Four graphs of primary production

Graph 1: Imagine we fill up to two 1 L glass bottles with pond water, cap them, and leave them floating in the pond for 24 h. The only thing is, one bottle is clear, and so allows light to pass into the bottle (light bottle), while the other one is spray painted black, so it prevents light from entering the bottle (dark bottle). We measured the amount of dissolved oxygen in both bottles as 6.24 mg O_2/L right before we set them out, but a day later the oxygen concentration in the light bottle was 6.39 mg O_2/L and that in the dark bottle was 6.16 mg O_2/L.

- Draw a graph showing the data from this little experiment. Be sure to think about which comparison you want to emphasize. (Hint: *What processes are at work in each bottle?*)
- What do these numbers tell us? That is, what does the O_2 or change in O_2 represent?
- Draw on the graph the following: (that is, what, on the graph, shows us each thing?)
  - GPP
  - NPP
  - Ra

Graph B: Imagine we have a set of 10 identical plants in bell jars, so that nothing gets in or out of the jar, but we can sample the air and measure the concentration of CO_2 in it. Now imagine each plant in its bell jar is under one of a range of intensities of sunlight, from complete darkness to full, bright sunlight. We measure the concentration of CO_2 in the air around the plant right before the study and then after one hour. Draw a graph showing how the *change* in CO_2 concentrations (i.e., gain or loss) over the hour *depends on the light conditions*.

- Describe what is happening with increasing light intensity.
- What do these numbers tell us? That is, what does the change in CO_2 represent?
- Draw on the graph the following: (that is, what, on the graph, shows us each thing?)
  - GPP
  - NPP
  - Ra

Graph Three: Imagine instead we took a fast-growing plant, like bamboo, planted it in soil, and place the whole thing on a very sensitive balance. Let's pretend we also had a sophisticated watering system so that the *total amount of water stays constant*[1]. Draw what the data would look like if we weighed the whole plant + pot every hour for three days when the plant was placed next to an outside window.

[1] That is, let's ignore changers in water weight!

- What does the weight or change in weight tell us? What does it represent?
- Why does your graph have this particular shape?
- Can you find on the graph the following?
  - GPP
  - NPP
  - Ra

Graph IV Finally, imagine we are studying a nearby wheat field and every month we identify a 1 m-by-1 m square, dig it up, remove all of the soil, dry it out, and weigh the *dry biomass*[2]. While each month we are using a different square (because we are sampling destructively), the field is very homogeneous, so what you measure in the square is pretty much what is happening in the rest of the field. Draw the biomass in the plots for each month of the year[3].

[2] Usually when measuring biomass we will first dry it out in an oven and then weigh it. This is dry biomass. You can imagine that *wet* biomass would be more complicated simply because the amount of water in or on plant matter can vary a lot!

[3] Spring, summer, winter, and fall.

- What does the weight or change in weight of biomass tell us? What does it represent?
- Why does your graph have this particular shape?
- Can you find on the graph the following?
  - GPP
  - NPP
  - Ra