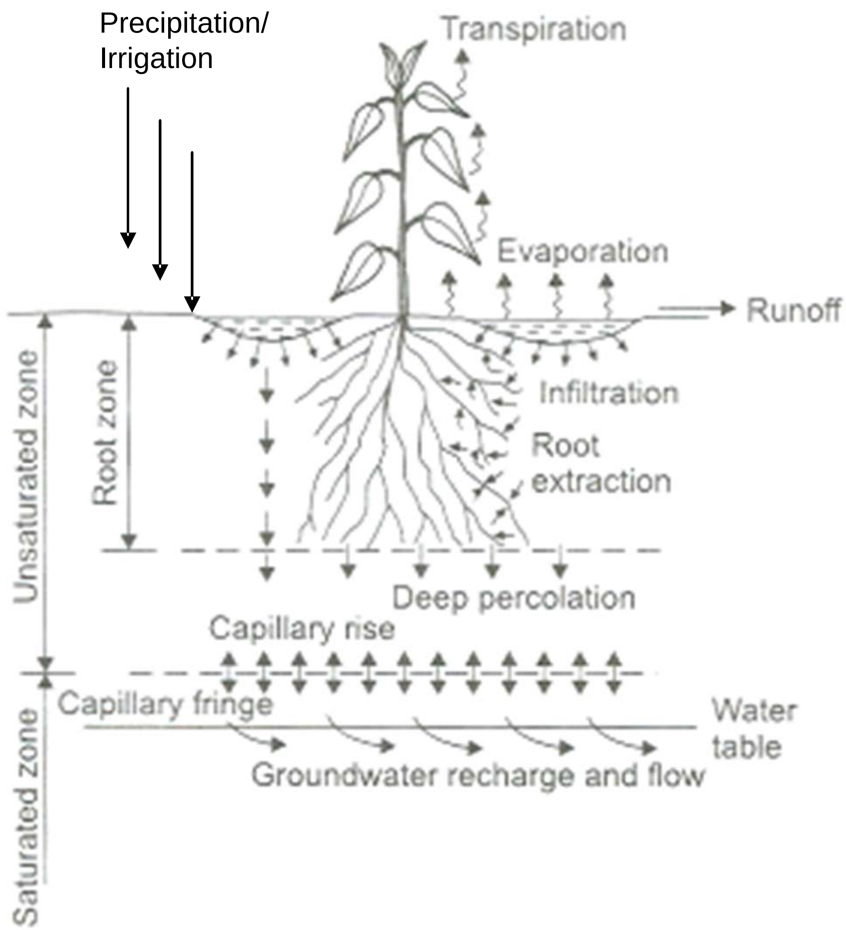
Papelis, DRI, unpublished data

Water balance - Win - Wout = <u>ΔW</u>

<u>W_{in} - Water gains:</u>
P - Precipitation
I - Irrigation
U - Upward capillary flow
R_{on} - Runon

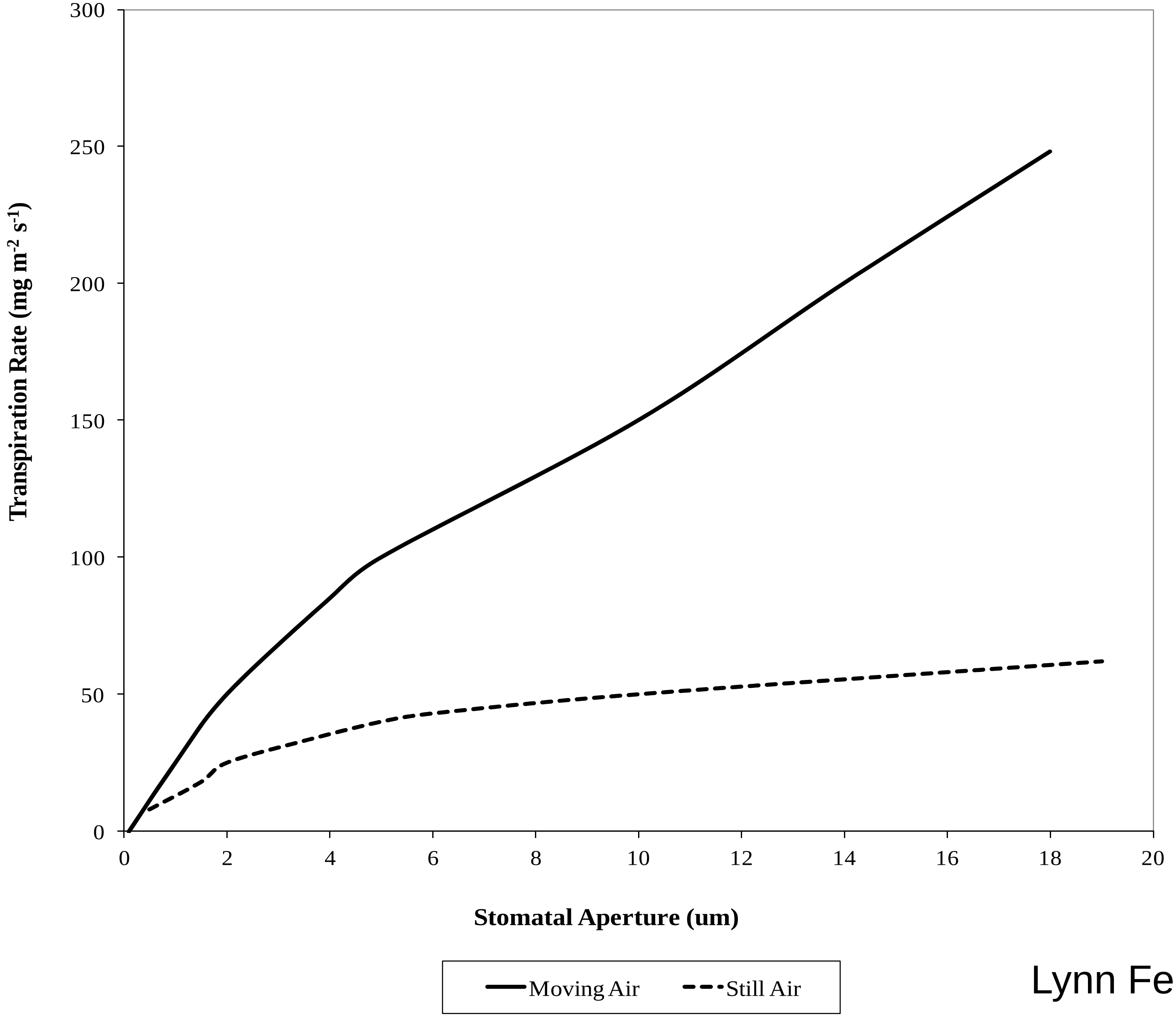
<u>W_{out} - Water losses:</u>
E - Evaporation from soil
T_r - Transpiration from plants
R_{off} - Runoff
D - Downward drainage

<u>ΔW - Change in storage:</u>
ΔS - Change in water storage
ΔV - Change in vegetative mass



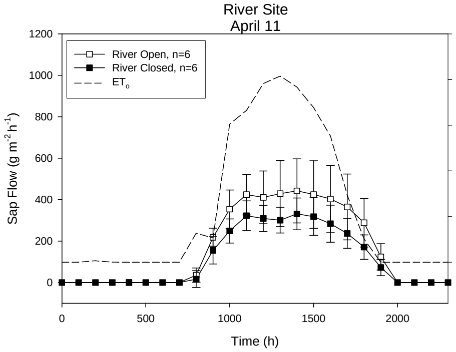
After Michael H. Young, 2008

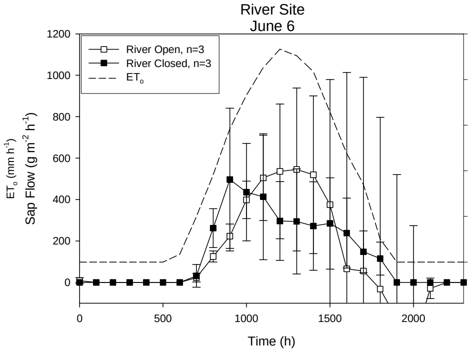
Remote Sensing

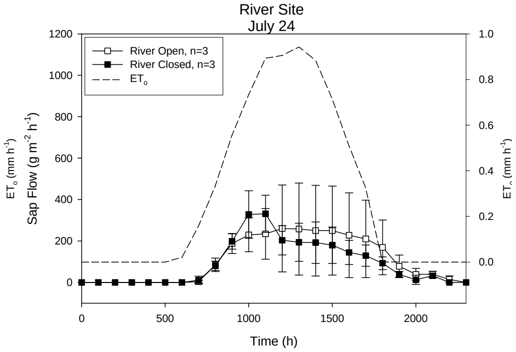


Lynn Fenstermaker

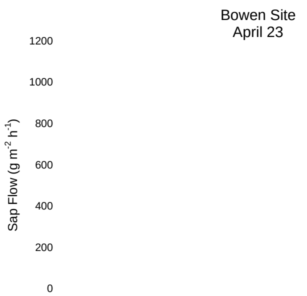
Sap Flow Results

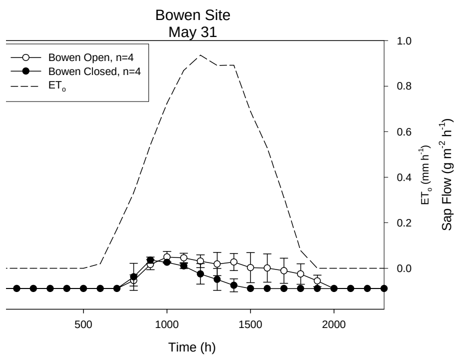


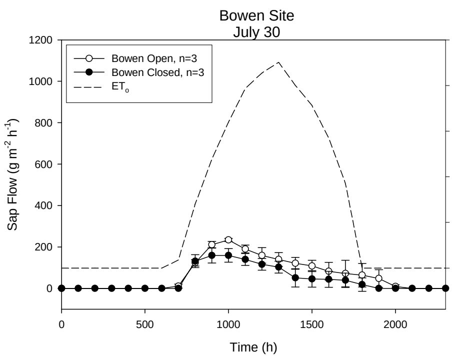


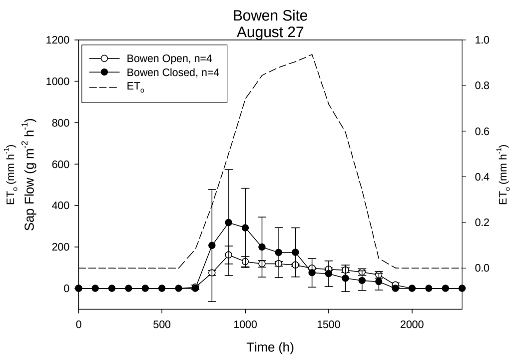


River Site sap flow: April 11, June 6, July 24 and Sept 4



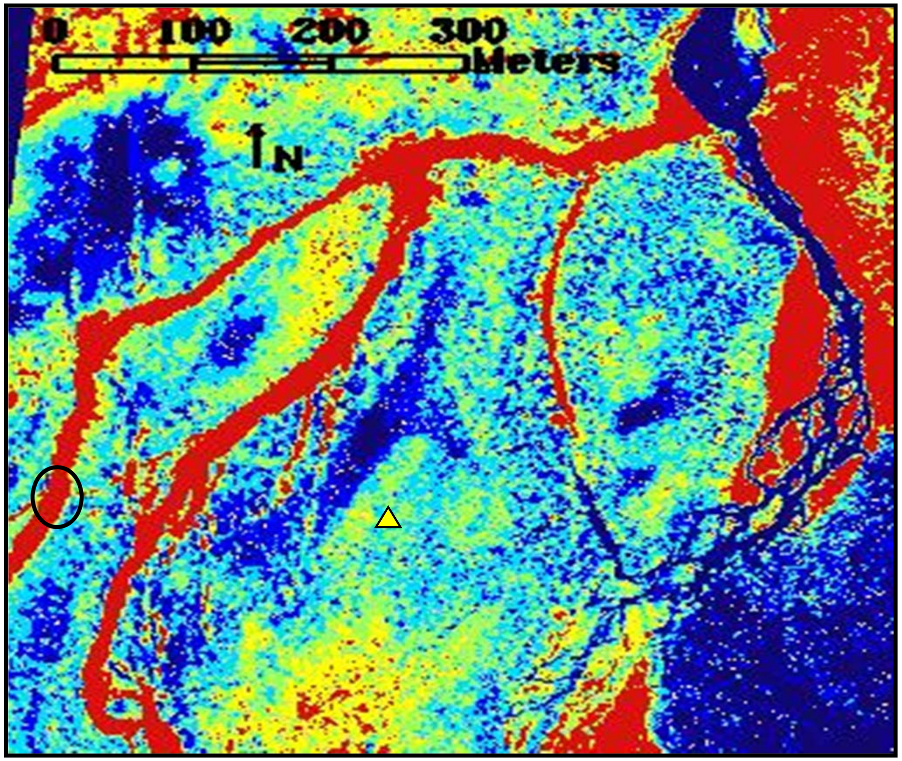




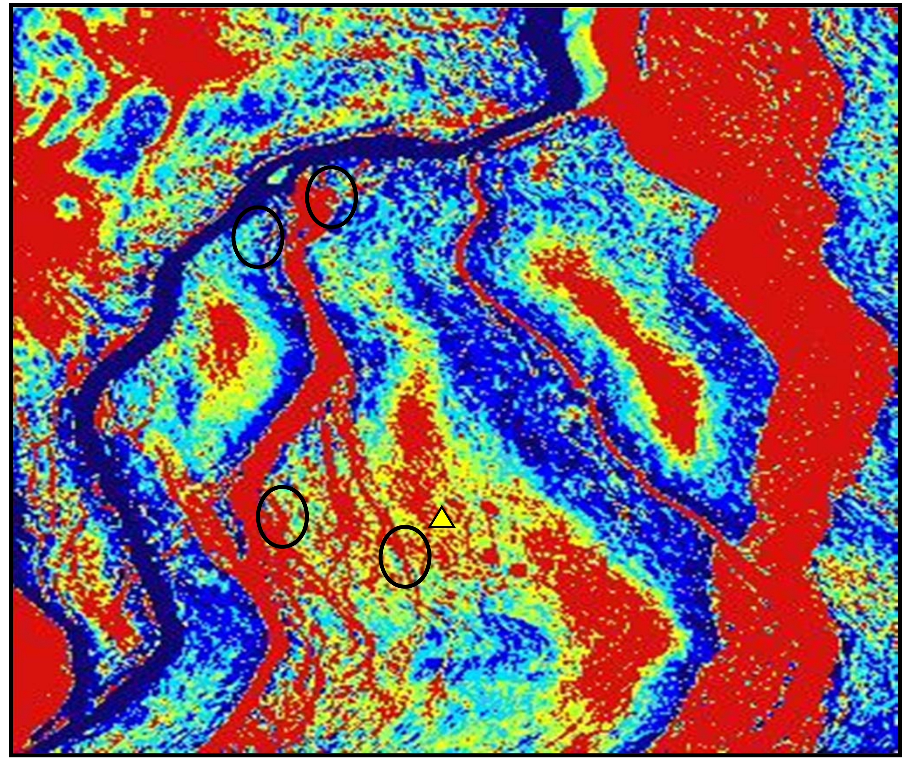


Bowen Site sap flow: April 23, May 31, July 30 and Aug 27

Lynn Fenstermaker



April 22, 1994 ET (mm day^{-1})



April 13, 1996 ET (mm day^{-1})

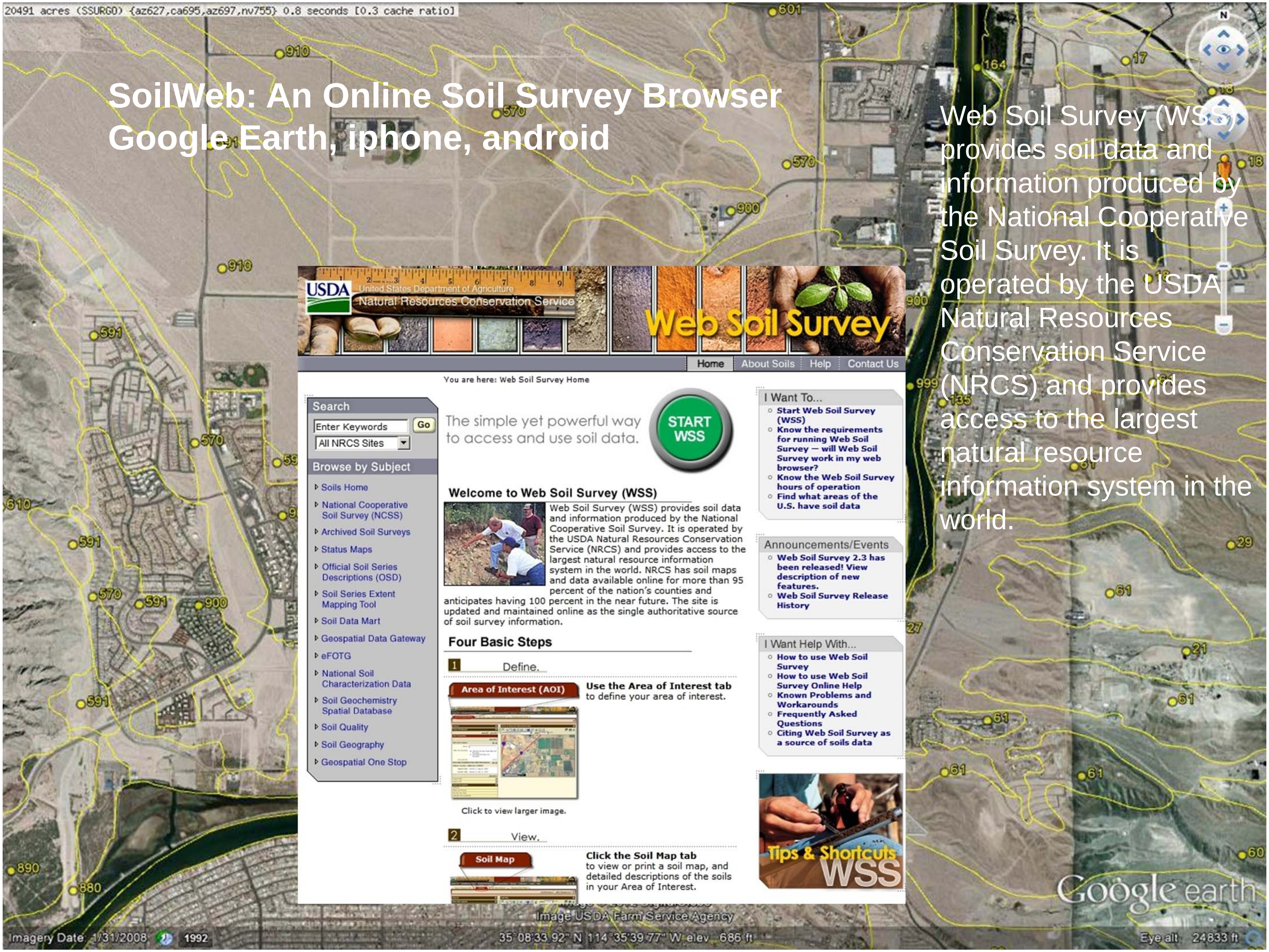
1994 and 1996 Sample Locations

Tower Location

0	2 - 4	6 - 8
0 - 2	4 - 6	> 8

Lynn Fenstermaker

SoilWeb: An Online Soil Survey Browser
Google Earth, iphone, android



USDA United States Department of Agriculture
Natural Resources Conservation Service

Web Soil Survey

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You are here: Web Soil Survey Home

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Enter Keywords Go
All NRCS Sites

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- Soils Home
- National Cooperative Soil Survey (NCSS)
- Archived Soil Surveys
- Status Maps
- Official Soil Series Descriptions (OSD)
- Soil Series Extent Mapping Tool
- Soil Data Mart
- Geospatial Data Gateway
- eFOTG
- National Soil Characterization Data
- Soil Geochemistry Spatial Database
- Soil Quality
- Soil Geography
- Geospatial One Stop

The simple yet powerful way to access and use soil data.

START WSS

Welcome to Web Soil Survey (WSS)

Web Soil Survey (WSS) provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world. NRCS has soil maps and data available online for more than 95 percent of the nation's counties and anticipates having 100 percent in the near future. The site is updated and maintained online as the single authoritative source of soil survey information.

Four Basic Steps

1 Define.

Area of Interest (AOI)

Use the Area of Interest tab to define your area of interest.

Click to view larger image.

2 View.

Soil Map

Click the Soil Map tab to view or print a soil map, and detailed descriptions of the soils in your Area of Interest.

I Want To...

- Start Web Soil Survey (WSS)
- Know the requirements for running Web Soil Survey — will Web Soil Survey work in my web browser?
- Know the Web Soil Survey hours of operation
- Find what areas of the U.S. have soil data

Announcements/Events

- Web Soil Survey 2.3 has been released! View description of new features.
- Web Soil Survey Release History

I Want Help With...

- How to use Web Soil Survey
- How to use Web Soil Survey Online Help
- Known Problems and Workarounds
- Frequently Asked Questions
- Citing Web Soil Survey as a source of soils data

Tips & Shortcuts WSS

Web Soil Survey (WSS) provides soil data and information produced by the National Cooperative Soil Survey. It is operated by the USDA Natural Resources Conservation Service (NRCS) and provides access to the largest natural resource information system in the world.

Scientists studying biota are often interested in the time scales that define how fast one ecosystem succeeds another after a disturbance. Generally, this response time is tens to hundreds of years. In fact, whether an ecosystem can ever reach steady state is a matter of debate.

If it is possible, steady state is a complex function of the extent and frequency of disturbances such as fires and insect infestations.

Water, responds at the shortest time scales. Water moves both downward (because of meteoric inputs) and upward (because of evapotranspiration mediated by roots that often extend to depths of tens of meters). Water residence times in soil are measured with stable isotopes to decipher the interplay of “old” and “new” water. These water types are characterized by long or short residence times varying from tens of years to minutes.

Key links:

Climate Data: http://www.wcc.nrcs.usda.gov/

Soils Data

Web Soil Survey:
http://websoilsurvey.nrcs.usda.gov/app/

NCSS Lab Data:
http://ssldata.nrcs.usda.gov/

Soilweb Cal Davis:
http://casoilresource.lawr.ucdavis.edu/drupal/node/902

Douglas J. Merkler
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