1.0 Describe forest ecology at the ecosystem level.

1.1 Identify forest ecology and its beginnings.

Ecology is a branch of biological science concerned with the distribution, abundance and productivity of living organisms and their interaction with each other and their physical environment. Ecology is a new science (at around 40 years of age), but many observations of the interrelationships of plants and animals have been made by man throughout time. Some of these interrelationships were observed in Greek writings of "plagues of field mice in their agriculture crops" and Chinese farmers planting garlic and onions within rows of other vegetables to discourage pests in their gardens. Early human hunters had observed interrelationships, as it provided knowledge of prey locations.

Today, the word ecology is a common household word, but its meaning is sometimes misused. A lot of people think that it means conservation and preservation, and is a sign for the "environmental movement". Ecology is amoral - meaning that it doesn't pass judgment. Ecology is a word that does not support or oppose the "Environmental Movement". Ecology is just a word that describes the interrelationships between living organisms and their environment. The "knowledge of ecology" may help us to make better informed decisions regarding the management of a specific environment. Also, because ecology is a newer science, there is still a lot of information yet to be discovered which can provide some challenges – especially as some ecosystems may change and will change.

1.2 Discuss some terms: organisms, populations, communities, niche, autecology and ecosystem.

An organism is any individual animal or plant having different organs and parts that function together as a whole for its well-being. A group of organisms of the same species are known as populations. When populations of different species are naturally assembled together (occur together in nature), then this is termed communities. When we have entire natural systems that are made up of communities and their physical environment, then we have ecosystems. For example, a rabbit is an organism and a group of rabbits would be termed a population. When you have a mixture of rabbits, balsam fir trees, and other plants and animals living together, we have a community. An ecosystem is a whole complex of physical factors, forming what we call the environment. It is an assembly of interacting organisms and their environment – each affecting the other – the environment acts on the organisms and the organisms act on the environment. A niche is the geographical range and habitat a species can or does occupy. The term niche also includes the ecological role (function) that this species can fulfill in an ecosystem. This niche is genetically engrained in a species, meaning that species have adapted to their niche and the functions they perform. No two unrelated organisms can have the exact niche, or one species will displace the other species where they overlap in areas. This doesn't happen too often in nature if one species is able to adapt to a different niche, which is the reason

for the term "genetically adapted". Some textbooks refer to the term "competitive exclusion". Autecology is the study of the life history of a single individual or species and its response to its environment. An example would be the life history of a sandhill crane, the food requirements of a moose, or the reproduction age of a jack pine tree. It is important to be aware of the autecology of our commercial tree species, which will help when giving consideration at the higher levels of populations, communities and ecosystems. Most emphasis today is placed on the management of the ecosystem, but one has to have knowledge of autecology before moving on to the higher levels.

Commercial Trees are discussed in the Boreal Forest section of the website.

1.3 Describe various relationships that commonly exist in forest ecology.

As you are probably aware, all members of the forest community are seen to affect other members by their presence, their vigor (or health), or their removal. The strength of these "effects" range from very little to very strong.

Some plant relationships are of a symbiotic nature in which neither species is harmed and at least one is benefited, from the relationship. The symbiotic relationship could be mutualistic in which both species are benefited. A very important mutual symbiotic relationship in forestry is that of mychorrizae (fungi) in the tree's roots which helps the tree gather phosphorous and is returned with food from the tree. Some areas won't grow trees because of the lack of mychorrizae, and some heather bogs won't support some tree species because of the lack of mychorrizae. The symbiotic relationship could be one of commensalism in which one species is benefited while the other species is neither benefited nor harmed. An example of commensalism could be a small fish attaching (via a sucker) itself to a larger fish for ease of transportation. Another example of commensalism would be the lichen plant attaching itself to a jack pine tree while receiving all its nutrients from the atmosphere and using the dry jack pine as a dry place to hang. A mutual relationship could be North America's cowbird feeding on parasites on the back of a large ungulate (elk) to both the benefit of the elk and the cowbird.

There are also relationships in which one of the partners is adversely affected and these are in a relationship termed antagonistic. Some antagonistic relationships include parasitism, predation and competition. Consumptive (eating) relationships occur when one species eats part of another species, thereby weakening that species or possibly killing that species. Most organisms interact with others either chemically or physically. For example, if one plant has leaves partially eaten by a deer, the chemicals emitted by the deer may harm other species of browsers eating off that plant. This process, called antibiosis, occurs between different species of animals, between microbial life forms and between different species of plants. Another definition considered antagonistic deals with antibiosis between plants or allelopathy. Some plants produce allelochemicals that don't allow seeds of other plants to germinate on that site: for example, red pine needles or walnut leaves. Some allelochemicals present in plants can prevent other plants from flowering (therefore not produce), and mess up other stages of development. Care must be

taken with some species introduced to an area because the allelochemical's full effect may not be fully understood. A lot of man's chemicals in the areas of herbicides, insect repellent and insecticides are derived from allelochemicals because of its economies and its ability to break down readily in nature.

1.4 Define some producers and uses in forest ecology.

Energy is what life is all about, and everything about life is associated with energy. Organisms are accumulations of energy, and without energy, they die. All organisms require a source of energy. For an organism to reproduce they need growth, to grow they require new energy, to acquire new energy they must do work and to do work they must expend energy. Merely to stay alive requires energy. Both evolution and ecology can be viewed from an energy point of view. The abundance, productivity and distribution of organisms are all ultimately determined by the availability of energy. We will turn our attention to the source of energy used by different organisms.

Organisms that use abiotic energy sources (non-living, such as the sun) are termed autotroph; an example would be plants. Organisms that depend on biotic energy sources (living) are known as heterotrophs. Autotrophs are commonly known as producers while heterotrophs are known as consumers. Most people are aware of the four classes of heterotrophs such as:

Herbivore – eat green plants only (vegetation only)
Carnivore – eat herbivores and other carnivores (meat only)
Omnivores – eat both plants and animals (meat and vegetation)
Saprotrophs – utilize the energy in dead or decomposing plants or animals.

Saprotrophs also include what are called decomposers, detrivores or detritus-feeders – depending upon what's being broken down, either plant or animal or their feces. A distinction should be made here between a saprophyte and a parasite. A saprophyte gets its energy from a dead or decomposing host while a parasite gets energy for a living host – usually without killing the host.