

FOR/FES-599

3-PG FOREST GROWTH MODEL

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Lecture 3

Generating missing Meteorological Data



Forest growth model requires :

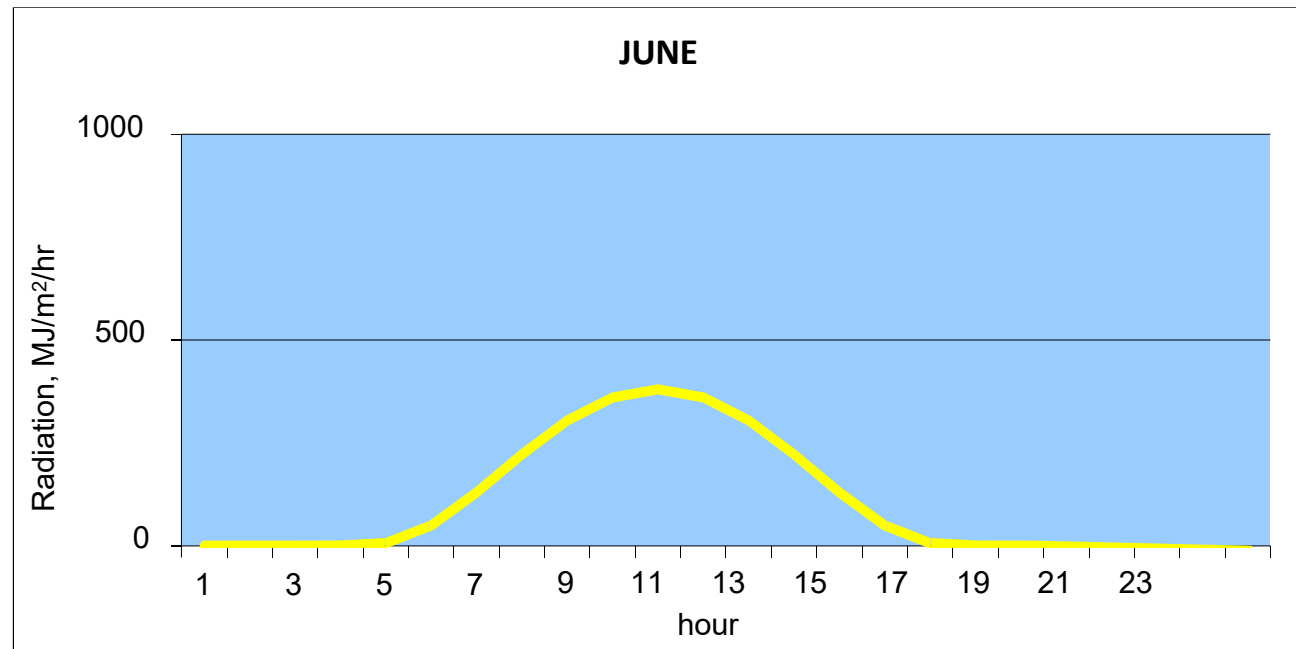
**Solar Rad, VPD, and frost days;
but usually only temperature extremes and precipitation are known.**

**The missing meteorological data can be derived from knowledge of
monthly temperature extremes, Latitude, Aspect, and Elevation.**

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Met. Data

If temperature extremes $>10^{\circ}\text{C}$
assume clear day at 45°N LAT. Potential daily radiation = $23 \text{ MJ/m}^2/\text{d}$
If temperature extremes only 3°C , then actual radiation = $12 \text{ MJ/m}^2/\text{day}$



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Met. Data

Vapor Pressure deficit can be estimated on a monthly basis by assuming that the relative humidity reaches 100% when the daily averaged temperature minimum is approached

$$1\text{-hr Fuel Moisture} = \text{RH} / 5$$



Frost days $< -2^{\circ}\text{C}$ should be expected to increase when the mean monthly minimum average temperature drops below a given value.

$$\text{FROST DAYS/MONTH} = T_{\text{min}} (-2.0) + 11.6;$$

IF FROST DAYS/MONTH ≤ 0 , then 0 Frost Days

IF T_{min} is < -9.0 , then set frost days/mo to 30

Calculation of vpd requires determining atmospheric water vapor concentration at saturation, (dew pt. temp.) then determining the difference from what the air can hold at maximum temperature.

- **VPD = (Sat Vap Pres at Tmax - Sat Vap Pres at Tmin)*0.62** ←[This coefficient adjusts for daytime vpd]
- **[(6.1078 * EXP(17.269 * Tmax / (237.3 + Tmax))) - 6.1078 * EXP(17.269 * Tmin / (237.3 + Tmin))]*0.62**

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References

- Coops, N.C., R.H. Waring, and J. Moncrieff. 2000. Estimating mean monthly incident solar radiation on horizontal and inclined slopes from mean monthly temperature extremes. *Journal of Biometeorology* 44:204-211.
- Running, S.W., R.R. Nemani, R.D. Hungerford. 1987. Extrapolation of synoptic meteorological data in mountainous terrain and its use for simulating forest evapotranspiration and photosynthesis. *Canadian Journal of Forest Research*. 17:472-83.
- Waring, R.H., and N. McDowell. 2002. Using a physiological process model with forestry yield tables to set limits on annual carbon balances. *Tree Physiology* 22:179-188.