

Exercise walk-through

1.8

Primary Productivity

AP Environmental Science

Primary productivity

Primary productivity is the rate producers store energy as **biomass**.

- **GPP** : total energy captured
- **NPP** : what is left after respiration

High where sun, warmth, water & nutrients meet: rainforests, estuaries, reefs, wetlands.

The key relationship

$$\text{NPP} = \text{GPP} - R$$

NPP is the energy actually available to **consumers** – the ecosystem's food supply.

Worked example – GPP, respiration, NPP

Grassland producers capture 20,000 kcal/m²/yr (GPP) and burn 8,000 in their own respiration. Find NPP.

- $NPP = GPP - R$
- $= 20,000 - 8,000$
- $= 12,000 \text{ kcal/m}^2/\text{yr}$

Only the **NPP** – not the full GPP – is available to the consumers above. Producers spend the difference staying alive.

Exercises 2.1-2.3

2.1 Write the equation relating NPP, GPP, and respiration.

[1]

2.2 For $GPP = 800$ and $respiration = 300$, find NPP.

[2]

2.3 Name one highly productive ecosystem.

[1]

Exercises 2.1-2.3

2.1 Write the equation relating NPP, GPP, and respiration.

[1]

2.1

- $\text{NPP} = \text{GPP} - \text{respiration}$
-

2.2 For $\text{GPP} = 800$ and $\text{respiration} = 300$, find NPP.

[2]

2.2

- $\text{NPP} = 800 - 300 = 500$
-

2.3 Name one highly productive ecosystem.

[1]

2.3

- Any one: tropical rainforest, estuary, coral reef, wetland

Exercise 3.1

3.1 Net primary productivity is the energy

[1]

☐

A captured before respiration

B available to consumers after producer respiration

C lost as heat only

D stored in rocks

Exercise 3.1

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3.1 B

- available to consumers after producer respiration

Exercise 3.2 (a)

3.2 A grassland has $\text{GPP} = 1200 \text{ kcal/m}^2/\text{yr}$ and $\text{respiration} = 500$.

(a) Calculate the NPP.

[2]

Exercise 3.2 (a)

3.2 A grassland has $\text{GPP} = 1200 \text{ kcal/m}^2/\text{yr}$ and $\text{respiration} = 500$.

(a) Calculate the NPP.

[2]

(a)

- $\text{NPP} = 1200 - 500 = 700 \text{ kcal/m}^2/\text{yr}$

Exercise 3.2 (b)

3.2 A grassland has $\text{GPP} = 1200 \text{ kcal/m}^2/\text{yr}$ and $\text{respiration} = 500$.

(b) Explain what NPP represents for the ecosystem.

[1]

Exercise 3.2 (b)

3.2 A grassland has $GPP = 1200 \text{ kcal/m}^2/\text{yr}$ and $\text{respiration} = 500$.

(b) Explain what NPP represents for the ecosystem.

[1]

(b)

- The energy available to the consumers (the rest of the food web)

Exercise 3.3

3.3 Explain why a tropical rainforest has higher NPP than a desert.

[2]

Exercise 3.3

3.3 Explain why a tropical rainforest has higher NPP than a desert. [2]

3.3

- A rainforest has abundant warmth, water, and sunlight, so producers photosynthesize much more than in a dry, resource-poor desert, giving higher NPP