STAPLES "Theory" + DEFORESTATION

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"Canada" starts with 1 unit of land

L hectares in forestry

$1-L$ hectares in agric

A hectare of forestry land yields $\frac{\psi f(L)}{L}$ dollars of nuts, firewood, etc. per yr. sustainably

A hectare of agric land yields $\frac{g(1-L)}{1-L}$ dollars of harvested crops per yr.

Land clearing yields timber R worth (net) $pR - C(R)$ per year.

AND agric. land

$$\frac{dL}{dt} = -R$$

for $-\frac{dL}{dt}$ loss of forest land and $\frac{dL}{dt}$ gain of agric land.

Annual income in early "Canada" becomes

$$\psi f(L) + g(1-L) + pR - C(R).$$

An optimal deforestation strategy results from maximizing the present value of national income in

$$Y = \int_0^T \left[\psi f(L) + g(1-L) + pR - C(R)\right] e^{-rt}\, dt$$

sub to $L(0) = L_0$ and $R = -\frac{dL}{dt}$.

Deforestation (land-clearing) ends when

$$\underbrace{p - C_R(R) + g_{(1-L)}(1-L^*)}_{\text{marg. gain from clearing a small bit of forested land}} = \underbrace{\psi f_L(L^*)}_{\text{marg. gain from retaining a small bit of forested land.}}$$