

# Resource partitioning: definition, types and the classic examples

[ ] Niche: a species' role and position: what it eats, where and when, what eats it, the conditions it tolerates

[ ] Competitive exclusion (Gause, 1934): complete competitors cannot coexist; two species competing for exactly the same limiting resource in the same way cannot both persist (Paramecium aurelia drove P. caudatum extinct in one tube)

[ ] Resource partitioning: competing species divide a limited resource so that each uses a different portion (place, time, size or type), reducing competition enough to coexist; niches overlap but do not coincide

[ ] Fundamental niche: the full range a species could occupy. Realised niche: where it actually lives, after competitors take their share

[ ] Character displacement: where competitors coexist, selection pushes their traits apart; alone, the traits are intermediate

| Type                      | Divided by                                            | Examples                                                                                                                                                           |
|---------------------------|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Spatial                   | place: height, depth, microhabitat                    | MacArthur's warblers at different heights; anoles on different perches; roots at different soil depths; barnacles at different shore heights                       |
| Temporal                  | time: day/night, season, flowering time               | hawks by day, owls by night; bats and swifts at different hours; spring and summer flowers sharing pollinators                                                     |
| Dietary and morphological | size or kind of food, often with different body parts | Darwin's finches' beak sizes; savanna grazers on grass of different heights (zebra tall, wildebeest middle, gazelle short); herons and egrets with different bills |

## MacArthur's warblers (1958), spruce forests of New England

| Warbler                | Feeding zone                   |
|------------------------|--------------------------------|
| Cape May               | top, outer branch tips         |
| Blackburnian           | upper middle, outer branches   |
| Black-throated green   | middle, inner and outer        |
| Bay-breasted           | lower middle, toward the trunk |
| Yellow-rumped (myrtle) | lowest branches and the ground |

## Three more classics

[ ] Caribbean anoles: on each island the same set of ecomorphs evolved independently (trunk-ground, trunk-crown, twig, grass-bush), partitioning perch height and diameter (Losos)

[ ] Darwin's finches: G. fortis and G. fuliginosa have intermediate beaks where each lives alone (Daphne Major, Los Hermanos) and divergent beaks where they live together (Santa Cruz, Floreana): character displacement (Lack; the Grants)

[ ] Connell's barnacles (1961): Chthamalus can live across the whole intertidal (fundamental niche) but Balanus crowds it off the lower rocks, so it is found only above (realised niche); remove Balanus and Chthamalus spreads down

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# Related ideas, why it matters, the curriculum, and a practice set

| Idea                     | What it is                                                  | How it differs                                                           |
|--------------------------|-------------------------------------------------------------|--------------------------------------------------------------------------|
| Niche differentiation    | species evolving to occupy different niches                 | the general process; partitioning is the division of one shared resource |
| Competitive exclusion    | one species eliminating another with the same niche         | what happens when partitioning fails                                     |
| Character displacement   | evolutionary divergence of traits where competitors coexist | the cause, over generations, of morphological partitioning               |
| Mutualism                | both species benefit                                        | partitioning species avoid each other; they do not help                  |
| Commensalism, parasitism | one benefits; the other unaffected or harmed                | not about competition                                                    |

- [ ] Explains biodiversity: how a forest holds hundreds of tree species when sharing a niche is fatal
- [ ] Predicts invasive damage where a newcomer overlaps a native's niche completely (grey squirrel against red)
- [ ] Guides conservation (protect a forest's whole vertical structure) and agriculture (intercropping species with different root depths)

| Curriculum | Where                                                                                              |
|------------|----------------------------------------------------------------------------------------------------|
| US         | AP Biology Unit 8 Ecology; HS-LS2-2, HS-LS2-6                                                      |
| IB         | C4 populations and communities: niches, competitive exclusion, fundamental and realised niche      |
| England    | A-level Biology populations in ecosystems                                                          |
| Australia  | Year 12 Biology species interactions                                                               |
| CBSE       | Class 12 Organisms and Populations: Gause's principle, resource partitioning, MacArthur's warblers |

## Practice

1. Define resource partitioning and state the principle it lets species escape.
2. Classify: owls and hawks; three finch species with different beak depths; two barnacles at different shore heights; two bats foraging at dusk and after midnight.
3. Why does the Cape May warbler not compete strongly with the Yellow-rumped warbler, though both eat insects in the same tree?
4. Explain fundamental against realised niche using Connell's barnacles.
5. Alone, *G. fortis* beaks are intermediate; with *G. fuliginosa* they are larger. Name and explain the pattern.
6. Two *Paramecium* species in one tube: one dies out. In a tube with two food types, both survive. Explain.

## Answers

1. The division of a limited resource among competing species so each uses a different portion; competitive exclusion.
2. Temporal; dietary/morphological; spatial; temporal.
3. They feed in different zones (top tips against ground and low branches): spatial partitioning of the same prey.
4. *Chthamalus* could occupy the whole shore (fundamental) but is confined to the upper zone by *Balanus* (realised).
5. Character displacement: selection favours *fortis* individuals with larger beaks that eat seeds *fuliginosa* cannot, reducing competition.
6. With one food, complete competitors: exclusion. With two food types, each specialises on one: partitioning allows coexistence.