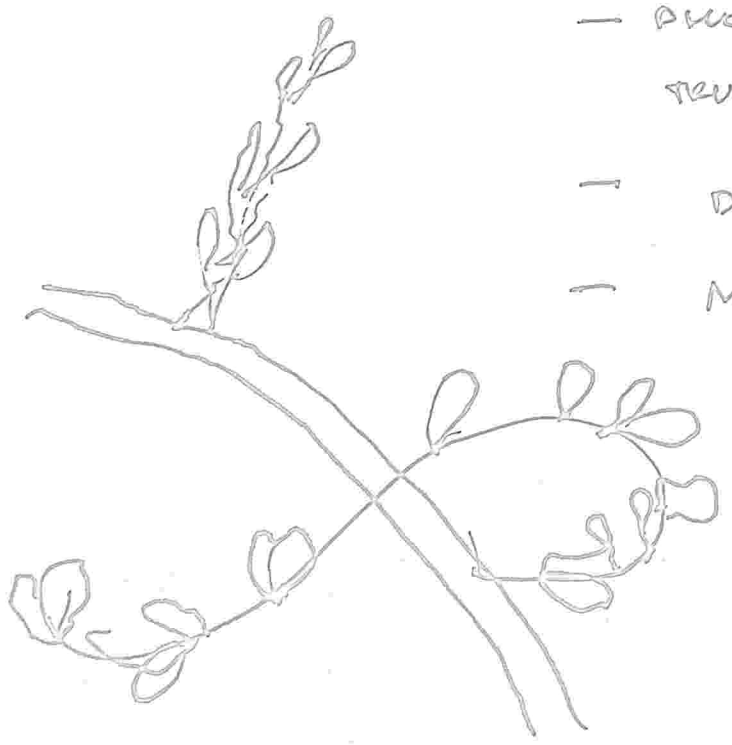
BIO 120: 20161109

KEEPING COOL WHILE KEEPING WATER ?

EXAMPLE: PALO VERDE (SP. "GREEN STICK")

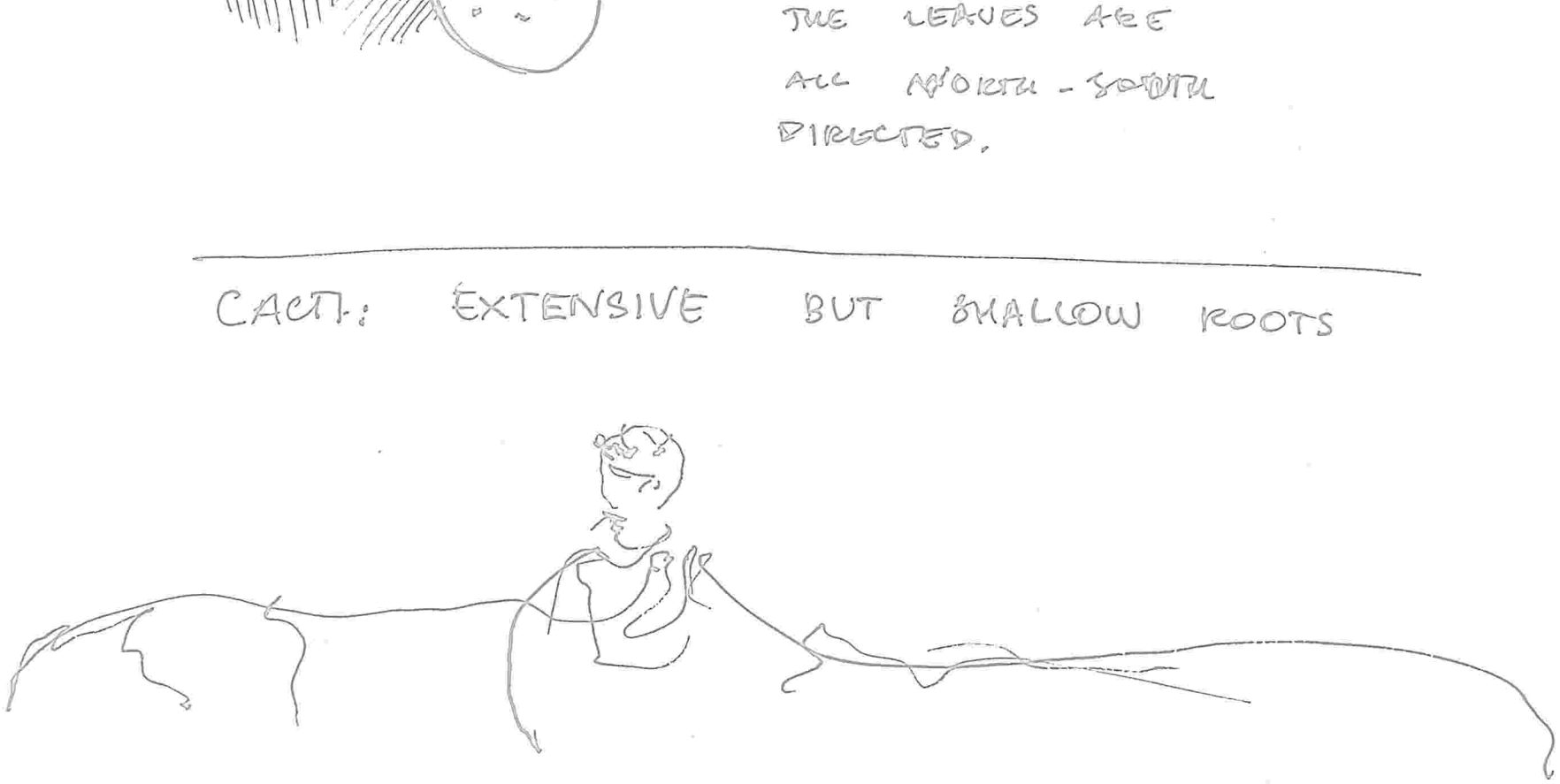


- PHOTOSYNTHETIC BARK ON TRUNKS & BRANCHES
- DROUGHT-DECIDIOUSNESS
- MICROPHYLLIC, LIKE EG MESQUITE

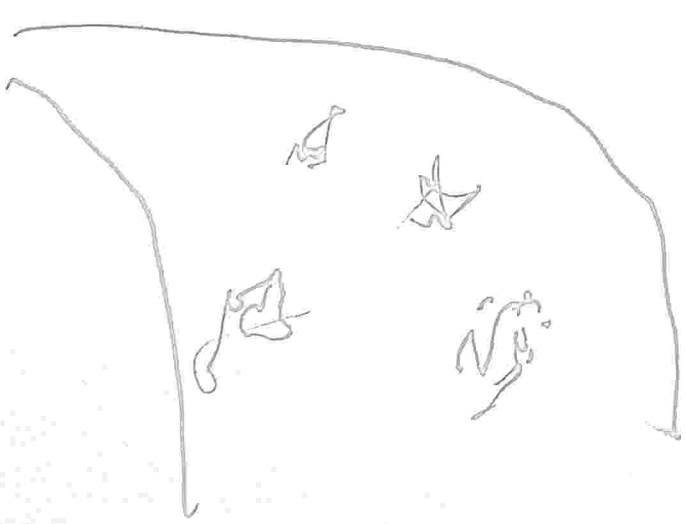
SANTA RITA PRICKLY PEAR

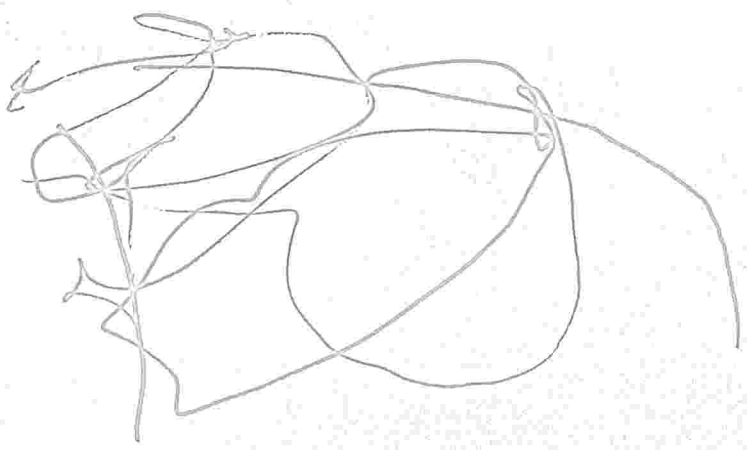
THE LEAVES ARE ALL NORTH-SOUTH DIRECTED.

CACTI: EXTENSIVE BUT SHALLOW ROOTS



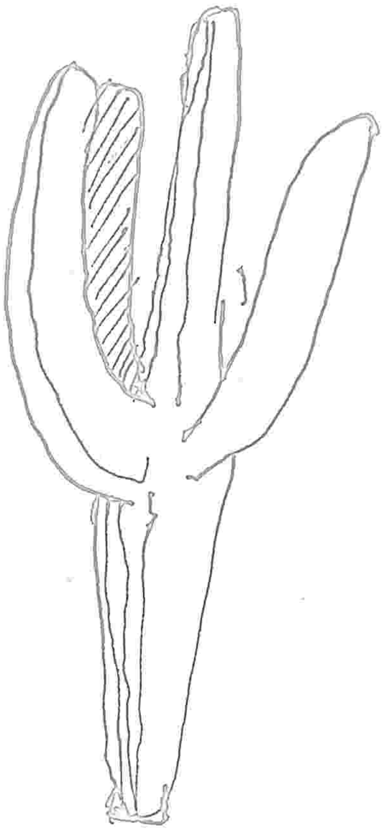
OCCASIONAL RAIN : RILLED RIVER





SAGUARO CACTUS

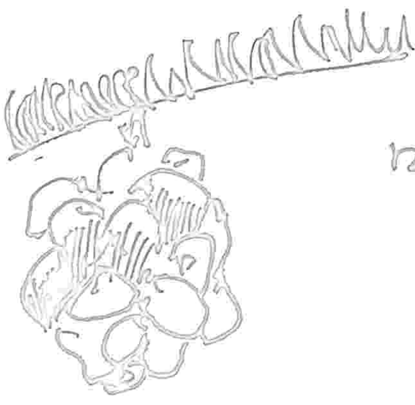
ADAPTED TO EPISODIC RAINS



- GROWS TO 15m, 200 Y., 5t TONNES
- EXTENSIVE, SHALLOW ROOTS
- ACCORDION-PLEATED TRUNK, ALLOWS EXPANSION
- MNEMONIC DIGRESSION FOR WATER STORAGE: DAVID GRONOMAN (d. 1982)
- CAN ABSORB UP TO 800 L FROM ONE STORM

EVERGREEN TREES

- SOME CONIFERS ARE NOT EVERGREEN
- MANY EVERGREENS ARE NOT CONIFERS



RED PINE

TAMARACK, WITH DECIDUOUS [illegible] [illegible]

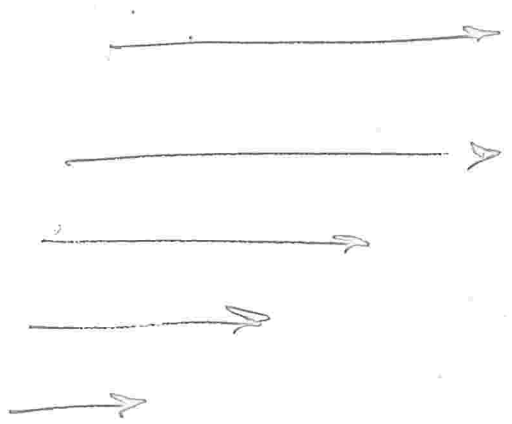
A MORE USEFUL TERMINOLOGY DIFFERENTIATES BETWEEN THE FOLLOWING LEAVES:

MESOPHYTIC

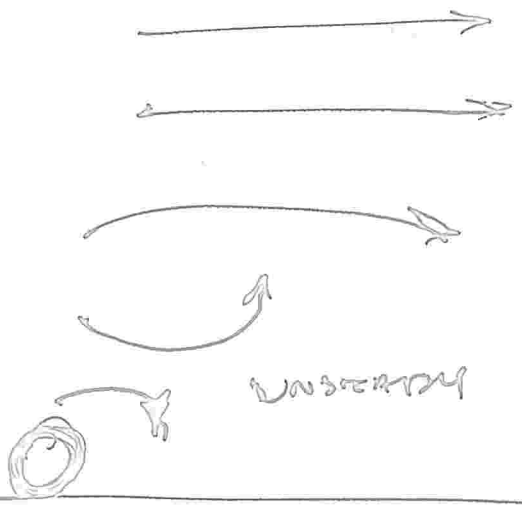
SCLEROPHYLL

LEAF SHAPE ALSO INFLUENCES GAS EXCHANGE THROUGH LAMINAR VS TURBULENT FLOW OF FLUIDS OVER SURFACES.

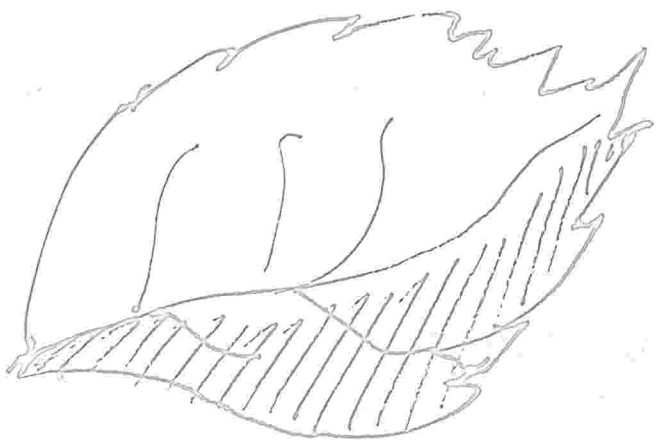
LAMINAR



TURBULENT



TURBULENT FLOW IS BETTER FOR GAS EXCHANGE

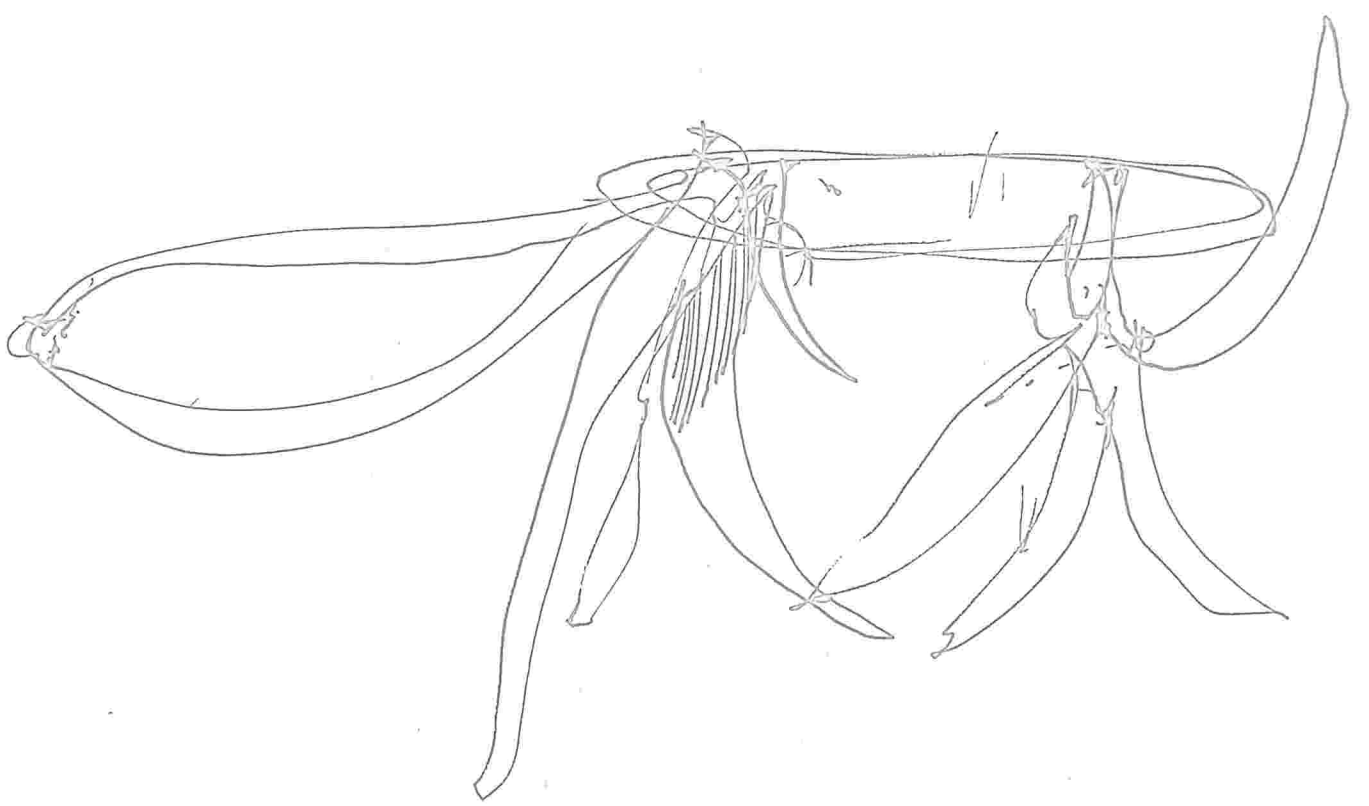


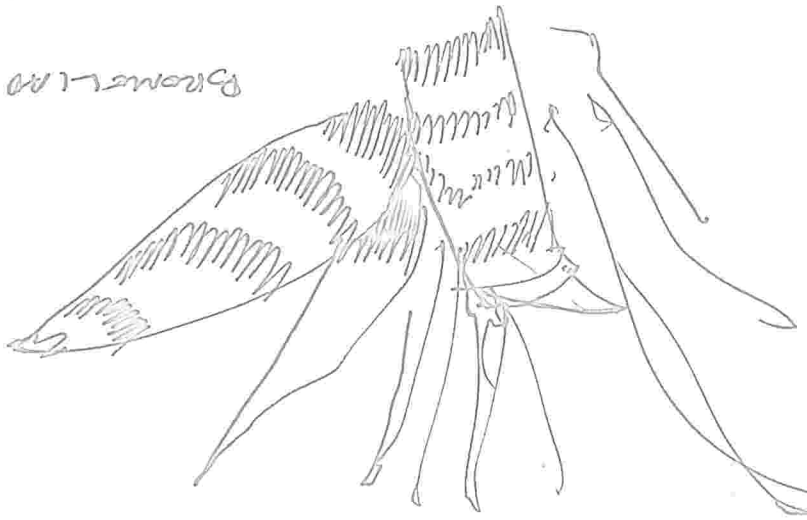
MORPHOLOGICAL PLASTICITY ALLOWS
THE SPECIES TO VARY THE
SIZE OF SINUSES OF THE LEAVES.

MONSTERA DELICIOSA PRODUCES
LEAVES WITH HOLES

NURSING

SEEDLING
CULTIVATED
BY PACO VERDE





PLANTS WITH EVERGREEN LEAVES COMMON IN 4 SITUATIONS.

1. BOREAL SPRUCE-FIR FORESTS,
2. TEMPERATE CLIMATES, WELL-DRAINED SANDY SOIL
3. MAINE BOGS, COOL SUMMERS, WET, ACID
4. MEDITERRANEAN HEATHS, DRY, HOT SUMMERS

EVERGREEN LEAVES CONSERVE NUTRIENTS IN POOR SOILS

SPIRE FIR GROWTH FORM SHEDS SNOW

SMALL LEAVES FAVORED IN DRY HABITATS

BIO120: POPULATION ECOLOGY 2016.01.09

POPULATION :: A COLLECTION OF INDIVIDUALS IN A CERTAIN AREA

POPULATION SIZE N := NUMBER OF INDIVIDUALS

DENSITY: N / AREA

POPULATION ECOLOGY : WHAT INFLUENCES N?

GENETICS : WHAT GENETIC VARIATION IS IN THE POPULATION?

- ASPEN: ONE SEED PRODUCES MANY IDENTICAL, CONNECTED STEMS
- DANDELION: NO SEX / MANY IDENTICAL SEEDS PRODUCE MANY IDENTICAL, UNCONNECTED PLANTS
- [illegible] : MANY UNIQUE SEEDS PRODUCE MANY IDENTICAL PLANTS

1. BASIC MODELS

DISCRETE		CONTINUOUS
DENSITY INDEPENDENT	GEOMETRIC	EXPONENTIAL
DENSITY DEPENDENT		LOGISTIC GROWTH

2. EXTENSIONS — EG. AGE

GOALS OF MOST POPULATION MODELS

- PREDICT $N(t)$
- PREDICT N_t
- PREDICT $\frac{-N(t_0) + N(t_0+\varepsilon)}{\varepsilon}$

CONTINUOUS-TIME AND DISCRETE-TIME APPROACHES ARE MORE SUITABLE FOR DIFFERENT ANIMALS.

DISCRETE MODEL:

$$N_{t+1} = N_t - D + B - E + I$$

B: BORN
I: IMMIGRATED
D: DEAD
E: EMIGRATED

USUALLY, POPULATION IS CONSIDERED AS CLOSED: $I = E = 0$.

SIMPLIFICATIONS:

— GEOMETRIC GROWTH.

- ASSUME BIRTH AND DATE RATES AS CONSTANT PER CAPITA
- $N_{t+1} = \lambda N_t \quad \exists \lambda \in \mathbb{R}$.

$$N = N_0 \lambda^t$$

— EXPONENTIAL GROWTH

- $\frac{dN}{dt} = \text{const} = rN \quad \exists (r \in \mathbb{R})$.
- $N_t = N_0 e^{rt}$

IF $r = \text{const} > 0$, THEN EXPONENTIAL GROWTH IS A BAD MODEL FOR REAL POPULATIONS IN THE LONG TERM.

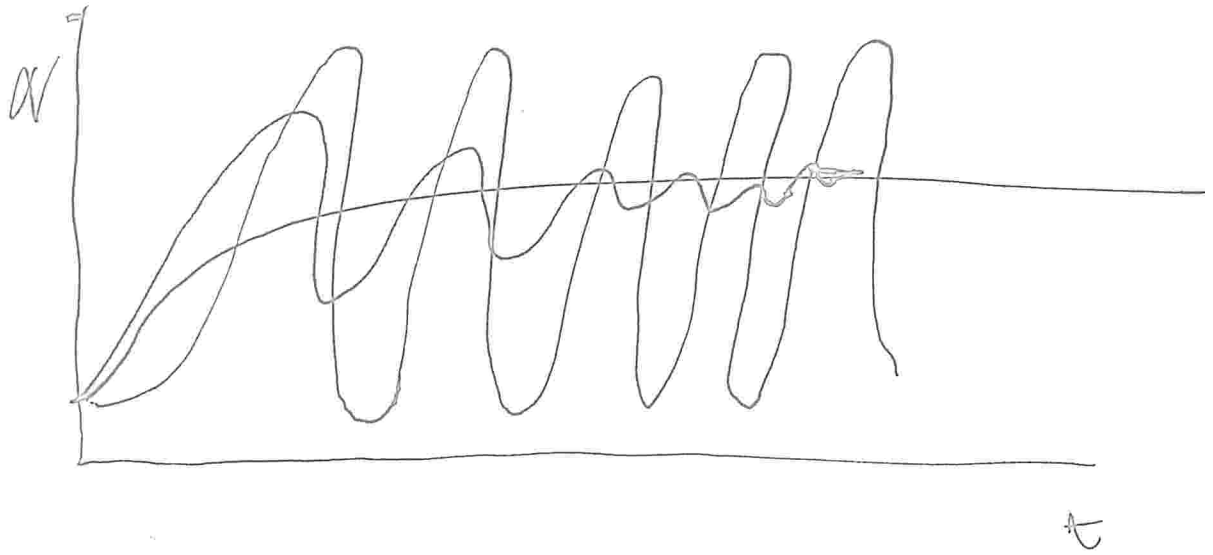
$r = \text{const} < 0$ IS ALSO BAD FOR THE EXISTENT POPULATIONS IN THE LONG TERM.

LOGISTIC MODEL

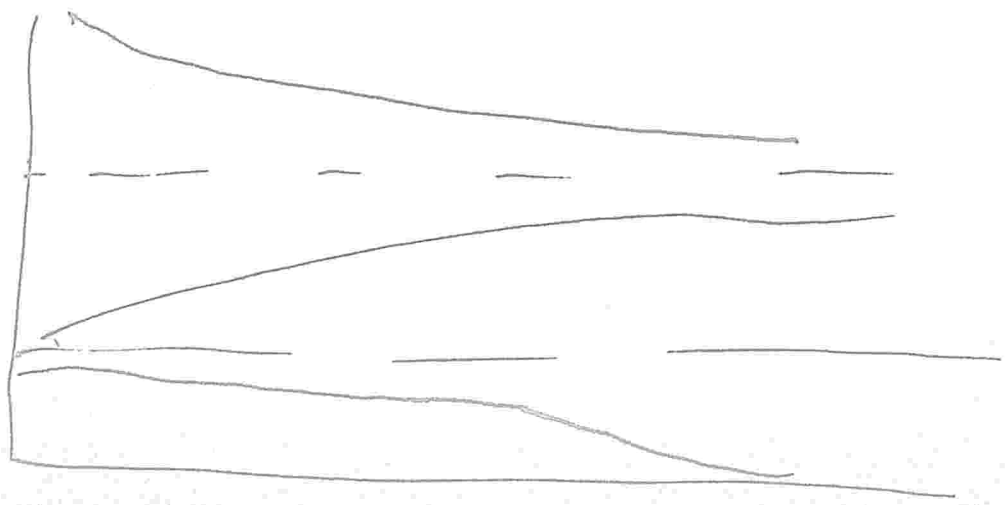
ALTERNATIVE FORMS OF DENSITY-DEPENDENCE:

- $\left(\frac{K-N}{K}\right)^Z$

- $\frac{dN_t}{dt} = rN_t\left[1 - \frac{N_{t-\tau}}{K}\right]$



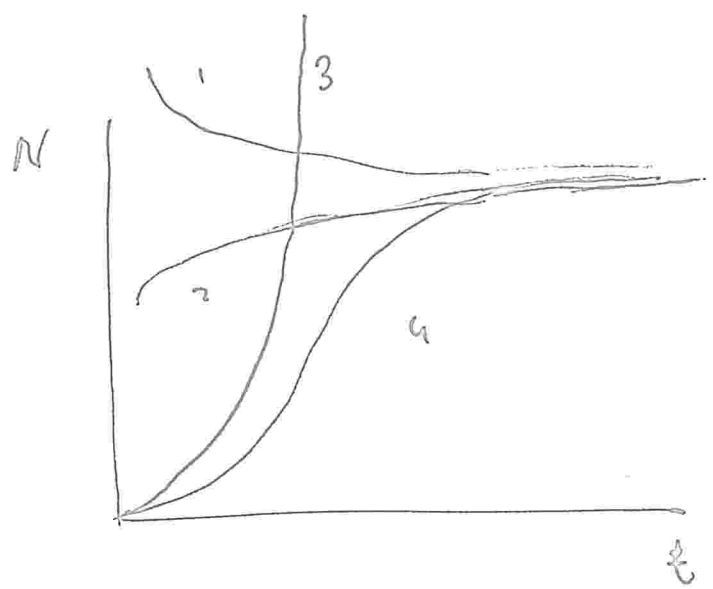
- ALLEE EFFECTS ARE NEGATIVE EFFECTS OF LOW DENSITY, ARISING FROM SOCIAL BENEFITS SUCH AS MATE FINDING, PREDATOR, LIVING, GROUP DEFENSE



LOGISTIC GROWTH (Verhulst 1837)

$$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$$, where

K is the carrying capacity



$$\frac{dN}{dt} = rN - \frac{rN^2}{k}$$

$N(t) =$

4	$N(0) =$ 300
2	$N(0) =$ 200
3	$N(0) =$ 10
1	$N(0)$ 10