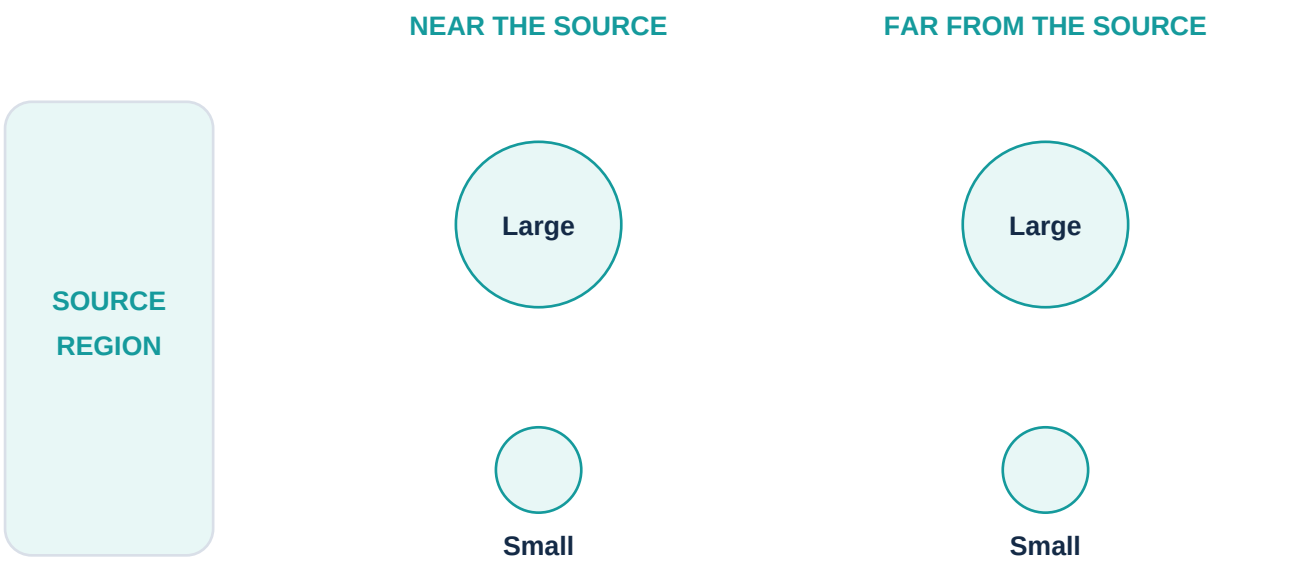
Which species reach an island?

Island biogeography studies the distribution, ecological relationships and communities of island organisms. Colonization begins when organisms arrive from elsewhere.

1. ARRIVAL IS ONLY THE FIRST STEP

Seeds may arrive by wind, birds may fly across water, and organisms may raft on floating vegetation. Colonists must survive and reproduce to establish a population. Another individual of a species already present does not add a new species to the island.

2. SIZE AND ISOLATION: A SIMPLE COMPARISON



Schematic: compare islands of similar age and environmental conditions.

3. EXPLAIN THE PATTERN, NOT JUST THE RANK

Nearer islands are generally easier to reach, increasing colonization. Larger islands often offer more habitats and support larger populations, reducing local extinction risk. Large, nearby islands are therefore expected to support more species than small, remote islands.

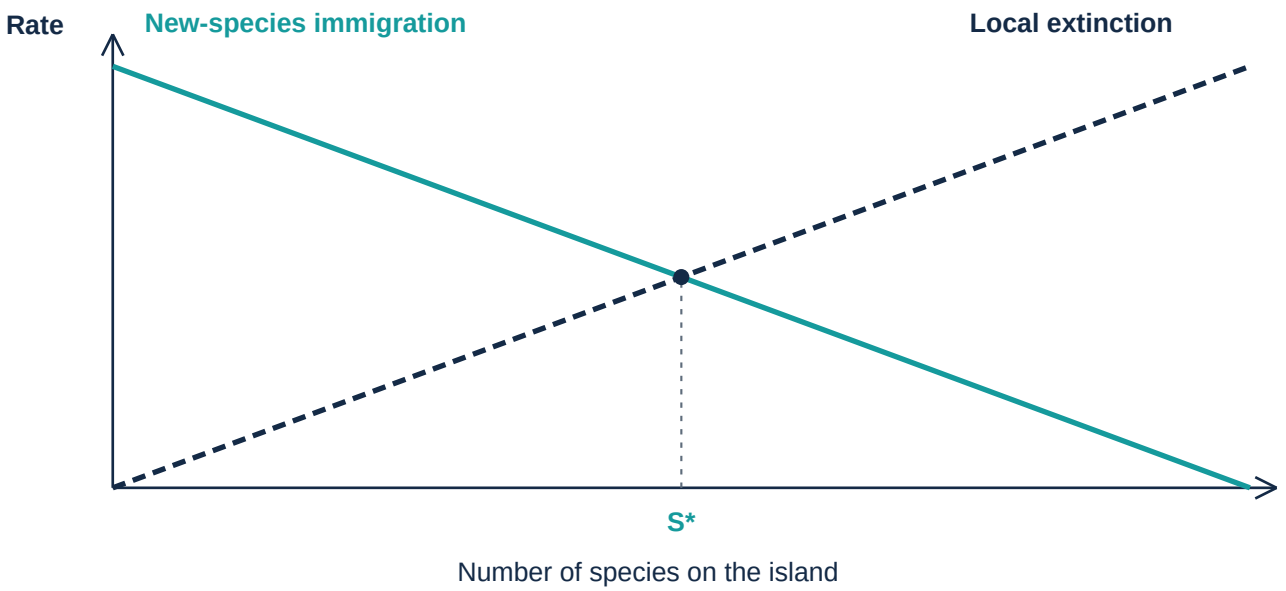
Island communities and colonization: College Board, ERT-2.D.
Island area and isolation: HHMI BioInteractive, educator materials.

Scope: College Board AP Environmental Science CED, Topic 2.3, p. 54.

Species change as richness stabilizes

Model extension: island species richness reflects the balance between establishment of new species and loss of resident species. The balance is dynamic, not motionless.

1. READ THE EQUILIBRIUM MODEL



S* marks equal rates. Lines are illustrative, not measured data.

2. EXPLAIN BOTH SIDES OF THE CROSSING

With few species present, many potential colonists are still absent, so immigration of new species is relatively high. As richness rises, fewer new species remain to arrive and more resident species are exposed to extinction. Below S*, gains exceed losses; above S*, losses exceed gains.

3. EQUILIBRIUM DOES NOT MEAN NO CHANGE

At S*, species can still arrive and disappear. For example, one species may replace another without changing richness. Local extinction means disappearance from that island, not necessarily extinction everywhere. Richness is a species count, not a count of individuals.

The model simplifies nature. Disturbance, habitat quality and organisms' dispersal abilities also affect island communities.

Immigration/extinction model: UC Berkeley, Biology 1B ecology lecture 8.
Dynamic equilibrium and local extinction: HHMI BioInteractive.

Scope: College Board AP Environmental Science CED, Topic 2.3, p. 54.

Isolation shapes evolution and risk

After colonization, isolated populations can change over generations. Island conditions may favor traits and resource use that differ from those of mainland populations.

1. FROM COLONISTS TO DISTINCT POPULATIONS

Limited movement between an island and the mainland can reduce gene flow. Natural selection and genetic drift can then cause populations to diverge; over long periods, new species may arise. An endemic species occurs naturally only in a particular area. Arrival and speciation are different processes.

2. SPECIALISTS HAVE A NARROWER NICHE

A specialist uses a limited range of resources or tolerates a narrow set of conditions. A generalist uses a wider range. Many island species have evolved specialized ways of using limited food or territory. Not every island species is a specialist, and specialization does not mean an organism consciously chooses to adapt.

3. INTRODUCTIONS CAN CHANGE THE COMPETITION

Illustrative example: a native bird depends heavily on one seed type. An introduced competitor can eat those seeds plus many other foods.

If the competitor depletes the shared seeds, the specialist may have few alternatives. Reduced food can lower survival and reproduction, threatening the native population.

Other invaders harm natives through predation, disease or habitat change. Not every introduced species becomes invasive.

4. APPLICATION: HABITAT ISLANDS ON LAND

Forest fragments surrounded by farms or roads can be isolated too. Protecting habitat and maintaining connections can support movement, but only when the species can use those connections.

Island evolution and endemism: National Park Service, Pearl Harbor.
Introduced-species impacts: National Park Service, Oceans and Coasts.

Scope: College Board AP Environmental Science CED, Topic 2.3, p. 54.