

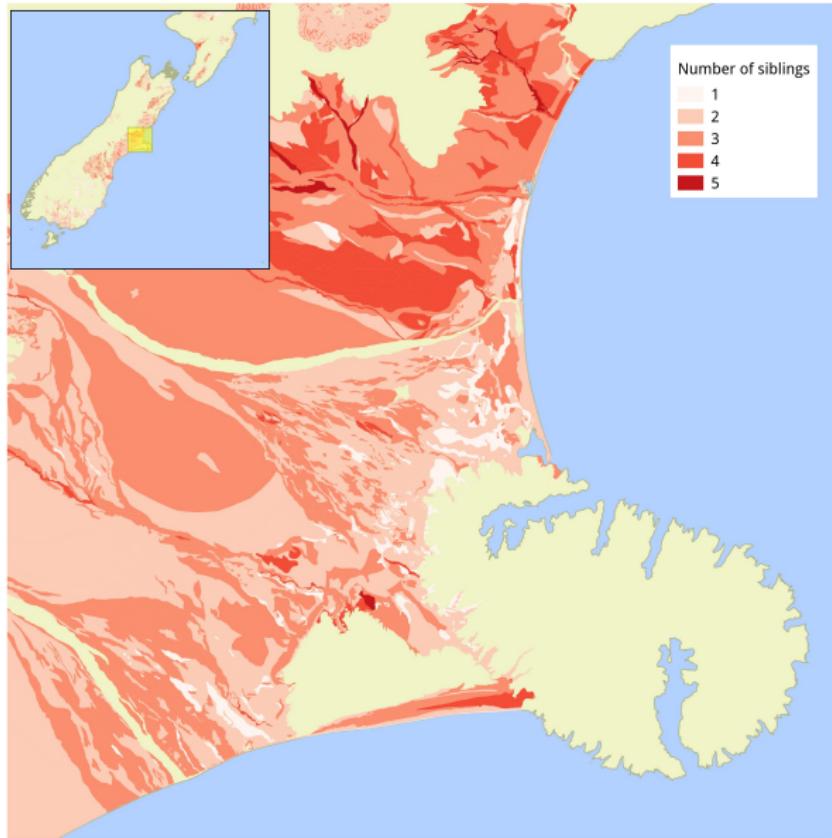
# a new perspective on soil survey data

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**Landcare Research  
Manaaki Whenua**





soils do not occur on their own

they occur in **associations**

a means to represent the **co-occurrence** of soils  
is the **adjacency matrix**

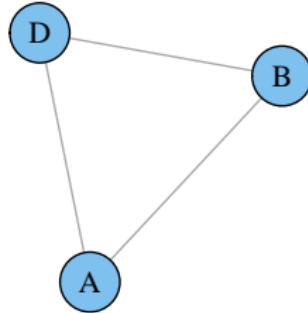
analogy with the **community matrix** used in ecology

compute **similarity matrix** using methods from numerical ecology

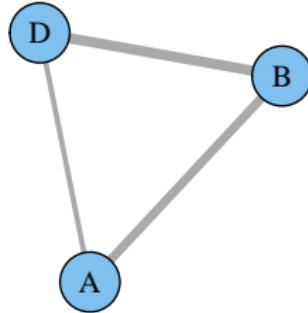
what we obtain is the **co-occurrence** probability

	A	B	C	D
A	–			
B	0.58	–		
C	0.00	0.00	–	
D	0.34	0.12	0.00	–

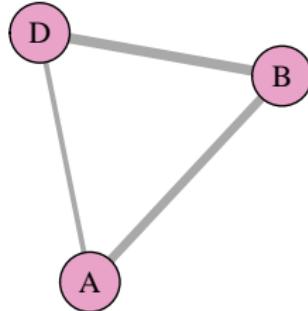
...and a representation of these relationships is  
a graph



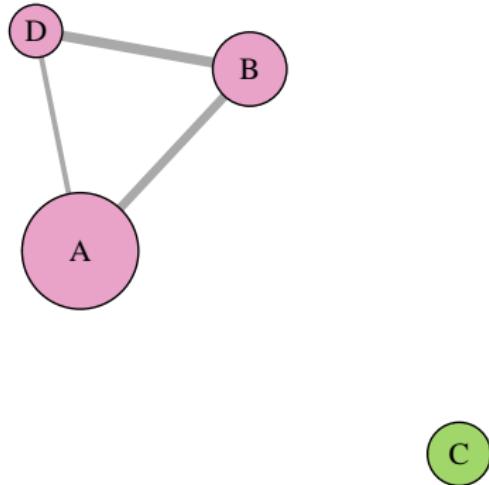
C



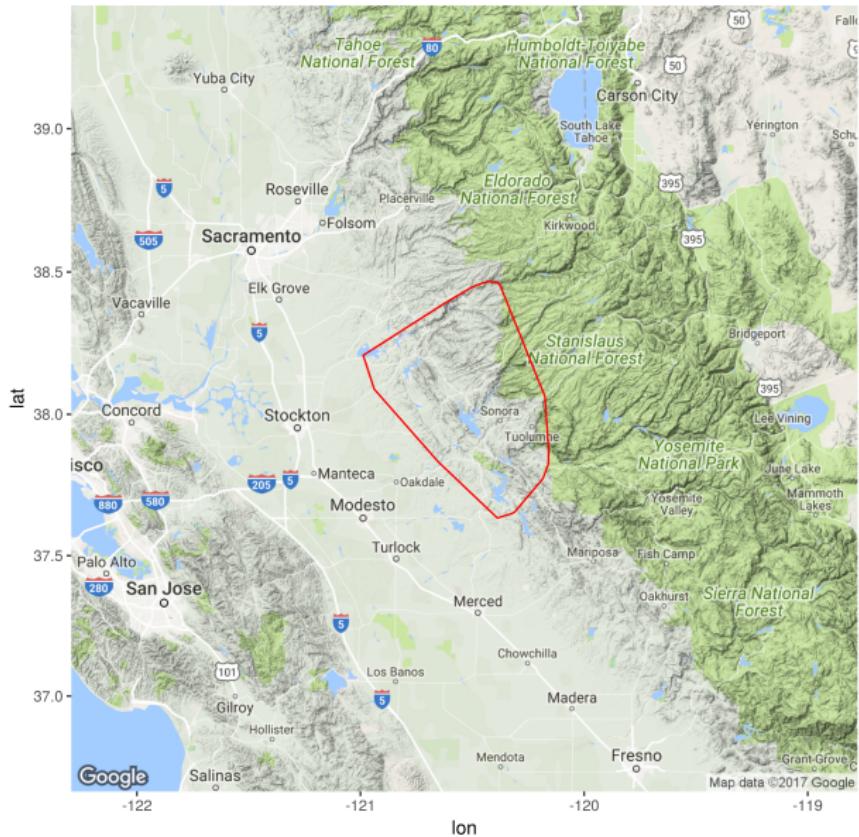
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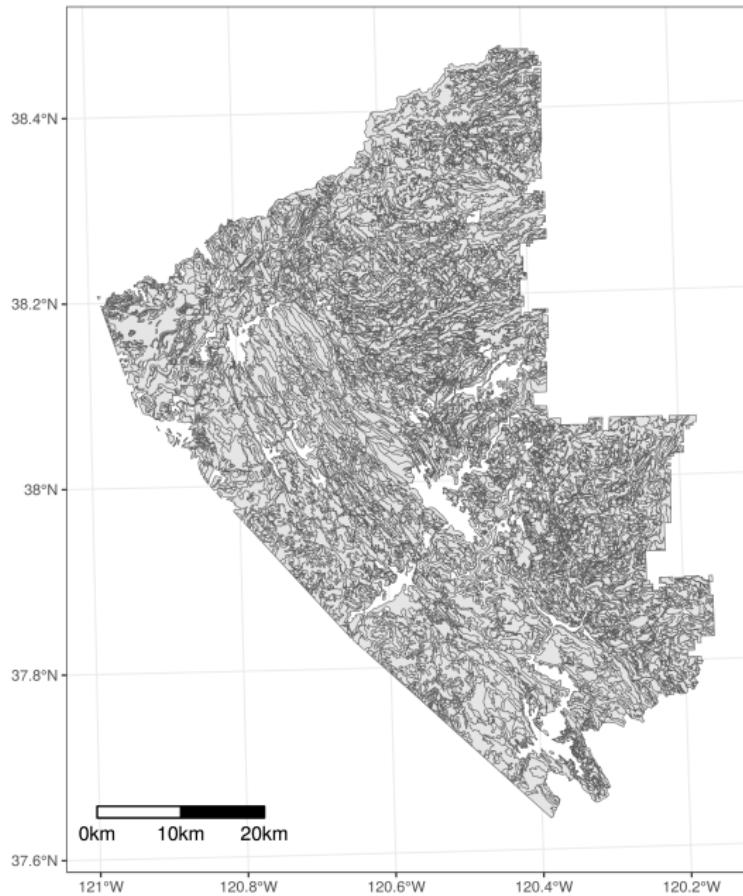


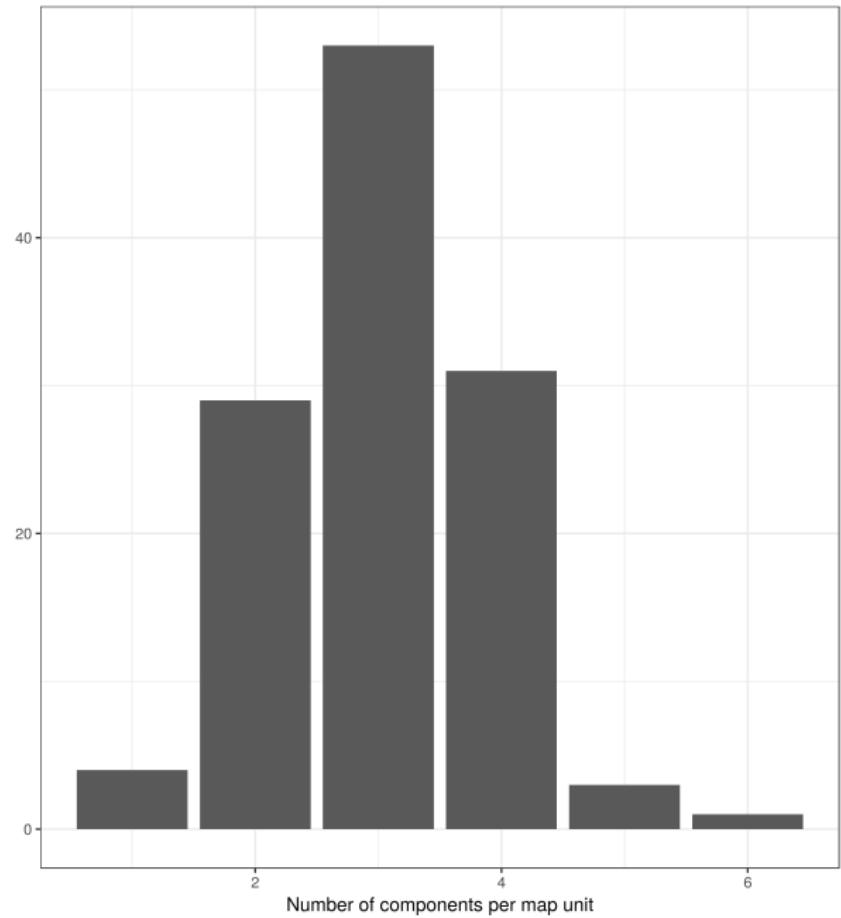
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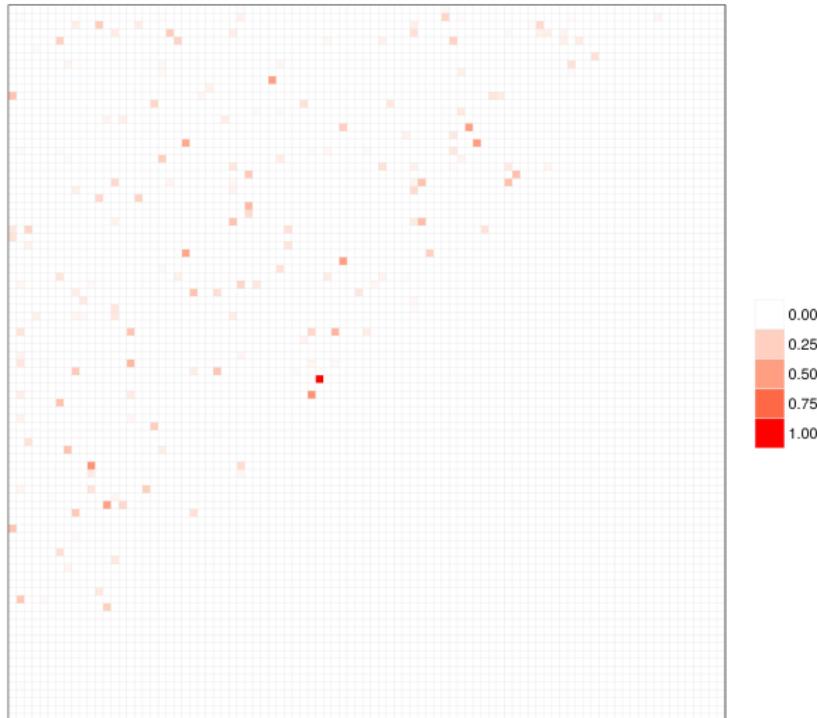
can the **structure** of these graphs help us gain  
**insight** from data?

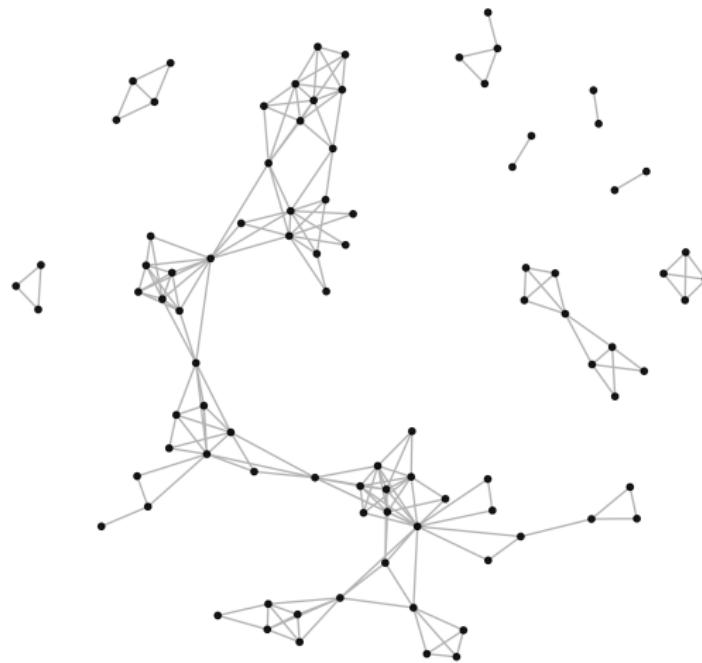


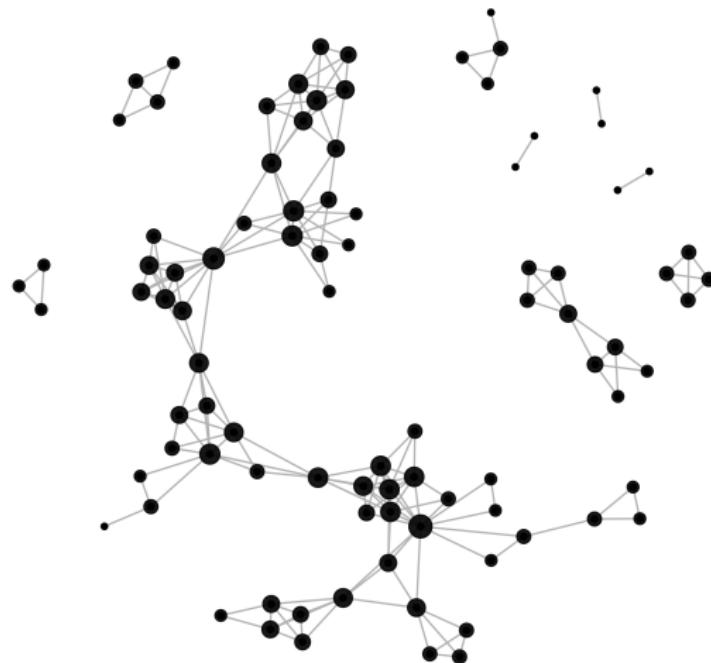


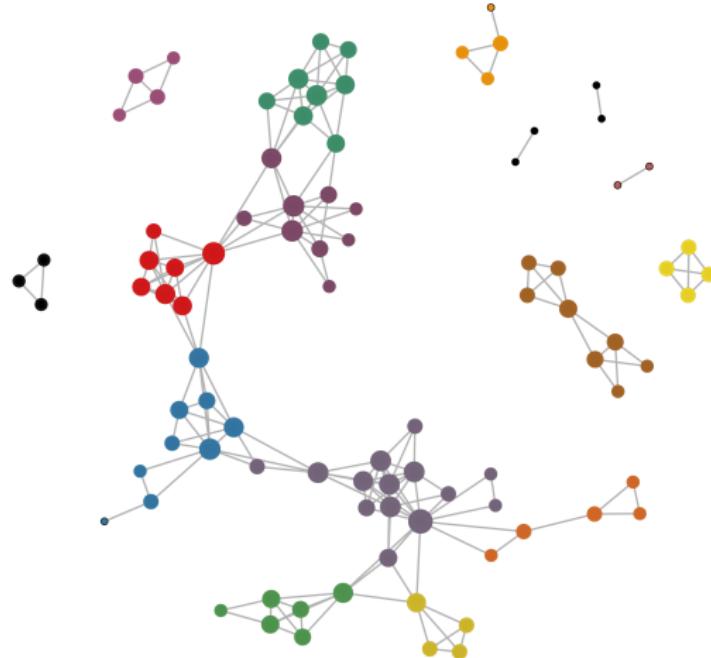


Co-occurrence probability matrix

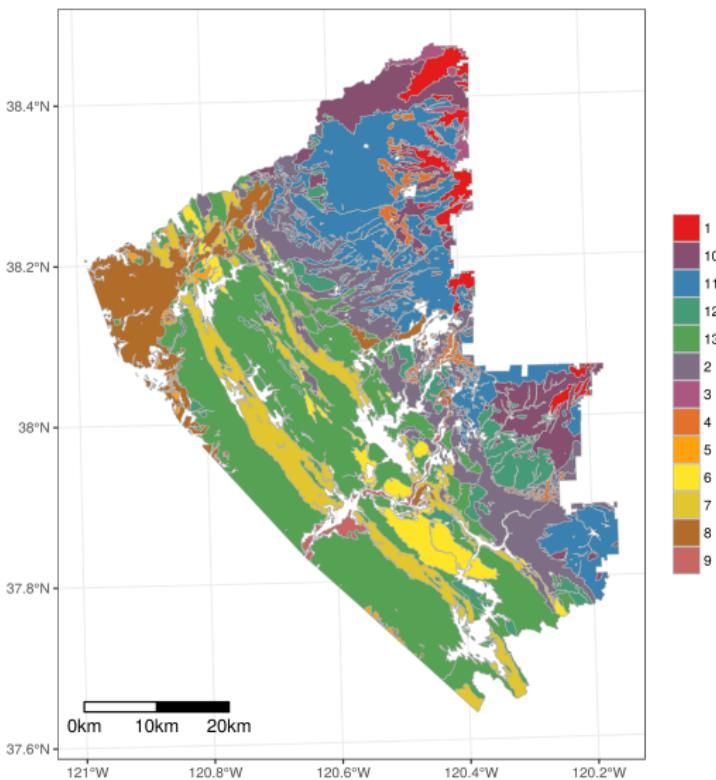




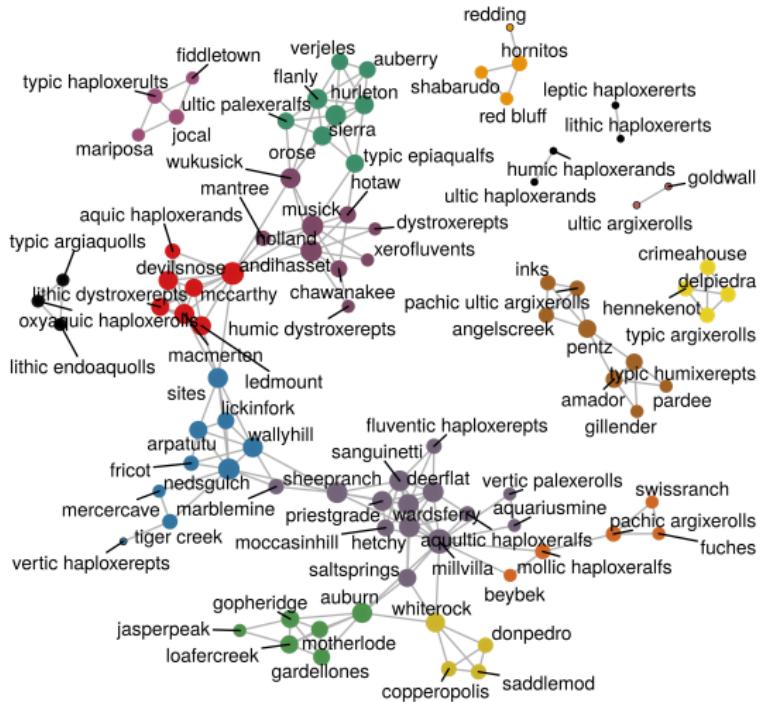




map communities  
back in  
geographical space



**expert** interpretation  
of the  
communities



1.



12.



13.



4.





4.



5.

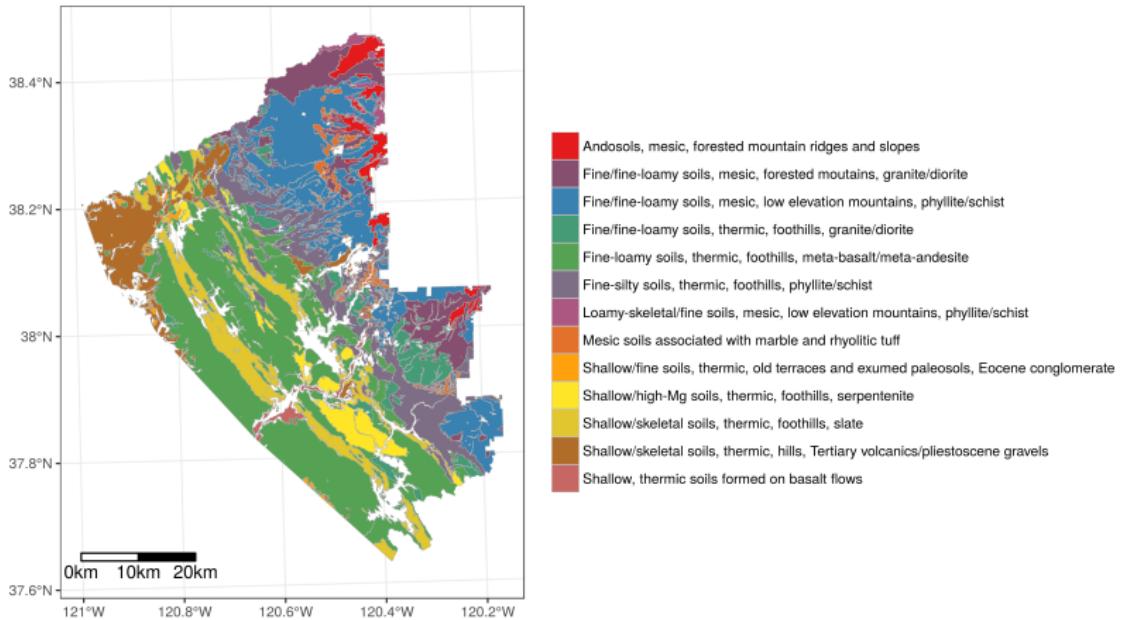


2.

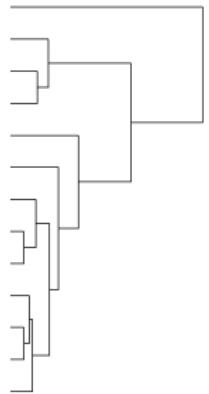
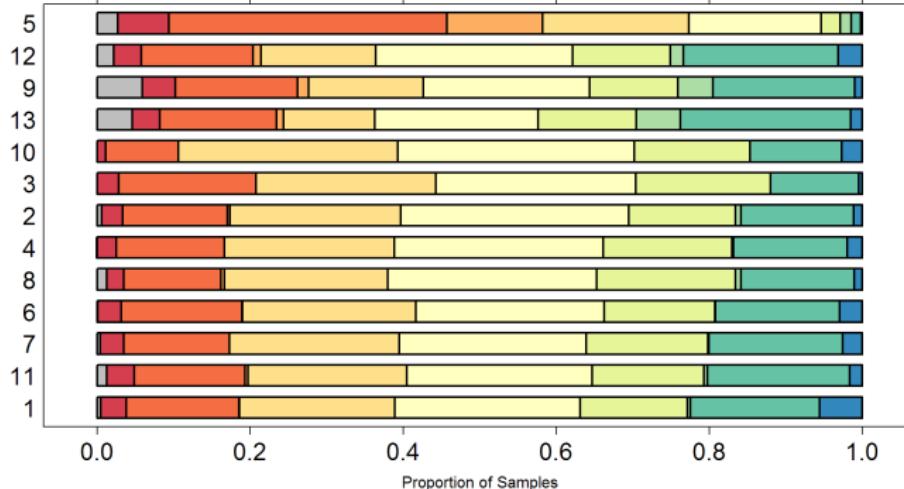


11.

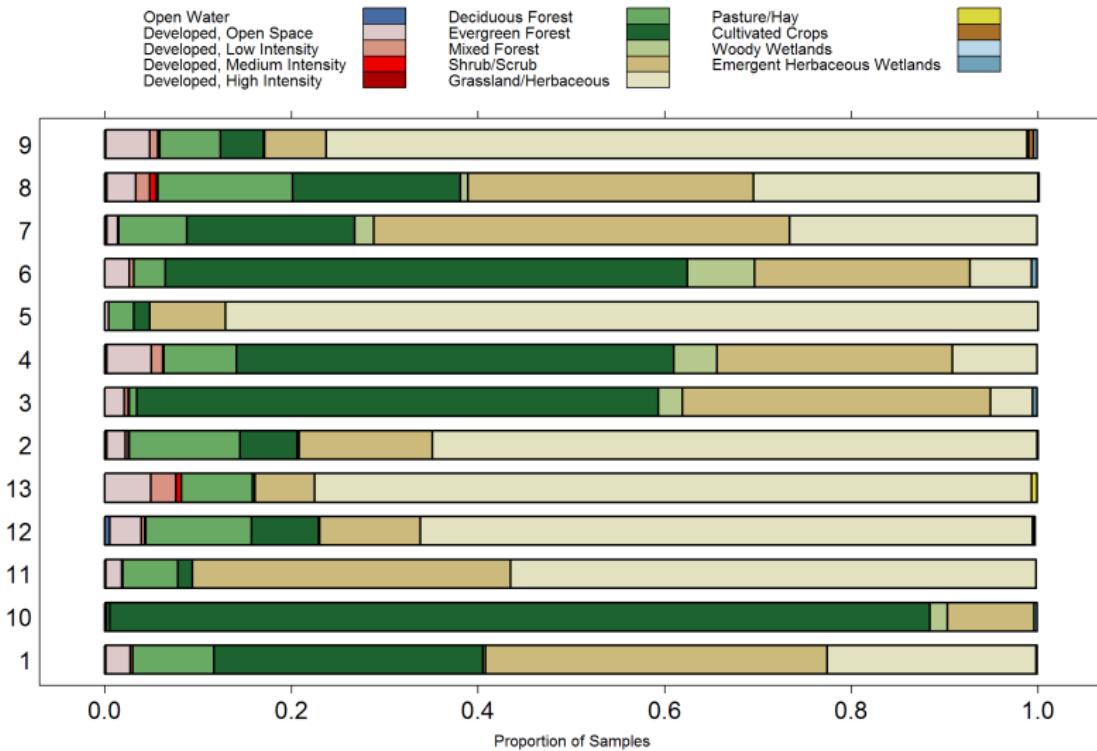




relationship to  
soil forming  
factors

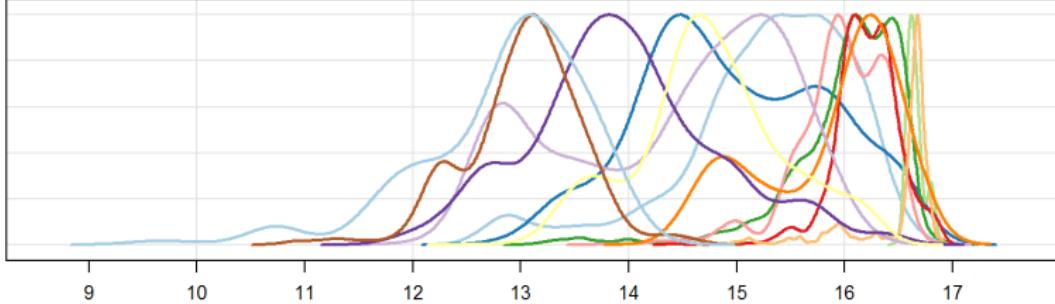


geomorphology

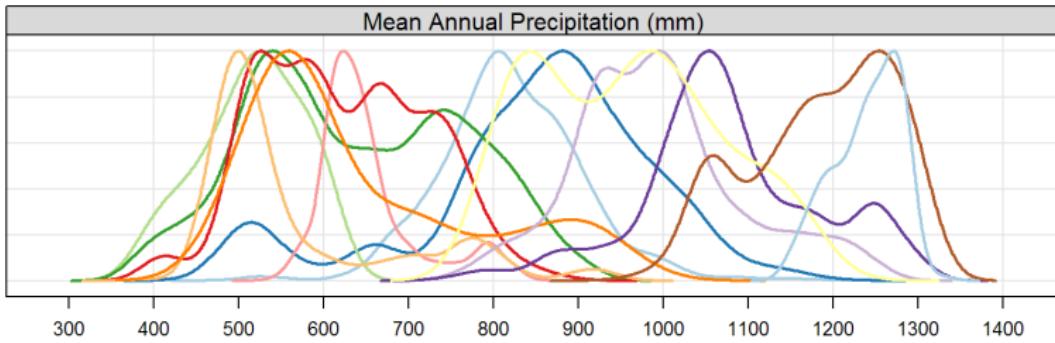


land cover

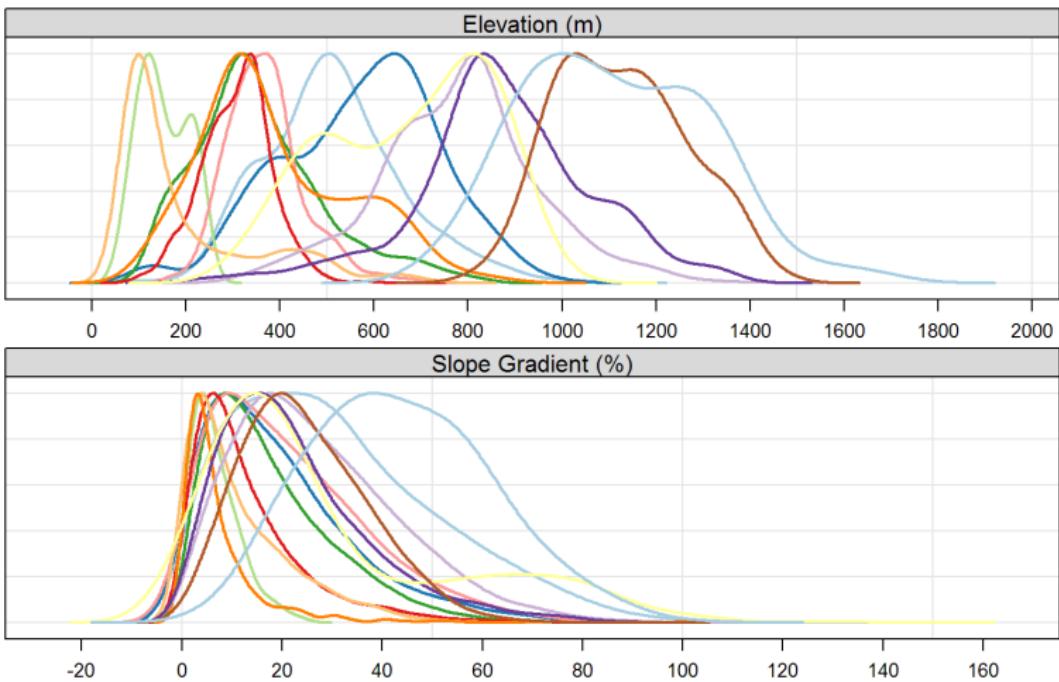
Mean Annual Air Temperature (degrees C)



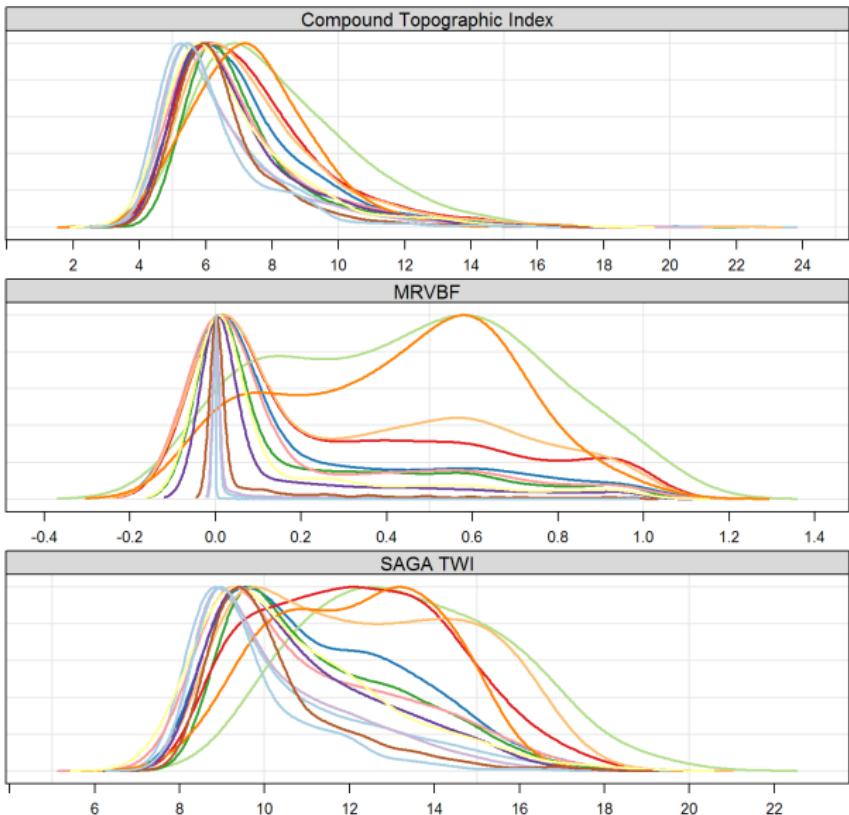
Mean Annual Precipitation (mm)



climate



terrain derivatives



more terrain derivatives

still early days for co-occurrence networks, but...

a tool for soil information **review**?

a tool for soil information **development**?

consequences for soil classes **predictions**?

one more thing

THIS IS YOUR MACHINE LEARNING SYSTEM?

YUP! YOU POUR THE DATA INTO THIS BIG  
PILE OF LINEAR ALGEBRA, THEN COLLECT  
THE ANSWERS ON THE OTHER SIDE.

WHAT IF THE ANSWERS ARE WRONG?

JUST STIR THE PILE UNTIL  
THEY START LOOKING RIGHT.



...from Murray Lark's keynote:

*“The purpose of computing is **insight**, not numbers”*  
— R. Hamming

SOIL SURVEY SERIES 1951, NO. 12

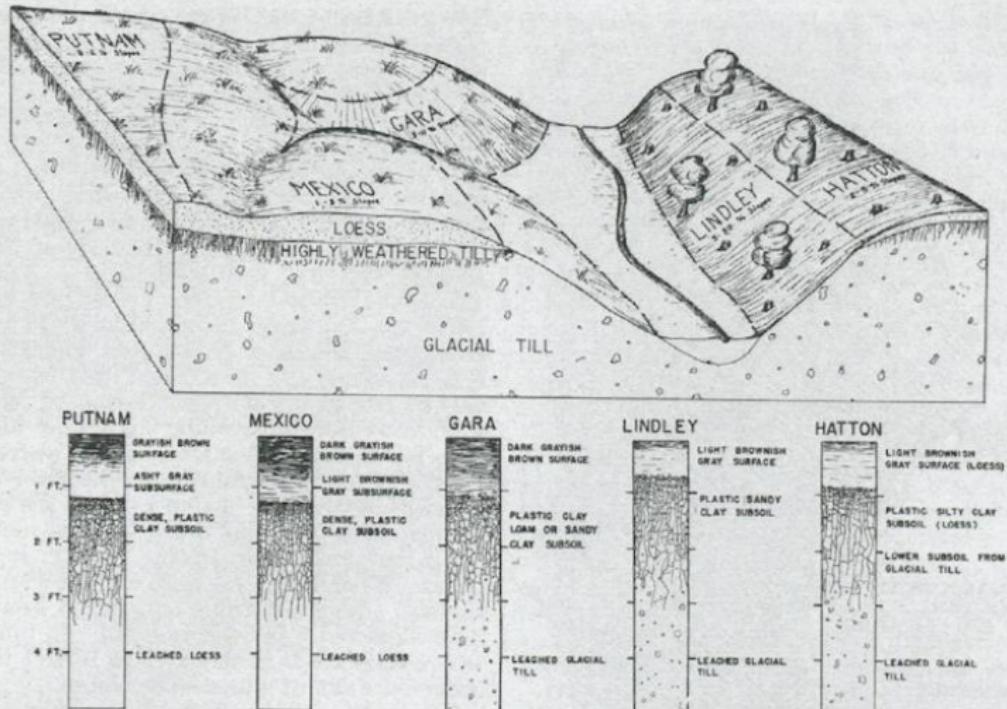


Figure 10.—Relationship of some of the soils of the uplands to parent material, slope, and native vegetation.

*"Where is the **Life***

*we have lost in **living**?*

*Where is the **wisdom***

*we have lost in **knowledge**?*

*Where is the **knowledge***

*we have lost in the **information**?"*

T.S. Eliot, "The Rock" (1934)

# Thanks.

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