10-2-05 ①

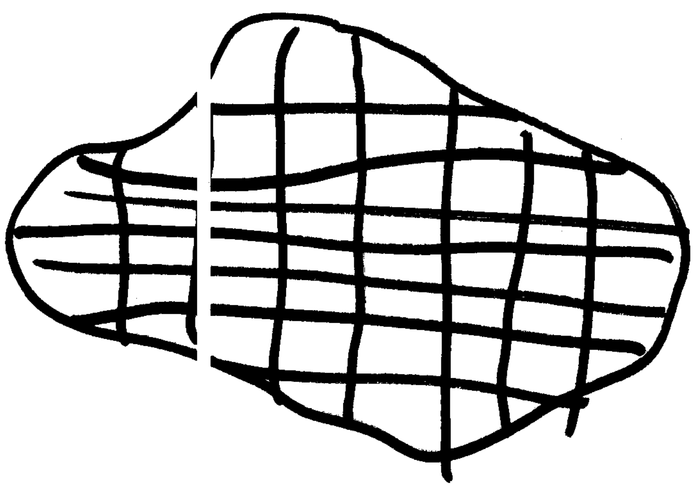
A trip to Eden (Island)

Rats Plenty of Food

p 113 No Competition

Expect Mutiplication

exponential growth.



2 rats 1 Island

↓

many rats 1 Island

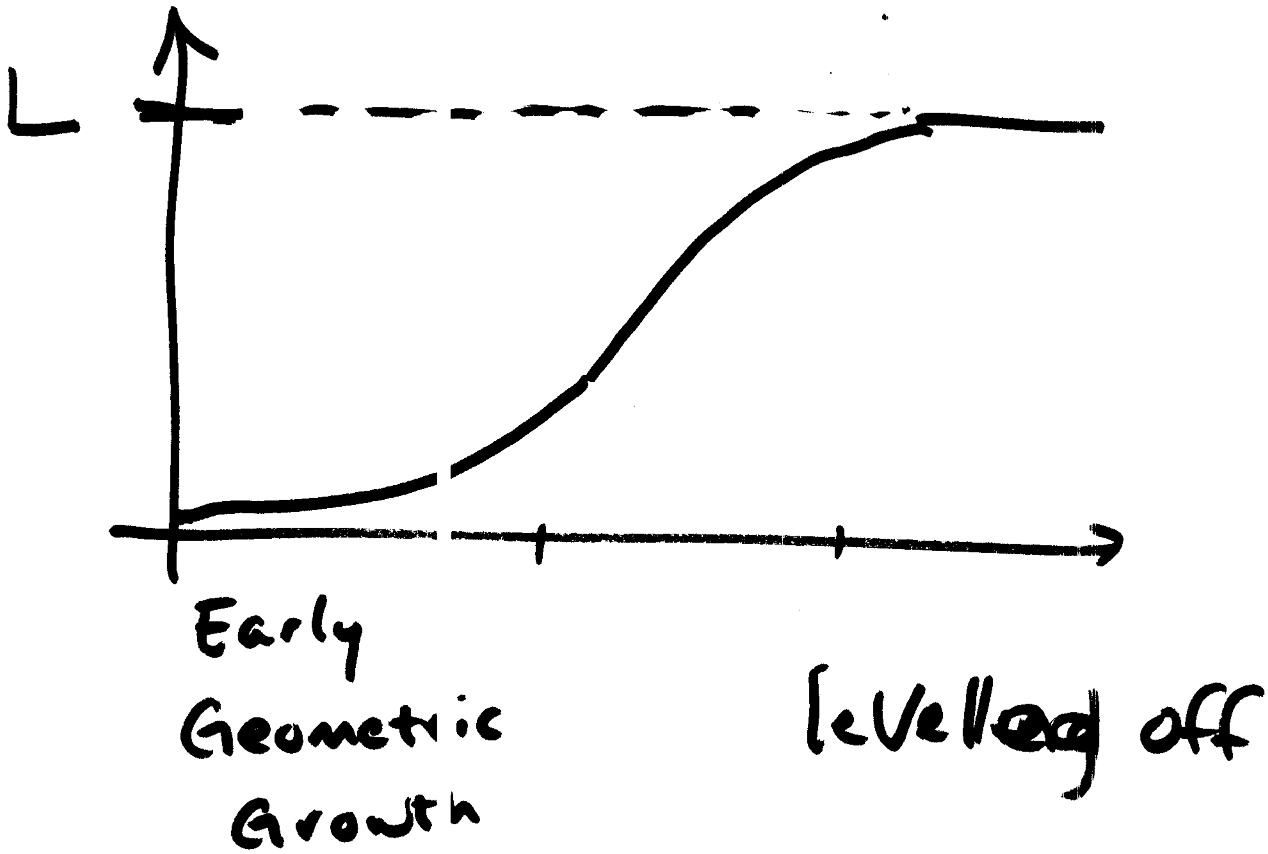
Eden becomes over crowded

after a few generations.

Expect growth to slow

maybe level off.

Population over time



Assumptions

I Early Exponential Growth

II No/Little growth if pop near "carrying cap"

III pop will decrease if it's greater than L

Logistic Model

$$\frac{\Delta y}{\Delta t} = r y \left(1 - \frac{y}{L}\right)$$

y = "pop"

t = "time"

r = early exponential growth rate

L = carrying capacity.

Eden for Rats

$L = 10{,}000$

$r = 41.42\% = .4142$

y = Rat Pop

t = time in Months

Month by month — $\Delta t = 1$

So

$$\Delta y = .4142 \cdot y \cdot \left(1 - \frac{y}{10{,}000}\right)$$

So if we know how many rats there are today we can predict how many rats there will be in one month.

t	y	Δy
0	2	$.4142(2)\left(1 - \frac{2}{10{,}000}\right) = .8282.. = .83$
1	2.83	
⋮	⋮	
?	5000	1035 - Biggest Possible increase
?+1		

(5)

t	y	$\Delta y = .4142\, y\left(1 - \frac{y}{10{,}000}\right)$
? ~~9900~~	9900	41 Small increase as pop nears L
?+1		
? ~~10500~~	10500	−217 Meets Assumpt. III decrease in pop if > L
?+1		

$y > 10{,}000$

$\frac{y}{10{,}000} > \frac{10{,}000}{10{,}000} = 1$

makes last factor $\left(1 - \frac{y}{10{,}000}\right)$ negative

$y \approx 10{,}000 \quad \frac{y}{10{,}000} \approx 1$

Make last factor $\left(1 - \frac{y}{10{,}000}\right)$ close to 0