Trees – A Technology Perspective

COMPLETE THE ASSIGNMENT AND PUT THIS FILE IN YOUR PORTFOLIO

Mark: _____ / 100 **Peer Assessed by: _____**

Due Date: To be completed and dropped off by the end of class today, May 20.

Contents

1 Expectations: The Student will…

Here ** is one of the requirements received from Dumfries House. Also, now you use your critical thinking skills to find at least one specific expectation from the curriculum document for this course that relates to "trees as technology".

1 Req't Code #	2 Requirement	3 What You Intend to Do To Exceed the Minimum Requirement Be as Precise as Possible	4 Status
**	Your research must include an investigation into the nature of wood as a strong, durable and pleasing furniture-building material as well as the matter of trees as a valuable sustainable resource.		
	Pick one Specific Expectation from the Curriculum document in the day1 pickup folder, (Tech_Educ_ONT_Gr11-12-new_curric-2009.pdf). This curriculum expectation will be closely related to this topic: ***Trees – A Technology Perspective***. Use your critical thinking skills to do enough investigation... and use your creative thinking skills to put together your evidence that you have successfully achieved this chosen Expectation.		

2 Some Resources

- www.mccowan.org/bill_mccowan.htm
- National Forest Week is in Sept: www.focusonforests.ca (Ontario Forestry Association)
- Tech_Educ_ONT_Gr11-12-new_curric-2009.pdf (the curriculum document for this course)
- Other links given to you in previous pickup folder documents
- Find several other web sites to help you develop your personal "***Trees as Technology***" perspective
- And… as follows below… sparse as it is… make it better … in your own words

3 Assignment -- 400 to 600 Words -- 100 Marks

Search below on the word "***Assignment***". Every student will choose a topic that matches your skill level and your interests. Regardless of your chosen topic, your report must delve deeply into the notion that trees can be viewed as an important foundational element of our technology-driven world. Your 400 word to 600 word research report will be used as evidence in SATEC's quest for Platinum ECO status – a great opportunity for you.

Your research report will be graded against these rubrics in the ***Feb 26/15*** pickup folder for this course:

- Rubric_Information_Processing.doc (Thinking)
- Written_Report_Rubric.doc (Communication).

You should be so proud of your research report that you would enthusiastically show it to the human resources manager at a job interview.

4 Input to You -- Trees as Technology

4.1 Life Cycle of a Tree

Wood is good – a remarkably hard, strong and beautiful building material. A piece of wood comes from a tree, a living organism. A tree has a natural life cycle. As a part of nature, the sizeable components of a tree such as leaves, twigs, branches and trunks are all subject to nature's natural forces from the moment the first cell forms to the moment it finally decomposes to basic chemical compounds. The durability of the wood over time thus depends on mother nature – rain, wind, freeze-thaw cycles, animals, insects, fungal spores and moulds. Moreover, trees are living organisms – they have an expected life span. Some species live many hundreds of years before the demise and death part of the cycle finally sets in.

Then humans interfered with the life cycle of the tree by cutting it and building things out of the wood. As humans began to use wood for their shelters, they noticed that they could prolong the useful life of their wood by protecting it from the elements. Adding a leak-proof roof to keep wood members dry was an obvious action to take. Sizing and bracing joints correctly would also help – mortise, tenon, pin and brace all needed to fit together just right to remove all looseness and reduce movement during heavy winds. Applying a surface treatment to discourage wood-destroying insects from "stopping by" to lay eggs also came to be recognized as a good idea. Over time, we developed surface treatments which hardened to protect a wood floor from the wear and tear of people and their shoes and toys. We also came to appreciate that we could keep a floor looking cleaner and more attractive if we first fill cracks with special fillers prior to the application of the final surface finish.

And of course, over time, we sadly discovered that the paints we were using were hazardous to our health – lead was a significant constituent in those old paints.

4.2 Trees and Wood: Salvage and Re-Use

We are slowly – but surely -- running out of resources on earth. Salvaging, re-using and re-cycling materials is generally a good idea, if done correctly and safely. There are some concerns with using old or fallen materials -- including safety concerns -- that must first be recognized, understood and then dealt with appropriately.

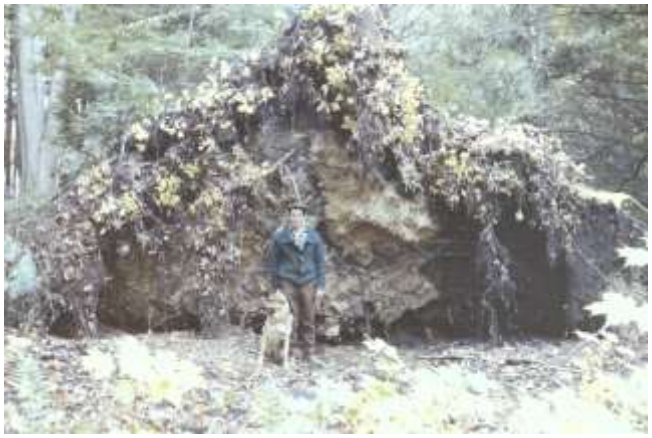
That fallen tree or those old pieces of wood in your hands may be beautiful and they may have an interesting story to tell in the product you'd like to build with them. Just make sure that part of the story they tell is how you personally took full control of the inquiry / design / build process – that you investigated the wood thoroughly and acted in a safe and responsible manner every step of the way.

Few man-made objects can bend and sway – deform elastically -- in a very strong windstorm so dramatically -- and suffer so little damage as can a tree. If a tree breaks in a windstorm it is very often at a "crotch" – a 'y' where two trunks diverge from one another. On closer examination, you will see how the wood in the crotch has been severely weakened by several decades of rainwater "getting in" to the crotch area. Good forest management would be to nick off one of

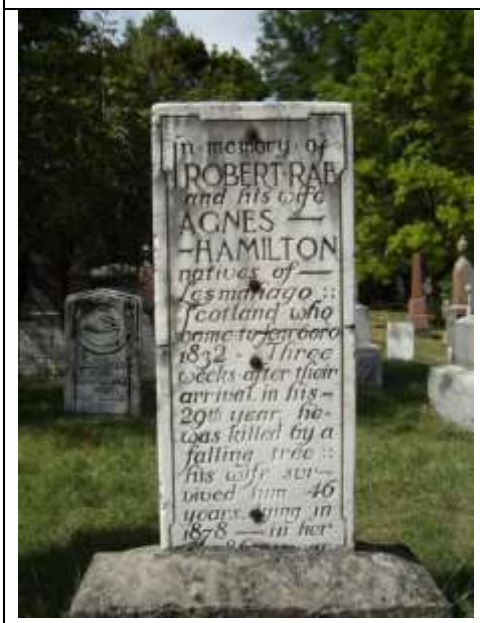
those two trunks or stems in its infancy to ensure that there is only one strong "leader" stem to grow straight up.

So, what do we do with that beautiful tree that has just fallen to the ground?

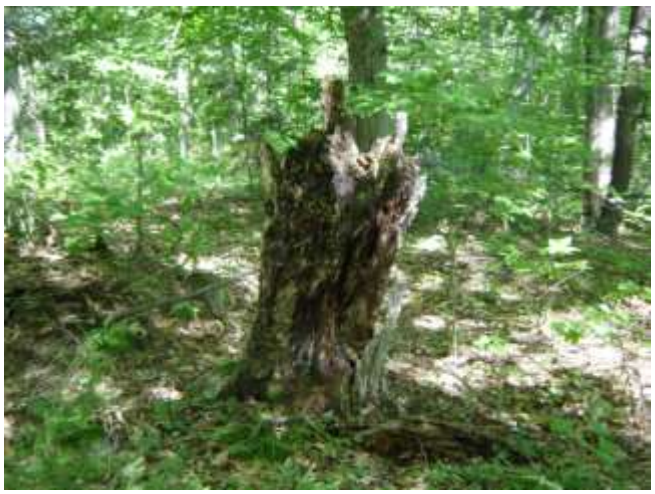
Still standing -- four-century old white pine in Pickering



A few meters from the old pine tree, this 40 inch diameter maple just couldn't stand it any longer… the high water table discouraged deep roots and it just fell over. Must have been at least 300 years old.

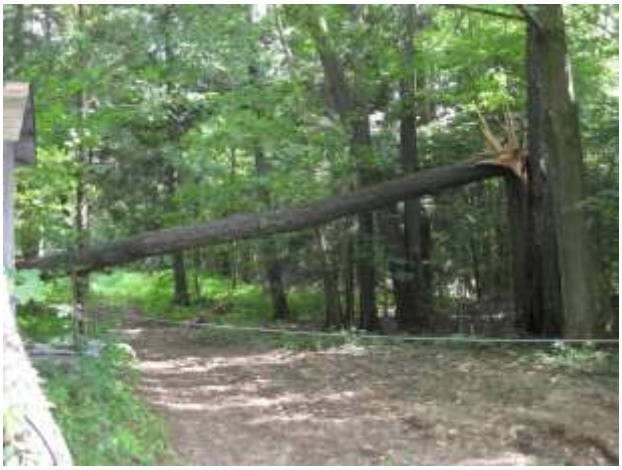


Tragedy in the Scarborough forest in 1832 – the perils of felling trees.



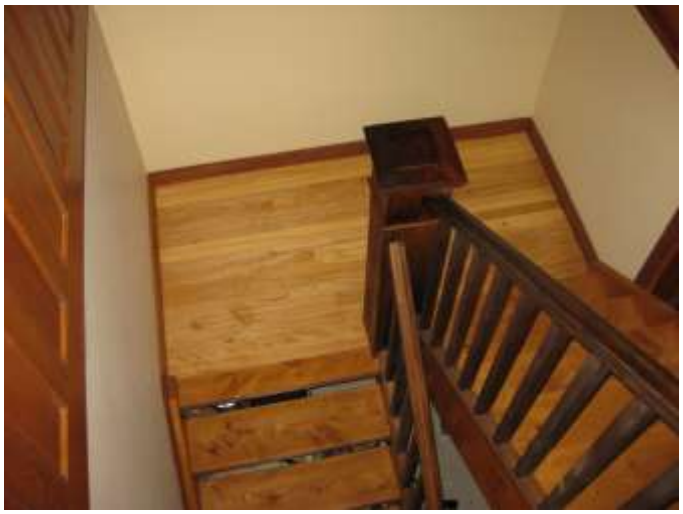
Burnt stump from the Vennachar forest fire (1903) 110 years earlier (near Plevna, Ont.)

In the summer of 2009, one of two trunks of a 90 foot tall black cherry tree broke off in a windstorm, knocking down one of two trunks of an 85 foot white pine as it fell. Both broke off at the crotch.



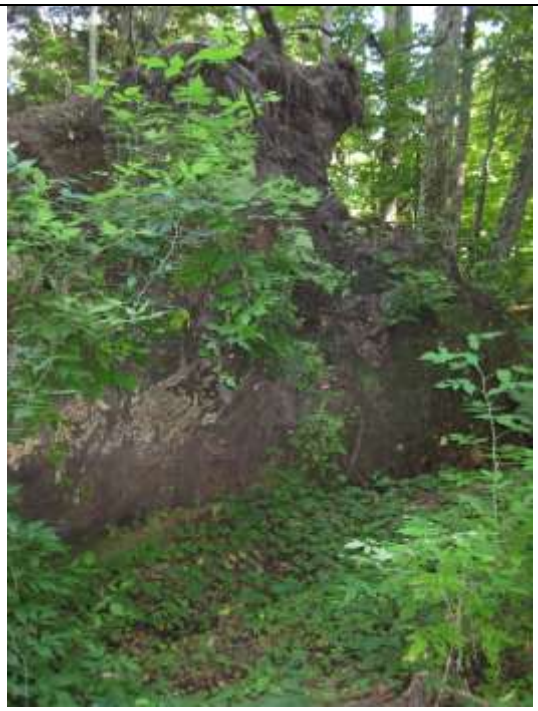
The black cherry just broke off at the crotch. How would you cut the wood fibres that are holding the one end up?

The fallen black cherry is now these kitchen cupboards. (The flooring is the oak from a 1917 Scarborough farmhouse.)



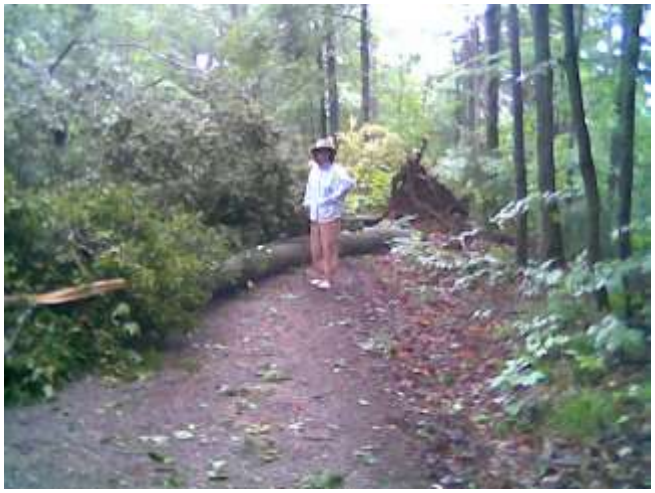
A white ash killed by the emerald ash borer beetle is now a bedroom floor and this staircase landing. (The treads of the staircase are from a fallen hemlock tree.)

A huge maple toppled in the tornado of August 2006, Plevna, Ontario. Slicing off a slab for public art at SATEC.

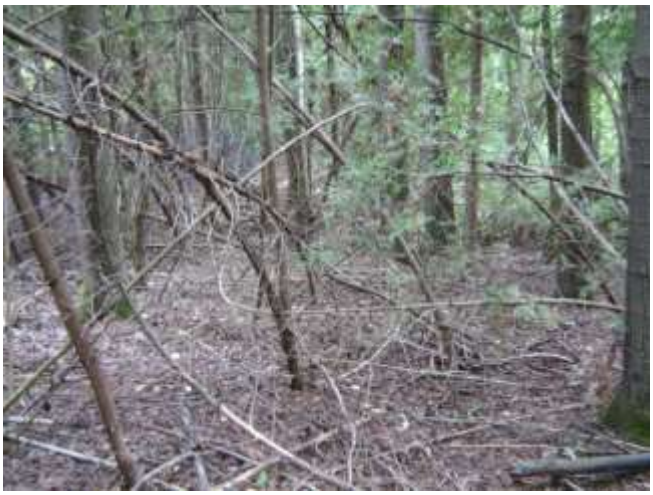


Dozens of basswood trees were uprooted by the same Tornado / Micro-Burst, Aug/06

The tornado-felled maple slab at SATEC – public art to commemorate SATEC's 50th anniversary.

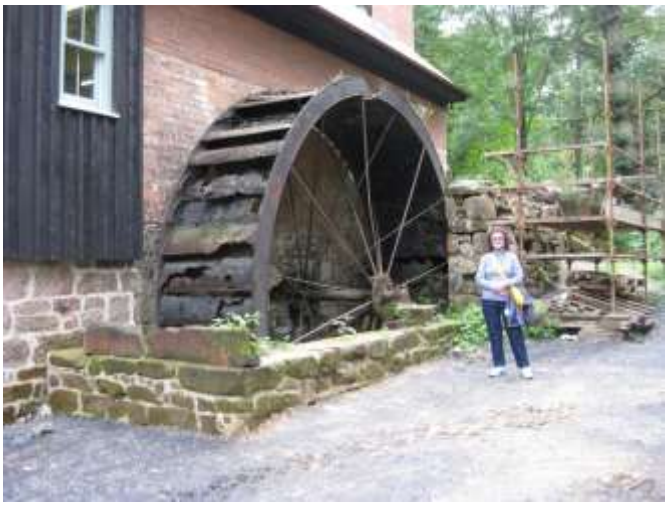


The tornado (or vicious micro-burst) "sounded like a herd of stampeding horses."



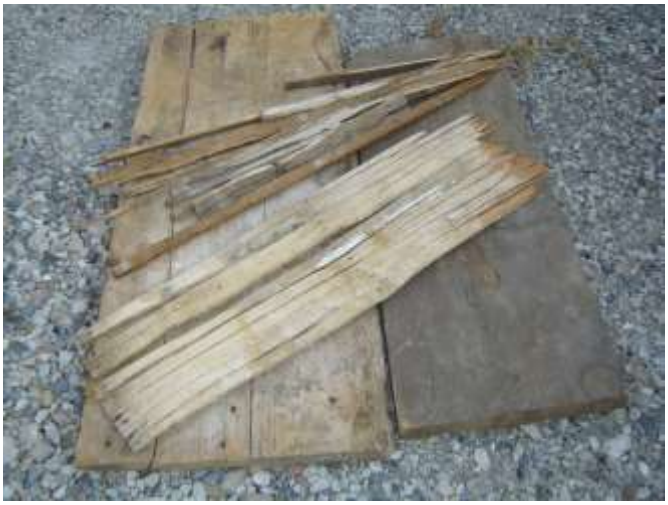
Cedar saplings in Pickering that lost the battle for sunlight.

Most of these Pickering white cedars just toppled over in the bush on their own. Note the root fibres along part of the length of the second log from the left.

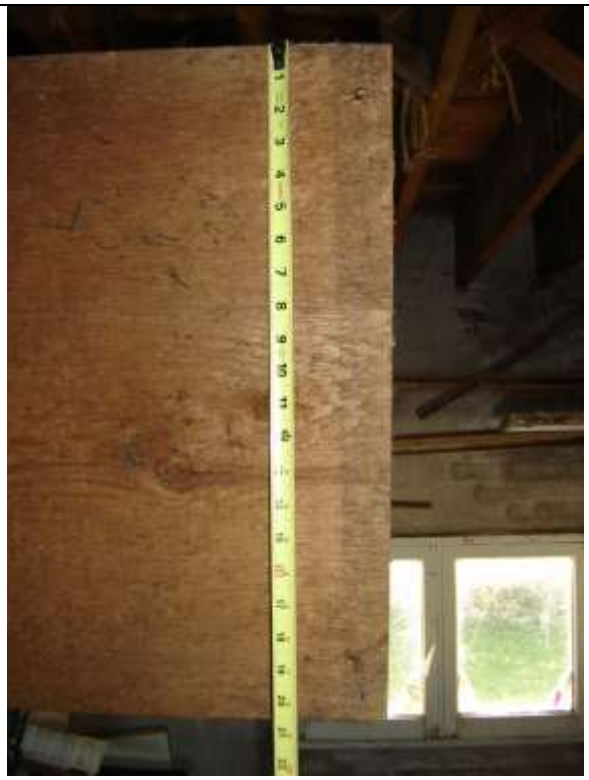


The water-wheel at the late 18th century Dumfries House Sawmill

Portable sawmill in Pickering, 2010 – gasoline engine-driven.



Split and spread like an accordion, this Scarborough farmer-made wood lath was used for plastering walls in the mid19th century.



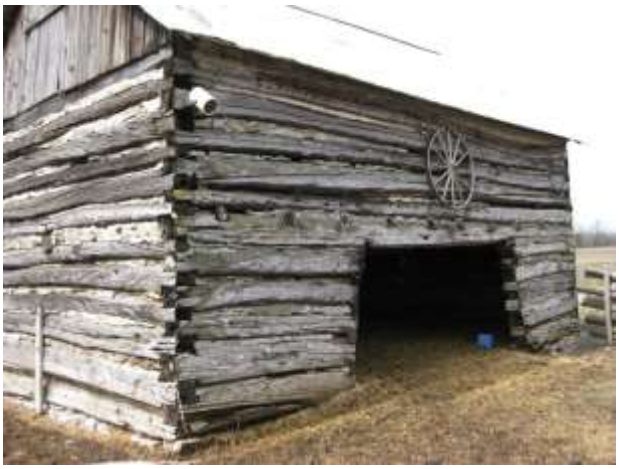
21-inch wide board from an old Scarborough farmhouse – great for a harvest table. How old might this tree have been?

Very "quick-and-dirty" solar powered lumber drying kiln in Pickering (with electric-assist to maintain temperature overnight.)

Wood-fired-hydronic lumber-drying kiln. Heat-treating oak trim from a 1917 Scarborough farmhouse.

The chestnuts died off a century ago, the elm around Toronto died 40 years ago. Now the ash and beech (shown above) are all dying in Ontario.

Carpenter ant damage in a fallen tree in the bush



Log barn in the Ottawa valley.

Air-drying “stickered” white pine.

Investigate and Think Critically About This – Add to your Research Report:
Why do you suppose mother nature did not make absolutely certain that only one leader stem will prevail – thus preventing development of a crotch and the resultant damage due to rainwater seeping downward and into the main trunk of the tree? Now pick a species of tree – such as black cherry in the above photographs. Did mother nature somehow anticipate such heavy windstorms when that species of tree was "designed"? Explain your position. Why would a tree break at a "crotch" if it breaks at all? Why would a crotch be a "weak" point? How can humans "interfere" with the tree growth process to prevent weak spots like this?

4.3 Tree Growth

A tree builds itself through a finely tuned process which carries the genetic information about the species. Cell division occurs in the very thin film of living cambium just under the tough protective bark, causing the tree to grow in its girth (diameter). On the inner side of the cambium, cell division results in a new layer of cells being added to the non-living wood. On the outer side of the cambium, cell division creates a renewed inner bark to transport food. In the spring, living cells are signalled to divide in order to increase girth and to elongate in order to increase in height.

4.3.1 Assignment Option… Add to Your Research Report

Consider this statement: "*A tree is a factory*". Do you agree or disagree with the statement? Explain your position. Describe in more detail the "Fabrication" process – how a tree is "built".

4.4 Roots

The roots absorb water and nutrients from the soil. In areas with a high water table or where the ground is generally wetter, the roots don't go very deep. Many trees in these locations can be uprooted – simply "tipped over" -- by a heavy wind storm, or even by gravity acting on heavy limbs on one side.

4.5 Trunk

The trunk is where the commercial value of a tree is located. Trees in Canada are "exogenous" -- during growth, new biomass is added directly under the bark. A tree grows upward, pushing its leaves up to where they can get more sunlight. Eventually the thick crowns of deciduous trees will prevent sunlight from reaching plant life nearer the ground. Less aggressive trees such as cedars will die off beneath the thick deciduous canopy.

4.6 Branches

Trees are smart. The arrangement of branches in many species is such that the leaves are assured as much sunlight as possible.

4.7 Leaves

Leaves absorb carbon-dioxide from the atmosphere through photosynthesis. This process adds to the biomass of the tree during the growing season.

4.7.1 Assignment Option… Add to Your Research Report

Do you agree or disagree with the following statement: "*A tree stores energy much like a battery*". Explain your position. Describe photosynthesis in terms of the fundamental concept, "Energy".

4.8 Wood

Engineered by nature – wood is the perfect building material. Some woods are incredibly strong, hard and tough. Most woods are extremely strong in pure tension. Some woods are extremely resistant to pure compression. Bending stresses are wood's "Achilles heal".

4.8.1 Assignment Option… Add to Your Research Report

Consider a long slender solid piece of wood under a bending load applied as a point force acting downward at the mid point. The piece of wood is simply supported at each end. What kind of very old well-known technology is this long piece of wood? Draw a visual diagram or representation of the tension and compression stresses in a cross-section of this piece of wood under the bending load. What is "happening" at the exact central axis from one end of the wood to the other? Is a piece of wood itself a "structure" – or is it just "material". What species of woods are stronger than others in resisting bending?

4.9 Grain

People who work with wood don`t really think much about how the tree grows. Woodworkers see certain patterns in the wood fibres – which they refer to as the grain. While these fibre patterns are generally the result of growth, woodworkers concern themselves more with how to work with those fibres than with how the grain came to be.

4.9.1 Assignment Option… Add to Your Research Report

Why do you think wood is stronger when struck with an axe perpendicular to the grain – as opposed to parallel to the grain? What do you think "across the grain" means? What do you think "with the grain" means? What do you think "against the grain" means? What hand tool do you use to "split" wood and how does that tool work? What kind of simple machine is this wood-splitting tool? What hand tool do you use to cut across the grain and how does that tool work? What hand tool do you use to cut along the grain and how does that tool work? What hand tools can you use to shave off thin slices of wood and what simple kind of machine is this? Who is in "control"? What does ergonomics have to do with all of this?

4.10 Getting Wood Ready to Work

A living tree is loaded with water. Once cut down, the water evaporates from the wood over time. The water content will be in the range of 20% when it is dried outdoors (but this can take a year or more depending on species and thickness). But the water content should be down to about 6% to 8% before you try to make furniture out of it. A kiln is used to dry the wood – at a modest temperature rise. A kiln is also used to heat-treat the wood to kill bugs / larvae in the wood – but this is done at a higher temperature than simple drying.

4.10.1 Assignment Option… Add to Your Research Report

Research the matter of drying and heat treating wood. It takes a great deal of energy to evaporate water. If energy is being used to evaporate the water from the wood, is the temperature of the wood really rising to the point where bugs are being killed? Can you heat treat wood without actually drying it first? What would it take to do this properly? Design an experiment to track the changes in moisture content of the wood as heat energy is being applied.

4.11 Joinery

To make a structure – table, chair, cupboard, house etc. – you can join pieces of wood together. Fasteners such as nails, screws and bolts can be used. In some cases you can use special grades of glue. All fasteners are made to particular specifications such as shear strength and tensile strength. Joints can also be made without nails, screws, bolts and glue.

4.11.1 Assignment Option… Add to Your Research Report

How does a Dado joint "work"? How does a Mortise and Tenon joint "work"? What hand tools are used to make these joints? What is it about a mortise and tenon joint that makes it even stronger than using nails? Historically, elm wood was not used much in furniture building – why do you suppose this is so? Compare and contrast elm with a more typical furniture-making species such as oak.

4.12 Machinery and Mechanism

Wood can be used to make machines of various kinds. Some wood species are better than others for various purposes.

4.12.1 Assignment Option… Add to Your Research Report

Consider these very simple machines – inclined plane, pulley, wheel and axle. Find examples where wood was used to make these simple machines. What wood species do you think was used for each of these machines and why? Consider a tall case grandfather clock. What simple machines are combined together to make a grandfather clock? Could wood be used to make the entire clock, including the many moving parts? What parts of the clock must be made of material other than wood?

4.13 Invasive Insects – Emerald Ash Borer

The emerald ash borer was introduced to North America in untreated skids or pallets from the far east. The ash trees are now all dying.

4.13.1 Assignment Option… Add to Your Research Report

What international standards should be in place to prevent another case of introducing insects that could destroy our forest? Does the emerald ash borer like to live on the warm (south) side of the tree? Does its boring activity change the properties of the ash wood, eg density and hardness? Describe two valuable lessons that students can benefit from as they design and build an object using ash wood?

5 Trees and the Fundamental Concepts of Technology

5.1 Assignment Option… Add to Your Research Report

Do you agree or disagree with the following statement:

Trees are nature's perfect technology.

Defend your position clearly by discussing trees in the context of technology. Which five of the thirteen fundamental concepts of technological education are most significant to your argument? Discuss each of your five chosen concepts in detail, giving clear examples in relation to trees. Can you derive another important concept (eg "strength") from two or more of the 13 fundamental concepts? Explain your derivation logically. Give an example from the world of trees to support your new "derived" concept.

6 Self and Peer Assessment

Inputs / Knowledge / Understanding That I Still Need or Connections that I Want to Make For This Unit: (give each a #)

1)
2)

Assessor's Name and Notes: The Peer Assessor must make the student think -- don't give him or her the answer!