BIOLOGY ACTIVITIES FOR THE NEWFOUNDLAND CONTEXT

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by

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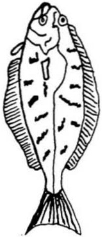

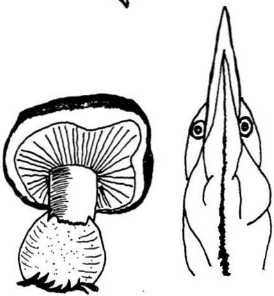

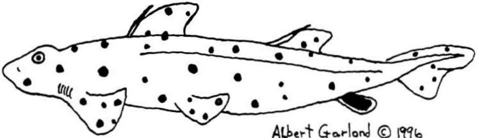

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Abstract

This project provides a theoretical framework to support the use of the local context and the experiences of students in the teaching and learning of biology. Eleven activities have been designed to incorporate the local context and the experiences of students in a small isolated fishing community. The stress is on linking the daily activities of these fishing people to the concepts and issues in the currently Biology 3201 course. However, these activities are adaptable to a general science course and may be moulded to fit specific contexts using student input. The final activity and the questionnaire in Appendix A provide the opportunities to continue the process and to design additional activities that fit the local context.

Acknowledgements

Remembering that one is the product of a complex interaction of experiences I find it hard to visualize everyone I should acknowledge in the production of this piece of work. I shall, therefore, state the obvious by saying that my supervisor, Dr. Clar Doyle, has been of most valuable assistance in providing constructive feedback and a positive attitude towards the project. It was the students of Cottrell's Cove Academy that inspired me to look at providing ways to bring the local context and their experiences into the biology lessons. It was the experience of doing the graduate courses at Memorial University with truly professional people that encouraged me to complete this work and will no doubt spur me on in my pursuit of being a lifetime learner as well as a teacher. At home I had the support of my best friend, mate and lover (M. Russell), who never doubted that I could and would finish this work. To all of them I say thank you for being there and being who you are.

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Theoretical Framework

Villarruel & Lerner (1994) point out that metatheoretical and theoretical perspectives "...have stressed that the key bases of development lie within the individual or the environment surrounding him or her or in the interaction between the individual and the environment (Lerner, 1986)" (2). We have to be aware of the context in which development is taking place because the context influences development. Thus, we can see that

> ...the theory of developmental contextualism (Lerner, 1991, 1992; Lerner & Kauffman, 1985) is a useful frame for discussing the dynamic linkages between development of a child's individual characteristics (for example, cognitive abilities) and the diverse and changing ecology within which the child lives (3).

That context contains many elements which include, but are not limited to, social, economic, geographic, environmental, historical, cultural and workforce dynamics. Each of these may have their effect upon the individual because "...cognitive processes do not unfold independently of the context; rather, they are the products of the linkages between a specific person and specific contexts (Baltes, 1987; Featherman, 1983; Lerner, 1984)" (4). We must take into account these contexts when designing and implementing curriculum. Villarruel & Lerner (1994) stated that "...when youth serving professionals design interventions, the efforts must extend to the multiple settings within which the child lives..., that is the areas of the community within which the child interacts when not in school" (4). Further they say that "...youth serving professionals seeking to develop effective learning programs should focus their developmental explanations and observations and especially their interventions in terms of learner multicontext relations" (5). In looking at an area such as biology, we cannot reasonably expect positive results if we deliberately ignore the contexts under which the students that come to our classes have developed biological concepts. The students in a small isolated fishing community live within several unique contexts. Historically, they are linked by hundreds of years of continuous involvement in the fishery. Economically, the environment and what is directly drawn from that environment has supported their basic needs of food, shelter and an income. A whole culture has grown up around this way of living and the effects of environment upon those who challenge the natural forces in the quest for a livelihood. The closeness to the environment and the dependence upon it for their basic needs is one context that forms a link between the study of biology and what it means to be part of a fishing community.

Cornbleth (1990) claims that

> Curriculum construction is an ongoing social activity that is shaped by various contextual influences within and beyond the classroom and accomplished interactively, primarily by teachers and students. The curriculum is not a tangible product but the actual day-to-day interactions of students, teachers, knowledge and milieu (24).

Part of these interactions must take into account the fact that the people we deal with in our classes have, from an early age, experienced the dynamics of a fishing community and its closeness to the environment. The experiences they bring to class are the points from which we, as educators, make our start in the effort to educate. Therefore, we should shape curriculum to envelop these experiences.

In a study by Ramsden (1994), there is a statement that curriculum materials should "start from personal experience" (9). In this study, a Salters' Science course was used that pays particular attention to "the use of everyday contexts as starting points from which to develop scientific concepts..." (7) and "...there was broad agreement amongst the teachers of the benefits of the course to their pupils, most particularly the use of everyday contexts and applications as starting points..." (10).

Stinner (1995) emphatically states that "there is strong evidence that we must connect cognitive activity to context, that learning methods embedded in context are not merely useful; they are essential (Martin & Brouwer, 1991; McNay, 1993; Roth & Roychoudhury, 1993; Shymonsky & Klye, 1992)" (556). He says that to spur students in science "...the context should be so planned that the questions and problems that are generated capture the students' interest and that they seem 'real' and make sense to the students" (557). One of the guidelines for designing contextual settings is to "provide the student with experiences that can be related to his/her everyday world, as well as being simply and effectively explained by the scientists' science, but at a level that makes sense to the student" (562). Part of Stinner's (1995) argument is that "we should develop and use special kinds of contexts and contemporary issues that strongly relate to students' experiences and interests" (564).

The Implications for Biology

In the Biology 3201 curriculum guide developed by the Department of Education (Training Division of Program Development, 1995), we see the importance of laboratory experience expressed in the following way,

> Important to the teaching of biology is the incorporation of a laboratory experience. Laboratory activities should be integral, rather than an additional part of the biology program.... They are important because they offer the students the opportunity to learn new content, but at the same time develop psychomotor skills. A set of core laboratories has been identified, but teachers are encouraged to expand their students' laboratory experience beyond these boundaries (11).

In this project, I wish to take up that challenge. I agree with the statement in the first paragraph under philosophy of instruction, which states that

> The process for deciding on which instructional strategies should be used rests with the teacher, but it requires that he/she focus on, among other things, the intended learning outcomes for the course; and the prior experiences and knowledge, the interests, the learning styles and the level of development of the students (11).

There has been extensive research into the effects of prior learning or experiences upon science teaching and learning. Osborne & Wittrock (1985) state that

> Teachers can provide sensory input which will help pupils generate links to appropriate aspects of their memory store. For example, teachers can exemplify how the topic to be taught, or the scientific principle being discussed, relates to the pupils' prior experiences both in and beyond the classroom (72).

Furthermore,

> For successful assumption then, instruction needs to encourage learners to generate firm links between constructed meanings and a variety of appropriate aspects of knowledge structures in memory. Scientific ideas have historical, philosophical, technological, mathematical, experimental and everyday aspects to them, and learners should be actively encouraged by teachers to generate links from newly constructed ideas to existing ideas in as many of these areas as possible (75).

Their claim is that "where pupils genuinely feel that classroom learning is helping them make better sense out of their world and the assessment mechanism rewards their endeavours to do this, they are likely to be well motivated" (75).

Harlen & Osborne (1985) say that the ideas that children generate should have significance for making sense of everyday events at a level meaningful to the children and relatable to prior experiences in a range of ways that relate both to the children's needs and the needs of society. The purpose of the activities in my project is to do just that. We have to bring biology to a level whereby it can help students make sense out of their everyday experiences, but it must also link into and make sense out of prior experiences, which for these people are very closely linked to the land and the sea.

What is it that society requires of students in a small isolated fishing community? Is it technical skill? Is it the ability to understand and function within a complex society? Is it the skills needed to hold a job or make a living? Maybe it is all of these and more! One thing I am sure of is that before young people can make sense out of the modern world, they must first make sense out of their immediate world with its environment. This, I believe, is an important stepping stone to the understanding of some of the most complex and vital issues that arise in modern society. How should we treat the environment? What does it mean to live in harmony with nature? The wider questions that society must answer and has refused to do so have greatly affected every aspect of these young people's lives. Families are forced to move away, workers lose their dignity and independent being unable to use their skills to earn a living from the sea. In many ways it is those who have stuck to their roots in fishing, lumbering and farming that are paying the price for a society whose unquenchable thirst calls for more and more resources, while, at the same time, irreparably damaging those very resources it needs to survive.

Students come to our science classes with experiences from which they have made sense of their world. Many studies show that when we ignore those experiences and the schemata that have been generated to make sense of what is happening, then the chances of changing those structures by simple instruction where the teacher attempts to communicate meaning is not very effective and even dismal in results (Osborne & Freyberg, 1985).

Investigators have found that meaning for our students does not come from outside but is constructed inside by an active process of putting experiences together into a framework that makes sense out of their worlds (Wittrock, 1974). Therefore, I believe it is reasonable to look at the experiences provided by the environment because it is these same experiences from which students have constructed a structure that makes sense to them. The challenge in science is to tap what the student already knows. What a student knows is not wrong since the intention of the construction is to make sense out of the world. It does that! However, educators can shape that structure by realizing how the student makes sense out of his/her world and moving from that point whether it be an alteration, confirmation or a complete makeover of the concepts and supporting structures. I propose to bring biology closer to what students know by providing activities that reflect the everyday experiences that have shaped what students know. They should feel comfortable with the materials because they are part of one's everyday life. Biology is about life. It is a living science. Just as these people are in the process of interacting with living things in their everyday affairs, so to biology is about living interactions. The experience of these people put them very close to nature and the biological processes that science has identified. Helping them put their own experiences into a biological context can go a long way to making biology meaningful for students of a small fishing community, I propose that learning biology when related to one's close personal experiences with making a living from nature or fitting into a niche should provide lots of opportunities to generate links between what is already known and the science of biology.

I shall now describe the project site to give the reader some idea of the potential for biology activities that exists there, followed by 11 activities designed specifically to be used at that site. At the beginning of each activity is a note that tells how this activity links into the local context. In each activity I have also listed instructional implications from the Biology 3201 course description that link into this activity and some of the intended learning outcomes that one should accomplish by completing the activity.

The Project Site

Cottrell's Cove Academy is located on the perimeter of a small fishing community of about 200 people. There are 65 children in the all-grade school. Feeding into the school are children from Moores Cove (population 80) and Fortune Harbour (population 100). Over the last decade, the three communities have been hard hit by the decline in the fishery with the result that many families have had to move away to find employment. The school population over that period has halved. The majority of young people who finish school leave the community in pursuit of higher education and jobs.

The area is somewhat isolated in nature with only one general store in each of two communities, no gasoline available locally, and the next nearest large community a 50 km trip. The school is central to many community activities and there is a constant buzz many nights of the week. People know each other and the students are able to name everyone in the community.

These are people close to the land and sea. Just about everyone is involved in the fishery in some form. Lobster, salmon and cod, when it was available, were the mainstays of these communities. Aquaculture is quickly opening up as a resource to be developed with the opening of a mussel farm that is expanding in the community of Fortune Harbour with satellite seeding grounds in Cottrell's Cove. Both adults and young people find employment in the mussel processing plant that Atlantic Ocean Farms has established at Fortune Harbour.

A majority of households depend upon wood for fuel and harvest the same each year. A lot of the houses in the area are constructed from wood harvested locally and run through small sawmills. The building of a home is a community or extended family affair and takes place at a surprising rate once started. Boats are handmade from local materials, but this is changing. Food sources are supplemented by the catching of game, such as rabbits and moose. People raise crops of cabbage, carrot, rhubarb, etc., and also raise animals, such as ducks, chickens and goats.

The school is outside the residential area of Cottrell's Cove and is located on the edge of acres of wooded land with a pond just at the back of the school. Other ponds and various terrain ranging from bogs to hills are within short distance of the building. The seashore is within two kilometres of the building. It is not unusual to see wildlife, such as moose, rabbits, squirrels, foxes, beavers, muskrat, and bats within short distance of the school. During the Fall, the harbour is visited by humpback whales, porpoises and seals, as well as schools of mackerel and herring. There are numerous types of birds, including bald eagles, ducks, and occasional snowy owls that appear in the area. Overall, the surrounding environment provides lots of opportunity for field experiences with the added advantage that its just a walk outside the school door to get there!

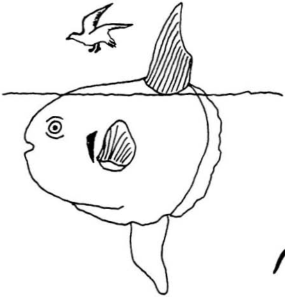
How to Use These Activities

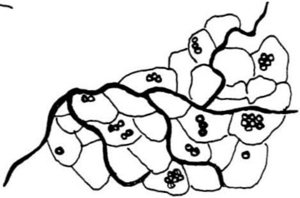
The activities that follow are for use with the Biology 3201 course, but could also be used in a general science program. These activities are designed with a small relatively isolated fishing community in mind, but may find some use outside of that context. The activities are flexible enough to allow student input. These activities may form a core around which evolve deeper, richer activities or out of which may be born new activities. You will find in Appendix A, attached to the end of these activities, a questionnaire to be used to get student input during and after each activity. The responses from these questionnaires should help shape the activity to fit the local context to an even greater degree.

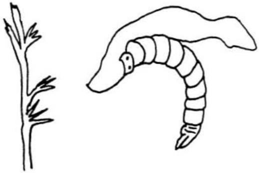
Profiles of the different field studies (Freshwater Biome, The Bog Field Trip) could be built up over several seasons or from year-to-year and can form the basis of a permanent display. Additional material from each group who complete the activity adds more to the picture and confirms what has already been established.

The time periods to complete these activities has been left open. Most of the initial work in the field can be completed within a two-hour period, while the debt of study will determine the time devoted to completing the analysis or projects that stem from these activities.

SYMBIOSIS







<u>Notes for Symbiosis</u>

The people of a fishing settlement are familiar with may symbiotic relationships because the activities of their daily lives bring them into contact with organisms that display these relationships. When they cut wood they are aware of organisms that cling to the wood as substrate and source of nourishment. When they fish they find organisms, such as remoras, attached to fish. They are aware of the organisms associated with the internal organs of the fish and animals they gut. They are aware of organisms growing on whales' backs, in fish gills and muscle. If they scallop fish they see organisms attached to the shells or see in the shells the tiny tunnels of burrowing organisms. In some cases they have learned to use these relationships to their own advantage. For example, the knowledge that maggots help to clean a wound was probably derived from seeing this occur in wounded animals and applying it to humans. They are aware that certain organisms stay together in close association and that a sign of one probably means the other is there.

This activity is meant to build upon those experiences by allowing the student to examine more closely some of these relationships. The number of these symbiotic relationships should help to convince the student of the need to study them more closely. The students may find that something in science that sounds foreign may be well known to the everyday lay person.

<u>Symbiosis</u>

Instructional implications from the course description (Government of Newfoundland and Labrador, 1995) that link into this activity.

1.3.2 The student will be expected to demonstrate an understanding that symbiotic relationships allow two different organisms to interact closely so that at least one benefits.

1.3.2.1 Illustrate with examples how special symbiotic relationships allow plants and animals take advantage of one another to find food, shelter, protection and to aid in reproduction (eg. commensalism, mutualism, parasitism).

<u>The Intended Learning Outcomes for this Activity</u>

1. To use 10 local examples to illustrate and examine the above and thereby to tie into what is culturally familiar to the students' experiences.
2. To be able to use the microscope to distinguish between the host and the symbiont.
3. To look at some of the benefits that we can derive from a knowledge about symbiosis.
4. To become more aware of the physical closeness of these organisms in symbiosis.
5. To state the size difference between the host and the symbiont.
6. The list the advantages and disadvantages afforded the individuals in symbiosis.
7. To add to the list of symbiotic relationships other locally recognized examples generated by the students' experiences.

Materials

The following is a list of local examples that could be used to achieve the objectives of this exercise.

1. Shelf fungus on trees
2. Reindeer moss
3. Old mans beard
4. Lichens on tree trunks
5. Worms in trout guts
6. Barnacle on whale skin
7. Galls on plants
8. Clover and bacteria...roots
9. Coral clam seastar association
10. Squid and luminescent bacteria
11. Fungus and human foot
12. Potato wart
13. Maggots of blowfly and wound
14. Whale lice
15. Bacteria in large intestine...humans
16. Lice and ticks on birds and mammals
17. Worms in flesh of codfish
18. Sea birds on backs of basking whales

19. Keeping of bees on a blueberry farm

20. Bacteria on the human skin

For collecting you will need the following materials:

plastic bags

containers with lids

small handsaw

trowel

tags

pencils

For photographing you will need:

a camera with film

a note book to record each picture

In the lab you will need:

magnifying glasses

microscope

microscope slide

scalpel

Procedure

1. Collect and note photographically as much of the material as can be found locally.

   One student could handle the camera while another records the photograph number and what it is. A third student in the group could actually collect the specimen photographed to bring it back to the laboratory.

2. The teacher sets up, in the lab, other examples that are not easily obtainable.
3. Use microscopes and magnifying glasses to examine samples, where it is hard to distinguish by eyesight alone that indeed two organisms are involved...lichens are good for this.
4. At the lab discuss each example in turn with the class.
5. Use the filling in of Table One to focus students' attention.
6. Tell the story of how native North Americans used maggots in curing an infection. Relate this to what happens in nature when an animal is wounded. Discuss medical uses of leeches to keep the blood flow constant in cases of severed parts until reattachment. Discuss how maggots can be an alternative to amputation. In each case, identify the relationship and the advantages and disadvantages to the organisms involved.
7. When the pictures are completed, use these as a means to review the collecting trip and what was found. The class may wish to make a chart using the information they have learned along with the photographs to tell a story about symbiosis.

Table One

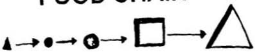
Host	Advantage	Disadvantage	Symbiont	Advantage	Disadvantage	Size comparison to host	Relationship

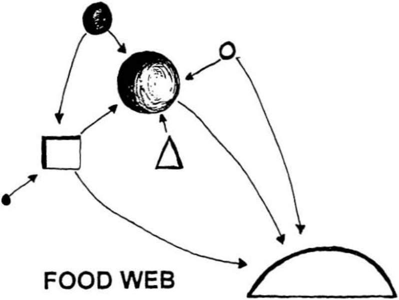
Questions

Note: Table One will be used in answering the questions for this activity.

1. What are the organisms involved in each relationship?
2. Which organisms gain and what do they gain?
3. Which organisms lose and what do they lose?
4. Name the organisms in the relationships that aren't affected.
5. In light of your answers to questions one to three, what is the scientific term for each of the relationships?
6. In each case, which is larger -- the host or symbiont?

FOOD CHAIN





FOOD WEB

Notes for Food Chain, Food Web

Input from the students' own experiences should be sought in this activity. Those who snare rabbits can tell stories about having their captured prey eaten by other organisms. Fisherpeople and trappers are aware of some of the feeding relationships between organisms and use this knowledge in their attempts to capture other organisms of commercial and domestic value. Cleaning of animals, fish and birds sometimes reveals their stomach contents. All of these experiences are valuable sources of information when it comes to constructing food chains and webs.

Breaking a food web down into its constituent food chains and realizing that one organism may be a food source for many other organisms helps to bring an appreciation of the complexity of food webs and the competitive nature of obtaining food.

Don't forget to include humans in these food chains and webs. Show that in some cases the human is not at the top of the food chain by producing a food chain or food web where the human may be consumed.

The game shows the competition for certain food sources in that certain cards can be recaptured by another organism. Judging from the results of the public examination in Biology 3201 (Summer 1995), it appears that students have great difficulty in determining the difference between a food chain and a food web. Plenty of practice using local examples may prove beneficial in helping to make that distinction.

Food Chain, Food Web

Instructional implications from the course description (Government of Newfoundland and Labrador, 1995) that link into this activity.

1.3.1.5 Describe the feeding relationships in an ecosystem in terms of competition, food chains, and food webs.

The Intended Learning Outcomes for this Activity

1. To become aware of the many feeding relationships in local organisms.
2. To construct food chains and food webs based upon local organisms.
3. To realize that any food web is a combination of food chains.
4. To see that organisms depend upon a variety of food sources.

Materials

Information sheets on local organisms and what they eat. Some possible sources are Smithmark Canadian Nature guides, other plant and animal guides, museum mininotes about particular organisms, such as the black bear, published by the Newfoundland Museum, and publications by the Department of Agriculture and Forestry, Government of Newfoundland and Labrador.

Student input as to what eats what.

Small cards...could use filing cards

Sheet with blank chart...Appendix

Chalkboard chart with heading of organism and list of what it eats below

Procedure

Divide up the information sheets among the students who are in groups of two or three. Have them determine what the organism eats and add this to the chalkboard chart. For each organism put its name on a card. Use the chart to list on the card the foods that the organism eats. Pass out the rules to the game and have students in groups of three or four play the game.

Rules

One card is dealt to each player until one player calls a card (the card called must be a consumer and the player who calls the card must have it in their hand before calling). The other players must release all the food courses for the called card back to the calling player (check the list if necessary). For example, if a player calls the fox card, the other players would have to surrender all food cards they have in their hands under the list with heading of fox. If the surrendered cards contain another organism that is in the chart with food sources listed below, the player may then call for those cards. This continues until a call produces no cards, at which point one new card goes to each player until someone else calls a card. When all the cards are gone from the deck, each player takes their cards and lays them out to form food chains or food webs. A food web is considered higher than a food chain. Food chains and food webs are ranked according to the number of different organisms present. A four link food chain would be considered higher than a three link food chain and a food web with 12 different organisms would be considered higher than one with eight organisms. Points are determined by counting the number of organisms in the food chain or the food web, giving one point per organism. Any card not used is not counted. For each food web, add one point for each food chain that is three links or more and which the player can point out. The game could be played in one round or by a number of rounds with the highest points winning.

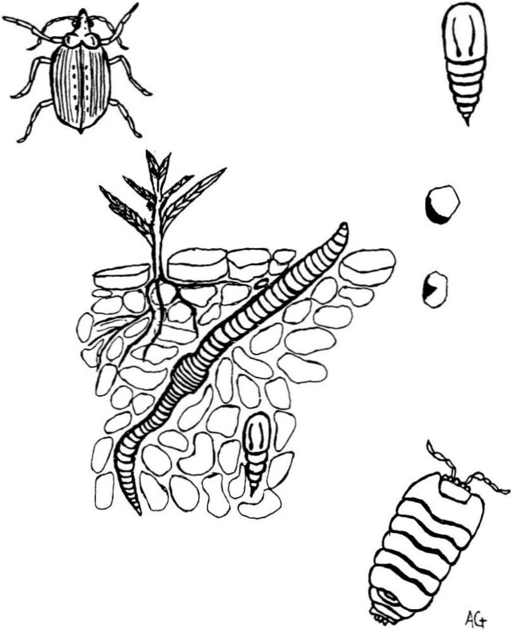
<u>**Question**</u>

1. For the food sources that are consumed by more than one organism, make up competing charts similar to the example below.

rabbit		bear
	spruce tips	
moose		squirrel

2. How many links in the longest food chain in the group in which you are playing? Compare this with the results from the other groups.
3. Which organisms have the most food sources?
4. Which organisms have the least food sources?
5. What do you think would be the difference in the affect on the organisms in Questions 3 and 4 if one food source was removed? Explain.
6. What was the largest number of food chains taken out of one food web?

BIOTIC
ABIOTIC



AG

Notes for Biotic and Abiotic

Gardening has long been associated with the outport life. Small kitchen gardens have provided fresh produce and enough vegetables to keep a family supplied through the winter. The care of the garden required fertilizing with natural fertilizers, such as kelp and caplin. The soil was tilled with the removal of large rocks. Here in the kitchen garden were all the elements of a system that incorporated biotic and abiotic factors to benefit the family. At planting and harvest time the most intensive interactions between the human and those factors occurred. Most young people in this context have had opportunity to observe first hand some of the interactions that make up a system. They are aware of the organisms that exist in the soil and that associate themselves with plants, they are aware of the techniques used to loosen the soil to allow air into it, they are aware of the need for special nutrients provided by natural fertilizers, and they are aware of the constant need for monitoring of so-called pests and the growth of plants to ensure a good crop. They know that certain organisms, such as worms, are a good sign of a system that is working well. This activity allows the students to see how intertwined the biotic and abiotic factors in a system really are.

One may find that students have their own names for some of the different organisms found in the sample or that they have no name for the organism. In the case where they have no name, it may be better to assign a letter to the organism until the student has an opportunity to use the keys later on to identify what he or she has found. There may be agreement upon what an organism is when, in actual fact, this is not the accepted name for the organism. Merely telling the student the difference may not be as effective as one might assume! However, if the student uses written sources of information, especially those that provide photographs, they may find that the picture of the organism does not match with what they have. This is where a pictured key may be of help in identifying the organism and, therefore, the accepted name and other pertinent information.

The question of whether something is biotic or abiotic may arise around pieces of decaying matter. This will provide opportunity to sharpen the definition of "biotic."

When the sample is brought to the laboratory, it is a good idea to tease the material out into a thin layer on the wax paper. Students should give the material a few minutes in the open air before some organisms may show movement. The number, as well as the variety of organisms, should be noted. Students should be reminded that some organisms exist on the microscopic level.

Respect for the sample should be stressed by requiring that the organisms and earth be returned to the original location when finished.

Biotic and Abiotic

Instructional implications from the course description (Government of Newfoundland and Labrador, 1995) that link into this activity.

1.1.1.2 Define biotic factors and describe their effects on ecological interactions.

1.1.1.3 Define abiotic factors and describe how each of the following abiotic factors affects ecological interactions

1) availability of water

2) changes in temperature

3) amount of light present in the environment

4) availability of organic and inorganic nutrients, and

5) composition of the soil.

The Intended Learning Outcomes for this Activity.

1. To list factors that make up the composition of the soil.

2. Given a sample attempt the separation of biotic and abiotic components.

3. To become aware of the close interaction of the biotic and abiotic components in a soil sample.

4. To familiarize oneself with local examples of biotic and abiotic factors.

5. To suggest some interactions between biotic factors and also between biotic and abiotic factors.

Materials

Trowel

Sod sample with soil (6 cm x 6 cm)

Magnifying glasses

Microscope

Glass slides

Tweezers

Two feet of wax paper

Clear plastic bag

Soil thermometer

Two clear containers with lids; one marked biotic, the other abiotic

Procedure

Take the soil temperature using the soil thermometer. Use a trowel to take a sod sample 6 x 6 x 6 cm and put the sample into a plastic bag. Bring the sample to the lab and separate into its component parts on top of the wax paper using tweezers, magnifying glass, and stereo microscope. Put the biotic factors into the container marked biotic and the abiotic factors into the container marked abiotic.

Questions and Directives

1. Identify as many of the biotic factors in the bottle marked biotic as you can.
2. Identify as many of the abiotic factors in the bottle marked abiotic as you can.
3. What biotic factors are still in the container marked abiotic?
4. What abiotic factors are still contained in the bottle marked biotic?
5. Name some factors outside the actual sample which may affect the sample but are not present or have been changed due to removing the sample from its original location. Label each factor with an "A" for abiotic and a "B" for biotic.
6. In the state of being separated from the abiotic factors, can the biotic factors survive very long? Why or why not? Give examples with your answers if possible.
7. Research question: What do the biotic factors you have found feed upon? Are those foods present in your sample?

FRESH WATER BIOME

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Notes for Freshwater Biome

To describe a freshwater environment without knowing it denies one the opportunity of expanding the base of experience and, thus, the chance to more fully comprehend at a deeper level what constitutes a freshwater biome.

Young people are attracted to water from an early age and enjoy "mucking" around. Catching bennies, eels and frogs seems to be a popular pastime with young people. Who has not marvelled at the discovery of a caddisfly house or been awed while watching a beaver do its work or young ducklings following their mother. Trouting is a popular pasttime that provides a good meal for the family. These already have to contribute to our appreciation and description of the freshwater biome.

This activity gives young people an opportunity to systematically look at what is familiar and to find a "strangeness" in the familiar in the form of new discoveries and insights into the complexities of a freshwater biome. This activity can be expanded to do a study over a period of time by repeating the procedure during different seasons of the year. The changes that occur can be an indication of the dynamic nature of this system of nature. The profile can become a work of art where students' talents contribute to a finished product that reflects individuality in drawing and presenting the findings. Environmental concern can be reflected by the school adopting a portion of a stream and keeping it clean of litter. All specimens should be kept a minimum of time and returned by the students to their original location.

Freshwater Biome

Instructional implications from the course description (Government of Newfoundland and Labrador, 1995) that link into this activity.

1.2.1.5 Describe marine and freshwater biomes

1.2.1.6 Describe how differences in abiotic factors affect life in aquatic biomes contrasted with terrestrial biomes.

The Intended Learning Outcomes for this Activity.

1. To use keys to identify organisms in a freshwater biome.
2. To make a profile across a freshwater stream.
3. To suggest other means of examining a freshwater biome.
4. To list the biotic and abiotic factors associated with a freshwater biome.
5. To draw on one's own experiences to add to the total picture of what a freshwater biome is.
6. To appreciate the complexity of a freshwater biome in terms of the number of factors involved and their dynamic nature with the passing of time.
7. To become more environmentally aware of the need to keep in check the human activities that may impact in a negative way upon this environment.
8. To create art that reflects the spatial relationships between the factors in a freshwater biome.

Materials

String

Pegs - several feet long

A long pole

Marker

Collecting bottles

Record book

Pencil

A tape in metres

Thermometer

Keys to plants, insects, etc.

Various art materials (pens, pencils, clay, paint, brushes, etc.).

Procedure

The study site will be a stream. Use a string and peg on one side of the stream set back two metres from the water's edge. Cross the stream with the string and secure it two metres from the opposite sides water edge as per Figure One.

Measure the height or depth at even intervals of 30 cm from the starting points until you reach the ending point. Use this information to plot a profile as demonstrated in Figure One.

Collect plants, insects, etc., along the line and within 30 cm of the line to the left and right when looking down the length of the line. Note if you see any fish or other organisms and the locations of rocks. Make your record so that you can add these features into the profile at their exact locations with reference to the line across the stream. Take soil samples on each bank and three in the stream, one on each side and one in the middle. Put into bottles and label. Take the temperature at the surface of each side of the bank and directly over the middle and near the surface of the water. Take soil temperatures on both banks and the water temperatures of the surface water and the deepest part of the stream along the string.

Examine soil samples for organisms. Use keys to try and identify some of the organisms. Use keys to try and identify some of the organisms. Record whether each side of the bank is in sunlight or shade and also if the portion of the stream you are examining is in sunlight or shade. Take a photograph of the left and right bank and also the stream.

The profile can be done on graph paper or, if this is used as a science project, an enlarged profile can be made with notes, diagrams and pictures, drawings or models of the orgnisms and other materials noted at the site.

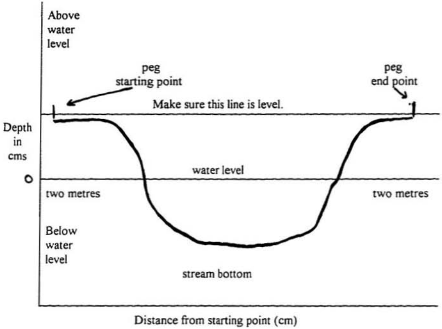
In completing this procedure it is necessary to measure elevations and depths. A marked long pole can be used for this purpose.

Questions and Directives

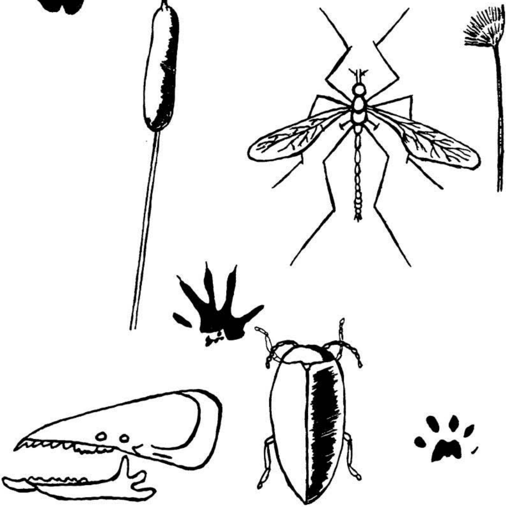
1. Name the abiotic factors present in this freshwater environment.

2. Give instances where the abiotic factors differ. In each case explain why they differ.
3. How many different organisms were you able to locate at the site?
4. Suggest other ways that we could study this site which could be incorporated into our next visit.
5. How does our presence affect this site?
6. What indications are there that human activity outside of our study group may be affecting this site?
7. Give a report on one of the organisms collected.
8. What food chains or food webs can be constructed using the information about the organisms noted at the site?
9. How would you go about building a model to give people a "feel" for this profile of a freshwater environment? What would you include in the model?
10. In your life experience, what contact, either directly or indirectly, have you had with freshwater? What type of experiences do you associate with freshwater environments?

Figure One


Above
water
level
peg
starting point
peg
end point
Make sure this line is level.
Depth
in
cms
water level
0
two metres
two metres
Below
water
level
stream bottom
Distance from starting point (cm)

THE BOG FIELD TRIP



Notes for the Bog Field Trip

Bogs are a vital part of outport life. It is in these areas that local hunters find moose feeding on delicate water plants and trap animals. The bog is a valuable source of dark humus rich soil which is collected and added to local gardens. Aesthetically, the bogs provide a wide variety of beautiful plants, including the pitcher plant, blue flags and cotton grass, which was used to stuff pillows. Bogs support edible berries, such as marsh berries and wild currents. Bogs have also served as ways of passage allowing easy access to wood in wintertime.

This activity takes a deeper look at what a bog actually is. It can be used to link into several environmental issues relating to the balance of interactions occurring in this system and how human activity affects that balance.

Identification guides, such as Smithmark Canadian Nature Series, given an indication of habitat and this can be used to confirm any suggestions by the young people about what they have seen on a bog. The guides will also give some indication of food eaten by particular organisms, so that one may be able to construct food chains and webs using the collected information along with the information in the guide. The food chain or web could be specific or general in nature. For example, we may find numerous types of spiders on the bog and we know from other experiences that spiders capture bugs, but we cannot be sure that a particular spider eats a particular bug unless we collect the spider and its prey captured in a web. One will probably be amazed by the great variety of organisms that a bog supports.

A discussion about some of the uses that bogs provide may prove useful. The production of peat for cleaning up oil spills and the farming of bogs can lead to discussions about why bog material is so useful in these ways.

Changes, such as the establishment of more substantial forms of vegetation in the form of trees and shrubs near the borders and which gradually encroach onto a bog can lead to discussions about the dynamic nature of a bog and the succession that takes place there. A lot of young people in small settlements have access to all-terrain vehicles so that a discussion of why the government sees the need to protect bogs may focus their attention to the delicate balance that exists in these areas and how easy it is to upset that balance. We tend only to see the more gross features of a bog and do not have enough time to stop and examine some of the finer features of this habitat. With this field trip it is hoped that the students will have the time to take a closer look at what a complex system this really is!

The Bog Field Trip

Instructional implications from the course description (Government of Newfoundland and Labrador, 1995) that link into this activity.

1.3.1 The student will be expected to demonstrate an understanding that ecosystems are descriptions of any part of the biosphere that are composed of complete interactive units of living organisms.

1.3.1.5 Describe the feeding relationships in an ecosystem in terms of competition, food chains and food webs.

1.3.1.6 Show how the many interrelated food chains (food web) of an ecosystem give a community stability and identify the conditions necessary for a stable, self-sustaining ecosystem.

1.4.1.6 Describe the fragility and stability in ecological communities by making reference to the restricted dependence of life in a biome.

1.5.1.2 Define and give examples of each of these heterotrophic types: herbivores, carnivores, omnivores and saprobes.

The Intended Learning Outcomes of this Activity.

1. To list the great variety of life forms present on and in a bog.
2. To suggest some possible feeding relationships in the form of food chains or food webs that can be constructed using the organisms found in a bog.
3. To see a bog as an example of a succession in progress.
4. To list the biotic and abiotic factors that make a bog a unique ecosystem.
5. To find examples of herbivores, carnivores, producers, omnivores and saprobes in the bog ecosystem.
6. To construct a mental picture of a complex, but yet delicately balanced, ecosystem thereby becoming more aware of the need to protect such areas.

Materials

Ph paper

100 m line marked at 10 m intervals

Two pegs

Sample bottles

Butterfly net

Keys or guides - insects/plants/spiders

Plastic containers

Plastic bags

Trowel

Container of water to fill traps

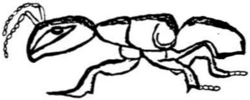
Procedure

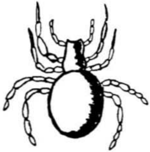
Run the line from the middle of the bog towards the edge of the bog. Record and take samples of plants along the line. Use butterfly nets to collect insects. Look on plants and the bog surface for insects and collect the same. Take two samples of bog soil for laboratory examination. Set out the insect traps by inserting them in the bog with their tops level to the surface of the bog and filling them with water. Leave them for one week before collecting. Use the guides to identify as much as possible. Plants may be pressed between sheets and dried. Ask students what organisms they have seen on or in a bog. Based upon collected material and observation, suggest some feeding relationships. Take the Ph of bog water and also the water squeezed out of the bog soil. Weigh one sample of bog soil and record. Let dry and weigh again. Estimate the per cent of water in the sample. Look at the second sample under binocular microscope and magnifying lens. Can you identify parts of organisms? What are they? Are there living organisms in the sample?

Questions and Directives

1. What types of damage would be done if all-terrain vehicles were allowed to constantly cross a bog area? How can this be prevented?
2. How are the organisms in a bog ecosystem linked to each other?
3. How are bogs and bog material used locally?
4. What abiotic and biotic factors make a bog different from other areas, such as a forest?
5. Identify the type of feeding relationship for each organism.
6. Do the plant types and sizes change as you work from the middle of the bog to the edge? Explain.
7. Where does the material in the bog come from?
8. What affect does the bog environment have on decomposition? Explain.
9. What adaptations do plants that grow on bogs have?

THE SPRUCE TREE AS HABITAT





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Notes for the Spruce Tree as Habitat

Small isolated communities rely upon wood for heating their homes and for building material. A good portion of time is spent in the winter harvesting, gathering, and cutting it at local sawmills to make lumber for building materials to be used to make homes, sheds, fencing and the like. The young people are involved in all aspects of this wood harvesting, gathering, and processing and are, therefore, familiar with the organisms that associate with the tree and, in particular, those organisms that depend upon the tree as their habitat. Those experiences provide a wealth of knowledge that can be combined with the observations in this activity to produce a wider view of the tree as habitat!

This activity is better done during the early fall or late spring because these are the times that living organisms on the tree are the most conspicuous and because a lot of insects are out of hibernation and have hatched and started feeding. The list of organisms found on the tree will include both plants and animals who depend on the tree for food, nesting sites, protection, substrate to attach to, exposure to sunlight, and in different relationships, such as commensalism, parasitism, and mutualism.

In our area there has been a rather large infestation of the spruce bud worm. Students will no doubt notice the number of larvae and the damage done to trees.

One must appreciate that a tree does not live in isolation but is at the hub of a living wheel supported by many spokes that branch off in different directions. Destroying a tree means affecting numerous other organisms that depend upon the tree. It is hoped that this activity will allow the student to appreciate the number and variety of organisms that interact with the tree and thereby realize its role in a complex system.

The Spruce Tree as Habitat

Instructional implications from the course description (Government of Newfoundland and Labrador, 1995) that link into this activity.

1.3.1.1 Define habitat.

1.3.1.2 Define niche and relate it to habitat.

1.3.1.3 Define competition and explain how competition arises among organisms.

1.3.1.4 Differentiate between interspecific and intraspecific competition.

1.5.1.2 Define and give examples of each of these heterotrophic types: herbivores, carnivores, omnivores and saprobes.

2.1.1.8 Show how taxonomic keys, often dichotomous in nature, can be used to help classify certain organisms.

The Intended Learning Outcomes for this Activity.

1. To become aware of the interrelatedness of organisms that spend some part of their life on spruce trees.
2. To use dicotymous keys to identify organisms.
3. To list five feeding relationships that exist around a tree.
4. To list 10 organisms that depend on the spruce tree and the advantages for the organisms that exist there.
5. To discuss the impact that human activity has on this habitat.

Materials

Guides or keys to insects, plants and spiders

Samples of cross sections of tree trunks

Skirt to go around the base of the tree (could be made up of plastic garbage bags)

Collecting bottles

Tape marked in centimetres

Note book

Procedure

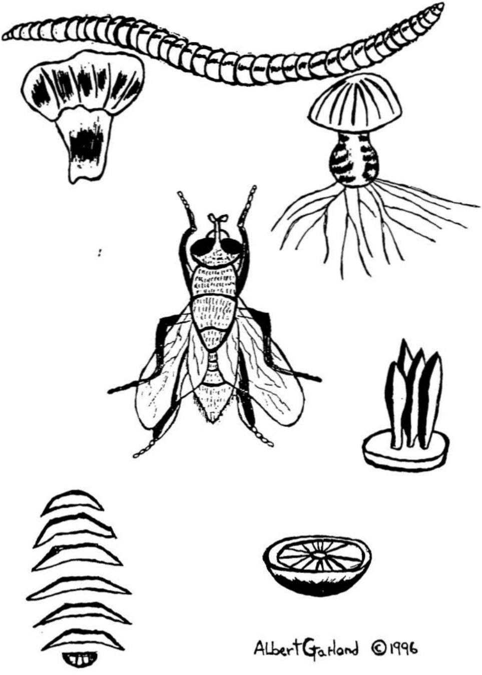
This activity can be done with students forming groups of two to four. The tree can be marked with a piece of coloured wool so that it can be observed over a period of time. The skirt is put at the base of the tree and spread out to capture anything that falls from the tree when it is shook. The bark should be examined and anything growing there should be noted and samples taken. Specimens can be collected at different heights and from the branches with proper care being paid to safety. The circumference of the tree should be taken at the base. This can later be compared to a lab sample to get an estimate of the age of the tree.

Questions and Directives

1. What organisms use the spruce tree as a habitat or place to live, even for a part of their life?
2. What do these organisms gain from the tree?
3. Does the tree gain anything from these relationships?

4. Is there competition among the organisms that use the spruce tree? How is competition reduced?
5. Are there relationships where one organism depends upon another? Examples.
6. How do humans use the spruce tree? How would this affect the other organisms that depend on the tree?

DECOMPOSERS



<u>**Notes for Decomposers**</u>

The opportunity for young people in outports to see the results of decomposition and decomposers is varied and numerous. In the garden's natural manure is used to enrich the soil. These contain decomposers and young people would readily identify certain types of flies, maggots, and worms, as well as fungi, with this material. Securing and harvesting wood means that a good many of them spend considerable time in the woods where naturally decaying plant material supports a wide variety of decomposers and the other organisms that, in turn, prey on the decomposers. When cleaning rabbit and moose the internal organs and skins are discarded and subject to decomposers and exposure to the air. On the water and the sea shores carcasses of seals, sharks, seabirds and whales are sometimes encountered and again lead to the experience of seeing the results of decomposition and no doubt some sightings of decomposers.

Young people's experiences of decomposition and decomposers can be used as the starting point for this activity by introducing the topic by way of a discussion about some of these experiences. Smells and sights in these instances tend to be strong and memorable because of this. Discussions about the organisms involved and what is happening can lead to a summary of these experiences. I have found that young people are fascinated about what happens to your physical body when we die and about the work of embalmers to prevent and slow down decomposition. The role of decomposers in recycling of materials can be presented here to stress the importance of decomposers in recycling limited materials. Discussion of how we have used our knowledge about decomposers to build systems that use them in the recycling of human waste can lead to more research into how these systems are constructed, where they are located, and how they work.

Decomposers

Instructional implications from the course description (Government of Newfoundland and Labrador, 1995) that link into this activity.

1.5.1.3 Explain the role played by decomposers in an ecosystem.

The Intended Learning Outcomes for this Activity

1. To become familiar with local examples of decomposers.
2. To state the role played by decomposers in recycling of materials in an ecosystem.
3. To list the benefits afforded by decomposers to other organisms.
4. To realize that decomposers attract other organisms that link into a complex food web.

Materials

Plastic bag

Shovel

Terrarium

Keys

Procedure

The idea of this activity is to collect a piece of decaying wood and the area directly beneath it. This could be a natural fall or a piece from the bottom line of a wood pile.

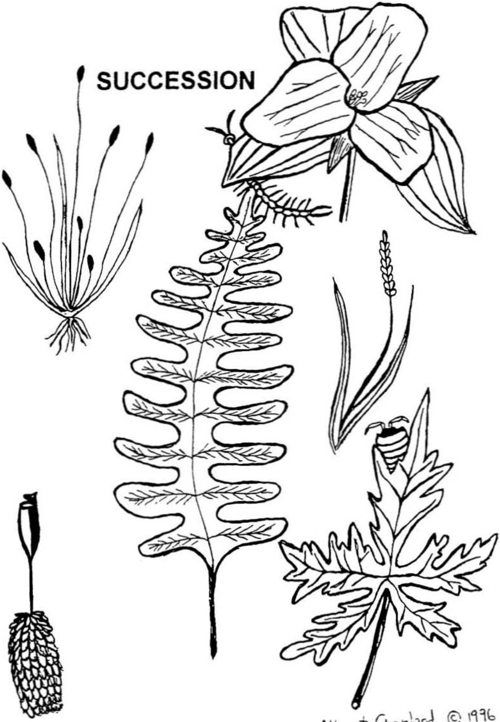
Collect the specimen into a clear plastic bag. Also take the soil directly beneath the decaying wood. Place the wood chunk and the soil into a terrarium or other clear large container with a lid. The wood piece should be dissected out to reveal any hidden organisms. Also, the soil sample should be searched for organisms. A sieve may be of help here. A lot of the organisms will be identified by their common names, but keys or picture guides may be used for unknown organisms.

Questions and Directives

1. Describe the state of the wood chunk.
2. What organisms are directly on the wood chunk?
3. What organisms were found in the soil directly beneath the wood chunk?
4. What do each of these feed on?
5. Are any of them decomposers? Which ones?
6. Keep the soil and the wood moist by adding an occasional 250 mls of water.
7. Observe the activity on and around the wood chunk.
8. How does this relationship with the decaying wood benefit the decomposers?
9. How does the environment benefit from the decomposers? Use examples in your answer.
10. What types of organisms have you noticed on or near dead decaying bodies or waste products of organisms?
11. What would happen if there were no decomposers?
12. How do detectives use flies to determine where a body might be found?

13. How do forensic scientists use flies in determining how long a body has been decomposing?

SUCCESSION



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Notes for Succession

In this area of the province (Notre Dame Bay) there are many opportunities for young people to experience and observe the different types of succession. The area is heavily forested with climax communities of conifer trees. The cutting of trees for local use and by the paper making companies allows secondary succession to occur. Also, the area's population has diminished leaving abandoned farm land and family land that, over a period of time, displays the steps in secondary succession. Lichens on bare rock illustrate the beginnings of primary succession. Talus at the base of hills show the beginnings of soil formation. Plants grow out of cracks which have trapped some of the new soil. Moss covers areas of shallow soil.

The aim of this activity is to draw some comparisons between these different types of succession. Some general indication of the time involved will be gained by these comparisons. The complexity of each succession should be indicated by the variety and types of organisms recorded. Students should be made aware of the limitations of their small sample area and could possibly take a second sample area to determine if the first area is truly representative of the type of succession under study. Elements of the climate and geography, such as position on the earth and the type of underlying rock, should be researched to give a more complete picture of what contributes to each succession.

Succession

Instructional implications from the course description (Government of Newfoundland and Labrador, 1995) that link into this activity.

1.4.1.1 Define ecological succession.

1.4.1.2 Describe the main factors responsible for ecological succession: climatic and geographical forces plus change in a community caused by its own inhabitants.

1.4.1.3 Define: dominant species, climax community, primary succession, and secondary succession.

1.4.1.4 Explain how primary succession differs from secondary succession.

The Intended Learning Outcomes for this Activity

1. To look at local examples of the different types of successions and to compare them to each other.
2. To get some appreciation of the time required to replace climax communities.

Materials

Measuring tape (metres)

Thermometer

Light metre

Marked rod in centimetres

Four pegs

Hammer

Lab samples of cross section of trees

Procedure

We will look at the following four areas cut over #1. cut over #2. climax community and primary succession. Each group will be responsible for one area and should measure off a square five metres by five metres. Your group should find and record the following information for your sample area:

1. The name of the sample area.
2. The number and types of plants.
3. The diameters of any trees at their thickest point on the trunk.
4. Note any types of organisms present.
5. The presence or absence of soil.
6. The deepness of the soil where present.
7. The temperature at ground level.
8. Note whether the area is in sunlight or shade.
9. Give a description of the area you are studying.
10. Be prepared to reconstruct the area in model form. For this. your notes need to be thorough and precise.

Questions and Directives

1. Devise a means of estimating the age of the trees present by using the diameters and the ring count of the lab specimens.

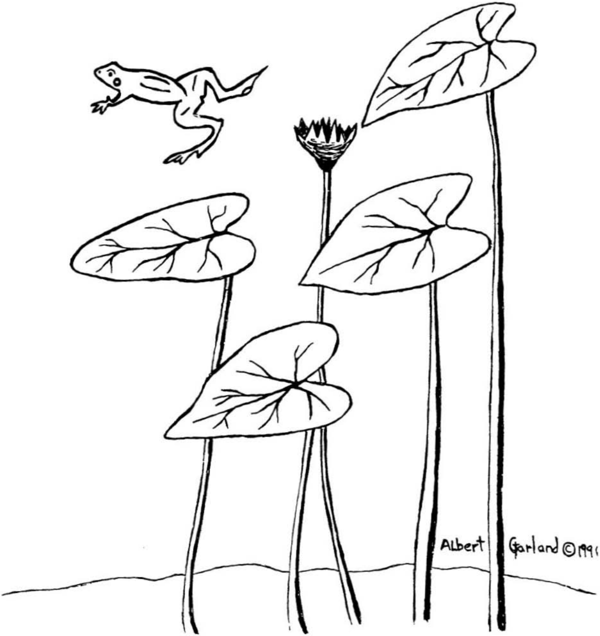
2. How is the cut over area different both biotically and abiotically from the uncut area.

3. Explain the reason or reasons for each difference.

4. What biotic and abiotic factors are present in the primary succession?

5. Explain how the primary and secondary succession areas differ in the following respects: a) temperature, b) depth of soil, c) number and types of organisms, d) spacing of organisms, e) size of organisms. Explain the reason for each difference.

SUCCESSION IN A POND



Notes for Succession in a Pond

Within one kilometre of the school we have a small pond that is fairly shallow and undergoing succession. The sides of the pond are gradually filling with plant material and mud. Established in these more shallow areas are reeds and masses of lily pads. The contrast with the centre of the pond is greatest during the spring and fall when the lily pads are in full bloom. They form a wide ring around an area at the centre which is clear and measures about 100 feet in diameter. The edge of the pond is very shallow and a thick layer of material lays at the bottom. Discussion about the nature of this material, where it comes from, and what the results will be if this trend continues will bring to light some of the changes that occur when a natural succession involving a pond continues. This area is very familiar to the young people because it is here that they swim in the summer. There is a brook that runs near the pond and it is the deep area in this brook called the "pot hole" that is used for swimming. The pond contains trout and is used as a fish pond. Around the edge of the pond is a wide area that floods during heavy rain. It would be interesting to speculate about what the area looked like 100 years ago. We have older members of the community that could comment on what the area looked like 50 years ago.

Succession in a Pond

Instructional implications from the course description (Government of Newfoundland and Labrador, 1995) that link into this activity.

1.4.1.5 Explain how succession on land, which leads to development of a forest community, differs from succession in lakes and ponds.

1.4.1.6 Describe the fragility and stability in ecological communities by making reference to the restricted dependence of life in a biome.

The Intended Learning Outcomes for this Activity

1. To look at a local example of succession occurring in a pond.
2. To get some idea of what the pond was like in the past.
3. To record the state of the pond in the present.
4. To become aware of the trend in this succession and to project that trend ahead to envisage what the area will look like in the future.
5. To think about the changes that the succession will mean to the organisms presently living in the area.

Materials

A long rope marked at one metre intervals

A small row boat

Life jackets

A long pole marked in metres

Plant guides

Collecting bottles and bags

Procedure

Start the marked line six metres from the shoreline and bring it across the middle of the pond to the opposite side and a further six metres from the shore as illustrated in Figure Two. Use the marked pole to measure the depth of the water at one metre intervals and put the results into Table Two. You may wish to collect samples of plants from the shallow areas towards the shore and six metres inland. Make sure to mark the distance from the shoreline on each sample.

Questions and Directives

1. Use the results from your table to draw a profile of the bottom of the pond.
2. Describe the shape of the bottom profile. Suggest a reason why it takes this shape.
3. Where does the material along the sides and the bottom of the pond come from?
4. What is the progression of plant types when working from the end of the rope towards the middle of the pond?
5. Project ahead in time and, using a different coloured line, draw what you think the bottom profile will look like in 50 years time. What would case the change you have drawn?
6. What plants occur near the shoreline on the land? Are these deciduous, perennials or annuals? What happens to the materials from the plants, such as the leaves, roots and stems?

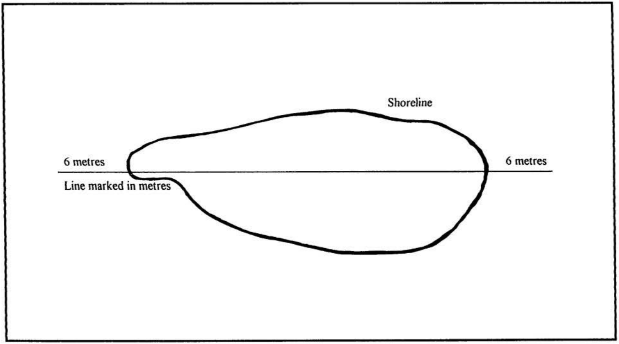
7. If the trend that you predicted on the graph continues, what will happen to the organisms presently living here?

8. Question an older member of the community and ask them about this pond. Was it always the same size and depth?

Table Two

Distance (metres)	Depth (metres)

Figure Two



SEED PROTECTION AND DISPERSAL IN ANGIOSPERMS

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Notes for Seed Protection and Dispersal in Angiosperms

The school is located between Cottrell's Cove and Fortune Harbour and is surrounded by natural settings that include bogs, forest and fields, where secondary succession is occurring. During the fall, the last of the flowering plants are nearing the end of their bloom and producing seeds which are soon dispersed. Especially prevalent are the seeds of thistles and fireweed which, during the beautiful fall days, float around the air with occasional parachutes, slipping through the open classroom windows to the amusement and joy of some students who appreciate the diversion of blowing them around the room.

Young people collect one type of seed that has spiky fruit and toss them at each other's clothing where they promptly stick on. They appreciate the nature of the fruit's ability to stick to clothing and use its characteristics in a fun way. The young people are also fans of damson fruit with its large seed. They consume these on the sly during school hours with the subsequent piles of seeds to contend with and disperse. People of the area collect numerous berries to use during the winter. These include black currant, red currant, partridge berry, strawberry, blueberry, crowberry, highbush cranberry, chuckle pears, dog berry and marsh berry.

The following activity is suggested as the beginning of the study of angiosperm seeds, how they are protected and how they spread. As one can see by the above, the young people are familiar with many different types of seeds and fruit and also with some of the characteristics of these. It is hoped that this activity could be used to build onto and focus that knowledge.

Seed Protection and Dispersal in Angiosperms

Instructional implications from the course description (Government of Newfoundland and Labrador, 1995) that link into this activity.

2.2.1.5 List possible reasons why angiosperms are more diverse in number and kind than any other plant group.

The Intended Learning Outcomes from this Activity

1. To become aware of the ways seeds are protected.
2. To list five ways seeds are dispersed.
3. To become aware of the diverse nature of the mechanisms involved in dispersal and protection of angiosperm seeds and how these offer angiosperms in advantage over other plants.
4. To list 10 local examples of angiosperms, their seeds and protective structures.

Materials

Magnifying glass or microscope

Collecting bags or bottles

Note pads with pencils

A camera with film

Heavy socks or vamps

Keys for angiosperms

Craft materials to make models

Acetate sheets to make clear pockets for seeds

A container of water

Large sheet of heavy paper or cardboard

Tape and glue

Procedure

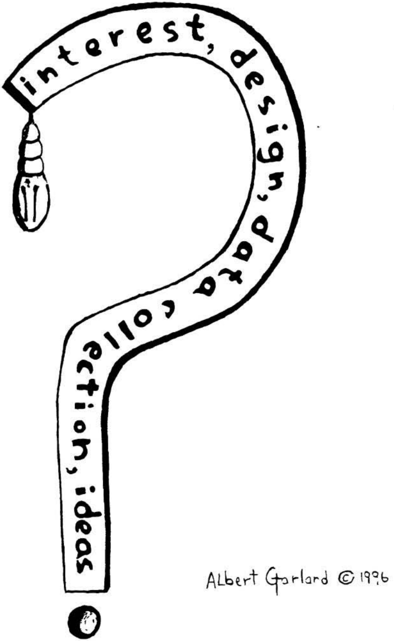
In the field, collect as many seeds as possible. These can be collected directly off the plant in which case it might be a good idea to collect a larger portion of the plant for later identification. Wearing a pair of heavy wool socks over the shoes while in the field may net some different types of seeds. Students should collect the fruits of plants to later look at the seeds contained within. It would be helpful to collect the seeds from various locations, such as a field and along the sea shore, as well as in the woods. Local examples that could be collected include blueberries, dandelion, partridge berry, crab apple, damson. fireweed, highbush cranberry, blue Iris, thistle, wild peas, raspberry, wild strawberry, blackberry, rose hops and pincherry. Another source of seeds is to look at the droppings of birds and other animals.

Questions and Directives

1. In each of the plants you look at, identify where the seeds are located.
2. In each case, extract the seeds from the fruit or case and suggest a means of dispersal for each example.

3. Use the keys to identify the plant from which the seed came from. In some cases you may already know the plant, so name it and put this information with the respective seeds.
4. Try wearing a pair of wool socks or vamps in the field and through the woods. Examine what has stuck to these. Any seeds? How are these seeds specialized.
5. Examine bird and animal droppings. Are there any seeds? From which plants do you think these seeds came? What does the bird or animal eat that has seeds in it?
6. Make up plastic pockets to put your seeds into.
7. Make a chart that divides seeds into different groups dependent upon the way they are dispersed.
8. What is the role of fruit when it comes to seeds?
9. During which season do we note parachutes? From which plants do they come?
10. Look at a parachute under a magnifying lens. Identify the location of the seed.
11. Make a model of three different seeds to show how they differ and how they are dispersed.
12. Check to see which seeds float.
13. Take pictures of plants and mount their seeds next to them with ways of dispersal and protection for the seed listed next to the picture.
14. Tell the story of a seed and its journey to where it will grow.

STUDENT DESIGNED ACTIVITY



Notes for Student-designed Activities

This activity is meant to allow the student the freedom to design an activity that interests them. The activity is a means of procuring student input into what interests them in biology. I have placed it not to mark the end, but rather to mark a beginning. The ultimate link to student experience must come from the students themselves. The response to this activity should provide a means of establishing student interests and experiences that link into biology and into the local context. This activity requires all the resources of planning and carrying out a plan. This activity is better used once the student has completed the other activities and has a feel for the variety of possibilities that one gains by doing the activities.

The activities in this package are meant to generate opportunities for further study and for input from the students' own experience. One measure of the success of these activities would be the spin-off activities created by students and the suggestions that they give to improve each activity making it closer to the local context.

Student-designed Activity

The intended learning outcomes of this activity

1. To design your own activity relating to some biological topic covered in this course.
2. To determine what data needs to be collected and how it is to be collected and recorded.
3. To make a creative presentation of the results of your activity.

4. Wherever possible to incorporate your own experiences into this activity.

5. To use feedback to make adjustments to the activity.

To the Student

The purpose of this activity is to give you an opportunity to look at a topic in biology that interests you. The activity could take many forms and will be determined by your creativity. It could be a field study, an experimental set-up, a collection to show special aspects of organisms or a game based on living organisms and their interactions, just to name a few. The course outline with its intended learning outcomes may be of help in determining some of the possibilities.

The first step is to determine an area where you have some interest and/or experience. From there it might be helpful to brainstorm about the possibilities, writing them down in a list. You should look at your list to determine what you need to complete the activity. Make a list of the materials you need. Think about ways you can accomplish what you have chosen to do. Pick methods that you feel comfortable with. Perhaps you can find someone in the class who is interested in the same topic and both of you could divide or share the work to develop a joint activity.

Think of your activity in terms of learning. What do you want to show your audience? If you were given this activity would you find it an interesting and rewarding learning experience?

Once you have developed an outline for your activity, make a presentation to the class explaining what your propose to do. Get feedback from the class. Do they think this is a good idea? Do they have suggestions about how to accomplish what you want to do? Are there things that you could add or change to improve your design? Be open to suggestions! Try to incorporate some of the suggestions into your design.

The next step is to carry out the activity and to present your results or product. Be sure to carefully outline what you did and how you did it together with any results or products. You might like to set up a display explaining what you did, how you did it, and showing your results or product. Be creative! Get feedback from your audience. What do they think of the activity? Have they learned something from the activity? What have they learned? Ask questions and note down answers. Now look at your activity and the feedback from the audience. Are there things that you would change in your activity? Which things would you change and how? What is good about your activity?

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Appendix A

Student Input for Changes and Improvements

1. How can this activity be improved?

2. Are there things we could look at other than those mentioned in this activity?

3. How might we go about this?

4. Do you have an idea for a different technique to use in this activity? Outline what you would do.

5. List any parts of this activity that are not needed.

6. What are your suggestions for collection of data?

7. How could that data be used?

8. Brainstorm! What are your suggestions for generating different forms of products from this activity (verbal, non-verbal, creative)?

9. How much time do you need to complete all parts of this activity?

10. What other experiences or knowledge do you have that relate to this activity?