Succession and Climax
Teacher Background

Developed by Bob Tallman with funding support, in part, from the USDA Forest Service Community Forestry Grant. Information from "How to Lead a Field Trip, a Ward's Curriculum Aid." By Ward's, P.O. Box 1712, Rochester, N.Y. 14603, copyright 1970.

The concepts of Succession and Climax are important to understanding the food webs seen in Michigan habitats.

Let us suppose that you owned a field in an area that was covered by deciduous forest before the coming of Europeans. Around the field in unused areas of land are species of the trees, shrubs, and herbs characteristic of that region.

Now let us suppose that you cleared that field of vegetation completely. Since we are dealing with an imaginary field, we can imagine that you even had some way of destroying dormant seeds buried in the soil. As the years pass, what would be the nature of the plant life that would inhabit the field?

The first pioneer plant forms might be mosses and lichens, but they would soon be followed by various grasses and other herbs, especially those with airborne seeds. The field would then be covered by a growth of herbaceous plants of the sort commonly lumped together as "weeds."

Next to appear, within two or three years, would be woody plants of the shrub form, their seeds brought in by winds or animals. These would be species the seedlings of which could exist in full sunlight and in root competition could successfully strive against the temporarily dominate grasses and herbs. As the shrubs grow larger their shade reduces the number of herbaceous plants that require strong light.

However, in the shade of the shrubs, tree seedlings arise, the tree seeds likewise having been brought in by wind or animals. They are species which are able to begin growth in the shade of the shrubs, but achieve most rapid growth in full sun, after they eventually overtop the shrubs. The first group of shrubs is then in turn largely eliminated by the shade cast over them by the trees, and replaced as a forest understory by shade-tolerant species.

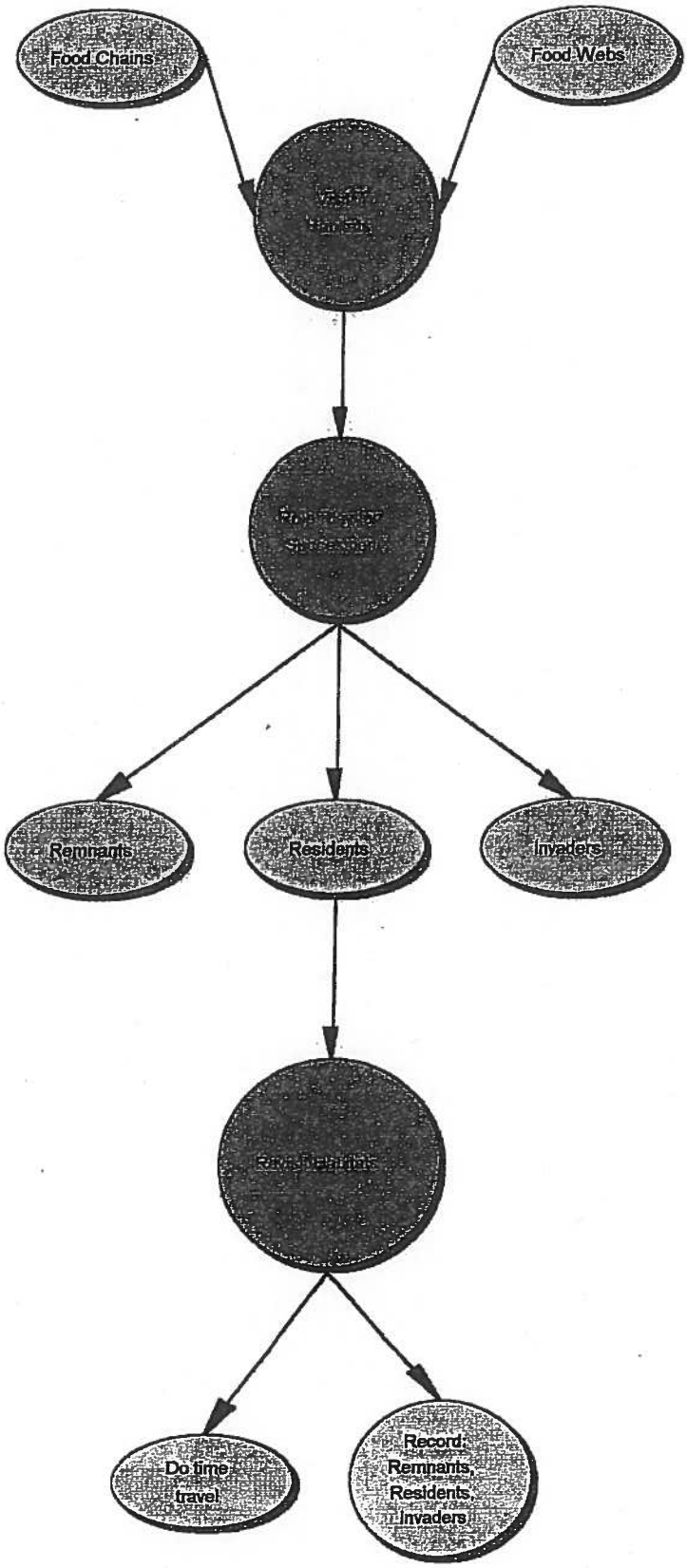
However, as noted above, these pioneer tree species require full sun or sunny days for vigorous growth. Their own saplings do not thrive in the shade of their parents. These trees will be replaced by shade-tolerant species or those which thrive in cloudy day sunlight.. When an aggregation of tree species has been reached that successfully reproduces its own kind, generation after generation, the plant association has become stable and is called a climax association. To phrase it another way, a climax association is one that is capable of perpetuating itself under the conditions imposed by its own existence. Unless disturbed, a climax association may not change for many centuries. However, the particular species comprising the climax will be determined by physical factors of climate, soil, temperature, terrain, and locality.

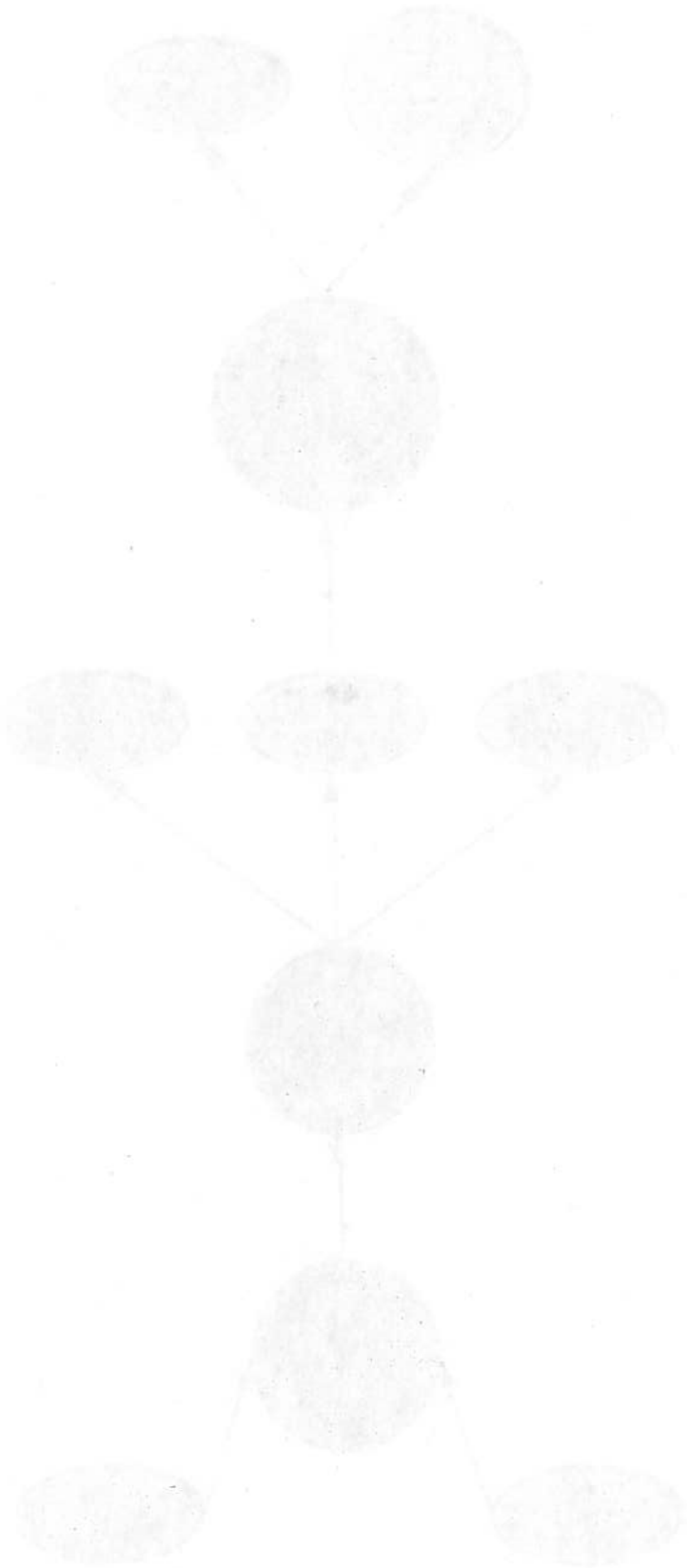
A rule of thumb to determine whether a forest area is a climax or not is to see if the tree sapling growing there are of the same species as the mature trees. If they are, then the forest is probably a climax formation; if not, the area is still undergoing successional changes.

Of course, each stage of succession includes an association or food web of animal species which find the conditions needed to survive in the habitat of that stage.

Successional changes leading to a climax formation may require a long period of time, possibly as much as several hundred years, depending upon the severity of the initial disturbance and local conditions. The factors that enter into its determination may be quite complex. However, the facts of succession and climax are observable, regardless of how obscure the determinants might be.

Back to the Future with Old Field Succession





Indianfields Club Exchange
Nature Center of Tuscola County

Land Succession in Michigan

Lesson Plan **Level: 5th – 7th Grade**

Developed by Bob Tallman with funding support, in part, from the USDA Forest Service Community Forestry Grant

Program Description: Students (who understand food webs in different environments) will visit seven habitats at Indianfields Township Park or the Caro Exchange Club Woods. Students will observe plants and animals and do an increment boring. They will discuss the organisms in each habitat and the ways in which they interact. The emphasis is on the change in the food webs over time. Students will create a timeline for food web succession.

MEAP Benchmarks:

SCIII.1.E.4: Develop an awareness of and sensitivity to the natural world.
SCII.III.5.MS.1: Describe common patterns of relationships among populations.
SCI.III.5.MS.2: Describe how all organisms acquire energy directly or indirectly from the sunlight.
SCI.III.5.MS.3: Predict the effects of changes in one population in a food web on other populations.
SCI.III.5.MS.4: Describe the likely succession of a given ecosystem over time.

Pre-visit Suggestions:

1. Be sure that every student is dressed for the weather conditions. Layers work best. Tell them to wear shoes that can get muddy.
2. Each student should have paper and pencil on which to record the organisms observed. A clipboard or 5 X 7 steno notebook work well.
3. Bring a camera to record each habitat.

Benchmark Question: What are the responses of an ecosystem to events that cause it to change?

Focus Question: What are the changes over time in the environment (ecological succession)?

More alternate activities or assessments:

Given 7 mid-Michigan communities, arrange and describe the sequence of communities over the next 300 years.

Assume a mid-Michigan shrub community is bulldozed as if to prepare for farming. Instead, the land is left vacant with no further intervention by man. Predict the sequence of events in a 200 year period.

Look at the plants and animals in a particular sampled or hypothetical mid-Michigan community. Using sample community lists, identify which community or stage is represented. List the resident, remnant, and invader species for that community.

A mid-Michigan climax community, a tolerant tree forest, is cleared and stumps are removed as if to prepare for farming. Instead, no further human activity occurs. Predict the sequence of communities for the next 200 years.

A gravel pit in mid-Michigan is abandoned. Predict the succession of communities in the next 200 years.

Visit:

1. Do Role Play in order to define the succession vocabulary: succession, resident, remnant, invader.

2. Develop timeline concept for succession of food web communities. Use numbers showing the years each food web community takes to develop and physically move the group to the new food web community. (Bare ground at 0 years, grassland at 15 years, mixed herbaceous at 30 years, etc.)

3. Observe plants and animals recording examples of remnants, residents, and invaders in each Community on the worksheet. Make observations in seven food web communities. Continue using the numbers to emphasize the timeline (succession) concept.

4. Do an increment boring of a larger tree that is a remnant from the intolerant tree community that is growing in a tolerant tree community or climax community. The growth rings should be getting smaller closer to the cambium layer. Take the increment boring back to the classroom.

Post-visit Suggestions:

1. Create a timeline for the succession of communities in Michigan using a computer program like Timeliner by Tom Snyder Productions or by drawing the community as a series of pictures. Then compare the time period to a historical period familiar to the students.

2. Discuss the worksheet to compare the remnants, residents, and invaders.

Succession Role Play

1. Define 2 social groups within a class (Use two groups of students who usually are seen together.) Present the role play as a scene in the cafeteria.

2. On the first day one group sits in the center of a large space, pretending they are at a cafeteria table. These are the residents. (There are two extra "chairs"). Second group makes a ring around them. All others watch.

3. Two individuals from the outer group invade the center group (sit at the table because there are 2 extra chairs).

4. The next day, three more from the second group come in first. (The new group arrives first and takes the chairs.)

5. Three of the center (resident) group don't sit down because there aren't any chairs.

6. More of the second group invade, and residents leave.

7. The invading group have now become the residents (it's their table) and those who were in the center originally are now the remnants.

Discuss the concepts of residents, remnants, and invader species and the fact that with food webs this happens over years.

Field Procedure:

Taking an Increment Boring

1. Select a spot on the trunk which is shoulder height for the students and which is not obvious to the casual visitor to the woods.
2. Remove the borer from the handle and lock it into the center of the handle. Insert the extractor into the backside of the borer.
3. Place the borer tip and put pressure on the handle toward the tree. Keep the borer from wobbling. Turn the handle slowly clockwise while maintaining pressure.
4. Insert the borer, approximately 3". Then turn the handle counter-clockwise one quarter turn. Then turn back to the original stop point.
5. Now turn counter-clockwise until the borer is removed. Keep the extractor in the borer until it is removed from the trunk of the tree.
6. Use the rod to push backwards on the sample until it starts moving. Then the extractor will remove the sample from the borer tube. Do not let the sample flick or break.
7. Place the core in a small box (pen box, check box, wooden match box) before examining.
8. Fill the hole in the trunk as soon as possible with black bathtub caulk.
9. After each use, clean the borer parts with a cleaning agent like gun cleaning fluid and swab with oil. If needed, use a conical sharpening stone to sharpen the tip of the borer.
10. Examine the sample looking at the width of the rings. Fast green may be used to stain the sample. If the sample separates at the growth rings, use Elmers glue or wood glue to realign the sections.

Job # 1 Collect Plants

Objective: Collect and identify plants in this community

Equipment:
Wet paper towel
Garbage bag
Piercing knife
Cardboard spacers
Plant press and rope
Newspaper

Procedure:
*Collect one of each kind of plant in this community
*Press plants in plant press before leaving class
*List each plant
*Label as remnant, resident, or invader
*Compute % of Remnant, resident, and invader
*Compare % of remnant, resident and invader with other stages

Job # 2 Collect Soil Sample

Objective: Determine soil type, identify soil animals

Equipment:
Shovel
Ruler
Plastic ziplock bag
Small glass jar containing alcohol
Burlesse Funnel
Ring stand
Light
Aluminum foil
Centrifuge (optional)
*

Procedure:
Collect soil sample 1 dm X 1 dm X enough depth to fill ziplock bag
In classroom, put soil in Burlesse Funnel with light
After 24 hours, remove and examine organisms in alcohol
*Identify and count organisms
*Label jar and store
*Make list of soil organisms
*Keep soil in labeled plastic bag for color and texture comparisons
*Compare soil with soil from other locations
*Centrifuge soil sample. Measure in mm and draw soil profile

Job #3 Collect Animals

Objective: Collect and identify animals above the ground

Equipment:
Insect net
Killing jar
Formalin
2 small glass jars
(2 cm formalin in one)

Procedure:
Collect one of each kind of animal. Butterflies & moths kept dry. Other insects placed in formalin jar
*Make list of animals seen but not captured.
*Identify animals
*Compute % of Remnant, resident, and invader
*Compare % of remnant, resident and invader with other stages

4: Count Plants and Animals

iective: Determine the density of ganisms in this community

uipment:
ing
.oofing Nails
ıeter Quadrat
:ording sheet

ɔcedure:
Iypothesize the 3 most common
nts and the 3 most common
mals in the community
ount and record these designated
nts and animals within a 1 meter
adrat
Ieasure and record the height
the community
stimate and record the percent
ıopy cover
:ompare counts, heights, percentage
ɔund cover, and percentage canopy
th that of other stages

Job # 5: Clean up

Equipment:
Broom
Dustpan

Procedure:
*Help Job 1 Group with collecting plants
*Sweep bus
*Return all equipment to storage
*Clean and straighten classroom before leaving

Indianfields Club Exchange
Nature Center of Tuscola County

Plant and Animal Populations

Lesson Plan **Level: 9th – 10th Grades**

Developed by Bob Tallman with funding support, in part, from the USDA Forest Service Community Forestry Grant

Program Description: Students will visit two or more habitats at Indianfields Township Park or the Caro Exchange Club Woods. Students will observe plants and animals using a quadrat, examine soil, measure the height of the community, discuss the organisms in the habitat and the ways in which they interact. The emphasis is on the characteristics of each food web, energy flow through the food web, and factors regulating population size. Each class will be given a set of pictures naming the organisms observed in each habitat.

MEAP Benchmarks:

SCII.III.5.HS.1: Describe common ecological relationships between and among species and their environments.
SCI.III.5. HS 2. Explain how energy flows through familiar ecosystems.
SCI.III.5.HS 3. Describe general factors regulating population size in ecosystems.

Pre-visit Suggestions:

1. Be sure that every student is dressed for the weather conditions. Layers work best. Tell them to wear shoes that can get muddy.
2. Each student should have paper and pencil on which to record the organisms observed. A clipboard works best.
3. Bring a camera to record each habitat.
4. Suggested vocabulary: producer, consumer, decomposer, predator, prey, parasite, competition, mutually beneficial, habitat, ecosystem, herbivore, saprovore, carnivore, omnivore, migration

Visit:

1. Students observe plants and animals in 2 or more habitats. In each food web community, they will count the organisms using a quadrat.

2. In each habitat, they will dig a hole to examine soil looking a layers and any animals present. They will sieve the soil and take a sample black to grow any seeds which might be present.
3. They will measure and compare the height of the communities.
4. Students will record the organisms observed and discuss how the food webs differ

Post-visit Suggestions:

1. Use the pictures of organisms observed at the site to create a food web showing relationships with string or yarn. This could be done on the floor or on a bulletin board, as a class project or in groups.
2. Create cards with the names of the organisms seen. Use the cards to create a food web by joining them with string or yarn. This could be used as an assessment.
3. Have students write a description of one of the wood webs defining all the vocabulary terms in context.

Field Procedures:

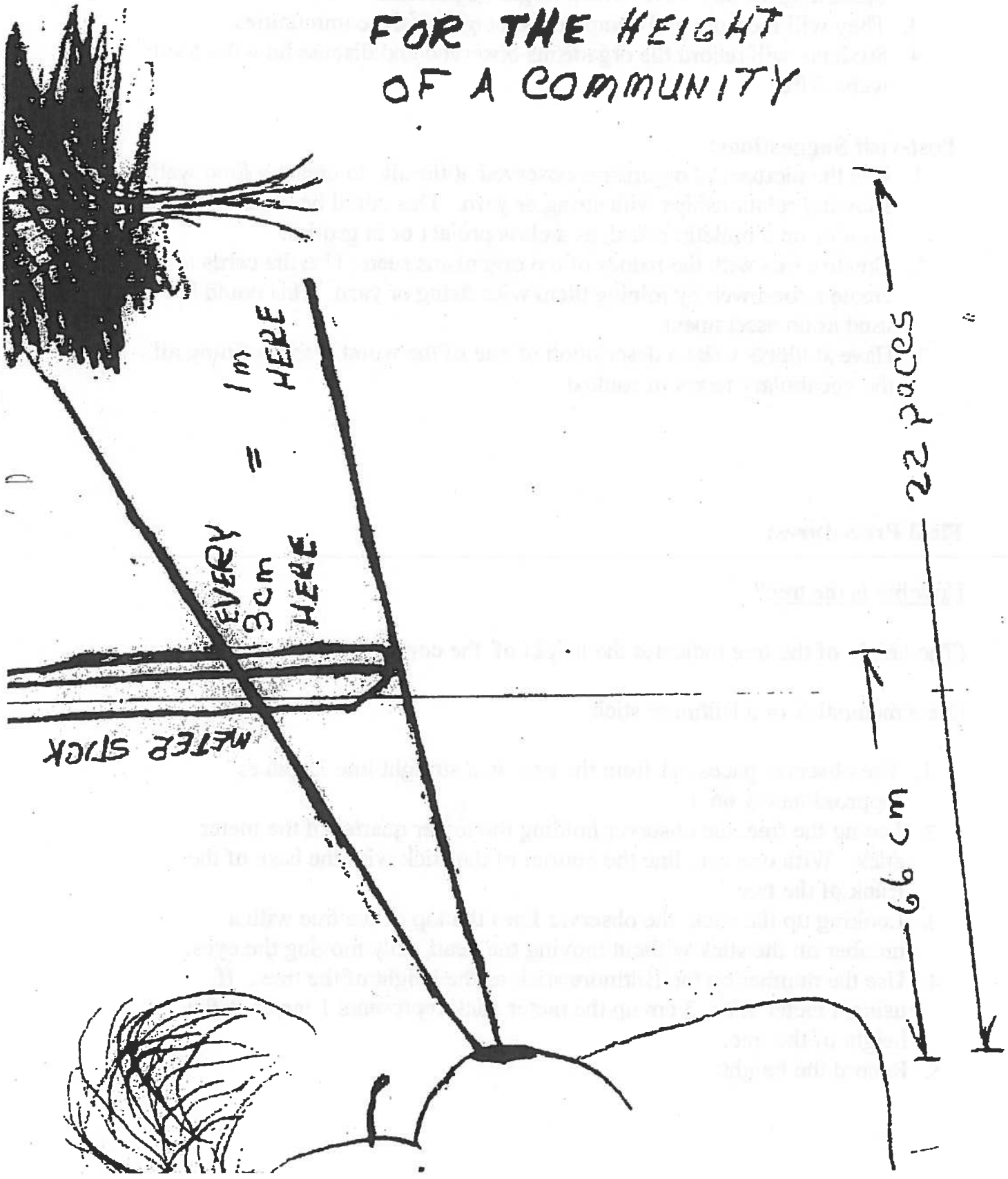
<u>How big is the tree?</u>

(The height of the tree indicates the height of the community.)

Use a meterstick or a Biltmore stick.

1. The observer paces out from the tree in a straight line 22 paces (approximately 66').
2. Facing the tree, the observer holding the lower quarter of the meter stick. With one eye, line the bottom of the stick with the base of the trunk of the tree.
3. Looking up the stick, the observer lines the top of the tree with a number on the stick without moving the head, only moving the eyes.
4. Use the number on the Biltmore stick as the height of the tree . If using a meter stick, 3 cm up the meter stick represents 1 meter in the height of the tree.
5. Record the height.

TRIANGLATION FOR THE HEIGHT OF A COMMUNITY



Field Procedures:

Sampling Using a Quadrat

This method is used to collect data on a sample of a food web. Quadrat offers a means of sampling a given area by counting specific items within the boundary of the quadrate.

Materials: 1 meter square quadrat
String
Notebook and pencil

1. Place the quadrat over a representative area of the habitat.

2 . Identify and make a list of each plant and animal found in the quadrat. (It is not necessary to know the name of each. A description will do. A leaf (and flower, if present) of each plant can be collected to take back to the field trip leader or to the classroom for further identification.)

4. Count the number of each kind of plant and animal on the list and record the total number. The quadrat can be restrung for smaller areas (1 or 5 dm) where the count numbers are large.

Comparing the quantities as well as the kinds of organisms between food webs, helps to distinguish the difference between the food webs.

Field Procedures:

Screening a Soil Sample for Organisms

Materials: shovel or hand trowel
Zip lock baggie
Centrifuge
Sieve

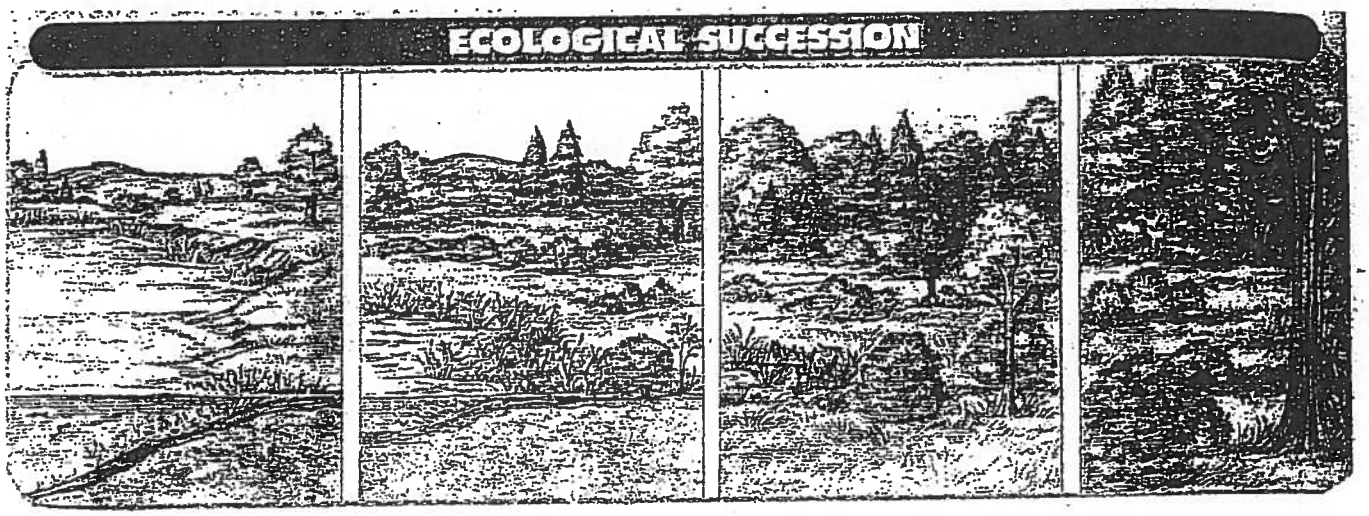
1. Dig a sample of soil from a 10 cm area and place it in a quart zip lock bag.
2. Soil is shaken through the screen.
3. Roots and animals are observed and counted.
4. Soil is then placed back in plastic bag with the root.
5. Take the soil sample back to the classroom. Place it in a container and water it. Observe and record any seeds that sprout.

After returning to the classroom, use a centrifuge, if available, to examine the composition of the sample.

1. Place 2 cm of soil in a centrifuge tube.
2. Add 3 cm of water for a total of 5 cm of material in the tube of different materials.
3. Place the thumb over the opening and shake.
4. Place the tube in the centrifuge and spin.
5. The side profile of the soil will show the layers of different materials in the soil.

Ecological Succession Lab

A Hands on Lab Unit
High School Level
Based on Mid Michigan Ecology



Bob Tallman
Developed Fall, 1970 - Fall, 2000
Revised February, 2001

Ecological Succession Lab

Bob Tallman

Revised February, 2001

In Southern Michigan, as in other Biomes, there is a succession of communities which may be observed and measured. This succession of communities can be thought of as a Timeline from the Pioneer Stage to Climax Stage. Once the students understand the concept of change over time, it enables them to view any community with reference to both its past and its future condition.

A given organism found in any community is considered a resident, a remnant of any previous stage or an invader from any future stage. Invader plants appear to drive the change. Animals tend to follow the plants which are the basis for their food chain or food web. Succession of communities is a continuum rather than a series of stages. However, general stages can be identified. Each community creates physical conditions to which the invader species are better suited than the resident species. The succession is orderly and directional from Pioneer to Climax.

This lab meets Science Benchmark currently called III.5.HS.4: All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact.

This lab gives teachers and students a way to examine the communities in their continuum. Or, they may sample in one or 2 communities and use the data given to make comparisons.

The research for this lab is a summary of findings reported by S.L. Beckwith, "Ecological succession on abandoned farm lands and its relation to wildlife management." Ecological Monographs 23, 1954. The research was continued by the Biology students at Mayville High School from September, 1970 through September 2000.

The Community Stages in most Southern Michigan locations include

Community / Stage	Years to Develop	Age of Continuum
Pioneer	0-3	1-3 Years
Perennial Grass	1-12	1-15 Years
Mixed Herbaceous Perennial	5-16	6-31 Years
Shrub	16-20	23-51 Years
Intolerant Tree	5-50	28-101 Years
Mid-tolerant Tree	25-80	53-181 Years
Tolerant Tree	Climax	181 plus age of oldest Tolerant Tree Stage trees

Southern Michigan Succession
Pioneer Community

The Pioneer Community is found on bare subsoil (soil without nutrients) and bare topsoil (such as in abandoned farmland). A Pioneer Community may also be found on tree bark or rock.

On abandoned farmland, this community lasts about 0 – 3 years.

The plants in this community are of four basic types: annuals, biennials, mosses (in moist or wet areas), and lichens (in dry areas). An annual is a plant that grows from seed, leafs out, flowers, and produces seed in one year. A biannual is a plant that grows from seed and leafs out the first year. After winter, the plant flowers and produces seed in the second year.

Pioneer Community could become the Climax community with a lack of water and/or dry winds as in a desert or on a sand dune.

The plants and animals that are examples of this community in Southern Tuscola County include:

PLANTS	ANIMALS
Lichens	Killdeer, *Charadrius vociferous*
Mosses	Prairie deer mouse, *Peromysuus maniculatus*
Bermuda grass, *Cynodactylon dactylon*	Savannah sparrow, *Passerculus sandwichensis*
Biennial winter cress, *Barbarea vulgaris*	Vesper sparrow, *Pooecetes maniculatus*
Bindweed, *Polygonum oilinode*	Wolf spider, *Lycosa gulosa*
Blank medic, *Medicago lupulinia*	
Broad leaf plantain, *Plantago major*	
Chickweed, *Stellaria media*	
Chicory, *Cichorium intybus*	
Cinquefoil, *Potentilla recta*	
Common milkweed, *Asclepias syriaca*	
Crabgrass, *Agropyron repens*	
Creeping Charlie, *Glechoma hederacea*	
Dandelion, *Taraxacum officinale*	
Dry sandbur, *Cenchrus pauciflorus*	
Fall panicum, *Panicum dichotomiflorum*	
Foxtail grass, *Setaria lutescens*	
Ground ivy, *Glechoma hederaceae*	
Horsetail, *Equisetum arvense*	
Knotweed, *Polygonum avicularia*	
Narrow leaf plantain, *Plantago lanceolata*	
Peppergrass, *Lepidium virginicum*	

Prostrate spurge, *Euphorbia supina*	
Ragweed, *Ambrosia artemisiifolia*	
Red sorrel, *Rumex acetosella*	
Russian thistle, *Salsola kali*	
Shepherd's purse, *Capsella bursa-pastoris*	
Spotted knapweed, *Centaurea maculosa*	
Winter cress, *Barbarea vulgaris*	
Witchgrass, *Panicum capillare*	
Wood sorrel, *Oxalis europaea*	
Yelllow rocket, *Barbarea vulgaris*	
Wild mustard, *Bassica kaber*	

Pioneer Community

Southern Michigan Succession
Perennial Grass Community

The Perennial Grass Community is characterized by grasses which mostly cover the ground. This stage usually lasts for 1 to 12 years. It usually starts suddenly but disappears gradually to the next stage. Mowing, light grazing, or yearly burning can prolong this stage so that it can be considered a Climax Community.

There is the beginning of soil formation with the decay of dead plants and animals. Many of the plants are perennials, plants that, once sprouted, grow and flower year after year until competed out of the community. Usually, the top of the perennial plant dies each fall, giving the appearance of a dead plant, but the root and a few leaves at the base survive for the next year. Most of these perennials are grasses. Grass is a group of plants with narrow leaves with parallel veins. The leaf wraps around the stem but with a slit on the reverse side. This protects the growing point or meristem of the grass below the leaves helping the grass to survive burning. Grass usually spreads by rhizomes as well as by seed.

The plants and animals that are examples of this community in Southern Tuscola County include:

PLANTS	ANIMALS
Bluegrass, *Poa pratensis*	Ants, *Camporotus herculeanus*
Blackeyed Susan, *Rudbeckia hirta*	Bob white, *Cilinus virginianus*
Buffalo clover, *Trifollium stoloniferum*	Chipping sparrow, *Spizella passerina*
Burdock, *Arctium minus*	
Canada thistle, *Cirsium vulgare*	Flies, *Musca domestical*
Common mullein, *Varbascum thapsus*	Garden spider, *Araneus diadematus*
European Daisy, *Bellis perennis*	Garter snake, *Thamnophis sirtalis*
Field dodder, *Cuscuta pentagona*	Kingbird, *Tyrannus tryannus*
Milfoil, *Achilec millefolium*	Leaf hoppers, *Platymetopius acutus*
Orange hawkweed, *Heiracium aurantiacum*	Meadow lark, *Sturnella magna*
Prickley lettuce, *Loctum scariola*	Mosquito, *Culex pipiens*
Quackgrass, *Agrapyron repens*	Ribbon snake, *T. sauritus sauritus*
Red sorrel, *Rumex acetosella*	Scavenger beetles, *Lathyrildae sp.*
Sweet clover, *Melilotus alba*	Sparrow hawk, *Fako spafuerius*
Timothy *Phleum pratense*	Spittle bug, *Lepyronia quadramgi;aros*
Wild carrot, Dauetis carota	Thirteen-lined ground squirrel, *Cittellus tridecemlineatus*
Yellow hawkweed, *Heiracium pratense*	Turkey vulture, *Cathartes aura*
	Velvet mite, *Trombididae sp.*
	Weasel, *Mustela sp.*
	White footed mouse, *Feroyscus leucopus*

Southern Michigan Succession
Mixed Herbaceous Perennial Community

The Mixed Herbaceous Perennial Community is characterized by grasses and large flowering plants 1 to 2 meters high without woody stems. These plants are usually perennials.

This community lasts for 5 to 16 years depending on the soil development of previous communities. These communities may have the greatest diversity of food webs.

Herbaceous plants are those characterized by non-woody stems which die down to the ground at the end of the growing season.

The plants and animals that are examples of this community in Southern Tuscola County include:

PLANTS	ANIMALS
Bergamot, *Monarda fistulosa*	Aphid, Aphididae
Bull thistle, *Cirsium vulgare*	Centipede, Diplopoda and Glomerida
Burdock *Actium minus*	Cricket, *Gryllus pennsylvanicus Burmeister* and *Gryllus veletis*
Dogbane, *Apocynum androsaemifollum*	Earthworm, Oligochaeta
Feabane, *Erigoron sp.*	Golden garden spider, *Araneus diadematus*
Golden rod, *Solidago Canadensis*	Goldfinch, *Spinus tristis*
Milkweed, *Ascleplas purpurascens*	Grasshopper sparrow, *Ammodramus savannarum*
New England aster, *Aster novae-angliae*	Henslow's sparrow, *Passerherbulus henslowii*
St. John's Wort, *Hypericum sp.*	Honey bee, *Apis mellifera*
Stinging nettle, *Urtica dioica*	Lady bug, *Epilachna sp.*
Teasel, *Dipsacus sylvestris*	Marsh hawk, *Circus cyaneus*
White aster, *Aster ericolades*	Meadow vole, *Microtus pennsylvanicus*
White aster, *Aster pilosus*	Millepede, Julida sp.
Yarrow, *Achillea millefollum*	Pill bug, *Armadillidium vulgare*
	Rough-legged hawk, *Buteo lagopus*
	Short-billed marsh wren, *Cistothorus platensis*
	Stink bug, Scutelleridae
	Velvet mite, *Trombidium sp.*

Southern Michigan Succession
Shrub Community

The Shrub Community is characterized by woody stemmed shrubs. A single plant often has new plants that develop out from the root as an invader. This community ranges from 2 to 5 meters in height. The Shrub Community lasts for 16 to 20 years.

Shrub Communities tend to be more like food chains than food webs with each community basically dominated by one species of shrub. A shrub is a woody stemmed plant that remains low and produces shoots or trunks from the base. A mature shrub is often as wide as it is tall. . The developed shrub community usually has a dense canopy that shades out most of the other plants except for young trees. A canopy is a network of branches formed by the neighboring shrubs or trees over the communities below.

The plants and animals that are examples of this community in Southern Tuscola County include:

PLANTS	ANIMALS
Apple, *Pyrus malus*	Brown thrasher, *Taxostoma rufum rufum*
Asparagus, *Asparagus officinalis*	Cardinal, *Richmondena cardinalis*
Barberry, *Berberis sp.*	Cat bird, *Dumtella carolinensis*
Black nightshade, *Solanum bulcamara*	Chickadee, *Parus atricapillus*
Blackberry, *Rubus allegheniensis*	Field sparrow, *Spizella pusilla*
Blueberry, *Vaccinium augustifolium*	Grub, *Phyllophaga sp.*
Bristly black currant, *Ribes lacustre*	Morning dove, *Zenaidura Macroura*
Buttonbush, *Cephalanthus occidentials*	Pillbugs, Porcellionidae
Elderberry, *Sambucus pubens*	Song sparrow, *Melospiza melodia*
Gooseberry, *Ribes grossularaia*	Sowbugs, Oniscidae
Hazelnut, *Corylus cornuta*	Spider, *Liphistus sp.*
Honeysuckle, *Lonicera sp.*	Starnosed mole. *Condylura cristata*
Huckleberry, *Gaylussacia brachyeera*	Wood cock, *Philohela minor*
Leather leaf, *Chamaedaphne calyculata*	Yellow warbler, *Dendroica petechia*
Missouri gooseberry, *Ribes missouriense*	White breasted nuthatch, *Sitta carolinensis*
Muscadine grape, *Vitis rotundifolia*	
Oswego tea, *Monarda didyma*	
Pasture Gooseberry, *Ribes cynosbatl*	
Poison ivy, *Rhus radicans*	
Raspberry, *Rubus strigosus*	
Red osier dogwood, *Cornus stolonifera*	
Red panicle dogwood, *Cornus racemosa*	
Rose, *Rosa multiflora*	
Spiraea, *Spiraea alba*	
Staghorne sumac, *Rhus typhina*	
Virginia creeper, *Parthenscissus guinquefolia*	
Wild black current, *Ribes americanum*	

Intolerant Tree Community
Southern Michigan Succession

The Intolerant Tree Community is characterized by trees that grow best in the sunlight with shrubs of the Shrub Community underneath them. In other words, they are intolerant of shade. They grow to 7 to 20 meters in height and produce little or no canopy.

This stage takes 5 to 50 years to develop. On abandoned croplands, these trees sometimes may be seen 20 to 25 years after the land is abandoned thus skipping earlier stages. This stage can last 50 years.

On good soil this community may not occur at all, and more advanced tree stage will invade instead. In such a case, the plants and animals of the Intolerant Tree Community would not appear at all.

On poor soil, or in areas of poor drainage, the Intolerant Tree Community may sometimes be the Climax Community.

The plants and animals that are examples of this community in Southern Tuscola County include:

PLANTS	ANIMALS
Apple, *Pyrus malus*	Chipmunk, *Tamias striatus*
Bigtooth aspen, *Populus grandidentata* Choke cherry, *Prunus virginiana*	Least weasel, *Mustela rixosa*
Black cherry, *Prunus serotina*	Opossum, *Didelphis marsupialis*
Black raspberry, *Rubus occidentalis*	Ruffed grouse, *Bonasa umbellus*
Black willow, *Salix nigra*	White footed mouse, *Peromyscus leneopus Rafinesque*
Boxelder, *Acer Negundo*	
Cottonwood, *Populus heterophylla*	
Eastern juniper, *Juniperus virginiana*	
Hawthorn, *Crataegus sp.*	
Interrupted fern, *Osmunda claytoniana*	
Peach leaf willow, *Salix amygdaloides*	
Quaking aspen, *Populus tremuloides*	
Red mulberry, *Morus ruba*	
Sensitive fern, *Onoclea sensibilis*	
Speckled alder, *Alnus rugosa*	
Tartarian honeysuckle, *Lonicera tatarica*	
Virgins bower, *Clematis virginiana*	
White birch, *Betula papyrifera*	

Southern Michigan Succession
Mid-tolerant Tree Community

The Mid-tolerant Tree Community is characterized by mid-sized trees that are taller, 11 to 25 meters, and produce a canopy over the community. This community usually lasts 50 to 80 years.

Mid-tolerant trees often have a head start in areas with good topsoil and the Intolerant Tree Community, and even the Shrub Community, may not occur.

In the early development of this stage, most of the plants and animals of the Intolerant Tree Community are present. But as the taller mid-tolerant trees grow over the top and form a canopy, the Intolerant Trees and animal residents of that community quickly disappear.

Sometimes on upland sandy sites, the Mid-tolerant Oak and Hickory woods will be the Climax Community in Southern Michigan. Shrub Community plants will be almost completely gone as will most remnant plants from earlier stages. The plants of the floor and midlevel are shade tolerant shrubs that flower in either the very early spring or late fall.

The plants and animals that are examples of this community in Southern Tuscola County include:

PLANTS	ANIMALS
Adder's tongue, *Ophioglassum americanum*	Blue jay, *Cyanocitta cristata*
American elm, *Vimus Americana*	Cerulean warbler, *Dendroica cerulea*
Bitternub hickory, *Carya cordiformis*	Fox squirrel, *Sciurus niger*
Black ash, *Fraxinus nigra*	Red backed salamander, *Plethon cinereus*
Black oak, *Quercus velutina*	Red squirrel, *Tamiasciurus hudsonicus*
Blood root, *Sangulnaria canadensis*	Scarlet tanager, *Piranga olivacea*
Blue ash, *Fraxinus quadragulata*	Short tailed shrew, *Blarina brevicauda*
Blue beech, *Carpinus caroliniana*	Towhee, *Pipilo erythrophthalmus*
Bristly black gooseberry, *Ribes lacustre*	Veery, *Hylocichla fuscescens*
Christmas fern, *Polystichum acrostichoides*	Yellow throated vireo, *Vireo flavifroris*
Clubmoss, *Lycopodium lucidulum*	
Common witch-hazel, Hamamelis virginiana	
False Solomon seal, *Smilacina sp.*	
Ground cedar, *Lycopodium complanatum*	
Jack-in-the-pulpit, *Arisaema triphylllum*	
Maiden hair fern, *Adiantum pedatum*	
Maple leaf viburnum, *Viburnum acerifolium*	
Mockernut hickory, *Carya tomentosa*	
Pin oak, *Quercus palustris*	

Red ash, *Fraxinus pennsylvania*	
Red maple, *Acer rubrum*	
Red oak, *Quercus boreals*	
Red pine, *Pinus resinosa*	
Running strawberry, *Euonymus obovatos*	
Scarlet oak, *Quercus coccinea*	
Scotch pine, *Pinus sylvestris*	
Shagbark hickory, *Carya liciniosa*	
Shield fern, *Dryopteris austriaca*	
Slippery elm, *Vimus rubra*	
Soft maple, *Acer sacharina*	
Spicebush, *Lindera Benzoin*	
Spring beauty, *Claytonia virginica*	
Trillium, *Trillium sp.*	
Violet, *Violet sp.*	
White ash, *Fraxinus Americana*	
White cedar, *Thuja occidentallis*	
White lettuce, *Prenanthes altissima*	
White oak, *Quercus alba*	
White pine, *Pinus strobes*	
White swamp oak, *Quercus bicolor*	
Wild black current, *Ribes Americanum*	
Wood nettle, *Laportea canadensis*	
Woods aster, *Aster divaricatus*	
Woods goldenrod, *Solidago flexicaulis*	
Woodsgrass, *Diarrhena Americana*	

Mid-tolerant Tree Community

Southern Michigan Succession
Tolerant Tree Community

The Tolerant Tree Community is characterized by large trees, dense canopy, and open midlevel and floor level. The trees are tolerant of or able to grow in shade. These trees can grow under trees of the same kind. Because of this rapid replacement, there is a continuation of this tree community generation after generation. It is thus the Climax Community on lands with good soils.

This community is usually found on heavier, more fertile soils. When the trees of this community are cut, the soil left behind makes the best farmland of all the communities.

The canopy is very thick and the highest trunks with few limbs. Trees grow large, eliminating weaker ones and leaving a distance of all the stages. Most lower limbs of trees die and drop off, leaving large, straight, clean 15 to 40 feet between trees. Sugar maple, beech, and basswood are the characteristic trees of this stage in Michigan. Many insects live in the canopy and provide a food source for high-flying, insect eating birds.

The floor of this community has very few species of plants. Most live close to the ground in areas receiving a minimal amount of sunlight. Many of these plants flower in the spring and then produce leaves during the summer, a reverse of the usual pattern of flowering plants. There are hundreds of species of animals on the floor and in the soil. Most of these are saprophytes that help to decay and recycle dead plant and animal material.

This community has a large water holding capacity. Streams and small creeks develop as this stage continues.

The plants and animals that are examples of this community in Southern Tuscola County include:

PLANTS	ANIMALS
Adder's tongue, *Erythronium sp.*	Acadian flycatcher, *Empidonax virescens*
Basswood, *Tilia Americana*	Pileated woodpecker, *Dryocopus pileatus*
Beech, *Fagus grandifolia*	Rd shouldered hawk, *Buteo lineatus*
Blue cohosh, *Caulophyllum thaletroides*	Wood thrush, *Hylocichla mustelina*
Hemlock, *Tsuga Canadensis*	
Hornbeam, *Ostrya virginiana*	
Indian pipe, *Monotropa uniflora*	
Running strawberry, *Euonymus obovatus*	
Spring beauty, *Claytonia sp.*	
Sugar maple, *Acer saccharum*	
Violet, *Viola canadensis*	
Violet, *Viola hustata*	
Violet, *Viola tripartite*	

Job # 1 Collect Plants

Objective: Collect and identify plants in this community

Equipment:
Wet paper towel
Garbage bag
Piercing knife
Cardboard spacers
Plant press and rope
Newspaper

Procedure:
*Collect one of each kind of plant in this community
*Press plants in plant press before leaving class
*List each plant
*Label as remnant, resident, or invader
*Compute % of Remnant, resident, and invader
*Compare % of remnant, resident and invader with other stages

Job # 2 Collect Soil Sample

Objective: Determine soil type, identify soil animals

Equipment:
Shovel
Ruler
Plastic ziplock bag
Small glass jar containing alcohol
Burlesse Funnel
Ring stand
Light
Aluminum foil
Centrifuge (optional)
*

Procedure:
Collect soil sample 1 dm X 1 dm X enough depth to fill ziplock bag
In classroom, put soil in Burlesse Funnel with light
After 24 hours, remove and examine organisms in alcohol
*Identify and count organisms
*Label jar and store
*Make list of soil organisms
*Keep soil in labeled plastic bag for color and texture comparisons
*Compare soil with soil from other locations
*Centrifuge soil sample. Measure in mm and draw soil profile

Job #3 Collect Animals

Objective: Collect and identify animals above the ground

Equipment:
Insect net
Killing jar
Formalin
2 small glass jars
(2 cm formalin in one)

Procedure:
Collect one of each kind of animal. Butterflies & moths kept dry. Other insects placed in formalin jar
*Make list of animals seen but not captured.
*Identify animals
*Compute % of Remnant, resident, and invader
*Compare % of remnant, resident and invader with other stages

Job # 4: Count Plants and Animals

Objective: Determine the density of Organisms in this community

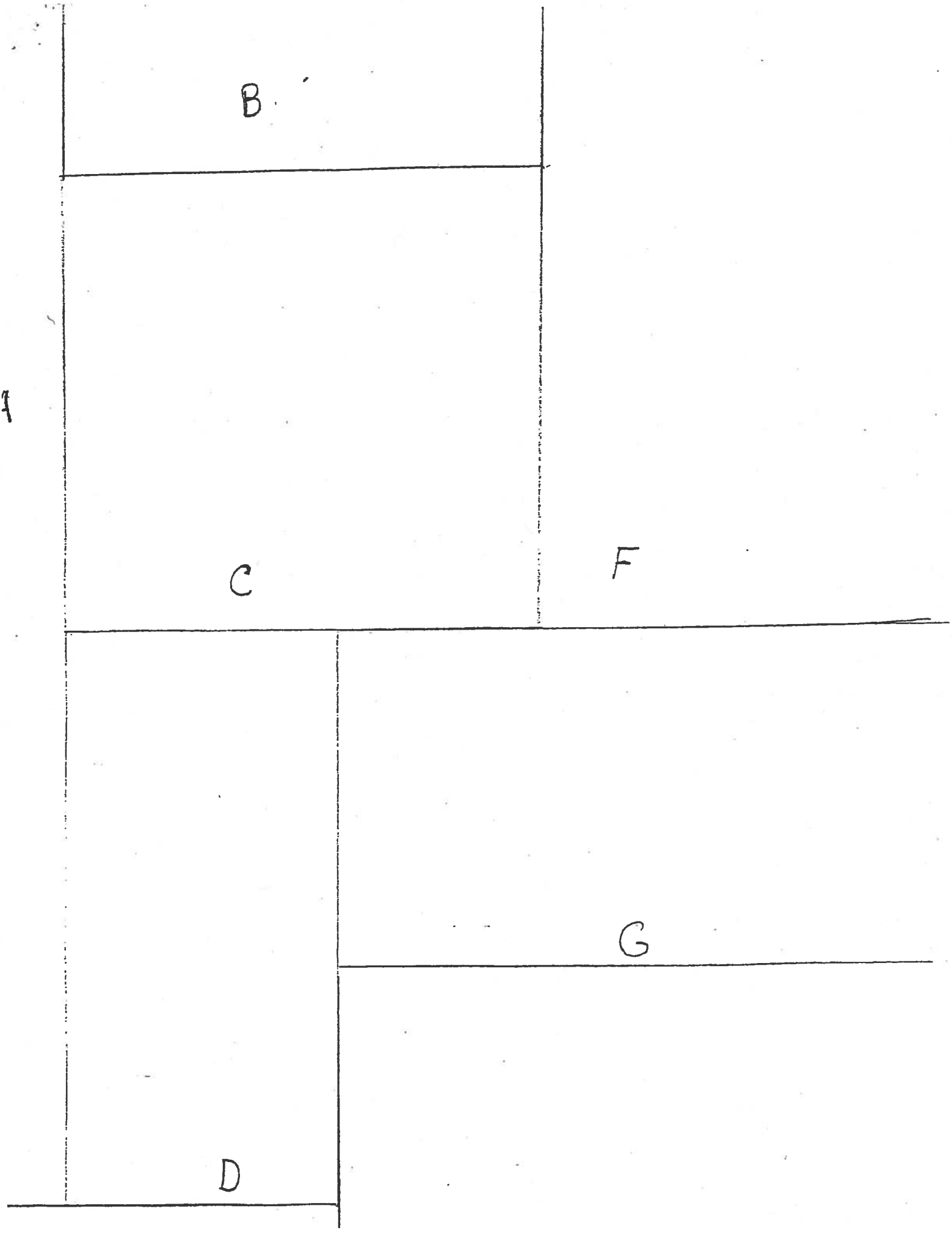
Equipment:
String
8 Roofing Nails
1 meter Quadrat
Recording sheet

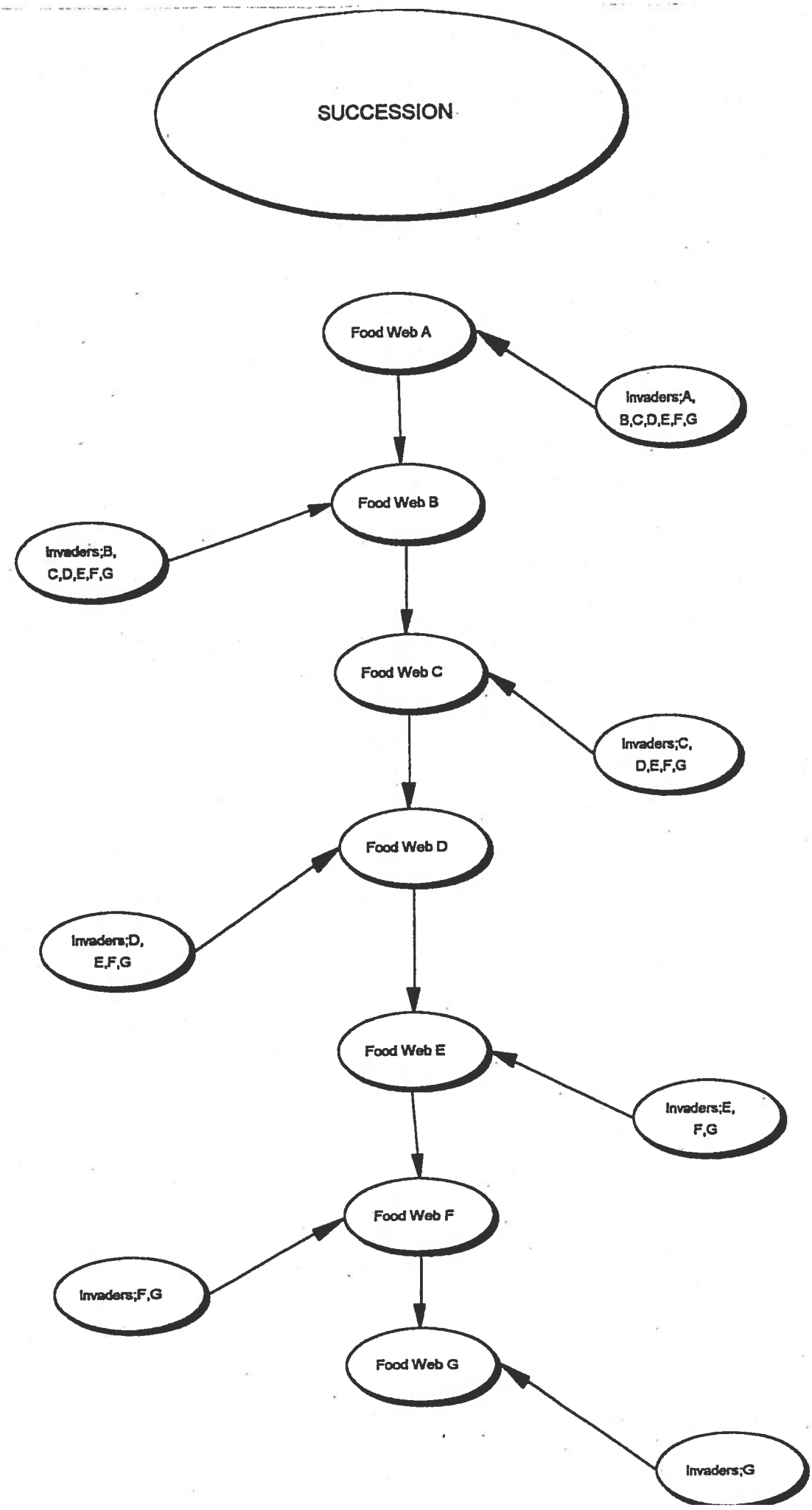
Procedure:
*Hypothesize the 3 most common plants and the 3 most common animals in the community
*Count and record these designated plants and animals within a 1 meter quadrat
*Measure and record the height of the community
*Estimate and record the percent canopy cover
*Compare counts, heights, percentage ground cover, and percentage canopy with that of other stages

Job # 5: Clean up

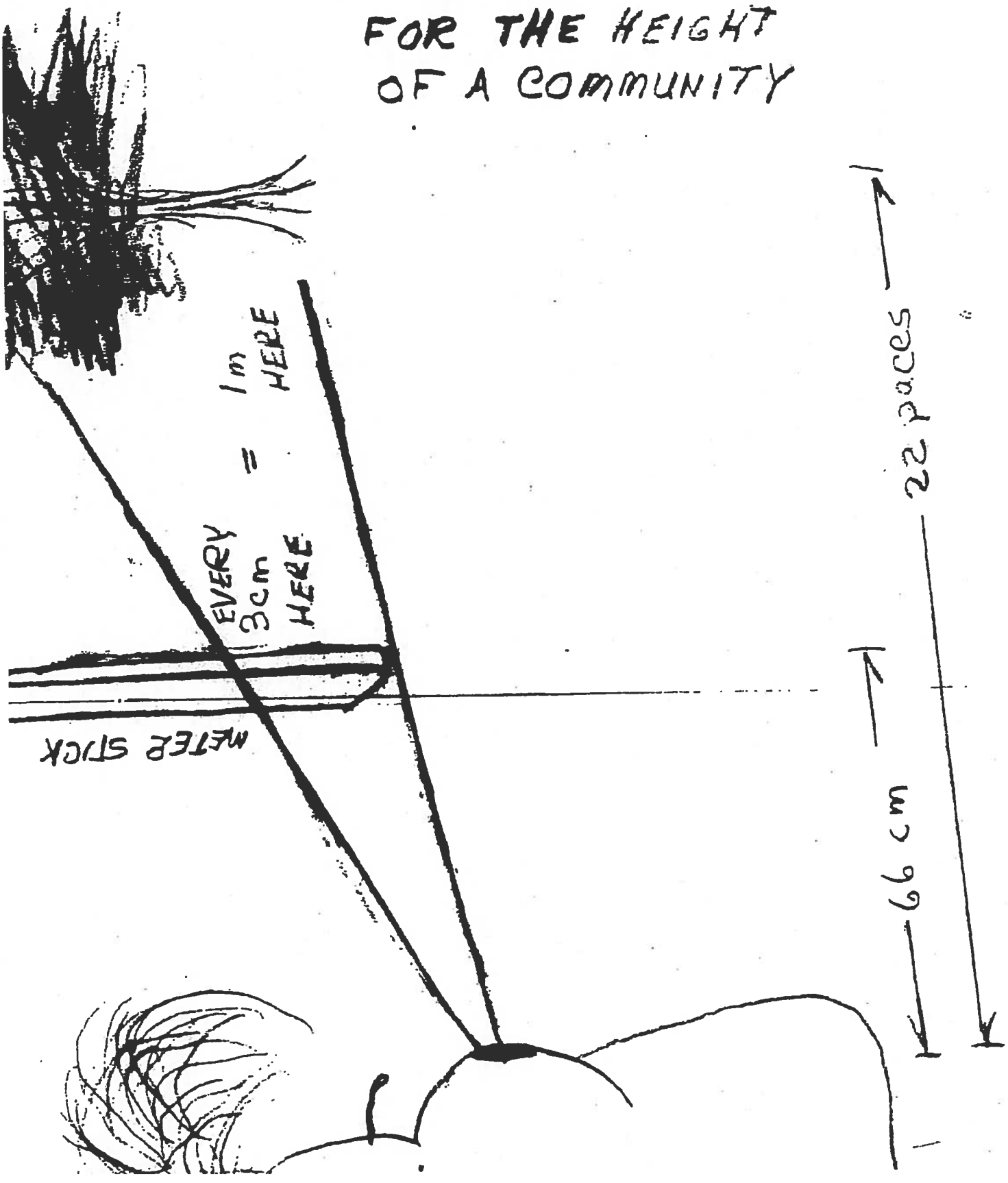
Equipment:
Broom
Dustpan

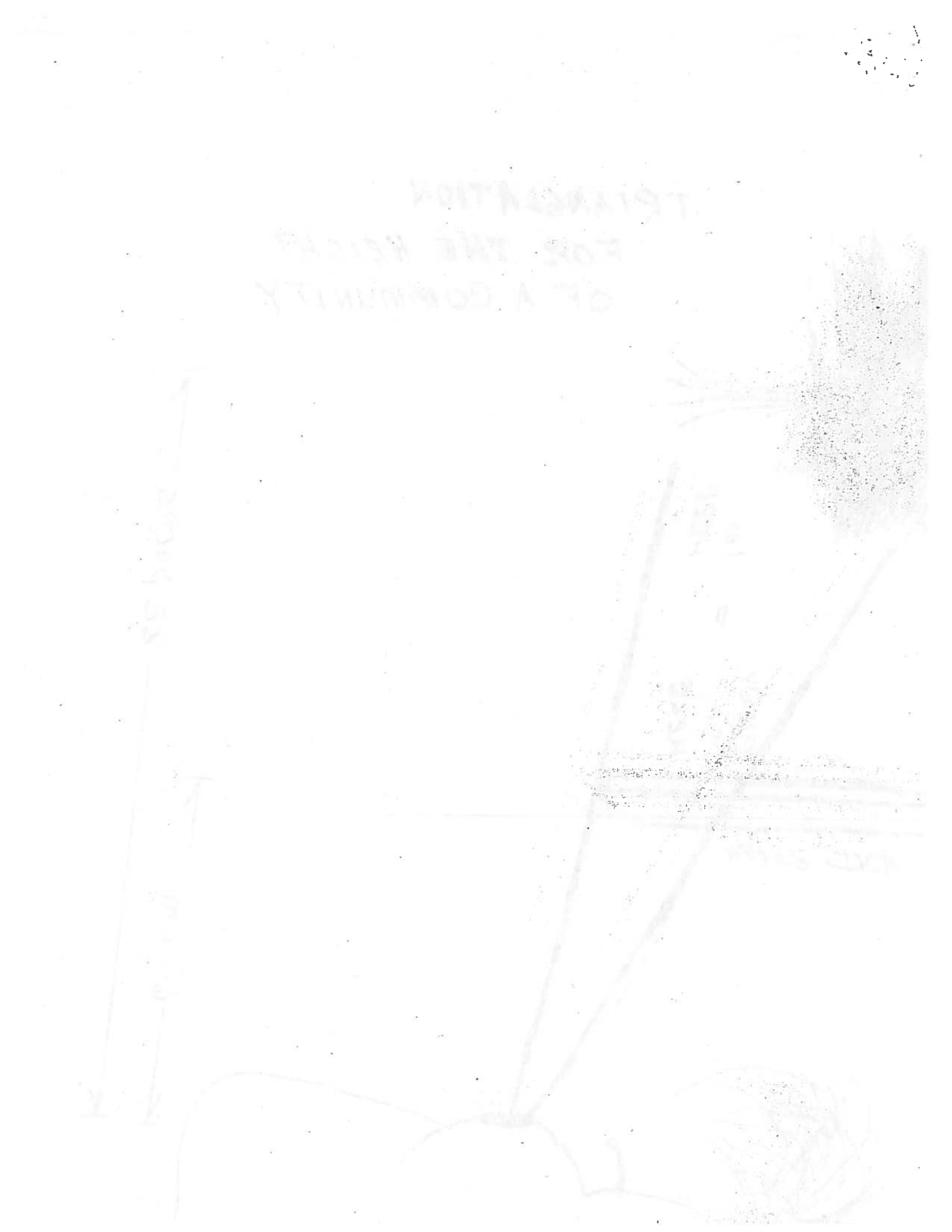
Procedure:
*Help Job 1 Group with collecting plants
*Sweep bus
*Return all equipment to storage
*Clean and straighten classroom before leaving


B
C
F
G
D


SUCCESSION
Food Web A
Invaders;A, B,C,D,E,F,G
Food Web B
Invaders;B, C,D,E,F,G
Food Web C
Invaders;C, D,E,F,G
Food Web D
Invaders;D, E,F,G
Food Web E
Invaders;E, F,G
Food Web F
Invaders;F,G
Food Web G
Invaders;G

TRIANGLATION FOR THE HEIGHT OF A COMMUNITY






3
years after bare ground

Pioneer Food Web

1 - 3 years
Recognize with some bare soil
Annuals and biennials

15

years after bare ground

Perennial Grass Food Web

1 - 12 years

Recognize with ground covered with plants, mostly grass

Can be maintained by mowing because grass growing point is low to ground in leaf sheaths


30
years after bare ground

Mixed Herbaceous Perennial Food Web

5 - 16 years

Recognize with large (1-2m) flowering non-woody plants

These communities have greatest diversity of food webs.

years after bare ground

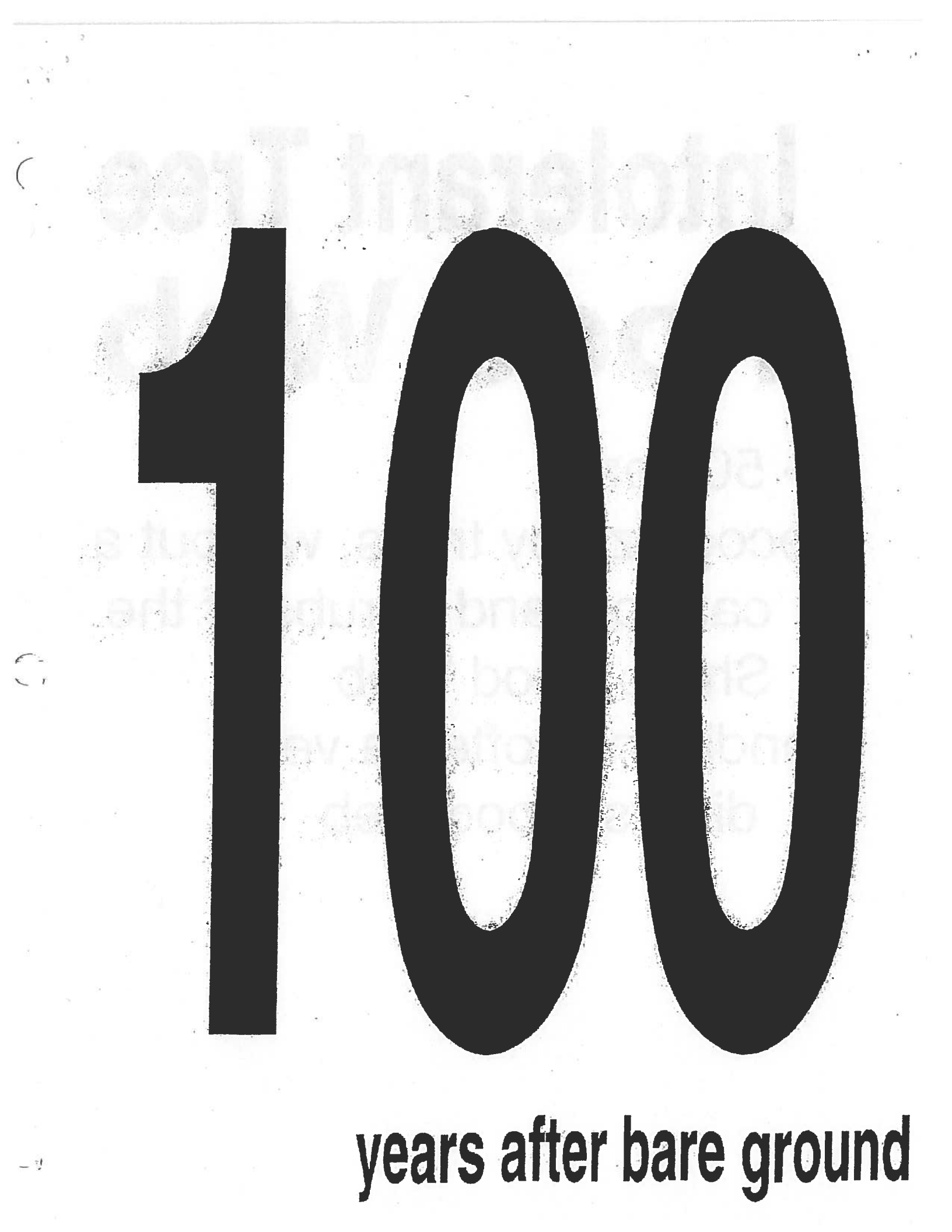
Shrub Food Web

16 - 20 years

Recognize by woody-stem plants which are as wide as tall

Many shrubs develop young plants from extended roots.

Often a food chain

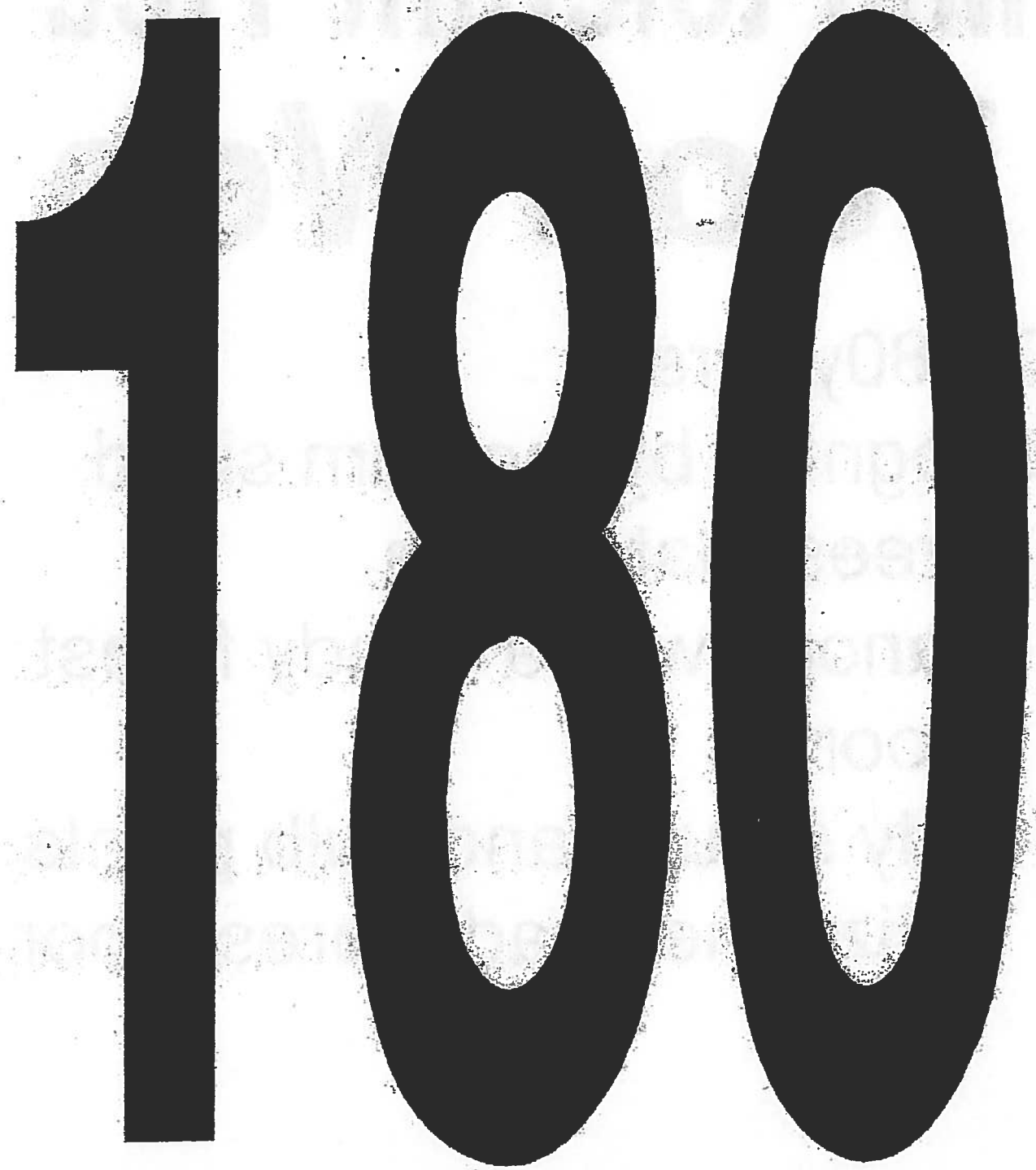

100
years after bare ground

Intolerant Tree Food Web

5 - 50 years

Recognize by trees, without a canopy, and shrubs of the Shrub Food Web

Condition is often a very diverse food web



years after bare ground

Mid-tolerant Tree Food Web

50 - 80years

Recognize by medium sized trees that form a canopy with a shady forest floor.

Woody shrubs and bulb plants utilize the shady forest floor

260

years after bare ground

Tolerant Tree Food Web

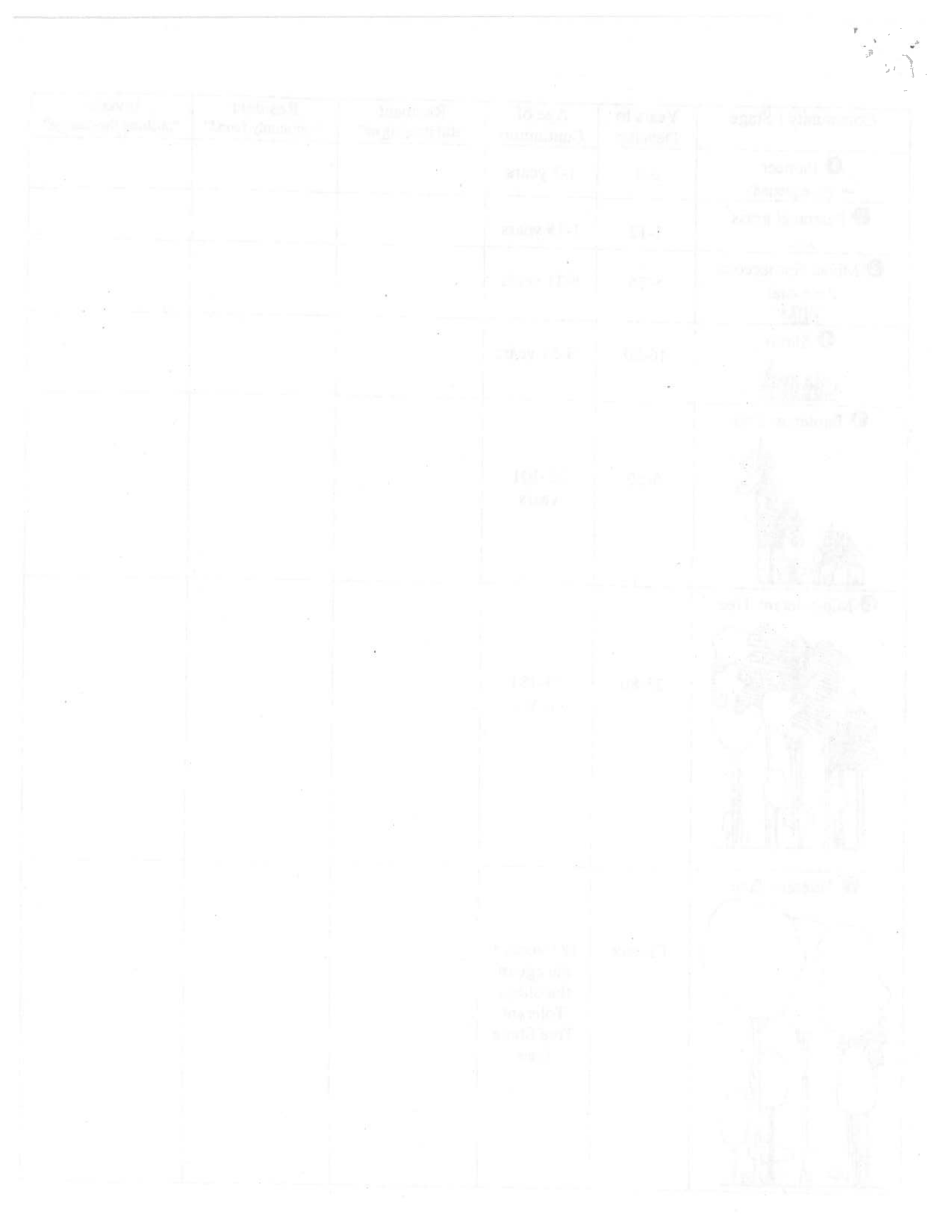
Continues until disturbed

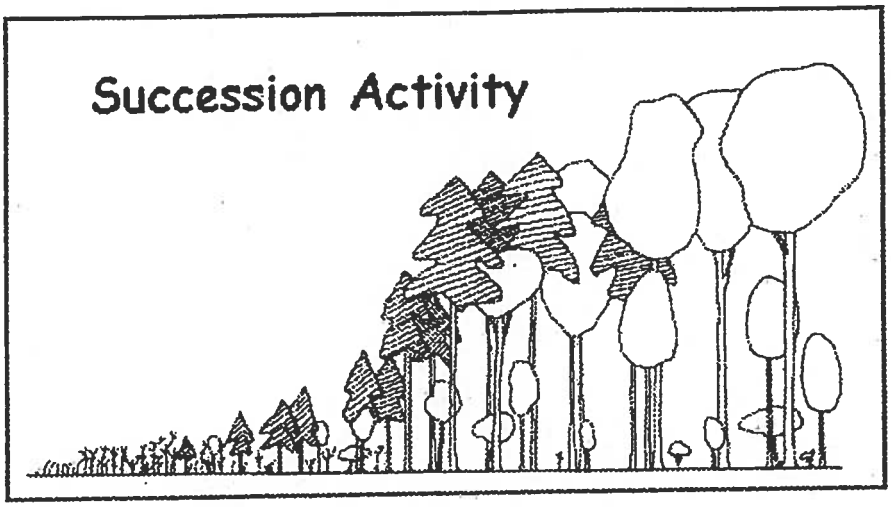
Recognize by large sized trees that form a dense canopy with a shady forest floor.

Woody shrubs and bulb plants utilize the shady forest floor

Best soil

Community / Stage	Years to Develop	Age of Continuum	Remnant "still hanging on"	Resident "commonly found"	Invader "pushing the change"
❶ Pioneer (bare ground)	0-3	1-3 years			
❷ Perennial grass	1-12	1-15 years			
❸ Mixed Herbaceous Perennial	5-16	6-31 years			
❹ Shrub	16-20	23-51 years			
❺ Intolerant Tree	5-50	28-101 years			
❻ Mid-tolerant Tree	25-80	53-181 years			
❼ Tolerant Tree	Climax	181 years + the age of the oldest Tolerant Tree Stage Tree.			





Back to the Future!

Name: _____

Some of the spelling words for this activity.

moss	grass	dandelion
horsetail	thistle	phrapmites
chickweed	clover	mullein
knapweed	plantain	golden rod
milkweed	marsh marigold	stinging nettle
white aster	blackberry	honeysuckle
raspberry	sumac	barberry
poison ivy	aspen	cherry
willow	juniper	white birch
hawthorn	adder's tongue	elm
ash	black oak	red maple
red pine	running strawberry	white pine
hemlock	spring beauty	sugar maple
violet	beech	Indian pipe