NPP-STAT-MODEL

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June 2020

The ring-width model assumes that for tree i for year t there is an underlying true diameter $D_{i,t}$ and increment $X_{i,t}$.

These latent states are related to each other via the process:

$$D_{i,t} = D_{i,t-1} + 2 \cdot X_{i,t}/10$$

The latent increment is lognormally distributed with a mean determined by the sum of a tree-specific parameter β_i and a year-specific parameter β_t as follows:

$$X_{i,t} \sim \text{lognormal}(\beta_i + \beta_t, \sigma^x)$$

Then, the observed diameters $D_{i,t}^{\text{obs}}$ and increments $X_{i,t}^{\text{obs}}$ are defined as:

$$\begin{aligned}
\log(D_i^{\text{obs}}) &\sim \text{student-t}(3, \log(D_i), \sigma_{obs}^d) \\
\log(X_{i,t}^{\text{obs}}) &\sim \text{normal}(\log(X_{i,t}), \sigma_{obs}^x)
\end{aligned}$$

, where σ_{obs}^d is assumed to be fixed (at a value estimated at sites with both census and increment data).

Priors are defined as follows:

$$\begin{aligned}
\beta^\mu &\sim \text{normal}(0, 1.0/0.00001) \\
\sigma_{obs}^x &\sim \text{uniform}(0, 2.0) \\
\sigma_x &\sim \text{uniform}(1e-6, 1000) \\
\beta^\sigma &\sim \text{uniform}(1e-6, 1000) \\
\beta_t^\sigma &\sim \text{uniform}(1e-6, 1000) \\
D_{i,0} &\sim \text{uniform}(0, 50) \\
\beta_i &\sim \text{normal}(\beta^\mu, \beta^\sigma) \\
\beta_t &\sim \text{normal}(0, \beta_t^\sigma)
\end{aligned}$$