Forest Warming Paradox

Energy balance of a forest

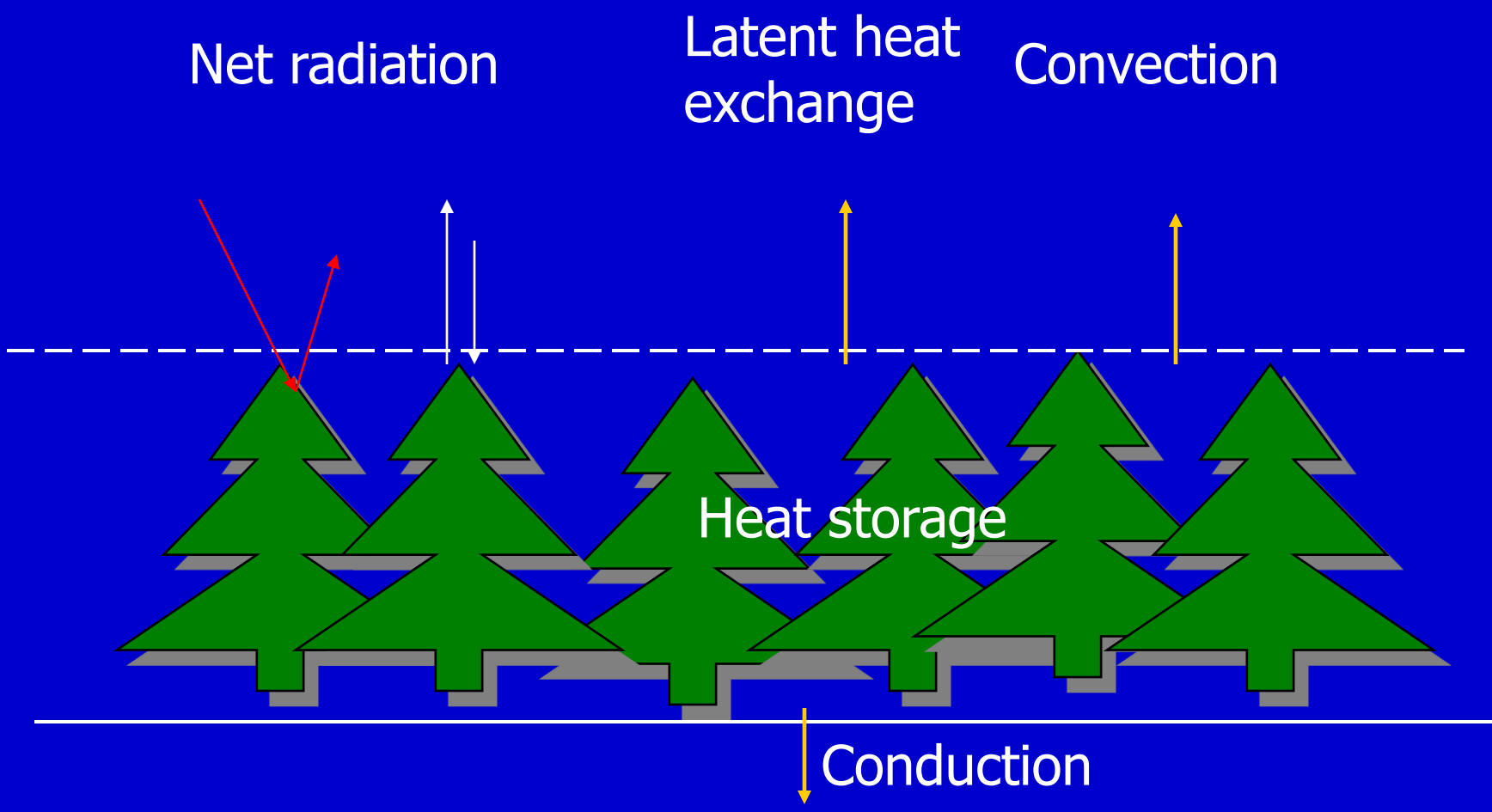


Table 2. Annual mean values (6 years) of radiation fluxes, albedo, and surface (skin) temperature in the semi-arid forest (Yatir) and in the shrubland background.

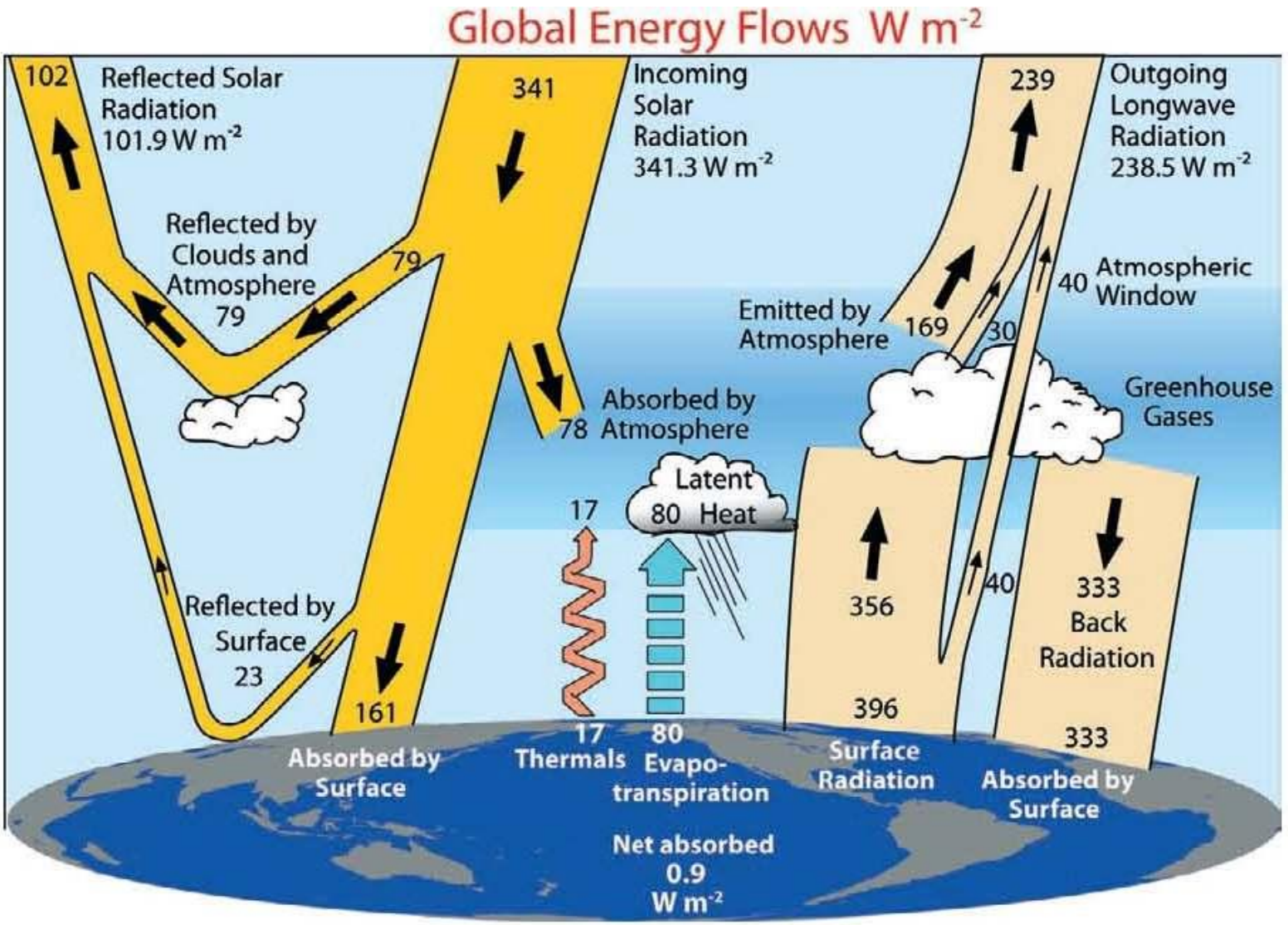
Variable	Forest	Shrubland
Global radiation (E_g, W m ^{2})	238	238
Albedo (unit-less)	0.11	0.21
Net solar radiation (S_n, W m ^{2})	212	188
Net longwave radiation (L_n, W m ^{2})	−96	−121
Net radiation ($R_n = S_n + L_n$, W m ^{2})	115	67
Skin temperature (°C)	19	24*

*(27)

Source: Rotenberg

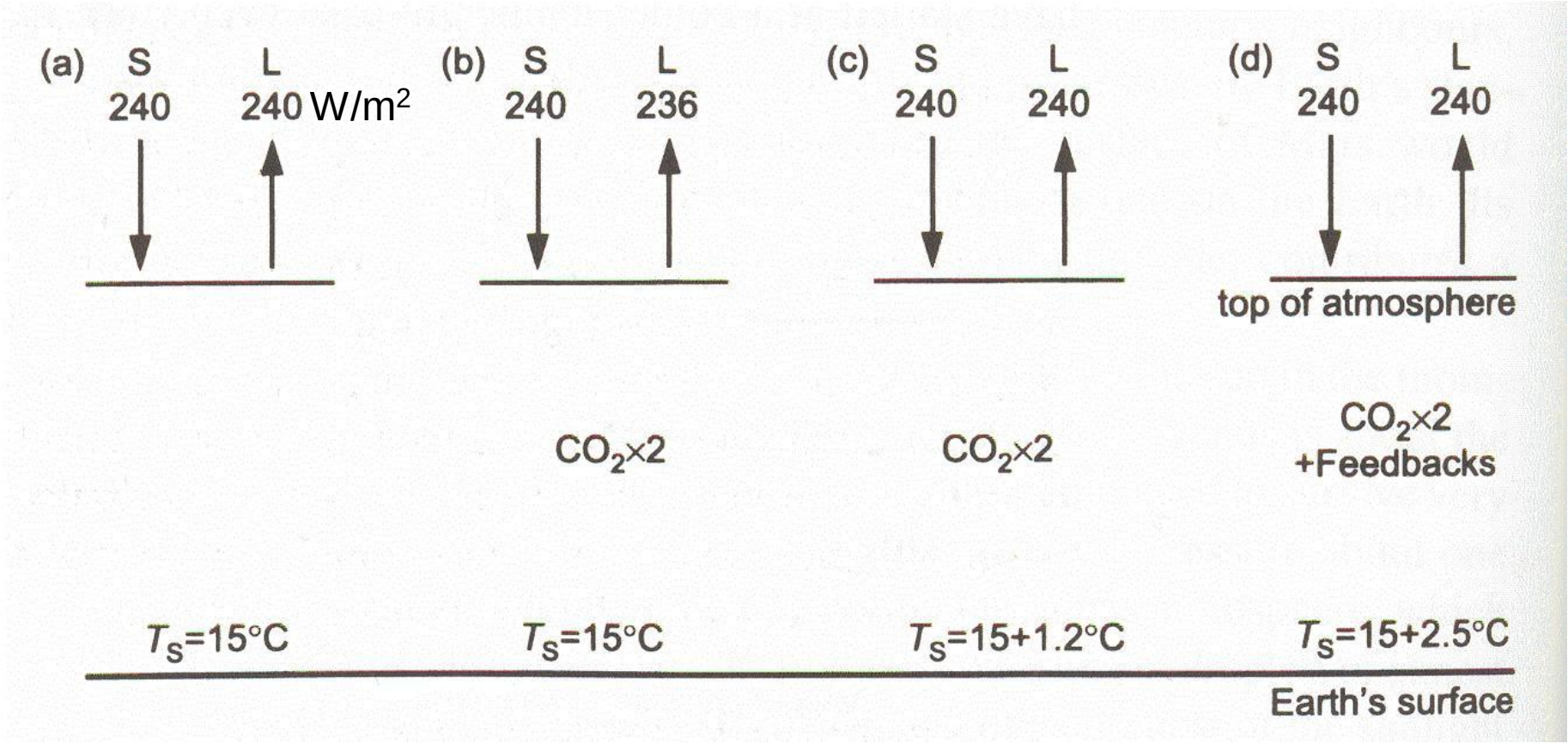
Paradoxes and questions

- The forest is cooler despite more radiation loading than the shrub land.
- A cooler surface leads to a warmer climate system.
- Is longwave radiation a forcing term or part of a feedback mechanism?
- Are surface processes and CO_2 radiative forcing two additive quantities?



Source: Trenberth

The enhanced greenhouse effect without and with feedbacks



Basic versus apparent climate sensitivity

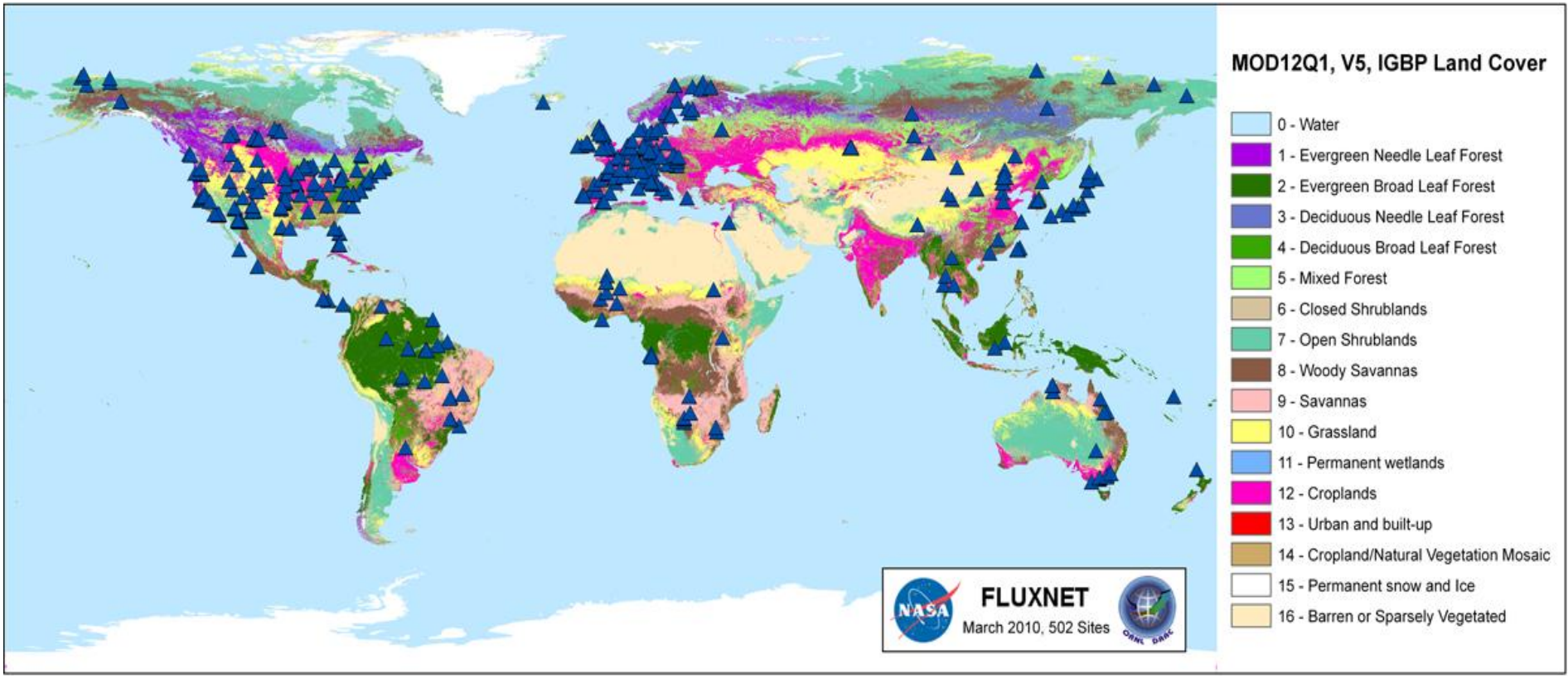
Basic or intrinsic sensitivity

$$\Delta T_o = \lambda_o \Delta Q \qquad \lambda_o = \frac{1}{4\sigma T^3}$$

Apparent sensitivity

$$\Delta T_a = \frac{\lambda_o \Delta Q}{1 - \sum g_i}$$

FluxNet



Source: http://www.fluxnet.ornl.gov/fluxnet/graphics.cfm

Blame the trees for global warming

Source: alaska-in-pictures.com