2019

Discussion paper: Developing strategic direction for managing forest pests in Ontario

DECEMBER 2019

MINISTRY OF NATURAL RESOURCES AND FORESTRY

ISBN 978-1-4868-3749-6

Contents

Purpose

You are invited to participate in a conversation about how the Ministry of Natural Resources and Forestry can improve forest pest management in Ontario.

To set the stage for your participation, Part 1: Introduction and context, provides the current policy context and reasons for new strategic direction. Part 2: Proposed strategic direction, outlines proposed strategic objectives, principles, and management actions that would comprise direction for how Ontario will respond to forest pests. The latter is what we are seeking your feedback about.

Discussion questions are listed on page 18 as a guide only. We welcome your comments on any aspect of the proposal. Your feedback will help us to refine the proposed elements of the strategic direction.

About this document

Terms defined in the glossary (Appendix 1) are in *italic* font on first use in text.

Part 1: Introduction to forest pest management in Ontario

The Ministry of Natural Resources and Forestry (MNRF) is responsible for forest pest management on Crown land and for pests regulated under the Invasive Species Act on all land in Ontario. The ministry recognizes the importance of prevention, early detection, and early response in managing *native forest pests* and in avoiding the establishment of/*eradicating invasive species*.

As part of that responsibility, the MNRF is proposing strategic direction for managing forest pests to modernize and enhance current forest pest management efforts by enabling a cohesive and coordinated effort across the province. The proposed strategic direction is based on what we've learned from past experience and considers the ongoing need to respond quickly to both native forest pests and invasive species. The strategic direction will improve service delivery by ensuring strategic and efficient government response to pest outbreaks. Improved response will help to protect forest health and improve the resilience of Ontario's forests. A more resilient forest will help to protect the sustainability of Ontario's wood supply in the face of new and changing pressures on our natural resources.

Forest pests

Forest pests are native or invasive species of insects, diseases, and plants that threaten forest health. Severe outbreaks of native pests and introductions of invasive pests can negatively affect *forest health* and human *values* at landscape scale (USDA-FS 2019). Outbreaks that cause widespread damage or tree mortality can affect forest health and may reduce the quantity and quality of wood supply, compromise cultural values, increase fire hazard, reduce *biodiversity*, and limit opportunities for tourism and recreation. Pest outbreaks may have serious socioeconomic implications for northern communities reliant on the forest sector and wood supply. And they can influence global trade, as some countries may choose to impose trade restrictions on wood products to reduce or avoid the chance of introducing new species into their forests.

Described below are the important differences between the *risks* and *effects* of native versus invasive forest pests. Risk refers to both the chance of a pest occurring and the consequences if it does. Effects refers to both positive and negative influences of pests on forest health and human values.

Native forest pests

Native forest pests include native insects and diseases that have historically lived in Ontario's forests and have a role in keeping forests healthy and resilient. Like other types of *forest disturbances,* such as fire and extreme weather, native insects and diseases can have positive and negative effects on the landscape depending on how severe the outbreak is, and which forest values are affected. Native insects and diseases have a role in helping renew the forest

by creating conditions suitable for new growth. For example, jack pine budworm helps to eliminate sick and old trees and reduces competition among younger trees. Native diseases, such as Armillaria root disease, help with nutrient cycling by speeding up the death and decomposition of weak and old trees.

The area affected by forest pests in Ontario varies from year to year (Figure 1). In most years, native forest pest populations are low, pose little risk, and do not cause significant damage. Occasionally, populations rise rapidly to a level that can result in *forest damage* at landscape scale, which is referred to as an outbreak. Many native pests have regular outbreak cycles. The effects of an outbreak depend on how often it occurs, how long it lasts, and how far it spreads. Severe or repeated outbreaks of native forest pests can pose a risk to forest ecosystems and the *services* they provide.

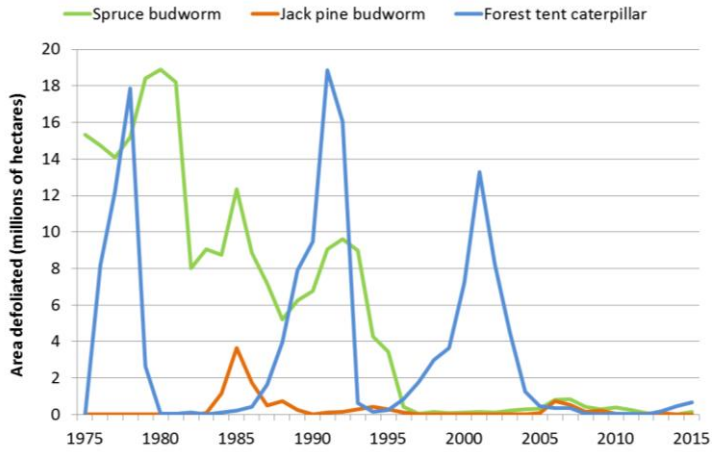

Figure 1. Annual variability in the area defoliated by three major native insect pests in Ontario over a 40-year period.

Invasive forest pests

Invasive forest pests include insects, diseases, and plants that are not native to Ontario's forests and can pose an immediate and serious risk to the environment. Often, invasive pests thrive in their new environment because they have no natural enemies. In addition, native species are unlikely to have defense mechanisms against invasive forest pests, which in many cases can kill healthy trees very quickly.

Invasive species pose a significant risk at a landscape scale, with possible effects on biodiversity, ecosystem stability, and species at risk (Pimentel et al. 2001; Wilcove and Chen 2008). In fact, invasive species are the second leading reason for some species to be at risk of extinction (OMNR 2012). Butternut, American chestnut, and flowering dogwood trees are listed as endangered in Ontario because of invasive diseases (OMNRF 2019a). Other invasive pests such as Dutch elm disease, emerald ash borer, and beech bark disease have destroyed millions of trees across the landscape, thereby reducing biodiversity in Ontario (Euale et al. 1980; Benor et

al. 2006; Donovan et al. 2013; Michigan DNR 2019). Kudzu and dog strangling vine are examples of invasive plant pests that significantly affect native ecosystems by outcompeting native vegetation, killing trees, and changing the overall structure and function of forest ecosystems.

How are forest pests managed in Ontario?

Most forests in central and northern Ontario are owned by the Crown. The MNRF is responsible for maintaining the long-term health of Ontario's Crown forests, in accordance with the Crown Forest Sustainability Act (Statutes of Ontario 1995). As part of that responsibility, MNRF conducts annual surveys to monitor and assess forest health across the province (OMNRF 2019b) and generates maps of disturbed areas to show where damage caused by forest pests and severe weather occurred (OMNRF 2019c).

MNRF manages forest pests to reduce risks to and effects on forest values in the Area of the Undertaking (AOU; managed Crown forest) (Figure 2) for all Ontarians. Depending on the amount of *pest damage* and related effects, some forests may require *protection* (OMNRF 2019b). Since pest outbreaks can occur at landscape scale, planning for management activities also occurs at landscape scale. When outbreaks occur in Crown forests, MNRF works with forest stakeholders and Indigenous communities to determine the most appropriate response. If necessary, the ministry can develop a plan for controlling insect pests.

Figure 2. Area of the Undertaking (area of managed Crown forest) in Ontario.

Insect pest management plans are developed in accordance with requirements set out in the Forest Management Planning Manual (OMNRF 2017) and Declaration Order MNR-75 (Environmental Assessment Act) (MOECC 2015). When a response option includes pesticides, requirements for planning and consultation exist in addition to fulfilling duty to consult obligations as outlined in Aboriginal and treaty rights recognized and affirmed under section 35 of the Constitution Act (1982).

Forest managers can also act to reduce the negative effects of forest pests. In accordance with the Forest Management Planning Manual, the holder of a *sustainable forest licence* can amend their forest management plan to speed up or redirect the harvest in areas affected by forest pests. They can also submit plans to salvage damaged trees. To offset costs associated with pest control in Crown forests, the government and license holders can access funds from the *Forestry Futures Trust*.

The Invasive Species Act supports the prevention, early detection, rapid response, and eradication of invasive species that threaten Ontario's natural environment. This act enables MNRF to regulate invasive forest pests as restricted or prohibited, which could limit or ban activities that may cause their introduction or spread (e.g., possession, transportation, sale, release, propagation). The act also allows for the regulation of carriers or pathways of invasive forest pests (e.g., transportation of wood products).

A shared responsibility

While most forest area in Ontario is owned by the Crown, some forests are under federal or municipal jurisdiction or are privately owned. This means that the responsibility for maintaining long-term forest health is shared amongst different levels of government, Indigenous communities, and private landowners.

Municipalities, private forest owners, and homeowners are responsible for managing pests on their lands. Federal, provincial, territorial, and municipal governments are responsible for pest management on lands under their jurisdiction. Each jurisdiction is also responsible for the costs of managing pests on their lands (Table 1).

Table 1. Overview of jurisdictional responsibilities for forest pest management in Ontario.

Lead jurisdiction	Responsibilities
Federal government	• Pests on federal lands • Invasive pests regulated under the Plant Protection Act
Provincial government	• Pests in Crown forests • Pests regulated under the Invasive Species Act
Municipal government	• Pests on city property
Private	• Pests on private property

While the primary responsibility for forest pest management is usually borne by whomever owns or manages the forest, forest pests and their effects cross jurisdictional boundaries. Therefore, Ontario works with partners in other jurisdictions to ensure that pests affecting Ontario's forests are managed effectively and efficiently.

MNRF collaborates with federal and provincial partners through the Canadian Council of Forest Ministers' Forest Pest Working Group. Ontario also provides training and information to help municipalities and private landowners manage pests on their lands.

Why do we need strategic direction for managing forest pests?

Ontario has a history of managing periodic outbreaks of native forest pests such as jack pine budworm and spruce budworm. Managing both native and invasive pests is becoming more complex due to global trade and climate change. MNRF is proposing strategic direction to promote efficient and effective response to forest pest outbreaks to address management concerns under these complex and changing conditions. A strategic approach to forest pest management will help to ensure our natural resources remain healthy and our wood supply is protected for current and future generations.

Emerging pressures on Ontario's natural resources

Global trade increases risks from invasive forest pests, as they can be unintentionally transported into Canada via shipping materials or vehicles (Klapwijk et al. 2016). Almost 50 species of invasive forest insects and diseases are established in Canada (OMRF 2019d). Invasive insects and diseases are costing the Canadian forest sector about $20 billion per year for containment and control, over and above resulting production losses and reduced market access (EC 2010). Further, invasive forest pests pose a significant threat to forest biodiversity.

Climate change may cause more frequent and severe outbreaks of native forest pests by making conditions more favourable for populations to thrive. In particular, a native forest pest may become more destructive, as happened with mountain pine beetle in western Canada. Similar problems could happen in Ontario with native insect pests such as jack pine budworm, spruce budworm, and forest tent caterpillar.

A changing climate can also make it easier for invasive forest pests to survive and become established in new environments (Ramsfield et al. 2016). Pests previously limited by weather conditions may be able to live and reproduce in Ontario's forests.

Collectively, the effects of climate change and globalization are expected to make forests more *vulnerable* to pest disturbances. Ontario must anticipate these risks and act quickly to minimize negative effects. And Ontario's policies must enable timely action to reduce the risks posed by and effects of forest pests on forest values in the AOU. Forest pest management direction is provided through four pieces of legislation:

- The Crown Forest Sustainability Act (Statutes of Ontario 1995) enables the funding of pest control on Crown lands. The Forest Management Planning Manual (OMNRF 2017;

regulated under the Crown Forest Sustainability Act) enables the development of an insect pest management program.

- The Environmental Assessment Act (Declaration Order MNR-75) (MOECC 2015) sets out requirements for insect pest management plans, including consultation.
- The Forestry Act (Statutes of Ontario 1990) enables the control of pest infestations on any land in Ontario.
- The Invasive Species Act (Statutes of Ontario 2015) enables prevention and control of invasive pests that affect the natural environment.

Each of these laws enables actions for a specific type of forest pest or a single type of management. However, no policy establishes overall direction for how MNRF should manage all pests, or how to prioritize the risks of different forest pests when allocating limited resources. A lack of direction can lead to delays in carrying out management actions when they are urgently needed. MNRF is proposing risk-based strategic direction that enables forest managers to take timely, efficient, and measurable action.

Part 2: Proposed strategic direction

MNRF is committed to sustainably managing Ontario's natural resources to provide continuous benefits for all Ontarians. The proposed direction set out in this document strives to balance the ecological role of native forest pests with the need to protect forest health and human values. The intended outcome of this policy is to establish a strategic, risk-based approach for managing all forest pests in Ontario. The actions proposed are part of MNRF's current business, however, the strategic direction proposed will help to coordinate those actions across the ministry to ensure a cohesive, risk-based, and efficient approach to the way we manage pests in Ontario.

The strategic direction for Ontario adopts a proactive approach, where the risks of a known pest will be assessed in advance of an outbreak or event. This will enable broader and more timely consideration of the full range of forest pests across the province.

Under this approach, pest events that pose the greatest risk to forest health and human values will be prioritized and responded to as quickly as possible to minimize damage and negative effects. Forest pests that are not threatening forest health or human values will not be actioned in recognition of their ecological role in renewing forest ecosystems.

This approach will enable more efficient allocation of limited resources to management actions with the greatest benefit for Ontarians. This direction is consistent with other strategic approaches for managing natural disturbances, such as MNRF's Wildland Fire Management Strategy (OMNRF 2014), and supports improving resilience of natural ecosystems and *sustainable forest management* objectives under A Made-in-Ontario Environment Plan (MECP 2018).

Purpose

To establish strategic, risk-based direction for managing forest pests in Ontario.

Scope

This strategic direction applies to native and invasive forest pests in Crown forests in Ontario.

Jurisdictional roles and responsibilities

While the provincial government has primary responsibility for maintaining long-term Crown forest health, this responsibility is shared with other jurisdictions and agencies who own or manage forests in Ontario.

Ontario is committed to collaborating with other jurisdictions/agencies to ensure that forest pests are managed effectively and efficiently across the province. Formal collaborative mechanisms will continue to be used to share information, especially about pest risks and management decisions in other jurisdictions/by other agencies (Table 2). MNRF will also use

collaborative mechanisms to encourage partners to make Ontario's interests a priority for action within their mandate.

Table 2. Potential collaborators for Ontario's forest pest management initiatives.

Jurisdiction	Group/agreement
Federal	Canadian Council of Forest Ministers' Forest Pest Working Group Canada-Ontario Memorandum of Understanding Concerning Cooperation in Forestry National Plant and Animal Health Strategy
Province/state	Critical Plant Pest Management Committee Great Lakes Forest Fire Compact Ontario-Quebec Memorandum of Understanding Concerning Collaborative Actions on Forestry

Depending on resources and capacity, MNRF will continue to support collaborative forest pest management efforts where Ontario does not have the lead responsibility, including invasive forest pests regulated under the federal Plant Protection Act (1990), and forest pest outbreaks on municipal or private lands.

In addition to the Forest Management Planning Manual (OMNRF 2017) requirements for Indigenous consultation on developing a forest management plan for areas in the AOU, forest managers must also develop a consultation plan when establishing an insect pest management program. Consultation and involvement with Indigenous communities is integral to the forest management planning process. Consultation and involvement are conducted in a manner that respects Aboriginal and treaty rights, and that assists the Crown in addressing its duty to consult obligations, where triggered.

The MNRF will continue to work with Indigenous communities to ensure the long-term health of Ontario's Crown forests through the preparation and implementation of forest management plans, including the collection of traditional ecological knowledge such as values information, and addressing emerging issues such as native forest pests, invasive species, and climate change.

Principles

The principles outlined here reflect the overall approach for how forest pests will be managed in Ontario. Forest pest management will be:

- Evidence-based
    - Base management decisions on the best available evidence about risks and effects.

- Recognizing that current information, data, and traditional ecological knowledge are critical to assess risks, identify effects and management actions for forest pests in Ontario.

- Efficient
  - Whenever possible, use a proactive approach to ensure management actions are efficient and cost-effective.
  - Recognizing that early action to prevent outbreaks and minimize negative effects is more efficient and cost-effective than reacting later, use a proactive approach to ensure better value for money while helping to avoid future costs associated with pest damage in Ontario.

- Collaborative
  - Apply a coordinated effort across multiple jurisdictions since forest pests often cross jurisdictional boundaries.
  - Recognizing that the responsibility for forest pest management usually depends on who owns or manages the forest, collaborate with other jurisdictions, partners, and stakeholders to ensure that forest pests are managed effectively and efficiently across the province.

Objectives

The MNRF manages Crown forests to meet the long-term social, economic, and ecological needs of Ontarians. Accordingly, pest management will help to ensure that Ontario's Crown forest ecosystems are healthy and that negative socioeconomic effects are minimized. MNRF will also act to ensure that Ontarians understand the risks posed to natural resources by forest pests and are knowledgeable about best management practices.

The objectives of forest pest management are to:

- Maintain healthy and resilient forests by:
  - Maintaining the ecological role of forest pests in natural ecosystem processes
  - Protecting forest ecosystems from extreme pest outbreaks

- Minimize socioeconomic impacts from forest pests by:
  - Protecting jobs by maintaining the volume and quality of wood supply
  - Maintaining opportunities for recreation and tourism, such as hunting and fishing
  - Protecting communities by reducing fire hazard and risks to public safety

- Raise awareness of forest pests by:
    - Promoting understanding of the ecological role of forest pest disturbances
    - Sharing information about forest pest status, risks, management actions, and best practices

Management actions

Forest pest management is about more than just responding to an outbreak. This proposed strategic direction describes a comprehensive set of management actions, some ongoing and some new. Most actions represent foundational, ongoing work that is critical to decision making, such as monitoring, research, and response. Other actions reflect new focus areas that will improve overall preparedness, including risk assessment and communications.

Through the following potential management actions, MNRF will maintain healthy forests, minimize socioeconomic impacts, and raise awareness of forest pests while following an evidence-based, proactive and collaborative approach. At any given time, a range of management actions may be undertaken, as appropriate depending on the circumstances.

Monitor

MNRF will continue to monitor forest health using the best available methods, tools, and technologies.

Forest health monitoring produces essential information about where forest pest outbreaks are occurring and how severe the damage is. To detect pest outbreaks early, MNRF must continue to monitor severe weather events, such as wind, drought, and ice storms, as affected trees can become stressed or die, making them more vulnerable to infestation by pests.

Monitoring information is a key input to risk assessments and, therefore, is crucial to inform the overall decision-making process. In addition, monitoring data is helpful for assessing the condition of forest ecosystems and evaluating the effectiveness of pest control actions.

Monitoring actions - MNRF will:

- Collect annual information about forest pest activity and severe weather events across Ontario
- Detect and identify new pests
- Make associated data and information available online

Assess

MNRF will assess the risks of forest pests in advance of an outbreak or introduction.

Pest management is costly for the government, forest managers, and forest owners. MNRF is modernizing service delivery to provide greater clarity on policy and tools to make decisions to improve cost efficiency of actions by taking a strategic approach. Understanding the risks posed by the full range of forest pests is important to prioritize investments. A risk-based approach ensures that resources can be invested where they will provide the most benefits. Information, evidence, and data produced from monitoring and research will form the basis for the risk assessments.

For native forest pests, risk assessments will estimate the likelihood of an outbreak, the severity of the effects should an outbreak occur, and the probability of successful intervention. For new invasive forest pests, a risk assessment will also determine the likelihood of its introduction and establishment in Ontario.

Risk assessments will identify and quantify pest effects on forest health and a range of values, including wood supply, global trade, public safety (fire hazard), wildlife habitat, carbon storage, recreation, tourism, and features of significance to Indigenous peoples and communities.

To allocate resources effectively, MNRF needs to know which pests pose the greatest risk. Therefore, the relative risks of different forest pests will be assessed to establish a prioritized list to inform decisions. Priority will be assigned to pests expected to have the most severe effects and with the highest probability of successful intervention.

Assessment actions - MNRF will:

- Conduct forest pest risk assessments and update them regularly
- Identify forest pest knowledge gaps
- Assess relative risks of different forest pests to establish a prioritized list, which will inform decisions and investments

Respond

MNRF will continue to respond to outbreaks where the provincial government has the lead jurisdictional responsibility.

The results of monitoring and pest risk assessments will be used to determine which response action(s) are appropriate. The type of response will largely depend on whether the pest is invasive or native, and the level of risk it poses to forest health and human values. For invasive pests, the focus will be on preventing introductions and, if introduced, eradicating populations, where feasible. The focus for native pests is to control populations during severe outbreaks to minimize damage so that trees have a higher chance of survival. Eradication is not appropriate

for native pests since they have a role in natural ecosystem processes. Where effects cannot be avoided, the appropriate response will be to slow the spread and ultimately find ways to adapt to the pest and its effects.

In carrying out a response to a pest outbreak, MNRF will consult with Ontarians and will collaborate with other jurisdictions as necessary. MNRF will fulfill legal obligations for consulting with Indigenous communities. In addition, MNRF will share information with stakeholders, Indigenous communities, and the public to ensure a clear understanding of when, where, why, and how management actions are taken.

Potential response actions for native forest pests - MNRF will:

- Reduce the potential for, or severity of, outbreaks through proactive forest management practices (e.g., providing support for timely and targeted action to address pest outbreaks through spray programs)
- Conduct targeted surveys to delineate outbreaks and assess their severity
- Control outbreaks (e.g., apply pesticide, remove infested trees) to reduce negative effects
- Conduct targeted and timely education and communication about outbreaks and response
- Adapt to pest effects that cannot be avoided by developing best management practices (e.g., choose appropriate species for replanting)
- Allow outbreak to run its course (take no action) where appropriate (e.g., events with low risk to forest health and human values)

Potential response actions for invasive pests - MNRF will:

- Prevent introductions
- Conduct targeted monitoring of a suspected introduction or infestation
- Control or contain populations to slow the spread (e.g., regulate the movement of wood products, apply pesticide, remove or destroy infested trees)
- Eradicate pest populations (e.g., regulate the movement of wood products, apply pesticide, remove and destroy infested trees)
- Adapt to pest effects that cannot be avoided by developing best management practices (e.g., identify resistant trees for possible breeding program)
- Conduct targeted education and communication about introductions, outbreaks, and prevention
- Take no action in cases where a pest is likely to become established or intervention is not likely to be successful

Research

MNRF will focus research efforts on addressing knowledge gaps for forest pests that pose higher risks.

MNRF has a wealth of knowledge about native forest pests because of past investments in collaborative, long-term research programs, along with past management actions. Continued research on native forest pests will help to improve our approach to management to control/adapt to them and will shed light on new areas of uncertainty, such as the effects of climate change on forest pests. As invasive forest pests often arrive unexpectedly, very little is known about them and how they will behave in new environments. For invasive forest pests, research is critical in providing the knowledge and tools required for timely actions to minimize negative effects (McKenney et al. 2012; Earle 2019; Shlarbaum et al. 2019).

For both native and invasive forest pests, knowledge gaps need to be identified so that recommendations can be made about research priorities. Risk assessments will help to establish the knowns and uncertainties related to forest pests. This will enable MNRF to address knowledge gaps in advance, rather than waiting for a native pest to become a problem or for an invasive pest to arrive. Where necessary, research efforts will be focused on addressing knowledge gaps for forest pests with the highest risk of having negative effects on forest health. Research results will be used to update risk assessments, best practices, and response plans.

Research actions - MNRF will:

- Address knowledge gaps identified through risk assessments
- Improve understanding of pest biology, risks, effects, and control options
- Improve understanding of climate change effects on forest pests
- Improve understanding of the cumulative effects of natural disturbances on forests
- Examine and assess forest pest management practices used in other jurisdictions
- Evaluate effectiveness of past control actions
- Make research results available
- Use new information to update risk assessments and response plans regularly

Communicate

MNRF will improve public awareness of forest pest events, risks, and effects as well as planned responses.

Since it is not appropriate, nor possible, to control all forest pest outbreaks, Ontarians need to understand the role of forest pest disturbances in ecological cycles. Some disturbance by pests

is necessary for forest renewal. The ministry will clearly explain the risk-based criteria that are used to determine whether forest pest outbreaks will be left to follow their natural course or warrant action.

When a severe potentially damaging forest pest event does occur, it is often crucial to act quickly. Improving public awareness of forest pest status, risks, and effects will help to build support for early action, which is when it is most likely to be successful. In many cases, forest pest outbreaks worsen with time, and their effects and costs to control increase if action is delayed. This is especially true for invasive forest pests.

To implement timely forest pest management actions, MNRF needs support from Indigenous communities, stakeholders, and the public. This support is only possible if MNRF shares information about its approach and the associated management actions in advance. In addition to meeting legal consultation obligations, MNRF will clearly explain when, where, why, and how pest management actions are undertaken. Information will be shared through an accessible website, along with formal government reports.

Communication actions - MNRF will:

- Make information available online
- Report on progress in implementing this strategic direction every five years

Review

MNRF will review this strategic direction regularly.

MNRF will ensure adaptive management is incorporated into the regular review cycle to further link the strategic direction to the forest policy framework. MNRF will analyze past pest effects and trends to identify emerging issues and opportunities for improvement. MNRF will also evaluate how well management actions are meeting strategic objectives. The strategic direction will be updated to incorporate new information, science, and best practices.

Review actions - MNRF will:

- Conduct a review of the strategic direction at regular intervals
- As required, update the strategy to reflect the results of periodic reviews, along with new information, science, and best practices

Next steps

Through this discussion paper, Ontario is initiating a dialogue about proposed strategic direction for improving the way forests pests are managed in the province by clarifying the intent of forest pest management efforts and ensuring efficient use of resources via a risk-based approach.

The MNRF wants to know what you think about the proposed approach. We welcome your input on the questions listed below or other aspects of the strategic direction and will use your feedback to inform the recommended strategic direction (Figure 3).

The recommended strategic direction will guide the government's action to establish a strategic, risk-based approach for managing forest pests in Ontario.

Figure 3: Timeline for developing and implementing strategic direction for managing forests pests in Ontario.

Discussion questions

The following questions are provided as a guide only; we welcome your comments on any aspect of the proposal. Your feedback will help us to refine the proposed elements of the strategic direction.

1. How important is it to you that the province maintain an active role in forest pest management?
2. What are the effects of forest pests that most concern you?
3. What specific aspects of forest pest management would you like to see improved (e.g., prevention, detection, monitoring, risk assessment, response, research, communication)?
    a. Please list the aspects you would like to see improved in order of priority.
    b. For each aspect you prioritized above, please describe the improvements that are needed.

Literature cited

Benor, T.K., S.S. Metcalf, L.E. Fontenot, B. Sangunett and B. Hannon. 2006. Modeling the spread of the emerald ash borer. Ecological Modelling 197: 221.

Charter of Rights and Freedoms, s 35, Part 2 of the Constitution Act, 1982, being Schedule B to the Canada Act 1982 (UK), 1982, c 11. <https://laws-lois.justice.gc.ca/eng/const/page-16.html#h-52>. Accessed August 2019.

Crown Forest Sustainability Act, 1994, S.O. 1994, c. 25. <https://www.ontario.ca/laws/statute/94c25>. Accessed August 2019.

Earle, C.J. (ed.). 2019. Cronartium ribicola: White pine blister rust. The Gymnosperm Database. <https://www.conifers.org/pi/blstrust.php>. Accessed May 2019.

[EC] Environment Canada. 2010. Invasive Alien Species Partnership Program: 2005-2010 report. Environment Canada, Gatineau, QC. <https://www.ec.gc.ca/nature/default.asp?lang=En&n=B008265C-1>. Accessed May 2019.

Euale, L.R., L.M. Gardiner, G.O. Huntley, L.G. Jago and E.S. Kondo. 1980. An integrated Dutch elm disease control program for Sault Ste, Marie, Part III. Canadian Forest Service, Great Lakes Forest Research Centre, Sault Ste. Marie, ON. Report O-X-307.

Donovan, G.H., D.T. Butry, Y.L Michael, J.P Prestemon, A.M. Liebhold, D. Gatziolis and M.Y. Mao. 2013. The relationship between trees and human health evidence from the spread of the emerald ash borer. American Journal of Preventative Medicine 44: 139.

Hodge, J. National Forest Pest Strategy – Pest Risk Analysis Framework: User's Guide. Canadian Council of Forest Ministers, Forest Pest Working Group, Ottawa, ON. 40 p. <https://www.ccfm.org/pdf/National%20Forest%20Pest%20Strategy_Pest%20Risk%20Analysis%20Framework_User's%20Guide_EN.pdf>. Accessed May 2019.

Klapwijk, M.J., A.J.M. Hopkins, L. Eriksson, M. Pettersson, M. Schroeder, A. Lindelow, J. Ronnberg, E.C.H. Keskitalo and M. Kenis. 2016. Reducing the risk of invasive forest pests and pathogens: Combining legislation, targeted management and public awareness. Ambio 45(2): 223–234.

McKenney, D.W., J. Pedlar, D. Yemshanov, D.B. Lyons, K.L. Campbell and K. Lawrence. 2012. Estimates of the potential cost of emerald ash borer (*Agrilus planipennis* Fairmaire) in Canadian municipalities. Arboriculture and Urban Forestry 38(3): 81–91.

Michigan [DNR] Department of Natural Resources. 2019. Forest Pest Alert: Beech Bark Disease. Midwest Invasive Species Information Network.

<https://www.michigan.gov/documents/mdard/BeechBarkDisease_3-14_453016_7.pdf>. Accessed May 2019.

[MOECC] Ministry of Environment and Climate Change. 2015. Declaration Order MNR-75: Environmental Assessment Requirements for Forest Management on Crown Lands in Ontario. Toronto, Ontario. <https://www.ontario.ca/page/environmental-assessment-requirements-forest-management-crown-lands-ontario-mnr-75>. Accessed August 2019.

[MECP] Ministry of Environment, Conservation and Parks. 2018. A Made-in-Ontario Environment Plan. Toronto, Ontario. <https://prod-environmental-registry.s3.amazonaws.com/2018-11/EnvironmentPlan.pdf>. Accessed August 2019.

[NRCan] Natural Resources Canada. 2019. Forest pest management. <https://www.nrcan.gc.ca/forests/fire-insects-disturbances/pest-management/13361>. Accessed May 2019.

[OMNR] Ontario Ministry of Natural Resources. 2012. Ontario invasive species strategic plan 2012. Toronto, ON. 68 p.

[OMNRF] Ontario Ministry of Natural Resources and Forestry. P00464 2014. Wildland Fire Management Strategy. Toronto: Queen's Printer for Ontario.

[OMNRF] Ontario Ministry of Natural Resources and Forestry. 2017. Forest management planning manual. Ontario Ministry of Natural Resources and Forestry, Toronto, ON. 462 p.

[OMNRF] Ontario Ministry of Natural Resources and Forestry. 2019a. Invasive insects and disease. <https://www.ontario.ca/page/invasive-insects-and-disease>. Accessed June 2019.

[OMNRF] Ontario Ministry of Natural Resources and Forestry. 2019b. Native insects and disease. <https://www.ontario.ca/page/native-insects-and-disease>. Accessed June 2019.

[OMNRF] Ontario Ministry of Natural Resources and Forestry. 2019c. Forest health conditions. Retrieved from: <https://www.ontario.ca/page/forest-health-conditions>. Accessed June 2019.

[OMNRF] Ontario Ministry of Natural Resources and Forestry. 2019d. Invasive species in Ontario. <https://bcinvasives.ca/documents/Downe_final.pdf>. Accessed June 2019.

Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds). 2007. Appendix I: Glossary. In Climate change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK/New York, NY.

Pimentel, D., S. McNair, J. Janecka, J. Wightman, C. Simmonds, C. O'Connell, , E. Wong, L. Russel, J. Zern, T. Aquino and T. Tsomondo. 2001. Economic and environmental threats of alien plant, animal, and microbe invasions. Agricultural Ecosystems and Environment 84: 1–20.

Plant Protection Act (S.C. 1990, c. 22). <https://laws-lois.justice.gc.ca/eng/acts/p-14.8/>. Accessed August 2019.

Ramsfield, T.D., B.J. Bentz, M. Faccoli, H. Jactel and E.G. Brockerhoff. 2016. Forest health in a changing world: Effects of globalization and climate change on forest insect and pathogen impacts. Forestry 89(3): 245–252.

Schlarbaum, S.E., F. Hebard, P.C. Spaine and J.C. Kamalay. 2019. Three American tragedies: chestnut blight, butternut canker, and Dutch elm disease. USDA-FS-SRS. <https://www.srs.fs.usda.gov/pubs/ja/ja_schlarbaum002.htm>. Accessed May 2019.

Statutes of Ontario. 1990. Forestry Act, R.S.O. 1990. Chapter F.26.

Statutes of Ontario. 1995. Crown Forest Sustainability Act, revised. R.S.O. 1998. Chapter 25 and Ontario Regulation 167/95.

Statutes of Ontario. 2015. Invasive Species Act. S.O. 2015. Chapter 22, Bill 37.

Stolte, K.W. 1997. 1996. National technical report on forest health. USDA Forest Service, Southern Research Station. <https://www.fs.fed.us/foresthealth/fhm/pubs/96insect.htm>. Accessed May 2019.

[USDA-FS] United States Department of Agriculture - Forest Service. 2019. Protecting the Forest. < https://www.fs.fed.us/foresthealth/protecting-forest/index.shtml>. Accessed September 2019.

Wilcove, D.S. and L.Y. Chen. 2008. Management costs for endangered species. Conservation Biology 12: 1405–1407.

Appendix 1: Glossary

Biodiversity is the variety and variability among living organisms from all sources, including terrestrial, marine and aquatic ecosystems, and the ecological complexes of which they a part; includes diversity within and among species and of ecosystems (OMNRF 2017).

Disease is the harmful deviation from normal functioning of physiological processes and can be abiotic or biotic in origin (OMNRF 2017).

Ecosystem services are ecological amenities or functions that are of value (monetary or non-monetary) to individuals or society. They include supporting services such as maintaining productivity or biodiversity; provisioning services such as goods, fibre, or fish; regulating services such as climate regulation or carbon sequestration; and cultural services such as tourism or spiritual and aesthetic appreciation (Parry et al. 2007).

Effects refers to both positive and negative influences of forests pests on forest health and forest values (Stolte 1997; NRCan 2019).

Eradication refers to completely removing a species from an ecosystem.

Forest damage occurs from individual trees being damaged by native insects and diseases or invasive insects, diseases, and plants at landscape scale.

Forest health is the condition of a forest ecosystem that sustains the ecosystem's complexity while providing for the needs of the people of Ontario (Statutes of Ontario 1995; OMNRF 2017).

Forest pests are native or invasive species of insects, diseases, and plants that threaten forest health (NRCan 2019).

Forestry Futures Trust is a fund that provides funding for silvicultural expenses in Crown forests where forest resources have been killed or damaged by fire or natural causes; silvicultural expenses on land managed under a forest resource licence, if the licensee becomes insolvent; intensive stand management and pest control for forest resources in Crown forests; and other purposes as may be specified by the Minister (CFSA Section 51(3); OMNRF 2017).

Natural disturbance is an event (e.g., fire, wind, ice storm) that changes the course of succession of a forest stand(s) (OMNRF 2017).

Pest risk assessment is the process of identifying a hazard and estimating the risk associated with it by analyzing scientific and socioeconomic evidence to characterize, evaluate, and summarize the risk in a way that addresses the needs of decision makers (Hodge 2015)

Protection refers to forest management operations carried out to prevent, control, or manage the spread of or the damage caused by insects and diseases; may involve the use of insecticides or manual treatments (OMNRF 2017)

Resilience is "the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change" (Parry et al. 2007)

Risk refers to the likelihood of something occurring and its consequences (Hodge 2015).

Sustainable forest management is the management of forests to maintain a healthy forest ecosystem which provides a continuous, predictable flow of benefits (OMNRF 2017)

Value is a term used to describe known natural, cultural, or First Nation or Métis resource attribute or use of land (OMNRF 2017)

Vulnerability is "the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity" (Parry et al. 2007).