

What is going on here?

American Scientist



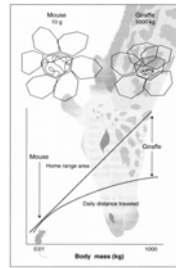
The caterpillar of *Manduca sexta* is eating a portion of a tobacco plant. The damaged portion of plant reacts to the invasion by giving off chemical signals that attract parasitoid wasps that lay their eggs on the caterpillars (their natural host), thus killing them and controlling their populations! But wait. There's more!

Genome Sequence of a Polydnavirus: Insights into Symbiotic Virus Evolution

Eric Espagne,^{1,2} Catherine Dupuy,^{1,2} Elisabeth Huguet,¹ Laurence Cattalini,³ Bernille Provost,⁴ Nathalie Martin,² Maryline Poirié,⁵ Georges Periquet,² Jean Michel Drezen¹

Little is known of the fate of viruses involved in long-term obligate associations with eukaryotes. For example, many species of parasitoid wasps have symbiotic viruses to manipulate host defenses and to allow development of parasitoid larvae. The complete nucleotide sequence of the DNA enclosed in the virus particles injected by a parasitoid wasp revealed a complex organization, revealing a eukaryotic genome more than a viral genome. Although endocellular symbiotic genomes have undergone a dramatic loss of genes, the evolution of symbiotic viruses appears to be characterized by extensive duplication of virulence genes coding for truncated versions of cellular proteins.

Science. 2004. Vol. 306: 286-289



“Like, man, like I need my space.”

The mathematics of personal space. The ability of mammals to traverse their home ranges (ranging) and include same-species neighbors scales with body size. Small mammals, such as the mouse, cover their home range (red path) in a short time, interact with neighbors, and defend exclusive home ranges. Larger mammals, such as the guinea pig, take longer to cover their home ranges, so that frequent interactions with neighbors is impossible. As a result, large mammals are unable to maintain an exclusive home range and must share parts of the home range (pink shaded area) and resources with intensive neighbors. Such forced sharing means that the home ranges of large mammals need to be bigger than that predicted from their resource requirements.

Science. 2004. Vol. 306: 238

The Ecology Of Running Waters



The Earth - From Space
A Satellite View of The World

The Hydrological Cycle

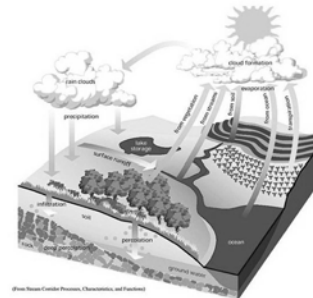
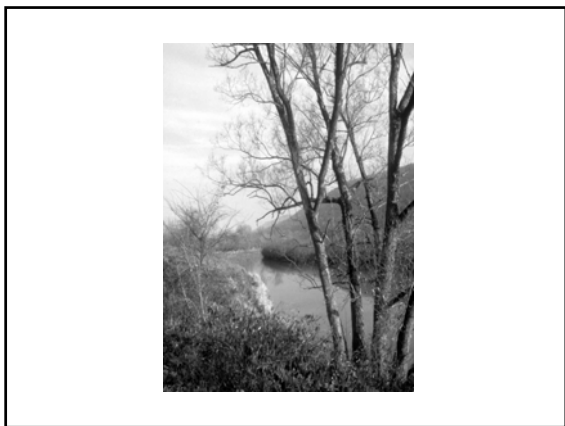
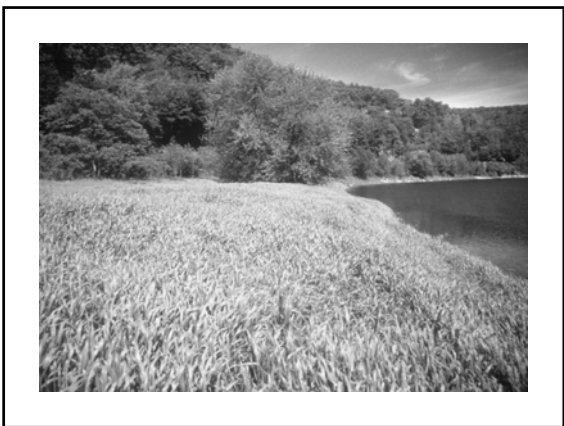
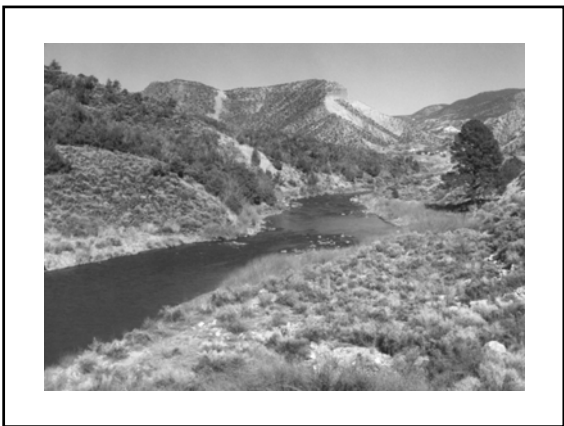
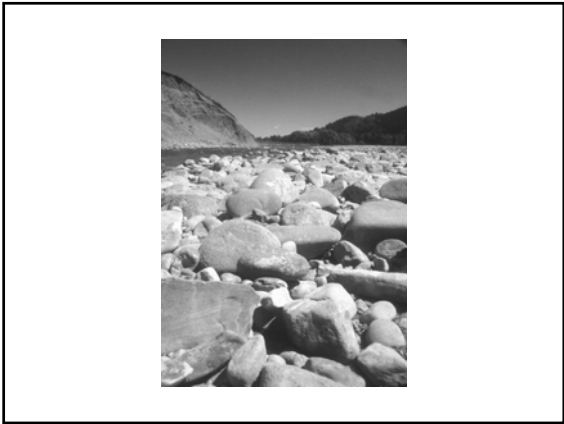
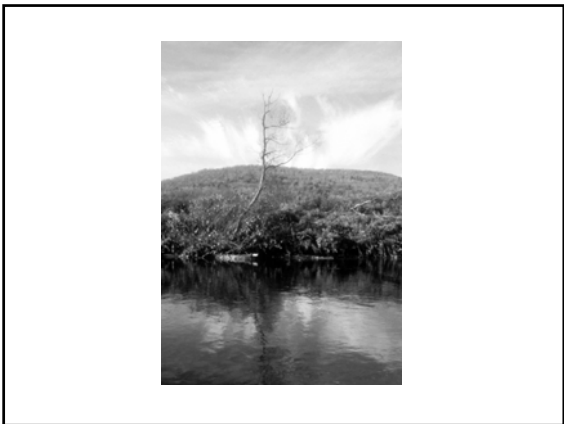
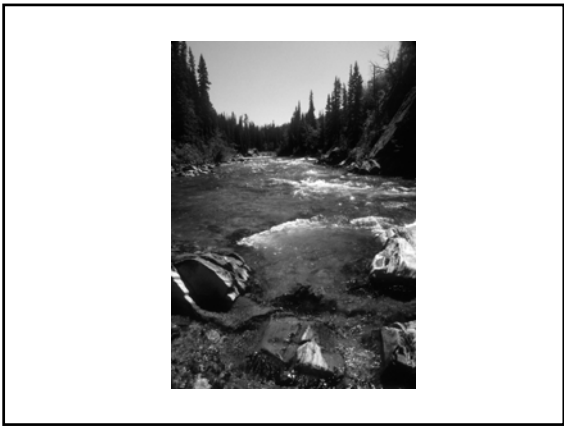


Photo Source: Center for Process, Characteristics, and Feedback

Some Nice Places





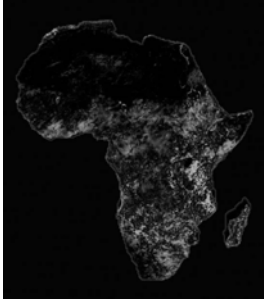




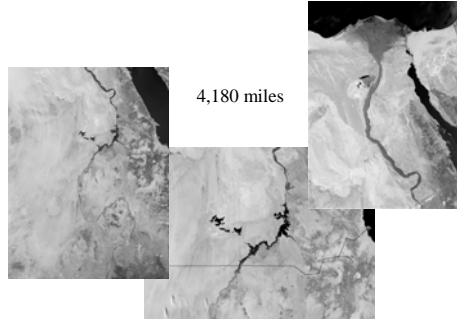
25 Longest Rivers In The World

Rank	River	Length	Location
1	Nile	6692km (4160mi)	North/East Africa
2	Amazon	6436km (4000mi)	South America
3	Chang Jiang (Yangtze)	6378km (3964mi)	China
4	Huang He	5463km (3395mi)	China
5	Ob-Irtysh	5410km (3362mi)	Russia
6	Amur	4415km (2744mi)	Northeast Asia
7	Lena	4399km (2734mi)	Russia
8	Congo	4373km (2718mi)	Central Africa
9	Mackenzie	4241km (2635mi)	Canada
10	Mekong	4183km (2600mi)	Southeast Asia
11	Niger	4167km (2590mi)	Africa
12	Yenisey	4092km (2543mi)	Russia
13	Parana	3998km (2485mi)	South America
14	Mississippi	3765km (2340mi)	USA
15	Missouri	3725km (2315mi)	USA
16	Murray-Darling	3717km (2310mi)	Australia
17	Volga	3685km (2290mi)	Russia
18	Purus	3379km (2100mi)	Brazil
19	Madeira	3229km (2013mi)	Brazil
20	Sao Francisco	3199km (1988mi)	Brazil
21	Yukon	3184km (1979mi)	Alaska/Canada
22	Rio Grande	3057km (1900mi)	USA/Mexico
23	Brahmaputra	2896km (1800mi)	India
24	Indus	2896km (1800mi)	India
25	Danube	2868km (1776mi)	Europe

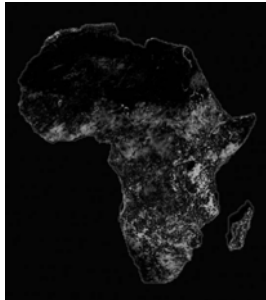
The Nile River



The Nile River



Okavango River

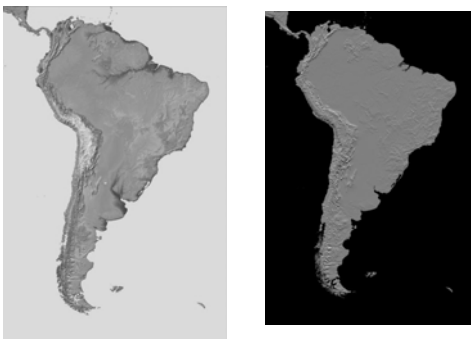


Okavango Delta, Botswana

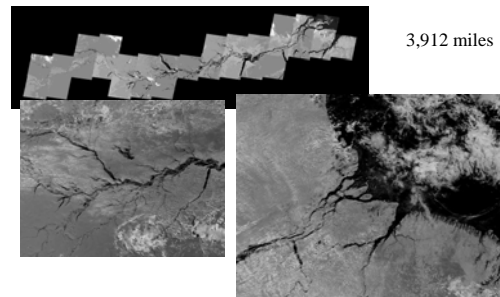
QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.



The Amazon River



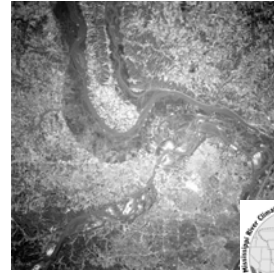
The Amazon River



Mississippi-Missouri River



Mississippi-Missouri River



3,710 miles



"The river is the carpenter of its own edifice"

Luna Leopold



A View of the River

Luna B. Leopold

Harvard University Press
Cambridge, Massachusetts
London, England
1969

"The river where you set your foot just now is gone,
those waters giving way to this, then this" — Heraclitus



River Meanders



Colorado River Photo: Thomas Wiewandt

Origins Of Rivers

Origins Of Rivers: Aquifers



Origins Of Rivers: Springs



Source of Boiling Springs River, Pennsylvania

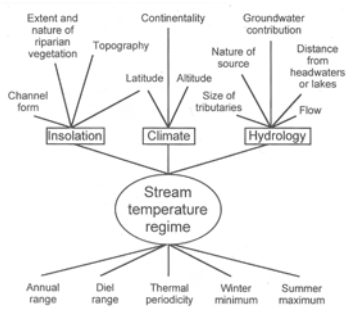
Origins Of Rivers: Underground rivers



Source of Crows Nest River, Alberta

Physical Characteristics

Factors Affecting The Temperature Regime Of A Stream

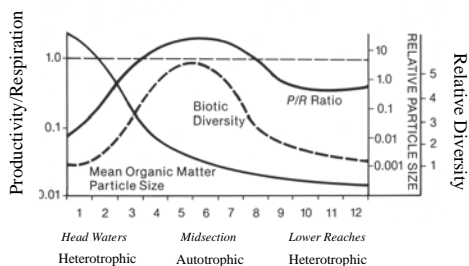


Stream Order*

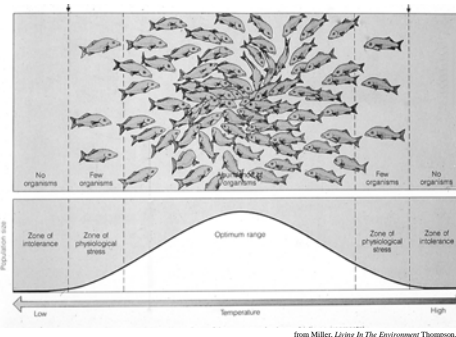


* Dendritic system

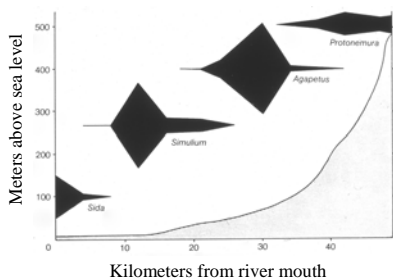
Stream Order: General Considerations



Tolerance Limits



Rivers Are Linear Gradients



Chemical Characteristics

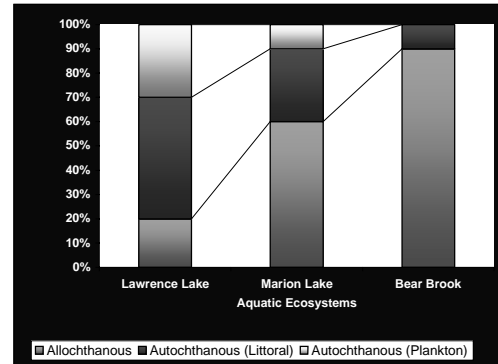
Components Of Fresh water

- | | |
|---|---|
| <p>A. Dissolved Inorganic Compounds</p> <ol style="list-style-type: none"> 1. Calcium 2. Magnesium 3. Sodium 4. Iron 5. Sulfate 6. Chloride | <p>D. Particulate Organic matter</p> <ol style="list-style-type: none"> 1. Bacteria 2. Algae 3. Leaves |
| <p>B. Particulate Inorganic Compounds</p> <ol style="list-style-type: none"> 1. Silt 2. Suspended material | <p>E. Dissolved Gasses</p> <ol style="list-style-type: none"> 1. Oxygen 2. Nitrogen 3. Carbon dioxide 4. Methane 5. Hydrogen sulfide |
| <p>C. Dissolved Organic Compounds</p> <ol style="list-style-type: none"> 1. Nitrogen 2. Phosphorous 3. Bicarbonate | |

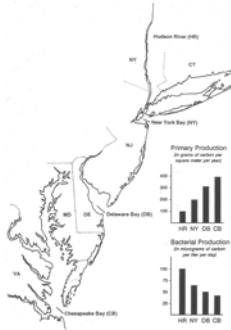
Productivity

Autochthonous vrs Allochthonous

Sources Of Energy



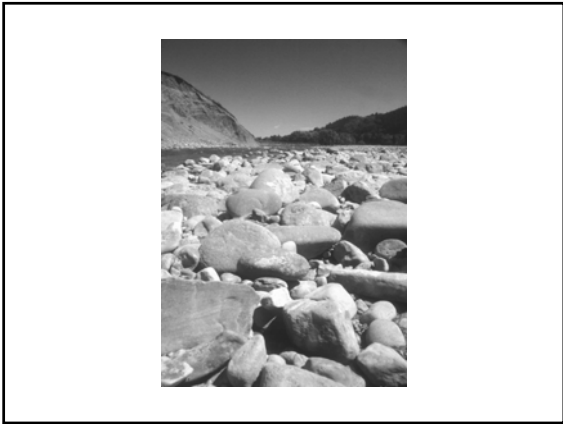
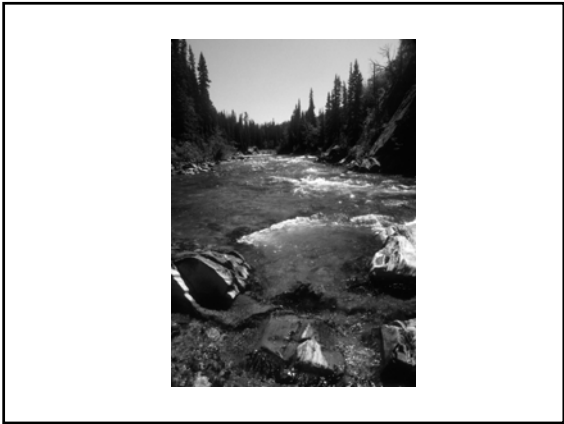
Primary Productivity



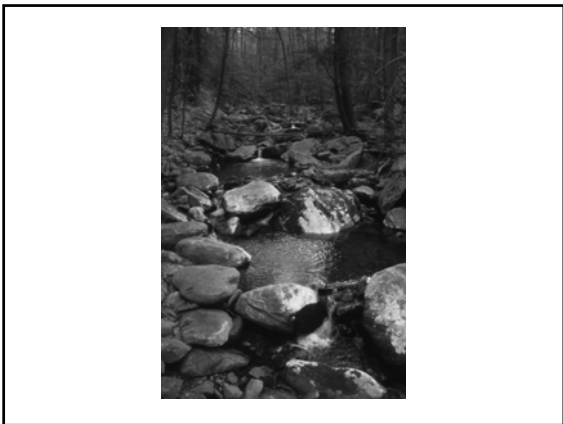
River Types

River Types: Freestone

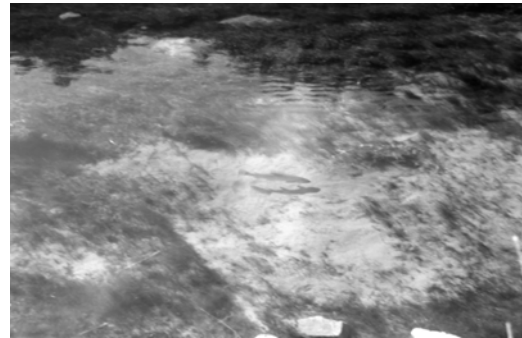




River Types: Feeder Streams

A collage of four black and white photographs illustrating different types of feeder streams. The top-left photo shows a small stream flowing through a forest. The top-right photo shows a stream cascading down a rocky cliff face. The bottom-left photo shows a stream flowing through a forested area. The bottom-right photo shows a stream flowing through a rocky canyon.

River Types: Limestone



River Types: Tailwater Fisheries

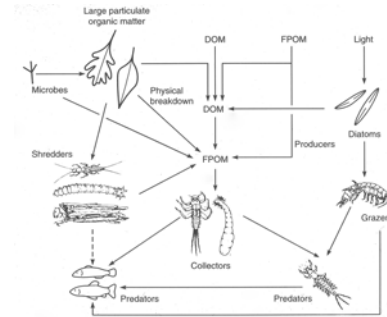


Autochthonous vrs Allochthonous:

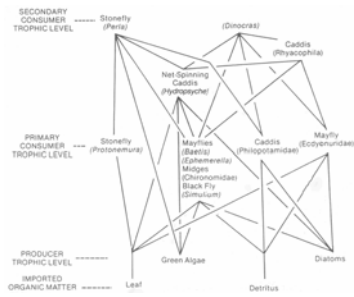
Freestone vrs Limestone



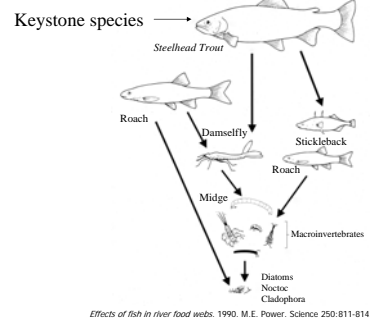
Food Webs



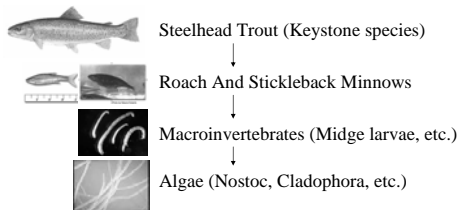
Trophic Levels



Trophic Levels



Food Pyramid In A Western Trout Stream

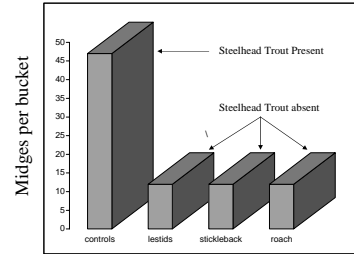


What Happens To The Trophic Levels Of An Ecosystem When A Keystone Species Is Removed?

You Get More Algae!

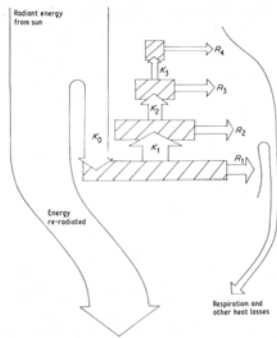
Why?

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

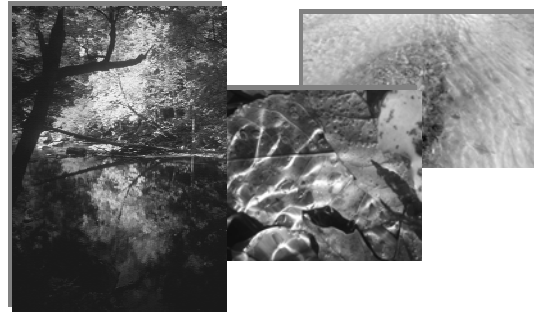


Wootton, J.T., M.S. Parker and M.E. Power. 1996. The effect of disturbance on river food webs. *Science* 273:1558-1560.

Trophic Levels And Energy Flow

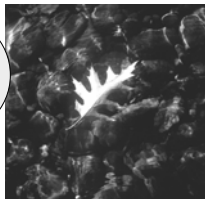
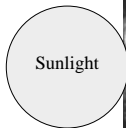


*Energy Flow Into The River:
The Role Of Leaves*



Energy Considerations

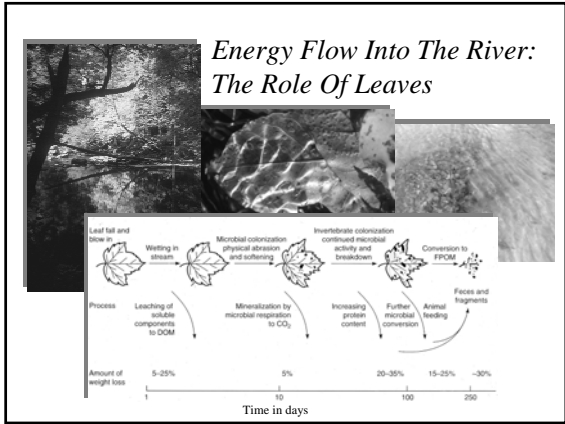
*A: Sun's rays,
100 Units of
dilute energy.*



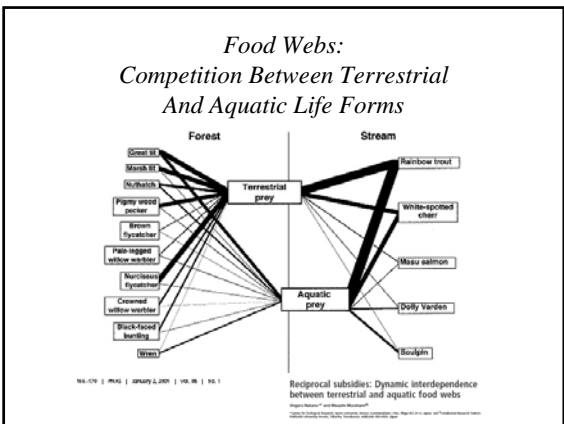
*C: Oak Leaf,
energy conversion
system - 2 units of sugar.
Concentrated energy.*

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

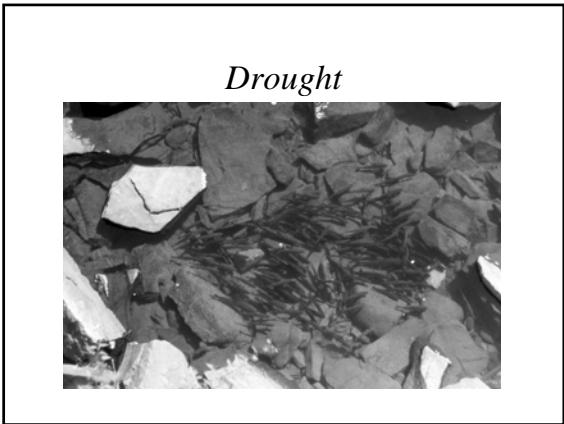
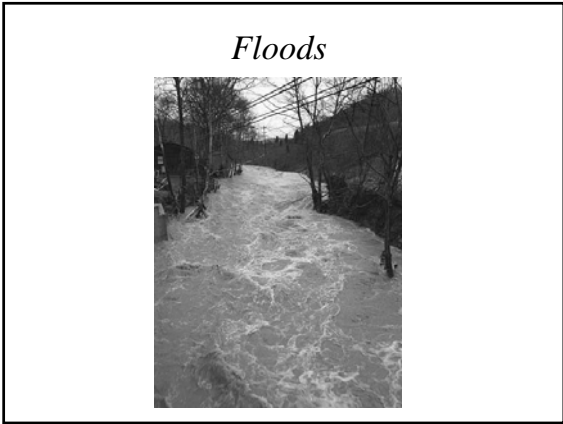
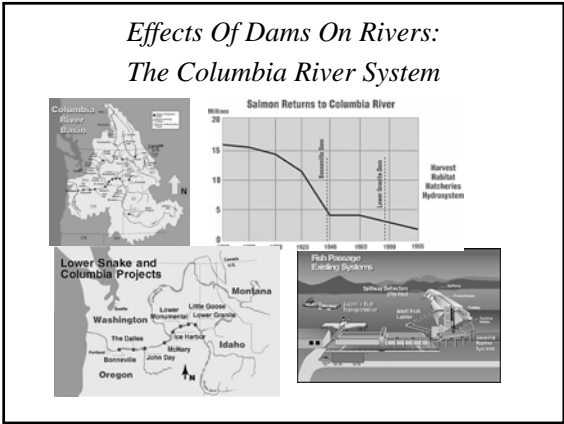




- ### The Value Of Trees To The River
1. Trees have roots that hold the soil on the bank, retarding the erosion process
 2. Trees shade the river moderating the ambient temperature
 3. Trees provide shelter and niches for a wide variety of wildlife
 4. Trees that fall into the river provide a long-term 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

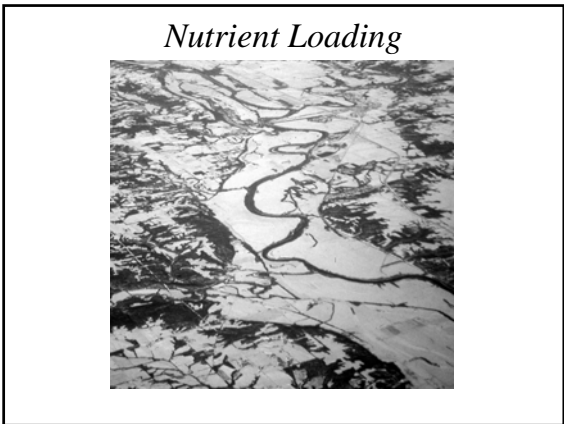


Pollutions: Niagara River Area of Concern

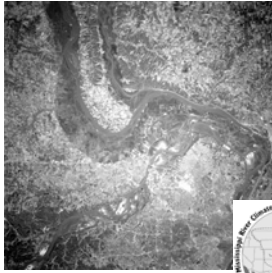
Beneficial Use Impairments

✓ Restrictions on Fish & Wildlife Consumption	Eutrophication or Undesirable Algae
Tainting of Fish & Wildlife Flavor	Restrictions on Drinking Water Consumption, or Taste & Odor
Degradation of Fish & Wildlife Populations	Beach Closings
✓ Fish Tumors or Other Deformities	Degradation of Aesthetics
Bird or Animal Deformities or Reproductive Problems	Degradation of Phytoplankton & Zooplankton Populations
✓ Degradation of Benthos	Added Cost to Agriculture & Industry
✓ Restrictions on Dredging Activities	✓ Loss of Fish & Wildlife Habitat

<http://www.epa.gov/docs/gtrlakes/aoc/niagara.html>



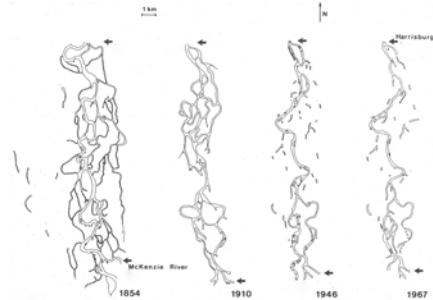
Mississippi-Missouri River



3,710 miles

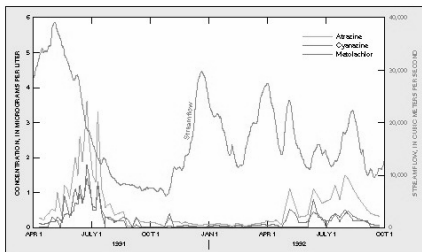


Encroachment



Pollutions

Figure 42--Herbicide Variations Through Time



<http://water.usgs.gov/pubs/circ/circ1133/images/fig42.jpeg>

Encroachment

Figure 15--Population Stress

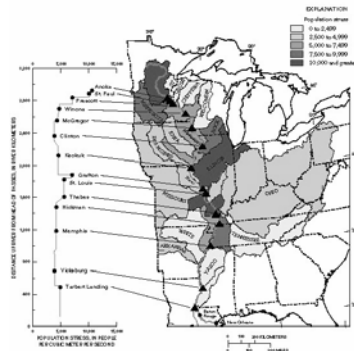
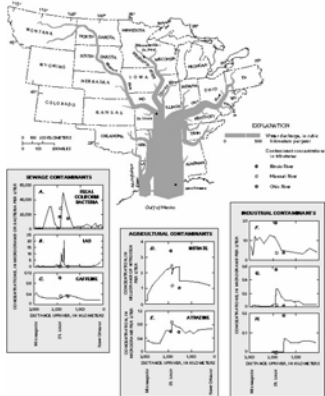


Figure 1--Dissolved Contaminants

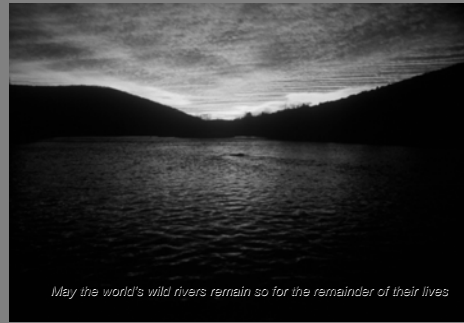


Welcome To The Dead Zone



The Gulf of Mexico Dead Zone
and
Red Tides

Its Getting Late



May the world's wild rivers remain so for the remainder of their lives