

Ecology as a management tool

Environmental Managers Association of BC

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Methods and Statistics Canada

Environmental Services
Quality Management



Date

We are not entering the data age. **We are in it.**



How does your business work?




7.9

6,320

4,727,897

BIG DATA



Data has no value **unless** it is
seen and understood.



Social ecology

“Peter F. Drucker ... a self-described ‘social ecologist,’ who explored the way human beings organize themselves and interact much the way an ecologist would observe and analyze the biological world.”

From the eulogy of Peter F. Drucker (1909–2005)



How a snail told me everything
I need to know about data science.



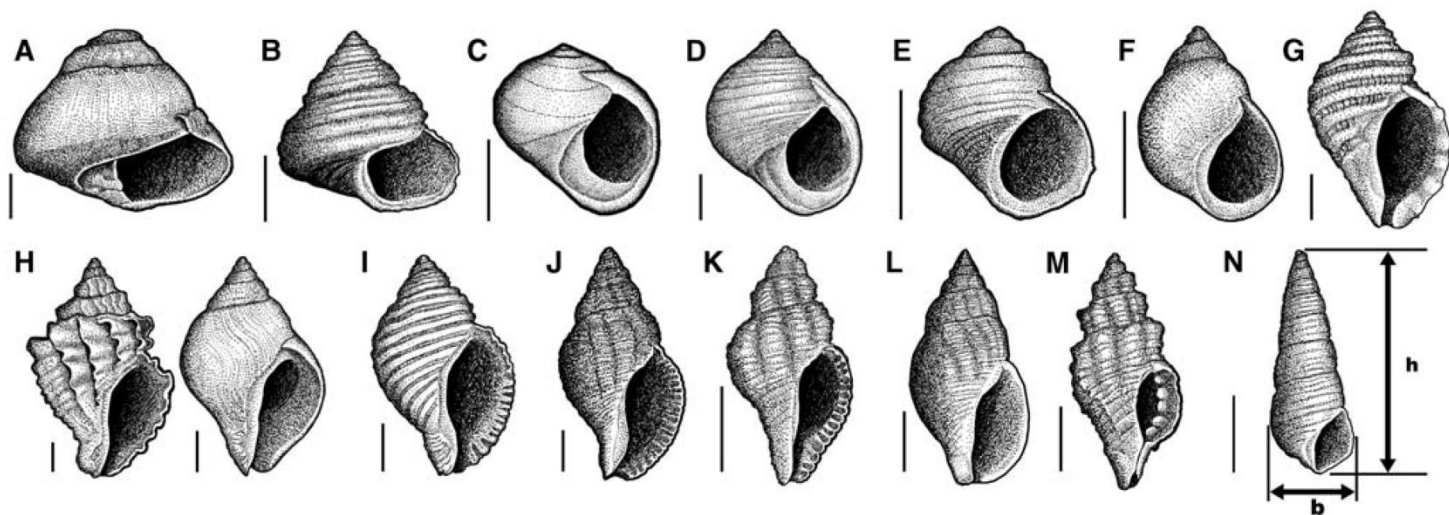


Figure 1. Line drawings of the intertidal gastropods used in this study, in order of increasing shell elongation. **A.** *Tegula funebris*. **B.** *Calliostoma canaliculatum*. **C.** *Littorina obtusata*. **D.** *Littorina littorea*. **E.** *Littorina sitkana*. **F.** *Littorina scutulata*. **G.** *Nucella osterina*. **H.** *Nucella lamellosa* (a sculptured morph and a smooth morph). **I.** *Nucella canaliculata*. **J.** *Lirabuccinum dirum*. **K.** *Ocenebrina lurida*. **L.** *Amphissa columbiana*. **M.** *Ocenebrina interfossa*. **N.** *Bittium eschrichtii*, showing measurement of shell height and breadth. Scale bars = 5 mm.

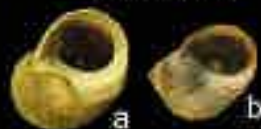
Table 1. Summary of regression lines, describing the relationship between shell elongation (height/breadth) and angular retraction (y = angular retraction; x = shell elongation).

Group analysis	Family	n	Equation (slope) x + (intercept)	R^2	P	Shape (sum variance)
Within species (no. of populations)						
<i>Amphissa columbiana</i> (1)	Columbellidae	13	$(65.79)x + (25.60)$	0.308	0.05	2.08×10^{-3}
<i>Bittium eschrichtii</i> (2)	Cerithidae	40	$(-0.35)x + (198.19)$	<0.001	0.98	1.87×10^{-3}
<i>Calliostoma canaliculatum</i> (1)	Calliostomatidae	20	$(-44.63)x + (181.69)$	0.055	0.32	0.55×10^{-3}
<i>Littorina scutulata</i> (2)	Littorinidae	40	$(33.23)x + (74.55)$	0.170	0.008*	1.56×10^{-3}
<i>Littorina sitkana</i> (2)	Littorinidae	35	$(-38.10)x + (172.26)$	0.067	0.13	0.74×10^{-3}
<i>Littorina obtusata</i> (1)	Littorinidae	24	$(30.56)x + (97.77)$	0.005	0.73	n/a
<i>Littorina littorea</i> (1)	Littorinidae	24	$(-73.03)x + (219.60)$	0.060	0.25	n/a
<i>Lirabuccinum dirum</i> (3)	Buccinidae	42	$(58.30)x + (34.73)$	0.089	0.06	1.29×10^{-3}
<i>Nucella canaliculata</i> (2)	Muricidae	40	$(-46.39)x + (186.57)$	0.057	0.14	0.65×10^{-3}
<i>Nucella lamellosa</i> (3)	Muricidae	60	$(54.53)x + (67.82)$	0.135	0.004*	3.40×10^{-3}
<i>Nucella ostrina</i> (4)	Muricidae	62	$(34.87)x + (45.20)$	0.022	0.25	0.97×10^{-3}
<i>Ocenebrina interfossa</i> (1)	Muricidae	20	$(-54.59)x + (302.88)$	0.190	0.06	2.49×10^{-3}
<i>Ocenebrina lurida</i> (1)	Muricidae	22	$(-5.40)x + (168.82)$	0.001	0.89	1.12×10^{-3}

GREENLAND



ICELAND



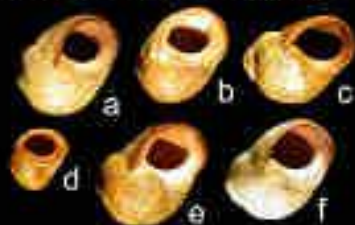
NORWAY



RUSSIA



BAY OF FUNDY, CANADA



WALES



IRELAND



GULF OF MAINE, USA



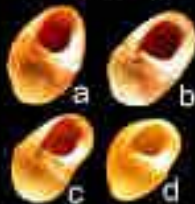
ENGLAND



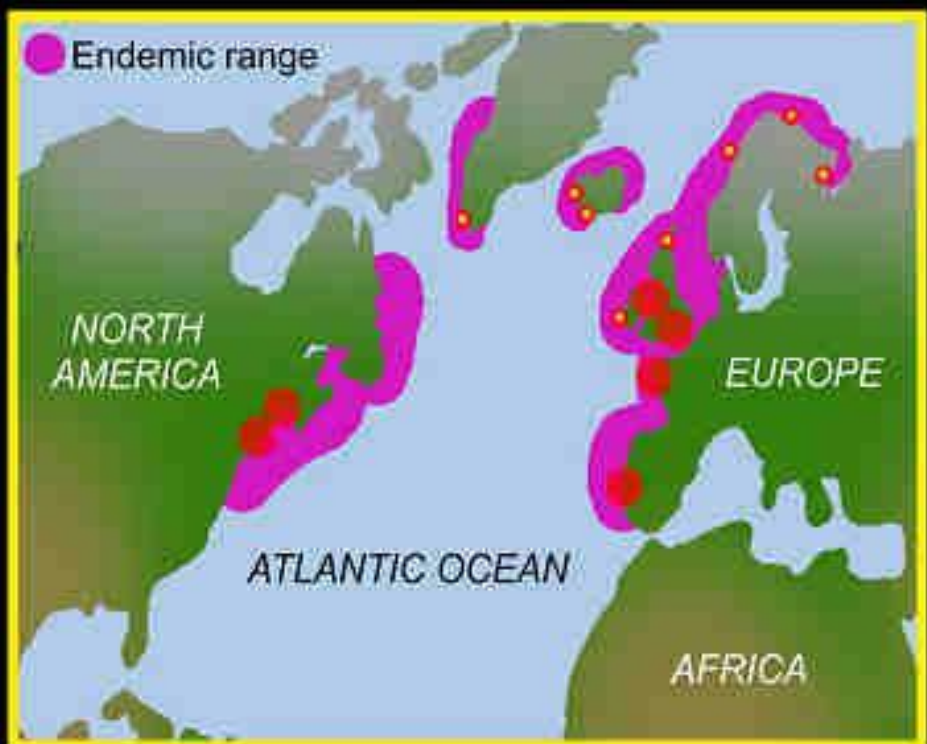
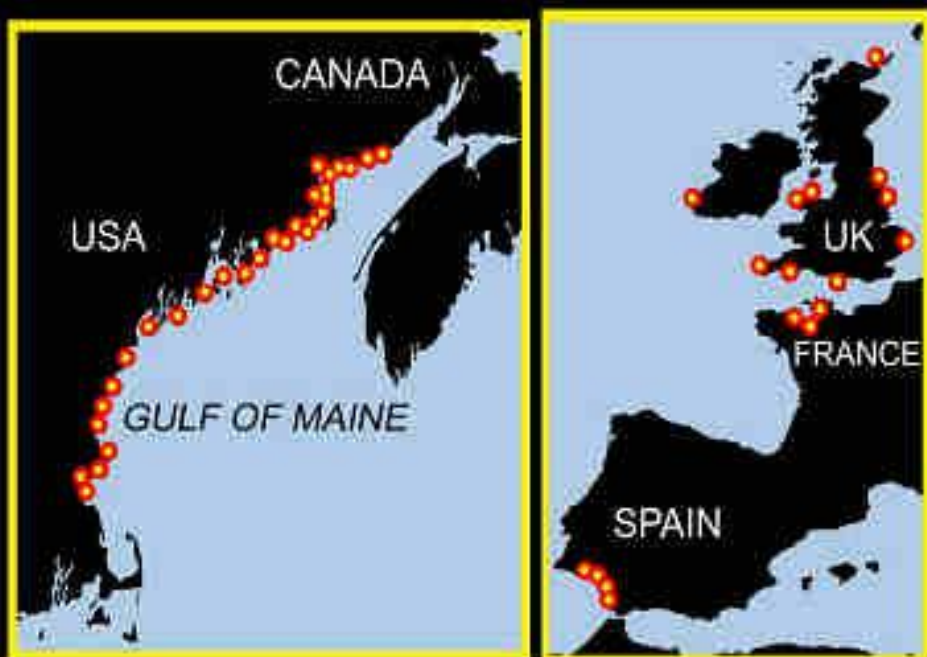
FRANCE



SPAIN



8 mm



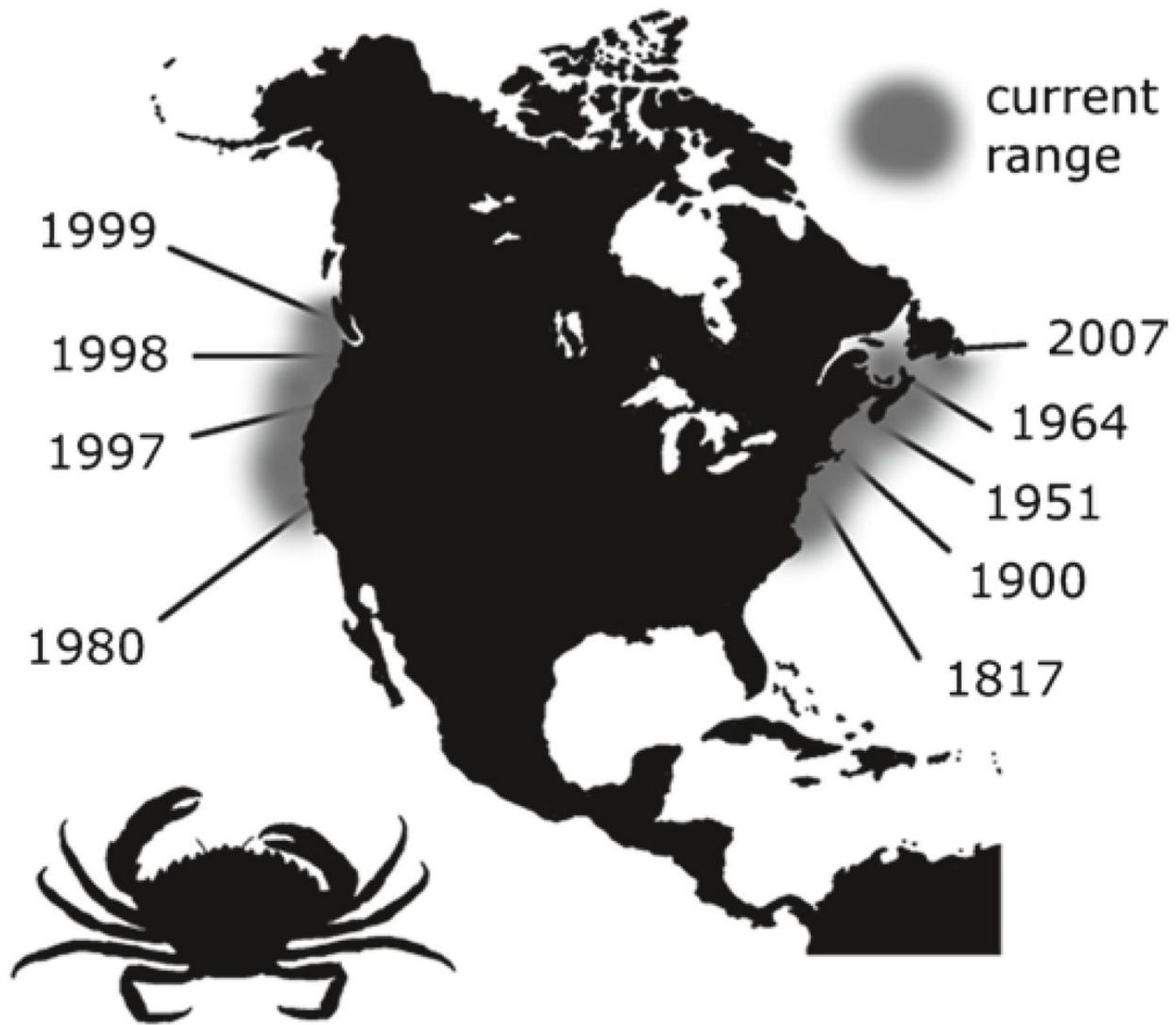
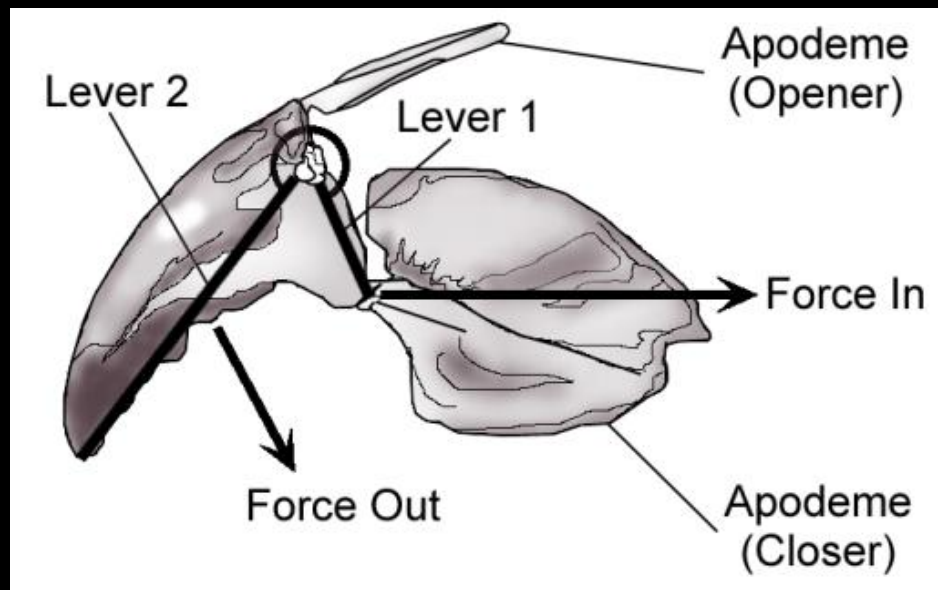
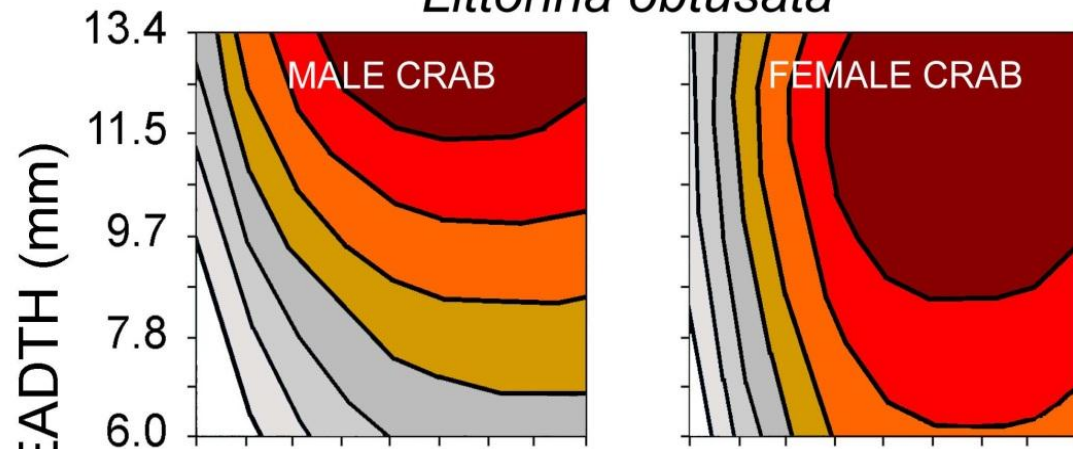


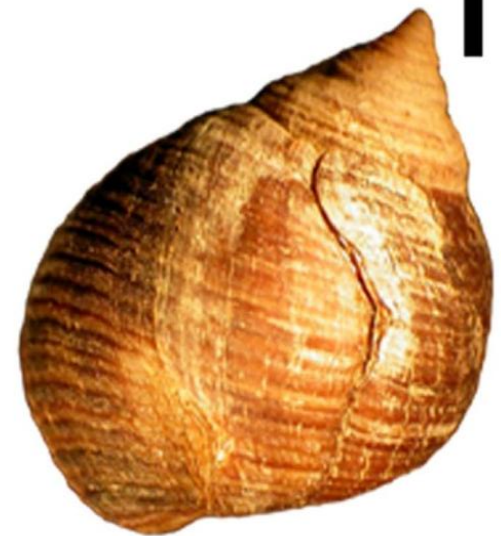
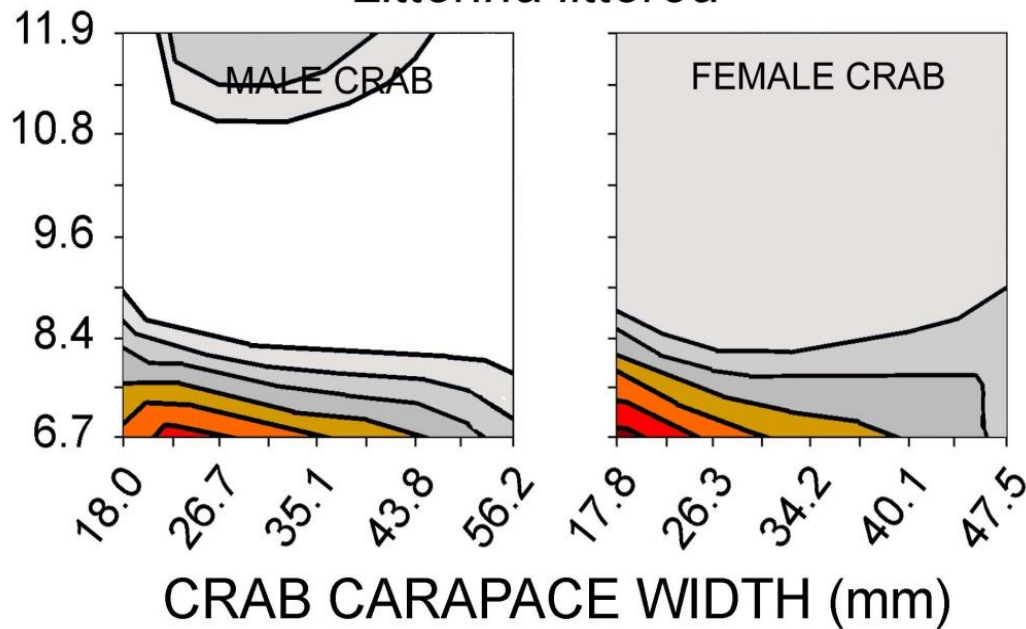
Fig. 1 Timeline of invasion: European green crab, *Carcinus maenas*, in North America



Littorina obtusata



Littorina littorea



Ecology 101 = Quality Management

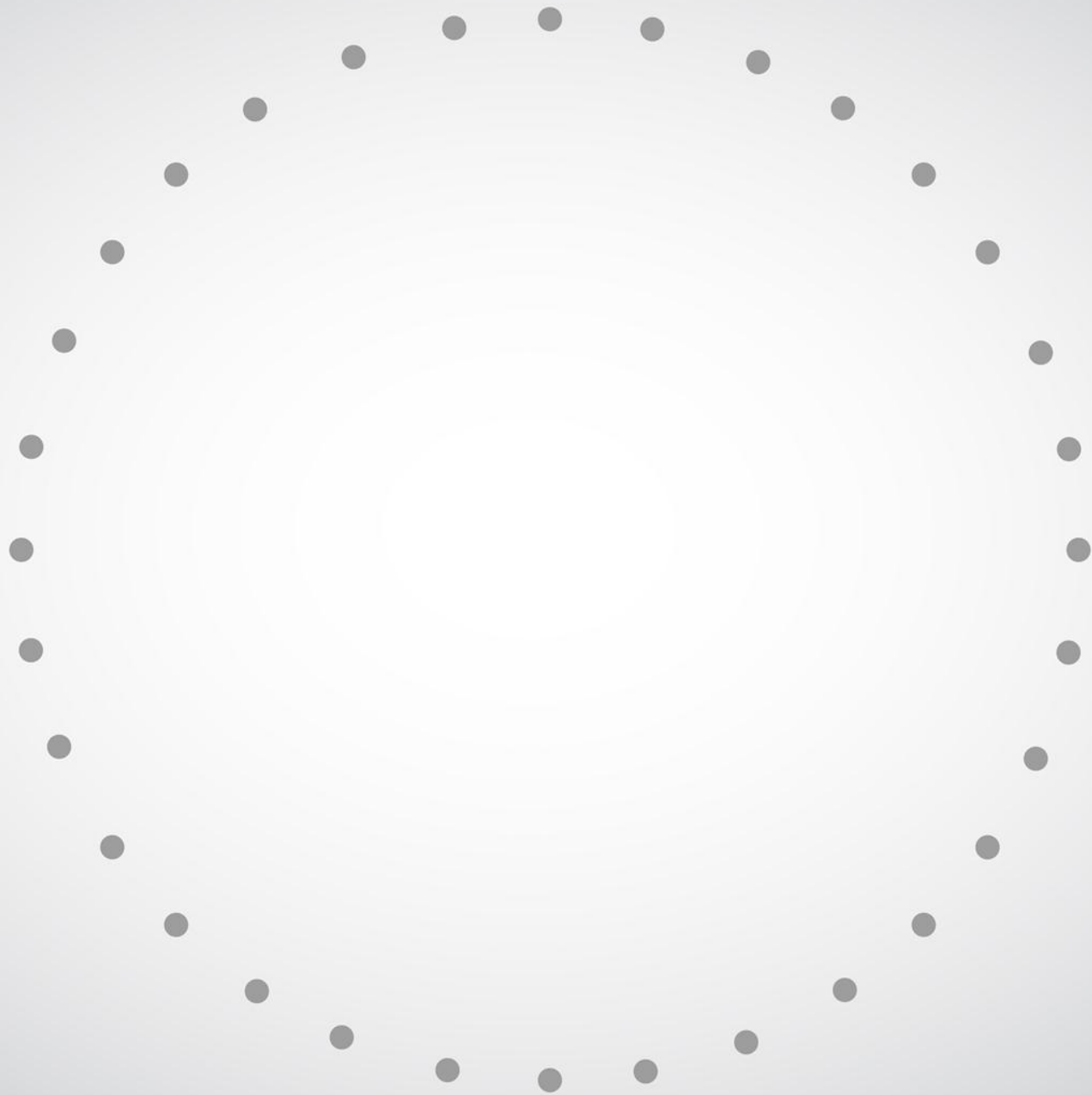
1. Ask a good question. Be specific.
2. Define your population. Be specific.
3. Collect data to answer the specific question.
4. Analyze data to identify factors with the most explanatory power. Avoid excess.

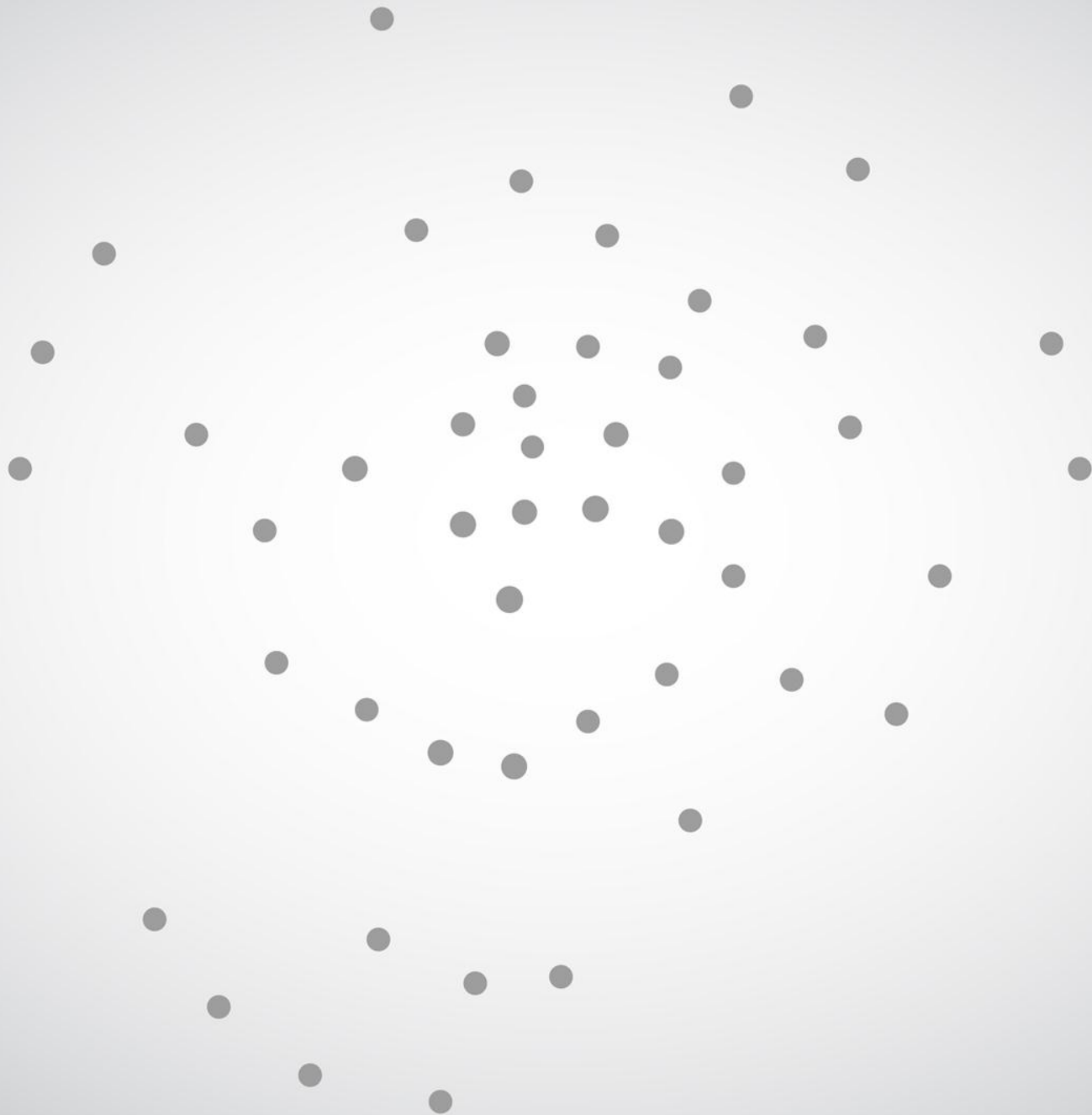


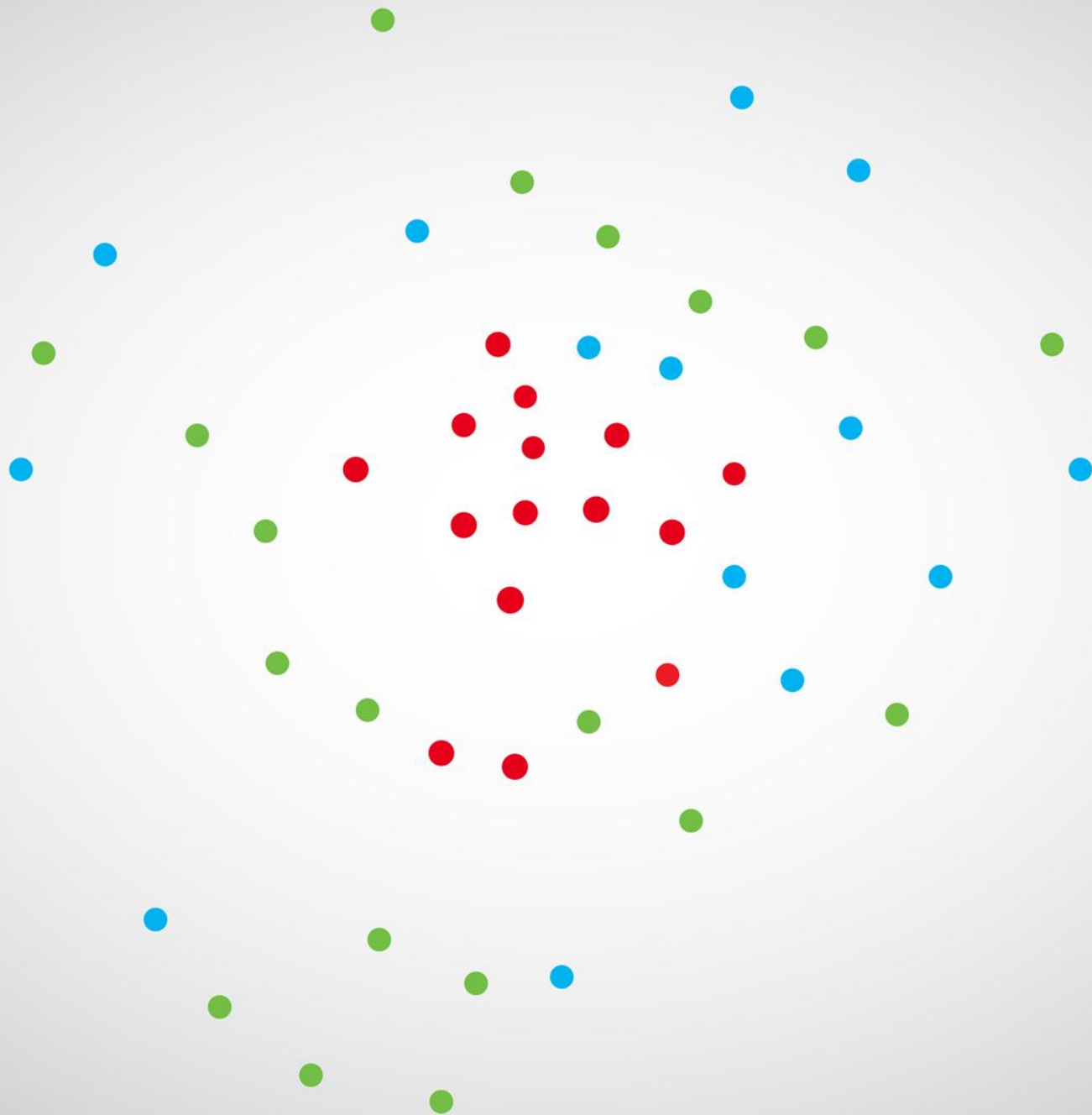


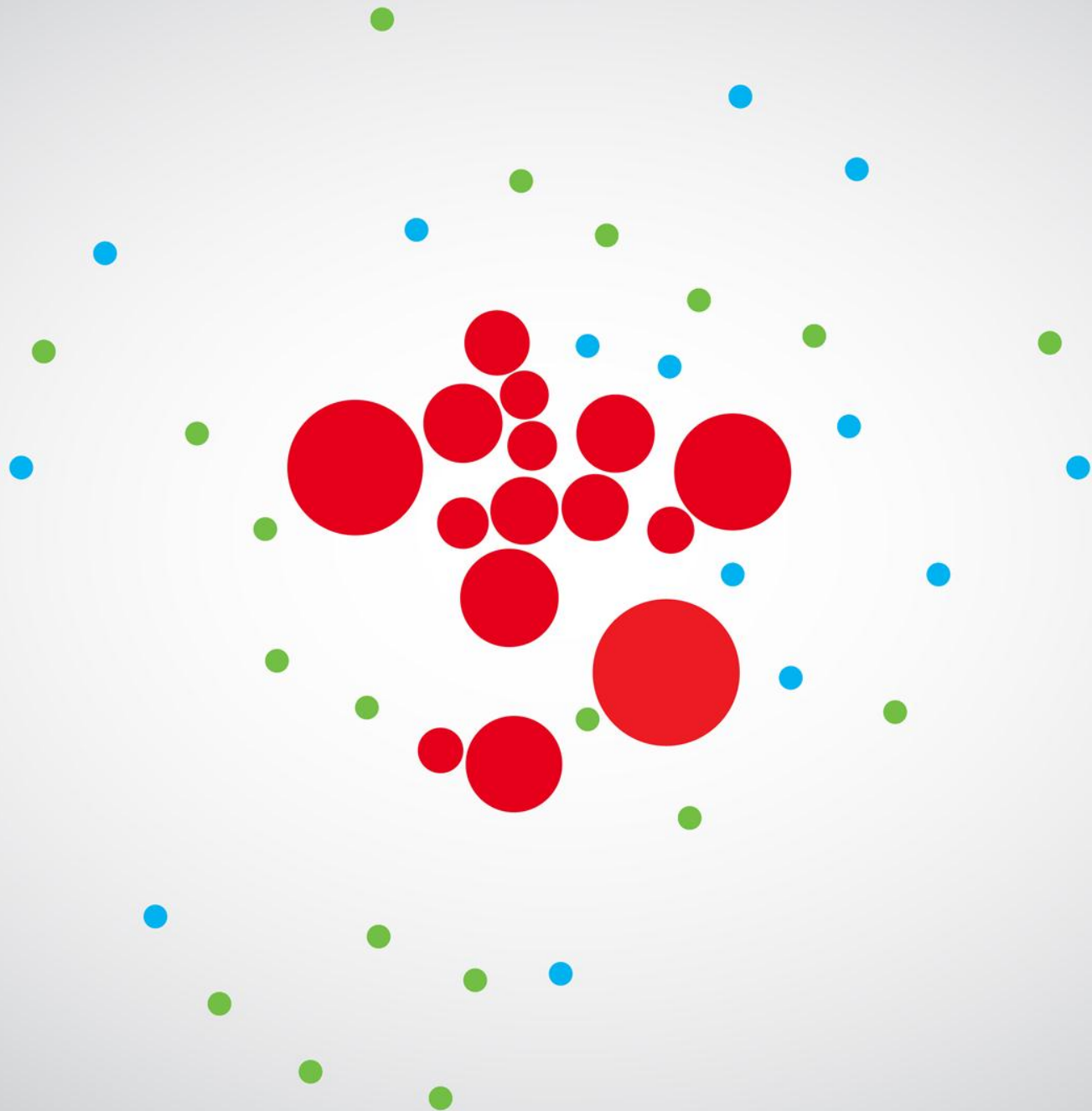
Ecology 101 for Managers

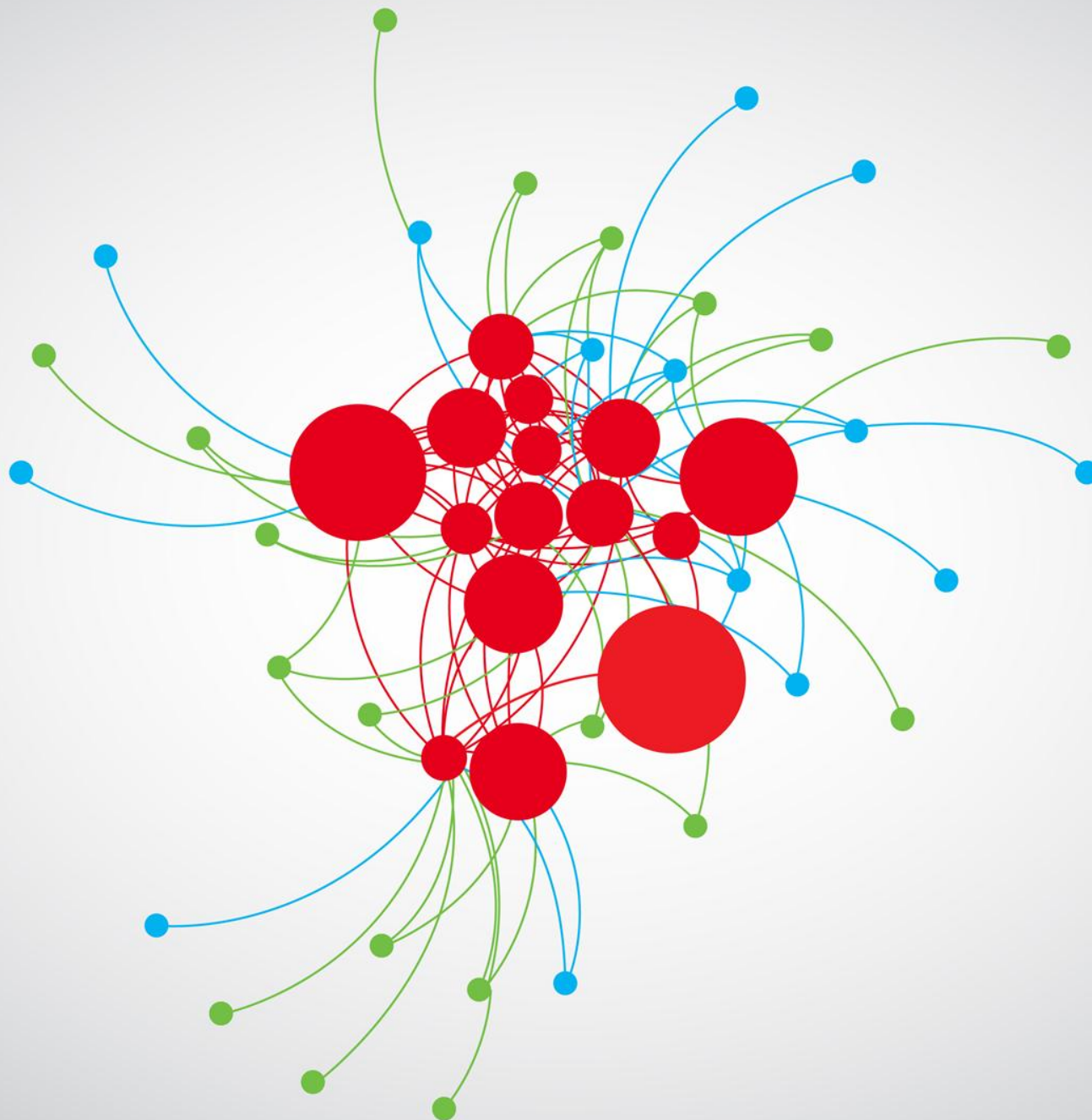
Works well with others...or do they?





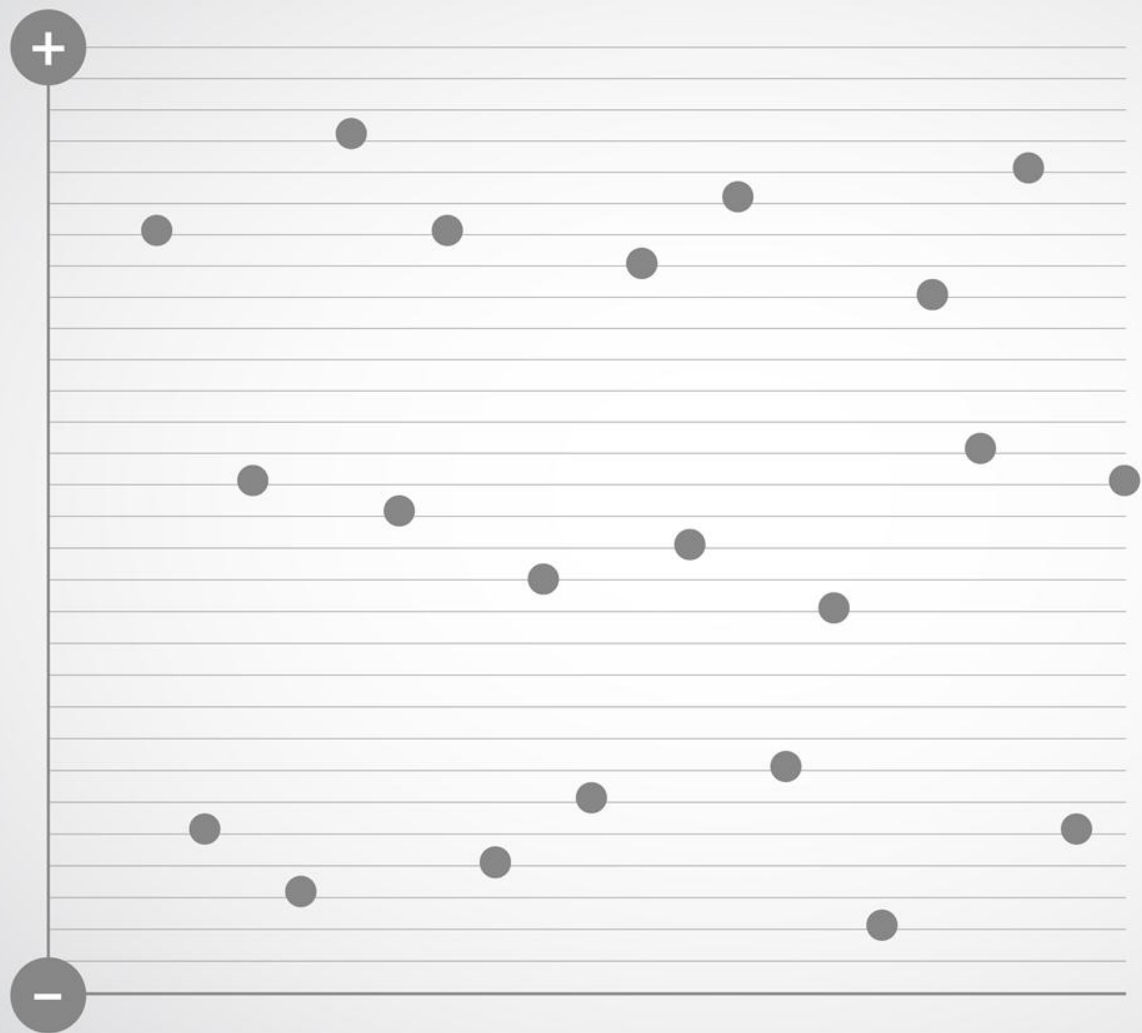


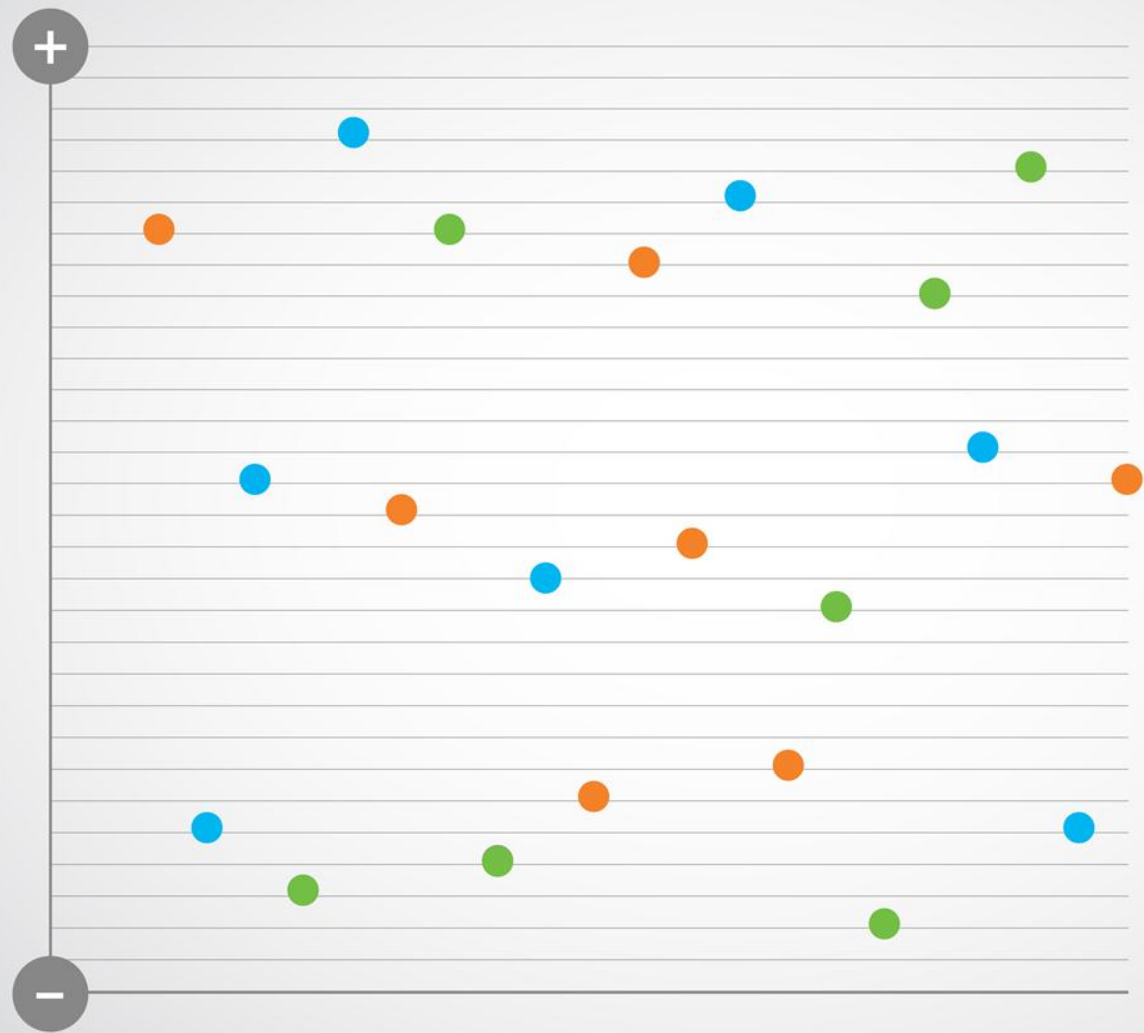


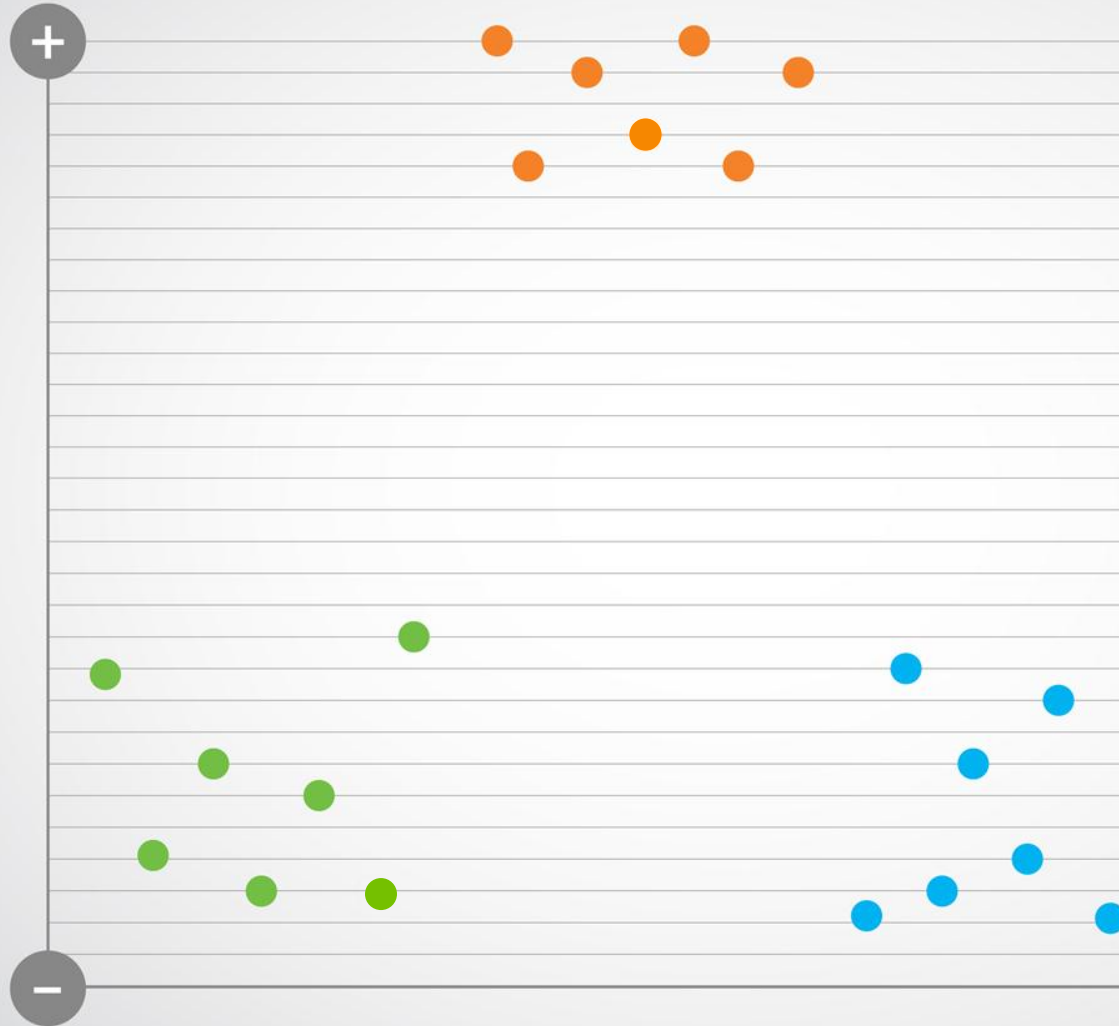


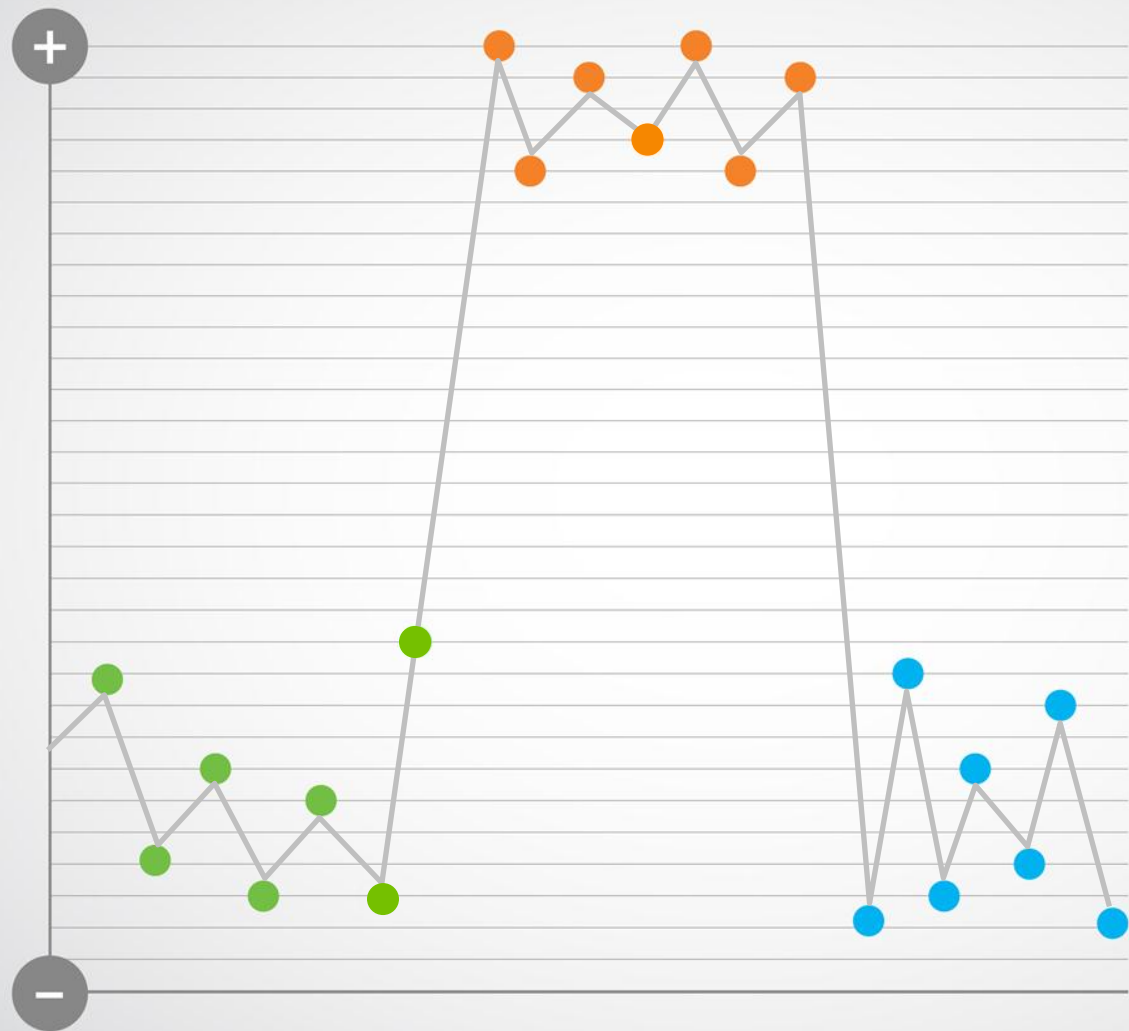
Ecological patches. Cluster analysis.

Applying advanced techniques in ecology to understand your business culture.

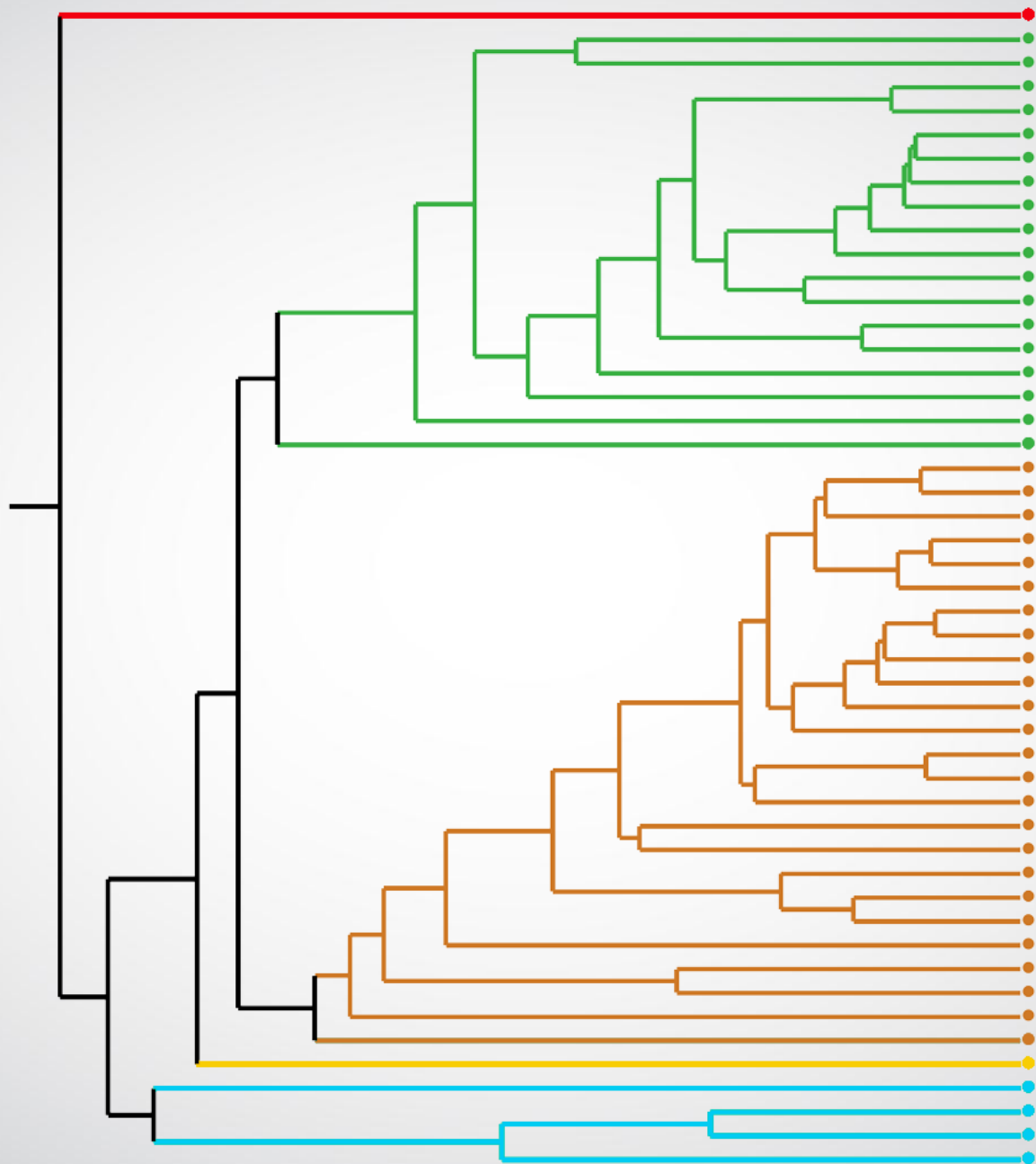












Ecology as a tool for business

1. Ask a good question. Be specific.
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4. Analyze data to identify factors with the most explanatory power. Avoid excess.

Thank you

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Environmental Services Quality Management