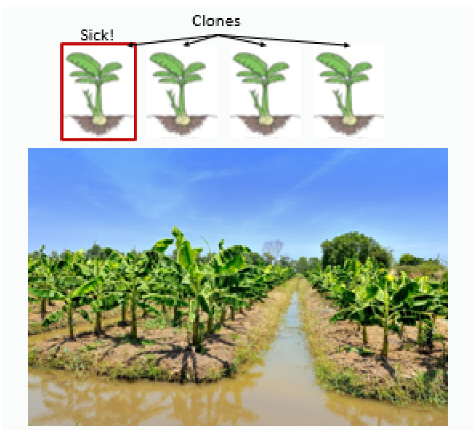
Lesson 9 Outline
Conservation Genetics

Learning Objectives
At the end of the lesson, you will be able to answer the following questions:

1. Why is genetic variation important and how do we quantify it?
2. What are the similarities and differences between genetic drift and inbreeding?
3. How can we use our knowledge of adaptation, genetic drift, and inbreeding for applied conservation genetics?

Learning Objective 1: Why is genetic variation important and how do we quantify it?



Make a prediction: is there likely to be resistance among your banana plants? Why?

Why is genetic variation important for adaptation to changing environments?

Observed heterozygosity (H_O):

Quiz Yourself: Calculate H_O

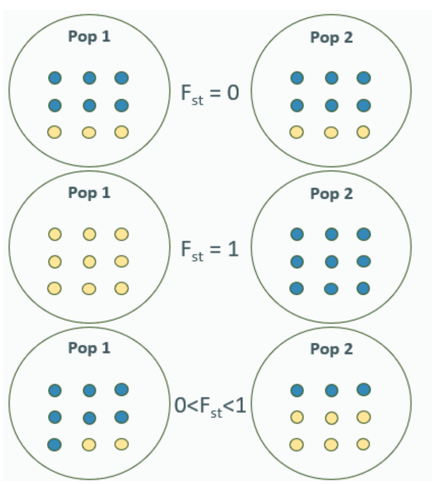
Locus	**YY**	**YB**	**BB**	H_O

1	0	0	100	
2	0	5	95	
3	60	23	17	
4	25	13	62	

Mean H_O =

Expected heterozygosity (H_E):

Fixation Index (F_{st}):



Learning Objective 2: What are the similarities and differences between genetic drift and inbreeding?

Genetic Drift:

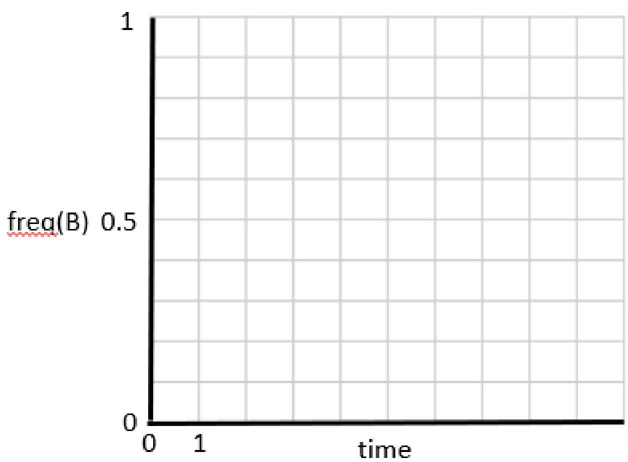
1.
2.
3.

Let's Experiment: Imagine we have 5 heterozygous (Bb) rabbits

1. Record the initial allele frequencies

2. Generate the next generation by flipping two coins (B: heads, b: tails). Repeat for 5 total offspring
3. Record the allele frequencies in the next generation

Offspring ID	Replicate 1
1	
2	
3	
4	
5	
Freq(B)	



Summary of Genetic drift:

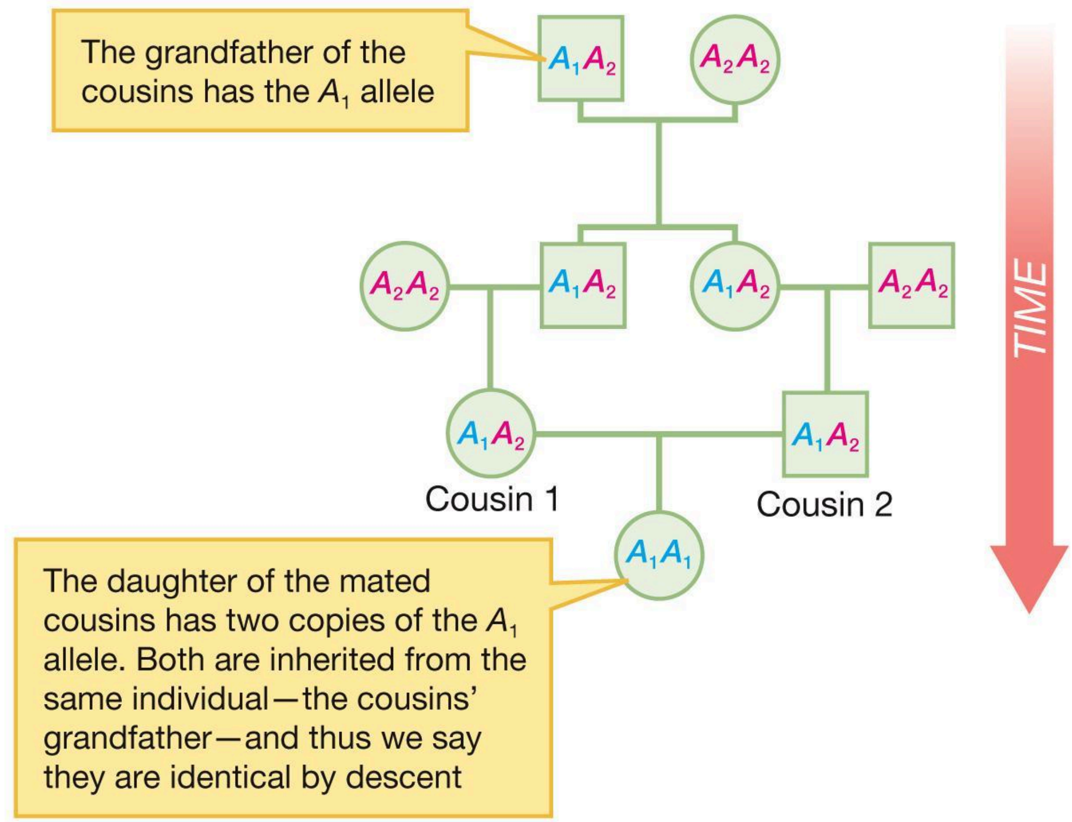
1.
2.

What are Founder Events?

What are Bottlenecks?

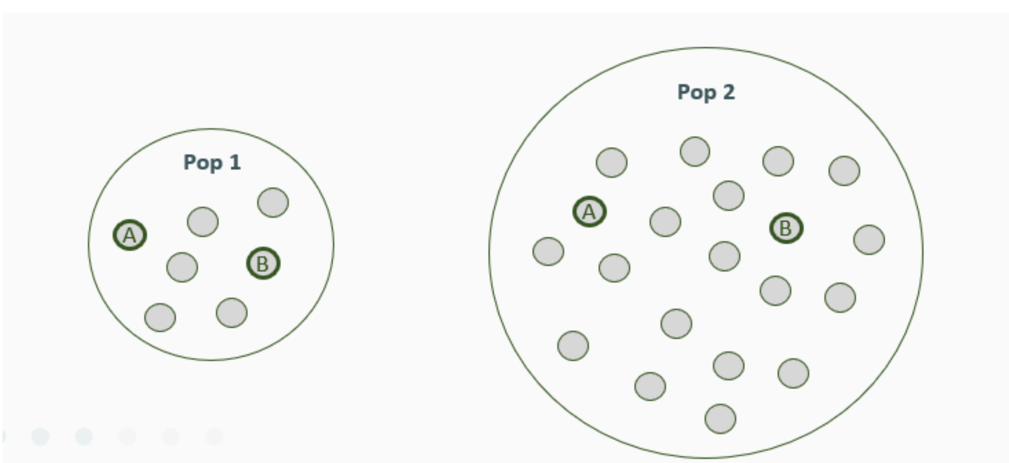
What is the relationship between the strength of drift and population size?

Inbreeding:



Inbreeding depression:

Think Critically: assuming random mating, is mating between cousins (A and B) more likely in pop 1 or 2?



Inbreeding Coefficient (F_{IS}):

Quiz Yourself: Calculate F_{IS}

Mean H_O = 0.103

Mean H_E = 0.222

Let's Review drift and inbreeding in small populations:

- [T/F]: genetic drift often helps natural selection purge problematic mutant alleles
- [T/F]: if problematic mutant alleles are in a population, inbreeding can result in them being expressed more frequently
- [T/F]: genetic drift is stronger in small populations
- [T/F]: inbreeding is less frequent in small populations

Learning Objective 3: How can we use our knowledge of adaptation, genetic drift, and inbreeding for applied conservation genetics?

Make a prediction: how has genetic variation changed over time for the Florida panther?

Quiz yourself: [drift/inbreeding] is responsible for disease alleles being maintained in the population and [drift/inbreeding] is responsible for those alleles being expressed

Heritage Group	*Total Number of Individuals Observed Over Time Period*	*Average Heterozygosity*	*Proportion of Male Cryptorchid*	*Proportion with Atrial Septal Defects*
Prior to Texas Cougar Introduction				
1970–1984	33	0.231	0.33	0.33
1985–1989	37	0.208	0.50	0.16
1990–1995	62	0.190	0.63	0.21

Quiz yourself: If Texas Cougars went through the same bottleneck as the Florida Panthers (33 individuals for 25 generations), what would be resulting heterozygosity given H_0 = 0.318

A) 0.246

B) 0.217

C) 0.176

D) 0.146

Why might H be lower than predicted?

Effective population size:

<u>N_e is disproportionately affected by population bottlenecks</u>

Let's say census population sizes over 4 generations were N = 1000, 50, 500, and 1000… Will N_e be closer to 100, 500, or 1000?

A) 100

B) 500

C) 1000

<u>N_e with unequal sexes</u>

Imagine our population of 30 Florida panthers was 24 females and 6 males…. What is the effective population size in this case?

A) 19.2

B) 23.5

C) 27.1

D) 30

Think Critically: What effect (qualitatively) would using N_e instead of N have in our calculation of H_t?

A) H_t would be higher

B) H_t would be the same

C) H_t would be lower

Genetic Rescue: