BioSim parameter- and function descriptions

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Animals

Herbivores and Carnivores share the same parameters (excepting $DeltaPhiMax$ which only applies to Carnivores, see section regarding the parameter for more information).

w_birth & sigma_birth

When calculating the birthweight of a new animal, the species' *w_birth* and *sigma_birth* are used.

$$\mu = \log\left(\frac{{w_{\text{birth}}}^2}{\sqrt{{\text{sigma}_{\text{birth}}}^2 + w_{\text{birth}}^2}}\right)$$

$$\sigma = \sqrt{\log\left(1 + \frac{\text{sigma}_{\text{birth}}^2}{w_{\text{birth}}^2}\right)}$$

The newly calculated values are then used in a log-normal function in order to draw randomly distributed samples of the new animals birthweight.

w_birth & sigma_birth & zeta & xi & gamma

In addition to calculating the birthweight, *w_birth* and *sigma_birth* are used along with *zeta* in order to calculate the weight threshold for an animal to give birth. If this condition is not met, the animal will not give birth.

$$\text{weight} \geq \text{zeta}(w_{\text{birth}} + \text{zeta}_{\text{birth}})$$

When an animal gives birth, it loses weight.

$$\text{weight} \quad \text{-=} \quad \text{xi} \times \text{baby weight}$$

An animal may only give birth if is able to lose this weight (its weight cannot be negative).
The probability of producing offspring is also dependent on its *gamma*. The animal may in addition only give birth with a probability of the sum of its fitness and *gamma*.

beta

When an animal eats, it gains weight accordingly

$$\text{weight} \quad \text{+=} \quad \text{beta} \times \text{food eaten.}$$

eta

Each year the animal loses weight accordingly

$$\text{weight} \quad \text{-=} \quad \text{eta} \times \text{weight.}$$

phi_age & a_half & phi_weight & w_half

The animals fitness is calculated as

$$\Phi = \begin{cases} 0 & w \leq 0 \\ q^{+}(a, a_{\frac{1}{2}}) \times q^{-}(w, w_{\frac{1}{2}}) & \text{elsewhere} \end{cases}$$

where $q^{\pm}$ is calculated by

$$q^{\pm}(x, x_{\frac{1}{2}}, \phi) = \frac{1}{1 + e^{\pm\phi(x - x_{\frac{1}{2}})}},$$

substituting x with *phi_age* and a_half for q^{+} and with *phi_weight* and w_half for q^{-}.

mu & F

The movement of an animal depends on multiple factors. The first being a probability calculated as mu times the animals fitness. In addition, if this is satisfied, an animal may still be static. The additional probability is calculated by

$$\text{abundance} = \frac{\text{food available}}{(\text{N} + 1) \times \text{F}},$$

where N is the number of animals of the same species in the cell, F is the amount of fodder an animal tries to eat every year.
The propensity is then calculated for each of the possible cells the animal may move to by

$$\pi = \exp(\text{abundance})$$

and the probability of moving to the selected cell

$$\text{probability} = \frac{\pi_{i=\text{selected}}}{\sum_{i=1}^{4} \pi_i}$$

If π is 0 for all the neighboring cells, the probability of movement is set at 50%.

omega

An animal may die. The probability of death is calculated as

$$\text{probability} = \text{omega}(1 - \text{fitness}).$$

DeltaPhiMax

When a carnivore tries to eat a herbivore, it compares the herbivores' fitness to its own. If this difference is below $DeltaPhiMax$, the probability of killing that herbivore is

$$\text{probability} = \frac{\text{difference}}{\text{DeltaPhiMax}}$$

Movement

stride

The number of cells an animal moves per year.

Highland & Lowland & Desert & Water

The terrain-types the animal may move to ($True$ for the movable types and $False$ otherwise).

Island

Highland & Lowland & Desert & Water

> Describes the amount of available fodder in the selected terrain-type. See section on eating for information about how the available fodder is used.

alpha & v_max

> The regrowth of fodder in a cell is determined by the factors *alpha* and *v_max* through the equation
>
> $$\text{available\_fodder} = \min\left[\text{current\_fodder} + \text{v\_max}\left(1 - \frac{\text{alpha}(\text{f\_max} - \text{current\_fodder})}{\text{f\_max}}\right), \text{f\_max}\right]$$
>
> where *f_max* is the value set in the previous section.