

Ecological modelling with Simile

Lecture 3 Population submodels

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When do we need to use a population submodel?

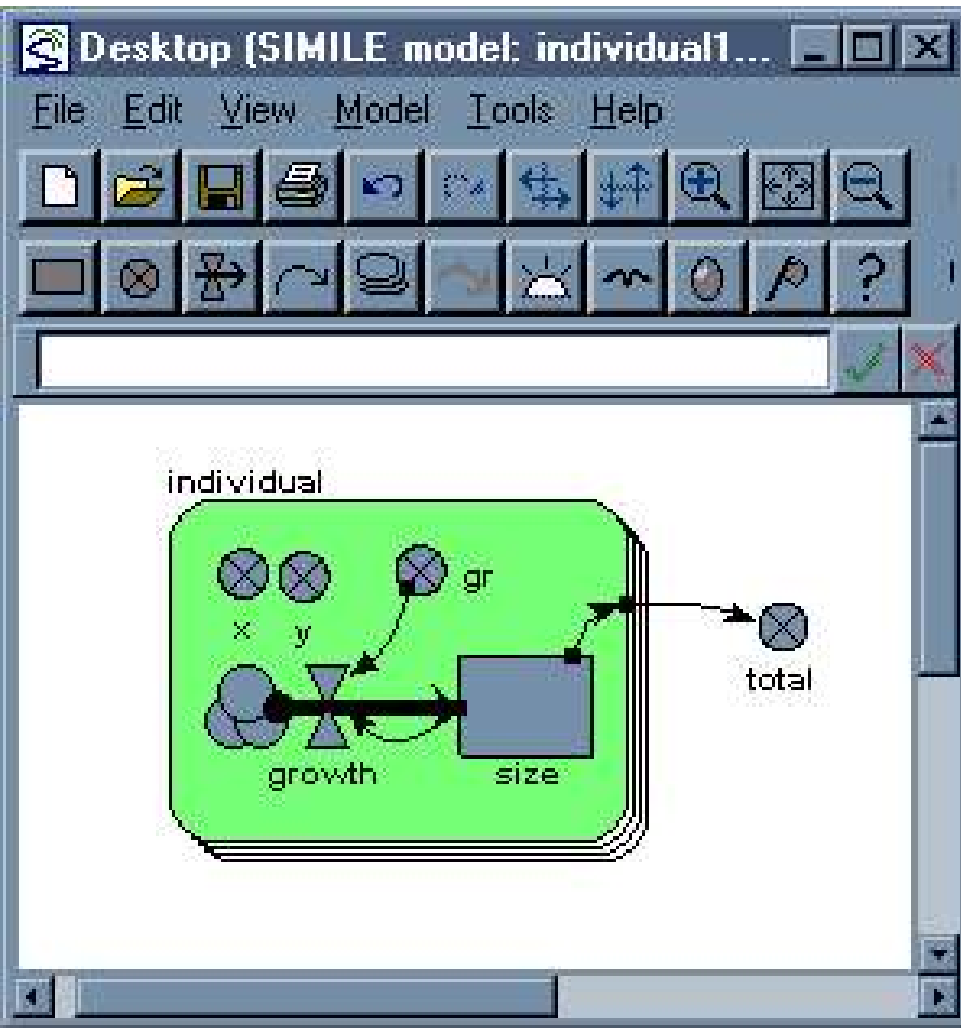
Individual-based modelling involves representing each individual separately, rather than using one or several state variables to represent the aggregate population.

If you have a fixed number of individuals, you can use a **fixed-membership multiple-instance** submodel (Lecture 2).

If you have a varying number of individuals, you need to use a **population submodel**.



Fixed population size



```
x = rand(0,80)
```

```
y = rand(0,100)
```

```
gr = rand(1,3)
```

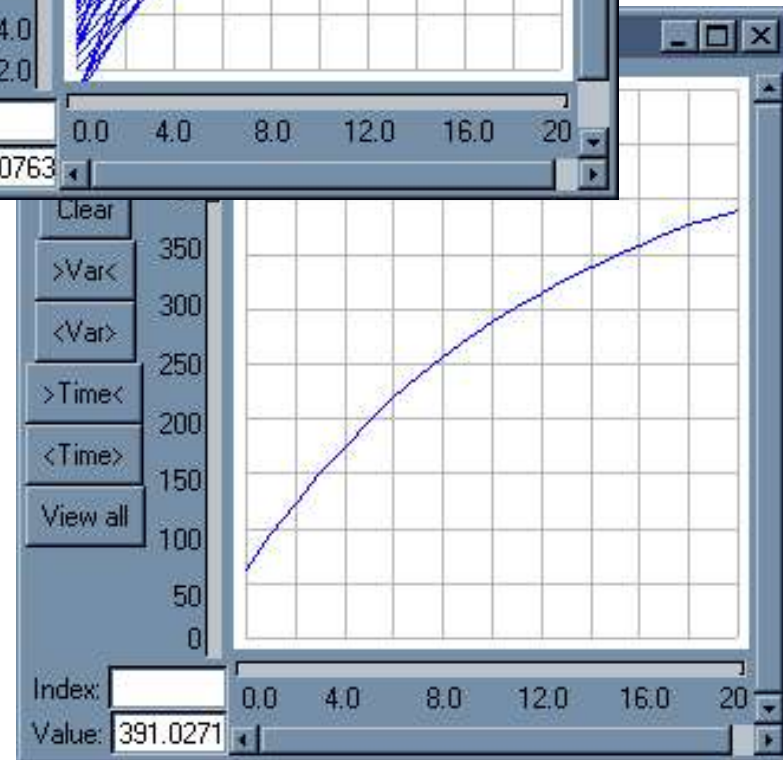
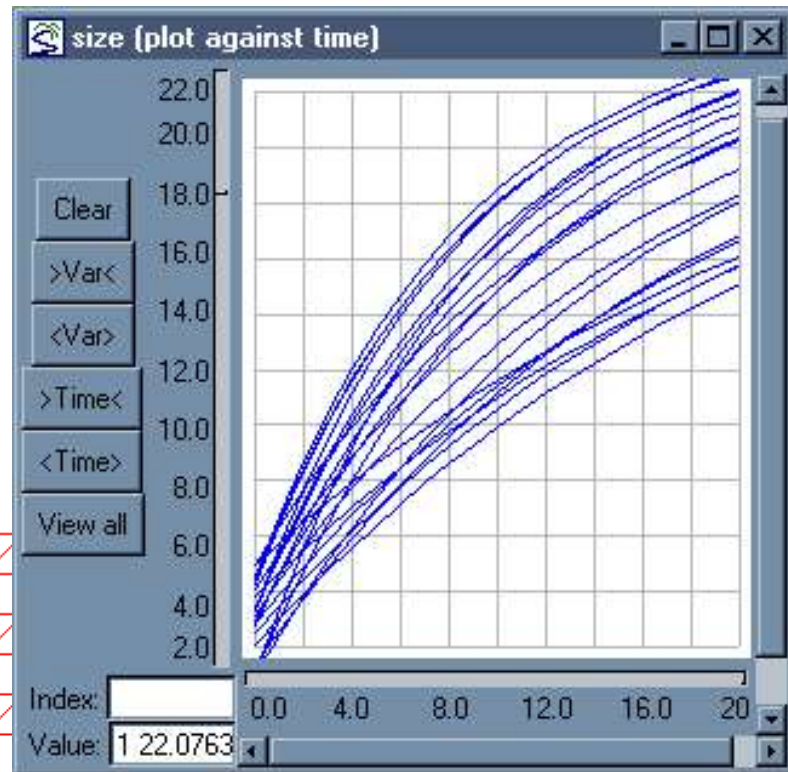
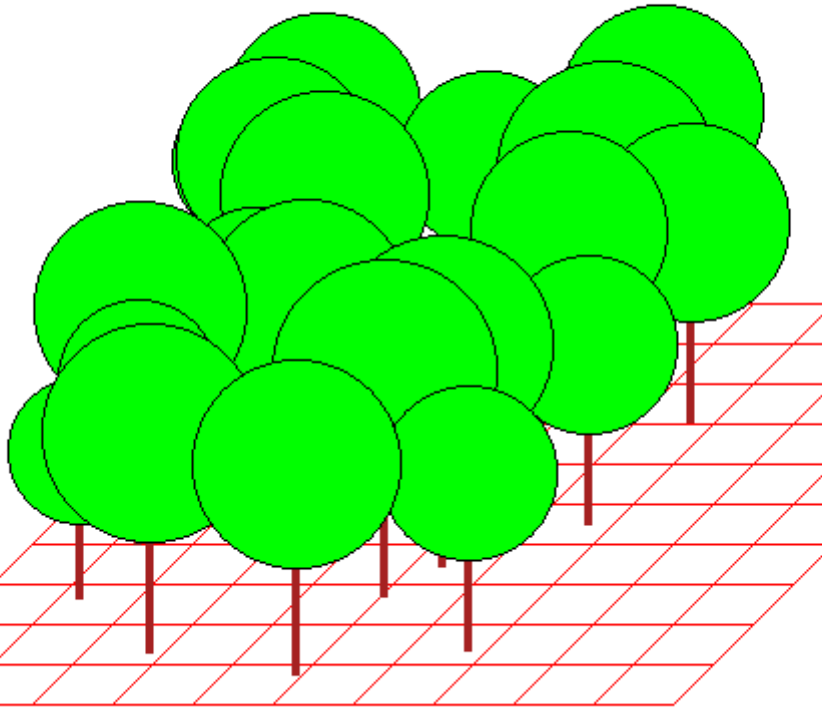
```
growth = gr*(1-size/25)
```

```
size = rand(1,5)
```

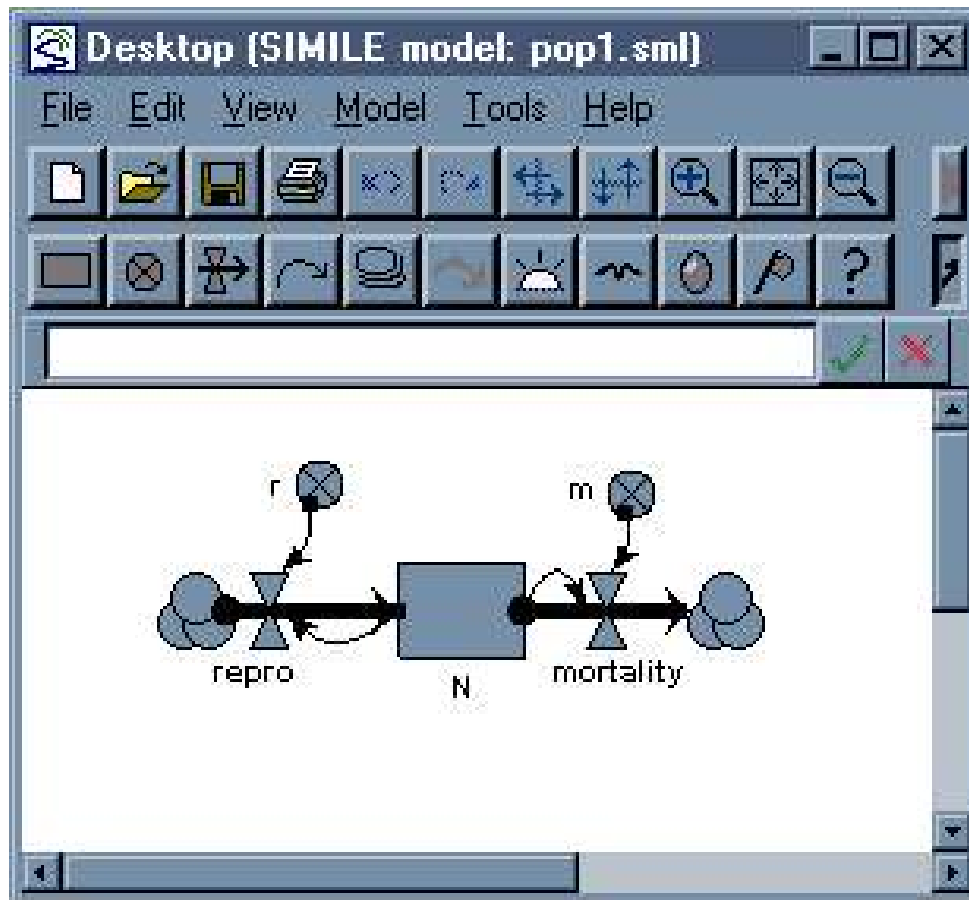
```
total = sum([size])
```



Fixed population size: results

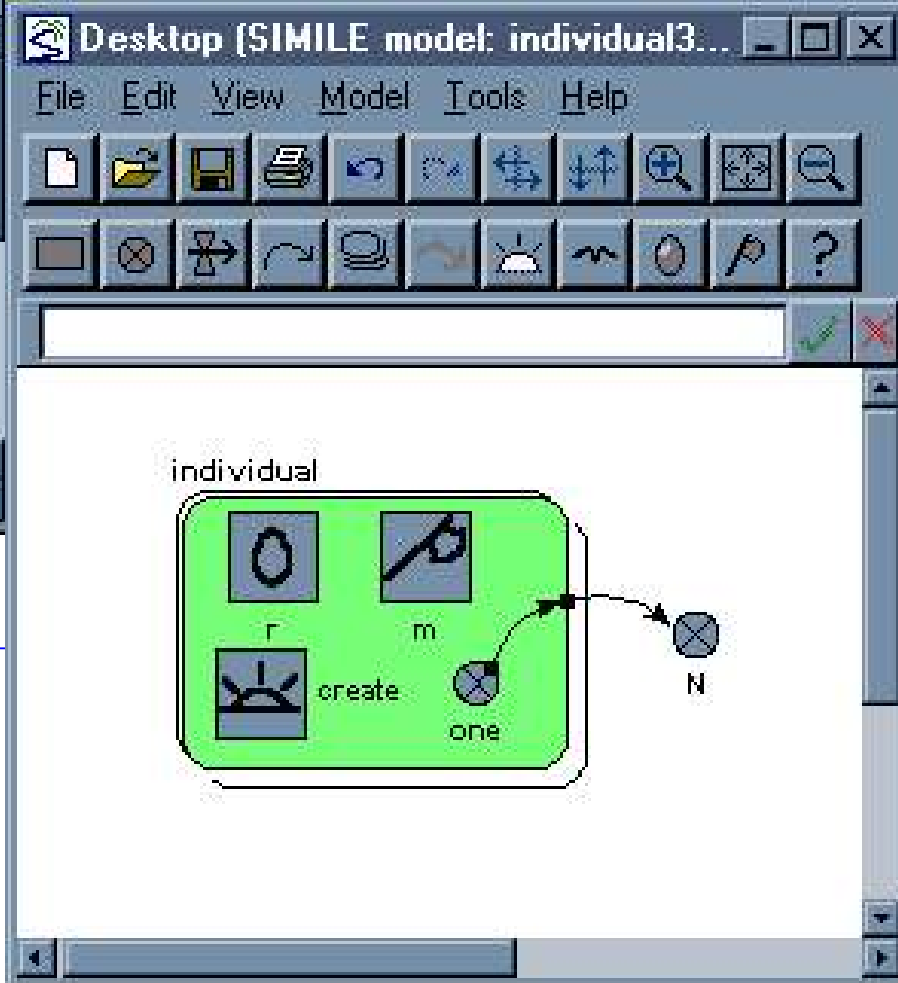


Simple dynamic population

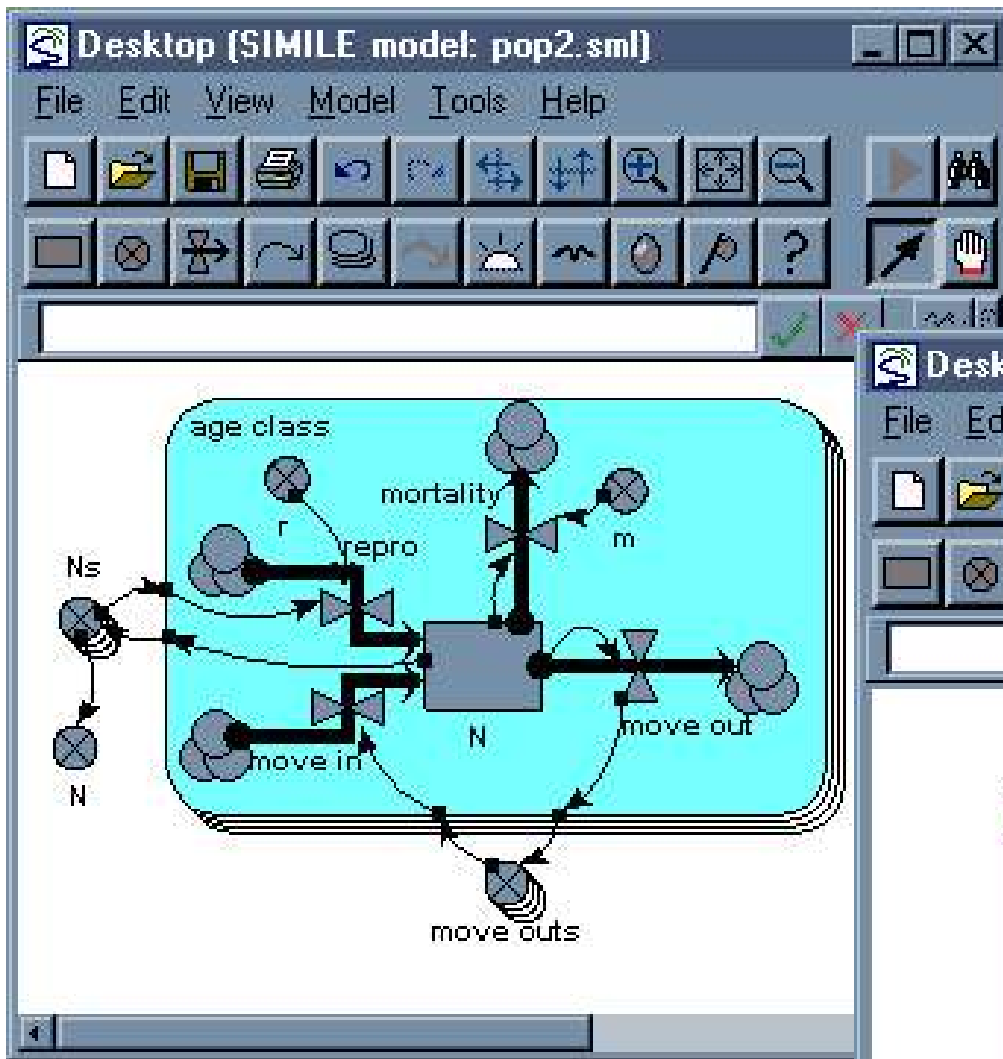


```

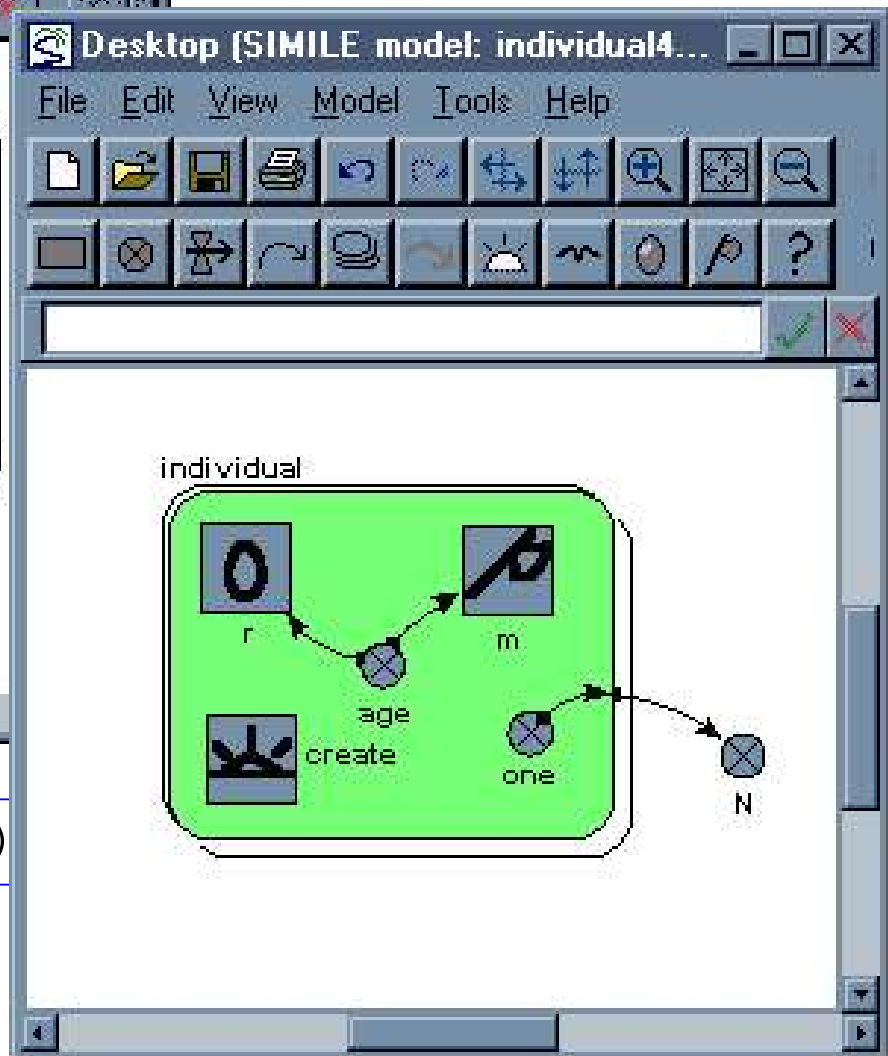
r = rand_var(0,1) < 0.3
m = 0.2
create = 10
one = 1
N = sum({one})
  
```



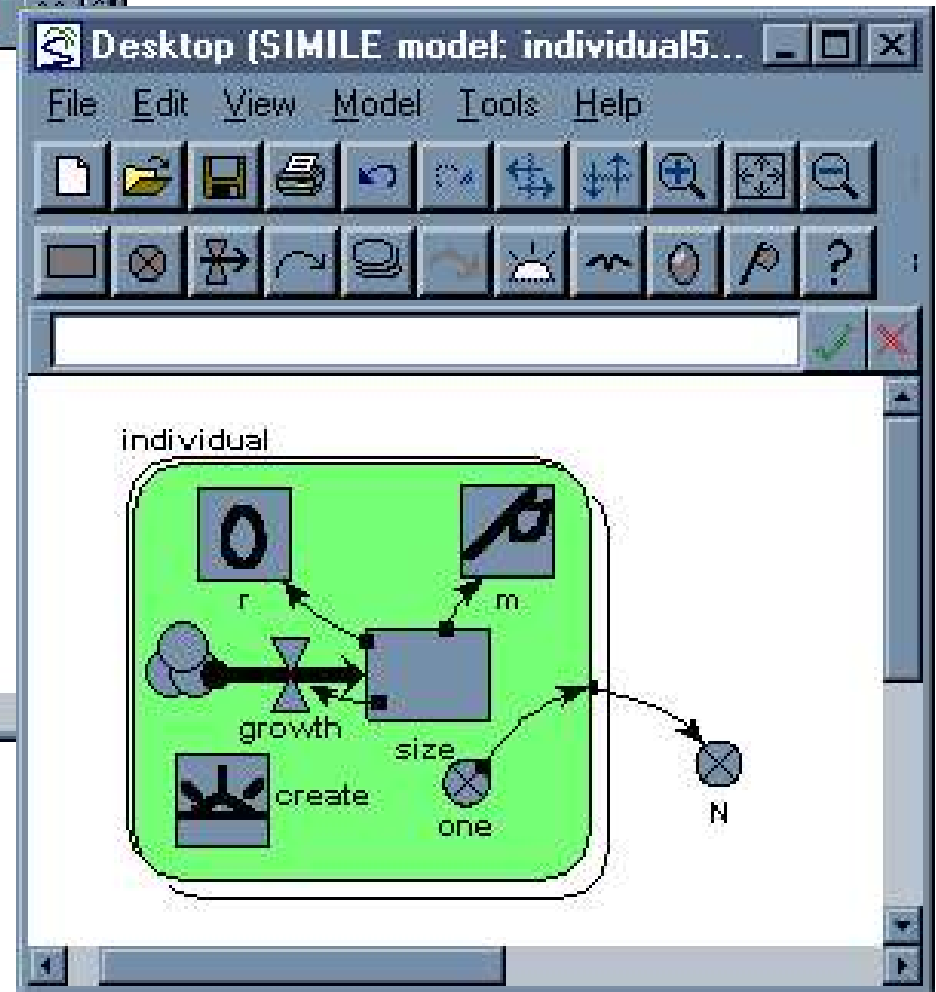
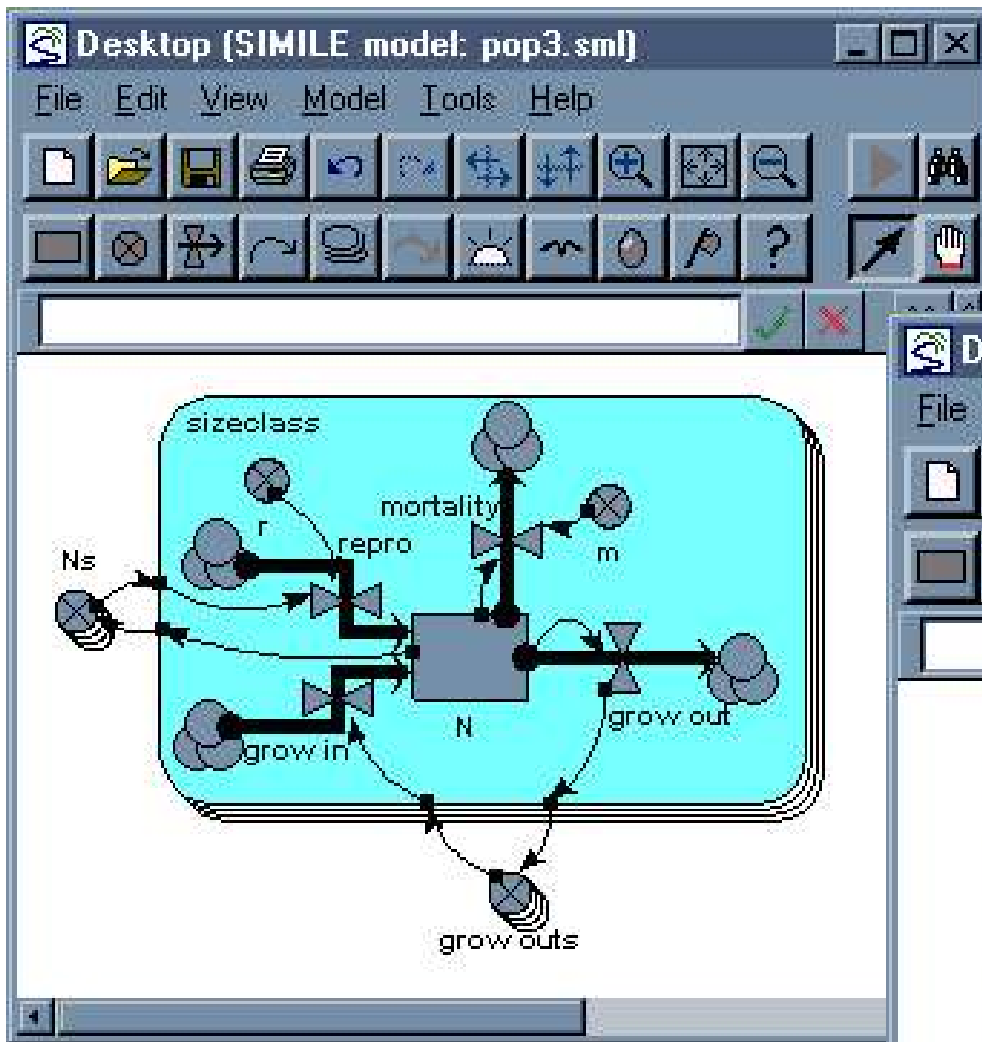
Age-class population



`age = time(1) - init_time(1)`



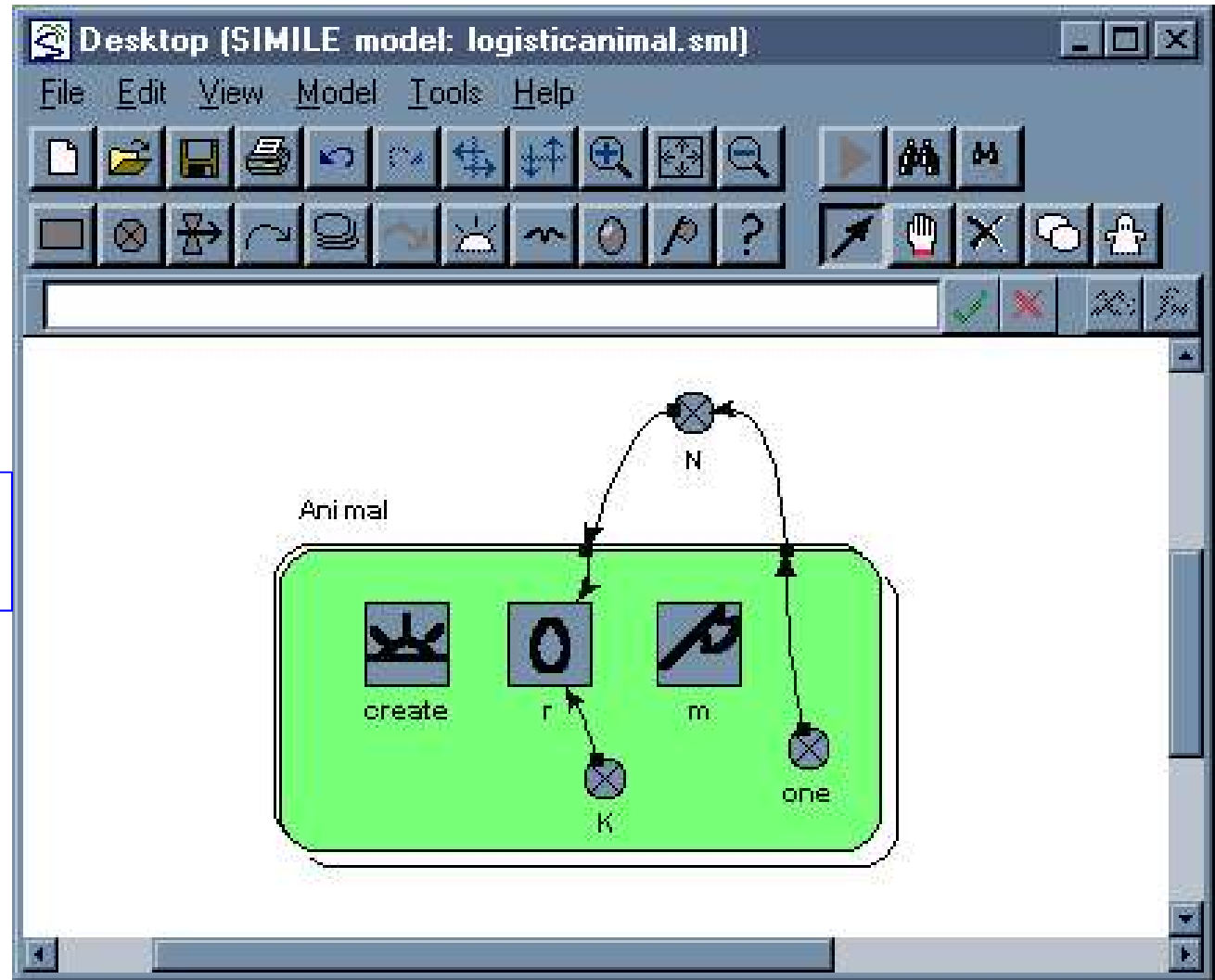
Size-class population



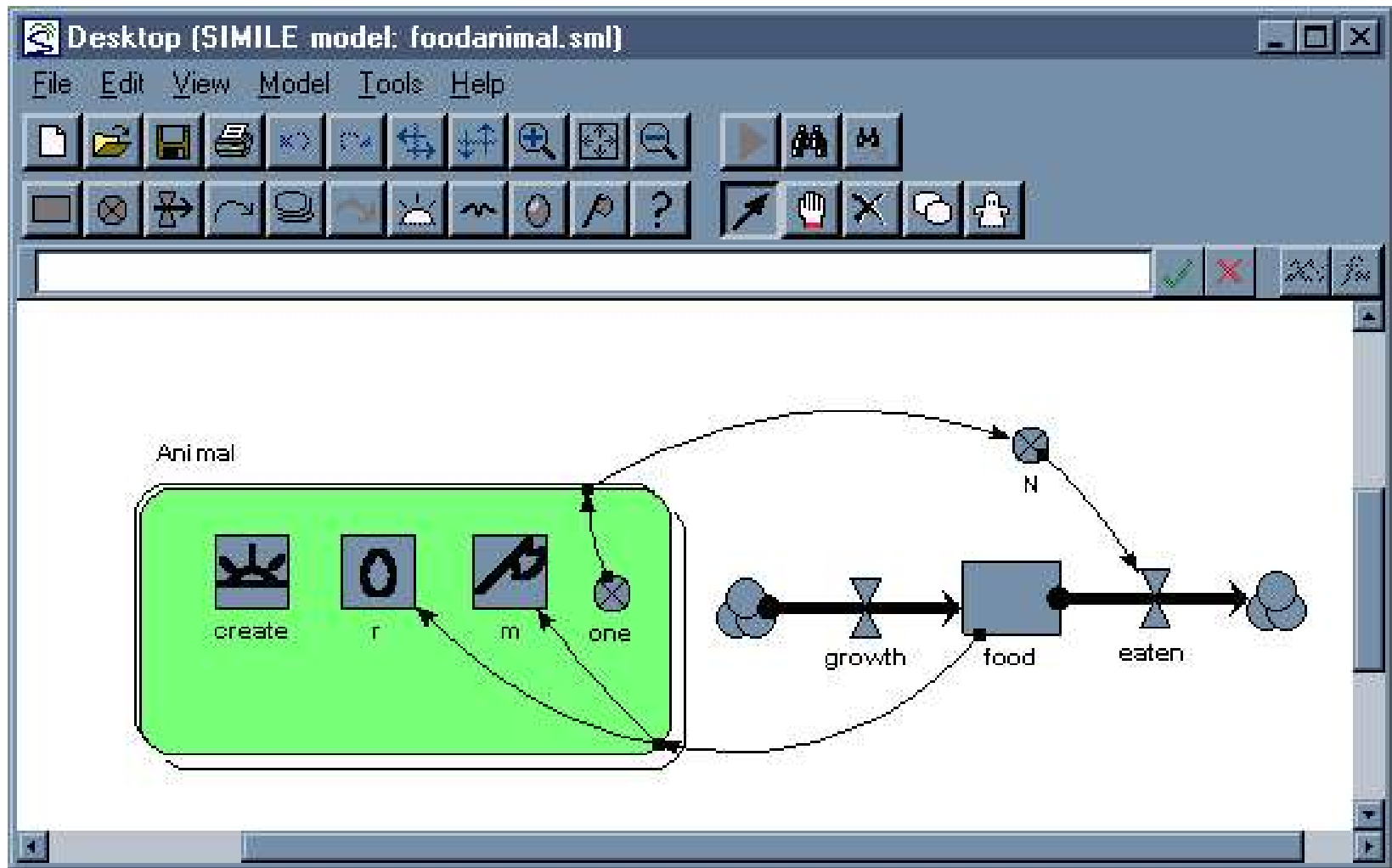
Simple density-dependence

$$N = \text{sum}(\{\text{one}\})$$

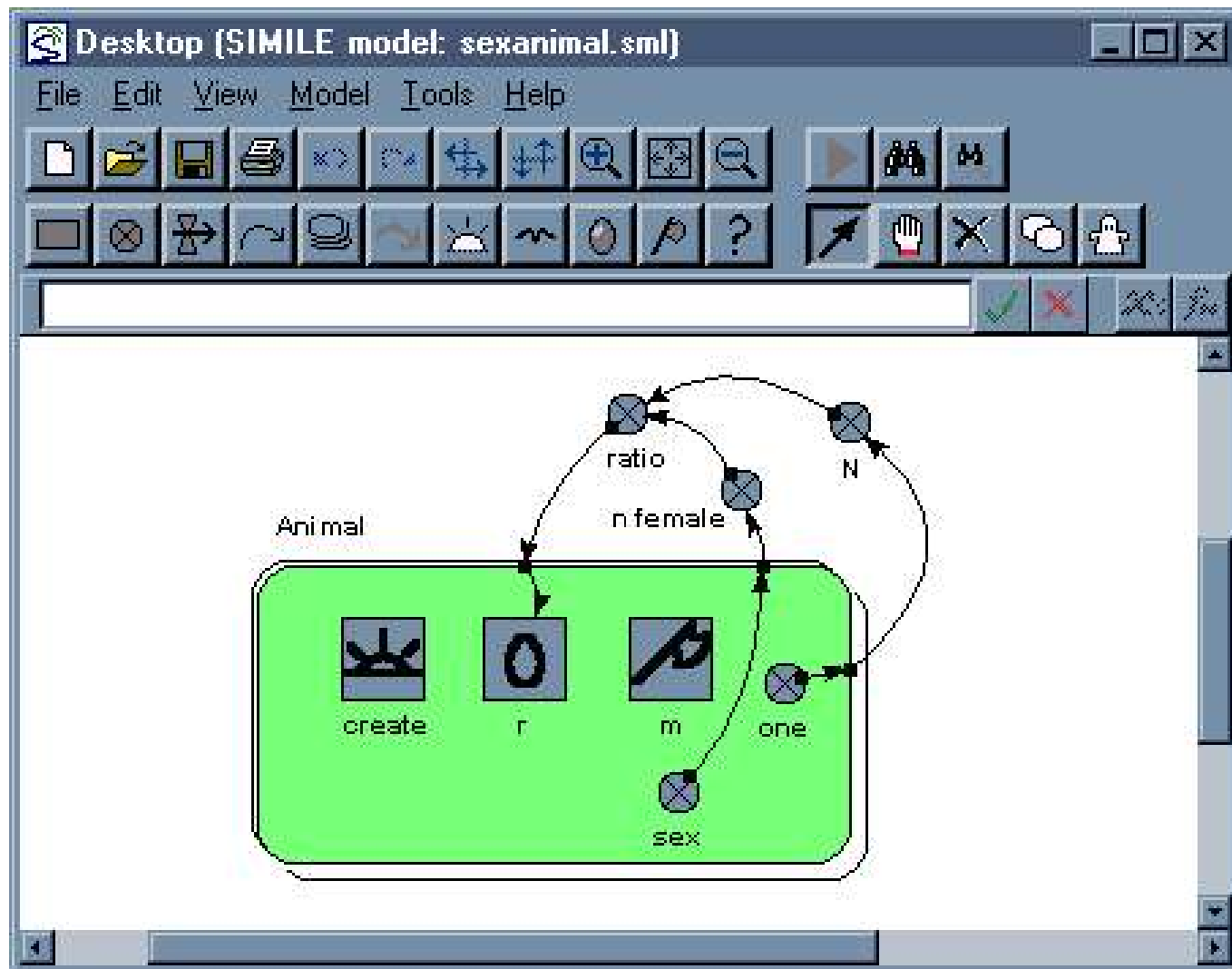
$$r = 0.5 * (1 - N/K)$$



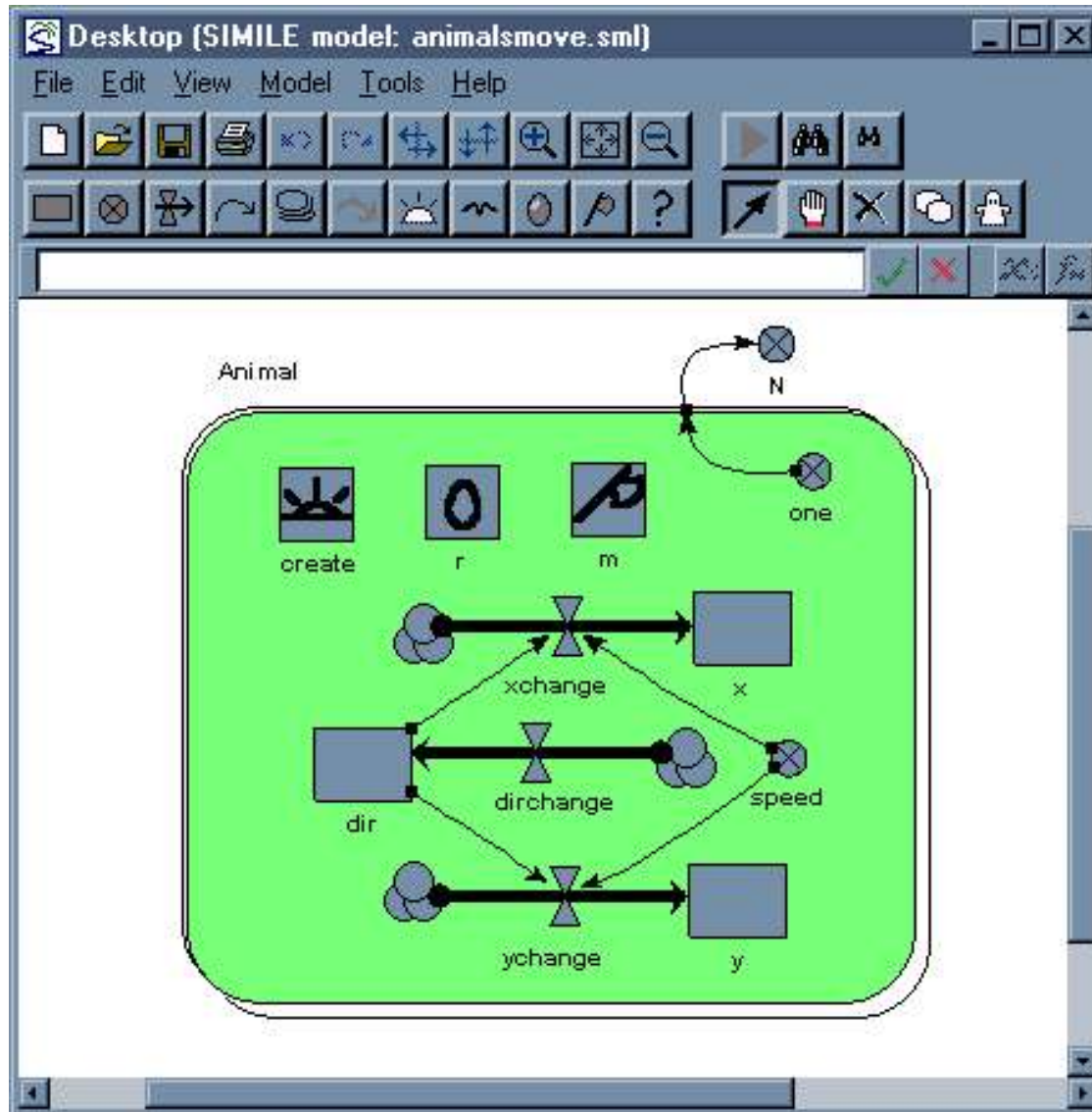
Interaction with food



Male and female individuals



Animal movement



Animal movement

