Five-Year Report on the
Status of Forestry

APRIL 2011 – MARCH 2016

Manitoba

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Five-Year Report on the **Status of Forestry**

APRIL 2011 – MARCH 2016

MINISTER
OF SUSTAINABLE DEVELOPMENT

Room 330
Legislative Building
Winnipeg, Manitoba R3C 0V8
CANADA

Letter from the Minister

To Her Honour, The Honourable Janice Filmon

Lieutenant-Governor of Manitoba

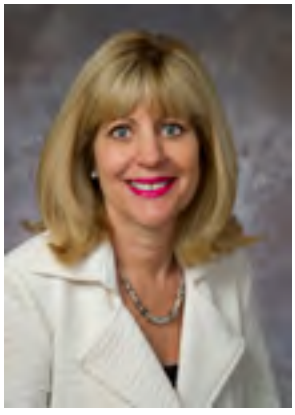
Your Honour:

As Minister responsible for the department of Sustainable Development, I am pleased to present the Five-Year Report on the Status of Forestry to the legislature for the period ending March 31, 2016.

Our forests are an important part of life in Manitoba. From employment to recreation to education, this vast resource offers all Manitobans a variety of economic, environmental and cultural benefits. Managing the forests appropriately - managing the forests sustainably - means finding that balance between growth and protection.

Working with communities throughout Manitoba, as well as with local and national organizations, Manitoba continues to protect and enhance both urban and natural forests by monitoring and managing invasive forest insects and disease, by preparing for a changing climate and predicting how this will affect Manitoba's forests, by encouraging new and existing development and an emerging biomass industry to help reduce energy costs, and by consulting and recognizing the rights of First Nations, Métis and Indigenous communities throughout Manitoba.

This report reviews the last five years of forestry in Manitoba.



Yours truly,

Cathy Cox
Sustainable Development Minister

MINISTRE
DU DÉVELOPPEMENT DURABLE

Bureau 330
Palais législatif
Winnipeg (Manitoba) R3C 0V8
CANADA

Lettre de la ministre
à Son Honneur, l'honorable Janice Filmon
Lieutenante-gouverneure du Manitoba

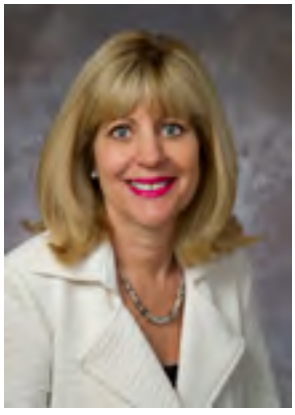
Votre Honneur,

En tant que ministre du Développement durable, j'ai le plaisir de présenter le Rapport quinquennal sur l'état des forêts à l'Assemblée législative pour la période qui s'est terminée le 31 mars 2016.

Nos forêts constituent une partie importante de la vie de notre province. De l'emploi aux loisirs en passant par l'éducation, cette vaste ressource offre à tous les Manitobains et les Manitobaines toutes sortes d'avantages économiques, écologiques et culturels. Une gestion adaptée des forêts, une gestion durable des forêts, est une gestion qui permet de garder un équilibre entre la croissance et la protection.

En collaboration avec les collectivités de toute la province, de même qu'avec des organisations locales et nationales, le Manitoba continue de protéger et de bonifier aussi bien les forêts urbaines que les forêts naturelles en surveillant et en gérant les insectes et les maladies qui peuvent envahir les arbres, en se préparant en vue du changement climatique et en faisant des prédictions sur les conséquences à prévoir pour les forêts, en encourageant les initiatives nouvelles et existantes, de même que la nouvelle industrie de la biomasse qui permettra de réduire les coûts de l'énergie, et en consultant les communautés autochtones, métisses et des Premières nations de toute la province, ainsi qu'en reconnaissant les droits de celles-ci.

Ce rapport passe en revue l'état des forêts du Manitoba dans les cinq dernières années.



Je vous prie d'accepter, Votre Honneur, l'expression de mes sentiments les plus respectueux.

La ministre du Développement durable,
Cathy Cox

Manitoba
Sustainable Development
Deputy Minister
Room 314 – Legislative Building
Winnipeg, MB R3C 0V8
T 204-945-3785 **F** 204-945-3586
dmsdev@leg.gov.mb.ca

Letter from the Deputy Minister
To the Honourable Cathy Cox,
Sustainable Development Minister

Honourable Minister:

I am pleased to submit the Five-Year Report on the Status of Forestry to the Legislature for the period April 1, 2011 to March 31, 2016.

This report reviews the Department's programs, highlights changes and challenges to Manitoba's forests and forest industries, and identifies how the Province is managing these issues.

Yours Truly,

Bruce Gray
Acting Deputy Minister of Sustainable Development

Manitoba
Développement durable

Sous-ministre
Salle 314 - Palais Legislatif
Winnipeg (Manitoba) Canada R3C 0V8
Tél. : 204 945-3785 Téléc. : 204 945-3586
dmsdev@leg.gov.mb.ca

Lettre du sous-ministre
à Madame Cathy Cox,
ministre du Développement durable

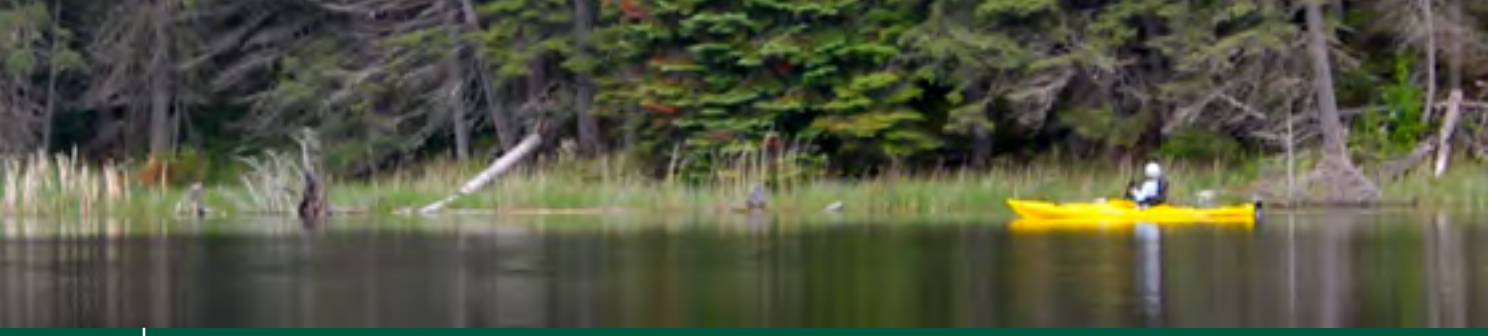
Madame la Ministre,

J'ai le plaisir de présenter le Rapport quinquennal sur l'état des forêts à l'Assemblée législative pour la période du 1er avril 2011 au 31 mars 2016.

Ce rapport examine les programmes du ministère, souligne les changements, ainsi que les défis qui se posent aux forêts et l'industrie forestière du Manitoba, et indique de quelle façon la Province traite ces questions.

Veuillez agréer, Madame la Ministre, l'expression de mes sentiments respectueux.

Le sous-ministre adjoint interimaire du Développement durable
Bruce Gray



Executive Summary / Sommaire

Forests, whether urban or natural, are important to every community in Manitoba. Manitoba continues to support the management of our forests for sustainable development and a growing green economy.

Les forêts, qu'elles soient urbaines ou naturelles, sont importantes pour toutes les collectivités du Manitoba. Le Manitoba continue à appuyer une gestion de nos forêts qui favorise le développement durable et une économie verte florissante.

In cities and towns, trees add value to people's homes and lives. Protecting this value is therefore an important aspect of managing an urban forest.

Dutch elm disease has destroyed many elm trees since it was first introduced to Manitoba in 1975. And because of Manitoba's management efforts, many communities continue to enjoy large, mature elm on their yards and boulevards. In 2016, 38 communities transitioned to community forestry agreements to encourage local response to protecting communities from the further spread of this disease to healthy elm trees.

Manitoba continues to monitor for invasive species like European gypsy moth, emerald ash borer, and mountain pine beetle. These insects are not just threats to urban forests, but could destroy large portions of Manitoba's natural forests as well. By working with communities throughout the province, and with both national and local organizations, such as the Canadian Food Inspection Agency, the City of Winnipeg,

Les forêts, qu'elles soient en milieu urbain ou naturel, sont importantes pour chacune des collectivités du Manitoba. Le Manitoba continue d'appuyer la gestion de nos forêts pour favoriser le développement durable et une économie verte en croissance.

Dans les villes, les arbres ajoutent de la valeur aux propriétés des résidents et dans leur vie. La protection de cette valeur est donc un important aspect de la gestion des forêts urbaines.

La maladie hollandaise de l'orme a détruit beaucoup d'ormes depuis son arrivée au Manitoba en 1975. Et grâce aux efforts de gestion du Manitoba, de nombreuses collectivités continuent de profiter de gros ormes matures dans leur cours et le long de leurs boulevards. En 2016, 38 collectivités ont conclu un accord de foresterie communautaire afin d'encourager une intervention locale pour empêcher la propagation de la maladie aux ormes sains.

Le Manitoba continue de surveiller les espèces envahissantes comme la spongieuse européenne, l'agrile du frêne et le dendroctone du pin ponderosa. Ces insectes ne menacent pas seulement les forêts urbaines : ils pourraient également détruire de vastes portions des forêts naturelles du Manitoba.

and educational programs like Envirothon, Manitoba is engaged with the public to help increase awareness about how to prevent the spread of forest insects and disease.

Climate change will also affect Manitoba's forests. Studies are underway to help improve the understanding of how and where forests will be affected and the role forests play in mitigating and adapting.

Greenhouse gas reducing technologies, such as biomass utilization can mitigate climate change. Many forestry companies in Manitoba have added a biomass utilization component to their business. This helps reduce energy costs and carbon emissions, and encourages an emerging, environmentally-friendly industry using forest and other renewable products.

Adopted technologies help to improve the collection of forest data. Geographic Information Systems (GIS) technology is increasingly relied on to collect, store, and distribute large amounts of data. Others, such as Light Detection and Ranging (LiDAR) and unmanned aerial vehicles (UAVs) have a great potential to enhance data collection in the future.

Better data means better management of forest resources. During this reporting period, there were updates to the Forest Lands Inventory (FLI) for the Highrock Forest Section, and updates to the wood supply analyses for the Pineland, Saskatchewan River, and Highrock Forest Sections, representing 17 per cent of Manitoba's total forested area. These large updates to the forest landscape contribute to a better, more accurate ecological understanding of important areas for the forest sector in Manitoba, ensuring that harvests remain at environmentally responsible and sustainable levels.

This responsibility continues beyond harvesting trees. Over 39 million trees were planted on Crown lands throughout

En travaillant avec des collectivités de l'ensemble de la province, et avec des organismes nationaux et locaux, comme l'Agence canadienne d'inspection des aliments, la Ville de Winnipeg et des programmes éducatifs comme Envirothon, le Manitoba s'engage à aider à sensibiliser le public sur les façons d'empêcher la propagation de maladie et d'insectes s'attaquant aux arbres.

Le changement climatique aura aussi des répercussions sur les forêts du Manitoba. Des études sont en cours pour aider à comprendre comment et où les forêts seront touchées et le rôle que les forêts jouent dans l'atténuation des effets et l'adaptation.

Les technologies de réduction des émissions de gaz à effet de serre, comme l'utilisation de la biomasse, peuvent aider à atténuer les conséquences du changement climatique. Beaucoup d'entreprises de foresterie au Manitoba ont ajouté une composante d'utilisation de la biomasse à leurs activités commerciales. Cela aide à réduire les coûts en énergie et les émissions de gaz carbonique, et encourage une industrie émergente et respectueuse de l'environnement qui utilise des produits forestiers et d'autres produits renouvelables.

Les technologies adoptées aident à améliorer la collecte de données forestières. On s'appuie de plus en plus sur les systèmes d'information géographique pour recueillir, emmagasiner et distribuer de grandes quantités de données. D'autres technologies, comme le LIDAR (détection et localisation par la lumière) et les véhicules aériens sans pilote offrent un grand potentiel pour l'amélioration de la collecte de données.

De meilleures données entraînent une meilleure gestion des ressources forestières. Pendant la période visée par le rapport, l'inventaire des terres forestières a été mis à jour en ce qui concerne la région forestière Highrock. Les analyses de l'approvisionnement en bois ont aussi été mises à jour pour les régions forestières Pineland, de la rivière Saskatchewan et Highrock, qui représentent 17 % du total des zones boisées du Manitoba. Ces vastes mises à jour contribuent à

Manitoba, and over 53,000 hectares were surveyed for Certificates of Forest Renewal. An additional six million trees were planted for shelterbelts and on farm and private lands through the Trees For Tomorrow program, which was completed in 2012.

There is also a responsibility to engage and consult with First Nations, Métis, and Indigenous communities on partnerships or forest practices that may affect their communities. In 2011, the Highrock Volume Sampling Project with Mathias Colomb Cree Nation was completed. This was a project to help lessen the impacts of the economic downturn on northern communities and helped Forestry and Peatlands Management Branch verify the growth rates of Manitoba's northern forests.

Partnering with communities to protect or improve Manitoba's natural or urban forests helps lead to positive environmental, social, and economic outcomes for all Manitobans, and ensures that forests will be available for generations to come.

améliorer et à préciser les connaissances écologiques relatives à des secteurs importants de la forêt manitobaine. Elles permettent aussi de veiller à ce que l'exploitation des ressources se fasse à un niveau responsable et durable sur le plan écologique.

Cette responsabilité ne s'arrête pas à l'exploitation des arbres. Plus de 39 millions d'arbres ont été plantés sur des terres domaniales du Manitoba et plus de 53 000 hectares ont fait l'objet de levés en vue de certificats de reboisement de reconstitution. Six millions d'autres arbres ont été plantés pour servir de haies brise-vent, de même que sur des terres agricoles et des terrains privés grâce au programme Des arbres pour l'avenir, qui s'est terminé en 2012.

Il nous incombe également de consulter les communautés autochtones, métisses et des Premières nations, et de collaborer avec elles en ce qui concerne les partenariats ou les pratiques forestières qui pourraient les toucher. En 2011, le projet d'échantillonnage intitulé Highrock Volume Sampling Project, qui était mené avec la nation crie de Mathias Colomb, s'est terminé. Ce projet visait à réduire les conséquences du ralentissement économique sur les collectivités du Nord et à aider la Direction des forêts et de la gestion des tourbières à vérifier les taux de croissance des forêts du nord du Manitoba.

Les partenariats établis avec les collectivités pour protéger ou améliorer les forêts naturelles ou urbaines du Manitoba entraînent des résultats environnementaux, sociaux et économiques positifs pour tous les Manitobains et permettent de veiller à ce que les forêts continuent à exister pour les générations à venir.

Introduction

Our forests provide many economic, environmental and cultural benefits. Through The Forest Act and The Forest Health Protection Act, the Forestry and Peatlands Management Branch attempts to maintain and enhance these benefits for every Manitoban. From the trees that line our streets to the forest products and jobs that industry provides, our forests are indispensable parts of life in Manitoba.

The Forestry and Peatlands Management Branch has three sections: Planning and Development, Inventory and Analysis, and Urban Forestry, Health and Field Services.

The **Planning and Development** section provides cutting authorities, establishes conditions for all forestry operations, tracks and monitors timber harvesting, collects associated timber dues and charges, and ensures the successful renewal of harvested Crown forests. The section also fosters economic development by supporting new and existing industries and by facilitating increased Indigenous participation in the forest sector.

The **Inventory and Analysis** section supports the management of Manitoba's forest and peatlands resources through program areas of: forest and peatlands inventories; GIS and technology support; wood supply and resource analysis; forest growth, and climate change analysis.

The **Urban Forestry, Health, and Field Services** section conducts monitoring and control programs to reduce damage from invasive and native forest insects and disease. The section also delivers urban forestry programs, engaging communities to enhance forests within urban areas throughout Manitoba.

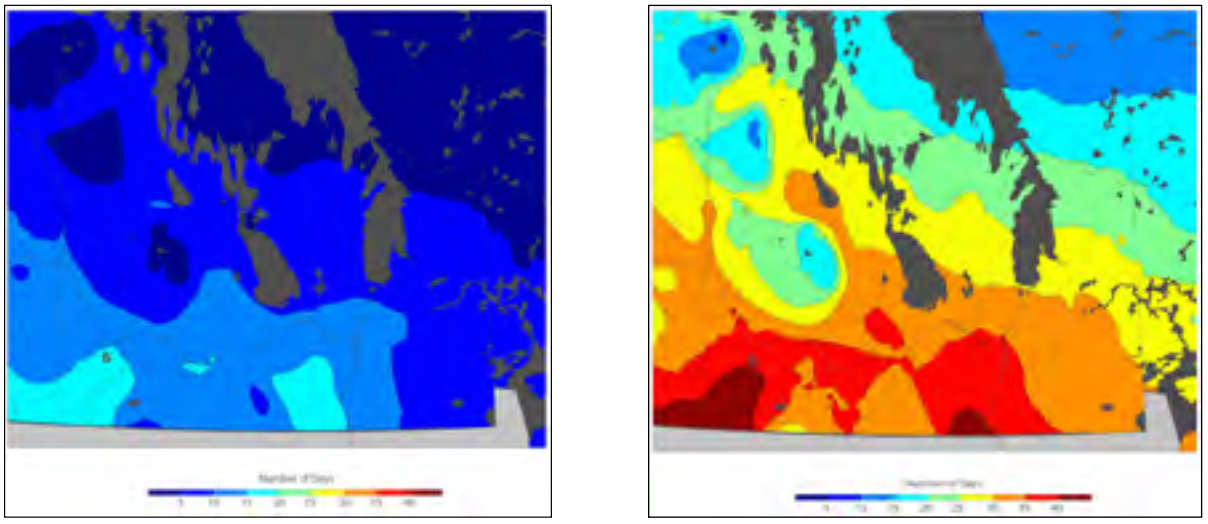
Climate Change: How will it affect our forests?

As the climate changes, so will our forests. The change may be so severe that it will overwhelm the forest's natural ability to adapt. To understand what this would mean for Manitoba's forests, the Forestry and Peatlands Management Branch completed a vulnerability assessment of the Pineland Forest Section in southeastern Manitoba. It found that the Pineland Forest Section is 1.5°C warmer now than it was 100 years ago, and, if left unchecked, could be 3.5°C to 8.5°C warmer by 2100.

What does this mean for our forests?

It means the summers will be drier, fires and windstorms more frequent, insects and disease will spread more freely in increasingly stressed trees, and the forest's composition may shift toward hardwood species like trembling aspen.

One solution may be to prepare our forests for the future by planting trees from warmer climates. When mature, these trees should be better able to adapt to the new conditions. In partnership with the Saskatchewan Ministry of the Environment, Forestry and Peatlands Management Branch staff established assisted migration trials by planting Jack pine seedlings from Ontario, Minnesota and Wisconsin at three different locations in the Pineland Forest Section. This trial will help find new ways of sustainably managing our forests in a rapidly changing environment, if required.



Left: Annual number of hot days above 30°C (1981-2010); Right: Annual number of hot days above 30°C (2021-2050)
Source: Prairie Climate Atlas

Climate is what we expect. Weather is what we get.

Although increasingly hotter temperatures will contribute to the severity and frequency of fires, fires have always occurred in the boreal forest. From 2011-2015, 96 per cent of the area burned was due to lightning, rather than people. This represents 1.5 million hectares, or seven per cent of total forested land, burned over the last five years. These burned areas are left to naturally renew or are planted to increase the recovery. Unfortunately, climate change is expected to increase the frequency of lightning strikes as well.

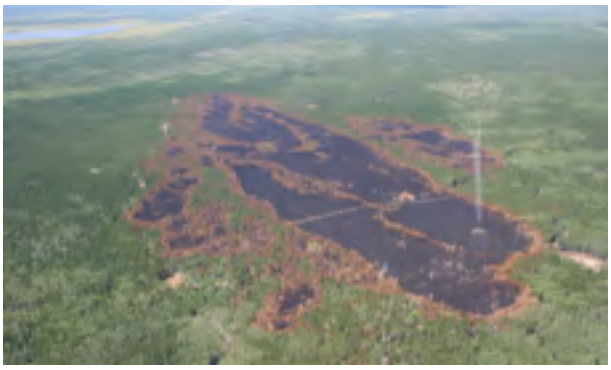
Fire in Sandilands Provincial Forest in 2012

Table 1: Annual fire statistics

	Number of fires					Area burned (hectares)				
YEAR	HUMAN	%	LIGHTNING	%	TOTAL	HUMAN	%	LIGHTNING	%	TOTAL
2011	156	50%	159	50%	315	26,229	21%	100,367	79%	126,256
2012	204	41%	293	59%	497	21,027	10%	195,861	90%	216,888
2013	192	39%	302	61%	494	896	1%	1,114,519	99%	1,115,415
2014	115	47%	130	53%	245	1,172	3%	37,936	97%	39,108
2015	164	36%	295	64%	459	6,779	10%	61,353	90%	68,132
TOTAL	831		1,179		2,010	56,103		1,510,036		1,566,139
5 Yr Ave	166	41%	236	59%	402	11,221	4%	302,007	96%	313,228
Historical Avg (1918-2015)	279	70%	146	30%	426	52,629	42%	161,034	58%	205,539

Blow down damage in Duck Mountain Provincial Forest in 2012

Wind will also damage large sections of the forest. In 2011, 14,300 hectares within Duck Mountain Provincial Forest were affected. Similarly, in 2012, there was widespread damage to Jack pine stands in the Sandilands Provincial Forest. High winds snapped trunks in two or left them leaning. Salvage operations remain ongoing in the area and will continue until the wood is no longer marketable. Once salvaged, these areas will be planted or left for natural renewal.



Forest fire in northern Manitoba

Jack pine blow down damage in Sandilands Provincial Forest in 2012

Large amounts of dead and dry debris will make fires more likely to occur. But it can also increase insect populations that breed and feed in deadwood. After the 2012 windstorm damaged large sections of the Sandilands Provincial Forest, the local populations of pine engraver (*Ips pini* and *Ips grandicollis*; small bark beetles that feed in pine trees) and sawyer beetle (*Monochamus scutellatus*; a large black beetle with equally large antennae) exploded. The branch continues to monitor these insects and is working with industry to utilize the damaged timber.

Whether weather or climate, events like these offer a glimpse of what may become more common in the future.

Sawyer beetle

Aerial view of blow down damage

Biomass Industry

Broken, damaged or decayed wood may be less desirable as a commodity to some, but useful to others. It can still be used as a fuel. Increasingly, companies are seeing the benefits that biomass utilization can bring, which include decreased energy costs and carbon emissions, all the while promoting the growth of a new and environmentally sustainable industry. Manitoba Hydro's Power Smart Bioenergy Optimization Program and provincial funding through Manitoba's Biomass Energy Support Program allowed companies like Tolko Industries Ltd., Spruce Products Ltd., and Pineland Forest Nursery to add biomass utilization as a component of their business.

Tolko Industries Ltd. has reported producing up to 170,000 tonnes of kraft paper annually. To cook the pulp and dry the paper, Tolko used two boilers. One of them was a $20 million dollar biomass power boiler. Fueled by biomass, hog fuel, and waste oil, the biomass boiler produced 40 per cent of the facility's steam. As well, collaborating with Manitoba Hydro and Ensyn Technologies, Tolko was part of the Pyrolysis Oil Demonstration Project. Pyrolysis oil, a highly oxygenated brown liquid, is made by quickly burning wood waste. The oil was then used as a renewable fuel.

These two initiatives allowed Tolko Ltd. to reduce their fossil fuel consumption by 33 per cent*. Further, if the entire mill had run on pyrolysis oil, Tolko could have reduced their greenhouse gas emissions by 25,000 tonnes every year.

Unloading wood chips at Pineland Forest Nursery

Spruce Products Ltd. produces 40 million board feet of lumber each year. Teaming up with Manitoba Hydro and Waste Gas Power, Spruce Products Ltd. joined the Waste Heat Demonstration Project. The project installed an Organic Rankine Cycle (ORC) generator

*Fossil fuel use compared 2009 and 2014 data.

Greenhouse at Pineland Forest Nursery

to use the excess steam coming from their wood waste boilers. The ORC generator has allowed Spruce Products Ltd. to reduce their electricity costs by 15 per cent.

Heating costs for any nursery in Canada are significant in the winter. Pineland Forest Nursery (PFN) looked to biomass for a solution to heat their 7,000m^2 greenhouse. The addition of a Blue Flame Stoker biomass burner has allowed PFN to reduce their heating costs by $100,000. Woody biomass from salvage operations, highway expansions, right-of-way clearings, and sawdust from local mills is now used to produce the heat to help grow the next generation's forests. Not only has this saved money, but it's also reduced greenhouse gas emissions by 565 tonnes. Further, by collaborating with organizations like the Natural Sciences and Engineering Research Council of Canada and the Canadian Wood Fibre Centre, PFN is helping to increase our understanding of how biomass should be managed. What is the best way to dry and store biomass? How large should it be piled? What is the best way to prevent rot? Answers to these questions will influence how future biomass industries operate.

Bioenergy is a new and growing market in the forestry sector in Manitoba. By supporting new technologies such as this, Manitobans are helping reduce our ecological footprint and at the same time promoting environmentally sustainable and local industries.

Seedlings growing in the greenhouse

Forest Industry

Although OSB and lumber markets have improved since the economic downturn, they remain highly variable. In 2012/2013, when the U.S. housing market showed signs it would recover, OSB and timber prices jumped, only to fall again when the recovery was slower than expected. Kraft paper market prices have increased steadily and newsprint prices have remained relatively stable. Manitoba continues to move forward in this uncertain time.

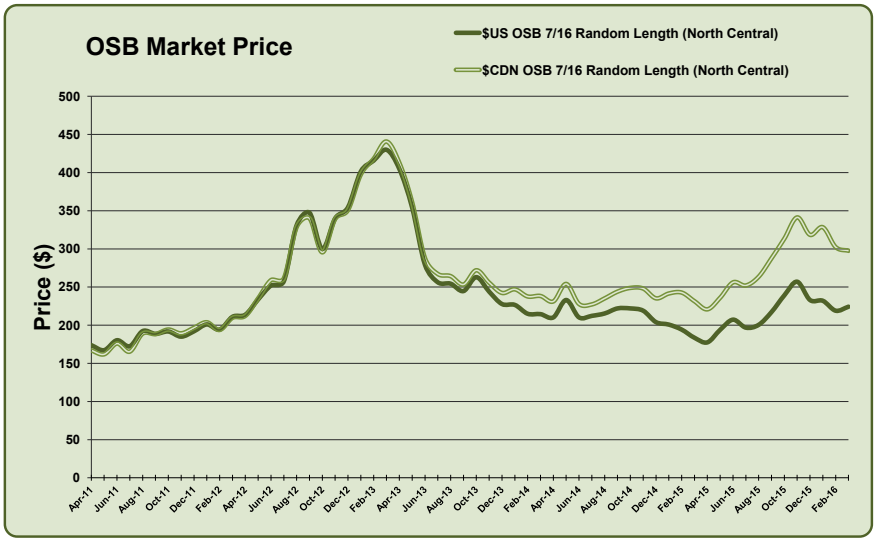
Because the oriented strand board (OSB) market has remained low through this period, Louisiana Pacific Corporation (LP) made a significant investment in Manitoba to ensure the viability of their Swan Valley operations. LP has converted their facilities to specialize in high-value products. In 2015, LP invested over $100 million dollars to expand their OSB mill into one that produces LP SmartSide® siding. The engineered wood siding allows LP's Manitoba operation to remain competitive and increase employment.

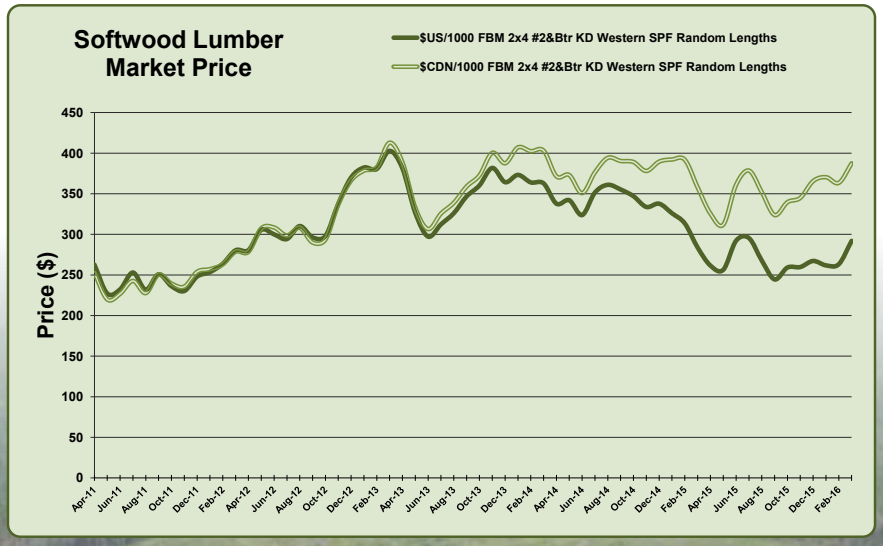
The turbulent value of the Canadian dollar during the reporting period has also created challenges for Manitoba's forest industry.

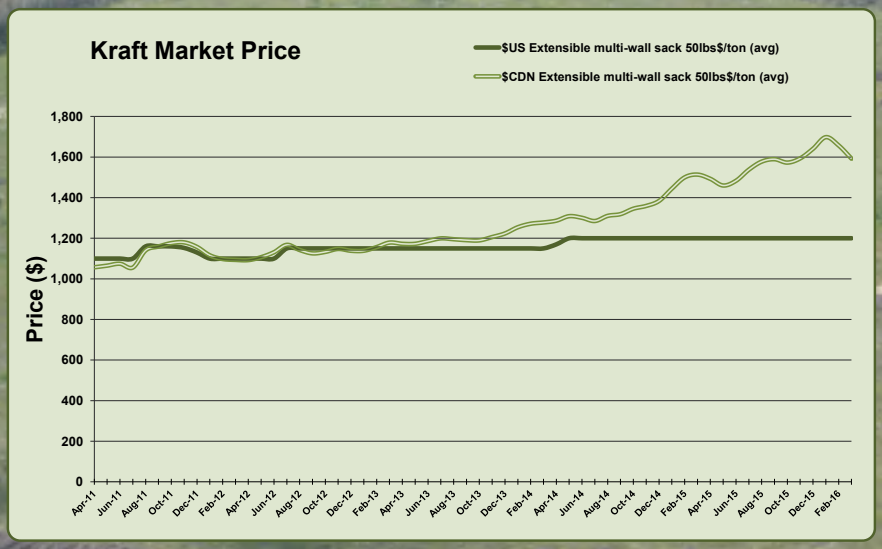
Louisiana Pacific Canada

Softwood lumber

Commodity Market Prices: Oriented Strand Board, Softwood Lumber, and Kraft







Technology

GIS Technologies

Many organizations, companies and governments have recognized the importance of managing and analyzing spatial information using geographic information system (GIS) technologies. The Forestry and Peatlands Management Branch is no exception. Forest inventories, silvicultural data, harvest and fire boundaries and forest plot locations are some examples of spatial datasets that are managed using GIS technology. GIS is also being used to collect, store and analyze spatial information and has become indispensible for sustainable forest management. The use of web-maps, GIS web applications and dashboards will only grow as mobile device usage and reliance increases.

New Technologies

As the costs associated with new technology decrease, new opportunities become available. This tends to increase both efficiency and accuracy compared to older ways. For example, the Dutch Elm Disease (DED) Management Program now uses mobile devices to help track diseased trees. Information on a tree's location, size and health is now instantly uploaded into the DED database and scheduled for removal. As a result, less paper is used and the information is sent immediately and directly to those who need it.

Forestry Technician using mobile device

Because mobile devices are easy to use, other field programs have adopted them as well. Forestry technicians working with the forest health monitoring program, forest renewal program and permanent sample plot program are now surveying and capturing data using mobile devices. Because they have access to web-based GIS, they have the added benefit of reducing the amount of time spent typing or digitizing data collected in the field.

Another exciting addition to the Forestry and Peatlands Management Branch is the ability to see the forest in 3D on a computer screen. Rather than a flat map, the new forest

inventory in Nelson River Forest Section follows the contours and curves of the forest landscape. Low lakes lie between raised rock outcrops and the green pine trees perched on top pops through the screen. It's an impressive and immersive effect and one that adds to the quality and detail of the data that's collected from it.

The Branch continues to test and investigate new technologies to improve how data is collected. Unmanned aerial vehicles (UAVs, or drones), provide high-quality photographs of relatively small areas. This may allow foresters to capture harvest cut block shapes and sizes, forest renewal status and competition levels much more efficiently. Drones may also be able to record how the forest changes as it grows.

LiDAR (Light Detection and Ranging) – like radar, but with lasers – is another technology that would greatly enhance how we manage the forest. Unlike a standard photograph, where you only see the top of the forest, LiDAR may allow us to see what's underneath as well. It may also allow us to automatically classify the species and height of every tree in the forest, giving managers an unprecedented level of detail and control.

Better technologies can mean better management of the landscape. In 2014, Forestry and Peatlands Management and Tolko Industries Ltd. successfully conducted a trial study near Grand Rapids to help identify bat caves using infrared cameras. This technology can help provide better operational planning options on high risk or sensitive sites.

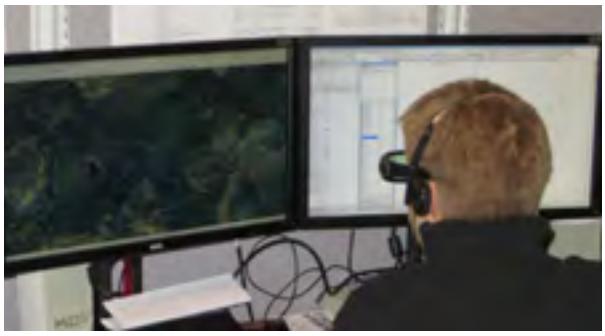


Photo-interpreter

Unmanned aerial vehicle

Terrestrial LiDAR point cloud.

Forest Inventory

In order to sustainably manage our forests, we must first know what we are managing. How much forest do we have? Where is it? What species make it up? How old are the trees? How tall? These are not easy questions to answer, but it can be done using Manitoba's Forest Lands Inventory (FLI).

An FLI is about more than just trees. It is a way to capture ecological data as well. Soil moisture and composition, slope aspect, water drainage patterns, and wetland type (Forestry and Peatlands Management classifies wetlands in ten different ways) are also collected. This allows for broader applications of the data; for example, for estimating wildlife habitat.

Manitoba's FLI involves acquiring aerial imagery, or high-quality photographs, of large sections of forested land. The area is then photo-interpreted, which means that someone has looked at that photo and classified each and every part of the forest. This allows us to know where our forests are, what species are present, and therefore, how best to manage it. An accurate, up-to-date inventory is one of the most important parts of ensuring the sustainability of Manitoba's forests and forest ecosystems.

In 2011, the FLI for 2.3 million hectares was completed for the Highrock Forest Section.

And in 2011 and 2013, new imagery was acquired for the Nelson River Forest Section. This high-quality imagery was also shared with the City of Thompson's Planning Department and indigenous communities throughout the area. Photo-interpretation of 1.5 million hectares in the Nelson River Forest Section will be completed in 2016.

Acquiring new imagery is also important when large portions of the forest change quickly and drastically. In 2011, Duck Mountain Provincial Forest experienced severe blowdown. To capture the extent of the damage, new imagery was acquired and photo-interpreted in 2012.

Wood Supply Analysis

Once a forest inventory is completed, the amount (or volume) of wood available for harvesting can be determined. This is called wood supply analysis, and it helps ensure that our forests are not harvested beyond sustainable levels.

Many factors will influence this, including:

- protected and old forest areas
- requirements for habitat diversity, such as for Woodland Caribou
- non-timber forest resources, like recreation or trapping
- new emerging markets, such as bio-energy

The importance of some of these factors will change as our values change. All of this means that the analysis of how much wood can be harvested must be updated continuously.

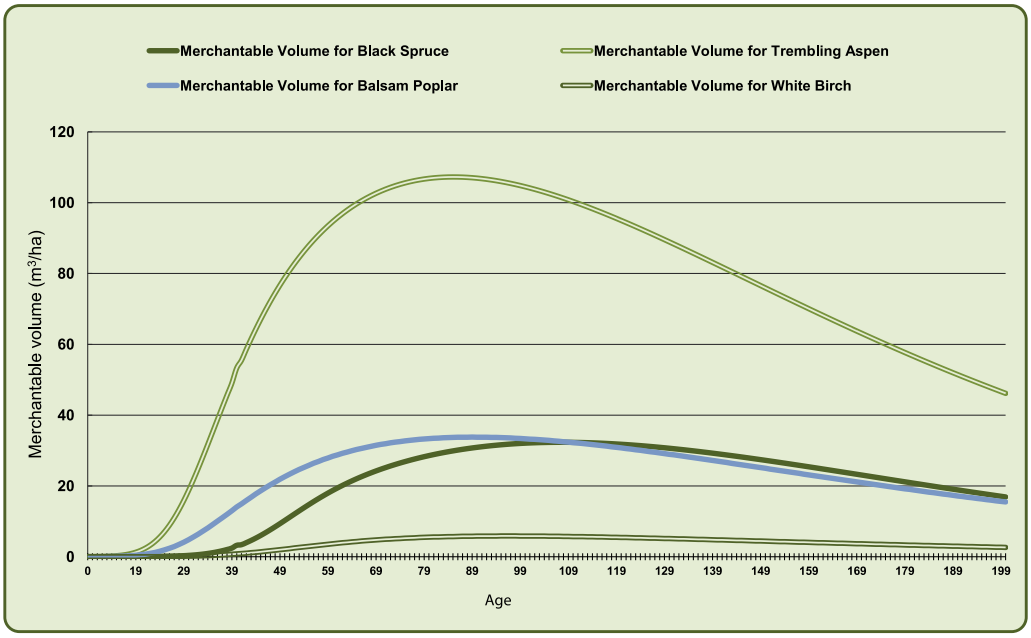
For example, after Manitoba announced that there would no longer be logging in provincial parks, the wood supply analysis for the Pineland Forest Section had to reflect this. In 2013, an updated wood supply for the area was completed, which excluded Whiteshell Provincial Park. Similarly, in 2013, wood supply analyses for the Saskatchewan River Forest Section and for portions of the Highrock Forest Section were updated.

An updated wood supply analysis for portions of the Mountain Forest Section is ongoing.

Manitoba's Growth and Yield Projection System (MGYPSY)

Naturally, forests grow and change over time. And predicting what the forest will look like in twenty, fifty, or one hundred years is complicated. Jack pine, densely planted in a southern sandy soil, will grow and die differently than black spruce naturally regenerating in a northern bog. MGYPSY (Manitoba's Growth and Yield Projection System) allows us to see into the future. Developed in 2012, it models species-specific growth rates (and therefore volume) in a variety of different soil types throughout the province. This information directly informs how Manitoba sets its sustainable harvest levels for each forest section.

Example of MGYPSY's volume predictions over time



Sustainable Harvest Levels

Sustainable harvest levels (SHLs) are different for different areas of the province. The approved SHL is the maximum amount of timber volume that can be harvested in a given area each year. Accurate measurements and modeling of growth rates are therefore crucial to managing the forest sustainably.

Not every forest section has SHL because harvesting does not occur in every forest section. However, the full potential SHL in Manitoba is 5,216,899 m^3 of softwood and 2,708,365 m^3 of hardwood.

TABLE 2: MANITOBA SUSTAINABLE HARVEST LEVELS BASED ON CURRENT UTILIZATION*

Forest Section	Softwood (m^3/yr)	Hardwood (m^3/yr)
Aspen Parkland **	-	-
Mountain	387,457	815,673
Pineland **	167,223	102,695
Lake Winnipeg East	617,222	15,694
Interlake	264,600	74,220
Saskatchewan River **	379,896	-
Highrock **	609,709	-
Churchill River **	76,080	-
Nelson River **	818,390	28,910
Hayes River **	821,960	-
All Sections	4,142,537	1,037,192

Note: * Utilization levels vary throughout the province

** Although an SHL is not listed for all species, a sustainable harvest volume is available depending on the management techniques

Engagement and Consultation

Mathias Colomb Cree Nation

Before MGYPSY was available, the growth rate of a forest was estimated by volume sampling. This involved sending large survey crews into the forest to sample and collect data from a variety of different types of forest. Manitoba Sustainable Development partnered with Mathias Colomb Cree Nation to deliver the Highrock Volume Sampling Project, a two-year community-based timber volume sampling program. Completed in the fall of 2011, the partnership with Mathias Colomb Cree Nation allowed the community to receive high-quality aerial imagery of their community and surrounding areas, and provided volume sampling data that helped verify the interpretation and wood supply analysis of the Highrock Forest Section.

Example of imagery provided to Mathias Colomb Cree Nation

Orientation to Forestry Camp at Egg Lake, Manitoba

For a week in August 2015, 16 students in northern Manitoba, clad in hard hats and work boots, lived life as would-be foresters. The Orientation to Forestry Camp at Egg Lake introduced the students to Northern Manitoba's valuable forestry industry. Partnered with the Northern Manitoba Sector Council, Opaskwayak Cree Nation, Frontier College and the Northern Manitoba Mining Academy of University College of the North, the camp was a resounding success. Students were taught the basics of navigation and GPS use, had tours of Tolko's mill and learned how forestry can be an exciting and rewarding career. And, most importantly, it was an enjoyable learning opportunity!

Sawmill Feasibility Study

In January 2016, the Forestry and Peatlands Management Branch contributed a one-time grant of $35,000 to Swampy Cree Tribal Council for a feasibility study on re-opening Tolko's sawmill in The Pas. The sawmill was closed in 2009, when a weak forest products market caused the mill to become economically unsustainable.

Shoal Lake No. 40 First Nation – Shoal Lake Access Road

For several years, the Forestry and Peatlands Management Branch has been helping plan and construct the all-season access road to Shoal Lake No. 40 First Nation. Shoal Lake Access Road will span over 25 kilometers, through Northwest Angle Provincial Forest and South Whiteshell Provincial Forest. It will link the small community to the Trans Canada Highway, just west of Falcon Lake. Three timber sale agreements were issued to the community during the construction of the winter road. A planting contract was developed and community members planted 75,000 red pine seedlings. As well, members received training on how to use chainsaws, brush saws and other heavy equipment, and training on GPS data collection and orienteering in the forest.

Duty to Consult

The Forestry and Peatlands Management Branch recognizes the rights of First Nations, Metis and other Indigenous communities throughout Manitoba. Forestry operating plans and timber allocation requests are reviewed with both community members and industry representatives. These are open dialogues to discuss timber harvesting, access development and rehabilitation, and any forest renewal activities (ex: tree planting or herbicide-use) that may be occurring near their communities.

Forestry Camp at Egg Lake

Forest Stewardship

The forest is an important part of every community in Manitoba. Because of this, we must make sure that it survives long into the future.

Forests are about more than just trees; they are diverse and adaptive communities of plants, animals, fungi and microorganisms. And managing them appropriately means managing them sustainably. When spruce or pine are planted, this gives the trees a head start. As a result, they grow faster, filling in the landscape quicker. Raspberry and rose will rise again among suckering aspen. Cherries, blueberries and saskatoons will bloom. And Manitoba's many flowers (crocuses, pitcher plants, orchids) will dot the landscape like before.

These young forests will age and grow, and Manitobans will continue to enjoy everything that our forests provide.

Forests are dynamic and variable ecosystems – constantly changing as they age. Some species (of insects or birds) prefer very young, open forests, briefly appearing after fires. Others find their homes in the deadwood of old oaks. Maintaining the biodiversity and variability of forests across the landscape helps ensure that we will always have forests to visit and use.

From 2011 to 2015, over 39 million trees were planted on Crown lands throughout Manitoba; and 53,107 hectares were surveyed for Certificates of Forest Renewal. These efforts, by both industry and Forestry and Peatlands Management Branch, helps ensure that what was harvested in the forest is what is growing back.

To give a very old example, the Scots pine trees in pictured below were planted near Spruce Woods Provincial Forest in 1916, as part of a study conducted by the Dominion Forest Service. The first photo shows the trees in 1946, when they would have been 30 years old. The second photo shows the very same trees, now 100 years old, in 2015.

Maintaining our forests – their diversity, productivity, and resilience – ensures that they will be available for generations to come.

TABLE 3: HARVEST AND PLANTED AREA TRENDS IN MANITOBA (IN HECTARES)

	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006-2010	2011-2016
Softwood	54,149	53,377	50,984	56,000	56,820	52,940	25,809
Hardwood	0	5,045	6,769	23,000	28,352	19,428	18,194
Planted	11,735	29,475	31,128	32,220	40,204	39,540	19,511

Note: Harvest areas are estimated based on harvested volumes. As well, depending on the silvicultural prescription, some harvested areas are left for natural renewal.

Left: Scots pine trees in 1946. Right: Scots pine trees in 2015.

Urban Forestry

It's difficult to estimate the value of a tree. Trees provide shade, calm the summer's heat, and brace against icy winter winds, saving homeowners money on both heating and cooling. A well-placed tree, especially a large one, increases the value of your home. When trees are present, business goes up[1] and crime goes down[2]. There are aesthetic and environmental benefits. Each tree can support a wealth of animals: insects and spiders, birds and mammals, even other plants. And each will help support a vibrant and diverse urban ecosystem. Manitoba is fortunate to have such rich landscapes. How then to estimate its value? How much is the Old Oak Tree of Souris, estimated to be over 550 years old, worth? Many would say that such a tree is priceless.

But let's talk numbers.

The average elm in Winnipeg is estimated to be worth close to $3,960 per tree[3]. That makes the elm population in Winnipeg alone worth over $1 billion. Maple, ash, oak, poplar, pine, spruce, larch, linden, fir, cedar, butternut, willow, walnut, olive, cherry, apple, birch and cottonwood also make up our urban forest. So how much are trees worth? A lot!

Protecting and enhancing this value for Manitobans becomes essential. Insects and disease, both native and invasive, threaten to destroy large numbers of trees, and, if left unchecked, would drastically alter the urban landscape. European gypsy moth, an invasive insect, can defoliate large numbers of oak, aspen and maple. Dutch elm disease, an invasive fungus from Europe, has spread throughout Manitoba since it was first detected. Others, like forest tent caterpillar, are native to Manitoba, but even they can cause damage if their populations get too high.

Managing appropriately requires a variety of strategies. To this end, the Forestry and Peatlands Management Branch has several programs to maintain a healthy urban forest for the benefit of all Manitobans. The Heritage Tree program, Trees for Tomorrow Program and the Dutch Elm Disease Management program are examples of how the Urban Forestry, Health, and Field Service section managed or enhanced the urban landscape.

[1] Wolf, K.L. 2013 (spring). The Urban Forest. Communities & Banking 24, 2: 25-27.

[2] Kuo, F.E., & Sullivan, W.C. (2001). "Environment and crime in the inner city: Does vegetation reduce crime?" Environment and Behavior, 33(3), 343-367.

[3] Barwinsky, Martha, City of Winnipeg Public Works Department, personal communication.

Heritage Trees

In 2015, Forestry and Peatlands Management Branch, in partnership with the Manitoba Forestry Association and Trees Winnipeg, launched Manitoba's Heritage Tree Program, the first of its kind in Canada. Legislated under the Forest Health Protection Act, its aim is to increase public recognition of trees in Manitoba that are of historical significance, exceptional in size, rare or notable.

For more information, please visit **www.gov.mb.ca/sd/forestry/**

The Point Douglas Cottonwood

On Arbor Day, May 7, 1891, on the hottest day of the year, a nine-year old girl named Bessie Goodman rushed to the bank of the Red River to find a tree. The principal of Argyle School (of what is now Argyle Alternative High School) had announced that there would be tree planting in the schoolyard that day, and so Bessie, wanting to take part, came prepared. Clutched in her hands, still black with dirt, was a small cottonwood seedling. Unbeknownst to Bessie, the trees were to be planted by city officials and not by schoolchildren like herself. Saddened that she could not plant her tree among the others, Bessie, and her cottonwood, wilted. Seeing Bessie's disappointment, her teachers allowed her to plant the small tree by the school's water pump, expecting that it would not survive for long. But, while all the other trees planted that day soon drooped and died, it was Bessie's tree, soaking up spilled water from the pump, that lived and thrived. Her cottonwood, still alive after 125 years, and now over 20 metres tall, was the first tree designated in October 2015 under Manitoba's Heritage Tree Program.

Point Douglas Cottonwood

TREES *for* TOMORROW

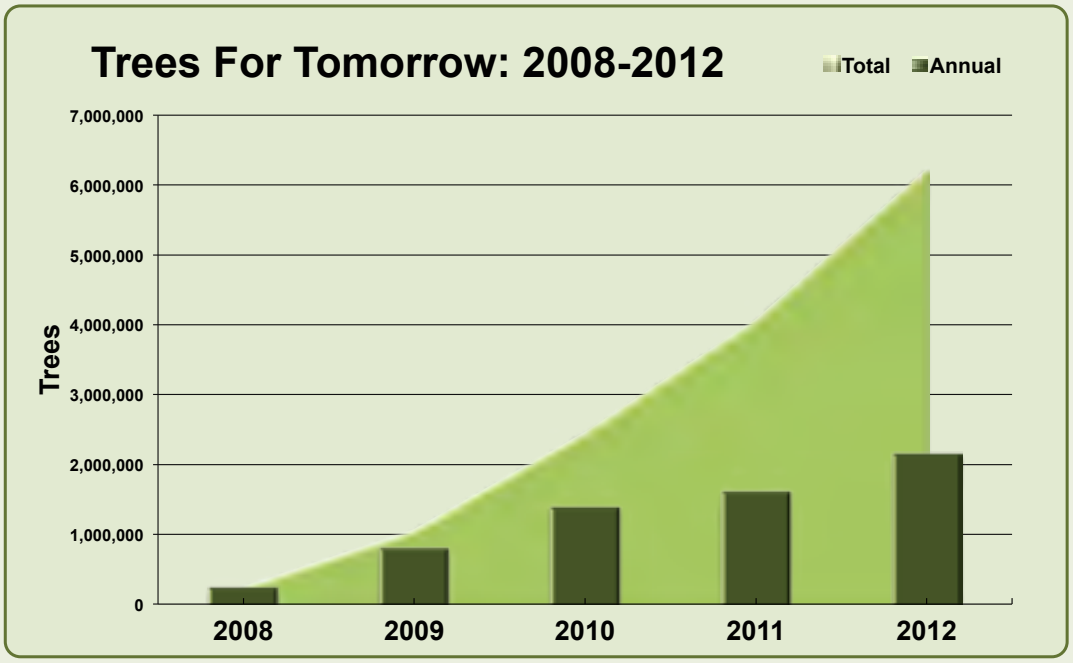
Launched in 2008 as part of Kyoto and Beyond, and extended in 2011, the first phase of Trees For Tomorrow concluded in 2012 with the planting of its 6,234,100th tree. Pine, spruce, willow and hybrid poplar were provided to the public, and schools, First Nations, industries and municipal governments planted shelterbelts for woodlots, established new plantations on farmland, or planted them on private lands throughout rural and urban Manitoba. These new trees will help sequester carbon, reduce soil erosion and help support our native wildlife.

How much carbon will be sequestered? By 2042, the Trees for Tomorrow program will have reduced greenhouse gases by 942,716 CO2. That's the equivalent of taking 200,578 cars off the road! As well, the Canadian Wood Fibre Centre, the Biometeorology and Soil Physics and Manitoba Sustainable Development collaborated to install and monitor an Eddy-Covariance Flux Tower in an area recently planted with hybrid poplar. The tower measures the energy, water and carbon balances between the soil and the atmosphere, and will help provide a more complete account of how plantations and forests affect climate change.

Eddy-Covariance Tower Site: Hybrid Poplar was planted in April, 2012. The picture below was taken in August, 2014.

Planting new trees will always be necessary and urban environments come with unique challenges. Road salts can damage both the roots and buds of a tree. Construction, cars and lawnmowers can scar a tree's trunk. And compacted soils can often make a tree's life hard. So, planting the right kind of tree in the right kind of place will help ensure its survival for generations.

White spruce planted along Summit Road



Invasive Forest Insects and Disease

Dutch Elm Disease Management Program

Sometimes a tree must be removed to save others.

Since 1975, when Dutch elm disease (DED) was first detected in Manitoba, the provincial DED management program has been protecting the remaining urban elm population by removing infected trees.

Because of this, many of Manitoba's towns and cities continue to enjoy large, mature elms on their yards and boulevards. These trees, mostly American elms, are exceptionally hardy, and are able to withstand harsh urban environments. Their form, like large unfolded umbrellas, made them ideal trees for lining and shading streets.

But they are also susceptible to Dutch elm disease, an invasive fungus that grows within the water conducting tissues of a tree. If a tree can't get water, it wilts and dies. And many of our elms have disappeared as a result.

The disease is spread by elm bark beetles. These tiny insects bore and breed underneath the bark of dead or dying elms, carrying the deadly fungus in small grooves on their body, and infecting nearby healthy trees. By removing and destroying diseased or dead elms, the beetle's population can be controlled, slowing the spread of DED in our communities.

American elm tree infected with Dutch elm disease

Native elm bark beetle larvae

Top Left Photo Credit: Debbie Miller, USDA

Historically, this has meant removing 2.5 per cent of the elm population each year. Despite this, over 255,000 elm trees remain in Winnipeg, and thousands more in communities throughout Manitoba.

Thirty-eight communities across Manitoba, including Dauphin, Portage la Prairie, Morden, Steinbach, Neepawa and Brandon, continue to partner with the province in the program. The City of Winnipeg has its own independent program, which is supported by an annual grant from the province. Through these partnerships, Manitoba's communities still maintain healthy elm populations.

Community involvement is an important aspect of protecting urban forests. In 2015, 19 communities signed on to Community Forestry Agreements (CFAs). These new agreements allow communities to manage and protect their own urban forests, and will help develop local expertise in controlling new invasive insects, like emerald ash borer. In its inaugural year, all 19 communities successfully removed their dead or diseased trees, and in 2016, an additional 19 communities signed CFAs with the province.

The Agreements provide funding to remove infected trees, to apply pesticides, and to the regular pruning of dead branches, all of which help limit the spread of the disease.

Finding better, more efficient ways of managing DED has always been a part of the program's success. For example, research by the province, the City of Winnipeg and the University of Manitoba has found there are more bark beetles in trees that show the early signs of DED infection (wilting, yellow leaves, typically at the top of the crown). This means that if a tree is removed as soon as possible

Provincial employee removing a diseased elm

the chance of transmitting DED from tree to tree is significantly reduced. Follow-up studies showed that this was the case.

Further research showed that only a fraction of these trees have significant numbers of beetles. These trees are called brood trees; and recognizing and prioritizing them for rapid removal is currently being studied. If the method is successful, it will allow communities to focus on a small number of brood trees immediately, while the large majority of diseased trees may be removed later.

Dark staining on exposed elm is evidence of Dutch elm disease

Dutch Elm Disease Resistance

The elm resistance project is an ongoing collaboration between the province and the University of Manitoba. Its goal is to develop clones of American elm trees that do not die from Dutch elm disease.

The project began in the early 90s when researchers noticed that not every elm was as susceptible to the fungus. Some elm trees remained healthy, even after all the others died. These trees seemed resistant.

Seeds from these resistant trees were collected and planted in several locations in southern Manitoba. To ensure the seedlings were as resistant as their parents were, over the next twenty years they were regularly inoculated with DED spores. Many seedlings died from the treatments, but three did not.

These three seedlings are now being evaluated by the Western Nursery Growers Group, a collaboration of leading nurseries in the Prairie Provinces. The organization will further test the seedlings for growth, form and disease resistance. If successful, the seedlings will then be considered for commercial propagation and finally, distribution to the public.

European Gypsy Moth

There are also new threats to the forest. European gypsy moth, not considered to be established in Manitoba, is one of the most destructive forest insects in North America. The caterpillars consume the leaves of oak, poplar, elm, maple and birch – and will even attack conifers if starved. Forestry and Peatlands Management Branch and the Canadian Food Inspection Agency (CFIA) monitor for gypsy moth using pheromone baited traps that attract male moths.

Gypsy moth egg mass

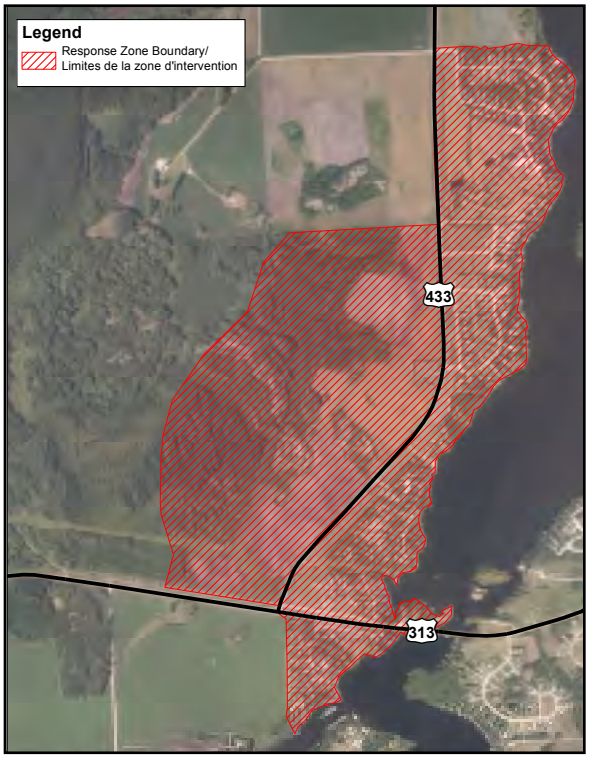
It is not unusual to find one or two moths in these traps, but if higher numbers are found then ground surveys are required. These surveys, conducted by the province and the CFIA, can help determine if an established breeding population is present. In 2009, European gypsy moth was detected in the La Salle and St. Germaine areas, south of Winnipeg. This prompted the province to spray a biological insecticide, *Bacillus thuringiensis kurstaki* (Btk), to eradicate the moth. Likewise, in 2012, the area around St. Vital Park in Winnipeg was treated.

Gypsy moth treatment area in 2012

Follow-up surveys found that both treatments were successful.

However, in 2014, a new population near Lac du Bonnet was found. And in the spring of 2015, this area was also sprayed. Follow-up surveys found that a small residual population has persisted in the treated area. As a result, a mass trapping exercise to eradicate the remaining population will be completed in 2016.

Provincial legislation allows for immediate action when new populations are discovered. Eradication of this invasive insect is critical because if European gypsy moth becomes established in Manitoba, the CFIA would regulate the affected areas under the Plant Protection Act. Trade of forestry products (Christmas trees, nursery stock) in both domestic and international markets would be restricted. Tourism to provincial parks and recreational outfitters could be affected. And considerable damage would be done to both urban and rural trees.



Gypsy moth response zone near Lac du Bonnet

Who was Etienne Leopold Trouvelot? A Cautionary Tale.

Leopold Etienne Trouvelot. Source: http://www.fs.fed.us

Mr. Trouvelot has the unfortunate distinction of single-handedly introducing European gypsy moth into North America. An amateur entomologist, he tried to establish a new silk industry in Massachusetts in 1868 by importing and breeding hardier moths, one of which happened to be European gypsy moth. He raised millions of them in his backyard until a strong wind broke apart the cage that held them. Hundreds of caterpillars escaped into the nearby forest, and soon their populations grew. Residents described the insects as roving black blankets, eating everything they touched. Shortly after, E.L. Trouvelot lost his interest in insects and sailed back to France.

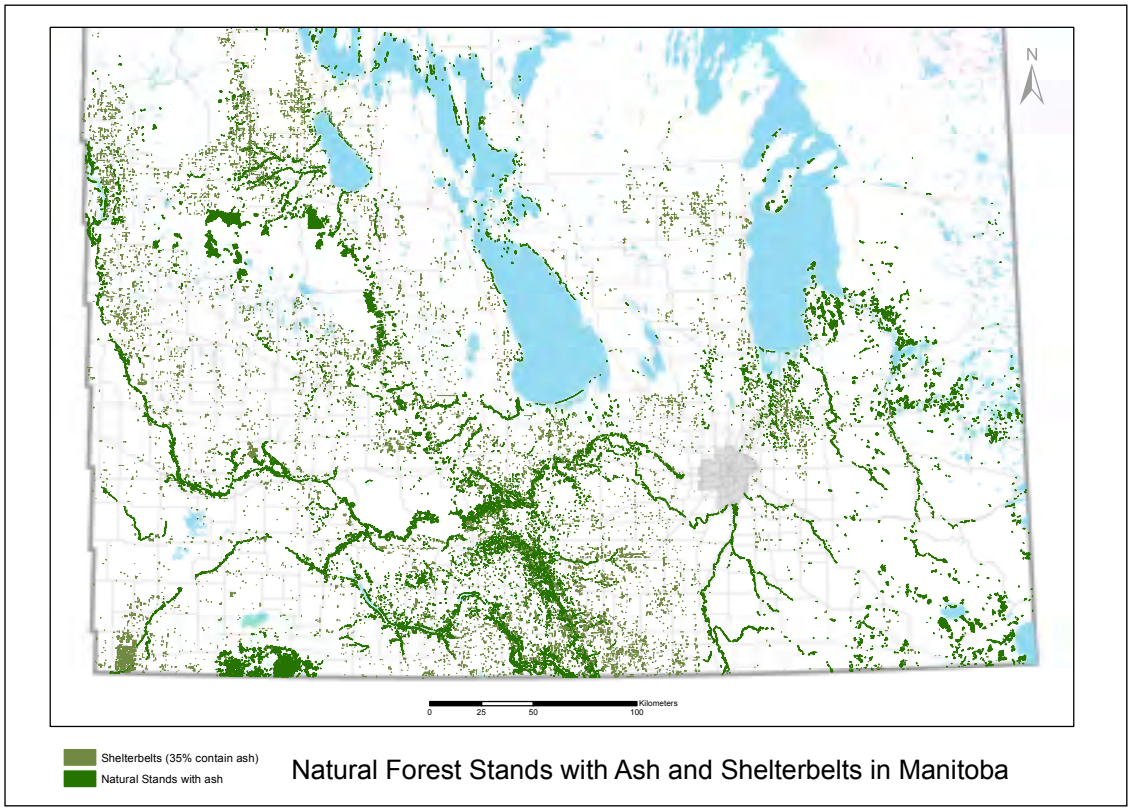
Emerald Ash Borer (EAB)

This iridescent jewel beetle from China has killed millions and millions of ash trees in Ontario, Quebec and the U.S. Although thought to have been here since the 1990s, EAB was first detected in North America in 2009, and could arrive in Manitoba at any time. A recent inventory estimated that over 600,000 ash trees are in Manitoba's communities, and millions more exist along our rivers, in rural shelterbelts, and in natural forests.

EAB larvae bore winding S-shaped tunnels under the bark of ash, cutting off the tree's water supply, and eventually killing it. Worse, these infestations are hard to detect and so it may be years before the symptoms are recognized. By then, the insect will have emerged as an adult and already be on its way to the next ash tree.

Green emerald ash borer trap

Preparation and early detection are therefore crucial elements to prevent widespread damage. Forestry and Peatlands Management monitors baited sticky traps throughout the province. And a new initiative will try to use a natural predator - a wasp, the smoky-winged beetle bandit - as an early warning system.



Ash Inventory Map

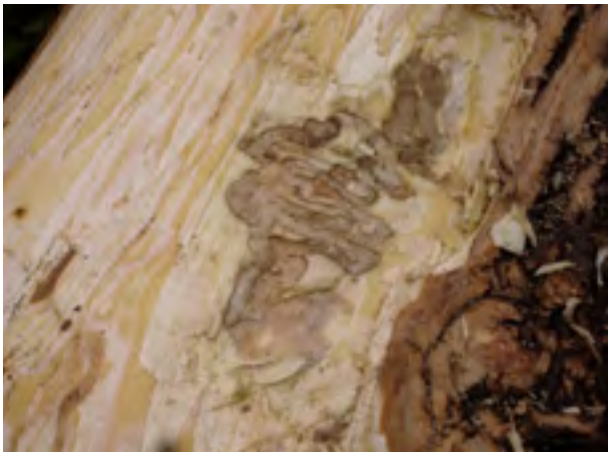
Smoky-winged Beetle Bandits

These solitary, ground-nesting wasps have a peculiar behavior. They will hunt and collect jewel beetles like emerald ash borer (EAB), paralyze them, and lay their eggs on the immobile prey. In partnership with the Canadian Food Inspection Agency and the City of Winnipeg, Forestry and Peatlands Management Branch is trying to use these wasps to help search for emerald ash borer in Manitoba. By transplanting their underground homes to areas that may be at risk of EAB infestation, they can be used as an additional surveillance tool. Don't worry, they don't sting!

A Cerceris fumipennis wasp and her EAB prey. Photo credit: Phillip Careless, CFIA.

Mountain Pine Beetle

Invasive species don't always come from overseas. Some, like mountain pine beetle (MPB), have instead expanded their traditional range. Native to western North America, this small bark beetle has been spreading north and east across Canada with milder winter temperatures. Historically, outbreaks were confined to lodgepole pine forests within British Columbia and parts of Alberta. But now there is evidence MPB can survive in Jack pine trees as well, which are native to the boreal forests of Canada, including Manitoba. Jack pine are an integral part of boreal ecosystems and are an important species of the province's forest industry. If the spread continues east, it could have devastating consequences here. MPB has not been detected in Manitoba, but the branch continues to monitor and work with neighbouring jurisdictions.



Emerald ash borer larvae tunnel

Mountain Pine Beetle-killed lodgepole pine at Kinuso Falls, B.C.

Spray Efficacy Research Group International (SERG-I)

While it is known that mountain pine beetle can and has reproduced in Jack pine, more needs to be known about how this insect spreads in new environments. Thankfully, our understanding is improving. Through the Spray Efficacy Research Group International (SERG-I), Manitoba funds and helps with several research projects. What are the best ways to detect MPB at low densities? How can we better identify areas that are at risk? What factors contribute to their survival? The answers to these questions will be necessary in order to manage or prevent the spread of an insect that has been both environmentally and economically damaging to the forest and forest industries in western Canada.

Turning Risk Into Action for the Mountain Pine Beetle Epidemic (TRIA-Net)

TRIA-Net, a collaborative research project under the Natural Resources and Engineering Research Council (NSERC), is working to protect Canada's pine forests from mountain pine beetle. Study areas include genomics, molecular analyses, population genetics, systematics, ecology, and population dynamics. TRIA-Net will help forest managers make informed policy decisions and improve the management of mountain pine beetle. Manitoba directly benefits from their work on how the insect interacts with Jack pine in boreal forests. Forestry and Peatlands Management Branch joined the project in 2013.

What can you do to help?

You never know what's lurking in a piece of pine or ash. Moving firewood into or around Manitoba is one of the surest ways to spread forest insects and disease. Gypsy moth, emerald ash borer, mountain pine beetle and Dutch elm disease are spread by transporting firewood. Wood disposal sites are set up along the main highways near the Saskatchewan and Ontario borders where travellers can deposit any firewood they are transporting. Prevent the spread of forest insects and disease. **Don't move firewood!**

Firewood disposal site

Don't move firewood!

Native Forest Insects and Disease

In addition to invasive species, Manitoba monitors the populations of several damaging native forest insects and disease. In some situations, when an outbreak poses a fire hazard or may cause a loss in commercially important forests, the province may begin a management program to control the insect or disease.

Aerial Surveys

In 2013, the Forestry and Peatlands Management Branch expanded its aerial survey program. Instead of targeting a single species – such as spruce budworm – the aerial survey program now includes a province-wide visual assessment to determine what type of damage is affecting the forest. As insect populations rise, they will spread throughout the forest landscape. Monitoring these changes is important for knowing when and where to act.

Eastern Larch Beetle

A cousin of mountain pine beetle, eastern larch beetle (ELB) attacks larch trees. Normally, ELB attack trees that are already stressed by other insects or by drought, but during outbreaks the beetles will attack healthy trees. Many larch have died throughout Manitoba and ELB is now affecting about 75,274 hectares of forested area. ELB prefers larger, older larch and this may affect not only the regeneration of these forests (older larch produce the most seeds), but may also impact great grey owls, which nest in these habitats.

Cessna 337-G

Spruce Budworm

Historically, the most significant insect defoliator of Manitoba's boreal forest is the spruce budworm. When populations are large, their caterpillars can defoliate millions of hectares of spruce and fir.

Currently, their numbers are decreasing, as they are at a low point in their cycle. In 2010, 5,385 hectares near Grass River Provincial Park experienced severe spruce budworm defoliation. In 2011, the area was treated with a combination of Mimic(c) 240 LV (tebufenozide) and the biological pesticide *Bacillus thuringiensis kurstaki* (Btk). The treatment was able to lower the amount of affected area to 470 hectares, a reduction of 91 per cent.

Spruce budworm larva

Jack Pine Budworm

An insect related to spruce budworm, and equally as destructive, is the Jack pine budworm. And, as the name suggests, it consumes the needles of Jack pine trees. Unlike spruce budworm, Jack pine budworm populations are increasing in Manitoba. An estimated 15,154 hectares in north Interlake were defoliated in 2015 and it's predicted that populations will expand in 2016.

Jack pine budworm larva

Jack pine budworm defoliation in the Interlake, 2015

Forest tent caterpillar

Hardwoods also have their defoliators. In 2013, an outbreak of forest tent caterpillar (FTC) began in many areas of Manitoba. In 2014, FTC affected 655,804 hectares. Outbreaks tend to occur every 10 to 15 years, the last of which peaked in 2003. The hairy, blue and black caterpillars eat the leaves of aspen, maple and elm (among several others), but the trees are typically able to recover, even after several years of defoliation. FTC outbreaks tend to last between three and six years, and then starvation, predation and parasitism cause their populations to collapse.

Forest tent caterpillar larvae

Management Techniques

Not all insects are the same. Sometimes, in order to save vast numbers of trees, insecticides are required. Whether an insect is native or invasive, insecticide remains an important tool to help prevent excessive damage to the forest. The type of insecticide to use depends on the insect. For example, Bacillus thuringiensis kurstaki (Btk), a naturally occurring soil-dwelling bacterium, affects the gut of any moth that eats it. Another method is to harvest the infested trees. And both techniques are used when forest insect populations get too large.

Aerial spray

ENVIROTHON

Since it began in 1997, almost 3,000 students in Manitoba have competed in Envirothon. Coordinated and hosted by the Manitoba Forestry Association, the competition encourages high school students to learn about environmental issues in a fun and engaging way. Topic themes change every year and students learn about forestry, soils, wildlife and aquatic ecology.

The winner of the provincial Envirothon goes on to represent Manitoba in the Canon North American Envirothon. In New Brunswick, in 2011, the five-member team from Swan Valley Regional Secondary School won first place! To register your team or learn more, go to **thinktrees.org**

Sustainable Development supports the Envirothon with funding and volunteers. In 2016, the five-year funding agreement with the Manitoba Forestry Association was renewed.

Year	Location	Theme	Winner
2011	Gimli	Salt and Fresh Water Estuaries	Swan Valley Regional Secondary School
2012	Pinawa	Nonpoint Source Pollution and Low Impact Development	Swan Vallery Watershed Conservation District
2013	International Peace Garden	Sustainable Rangeland Management	Swan Vallery Watershed Conservation District
2014	Brandon University	Sustainable Agriculture & Locally Grown	Swan Vallery Watershed Conservation District
2015	Canadian Mennonite University	Urban & Community Forestry	Vincent Massey Collegiate

Partnerships

Canadian Council of Forest Ministers
Canadian Food Inspection Agency
Canadian Forest Service
City of Winnipeg
Economic Development Committee of the Shoal Lake Watershed Group
Envirothon
FP innovations
Frontiers Foundation Inc.
International Institute for Sustainable Development
LP Canada Ltd.
Manitoba Forestry Association
Manitoba Hydro
Manitoba Model Forest
Mathias Colomb Cree Nation
Metis Rights Coalition
Mountain Forest Section Renewal Company
National Forests Sinks Committee
National Research Council
Nelson House Resource Management Board
Opaskwayak Cree Nation
Pimitotah Resource Advisory Board
Pineland Forest Nursery
Province of Ontario
Province of Saskatachewan
Saskatchewan Research Council
Scouts Canada
SERG-International
Spruce Products Ltd.
State of Minnesota
Tolko Ltd.
Trees Winnipeg
University College of the North
University of Manitoba
University of Winnipeg
Western Nursery Growers Group
Whiteshell Fire Smart Initiative
Woodlot Association of Manitoba

Publications

Manitoba's Submission Guidelines for Forest Management Operating Plans (2011)

Forestry Road Management (2012)

Manitoba Manual of Scaling Instructions, Fourth Edition (2013)

Wood Supply Analysis Report for Forest Management Unit 24 (2013)

Forest Pest Management Guidelines (2014)

Manitoba Hardwood Renewal Survey Manual (2014)

Pre-Harvest Surveys (2014)

Manitoba Free to Grow Survey Manual (2014)

Biomass Management (2015)

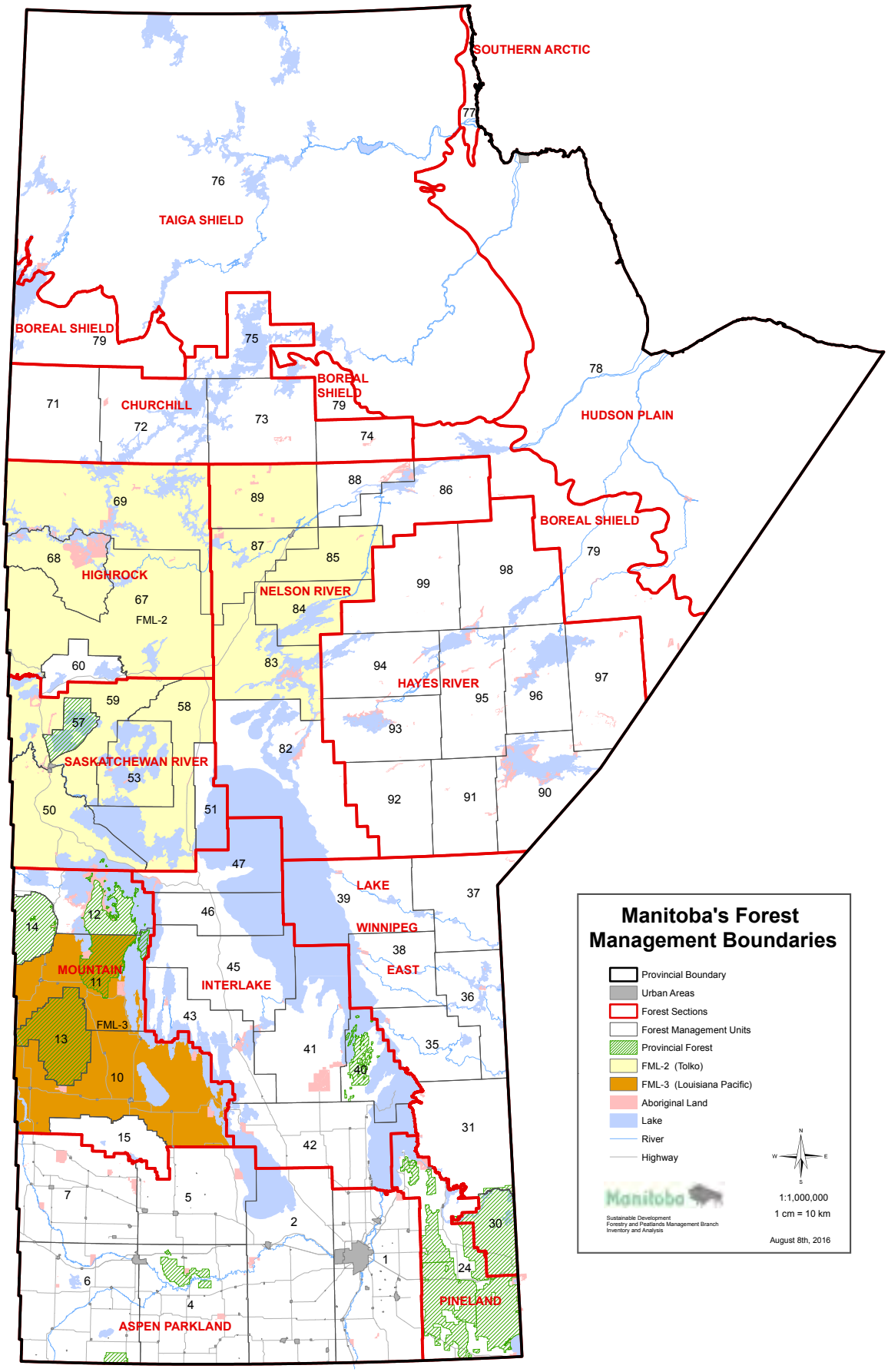
Appendices

For the purposes of this report, and to provide a link between past and future reporting, both standards (Forest Section-based reporting and Ecozone-based reporting) are shown.

The tables include the recently completed Highrock FLI data. As well, silvicultural data from renewal and Free-to-Grow surveys are included to accurately reflect current forest conditions.

Land cover types for Appendices 1 and 2 are from the Earth Observation for Sustainable Development (EOSD) Landsat imagery, with dates ranging from 1999-2002. This includes fire areas calculated for the forest sections that were previously referred to as the "white zone", ex: Boreal Shield, Taiga Shield, Hudson Plain, and Southern Arctic forest sections.

Appendices 3 and 4, although similar to appendices 1 and 2, separate mixedwood into softwood-leaning and hardwood-leaning mixedwood.


SOUTHERN ARCTIC
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TAIGA SHIELD
BOREAL SHIELD
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BOREAL SHIELD
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HUDSON PLAIN
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BOREAL SHIELD
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PINELAND
ASPEN PARKLAND
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Provincial Forest
FML-2 (Tolko)
FML-3 (Louisiana Pacific)
Aboriginal Land
Lake
River
Highway
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Manitoba
Sustainable Development
Forestry and Peatlands Management Branch
Inventory and Analysis
1:1,000,000
1 cm = 10 km
August 8th, 2016

Appendix 1: Area of Cover Types by Forest Section for the Entire Province (in km²)

FOREST SECTION	Cloud[1]	Hardwood	Mixedwood	No Data[1]	Non Forest	Non Productive	Softwood	Shadow[1]	Total Forest	Total Land	Water	Fires (2011-16)[2]	Grand Total
ASPEN PARKLAND	0.00	7,051.24	132.00	0.00	54,881.81	1,455.84	126.91	0.00	7,310.15	63,647.80	3,072.17		66,719.98
BOREAL SHIELD	35.21	21.87	174.23	0.03	5,997.06	7,496.06	10,474.97	9.01	10,671.07	25,619.18	4,538.44	1,454.98	30,201.87
CHURCHILL RIVER	0.00	155.22	659.70	0.00	753.30	7,919.12	15,470.85	0.00	16,285.76	24,958.18	6,002.53		30,960.71
HAYES RIVER	0.00	483.35	2,152.76	0.00	2,206.73	29,661.03	21,060.69	0.00	23,696.80	55,564.57	11,780.95		67,345.52
HIGHROCK	0.00	839.90	3,487.41	0.00	4,879.97	8,449.77	13,760.34	0.00	18,087.66	31,417.40	5,301.68		36,719.08
HUDSON PLAINS	142.77	336.35	383.92	0.14	31,811.23	38,897.10	23,939.12	106.65	24,659.40	103,158.87	23,583.38	7,791.14	126,991.80
INTERLAKE	0.00	5,999.98	2,108.90	0.00	10,024.06	7,363.05	4,316.46	0.00	12,425.34	29,812.45	17,670.38		47,482.83
LAKE WINNIPEG EAST	0.00	1,246.95	3,267.53	0.00	3,068.97	11,239.64	14,960.13	0.00	19,474.62	33,783.22	7,597.86		41,381.08
MOUNTAIN	0.00	8,951.11	2,352.37	0.00	13,169.86	1,232.96	4,787.03	0.00	16,090.50	30,493.33	6,326.16		36,819.49
NELSON RIVER	0.00	587.88	2,823.20	0.00	3,367.43	20,259.68	11,906.74	0.00	15,317.82	38,944.94	10,040.32		48,985.26
PINELAND	0.00	1,834.50	857.32	0.00	2,627.83	2,800.82	3,163.81	0.00	5,855.64	11,284.29	1,144.51		12,428.80
SASKATCHEWAN RIVER	0.00	645.03	1,738.07	0.00	4,238.33	9,075.00	7,294.10	0.00	9,677.20	22,990.53	8,958.56		31,949.09
SOUTHERN ARCTIC	0.00	0.00	0.00	0.00	827.43	189.31	56.80	0.00	56.80	1,073.54	381.04	0.00	1,454.58
TAIGA SHIELD	0.01	1.68	39.13	0.01	26,127.87	18,274.85	17,847.15	0.00	17,887.96	63,323.20	7,290.14	1,032.53	70,613.36
Grand Total	**177.99**	**28,155.07**	**20,176.56**	**0.18**	**163,981.87**	**164,314.25**	**149,165.09**	**115.66**	**197,496.72**	**536,071.50**	**113,688.12**	**10,278.66**	**650,053.44**

[1] Land cover types from the classified EOSD Landsat imagery with dates ranging from 1999-2002.

[2] Fire areas only calculated for the forest sections previously referred to as the white zone, i.e., forest sections Boreal Shield, Hudson Plains, Taiga Shield, and Southern Arctic.

Appendix 2: Area of Cover Types by Ecozone for the Entire Province (in km²)

ECOZONE	Cloud	Hardwood	Mixedwood	No Data	Non Forest	Non Productive	Softwood	Shadow	Total Forest	Total Land	Water	Fires (2011-16)	Grand Total
Boreal Plain	0.00	15,154.53	6,376.58	0.00	26,599.86	19,361.43	16,945.92	0.00	38,477.03	84,438.32	40,446.14		124,884.46
Boreal Shield	35.21	5,026.59	13,280.22	0.03	22,456.90	84,508.85	89,544.73	9.01	107,851.54	216,272.27	36,574.60	1,454.98	252,891.13
Hudson Plain	0.01	1.68	39.13	0.01	26,127.87	18,274.85	17,847.15	0.00	17,887.96	63,323.20	7,290.14	1,032.53	70,613.36
Prairie	0.00	7,631.93	84.67	0.00	56,054.31	1,437.20	86.85	0.00	7,803.45	65,294.95	4,204.99		69,499.95
Southern Arctic	0.00	0.00	0.00	0.00	827.43	189.31	56.80	0.00	56.80	1,073.54	381.04	0.00	1,454.58
Taiga Shield	142.77	340.33	395.97	0.14	31,915.51	40,542.61	24,683.65	106.65	25,419.94	105,669.21	24,791.21	7,791.14	130,709.98
Grand Total	**177.99**	**28,155.07**	**20,176.56**	**0.18**	**163,981.87**	**164,314.25**	**149,165.09**	**115.66**	**197,496.72**	**536,071.50**	**113,688.12**	**10,278.66**	**650,053.44**

Appendix 3: Area of Cover Types by Forest Section for the "Green Zone" (in km^2)

FOREST SECTION	Hardwood	Mixed Hardwood	Softwood	Mixed Softwood	Non Forest	Non Productive	Total Forest	Total Land	Water	Grand Total
ASPEN PARKLAND	7,051.24	109.15	126.91	22.84	54,881.81	1,455.84	7,310.15	63,647.80	3,072.17	66,719.98
CHURCHILL RIVER	155.22	295.13	15,470.85	364.57	753.30	7,919.12	16,285.76	24,958.18	6,002.53	30,960.71
HAYES RIVER	483.35	917.28	21,060.69	1,235.49	2,206.73	29,661.03	23,696.80	55,564.57	11,780.95	67,345.52
HIGHROCK	839.90	1,653.86	13,760.34	1,833.55	4,879.97	8,449.77	18,087.66	31,417.40	5,301.68	36,719.08
INTERLAKE	5,999.98	1,389.11	4,316.46	719.79	10,024.06	7,363.05	12,425.34	29,812.45	17,670.38	47,482.83
LAKE WINNIPEG EAST	1,246.95	1,576.04	14,960.13	1,691.49	3,068.97	11,239.64	19,474.62	33,783.22	7,597.86	41,381.08
MOUNTAIN	8,951.11	1,535.01	4,787.03	817.36	13,169.86	1,232.96	16,090.50	30,493.33	6,326.16	36,819.49
NELSON RIVER	587.88	1,301.17	11,906.74	1,522.03	3,367.43	20,259.68	15,317.82	38,944.94	10,040.32	48,985.26
PINELAND	1,834.50	535.68	3,163.81	321.64	2,627.83	2,800.82	5,855.64	11,284.29	1,144.51	12,428.80
SASKATCHEWAN RIVER	645.03	821.64	7,294.10	916.43	4,238.33	9,075.00	9,677.20	22,990.53	8,958.56	31,949.09
Grand Total	**27,795.16**	**10,134.09**	**96,847.06**	**9,445.19**	**99,218.29**	**99,456.92**	**14,4221.49**	**342,896.71**	**77,895.12**	**420,791.83**

Appendix 4: Area of Cover Types by Ecozone for the "Green Zone" (in km^2)

ECOZONE	Hardwood	Mixed Hardwood	Softwood	Mixed Softwood	Non Forest	Non Productive	Total Forest	Total Land	Water	Grand Total
Boreal Plain	15,154.53	3,864.20	16,945.92	2512.38	26,599.86	19,361.43	38,477.03	84,438.32	40,446.14	124,884.46
Boreal Shield	5,004.73	6195.59	79,069.76	6910.39	16,459.84	77,012.78	97,180.47	190,653.10	32,036.16	222,689.25
Prairie	7,631.93	68.14	86.85	16.53	56,054.31	1,437.20	7,803.45	65,294.95	4,204.99	69,499.95
Taiga Shield	3.98	6.16	744.53	5.88	104.29	1,645.51	760.55	2,510.34	1,207.83	3,718.18
Grand Total	**27,795.16**	**10,134.09**	**96,847.06**	**9445.19**	**99,218.29**	**99,456.92**	**144,221.49**	**342,896.71**	**77,895.12**	**420,791.83**

Appendix 5: Age Class Distribution by Forest Section for the Forested "Green Zone" (in km²)

FOREST SECTION	0-20	21-40	41-60	61-80	81-100	101-120	121-140	141+	Non Forest	Non Productive	Total Forest	Total Land	Water	Grand Total
ASPEN PARKLAND	114.83	202.98	1350.32	3,204.94	2,014.79	399.06	23.22	0.00	54,881.81	1,455.84	7,310.15	63,647.80	3,072.17	66,719.98
CHURCHILL RIVER	3,562.29	5,469.58	3,095.94	1,505.50	2,303.94	52.42	164.56	131.54	753.30	7,919.12	16,285.76	24,958.18	6,002.53	30,960.71
HAYES RIVER	4,998.63	3,127.65	4,923.55	3,194.77	4,635.75	37.75	1,577.25	1,201.45	2,206.73	29,661.03	23,696.80	55,564.57	11,780.95	67,345.52
HIGHROCK	2,687.32	3,888.27	3,062.13	2,426.93	2,935.37	1,415.19	1,276.38	396.08	4,879.97	8,449.77	18,087.66	31,417.40	5,301.68	36,719.08
INTERLAKE	354.51	3,690.79	2,123.37	3,168.49	2,133.06	719.63	139.97	95.53	10,024.06	7,363.05	12,425.34	29,812.45	17,670.38	47,482.83
LAKE WINNIPEG EAST	2,321.72	4,996.71	2,155.51	4,978.98	2,315.82	1,633.84	889.56	182.48	3,068.97	11,239.64	19,474.62	33,783.22	7,597.86	4,1381.08
MOUNTAIN	877.58	2,154.99	2,251.35	2,844.91	3,087.32	2,814.44	1,423.50	636.43	13,169.86	1,232.96	16,090.50	30,493.33	6,326.16	36,819.49
NELSON RIVER	1,065.86	3,263.10	2,989.13	2,293.93	2,228.78	1,709.96	1,523.37	243.69	3,367.43	20,259.68	15,317.82	38,944.94	10,040.32	48,985.26
PINELAND	766.77	570.64	869.98	1,361.75	1,054.92	873.06	324.28	34.23	2,627.83	2,800.82	5,855.64	11,284.29	1,144.51	12,428.80
SASKATCHEWAN RIVER	1,687.51	1,089.23	1,313.21	1,559.83	1,419.53	1,036.60	472.20	1,099.09	4,238.33	9,075.00	9,677.20	22,990.53	8,958.56	31,949.09
Grand Total	**18,437.01**	**28,453.95**	**24,134.50**	**26,540.03**	**24,129.28**	**10,691.93**	**7,814.29**	**4,020.51**	**99,218.29**	**99,456.92**	**144,221.49**	**342,896.71**	**77,895.12**	**420,791.83**

Appendix 6: Age Class Distribution by Ecozone for the Forested "Green Zone" (in km²)

ECOZONE	0-20	21-40	41-60	61-80	81-100	101-120	121-140	141+	Non Forest	Non Productive	Total Forest	Total Land	Water	Grand Total
Boreal Plain	2,988.04	6,640.41	5,853.99	7,480.82	6,764.01	4,653.46	2,224.32	1,871.97	26,599.86	19,361.43	38,477.03	84,438.32	40,446.14	124,884.46
Boreal Shield	15,309.58	20,896.58	16,893.10	15,402.68	15,400.30	5,592.36	5,578.61	2,107.27	16,459.84	77,012.78	97,180.47	190,653.10	32,036.16	222,689.25
Prairie	54.73	618.71	1,288.93	3,458.75	1,964.81	405.23	11.29	0.99	56,054.31	1,437.20	7,803.45	65,294.95	4,204.99	69,499.95
Taiga Shield	84.66	298.25	98.48	197.78	0.15	40.89	0.07	40.28	104.29	1,645.51	760.55	2,510.34	1,207.83	3,718.18
Grand Total	**18,437.01**	**28,453.95**	**24,134.50**	**26,540.03**	**24,129.28**	**10,691.93**	**7,814.29**	**4,020.51**	**99,218.29**	**99,456.92**	**144,221.49**	**342,896.71**	**77,895.12**	**420,791.83**

Appendix 7: Softwood and Hardwood Harvest Volumes by Year and Forest Section (in cubic metres)

	2011-2012			2012-2013			2013-2014		
FOREST SECTION	**Hardwood**	**Softwood**	**Total (m^3)**	**Hardwood**	**Softwood**	**Total (m^3)**	**Hardwood**	**Softwood**	**Total (m^3)**
ASPEN PARKLAND	1,348	25,470	26,818	951	110	1,061	1,182	184	1,365
CHURCHILL RIVER	23	750	773	-	-	-	-	340	340
HAYES RIVER	-	30	30	150	150	300	-	-	-
HIGHROCK	578	76,017	76,596	150	113,891	113,891	2,715	130,136	132,851
INTERLAKE	5,069	14,618	19,687	5,336	47,581	52,917	2,092	23,882	25,974
LAKE WINNIPEG EAST	1,076	1,689	2,765	1,457	6,645	8,101	204	8,485	8,690
MOUNTAIN	504,204	176,249	680,453	39,0979	220,161	611,140	382,384	281,373	663,757
NELSON RIVER	38	2,485	2,523	13,821	4,383	18,204	26,841	19,061	45,902
OUTSIDE	15	-	15	-	-	-	-	-	-
PINELAND	73,438	136,288	209,726	82,240	63,286	145,526	67,048	72,548	139,596
SASKATCHEWAN RIVER	3,014	202,043	205,057	40,581	253,522	294,103	48,814	164,383	213,196
UNSPECIFIED FMU	1,925	6,468	8,393	5,497	65,519	71,015	794	1,741	2,535
Grand Total	**590,727**	**642,107**	**1,232,834**	**541,161**	**775,247**	**1,316,258**	**532,074**	**702,133**	**1,234,207**

	2014-2015			2015-2016			TOTAL		
FOREST SECTION	**Hardwood**	**Softwood**	**Total (m^3)**	**Hardwood**	**Softwood**	**Total (m^3)**	**Hardwood**	**Softwood**	**Total (m^3)**
ASPEN PARKLAND	501	329	830	461	221	683	4,442	26,313	30,756
CHURCHILL RIVER	-	600	600	3	35	38	25	1725	1,750
HAYES RIVER	-	300	300	-	-	-	150	480	630
HIGHROCK	1,142	164,699	165,841	185	93,343	93,528	4,770	578,087	582,708
INTERLAKE	2,843	18,271	21,114	2,544	17,039	19,583	17,884	121,391	139,275
LAKE WINNIPEG EAST	309	1,624	1,933	351	937	1,288	3,396	19,379	22,775
MOUNTAIN	474,668	284,349	759,017	213,704	242,416	456,120	1,965,938	1,204,549	3,170,487
NELSON RIVER	22,233	73,353	95,586	17,561	70,726	88,287	80,494	170,008	250,502
OUTSIDE	-	-	-	-	-	-	15	-	15
PINELAND	85,929	157,749	243,678	92,721	183,655	276,375	401,375	613,526	1,014,901
SASKATCHEWAN RIVER	34,956	173,668	208,624	24,667	106,539	131,206	152,032	900,153	1,052,186
UNSPECIFIED FMU	-	420	420	163	8,102	6,218	8,378	82,249	88,582
Grand Total	**622,580**	**875,361**	**1,497,942**	**352,359**	**723,012**	**1,073,325**	**2,638,901**	**3,717,861**	**6,354,566**

Notes: Includes volumes reported by EDT, timber return, quota, commercial and personal use timber permits. September 1, 2016

Manitoba Sustainable Development
Peatlands and Forestry Branch
Box 70 , 200 Saulteaux Crescent
Winnipeg, Manitoba R3J 3W3
204-945-7989