CANADIAN TECHNOLOGY STANDARDS

RENEWABLE RESOURCES – TECHNOLOGIST (RRTY 2021)

Preamble

The Canadian Technology Standards (CTS) are a collection of learning outcomes for Canada's engineering technology and applied science profession at the technician and technologist level.

Stakeholders

The CTS may be utilized by accreditation bodies, provincial professional associations, educational institutions, government agencies, industry and others for the purposes accreditation, certification and other applications.

Educational Programs

The Renewable Resources CTS is relevant to programs including, but not limited to, forestry, hydrology, recreation, fish and wildlife, ecosystem management, and land management at the at the technologist level.

Learning Outcomes

This CTS list Discipline Learning Outcomes (DLO) which describe the significant and essential learning that students have achieved and can reliably demonstrate at the time of graduation. Each DLO has a number of Learning Outcome Indicators (LOI), which are examples illustrating, defining and clarifying the level of performance expected. The list of LOI is not comprehensive and there may be other indicators which can be used to assess achievement of learning outcomes.

Graduate Capability

Students graduating from an accredited program have demonstrated achievement of all general learning outcomes, including a prescribed level of math, and discipline learning outcomes selected by the program.

Having completed a program that is based on applied mathematics and scientific and engineering theory, principles and practices and having acquired the knowledge, skills and attitudes to function in the work place, graduates are;

- able to evaluate assignments, establish objectives, set parameters and determine appropriate procedures and actions.
- able to exercise due diligence in the workplace and adhere to related practices, applicable laws and health and safety practices.
- able to work in accordance with labor-management principles and practices.
- able to work independently or interdependently as part of a discipline or multi-disciplinary team.
- prepared to assume responsibility for their work.

Graduate Career Opportunities

Graduates of Renewable Resources Technology - Technologist programs have career opportunities in such areas as: business, industry, construction, government, and public organizations. They may find employment in renewable resources management careers such as: planning; operations; design of programs, processes, infrastructure, or systems; maintenance of equipment or systems; interpretation or preparation of specifications, or instructions; project management; administration; field and customer service; supervision of projects; and training activities.

Discipline Learning Outcomes (DLOs)

RRTY01   Forest Measurements
➤ Design, prepare, and implement standard field measurements and sampling procedures to collect data for analysis and reporting using standard statistical principles.

Learning Outcome Indicators include:
1.1   Employ air photos for navigation, identifying photo tie points, and recognizing key features.
1.2   Employ forest mensuration equipment accurately and efficiently.
1.3   Interpret common survey and sampling methods.
1.4   Interpret characteristics of sample.
1.5   Analyze results of samples using basic statistical processes for analyzing the results of a sample.
1.6   Discuss role measurements and related principles in context of sustainable resource management.
1.7   Plan and carry out standard survey measurements and sampling procedures.
1.7.1 Identify statistical and practical significance of CV, SD, SE, and confidence limits.
1.7.2 Perform as resource assistant.
1.7.3 Conduct cruises and inventory surveys utilizing statistical methods and sampling procedures.
1.7.4 Prepare maps from field data.
1.7.6 Identify and apply appropriate estimation techniques in forest measurements.
1.7.7 Determine tree and stand volumes and log volumes and values.
1.7.8 Perform plot, point, line transect, and distance methods of sampling.
1.7.9 Interpret and compute data from plot, point, line transect, and distance methods of sampling.
1.7.10 Design valid sampling plan utilizing structured approach.

RRTY02   Forest Operations
➤ Contribute to preparation, implementation, and supervision of stand and operational plans such as forest road construction and management, cut block planning, harvesting, and timber transportation to meet planning objectives and strategies.

Learning Outcome Indicators include:
2.1   Identify and describe different types of harvesting and transportation systems.
2.2   Identify effects of forest management practices on ecosystem processes and components.
2.3   Identify potential environmental impacts of forest management activities.
2.4   Identify protection measures for natural drainage courses, wildlife habitats, and preservation areas.
2.5   Identify and apply principles of sustainable development in practice of forestry.

2.6 Demonstrate knowledge of proper road construction, maintenance, and deactivation techniques.

2.7 Collect data for forest road and harvest permits.

2.8 Recommend and implement appropriate operational activities to meet planning objectives and strategies.

2.8.1 Interpret issues related to implementation of operational level field plans to meet defined strategies.

2.8.2 Evaluate site data and recommend harvesting systems.

2.8.3 Interpret design of appropriate transportation systems based on selected harvesting system.

2.8.4 Develop logging plans compatible with technical, environmental, and economic constraints.

2.8.5 Create strategies for road maintenance and deactivation.

2.8.6 Design and survey for appropriate drainage structures.

2.8.7 Recommend measures to protect stands from fire, insects, or disease, and to preserve other resource values.

2.8.8 Assess characteristics of soils and surficial materials that affect forest operations.

2.8.9 Conduct watershed assessments, including field procedures, data collection, scoring, and mapping.

2.8.10 Create layers and reports relevant to forestry operational activities utilizing basic GPS tools such as buffer, clip and intersect.

2.8.11 Create work schedules for different job operations and project phases using planning and scheduling software.

RRTY03 Forest Protection

➢ Assess and identify forest health hazards and risks and recommend appropriate stand management strategies and activities to reduce risk from losses due to damaging agents such as fire, fuel, pests and disease.

Learning Outcome Indicators include:

3.1 Identify and report fuel management concerns and hazards.

3.2 Discuss importance of insect and disease issues.

3.3 Identify common stand level signs and symptoms and probable agents for the damages.

3.4 Contribute to implementation, and supervision of hazard assessments, hazard analysis, and hazard abatement.

3.5 Specify and utilize appropriate firefighting equipment.

3.6 Discuss potential for fire management in relation to silviculture, wildlife habitat, ecosystem restoration, pest reduction, hazard reduction, and risk management.

3.7 Recommend or implement appropriate protection management strategies and activities.

3.7.1 Identify specific pest organisms and damage agents to host species.

3.7.2 Conduct prescribed pest detection surveys following standard procedures.

3.7.3 Determine incidence, intensity, and extent of pest problems applying sampling

methods.

3.7.4 Analyze and identify factors influencing fire behaviour characteristics.

3.7.5 Make recommendations for management strategies based on fuel assessments.

3.7.6 Plan, direct, and construct fire control lines including fire crew organization, supervision, and safety on small fires.

RRTY04   Silviculture

➢ Create plans and reports for artificial and natural stand establishment based on evaluation of relevant collected data.

Learning Outcome Indicators include:

4.1   Illustrate methods of achieving regeneration.

4.2   Interpret silvicultural systems.

4.3   Identify main tree species in region or area.

4.4   Compare range, habitat, and phonological differences of species in region or area.

4.5   Appraise relative commercial value of species in region or area.

4.6   Interpret characteristics and use of productivity classification or indexing systems such as site index.

4.7   Identify stages and regulatory factors of plant growth and development.

4.8   Outline stand tending prescriptions such as vegetation management, juvenile spacing, commercial thinning, pruning, and fertilization.

4.9   Recommend actions, and implement basic silvicultural activities, based on collected site information.

4.9.1 Implement appropriate methods of achieving regeneration.

4.9.2 Evaluate relative commercial value of each species in given stands.

4.9.3 Determine site indices and site class given appropriate age-height data and/or curves for dominant and co-dominant trees.

4.9.4 Specify appropriate planting methods for given sites and conditions.

4.9.5 Specify procedures to follow and consideration to take when preparing sites for planting.

4.9.6 Identify seedling characteristics, initial growth rates, survival rates, tolerances, and/or preferred growth conditions for use in developing regeneration plans.

4.9.7 Recommend tree species appropriate to given sites.

4.9.8 Perform all phases of silviculture survey and make appropriate recommendations.

4.9.9 Recommend appropriate stand tending prescriptions including vegetation management, juvenile spacing, commercial thinning, pruning, and fertilization.

4.9.10 Determine appropriate use of silviculture system.

4.9.11 Collect data for pre-harvest silviculture planning.

4.9.12 Estimate site quality by assessing stand characteristics such as density and growth rate.

4.9.13 Estimate site productivity by assessing habitat characteristics such as precipitation and soil properties; and

4.9.14 Identify types and symptoms of plant reactions to environmental stresses.

RRTY05   Resource Planning and Management
➢ Interpret legislative directives that define resource values and assist in development and evaluation of land or resource use plans.

Learning Outcome Indicators include:
5.1   Evaluate plans for existing land use against legislative directives that define resource values on specific site.
5.2   Apply six CCFM criteria for sustainable development such as: conservation of biological diversity; maintenance and enhancement of forest ecosystem condition and productivity; conservation of soil and water resources; forest ecosystem contributions to global ecological cycles; multiple benefits of forests to society; and accepting society's responsibility for sustainable development.
5.3   Implement, prepare, and manage biodiversity and sustainable development plans.
5.4   Implement, prepare, and manage survey or monitoring activities to assess soil and water quality and quantity.
5.5   Implement stand management practices.

RRTY06   Ecological Systems
➢ Classify ecosystems and assist in development and evaluation of ecosystem restoration plans, interpreting legislated directives for land use priorities in sensitive areas.

Learning Outcome Indicators include:
6.1   Interpret legislated directives for land use priorities in sensitive areas such as riparian ecosystems, sensitive soils and terrain, and critical wildlife habitat and recommend techniques to minimize human impacts on these values.
6.2   Classify ecosystems and understand different levels of complexity and interrelationships between organisms in ecosystems.
6.3   Assess vegetation succession status, forest stand structure and dynamics, and landscape features.
6.4   Prepare ecosystem restoration plans for impacts such as wild land fire, entomology, and human use.

RRTY07   Geographic Information Systems
➢ Evaluate, interpret, and access digital geospatial data using modern software and hardware tools.

Learning Outcome Indicators include:
7.1   Interpret and evaluate geospatial data from a variety of traditional media types such as maps, plans, air photos, and satellite images.
7.2   Interpret and evaluate digital geospatial data using modern software and hardware tools.

7.3   Perform queries on digital geospatial data based on resource management constraints.
7.4   Create hard copy mapping products using a variety of software and hardware combinations.
7.5   Present analytical results in a public setting and explain the capability and limitations of geospatial analysis.
7.6   Demonstrate ability to use data and tools in ethical way.
7.7   Manage data and files systematically and in organized hierarchical file structure.

RRTY08   Wildlife Resources Management

➢ Create plans and reports based on the collection, analysis, and evaluation of relevant wildlife resources data, and monitor for wildlife resource management.

Learning Outcome Indicators include:
8.1   Recommend wildlife management practices to conserve, protect, and enhance wildlife resources and their habitats.
8.2   Identify common wildlife species and prescribe management strategies for each species or group.
8.3   Assess wildlife and effect of management strategies based on supervised surveys and monitoring activities and compile and interpret data collected from these surveys.
8.4   Evaluate wildlife habitat for quality, carrying capacity, population dynamics, and application to wildlife populations.

RRTY09   Fisheries/Aquatic Environmental Management

➢ Prepare plans and reports and monitor for fisheries or aquatic resources based on the collection, evaluation and analysis of relevant fisheries or aquatic environmental management data.

Learning Outcome Indicators include:
9.1   Recommend management practices to conserve, protect, and enhance fishery resources and their habitats.
9.2   Identify common fish species and prescribe management strategies for each species or group.
9.3   Assess aquatic life and effect of management strategies from supervised surveys and monitoring activities and compile and interpret data from these surveys.
9.4   Evaluate habitat quality and carrying capacity, population dynamics, and applications to fisheries populations.

RRTY10   Range Management

➢ Collaborate in planning and directing of range utilization, consistent with other uses and conserving natural resources.

Learning Outcome Indicators include:
10.1   Identify plants important to range plant communities.
10.2   Collect data specific to and required for range management.
10.3   Evaluate condition of range resources on the forest land base.
10.4   Create range use plan.
10.5   Create range tenure system for public land use.

RRTY11   Park Management and Safety

➢ Collaborate in preparation, planning, and implementation of management and operational plans such as preservation and maintenance of recreational values and preservation of natural and unique ecosystems, species, and features, including cultural heritage within protected area designation.

Learning Outcome Indicators include:
11.1   Interpret legislated directives for land use priorities in areas designated for park use.
11.2   Assess impact of visitor management and impact strategies from supervised surveys and monitoring activities and compile and interpret data from these surveys.
11.3   Prepare, implement, and manage hazard assessments, hazard analysis, and hazard abatement, including appropriate search and rescue strategies.
11.4   Organize hazard assessment surveys for issues, such as: wildlife encounters; weather severity; and fuel conditions related to wildfire risk.
11.5   Recommend recreational land management practices in areas of site management, operational plans, visual management, and visitor management.
11.6   Evaluate public notices and carry out evacuation plans.
11.7   Evaluate ecosystems and design public access facilities to minimize impact.
11.8   Evaluate impacts on parks and generate mitigation and restoration plans.
11.9   Recommend mitigation and restoration plans.

RRTY12   Recreational Land Management

➢ Collaborate in development of planning and management through environmental evaluation of natural environment including preservation and maintenance of recreational values and the preservation of natural and unique ecosystems, species, features, and cultural heritage.

Learning Outcome Indicators include:
12.1   Evaluate existing land use plans against legislative directives that define recreational forest values on specific site.
12.2   Assess impact of visitor management strategies from supervised surveys and monitoring activities and compile and interpret data from these surveys.

12.3   Prepare, implement, and supervise hazard assessments, hazard analysis, and hazard abatement such as examining potential avalanche hazards and search and rescue strategies.
12.4   Recommend recreational land management practices such as site management, operational plans, visual management, and visitor management.
12.5   Create, implement, and supervise hazard assessment activities.

RRTY13   Aboriginal Resource Management
➢   Evaluate and, analyze collected relevant data to incorporate native cultural values with land management practices by describing Aboriginal title, sovereignty, First Nations governance, and treaty processes. Collect, analyze, and, evaluate relevant data for traditional use study.

Learning Outcome Indicators include:
13.1   Interpret Aboriginal title, treaty history and processes, sovereignty, and First Nations governance.
13.2   Formulate collected knowledge/data base of traditional values of Aboriginal communities, and examine social implications of acquisition and use of data gathered during traditional land use studies.
13.3   Create terms of reference documents for traditional land use studies.
13.4   Interpret culturally modified sites and landmarks.
13.5   Classify ethno-botany and traditional uses of regional flora and fauna.
13.6   Design and apply new methods of managing ecosystem from Aboriginal perspective.

RRTY14   Environmental Law
➢   Interpret and evaluate Canadian Environmental Law and policy for defined jurisdictions.

Learning Outcome Indicators include:
14.1   Interpret and evaluate existing Canadian environmental law and policy, which can include forestry law and natural resources laws for defined jurisdictions.
14.2   Conduct enforcement of acts such as Fisheries Act and authorizations connected with act.
14.2.1   Conduct environmental assessments and reviews of projects and appeals, both through Judicial Review and through Environmental Appeal Board.
14.3   Identify relevant concepts of constitutional jurisdiction, administrative law, and evolving role of First Nations.
14.4   Evaluate interface between respective visions for resource management held by industry, public, and interest groups including: environmental standards and framework within which local industry must operate; Aboriginal claims and effect they would have on industrial operations; legal framework within, which government weighs competing interests of wildlife, public heritage, environment,

and industry; challenges to tenure issued by government, administrative enforcement, and appeal mechanisms under various Resource Acts and Regulations.

RRTY15   Forest Hydrology

➢ Design, prepare, and conduct measurements and sampling procedures to collect hydrological data for analysis and reporting.

Learning Outcome Indicators include:

15.1   Apply knowledge of hydrologic and hydraulic principles.

15.2   Interpret terrain and groundwater features using air photos and maps.

15.3   Analyze stream channels and drainage structures documenting stream hydrology, channel morphology, sediment transport capability, mass wasting processes, and impacts and methods to minimize wasting.

15.4   Classify stream sediment load and calculate movement rates and sediment discharge.

15.5   Analyze precipitation records to determine probable maximum precipitation events, frequency, and relationships between frequency, intensity, and duration.

15.6   Determine watershed boundaries and characteristics, drainage patterns, catchments area boundaries, and natural flow.

15.6.1 Calculate design peak flows and estimate peak flows by flood routing techniques.

15.6.2   Detect flood plains and recommend methods for flood damage mitigation.

Additional Notes:

Forest hydrology combines aspects of two separate disciplines: hydrology and forestry.

Hydrology is the science that studies the waters of Earth. Hydrology seeks to understand where water occurs, how water circulates, how and why water distribution changes over time, the chemical and physical properties of water, and the relation of water to living organisms.

Forestry is the science that seeks to understand the nature of forests and the interactions between the parts comprising a forest. In recent decades, forestry has adopted more of an ecosystem management approach while still including timber production as an important goal. Although a forest is an ecosystem dominated by trees, a healthy forest includes other plants as well as soil, terrestrial, and aquatic animals, and water—plus people who use the forest and its resources. Modern forest management therefore requires not only an understanding of forest science, soil science, and hydrology, but also principles of wildlife biology, land-use planning, and recreation planning.