

<i>Analyzing Issues</i>	Minimum Level of Performance 3	Observed Level of Performance
<p><i>The student:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> analyzes <u>five</u> current issues in forest management: <ul style="list-style-type: none"> – accurately describes each issue – clarifies different points of view regarding each issue <i>e.g., social, economic, environmental</i> – identifies two or more useful alternatives regarding each issue – assesses each alternative on the basis of immediate/long-term consequences <input type="checkbox"/> critiques <u>one</u> newspaper/magazine article or video documentary regarding an issue in forest management with respect to: <ul style="list-style-type: none"> – range of viewpoints/biases evident – validity/reliability of information presented – recommended course of action <p>See assessment tools generic to CTS: Assessment Framework: Issue Analysis (CTSISS) Guide to Critiquing Media Information (FORMED)</p>		
<i>Comparing Local and Global Issues</i>	Minimum Level of Performance 3	Observed Level of Performance
<p><i>The student:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> accurately describes <u>one</u> international forest issue <input type="checkbox"/> compares the international issue with a similar forest issue in Canada <input type="checkbox"/> suggests <u>two</u> or more strategies/actions for dealing with the issue at local and global levels <input type="checkbox"/> assesses each strategy/action on the basis of consequences for society, the economy and the environment <p>See assessment tools generic to CTS: Assessment Framework: Research Process (CTSRES)</p>		

<i>Citizenship: Goals and Actions</i>	Minimum Level of Performance 3	Observed Level of Performance
<p><i>The student:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> explains different philosophies/ethics regarding the use of forests and how best to ensure their sustainability <input type="checkbox"/> summarizes the goals and accomplishments of <u>one</u> environmental conservation group <input type="checkbox"/> negotiates and debates <u>one</u> current issue in forest management: <ul style="list-style-type: none"> – clearly states a position on the issue – presents a convincing argument in logical sequence supporting the position – provides a relevant and convincing rebuttal to opposing arguments – develops a shared agreement on preferred alternatives <input type="checkbox"/> through group consensus building, proposes a plan for the conservation and management of forested regions that includes individual actions, shared actions and leadership roles <p>See assessment tools generic to Forestry: Negotiation and Debate (FORNEG-3)</p>		
<i>Managing Learning</i>	Minimum Level of Performance 3	Observed Level of Performance
<p><i>The student:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> sets clear goals and establishes steps to achieve them <input type="checkbox"/> uses personal initiative to formulate questions and find answers <input type="checkbox"/> demonstrates resourcefulness in gathering information <input type="checkbox"/> plans and uses time effectively, prioritizing tasks on a consistent basis <input type="checkbox"/> assesses and refines approach to task/project based on feedback and reflection 		

<i>Research and Communication</i>	Minimum Level of Performance 3	Observed Level of Performance
<p><i>The student:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> accesses a range of relevant information sources and recognizes when additional information is required <input type="checkbox"/> interprets, organizes and combines information in creative and thoughtful ways <input type="checkbox"/> recognizes underlying bias/assumptions/values in information and ideas <input type="checkbox"/> demonstrates effective use of a variety of communication media: <i>e.g., written, oral, multimedia</i> <input type="checkbox"/> communicates thoughts/feelings/ideas clearly to justify or challenge a position <input type="checkbox"/> maintains acceptable grammatical and technical standards through proofreading and editing <input type="checkbox"/> gives evidence of adequate information gathering by citing relevant information sources 		

<i>Collaboration, Teamwork and Ethics</i>	Minimum Level of Performance 3	Observed Level of Performance
<p><i>The student:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> works with a range of peer members <input type="checkbox"/> shares information/opinions/suggestions, maintaining a balance between speaking and listening <input type="checkbox"/> listens to and respects the views of others, requesting clarification as necessary from other group members <input type="checkbox"/> negotiates with sensitivity solutions to problems <input type="checkbox"/> assesses the consequences of personal/group actions on society and the environment 		

RATING SCALE	4 Meets project/task objectives in a self-directed manner, selecting and implementing the most appropriate course of action. Problems are solved in effective and creative ways. Quality and productivity exceed standards.	3 Meets project/task objectives in a self-directed manner, selecting and using resources/processes efficiently and effectively. No errors or deficiencies are noted. Quality and productivity consistently meet standards.	2 Meets project/task objectives with limited assistance in planning, solving problems and in selection and use of resources/ processes. Only minor errors/deficiencies are noted. Quality and productivity meet standards, but are occasionally inconsistent.	1 Completes task as directed, demonstrating basic skills/completeness by following a guided course of action. Quality and productivity meet standard but are inconsistent.	0 Has not yet completed the task. Major deficiencies and/or errors are evident.
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Assessment Criteria and Conditions:

- identifying and explaining applications of timber cruise data and nonfibre data in resource management
- demonstrate applications of a sample set of forest survey data

Suggested Reference(s):

- *Managing the Forest*
- *Woodlot Management Guide for the Prairie Provinces*
- *Natural Resources Measurements*
- *Forest Mensuration*

STANDARD: Respond to a standard of 3 on the rating scale.

Rating Scale

The student:

- 4 meets project/task objectives in a self-directed manner. Provides explanations and critical judgements based on a superior knowledge base. Demonstrates an understanding of relevant concepts and related issues.
 - 3 meets project/task objectives in a self-directed manner. Provides explanations and comparisons of relevant concepts using more precise terminology. Requires little or no prompting.
 - 2 meets project/task objectives with limited assistance in planning and in selecting and using resources. Applies knowledge of concepts in different situations using correct terminology. Requires occasional prompting.
 - 1 completes task as directed, demonstrating basic skills/completeness by following a guided course of action. Uses simple recall to demonstrate basic knowledge of concepts. Requires prompting.
 - 0 does not complete the task, or is unable to provide a suitable response.
- N/A Not Applicable

Background Information

See *Managing the Forest*, Inventory:

- Timber Inventory
- What Tree is That?
- Grouping Trees
- What is a Tree?
- Tree Growth
- Measurement Activities
- Maps
- Air Photographs

See *Woodlot Management Guide for the Prairie Provinces*, Section F – Inventory:

- Steps to Conduct an Inventory
- Maps
- Cruising
- Designing a Cruise
- Measuring Cruise Plots
- Plot Sizes
- Measuring Tree Diameter
- Measuring Tree Age
- Measuring Tree Height
- Processing Cruise Data
- Sample Compilation

Sample Questions/Activities

1. **Discuss applications of timber cruise data in resource management;** e.g.:
 - estimating fibre volumes
 - projecting forest growth
 - planning harvest operations.
2. **Perform mathematical calculations to determine timber volumes for a sample forested area.**
3. **Explain applications of nonfibre data in resource management;** e.g.:
 - measures of water and soil quality
 - watershed potential
 - number and density of wildlife.
4. **Discuss potential applications of sample nonfibre data obtained from local government/industry.**
5. **Interpret a set of sample forest survey data;** e.g.:
 - consider bias, error and other limitations in the sample data
 - extrapolate the data to estimate forest populations
 - suggest applications of the data in resource management
 - suggest modifications to sample design that may increase accuracy of the survey.
6. **Research applications of computer software in processing forest survey data.**

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not Applicable

Assessment Tools

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TASK CHECKLIST

The student:

Preparation and Planning

- sets clear goals and establishes steps to achieve them
- creates and adheres to detailed timelines
- uses personal initiative to formulate questions and find answers
- plans and uses time effectively, prioritizing tasks on a consistent basis

Information Gathering and Processing

- accesses a range of relevant information sources and recognizes when additional information is required
- demonstrates resourcefulness in collecting data
- interprets, organizes and combines information in creative and thoughtful ways
- records information accurately with appropriate supporting detail and using correct technical terms
- recognizes underlying bias/assumptions/values in information sources
- assesses and refines approach to the task and project status based on feedback and reflection

Content

- explains applications of aerial photography in current data collection practices
- interprets information regarding the forest resource in one or more aerial photographs
- _____
- _____

Content (continued)

- explains applications of satellite imagery in current data collection practices
- interprets one or more satellite images used in forest inventory
- _____
- explains applications of one or more computer-based mapping systems in data manipulation and/or data storage
- _____

Collaboration and Teamwork

- cooperates with group members
- shares work appropriately among group members
- negotiates with sensitivity solutions to problems
- displays effective communication and leadership skills

Information Sharing

- demonstrates effective use of a variety of communication media:
e.g., written, oral, audio-visual
- communicates thoughts/feelings/ideas clearly to justify or challenge a position
- maintains acceptable grammatical and technical standards
- gives evidence of adequate information gathering by citing seven or more relevant information sources

REFLECTIONS/COMMENTS:

Assessment Criteria and Conditions:

- given a range of relevant in-school/community resources, identifying and describing:
 - fibre and nonfibre products and services derived from Alberta’s forests
 - forecasts regarding the future use of forests in Alberta and Canada

Suggested Reference(s):

- *Alberta’s Focus on Forests*
- *Our Growing Resource*
- *Woodlot Management Guide for the Prairie Provinces*

STANDARD: Respond to a standard of 3 on the rating scale.

Rating Scale

The student:

- 4 meets project/task objectives in a self-directed manner. Provides explanations and critical judgements based on a superior knowledge base. Demonstrates an understanding of relevant concepts and related issues.
 - 3 meets project/task objectives in a self-directed manner. Provides explanations and comparisons of relevant concepts using more precise terminology. Requires little or no prompting.
 - 2 meets project/task objectives with limited assistance in planning and in selecting and using resources. Applies knowledge of concepts in different situations using correct terminology. Requires occasional prompting.
 - 1 completes task as directed, demonstrating basic skills/completeness by following a guided course of action. Uses simple recall to demonstrate basic knowledge of concepts. Requires prompting.
 - 0 does not complete the task, or is unable to provide a suitable response.
- N/A Not Applicable

Background Information

See *Alberta’s Focus on Forests*, Unit 4 – Forest Resources and Technologies:

- 4.2: Products from Canada’s Forests
- 4.3: Surveying the Forest Resource
- 4.4: From Pulp to Paper
- 4.5: Pulp and Paper: The Technology-Environment Connection.

See *Our Growing Resource*, Chapter 3: Production and Products – Today’s Forest Industry:

- Lumber
- Panelboard
- Pulp and Paper.

See *Woodlot Management Guide for the Prairie Provinces*, Section III – Products/Markets:

- Fibre Markets
- Energy
- Christmas Trees
- Food.

Sample Questions/Activities

1. **Identify 20 or more fibre-based products and services derived from Alberta’s forests; e.g.:**
 - primary wood products
 - wood-fabricated products
 - pulp and paper products
 - chemical products
 - food products.
2. **Identify 10 or more nonfibre values derived from Alberta’s forests; e.g.:**
 - trapping, hunting and fishing
 - guiding and outfitting
 - tourism and recreational pursuits
 - ecological values
 - aesthetic and spiritual values.
3. **Describe trends in the consumptive and nonconsumptive use of forests in Canada and Alberta; e.g.:**
 - recreation
 - trapping
 - logging
 - oil and gas development.
4. **Given a selected forest region, identify a range of forest products and services that could be derived from that site.**
5. **Identify a range of common products derived from a given tree species.**

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not Applicable

Assessment Tools

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TASK CHECKLIST

The student:

Preparation and Planning

- sets clear goals and establishes steps to achieve them
- creates and adheres to detailed timelines
- uses personal initiative to formulate questions and find answers
- plans and uses time effectively, prioritizing tasks on a consistent basis

Information Gathering and Processing

- accesses a range of relevant information sources and recognizes when additional information is required
- demonstrates resourcefulness in collecting data
- interprets, organizes and combines information in creative and thoughtful ways
- records information accurately with appropriate supporting detail and using correct technical terms
- recognizes underlying bias/assumptions/values in information sources
- assesses and refines approach to the task and project status based on feedback and reflection

Content

- identifies, describes and sequences the steps/processes that are involved in one milling or pulping technology
- identifies materials and services that are required at each stage of production; e.g.:
 - human and natural resources
 - energy and technologies
 - inspection and regulation

Content (continued)

- describes products and/or services made available through applications of the milling or pulping technology
- develops a flow chart of steps and processes involved in the production process
- identifies potential affects of the milling or pulping process on the environment, and precautions taken by industry to eliminate/minimize environmental impact
- _____

Collaboration and Teamwork

- cooperates with group members
- shares work appropriately among group members
- negotiates with sensitivity solutions to problems
- displays effective communication and leadership skills

Information Sharing

- demonstrates effective use of a variety of communication media:
e.g., written, oral, audio-visual
- communicates thoughts/feelings/ideas clearly to justify or challenge a position
- maintains acceptable grammatical and technical standards
- gives evidence of adequate information gathering by citing seven or more relevant information sources

REFLECTIONS/COMMENTS:

RATING	ASSESSMENT CRITERIA
<p>4 3 2 1 0</p>	<p><i>The student:</i></p> <p>Schedules Tasks</p> <ul style="list-style-type: none"> <input type="checkbox"/> defines the task <input type="checkbox"/> identifies task components and organizes them into a logical sequence <input type="checkbox"/> uses time effectively <input type="checkbox"/> _____
<p>4 3 2 1 0</p>	<p>Gathers Relevant Information</p> <ul style="list-style-type: none"> <input type="checkbox"/> poses important questions regarding potential customers/markets <input type="checkbox"/> accesses basic in-school/community information sources regarding the product/service and potential customers/markets <input type="checkbox"/> interprets and organizes information into a logical sequence <input type="checkbox"/> _____
<p>4 3 2 1 0</p>	<p>Develops the Plan</p> <ul style="list-style-type: none"> <input type="checkbox"/> describes the product/service and marketing goals <input type="checkbox"/> assesses consumer preferences, and how these may be met through product diversification/specialization <input type="checkbox"/> identifies potential markets in North America, the Pacific Rim, Europe and two other selected regions <input type="checkbox"/> outlines the sequence of steps, materials, and processes involved in product/service development <input type="checkbox"/> establishes a pricing strategy based on market analysis and cost factors <input type="checkbox"/> establishes a packaging/labelling, advertising and promotion strategy consistent with marketing goals and consumer preferences <input type="checkbox"/> summarizes opportunities and challenges relevant to the marketing plan <input type="checkbox"/> _____
<p>4 3 2 1 0</p>	<p>Assesses and Communicates the Plan</p> <ul style="list-style-type: none"> <input type="checkbox"/> presents marketing plans in a logical sequence using two or more communication media <input type="checkbox"/> uses correct grammar and technical terms <input type="checkbox"/> predicts the likelihood of suggested outcomes/sales being realized <input type="checkbox"/> makes summative statements regarding strengths/weaknesses and general feasibility of the marketing plan <input type="checkbox"/> _____

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not Applicable

<p>REFLECTIONS / COMMENTS</p>
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<i>Industry Research</i>	Minimum Level of Performance 3	Observed Level of Performance
<p><i>The student:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> identifies <u>six</u> or more types of forest research being conducted in Canada <input type="checkbox"/> explains the role of the Alberta Forest Research Advisory Council in coordinating forest research activities in Alberta <input type="checkbox"/> explains applications of data banks and information systems in forest research <input type="checkbox"/> summarizes <u>one</u> current forest research project in Canada with respect to: <ul style="list-style-type: none"> – research objectives and participating agencies – information-gathering strategies – project status and implications for forest industry <p>See assessment tools generic to Forestry: Presentations/Reports (FORPRE-3)</p>		
<i>Technology Applications</i>	Minimum Level of Performance 3	Observed Level of Performance
<p><i>The student:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> identifies applications of technology in <u>six</u> or more sectors of the forest industry; e.g., inventory, silviculture, protection, harvest, processing, management <input type="checkbox"/> analyzes <u>three</u> technologies currently used in the forest industry by identifying: <ul style="list-style-type: none"> – specific problems/needs being addressed – basic components and principles of operation – benefits and costs with respect to social/economic/environmental factors <input type="checkbox"/> describes <u>one</u> or more emerging technologies in the forest industry and needs being addressed <p>See assessment tools generic to CTS: Assessment Framework: Research Process (CTSRES)</p>		

<i>Technology Careers</i>	Minimum Level of Performance 3	Observed Level of Performance
<p><i>The student:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> identifies occupational opportunities within <u>six</u> career clusters related to forest technology; e.g., inventory, silviculture, protection, harvest, processing, management <input type="checkbox"/> describes employment conditions and requirements within <u>one</u> career cluster; e.g., job description/working conditions, remuneration, entry requirements, training opportunities, potential for advancement/entrepreneurship <input type="checkbox"/> makes forecasts regarding career trends in forest technology, future occupational opportunities and related employment conditions and requirements <p>See assessment tools generic to Forestry: Career Search: Advanced Level (FORCAR-3)</p>		
<i>Managing Learning</i>	Minimum Level of Performance 3	Observed Level of Performance
<p><i>The student:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> sets clear goals and establishes steps to achieve them <input type="checkbox"/> uses personal initiative to formulate questions and find answers <input type="checkbox"/> plans and uses time effectively, prioritizing tasks on a consistent basis <input type="checkbox"/> assesses and refines approach to task/project based on feedback and reflection 		

<i>Research and Communication</i>	Minimum Level of Performance 3	Observed Level of Performance
<p><i>The student:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> accesses a range of relevant information sources and recognizes when additional information was required <input type="checkbox"/> interprets, organizes and combines information in creative and thoughtful ways <input type="checkbox"/> records information accurately with appropriate supporting detail and using correct technical terms <input type="checkbox"/> demonstrates effective use of a variety of communication media: <i>e.g., written, oral, multimedia</i> <input type="checkbox"/> maintains acceptable grammatical and technical standards through proofreading and editing <input type="checkbox"/> gives evidence of adequate information gathering by citing relevant information sources 		

<i>Collaboration and Teamwork</i>	Minimum Level of Performance 3	Observed Level of Performance
<p><i>The student:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> cooperates with group members <input type="checkbox"/> shares work appropriately among group members <input type="checkbox"/> negotiates solutions to problems <input type="checkbox"/> displays effective communication and leadership skills 		

RATING SCALE	4 Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.	3 Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.	2 Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.	1 Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.	0 Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

SILVICULTURE

- biotechnology
- scarification
- vegetation control
-
-
-

FOREST INVENTORY/PROTECTION

- laser disc technology
- Geographic Information Systems (GIS)
- Global Positioning Systems (GPS)
-
-
-

GREEN HOUSE AND NURSERY OPERATIONS

- container systems
- environmental control systems
- packaging and storage systems
-
-
-

FOREST HARVEST

- feller bunchers
- delimiters
- on-site chipping
- on-board computer control systems
-
-

WOOD PRODUCTION AND UTILIZATION

- lasers in sawmills
- pulping technology
- computer process control
-
-
-

FOREST MANAGEMENT

- satellite imagery
- aerial photography
-
-
-
-

Assessment Criteria and Conditions:

- identifying and describing:
 - organic and inorganic components of forest soils and their function in forest ecosystems
 - major types of air pollutants and their affect on forest ecosystems

Suggested Reference(s):

- *Alberta’s Focus on Forests*
- *Woodlot Management Guide for the Prairie Provinces*

STANDARD: Respond to a standard of 3 on the rating scale.

Rating Scale

The student:

- 4 meets project/task objectives in a self-directed manner. Provides explanations and critical judgements based on a superior knowledge base. Demonstrates an understanding of relevant concepts and related issues.
- 3 meets project/task objectives in a self-directed manner. Provides explanations and comparisons of relevant concepts using more precise terminology. Requires little or no prompting.
- 2 meets project/task objectives with limited assistance in planning and in selecting and using resources. Applies knowledge of concepts in different situations using correct terminology. Requires occasional prompting.
- 1 completes task as directed, demonstrating basic skills/completeness by following a guided course of action. Uses simple recall to demonstrate basic knowledge of concepts. Requires prompting.
- 0 does not complete the task, or is unable to provide a suitable response.

N/A Not Applicable

Background Information

See *Alberta’s Focus on Forests*, Unit 3 – Conditions Affecting Growth:

- 3.1: A Lot Depends on Location
- 3.2: Life History of a Tree
- 3.3: Woodland Whodunit
- 3.4: Forests: Thriving or Declining
- 3.5: Controlling Fire
- 3.6: Urban Wilderness at School.

See *Woodlot Management Guide for the Prairie Provinces*, Section I – Woodlot Assessment:

- Forest Ecology
- Ecological Areas
- Soils
- Tree Species.

Sample Questions/Activities

1. **Describe physical characteristics used to classify forest soils, and the effect of different soils on plant growth;** e.g.:
 - texture
 - porosity.
2. **Explain the function or organic and inorganic components of forest soils;** e.g.:
 - micro- and macro-organisms
 - gases and minerals
 - organic matter
 - water.
3. **Explain the effects of soil acidity, alkalinity and temperature on the growth of trees and other forest plants.**
4. **Describe indicators of water quality in the forest, and its effects on trees and other plants;** e.g.:
 - surface water
 - ground water.
5. **Describe the effects of known air pollutants on forest ecosystems;** e.g.:
 - ozone
 - particulate matter
 - oxides and nitrogen
 - sulphur dioxide.

TASK	OBSERVATION/RATING					
Management	4	3	2	1	0	N/A
Teamwork	4	3	2	1	0	N/A
Equipment and Materials	4	3	2	1	0	N/A
Investigative Techniques	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not Applicable

TASK CHECKLIST

The student:

Management

- prepares self for task
- organizes and works in an orderly manner
- interprets and carries out instructions accurately
- plans and uses time effectively in a logical sequence
- displays leadership in adhering to routine procedures
- attempts to solve problems prior to requesting help

Teamwork

- cooperates with group members
- shares work appropriately among group members
- negotiates with sensitivity solutions to problems
- displays effective communication skills

Equipment and Materials

- independently selects and uses equipment/materials
- demonstrates concern for safe procedures/techniques
- measures accurately and efficiently
- practises proper sanitation procedures
- minimizes waste of materials
- anticipates potential hazards and emergency response

Investigative Techniques

- identifies two or more local soil types using soil triangle and hand texturing techniques
- makes predictions that can be tested regarding the effects of:
 - soil pH on the growth of trees
 - temperature on the growth of trees
 - water quantity on the growth of trees
- plans and conducts field investigations to test each predictions
- uses relevant information to explain observations regarding the effects of soil pH, temperature and water quantity on the growth of trees
- _____
- analyzes relationships among manipulated/responding variables
- obtains accurate results that confirm/reject each prediction and answer related questions
- summarizes, applies and evaluates observations and experimental outcomes
- _____

REFLECTIONS/COMMENTS:

INFERENCE

Definition: to derive a conclusion from facts or premises

Synonyms: infer, deduce, deduct, draw, gather, judge

Criteria for Assessing Inferences

Inferences made in advanced level courses should:

- communicate the process used to derive conclusions
- be reliable and valid in light of information gathered.

Inferences must be communicated in a logical sequence with sufficient supporting detail. Both the type and amount of information used to derive a conclusion are important in determining the reliability/validity of the inference.

Each inference made regarding interrelationships in forest ecosystems should provide:

- a clear statement of the factors being investigated
- relevant facts and detail that support more than one point of view;
e.g., cultural, ethical, economic, environmental, health-related, scientific, political
- a logical sequence of ideas that lead to a conclusion
- evidence that different points of view were considered in deriving the conclusion
- a valid and realistic conclusion that is based on analysis and synthesis of information.

RATING SCALE

4	3	2	1	0
Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

Causal Relationships and Inferences

The student makes two or more inferences regarding each of the following:

- the effects of local forests on soil; e.g.:
 - nutrient content
 - hydrologic cycle
 - pH balance
- the effects of local forests on water; e.g.:
 - surface water
 - ground water
- the effects of local forests on weather
- the effects of local forests on biotic factors; e.g.:
 - plants
 - animals
- the effects of global forests on climate
- structural adaptations of living organisms to changes in a forest environment; e.g.:
 - adaptation to site conditions
 - reproductive adaptation
- behavioural adaptations of living organisms to changes in a forest environment
- _____
- _____
- _____

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not Applicable

Assessment Tools

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TASK CHECKLIST

The student:

Preparation and Planning

- sets clear goals and establishes steps to achieve them
- creates and adheres to detailed timelines
- uses personal initiative to formulate questions and find answers
- plans and uses time effectively, prioritizing tasks on a consistent basis

Information Gathering and Processing

- accesses a range of relevant information sources and recognizes when additional information is required
- demonstrates resourcefulness in collecting data
- interprets, organizes and combines information in creative and thoughtful ways
- records information accurately with appropriate supporting detail and using correct technical terms
- recognizes underlying bias/assumptions/values in information sources
- assesses and refines approach to the task and project status based on feedback and reflection

Content

- explains how each tree species has unique site and climatic requirements that determine its ability to grow in particular environments
- provides descriptive accounts of the silvics of five common Alberta tree species; e.g.:
 - tree form
 - growth patterns and life cycle
 - soil requirements

Content (continued)

- climatic and moisture requirements
- aspect and elevation
- provides descriptive accounts of the structural characteristics and environments of three common Alberta forest associations, and factors that have determined their existence; e.g.:
 - location on a map
 - soil type
 - position of slope
 - overstorey and dominant understorey

Collaboration and Teamwork

- cooperates with group members
- shares work appropriately among group members
- negotiates with sensitivity solutions to problems
- displays effective communication and leadership skills

Information Sharing

- demonstrates effective use of a variety of communication media: e.g., *written, oral, audio-visual*
- communicates thoughts/feelings/ideas clearly to justify or challenge a position
- maintains acceptable grammatical and technical standards
- gives evidence of adequate information gathering by citing seven or more relevant information sources

REFLECTIONS/COMMENTS:

COMMON FOREST ASSOCIATIONS IN ALBERTA

FOR3090-5

Natural Subregion	Forest Association	Structure	Soil Texture	Soil Moisture	Slope Position
Montane	Lodgepole Pine/Bearberry	Tree/Shrub	silty loamy	Very dry	Upper
	White Spruce/Horsetail	Tree/Forb	peaty	Wet	Toe
	Aw-Sw-Pl/Hairy Wild Rye	Tree/Grass	fine loamy to clayey	Moist	Upper
Lower Foothills	Lodgepole Pine/Lichen	Tree/Lichen	sandy	Very dry	Upper
	Pl-Sb/Labrador Tea	Tree/Shrub	loamy or clayey	Moist	Middle
	Sb-Pl/Labrador Tea	Tree/Shrub	silt loam to silty clay loam	Wet	Lower
	Treed Bog	Tree/Shrub	organic	Wet	Depression
	Sb-Sw/Labrador Tea/Horsetail	Tree/Shrub/Forb	organic	Wet	Toe
	Aw-Sw-Pl/Low Bush Cranberry	Tree/Shrub	fine loamy clayey	Moist	Middle
	Treed Poor Fen	Tree/Shrub	organic	Wet	Depression
	Aw-Sw-Pl/Bracted Honeysuckle	Tree/Shrub	fine loamy - clayey	Moist	Lower
	Aw-Sw-Pl/Hairy Wild Rye	Tree/Grass	Fine loamy	Dry	Upper
Upper Foothills	Lodgepole Pine/Lichen	Tree/Lichen	fine loamy clayey	Very dry	Upper
	Pl-Sb/Labrador Tea	Tree/Shrub	fine loamy clayey	Moist	Middle
	Sb-Pl/Labrador Tea	Tree/Shrub	silt loam to clay loam	Wet	Lower
	Treed Bog	Tree/Shrub	organic/loam	Wet	Depression
	White Spruce/Horsetail	Tree/Forb	silty loam - clay loam	Wet	Lower
	Pl/Tall Bilberry	Tree/Shrub	fine loamy - clayey	Moist	Upper
	Pl/Hairy Wild Rye	Tree/Grass	fine loamy	Dry	Upper
Pl/Bracted Honeysuckle	Tree/Shrub	silt loam to clay foam	Wet	Toe	

Natural Subregion	Forest Association	Structure	Soil Texture	Soil Moisture	Slope Position
Boreal Mixed Wood	Jack Pine/Lichen	Tree/Lichen	sandy, loamy sandy	Very dry	Upper
	Pj-Sb/Labrador Tea	Tree/Shrub	clayey to loamy	Moist	Middle
	Sb-Pj/Labrador Tea	Tree/Shrub	variable	Moist	Lower
	Treed Bog	Tree/Shrub	organic	Wet	Toe
	Sb/Labrador Tea/Horsetail	Tree/Shrub	variable	Wet	Toe
	Pj-Aw/Blueberry	Tree/Shrub	sandy-loamy sand	Dry	Upper
Foothills Parkland	Aw-Sw/Low Bush Cranberry	Tree/Shrub	loamy to clayey	Moist	Middle
	Pb-Aw/Dogwood	Tree/Shrub	loamy to clayey	Moist	Lower
	Sw/Horsetail	Tree/Forb	peaty	Moist	Toe
	Aw/Saskatoon/Sarsaparilla	Tree/Shrub/Forb	loamy or clayey	Dry to moist	Middle to upper
Central Parkland	Aw/Saskatoon/Sarsaparilla	Tree/Shrub/Forb	loamy or clayey	Dry to moist	Middle to Upper
	Aw-Pb/High Bush Cranberry	Tree/Shrub	loamy or clayey	Moist	Depressions
	Pb/Dogwood/Horsetail	Tree/Shrub/Forb	loamy or clayey	Moist	Flats and Depressions
Peace River Parkland	Pb/Dogwood/Horsetail	Tree/Shrub/Forb	loamy or clayey	Moist	Flats and Depressions

Tree Species Abbreviations:

Aw – Trembling Aspen
 Pb – Balsam Poplar
 Pl – Lodgepole Pine
 Pj – Jack Pine
 Sb – Black Spruce
 Sw – White Spruce

Definitions

Forb:

any non-woody plant species other than grass or a grass-like plant.

Grass:

any member of the grass family.

Shrub:

any woody species with relatively low growth habit; often has several basal shoots

Tree:

a woody species with a single bole that is normally taller than a shrub.

COMMON FOREST ASSOCIATIONS IN THE CENTRAL PARKLAND SUBREGION

Schematic A

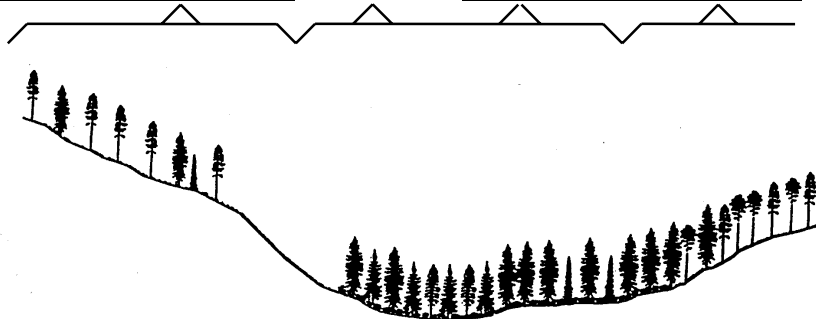
Forest Association	Aw/Saskatoon/ Sarasparilla	Aw-Pb/High Bush Cranberry	Pb/Dogwood/ Horsetail
Soil Texture	Loamy or clayey	Loamy or clayey	Loamy or clayey
Soil moisture	Dry to Moist	Moist	Moist



COMMON FOREST ASSOCIATIONS IN THE MONTANE SUBREGION

Schematic B

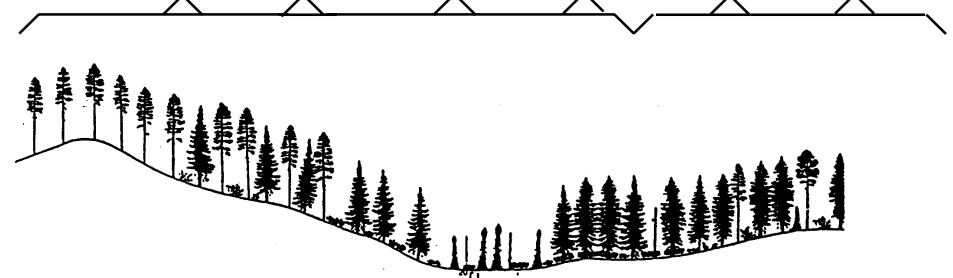
Forest Association	PI/Bearberry	Sw/Horsetail	Aw-Sw-PI/Hairy Wild Rye
Soil Texture	Silty loamy	Peaty	Fine loamy to clayey
Soil moisture	Very dry	Wet	Moist



COMMON FOREST ASSOCIATIONS IN THE LOWER FOOTHILLS SUBREGION

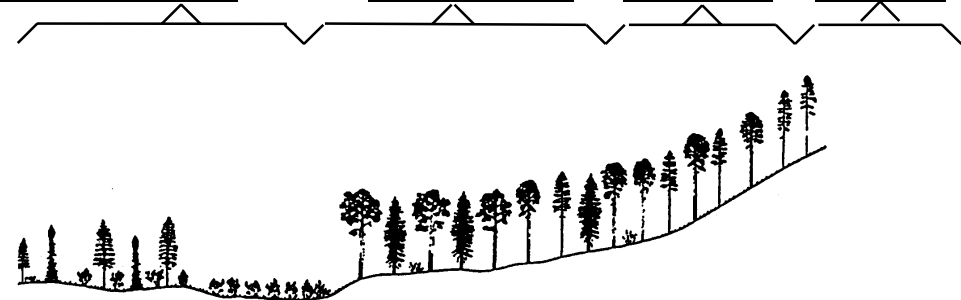
Schematic A

Forest Association	PI/Lichen	PI-Sb/ Labrador Tea	Sb-PI Labrador Tea	Treed Bog	Sb-Sw/ Labrador Tea /Horsetail	Aw-Sw-PI/ Low Bush Cranberry
Soil Texture	Sandy	Loamy or clayey	Silt loam to silty clay loam	Organic	Organic	fine Loamy clayey
Soil moisture	Very dry	Moist	Wet	Wet	Wet	Moist



Schematic B

Forest Association	Treed poor fen	Aw-Sw-PI Bracted Honeysuckle	Aw-Sw-PI/ Low Bush Cranberry	Aw-Sw-PI/ Hairy Wild Rye
Soil Texture	Organic	Fine Loamy Clayey	Fine loamy clayey	Fine loamy
Soil moisture	Wet	Moist	Moist	Dry



COMMON FOREST ASSOCIATIONS IN THE UPPER FOOTHILLS SUBREGION

Schematic A

Forest Association	PI/ Lichen	PI-Sb/ Labrador Tea	Sb-PI Labrador Tea	Tree Bog	Sw/ Horsetail
Soil Texture	Sandy	Loamy or clayey	Silt loam to silty clay loam	Organic	Peaty
Soil moisture	Very dry	Moist	Wet	Wet	Moist



Schematic B

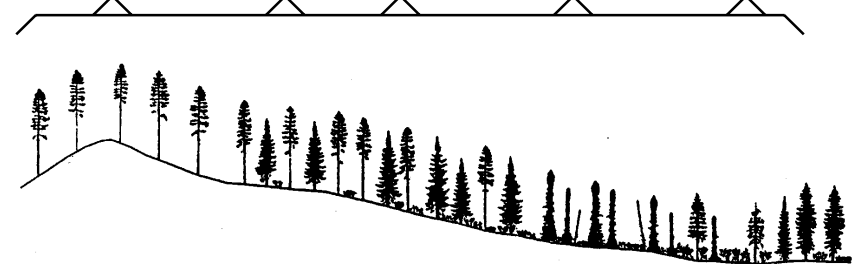
Forest Association	PI/Tall Bilberry	PI/Hairy Wild Rye	PI/Bracted Honeysuckle
Soil Texture	Fine loamy - clayey	Fine loamy	Silt loam to clay loam
Soil moisture	Moist	Dry	Wet



COMMON FOREST ASSOCIATIONS IN THE BOREAL MIXEDWOOD SUBREGION

Schematic A

Forest Association	Pj/Lichen	Pj-Sb/ Labrador Tea	Sb-Pj/ Labrador Tea	Treed Bog	Sb/Labrador Tea/ Horsetail
Soil Texture	Sandy to loamy sand	Clayey to loamy	Variable	Organic	Variable
Soil Moisture	Very dry	Moist	Moist	Wet	Moist



Schematic B

Forest Association	Pj-Aw/ Blueberry	Aw-Sw/Low Bush Cranberry	Pb - Aw/ Dogwood	Sw/ Horsetail
Soil Texture	Sandy - loamy sand	Loamy to clayey	Loamy to clayey	Peaty
Soil Moisture	Dry	Moist	Moist	Moist



Introduction

The identification guide includes only the most common insects and diseases that affect the forests of Alberta. It comprises the following identification keys:

Key 1: General	Key 5: Animal Damage
Key 2: General	Key 6: Disease
Key 3: Abiotic Injury	Key 7: Disease
Key 4: Abiotic Injury	Key 8: Insect Damage.

Each key is not intended to be exhaustive in pests and pest damages it can be used to identify. The key serves only as a beginner's guide to the identification of some common agents of forest change in Alberta.

Each identification key is based on information provided from the following source:

Finck, Kelly E., P. Humphreys and G. Hawkins. 1989. *Field Guide to Pests of Managed Forests in British Columbia*. Forestry Canada and B.C. Ministry of Forests, Victoria, B.C. Joint Publ. No. 16. 188p.

Glossary of Terms

Chlorotic:	yellowish foliage owing to lack of chlorophyll
Frass:	solid excrement and chewed debris from insects, especially larvae
Galleries:	wandering tunnels or cavities under bark or in wood, associated with bark beetles or wood borers
Pitch tube:	a lump of pitch accumulating on the outside of the bark of a conifer resulting from pitch flow caused by bark beetle attack
Resinosus:	an abnormal flow of pitch from a conifer usually in response to infection, insect activity or wounding

Using the Keys

There are various factors/agents that cause damage in forest stands and in wood products. These can be grouped into the following categories:

- disease
- abiotic injuries—primarily owing to climatic and soil factors
- animal damage
- insect damage.

When identifying the cause of damage in a forest stand we usually focus attention on the symptoms because they are visible. The first step is to use General Keys to determine which of the above agents of change are responsible.

Notice that each of the keys provides two choices, e.g.:

- a. whole tree affected
- b. part of the tree affects.

Read both choices before selecting the appropriate one.

The General Keys will direct you to one of the above agents of change (disease, abiotic injury, animal damage or insect damage). Some of the keys will identify a large group of pests; e.g., trunk rots or root rots. Since there are many species of these pests, they are significant in the changes they cause in a stand of trees. The key on animal damage is based on symptoms. Specific animals causing the damage are not identified as the key is intended to establish the type of damage observed. The insects and diseases included in these keys are representative of the most common organisms found in the forests of Alberta.

You will use the identification guide to identify:

- 4 living agents of change
- 4 nonliving agents of change.

KEY 1 – GENERAL 1

a. Whole tree affected

- b. Crown entirely or partially discoloured, bright yellow, brown or red or lacking foliage; trees may be broken, laying on ground or erect and lower stem buried in sediment; crown, if present, may not be deformed
- c. Widespread area affected, especially in low lying areas or in bands along slopes, near industrial sites, adjacent to streams or on lower slopes in mountainous terrain; trees in small clumps are uniformly affected

Key 4 Abiotic Injuries 2

- c. Trees affected randomly and to a varying extent
- d. Resinosis present on stem or at root collar

- e. Resinosis at root collar
- f. Resinosis, mycelia, fruiting bodies around root collar

Key 6 Disease 1

- f. Resinosis, galleries, frass around root collar, roots chewed

Key 8 Insect Damage

- e. Resinosis, swelling, cankers or fruiting bodies on main stem or branches

Key 6 Disease 1

- d. Bark removal from stems or roots

Key 5 Animal Damage

- b. Crown thin, chlorotic, poor growth, crown not generally deformed
 - g. Widespread area affected, impact on trees quite uniform, no evidence of disease, no industrial site nearby nor are trees on poor sites

Key 3 Abiotic Injuries 1

- g. Affected trees in patches or scattered individuals, standing dead and/or windthrown trees; trees affected to varying degrees

Key 6 Disease 1

a. Part of tree affected

- h. Foliage, leaders and/or branch tips affected

Key 2 General 2

- h. Main stem and/or branches affected

- a. Trees erect or windthrown in random manner, cankers, fruiting bodies, resinosis, brooms or swellings

Key 6 Disease 1

- i. No cankers, fruiting bodies, resinosis, brooms or swellings

- j. Splintered breakage of main stem, tops and/or branches, windthrown trees lying all in the same direction

Key 3 Abiotic Injuries 1

- j. Pitch, frass or cottony tufts present, branch or main stem gouting and /or breakage which may or may not be present

Key 8 Insect Damage

KEY 2 – GENERAL 2

a. Foliage affected

- a. Trees affected in widespread area, especially in low lying areas or in bands along slopes

Key 3 Abiotic Injuries 1

- b. Trees affected in large to small areas, generally to varying extent
 - c. Needles uniformly coloured or mottled small fruiting bodies or blisters present, main stems or branches may not be affected

Key 6 Disease 1

- c. Extensive defoliation or needles uniformly discoloured or mottled, generally from top of crown downward and from the tips inward, chewed or clipped needles, mined buds, exit holes, webbing, frass and/or insects present

Key 8 Insect Damage

a. Leaders and/or branch tips affected

- d. Bark removed or tips clipped off

Key 5 Animal Damage

- d. Bark not stripped, tips and/or buds not clipped
 - e. Tips may or may not curl, buds or needles mined, exit holes, frass, webbing or cottony tufts present

Key 8 Insect Damage

- e. Tips discoloured
 - f. Small dark fruiting bodies or white to orange blisters or cankers on bark

Key 6 Disease 1

- f. Buds mushy, in low lying areas or industrial site nearby

Key 3 Abiotic Injuries 1

KEY 3 – ABIOTIC INJURIES 1

(Injuries to Crown/Foliage or Tips)

- a. **Tree leaning, windthrown or laying on ground** **Key 4 Abiotic Injuries 2**
- a. **Tree erect**
 - a. Damage to main stem and/or branches **Key 4 Abiotic Injuries 2**
 - b. Damage to crown
 - Foliage discoloured or leaders and branch tips damaged
 - c. Tips of leaders, branches or branchlets affected (including buds). Damage most intense in depressions. Buds, new shoots, and needles brown in spring. Shoots and needles brown in the fall. Mushy buds, all species in a stand may be affected. **Frost Damage**
 - c. Foliage discoloration not restricted to the leader, branch or branchlet tips. No evidence of insects, animals or disease. No industrial site nearby, generally no noticeable discoloration/necrosis or deciduous and/or shrub layer. Crown is deep red-brown to brown **Frost Damage**
 - d. Damage in an elevational band along a slope **Red Belt Injury**
 - d. Damage does not extend in a band along a slope; needles, if any, lacking flecking
 - e. Crown is brown from top down and from new to old needles; needles may drop especially in late summer **Drought Damage**
 - e. Crown devoid of foliage or entire crown reddish brown, scorched appearance, evidence or burned bark. **Fire Damage**

KEY 4 – ABIOTIC INJURIES 2

(Injuries to Main Stem/Branches or Whole Tree)

- a. **Tree leaning, windthrown or broken; young to mature trees**
 - b. Trees windthrown or broken
 - c. Trees blown over, crown intact, root “mats” present, trees lie in one direction, branches and stem of adjacent trees may be scarred or splintered) **Wind Damage (Windthrow and/or Windsnap)**
 - c. Evidence of numerous broken trees aligned at right angles to the slope on steep middle and lower slopes; sharp demarcation between old and young trees, damaged area may be occupied by shrubs and forbs. **Avalanche Damage**
 - b. Young trees bent over or deformed, older trees with uneven and splintered breakage of tops and/or upper branches, cankers not evident **Snow or Ice Damage**
- a. Tree erect, damage to main stem and/or branches
 - d. Bark removal of main stem generally evident
 - e. Main stem severely debarked and deeply gouged, exposed wood splintered; evidence of logging or construction activities adjacent, may also be associated with adjacent windfall **Mechanical Damage**
 - e. Main stem may be debarked but no evidence of gouging, splintering on wood; evidence or burned branch ends and charcoal **Fire Damage**
 - d. Main stem not severely damaged
 - f. Branches and/or top not broken or splintered, cankers not evident **Snow and Ice Damage**
 - f. Branches and/or top not broken or splintered
 - g. Upper surface of branches have wounds or scars associated with green ragged crown, lesions may or may not be on main stem **Hail Damage**
 - g. Lesions on main stem, bark removed from lesion or lower stem buried
 - h. Elongated basal scars at ground level **Fire Scar**
 - h. Lower section of stem buried by sediment from adjacent stream. Level topography adjacent to a stream. Evidence of periodic deposition of overburden. **Flooding Damage**

KEY 5 – ANIMAL DAMAGE

- a. **Bark removed from roots, branches or stem** **Debarking**
- a. **Portions of stems, twigs or branches severed, cut or splintered**
 - b. A relatively clean cut on twig, branch or stem
 - c. Stems and/or branches severed, multiple tooth marks on wood, numerous chips on ground below damage **Cutting**
 - c. Single, smooth, oblique cut, lack of multiple tooth marks **Clipping**
 - b. Twigs or stem with a ragged, torn appearance **Browsing**



KEY 6 – DISEASE 1

Diseases of roots and those affecting more than one kind of tissue

- a. **Whole tree affected**
No cankers; scattered pockets of trees with thin chlorotic crowns with poor growth or standing dead, wind toppled trees in criss-cross pattern, trees of all ages affected **Root Rots**
- a. **Part of tree affected**
 - b. Part of crown affected
Crown red, dead top and/or branches, cankers on main stem and/or branches on pines only **Key 7 Disease 2**
 - b. Either foliage or stem and/or branches affected
Main stem and/or branches affected
 - c. Mature to overmature stand with conks visible on the main stem or at the base of the tree **Key 7 Disease 2**
 - c. Young to mature stand, stem lacks conks but may have flattened areas or swellings; brooms may occur in the crown
 - d. no pronounced swelling, necrotic areas consist of flattened or depressed tissue
 - d. Spindle to oval-shaped swellings present and/or deformation, necrotic areas raised
 - e. No brooms or aerial shoots **Key 7 Disease 2**
 - e. Brooms present
Minor needle discoloration, no blisters on needles, aerial shoots or basal cups on swollen areas of branches and brooms. Aerial shoots around in cross section, branch pattern whorled. **Lodgepole Pine Dwarf Mistletoe**

KEY 7 – DISEASE 2

Cankers, Rusts and Trunk Rots

- a. **Various types of fungal fruiting bodies (conks) visible on tree trunks or fruiting bodies on ground near base of tree**

Trunk Rots

- a. **Absence of conks or fruiting bodies on stem or near base of tree**
 - a. No noticeable swelling on stem, necrotic areas consist of flattened or depressed tissue, dead bark may have sloughed off stem
 - b. On Aspen, rough, flattened area, black cracked bark

Hypoxylon Canker

- c. On Lodgepole Pine, elongated sunken, perennial canker, usually on lower bole. Resinosis, branch flagging, blue-black stain in sapwood under the canker

Atropellis Canker

- b. Spindle to oval-shaped swellings present on pines, raised necrotic areas on main stem and/or branches. Noticeable blistering of bark, sometimes elongated scars. Fruiting structures are white, yellow or orange powdery blisters.

Pine Stem Rusts

KEY 8 INSECT DAMAGE

- a. **Entire crown affected**

- b. Coniferous hosts. Needles chewed to varying degrees, needle stubs may or may not remain on the tree

Defoliators (Sawflies or Budworms)

- b. Deciduous hosts

Defoliators (Tent Caterpillars, Leaf-Eating Beetles, Leaf Miners)

- a. **Leaders and branches, stems or roots affected**

- h. Main stems affected
 - i. Entire tree dying, crown yellow or reddish brown; boring dust around base of tree, tunnels on inside of bark

Bark Beetles

- i. Tree may be alive or dead; may have presence of sap flow from insect entrance holes; insect feeding penetrates deeply into wood

Wood Borers or Carpenter Ants

- h. Roots or root collar area affected. Pitch tubes at root collar. Resin-soaked duff near root collar. Trees up to 3 m tall are most susceptible, entire crown may be reddish.

Warren's Root Collar Weevil



Assessment Criteria and Conditions:

- identifying and describing:
 - major components of silviculture, including stand establishment, stand management and harvest
 - the silvics of five Alberta tree species.

Suggested Reference(s):

- *Our Growing Resource*
- *Woodlot Management Guide for the Prairie Provinces*
- *Native Trees of Canada*

STANDARD: Respond to a standard of 3 on the rating scale.

Rating Scale

The student:

- 4 meets project/task objectives in a self-directed manner. Provides explanations and critical judgements based on a superior knowledge base. Demonstrates an understanding of relevant concepts and related issues.
 - 3 meets project/task objectives in a self-directed manner. Provides explanations and comparisons of relevant concepts using more precise terminology. Requires little or no prompting.
 - 2 meets project/task objectives with limited assistance in planning and in selecting and using resources. Applies knowledge of concepts in different situations using correct terminology. Requires occasional prompting.
 - 1 completes task as directed, demonstrating basic skills/completeness by following a guided course of action. Uses simple recall to demonstrate basic knowledge of concepts. Requires prompting.
 - 0 does not complete the task, or is unable to provide a suitable response.
- N/A Not Applicable

Background Information

See *Our Growing Resource*, Chapter 2 – The Challenge of Sustainable Development:

- Managing Forest Development
- Integrated Resource Management – Accommodating Many Uses
- Harvest Planning and Practices
- Reforestation
- Air and Water Quality
- Building Sustainable Businesses.

See *Woodlot Management Guide for the Prairie Provinces*, Section IV– Woodlot Management:

- Management Planning
- Reforestation
- Stand Tending
- Harvest
- Fire Protection.

Sample Questions/Activities

1. **Provide a comprehensive definition of silviculture and its role in forestry.**
2. **Identify and explain major components of silvicultural systems, including:**
 - stand establishment
 - stand management
 - harvest and cutting methods.
3. **Explain how individual tree species have unique ecological requirements that determine suitable silvicultural practices.**
4. **Describe and compare the silvics of five or more Alberta tree species with respect to:**
 - growth characteristics
 - reproduction habitat requirements; e.g., soil, water, temperature.
5. **Describe one or more research programs designed to improve silvicultural practices; e.g.:**
 - biotechnology
 - application of information technology
 - cultural/operational applications.
6. **Develop a glossary of 20 or more terms relevant to silviculture.**

A. TREE NAME

1. Common: _____

2. Botanical: _____

B. GROWTH FORM

C. HABITAT REQUIREMENTS

1. Climate:

2. Soils and Topography:

3. Associated Trees and Shrubs:

DISTRIBUTION

(as outlined on a map of Canada)

D. LIFE HISTORY

1. Reproduction and Early Growth

(a) Flowering and Fruiting:

(b) Seedling Development:

(c) Vegetative Reproduction (if applicable):

2. Sapling to Maturity

(a) Growth and Yield:

(b) Reaction to Competition:

(c) Major Enemies:

GROWTH FORM
(as sketched or outlined)

TASK	OBSERVATION/RATING					
Management	4	3	2	1	0	N/A
Teamwork	4	3	2	1	0	N/A
Equipment and Materials	4	3	2	1	0	N/A
Investigative Techniques	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not Applicable

TASK CHECKLIST

The student:

Management

- prepares self for task
- organizes and works in an orderly manner
- interprets and carries out instructions accurately
- plans and uses time effectively in a logical sequence
- displays leadership in adhering to routine procedures
- attempts to solve problems prior to requesting help

Teamwork

- cooperates with group members
- shares work appropriately among group members
- negotiates with sensitivity solutions to problems
- displays effective communication skills

Equipment and Materials

- independently selects and uses equipment/materials
- demonstrates concern for safe procedures/techniques
- measures accurately and efficiently
- practises proper sanitation procedures
- minimizes waste of materials
- anticipates potential hazards and emergency response

Investigative Techniques

- uses relevant information to explain observations regarding natural regeneration; e.g.:
 - seed supply
 - vegetative reproduction
- uses relevant information to explain observations regarding artificial regeneration; e.g.:
 - direct seeding
 - bare-root/container seedlings
- makes predictions that can be tested regarding one or more methods of regeneration
- plans, sets up and conducts experiments to test a prediction
- analyzes relationships among manipulated/responding variables
- obtains accurate results that confirm/reject prediction and answers related questions
- summarizes, applies and evaluates observations and experimental outcomes; e.g.:
 - for species with wind-disseminated seed, assesses height and/or age of seedlings as a function of distance from edge of cutblock
 - for species with slash borne cones, assesses whether adequate seed is available per unit area
 - for direct seeding, is sufficient seed being broadcast to insure block stocking?
 - for bare root/container planting, are sufficient seedlings being planted to insure a fully stocked stand?

REFLECTIONS/COMMENTS:

TREE IMPROVEMENT

1. Explain major objectives of a tree improvement program.
2. Identify factors to consider in choosing a natural seed production area.
3. Cite advantages and disadvantages of clonal and seedling seed orchards.
4. Describe methods of increasing seed production in a seed production area.

CONE COLLECTION

1. Identify major factors influencing seed production in conifers.
2. Large cone crops in pine occur if climatic conditions are favourable. What stages of flower and cone development are the most critical? What kind of climatic conditions favour each of these stages?
3. Identify reasons for conducting a cone crop survey.
4. Describe methods of collecting cones from natural forest stands.
5. Seed testing is carried out for a number of parameters. Identify and explain three of them.
6. Identify and explain one physical test conducted to determine the viability of seed.

SITE PREPARATION

1. Provide reasons for ensuring adequate site preparation.
2. Describe mechanical methods of site preparation.
3. Explain advantages of a brush rake over an angled dozer blade in scarification operations.
4. Identify two functions of a drag type scarifier.
5. Identify types of mechanical scarification equipment that are commonly used in addition to those listed above.

SEEDING

1. Identify factors that determine the timing of a successful direct seeding operation.
2. What is the recommended time of year for carrying out a conifer seeding operation in Alberta? Give reasons for conducting conifer seeding operations at this time.
3. Seeding operations in Alberta have at times failed. Identify factors that may influence the success rate of seeding operations.
4. Identify biological advantages of spot seeding over broadcast seeding.

CONTAINER PLANTING

1. Explain requirements of a successful container system.
2. Describe desirable physical characteristics of container seedlings.
3. Explain advantages of growing seedlings in containers rather than as bare root stock in a nursery.
4. One of the critical elements in survival of a tree seedling is to maintain a favourable water balance. What is meant by the water balance? How can a tree seedling maintain a favourable water balance?

INTERMEDIATE STAND TREATMENTS

1. Define and give examples of intermediate stand treatments.
2. What is the major objective of release cutting? Identify the predominant growth stage(s) for trees that are released.
3. Describe methods of undertaking a liberation cut in a stand. Identify advantages and disadvantages of each method.

PRUNING

1. Identify and explain three stages of natural pruning. Briefly describe factors that may affect each stage.
2. Identify and describe three objectives of artificial pruning.
3. Explain potential hazards that may result from the excessive pruning of spruce trees.
4. What minimum live crown ratio should be attained when pruning?
5. Cite reasons for pruning conifers in the late winter or early spring.

PRUNING (continued)

6. Why is it important when pruning large diameter limbs (i.e., over 4 cm in diameter) that the initial cut be made 10 to 15 cm away from the bole of the tree?
7. Explain why hand pruning saws have curved blades and teeth pointing back toward the handle.
8. Why is it important when pruning to make a clean cut that is flush with the bole?

FERTILIZATION

1. Explain the process of organic matter decomposition on the forest floor.
2. Identify and explain important principles of fertilizer application.
3. Explain ways in which wood quality in a forest stand is altered as a result of fertilizer application.
4. Why should fertilizer high in phosphorous be used at the time of planting?
5. One example of a mixed fertilizer is 10-52-10. Explain what these numbers mean? What purpose would this fertilizer be most suited to?
6. Suggest fertilizers appropriate to three different stages of forest growth.
e.g., seedling establishment
after crown closure
10 to 15 years before harvest

SITE PREPARATION	
<i>The student:</i>	
<input type="checkbox"/>	lists six or more objectives of site preparation
<input type="checkbox"/>	explains techniques and applications of mechanical site preparation; e.g.: <ul style="list-style-type: none"> <input type="checkbox"/> scalping <input type="checkbox"/> trenching <input type="checkbox"/> plowing mixing <input type="checkbox"/> mounding
<input type="checkbox"/>	identifies and describes common types of equipment used in mechanical site preparation; e.g.: <ul style="list-style-type: none"> <input type="checkbox"/> blade <input type="checkbox"/> plow <input type="checkbox"/> drag scarifier <input type="checkbox"/> disc trencher <input type="checkbox"/> spot scarifier <input type="checkbox"/> moulder/inverter
<input type="checkbox"/>	demonstrates techniques and applications of manual and motor manual site preparation
<input type="checkbox"/>	explains applications of fire and herbicides in site preparation
<input type="checkbox"/>	identifies geographic areas not suited to site preparation and explains why
<input type="checkbox"/>	assesses three or more site preparation methods relative to site location

CONE COLLECTION AND SEED EXTRACTION	
<i>The student:</i>	
<input type="checkbox"/>	identifies and describes common methods of cone collection; e.g.: <ul style="list-style-type: none"> <input type="checkbox"/> squirrel caches <input type="checkbox"/> felling and picking <input type="checkbox"/> aerial collection
<input type="checkbox"/>	identifies appropriate equipment and safe techniques for one or more methods of cone collection
<input type="checkbox"/>	describes handling, tagging and temporary storage procedures for collected cones
<input type="checkbox"/>	demonstrates seed extraction and seed cleaning techniques
<input type="checkbox"/>	conducts one or more seed tests; e.g.: <ul style="list-style-type: none"> <input type="checkbox"/> purity <input type="checkbox"/> weight <input type="checkbox"/> germination <input type="checkbox"/> moisture content <input type="checkbox"/> viability
<input type="checkbox"/>	describes methods of seed storage
<input type="checkbox"/>	

DIRECT SEEDING	
<i>The student:</i>	
<input type="checkbox"/>	describes characteristics of a favourable seed bed; e.g.: <ul style="list-style-type: none"> <input type="checkbox"/> physical nature of the forest floor <input type="checkbox"/> kind and amount of vegetation
<input type="checkbox"/>	describes techniques and applications of direct seeding; e.g.: <ul style="list-style-type: none"> <input type="checkbox"/> broadcast seeding <input type="checkbox"/> spot seeding
<input type="checkbox"/>	identifies and describes common types of equipment used in direct seeding
<input type="checkbox"/>	outlines steps that can be taken to enhance success with direct seeding; e.g.: <ul style="list-style-type: none"> <input type="checkbox"/> timing the seeding operation <input type="checkbox"/> preparing the seed bed <input type="checkbox"/> managing seed quality and quantity <input type="checkbox"/> controlling seed predators
<input type="checkbox"/>	
<input type="checkbox"/>	

PLANTING STOCK

The student:

- demonstrates correct techniques for the care and handling of bare root and container stock; e.g.:
 - physical handling
 - temperature control
 - moisture/humidity control
- demonstrates three or more hand-planting methods; e.g.:
 - L-slit method
 - mattock method
 - planting bar method
 - wedge method
- identifies and describes common hand-planting tools and equipment; e.g.:
 - planting spade
 - dibble
 - planting bar
 - pottiputki
 - mattock
- demonstrates correct planting technique; e.g.:
 - cleans out planting spot before making hole
 - keeps roots of planting stock moist at all times, taking plants out of planting bag one at a time
 - makes hole large and deep enough to ensure proper placement of roots
 - plants firmly in ground to correct depth and within 30% of vertical
 - closes hole from bottom to top, packing soil firmly against roots to prevent air pockets
 - performs final check by gently tugging on plant

SPACING AND THINNING

The student:

- identifies optimum spacing and stocking rates for one or more species of seedlings
- describes generally accepted rules of thumb for scheduling spacing and thinning treatments of crop trees
- describes applications of three or more thinning treatments; e.g.:
 - juvenile spacing
 - sanitation spacing
 - conifer release
 - commercial thinning
- establishes criteria for identifying trees to keep and trees to cut in a forest stand
- inspects crop trees for damage, e.g.:
 - broken stems
 - saw nicks
 - broken leaders
 - stripped limbs
- selects dominant and codominant trees to be saved as crop trees in a forest stand
- describes two or more thinning treatments; e.g.:
 - cutting with brush saws/chain saws
 - girdling
 - hand pulling
 - use of herbicides
-

PRUNING AND SANITATION

The student:

- identifies reasons for artificial pruning
- describes factors that determine the timing of pruning operations
- identifies criteria for selecting crop trees to be pruned; e.g.:
 - species characteristics
 - growth rate
 - number, size and age of trees
- demonstrates correct pruning technique; e.g.:
 - live crown ratio greater than 40%
 - proper pruning height
 - branch cuts flush with bole
- identifies and describes common pruning tools and equipment; e.g.:
 - hand and pole saws
 - axes, brushhooks and hatchets
 - chisels and pulling knives
 - machines
- inspects residuals in a forest stand for:
 - signs of damage
 - quality of stems
- verifies that slash in a forest stand is bucked to lay flat on the ground
-
-

STANDARD IS 2 IN EACH APPLICABLE TASK

Rating Scale

The student:

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not Applicable

REFLECTIONS/COMMENTS

TASK	OBSERVATION/RATING					
Preparation and Planning	4	3	2	1	0	N/A
Information Gathering and Processing	4	3	2	1	0	N/A
Content	4	3	2	1	0	N/A
Collaboration and Teamwork	4	3	2	1	0	N/A
Information Sharing	4	3	2	1	0	N/A

STANDARD IS 3 IN EACH APPLICABLE TASK

Rating Scale

The student:

- 4 exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.
- 3 meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.
- 2 meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.
- 1 meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.
- 0 has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

N/A Not Applicable

Assessment Tools

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TASK CHECKLIST

The student:

Preparation and Planning

- sets clear goals and establishes steps to achieve them
- creates and adheres to detailed timelines
- uses personal initiative to formulate questions and find answers
- plans and uses time effectively, prioritizing tasks on a consistent basis

Information Gathering and Processing

- accesses a range of relevant information sources and recognizes when additional information is required
- demonstrates resourcefulness in collecting data
- interprets, organizes and combines information in creative and thoughtful ways
- records information accurately with appropriate supporting detail and using correct technical terms
- recognizes underlying bias/assumptions/values in information sources
- assesses and refines approach to the task and project status based on feedback and reflection

Content

- explains factors relevant to choosing a suitable method of harvest:
 - silvics of tree species
 - intended utilization
 - impact on wildlife and watershed
 - impact on other stakeholder groups
- provides a descriptive account and explains advantages/disadvantages of the:
 - clearcutting system of harvest
 - seed tree system of harvest

Content (continued)

- shelterwood system of harvest
- selection system of harvest
- makes recommendations (based on silvics) regarding an appropriate harvest method for each of seven Alberta tree species
- identifies social, economic and environmental factors that may influence harvest methods
- explains modifications to harvest systems that accommodate local site conditions and management objectives; e.g.:
 - clearcutting with reserves
 - forest ecosystem networks
 - single-tree selection

Collaboration and Teamwork

- cooperates with group members
- shares work appropriately among group members
- negotiates with sensitivity solutions to problems
- displays effective communication and leadership skills

Information Sharing

- demonstrates effective use of a variety of communication media; e.g., *written, oral, audio-visual*
- communicates thoughts/feelings/ideas clearly to justify or challenge a position
- maintains acceptable grammatical and technical standards
- gives evidence of adequate information gathering by citing seven or more relevant information sources

REFLECTIONS/COMMENTS:

Assessment Criteria and Conditions:

- definitions and Alberta examples of sustainable development, sustained yield, integrated land use and multiple use management.

Suggested Reference(s):

- *Our Growing Resource*
- *Alberta’s Focus on Forests*
- *Managing the Forest*

STANDARD: Respond to a standard of 3 on the rating scale.

Rating Scale

The student:

- 4 meets project/task objectives in a self-directed manner. Provides explanations and critical judgements based on a superior knowledge base. Demonstrates an understanding of relevant concepts and related issues.
 - 3 meets project/task objectives in a self-directed manner. Provides explanations and comparisons of relevant concepts using more precise terminology. Requires little or no prompting.
 - 2 meets project/task objectives with limited assistance in planning and in selecting and using resources. Applies knowledge of concepts in different situations using correct terminology. Requires occasional prompting.
 - 1 completes task as directed, demonstrating basic skills/completeness by following a guided course of action. Uses simple recall to demonstrate basic knowledge of concepts. Requires prompting.
 - 0 does not complete the task, or is unable to provide a suitable response.
- N/A Not Applicable

Background Information	Sample Questions/Activities
<p>See <i>Our Growing Resource</i>, Chapter 2 – The Challenge of Sustainable Development:</p> <ul style="list-style-type: none"> • Managing Forest Development • Integrated Resource Management – Accommodating Many Uses • Harvest Planning and Practices • Reforestation • Air and Water Quality • Building Sustainable Businesses. <p>See <i>Alberta’s Focus on Forests</i>, Unit 5 – Forest Management for All:</p> <ul style="list-style-type: none"> • 5.1: Forest Values • 5.2: Decision for Change • 5.3: Forest Perspectives • 5.4: Reforestation: Forests or Tree Farms? • 5.5: Integrated Resource Management. 	<ol style="list-style-type: none"> 1. Explain the goals of “sustainable development” and “sustainable yield” within the context of Alberta’s forests. 2. Interpret and discuss the meaning of the following definition of sustainable forest management: <i>“the development of forests to meet current needs without prejudice to their future productivity, ecological diversity, or capacity for regeneration.”</i> 3. Identify and explain major components/considerations relevant to sustainable forest management; e.g.: <ul style="list-style-type: none"> – timber resources – biodiversity of wildlife – air, land and water quality. 4. Explain why forests can and should serve many purposes. 5. Compare principles of integrated land use with principles of multiple use management by citing examples of each within Alberta. 6. Explain strategies for consultation and public involvement in forest management decisions in Alberta.

MANAGEMENT OUTCOMES

The student:

- identifies short- and long-term management goals for the area based on single use of the forest (e.g., recreation)
- justifies management goals as the preferred alternative for the area
- proposes a management plan for the area consistent with management goals that includes:
 - a statement of government policies and guidelines
 - a schedule of management activities
 - a process for public involvement
 - a strategy for monitoring use and resolving potential conflicts
- presents the management plan to class/peers in a logical sequence, supporting points with sound evidence
- identifies significant features of management plans presented by class/peers for the same area based on other types of forest use (e.g., wildlife habitat, wood fibre)
- negotiates with class/peers a set of compromised management goals and strategies for the area that support integrated land use (e.g., lumber, recreation, wildlife, gas, grazing) based on social, economic and environmental factors
- presents an integrated management plan for the forested area consistent with compromised management goals and strategies that attempts to address:
 - the views of relevant stakeholder groups
 - short- and long-term goals and objectives
 - proposed management standards and guidelines
 - a process for public involvement
 - a strategy for monitoring use and resolving potential conflicts.

PLANNING PROCESSES

Planning and Preparation

- sets goals and establishes steps to achieve them
- creates and adheres to useful timelines
- uses personal initiative to formulate questions and find answers
- plans and uses time effectively

Information Gathering and Processing

- accesses a variety of relevant information sources
- interprets, organizes and combines information in effective ways
- uses appropriate methods to calculate data and obtain accurate results

Collaboration and Teamwork

- cooperates with and shares work appropriately among team members
- shares information/opinions/suggestions, maintaining a balance between speaking and listening
- considers the ideas and suggestions of others, and when appropriate integrates new ideas into personal frame of reference

Negotiating and Debating

- explains positions adopted by presenting examples of possible consequences and implications
- presents a realistic plan in logical sequence supporting positions adopted
- provides a relevant and convincing rebuttal to opposing views
- negotiates solutions to problems and shared agreements by resolving divergent points of view

RATING SCALE

4	3	2	1	0
Exceeds defined outcomes. Plans and solves problems effectively and creatively in a self-directed manner. Tools, materials and/or processes are selected and used efficiently, effectively and with confidence.	Meets defined outcomes. Plans and solves problems in a self-directed manner. Tools, materials and/or processes are selected and used efficiently and effectively.	Meets defined outcomes. Plans and solves problems with limited assistance. Tools, materials and/or processes are selected and used appropriately.	Meets defined outcomes. Follows a guided plan of action. A limited range of tools, materials and/or processes are used appropriately.	Has not completed defined outcomes. Tools, materials and/or processes are used inappropriately.

STANDARD IS 2 IN MANAGEMENT OUTCOMES AND PLANNING PROCESSES

