a new perspective on soil survey data

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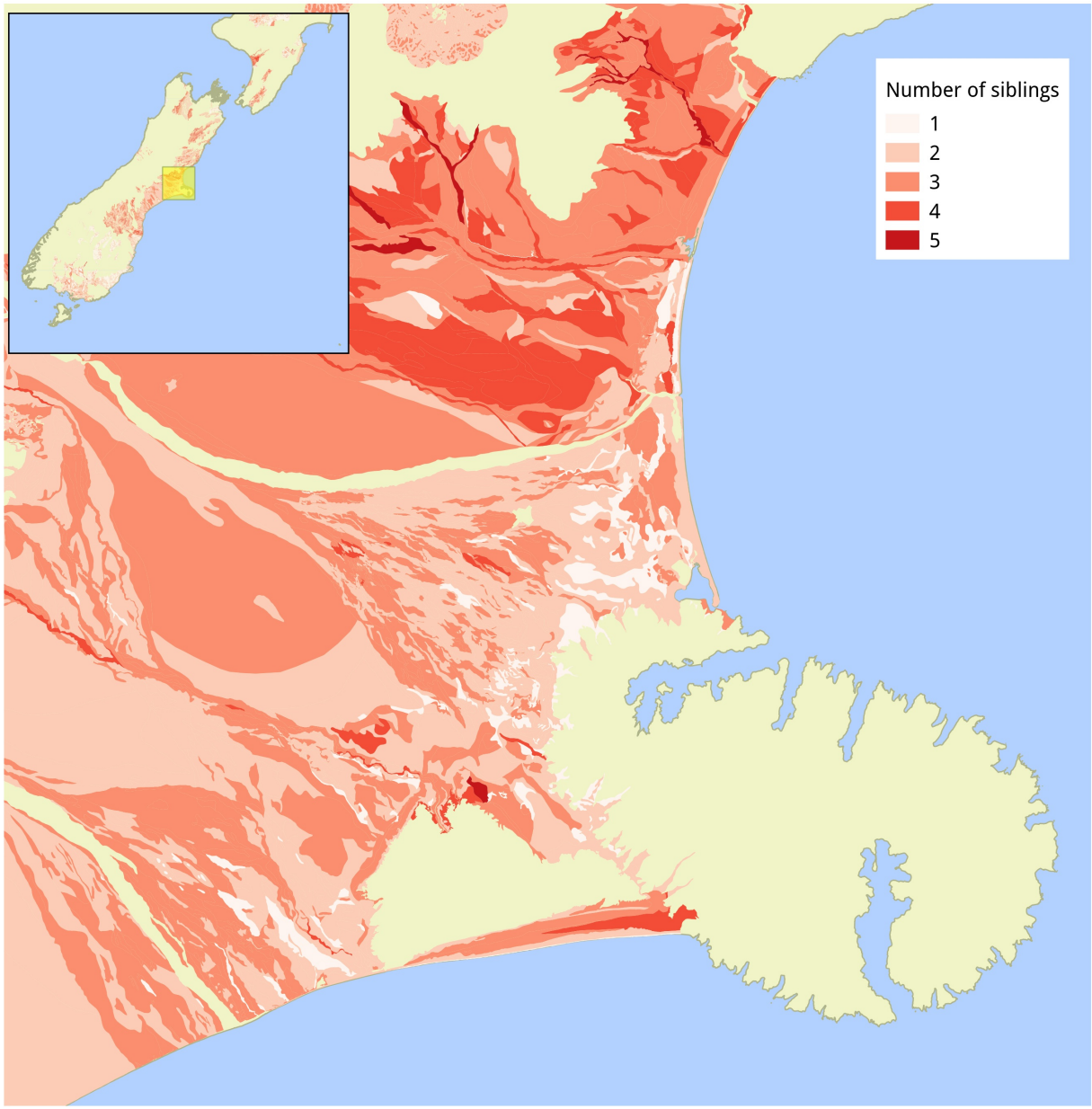
Landcare Research
Manaaki Whenua

Te Pūnaha Matatini
Data ▪ Knowledge ▪ Insight

`smap.landcareresearch.co.nz` — 10 000+ polygons!

soils do not occur on their own

they occur in associations


Number of siblings
1
2
3
4
5

can we study soil associations?

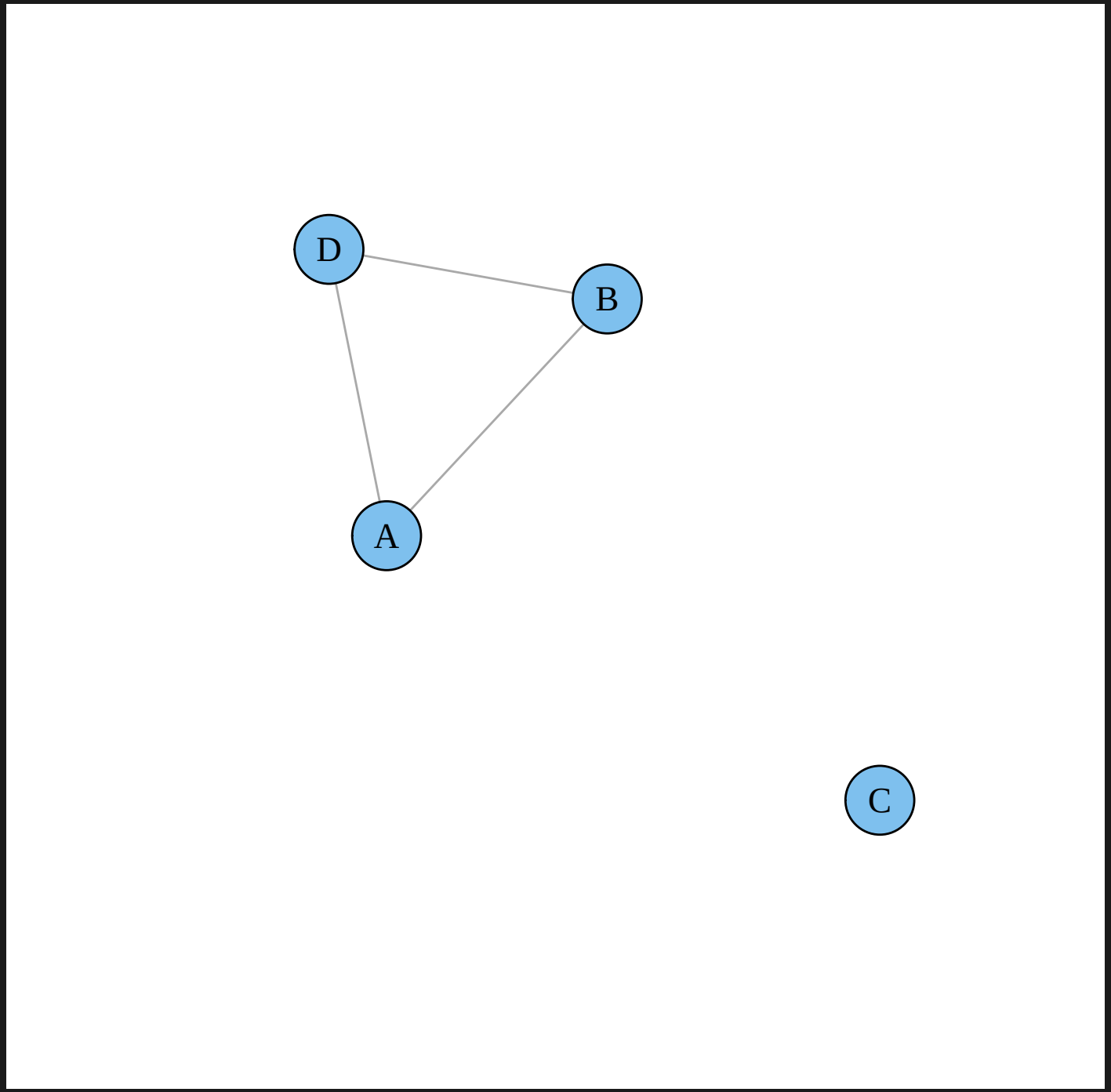
a means to represent co-occurence of soils is the adjacency matrix

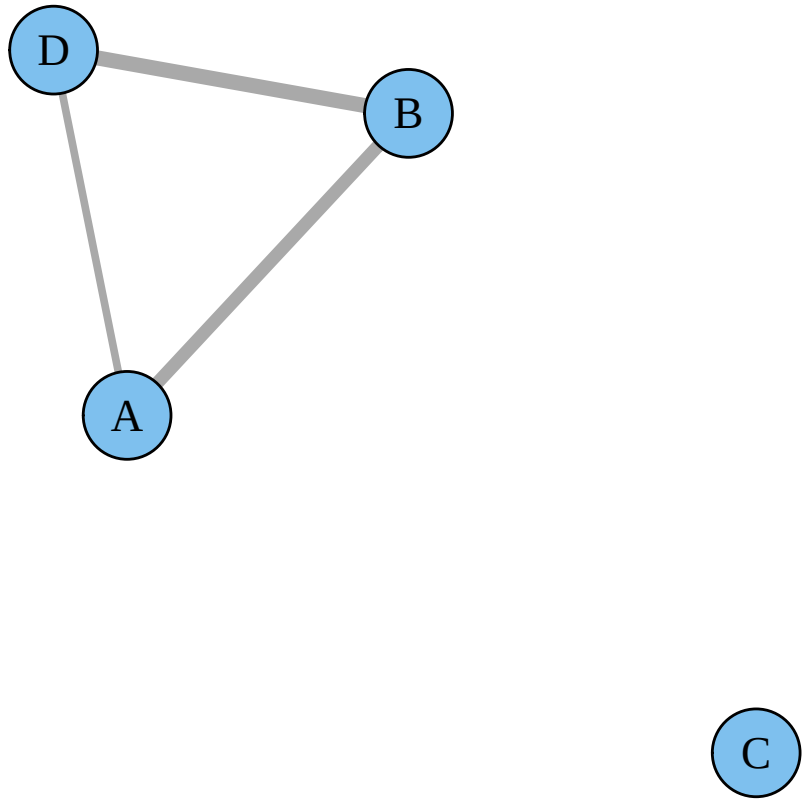
analogy with the community matrix used in ecology

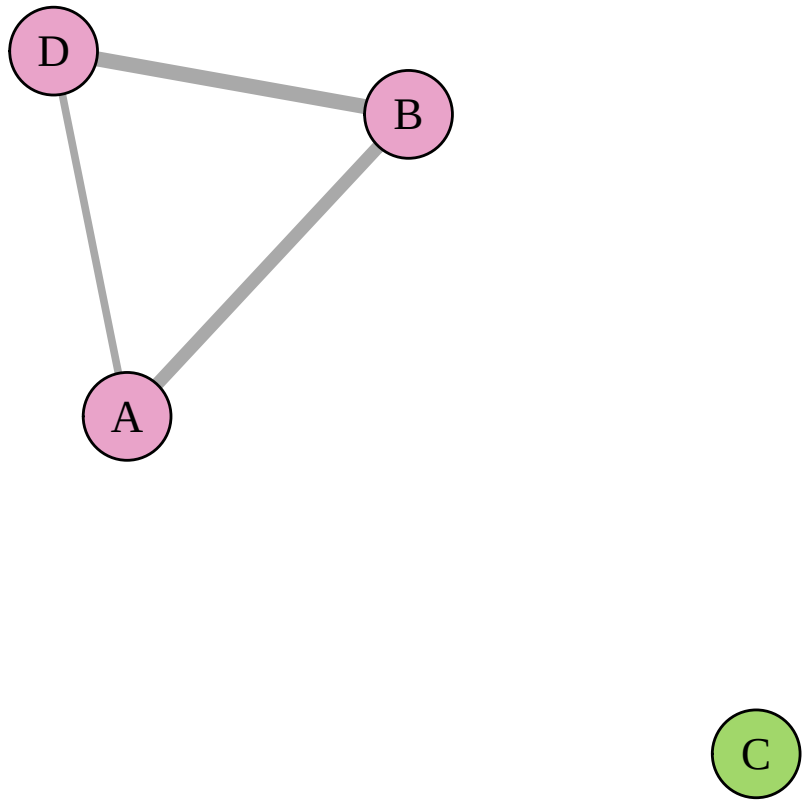
compute similarity matrix using methods from ecology

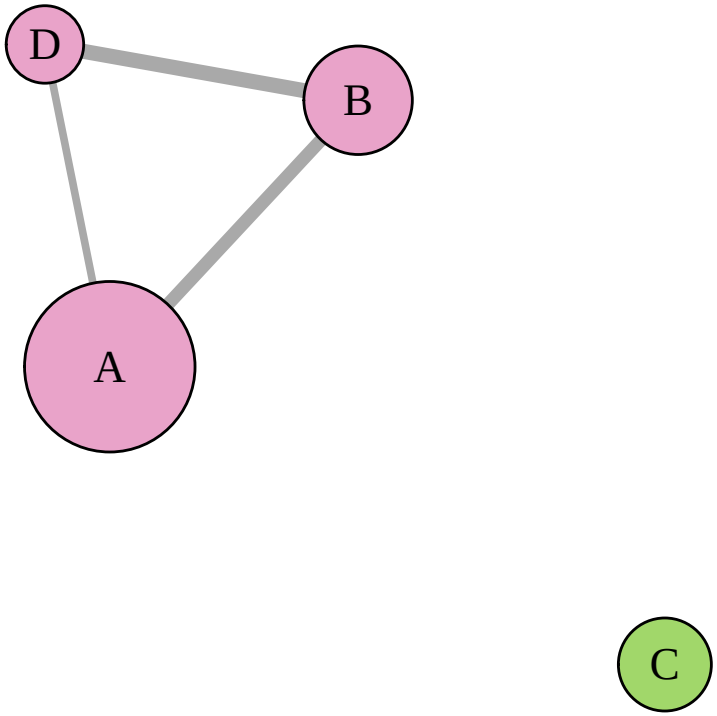
	A	B	C	D
A	0.00			
B	0.58	0.00		
C	0.00	0.00	0.00	
D	0.34	0.12	0.00	0.00

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

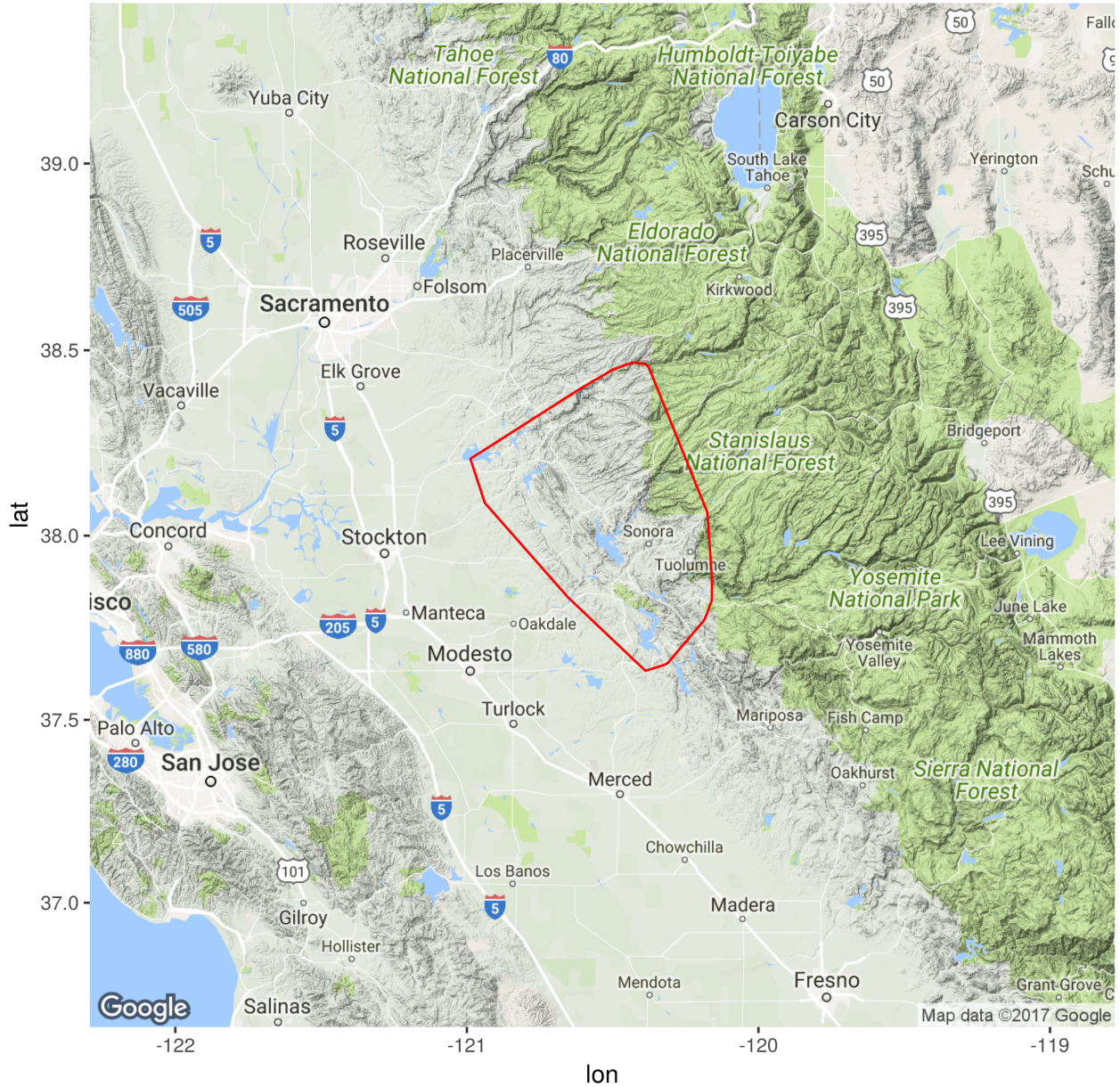

D
B
A
C

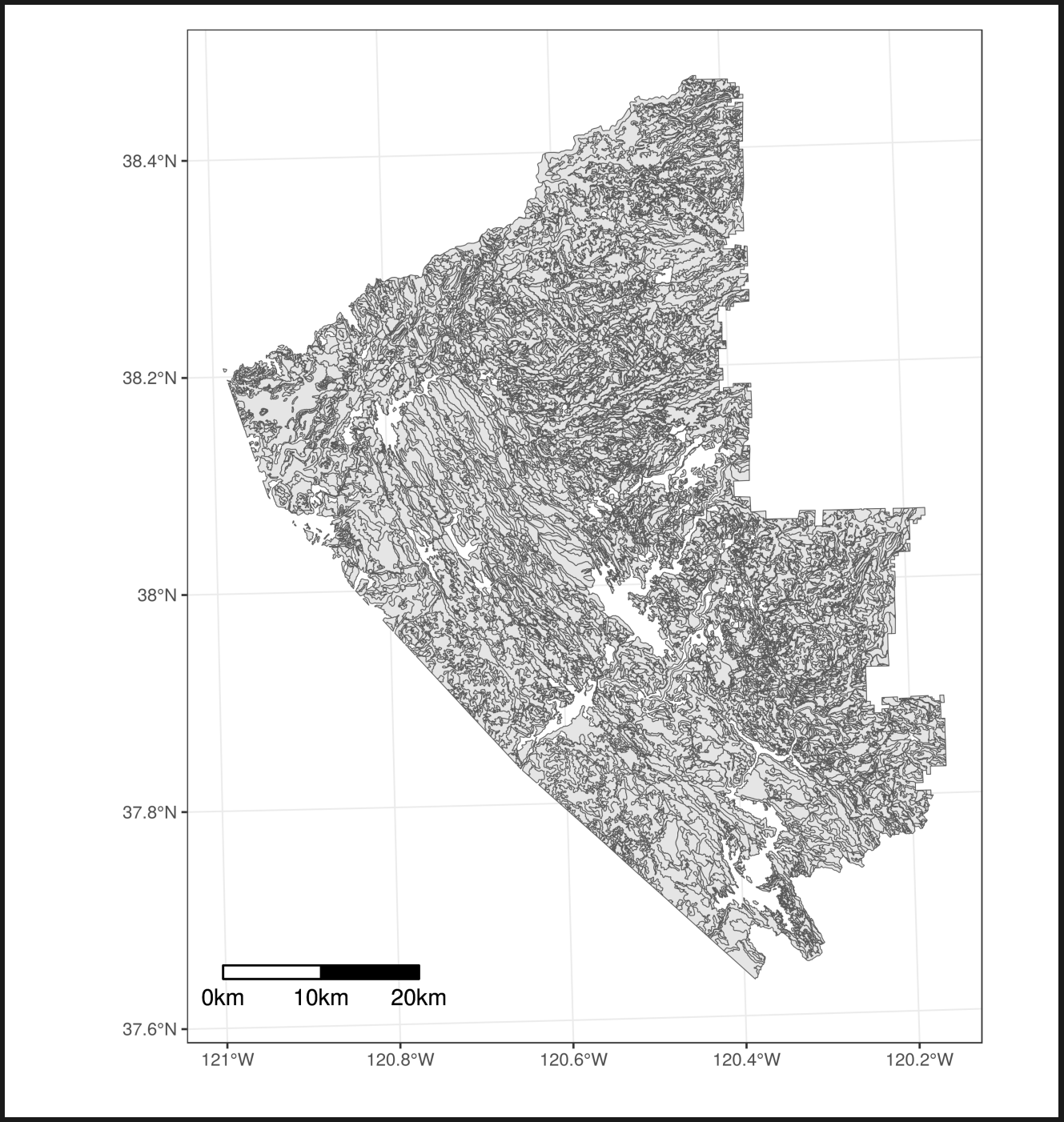

D
B
A
C

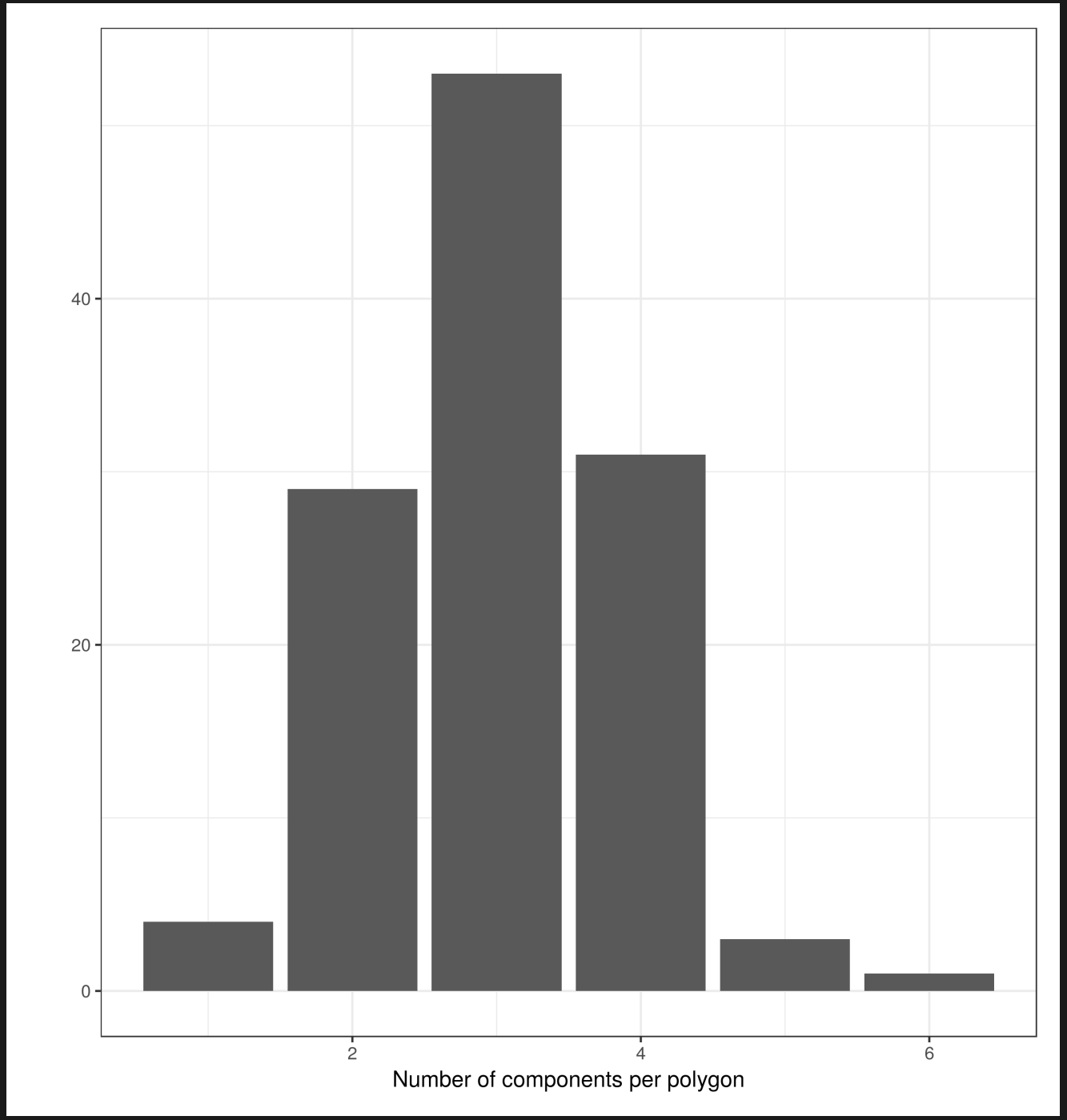

D
B
A
C


D
B
A
C

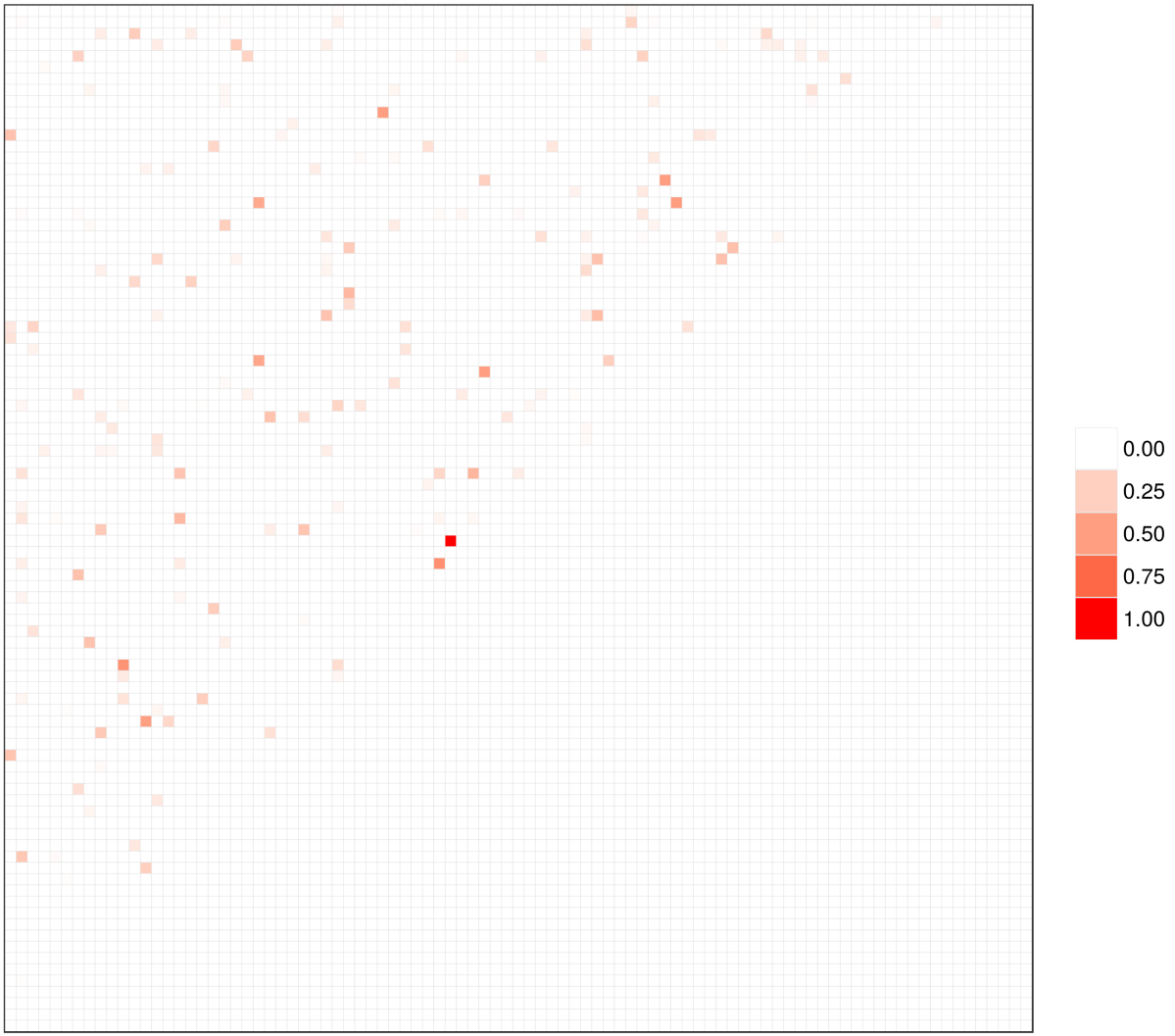
structure of networks
can help us
gain insight from data

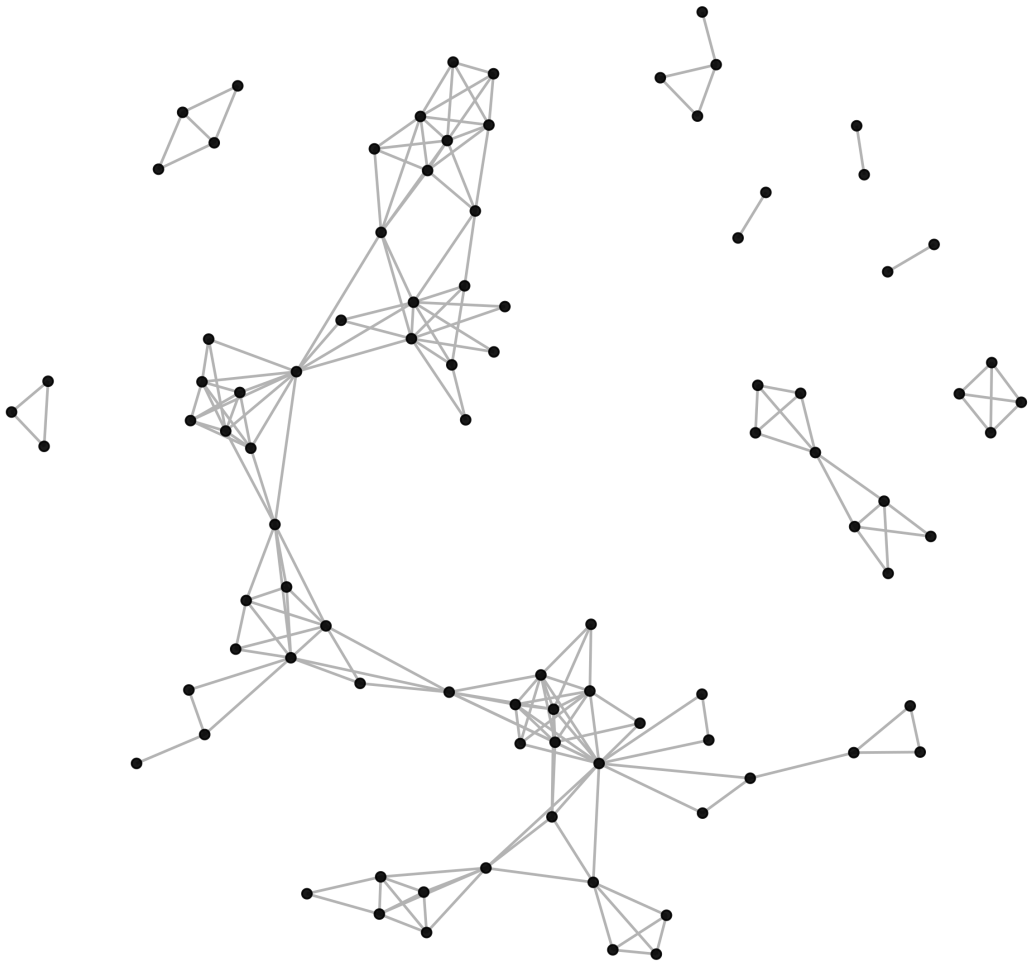

Tahoe National Forest
Humboldt-Toiyabe National Forest
Yuba City
Carson City
South Lake Tahoe
Yerington
Roseville
Placerville
Eldorado National Forest
Folsom
Kirkwood
Sacramento
Elk Grove
Vacaville
Stanislaus National Forest
Bridgeport
Concord
Stockton
Sonora
Lee Vining
Tuolumne
Yosemite National Park
Manteca
Oakdale
June Lake
Modesto
Yosemite Valley
Mammoth Lakes
Turlock
Mariposa
Fish Camp
Palo Alto
San Jose
Oakhurst
Sierra National Forest
Merced
Chowchilla
Los Banos
Madera
Gilroy
Hollister
Mendota
Fresno
Salinas
Grant Grove
Google
Map data ©2017 Google
39.0
38.5
38.0
37.5
37.0
lat
-122
-121
-120
-119
lon

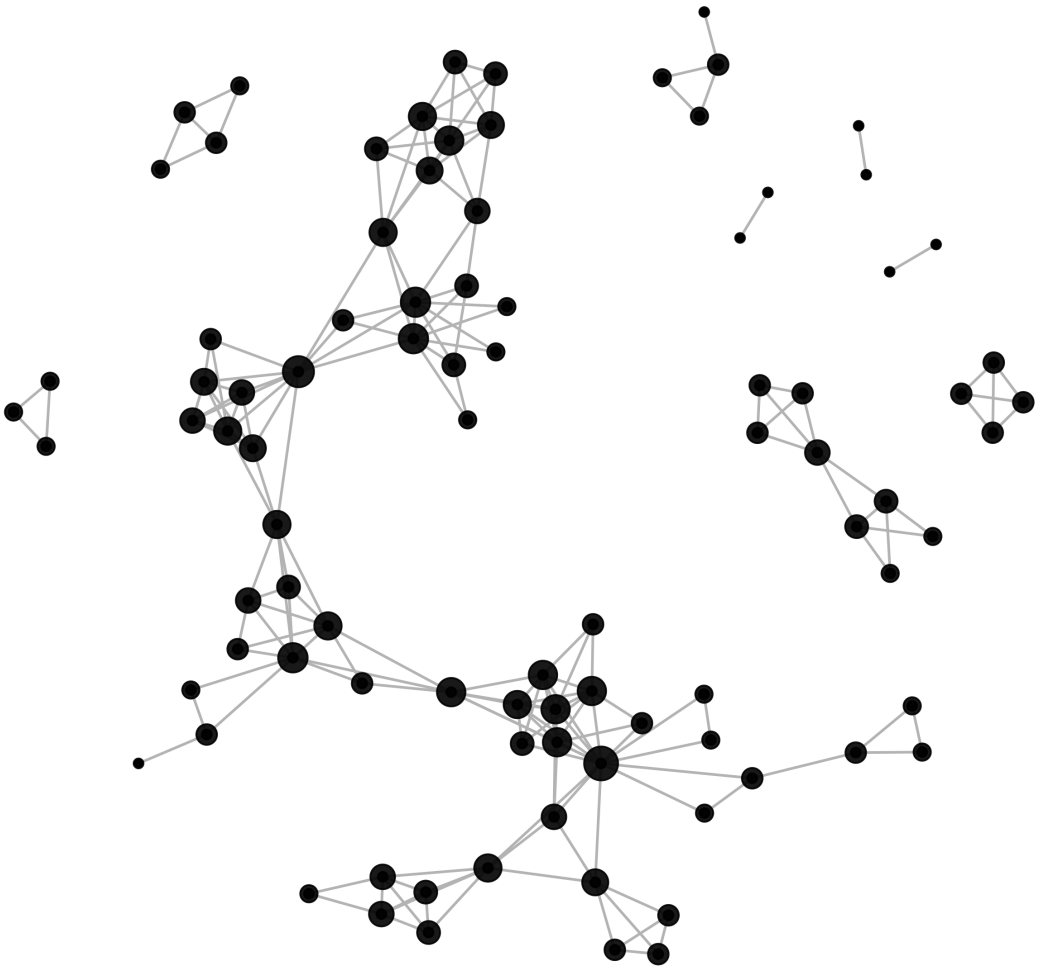

38.4°N
38.2°N
38°N
37.8°N
37.6°N
121°W
120.8°W
120.6°W
120.4°W
120.2°W
0km
10km
20km

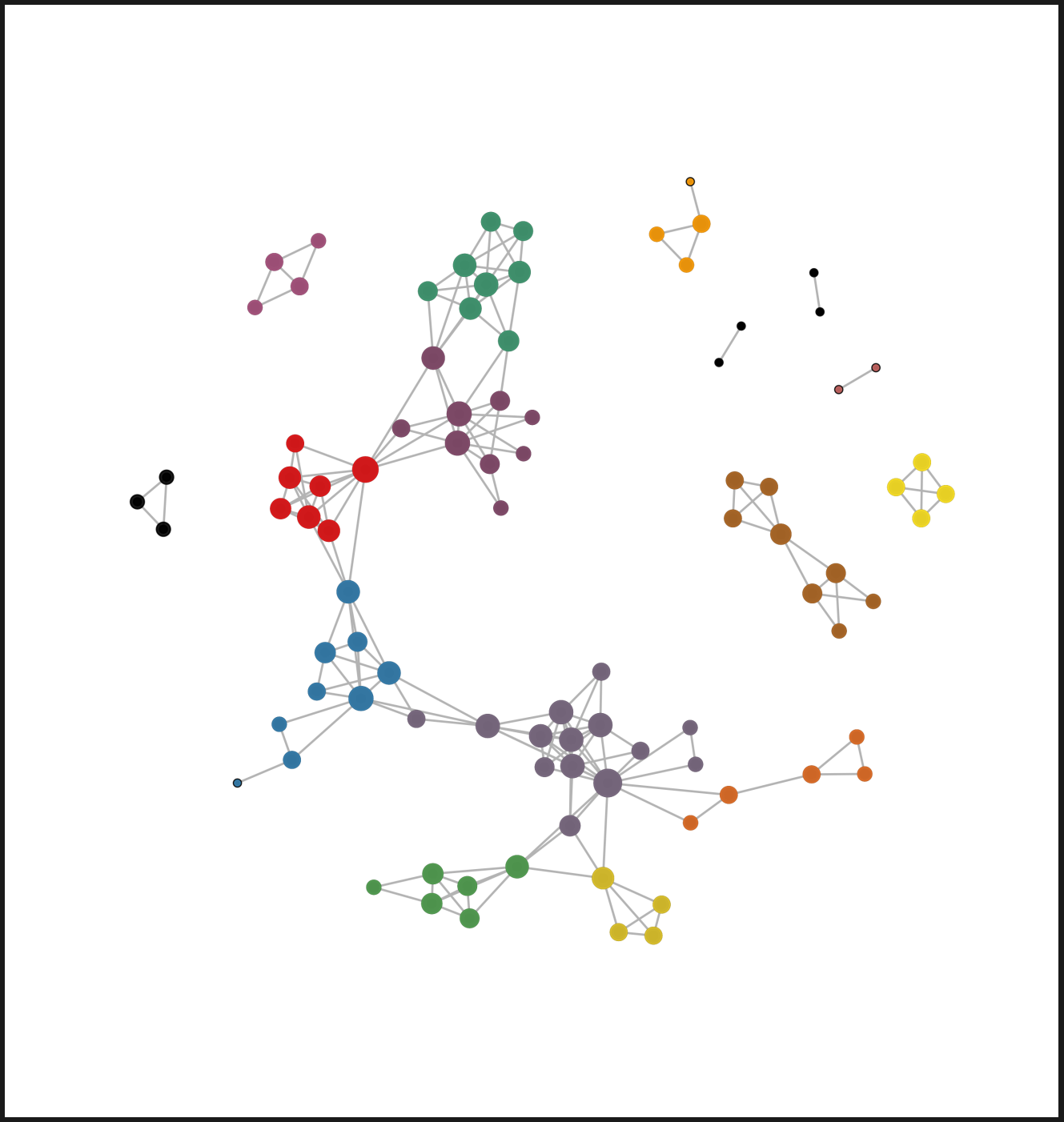

40
20
0
2
4
6
Number of components per polygon

Co-occurence probability matrix

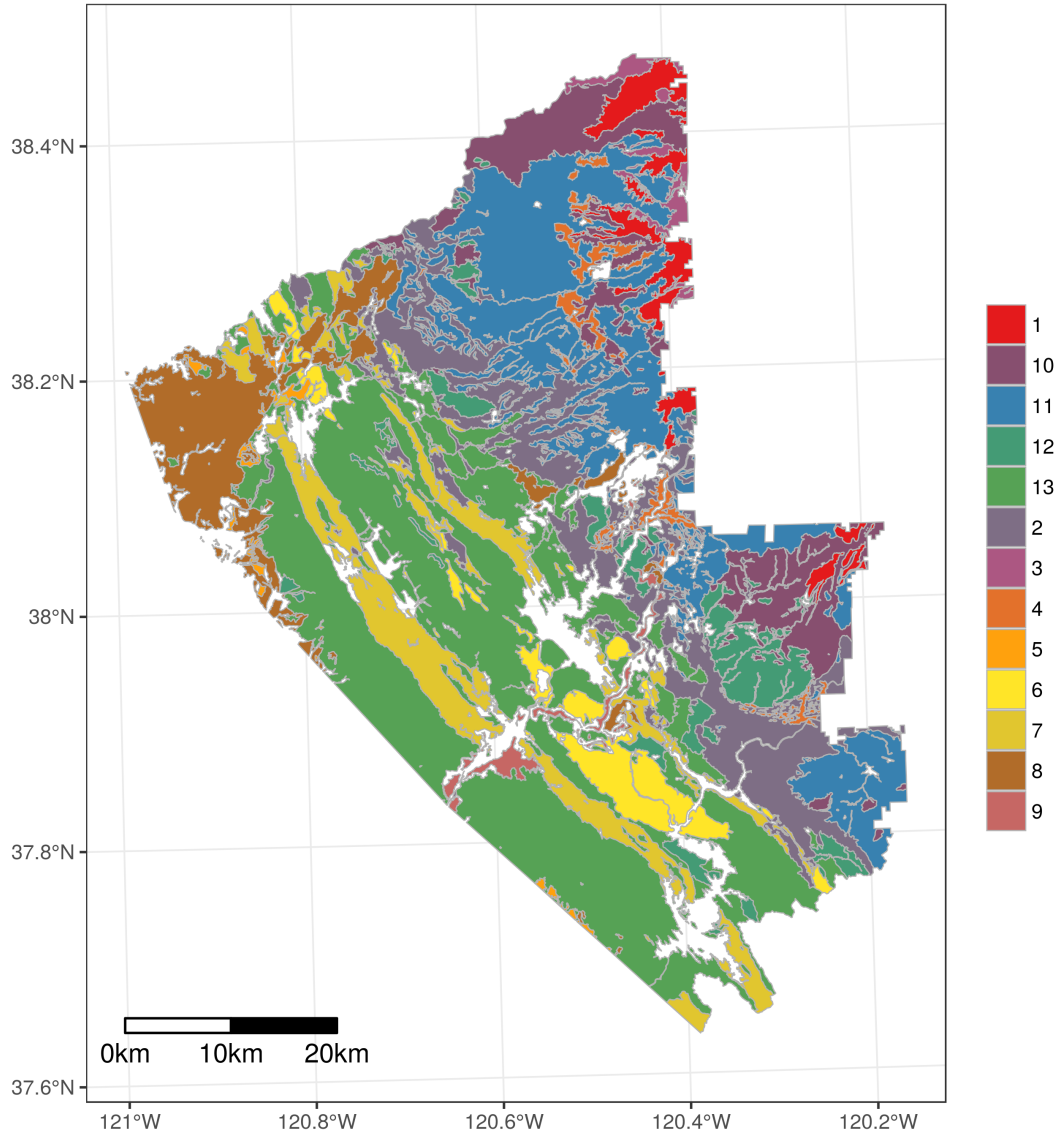




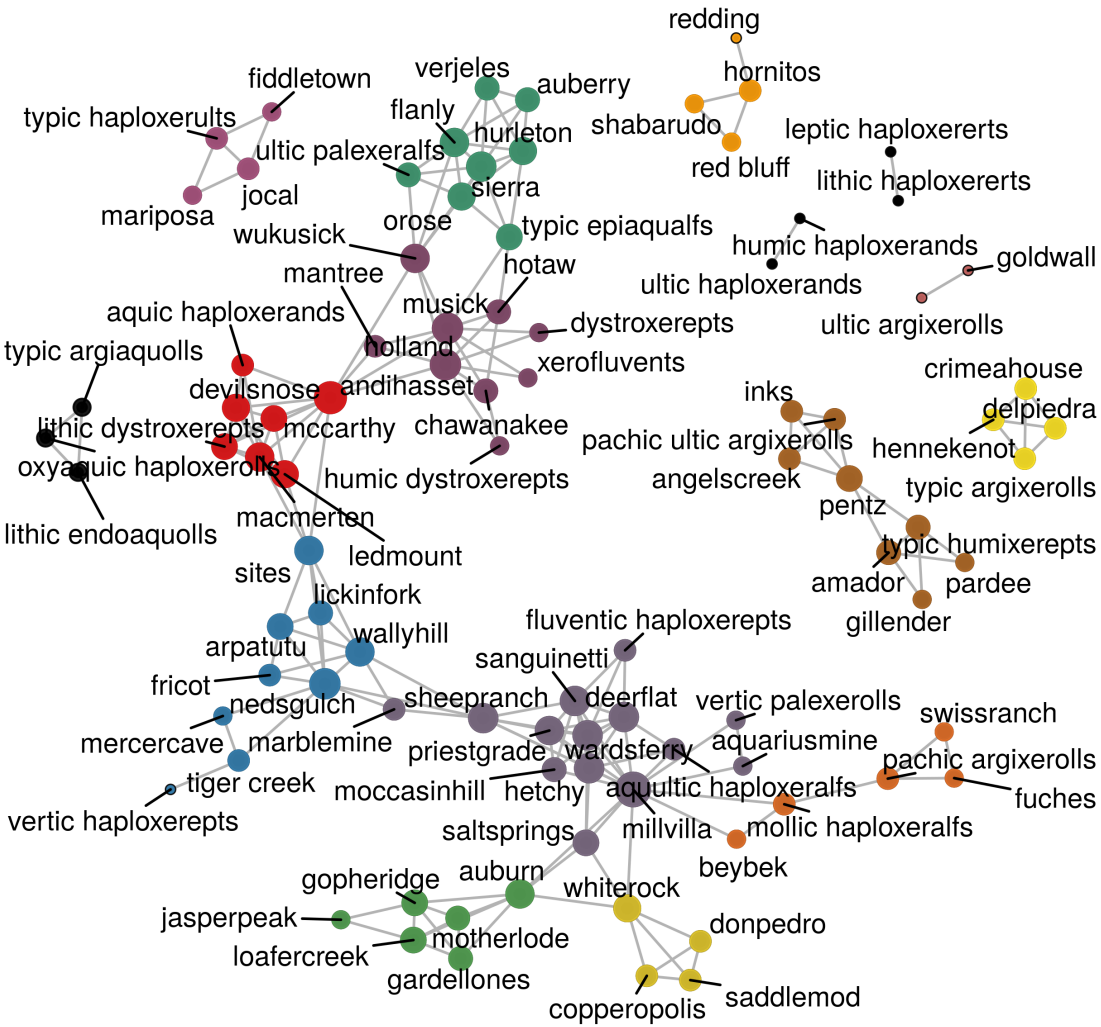


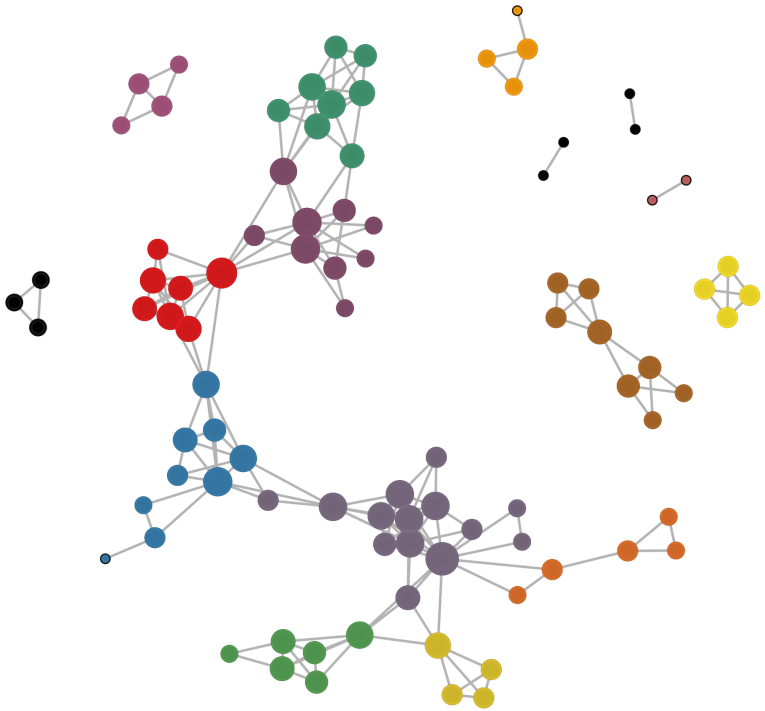


map communities
back in
geographical space

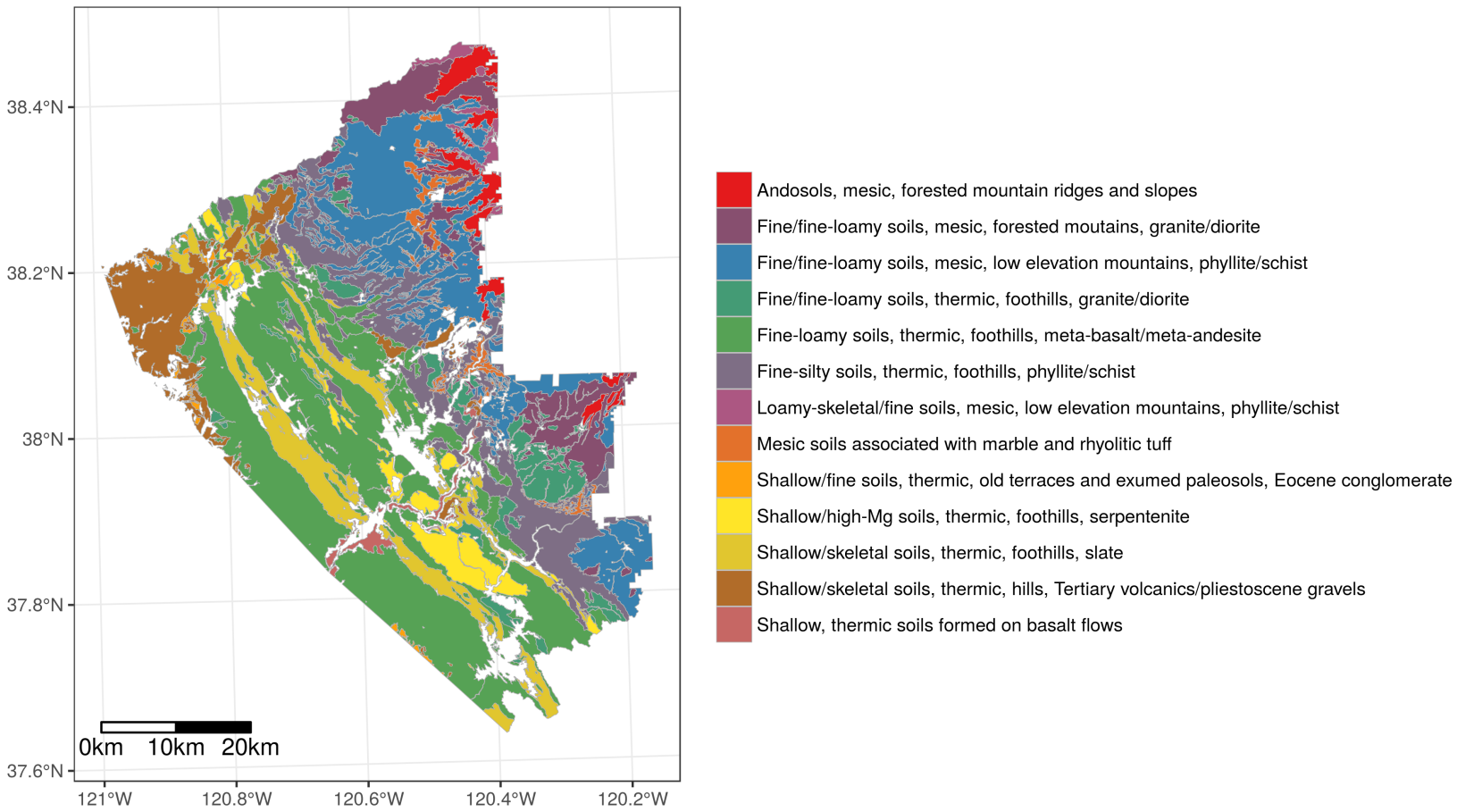

38.4°N
38.2°N
38°N
37.8°N
37.6°N
121°W
120.8°W
120.6°W
120.4°W
120.2°W
0km
10km
20km
1
10
11
12
13
2
3
4
5
6
7
8
9

expert interpretation
of the
communities


redding
hornitos
shabarudo
red bluff
leptic haploxererts
lithic haploxererts
humic haploxerands
goldwall
ultic haploxerands
ultic argixerolls
fiddletown
typic haploxerults
ultic palexeralfs
jocal
mariposa
verjeles
auberry
flanly
hurleton
sierra
orose
typic epiaqualfs
wukusick
hotaw
mantree
musick
dystroxerepts
xerofluvents
holland
andihasset
chawanakee
aquic haploxerands
typic argiaquolls
devilsnose
lithic dystroxerepts
mccarthy
oxyaquic haploxerolls
humic dystroxerepts
macmerten
ledmount
lithic endoaquolls
sites
lickinfork
wallyhill
arpatutu
fricot
nedsgulch
mercercave
marblemine
tiger creek
vertic haploxerepts
crimeahouse
delpiedra
inks
pachic ultic argixerolls
hennekenot
angelscreek
typic argixerolls
pentz
typic humixerepts
amador
pardee
gillender
fluventic haploxerepts
sanguinetti
deerflat
sheepranch
vertic palexerolls
swissranch
aquariusmine
priestgrade
wardsferry
pachic argixerolls
moccasinhill
hetchy
aquultic haploxeralfs
fuches
saltsprings
millvilla
mollic haploxeralfs
beybek
auburn
whiterock
gopheridge
jasperpeak
motherlode
loafercreek
gardellones
donpedro
copperopolis
saddlemod



- Andosols, mesic, forested mountain ridges and slopes
- Fine/fine-loamy soils, mesic, forested moutains, granite/diorite
- Fine/fine-loamy soils, mesic, low elevation mountains, phyllite/schist
- Fine/fine-loamy soils, thermic, foothills, granite/diorite
- Fine-loamy soils, thermic, foothills, meta-basalt/meta-andesite
- Fine-silty soils, thermic, foothills, phyllite/schist
- Loamy-skeletal/fine soils, mesic, low elevation mountains, phyllite/schist
- Mesic soils associated with marble and rhyolitic tuff
- Shallow/fine soils, thermic, old terraces and exumed paleosols, Eocene conglomerate
- Shallow/high-Mg soils, thermic, foothills, serpentenite
- Shallow/skeletal soils, thermic, foothills, slate
- Shallow/skeletal soils, thermic, hills, Tertiary volcanics/pliestoscene gravels
- Shallow, thermic soils formed on basalt flows
- NA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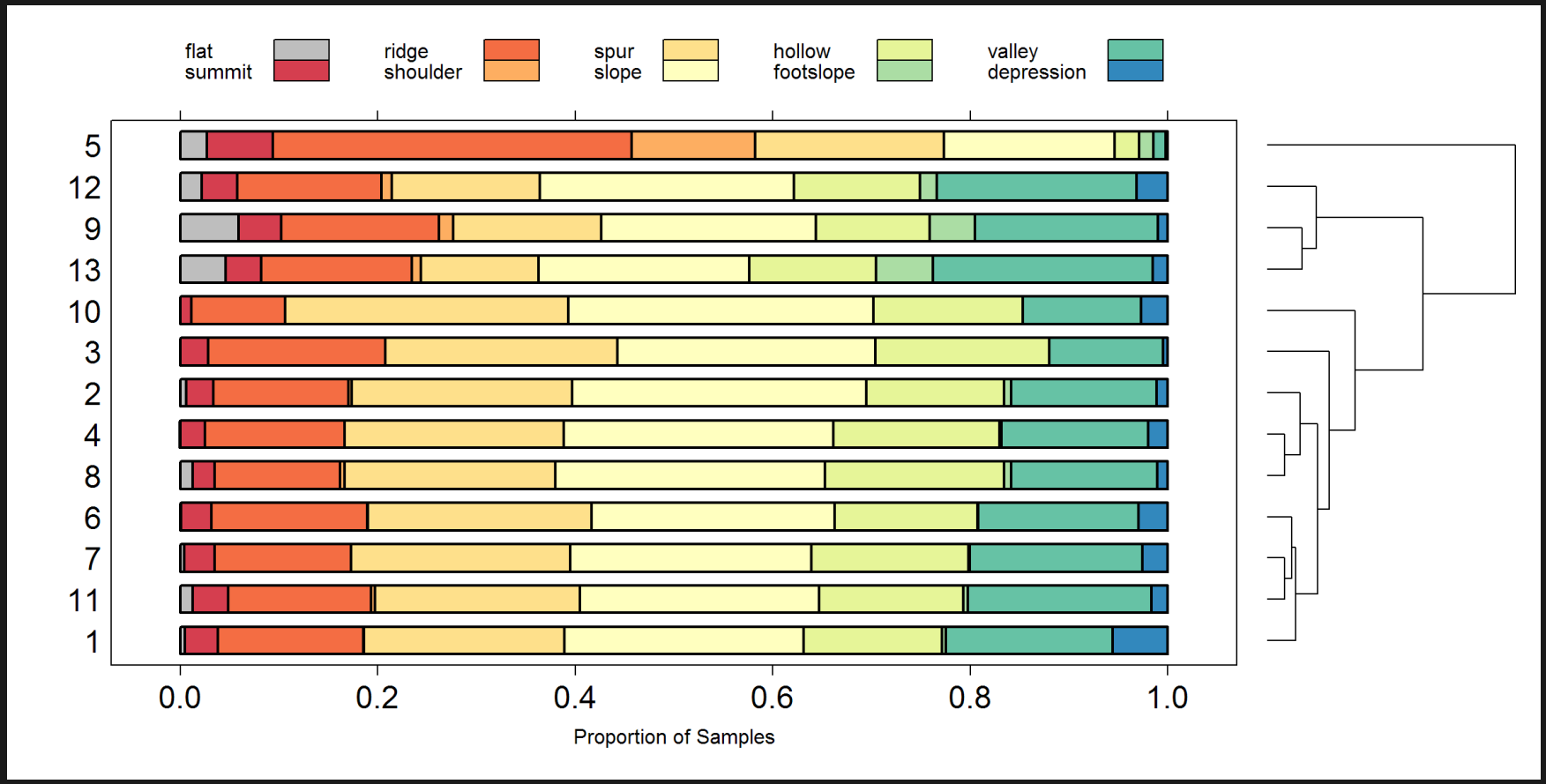
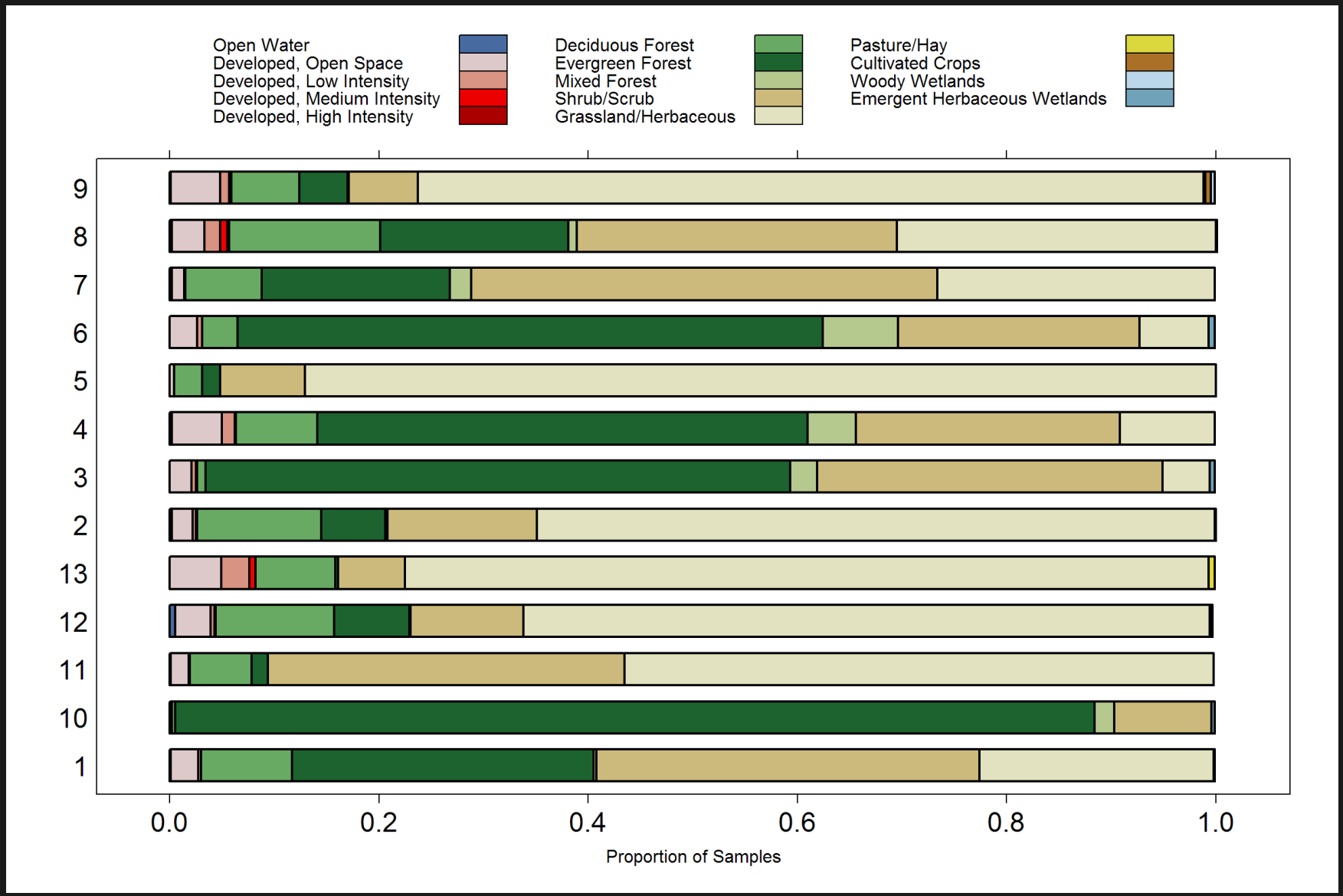
Shallow, thermic soils formed on basalt flows

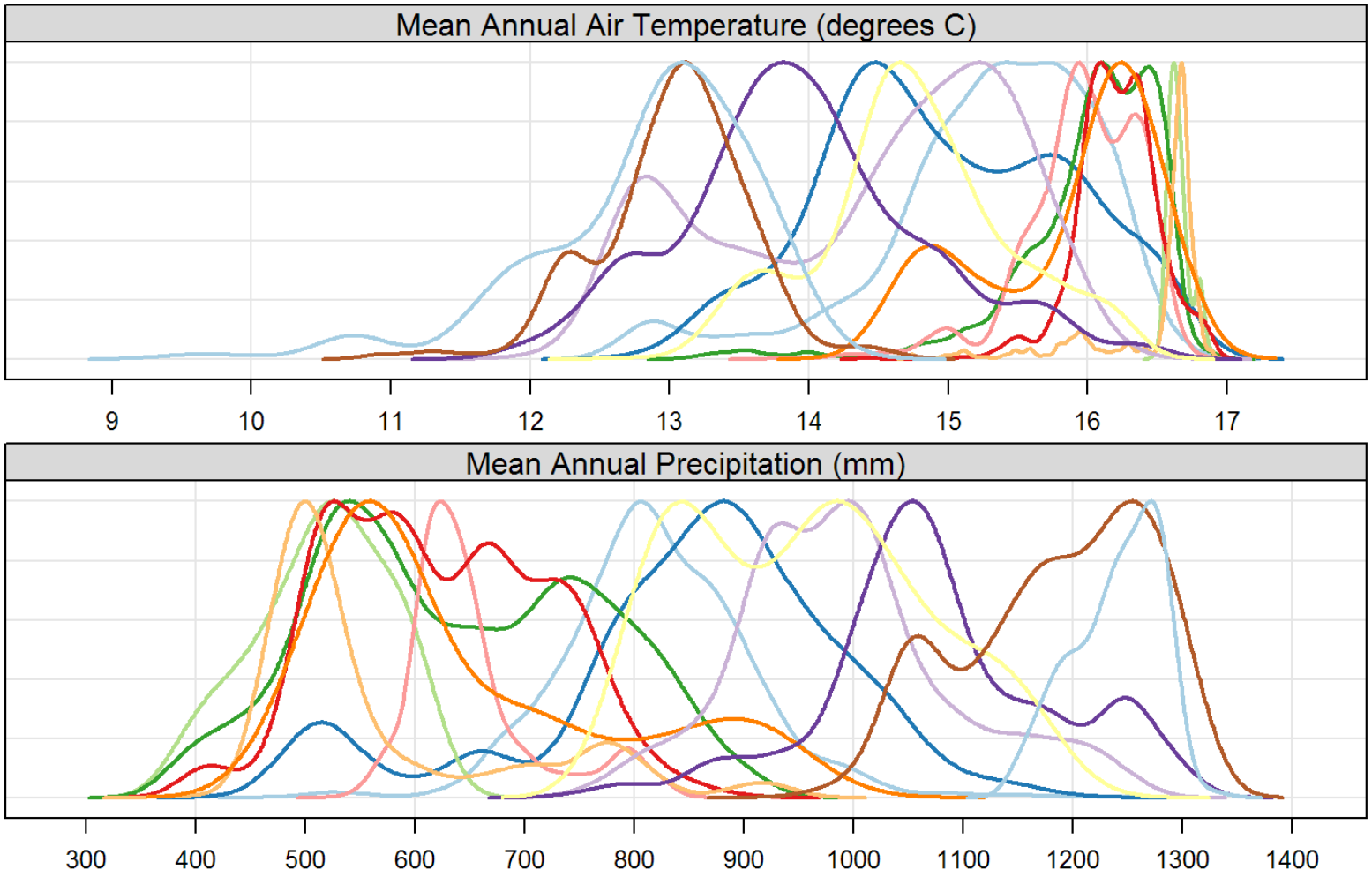
relationship to
soil forming
factors



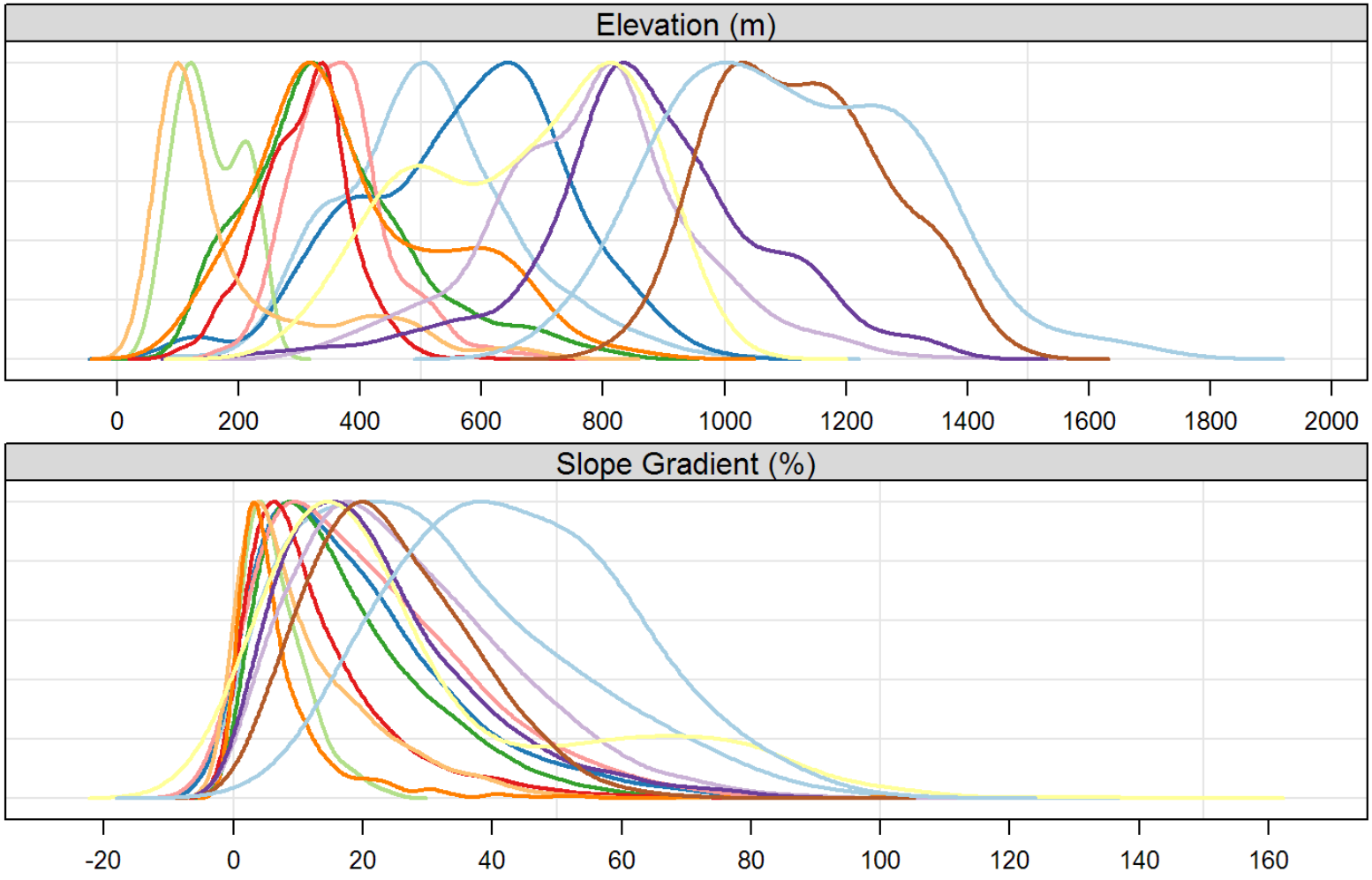
geomorphology


Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Grassland/Herbaceous
Pasture/Hay
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands
9
8
7
6
5
4
3
2
13
12
11
10
1
0.0
0.2
0.4
0.6
0.8
1.0
Proportion of Samples

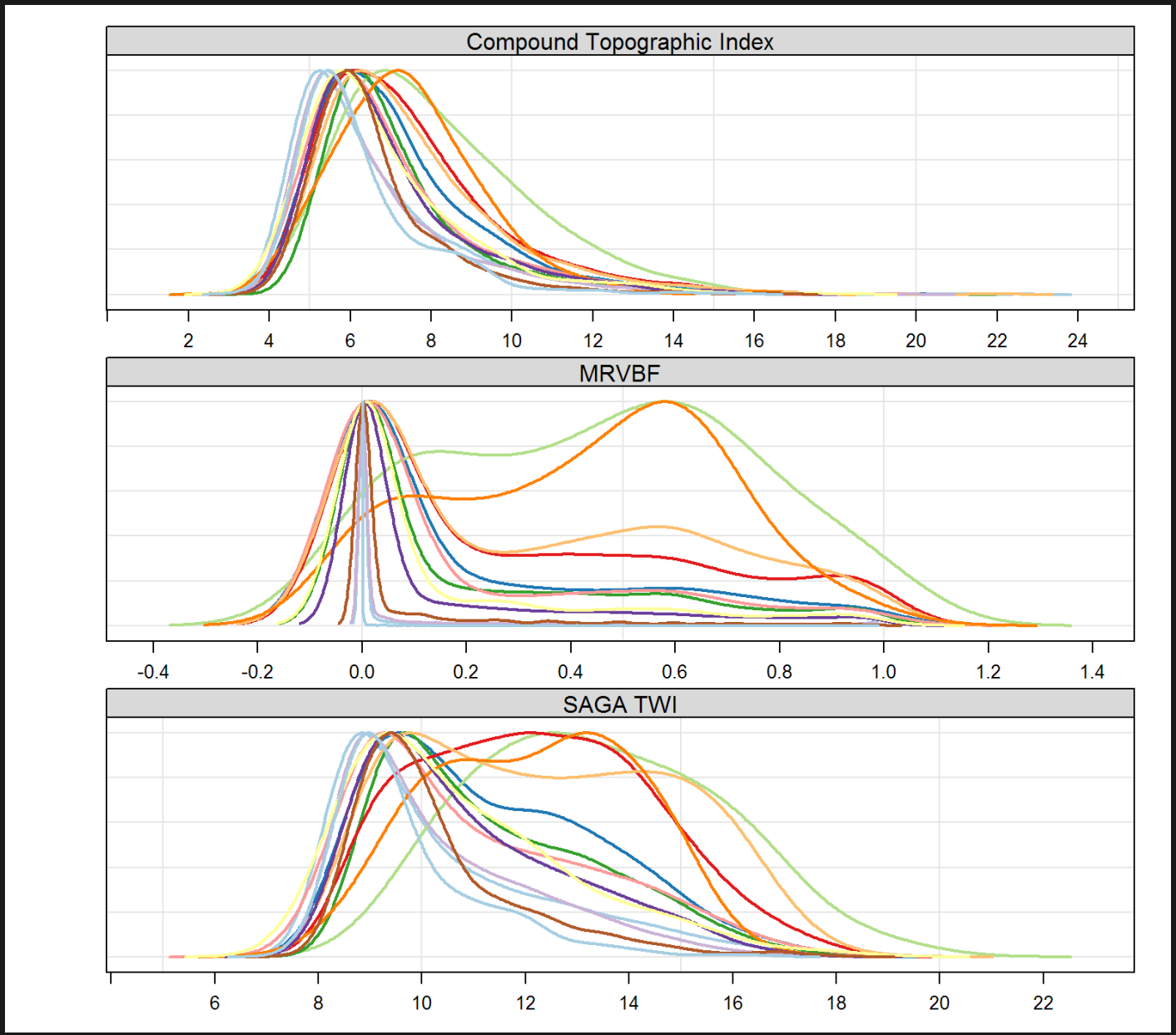
land cover


Mean Annual Air Temperature (degrees C)
9
10
11
12
13
14
15
16
17
Mean Annual Precipitation (mm)
300
400
500
600
700
800
900
1000
1100
1200
1300
1400

climate



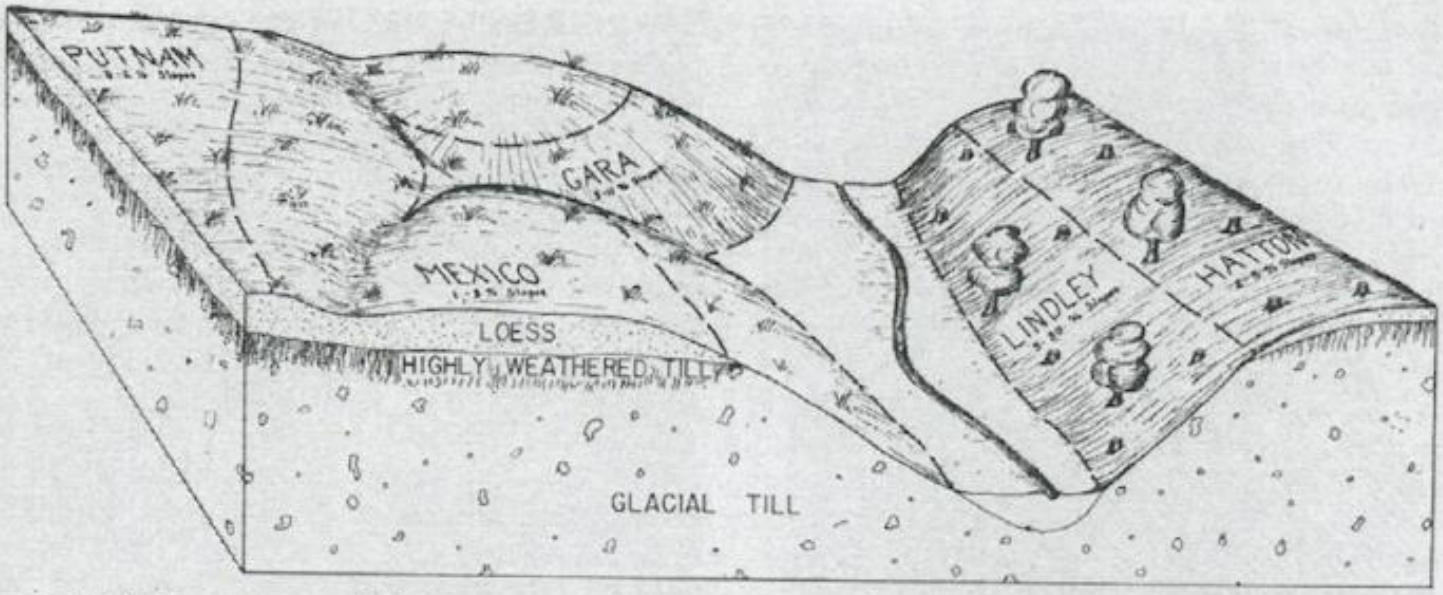
terrain derivatives



more terrain derivatives

...from Murray Lark's keynote:

> *"The purpose of computing is insight, not numbers"*
> *— R. Hamming*



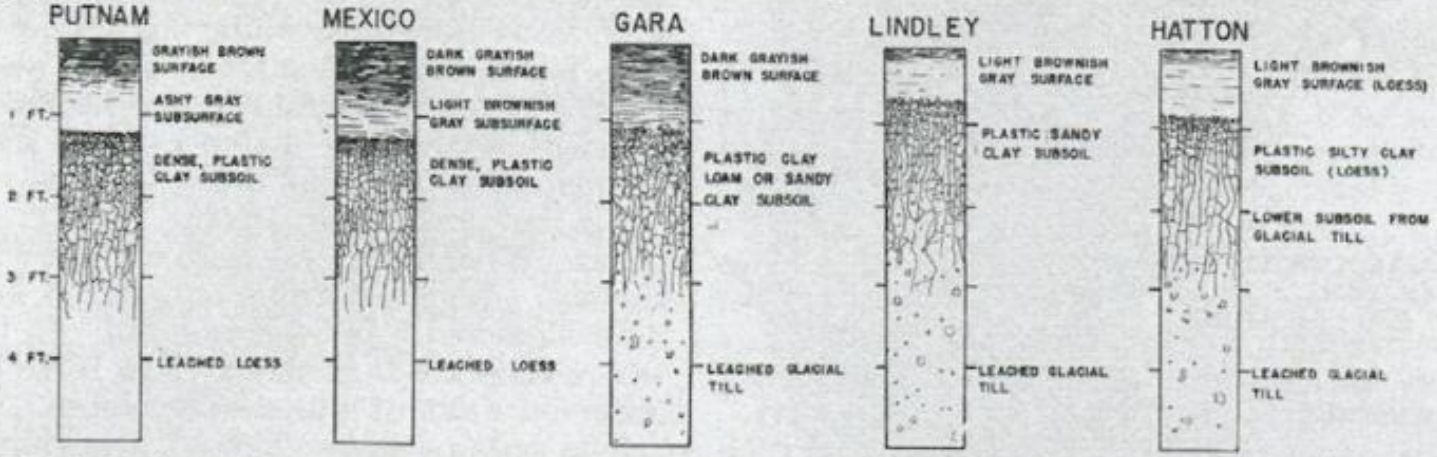


Figure 10.—**Relationship of some of the soils of the uplands to parent material, slope, and native vegetation.**

*“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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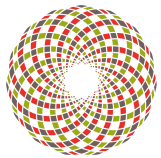
Manaaki Whenua



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