Logistic growth curves

logistic curves

You can describe an S-shaped growth curve in a lot of ways, depending on how you want to interpret the parameters and the scale of the variation. The source of variation is important, because it alters the assumptions in the statistical model.

In R, the `nlme` package has several built-in functions for nonlinear models with random effects. And of course, you can do anything else want.

Version 1

$$y = \frac{\phi_1}{1 + e^{(\phi_2 - \phi_3 \cdot t)}}$$

```
logis1 <- function(x, tti, asym, rate){
  y <- asym/(1 + exp(tti - rate * x))
  y
}
```

Version 2

From Pinheiro and Bates (2000).

$$y = \frac{\text{Asym}}{1 + e^{((\text{xmid} - t)/\text{scal})}}$$

```
logis2 <- function(x, xmid, asym, scal){
  y <- asym/(1 + exp((xmid-x)/scal ))
  y
}
```

Version 3

From Pop Eco.

$$y = \frac{b_0 e^{rt}}{1 + \alpha b_0 \left(e^{rt} - 1\right)}$$

```
logis3 <- function(x, b0, r, alpha){
  b0*exp(r*x) / (1 + alpha*b0*(exp(r*x)-1) )
}
```

```
layout( matrix(c(1,2,3), nrow=1) )
curve(logis1(x, tti=5, asym=20, rate=1), 0, 10, ylim=c(0, 20))
curve(logis2(x, xmid=5, asym=20, scal=1), 0, 10, lty=2, col=2)
curve(logis3(x, b0 = 0.133857, r=1, alpha=.05), 0, 10, lty=3, col=3)
```