This document shows the analytical solution to the population model without a consumer as well as its behaviour.

First, we must substitute the respiration and photosynthesis functions into so that we have

Where we have

Now, we have by rearranging the equation

Now we let and g = , so we have that

Now we use separation of variables and integrate both sides. Which gives

While the RHS can be solved using integration my partial fractions. Where we have

Where, So, , and . So, we have that

When ignoring the integration constant which is subsumed by the constant C on the LHS. Equating the LHS and RHS gives

So now we can sub in B at t = 0 to get F which gives

And now we have B for all times t given the parameters in the experiment. Now, if we choose to keep all the parameters fixed across the experiment other than T and I we can pool these parameters in together to make behaviour simplify greatly.

**Behaviour of the system**

This system has two equilibrium points and . One of which is stable while the other is not stable. If , the Biomass B will approach zero, the Biomass B will approach .