

Diversity and Spatial Scale

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Alpha Diversity

- the diversity within a site, or quadrat
- within-habitat diversity
- local diversity
- measured locally, at a single site
- measured as number of species within a given area
- refers to a group of organisms interacting and competing for the same resources or sharing the same environment.

| | N_i | p_i | $\ln(p_i)$ | $p_i * \ln(p_i)$ |
|------------|-----------|--------------|------------|------------------|
| Species A | 6 | 0.333 | -1.100 | -0.366 |
| Species B | 3 | 0.167 | -1.790 | -0.298 |
| Species C | 1 | 0.056 | -2.882 | -0.161 |
| Species D | 8 | 0.444 | -0.812 | -0.361 |
| SUM | 18 | 1.000 | | -1.186 |

There are 4 species → Species richness = 4.

There are 18 individuals.

Shannon Index: $H' = - \sum p_i * \ln(p_i) = -(-1.186) = 1.186$

Beta Diversity

- the change in species composition from site to site
- between-habitat diversity
- species turnover
- refers to the response of organisms to spatial heterogeneity

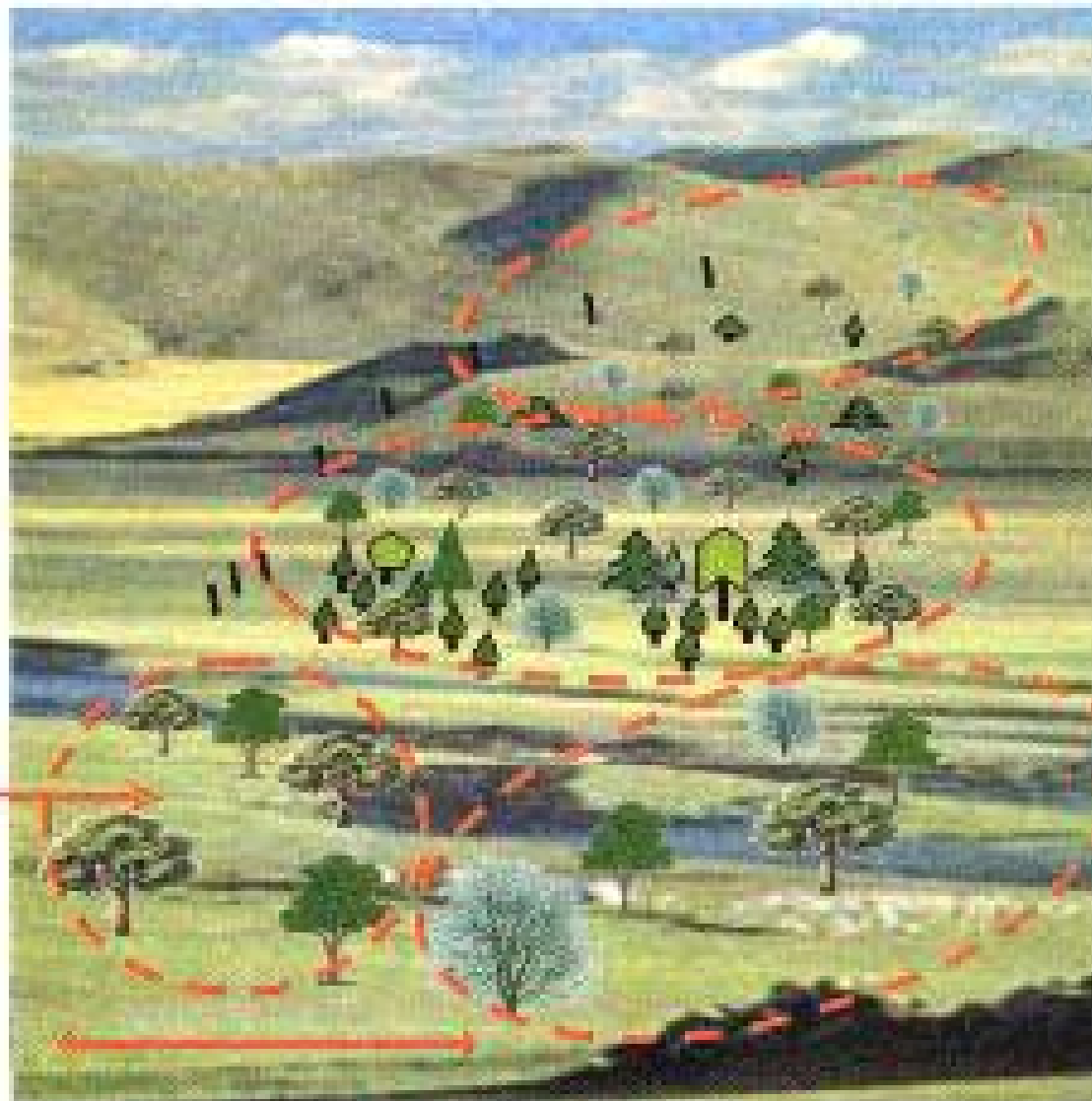
Beta Diversity

- high beta-diversity implies low similarity between species composition of different habitats
- usually expressed in terms of similarity index between communities (or species turnover rate) between different habitats in same geographical area (often expressed as some kind of gradient)

Gamma Diversity

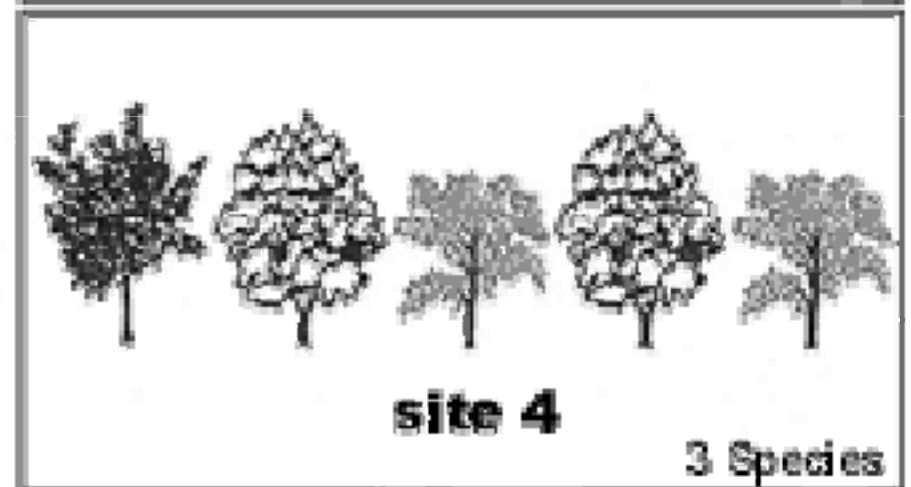
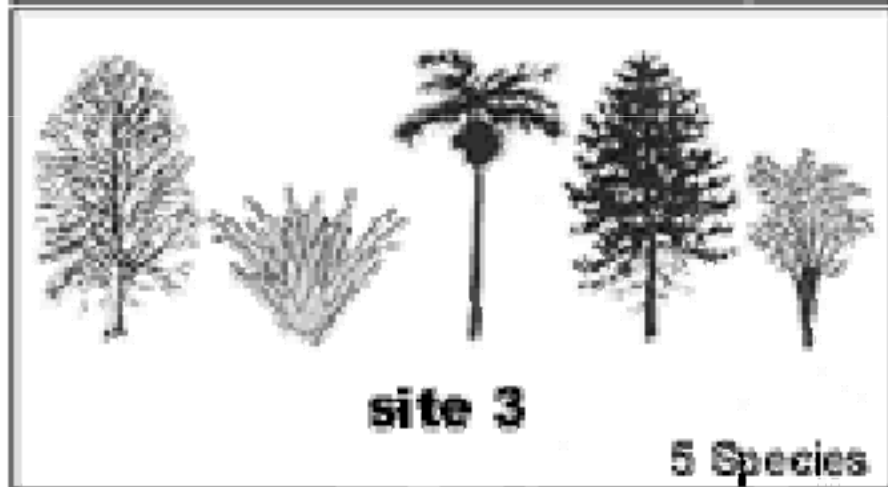
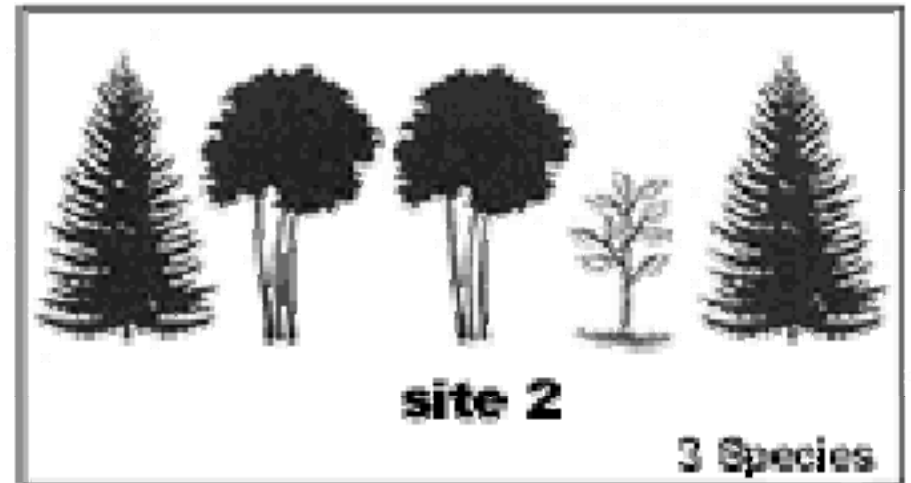
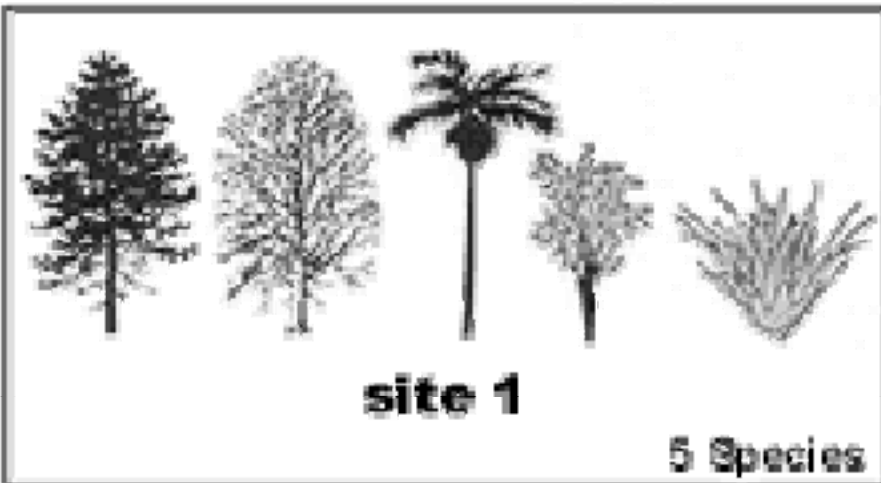
- the diversity of a landscape, or of all sites combined
- regional diversity
- geographical diversity

Alpha
diversity
of a
community



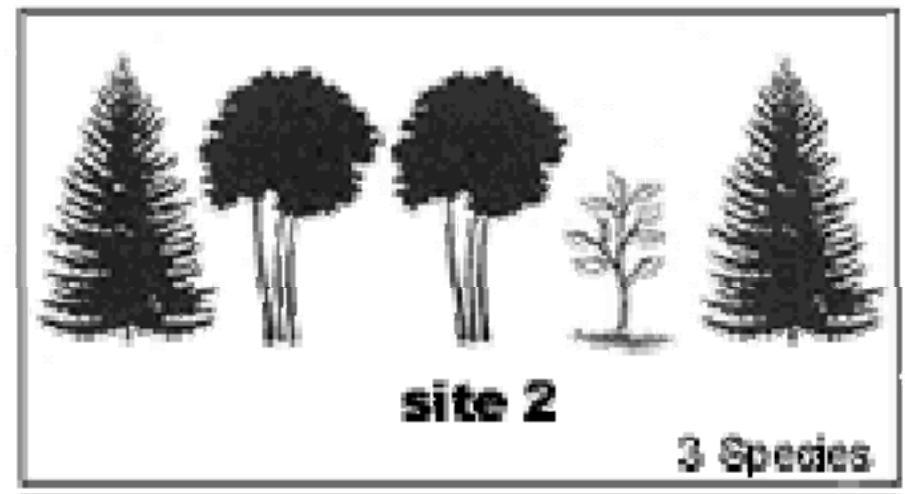
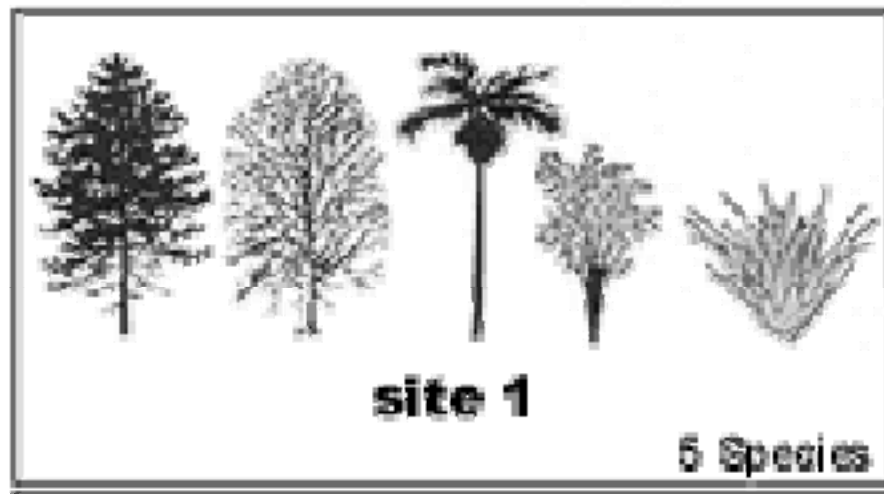
Beta diversity
between
communities

Gamma
diversity of
a region



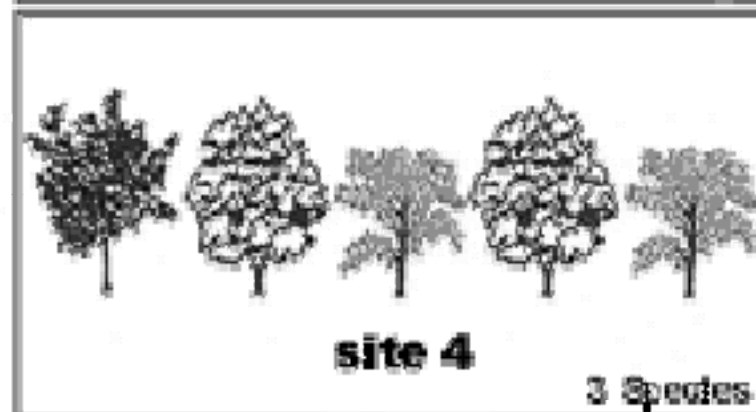
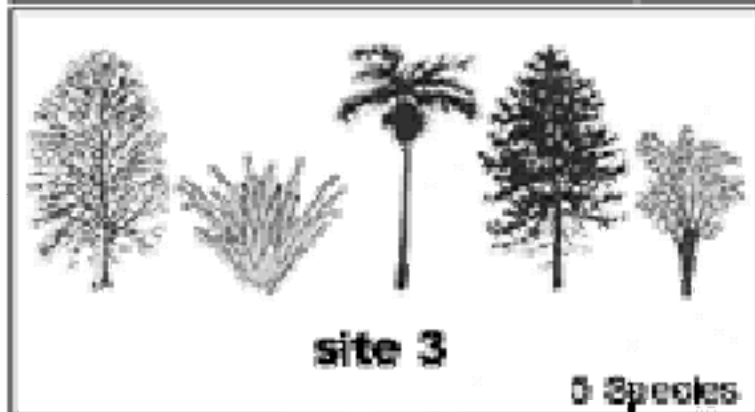
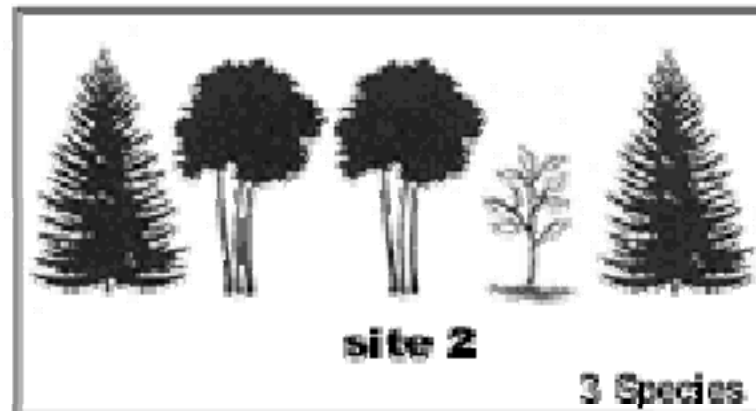
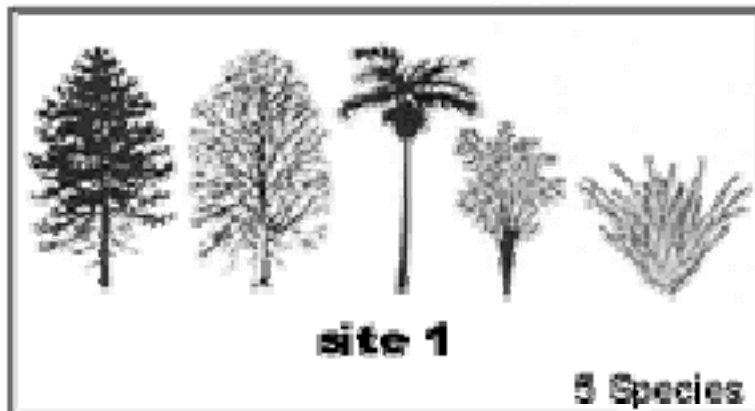
Region X

Region Y



ALPHA-, BETA- AND GAMMA-DIVERSITY.

Alpha diversity is measured locally, at a single site, as at sites 1 and 2. Site 1 has higher alpha-diversity than site 2.

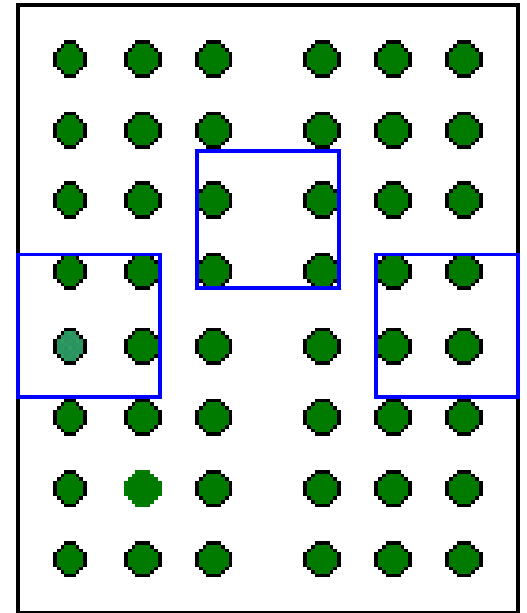
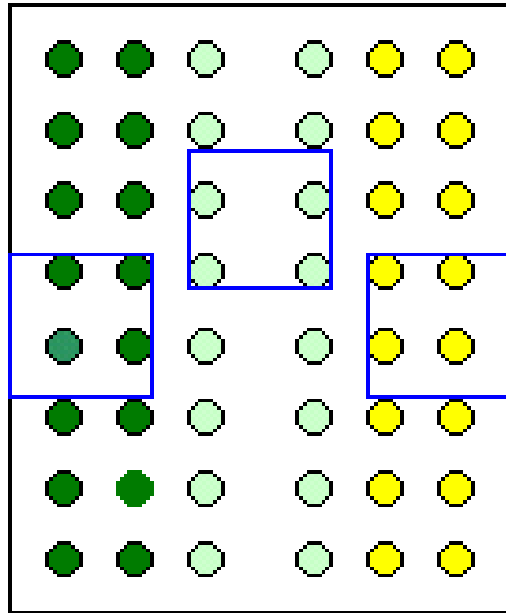
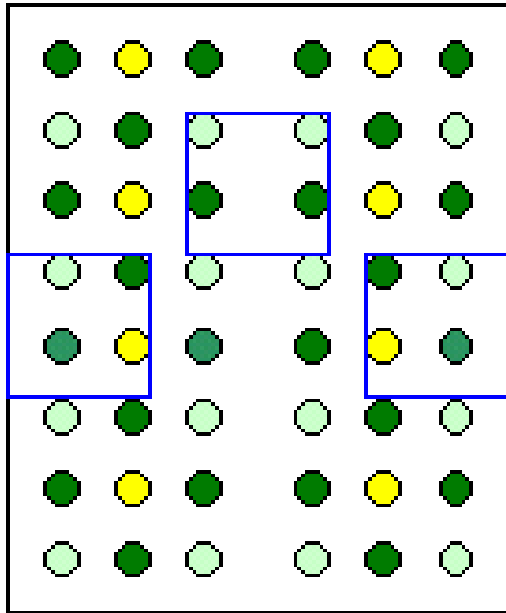


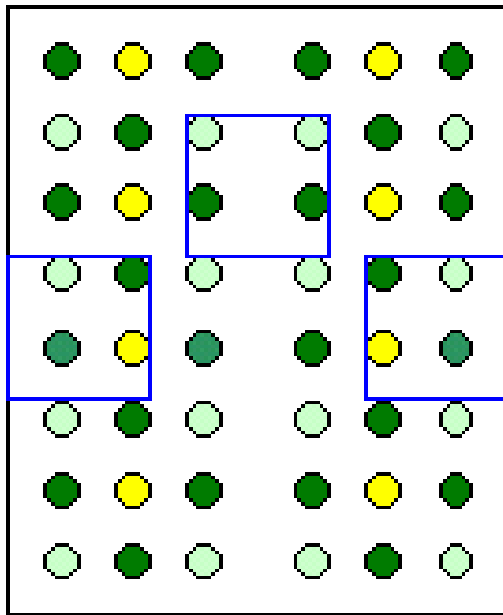
Region X

Region Y

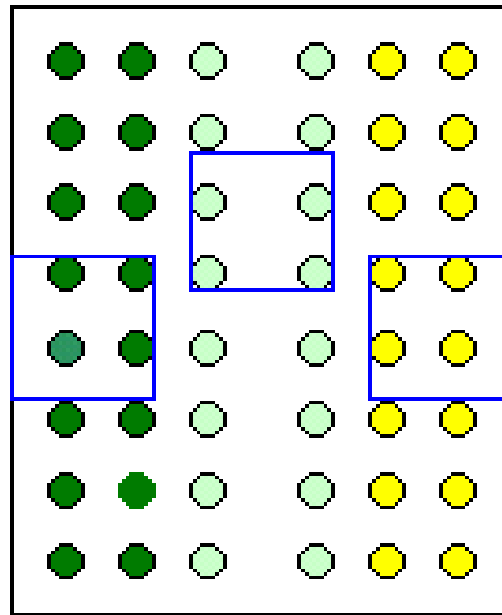
Beta-diversity measures the amount of change between two sites or along a gradient, as in regions X and Y. Region Y has higher beta-diversity than region X, as there is a higher turnover of species among the sites in region Y.

Gamma-diversity is similar to alpha-diversity, only measured over a large scale. Both alpha- and beta-diversity contribute to gamma-diversity. Region X has high alpha-diversity at its sites, but they are all fairly similar; the region thus has low beta-diversity and only moderate gamma-diversity. Region Y has low alpha-diversity at its sites, but the sites differ from each other; the region therefore has high beta-diversity, and higher gamma-diversity than region X.

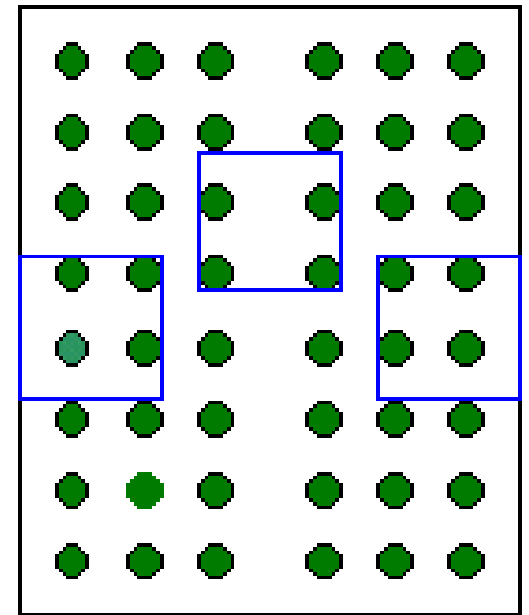




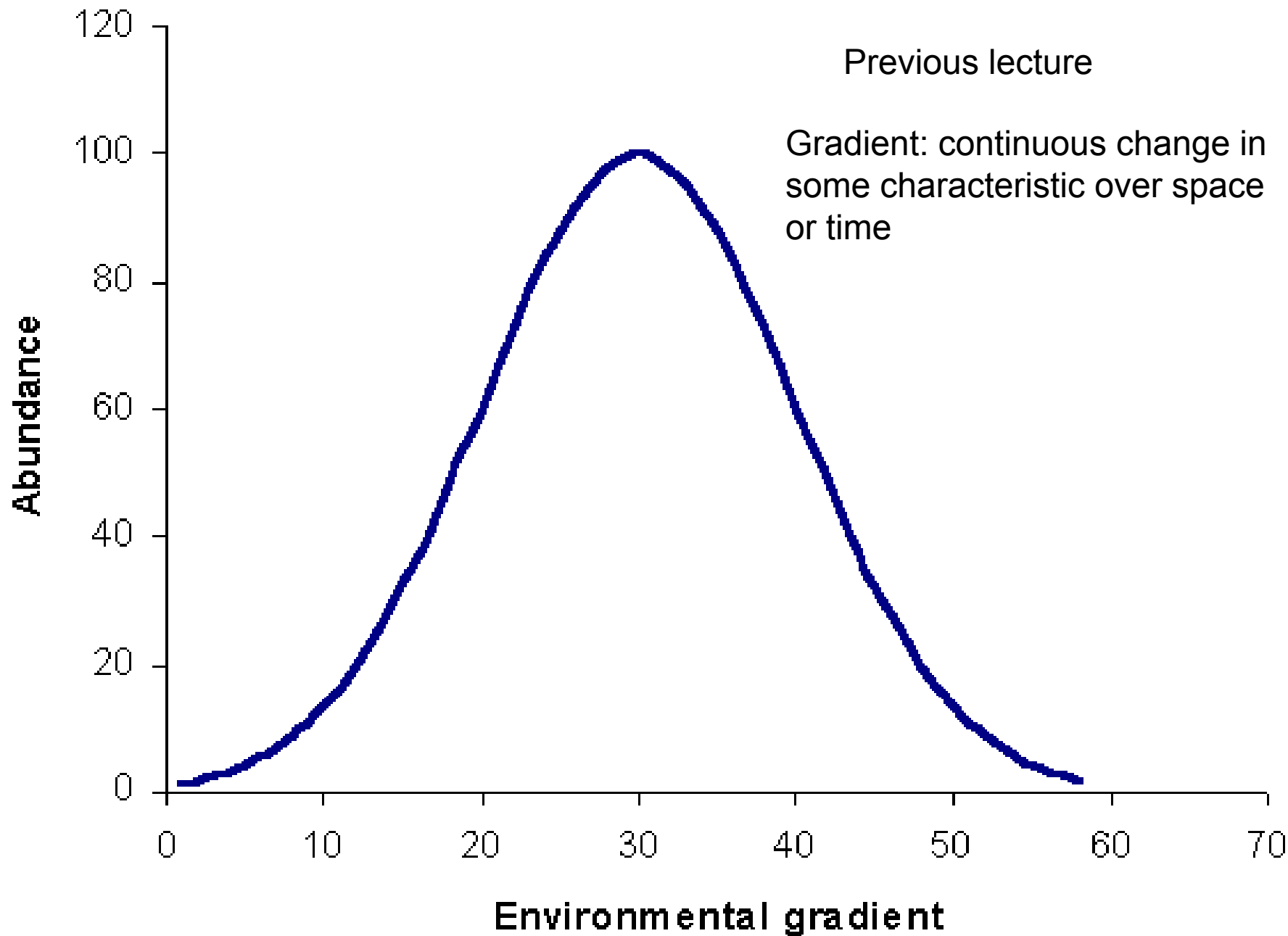
High *Alfa* and
high *Beta*



Low *Alfa* and
high *Beta*



Low *Alfa* and
low *Beta*



Previous lecture

Gradient: continuous change in some characteristic over space or time

