Return Bids to :
Retourner Les Soumissions à :

Natural Resources Canada/
Ressources Naturelles Canada

Bid Receiving/Réception des soumissions
See herein for bid submission instructions/
Voir ici pour les instructions de soumission des offres

Request for Standing Offer
Demande d'offre à commandes

Canada, as represented by the Minister of Natural Resources Canada, hereby requests a Standing Offer on behalf of the client identified herein.

Le Canada, représenté par le ministre des Ressources naturelles Canada, autorise par la présente, une offre à commandes au nom de client identifié ci-après

Comments – Commentaires

Issuing Office – Bureau de distribution

Finance and Procurement Branch/
Services liés aux finances et à l'approvisionnement
Natural Resources Canada/
Ressources Naturelles Canada
580 rue Booth Street
Ottawa, ON K1A 0E4

Title – Sujet
Writing of Pest Fact Sheets for NRCan's Trees, Insects, and Diseases of Canada's Forests Database

Solicitation No. – No de l'invitation	Date
NRCan-5000057817	April 3, 2023

Client Reference No. - Nº de reference du client
163000

Requisition Reference No. - Nº de la demande
500057817

Solicitation Closes – L'invitation prend fin
at – à 02:00 PM EDT
on – le May 4, 2023

Address Enquiries to: - Adresse toutes questions à:	Buyer ID – Id de l'acheteur
Andrea Berthelet at : andrea.berthelet@nrcan-rncan.gc.ca	A97
Telephone No. – No de telephone	**Fax No. – No. de Fax**
343-543-7092	

Security – Sécurité
There is no security requirement applicable to the Standing Offer

Destination – of Goods, Services and Construction:
Destination – des biens, services et construction:

Ressources Naturelles Canada/
Natural Resources Canada
580 rue Booth Street
Ottawa, ON K1A 0E4

Vendor/Firm Name and Address
Raison sociale et adresse du fournisseur/de l'entrepreneur

Telephone No.:- No. de téléphone:_____
Facsimile No.: - No. de télécopieur:_____
Email : - Courriel : _____

Name and Title of person authorized to sign on behalf of Vendor/Firm (type or print)
Nom et titre de la personne autorisée à signer au nom du fournisseur/de l'entrepreneur (taper ou écrire en caractères d'imprimerie)

_____ _____
Signature **Date**

TABLE OF CONTENTS

PART 1 - GENERAL INFORMATION

1.1 Introduction

The Request for Standing Offers (RFSO) is divided into seven parts plus attachments and annexes, as follows:

Part 1	General Information: provides a general description of the requirement;
Part 2	Offeror Instructions: provides the instructions applicable to the clauses and conditions of the RFSO;
Part 3	Offer Preparation Instructions: provides Offerors with instructions on how to prepare their offer to address the evaluation criteria specified;
Part 4	Evaluation Procedures and Basis of Selection: indicates how the evaluation will be conducted, the evaluation criteria which must be addressed in the offer, and the basis of selection;
Part 5	Certifications and Additional Information: includes the certifications and additional information to be provided;
Part 6	Security, Financial and Insurance Requirements: includes specific requirements that must be addressed by Offerors; and
Part 7	7A, Standing Offer, and 7B, Resulting Contract Clauses: 7A, includes the Standing Offer containing the offer from the Offeror and the applicable clauses and conditions; 7B, includes the clauses and conditions which will apply to any contract resulting from a call-up made pursuant to the Standing Offer.

The Annexes include:
Annex A - Statement of Work,
Annex B - Basis of Payment,
Annex C – Report Card
Annex D – Annual Standing Offer Usage Report

The Attachments include:
Attachment 1 to Part 3 – Financial Proposal Page
Attachment 1 to Part 4 – Evaluation Criteria, Stream One, Insects
Attachment 2 to Part 4 – Evaluation Criteria, Stream Two, Pathogens
Attachment 1 to Annex A - Statement of Work - Example Pest Fact Sheets,

1.2 Summary

1.2.1 The overall objective is to update the Natural Resources Canada database on Trees, Insects and Diseases of Canada's Forests (TIDCF). Within the scope of this work, about 450 individual pest fact sheets will need to be written for individual insects and pathogens that feed on or otherwise damage trees in Canadian forests, plantations, or urban or horticultural environments. The intended audience for the fact sheets is a more sophisticated one, including forest management and protection staff, pest extension personnel, arborists and tree care specialists, park naturalists, students of post-secondary institutions, and educators, although the general public will also be able to make use of the information.

NRCan is seeking to establish up to eight (8) Standing Offers for the writing of individual pest fact sheets for the Trees, Insects and Diseases of Canada's Forests (TIDCF) database. There will be two (2) streams, with a maximum of four (4) standing offers per stream:

Stream 1 – Insects,
Stream 2 – Pathogens (i.e., fungi, bacteria, viruses, parasitic plants, nematodes).

The period of the Standing Offer will be from the date of the Standing Offer to April 30, 2024. It also includes three (3) option years.

1.2.2 This Request for Standing Offers (RFSO) is to establish Departmental Individual Standing Offers (DISO) for the requirement detailed in the RFSO, to the Identified Users (NRCan) across Canada, excluding locations within Yukon, Northwest Territories, Nunavut, Quebec, and Labrador that are subject to Comprehensive Land Claims Agreements (CLCAs). Any requirement for deliveries to locations within CLCAs areas within Yukon, Northwest Territories, Nunavut, Quebec, or Labrador will have to be treated as a separate procurement, outside of the resulting standing offers.”

1.3 Security Requirements

There are no security requirements associated with this Request for Standing Offer.

1.4 Debriefings

Offerors may request a debriefing on the results of the request for standing offers process. Offerors should make the request to the Standing Offer Authority within 15 working days of receipt of the results of the request for standing offers process. The debriefing will be done in writing, by email.

PART 2 - OFFEROR INSTRUCTIONS

2.1 Standard Instructions, Clauses and Conditions

All instructions, clauses and conditions identified in the Request for Standing Offers (RFSO) by number, date and title are set out in the Standard Acquisition Clauses and Conditions Manual (https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) issued by Public Works and Government Services Canada.

Offerors who submit an offer agree to be bound by the instructions, clauses and conditions of the RFSO and accept the clauses and conditions of the Standing Offer and resulting contract(s).

The 2006 (2022-12-01) Standard Instructions - Request for Standing Offers - Goods or Services - Competitive Requirements, are incorporated by reference into and form part of the RFSO.

Subsection 5.4 of 2006, Standard Instructions - Request for Standing Offers - Goods or Services - Competitive Requirements, is amended as follows:

Delete: 60 days
Insert: 120 days

2.2 Submission of Offers

Offers must be submitted only to the Natural Resources Canada (NRCan) Bid Receiving Unit, as specified below, by the date and time indicated on page 1 of the RFSO.

NRCan Bid Receiving Unit:

Offerors must submit all offers using the Canada Post Canada (CPC) Connect service. Given the current constraints on NRCan's networks, the electronic mail system has a limit of 1GB per single message received and a limit of 20GB per conversation.

Offers must be submitted no later than the date and time indicated on page 1 of the bid solicitation.

Only offers submitted using CPC Connect service will be accepted.

At least five (5) business days before the solicitation closing date, it is necessary for the Offeror to send an email requesting to open CPC Connect conversation to the following address:

procurement-approvisionnement@NRCan-RNCan.gc.ca

Note: Offers will not be accepted if e-mailed directly to this address. This e-mail address is to be used to open CPC Connect conversation, as detailed in the Standard Instructions 2003 (article 08, paragraph 2), or to send offers through CPC Connect message if the offeror is using its own licensing agreement for CPC Connect.

Note 2: Send as early as possible in order to ensure a response, Requests to open a CPC Connect conversation received after that time may not be answered.

IMPORTANT: It is requested that you write the solicitation number in "Subject" of the email:

NRCan-5000057817 - Writing of Pest Fact Sheets for NRCan's Trees, Insects, and Diseases of Canada's Forests Database

NRCan will not assume responsibility for offers directed to any other location.

The onus is on the Offeror to ensure that the offer is submitted correctly using CPC Connect service. Not complying with the instructions may result in NRCan's inability to ascertain reception date and/or to consider the offer prior to contract award. Therefore, NRCan reserves the right to reject any offer not complying with these instructions.

Due to the nature of the solicitation, offers transmitted by email, mail or facsimile to NRCan will not be accepted.

2.3 Former Public Servant

Contracts awarded to former public servants (FPS) in receipt of a pension or of a lump sum payment must bear the closest public scrutiny, and reflect fairness in the spending of public funds. In order to comply with Treasury Board policies and directives on contracts awarded to FPS, Offerors must provide the information required below before the issuance of a standing offer. If the answer to the questions and, as applicable the information required have not been received by the time the evaluation of offers is completed, Canada will inform the Offeror of a time frame within which to provide the information. Failure to comply with Canada's request and meet the requirement within the prescribed time frame will render the offer non-responsive.

Definitions

For the purposes of this clause,

"former public servant" is any former member of a department as defined in the *Financial Administration Act* R.S., 1985, c. F-11, a former member of the Canadian Armed Forces or a former member of the Royal Canadian Mounted Police. A former public servant may be:

a. an individual;

b. an individual who has incorporated;

c. a partnership made of former public servants; or

d. a sole proprietorship or entity where the affected individual has a controlling or major interest in the entity.

"lump sum payment period" means the period measured in weeks of salary, for which payment has been made to facilitate the transition to retirement or to other employment as a result of the implementation of various programs to reduce the size of the Public Service. The lump sum payment period does not include the period of severance pay, which is measured in a like manner.

"pension" means a pension or annual allowance paid under the *Public Service Superannuation Act* (PSSA), R.S., 1985, c. P-36, and any increases paid pursuant to the *Supplementary Retirement Benefits Act*, R.S., 1985, c. S-24 as it affects the PSSA. It does not include pensions payable pursuant to the *Canadian Forces Superannuation Act*, R.S., 1985, c. C-17, the *Defence Services Pension Continuation Act*, 1970, c. D-3, the *Royal Canadian Mounted Police Pension Continuation Act* , 1970, c. R-10, and the *Royal Canadian Mounted Police Superannuation Act*, R.S., 1985, c. R-11, the *Members of Parliament Retiring Allowances Act*, R.S. 1985, c. M-5, and that portion of pension payable to the *Canada Pension Plan Act*, R.S., 1985, c. C-8.

Former Public Servant in Receipt of a Pension

As per the above definitions, is the Offeror a FPS in receipt of a pension? **YES** ( ) **NO** ( )

If so, the Offeror must provide the following information, for all FPS in receipt of a pension, as applicable:

a. name of former public servant;

b. date of termination of employment or retirement from the Public Service.

By providing this information, Offerors agree that the successful Offeror's status, with respect to being a former public servant in receipt of a pension, will be reported on departmental websites as part of the published proactive disclosure reports in accordance with Contracting Policy Notice: 2019-01 and the Guidelines on the Proactive Disclosure of Contracts.

Work Force Adjustment Directive

Is the Offeror a FPS who received a lump sum payment pursuant to the terms of the Work Force Adjustment Directive? **YES** ( ) **NO** ( )

If so, the Offeror must provide the following information:

a. name of former public servant;

b. conditions of the lump sum payment incentive;

c. date of termination of employment;

d. amount of lump sum payment;

e. rate of pay on which lump sum payment is based;

f. period of lump sum payment including start date, end date and number of weeks;

g. number and amount (professional fees) of other contracts subject to the restrictions of a work force adjustment program.

2.4 Enquiries - Request for Standing Offers

All enquiries must be submitted in writing to the Standing Offer Authority no later than ten (10) calendar days before the Request for Standing Offers (RFSO) closing date. Enquiries received after that time may not be answered.

Offerors should reference as accurately as possible the numbered item of the RFSO to which the enquiry relates. Care should be taken by Offerors to explain each question in sufficient detail in order to enable Canada to provide an accurate answer. Technical enquiries that are of a proprietary nature must be clearly marked "proprietary" at each relevant item. Items identified as "proprietary" will be treated as such except where Canada determines that the enquiry is not of a proprietary nature. Canada may edit the question(s) or may request that Offerors do so, so that the proprietary nature of the question(s) is eliminated, and the enquiry can be answered to all Offerors. Enquiries not submitted in a form that can be distributed to all Offerors may not be answered by Canada.

2.5 Applicable Laws

The Standing Offer and any contract resulting from the Standing Offer must be interpreted and governed, and the relations between the parties determined, by the laws in force in Ontario.

Offerors may, at their discretion, substitute the applicable laws of a Canadian province or territory of their choice without affecting the validity of their offer, by deleting the name of the Canadian province or territory specified and inserting the name of the Canadian province or territory of their choice. If no change is made, it acknowledges that the applicable laws specified are acceptable to the Offerors.

2.6 Bid Challenge and Recourse Mechanisms

(a) Several mechanisms are available to potential Offerors to challenge aspects of the procurement process up to and including contract award.

(b) Canada encourages Offerors to first bring their concerns to the attention of the Contracting Authority. Canada's Buy and Sell website, under the heading "Bid Challenge and Recourse Mechanisms" contains information on potential complaint bodies such as:

- Office of the Procurement Ombudsman (OPO)
- Canadian International Trade Tribunal (CITT)

(c) Offerors should note that there are strict deadlines for filing complaints, and the time periods vary depending on the complaint body in question. Offerors should therefore act quickly when they want to challenge any aspect of the procurement process.

PART 3 - OFFER PREPARATION INSTRUCTIONS

3.1 Offer Preparation Instructions

Canada requests that the Offeror submits its offer in accordance with section 08 of the 2006 standard instructions. The CPC Connect system has a limit of 1GB per single message posted and a limit of 20GB per conversation.

Canada requests that Offerors provide their offer in separately bound sections as follows:

Section I: Technical Offer (1 electronic copy)

Section II: Financial Offer (1 electronic copy) in a separate file

Section III: Certifications (1 electronic copy)

Prices must appear in the financial offer only. No prices must be indicated in any other section of the offer.

Due to the nature of the RFSO, offers transmitted by facsimile will not be accepted.

Canada requests that Offerors follow the format instructions described below in the preparation of their offer:

(a) use a numbering system that corresponds to the RFSO.

Section I: Technical Offer

In their technical offer, Offerors should explain and demonstrate how they propose to meet the requirements and how they will carry out the Work.

Section II: Financial Offer

Offerors must submit their financial offer in accordance with Attachment 1 To Part 3 – Financial Proposal Form.

3.1.2 Exchange Rate Fluctuation

C3011T (2013-11-06), Exchange Rate Fluctuation

Section III: Certifications Offerors must submit the certifications and additional information required under Part 5.

ATTACHMENT 1 TO PART 3 – FINANCIAL PROPOSAL FORM

Stream One - Insects	**Firm Per Diem Rate (Applicable Taxed Excluded)**
A. Stream One - Standing Offer Award to April 30, 2024	$
B. Stream One - Option Period #1 (May 1, 2024 to April 30, 2025)	$
C. Stream One - Option Period #2 (May 1, 2025 to April 30, 2026)	$
D. Stream One – Option Period #3 (May 1, 2026 to April 30, 2027)	$
Stream One – Insects – Total Evaluated Price: (E = A + B + C + D)	$

Stream Two - Pathogens	**Firm Per Diem Rate (Applicable Taxed Excluded)**
A. Stream Two - Standing Offer Award to April 30, 2024	$
B. Stream Two - Option Period #1 (May 1, 2024 to April 30, 2025)	$
C. Stream Two - Option Period #2 (May 1, 2025 to April 30, 2026)	$
D. Stream Two – Option Period #3 (May 1, 2026 to April 30, 2027)	$
E. Stream Two – Pathogens – Total Evaluated Price: (E = A + B + C + D)	$

PART 4 - EVALUATION PROCEDURES AND BASIS OF SELECTION

4.1 Evaluation Procedures

(a) Offers will be assessed in accordance with the entire requirement of the Request for Standing Offers including the technical evaluation criteria.

(b) An evaluation team composed of representatives of Canada will evaluate the offers.

4.1.1 Technical Evaluation

4.1.1.1 Technical Criteria (Mandatory and Point Rated)

Refer to:

Attachment 1 to Part 4 – Technical Evaluation Criteria – Stream One
Attachment 2 to Part 4 – Technical Evaluation Criteria – Stream Two

4.2 Basis of Selection

4.2.1 Basis of Selection - Highest Combined Rating of Technical Merit (70) and Price (30)

1. To be declared responsive, an offer must:
   a. comply with all the requirements of the Request for Standing Offers (RFSO); and
   b. meet all mandatory technical evaluation criteria; and
   c. obtain the required minimum of 42 points overall for the technical evaluation criteria which are subject to point rating. The rating is performed on a scale of 70 points.
2. Offers not meeting (a) or (b) or (c) above will be declared non-responsive.
3. The selection will be based on the highest responsive combined rating of technical merit and price. The ratio will be 70% for the technical merit and 30% for the price.
4. To establish the technical merit score, the overall technical score for each responsive offer will be determined as follows: total number of points obtained / maximum number of points available multiplied by the ratio of 70%.
5. To establish the pricing score, each responsive offer will be prorated against the lowest evaluated price and the ratio of 30%.
6. For each responsive offer, the technical merit score and the pricing score will be added to determine its combined rating.
7. Neither the responsive offer obtaining the highest technical score nor the one with the lowest evaluated price will necessarily be accepted. The responsive offer with the highest combined rating of technical merit and price will be recommended for issuance of a standing offer.

The table below illustrates an example where all three offers are responsive and the selection of the contractor is determined by a 70/30 ratio of technical merit and price, respectively. The total available points equal 135 and the lowest evaluated price is $45,000 (45).

Basis of Selection - Highest Combined Rating Technical Merit (70%) and Price (30%)				
		Offeror 1	**Offeror 2**	**Offeror 3**
Overall Technical Score		115/135	89/135	92/135
Evaluated Price		$55,000.00	$50,000.00	$45,000.00
Calculations	**Technical Merit Score**	115/135 x 70 = 59.63	89/135 x 70 = 46.15	92/135 x 70 = 47.70
	Pricing Score	45/55 x 30 = 24.55	45/50 x 30 = 27	45/45 x 30 = 30
Combined Rating		84.18	73.15	77.70
Overall Rating		1st	3rd	2nd

ATTACHMENT 1 to PART 4 - EVALUATION CRITERIA, STREAM 1, INSECTS

1. Mandatory Technical Evaluation Criteria - Stream 1, Insects

The Mandatory Criteria listed below will be evaluated on a simple pass/fail basis. Offers that fail to meet the mandatory criteria will be deemed non-responsive.

Criterion ID	Mandatory Criteria – Stream 1 - Insects	Proposal Page #	Pass/ Fail
M1	The Offeror MUST clearly identify that their offer applies to: • Stream 1 – Insect Fact Sheet		
M2	The Offeror MUST demonstrate* they meet the minimum educational requirements for the stream to which they are submitting an offer. For Stream 1 – Insects The Offeror MUST have a minimum M.Sc. or Ph.D. in one of the following: • entomology • forestry • forest health • forest science • forest biology • forest ecology *NRCan reserves the right to request proof of education in the form of a PDF or photo of their degree(s) prior to issuance of any resulting standing offer.		
M3	The Offeror MUST clearly demonstrate that they have a minimum of five (5) years' experience working on at least one or any combination of the following relevant areas of expertise and that this experience is aligned to the subject matter of the stream(s) to which the Offeror is submitting an offer(s): **For Stream 1 – Insects** The Offerors MUST demonstrate they have a minimum of five years experience in one or a combination for the following relevant areas of expertise: • forest or tree insect pests • forest health.		
M4	The Offeror must create and submit one (1) sample Pest Fact Sheet on a pest of their choice according to the instructions provided in the Annex A - Statement of Work (SW4.1). Example Pest Fact Sheets can be found at Attachment 1 To Annex "A". As per SW.4.5 - The sample Pest Fact Sheet must not to be copied (i.e., plagiarized) from existing material. Note: The sample Pest Fact Sheet will be further evaluated against R2. Note: If Offeror is submitting an offer for both streams, they only need to submit one sample pest fact sheet and the same sample will be used in the evaluation of each stream.		

2. Point Rated Technical Evaluation Criteria - Stream 1, Insects

The criteria contained herein will be used by NRCan to evaluate each offer that has met all of the mandatory criteria.

Offers must achieve the stated minimum points required overall for the rated criteria to be assessed as responsive under the point rated technical criteria section; Offers not meeting the minimum required points will be deemed non-responsive.

Offers will be evaluated based on the following criteria:

Criterion ID	Point Rated Technical Criteria	Points Breakdown	Max. Score
R1	**Work Experience** The Offeror has experience working on forest or tree insects or forest health, as described in SW.4.1.	**Maximum 10 Points** Points will be awarded as follows: **2 points** - for every year of applicable experience above the mandatory 5 years requested in M3, to a maximum of 10 point.	**/10**
R2	**Writing Experience** The Offeror's sample (1) Pest Fact Sheet, requested in M4, on a pest of their choice according to the instructions provided in the Statement of Work (SW.4.1), will be assessed according to: content, sentence structure, grammar, and spelling. Example Pest Fact Sheets can be found at Attachment 1 To Annex "A". Spelling of the submitted sample must follow the Oxford Dictionary in English or Le Petit Robert in French.	**Maximum 20 Points** Points will be awarded as follows: **Content (5 Points Max)** **A maximum of 5 points will be awarded for content.** Written work is clear and concise, and includes all major elements in each of the sections as outlined for the fact sheets in the SoW. **1 point will be deducted for each content error*, to a maximum of 5 points.** **Content error is defined as:** incorrect information, missing applicable information (major elements of sections as outlined in the SoW), unnecessarily wordy and/or lengthy, or unrelated information. **Sentence Structure (5 Points Max)** **A maximum of 5 points will be awarded for sentence structure** – All sentences have proper structure. **1 point will be deducted for each sentence structure error*, to a maximum of 5 points.** **Sentence structure error is defined as :** awkward or poor structure, or ambiguous meaning (e.g. missing or duplicate words, improper use of words). **Grammar (5 Points Max)** **A maximum of 5 points will be awarded for grammar** – No grammatical errors. **1 point will be deducted for each grammatical error*, to a maximum of 5 points.** **Grammatical error is defined as**: grammar, punctuation, or syntax error. **Spelling (Oxford Dictionary, Le Petit Robert) (5 Points Max)** **A maximum of 5 points will be awarded for spelling** – No spelling errors. **1 point will be deducted for each spelling error*, to a**	**/20**

Criterion ID	Point Rated Technical Criteria	Points Breakdown	Max. Score
		maximum of 5 points. **Spelling error is defined as**: the incorrect spelling of a word as indicated in the Oxford Dictionary in English or Le Petit Robert in French.	
R3	**Publication Record** The Offeror should demonstrate a publication record in scientific or technical publications, related to Stream 1 – Insects.	**Maximum 30 Points** Points will be awarded as follows: **3 points** for every publication	**/30**
R4	**Publication Record – Unrelated** The Offeror should demonstrate a publication record in scientific or technical publications, unrelated to forest or tree pests, or forest health.	**Maximum 10 Points** Points will be awarded as follows: **2 points** for every scientific or technical publication in which the subject matter is not related to this requirement	**/10**
		Total points	**/70**
		Total Points Required to be Compliant: **(Pass Mark 60%)**	**42**

ATTACHMENT 2 to PART 4 - EVALUATION CRITERIA, STREAM 2, PATHOGENS

1. **Mandatory Technical Evaluation Criteria - <u>Stream 2, Pathogens</u>**

The Mandatory Criteria listed below will be evaluated on a simple pass/fail basis. Offers that fail to meet the mandatory criteria will be deemed non-responsive.

Criterion ID	Mandatory Criteria - Stream 2, Pathogens	Proposal Page #	Pass/ Fail
M1	The Offeror MUST clearly identify that their Offer applies to: • Stream 2 – Pathogen Fact Sheets		
M2	The Offeror MUST demonstrate* they meet the minimum educational requirements for the stream to which they are submitting an offer. For Stream 2 – Pathogens The Offeror MUST have a minimum M.Sc. or Ph.D in one of the following: • pathology • forestry • forest health • forest science • forest biology • forest ecology • and/or mycology *NRCan reserves the right to request proof of education in the form of a PDF or photo of their degree(s) prior to issuance of any resulting standing offer.		
M3	The Offeror MUST clearly demonstrate that they have a minimum of five (5) years' experience working on at least one or any combination of the following relevant areas of expertise and that this experience is aligned to the subject matter of the stream(s) to which the Offeror is submitting an offer(s): **For Stream 2 – Pathogens** The Offerors MUST demonstrate they have a minimum of five years of experience in one or a combination for the following relevant areas of expertise: • forest or tree pathogens • forest health.		
M4	The Offeror must create and submit one (1) sample Pest Fact Sheet on a pest of their choice according to the instructions provided in the Annex A - Statement of Work (SW4.1). Example Pest Fact Sheets can be found at Attachment 1 To Annex "A". As per SW.4.5 - The sample Pest Fact Sheet must not to be copied (i.e., plagiarized) from existing material. Note: The sample Pest Fact Sheet will be further evaluated against R2. Note: If Offeror is submitting an offer for both streams, they only need to submit one sample pest fact sheet and the same sample will be used in the evaluation of each stream.		

2. Point Rated Technical Criteria - Stream Two, Pathogens

The criteria contained herein will be used by NRCan to evaluate each offer that has met all of the mandatory criteria.

Offers must achieve the stated minimum points required overall for the rated criteria to be assessed as responsive under the point rated technical criteria section; Offers not meeting the minimum required points will be deemed non-responsive.

Offers will be evaluated based on the following criteria:

Criterion ID	Point Rated Technical Criteria	Points Breakdown	Max. Score
R1	**Work Experience** The Offeror has experience working on forest or tree pathogens, or forest health, as described in SW.4.1.	**Maximum 10 Points** Points will be awarded as follows: **2 points** - for every year of applicable experience above the mandatory 5 years requested in M3, to a maximum of 10 point.	**/10**
R2	**Writing Experience** The Offeror's sample (1) Pest Fact Sheet, requested in M4, on a pest of their choice according to the instructions provided in the Statement of Work (SW.4.1), will be assessed according to: content, sentence structure, grammar, and spelling. Example Pest Fact Sheets can be found at Attachment 1 To Annex "A". Spelling of the submitted sample must follow the Oxford Dictionary in English or Le Petit Robert in French.	**Maximum 20 Points** Points will be awarded as follows: **Content (5 Points Max)** **A maximum of 5 points will be awarded for content.** Written work is clear and concise, and includes all major elements in each of the sections as outlined for the fact sheets in the SoW. **1 point will be deducted for each content error*, to a maximum of 5 points.** **Content error is defined as:** incorrect information, missing applicable information (major elements of sections as outlined in the SoW), unnecessarily wordy and/or lengthy, or unrelated information. **Sentence Structure (5 Points Max)** **A maximum of 5 points will be awarded for sentence structure** – All sentences have proper structure. **1 point will be deducted for each sentence structure error*, to a maximum of 5 points.** **Sentence structure error is defined as:** awkward or poor structure, or ambiguous meaning (e.g. missing or duplicate words, improper use of words). **Grammar (5 Points Max)** **A maximum of 5 points will be awarded for grammar** – No grammatical errors. **1 point will be deducted for each grammatical error*, to a maximum of 5 points.** **Grammatical error is defined as**: grammar, punctuation, or syntax error. **Spelling (Oxford Dictionary, Le Petit Robert) (5 Points Max)** **A maximum of 5 points will be awarded for spelling** – No spelling errors. **1 point will be deducted for each spelling error*, to a maximum of 5 points.** **Spelling error is defined as**: the incorrect spelling of a	**/20**

Criterion ID	Point Rated Technical Criteria	Points Breakdown	Max. Score
		word as indicated in the Oxford Dictionary in English or Le Petit Robert in French.	
R3	**Publication Record** The Offeror should demonstrate a publication record in scientific or technical publications, related to Stream 2 – Pathogens.	**Maximum 30 Points** Points will be awarded as follows: **3 points** for every publication	**/30**
R4	**Publication Record – Unrelated** The Offeror should demonstrate a publication record in scientific or technical publications, unrelated to forest or tree pests, or forest health.	**Maximum 10 Points** Points will be awarded as follows: **2 points** for every scientific or technical publication in which the subject matter is not related to this requirement.	**/10**
		Total points	**/70**
		Total Points Required to be Compliant: (Pass Mark 60%)	**42**

PART 5 – CERTIFICATIONS AND ADDITIONAL INFORMATION

Offerors must provide the required certifications and additional information to be issued a standing offer.

The certifications provided by Offerors to Canada are subject to verification by Canada at all times. Unless specified otherwise, Canada will declare an offer non-responsive, will have the right to set-aside a standing offer, or will declare a contractor in default if any certification made by the Offeror is found to be untrue whether made knowingly or unknowingly during the offer evaluation period, during the Standing Offer period, or during the contract period.

The Standing Offer Authority will have the right to ask for additional information to verify the Offeror's certifications. Failure to comply and to cooperate with any request or requirement imposed by the Standing Offer Authority will render the offer non-responsive, result in the setting aside of the Standing Offer or constitute a default under the Contract.

5.1 Certifications Required with the Offer

Offerors must submit the following duly completed certifications as part of their offer.

5.1.1 Integrity Provisions - Declaration of Convicted Offences

In accordance with the Integrity Provisions of the Standard Instructions, all Offerors must provide with their offer, **if applicable**, the declaration form available on the Forms for the Integrity Regime website (http://www.tpsgc-pwgsc.gc.ca/ci-if/declaration-eng.html), to be given further consideration in the procurement process.

5.2 Certifications Precedent to the Issuance of a Standing Offer and Additional Information

The certifications and additional information listed below should be submitted with the offer, but may be submitted afterwards. If any of these required certifications or additional information is not completed and submitted as requested, the Standing Offer Authority will inform the Offeror of a time frame within which to provide the information. Failure to provide the certifications or the additional information listed below within the time frame provided will render the offer non-responsive.

5.2.1 Integrity Provisions – Required Documentation

In accordance with the section titled Information to be provided when bidding, contracting or entering into a real property agreement of the Ineligibility and Suspension Policy (http://www.tpsgc-pwgsc.gc.ca/ci-if/politique-policy-eng.html), the Offeror must provide the required documentation, as applicable, to be given further consideration in the procurement process.

5.2.2 Federal Contractors Program for Employment Equity - Standing Offer Certification

By submitting an offer, the Offeror certifies that the Offeror, and any of the Offeror's members if the Offeror is a Joint Venture, is not named on the Federal Contractors Program (FCP) for employment equity "FCP Limited Eligibility to Bid" list) available at the bottom of the page of the Employment and Social Development Canada-Labour's website (https://www.canada.ca/en/employment-social-development/programs/employment-equity/federal-contractor-program.html#s4).

Canada will have the right to declare an offer non-responsive, or to set-aside a Standing Offer, if the Offeror, or any member of the Offeror if the Offeror is a Joint Venture, appears on the "FCP Limited Eligibility to Bid" list at the time of issuing of a Standing Offer or during the period of the Standing Offer.

5.2.3 Former Public Servant

Contracts awarded to former public servants (FPS) in receipt of a pension or of a lump sum payment must bear the closest public scrutiny, and reflect fairness in the spending of public funds. In order to comply with Treasury Board policies and directives on contracts awarded to FPS, Offerors must provide the information required below before the issuance of a standing offer. If the answer to the questions and, as applicable the information required have not been received by the time the evaluation of offers is completed, Canada will inform the Offeror of a time frame within which to provide the information. Failure to comply with Canada's request and meet the requirement within the prescribed time frame will render the offer non-responsive.

Definitions

For the purposes of this clause,

"former public servant" is any former member of a department as defined in the *Financial Administration Act* R.S., 1985, c. F-11, a former member of the Canadian Armed Forces or a former member of the Royal Canadian Mounted Police. A former public servant may be:

e. an individual;

f. an individual who has incorporated;

g. a partnership made of former public servants; or

h. a sole proprietorship or entity where the affected individual has a controlling or major interest in the entity.

"lump sum payment period" means the period measured in weeks of salary, for which payment has been made to facilitate the transition to retirement or to other employment as a result of the implementation of various programs to reduce the size of the Public Service. The lump sum payment period does not include the period of severance pay, which is measured in a like manner.

"pension" means a pension or annual allowance paid under the *Public Service Superannuation Act* (PSSA), R.S., 1985, c. P-36, and any increases paid pursuant to the *Supplementary Retirement Benefits Act*, R.S., 1985, c. S-24 as it affects the PSSA. It does not include pensions payable pursuant to the *Canadian Forces Superannuation Act*, R.S., 1985, c. C-17, the *Defence Services Pension Continuation Act*, 1970, c. D-3, the *Royal Canadian Mounted Police Pension Continuation Act* , 1970, c. R-10, and the *Royal Canadian Mounted Police Superannuation Act*, R.S., 1985, c. R-11, the *Members of Parliament Retiring Allowances Act*, R.S. 1985, c. M-5, and that portion of pension payable to the *Canada Pension Plan Act*, R.S., 1985, c. C-8.

Former Public Servant in Receipt of a Pension

As per the above definitions, is the Offeror a FPS in receipt of a pension? **YES** ( ) **NO** ( )

If so, the Offeror must provide the following information, for all FPS in receipt of a pension, as applicable:

c. name of former public servant;

d. date of termination of employment or retirement from the Public Service.

By providing this information, Offerors agree that the successful Offeror's status, with respect to being a former public servant in receipt of a pension, will be reported on departmental websites as part of the published proactive disclosure reports in accordance with Contracting Policy Notice: 2019-01 and the Guidelines on the Proactive Disclosure of Contracts.

Work Force Adjustment Directive

Is the Offeror a FPS who received a lump sum payment pursuant to the terms of the Work Force Adjustment Directive? **YES** ( ) **NO** ( )

If so, the Offeror must provide the following information:

h. name of former public servant;
i. conditions of the lump sum payment incentive;
j. date of termination of employment;
k. amount of lump sum payment;
l. rate of pay on which lump sum payment is based;
m. period of lump sum payment including start date, end date and number of weeks;
n. number and amount (professional fees) of other contracts subject to the restrictions of a work force adjustment program.

5.2.4 Education and Experience

M3021T (2012-07-18), Education and Experience

5.2.5 Status of Availability of Resources – Standing Offer

M3020C (2016-01-28), Status of Availability of Resources

_____ _____
Signature Date

_____
Printed Name

PART 6 - SECURITY REQUIREMENTS

6.1 Security Requirements

There are no security requirements associated with this RFSO.

PART 7 - STANDING OFFER AND RESULTING CONTRACT CLAUSES

A. STANDING OFFER

7.1 Offer

The Offeror offers to perform the Work in accordance with the Statement of Work at Annex A.

7.2 Security Requirements

There is no security requirement applicable to the Standing Offer.

7.3 Standard Clauses and Conditions

All clauses and conditions identified in the Standing Offer and resulting contract(s) by number, date and title are set out in the Standard Acquisition Clauses and Conditions Manual (https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) issued by Public Works and Government Services Canada.

7.3.1 General Conditions

2005 (2022-12-01) General Conditions - Standing Offers - Goods or Services, apply to and form part of the Standing Offer.

7.3.2 Annual Standing Offer Reporting

The Offeror must compile and maintain records on its provision of goods and services to Canada under contracts resulting from the Standing Offer. This data must include all purchases done by Canada, including those acquired and paid for by Canada acquisition cards.

The Offeror must provide this data in accordance with the reporting requirements detailed in Annex "D". If some data is not available, the reason must be indicated in the report. If no goods or services are provided during a given period, the Offeror must provide a "nil" report.

The data must be submitted on an annual basis to the Standing Offer Authority.

The data must be submitted to the Standing Offer Authority no later than June 30th of each year.

7.4 Term of Standing Offer

7.4.1 Period of the Standing Offer

The period for making call-ups against the Standing Offer is from date of Standing Offer to April 30, 2024.

7.4.2 Extension of Standing Offer

If the Standing Offer is authorized for use beyond the initial period, the Offeror offers to extend its offer for an additional three (3) one year option periods, under the same conditions and at the rates or prices specified in the Standing Offer.

The Offeror will be advised of the decision to authorize the use of the Standing Offer for an extended period by the Standing Offer Authority 30 days before the expiry date of the Standing Offer. A revision to the Standing Offer will be issued by the Standing Offer Authority.

7.4.3 Comprehensive Land Claims Agreements (CLCAs)

This Standing Offer is not subject to any Comprehensive Land Claims Agreements.

7.4.4 Delivery Points

Delivery of the requirement will be made to the delivery point specified at Annex “A” of the Standing Offer.

7.5 Authorities

7.5.1 Standing Offer Authority

The Standing Offer Authority is:

Name: **Andrea Berthelet**
Title: Procurement Specialist
Organization: Natural Resources Canada
Address: 580 Booth Street
Ottawa, Ontario K1A 0E4
Telephone: 343-543-7092
E-mail address: andrea.berthelet@nrcan-rncan.gc.ca

The Standing Offer Authority is responsible for the establishment of the Standing Offer, its administration and its revision, if applicable. Upon the making of a call-up, as Contracting Authority, he is responsible for any contractual issues relating to individual call-ups made against the Standing Offer by any Identified User.

7.5.2 Project Authority

The Project Authority for the Standing will be identified on each call-up against the Standing Offer.

The Project Authority is the representative of the department or agency for whom the Work will be carried out pursuant to a call-up against the Standing Offer and is responsible for all the technical content of the Work under the resulting Contract.

7.5.3 Offeror's Representative

Name:
Title:
Organization:
Address:
Telephone:
E-mail address:

7.6 Proactive Disclosure of Contracts with Former Public Servants

By providing information on its status, with respect to being a former public servant in receipt of a *Public Service Superannuation Act* (PSSA) pension, the Contractor has agreed that this information will be reported on departmental websites as part of the published proactive disclosure reports, in accordance with Contracting Policy Notice: 2012-2 of the Treasury Board Secretariat of Canada.

7.7 Identified Users

The Identified User authorized to make call-ups against the Standing Offer is any authorized representative of Natural Resources Canada.

7.8 Call-up Procedures

Authorized users are to place call-ups against the Standing Offers on a right of first refusal basis.

The NRCan Representative (Project Authority) will contact the first ranked Offeror under the required stream on a “Right of First Refusal” basis. The highest-ranked offeror will be contacted to determine if the requirement can be satisfied by that offeror. If the highest-ranked offeror is able to meet the requirement, a call-up is made against its standing offer. If that offeror is unable to meet the requirement, the identified user will contact the next ranked offeror. The identified user will continue and proceed as above until one offeror indicates that it can meet the requirement of the call-up. In other words, call-ups are made based on the "right of first refusal" basis. When the highest-ranked offeror is unable to fulfill the need, the identified user is required to document its file appropriately.

The Project Authority will provide the Offeror the list of fact sheets to be completed under the call-up. The Offeror will provide a quote in response to the list of specific fact sheets and in accordance with the rates of the Standing Offer. The level of effort will be discussed and mutually agreed upon by both the Project Authority and the Offeror, prior to the issuance of a call-up.

7.9 Call-up Instrument

The Work will be authorized or confirmed by identified User(s) using the Departmental 942 form “Call-up against a Standing Offer”.

7.10 Limitation of Call-ups

Individual call-ups against the Standing Offer must not exceed $39,999.99 (Applicable Taxes included).

7.11 Priority of Documents

If there is a discrepancy between the wording of any documents that appear on the list, the wording of the document that first appears on the list has priority over the wording of any document that subsequently appears on the list.

a) the articles of the Standing Offer;
b) the general conditions 2005 (2022-12-01). General Conditions - Standing Offers - Goods or Services
c) the supplemental general conditions 4007 (2022-12-01) Canada to Own Intellectual Property Rights in Foreground Information;
d) the general conditions 2010B (2022-12-01) General conditions: Professional services (medium complexity);
e) Annex A, Statement of Work;
f) Annex B, Basis of Payment;
g) the call up against the Standing Offer, including any annexes
h) Annex C – Report Card
i) the Offeror's offer dated _____ (*inserted at Standing Offer Issuance*).

7.12 Certifications and Additional Information

7.12.1 Compliance

Unless specified otherwise, the continuous compliance with the certifications provided by the Offeror with its offer or precedent to issuance of the Standing Offer (SO), and the ongoing cooperation in providing additional information are conditions of issuance of the SO and failure to comply will constitute the Offeror in default. Certifications are subject to verification by Canada during the entire period of the SO and of any resulting contract that would continue beyond the period of the SO.

7.13 Applicable Laws

The Standing Offer and any contract resulting from the Standing Offer must be interpreted and governed, and the relations between the parties determined, by the laws in force in Ontario.

7.14 Transition to an e-Procurement Solution (EPS)

During the period of the Standing Offer, Canada may transition to an EPS for more efficient processing and management of individual call-ups for any or all of the SO's applicable goods and services. Canada reserves the right, at its sole discretion, to make the use of the new e-procurement solution mandatory.

Canada agrees to provide the Offeror with at least a three-month notice to allow for any measures necessary for the integration of the Offer into the EPS. The notice will include a detailed information package indicating the requirements, as well as any applicable guidance and support.

If the Offeror chooses not to offer their goods or services through the e-procurement solution, the Standing Offer may be set aside by Canada.

B. RESULTING CONTRACT CLAUSES

The following clauses and conditions apply to and form part of any contract resulting from a call-up against the Standing Offer.

7.1 Statement of Work

The Contractor must perform the Work described in the call-up against the Standing Offer.

7.2 Standard Clauses and Conditions

7.2.1 General Conditions

2010B (2022-12-01) General Conditions - Professional Services (Medium Complexity) apply to and form part of the Contract.

7.2.2 Supplemental General Conditions

4007 (2022-12-01) Canada to Own Intellectual Property Rights in Foreground Information

7.3 Term of Contract

7.3.1 Period of the Contract

The period for making call-ups against the Standing Offer is from date of Standing Offer to April 30, 2024.

7.3.2 Delivery Date

Delivery must be completed in accordance with the call-up against the Standing Offer.

7.4 Proactive Disclosure of Contracts with Former Public Servants

By providing information on its status, with respect to being a former public servant in receipt of a *Public Service Superannuation Act* (PSSA) pension, the Contractor has agreed that this information will be reported on departmental websites as part of the published proactive disclosure reports, in accordance with Contracting Policy Notice: 2012-2 of the Treasury Board Secretariat of Canada.

7.5 Payment

7.5.1 Basis of Payment - Limitation of Expenditure

1. Canada's total liability to the Contractor under the Contract must not exceed $ _____ *(to be completed at time of call-up, not to exceed $39.999.99 per individual call-up)*. Customs duties are included and Applicable Taxes are extra.
2. No increase in the total liability of Canada or in the price of the Work resulting from any design changes, modifications or interpretations of the Work, will be authorized or paid to the Contractor unless these design changes, modifications or interpretations have been approved, in writing, by the Contracting Authority before their incorporation into the Work. The Contractor must not perform any work or provide any service that would result in Canada's total liability being exceeded before obtaining the written approval of the Contracting Authority. The Contractor must notify the Contracting Authority in writing as to the adequacy of this sum:
    a. when it is 75% committed, or

b. four months before the contract expiry date, or

c. as soon as the Contractor considers that the contract funds provided are inadequate for the completion of the Work,

whichever comes first.

3. If the notification is for inadequate contract funds, the Contractor must provide to the Contracting Authority a written estimate for the additional funds required. Provision of such information by the Contractor does not increase Canada's liability.

7.5.2 Basis of Payment: Cost reimbursable – Limitation of Expenditure

The Contractor will be paid for its costs reasonably and properly incurred in the performance of the Work, in accordance with the Basis of payment in Annex B, to a limitation of expenditure of $_____ *(to be completed at time of call-up, not to exceed $39,999.99 per individual call-up)*. Customs duties are included and Applicable Taxes are extra.

7.5.3 Method of Payment – Single Payment (Per Call-up)

Canada will pay the Contractor upon completion and delivery of the Work in accordance with the payment provisions of the Contract if:

a. an accurate and complete invoice and any other documents required by the Contract have been submitted in accordance with the invoicing instructions provided in the Contract;

b. all such documents have been verified by Canada;

c. the Work delivered has been accepted by Canada.

7.6 Invoicing Instructions

Invoices shall be submitted using **the following method:**

E-mail: Invoicing-Facturation@nrcan-rncan.gc.ca **Note:** Attach “PDF” file. No other formats will be accepted

Invoices and all documents relating to a contract must be submitted on the Contractor’s own form and shall bear the following reference numbers: Contract number: _____

Invoicing Instructions to suppliers: http://www.nrcan.gc.ca/procurement/3485

7.7 Insurance

The Contractor is responsible for deciding if insurance coverage is necessary to fulfill its obligation under the Contract and to ensure compliance with any applicable law. Any insurance acquired or maintained by the Contractor is at its own expense and for its own benefit and protection. It does not release the Contractor from or reduce its liability under the Contract.

7.8 Dispute Resolution

(a) The parties agree to maintain open and honest communication about the Work throughout and after the performance of the contract.

(b) The parties agree to consult and co-operate with each other in the furtherance of the contract and promptly notify the other party or parties and attempt to resolve problems or differences that may arise.

(c) If the parties cannot resolve a dispute through consultation and cooperation, the parties agree to consult a neutral third party offering alternative dispute resolution services to attempt to address the dispute.

(d) Options of alternative dispute resolution services can be found on Canada's Buy and Sell website under the heading "Dispute Resolution".

7.9 Unacceptable Work

Work submitted under any call-up to the standing offer may be evaluated by NRCan using the Report Card indicated at Annex D; and using the point system as indicated below. Each error will receive one point.

Work containing 3 points lost per 300 words or per document, whichever comes first, will be deemed unacceptable. For example, a 200-word document can lose a maximum of 3 points, while a 700-word document can lose a maximum of 9 points, before being deemed unacceptable.

Point System for Evaluation
Content **1 point for each content error*.** **Content error is defined as:** incorrect information, missing applicable information (major elements of sections as outlined in the SoW), unnecessarily wordy and/or lengthy, or unrelated information. **Sentence Structure** **1 point for each sentence structure error*.** **Sentence structure error is defined as:** awkward or poor structure, or ambiguous meaning (e.g. missing or duplicate words, improper use of words). **Grammar** **1 point for each grammatical error*.** **Grammatical error is defined as**: grammar, punctuation, or syntax error. **Spelling (Oxford Dictionary)** **1 point for each spelling error*.** **Spelling error is defined as**: the incorrect spelling of a word as indicated in the Oxford dictionary. **Note:** If the same error is made more than once in document, it will only count as one point.

7.10 Suspension of Standing Offer

7.10.1 On first unacceptable work submitted under the Standing Offer, NRCan will request the Standing Offer holder to provide corrective measures to ensure the number of errors will be reduced in the deliverables under future call-ups.

7.10.2 On second unacceptable work submitted under the Standing Offer, NRCan may suspend the Standing Offer. When a Standing Offer is suspended, NRCan may cease to place call-ups under the Standing Offer for a period of 12 consecutive months. If a supplier's Standing Offer is suspended, any call-ups that would normally be sent to the supplier may be sent to the next-ranked supplier. The suspension will take effect on the date of the suspension notice.

7.10.3 If a supplier submits unacceptable work three times (three failing report cards), NRCan may suspend the Standing Offer indefinitely and will not exercise any remaining option years. If a supplier's Standing Offer is suspended, any call-ups that would normally be sent to the supplier may be sent to the next-ranked supplier. The suspension will take effect on the date of the suspension notice.

7.10.4 Nothing in this section infringes upon the rights and remedies to which NRCan may otherwise be entitled under the Standing Offer.

ANNEX "A" - STATEMENT OF WORK

SW.1.0 TITLE

Writing of Pest Fact Sheets for NRCan's Trees, Insects, and Diseases of Canada's Forests Database

SW.2.0 BACKGROUND

Launched in 2000, the Trees, Insects and Diseases of Canada's Forests (TIDCF) is a public database of information on more than 200 native trees and arborescent shrubs, and about 250 insects and 175 diseases and other damage agents common in Canada's native, rural, and urban forests. The database is served to the Canadian public and other web users as dynamic content via the NRCan website. Each entry in the database contains similar information and images, and was originally developed by a small team of Canadian Forest Service pest specialists and research scientists in conjunction with information technology specialists. The original intent of the site was to facilitate public access to the federal government's information on trees and pests in both official languages.

SW.3.0 OBJECTIVES

The overall objective is to update the Natural Resources Canada database on Trees, Insects and Diseases of Canada's Forests (TIDCF). Within the scope of this work, about 450 individual fact sheets will need to be written for individual insects and pathogens that feed on or otherwise damage trees in Canadian forests, plantations, or urban or horticultural environments. The intended audience for the fact sheets is a more sophisticated one, including forest management and protection staff, pest extension personnel, arborists and tree care specialists, park naturalists, students of post-secondary institutions, and educators, although the general public will also be able to make use of the information.

SW.4.0 PROJECT REQUIREMENTS

SW.4.1 Scope of Work

A total of 450 fact sheets will be prepared during a four year period, or about 115 per year. The work will be divided into generally similar groups of facts sheets based on the category of pest, resulting in two streams. Stream One - Insects, Stream Two – Pathogens (i.e., fungi, bacteria, viruses, parasitic plants, nematodes). Each fact sheet will include relevant information on the pest or damage agent organized into the following sections: Nomenclature; General Information & Importance; Distribution & Hosts; Symptoms & Signs; Life Cycle (for insects) or Disease Cycle (for pathogens); Damage; Prevention & Management; Key Selected References (those used as a source of information although specific citations within the text are not necessary); and Suggested Photos & Captions. Additional details on critical information to report on in each of the sections is detailed below.

SECTION SPECIFICATIONS:

Nomenclature:

- Common English & French names
- Scientific name (as applicable)
- Class, Order and Family (insects) or Phylum, Class, Order, (pathogens)
- Scientific synonyms (as applicable)
- Common name synonyms

General Information & Importance:

- Identify the causal agent (insect, fungus, virus, bacterium, parasitic plant).
- Information on whether the insect or pathogen is an important forest pest or problem, or a pest or problem in other settings such as on landscape or urban plantings, nurseries, shelterbelts, plantations, horticulture, or Christmas tree production.
- Native species versus introduced species?
- For introduced species, is it acting invasively? Include likely origin and confirmed or suspected pathways of introduction. If known, include rate of spread.
- Is this a primary pest or a secondary pest?
- Is this a pest or other damage agent of young, juvenile, mature, over-mature trees?
- If available, information on frequency, size and intensity of outbreaks or damage should be provided.
- Seriousness of the pest to individual tree health, and/or the circumstances in which tree health might be threatened.

Distribution & Hosts:

- Focus should be on Canadian distribution or occurrence, then North American and global distribution where relevant, especially for introduced species.
- Main, secondary, and/or rare hosts. Alternate host(s) in the case of complex life or disease cycle.

Symptoms & Signs:

- Description(s) of commonly visible life stages of the insect (coloration, markings, size in mm) or pathogen (spores, fruiting structures, etc.).
- Host part(s) affected.
- Visual cues of attack and/or type of feeding damage.

Life/Disease Cycle:

- Life cycle or disease cycle duration.
- Timing of the various life/disease stages in terms of duration and time of year (i.e., month(s) visible, incubation, overwintering stage, etc.).
- Where different stages can be found.
- Other important details or unique characteristics of life or disease cycle, if relevant (e.g., primary/secondary host, symbiosis/associates, reproduction, mating, parthogenesis, heteroecious, autoecious, vectors, races, etc.).

Damage:

- Types of injuries to the host as a result of the pest's activity.
- Significance of injuries in terms of aesthetics, wood or fibre quality, tree form, growth loss, twig/branch mortality, tree mortality, tree reproduction.
- Socio-economic and/or ecological impacts of outbreaks, if available (as opposed to outbreak history information in the General Information & Importance section).
- Note any associations with other pests, susceptibility to other pests or damage agents (e.g., windthrow), or important environmental factors, if relevant.

Prevention & Management:

- What natural factors keep populations in check?
- Options for pest management (silvicultural, mechanical, biological, biocontrol products, chemical pesticides) for individual land owners, nurseries, tree growers, horticulture, forest management and protection.
- What can be done to avoid or mitigate damage
- References to biocontrol and chemical pesticides should be kept general, and should include a link to the Government of Canada's Pesticide Product Information Database. See example fact sheets provided as examples in this regard.

Key Selected References:

- 7-10 references related to the specifics presented in the various fact sheet sections.
- Include key CFS work, past and recent.

Suggested Photos & Captions:

- Actual photographs do not need to be supplied but a suggested list with appropriate captions should.
- Key symptoms and signs, life stages, etc.

SW.4.2 Tasks, Deliverables

a. Review the material that currently exists in the TIDCF database on the pests or other damage agents related to the specific call-up.

b. Review the most recent scientific and technical (e.g., pest leaflets, information reports, books, etc.) literature on the pests or other damage agents related to the specific call-up that have been published by the CFS and is available at their CFS Publications portal. Note that for some pests the most recent work might be several decades old.

c. Review other relevant scientific and technical literature. As with the CFS literature, the most recent work on a particular pest might be several decades old.

d. Write the fact sheet according to the specified requirements (including as specified in the Reference Documents listed in SW.6.1) based on the review of the pertinent scientific and technical literature. Total number of words for each fact sheet should be about 1400–1700 words in English, or 1600–2050 in French.

e. All fact sheets should be prepared using Microsoft Word, with one pest per MS Word document.

f. Submit one fifth (1/5) of the total number of fact sheets to be submitted for the call-up to the Project Authority for review by a date one fifth into the duration of the call-up. The Project Authority will return these to the writer within three (3) business days with comments. The writer will then revise these fact sheets based on the Project Authority's comments and ensure that all other fact sheets under the call-up do not have similar issues as identified during the Project Authority review and that they meet the standards specified in this Statement of Work. The Project Authority or another subject matter expert will review all pest fact sheets and if necessary return to the writer for correction before final delivery will be accepted.

SW.4.3 Schedule – Timeframe and Delivery Dates

The timeframe and delivery date of each group of fact sheets will be mutually agreed upon by the Offeror and the Project Authority prior to each call-up being issued. The Project Authority will provide the Offeror the list of fact sheets to be completed under the call-up. The Offeror will provide a quote in response to the list of specific fact sheets and in accordance to the rates of the Standing Offer. In most instances, the expected level of effort will be three (3) business days multiplied by the number of fact sheets to be written. In addition, the Project Authority will also need three (3) days to review a subset of the fact sheets (1/5th of total). In certain instances the level of effort may need to be adjusted due to difficulties or challenges associated with the specific fact sheets (i.e., recent taxonomic revisions to the species or species complex).

SW.4.4 Reporting Requirements

The Offeror will provide regular updates to the Project Authority on a bi-weekly basis, by either email, phone call or videoconference. The Offeror will inform the Project Authority immediately of any issues that may affect the timeline.

SW.4.5 Method and Source of Acceptance

All fact sheets will be assessed for accuracy of the information presented, quality of writing (clear and well articulated), typographical and grammatical errors, language and style appropriate for the target audience, required detail for each section of the fact sheet, and thoroughness of the key selected references. The written material is not to be copied (i.e., plagiarized) from existing material. Technical terms not already in the Glossary of the TIDCF webpage, must be defined and noted in the MS Word document for the pest so that the term can be added to the Glossary (if the term is used for multiple pests, it only needs to be defined once and included in one document). Final acceptance of the delivered fact sheets will be the decision of the Project Authority based on the criteria noted and delivery that is according to the agreed-upon schedule

All deliverables and services rendered under any call-up are subject to inspection by the Project Authority. The Project Authority shall have the right to reject any deliverables that are not considered satisfactory, or require their correction before payment will be authorized.

SW.4.6 Specifications and Standards

The number of fact sheets will be determined with each call-up. The fact sheet must be in accordance to the specified requirements (including as specified in the Reference Documents listed in SW.6.1) based on the review of the pertinent scientific and technical literature. Total number of words for each fact sheet should be about 1400–1700 words in English, or 1600–2050 in French. All fact sheets should be prepared using Microsoft Word, with one pest per MS Word document.

SW.5.0 OTHER TERMS AND CONDITIONS OF THE SOW

SW.5.1 Offeror's Obligations

In addition to the obligations outlined in Section 2 of this Statement of Work, the Offeror shall:

- keep all documents and proprietary information confidential;
- attend meeting with stakeholders virtually, if necessary;
- participate in teleconferences or virtual meetings, as needed;

Scientific Integrity Policy:

In satisfying the requirements of this agreement, the Recipient is encouraged to comply with the provisions and intent of the NRCan Scientific Integrity Policy (SIP) and to discharge its contractual obligations in support of research, science, or related activities in a manner consistent with all relevant NRCan SIP provisions. For more information on the Scientific Integrity Policy, please visit the NRCan website at: **https://www.nrcan.gc.ca/scientific-integrity/21665#a20**

SW.5.2 NRCan's Obligations

The Natural Resources Canada will provide a list of key forest insect and disease publications that have been published by the department (and its various precursors) during the past several decades. These will provide useful information on most of the pests and other damage agents that form the TIDCF database. The Government of Canada will not supply other information, data, reference material, equipment, tools or facilities other than what is accessible in its CFS Publications portal and its TIDCF portal. The Project Authority (an NRCan-CFS employee) and a scientific editor will review each fact sheet, and responsibility for the final version rests with the Project Authority, not with the contracted writer.

SW.5.3 Location of Work, Work Site and Delivery Point

The work is expected to take place at the supplier's place of business.

SW.5.4 Language of Work

The work may be conducted in either official language. NRCan will be responsible for any required translation.

SW.6.0 APPLICABLE DOCUMENTS AND GLOSSARY

SW.6.1 Applicable Documents

Fact sheets will be written in general accordance with the following style guide:

> *Canadian Forest Service style guide for scientific and technical publications. 1999. Natural Resources Canada, Canadian Forest Service, Headquarters, Science Branch, Ottawa, Revised. 123 p.*

A pdf of the latter publication is available on-line at the CFS Publications portal.

Spelling will be in accordance with the following dictionary:

> *The Oxford English Dictionary*. 2020. Available on-line at: https://www.oed.com/.
>
> *Le Petit Robert* : https://pro.lerobert.com/dictionnaire-petit-robert.html

Access to the TIDCF database can be found at the following link:

> https://tidcf.nrcan.gc.ca/en/

Four examples of pest fact sheets are provided as a further guide. Refer to Attachment 1 to Annex A – Statement of Work: Example Pest Fact Sheets

- Lodgepole Pine Dwarf Mistletoe, a parasitic plant;
- Nectria Canker, a fungus;
- Forest Tent Caterpillar, a common native forest insect; and
- Brown Spruce Longhorn Beetle, a non-native forest insect.

SW.6.2 Relevant Terms, Acronyms and Glossaries

NRCan – Natural Resources Canada
CFS – Canadian Forest Service, a sector within NRCan
TIDCF – Trees, Insects, and Diseases of Canada's Forests, an NRCan-CFS database on Canadian trees and their pests
Pest – in the context of this work, an animal, insect or infectious disease that damages trees in natural forests, plantations, or urban or horticultural environments
Disease – damage to trees caused by a complex interaction between a pathogen or abiotic agent, a susceptible host and predisposing environmental conditions
Pathogen – an infectious organism causing a disease, such as a bacterium, fungus, nematode, parasitic plant, or virus
Abiotic damage – disease symptoms in trees caused by non-infectious agents such as weather, chemicals, or nutrient deficiencies
Symptom – visible or detectable physical manifestation of the disease on the plant host (wilting, canker, etc.)
Sign – visible presence of the pathogen (usually a fungal fruiting body) on the plant host
Other damage agents – non-infectious biotic or abiotic agents that cause damage to trees, including birds, mammals, weather, or chemicals

ATTACHMENT 1 TO ANNEX "A" – EXAMPLE PEST FACT SHEETS

The following four (4) examples of pest fact sheets are provided as a further guide.

1. Lodgepole Pine Dwarf Mistletoe, a parasitic plant;
2. Nectria Canker, a fungus;
3. Forest Tent Caterpillar, a common native forest insect; and
4. Brown Spruce Longhorn Beetle, a non-native forest insect.

Example 1: Lodgepole pine dwarf mistletoe

- **Pathogen name:** *Arceuthobium americanum* Nutt. Ex Engelm.
- **Other common name(s):** none
- **French common name:** Faux-gui du pin tordu latifolié
- **Order:** Santalales
- **Family:** Santalaceae
- **Scientific Synonym(s):** *none*

General information & importance

Lodgepole pine dwarf mistletoe is a highly evolved parasitic plant with greatly reduced leaves and no apparent root system. It robs its host of water, carbohydrates, and nutrients through cellular connections at the point of infection.

There are three distinct races of *A. americanum*:

- on jack pine (*Pinus banksiana)* in the western Canadian interior
- on lodgepole pine (*Pinus contorta* var. *latifolia)* in Alberta, British Columbia, and western United States
- on Sierra lodgepole pine (*P. contorta* var. *murrayana*) in the Sierra Nevada and Cascade Mountains of western United States

Lodgepole pine dwarf mistletoe is second only to mountain pine beetle in the volume of wood lost in western Canada to its two principle hosts, lodgepole pine and jack pine. Older, severely infested stands have dead or weakened trees with poor growth and stem form. Tree density can also be quite low.

Where this pest occurs, forest management practices must be adjusted to minimize the potential re-infection of regenerating stands following harvest.

Distribution & hosts

Lodgepole pine dwarf mistletoe is currently found from eastern Manitoba to British Columbia. An isolated infestation of jack pine found in northwestern Ontario near Lac Seul in the 1960s is extirpated. Since then, additional lodgepole pine dwarf mistletoe infestations have not been found in Ontario.

The parasitic plant's northern distribution is limited by extremely cold winter temperature (about –40°C), which kills overwintering seeds.

The primary hosts in Canada are lodegepole pine and jack pine. Occasional hosts include Ponderosa pine (*Pinus ponderosa*). Rare hosts included white spruce (*Picea glauca*) and black spruce (*Picea mariana*).

Symptoms & signs

The most evident symptom of attack by lodgepole pine dwarf mistletoe is abnormal, dense branching known as witches' brooms. Broom shape and size vary with host, as well as the age and point of infection. Brooms on lodgepole pine tend to be denser than brooms on jack pine.

Two types of infections exist:

- Localized infections result in a spindle-shaped swelling of the twig or branch
- Systemic infections cause brooms

At localized infections, green to yellow-green aerial shoots up to 10 cm in length and about 1 to 1.5 mm in diameter can be found. Aerial shoots along the branches of brooms tend to be shorter, but spread out more abundantly along their length.

Lodgepole pine dwarf mistletoe plants are either male or female. Male flowers are small (about 2 mm across), three pedaled, and bright yellow. They occur for several weeks very early in the spring from late March until the end of April when some snow can still be found on the ground. Female plants flower at the same time, but flowers are inconspicuous.

By late July and early August, mature oval berries can be found on female plants. Each green berry contains a single seed, which discharges explosively when the berry is squeezed. Shoots can remain on the host for several years; however, they sometimes die or are cast in the fall. Basal cups remain and can be found at the surface of the twig or branch. Aerial shoots of dwarf mistletoe are generally not visible for 2 to 3 years after infection, so surveys for dwarf mistletoe must consider these latent infections.

There are several other species of dwarf mistletoe in Canada, but these occur on principal conifer hosts other than lodgepole or jack pine.

Elytroderma disease, caused by the fungus, *Elytroderma deformans*, also results in witches' broom on lodgepole pine, jack pine, and ponderosa pine, but lacks the small shoots of the dwarf mistletoe on swollen twigs and branches.

Disease cycle

Lodgepole pine dwarf mistletoe has a similar disease cycle on lodgepole pine and jack pine, but differs in overall duration; about 7 years on lodgepole pine and about 5 years on jack pine.

Seeds discharge in August and September with substantial force because of hydrostatic pressure build-up in maturing berries. When ripe, berries fall from female plants enabling seeds to be ejected and disperse up to 10 to 12 meters. Needle-bearing twigs intercept most seeds by chance because these provide the largest targets for dispersing seeds. Seeds are covered with a viscous layer that acts both as a lubricant when wet to allow the seeds to slide down needles and as an adhesive when dry to hold the seed to anything it lands on. Seeds landing on needles located along the upper sides of twigs and branches typically slide down to the base of needles where they overwinter. Seeds that are intercepted by needles along the lower sides typically slide off either to another part of the host or to the ground. Seeds germinate the following spring in May (range April to June). About 1 month later, a holdfast (specialized structure of the germinating seed that attaches to and penetrates the host) develops at the radicle tip where it has been obstructed. Host penetration begins by August.

About two years later, the first symptom of infection, a swelling of the twig at the point of penetration, becomes visible. Aerial shoots emerge about 1 month later, usually near the holdfast (if still attached).

The parasite's endophytic system (the system of tissues of the parasite within the host) is well established at this point.

During the third growing season, shoots continue to elongate and by the end of the season, shoots of both sexes are mature. In the subsequent growing season, male and female plants flower during April–May and mature fruits develop on female plants by the end of that growing season to repeat the disease cycle. A fungus, *Caliciopsis arceuthobii* (syn.: *Wallrothiella arceuthobii)*, commonly infects the flowers of female plants and ultimately affects dwarf mistletoe seed production. Presence of this fungus is evident as shiny black perithecia (fruiting bodies of the fungus) that appear on female flowers in the spring.

Damage

Heavy infections caused by lodgepole pine dwarf mistletoe substantially reduce wood quality, tree diameter and height growth, and in many cases, ultimately result in host tree mortality. Dead twigs, branches, and treetops from dwarf mistletoe infection also provide entry points for decay fungi and other secondary pests, further negatively affecting the host. Infected branches frequently break due to decay, excessive broom size, or snow load on large brooms. The latter situation can present a hazard in high-use recreational sites.

Stands where dwarf mistletoe has been established for a long time usually contain infection centres where tree density is low because of mortality and where most young understory trees are heavily infected. In western Canada where this parasitic plant is quite common, it is second only to mountain pine beetle in the amount of damage it causes to its two principle pine hosts.

Prevention & management

Pest management strategies for a particular pest vary depending on several factors. These include:

- the population level of the pest (i.e., how numerous the pest is on the affected host(s));
- the expected damage or other negative consequences of the pest's activity (either to the host, property, or the environment);
- an understanding of the pest's life cycle, its various life stages, and the various natural or abiotic agents that affect population levels;
- how many individual host specimens are affected (an individual tree, small groups of trees, plantations, forests);
- the value of the host(s) versus the costs of pest management approaches; and consideration of the various silvicultural, mechanical, chemical, biological, and natural control approaches available and their various advantages and disadvantages.

Decisions about pest management strategies requires information about each of these factors for informed decision-making. These various factors should then be weighed carefully in terms of costs and benefits before action is taken against a particular pest.

For lodgepole pine dwarf mistletoe, most infections on individual or a small number of pine trees can be removed mechanically by pruning to remove infected branches or cutting heavily infected trees. This approach works well for small parcels of private land and smaller woodlots where regular monitoring can be completed and new infections can be quickly detected and removed to reduce the chance of reinfection.

In lodgepole and jack pine forests, lodgepole pine dwarf mistletoe can only become established if there is an available supply of seeds. Therefore, removing residual infected pine trees from harvested areas, before replanting or before natural regeneration becomes established, will ensure that subsequent pine regeneration remains free of the parasitic plant.

Along the edges of harvested areas where lodgepole pine dwarf mistletoe is found in adjacent uncut pine forests, planting a 20 m wide buffer of resistant trees (white or black spruce) will minimize the risk that the parasitic plant will re-establish in the regenerating pine forest. It is important to monitor these buffers every 3–5 years to identify naturally regenerated lodgepole pine or jack pine that have become infected.

Infected regeneration should be cut. This is critical to ensure the parasite does not move back into regenerating areas. Similar approaches apply to areas burnt by wildland fires. When fires skip or only partially burn long-established infection centres, all large or small residual pine trees should be removed to ensure subsequent pine regeneration remains parasite-free.

There are no chemical pesticides that have proven effective against lodgepole pine dwarf mistletoe without negatively affecting the host tree.

Selected references

Baranyay, J.A.; Safranyik, L. 1970. Effect of dwarf mistletoe on growth and mortality of lodgepole pine in Alberta. Canada Department of Fisheries and Forestry, Canadian Forestry Service. Publication 1285. 24 p.

Baranyay, J.A.; Smith, R.B. 1972. Dwarf mistletoes in British Columbia and recommendations for their control. Environment Canada, Canadian Forestry Service, Pacific Forest Research Centre. Victoria, BC. Information Report BC-X-72. 18 p.

Brandt, J.P. 2006. Life cycle of Arceuthobium americanum on Pinus banksiana based on inoculations in Edmonton, Alberta. Canadian Journal of Forest Research *36(4):* 174–183*.* https://doi.org/10.1139/x05-288

Brandt, J.P.; Brett, R.D.; Knowles, K.R.; Sproule, A. 1998. Distribution of severe dwarf mistletoe damage in west-central Canada. Natural Resources Canada, Canadian Forest Service. Special Report 13. 27 p.

Brandt, J.P.; Hiratsuka, Y.; Pluth, D.J. 2004. Extreme cold temperatures and survival of overwintering and germinated Arceuthobium americanum seeds. Canadian Journal of Forest Research 34(1): 174–183. https://doi.org/10.1139/x03-200

Brandt, J.P.; Hiratsuka, Y.; Pluth, D.J. 2005. Germination, penetration, and infection by Arceuthobium americanum on Pinus banksiana. Canadian Journal of Forest Research 35(8): 1914–1930. https://doi.org/10.1139/x05-113

British Columbia Ministry of Forests, Lands, and Natural Resource Operations. 1995. Dwarf Mistletoe Management Guidebook. Available from: http://www.quickscribe.bc.ca/secure/repository/696_!Dwarf-Mistletoe.html*. Accessed 17 October 2020.*

Hawksworth, F.G. 1965. Life tables for two species of dwarfmistletoe. I. Seed dispersal, interception, and movement. Forest Science 11(2): 142–151. https://doi.org/10.1093/forestscience/11.2.142

Hawksworth, F.G.; Wiens, D. 1996. Dwarf mistletoes: Biology, pathology, and systematics. United States Department of Agriculture. Agricultural Handbook 709. 410 p.

Jerome, C.A.; Ford, B.A. 2002. The discovery of three genetic races of the dwarf mistletoe Arceuthobium americanum (Viscaceae) provides insight into the evolution of parasitic angiosperms. Molecular Ecology 11(3): 387–405. https://doi.org/10.1046/j.0962-1083.2002.01463.x

Ramsfield, T.D.; Shamoun, S.F.; van der Kamp, B.J. 2009. The phenology and impact of Caliciopsis arceuthobii on lodgepole pine dwarf mistletoe, Arceuthobium americanum. Botany 87(1): 43–48. https://doi.org/10.1139/B08-089

Smith, R.B. 1974. Infection and development of dwarf mistletoes on plantation-grown trees in British Columbia. Environment Canada, Canadian Forestry Service, Pacific Forest Research Centre. Information Report *BC-X-97. 21 p.*

Suggested photos & captions

Broom on lodgepole pine

Broom on jack pine

Infection centre in heavily infested jack pine

Infection centre in lodgepole pine

Male plant in bloom

Female plant with mature fruit

Dwarf mistletoe seed infecting its host

Example 2: Nectria canker

- **Pathogen name:** *Neonectria ditissima* (Tul. & C. Tul.) Samuels & Rossman
- **Other common name(s): Apple canker,** *European canker, target canker*
- **French common name:** Chancre nectrien
- **Phylum:** Ascomycota
- **Class:** Sordariomycetes
- **Order:** Hypocreales
- **Family:** Nectriaceae
- **Partial list of Synonyms:**
  Cylindrocarpon heteronema (Berk. & Broome) Wollenweb
  Dialonectria galligena (Bres.) Petch
  Nectria ditissima
  Nectria galligena Bres.
  Neonectria galligena (Bres.) Rossman & Samuels

General information & importance

Nectria canker is a common fungal disease in eastern hardwood forests and occurs on a variety of host species. It is also an important disease in apple orchards and occurs on susceptible ornamental tree species.

In forests, most losses are to young trees because cankers typically affect most of the circumference of infected main stems. Although older trees can be infected too, cankers are usually restricted to branches, which may be killed depending on the size of the canker, but the impact on the overall crown is minimal. During windstorms, stem breakage can occur at older, larger cankers.

The fungal pathogens, *Neonectria ditissima* and *Neonectria faginata*, in combination with two scale insects, *Cryptococcus fagisuga* (beech scale) and *Xylococculus betulae*, are responsible for beech bark disease (dealt with separately within the TIDCF database), which was first detected in Halifax, Nova Scotia on European beech (*Fagus sylvatica*) in 1890. The latter disease has been spreading throughout the range of American beech (*Fagus grandifolia*) as a result of the spread of beech scale, which in a non-native species from the Black Sea region of Europe.

Distribution & hosts

Nectria canker is common in eastern Canadian temperate hardwood forests and rare in western Canada. This fungus attacks a wide variety of temperate broad-leaved trees such as maples (*Acer* spp.), alders (*Alnus* spp.), birches (*Betula* spp.), hawthorns (*Crataegus* spp.), beeches (*Fagus* spp.), ashes (*Fraxinus* spp.), hollies (*Ilex* spp.), butternuts and walnuts (*Juglans* spp.), hop-hornbeams (*Ostrya* spp.), poplars and aspens (*Populus* spp.), oaks (*Quercus* spp.), willows (*Salix* spp.), lindens (*Tilia* spp.) and elms (*Ulmus* spp.), as well as fruit trees (apples (*Malus* spp.) and pears (*Pyrus* spp.).

Research indicates that in general Nectria canker is more severe in wetter temperate climates, which may explain the low incidence of this disease in the drier Prairie Provinces.

The disease can be found in many parts of the world where temperature and moisture conditions are suitable.

Symptoms & signs

The first symptom of fungal attack are small, dark sunken areas on the bark of young trees, often associated with bud or leaf scars, twig or branch stubs, or previous wounds. These small cankers are not easy to detect without careful examination of the host.

Once established in the host, however, the fungus is perennial.

Older cankers lack bark and the exposed wood forms ridges of more or less concentric callus tissue, often resembling a “target”. In the middle of these “target” cankers a branch stub or knot is often visible.

The sexual state of the fungus produces small (<0.5 mm diam.), orangey red to dark red ovoid perithecia (fruiting bodies), which usually occur in groups of up to 30 on the dead bark at the canker’s edge. Perithecia produce microscopic ascopores. Ascopores are ellipsoid to fusiform with narrowly rounded ends, hyaline (transparent or colourless), 1-septate, often slightly constricted at the septum, smooth to very finely spinulose (small spines), and about 16.9 µm × 7.4 µm in size. The asexual state produces sporodochia, which are small, white cushion-shaped fruiting bodies that produce conidia (spores). The microscopic conidia are cylindrical with rounded ends, straight to slightly curved, 5–6 septate, and about 75.9 µm × 7.1 µm in size. The red perithecia are typically much more visible than the white sporodochia.

There are two other species of *Neonectria* commonly encountered in Canada. These species are:

- the native *N. faginata* on beech in eastern North America (also linked to beech bark disease); and
- the introduced *N. coccinea,* also on beech in eastern Canada and the United States, but native to Europe.

The closely related native fungus *Nectria cinnabarina* is more commonly associated with crown dieback in a number of hardwood species and has a global distribution.

Disease cycle

The fungus overwinters as perithecia or mycelium in cankers on stems, twigs, or branches. Two types of fruiting bodies are produced by *Neonectria*, which under favourable weather conditions can occur simultaneously:

- asexual, which appears in the form of white sporodochia located in crevices of recently killed bark of young cankers; and

- sexual, which appears in the form of clusters of orangey red to dark red ovoid perithecia that develop in the second year after canker formation and in older infections.

The perithecia form on the bark adjacent to the canker during or soon after wet weather, and the ascospores they produce play a more important role in disease spread. Ascospores are spread during wet weather by rain splash and wind. These dispersed ascospores begin new infections at bud or leaf scars, twig or branch stubs, and other tree wounds. New infections often occur on younger trees. Ascospores germinate and the fungus colonizes the bark and the surface of the wood.

Nectria cankers develop slowly, especially during periods when the host is growing in the spring and summer. Once tree growth slows in late summer and fall or under stress conditions, the fungus advances into healthy tissue through the release of toxins that kill the host tissue before colonization. In the spring, when tree growth resumes, the host develops callous tissue to try to seal the wound, only to be killed again later in the season. The cycle is repeated each year, resulting in the appearance of successive ridges of callus tissue in the general shape of a target.

Nectria cankers achieve the highest spore production at temperatures of 10°C to 16°C. Optimal spore germination occurs between 20°C to 25°C with a lower limit of 1°C and an upper limit of 30°C. Wetness is critical to infection, however; minimum surface wetness for leaf scar infections is 24 hours at 10°C, 10 hours at 15°C and as little as 2 hours at 20°C.

Damage

Trees weakened or stressed by other factors such as frost, drought, wounds or pests are susceptible to Nectria canker.

Trees with older cankers that affect most of the stem's circumference are vulnerable to wind damage.

Decay is not often a problem within cankers, except with birch and alder.

This pathogen is considered the most damaging stem disease of birch and is also an important disease in apple production where control is often warranted so as to avoid serious economic consequences.

As mentioned earlier, the fungal pathogens, *Neonectria ditissi*ma and *Neonectria faginata*, and two scale insects, *Cryptococcus fagisuga* (beech scale) and *Xylococculus betulae*, interact together to cause beech bark disease. The latter disease is one of the more important forest diseases in eastern North America in terms of temporal and spatial extent as well as negative impact on its host, American beech.

Prevention & management

Pest management strategies for a particular pest vary depending on several factors. These include:

- the population level of the pest (i.e., how numerous the pest is on the affected host(s));
- the expected damage or other negative consequences of the pest's activity (either to the host, property, or the environment);
- an understanding of the pest's life cycle, its various life stages, and the various natural or abiotic agents that affect population levels;
- how many individual host specimens are affected (an individual tree, small groups of trees, plantations, forests);
- the value of the host(s) versus the costs of pest management approaches; and consideration of the various silvicultural, mechanical, chemical, biological, and natural control approaches available and their various advantages and disadvantages.

Decisions about pest management strategies requires information about each of these factors for informed decision-making. These various factors should then be weighed carefully in terms of costs and benefits before action is taken against a particular pest.

Nectria canker cannot be controlled in forests. However, maintaining healthy, vigorous trees minimizes losses. Thinning overly dense stands or completing improvement cuts to maintain stands at optimal density, with special attention to removing cankered trees during these cuts, is beneficial.

Maintaining tree health and vigour is also important for ornamental trees. Keeping trees well watered and occasionally fertilized is helpful. Trees should not be pruned during wet periods or in the spring when the weather is usually wetter, and pruning tools should be sanitized before pruning the next infected host tree. Protecting trees from mechanical injury to avoid potential points of disease infection is also a good practice.

In apple orchards, careful monitoring and stringent pruning when the weather is dry to minimize new infections can control the amount of available inoculum. Applying a protective fungicide after pruning can reduce exposure to infection.

Pesticides registered for use against *Neonectria ditissima* under specific situations may change from year to year for various reasons. Therefore, please search Health Canada's Pesticide Product Information Database for currently registered pesticides and product information for use against the pathogen. The application of any of registered product should be based on population size and applied only when necessary and against the indicated disease stage. It is also recommended to consult a local tree care professional. Chemical pesticides may be toxic to humans, animals, birds, fish, and other beneficial insects. Apply registered products only as necessary and according to all directions and precautions noted on the manufacturer's label. In some jurisdictions and situations, only a licensed professional can apply pesticides. Consulting relevant local authorities to determine local regulations that are in place is recommended.

Selected references

Agriculture and Agri-food Canada. 2019. Crop profile for apple in Canada, 2016. Fourth edition. Pest Management Program. Agriculture and Agri-Food Canada. Ottawa, Ontario. Accessed 5 November 2020. 94 p.

Beresford, R.M.; Kim, K.S. 2011. Identification of regional climatic conditions favorable for development of European canker of apple. Phytopathology 101(1): 135–146. https://doi.org/10.1094/PHYTO-05-10-0137

Bussières, G.; Innes, L.; Laflamme, G.; Tremblay, J. 2009. Centre collégial de développement de matériel didactique. Maladies des arbres du Québec. http://arbres.ccdmd.qc.ca/maladie_fiche_frame.php?IDMal=61&tri=1. (Accessed 5 November 2020).

Cale, J.A.; Garrison-Johnston, M.T.; Teale, S.A.; Castello, J.D. 2017. Beech bark disease in North America: Over a century of research revisited. Forest Ecology and Management 394: 86–103. https://doi.org/10.1016/j.foreco.2017.03.031

Castlebury, L.A.; Rossman, A.Y.; Hyten, A.S. 2006. Phylogenetic relationships of *Neonectria/Cylindrocarpon* on *Fagu*s in North America. Canadian Journal of Botany 84(9): 1417–1433. https://doi.org/10.1139/b06-105

Ghasemkhani, M. 2012. Genetic basis for resistance against fruit tree canker in apple. Introductory paper at the Faculty of Landscape Planning, Horticulture and Agricultural Science. 2012: 7. Swedish University of Agricultural Sciences, Balsgård, Sweden. 40 p.

Latorre, B.A.; Rioja, M.E.; Lillo, C.; Muñoz, M. 2002. The effect of temperature and wetness duration on infection and a warning system for European canker (*Nectria galligena*) of apple in Chile. Crop Protection 21(4): 285–291. https://doi.org/10.1016/S0261-2194(01)00099-0

Lortie, M. 1981. Nectria canker of hardwoods. Environment Canada. Canadian Forestry Service. Laurentian Forest Research Centre, Sainte-Foy, Quebec. Information Leaflet CRFL 10E.

Lortie, M.; Kuntz, J.E. 1963. Ascospore discharge and conidium release by *Nectria galligena* Bres. under field and laboratory conditions. Canadian Journal of Botany 41(8): 1203–1210. https://doi.org/10.1139/b63-101

Plante, F.; Hamelin, R.C.; Bernier, L. 2002. A comparative study of genetic diversity of populations of *Nectria galligena* and *N. coccinea* var. *faginata* in North America. Mycological Research 106(2): 183–193. https://doi.org/10.1017/S0953756201005329

Sinclair, W.A.; Lyon, H.H. 2005. Diseases of trees and shrubs. Second edition. Comstock Publishing Associates, Cornell University Press, Ithaca, New York.

Weber, R.W.S. 2014. Biology and control of the apple canker fungus Neonectria ditissima (syn. N. galligena) from a Northwestern European perspective. Erwerbs-Obstbau 56: 95–107. https://doi.org/10.1007/s10341-014-0210-x

Zalasky, H. Penetration and initial establishment of Nectria galligena in aspen and peachleaf willow. Canadian Journal of Botany 46(1): 57–60. https://doi.org/10.1139/b68-011

Suggested photos & captions

Cankers on various hosts

Fruiting bodies (perithecia and sporodochia)

Ascospores and conidia

Example 3:

Forest tent caterpillar

- **Scientific name:** *Malscosoma disstria* Hubner
- **Other common name(s):** none
- **French common name:** Livrée des forêts
- **Order:** Lepidoptera
- **Family:** Lasiocampidae
- **Scientific Synonym(s):** *none*

General information & importance

Forest tent caterpillar is a serious pest of many species of deciduous trees in North America. In Canada, outbreaks of this native forest pest are common in all but the most northern forest regions. When outbreaks occur, they cover extensive areas and usually completely strip the host trees of their foliage.

Outbreaks happen about every ten years and usually last 2 to 5 years. During outbreaks, forest tent caterpillar larvae tend to migrate collectively once local trees are stripped of their leaves. After larvae pupate, moth flights can include millions of individuals.

Some people might remember a ruined picnic or camping trip because of forest tent caterpillars, while others have lost control of their car while driving roads made slick by millions of migrating larvae. Even train locomotives have stalled on tracks too slippery for traction because of tent caterpillars.

Although the insect's common name implies that they make tents, this is not the case. They can sometimes be found grouped together on silken mats on tree trunks, especially on cool days or in the evening. Other species in the same genus (*Malacosoma*) make silken tents, but the larvae of these species look different from the forest tent caterpillar.

Distribution & hosts

The forest tent caterpillar is found in temperate and boreal deciduous forests from the Atlantic Provinces to British Columbia and north into the Yukon and the Northwest Territories. Its range extends to southern United States.

Due to its widespread distribution, the main hosts of this insect vary by bioclimatic region. In temperate regions, outbreaks of this insect are common on a wide variety of hardwoods but most commonly on sugar maple (*Acer saccharum*) and on red oak (*Quercus rubra*). In boreal regions, outbreaks occur on trembling aspen (*Populus tremloides*).

Symptoms & signs

The most conspicuous symptoms of forest tent caterpillar is defoliation in late May and June. Egg masses are found on host twigs from late summer to early spring. These masses contain 150 to 250 eggs, are grayish brown, and form foam-like bands that encircle individual twigs.

Newly hatched larvae are about 2 to 3 mm long, black, hairy, and feed in groups on emerging leaves following budbreak. Mature larvae are 45 to 55 mm long, hairy, have three pairs of thoracic legs, five pairs of abdominal prolegs, and distinct coloration and markings. Larvae are dark brown to black with a broad blue band along each side. The back of the caterpillar is black and marked by a row of creamy-white to white keyhole-shaped spots and very fine longitudinal orange lines. When viewed from the top, the blue colour dominates along with the white key-holed shaped spots.

Pupae are usually found in clumps of leaves tied together with silk, although they will attach their silken cocoons to whatever is convenient.

Adult moths are dark tan to brown in colour, with two oblique stripes on the forewings. Their wingspan is about 35 to 45 mm.

Life cycle

The forest tent caterpillar has one generation per year. In the spring, usually late April to early May, eggs hatch and larvae begin feeding on newly emerging leaves. Feeding continues for several weeks until larvae are full grown, usually mid to late June, depending on the region.

Mature larvae usually require two weeks for pupation, which typically occurs in late June. Adults usually emerge at the end of June to early July, mate, and females lay about 150–250 eggs in masses on twigs in the upper crowns of host trees. Embryos become fully developed larvae in the eggs before cold weather arrives, but do not emerge from eggs until the following spring.

Cold springs or severe late spring frosts are detrimental to the forest tent caterpillar by delaying leaf-out or killing larvae directly. Also, egg mortality resulting from extreme cold winter temperatures appear to be an important factor influencing the long-term changes in forest tent caterpillar populations in more northern climates.

Damage

During outbreaks, millions of hectares of trees can be completely defoliated, but even severely defoliated trees can withstand short outbreaks relatively well. Trees defoliated for the first time will usually produce another crop of leaves later in the growing season.

On sugar maple and trembling aspen, radial growth loss can range from 40% to 75% after three years of consecutive defoliation. Twig and crown dieback can also occur.

Mortality can occur after severe outbreaks, especially when these outbreaks are synchronous with or followed by droughts.

Prevention & management

Pest management strategies for a particular pest vary depending on several factors. These include:

- the population level of the pest (i.e., how numerous the pest is on the affected host(s));
- the expected damage or other negative consequences of the pest's activity and population level (either to the host, property, or the environment);
- an understanding of the pest's life cycle, its various life stages, and the various natural or abiotic agents that affect population levels;
- how many individual host specimens are affected;
- the value of the host(s) versus the costs of pest management approaches; and
- consideration of the various silvicultural, mechanical, chemical, biological, and natural control approaches available and their various advantages and disadvantages.

Decisions about pest management strategies requires information about each of these factors for informed decision-making. These various factors should then be weighed carefully in terms of costs and benefits before action is taken against any particular pest.

Several natural factors play a role in reducing populations of forest tent caterpillar once outbreaks have developed. Parasitoids and natural predators, such as birds that eat larvae and moths, can often be an important natural control.

The most important parasitoid is the large flesh fly, *Sarcophaga aldrichi*, whose population builds quickly after the start of an outbreak. It can destroy up to 80% of the pupae of a forest tent caterpillar population.

In severe outbreaks, starvation can kill millions of larvae if they exhaust their local food supply before they reach maturity.

On smaller individual ornamental trees, mechanical approaches to control are effective. Egg bands on twigs in the crown can be removed in the fall after leaves have dropped. In the spring, colonies of young larvae can be removed by hand or destroyed. Pressurized water can be used to dislodge larvae from the foliage, although if they are not prevented from climbing back up onto the tree, defoliation will likely resume.

Past research has demonstrated that biological insecticides based on *Bacillus thuringiensis* are effective against forest tent caterpillar larvae for larger trees or in forested situations. Pesticides registered for use against forest tent caterpillar under specific situations may change from year to year for various reasons. Therefore, please search Health Canada's Pesticide Product Information Database for currently registered pesticides and product information for use against forest tent caterpillar. The application of any of registered product should be based on population size and applied only when necessary and against the indicated life stage. It is also recommended to consult a local tree care professional. Chemical pesticides may be toxic to humans, animals, birds, fish, and other beneficial insects. Apply registered products only as necessary and according to all directions and precautions noted on the manufacturer's label. In some jurisdictions and situations, only a licensed professional can apply pesticides. Consulting relevant local authorities to determine local regulations that are in place is recommended.

Selected references

Cerezke, H.F. 1991. Forest tent caterpillar. Forestry Canada, Northwest Region, Northern Forestry Centre, Edmonton, Alberta, Forestry Leaflet 10.

Churchill, G.B.; John, H.H.; Duncan, D.P.; Hodson, A.C. 1964. Long-term effects of defoliation of aspen by the forest tent caterpillar. Ecology 45(3): 630–633. https://doi.org/10.2307/1936115

Cooke, B.J.; Roland, J. 2003. The effect of winter temperature on forest tent caterpillar (Lepidoptera: Tortricidae) egg survival and population dynamics in northern climates. Environmental Entomology 32(2): 299–311. https://doi.org/10.1603/0046-225X-32.2.299

Cooke, B.J.; Roland, J. 2007. Trembling aspen responses to drought and defoliation by forest tent caterpillar and reconstruction of recent outbreaks in Ontario. Canadian Journal of Forest Research 37(9): 1586–1598. https://doi.org/10.1139/X07-015

Cooke, B.J.; Fidgen, J.G.; MacQuarrie, C.J.K.; Roe, A.D. 2018. Forest tent caterpillar. Natural Resources Canada, Canadian Forest Service. Great Lakes Forestry Centre, Sault Ste. Marie, Ontario. Frontline Express 83. 2 p.

Cooke, B.J.; MacQuarrie, C.J.R.; Lorenzetti, F. 2012. The dynamics of forest tent caterpillar outbreaks across east-central Canada. Ecography 35(5): 1–14. https://doi.org/10.1111/j.1600-0587.2011.07083.x

Gray, D.R.; Ostaff, D.P. 2012. Egg hatch of forest tent caterpillar (Lepidoptera: Lasiocampidae) on two preferred host species. The Canadian Entomologist 144(6): 790–797. https://doi.org/10.4039/tce.2012.73

Gross, H.L. 1991. Dieback and growth loss of sugar maple associated with defoliation by the forest tent caterpillar. The Forestry Chronicle 67(1): 33–42. https://doi.org/10.5558/tfc67033-1

Hogg, E.H.; Brandt, J.P.; Kochtubajda, B. 2005. Factors affecting interannual variation in growth of western Canadian aspen forests during 1951-2000. Canadian Journal of Forest Research 35(3): 610–622. https://doi.org/10.1139/x04-211

Ives, W.G.H.; Wong H.R. 1988. Tree and shrub insects of the prairie provinces. Forestry Canada, Northern Forestry Centre, Edmonton, Alberta. Information Report NOR-X-292. 327 p.

Kouassi, K.C.; Lorenzetti, F.; Guertin, C.; Cabana, J.; Mauffette, Y. 2001. Variation in the susceptibility of the forest tent caterpillar (Lepidoptera: Lasiocampidae) to *Bacillus thuringiensis* variety *kurstaki* HD-1: Effect of the host plant. Journal of Economic Entomology 94(5): 1135–1141. https://doi.org/10.1603/0022-0493-94.5.1135

Lachance, D. 1995. Forest insect pests in the Quebec region, Chapter 3. *Pages* 27–40 *in* J.A. Armstrong and W.G.H. Ives, editors. Forest insect pests in Canada. Natural Resources Canada, Canadian Forest Service, Headquarters, Science and Sustainable Development Directorate, Ottawa. 732 p.

Pinkham, J.D.; Frye, R.D.; Carlson, R.B. 1984. Toxicities of *Bacillus thuringiensis* isolates against the forest tent caterpillar (Lepidoptera: Lasiocampidae). Journal of the Kansas Entomological Society. 57(4): 672–674. https://www.jstor.org/stable/25084576

Rose, A.H.; Lindquist, O.H. 1997. Insects of eastern hardwood trees. Natural Resources Canada, Canadian Forest Service, Headquarters, Science Branch, Ottawa, Ontario. 304 p.

Wood, C.S. 1992. Forest tent caterpillar. Forestry Canada, Pacific Forestry Centre, Victoria, BC. Forest Pest Leaflet 17.

Suggested photos & captions

Egg mass

Young and mature larvae

Pupa and cocoon

Adult male and female moth

Severer defoliation of temperate and boreal forests

Natural predators and parasites

Example 4:

Brown spruce longhorn beetle

- **Scientific name:** *Tetropium fuscum* (Fabricius)
- **Other common name(s):** none
- **French common name:** Longicorne brun de l'épinette
- **Order:** Coleoptera
- **Family:** Cerambycidae
- **Scientific synonym(s):** none

General information & importance

The brown spruce longhorn beetle is not native to Canada. It was discovered in 1999 in Nova Scotia. Recent research in Nova Scotia indicates that red spruce (*Picea rubens*) with reduced growth rates and low vigour are more susceptible to attack by the beetle than faster growing, more vigorous trees. The beetle can also complete its life cycle on healthy trees.

Distribution & hosts

In North America, the insect is only found in Nova Scotia and one location in New Brunswick, Canada, on red spruce, white spruce (*Picea glauca*), black spruce (*P. mariana*), and Norway spruce (*P. abies*). The insect's native range is discontinuous. It is found in Europe from Scandinavia to Turkey, and in Asia in Japan and western Siberia. The primary host in its native range is Norway spruce. It has been rarely reported in other species of spruce planted in Europe, such as Colorado blue spruce (*Picea pungens*) and Sitka spruce (*Picea sitchensis*), as well as Scots pine (*Pinus sylvestris*), European silver fir (*Abies alba*), and larch (*Larix* spp.).

Symptoms & signs

The most obvious indications of attack by this insect are streams of resin scattered along the trunk and holes in the bark about 4 mm across (exit holes where the adult beetle emerge). Such trees also typically have declining crowns, including yellowing needles and needle loss. If the bark is stripped from the tree, there will be networks of feeding galleries (tunnels) into the wood, up to 6 mm across and up to 40 mm deep. These galleries appear L-shaped when the wood is cut longitudinally. Coarse sawdust is often found in and around galleries or plugging the exit holes. There may also be sawdust on the ground around the base of the tree.

Larvae are somewhat flattened. They are creamy white in colour, legless, and 15 mm to 25 mm long. Beetles have flattened bodies, 10 to 15 mm long. They have a dark brown or black head and thorax as well as tan, brown, or reddish brown elytra (wing covers) that have two to three longitudinal stripes. The antennae of adults are red-brown and about half of their body length, and their legs are dark brown.

This introduced species is very similar in appearance to our native species of *Tetropium*. A specialist is required to make a positive identification.

Life cycle

In the spring, female beetles lay eggs in the bark of standing or recently felled trees. Eggs are usually laid singly, but sometimes in clusters of up to ten eggs. Larvae hatch 10 to 14 days later, and they bore into the phloem to feed, producing a network of irregular galleries packed with sawdust-like frass (excrement). After about two months, the larvae are full-grown. Most *fuscum* overwinter as prepupal larvae either under the bark or in characteristic L-shaped pupal cells, about 20 to 40 mm deep in the sapwood. Pupation occurs in spring and adults emerge about 14 days later, chewing a round or oval exit hole in the bark about 4 to 6 mm in diameter. The adults live about two weeks and are typically observed from June to August. Both males and females are strong flyers. Although restricted to Nova Scotia and one location in New Brunswick, this beetle would likely have one generation per year across most of the range of spruces in Canada.

The fungus, *Ophiostoma tetropii*, is often associated with BSLB and can be found in the beetle's galleries in the host. The role of this fungus in beetle's life cycle and it pathogenicity are not well known.

Damage

Damage to trees from this pest in Canada is currently limited. In its native range, it generally attacks dead, weakened, or cut trees. The insect occasionally reaches outbreak levels and can attack living, healthy trees at these times. In Europe, outbreaks have the potential to persist for a decade and cause damage across extensive tracts of conifer forest, most commonly stands of Norway spruce more than 50 years of age. In Nova Scotia, red spruce with reduced growth rates and low vigour are more susceptible to attack than faster growing, more vigorous trees.

Prevention & management

Pest management strategies for a particular pest vary depending on several factors. These include:

- the population level of the pest (i.e., how numerous the pest is on the affected host(s));
- the expected damage or other negative consequences of the pest's activity (either to the host, property, or the environment);
- an understanding of the pest's life cycle, its various life stages, and the various natural or abiotic agents that affect population levels;
- how many individual host specimens are affected (an individual tree, small groups of trees, plantations, forests);
- the value of the host(s) versus the costs of pest management approaches; and
- consideration of the various silvicultural, mechanical, chemical, biological, and natural control approaches available and their various advantages and disadvantages.

Decisions about pest management strategies requires information about each of these factors for informed decision-making. These various factors should then be weighed carefully in terms of costs and benefits before action is taken for any particular pest.

Several factors likely play a role in slowing the rate of spread of this introduced species, including parasitoids and natural predators that act as important natural control agents. Two native wasp species (*Rhimphoctona macrocephala* (Ichneumonidae) and *Wroughtonia occidentalis* (Braconidae)) regularly parasitize the brown spruce longhorn beetle. Predators known to feed on the beetle include woodpeckers.

Spruce trees with reduced growth rates and low vigour are more susceptible to attack than faster growing, more vigorous trees. Several forest management practices can reduce the risk of the brown spruce longhorn beetle becoming established in vulnerable trees. These include maintaining a healthy and vigorous forest through proper silviculture and harvest practices; removing trees that have been blown down, broken, or otherwise weakened or damaged; cutting and destroying or harvesting infested trees that show signs and symptoms of beetle attack; and processing cut logs during late fall or winter to help reduce the risk of further beetle spread.

Beetles, such as the brown spruce longhorn beetle, that feed on phloem and wood within trees are difficult to control with pesticides. Pesticides registered for use against the brown spruce longhorn beetle under specific situations may change from year to year for various reasons. Therefore, please search Health Canada's Pesticide Product Information Database for currently registered pesticides and product information for use against this beetle. The application of any of registered product should be based on population size and applied only when necessary and against the indicated life stage. It is also recommended to consult a local tree care professional. Chemical pesticides may be toxic to humans, animals, birds, fish, and other beneficial insects. Apply registered products only as necessary and according to all directions and precautions noted on the manufacturer's label. In some jurisdictions and situations, only a licensed professional can apply pesticides. Consulting relevant local authorities to determine local regulations that are in place is recommended.

Selected references

Canadian Council of Forest Ministers. 2014. Pest risk analysis: Risk assessment of the threat of brown spruce longhorn beetle to Nova Scotia forests. Canadian Council of Forest Ministers, Ottawa, Ontario. 85 p.

Flaherty, L.; Sweeney, J.D.; Pureswaran, D.; Quiring, D.T. 2011. Influence of host tree condition on the performance of *Tetropium fuscum* (Coleoptera: Cerambycidae). Environmental Entomology 40(5):1200–1209. https://doi.org/10.1603/EN11114

Harrison, K.J.; Smith, G.A. 2013. The discovery of *Ophiostoma tetropii* with the brown spruce longhorn beetle (*Tetropium fuscum*) in Halifax, Canada. *Pages* 213-217 *in* K.A. Seifert, Z.W. De Beer, and M.J. Wingfield, editors. The Ophiostomatoid fungi: expanding frontiers. CBS Biodiversity Series 12, CBS-KNAW Fungal Biodiversity Centre, Utrecht, The Netherlands.

Jacobs, K.; Seifert, K.A.; Harrison, K.J.; Kirisits, T. 2003. Identity and phylogenetic relationships of ophiostomatoid fungi associated with invasive and native *Tetropium* species (Coleoptera: Cerambycidae) in Atlantic Canada. Canadian Journal of Botany 81(4):316–329. https://doi.org/10.1139/b03-025

MacKinnon, W.E. 2012. Living with the brown spruce longhorn beetle. Atlantic Forestry Review 19(1):36–39.

O'Leary, K.; Hurley, J.E.; Mackay, W.; Sweeney, J. 2003. Radial growth rate and susceptibility of *Picea rubens* Sarg. to *Tetropium fuscum* (Fabr.). *Pages* 107–114 *in* M.L. McManus and A.M. Liebhold, editors. Proceedings: Ecology, Survey and Management of Forest Insects. 1–5 September 2002. Krakow, Poland. United States Department of Agriculture, Forest Service, Northeastern Research Station. General Technical Report NE-311.

Ramsfield, T.D. 2016. Evolving symbioses between insects and fungi that kill trees in Canada: New threats associated with invasive organisms. The Canadian Entomologist 148(S1): S160–S169. https://doi.org/10.4039/tce.2015.65

Smith, G.A.; Humble, L.M. 2000. The brown spruce longhorn beetle. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, British Columbia, Exotic Forest Pest Advisory 5, 4 p.

Sweeney, J.D.; Silk, P.J.; Rhainds, M.; MacKay, W.; Hughes, C.; Van Rooyen, K.; MacKinnon, W.; Leclair, G.; Holmes, S.E.; Kettela, E.G. 2017. First report of mating disruption with an aggregation pheromone: A case study with *Tetropium fuscum* (Coleoptera: Cereambycidae). Journal of Economic Entomology 110(3):1078–1086. https://doi.org/10.1093/jee/tow308

Kimoto, T.; Duthie-Holt, M.; Dumouchel, L. 2006. Exotic forest insect guidebook. Canadian Food Inspection Agency, 120 p.

Suggested photos & captions

Young and mature larvae

Pupa, and/or tunnels in wood

Adult beetle

Exit holes

Resin and sawdust on infested trees

Weakened crown

Natural predators and parasites

The adult has a flattened body, 1 to 1.5 cm long. The head and neck area are dark brown to black. The elytra (wing covers) can be tan, brown or reddish brown and have two to three longitudinal stripes. The antennae are red-brown and about half of the body length. The legs are dark brown. The egg measures 1 mm long, is oblong and white with a tinge of green. The larvae is yellow-white, about 14 to 28 mm long, and slightly flattened. The larva's head is reddish and about half of the body. The head is reddish brown and about 3 mm wide. The pupa is white and measures 10 to 17 m

ANNEX "B" - BASIS OF PAYMENT **(To be completed at Standing Offer Issuance)**

Stream 1 - Insects	Per Diem Rate (Applicable Taxed Excluded)
Stream One - Standing Offer Award to April 30, 2024	$
Stream One - Option Period #1 (May 1, 2024 to April 30, 2025)	$
Stream One - Option Period #2 (May 1, 2025 to April 30, 2026)	$
Stream One – Option Period #3 (May 1, 2026 to April 30, 2027)	$

Stream 2 - Pathogens	Firm Per Diem Rate (Applicable Taxed Excluded)
Stream Two - Standing Offer Award to April 30, 2024	$
Stream Two - Option Period #1 (May 1, 2024 to April 30, 2025)	$
Stream Two - Option Period #2 (May 1, 2025 to April 30, 2026)	$
Stream Two – Option Period #3 (May 1, 2026 to April 30, 2027)	$

ANNEX "C" – REPORT CARD

Report Card **For Call-ups awarded under the Departmental Standing Offer:** **Writing of Pest Fact Sheets for NRCan's Trees, Insects, and Diseases of Canada's Forests Database**		
Name of Project:		
Contract Number:		
Name of Supplier:	**Standing Offer Number:**	
Name of Person Completing Form:		
Date:		
Work submitted under any call-up to the standing offer may be evaluated by NRCan using this Report Card. Each error will receive one point, as indicated below. Work containing over 5 points lost per 300 words or per document, whichever comes first, will be deemed unacceptable. For example, a 200-word document can lose a maximum of 5 points, while a 700-word document can lose a maximum of 15 points, before being deemed unacceptable. Refer to Part B of the Standing Offer, Section 7.10 Suspension of Standing Offer for consequences of two or more report cards with a score of eleven or less.		
Criteria	**Point Breakdown**	**Number of Errors**
<u>Content</u> Written work is clear and concise, and includes all major elements in each of the sections as outlined for the fact sheets in the SoW.	**1 point for each content error. Content error is defined as:** incorrect information, missing applicable information (major elements of sections as outlined in the SoW), unnecessarily wordy and/or lengthy, or unrelated information.	
Comments:		
<u>Sentence Structure</u> All sentences have proper structure.	**1 point for each sentence structure error. Sentence structure error is defined as:** awkward or poor structure, or ambiguous meaning (e.g. missing or duplicate words, improper use of words).	
Comments:		
<u>Grammar</u> No grammatical errors.	**1 point for each grammatical error. Grammatical error is defined as**: grammar, punctuation, or syntax error.	
Comments:		
<u>Spelling (Oxford Dictionary)</u> No spelling errors.	**1 point for each spelling error. Spelling error is defined as**: the incorrect spelling of a word as indicated in the Oxford dictionary.	
Comments:		
	Total Points:	
	Total Word Count of Document:	
	Maximum Allowable Errors:	

ANNEX "D" – ANNUAL STANDING OFFER USAGE REPORT

Standing Offer Number: _____				
Annual Standing Offer Usage Report for the Period of: _____ to _____				
Stream Service Completed Under	**Call up#**	**Project Authority**	**Comments**	**Call-up amount ($)**
Total SO Expenditure Spent In Reporting Period:				**$**
Total SO Expenditure To Date:				**$**

Note: additional lines may be added to report, if required