1-5 Ecosystem Balance

Outcomes:

1. Describe and apply classification systems and nomenclature with respect to trophic levels in ecosystems. (214-1, 318-1)
   - Explain how humans have changed the flow of energy in ecosystems.
   - Explain the nitrogen cycle in terms of nitrogen fixation and denitrification.
2. Debate the use of fertilizers and pesticides in modern society and their effect on the environment. (117-5)
3. Define bioaccumulation. (318-2)
   - Identify what a pesticide is by describing the four categories of pesticides.
4. Describe the potential impact that overuse of fertilizers can have on ecosystems. (331-7)

Introduction

In our world today, nothing symbolizes status in society like a well-groomed lawn. This idea goes back to the days of lords and ladies in England. These well-to-do people showed off their lawns just like people show off cars today. The result, in our communities, is a landscape of perfect lawns and paved driveways. But is this really good for the environment? A well balanced environment is diverse in the amount of living things.

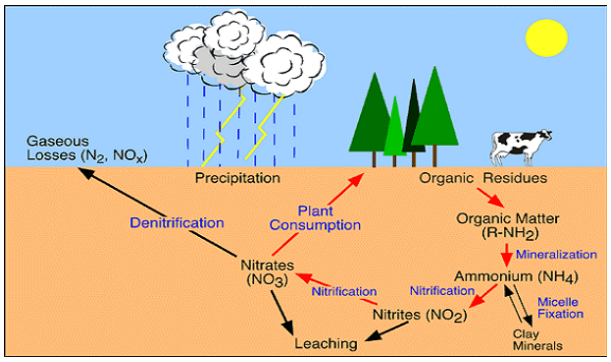
Let's consider the simple lawn, as we know it today. It is generally composed of a single variety of grass suited for our climate (most are produced through ***cross breeding*** varieties of different grasses that have the necessary characteristics for good growth in Newfoundland and Labrador). Unfortunately, single variety lawns are more likely to be harmed due to extreme climatic/environmental conditions, and pests (e.g., chinch bugs). As well, simple grass removes the organic nitrogen from the soil as it grows without replacing it.

Cross Breeding: The practice of mating one type of plant with another

Chemical Fertilizers: These are man made products meant to replace natural fertilizers

Depletion: When something is lost and not replaced

Chemical fertilizers are then added to the soil to make up for the ***depletion*** of soil nutrients like organic nitrogen. Fertilizers generally contain different amounts of nitrogen (chemical symbol N), phosphorus (chemical symbol P), and potassium (chemical symbol K). For example, a lawn fertilizer that is described with the numbers 20-5-10 would have a mixture of 20 parts nitrogen, 5 parts phosphorus, and 10 parts potassium. The numbers are always in the order: nitrogen, phosphorus and potassium. The most important of the three for grass growth is nitrogen. Normally, this exists in soils that have plants like clover and alfalfa grasses. These plants are part of the nitrogen cycle, the natural cycling of nitrogen from the atmosphere to the soil and then to plants and animals. Grasses can not do this. Unfortunately, clover is considered a weed and is not favored in most lawns. In fact, when clover does show up in lawns, the average homeowner will try to rid his/her lawn of clover by using chemical pesticides. This further adds to the disruption in the nitrogen cycle. Destroying plants that add nitrogen to the soil naturally, forces us to artificially add chemical nitrogen to make up for the shortage. Since these chemicals only work for a short period of time, more must be continually added and an artificial semi-cycle begins. This means there is no real balance and matter does not get cycled, as it should.



As mentioned, modern lawn care may also involve the use of **pesticides**. These are man made chemicals designed to rid us of unwanted plants and animals. There are two types of pesticides used:

Herbicides – destroy natural plants that maintain DE. Insect, kill the insects that help pollinate plants and act as decomposers.

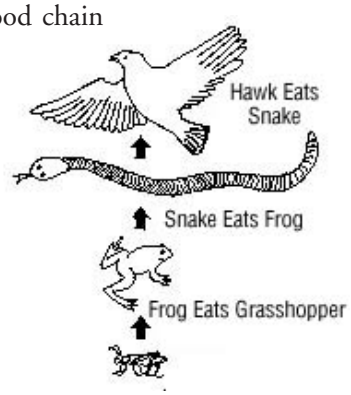
Insecticides – These are designed to destroy **insects or insect-like animals** that are considered pests, like cinch bugs and earwigs.

Imbalance: Means to not be in balance

Food Chain: A path of food getting from one organism to another

Like the fertilizers, these products also cause an ***imbalance*** in the environment. Since all living things are interconnected, the removal of one causes stress to another. The removal of clover causes nitrogen loss in the soil and this affects all plants. As well, pesticides often affect organisms in the environment besides the ones for which they were intended. This often affects ***food chains***. A food chain shows how each living thing gets its food. Some animals eat plants and some animals eat other animals. For example, a simple food chain links the trees & shrubs, the moose (that eat trees & shrubs), and the bears (that eat the moose). Each link in this chain is food for the next link. A food chain always starts with plant life and ends with an animal. Animals that eat only plants are called herbivores. Animals that eat other animals are called carnivores.

A simple food chain



Herbicides destroy plants that maintain a natural dynamic equilibrium. Insecticides kill the insects that help pollinate plants and act as decomposers. When earthworms, for example, take in the pesticides they may then be eaten by robins. Over a summer season, a robin may eat hundreds or thousands of worms. The poison then becomes more concentrated in robins. A second or third level ***consumer,*** like a hawk may eat 10 robins, making the poison even more concentrated in the hawk. This is a process called ***bioaccumulation***. Eventually, these man-made poisons make it to human populations. Exposure to chemical pesticides has even been shown to have negative effects on human health. (See **STSE 1-5 Supplement A and B**)

Consumers: Are organisms that eat other organisms. First level consumers are herbivores while second and third level consumers are usually carnivores

Bioaccumulation: Occurs when pollutants in plants and animals get more concentrated as you move up a food chain

Many of the fertilizers and pesticides applied are washed into storm drains and sewers during rainfalls. From here they eventually reach streams and rivers that represent water supplies for animals and humans.

Fish, birds and wild animals fall victim to chemicals not natural to their systems. Humans, in turn, end up with polluted water supplies.

The question is, "Are the perfect deep green lawns worth the risk to the environment and to us?" Considering all the possible negative consequences, it does not seem likely. You decide.

Analysis

1. What is the nitrogen cycle and how has it been affected by human activity?
2. What is a pesticide and why are they used?
3. Explain bioaccumulation/bioamplification.
4. Identify some ways that human health is negatively affected by pesticide use.
5. What would be the composition of a fertilizer with the following number sequence:
   a) 21-10-10
   b) 7-7-7

Extension

1. Research one of the Earth's cycles and present your finding to the class as a poster, video, or any other format.
2. Research common garden fertilizers to determine their chemical compositions and what they would be used for around a typical garden.
3. Go to the following websites and try the food chain games and projects: http://ecokids.earthday.ca/pub/eco_info/topics/frogs/chain_reaction/index.cfm
   http://www.borealforest.org/school/food_chain.htm
4. Research ways to maintain a proper healthy lawn without using chemical fertilizers and pesticides.

References

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http://www.peterboroughcollective.org/17lawn.htm\

http://www.hc-sc.gc.ca/english/iyh/environment/lawns.html

http://www.chem-tox.com/pesticides/pesticidereport.htm

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http://www.physicalgeography.net/fundamentals/9s.html

http://www.vtaide.com/png/foodchains.htm