

Climate Change workshop #2

**Estimate the steady-state birth rate of humans on Earth**

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What will be the birth rate on Earth when the human population reaches steady state?  
We are not experiencing Malthusian, exponential growth – it is leveling off.  
The current population is about 6.6 billion people:  $P_0 = 6.6 \times 10^9$  people, and the growth rate is about 100 million per year:  $dP/dt|_0 = 10^8$  people/year (in 2007).  
The current birth rate is about 300 million people per year, and the current death rate is about 200 million people per year.

When the human population levels off, the growth rate will be zero – that is, the birth rate ( $\text{Flux}_{\text{in}}$ ) will be equal to the death rate ( $\text{Flux}_{\text{out}}$ ).

Let's assume that the steady-state population, or “burden”, will be about 10 billion people – about half again as many as there are now:  $B = 10 \times 10^9 = 10^{10}$  people.

In steady-state,  $\text{Burden} = F_{\text{in}} * T = F_{\text{out}} * T$  where  $T = \text{lifetime}$

If the average human life expectancy will be about  $T = 60$  years, we can find the steady-state birth rate (and death rate):

Steady state flux  $F = B / T = 10^{10}$  people / 60 years =  $1/6 \times 10^9$  people/years

Steady state birth rate = death rate = 167 million people/years

This is lower than the current birth rate, which will require fewer babies per capita and lower than the current death rate, which is good news.

Current birth rate:  $300 \times 10^6$  people / year /  $660 \times 10^7$  people  $\sim 1/20$  / yr  $\sim 5\%$  / yr

Steady-state birth rate:  $1/6 \times 10^9$  people/yr /  $10^{10}$  people  $\sim 1/60$  / yr  $\sim 2\%$  / yr

This is a reasonable goal. Proven, humane motivators for population control are:

- excellent education for women
- easily accessible health care and birth control
- social security for the elderly