ABUNDANCE & DIVERSITY OF SPECIES

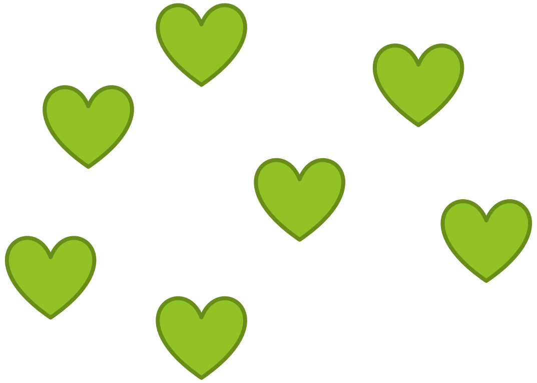
Justin Wied, Lab TA

RWSC 3310 – WILDLIFE MANAGEMENT TECHNIQUES

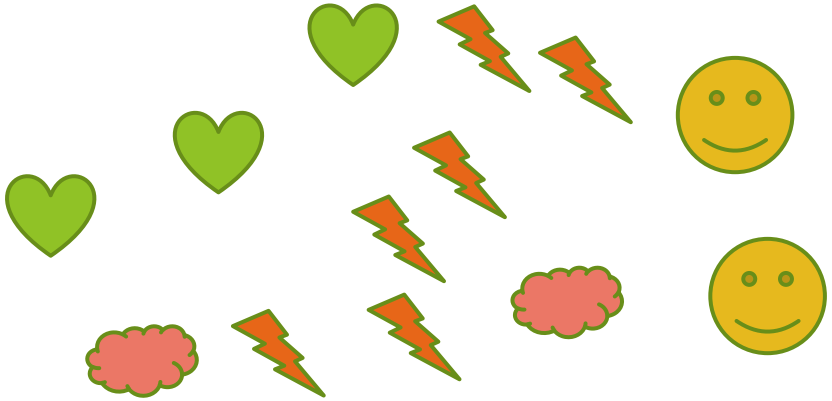
Texas A&M University-Kingsville

AUTECOLOGY & SYNECOLOGY

- Aut- (itself), Syn- (together)



- Populations (autecology)
  - One species
  - One location
  - One time

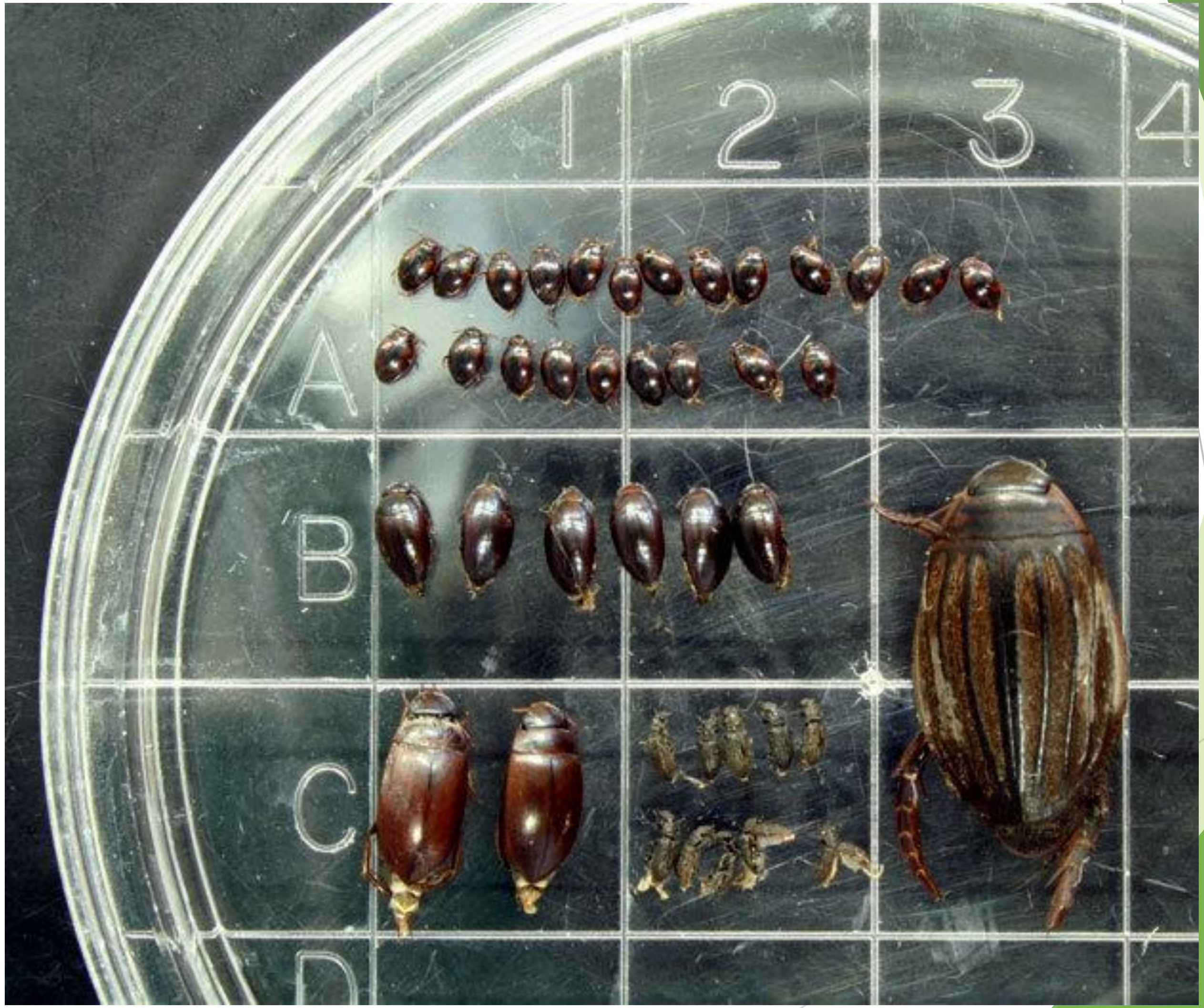


- Communities (synecology)
  - Assemblage of species
  - One location
  - One time

SPECIES ABUNDANCE

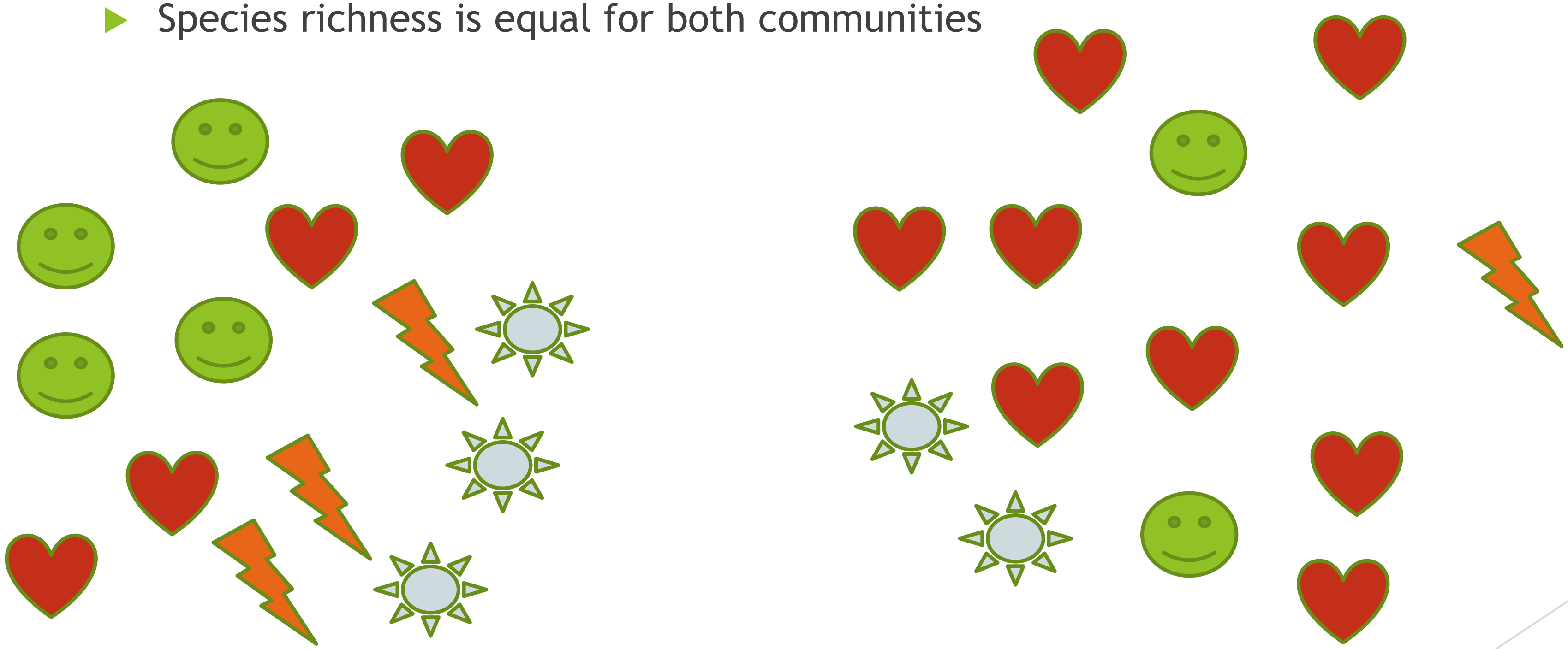
- Rare
- Common
- Abundant

- Community assemblages
  - Many common
  - Few rare
  - Few abundant



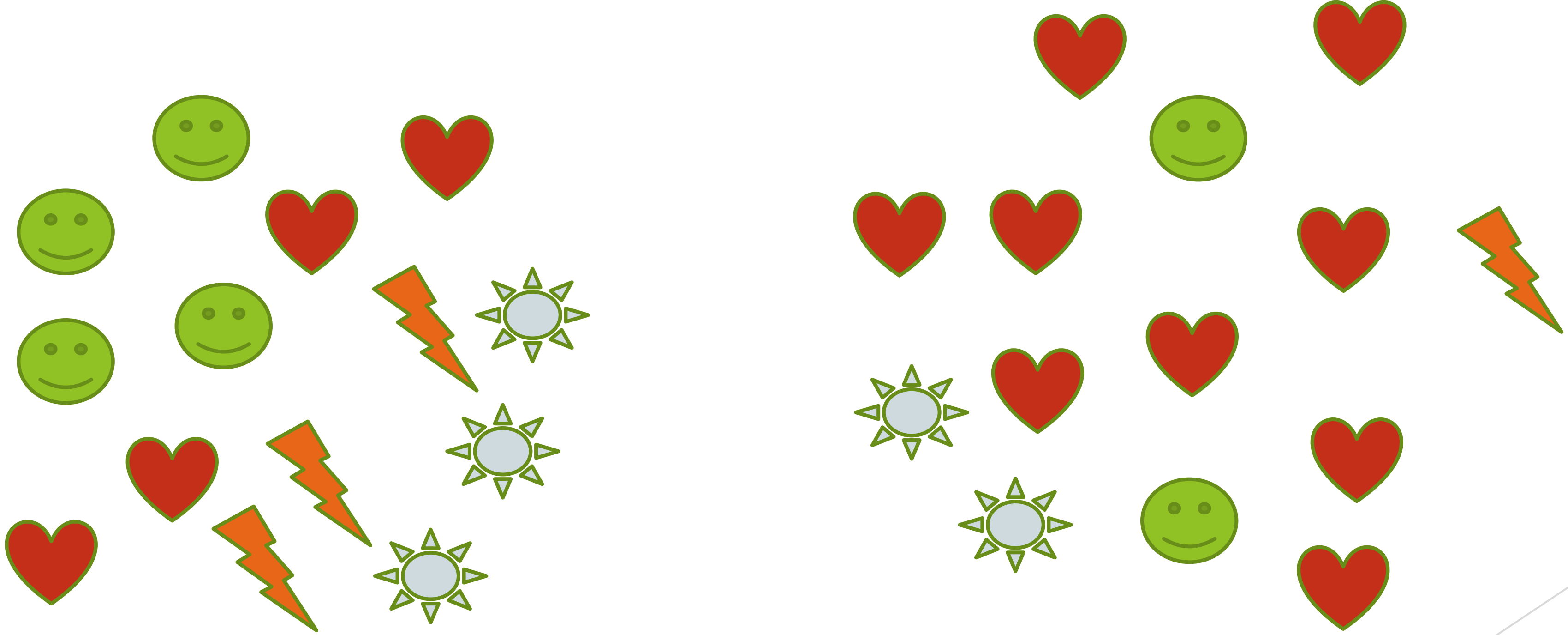
SPECIES RICHNESS

- Total number of species in each community
- Both communities have 4 species
    - Species richness is equal for both communities



SPECIES RICHNESS

- $D = \frac{s}{\sqrt{N}}$
- S = number of species present in sample
- N = total number of individual organisms



SPECIES RICHNESS

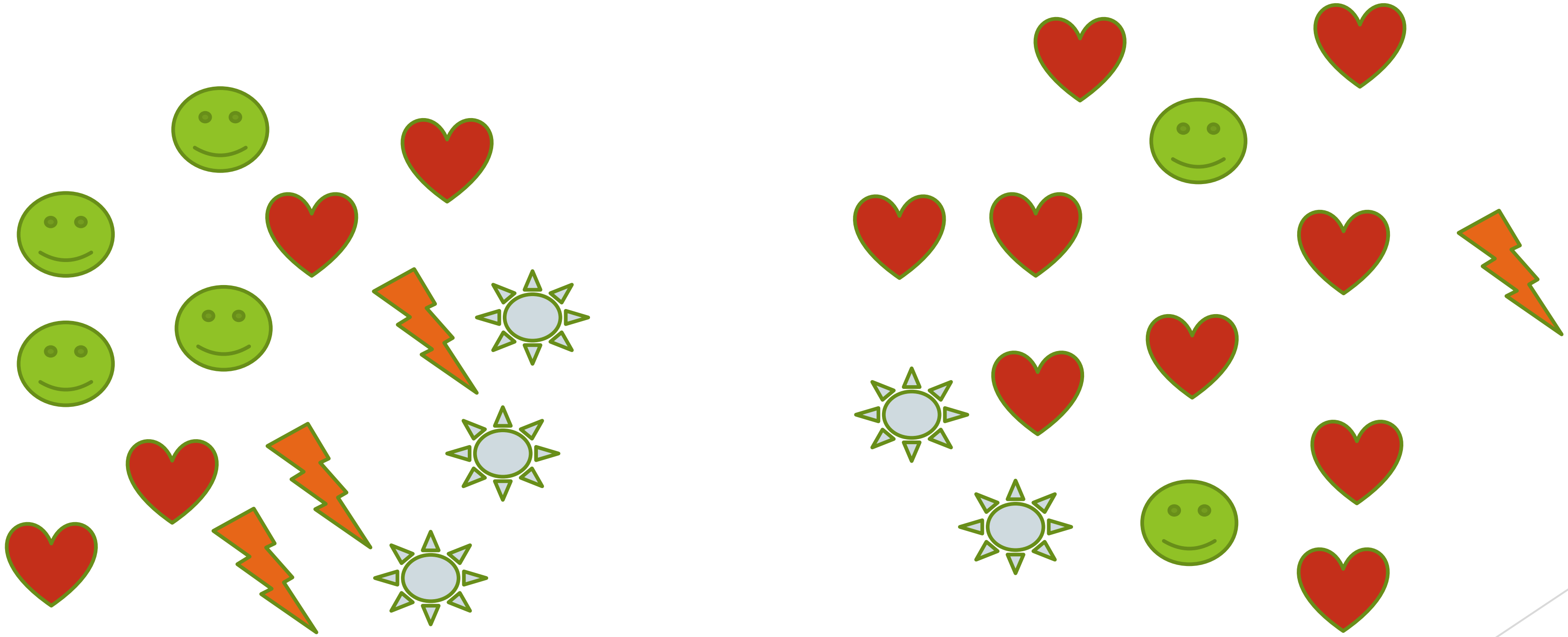
- Community A
- 14 total individuals (N)
- 4 species present (s)
- $D = \frac{4}{\sqrt{14}} = \frac{4}{3.74} = 1.07$

- Community B
- 14 total individuals (N)
- 4 species present (s)
- $D = \frac{4}{\sqrt{14}} = \frac{4}{3.74} = 1.07$

Species richness is the same in both communities!

SPECIES EVENNESS

- Relative abundance of each species to others
    - In other words, how equal are the numbers of each species
- One abundant species can reduce diversity of the community



SPECIES DIVERSITY

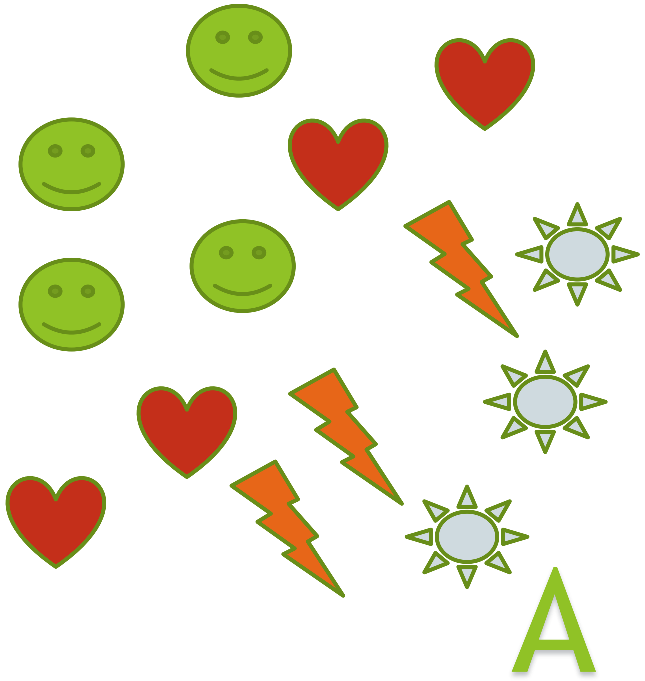
- How many species are present?
- How evenly represented is each species?
  - Does one population dominate the community?

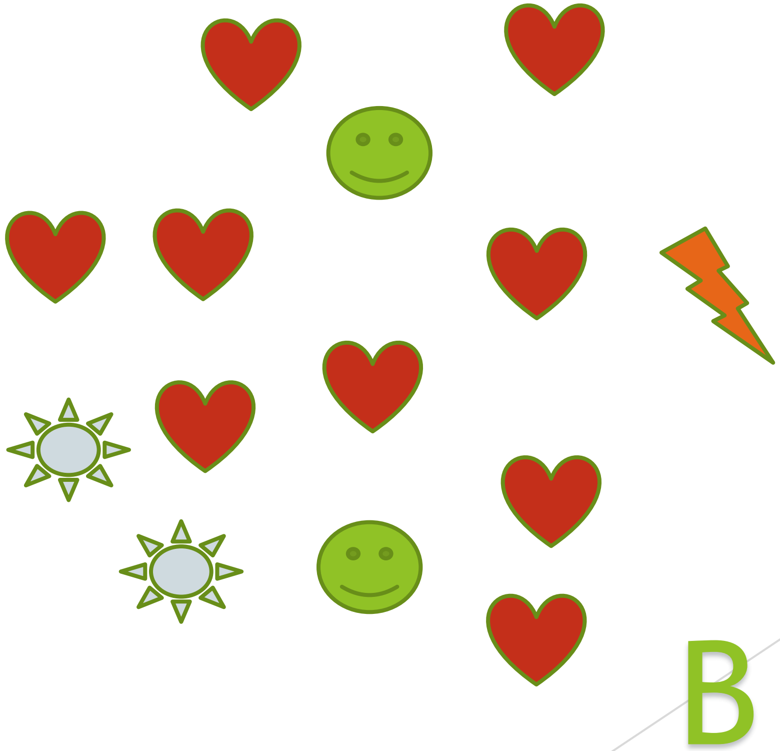
- To answer this, we have to calculate richness but include evenness

- Shannon-Weiner Index
- $H' = \sum(p_i)(|\ln p_i|)$
  - $p_i = proportion\ of\ individuals\ of\ a\ species\ to\ all\ individuals$
  - $|\ln(p_i)| = absolute\ value\ of\ natural \log of\ p_i$

SHANNON INDEX

- $H' = \sum(p_i)(|\ln p_i|)$





SHANNON INDEX

- Community A

14 individuals total (N)

☺ 4, so $(p_i = \frac{4}{14} = 0.29)$, thus $|\ln p_i| = |\ln 0.29| = 1.24$, and $0.29 \times 1.24 = 0.36$

♥ 4, so $(p_i = \frac{4}{14} = 0.29)$, thus $|\ln p_i| = |\ln 0.29| = 1.24$, and $0.29 \times 1.24 = 0.36$

⚡ 3, so $(p_i = \frac{3}{14} = 0.21)$, thus $|\ln p_i| = |\ln 0.21| = 1.56$, and $0.21 \times 1.56 = 0.33$

☼ 3, so $(p_i = \frac{3}{14} = 0.21)$, thus $|\ln p_i| = |\ln 0.21| = 1.56$, and $0.21 \times 1.56 = 0.33$

And finally, $H' = 0.36 + 0.36 + 0.33 + 0.33 = 1.38$

The Shannon Index of Community A is 1.38

SHANNON INDEX

- Community B

14 individuals total (N)

☺ 2, so $(p_i = \frac{2}{14} = 0.14)$, thus $|\ln p_i| = |\ln 0.14| = 1.97$, and $0.14 \times 1.97 = 0.28$

♥ 9, so $(p_i = \frac{9}{14} = 0.64)$, thus $|\ln p_i| = |\ln 0.64| = 0.45$, and $0.64 \times 0.45 = 0.29$

⚡ 1, so $(p_i = \frac{1}{14} = 0.07)$, thus $|\ln p_i| = |\ln 0.07| = 2.66$, and $0.07 \times 2.66 = 0.19$

☼ 2, so $(p_i = \frac{2}{14} = 0.14)$, thus $|\ln p_i| = |\ln 0.14| = 1.97$, and $0.14 \times 1.97 = 0.28$

And finally, $H' = 0.28 + 0.29 + 0.19 + 0.28 = 1.04$

The Shannon Index of Community A is 1.04

SHANNON INDEX

- So, Community A (1.38) > Community B (1.04)
- Community A has a higher diversity
  - Each species has an even amount on individuals
- Community B has a lower diversity
  - One species is abundant, while the others are rare