# Life History Strategies: r & K selection

- Life history trade-offs
- Energy allocation
- Reproductive strategies
- Experiment with dandelions

Table 9.1 Life history strategies discussed in chapters 9 and 10. The strategies in italics are those we might expect an imaginary, unbeatable life history to possess, other things being equal (see text)

| Life history stage | Trait | Range of alternative strategies | | Section |
|---|---|---|---|---|
| Reproduction | Sex | *Asexual* | Sexual | 9.3 |
| | Mating | *Selfing* | Outcrossing | 9.4 |
| | Gender | *Cosexual* | Dioecious | 9.4 |
| | Maturity | *Early* | Delayed | 10.1 |
| Birth | Seed crop frequency | *Annual* | Masting | 10.2 |
| | Seed size | *Large* | Small | 10.3 |
| | Germination | *Immediate* | Delayed | 10.3 |
| Growth | | *Clonal* | Aclonal | 10.4 |
| Death | | *Iteroparous* | Semelparous | 10.5 |

# R & K traits

**Table 5-2** Some traits that correlate with *r*- and *K*-selection. (Modified from E. Pianka, *American Naturalist* 104:592–597. Copyright © 1970 by University of Chicago Press. By permission.)

| Trait | *r*-selection | *K*-selection |
|---|---|---|
| Climate | Variable and/or unpredictable; uncertain | Fairly constant and/or predictable; more certain |
| Mortality | Often catastrophic; density independent | Density dependent |
| Survivorship | Usually types I and II (see Figure 4-9) | Often type III (see Figure 4-9) |
| Population size | Variable in time; not in equilibrium; usually well below carrying capacity of the habitat; recolonization each year | Fairly constant in time; in equilibrium; at or near carrying capacity of the habitat; no recolonization necessary |
| Intraspecific and interspecific competition | Variable; often lax | Usually keen |
| Life-span | Short, usually less than 1 year | Longer, usually more than 1 year |
| Selection favors | Rapid development; early reproduction; small body size; single reproduction period in life-span | Slower development; greater competitive ability; delayed reproduction; larger body size; repeated reproduction periods in life-span |
| Overall result | Productivity | Efficiency |

# Energy allocation

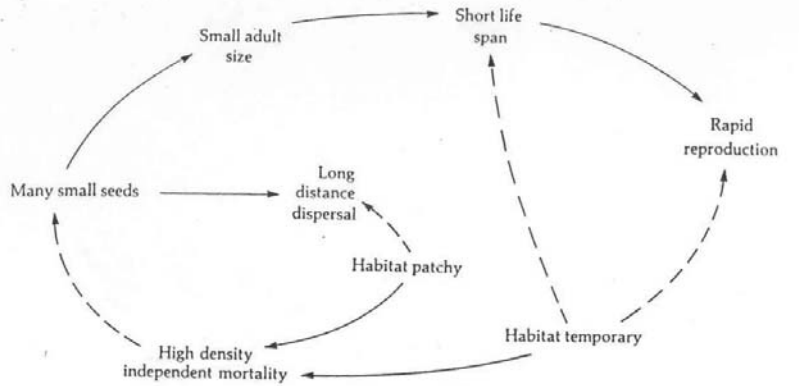



**Figure 5-7** A model showing selective forces (dashed arrows) and associated plant–plant and plant–habitat characteristics (solid arrows) for an *r*-selected population.

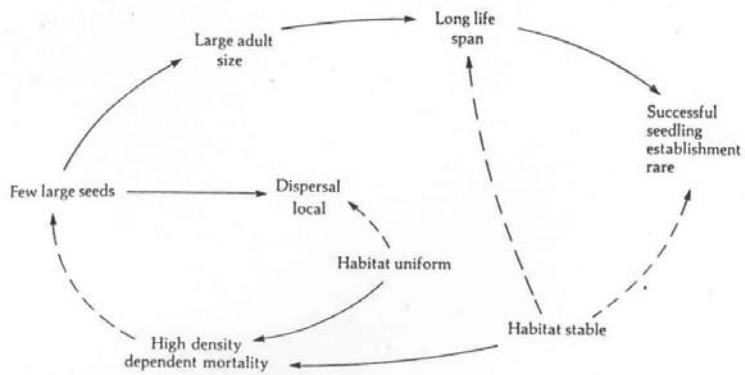



**Figure 5-9** A model showing selective forces (dashed arrows) and associated plant–plant and plant–habitat characteristics (solid arrows) for a *K*-selected population.

# Trade-offs

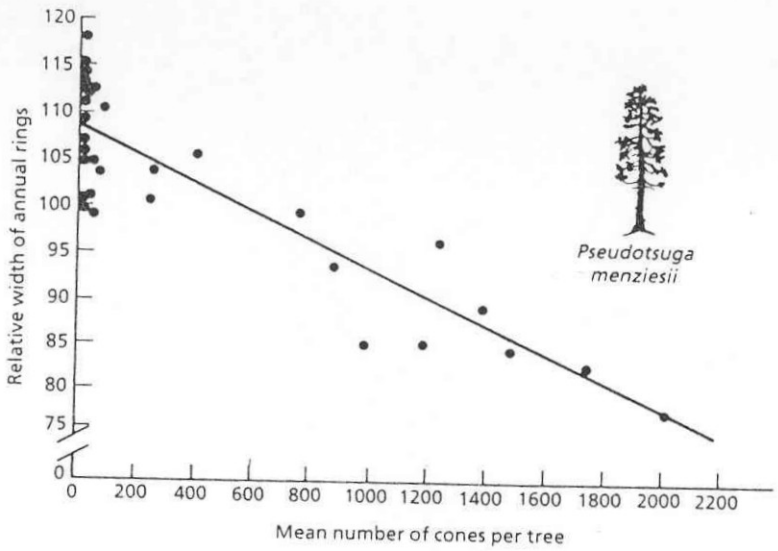



Fig. 9.1 The relationship between cone crop size and annual growth increment in a population of Douglas fir (from Eis *et al.* 1965).

# Inflorescences

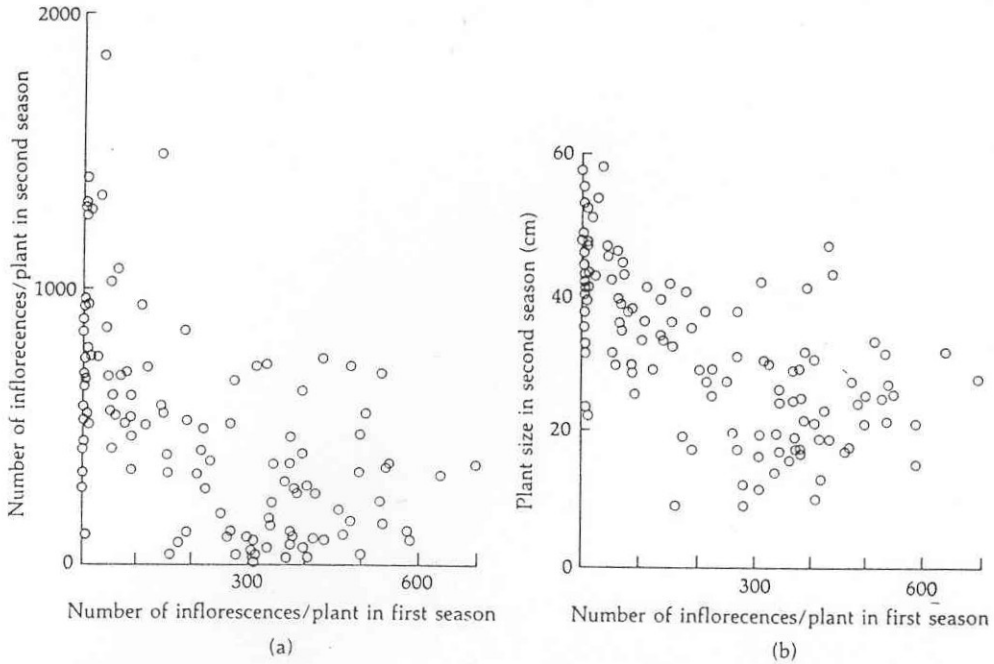
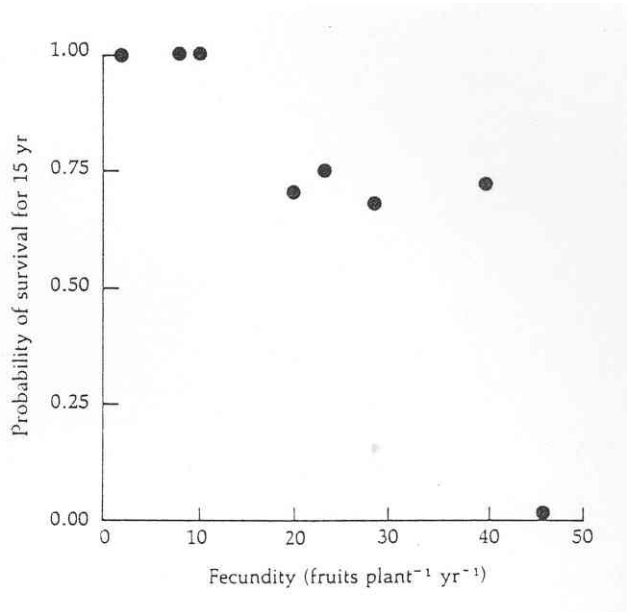



**Figure 5-2** Scatter diagrams of number of inflorescences per plant in the first season and (a) number of inflorescences per plant in the second, and (b) plant size in the second season. (From Law, *American Naturalist* 113:3–16. Copyright © 1979 by University of Chicago Press. By permission.)

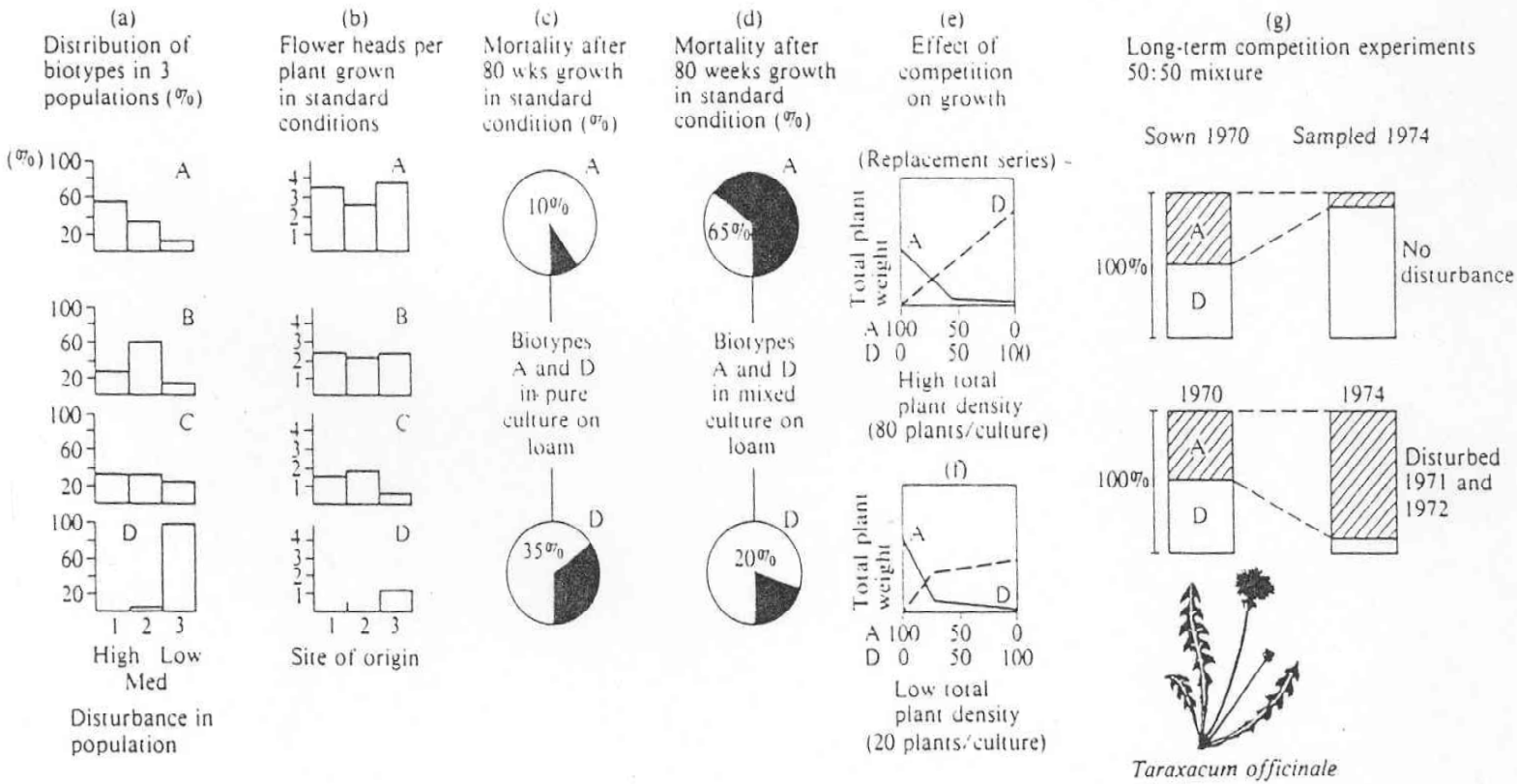
# Fecundity

**Figure 5-3** The probability of surviving for 15 years as a function of fecundity in ten-year-old plants of *Astrocaryum mexicanum* in Veracruz, Mexico. (From Pinero et al. *Journal of Ecology*. 70:473–481.)



# Experimental Test

Fig. 4.19 An experimental test of *r*- and *K*-selection in dandelions. (Data from Solbrig and Simpson 1974, 1977)



# Grimes Model

Table 5-3 Some characteristics of competitive, stress-tolerant and ruderal plants. (*Plant Strategies and Vegetation Processes* by J. P. Grime. Copyright © 1979 by John Wiley and Sons, Ltd. Reprinted by permission.)

| | Competitive | Stress tolerant | Ruderal |
|---|---|---|---|
| **Morphology** | | | |
| Life forms | Herbs, shrubs, and trees | Lichens, herbs, shrubs, and trees | Herbs |
| Morphology of shoot | High, dense canopy of leaves Extensive lateral spread above and below ground | Extremely wide range of growth forms | Small stature, limited lateral spread |
| Leaf form | Robust, often mesomorphic | Often small or leathery, or needlelike | Various, often mesomorphic |
| **Life history** | | | |
| Longevity of established phase | Long or relatively short | Long–very long | Very short |
| Longevity of leaves and roots | Relatively short | Long | Short |
| Leaf phenology | Well-defined peaks of leaf production coinciding with period(s) of maximum potential productivity | Evergreens, with various patterns of leaf production | Short phase of leaf production in period of high potential productivity |
| Phenology of flowering | Flowers produced after (or, more rarely, before) periods of maximum potential productivity | No general relationship between time of flowering and season | Flowers produced early in the life history |
| Frequency of flowering | Established plants usually flower each year | Intermittent flowering over a long life history | High frequency of flowering |
| Proportion of annual production devoted to seeds | Small | Small | Large |
| Perennation | Dormant buds and seeds | Stress tolerant leaves and roots | Dormant seeds |
| Regenerative strategies[1] | V, S, W, $B_s$ | V, $B_T$ | S, W, $B_s$ |

Table 5-3 *continued*

| | Competitive | Stress tolerant | Ruderal |
|---|---|---|---|
| **Physiology** | | | |
| Maximum potential relative growth rate | Rapid | Slow | Rapid |
| Response to stress | Rapid morphogenetic responses (root–shoot ratio, leaf area, root surface area) maximizing vegetative growth | Morphogenetic responses slow and small in magnitude | Rapid curtailment of vegetative growth, diversion of resources into flowering |
| Photosynthesis and uptake of mineral nutrients | Strongly seasonal, coinciding with long continuous period of vegetative growth | Opportunistic, often uncoupled from vegetative growth | Opportunistic, coinciding with vegetative growth |
| Acclimation of photosynthesis, mineral nutrition and tissue hardiness to seasonal change in temperature, light, and moisture supply | Weakly developed | Strongly developed | Weakly developed |
| Storage of photosynthate mineral nutrients | Most photosynthate and mineral nutrients are rapidly incorporated into vegetative structure but a proportion is stored and forms the capital for expansion of growth in the following growing season | Storage systems in leaves, stems, and/or roots | Confined to seeds |

Table 5-3 *continued*

| | Competitive | Stress tolerant | Ruderal |
|---|---|---|---|
| **Miscellaneous** | | | |
| Litter | Copious, often persistent | Sparse, sometimes persistent | Sparse, not usually pers[illegible]nt |
| Palatability to unspecialized [illegible] | Various | Low | Vario[illegible] often high |