The Ecology Of Running Waters

The Hydrological Cycle

Some Nice Places
**25 Longest Rivers In The World**

<table>
<thead>
<tr>
<th>Rank</th>
<th>River</th>
<th>Length (mi)</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Nile</td>
<td>4,180</td>
<td>North/East Africa</td>
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<tr>
<td>2</td>
<td>Amazon</td>
<td>4,000</td>
<td>South America</td>
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<tr>
<td>3</td>
<td>Chang Jiang</td>
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<td>China</td>
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<tr>
<td>4</td>
<td>Huang He</td>
<td>3,400</td>
<td>China</td>
</tr>
<tr>
<td>5</td>
<td>Ob-Irtysh</td>
<td>3,200</td>
<td>Russia</td>
</tr>
<tr>
<td>6</td>
<td>Amur</td>
<td>2,700</td>
<td>Northeast Asia</td>
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<tr>
<td>7</td>
<td>Lena</td>
<td>2,200</td>
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<tr>
<td>8</td>
<td>Congo</td>
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<td>Central Africa</td>
</tr>
<tr>
<td>9</td>
<td>Mackenzie</td>
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<tr>
<td>12</td>
<td>Parana</td>
<td>1,900</td>
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</tr>
<tr>
<td>13</td>
<td>Napo</td>
<td>1,800</td>
<td>South America</td>
</tr>
<tr>
<td>14</td>
<td>Nuwee</td>
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<td>15</td>
<td>Maroni</td>
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<td>20</td>
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<td>Amazon</td>
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<td>1,000</td>
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</tbody>
</table>

**The Nile River**

- Length: 4,180 miles
The Amazon River

Mississippi-Missouri River

“The river is the carpenter of its own edifice”
Luna Leopold

“A View of the River”
Luna B. Leopold

“The river where you set you foot just now is gone, those waters giving way to this, then this”
Heraclitus
River Meanders

Origins Of Rivers:

Aquifers

Source of Boiling Springs River, Pennsylvania

Underground rivers

Source of Crows Nest River, Alberta

Physical Characteristics
Factors Affecting The Temperature Regime Of A Stream

Stream Order:

General Considerations

Rivers Are Linear Gradients

Chemical Characteristics
Components Of Fresh Water

A. Dissolved Inorganic Compounds
   1. Calcium
   2. Magnesium
   3. Sodium
   4. Iron
   5. Sulfate
   6. Chloride

B. Particulate Inorganic Compounds
   1. Silt
   2. Suspended material

C. Dissolved Organic Compounds
   1. Nitrogen
   2. Phosphorous
   3. Bicarbonate

D. Particulate Organic matter
   1. Bacteria
   2. Algae
   3. Leaves

E. Dissolved Gases
   1. Oxygen
   2. Nitrogen
   3. Carbon dioxide
   4. Methane
   5. Hydrogen sulfide

Productivity

Autochthanoous vrs Allochthanoous

Sources Of Energy

Primary Productivity

River Types
River Types: Freestone

River Types: Feeder Streams
River Types: Limestone
River Types: Tailwater Fisheries

Autochthanous vs Allochthanous:
Freestone vs Limestone

Food Webs

Trophic Levels

Trophic Levels
Keystone species
Steelhead Trout
Roach
Damsel Fly

**Food Pyramid In A Western Trout Stream**

- Steelhead Trout (Keystone species)
- Roach And Stickleback Minnows
- Macroinvertebrates (Midge larvae, etc.)
- Algae (Nostoc, Cladophora, etc.)

**What Happens To The Trophic Levels Of An Ecosystem When A Keystone Species Is Removed?**

**You Get More Algae!**

**Why?**

**Trophic Levels And Keystone Species: Removal Of A Keystone Species**

**Trophic Levels And Energy Flow**

**Energy Flow Into The River: The Role Of Leaves**
Energy Considerations

A: Sun’s rays,
100 Units of
dilute energy.

B: Reflected Heat,
98 units.
Very dilute energy.

C: Oak Leaf,
energy conversion
system - 2 units of sugar.
Concentrated energy.

Energy Flow Into The River: The Role Of Leaves

Macroinvertebrates And The Processing Of Leaves
The Value Of Trees To The River

1. Trees have roots that hold the soil on the bank, retarding the erosion process
2. Trees shade the river moderating the ambient temperature
3. Trees provide shelter and niches for a wide variety of wildlife
4. Trees that fall into the river provide a long-term release of energy
5. Leaves fall into the river and provide up to 60% of the energy for macroinvertebrates

Factors Having A Negative Affect On Productivity:

Nutrient Loading
Encroachment
Deforestation
Industrial Pollutions
Thermal Pollution

Effects Of Dams On Rivers: The Columbia River System

Food Webs: Competition Between Terrestrial And Aquatic Life Forms

Floods

Drought
Pollutions:
Niagara River Area of Concern

 Beneficial Use Impairments

- Restrictions on Fish & Wildlife Consumption
- Tainting of Fish & Wildlife Harvest
- Degradation of Fish & Wildlife Populations
- Fish Tumors or Other Cancers
- Bird or Animal Deformities or Reproductive Problems
- Degradation of Fisheries
- Restrictions on Dredging Activities

Nutrient Loading

Mississippi-Missouri River

3,710 miles

Encroachment

Mississippi-Missouri River

Pollutions

Figure 42--Herbicide Variations Through Time
**Welcome To The Dead Zone**

_The Gulf of Mexico Dead Zone and Red Tides_

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**Its Getting Late**

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**Macroinvertebrates**
Macroinvertebrates: Development

Energy Flow Into The River
Life On A Rock

Effects Of Dams On Rivers:
The adverse effects of Hoover dam on the Colorado River