



## RAINFOREST DYNAMICS II: Nutrient Cycling

**Learning Objectives:**

1. Explain why rainforest soils are nutrient poor
2. Describe sources of nutrients in tropical rainforest soils
3. Explain the rainforest richness paradox
4. Identify important decomposer groups
5. Discuss adaptations to low soil fertility

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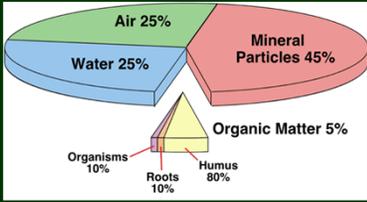
## NUTRIENT CYCLING

**Essential nutrients:**  
N, P, K, S, Ca, Mg

**Micronutrients:**  
Fe, Mo, Ni, Cu, Zn, Mn, B, Cl

**Where do soil nutrients come from?**

1. minerals in the soil (inherent fertility)
2. decomposition of **organic matter**




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## NUTRIENT CYCLING

**In tropical rainforests:**

1. Soil is highly **weathered**  
... soil fertility is low
2. Decomposition rates are high  
... little O.M. accumulation

**Weathering** = physical and chemical breakdown of rock

**Due to:**

- Lots of rain
- High temperature
- Long times




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## THE FERTILITY PARADOX

How can such poor soils hold such lush productive plant communities?

**ANSWER:**  
NUTRIENTS ARE EFFICIENTLY RECYCLED & RETAINED





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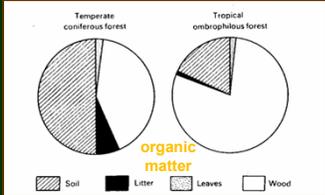
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## THE FERTILITY PARADOX explained

Where is the biomass in a rainforest?

1. Above-ground biomass = 75-80%
2. Below-ground biomass
3. Litter
4. Soil (mostly top 5 cm)





organic matter

Wood is the largest biomass pool in the forest, but it's not very nutritious!

- high C:N ratio

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## WASTE NOT, WANT NOT!

Patchy but Concentrated Nutrient Pools

**Wood**

- low quality, hard to degrade
  - termites (3-5% litter)
  - fungi






**Dung**

- high quality, readily useable
  - dung beetles
  - flies, ants

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**NUTRIENT CYCLING**

**LEAF LITTER**  
 9.5 – 12.4 Mg/ha/year  
 nutrient rich: ▼ C:N and C:P  
 temperature, moisture



Fungi, bacteria rapidly decompose leaves

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**NUTRIENT CYCLING**

**PLANT ADAPTATIONS TO POOR SOIL**

- Adaptions for nutrient **capture and uptake**



1. Surface root mat
2. Canopy roots
3. Mycorrhizae
4. Direct cycling
5. Nitrogen fixation

Little leaching occurs!

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**NUTRIENT CYCLING**

**PLANT ADAPTATIONS TO POOR SOIL**

- Adaptions for nutrient **retention**



1. Long-lived leaves
2. Mechanical and chemical defenses

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