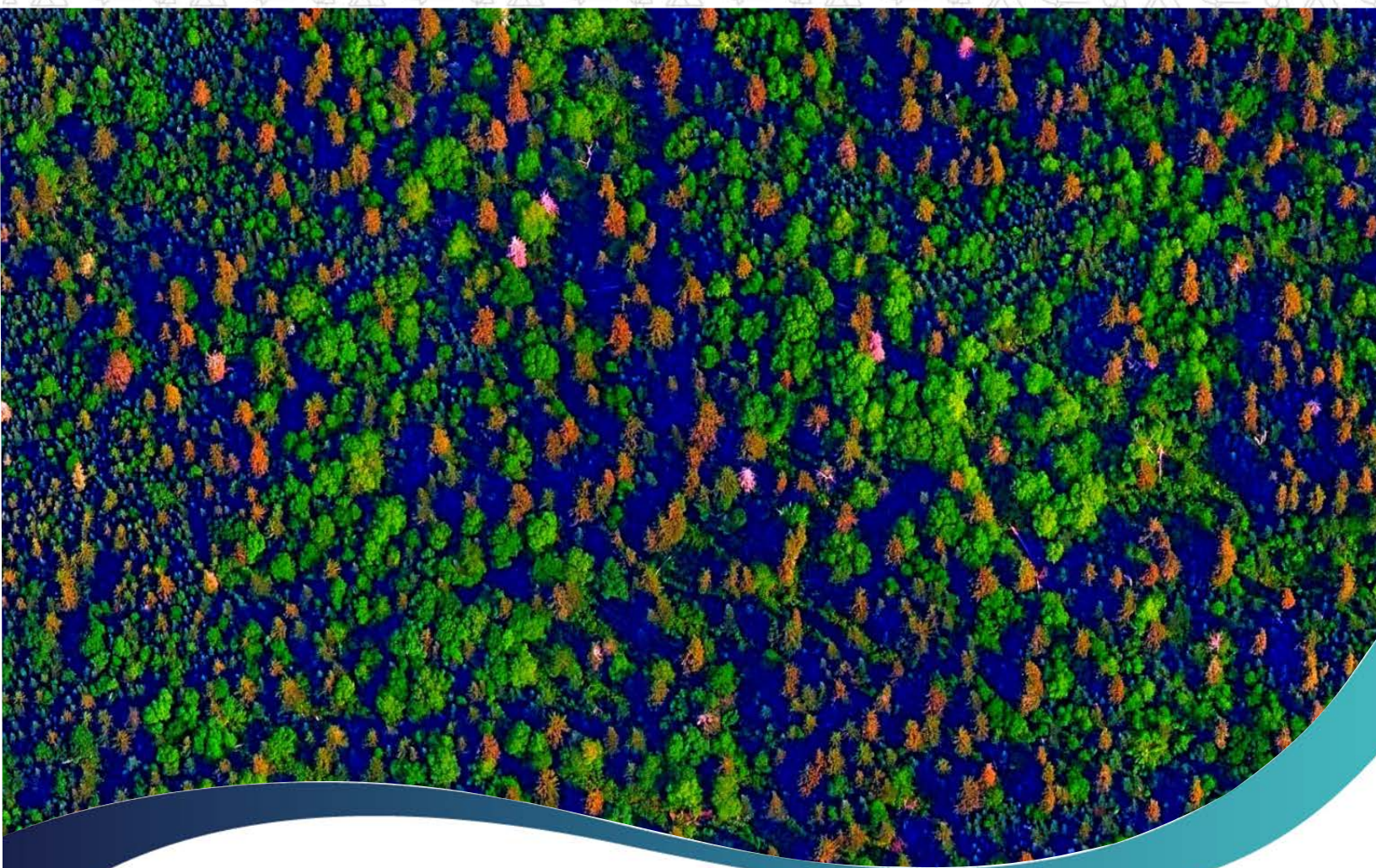


Photographic Interpretation of Forest Species in Southern Québec

October 2021

MINISTÈRE DES FORÊTS, DE LA FAUNE ET DES PARCS



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FOREWORD

The Direction des inventaires forestiers (DIF), Ministère des Forêts, de la Faune et des Parcs du Québec (MFFP), is responsible for producing ecoforest maps of southern Québec. These maps are the result of the interpretation of all the forest species observed from aerial photographs. Photographic interpretation of the various species found in Québec over the entire potential range of land conditions is an extremely complex task. Species identification has been facilitated by the use of aerial photographs projected onto 3D screens, using textural, shape and characteristic colour criteria for each species.

This Guide is intended to be the updated and improved second edition of the *Photographic Interpretation Guide for Forest Species in Southern Québec*, published in 2015. The Guide documents the photographic interpretation of Québec's main commercial forest species, specifically those that are visible in the canopy. Understory species, such as young fir trees, cannot be seen on aerial photographs, and are therefore not described in the Guide. The identification criteria provided in the Guide are taken from 20 cm frame-by-frame high-resolution digital aerial photographs, and are applicable only to aerial photographs of this resolution.

This Guide in no way replaces the ecoforest photographic interpretation standard.

You are invited to provide comments on any aspects of the Guide. They will be used to improve subsequent versions.

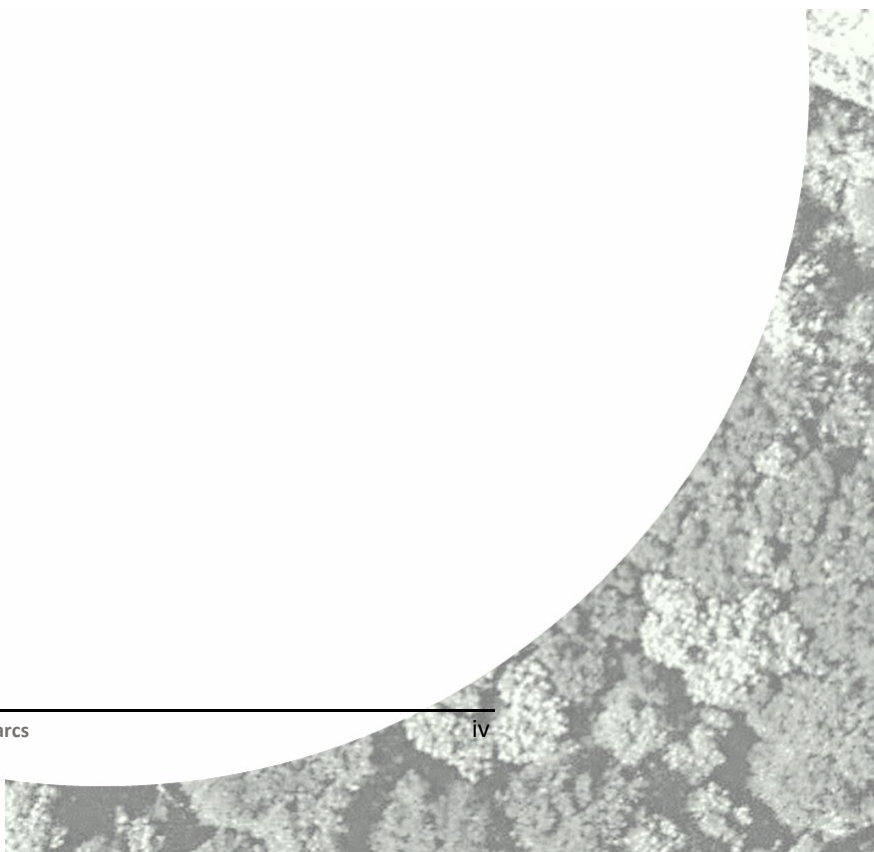
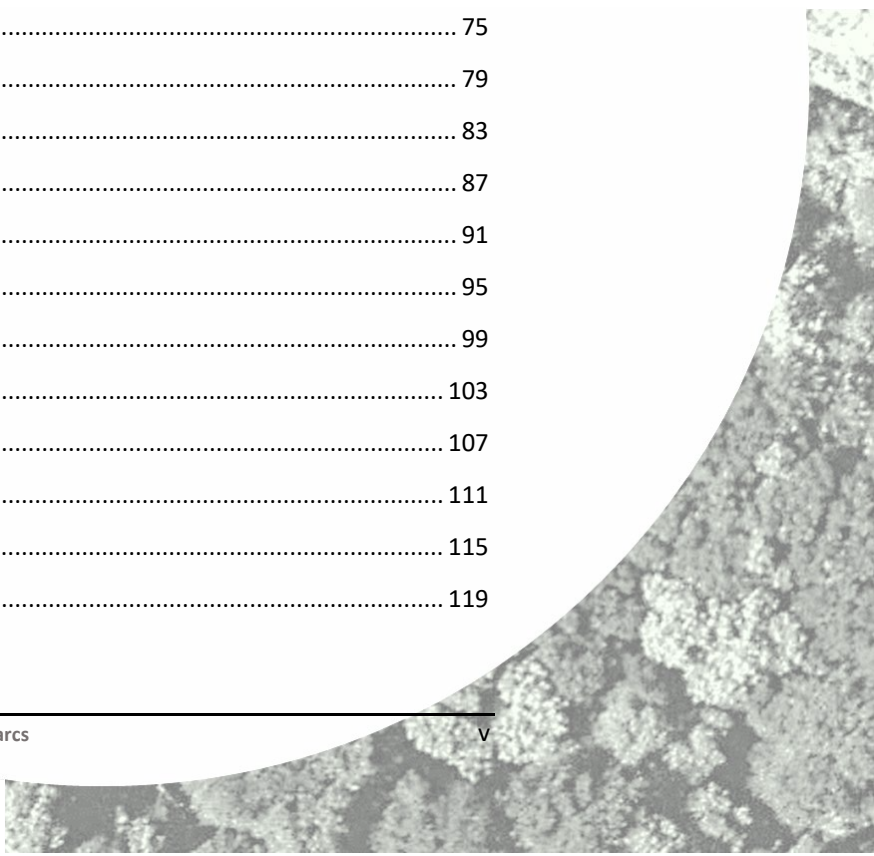
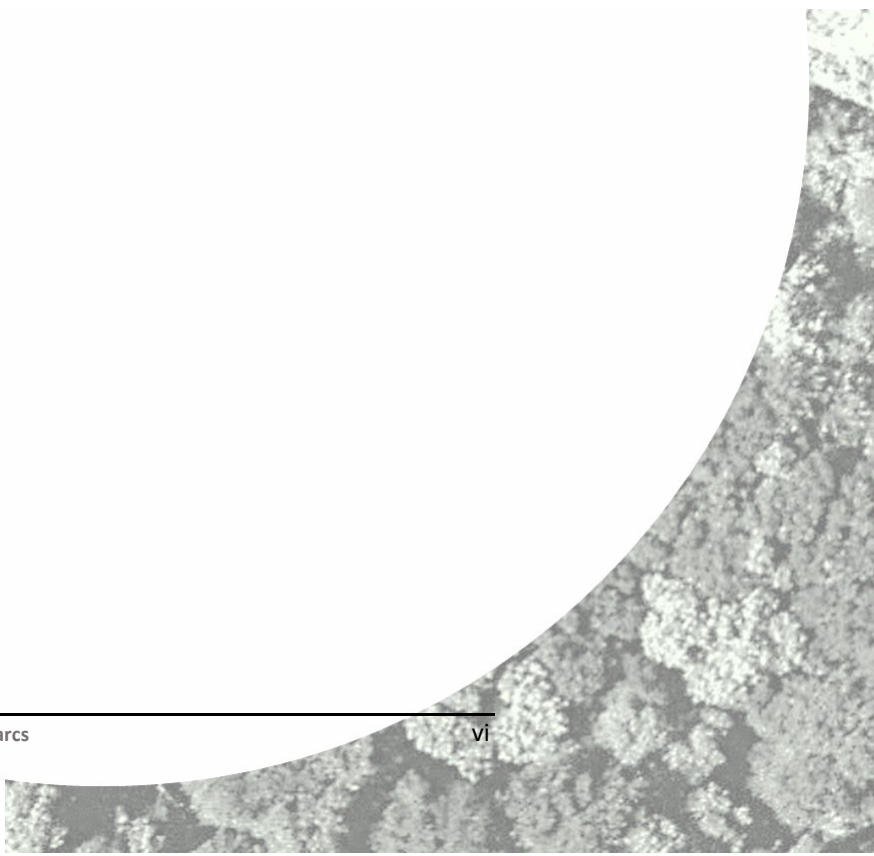


TABLE OF CONTENTS

INTRODUCTION	1
PROPOSED APPROACH.....	1
SOFTWOODS	7
White Spruce.....	11
Black Spruce	15
Red Spruce	19
Tamarack.....	23
Eastern White Pine.....	27
Jack Pine.....	31
Red Pine	35
Eastern Hemlock	39
Balsam Fir.....	43
Eastern White Cedar	47
HARDWOODS	51
Paper Birch.....	55
Grey Birch.....	59
Yellow Birch.....	63
Hickories.....	67
Northern Red Oak	71
Sugar Maple	75
Red Maple	79
Ashes.....	83
American Beech	87
White Elm.....	91
Eastern Hop-hornbeam.....	95
Large-toothed Aspen	99
Balsam Poplar	103
Eastern Cottonwood	107
Trembling Aspen	111
Basswood	115
RECAPITULATIVE TABLES.....	119





INTRODUCTION

This Guide provides the information required to identify commercial softwood and hardwood species through the interpretation of 3D aerial photographs, using shape, textural and characteristic colour criteria.

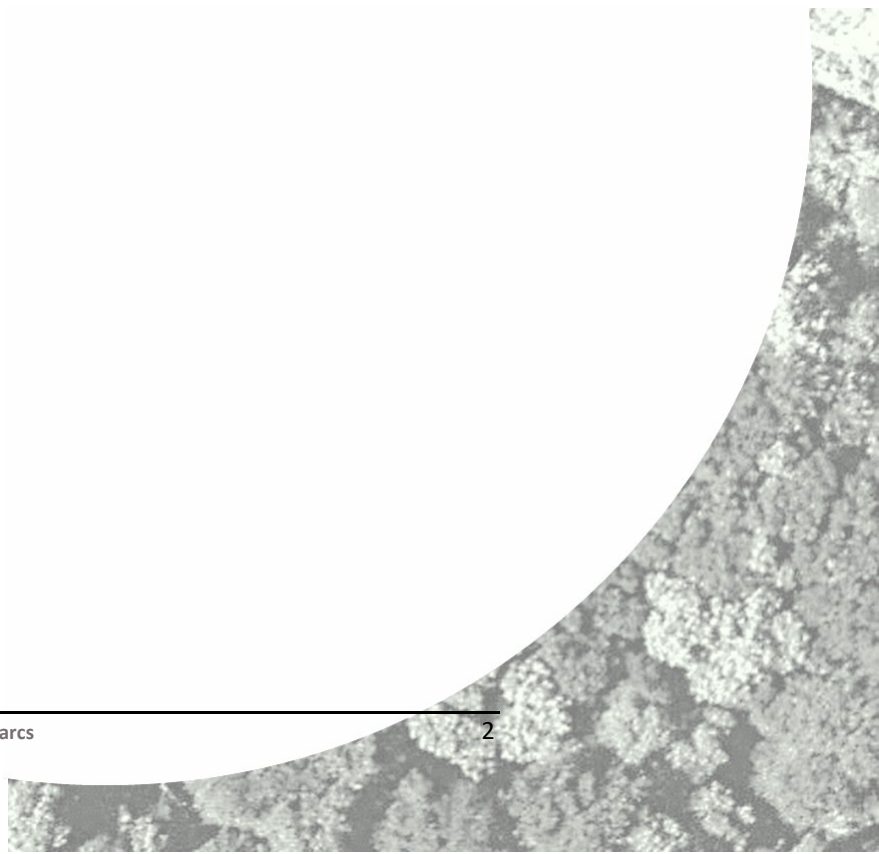
The first section proposes a simple approach with the aim of identifying the key factors to consider in photographic interpretation. The next two sections present softwood and hardwood interpretation factsheets. At the beginning of each of these sections is a series of tables illustrating the probable presence of species based on the soil moisture regime synthesis. The species factsheets deal with the sites where they are observed most frequently and their distribution within the bioclimatic domains² according to the soil moisture regime and surficial deposits. Additional information on each species' shape, textural and colour criteria is supported by red-green-blue (RGB) aerial photographs and infrared (NIR) aerial photographs.

The aerial photographs used were enhanced, meaning that their features, such as contrast, brightness, saturation and red, green and blue bands, were modified according to a method proposed by Dupuis et al.³ The enhanced aerial photographs accentuate the differences between species and facilitate their interpretation. Thus, all the species descriptions presented in this Guide are based on these enhanced image criteria. The image modifications were produced with the 3D viewing software, Summit Evolution (DAT/EM Systems International, 2012).

Finally, the fourth and last section offers recapitulative tables allowing the species to be compared with each other concerning the main identification criteria.

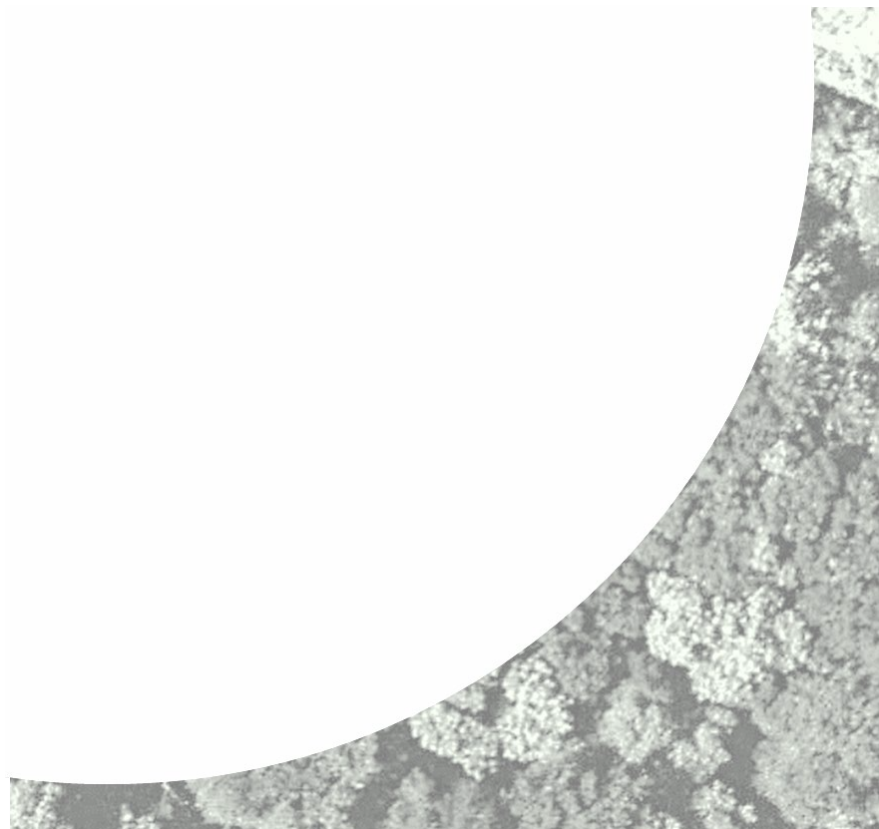
² Ministère des Forêts, de la Faune et des Parcs, 2021. *Classification écologique du territoire québécois*, Direction des inventaires forestiers, Gouvernement du Québec, 15 p. [<https://mffp.gouv.qc.ca/forets/inventaire/pdf/niveaux-superieurs-systeme-hierarchique.pdf>].

³ M. DUPUIS, A. LEBOEUF and E. VAILLANCOURT (2018), *Rehaussement des photographies aériennes dans un contexte de photo-interprétation écoforestière*, Gouvernement du Québec, Ministère des Forêts, de la Faune et des Parcs, 84 p. [<https://mffp.gouv.qc.ca/publications/forets/inventaire/Guide-rehaussement-photographies-aeriennes-diffuse.pdf>]



Section 1

PROPOSED APPROACH



The photographic interpretation process may vary from one individual to another depending on their competencies or experience in the field of forestry. It is undeniable that extensive experience in photographic interpretation will increase the reliability of the interpretation. Nonetheless, a systematic approach can help both novice and seasoned photographic interpreters.

This is the spirit in which this Guide proposes a five-stage approach to optimize identification of Québec forest species.

Stage 1 - Geographic location

There are several dozen forest species that can be identified with aerial photographs. Not all are present in each region of Québec. The probability of finding them varies from south to north and from east to west. Thus, locating the territory to be photographically interpreted may allow restriction of the number of species to be identified. This Guide uses the bioclimatic domains of southern Québec to distinguish the probable presence of the different forest species.

Stage 2 - Consultation of auxiliary data

Throughout the photographic interpretation process, photographic interpretation can rely on a multitude of special and documentary data that can help understand the territory. Here is some of the auxiliary data that must be consulted:

- the ecoforest maps of the previous ecoforest inventories;
- the location and contents of the field surveys (PET, PEP, POE);
- the georeferenced raster charts of surficial deposits at a scale of 1/50,000;
- the shapefile of intervention and disturbance layers;
- the LIDAR data;
- the field guide or guide identifying the territory's ecotypes;
- the physiographic series found in the guides to recognition of the ecotypes of the territory's ecological regions.

Stage 3 - Analysis of the physical environment

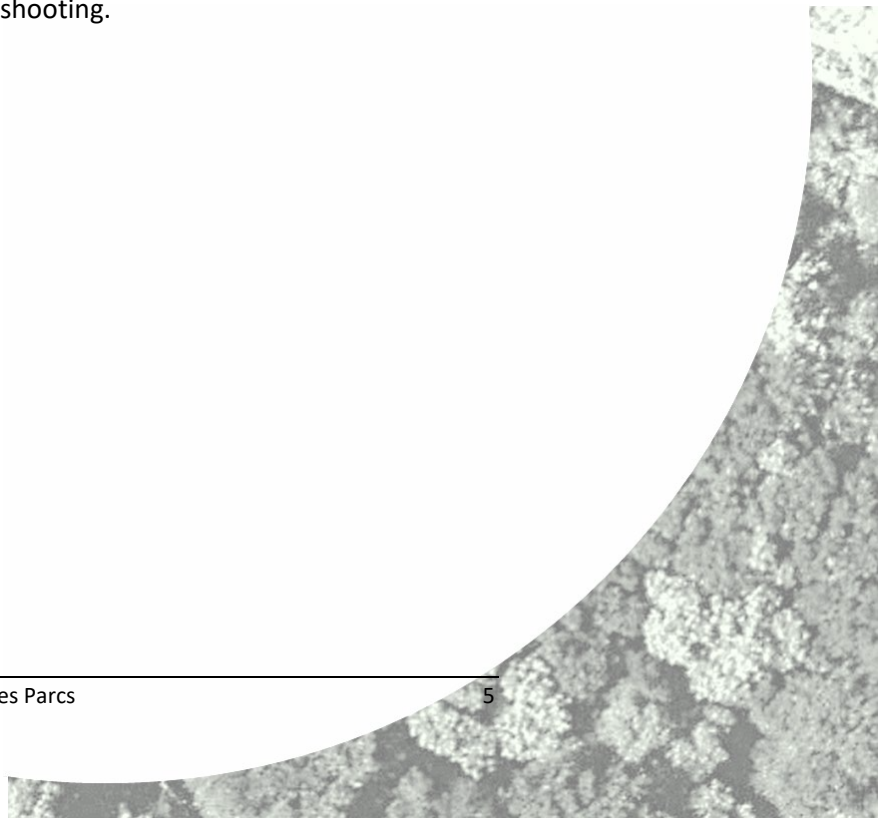
In addition to the geographic distribution, the topographical position, surficial deposits and soil moisture regime influence the distribution of forest species in the landscape. The forest species may show affinities with certain environments. It is therefore important for the photographic interpreter to know and understand the interactions between the physical and forest variables so as to be able to discern the most likely species based on these criteria.

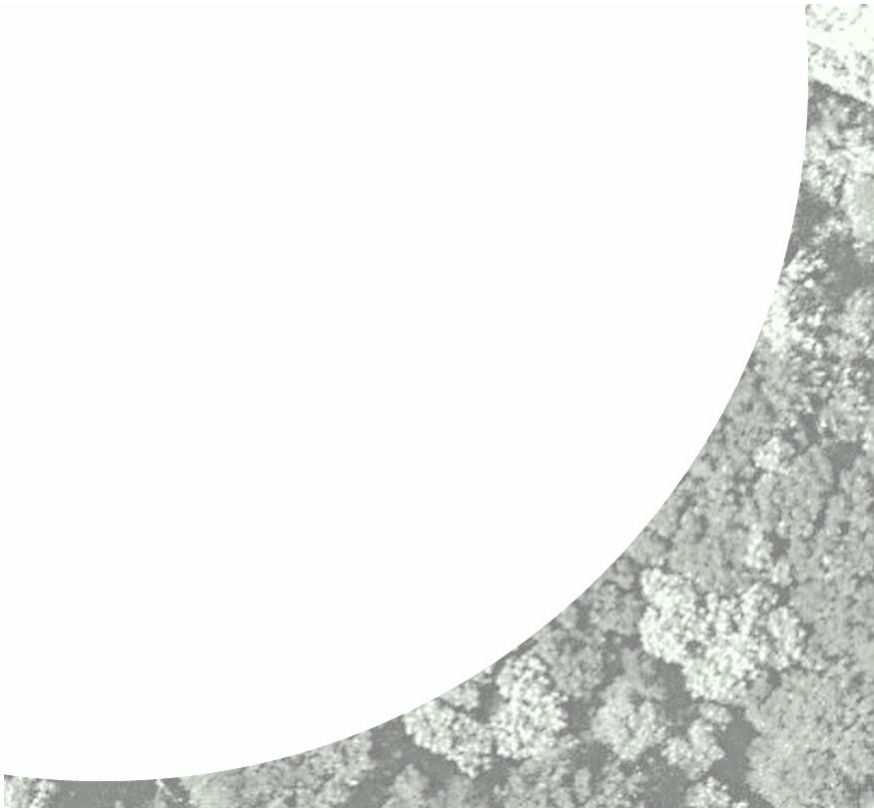
State 4 - Performance of checkpoints

A specialized knowledge of the territory cannot be complete without the performance of control points that will allow validation of the preliminary photographic interpretation and clarification of some uncertainties. Thus, whenever possible, it is recommended to perform control points in the field.

Stage 5 - Photographic interpretation by means of photographic features

Finally, the comparison of the features observed on the aerial photographs, such as the profile, the projection (texture) and the colour added to the geographic and biophysical features should allow a fairly accurate interpretation of the species composition of the forest stands. It should be noted that the colour may vary from one set of photos to another depending on the season and the time of shooting, as well as the atmospheric conditions during shooting.





Section 2

SOFTWOODS

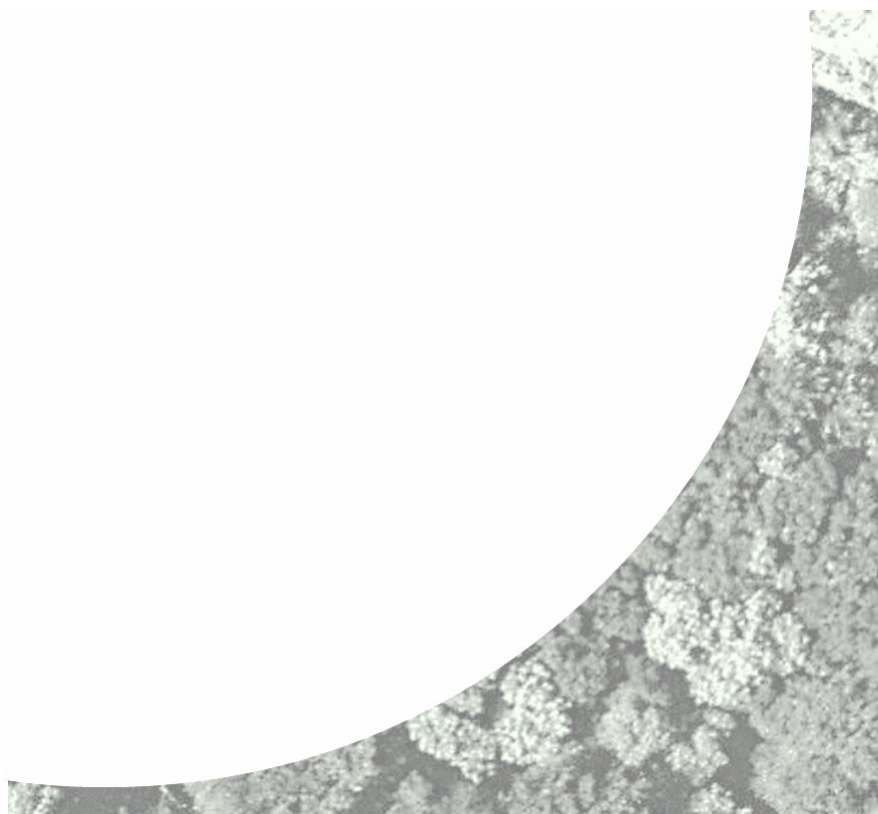


Table 1. Probable presence of softwoods in the **Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) bioclimatic domains**, depending on the soil moisture regime

		Dry		Mesic		Moist	Wet	
		Excessive	Fast	Good	Moderate	Imperfect	Poor	Very poor
White Spruce	p. 9							
Black Spruce	p. 13							
Red Spruce	p. 17							
Tamarack	p. 21							
Eastern White Pine	p. 25							
Jack Pine	p. 29							
Red Pine	p. 33							
Eastern Hemlock	p. 37							
Balsam Fir	p. 41							
Eastern White Cedar	p. 45							

 Probable
 Little or no probability

Table 2. Probable presence of softwoods in the **Balsam Fir - Yellow Birch bioclimatic domain**, depending on the soil moisture regime

		Dry		Mesic		Moist	Wet	
		Excessive	Fast	Good	Moderate		Poor	Very poor
White Spruce	p. 9							
Black Spruce	p. 13							
Red Spruce	p. 17							
Tamarack	p. 21							
Eastern White Pine	p. 25							
Jack Pine	p. 29							
Red Pine	p. 33							
Eastern Hemlock	p. 37							
Balsam Fir	p. 41							
Eastern White Cedar	p. 45							

 Probable
 Little or no probability

Table 3. Probable presence of softwoods in the **Balsam Fir - Paper Birch bioclimatic domain**, depending on the soil moisture regime

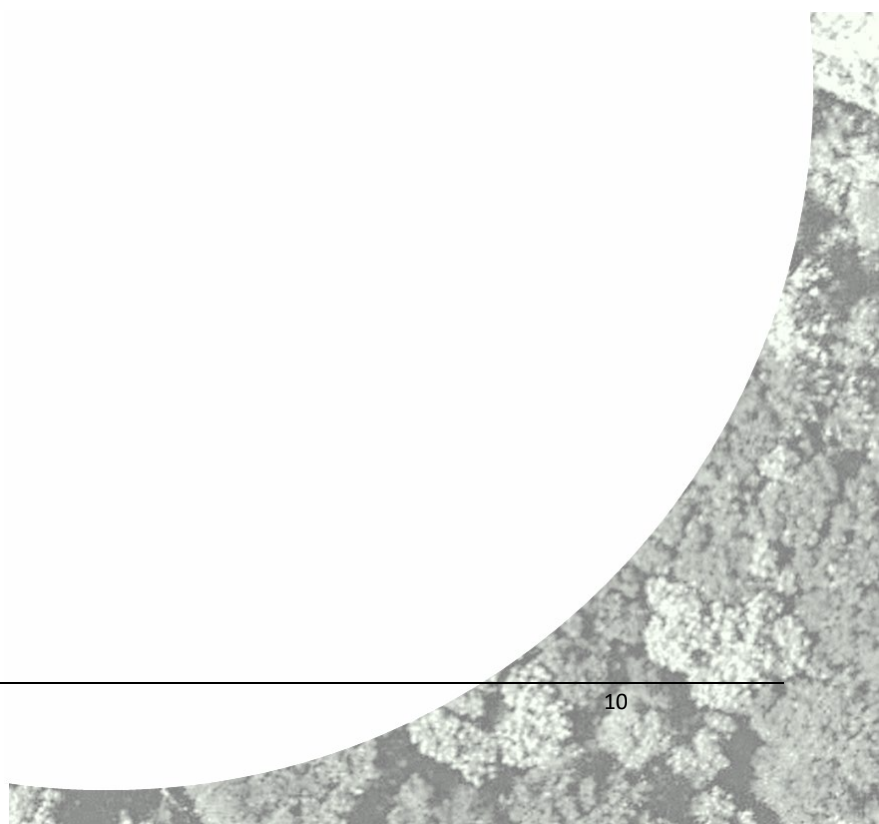
		Dry		Mesic		Moist	Wet	
		Excessive	Fast	Good	Moderate		Poor	Very poor
White Spruce	p. 9							
Black Spruce	p. 13							
Red Spruce	p. 17							
Tamarack	p. 21							
Eastern White Pine	p. 25							
Jack Pine	p. 29							
Red Pine	p. 33							
Eastern Hemlock	p. 37							
Balsam Fir	p. 41							
Eastern White Cedar	p. 45							

 Probable  Little or no probability

Table 4. Probable presence of softwoods in the **Black Spruce - feathermoss** and **Black Spruce - lichen bioclimatic domains**, depending on the soil moisture regime

		Dry		Mesic		Moist	Wet	
		Excessive	Fast	Good	Moderate		Poor	Very poor
White Spruce	p. 9							
Black Spruce	p. 13							
Red Spruce	p. 17							
Tamarack	p. 21							
Eastern White Pine	p. 25							
Jack Pine	p. 29							
Red Pine	p. 33							
Eastern Hemlock	p. 37							
Balsam Fir	p. 41							
Eastern White Cedar	p. 45							

 Probable  Little or no probability



White Spruce

Picea glauca (Moench) Voss.

Ecoforest criteria

Distribution

Although White Spruce is found in every bioclimatic domain of southern Québec (figure 1), this species is rarely dominant in a stand. It is generally found on mid-slopes.

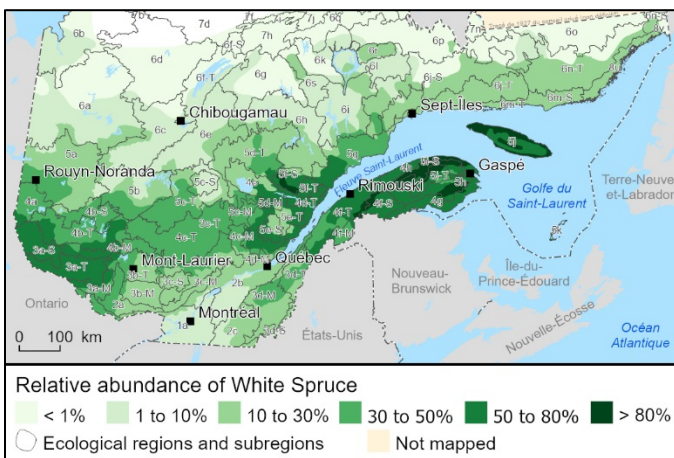


Figure 1. Relative abundance of White Spruce

White Spruce regenerates poorly post-fire. It therefore grows in a broad variety of environments in the bioclimatic domains where fires are infrequent: Balsam Fir - Paper Birch, Balsam Fir - Yellow Birch and Sugar Maple (Hickory, Basswood and Yellow Birch) domains.

In the Black Spruce - feathermoss and Black Spruce - lichen domain, where fires are more frequent, the species tends to become established on sites that are protected from fire, such as along seashores, along watercourses, dry ravines and high-altitude massifs.

In the agricultural sectors of the Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) domains, the stands that contain a significant percentage of White Spruce trees tend to be situated on former pasture land or wildland.

Soil moisture regime

White Spruce prefers mesic sites with a soil moisture regime ranging from good to moderate (table 5).

Surficial deposits

Surficial deposits and soil texture have less of an impact on the species' presence than topographical location and soil moisture regime.

Table 5. Probable presence of White Spruce depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain Basswood domain Yellow Birch domain Yellow Birch domain Paper Birch domain	Feathermoss domain	
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

 Probable  Little or no probability

Crown identification criteria

Profile

White Spruce trees are recognizably taller than other trees in the stand. The crown is relatively dense and broadly conical in shape, with a swollen, rounded top (figure 2).

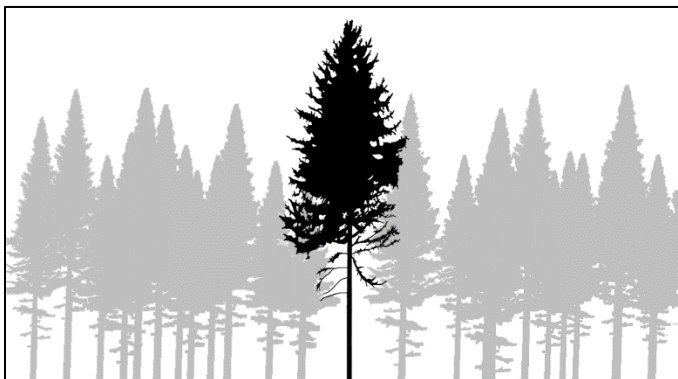


Figure 2. White Spruce profile

Projection

From above, the crown has a medium to wide radius, with a round shape and somewhat imperceptible branches, although this particular characteristic is more prominent in Red Spruce (figure 3).



Figure 3. White Spruce projection (RGB)

Colour

On enhanced naturally coloured (RGB) aerial photographs, White Spruce appears in pale brown, yellowish brown and yellowish green (figures 4 and 5).

On the other hand, on infrared (NIR) aerial photographs, it appears in brown or pinkish brown (young) (figures 6 and 7).

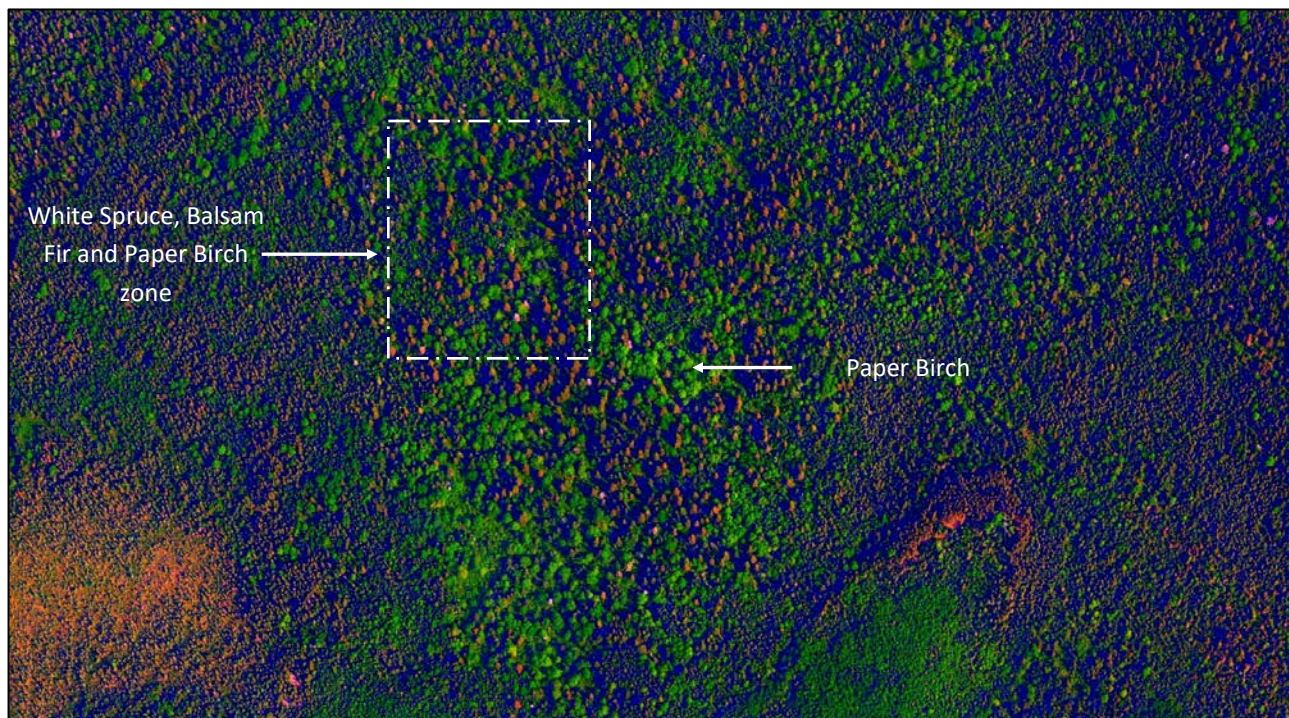


Figure 4. White Spruce, Balsam Fir and Paper Birch stands. White Spruce is distinguished by its colour and its often taller height than the other species of the stand. Balsam Fir is in the understory. (Enhanced RGB photography/Western Balsam Fir - Paper Birch subdomain)

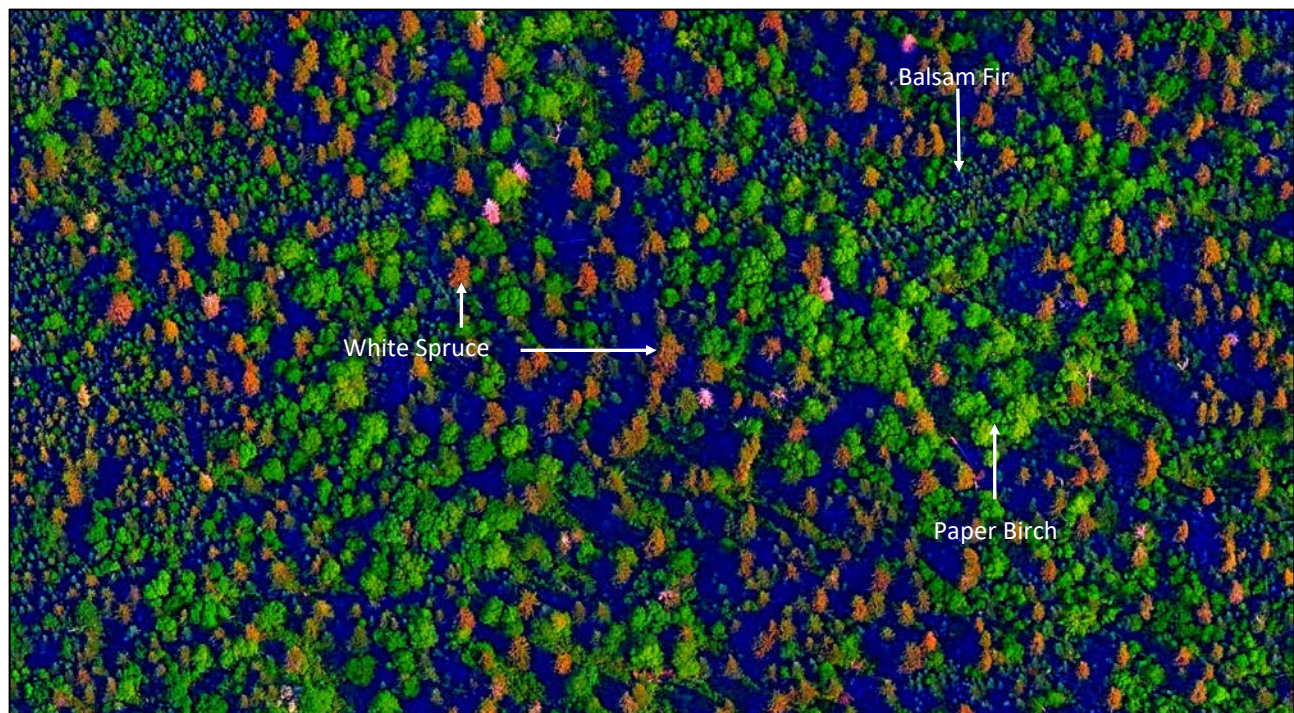


Figure 5. White Spruce, Balsam Fir and Paper Birch stands. White Spruce is not the dominant species of the stand. (Enhanced RGB photography/Western Balsam Fir - Paper Birch subdomain)



Figure 6. White Spruce, Balsam Fir and Paper Birch stands. White Spruce is distinguished by its colour and its often taller height than the other species of the stand. Balsam Fir is in the understory. (Enhanced NIR photography/Western Balsam Fir - Paper Birch subdomain)

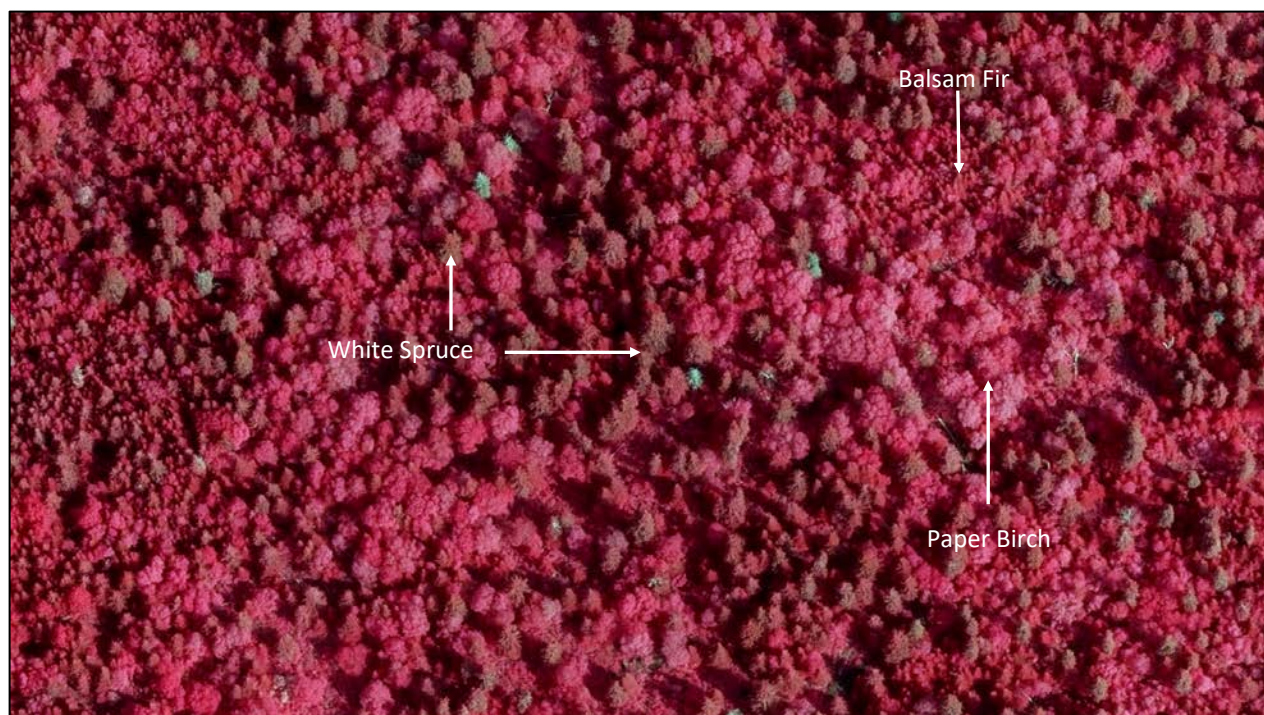


Figure 7. White Spruce, Balsam Fir and Paper Birch stands. White Spruce is not the dominant species of the stand. (Enhanced NIR photography/Western Balsam Fir - Paper Birch subdomain)

Black Spruce

Picea mariana (Mill.) B.S.P.

Ecoforest criteria

Distribution

Black Spruce is present in all Québec's bioclimatic domains, but it dominates in the Balsam Fir - Paper Birch domain, the Black Spruce - feathermoss domain, the Black Spruce - lichen domain and the forest tundra (figure 8).

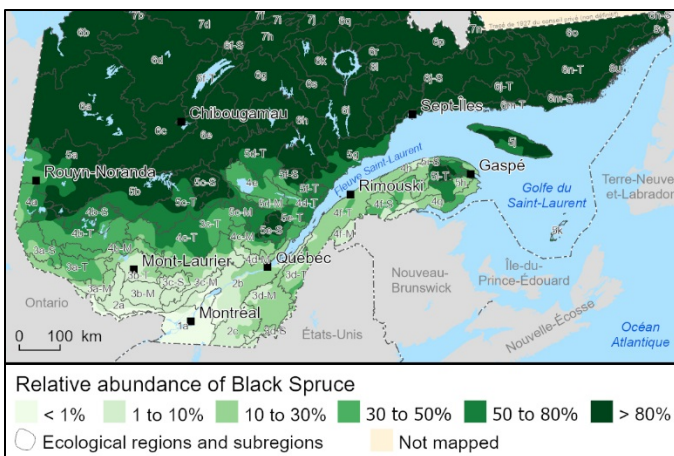


Figure 8. Relative abundance of Black Spruce

In the domains south of the Balsam Fir - Paper Birch domain, Black Spruce is found more frequently on poorly drained sites, rock escarpments and rock outcrops.

Soil moisture regime

Black Spruce prefers dry (fast) and wet (poor) soil moisture regime conditions in the domains south of the Balsam Fir - Paper Birch domain (table 6).

In the Balsam Fir - Paper Birch domain and the more northerly domains, Black Spruce is found across all soil moisture regime conditions.

Surficial deposits

The presence of Black Spruce south of the Balsam Fir - Paper Birch domain is associated with very thin or organic deposits. Further to the north, Black Spruce dominates on all types of surficial deposits.

Table 6. Probable presence of Black Spruce depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain	Basswood domain	Yellow Birch domain
	Yellow Birch domain	Yellow Birch domain	Paper Birch domain
	Feathermoss domain		
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			
	 Probable	 Little or no probability	

Crown identification criteria

Profile

At maturity, the Black Spruce crown is distinguished by its narrow cylinder shape and its fine, pointed top. In stands dominated by Black Spruce, crowns are shorter and somewhat regular. Young crowns tend to be more conical and have a fuzzier texture (figure 9), while old spruce trees will have a feathery crown.



Figure 9. Black Spruce profile

Projection

The diameter of the crown is relatively modest and its texture is clean-cut and compact, which means that the branches have little or no perceptibility. In a stand, the narrowness of the crown gives the impression of seeing deeply between the stems. Finally, the pattern of the stand is generally even (figure 10).

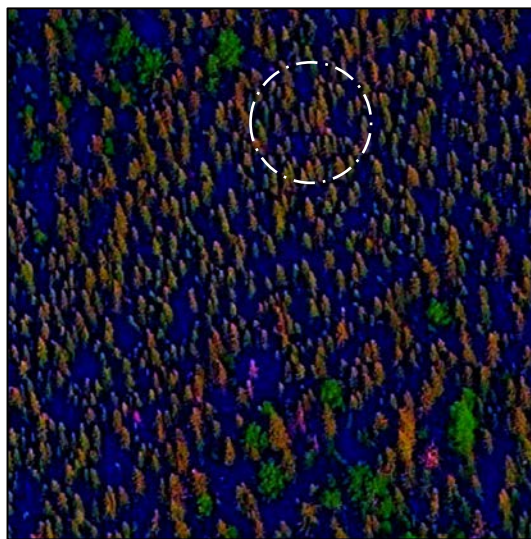


Figure 10. Projection of Black Spruce (RGB)

Colour

On naturally coloured (RGB) aerial photographs, mature Black Spruce stands are usually very dark green with a touch of yellow (figures 11 and 12). However, depending on site characteristics or the type of aerial photography, they may also range from yellowish-green to brownish-yellow. Younger stands are lighter in colour than mature stands.

On infrared (NIR) aerial photographs, mature forest stands are usually dark grey (ash grey) to turquoise (pale) (figures 13 and 14). Young stands are dark pink (bordering on violet), and are duller than hardwood forests.

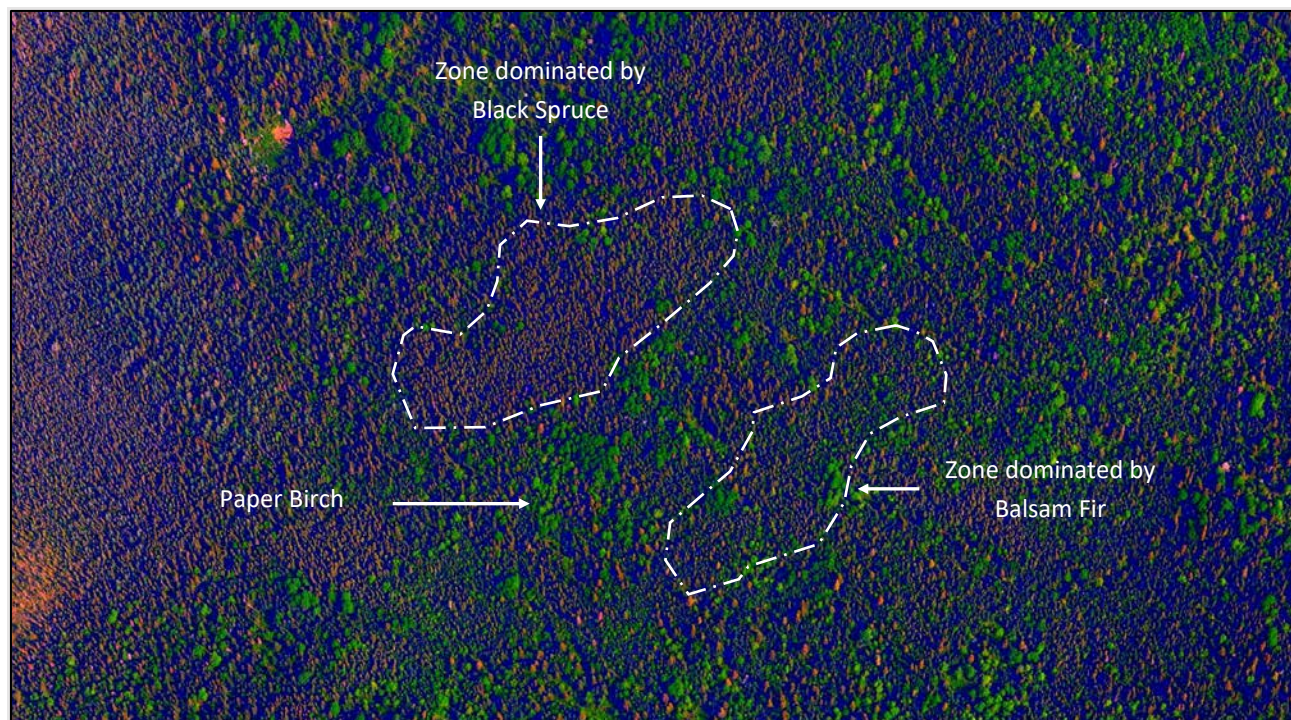


Figure 11. Black Spruce, Balsam Fir and Paper Birch stands (Enhanced RGB photography/Western Balsam Fir - Paper Birch subdomain)

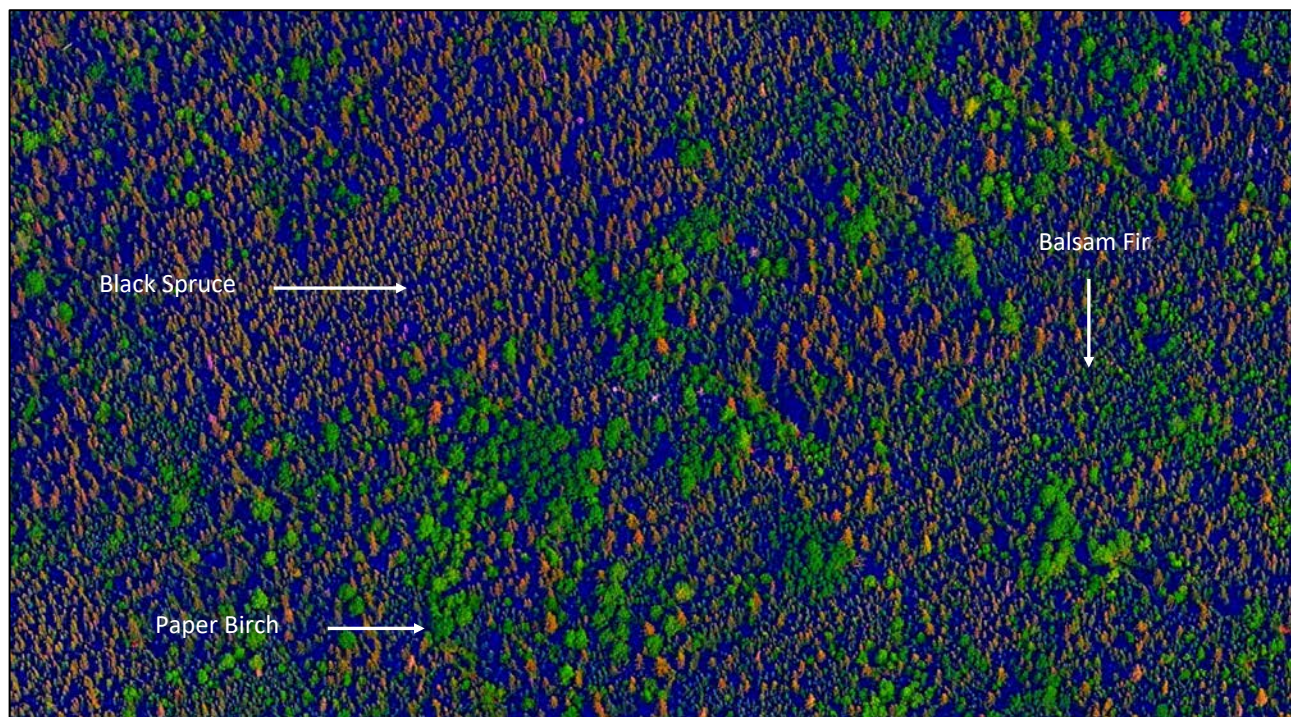


Figure 12. White Spruce, Balsam Fir and Paper Birch stands. The zone dominated by Black Spruce contains more yellow, while the zone dominated by Balsam Fir is greener (Enhanced RGB photography/Western Balsam Fir - Paper Birch subdomain)

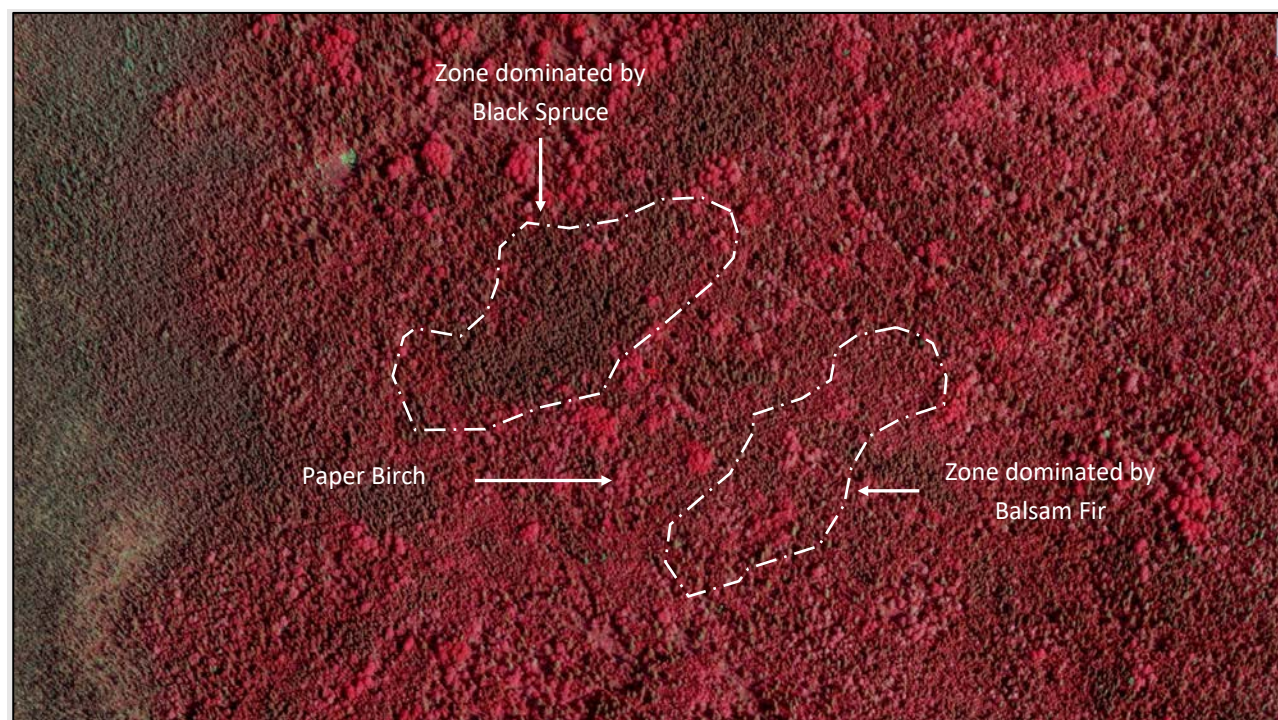


Figure 13. Black Spruce, Balsam Fir and Paper Birch stands (Enhanced NIR photography/Western Balsam Fir - Paper Birch subdomain)

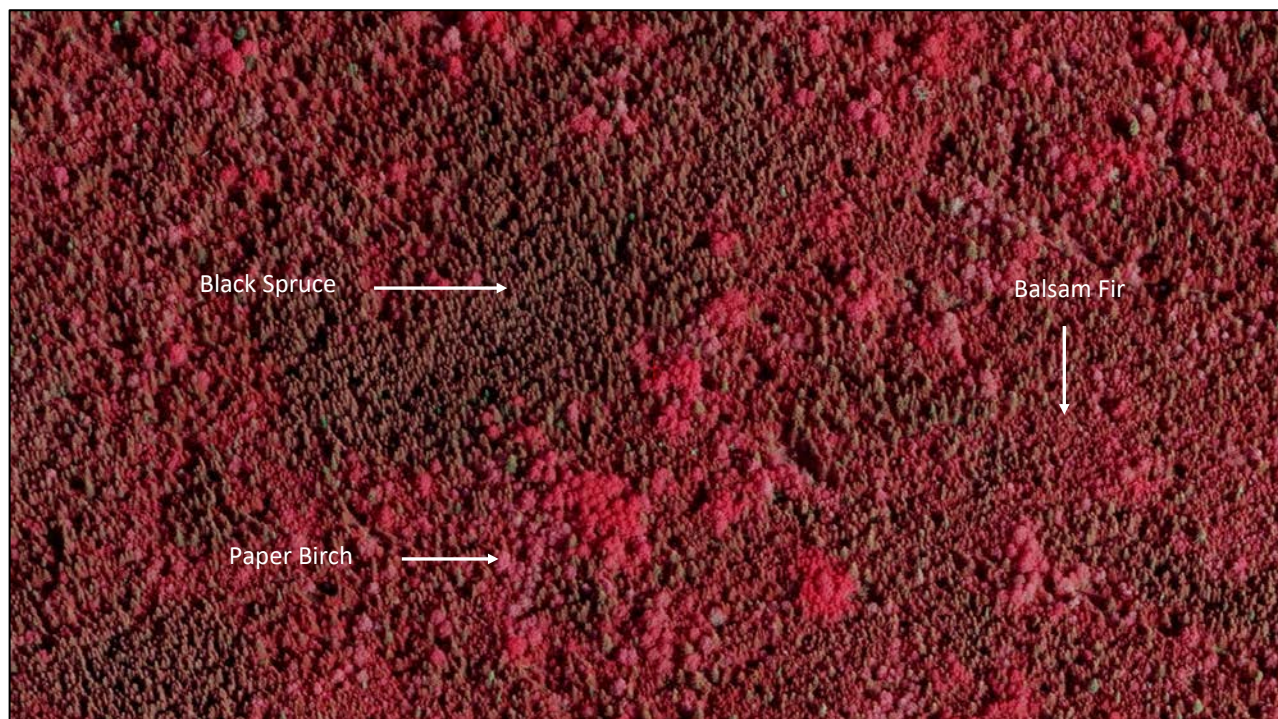


Figure 14. White Spruce, Balsam Fir and Paper Birch stands. The zone dominated by Black Spruce contains more brownish grey, while the zone dominated by Balsam Fir is more pink. (Enhanced NIR photography/Western Balsam Fir - Paper Birch subdomain)

Red Spruce

Picea rubens Sarg.

Ecoforest criteria

Distribution

Red Spruce is found more frequently in the Balsam Fir - Yellow Birch bioclimatic domain and in the Sugar Maple domains (figure 15).

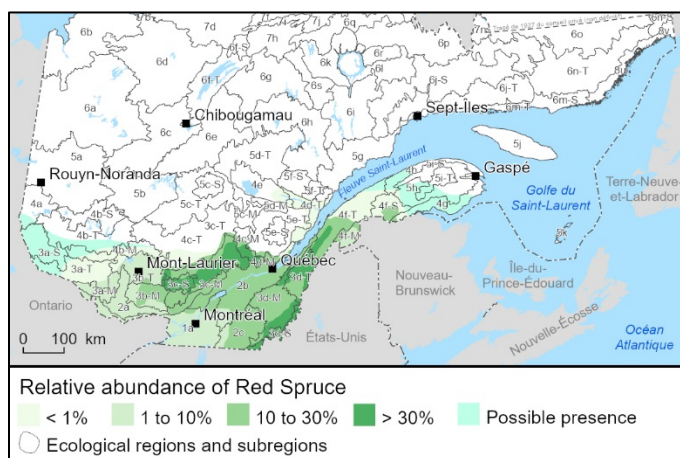


Figure 15. Relative abundance of Red Spruce

In the Balsam Fir - Yellow Birch domain, Red Spruce grows in topographical locations ranging from plains to mid-slopes.

On the periphery of its distribution range or its altitudinal position, Red Spruce may be confused with Black Spruce in rich environments.

Soil moisture regime

In the Sugar Maple (Hickory, Basswood and Yellow Birch) domains, it occupies moist sites (imperfect soil moisture regime) and poor sites (e.g. coarse deposits with a fast soil moisture regime). Although less plentiful than White Spruce, Red Spruce can also grow on sites that have been impoverished by agriculture (e.g. wildland).

In the Balsam Fir - Yellow Birch domain, Red Spruce can be found on gradients with soil moisture regime conditions ranging from good to imperfect, on all types of surficial deposits except for organic deposits.

Surficial deposits

Surficial deposits and soil texture have less of an impact on the species' presence than topographical location and soil moisture regime.

Table 7. Probable presence of Red Spruce depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir	Black Spruce -
	Bitternut Hickory domain Basswood domain Yellow Birch domain	Yellow Birch domain Paper Birch domain	Feathermoss domain
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

Probable Little or no probability

Crown identification criteria

Profile

The Red Spruce profile is cone-shaped with an elongated base (cylindrical), medium-sized and airy (figure 16). The ends of the branches may be raised.

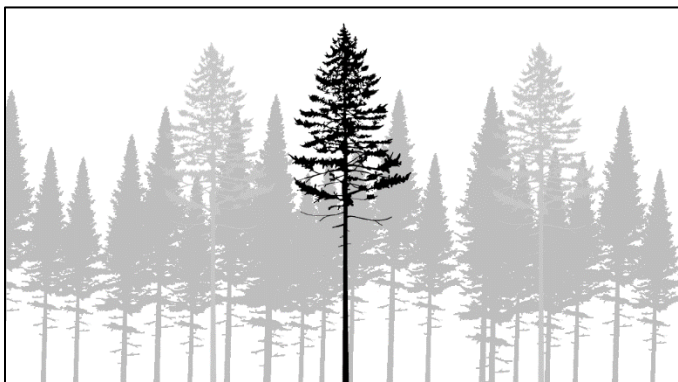


Figure 16. Red Spruce profile

Projection

The Red Spruce projection is recognizable as moderately star-shaped (more than White Spruce but less than Eastern White Pine). It also has a less defined crown than White Spruce (figure 17). Finally, the crown has a medium diameter.



Figure 17. Red Spruce projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs, Red Spruce appears as yellowish brown (figures 18 and 19).

On infrared (NIR) aerial photographs, its colour is pinkish brown (figures 20 and 21).



Figure 18. Red Spruce - Yellow Birch stand, Red Spruce shows a brownish colour. (Enhanced RGB photography/Western Balsam Fir - Yellow Birch subdomain)



Figure 19. Red Spruce - Yellow Birch stand, Red Spruce shows a brownish colour. (Enhanced RGB photography/Western Balsam Fir - Yellow Birch subdomain)



Figure 20. Red Spruce-Yellow Birch stand, Red Spruce shows a brownish colour. Enhanced NIR photography/Western Balsam Fir - Yellow Birch subdomain)

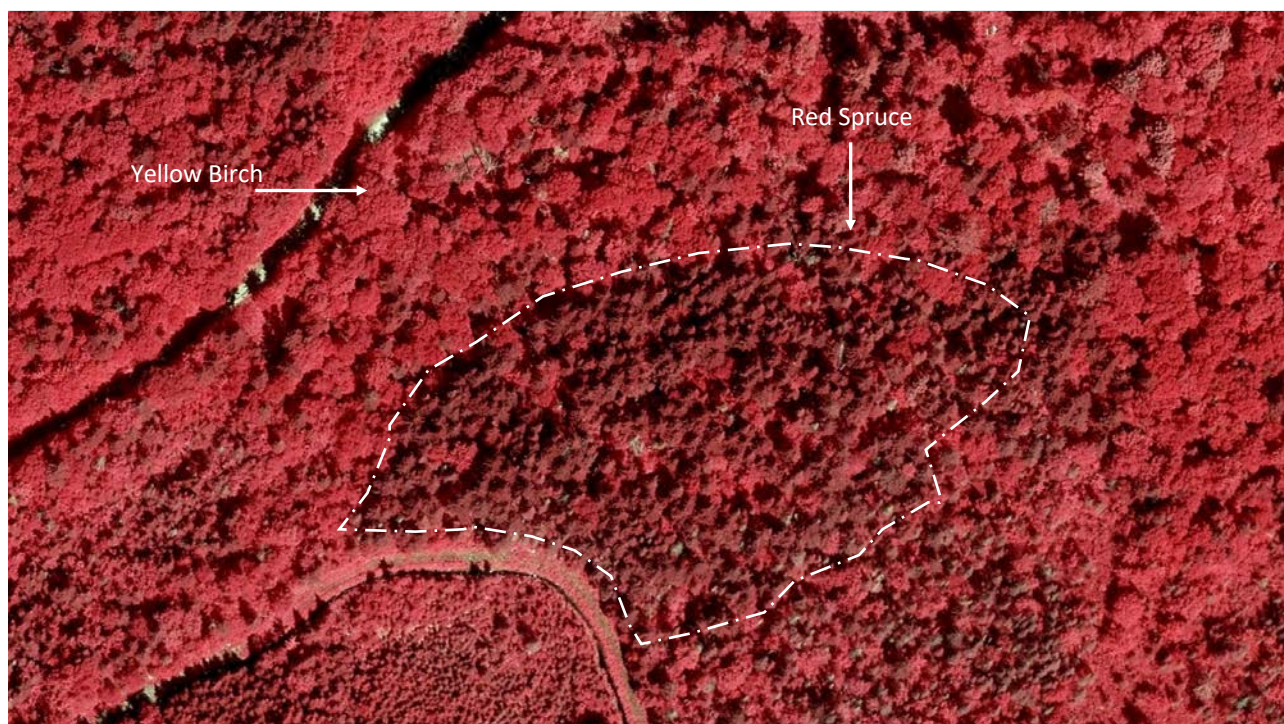


Figure 21. Red Spruce - Yellow Birch stand, Red Spruce shows a brownish colour. Enhanced NIR photography/Western Balsam Fir - Yellow Birch subdomain)

Tamarack

Larix laricina (Du Roi) K. Koch

Ecoforest criteria

Distribution

Tamarack grows in all the bioclimatic domains of Québec (figure 22).

In the domains south of the Black Spruce - lichen domain, it is found on wet sites (poor soil moisture regime), and sometimes on moist soils (imperfect soil moisture regime).

In the Black Spruce - lichen and forest tundra domains, it also colonizes moist and mesic (moderate soil moisture regime) sites.

Soil moisture regime

The soil moisture regime conditions with which Tamarack is most associated are poor and sometimes imperfect (table 8).

Surficial deposits

Surficial deposits and soil textures have little influence on Tamarack's distribution. Only poor soil moisture regime conditions are indicative of its presence.

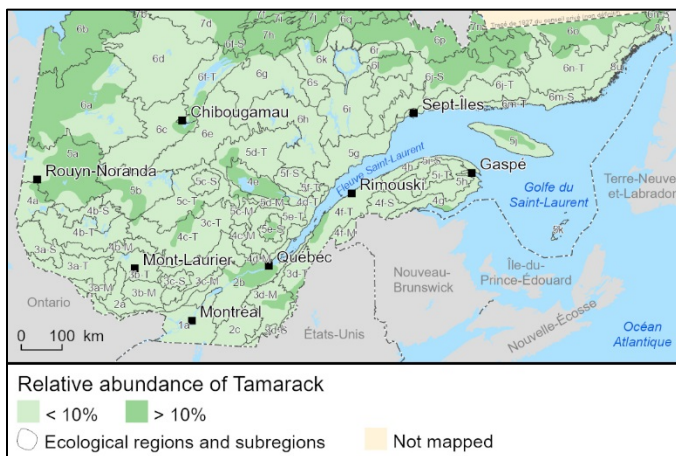


Figure 22. Relative abundance of Tamarack

Table 8. Probable presence of Tamarack depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain	Basswood domain	Yellow Birch domain
	Yellow Birch domain	Yellow Birch domain	Paper Birch domain
	Feathermoss domain		
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

 Probable  Little or no probability

Crown identification criteria

Profile

Tamarack has a conical profile with sparse foliage (figure 23).



Figure 23. Tamarack profile

Projection

Tamarack can be recognized by its slightly star-shaped projection. Compared to other star-shaped softwood crowns, the Tamarack crown is barer and has fewer points. Its medium-sized crown is fuzzier and shiner than pine crowns (figure 24). It has a taller crown than Balsam Fir and Black Spruce.



Figure 24. Tamarack projection (RGB)

Colour

Observation of Tamarack on naturally coloured (RGB) aerial photographs confers a very pale greenish grey colour (may be confused with hardwoods) (figures 25 and 26).

On infrared (NIR) aerial photographs, Tamarack has a bright, very pale pink appearance (may be confused with hardwoods), or more rarely, a turquoise colour (figures 27 and 28).

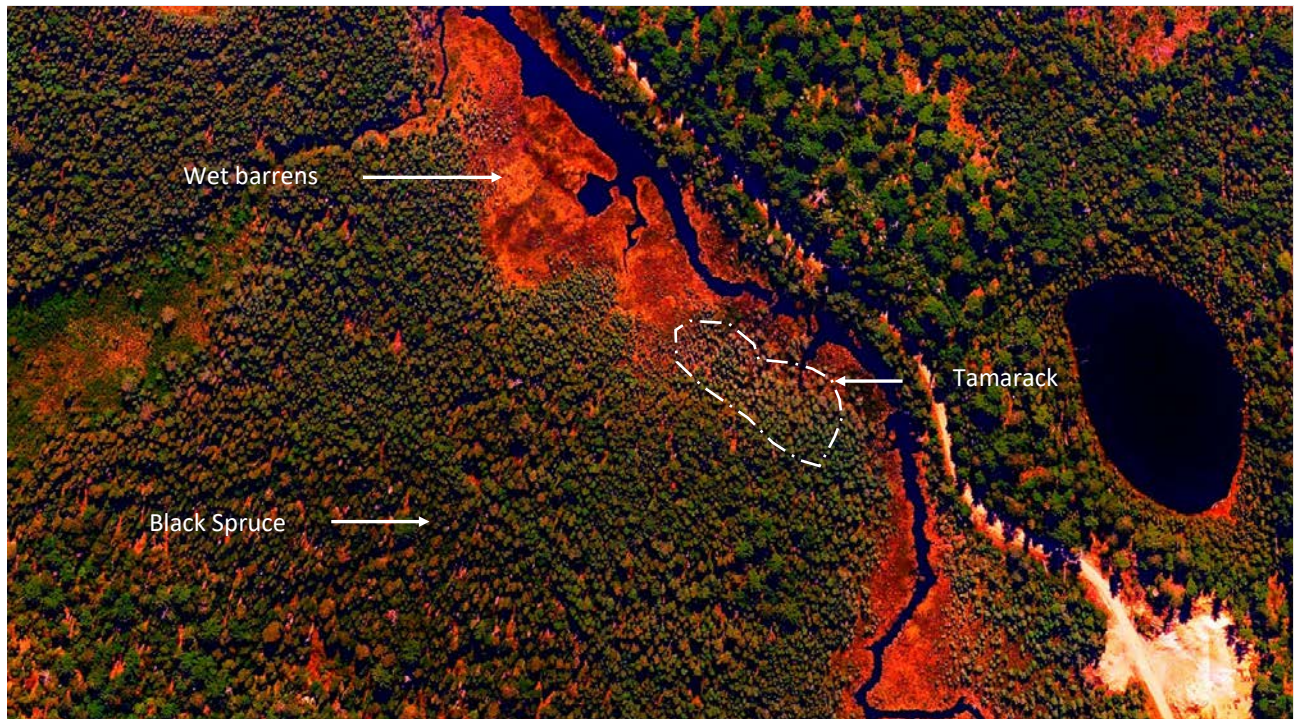


Figure 25. Tamarack and Black Spruce stands. On a small scale, Tamarack appears brighter than other softwoods. Moreover, the proximity of wet barrens is a clue to its probable presence. (Enhanced RGB photography/Western Sugar Maple - Yellow Birch subdomain)

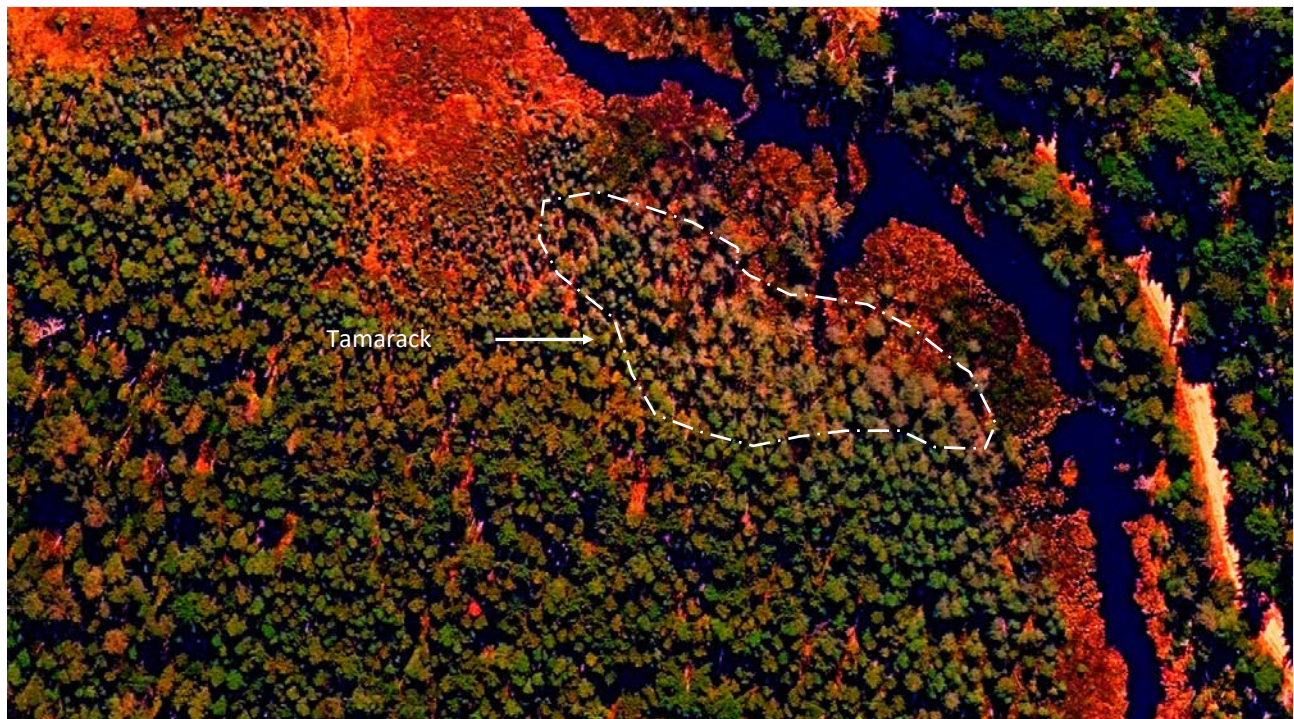


Figure 26. Tamarack stand. On this scale, it is possible to perceive Tamarack's star-shaped crown and fuzzier texture. (Enhanced RGB photography/Western Sugar Maple - Yellow Birch subdomain)

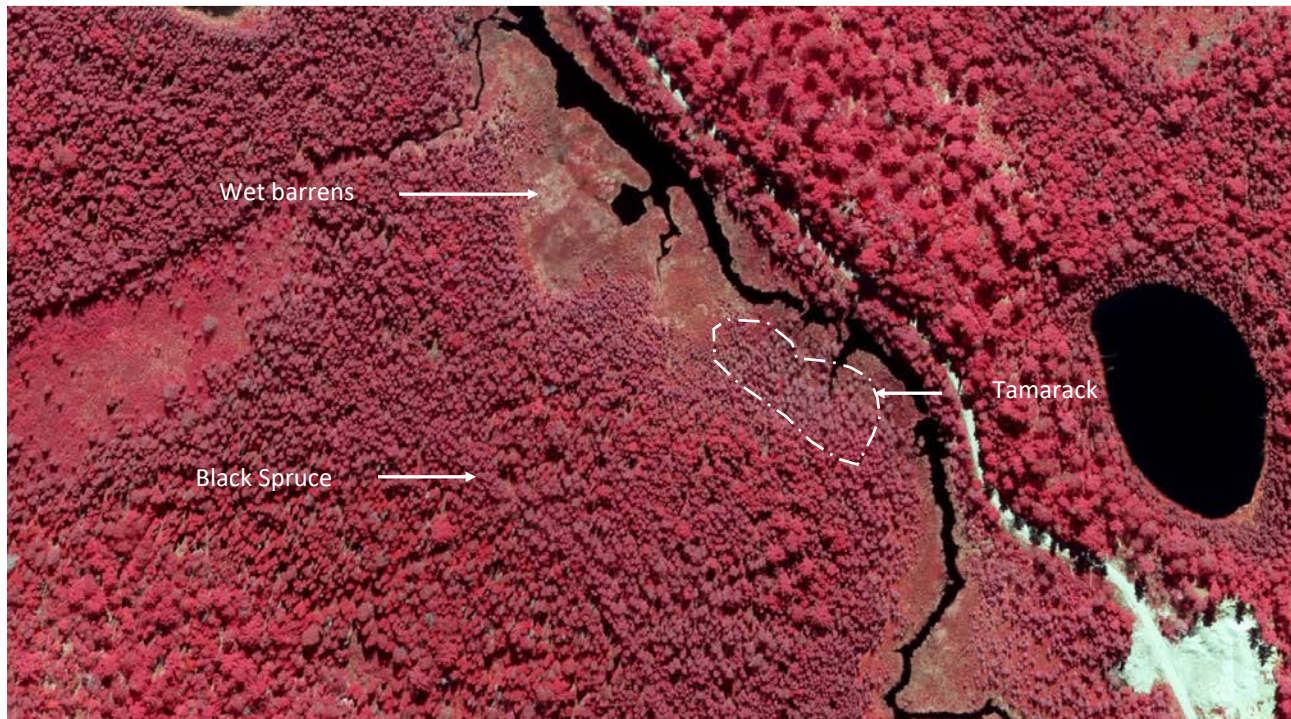


Figure 27. Tamarack and Black Spruce stands. On a small scale, Tamarack appears brighter than other softwoods. Moreover, the proximity of wet barrens is a clue to its probable presence. (Enhanced NIR photography/Western Sugar Maple - Yellow Birch subdomain)

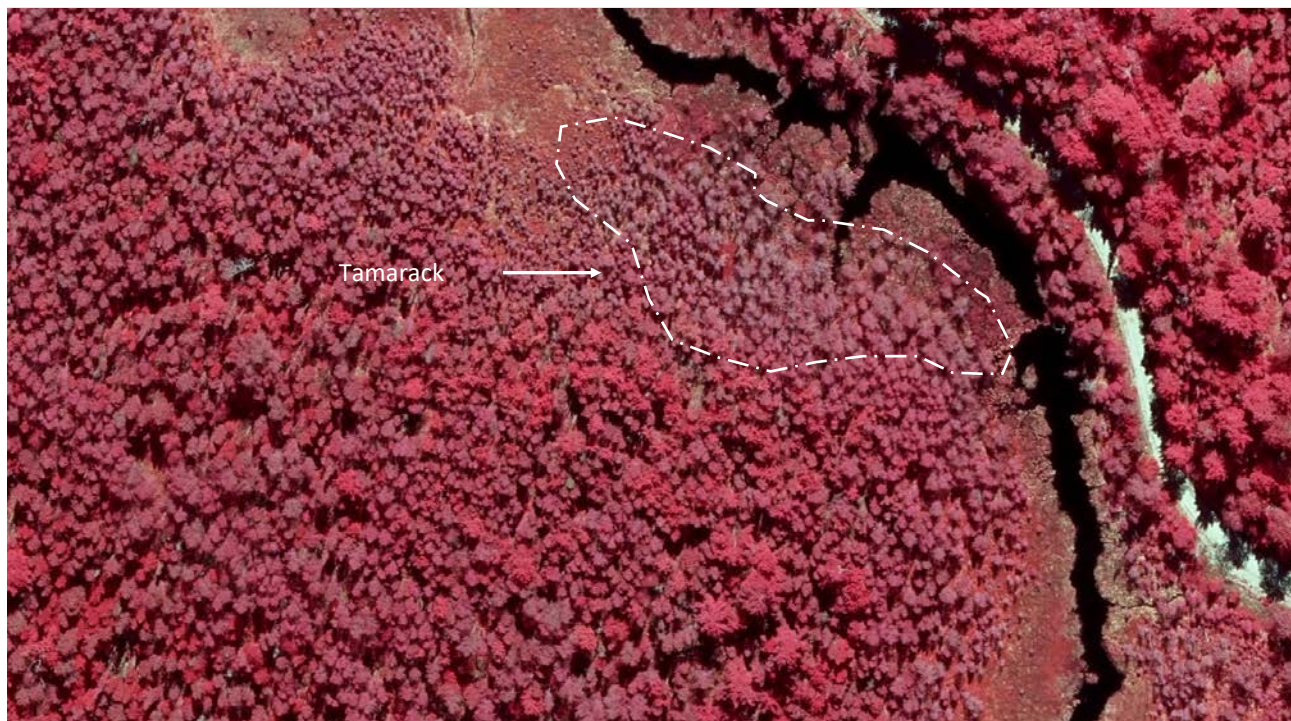


Figure 28. Tamarack stand. On this scale, it is possible to perceive Tamarack's star-shaped crown and fuzzier texture. (Enhanced NIR photography/Western Sugar Maple - Yellow Birch subdomain)

Eastern White Pine

Pinus strobus L.

Ecoforest criteria

Distribution

Eastern White Pine is observed more in sectors to the west of the Sugar Maple (Hickory, Basswood and Yellow Birch) bioclimatic domains. It can also be found in the southern portion of the Balsam Fir - Yellow Birch domain and is present sporadically in the Balsam Fir - Paper Birch domain (figure 29).

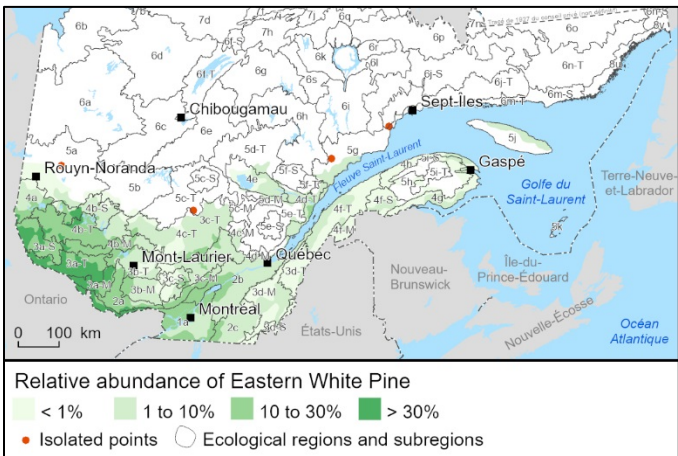


Figure 29. Relative abundance of Eastern White Pine

Generally, Eastern White Pine stands occupy sites well exposed to light, such as sandy plains and very steep slopes.

Soil moisture regime

In all the domains where it is present, Eastern White Pine benefits more from a fast to good soil moisture regime, but can also cope with a moderate soil moisture regime (table 9).

Surficial deposits

Eastern White Pine trees tend to be associated with coarse or very thin deposits. However, in the Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) bioclimatic domains, it colonizes a wide variety of sites (deposits-soil moisture regime).

Table 9. Probable presence of Eastern White Pine depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir - -	Black Spruce -
	Bitternut Basswood domain Yellow Birch domain	Yellow Birch domain Paper Birch domain	Feathermoss domain
Dry (excessive/fast)	Probable	Probable	Little or no probability
Mesic (good/moderate)	Probable	Probable	Little or no probability
Moist (imperfect)	Little or no probability	Little or no probability	Little or no probability
Wet (poor/very poor)	Little or no probability	Little or no probability	Little or no probability

 Probable  Little or no probability

Crown identification criteria

Profile

The Eastern White Pine profile is irregular and asymmetrical due to its many oversized branches randomly distributed on its trunk. Its crown often leans in the direction of the prevailing wind. Its somewhat rounded (sometimes flat) crown is conical-cylindrical. In mature stands, it is very often taller than the other species that accompany it (figure 30).

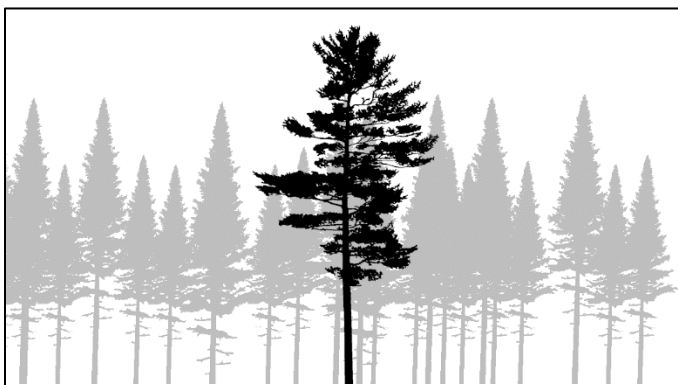


Figure 30. Eastern White Pine profile

Projection

The Eastern White Pine's large crown is irregularly star-shaped due to its very perceptible large branches (figure 31). It has a clean-cut appearance, so that many details of the crown are perceptible.



Figure 31. Eastern White Pine projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs, Eastern White Pine has a pale greyish green to pale ochre green appearance (figures 32 and 33). It is often very pale in the landscape.

On infrared (NIR) aerial photographs, it is brownish green (figures 34 and 35).

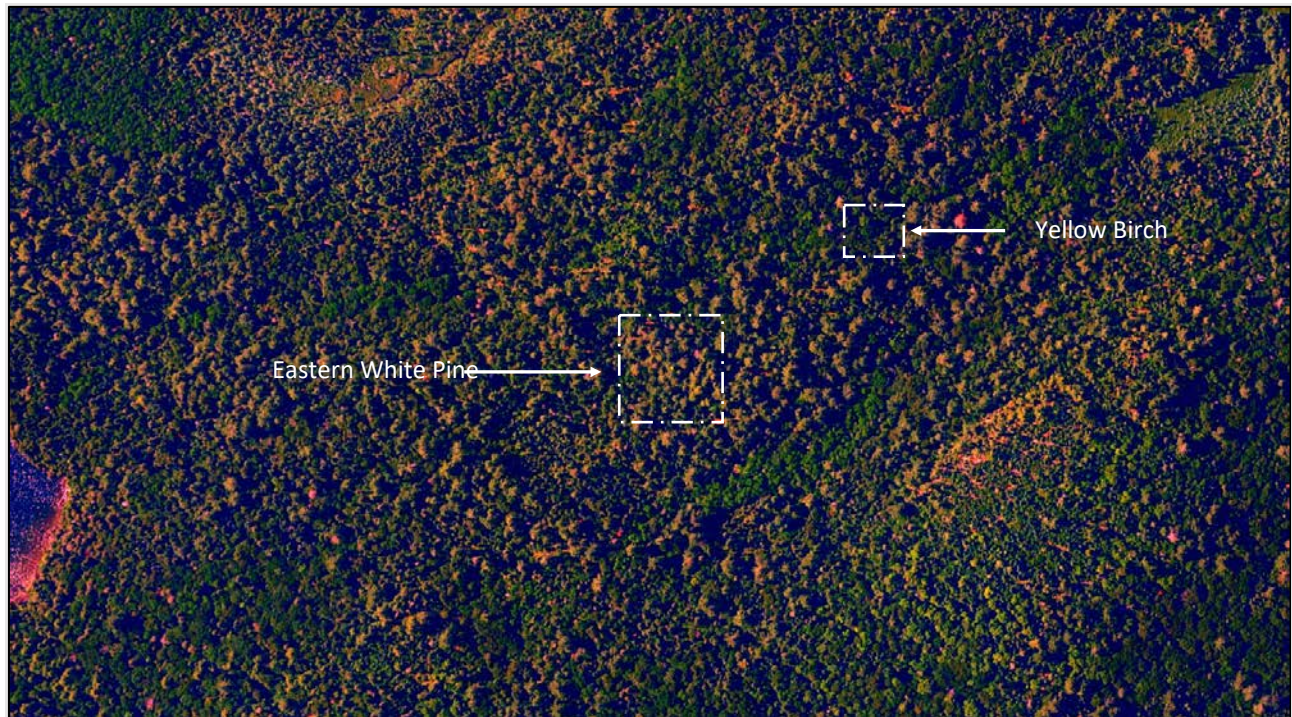


Figure 32. Eastern White Pine, Eastern Hemlock and Yellow Birch stands. On a small scale, Eastern White Pine is distinguished by its ochre colour. It is imperative to observe the photograph on a larger scale to distinguish it from Eastern Hemlock. (Enhanced RGB photography/Western Sugar Maple - Yellow Birch subdomain)

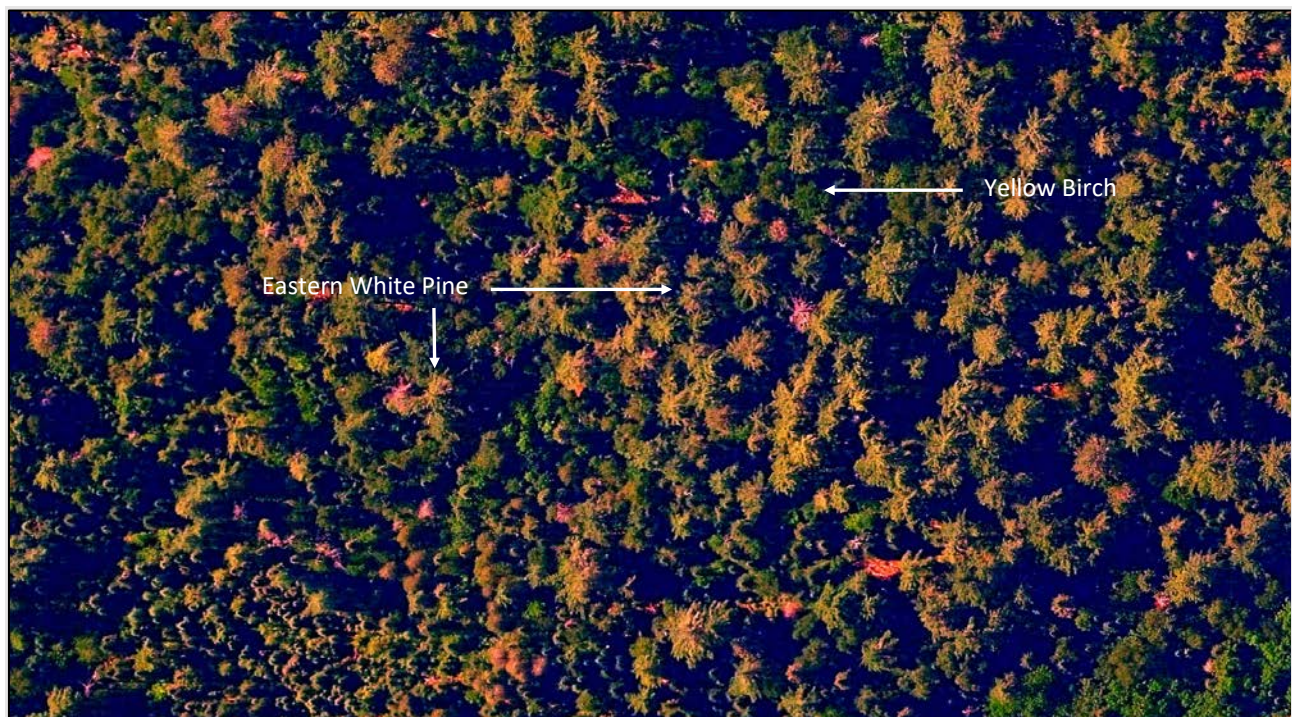


Figure 33. Eastern White Pine, Eastern Hemlock and Yellow Birch stands (Enhanced RGB photography/Western Sugar Maple - Yellow Birch subdomain)

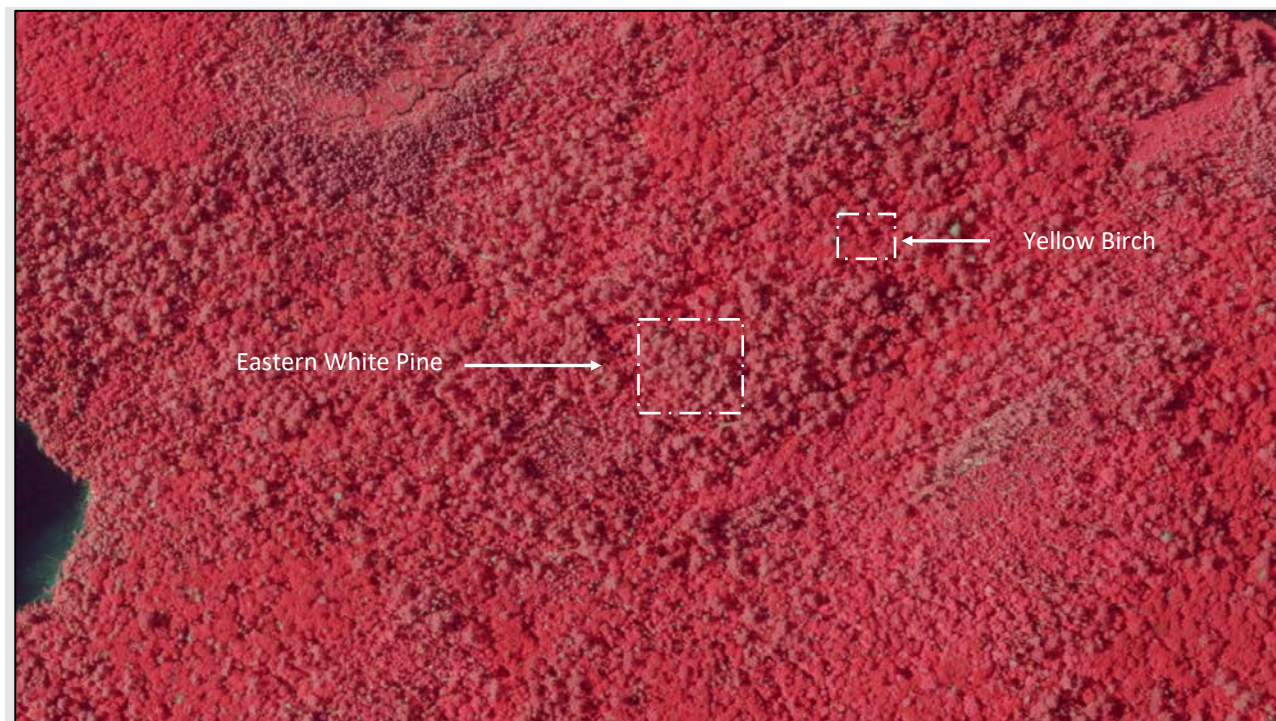


Figure 34. Eastern White Pine, Eastern Hemlock and Yellow Birch stands. On a small scale, Eastern White Pine is distinguished by its ochre colour. It is imperative to observe the photograph on a larger scale to distinguish Eastern Hemlock. (Enhanced NIR photography/Western Sugar Maple - Yellow Birch subdomain)

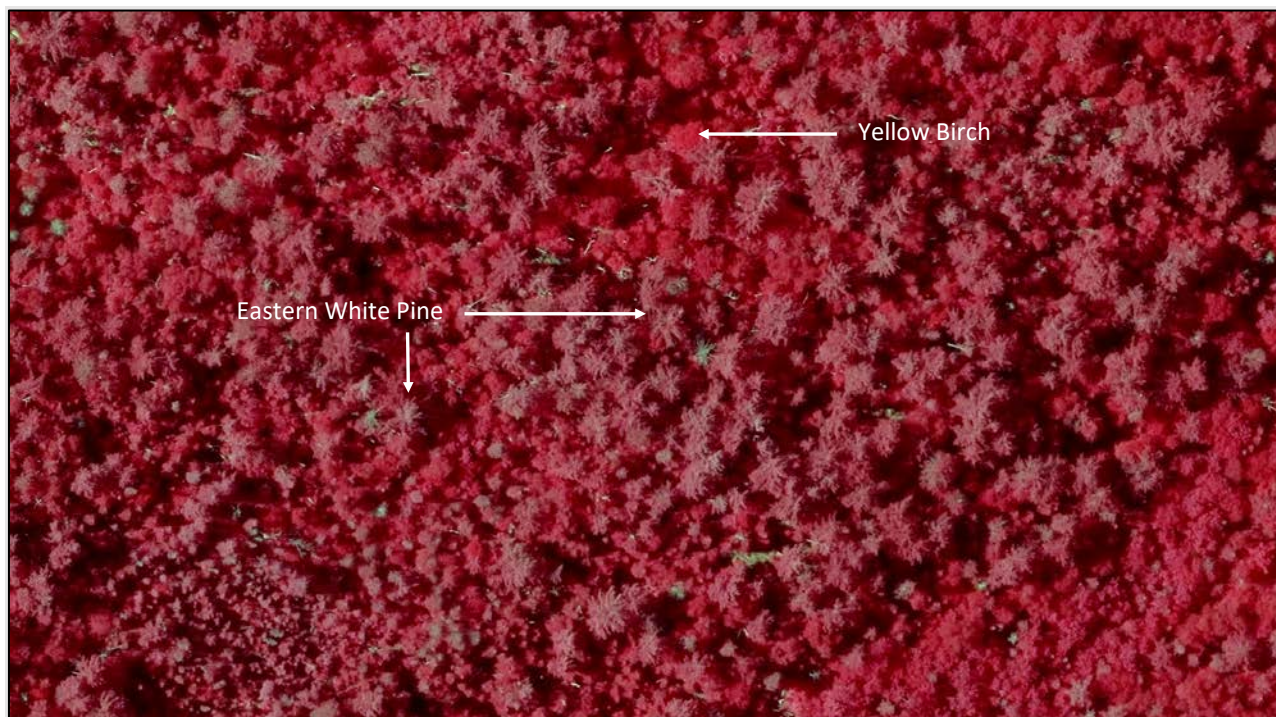


Figure 35. Eastern White Pine, Eastern Hemlock and Yellow Birch stands (Enhanced NIR photography/Western Sugar Maple - Yellow Birch subdomain)

Jack Pine

Pinus banksiana Lamb.

Ecoforest criteria

Distribution

Jack Pine grows in the Western Black Spruce - feathermoss and Western Balsam Fir - Paper Birch bioclimatic subdomains. It has also made inroads into the Balsam Fir - Yellow Birch subdomain to the west, in glacial outwash plains with coarser surficial deposits (figure 36). Given that its presence is promoted by frequent fire, the species is more common on drier sites.

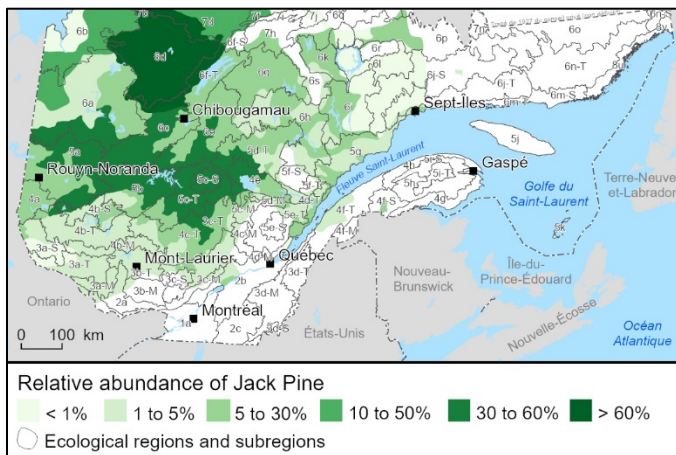


Figure 36. Relative abundance of Jack Pine

Soil moisture regime

Jack Pine is observed more frequently on well-drained sites (good soil moisture regime), but also grows on sites where the soil moisture regime is moderate (table 10).

Surficial deposits

Sandy outwash plains are probably the deposits on which Jack Pine is most frequently observed. However, any surficial deposit with fast water runoff is conducive to its presence. The species can be found on sandy deposits, thin tills and dead-ice moraines. Jack Pine also grows on sites with thick till deposits where fires are frequent.

Table 10. Probable presence of Jack Pine depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain	Basswood domain	Yellow Birch domain
	Yellow Birch domain	Paper Birch domain	Feathermoss domain
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

 Probable  Little or no probability

Crown identification criteria

Profile

The Jack Pine profile is cylindrical, with a rounded crown. It is also usually taller than other softwoods that accompany it, although less so at maturity (figure 37).



Figure 37. Jack Pine profile

Projection

Jack Pine crowns are irregular in shape. They may sometimes be star-shaped (with slightly perceptible branches). They are smaller in diameter than the crowns of the other pines. It is difficult to identify crown edges on aerial photographs. They look somewhat like a ball of steam (figure 38).

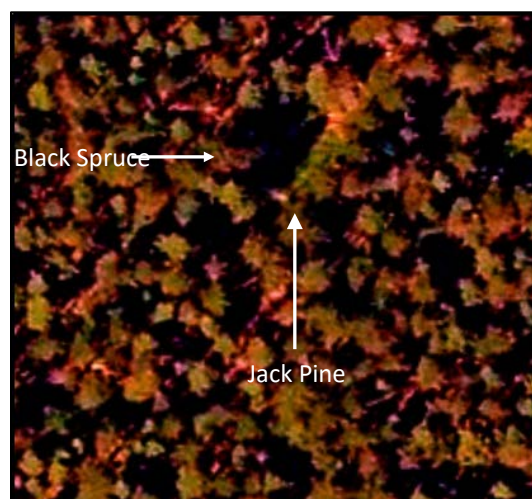


Figure 38. Jack Pine projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs, Jack Pine has a brownish to pinkish brown (greenish brown to pinkish brown) colour.

On infrared (NIR) aerial photographs, its appearance ranges from pinkish brown to caramel brown.

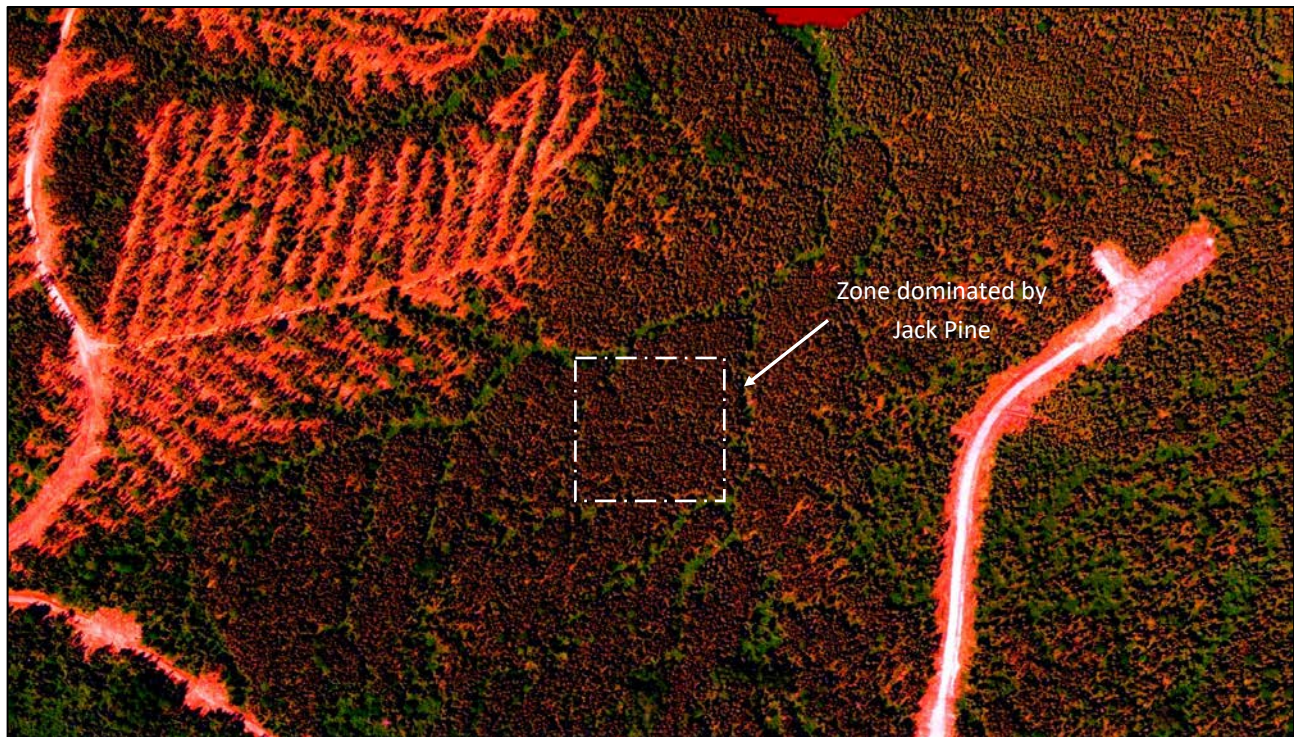


Figure 39. Jack Pine and Black Spruce stands. After enhancement, brown often dominates the Jack Pine colour scheme. (Enhanced RGB photography/Western Balsam Fir - Paper Birch subdomain)

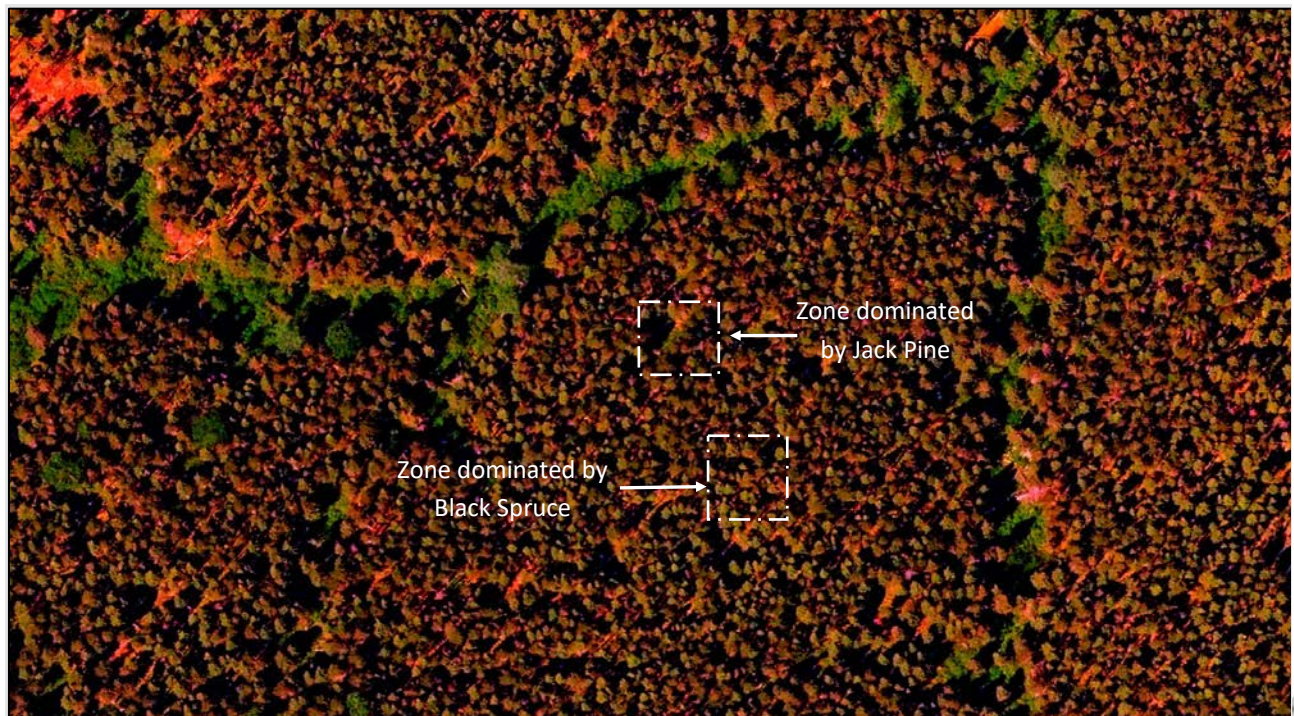


Figure 40. Jack Pine and Black Spruce stands. After enhancement, brown often dominates the Jack Pine colour scheme, while Black Spruce often shows a touch of yellow. (Enhanced RGB photography/Western Balsam Fir - Paper Birch subdomain)

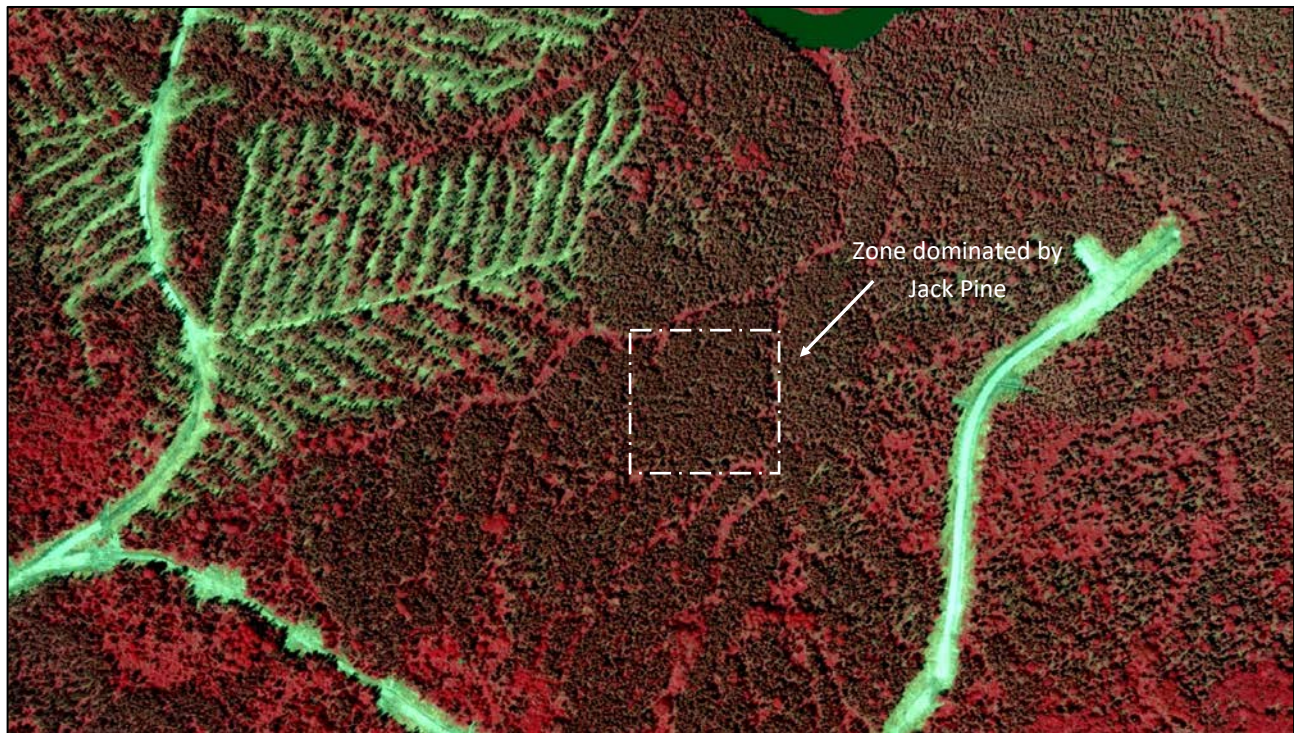


Figure 41. Jack Pine and Black Spruce stands. After enhancement, brown often dominates the Jack Pine colour scheme. (Enhanced RGB photography/Western Balsam Fir - Paper Birch subdomain)

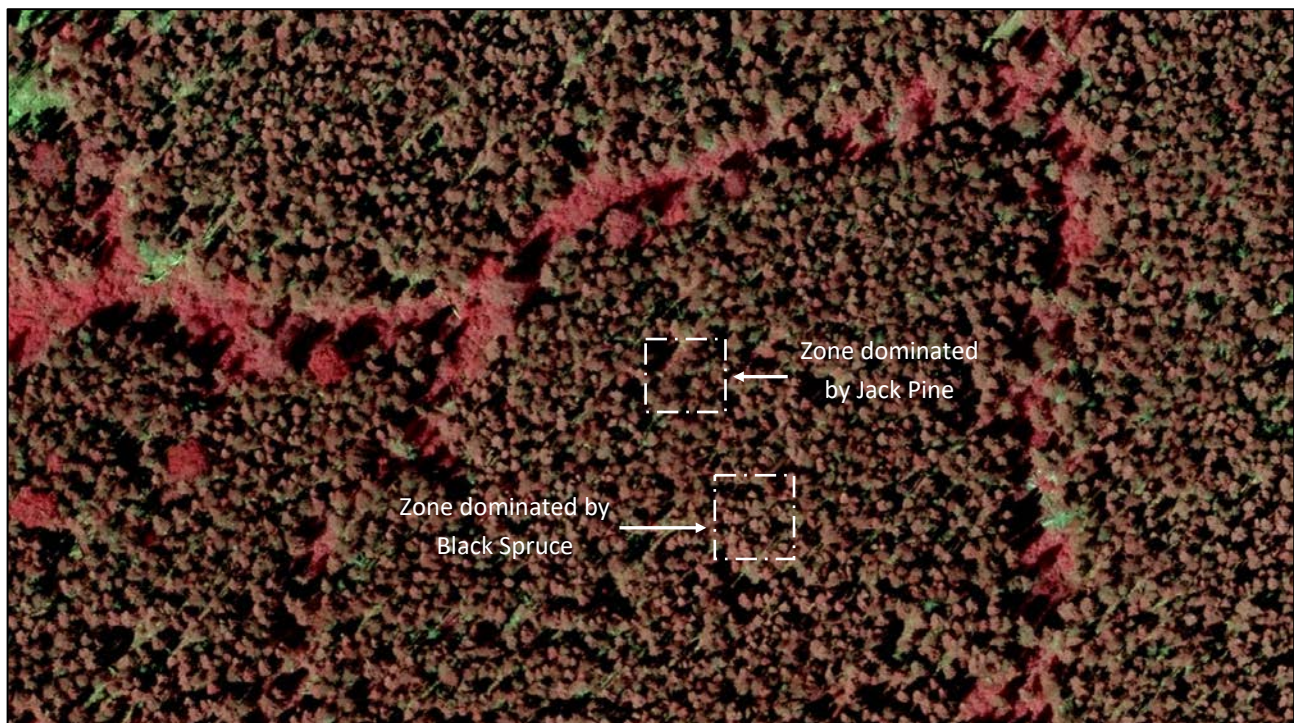


Figure 42. Jack Pine and Black Spruce stands. After enhancement, brown often dominates the Jack Pine colour scheme, while Black Spruce often shows a touch of grey. (Enhanced RGB photography/Western Balsam Fir - Paper Birch subdomain)

Red Pine

Pinus resinosa Ait.

Ecoforest criteria

Distribution

Like Eastern White Pine, Red Pine is observed more in sectors to the west of the Sugar Maple (Hickory, Basswood and Yellow Birch) bioclimatic domains. It is also observed in the southern portion of the Balsam Fir - Yellow Birch domain (figure 43).

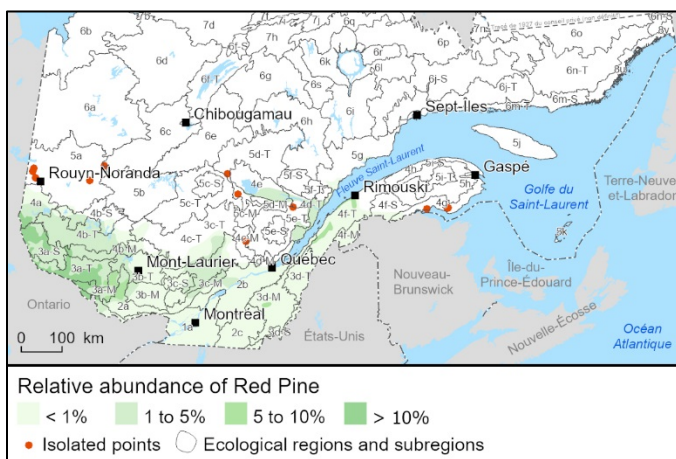


Figure 43. Relative abundance of Red Pine

Generally, Red Pine stands occupy sites well exposed to light, such as sandy plains and very steep slopes.

Soil moisture regime

Red Pine benefits more from a fast to good soil moisture regime, but can also cope with a moderate soil moisture regime (table 11).

Surficial deposits

Red Pine stands are established on sandy plains, very steep and well-drained slopes, and very thin deposits. In the Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) bioclimatic domains, it is established on a wide variety of sites. Red Pine trees tend to be associated with coarse or very thin deposits.

Table 11. Probable presence of Red Pine depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple - Bitternut Hickory domain Basswood domain Yellow Birch domain	Balsam Fir - Yellow Birch domain Paper Birch domain	Black Spruce - Feathermoss domain
Dry (excessive/fast)	Probable	Probable	Little or no probability
Mesic (good/moderate)	Probable	Probable	Little or no probability
Moist (imperfect)	Little or no probability	Little or no probability	Little or no probability
Wet (poor/very poor)	Little or no probability	Little or no probability	Little or no probability

■ Probable ■ Little or no probability

Crown identification criteria

Profile

The Red Pine profile has an elongated oval shape. Its crown is medium-sized compared to Eastern White Pine. Like Eastern White Pine, Red Pine is generally taller than the other accompanying species (figure 44).



Figure 44. Red Pine profile

Projection

From above, the crown is medium-sized when compared to Eastern White Pine. Its crown edges are fuzzy. The crowns resemble dishevelled, jagged balls and are denser than Jack Pine crowns (figure 45).



Figure 45. Red Pine projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs, Red Pine has a red-brown (reddish brown to pinkish brown) appearance (figures 46 and 47).

On infrared (NIR) aerial photographs, Red Pine ranges from dark brown to caramel brown (figures 48 and 49).

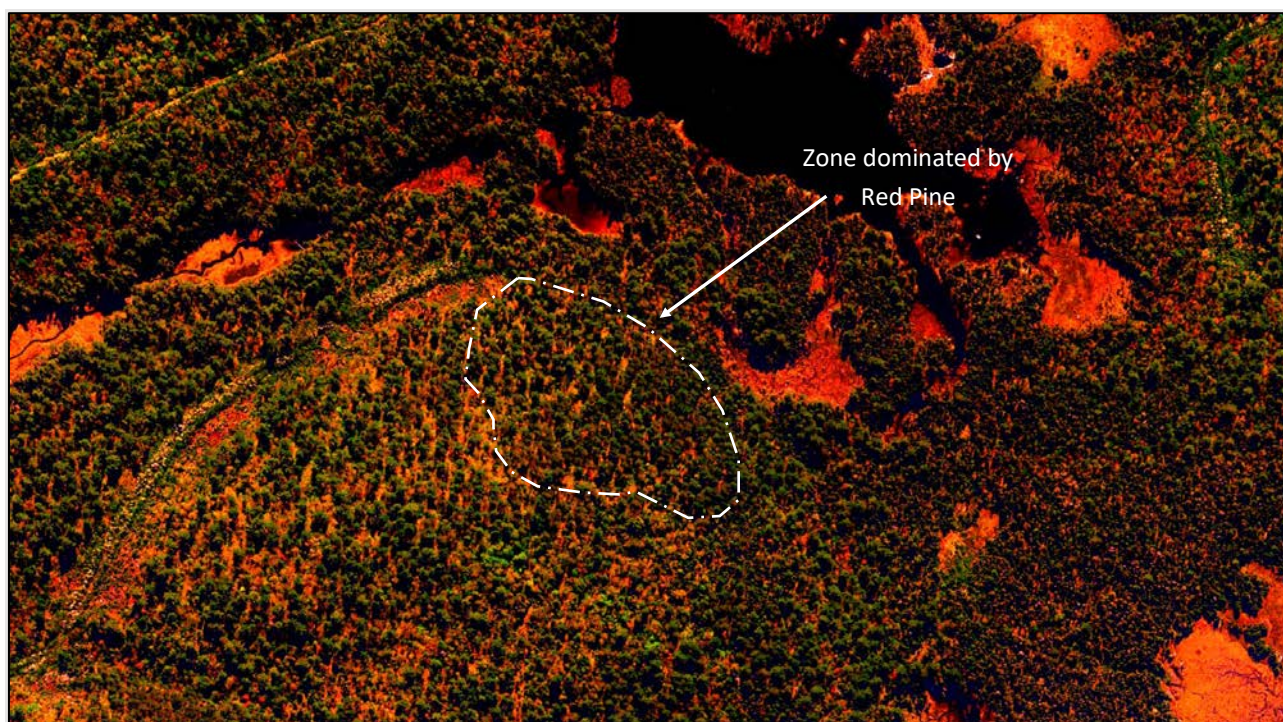


Figure 46. Red Pine stands accompanied by Eastern White Pine (Enhanced RGB photography/Western Sugar Maple - Yellow Birch subdomain)



Figure 47. Red Pine stands accompanied by Eastern White Pine (Enhanced RGB photography/Western Sugar Maple - Yellow Birch subdomain)

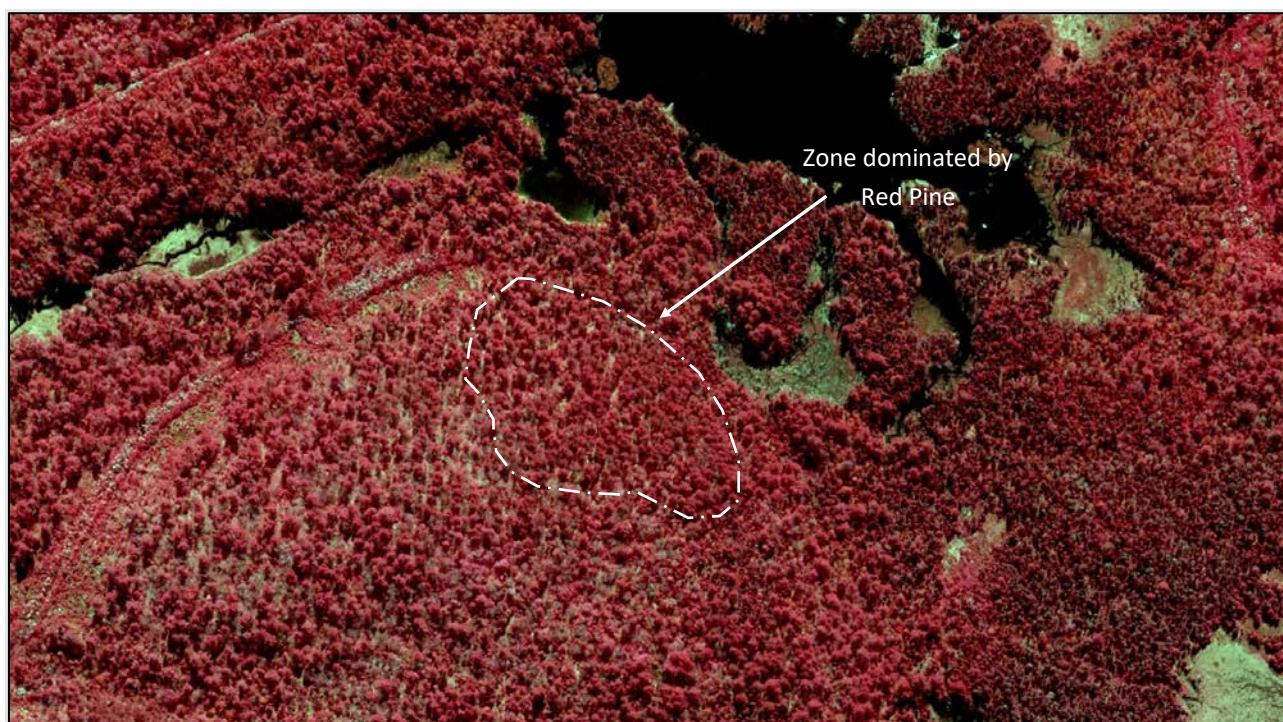


Figure 48. Red Pine stands accompanied by Eastern White Pine (Enhanced NIR photography/Western Sugar Maple - Yellow Birch subdomain)



Figure 49. Red Pine stands accompanied by Eastern White Pine (Enhanced NIR photography/Western Sugar Maple - Yellow Birch subdomain)

Eastern Hemlock

Tsuga canadensis (L.) Carr.

Ecoforest criteria



Distribution

Eastern Hemlock is found in the Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) bioclimatic domains (figure 50).

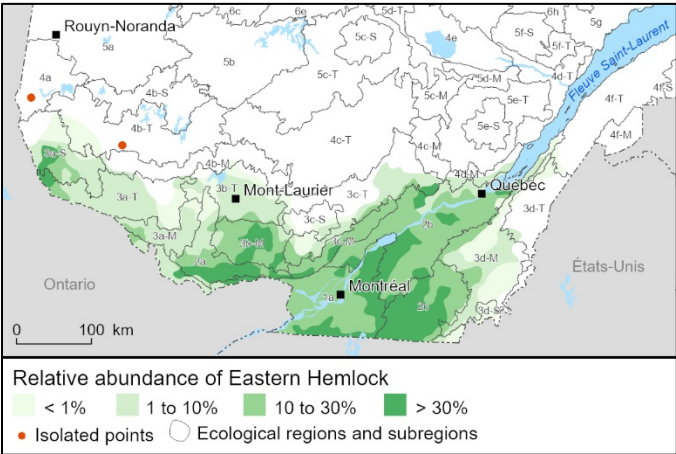


Figure 50. Relative abundance of Eastern Hemlock



Soil moisture regime

Stands are usually found on sites less conducive to growth, such as steep slopes which have a dry moisture regime. The species also grows on plains (mesic moisture regime) and on moist soils (imperfect soil moisture regime) (table 12).



Surficial deposits

Eastern Hemlock grows on coarse or very thin deposits where soil moisture regime conditions range from fast to good.

Table 12. Probable presence of Eastern Hemlock depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain Basswood domain Yellow Birch domain	Yellow Birch domain Paper Birch domain	Feathermoss domain
Dry (excessive/fast)			
Mesic(good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

Probable Little or no probability

Crown identification criteria

Profile

Eastern Hemlock crowns are conical in shape, with little elongation at the top. This profile may become irregular with age.



Figure 51. Eastern Hemlock profile

Projection

The crown is broad and compact (dense foliage), with a clean-cut appearance and swollen oval shape. There are only a few protruding fine branches. Eastern Hemlock crowns are also distinguished by their well-lit and shaded facets (clearly distinct) (figure 52). In the southern portion of the province, crowns appear fuzzier and duller on the screen, and can sometimes be confused with Red Maple.



Figure 52. Eastern Hemlock projection (RGB)

Colour

Eastern Hemlock has a yellowish green to yellowish brown (ochre) appearance on naturally coloured (RGB) aerial photographs (figures 53 and 54).

On infrared (NIR) aerial photographs, it is more yellowish brown (figures 55 and 56).



Zone dominated by
Eastern Hemlock,
accompanied by
Yellow Birch

Figure 53. Eastern Hemlock and Yellow Birch stand. Eastern Hemlock has an ochre-yellow colour, while Yellow Birch has a dark green colour. (Enhanced RGB photography/ Sugar Maple - Yellow Birch subdomain)



Figure 54. Eastern Hemlock and Yellow Birch stand. Eastern Hemlock trees have an oval projection with one face shaded and the other well-lit. (Enhanced RGB photography/ Sugar Maple - Yellow Birch subdomain)

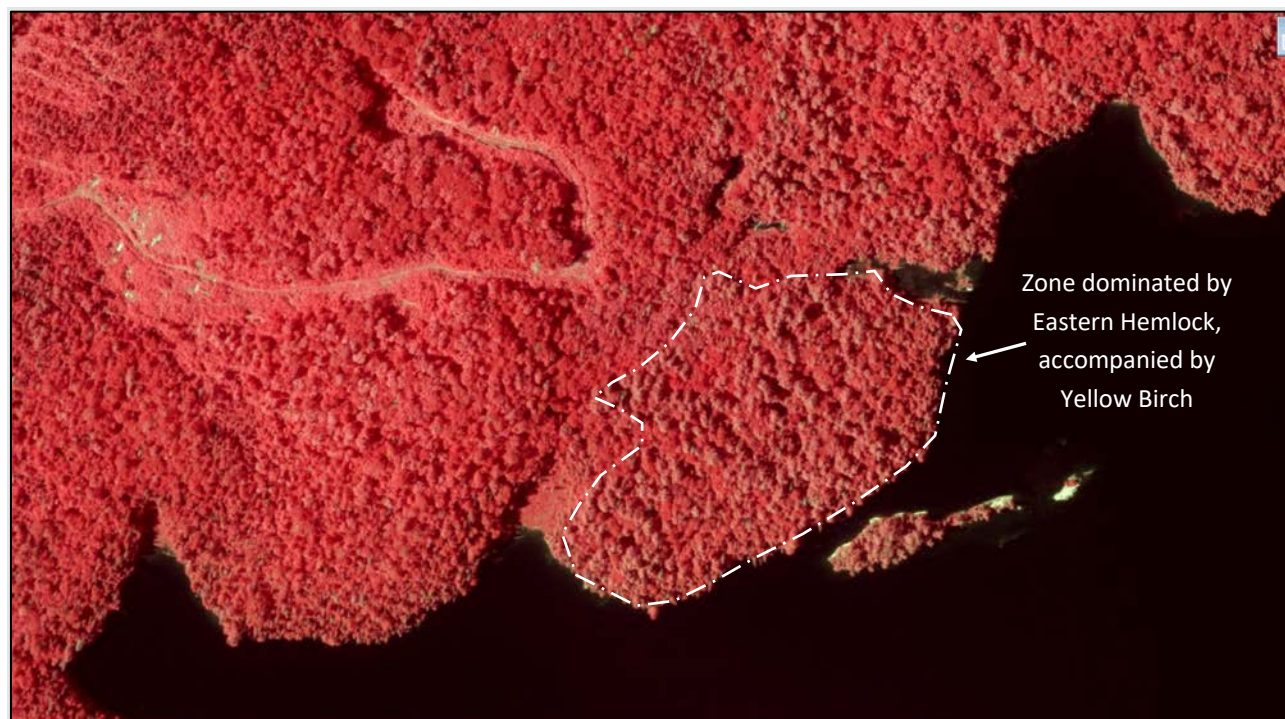


Figure 55. Eastern Hemlock and Yellow Birch stand. Eastern Hemlock has a yellowish-brown colour, while Yellow Birch has a dark pink colour. (Enhanced NIR photography/Eastern Sugar Maple - Yellow Birch subdomain)

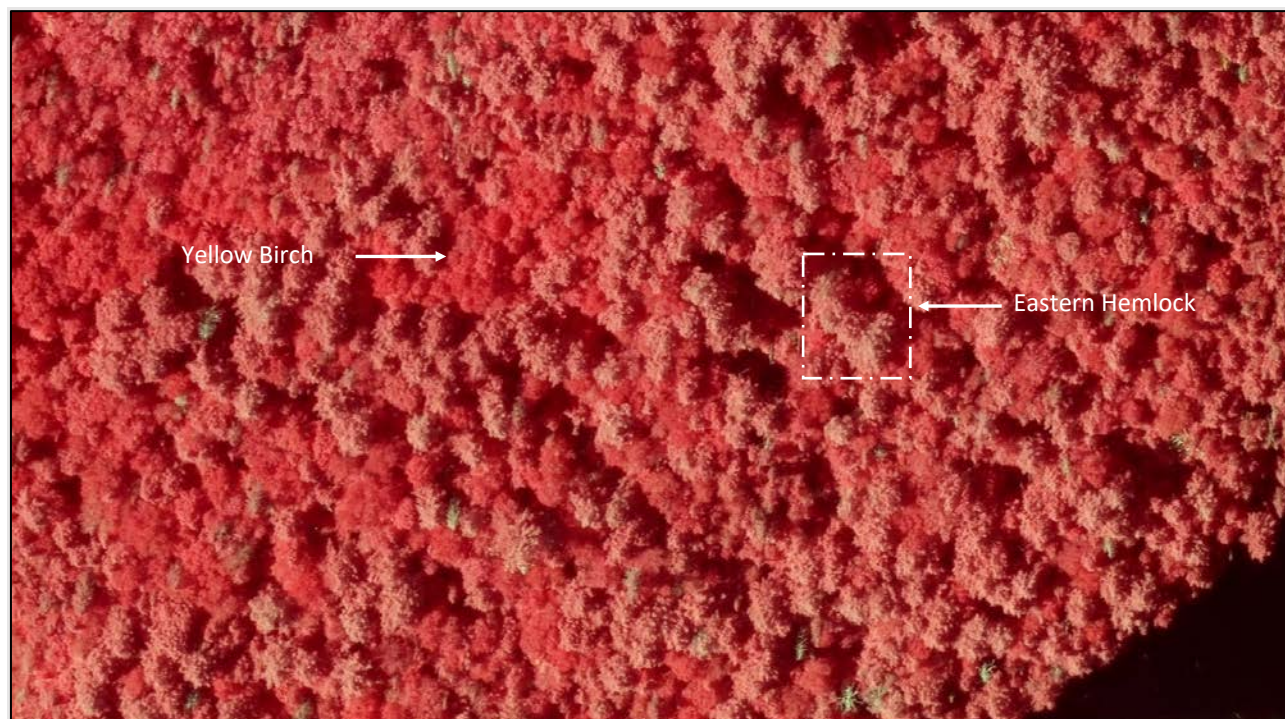


Figure 56. Eastern Hemlock and Yellow Birch stand. Eastern Hemlock trees have an oval projection with one face shaded and the other well-lit. (Enhanced NIR photography/Eastern Sugar Maple - Yellow Birch subdomain)

Balsam Fir

Abies balsamea (L.) Mill.

Ecoforest criteria



Distribution

Balsam Fir is present in all Québec's bioclimatic domains, but it dominates in the Balsam Fir - Paper Birch domain and the Balsam Fir - Yellow Birch domain (figure 57).

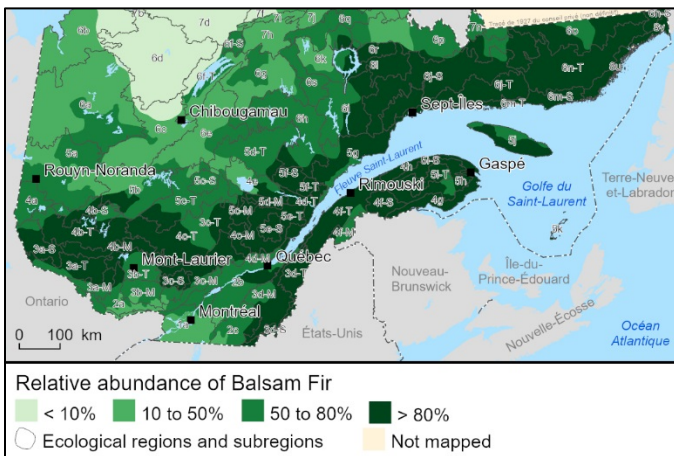


Figure 57. Relative abundance of Balsam Fir

In domains south of the Balsam Fir - Paper Birch domain, the Balsam Fir tends to occupy poorer sites, such as hilltops where annual temperatures are considerably lower due to the altitude, as well as the bottom portions of cool, damp slopes and sandy plains poorer in nutrients.

In the Balsam Fir - Yellow Birch and Balsam Fir - Paper Birch domains, Balsam Fir covers the slopes from top to bottom. In these domains, hilltops and plains are more frequently occupied by Black Spruce.

In the Black Spruce - feathermoss domain, Balsam Fir is observed on the upper halves of slopes, and also, fairly frequently, on well-drained stream banks. In the Eastern Black Spruce - feathermoss subdomain (Côte-Nord and Basse-Côte-Nord), the species also colonizes poorer sites, including plains and hilltops. In the Western Black Spruce - feathermoss subdomain, it grows on mesic sites with infrequent fires (e.g. sites to the east of peat bogs, north facing slopes, etc.). The species is also present sporadically in the Black Spruce - lichen domain, on the

best sites (the middle portion of well-drained slopes that are very rarely damaged by fire).



Soil moisture regime

South of the Balsam Fir - Yellow Birch domain, Balsam Fir can occupy sites with a mesic soil moisture regime, but tends to be found more on moist soils (imperfect soil moisture regime) (table 13). In both the Balsam Fir - Paper Birch and Balsam Fir - Yellow Birch domains, it grows in all soil moisture regime conditions except for wet soils. In the Black Spruce - feathermoss domain, it is observed more frequently on mesic soils (good soil moisture regime).



Surficial deposits

Surficial deposits have less of an influence on Balsam Fir distribution than the soil moisture regime. However, the species rarely grows on organic deposits; this is true across all bioclimatic domains. In the Black Spruce - feathermoss domain, Balsam Fir is associated with medium-textured deposits (till), but also grows on well-drained clay sites.

Table 13. Probable presence of Balsam Fir depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain	Basswood domain	Yellow Birch domain
	Yellow Birch domain	Paper Birch domain	Feathermoss domain
Dry(excessive/fast)			
Mesic(good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

Probable Little or no probability

Crown identification criteria

Profile

Mature Balsam Fir crowns are characterized by their narrow conical shape, elongated toward the top. The crown of this species is more pointed than that of other softwoods (figure 58). Balsam Fir stands generally tend to have an irregular pattern.

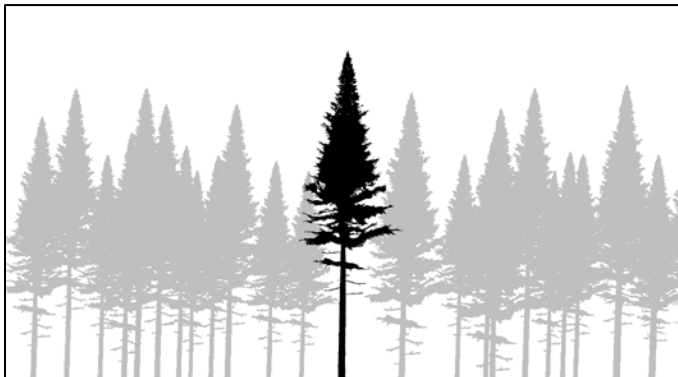


Figure 58. Balsam Fir profile

Projection

The Balsam Fir projection is round to oval. The crown has a medium diameter and its texture is very compact and smooth (figure 59). Balsam Fir branches are less protruding than White Spruce and Red Spruce.

Young crowns instead have a conical shape with a fuzzy texture.



Figure 59. Balsam Fir projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs, mature Balsam Fir stands appear purplish dark blue (figures 60 and 61). Young Balsam Fir stands are very dark green with a bluish tint. A stand that has been defoliated by an insect infestation is light red in colour.

On infrared (NIR) aerial photographs, mature Balsam Fir stands range from dull brown to pinkish brown (figures 62 and 63). Younger stands are pinkish brown, a colour sometimes confused with certain hardwoods. A stand that has been defoliated by an insect infestation is turquoise in colour.

Both on naturally coloured and infrared photographs, Balsam Fir trees may show a small white point at the top.

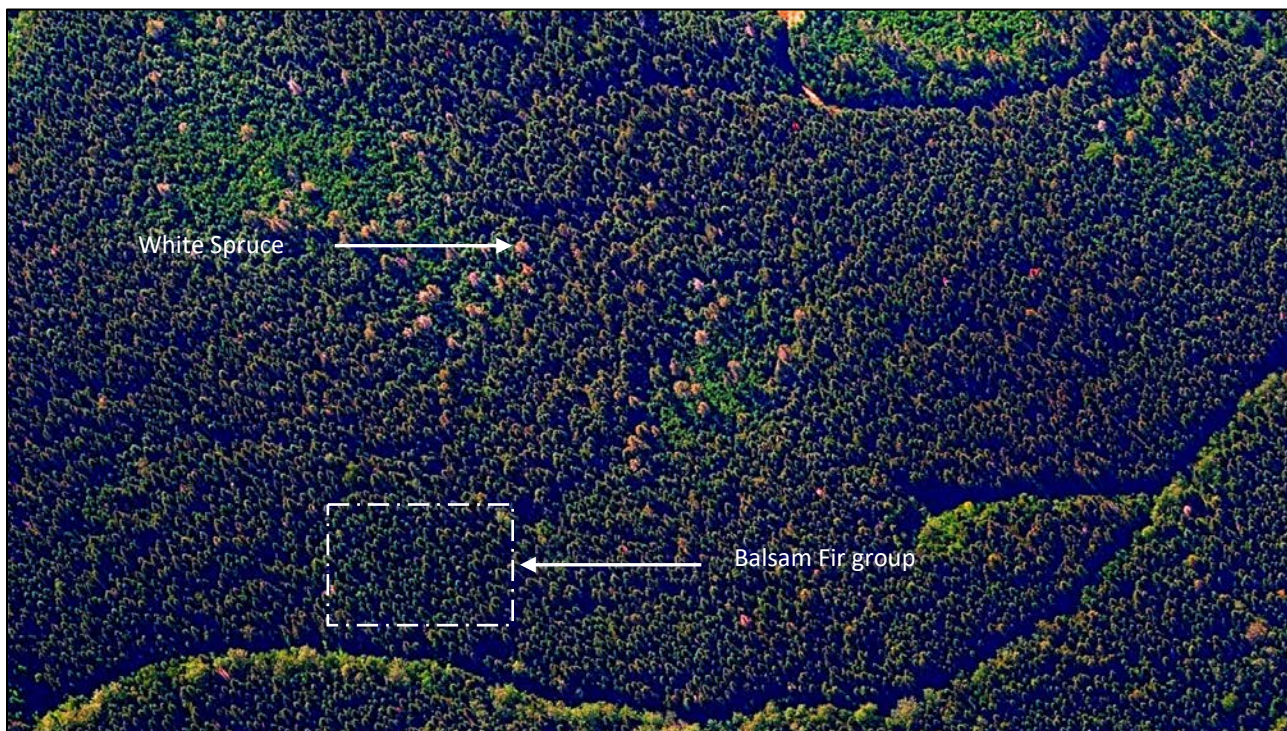


Figure 60. Balsam Fir and Paper Birch stands (Enhanced RGB photography/Eastern Balsam Fir - Paper Birch subdomain)



Figure 61. Balsam Fir and White Spruce stands. Balsam Fir branches are much less protruding and perceptible than White Spruce branches. Moreover, White Spruce trees often are taller and yellower than Balsam Fir. (Enhanced RGB photography/Eastern Balsam Fir - Paper Birch subdomain)

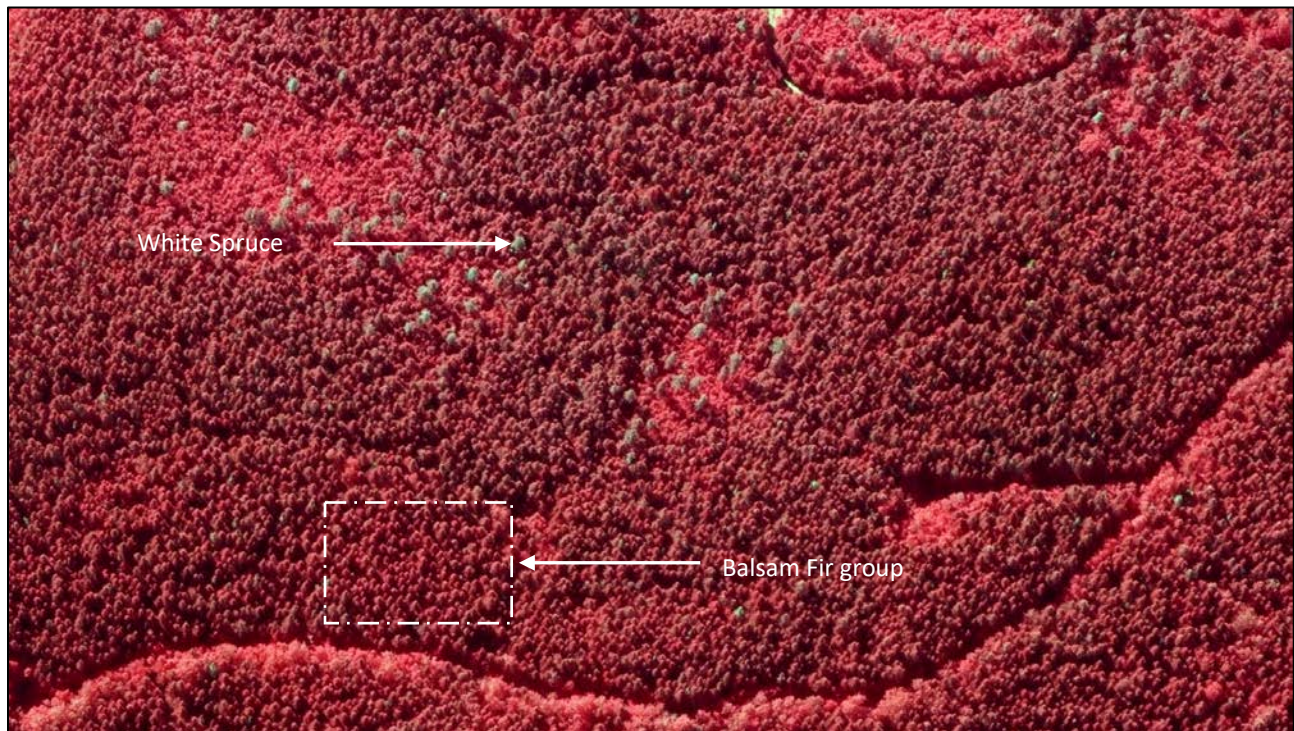


Figure 62. Balsam Fir and Paper Birch stands (Enhanced NIR photography/Eastern Balsam Fir - Paper Birch subdomain)

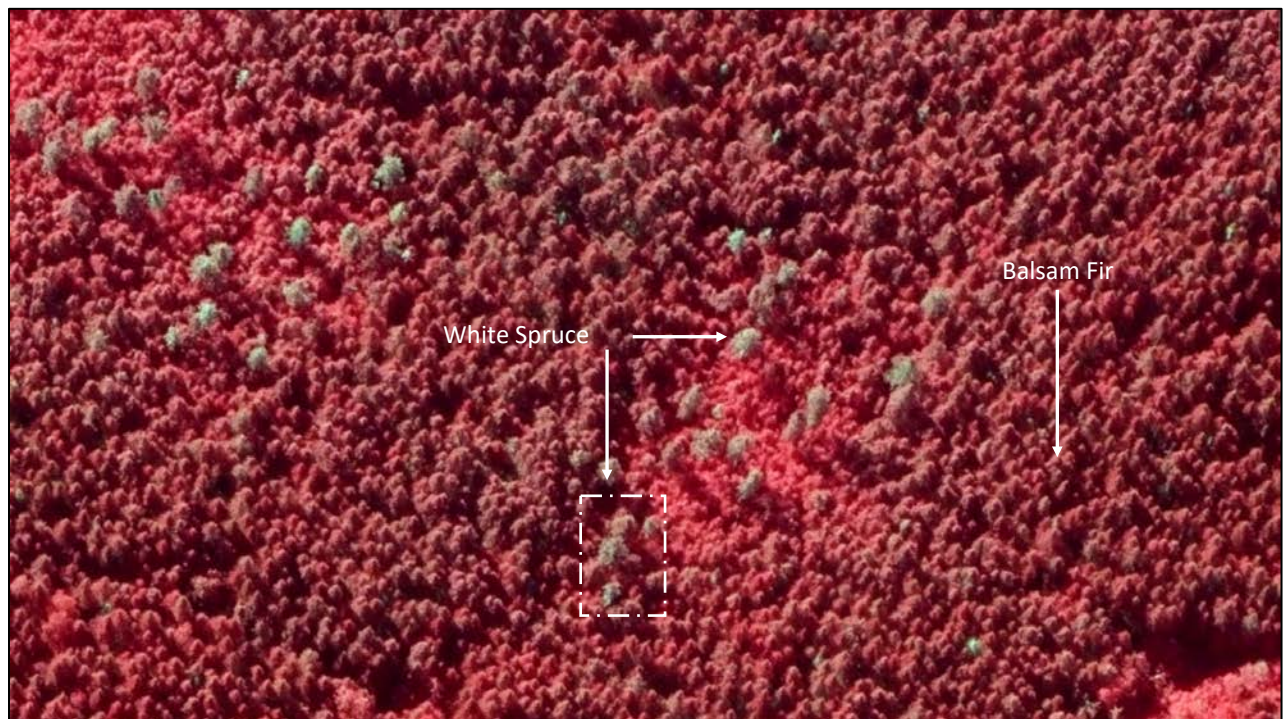


Figure 63. Balsam Fir and White Spruce stands. Balsam Fir branches are much less protruding and perceptible than White Spruce branches. Moreover, White Spruce trees often are taller and yellower than Balsam Fir. (Enhanced RGB photography/Eastern Balsam Fir - Paper Birch subdomain)

Eastern White Cedar

Thuja occidentalis L.

Ecoforest criteria

Distribution

Eastern White Cedar is found in the Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) bioclimatic domains (figure 64).

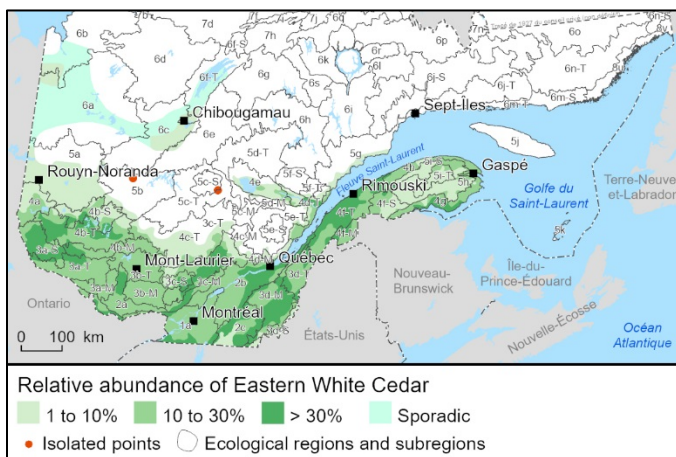


Figure 64. Relative abundance of Eastern White Cedar

It sporadically occupies the sectors of the Balsam Fir - Paper Birch and Black Spruce - feathermoss domains that are most conducive to growth. Generally speaking, it prefers basic pH sites (e.g. Trenton limestone in the St. Lawrence Valley) with sedimentary or meta-sedimentary rocks.

Soil moisture regime

In the Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) domains, Eastern White Cedar either grows on poorly-drained sites (wet moisture regime) or on steep slopes (dry soil moisture regime) (table 14).

Eastern White Cedar reaches its greatest range of soil moisture regime conditions in the Balsam Fir – Yellow Birch domain. It can be observed on dry to moist soil moisture regime sites.

In the domains further to the north, its presence is associated with dry, mesic and moist environments. On limestone sites, Eastern White Cedar can grow in all soil moisture regime conditions.

Surficial deposits

Surficial deposits and soil texture are not determining factors for its presence.

Table 14. Probable presence of Eastern White Cedar depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain Basswood domain Yellow Birch domain	Yellow Birch domain Paper Birch domain	Feathermoss domain
Dry (excessive/fast)	Probable	Probable	Little or no probability
Mesic (good/moderate)	Probable	Probable	Probable
Moist (imperfect)	Probable	Probable	Probable
Wet (poor/very poor)	Probable	Probable	Little or no probability

Probable Little or no probability

Crown identification criteria

Profile

The Eastern White Cedar profile is conical, with a rounded crown. Eastern White Cedar is generally smaller than the other species that accompany it (figure 65).

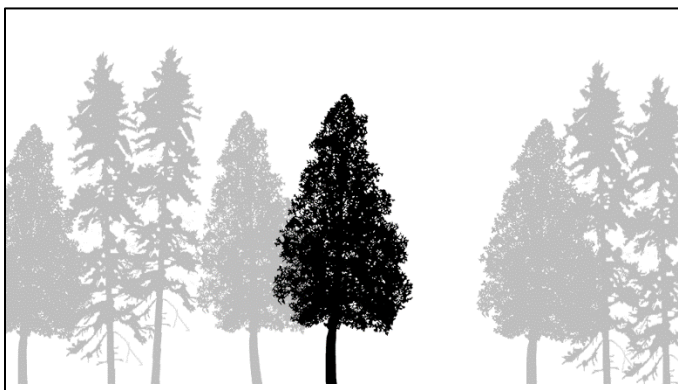


Figure 65. Eastern White Cedar profile

Projection

Eastern White Cedar has a round and regular shaped projection. It has a small diameter and no lateral branches protrude. The contour of Eastern White Cedar crowns does not appear to be clearly defined. The crown instead looks like a ball of steam (fuzzy) (figure 66).



Figure 66. Eastern White Cedar projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs, Eastern White Cedar trees appear in rusty brown (mature) or pinkish brown (young) (figures 67 and 68).

On infrared (NIR) aerial photographs, they appear in a combination of turquoise and pale brown (mature) or pale brown (young) (figures 69 and 70).

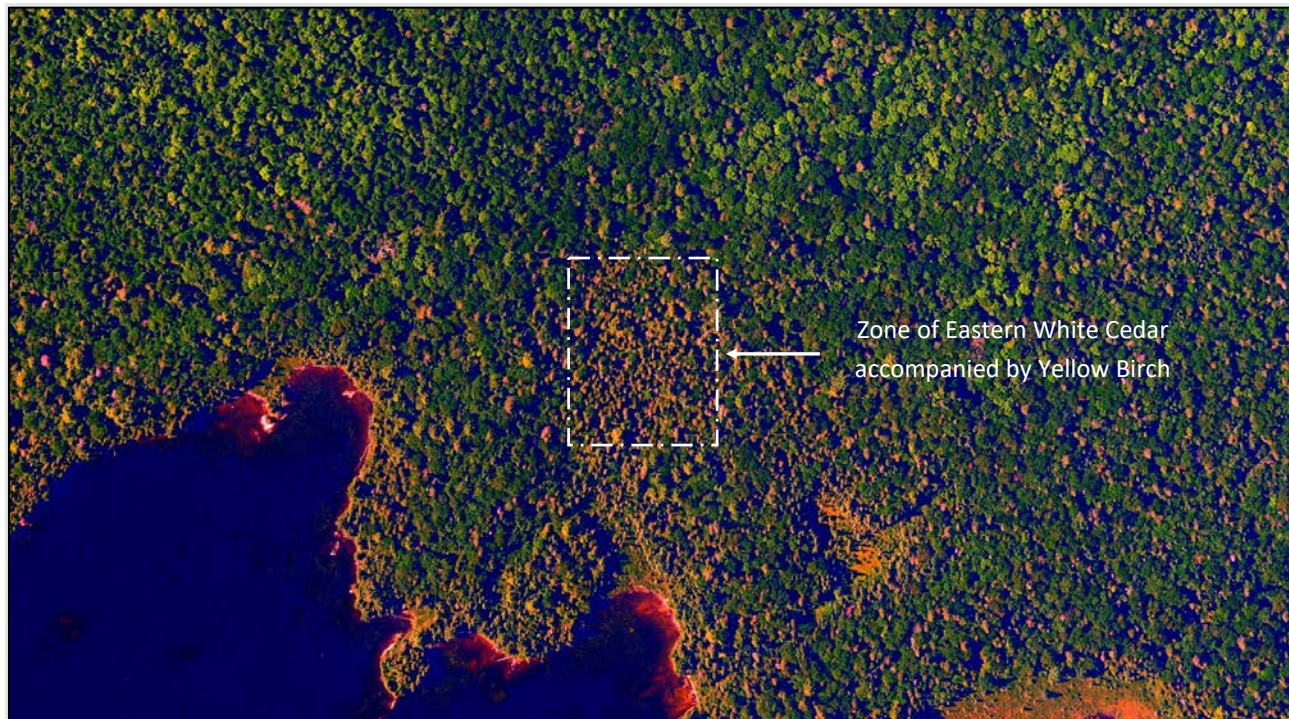


Figure 67. Stands of Eastern White Cedar accompanied by Yellow Birch. Eastern White Cedar is rusty brown and Yellow Birch is dark green. (Enhanced NIR photography/Eastern Sugar Maple - Yellow Birch subdomain)



Figure 68. Stands of Eastern White Cedar accompanied by Yellow Birch. Eastern White Cedar is rusty brown and Yellow Birch is dark green. (Enhanced NIR photography/Eastern Sugar Maple - Yellow Birch subdomain)

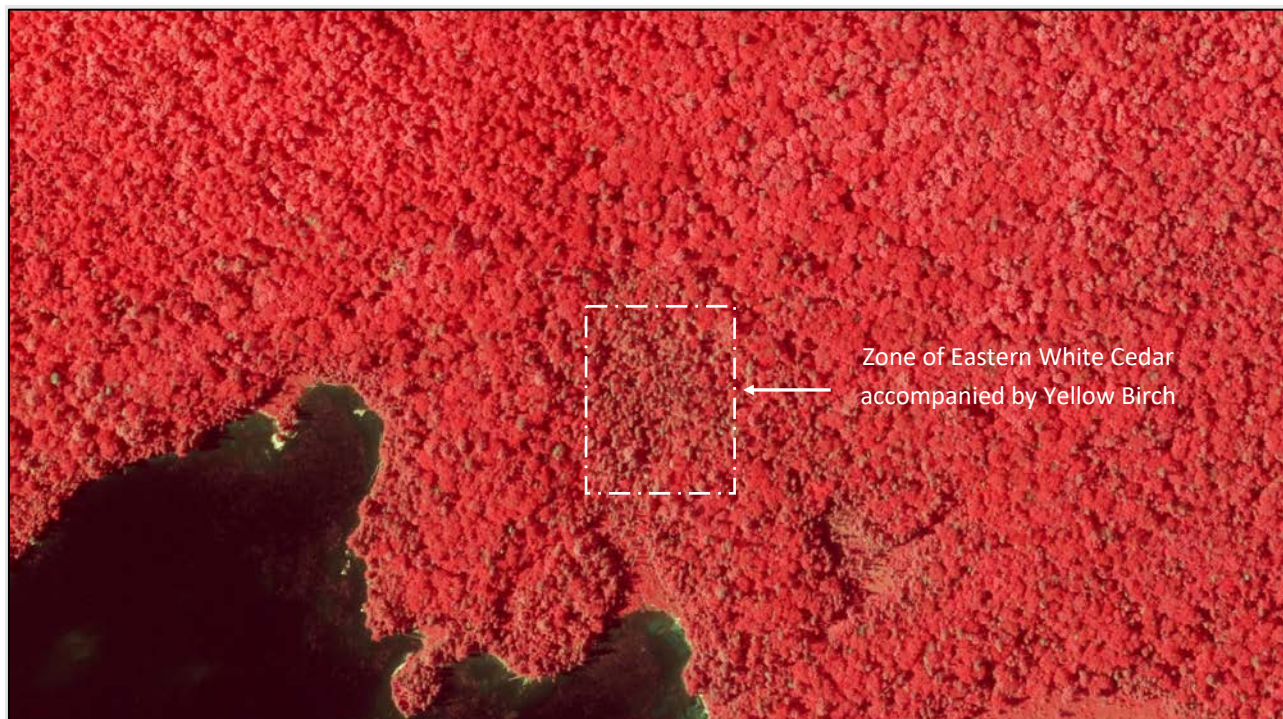


Figure 69. Stands of Eastern White Cedar accompanied by Yellow Birch. Eastern White Cedar is turquoise and pale brown and Yellow Birch is dark pink. (Enhanced NIR photography/Eastern Sugar Maple - Yellow Birch subdomain)



Figure 70. Stands of Eastern White Cedar accompanied by Yellow Birch. Eastern White Cedar is turquoise and pale brown and Yellow Birch is dark pink. (Enhanced NIR photography/Eastern Sugar Maple - Yellow Birch subdomain)

Section 3

HARDWOODS

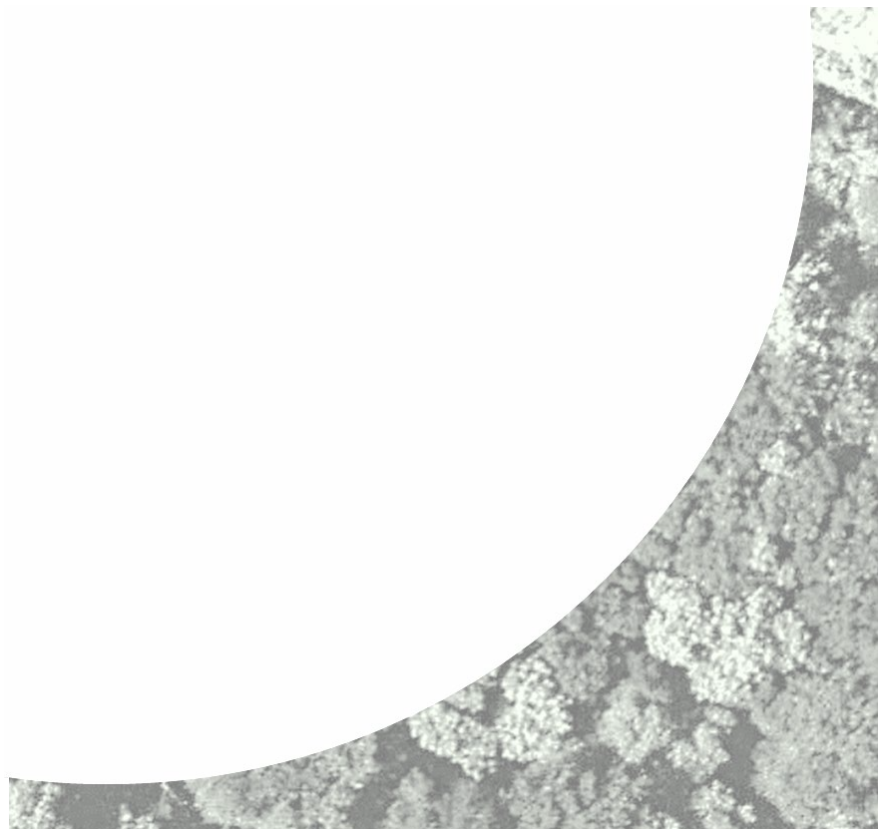


Table 15. Probable presence of hardwoods in the **Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) domains**, depending on the soil moisture regime

Species		Dry		Mesic		Moist	Wet	
		Excessive	Fast	Good	Moderate		Poor	Very poor
Paper Birch	p. 53							
Grey Birch	p. 57							
Yellow Birch	p. 61							
Hickory	p. 65			1	1	1	1	
Northern Red Oak	p. 69							
Sugar Maple	p. 73							
Red Maple	p. 77							
Northern Red Ash	p. 81					2		
White Ash	p. 81							
Black Ash	p. 81							2
American Beech	p. 85							
White Elm	p. 89							
Eastern Hop-hornbeam	p. 93							
Large-toothed Aspen	p. 97							
Balsam Poplar	p. 101							
Eastern Cottonwood	p. 105							
Trembling Aspen	p. 109							
Basswood	p. 113			2	2			

 Probable  Little or no probability

(1) Hickory trees are only present in the Sugar Maple - Bitternut Hickory domain.

(2) This species is not present in the Sugar Maple - Yellow Birch domain for this soil moisture regime class.

Table 16. Probable presence of hardwoods in the **Balsam Fir - Yellow Birch** and **Balsam Fir - Paper Birch domains**, depending on the soil moisture regime

Species		Dry		Mesic		Moist	Wet	
		Excessive	Fast	Good	Moderate		Poor	Very poor
Paper Birch	p. 53							
Yellow Birch	p. 61							
Sugar Maple	p. 73			1	1			
Red Maple	p. 77				1	1	1	
Balsam Poplar	p. 101							
Trembling Aspen	p. 109						1	

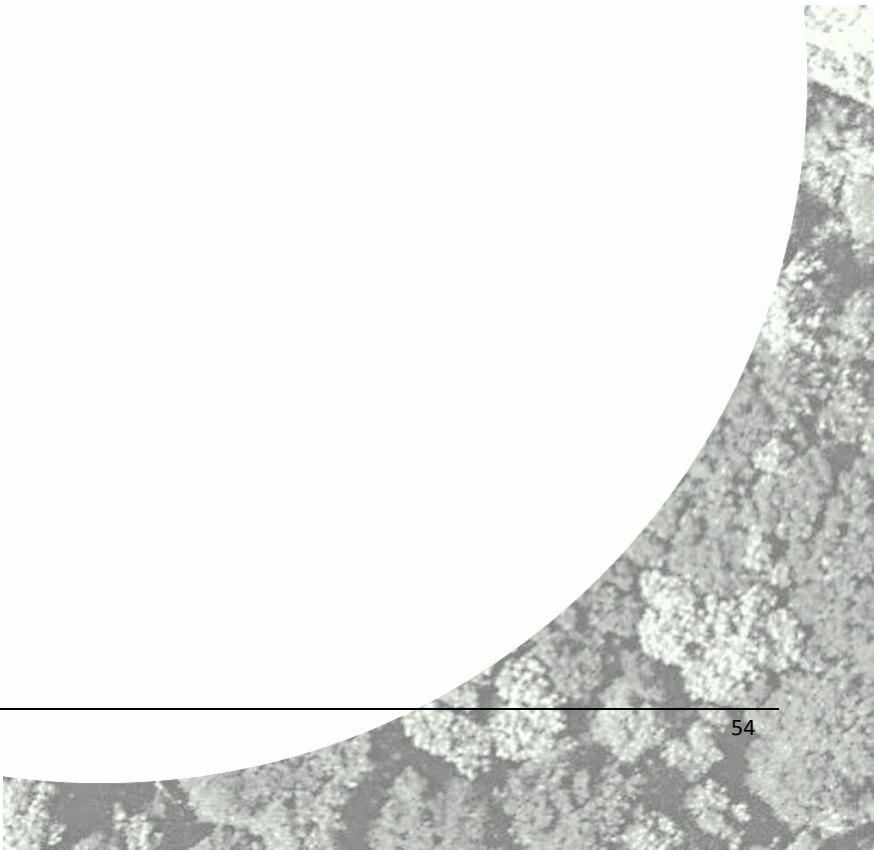
 Probable  Little or no probability

(1) This species is not present in the Balsam Fir - Paper Birch domain for this soil moisture regime class.

Table 17. Probable presence of hardwoods in the **Black Spruce domains**, depending on the soil moisture regime

Species		Dry		Mesic		Moist	Wet	
		Excessive	Fast	Good	Moderate		Poor	Very poor
Paper Birch	p. 53							
Balsam Poplar	p. 101							
Trembling Aspen	p. 109							

 Probable  Little or no probability



Paper Birch

Betula papyrifera Marsh.

Ecoforest criteria

Distribution

Paper Birch can be found in every bioclimatic domain south of the forest tundra (figure 71).

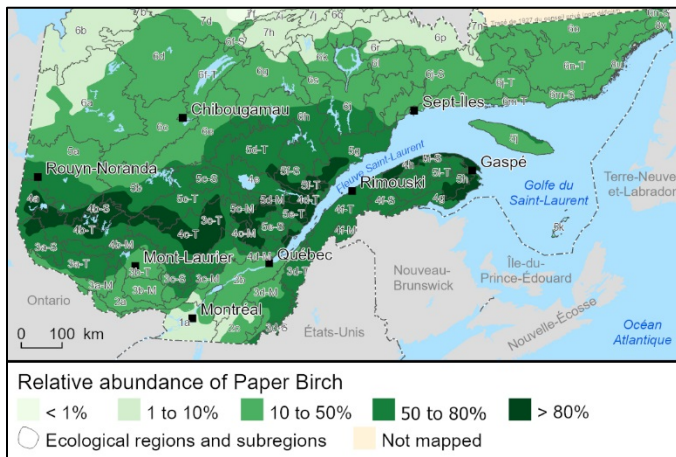


Figure 71. Relative abundance of Paper Birch

In the Black Spruce - feathermoss domain, it grows in landscapes near the tops of slopes on medium-sized hills. In the other bioclimatic domains, it can be found across the entire topography.

In domains south of the Balsam Fir - Paper Birch domain, Balsam Fir tends to occupy poorer sites, such as hilltops where annual temperatures are considerably lower due to altitude, as well as the bottom portions of cool, damp slopes and sandy plains poorer in nutrients.

Soil moisture regime

Paper Birch grows in all types of soil moisture regime conditions except for wet and moist soils (table 18).

Surficial deposits

The species has no preference for any specific surficial deposit or soil texture. However, it is unlikely to be found on sites with organic deposits.

Table 18. Probable presence of Paper Birch depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain	Basswood domain	Yellow Birch domain
	Yellow Birch domain	Paper Birch domain	Feathermoss domain
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

Probable Little or no probability

Crown identification criteria

Profile

The Paper Birch crown is distinguished by its very flat semicircular shape and medium density. Contrary to poplars, Paper Birch may be equal in height to the trees that surround it or shorter.



Figure 72. Paper Birch profile

Projection

The Paper Birch crown has a smaller diameter than Maples and Yellow Birch. The texture is irregular and fuzzy. The species is also generally shorter than Yellow Birch or Sugar Maple. Paper Birch crowns may appear to merge together, making it difficult to identify each individual tree (figure 73).



Figure 73. Paper Birch projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs, Paper Birch is a dull olive green (figures 74 and 75). Nonetheless, it is lighter than Yellow Birch. A touch of yellow appears in its foliage, giving it a brownish appearance.

On infrared (NIR) aerial photographs, it is a lighter dark pink than Yellow Birch (figures 76 and 77).

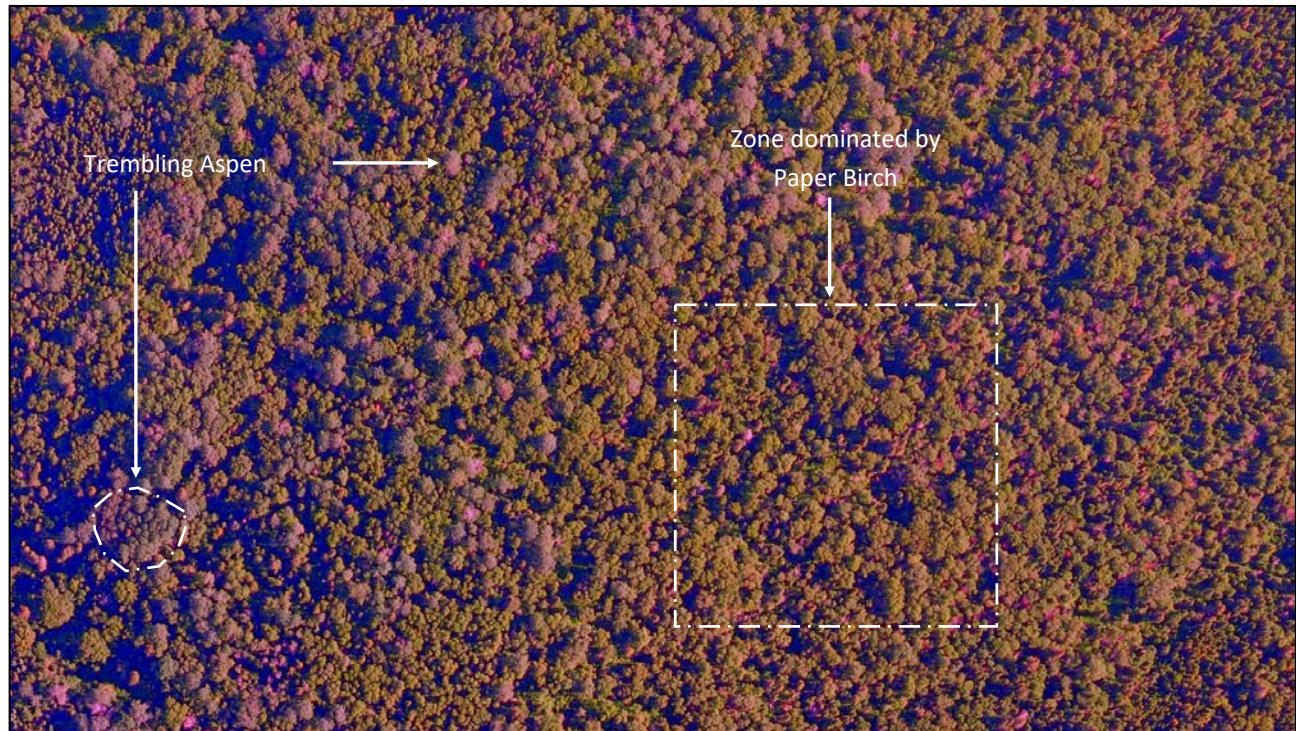


Figure 74. Paper Birch and Trembling Aspen stands. Paper Birch crowns are shorter and more interlaced than Trembling Aspen crowns. (Enhanced RGB photography/Western Balsam Fir - Paper Birch subdomain)



Figure 75. Paper Birch and Trembling Aspen stands. Paper Birch crowns are shorter and more interlaced than Trembling Aspen crowns. (Enhanced RGB photography/Western Balsam Fir - Paper Birch subdomain)

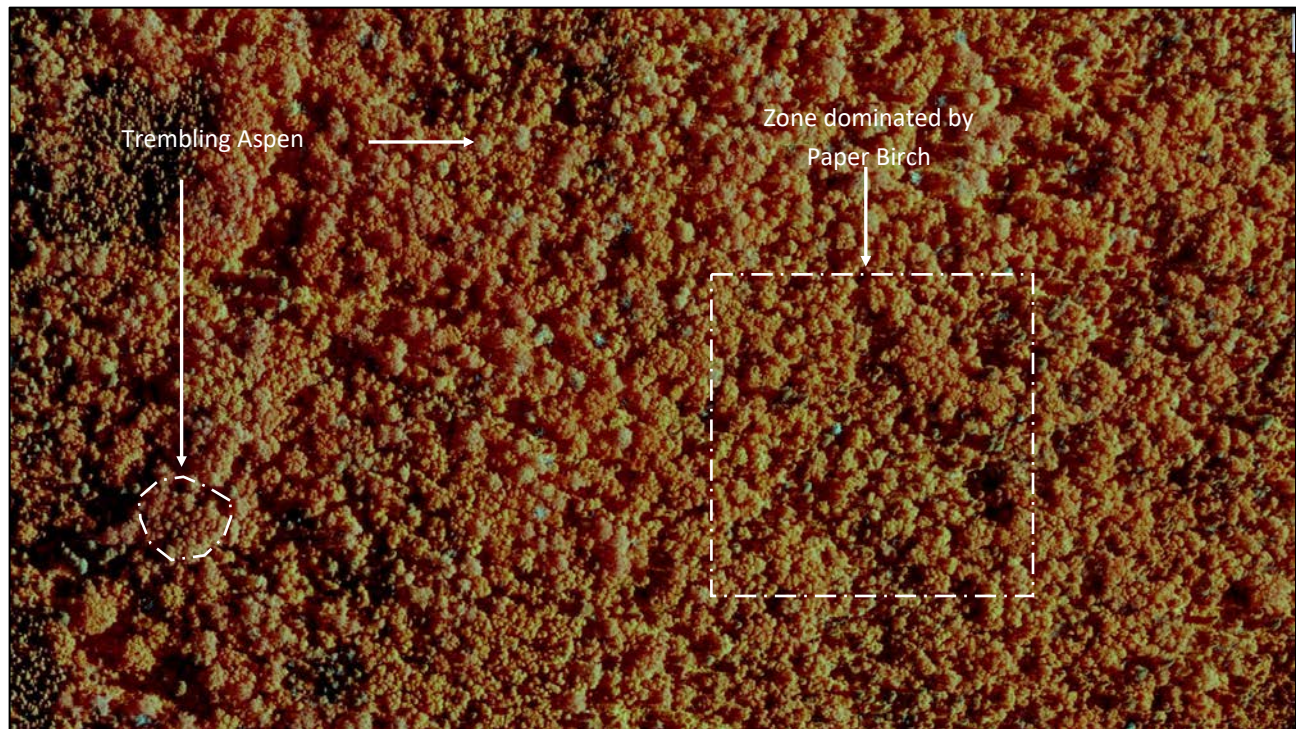


Figure 76. Paper Birch and Trembling Aspen stands. Paper Birch crowns are shorter and more interlaced than Trembling Aspen crowns. (Enhanced NIR photography/Western Balsam Fir - Paper Birch subdomain)

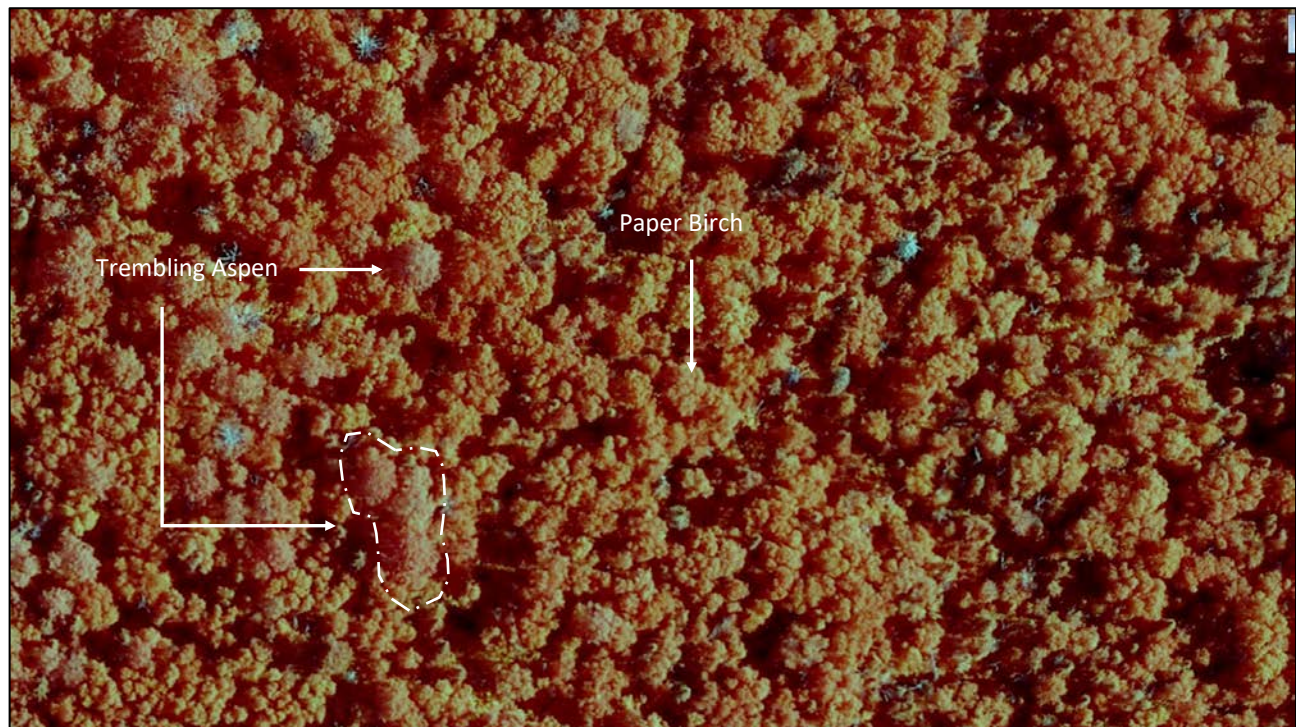


Figure 77. Paper Birch and Trembling Aspen stands. Paper Birch crowns are shorter and more interlaced than Trembling Aspen crowns. (Enhanced NIR photography/Western Balsam Fir - Paper Birch subdomain)

Grey Birch

Betula papyrifera Marsh.

Ecoforest criteria

Distribution

Grey Birch is present in the Sugar Maple - Basswood and Sugar Maple - Hickory domains. It only grows sporadically in the Sugar Maple - Yellow Birch domain (figure 78).

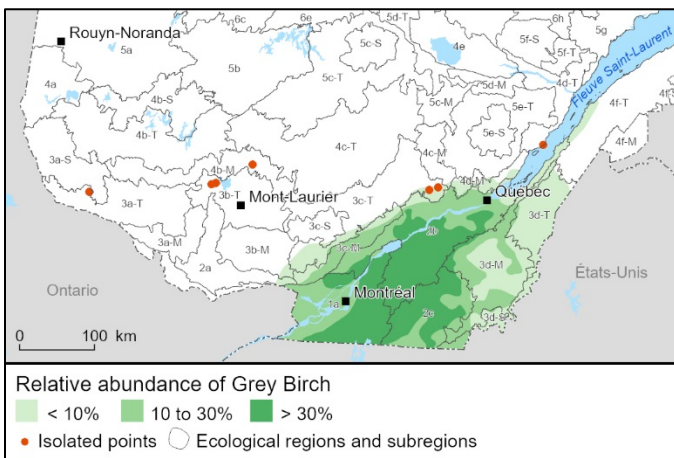


Figure 78. Relative abundance of Grey Birch

It is found throughout the entire topography, but is associated specifically with the upper portions of slopes on medium-sized hills in the St. Lawrence plains.

North of its range, it often grows in virtually pure stands. It is strongly correlated with former wildland and old logging areas. In other bioclimatic domains, Grey Birch shows no affinity for any given topographical position.

Soil moisture regime

Grey Birch can be found on all soil moisture regime conditions (table 19).

Surficial deposits

Grey Birch is not associated with any specific surficial deposit or soil texture.

Table 19. Probable presence of Grey Birch depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple - Bitternut Hickory domain	Balsam Fir - Basswood domain	Black Spruce - Yellow Birch domain	Feathermoss domain
Dry (excessive/fast)				
Mesic (good/moderate)				
Moist (imperfect)				
Wet (poor/very poor)				

Probable Little or no probability

Crown identification criteria

Profile

The Grey Birch crown is distinguished by its cylindrical shape and rounded top. The species is also shorter than the other species that accompany it (figure 79).



Figure 79. Grey Birch profile

Projection

The Grey Birch crown is small and its surface is fuzzy (figure 80).

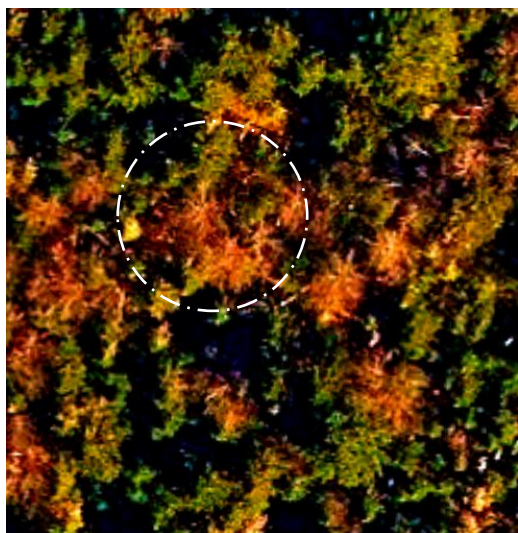


Figure 80. Grey Birch projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs, Grey Birch is yellowish brown to pinkish brown (figures 81 and 82).

On infrared (NIR) aerial photographs, its appearance is brownish grey (figures 83 and 84).

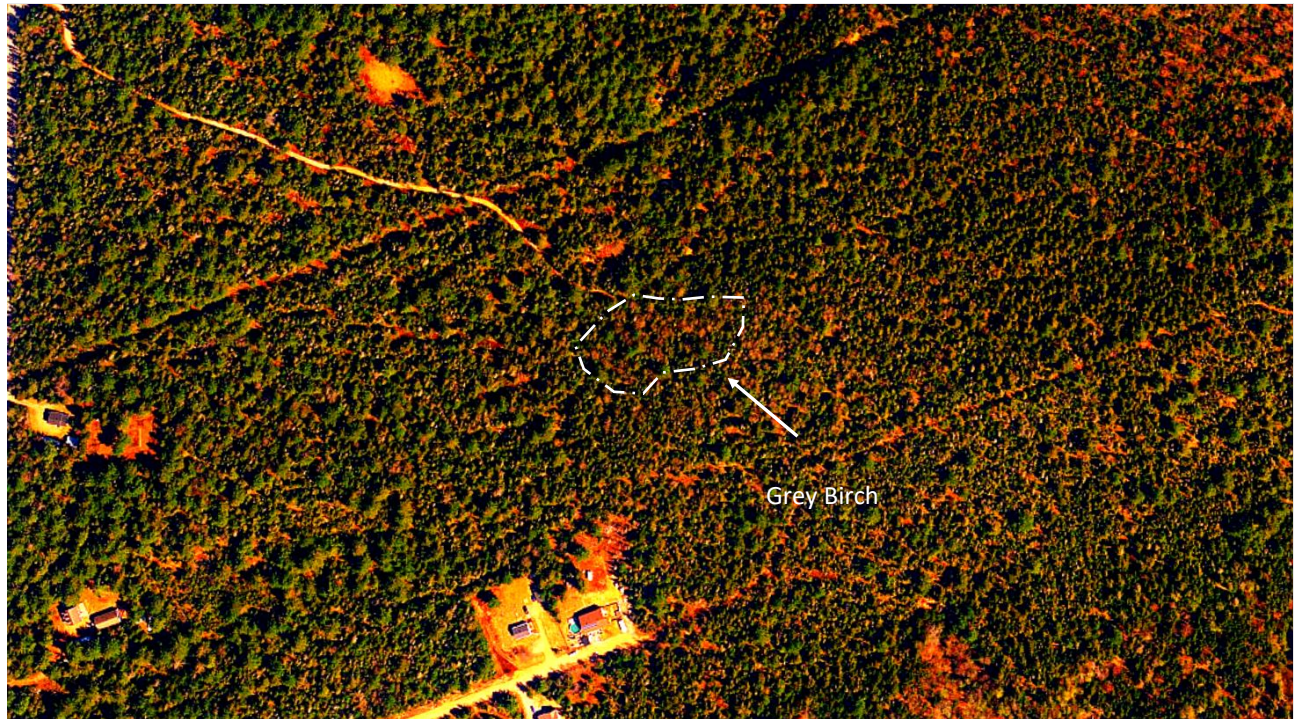


Figure 81. A few Grey Birch trees in a Spruce (Red and White) and Balsam Fir stand. At this scale, it is possible to distinguish the more yellowish brown colour of Grey Birch. (Enhanced RGB photography/Sugar Maple - Basswood domain)



Figure 82. A few Grey Birch trees in a Spruce (Red and White) and Balsam Fir stand. At this scale, it is possible to distinguish the more yellowish brown colour of Grey Birch. (Enhanced RGB photography/Sugar Maple - Basswood domain)



Figure 83. A few Grey Birch trees in a Spruce (Red and White) and Balsam Fir stand. At this scale, it is possible to distinguish the more brownish grey colour of Grey Birch. (Enhanced NIR photography/Sugar Maple - Basswood domain)

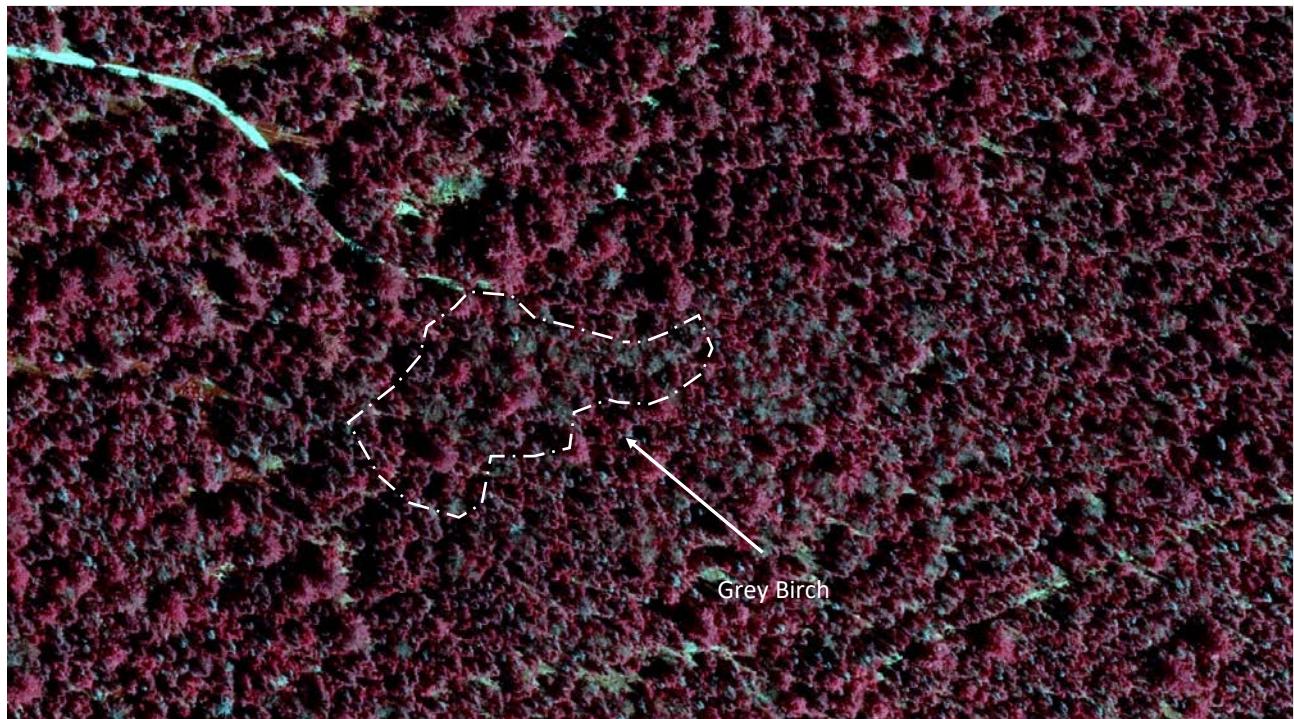


Figure 84. A few Grey Birch trees in a Spruce (Red and White) and Balsam Fir stand. At this scale, it is possible to distinguish the more brownish grey colour of Grey Birch. (Enhanced NIR photography/Sugar Maple - Basswood domain)

Yellow Birch

Betula alleghaniensis Britt.

Ecoforest criteria

Distribution

Yellow Birch grows in the Sugar Maple (Hickory, Basswood and Yellow Birch) and Balsam Fir - Yellow Birch bioclimatic domains. It grows sporadically in the Balsam Fir - Paper Birch domain (figure 85).

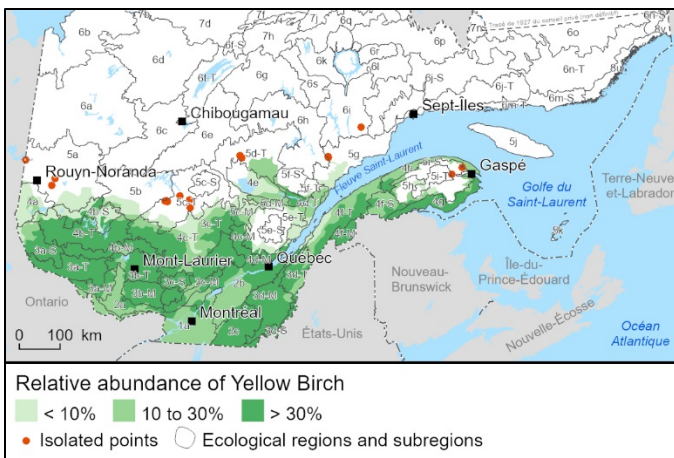


Figure 85. Relative abundance of Yellow Birch

In the Sugar Maple domains, the species is found mainly on the lower portions of slopes.

In the Balsam Fir - Yellow Birch domain it tends to prefer the middle and upper portions of slopes.

In the Balsam Fir - Paper Birch domain, it is usually found in the upper portions of slopes on medium-sized hills.

Soil moisture regime

In the Sugar Maple domains, Yellow Birch is associated more specifically with moist soil moisture regime sites (imperfect soil moisture regime), but can be found as an accompanying species on moderately drained sites. It is also commonly found in ravines.

In the Balsam Fir domains, it grows in all types of landscapes, on well-drained sites (moderate soil moisture regime) (table 20).

Surficial deposits

Surficial deposits and soil texture have less of an impact on the species' presence than topographical position and soil moisture regime. In the Balsam Fir - Paper Birch domain, Yellow Birch usually grows on the southern facing slopes of the landscape.

Table 20. Probable presence of Yellow Birch depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain	Basswood domain	Yellow Birch domain
	Yellow Birch domain	Yellow Birch domain	Paper Birch domain
	Yellow Birch domain	Paper Birch domain	Feathermoss domain
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

 Probable  Little or no probability

Crown identification criteria

Profile

The Yellow Birch crown is distinguished by its half-oval shape, stretching slightly upward at its centre (figure 86).



Figure 86. Yellow Birch profile

Projection

The Yellow Birch projection is round, with a medium to large diameter similar to the Sugar Maple. On aerial photographs, the texture of its crown appears similar to the Sugar Maple, although slightly fuzzier, smoother and airier (figure 87).

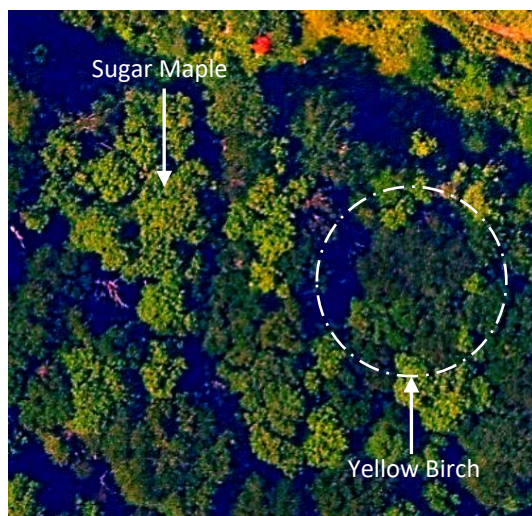


Figure 87. Yellow Birch projection (RGB)

Colour

Yellow Birch takes on a dark green colour on naturally coloured (RGB) aerial photographs (figures 88 and 89). It is often darker than the other shade-tolerant species, such as the Sugar Maple, Red Maple or American Beech trees that constitute the stand. If the photographs were taken in late summer, Yellow Birch will still appear green, contrary to Sugar Maple, which may turn yellow/orangey.

On infrared (NIR) aerial photographs, Yellow Birch appears dark pink (figures 90 and 91).

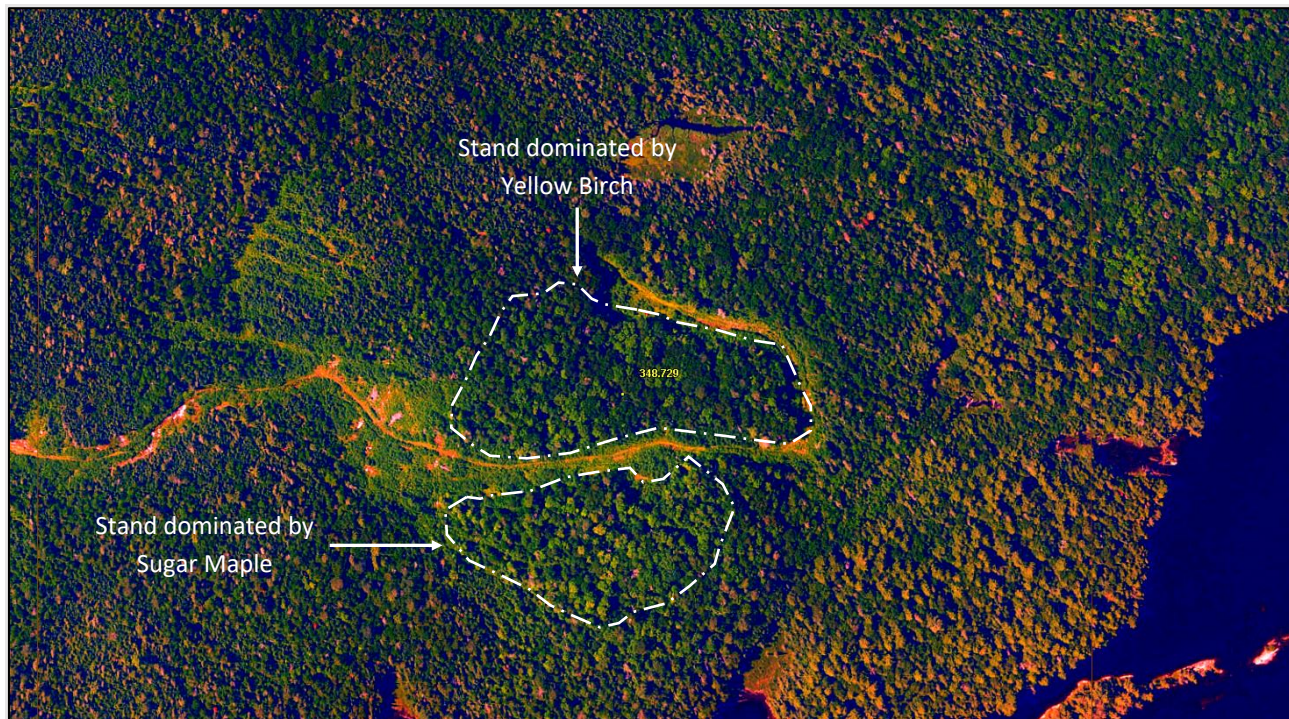


Figure 88. At the scale of the stand, Yellow Birch is often the hardwood with the darkest shade of green. (Enhanced RGB photography/Eastern Sugar Maple - Yellow Birch subdomain)

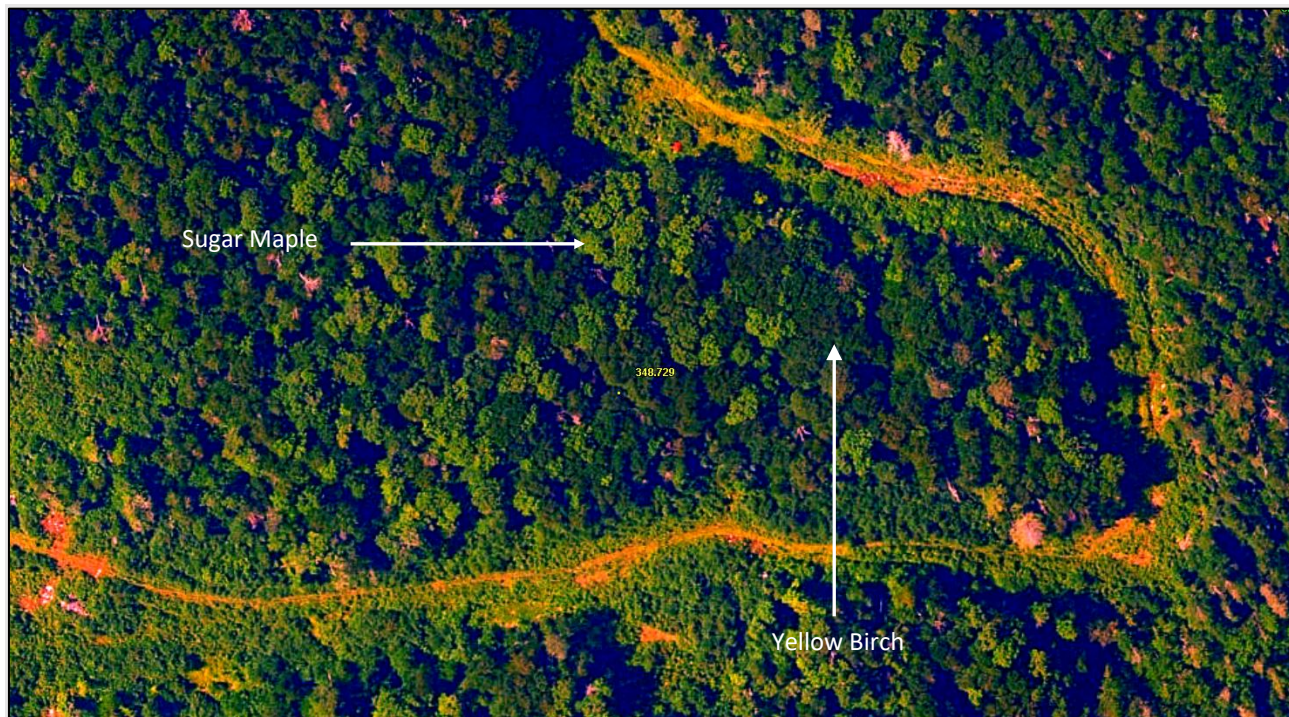


Figure 89. Apart from colour, Yellow Birch can be distinguished by its slightly airier appearance than Sugar Maple. (Enhanced RGB photography/Eastern Sugar Maple - Yellow Birch subdomain)

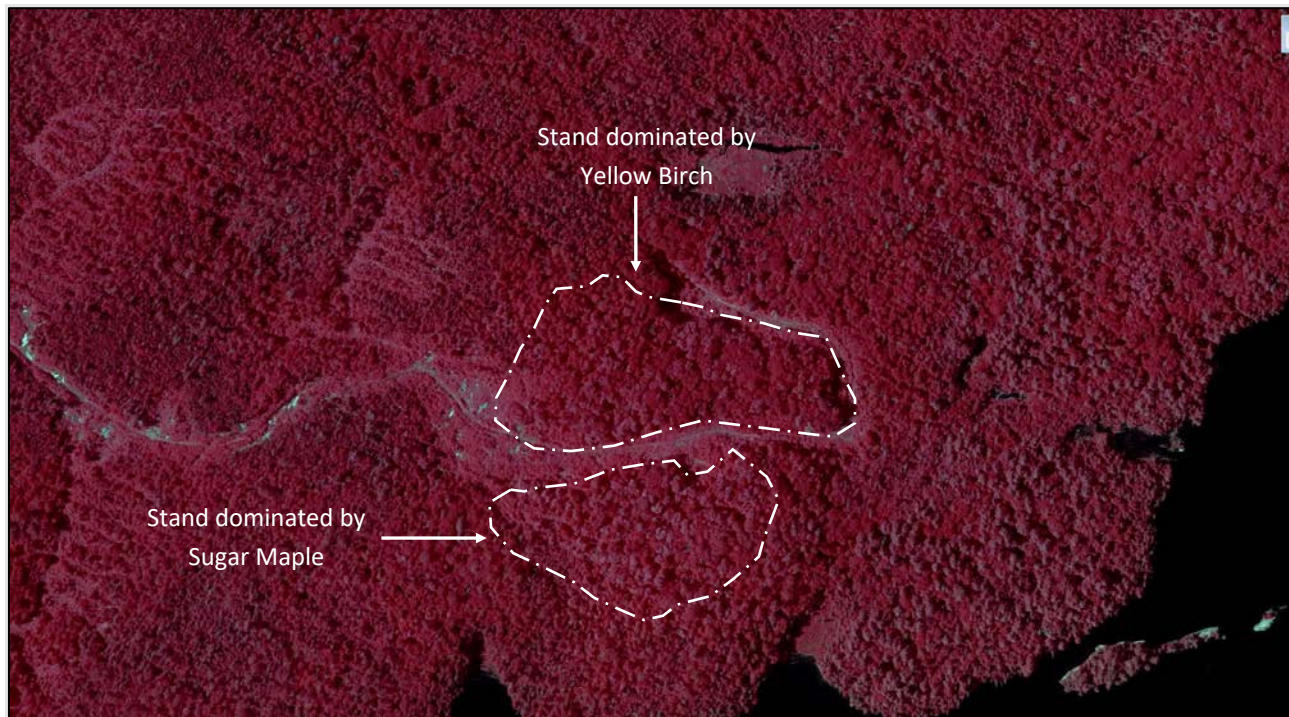


Figure 90. At the scale of the stand, Yellow Birch is often the hardwood with the darkest shade of pink. (Enhanced NIR photography/Eastern Sugar Maple - Yellow Birch subdomain)

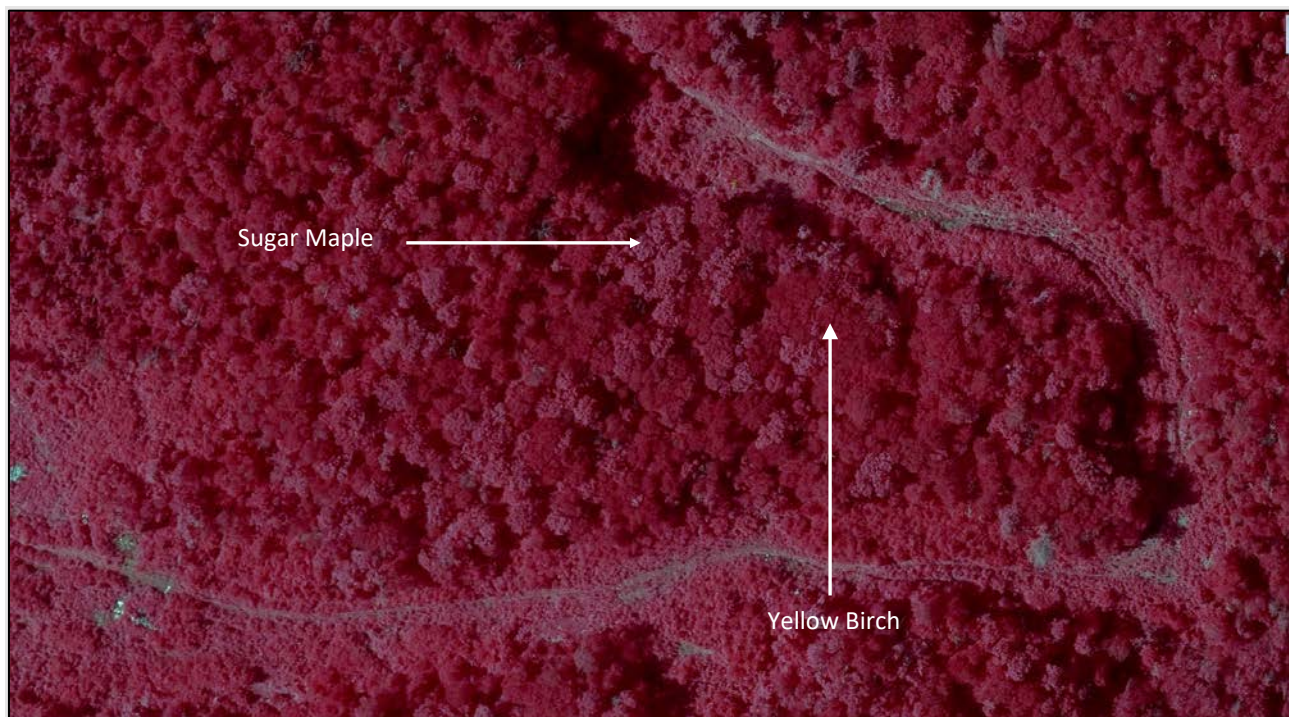


Figure 91. Apart from colour, Yellow Birch can be distinguished by its slightly airier appearance than Sugar Maple. (Enhanced NIR photography/Eastern Sugar Maple - Yellow Birch subdomain)

Hickories

Carya sp.

Ecoforest criteria

Distribution

Bitternut Hickory and Shagbark Hickory (which is rarer) are the identifying species of the Sugar Maple - Bitternut Hickory bioclimatic domain. Their presence in the Sugar Maple - Basswood domain remains exceptional (figure 92). Hickory trees accompany the main species of a stand. They are suited to all topographical positions.

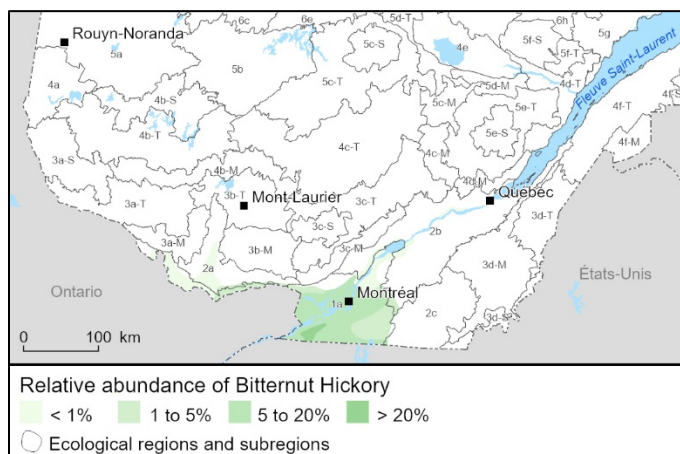


Figure 92. Relative abundance of Bitternut Hickory

Soil moisture regime

Hickory is mostly associated with soil moisture regime conditions varying from good to moderate, but a poor soil moisture regime is also appropriate (table 21).

Surficial deposits

Its presence is highly correlated with moderate to fine textured soils that are richer in nutrients.

Table 21. Probable presence of Hickory depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain	Basswood domain	Yellow Birch domain
	Yellow Birch domain	Paper Birch domain	Feathermoss domain
Dry (excessive/fast)			
Mesic(good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

■ Probable ■ Little or no probability

Crown identification criteria

Profile

The Hickory crown is very narrow, irregular and flat. Hickory trees tend to be shorter or the same height as other trees in the forest cover (figure 93).



Figure 93. Bitternut Hickory profile

Projection

The Hickory crown is medium to small in size, fairly dense, but divided in sections, and slightly fuzzy (figure 94).

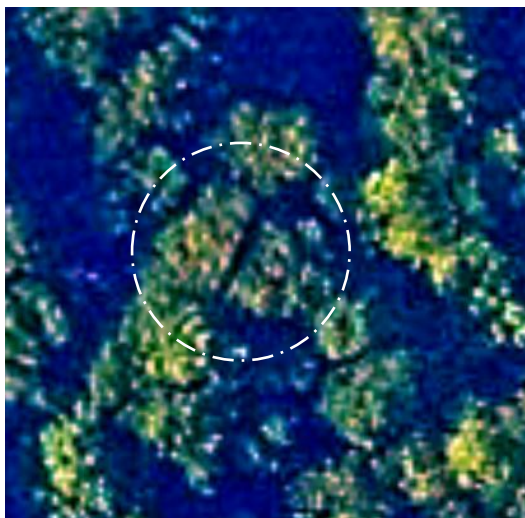


Figure 94. Bitternut Hickory projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs, Hickory trees have a fluorescent green colour (figures 95 and 96).

On infrared (NIR) aerial photographs, Hickory trees have a more salmon beige appearance (figures 97 and 98).



Figure 95. Bitternut Hickory (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)



Figure 96. Bitternut Hickory (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)

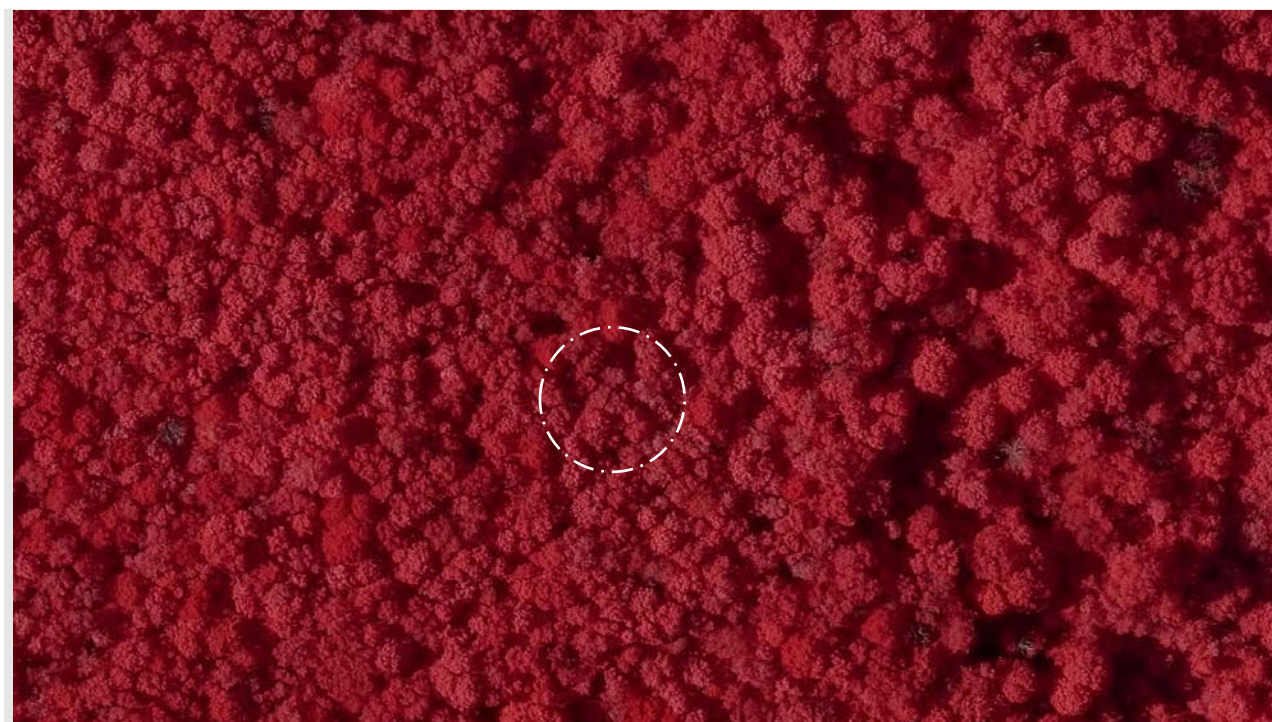


Figure 97. Bitternut Hickory (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)



Figure 98. Bitternut Hickory (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)

Northern Red Oak

Quercus rubra L.

Ecoforest criteria

Distribution

Northern Red Oak is found in the Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) bioclimatic domains (figure 99). Northern Red Oak stands grow across the entire topography; the key factor that determines their presence is the soil moisture regime.

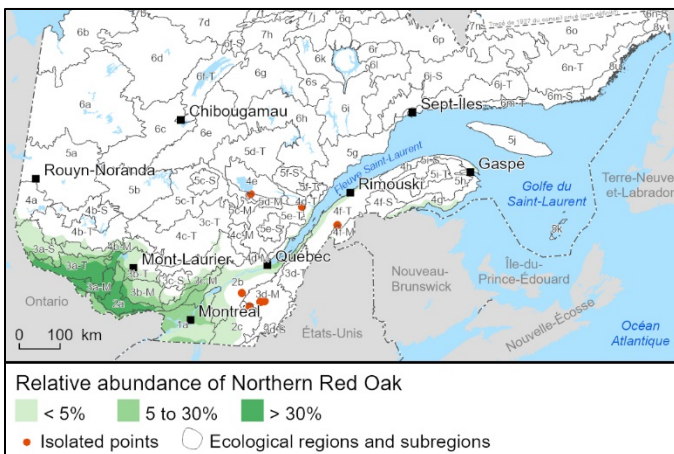


Figure 99. Relative abundance of Northern Red Oak

Soil moisture regime

Northern Red Oak trees are usually found on very well-drained sites (soil moisture regime described as excessive, fast or good) (table 22).

Surficial deposits

Northern Red Oak is often associated with thin surficial deposits, particularly on hilltops and upper slopes.

Table 22. Probable presence of Northern Red Oak depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain	Basswood domain	Yellow Birch domain
	Yellow Birch domain	Yellow Birch domain	Paper Birch domain
	Feathermoss domain		
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

Probable

Little or no probability

Crown identification criteria

Profile

The Northern Red Oak crown is shaped like a flat semicircle (figure 100).



Figure 100. Northern Red Oak profile

Projection

The crown is compact and fuzzy, with a texture composed of lumps and large hollows. It therefore has several darker patches (figure 101).



Figure 101. Northern Red Oak projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs, Northern Red Oak appears brownish green to greenish brown/orange (figures 102 and 103).

It shows as dark pink to orangey pink on infrared (NIR) aerial photographs (figures 104 and 105).

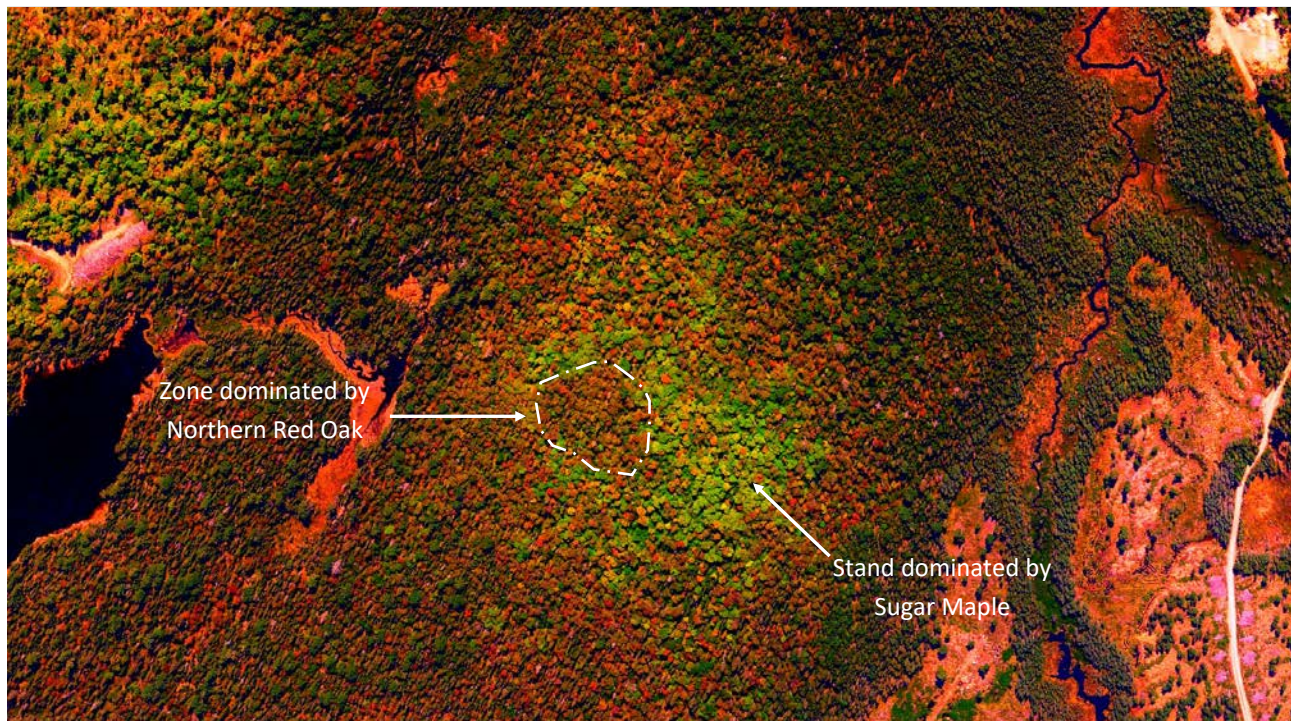


Figure 102. Northern Red Oak and Sugar Maple stand. Northern Red Oak has an orangey brown appearance. (Enhanced RGB photography/Sugar Maple - Yellow Birch domain)



Figure 103. Northern Red Oak and Sugar Maple stand. Northern Red Oak has an orangey brown appearance. (Enhanced RGB photography/Sugar Maple - Yellow Birch domain)

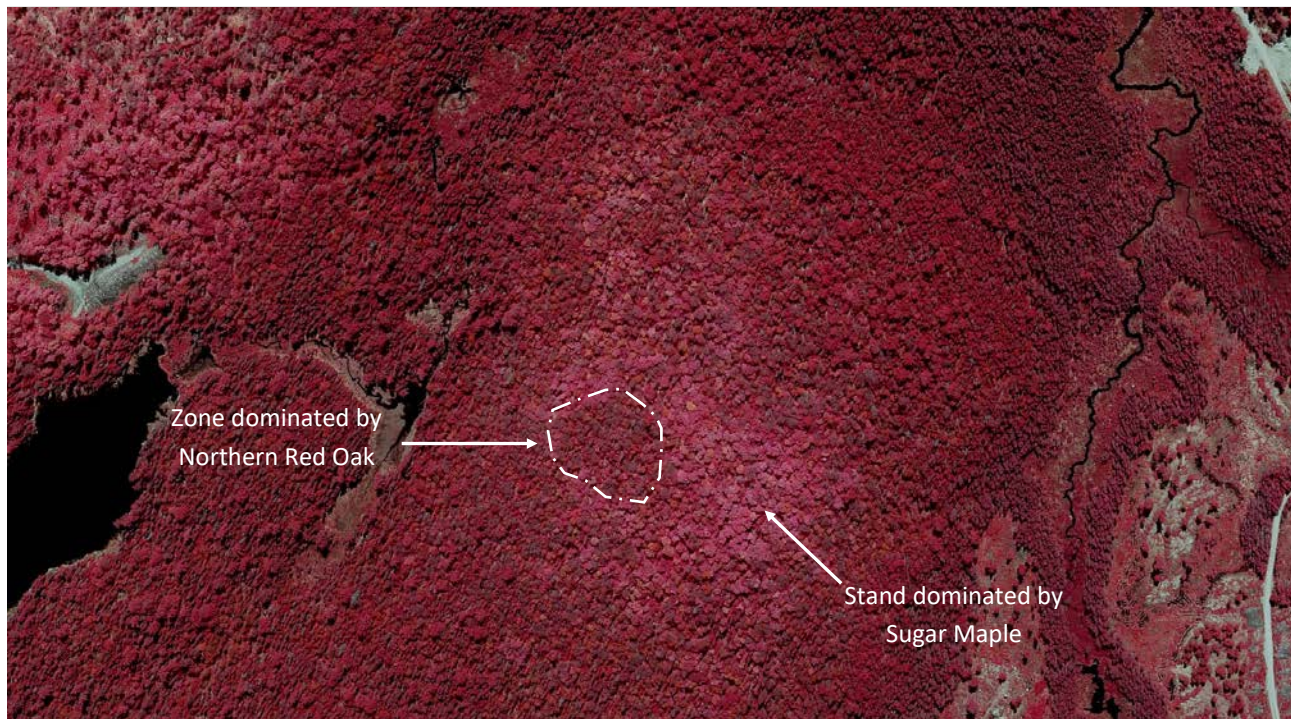


Figure 104. Northern Red Oak and Sugar Maple stand. Northern Red Oak has a dark pink appearance. (Enhanced NIR photography/Sugar Maple - Yellow Birch domain)

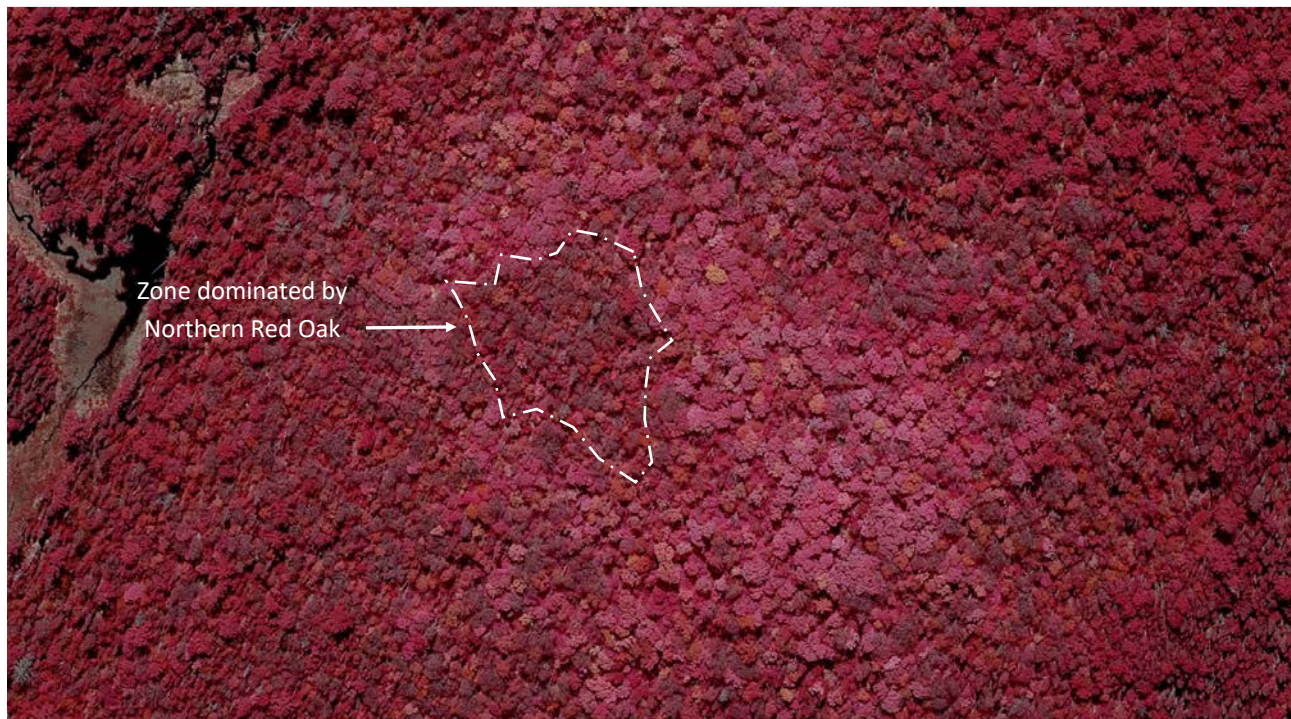


Figure 105. Northern Red Oak and Sugar Maple stand. Northern Red Oak has a dark pink appearance. (Enhanced NIR photography/Sugar Maple - Yellow Birch domain)

Sugar Maple

Acer saccharum Marsh.

Ecoforest criteria

Distribution

In the Sugar Maple (Hickory, Basswood and Yellow Birch) bioclimatic domains, Sugar Maple stands occupy every position on the slope (figure 106).

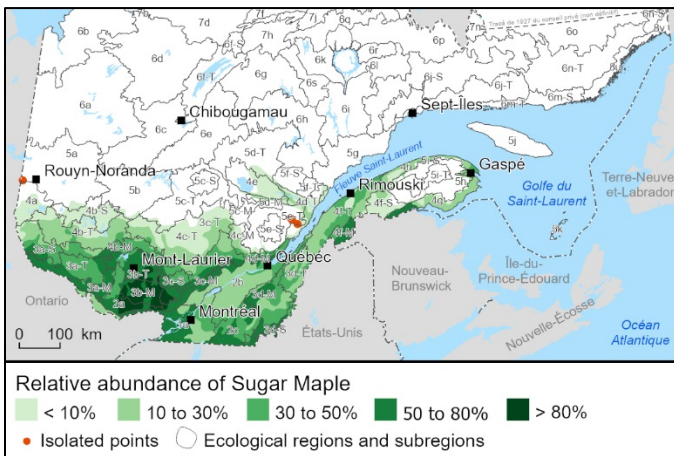


Figure 106. Relative abundance of Sugar Maple

In the Balsam Fir - Yellow Birch domain, however, they are generally limited to the higher portions of slopes.

Sugar Maples tend to be found only on southern facing slopes in the Balsam Fir - Paper Birch domain.

Soil moisture regime

Sugar Maple is often found on sites where the soil moisture regime varies from good to moderate (table 23).

Surficial deposits

Surficial deposits and soil textures have less impact on the Sugar Maple's presence than slope position and soil moisture regime conditions.

Table 23. Probable presence of Sugar Maple depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain	Basswood domain	Yellow Birch domain
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

Probable Little or no probability

Crown identification criteria

Profile

A Sugar Maple crown is distinguished by its flat curved shape with no protruding branches (figure 107).



Figure 107. Sugar Maple profile

Projection

From above, the Sugar Maple projection ranges from round to oval, with a diameter varying from medium to large. Due to its very compact appearance, wide deep holes are very rarely observed in the crown. In addition to its compact appearance and texture, composed of bumps and shallow hollows, it resembles a head of broccoli (figure 108). This is due to the way its branches



Figure 108. Sugar Maple projection (RGB)

are structured, at a more perpendicular angle to the trunk than is the case of a Red Maple crown. The Sugar Maple also has foliage at every stage of the crown, because it is more shade-tolerant.

Colour

On naturally coloured (RGB) aerial photographs, Sugar Maple appears in apple green colours (light green if it is young to bluish green if it is old) (figures 109 and 110). When the photographs are taken in late summer, Sugar Maple can turn yellow/orangey.

On infrared (NIR) aerial photographs, its colour ranges from pale pink to dark pink (figures 111 and 112).



Figure 109. Stand of Sugar Maples accompanied by some Yellow Birch trees. Sugar Maple has a light green colour compared to Yellow Birch. (Enhanced RGB photography/Western Sugar Maple - Yellow Birch subdomain)

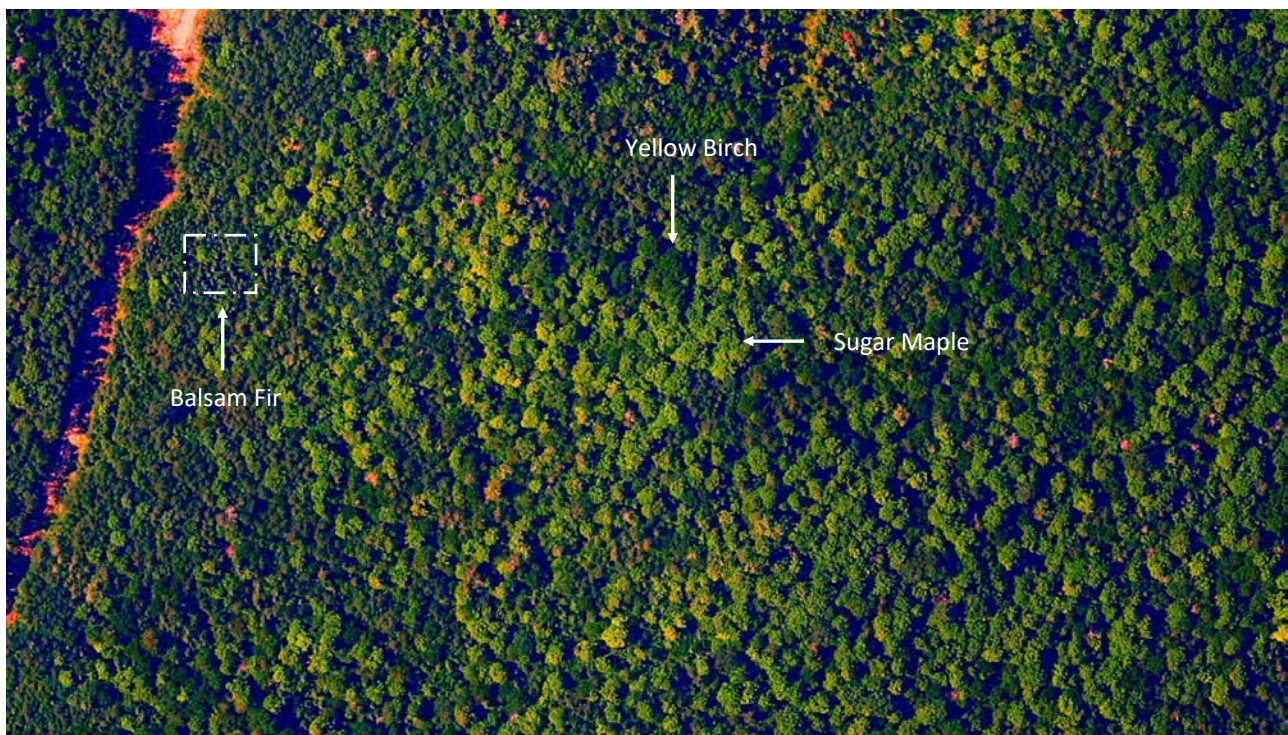


Figure 110. Stand of Sugar Maples accompanied by some Yellow Birch and Balsam Fir trees. Sugar Maple has a light green colour compared to Yellow Birch. (Enhanced RGB photography/Western Sugar Maple - Yellow Birch subdomain)

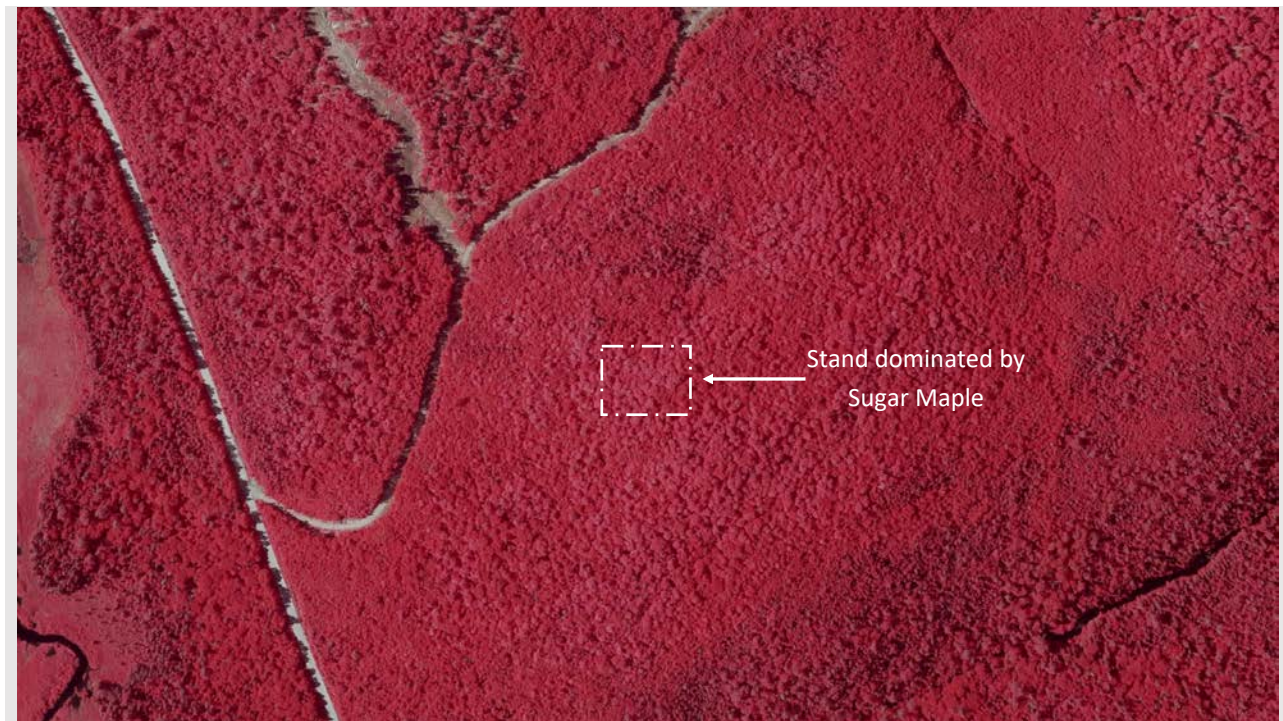


Figure 111. Stand of Sugar Maples accompanied by some Yellow Birch trees. Sugar Maple has a light pink colour compared to Yellow Birch. (Enhanced NIR photography/Western Sugar Maple - Yellow Birch subdomain)



Figure 112. Stand of Sugar Maples accompanied by some Yellow Birch and Balsam Fir trees. Sugar Maple has a light pink colour compared to Yellow Birch. (Enhanced NIR photography/Western Sugar Maple - Yellow Birch subdomain)

Red Maple

Acer rubrum L.

Ecoforest criteria

Distribution

Red Maple grows in the Sugar Maple (Hickory, Basswood and Yellow Birch) domains and the Balsam Fir - Yellow Birch bioclimatic domains (figure 113).

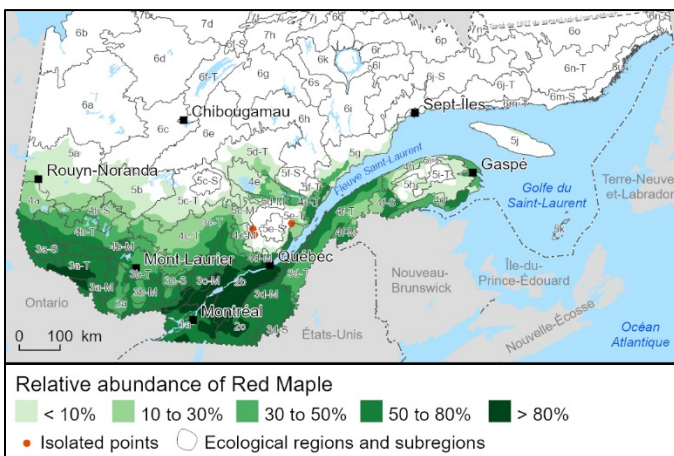


Figure 113. Relative abundance of Red Maple

Red Maple stands occupy every part of the slope, although the species tends to be more plentiful in mixed stands and on the lower portions of slopes.

Soil moisture regime

Suitable soil moisture regime conditions range from moderate to poor, although the species is observed more frequently in imperfect soil moisture regime conditions (table 24).

Surficial deposits

Surficial deposits and soil textures have less impact on the species' presence than slope position and soil moisture regime conditions.

Table 24. Probable presence of Red Maple depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain Basswood domain Yellow Birch domain	Yellow Birch domain Paper Birch domain	Feathermoss domain
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

Probable Little or no probability

Crown identification criteria

Profile

The Red Maple crown has a flat curve shape similar to the Sugar Maple, but differs from that species due to its less well-defined appearance and smaller size. In addition, the centre of the crown is higher than the perimeter (figure 115).



Figure 114. Red Maple profile

Projection

The Red Maple crown has a medium diameter. The shade and light (hollows and bumps) structure observed on aerial photographs is due to the fact that the crown branches point upwards (often in a feathery arrangement). These ascending branches are one of the criteria specific to the Red Maple.



Figure 115. Red Maple projection (RGB)

Colour

Both on naturally coloured (RGB) aerial photographs and infrared (NIR) aerial photographs, Red Maple foliage is paler and sometimes a little brighter than Sugar Maple foliage. Moreover, the presence of shaded areas in the Red Maple crown may give the impression that it is darker overall than the Sugar Maple crown.

When observed on naturally coloured (RGB) aerial photographs, the crown is apple green (figures 116 and 117). If photographs were taken in the fall, it will be bright green.

On infrared (NIR) aerial photographs, the colour is pale pink (figures 118 and 119).



Figure 116. Stands of Yellow Birch, Red Maple, Sugar Maple and American Beech trees (Enhanced RGB photography/Eastern Balsam Fir - Yellow Birch subdomain)



Figure 117. Stands of Yellow Birch, Red Maple, Sugar Maple and American Beech trees (Enhanced RGB photography/Eastern Balsam Fir - Yellow Birch subdomain)

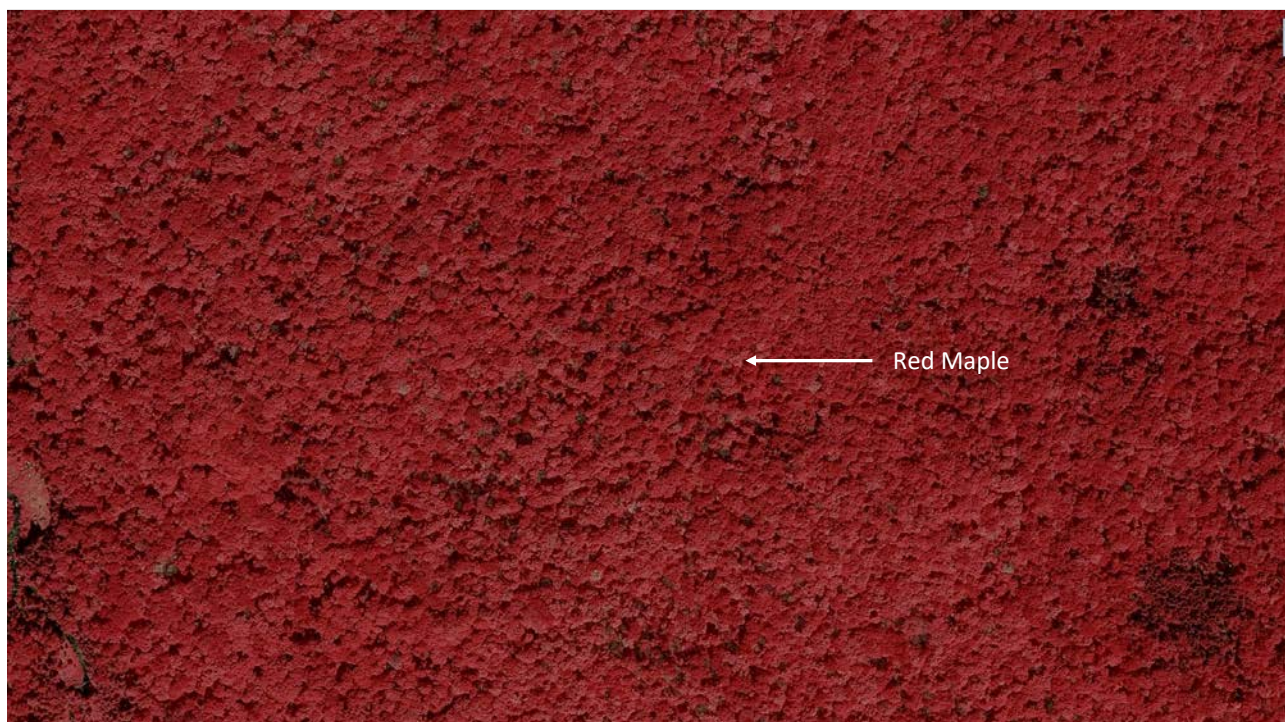


Figure 118. Stands of Yellow Birch, Red Maple, Sugar Maple and American Beech trees (Enhanced NIR photography/Eastern Balsam Fir - Yellow Birch subdomain)

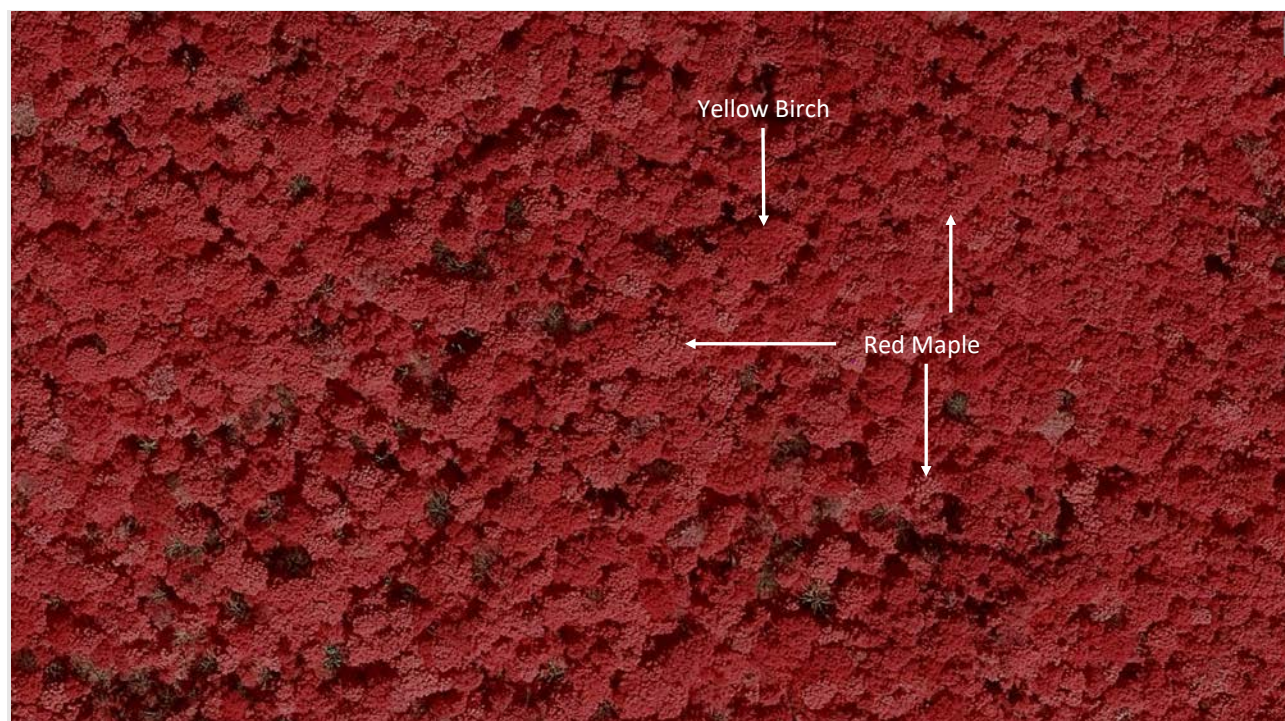


Figure 119. Stands of Yellow Birch, Red Maple, Sugar Maple and American Beech trees (Enhanced NIR photography/Eastern Balsam Fir - Yellow Birch subdomain)

Ashes

Fraxinus sp.

Ecoforest criteria

Distribution

In general, Ashes are found in the Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) bioclimatic domains (figure 120). They generally play the role of accompanying species in a stand.

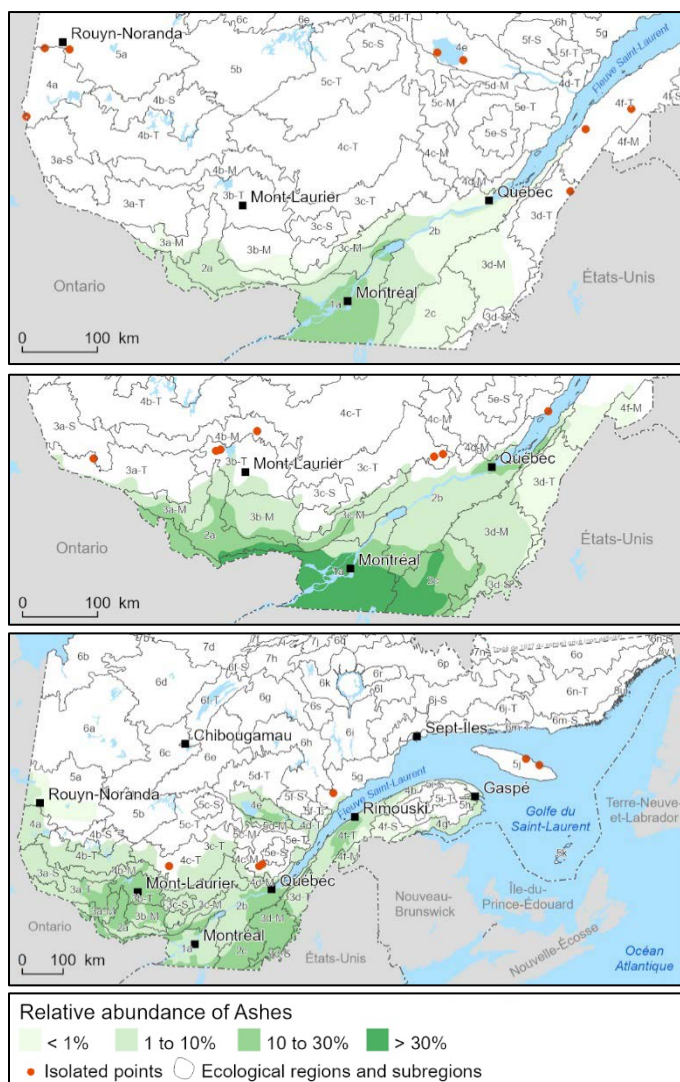


Figure 120. Relative abundance of Ashes (1-Northern Red Ash, 2-White Ash, 3-Black Ash)

Northern Red Ash is a characteristic species of the Sugar Maple - Bitternut Hickory and Sugar Maple - Basswood bioclimatic domains. White Ash extends as far as the Sugar Maple - Yellow Birch domain. Black Ash is a characteristic species of the Sugar Maple - Bitternut

Hickory, Sugar Maple - Basswood and Sugar Maple - Yellow Birch bioclimatic domains. It can be found exceptionally in the Balsam Fir - Yellow Birch domain.

Soil moisture regime

Northern Red Ash (NRA)

In its range, Northern Red Ash has an affinity for rich moist soils and sites bordering watercourses (table 25).

White Ash (WA)

White Ash grows in a broad range of site conditions, except for moist and wet soils (table 25).

Black Ash (BA)

In the Sugar Maple - Hickory and Sugar Maple - Basswood domains, Black Ash is observed on moist and wet sites. In the Sugar Maple - Yellow Birch and Balsam Fir - Yellow Birch domains, Black Ash tends to occupy rich moist soils and sites alongside watercourses (table 25).

Surficial deposits

Surficial deposits and soil textures have less impact on the presence of Ashes than the soil moisture regime conditions in which they evolve.

Table 25. Probable presence of Ashes depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -			Balsam Fir -	Black Spruce -
	Bitternut Hickory domain	Basswood domain	Yellow Birch domain	Yellow Birch domain	Paper Birch domain
Dry (excessive/fast)	WA	WA	WA		
Mesic (good/moderate)	WA	WA	WA		
Moist (imperfect)	NRA BA	NRA BA	BA	BA	
Wet (poor/very poor)	BA	BA			

■ Probable ■ Little or no probability

Crown identification criteria

Profile

The Ash crown silhouette is often fuzzy and shaped like a slender flame. In addition, some branches may be ascending (figure 121).



Figure 121. Ash profile

Projection

The Ash crown is medium-sized and its texture is often fuzzy. Black Ash crowns are usually airier than those of other Ashes (figure 122).

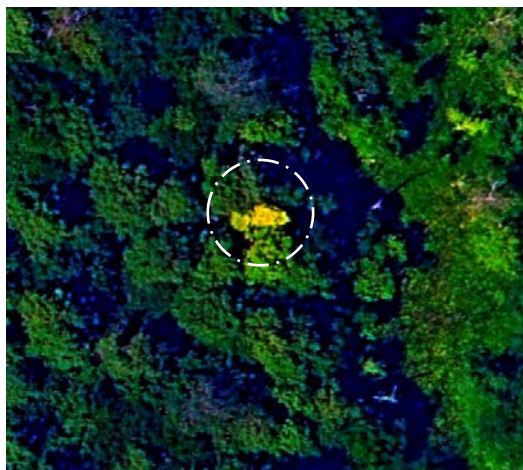


Figure 122. Black Ash projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs:

- **Northern Red Ash:** light brownish green;
- **White Ash:** light greyish green to greyish yellow;
- **Black Ash:** very light green to yellow.

On infrared (NIR) aerial photographs:

- **Northern Red Ash:** greyish orange;
- **White Ash:** salmon beige;
- **Black Ash:** pink.

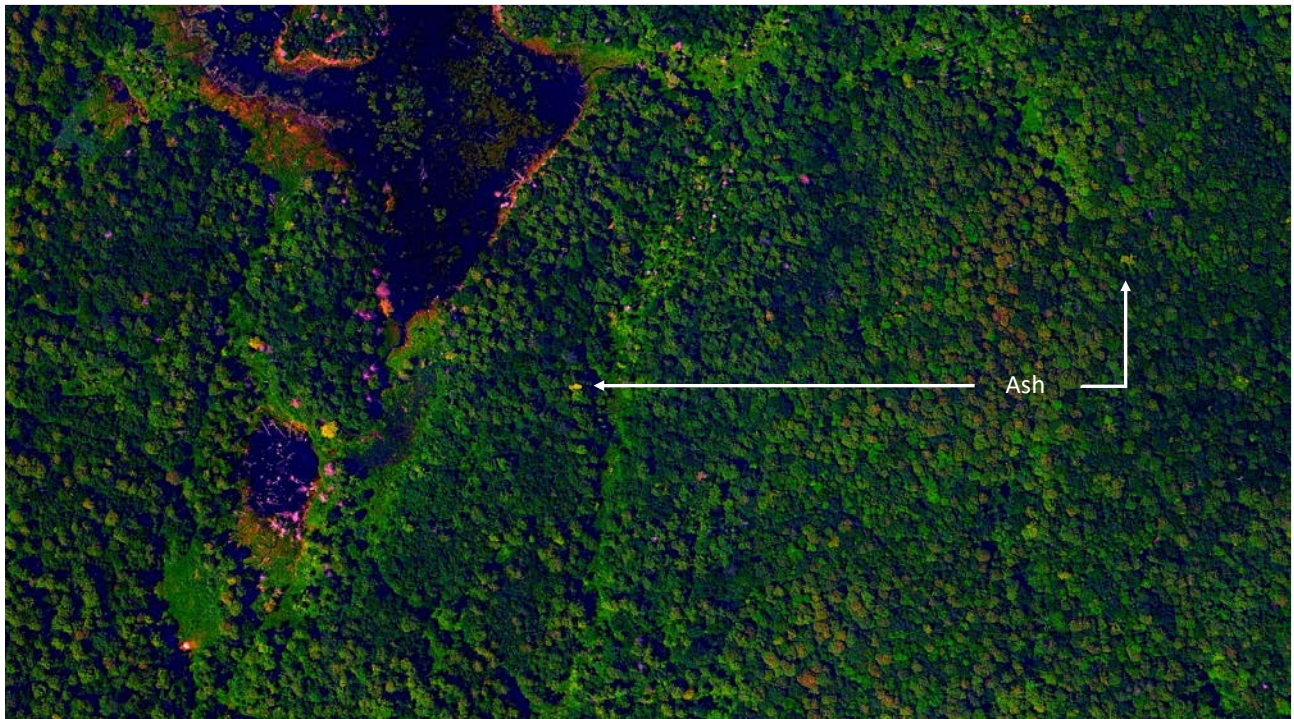


Figure 123. Black Ash dispersed in a Sugar Maple stand. At this scale, it is possible to distinguish the more yellow colour of Ashes compared to other hardwoods. (Enhanced RGB photography/Sugar Maple - Basswood domain)

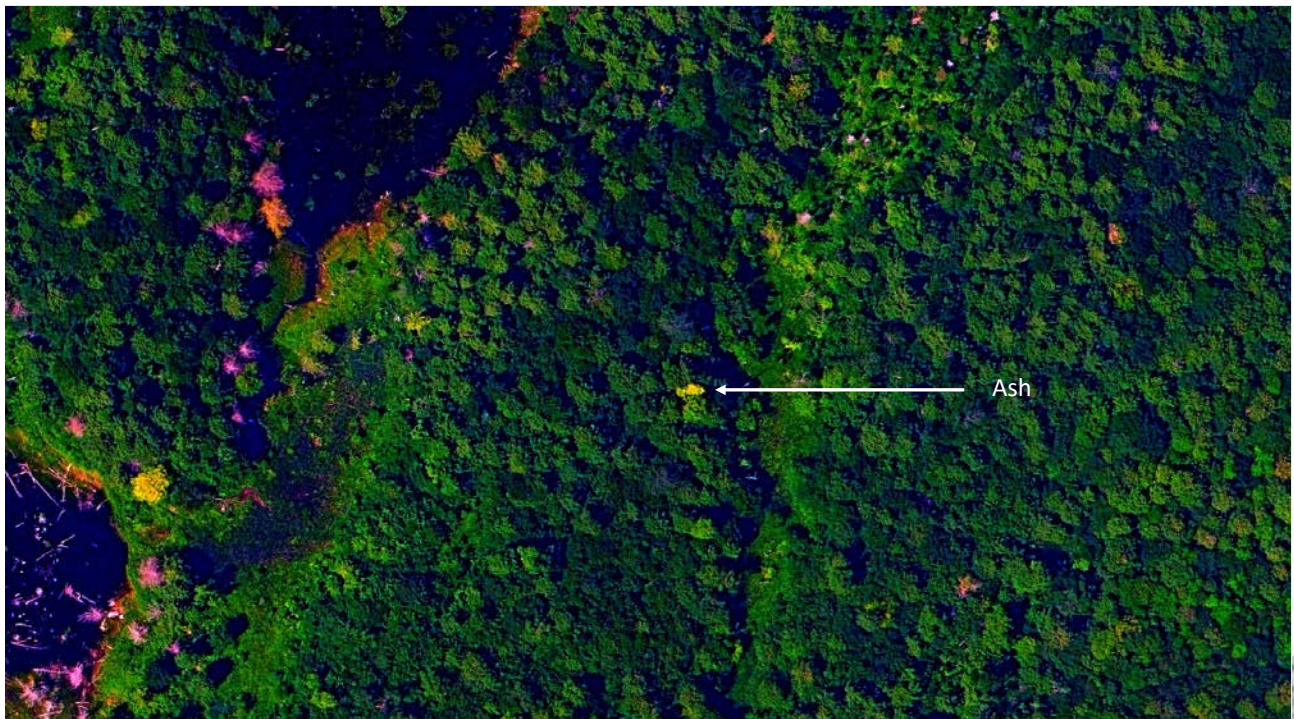


Figure 124. Black Ash dispersed in a Sugar Maple stand. At this scale, it is possible to distinguish the more yellow colour of Ashes compared to other hardwoods. The moist environment can also be a discrimination criterion. (Enhanced RGB photography/Sugar Maple - Basswood domain)

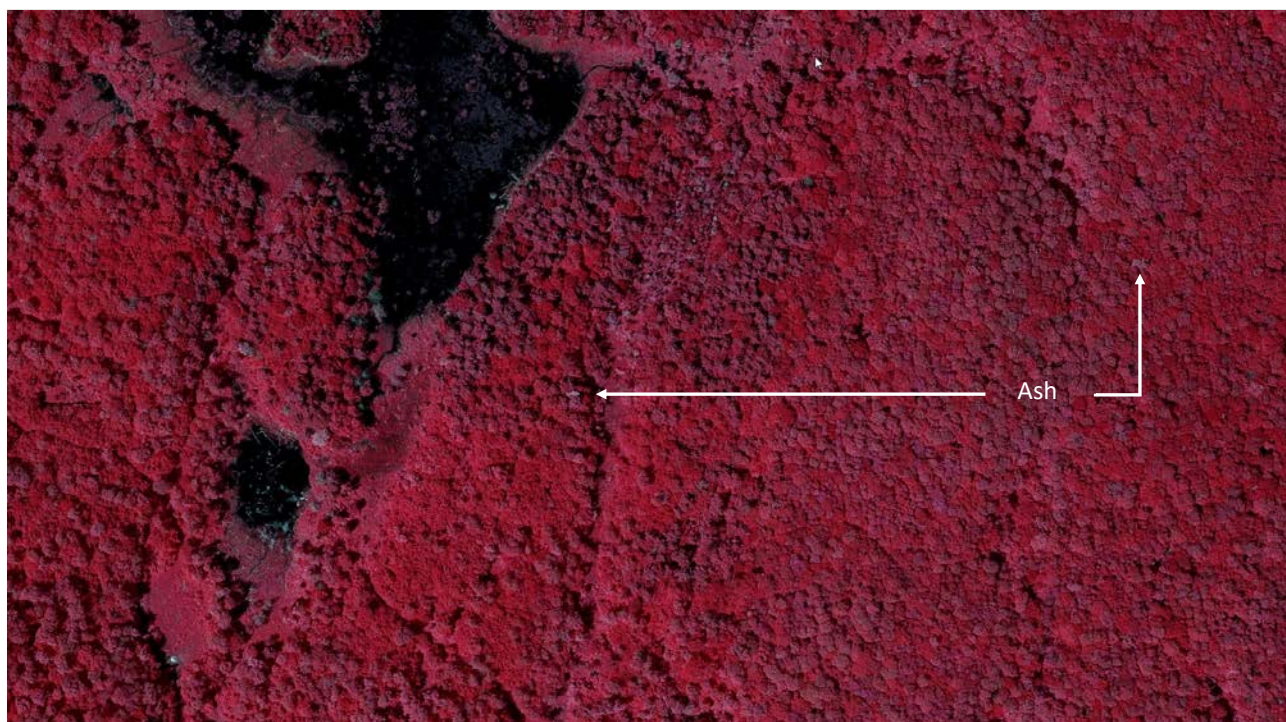


Figure 125. Black Ash dispersed in a Sugar Maple stand. At this scale, it is possible to distinguish the paler pink colour of Ashes compared to other hardwoods. (Enhanced NIR photography/Sugar Maple - Basswood domain)

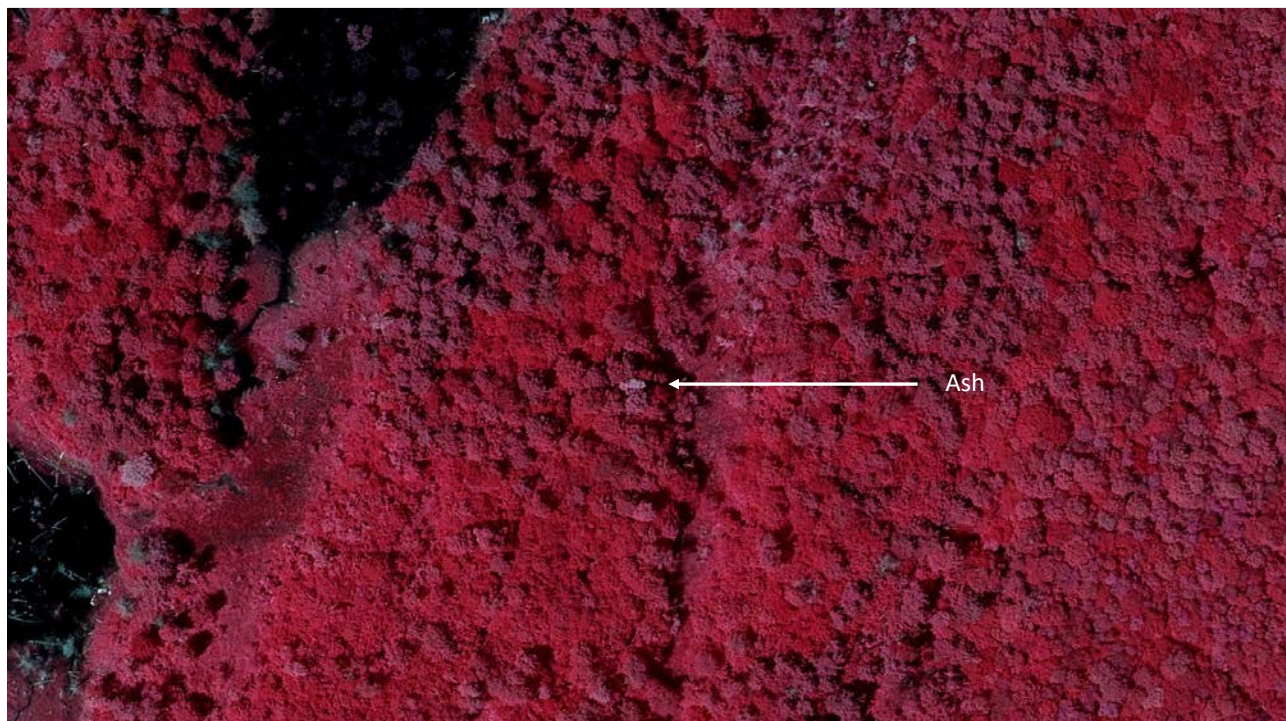


Figure 126. Black Ash dispersed in a Sugar Maple stand. At this scale, it is possible to distinguish the paler pink colour of Ashes compared to other hardwoods. The moist environment can also be a discrimination criterion. (Enhanced NIR photography/Sugar Maple - Basswood domain)

American Beech

Fagus grandifolia Ehrh.

Ecoforest criteria

Distribution

American Beech is found mainly in the Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) bioclimatic domains (figure 127).

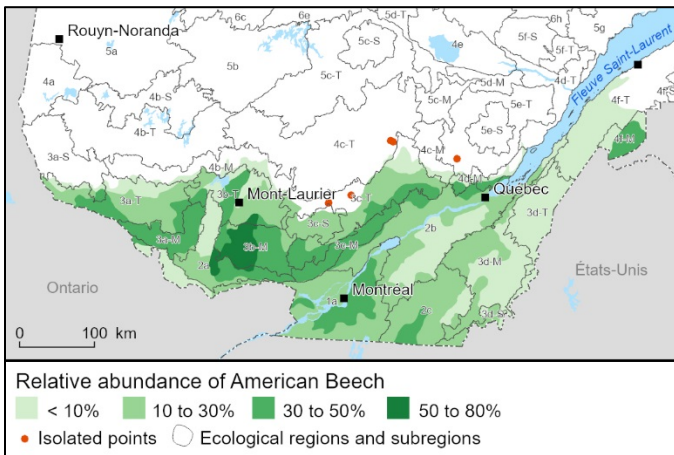


Figure 127. Relative abundance of American Beech

It only grows sporadically in the Balsam Fir - Yellow Birch domain. Stands containing American Beech trees grow across the entire topography.

Soil moisture regime

The American Beech prefers soil moisture regime sites ranging from good to moderate (table 26).

Surficial deposits

Its presence is not associated with any specific surficial deposit or soil texture. Only good to moderate soil moisture regime sites are indicators of its presence.

Table 26. Probable presence of American Beech depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain Basswood domain Yellow Birch domain	Yellow Birch domain Paper Birch domain	Feathermoss domain
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

■ Probable ■ Little or no probability

Crown identification criteria

Profile

The American Beech crown is distinguished by the lack of roundness in its structure (figure 128).



Figure 128. American Beech profile

Projection

The American Beech's crown surface is irregular (bumps and deep hollows), and has a remarkably fuzzy appearance compared to other hardwoods (figure 129).



Figure 129. American Beech projection (RGB)

Colour

On enhanced naturally coloured (RGB) aerial photographs, American Beech trees appear brownish to brownish green (figures 130 and 131).

On infrared (NIR) aerial photographs, their colour ranges from orangey pink to brownish pink (132 to 133).



Figure 130. Stand of Yellow Birch, Sugar Maple and American Beech trees. American Beech trees range from ochre yellow to brownish yellow. (Enhanced RGB photography/Sugar Maple - Yellow Birch domain)

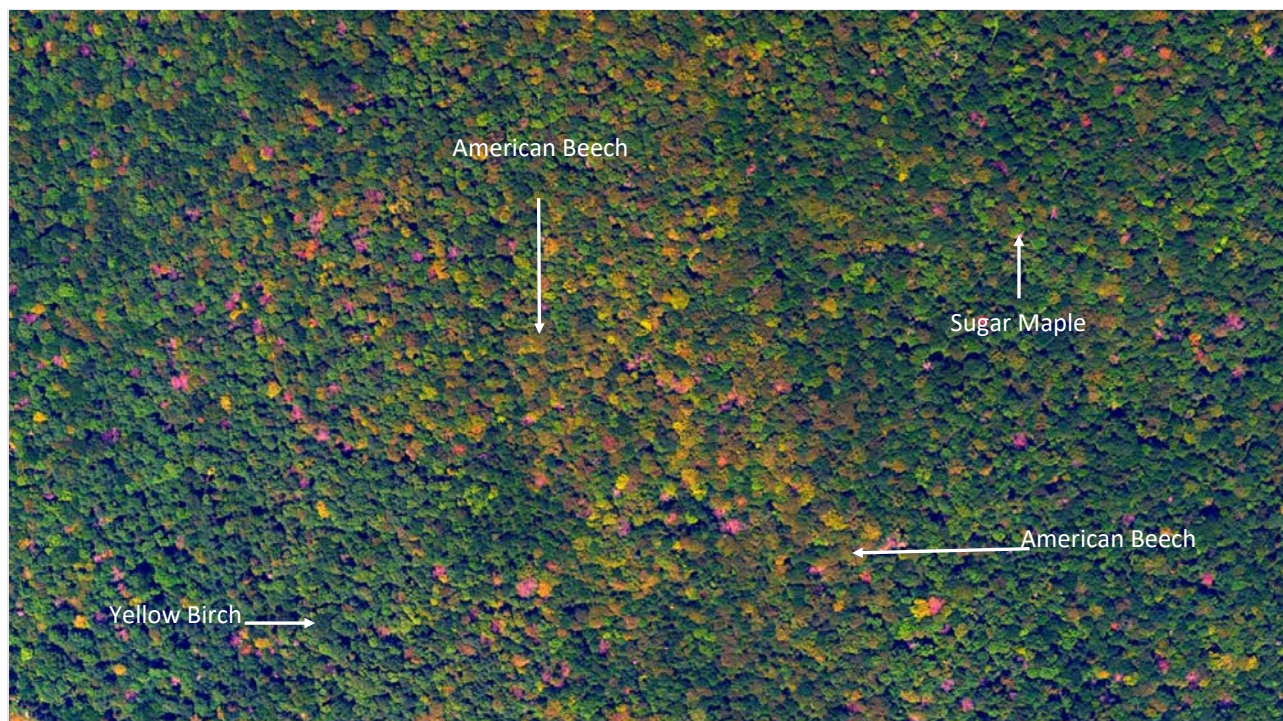


Figure 131. Stand of Yellow Birch, Sugar Maple and American Beech trees. American Beech trees range from ochre yellow to brownish yellow, while Yellow Birch is dark green and Sugar Maple is pale green. (Enhanced RGB photography/Sugar Maple - Yellow Birch domain)



Figure 132. Stand of Yellow Birch, Sugar Maple and American Beech trees. American Beech trees range from orangey pink to brownish pink. (Enhanced NIR photography/Sugar Maple - Yellow Birch domain)

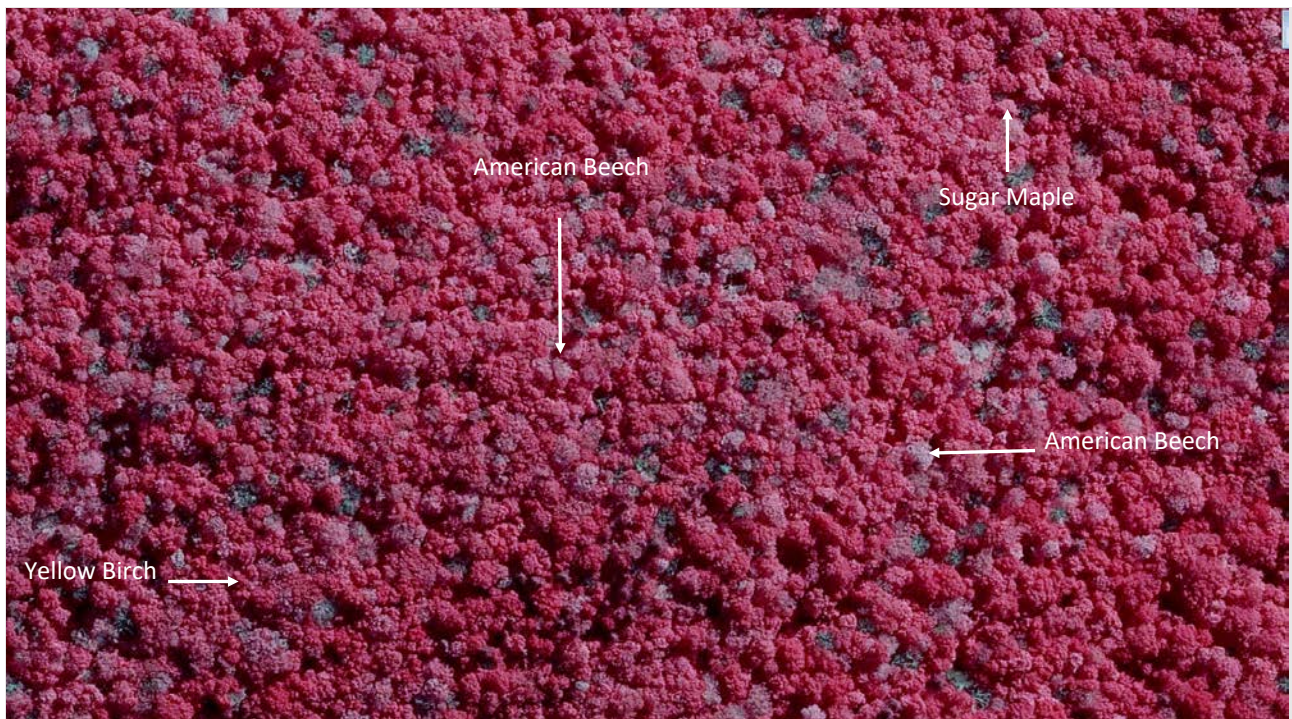


Figure 133. Stand of Yellow Birch, Sugar Maple and American Beech trees. American Beech trees range from orangey pink to brownish (greyish) pink, while Yellow Birch is dark pink and Sugar Maple is pale pink. (Enhanced NIR photography/Sugar Maple - Yellow Birch domain)

White Elm

Ulmus americana L.

Ecoforest criteria

Distribution

White Elm is found in the Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) bioclimatic domains (figure 134). It generally accompanies the main species of a stand.

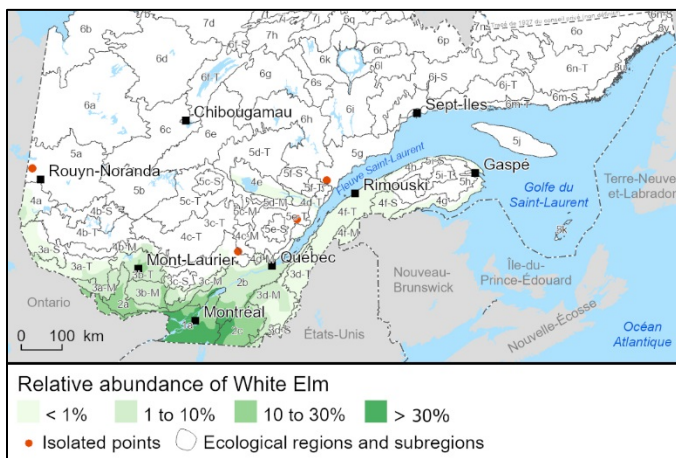


Figure 134. Relative abundance of White Elm

It is slightly more abundant along watercourses and on very rich sites. In the landscape, it tends to grow on plains and on the lower portion of slopes.

Soil moisture regime

White Elm takes advantage of soil moisture regime sites ranging from good to poor (table 27).

Surficial deposits

It grows most often in moderate to fine soils that are richer in nutrients.

Table 27. Probable presence of White Elm depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain Basswood domain Yellow Birch domain	Yellow Birch domain Paper Birch domain	Feathermoss domain
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

 Probable  Little or no probability

Crown identification criteria

Profile

The White Elm crown is distinguished by its narrow parabolic shape (figure 135).



Figure 135. White Elm profile

Projection

From above, the texture of this species' crown is regular and clean-cut (figure 136).



Figure 136. White Elm projection

Colour

Observed on naturally coloured (RGB) aerial photographs, White Elm is dark green (figures 137 and 138)

On infrared (NIR) aerial photographs, it appears orangey red (figures 139 and 140).



Figure 137. White Elm trees (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)



Figure 138. White Elm trees (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)



Figure 139. White Elm trees (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)



Figure 140. White Elm trees (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)

Eastern Hop-hornbeam

Ostrya virginiana (Mill.) K. Koch

Ecoforest criteria

Distribution

In Québec, Eastern Hop-hornbeam reaches its distribution limit in the Sugar Maple - Basswood domain, where it is found as an accompanying species (figure 141). It rarely represents more than 10% of the stems of a stand. This species is found in hardwood stands, sometimes in mixed stands, but never in exclusively softwood stands. Finally, it can be observed across the entire topography where the soil moisture regime favours it.

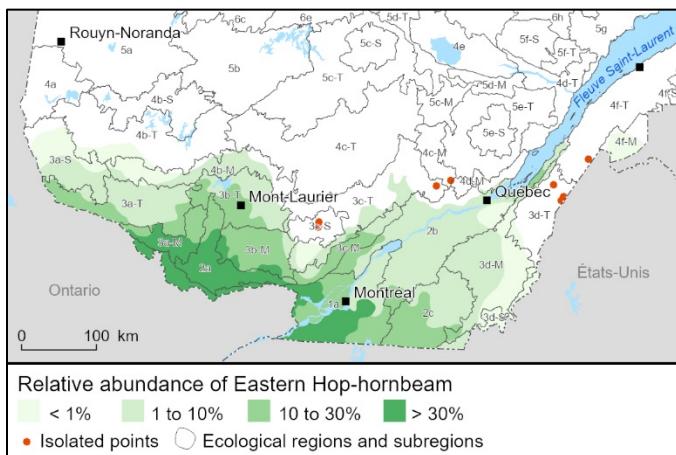


Figure 141. Relative abundance of Eastern Hop-hornbeam

Soil moisture regime

Eastern Hop-hornbeam appreciates mesic to mesic-dry soil moisture regime sites, more rarely a moist soil moisture regime. It will never be found in wet environments (table 28).

Surficial deposits

Eastern Hop-hornbeam appreciates soil textures ranging from medium texture (loam or silt) to coarse (sand).

Table 28. Probable presence of Eastern Hop-hornbeam depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain Basswood domain Yellow Birch domain	Yellow Birch domain Paper Birch domain	Feathermoss domain
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

 Probable  Little or no probability

Crown identification criteria

Profile

Eastern Hop-hornbeam is a small understory tree that very rarely will reach the dominant stratum of the stand. It is therefore often shorter than the trees that accompany it. Its social rank sometimes makes it difficult to see on aerial photographs (figure 142).



Figure 142. Eastern Hop-hornbeam profile

Projection

The Eastern Hop-hornbeam crown has a modest diameter. It is relatively round, moderately dense and has a slightly fuzzy appearance (figure 143).



Figure 143. Eastern Hop-hornbeam projection

Colour

Eastern Hop-hornbeam is dark green with some tinges of blue when observed on naturally coloured (RGB) aerial photographs (figures 144 and 145).

It has a dark pink appearance on infrared (NIR) aerial photographs (figures 146 and 147).

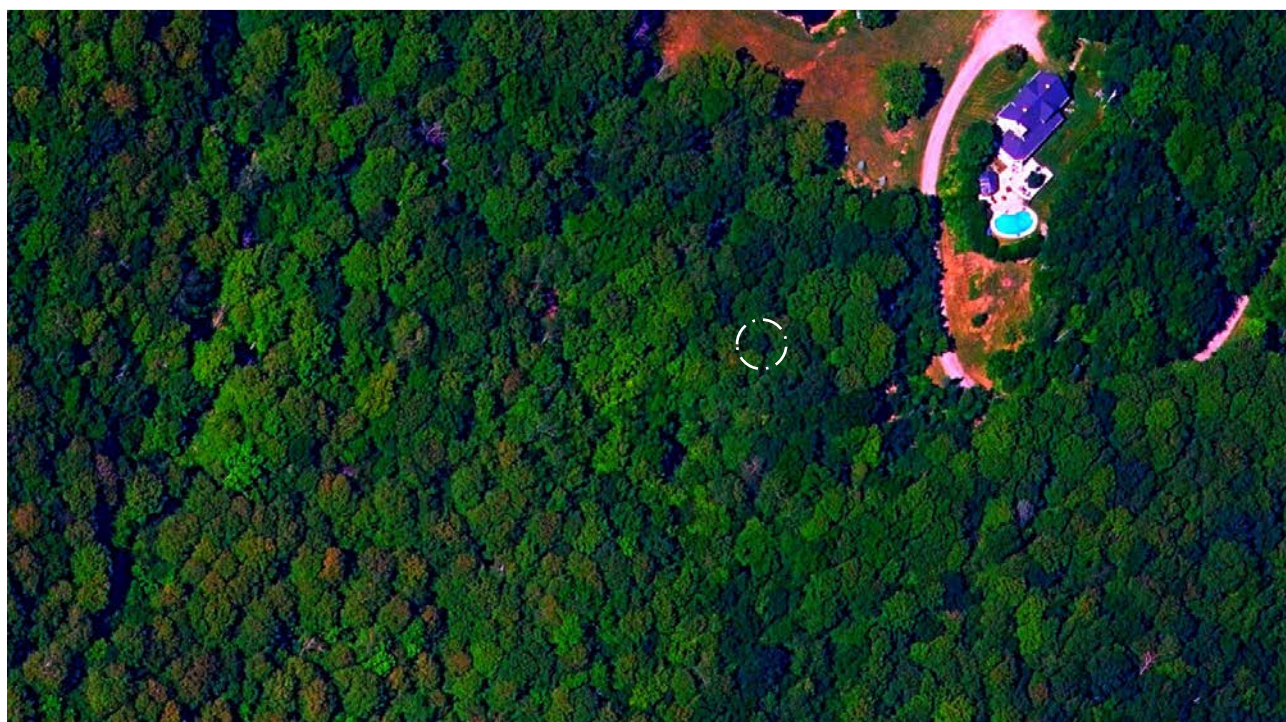


Figure 144. Eastern Hop-hornbeam (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)

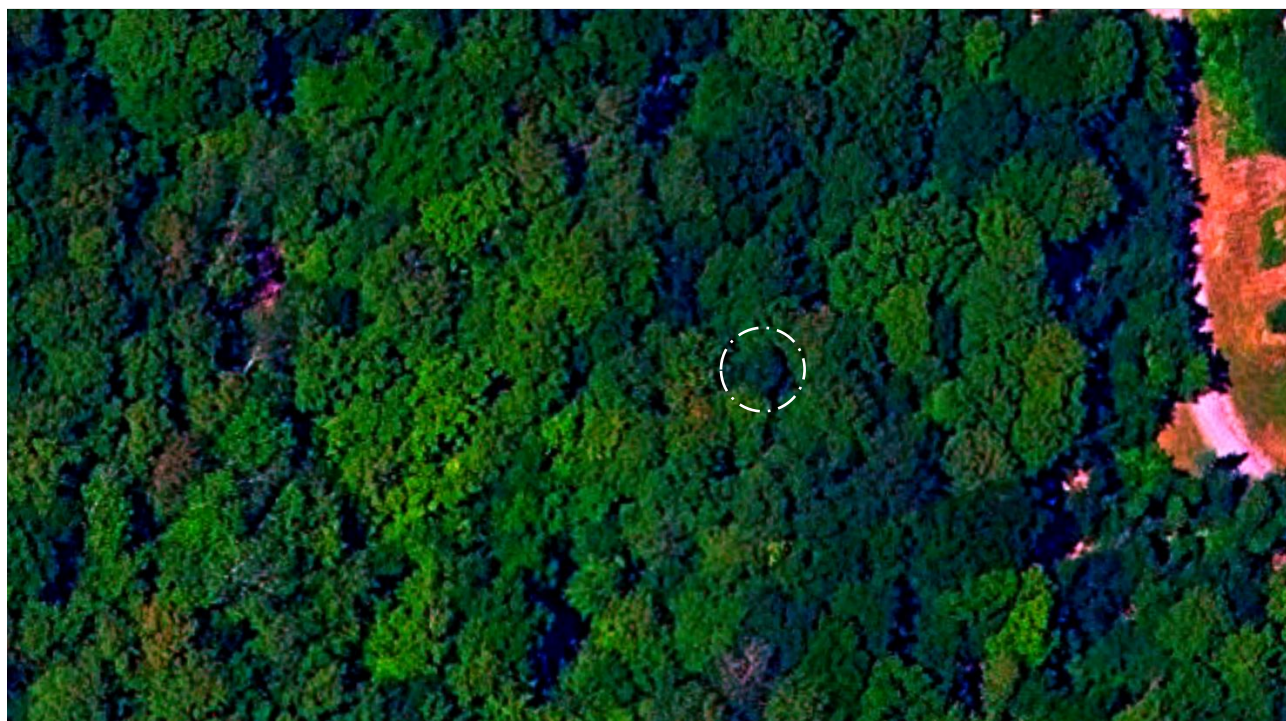


Figure 145. Eastern Hop-hornbeam (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)

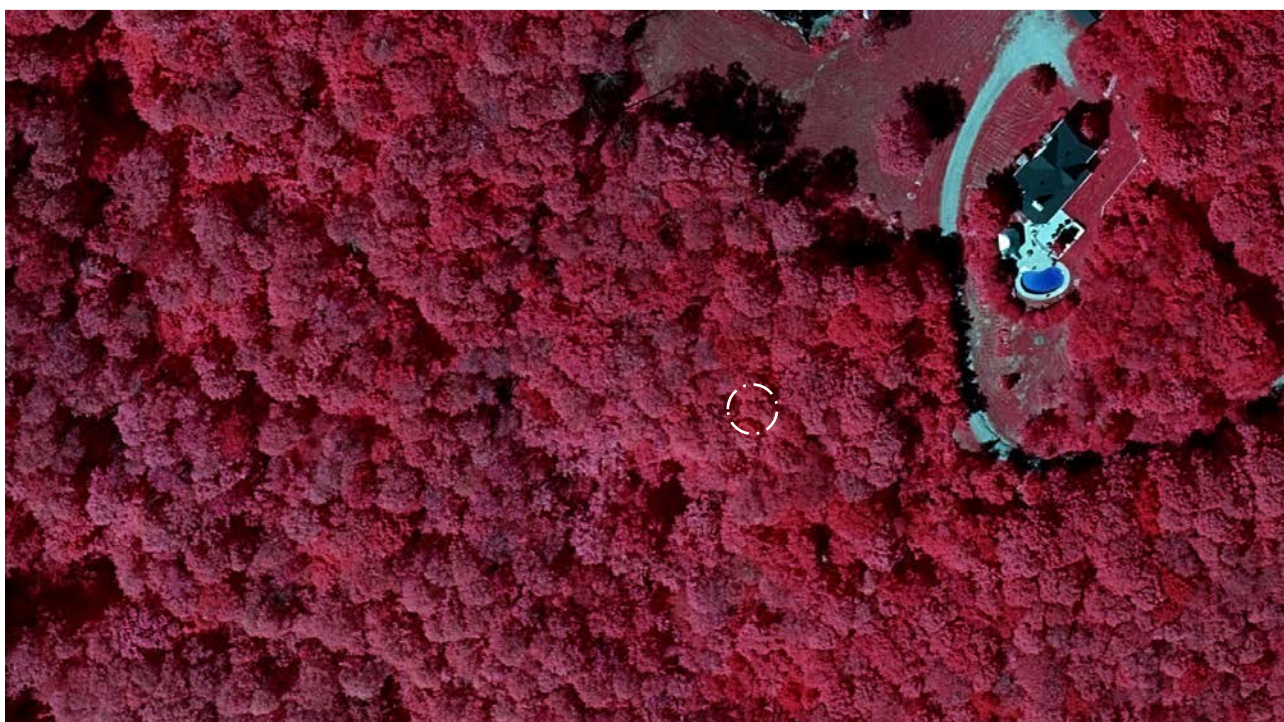


Figure 146. Eastern Hop-hornbeam (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)

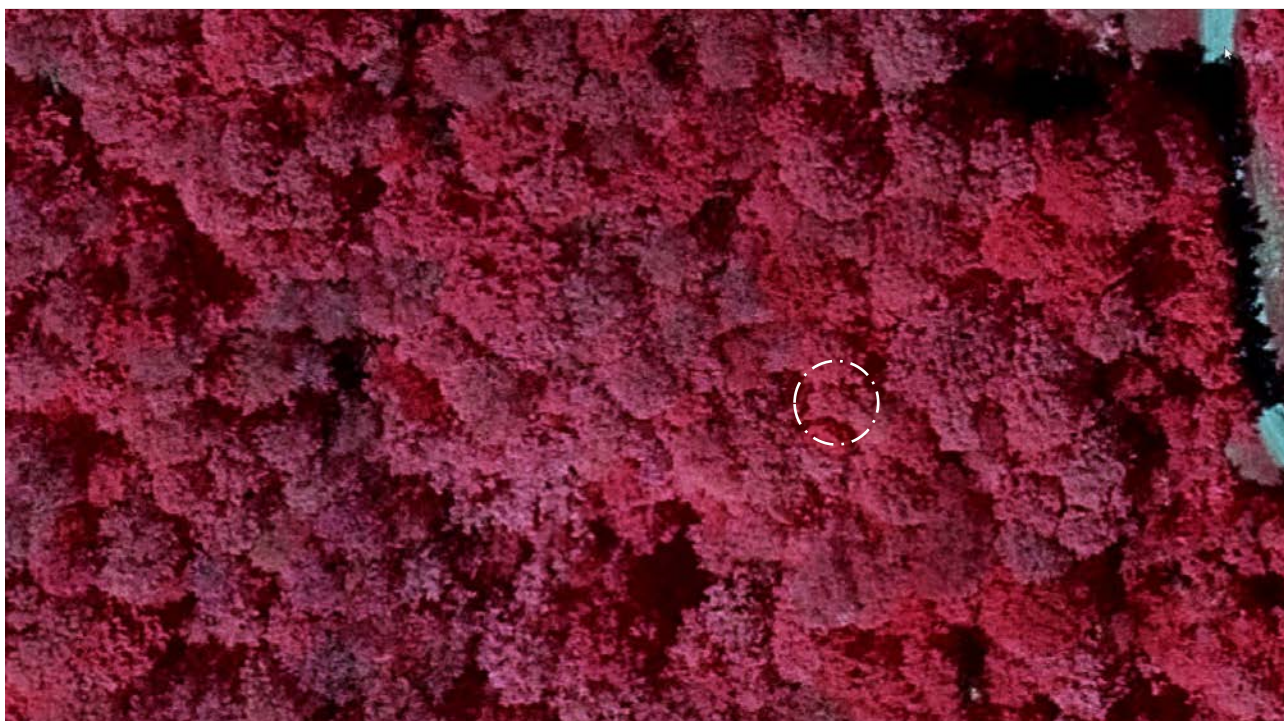


Figure 147. Eastern Hop-hornbeam (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)

Large-toothed Aspen

Populus grandidentata Michx.

Ecoforest criteria

Distribution

Large-toothed Aspen is found mainly in the Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) bioclimatic domains (figure 148).

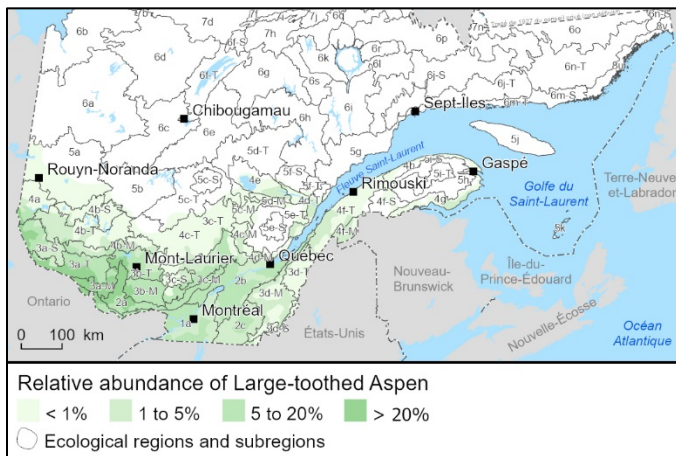


Figure 148. Relative abundance of Large-toothed Aspen

It is present sporadically in the Balsam Fir - Yellow Birch domain. Large-toothed Aspen stands grow throughout different slope positions. This aspen is almost never the dominant species in a stand.

Soil moisture regime

Large-toothed Aspen can be found in all types of soil moisture regime conditions except for very poor soil moisture regime (wet soils) (table 29).

Surficial deposits

The presence of Large-toothed Aspen is not associated with any specific surficial deposit or soil texture. However, it shows an affinity for soils with medium or fine textures that are richer in nutrients. It is unlikely to grow on organic deposits.

Table 29. Probable presence of Large-toothed Aspen depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain Basswood domain Yellow Birch domain	Yellow Birch domain Paper Birch domain	Feathermoss domain
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

■ Probable ■ Little or no probability

Crown identification criteria

Profile

The Large-toothed Aspen crown is taller than the crowns of other hardwoods in the stand (figure 149).



Figure 149. Large-toothed Aspen profile

Projection

From above, its crown is regular and fuzzy, and tends to be broader and sparser than the Trembling Aspen crown (figure 150).



Figure 150. Large-toothed Aspen projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs, Large-toothed Aspen appears brownish green to pale brown (figures 151 and 152).

On infrared (NIR) aerial photographs, it is a darker orangey pink than Trembling Aspen (figures 153 and 154).



Figure 151. Group of Large-toothed Aspen trees (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)



Figure 152. Group of Large-toothed Aspen trees (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)



Figure 153. Group of Large-toothed Aspen trees (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)

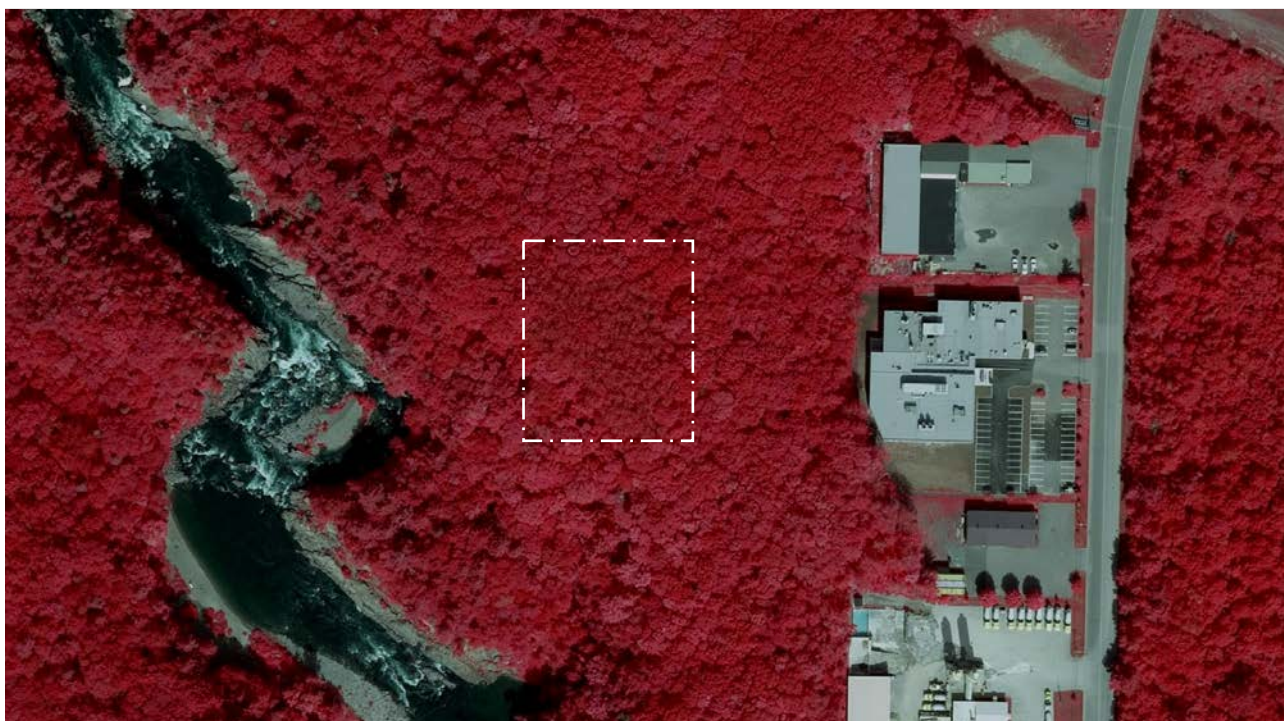


Figure 154. Group of Large-toothed Aspen trees (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)

Balsam Poplar

Populus balsamifera L.

Ecoforest criteria

Distribution

Balsam Poplar can be found in all the bioclimatic domains (figure 155). It grows on the lower portion of slopes and on plains that are rich in nutrients. It often grows along watercourses.

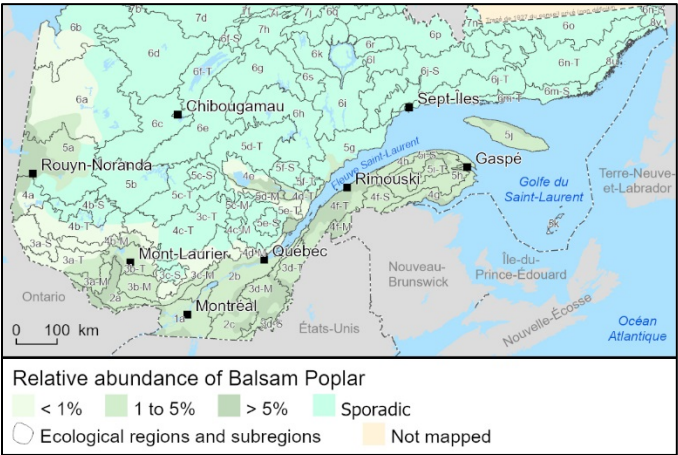


Figure 155. Relative abundance of Balsam Poplar

Soil moisture regime

Balsam Poplar grows on sites offering moderate soil moisture regime conditions (good, moderate, imperfect) (table 30).

Surficial deposits

The species adapts to all kinds of surficial deposits (although it is rarely found on organic deposits) and soil textures.

Table 30. Probable presence of Balsam Poplar depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain Basswood domain Yellow Birch domain Yellow Birch domain Paper Birch domain		Feathermoss domain
Dry (excessive/fast)			
Mesic(good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

Probable Little or no probability

Crown identification criteria

Profile

The Balsam Poplar crown is generally taller than other hardwood crowns in the stand. Its crown resembles the Trembling Aspen crown, but is narrower and more pointed (figure 156).



Figure 156. Balsam Poplar profile

Projection

The Balsam Poplar's crown surface is regular and fuzzy. Its texture is relatively compact for a poplar (figure 157).



Figure 157. Balsam Poplar projection (RGB)

Colour

Balsam Poplars have a light to dark brown to greenish brown colour on naturally coloured (RGB) aerial photographs. They are much darker than Trembling Aspen (figures 158 and 159).

On infrared (NIR) aerial photographs, Balsam Poplars range in colour from dark orange to brownish pink (figures 160 and 161).

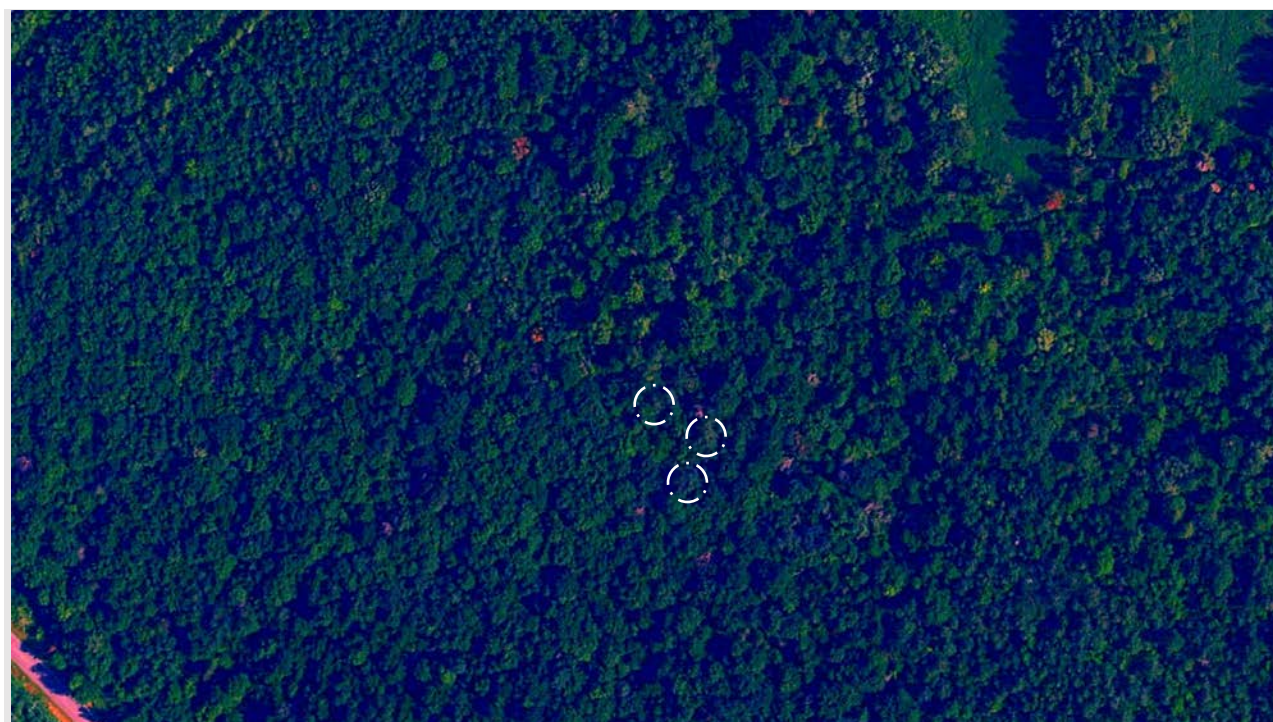


Figure 158. Examples of Balsam Poplars (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)



Figure 159. Examples of Balsam Poplars (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)



Figure 160. Examples of Balsam Poplars (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)

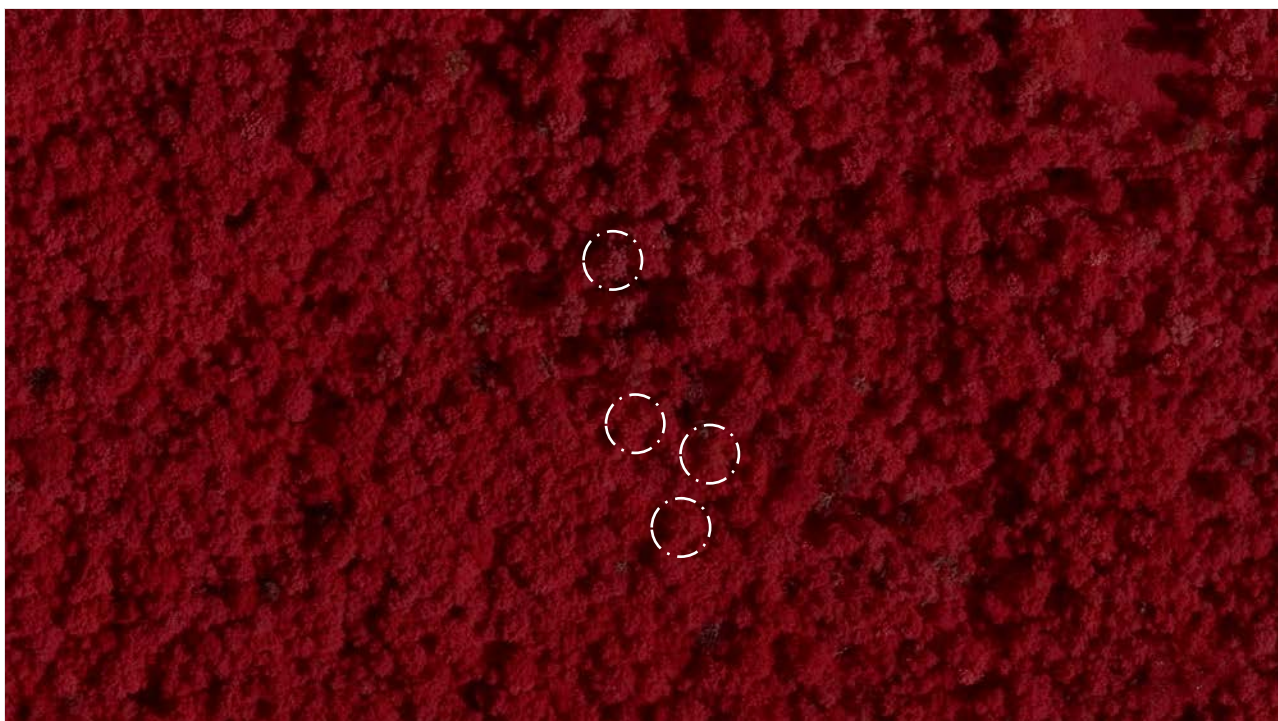


Figure 161. Examples of Balsam Poplars (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)

Eastern Cottonwood

Populus deltoides Bartr. Ex Marsh

Ecoforest criteria

Distribution

Eastern Cottonwood is mainly found in the Sugar Maple (Bitternut Hickory, Basswood and Yellow Birch) bioclimatic domains (figure 162). It is present only sporadically in the Balsam Fir - Yellow Birch domain.

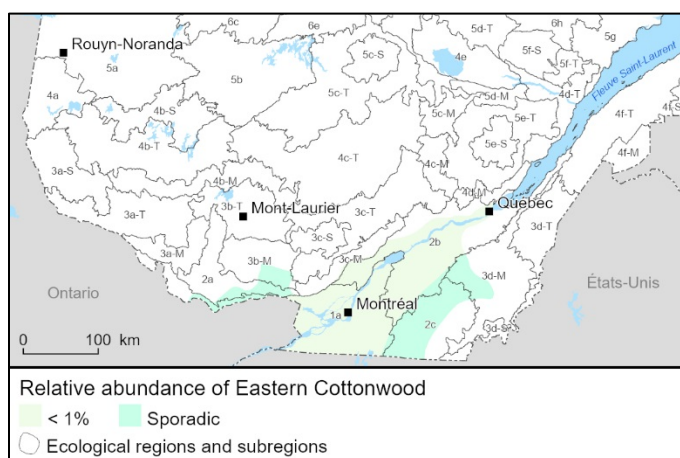


Figure 162. Relative abundance of Eastern Cottonwood

It is found on all slope positions, but has a special affinity for sites bordering watercourses. Eastern Cottonwood is rarely the dominant species in a stand.

Soil moisture regime

Paper Birch grows in all types of soil moisture regime conditions except for wet soils. It prefers sites with imperfect (moist) soil moisture regime (table 31).

Surficial deposits

Its presence is likely on all surficial deposits and soil textures, except organic deposits. Most often, it will be found in soils with moderate to fine texture that are richer in nutrients.

Table 31. Probable presence of Eastern Cottonwood depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain Basswood domain Yellow Birch domain	Yellow Birch domain Paper Birch domain	Feathermoss domain
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

 Probable  Little or no probability

Crown identification criteria

Profile

As in the case of other poplars, the Eastern Cottonwood crown can be recognized by its height, often taller than the crowns of other species in the stand. It has a small rounded crown (figure 163).



Figure 163. Eastern Cottonwood profile

Projection

Eastern Cottonwood branches are ascending and highly visible, resulting in an open and very sparse crown. The surface of its crown is irregular and fuzzy (figure 164).

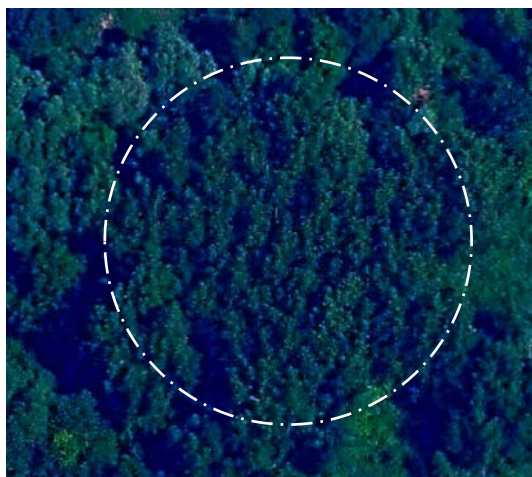


Figure 164. Eastern Cottonwood projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs, Eastern Cottonwoods appear dark green or greenish brown to pale brown (figures 165 and 166).

On infrared (NIR) aerial photographs, it appears rather beige (figures 167 and 168).



Figure 165. Examples of Eastern Cottonwood (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)



Figure 166. Examples of Eastern Cottonwood (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)

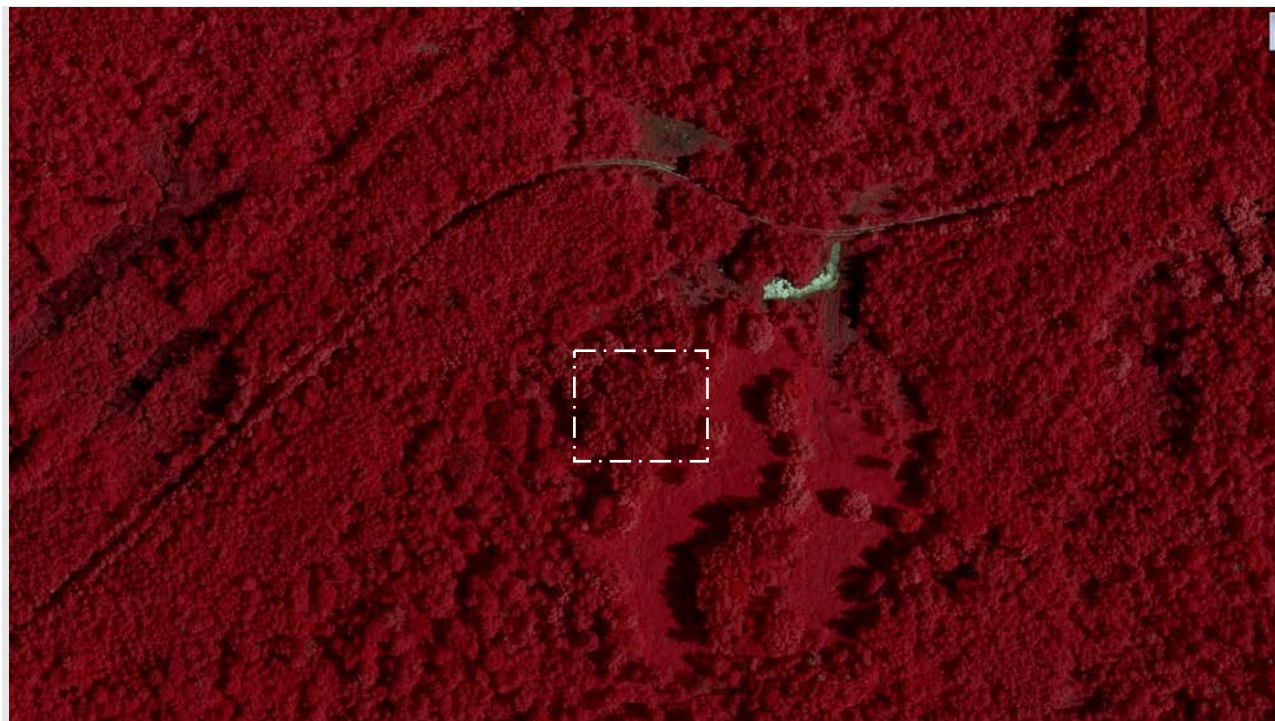


Figure 167. Examples of Eastern Cottonwood (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)

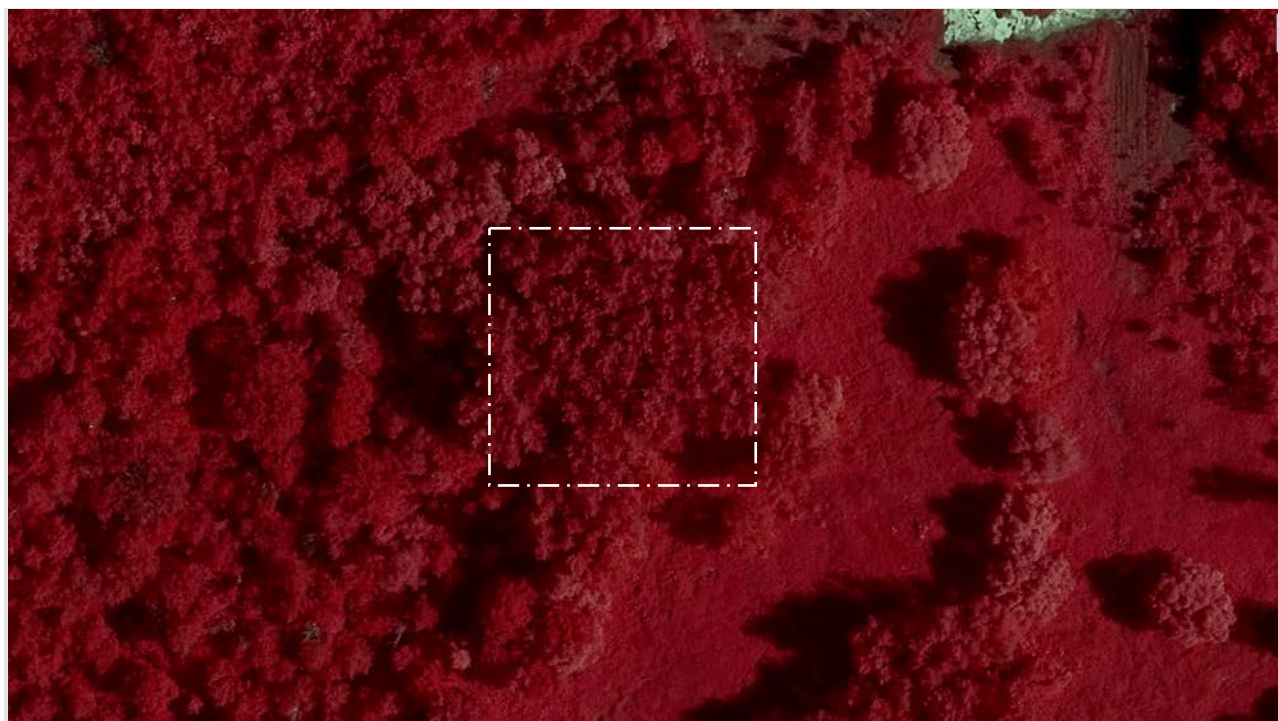


Figure 168. Examples of Eastern Cottonwood (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)

Trembling Aspen

Populus tremuloides Michx

Ecoforest criteria

Distribution

Trembling Aspen grows in all bioclimatic domains south of the forest tundra (figure 169).

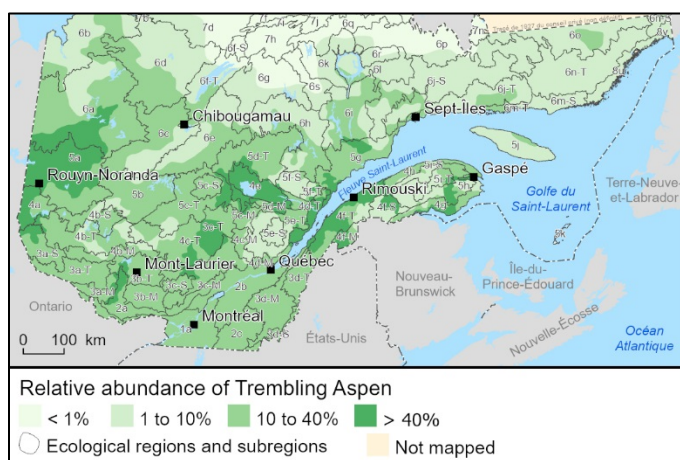


Figure 169. Relative abundance of Trembling Aspen

In the Black Spruce - lichen domain, Trembling Aspen occupies rich south-facing sites, while in the Black Spruce - feathermoss domain, it can be found on the upper portions of slopes on medium-sized hills or on rich sites.

In the bioclimatic domains south of the Black Spruce - feathermoss domain, Trembling Aspen grows across the entire topography, in all types of landscapes.

Soil moisture regime

All soil moisture regime conditions except for wet soils are suitable for Trembling Aspen (table 32).

Surficial deposits

Trembling Aspen can be observed on all kinds of surficial deposits (except organic deposits) and soil textures.

Table 32. Probable presence of Trembling Aspen depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain	Basswood domain	Yellow Birch domain
	Yellow Birch domain	Yellow Birch domain	Paper Birch domain
			Feathermoss domain
Dry (excessive/fast)			
Mesic(good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

 Probable  Little or no probability

Crown identification criteria

Profile

Due to its low shade tolerance, Trembling Aspen is very intolerant of competition from other trees around it. The Trembling Aspen crown therefore can be recognized by its height, generally taller than the crowns of other species in the stand. In addition, its silhouette may be shaped like an electric light bulb (figure 170).



Figure 170. Trembling Aspen profile

Projection

From above, the Trembling Aspen crown shows a regular and fuzzy surface. It has a smaller diameter than Maples and Yellow Birch. The crowns are detached from each other, so that it is almost possible to count each individual stem (figure 171).

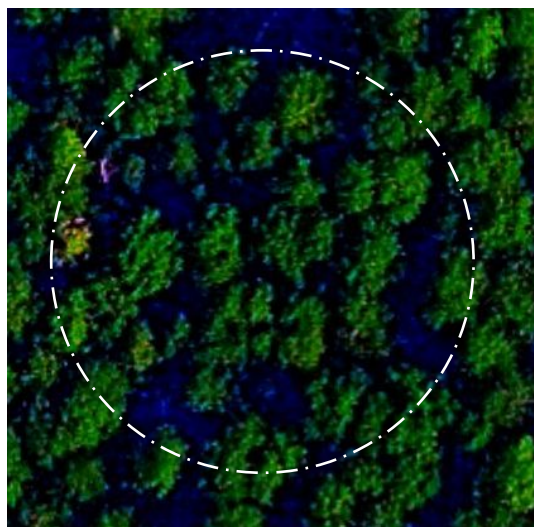


Figure 171. Trembling Aspen projection (RGB)

Colour

Trembling Aspen appears on naturally coloured (RGB) aerial photographs as bluish green (figures 172 and 173).

On infrared (NIR) aerial photographs, its colour is orangey pink (figures 174 and 175).



Figure 172. Stand of Trembling Aspen surrounded by Black Spruce trees (Enhanced RGB photography/Western Balsam Fir - Paper Birch subdomain)

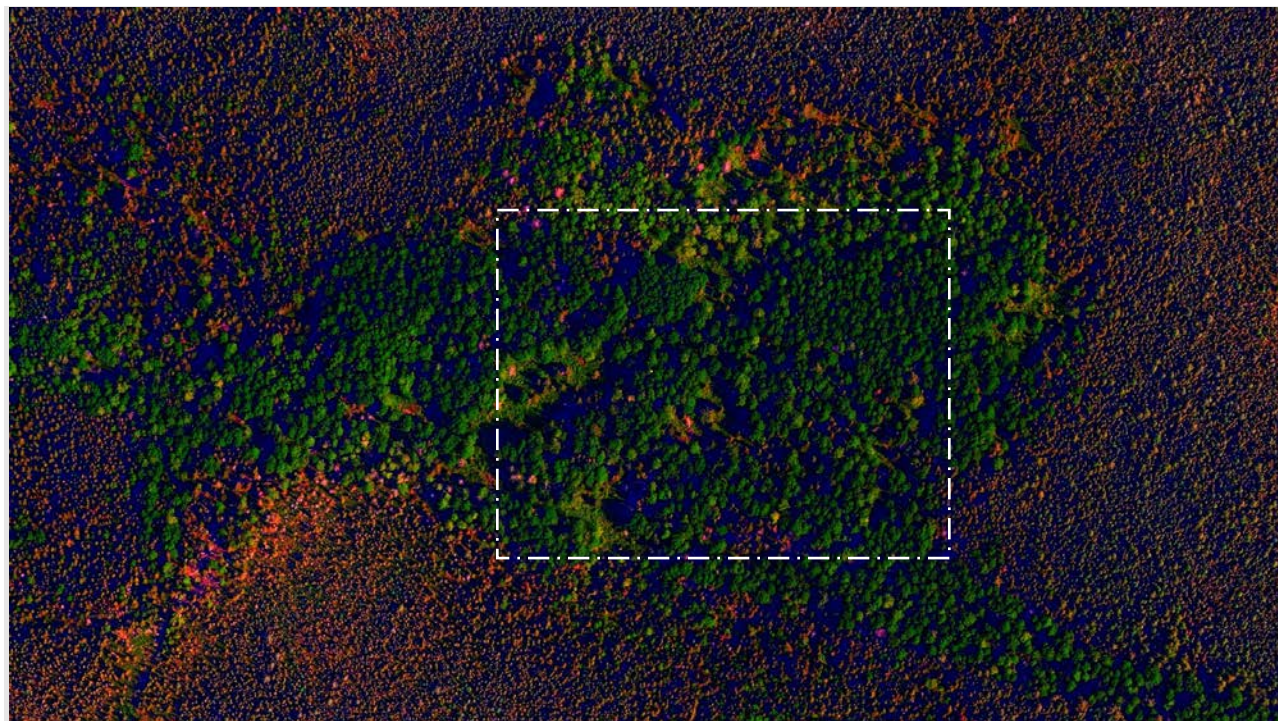


Figure 173. Stand of Trembling Aspen surrounded by Black Spruce trees. It is possible at this scale to recognize the absence of interlacing among Trembling Aspen stems. (Enhanced RGB photography/Western Balsam Fir - Paper Birch subdomain)



Figure 174. Stand of Trembling Aspen surrounded by Black Spruce trees (Enhanced NIR photograph/Western Balsam Fir - Paper Birch domain)

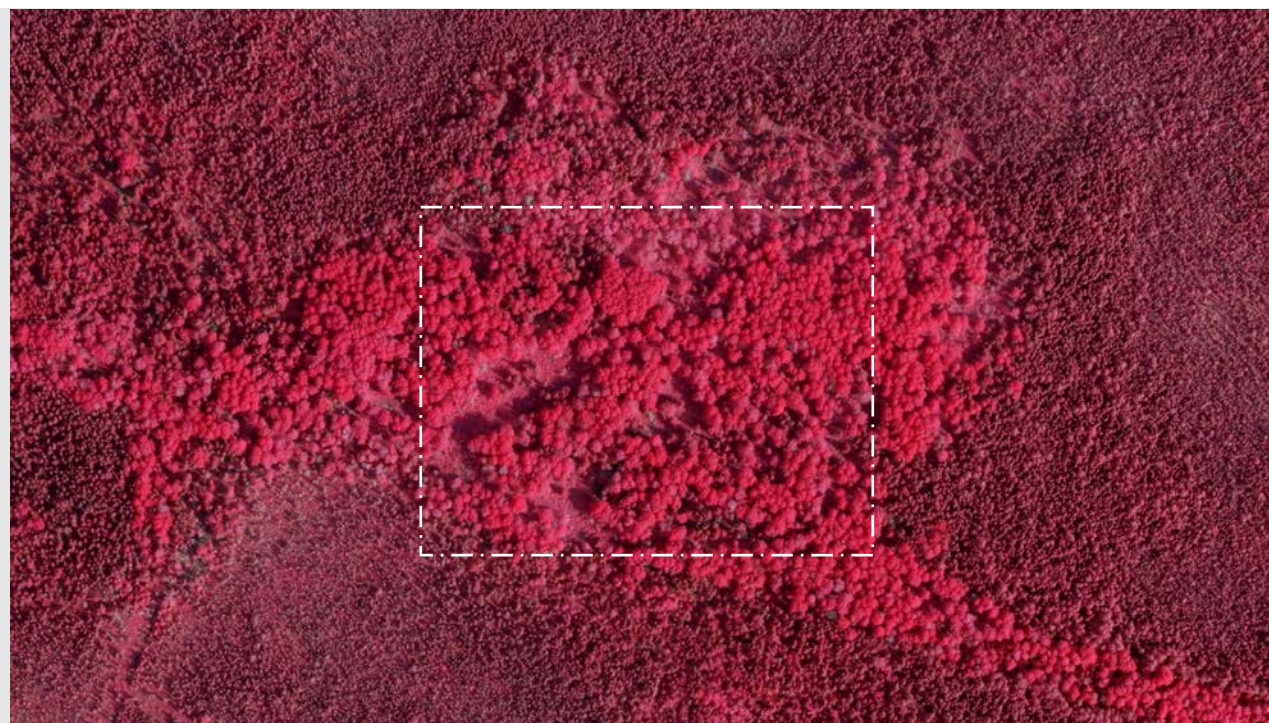


Figure 175. Stand of Trembling Aspen surrounded by Black Spruce trees. It is possible at this scale to recognize the absence of interlacing among Trembling Aspen stems. (Enhanced NIR photography/Western Balsam Fir - Paper Birch subdomain)

Basswood

Tilia americana L

Ecoforest criteria

Distribution

Basswood is a characteristic species of the Sugar Maple - Bitternut Hickory and Sugar Maple - Basswood bioclimatic domains (figure 176). It can also be found on protected sites in the Sugar Maple - Yellow Birch domain.

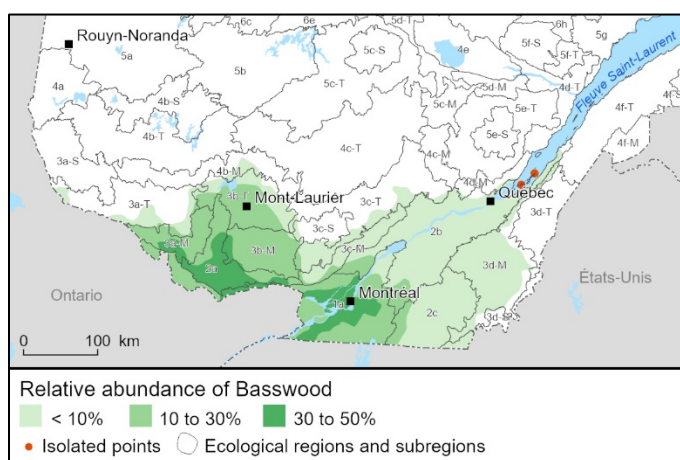


Figure 176. Relative abundance of Basswood

Basswood is almost never the dominant species in a stand. It can be found on every topographical position in the landscape.

In the Sugar Maple - Yellow Birch domain, its presence is limited to the middle and upper portions of slopes.

Soil moisture regime

Basswood grows on sites where the soil moisture regime varies from good to moderate (table 33).

Surficial deposits

This species is likely to be present on all kinds of surficial deposits and soil textures, except for organic deposits. It is more common on medium to fine textured soils that are richer in nutrients.

Table 33. Probable presence of Basswood depending on the bioclimatic domains and soil moisture regime synthesis

	Sugar Maple -	Balsam Fir -	Black Spruce -
	Bitternut Hickory domain	Basswood domain	Yellow Birch domain
	Yellow Birch domain	Paper Birch domain	Feathermoss domain
Dry (excessive/fast)			
Mesic (good/moderate)			
Moist (imperfect)			
Wet (poor/very poor)			

Probable Little or no probability

Crown identification criteria

Profile

The Basswood crown is distinguished by its half-egg shape, symmetrical and rounded at the top (figure 177).



Figure 177. Basswood profile

Projection

The texture of the Basswood crown is regular and fuzzy (figure 178). Its half-egg-shaped profile can give the impression of a conifer with very dense foliage.

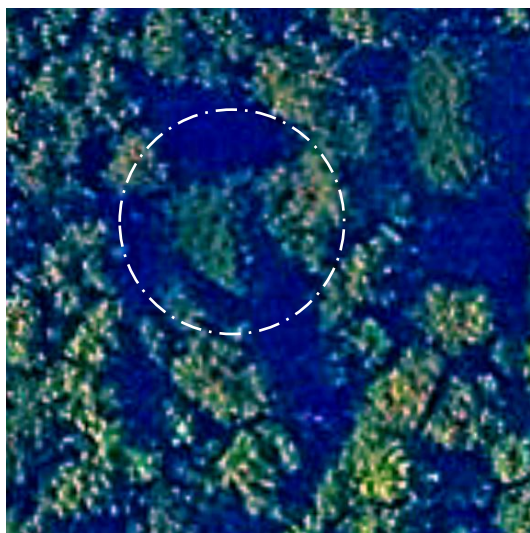


Figure 178. Basswood projection (RGB)

Colour

On naturally coloured (RGB) aerial photographs, Basswood appears dark green (sometime with a bluish tint) (figures 179 and 180).

On infrared (NIR) aerial photographs, it appears in dark orange (181 and 182).

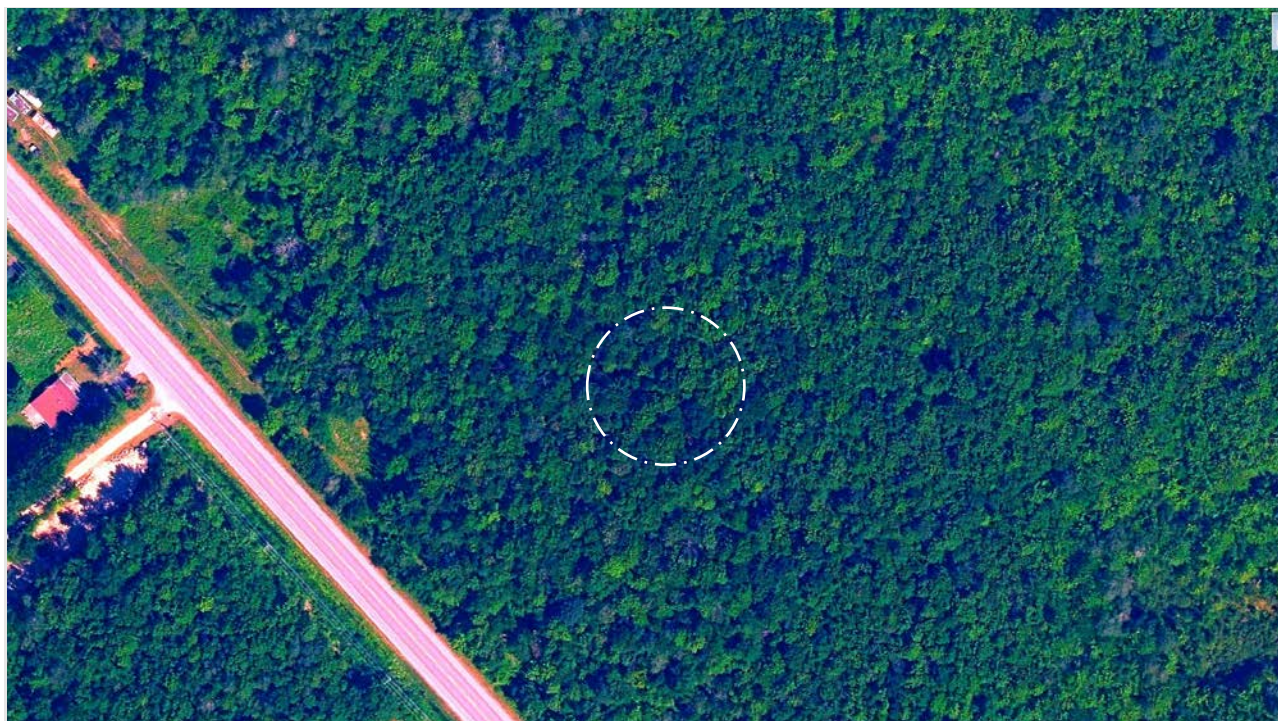


Figure 179. Basswood trees (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)



Figure 180. Basswood trees (Enhanced RGB photography/Sugar Maple - Bitternut Hickory domain)



Figure 181. Basswood trees (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)



Figure 182. Basswood trees (Enhanced NIR photography/Sugar Maple - Bitternut Hickory domain)

Section 4

RECAPITULATIVE TABLES

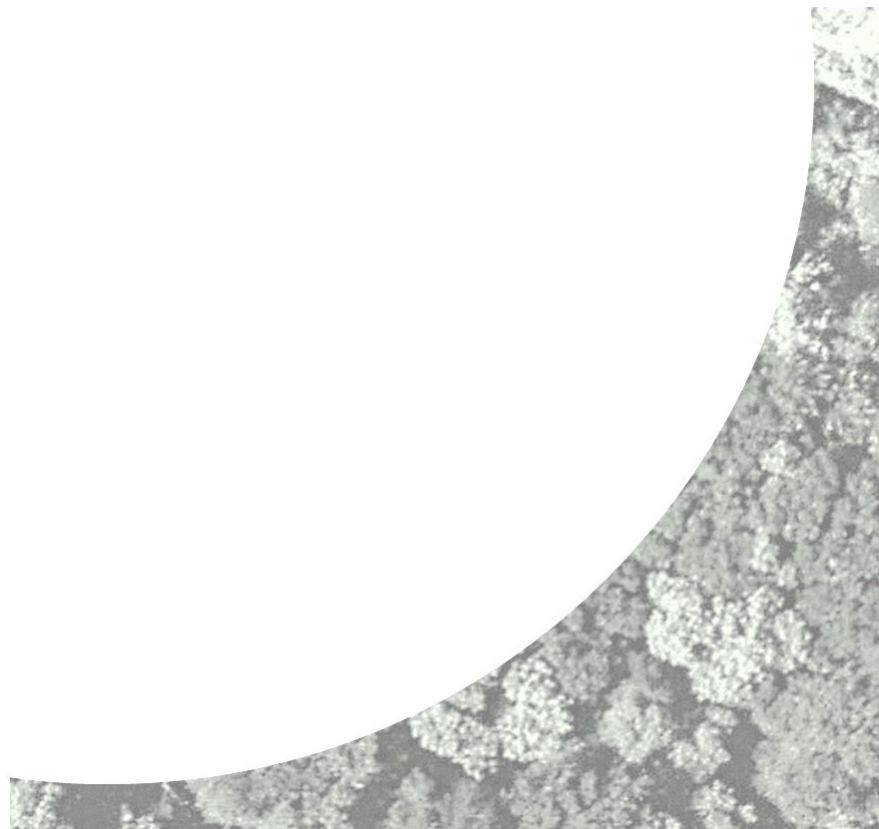


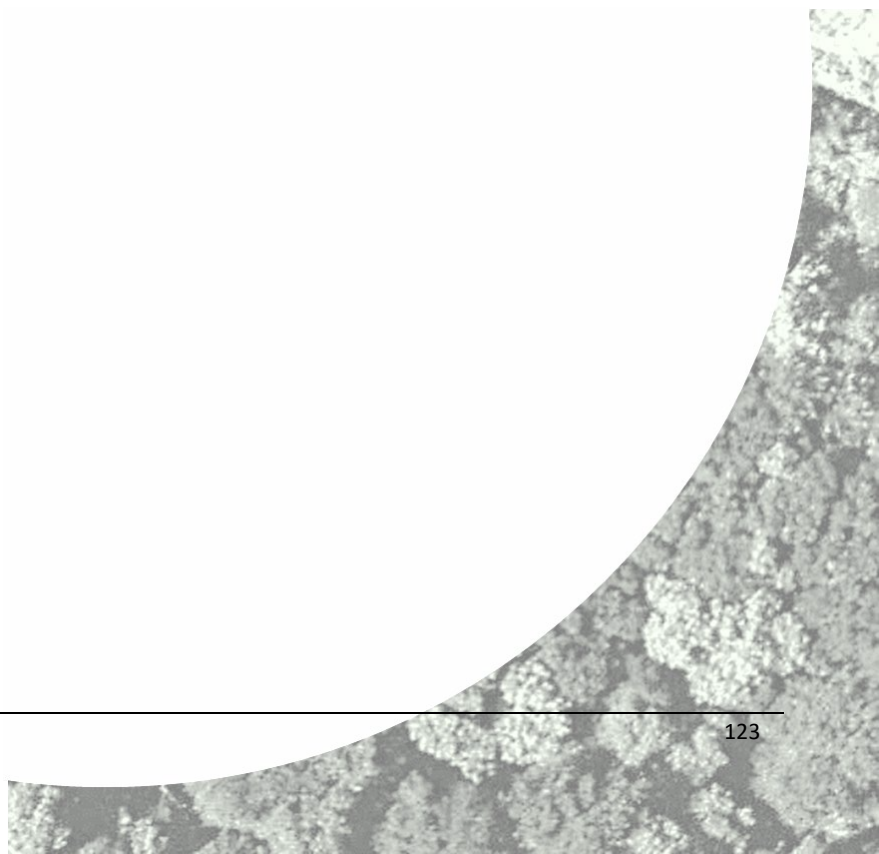
Table 34. Synthesis of the differentiation criteria of **softwood species**

SPECIES	BIOCLIMATIC DOMAINS	SHAPE AND TEXTURE	COLOUR (RGB)	COLOUR (NIR)	PAGE
White Spruce	1 to 5	Large conical crown, wide top, slightly perceptible branches	Pale brown, yellowish brown and yellowish green, a little darker than Black Spruce	Brown, pinkish brown, a little darker than Black Spruce	p. 9
Black Spruce	1 to 6	Linear and tubular crown, much narrower than the White Spruce crown	Dark green with a touch of yellow (more yellowish than White Spruce)	Dark grey (ash grey) to turquoise (pale), ashier grey than White Spruce	p. 13
Red Spruce	1 to 4	The star-shaped crown is the differentiation criterion compared to White Spruce.	Pale brown, yellowish brown and yellowish green (similar to White Spruce)	Same colour as White Spruce	p. 17
Tamarack	1 to 6	Slightly star-shaped projection, fuzzy and bright crown	Pale greenish grey, greyer and paler than the other softwoods	Pinker and paler than the other softwoods	p. 21
Eastern White Pine	1 to 4	Much wider and taller crown than other pines, more star-shaped crown than other pines	More greenish grey (dull) than Jack Pine and Red Pine	Greyer (duller) and lighter than Jack Pine and Red Pine	p. 25
Jack Pine	4 to 6	Perceptible branches, fuzzier crown than Red Pine, shorter and narrower crown than Red Pine	Brownish to pinkish brown, paler than Red Pine	Paler than Red Pine	p. 29
Red Pine	1 to 4	Taller and wider crown than Jack Pine, shorter and narrower crown than Eastern White Pine	Redder and darker than the other pines	More reddish brown than the other pines	p. 33
Eastern Hemlock	1 to 3	The discriminating criterion compared to hardwoods is the more compact texture of the crown and its more conical shape.	Yellower and lighter than the other softwoods	Yellower and lighter than the other softwoods	p. 37
Balsam Fir	1 to 6	Perfectly conical crown with a very narrow top, which generally has a white point	Bluer or greener than spruce species	More brownish and pinkish than White Spruce	p. 41
Eastern White Cedar	1 to 4	The discriminating criterion compared to the other softwoods is the narrower shape of the cone and its vaporous (fuzzy) appearance.	Similar to Jack Pine and Red Pine but redder than them	Similar to Jack Pine and Red Pine but more turquoise than them	p. 45

Table 35. Synthesis of the differentiation criteria of **hardwood species**

SPECIES	BIOCLIMATIC DOMAINS	SHAPE AND TEXTURE	COLOUR (RGB)	COLOUR (NIR)	PAGE
Paper Birch	1 to 6	Fuzzier and flatter crown than Yellow Birch, crowns more intermingled than Yellow Birch crowns	Darker green than Maples but lighter than Yellow Birch	Darker pink than Maples but lighter than Yellow Birch	p. 53
Grey Birch		Shorter than other softwoods with a narrower crown, but its colour remains the main discriminating factor	Much yellower than the other hardwoods	Brownish grey	p. 57
Yellow Birch	1 to 4	Oval shape, more upwardly extending and narrower than the Sugar Maple crown, fuzzier crown than the Sugar Maple and Red Maple crowns	Darker green than Maples	Darker pink than Maples	p. 61
Hickory	1	The Hickory crown is very narrow, irregular and flat. They are the same height or shorter than the rest of the stand.	Rather fluorescent green colour	Rather salmon beige colour	p. 65
Northern Red Oak	1 to 3	Taller and wider crown, shaped like a flat semi-circle	More brownish green than maples, birches and poplars, less yellow and darker than Beech	More brownish pink than maples, birches and poplars, darker than Beech	p. 69
Sugar Maple	1 to 4	The most compact hardwood, with a shape comparable to broccoli	Apple green, lighter than Yellow Birch but darker than Red Maple	Lighter pink than Yellow Birch but darker than Red Maple	p. 73
Red Maple	1 to 4	Slenderer and narrower crown than Sugar Maple, airier, less dense, less compact texture, perceptible ascending branches	Lighter green than Sugar Maple and lighter than Yellow Birch	Lighter pink than Sugar Maple and lighter than Yellow Birch	p. 77
Ash	1 to 3	The ash crown has a medium diameter. The shape looks like a slender flame, often fuzzy. Black Ash crowns are usually airier than those of other Ashes.	Northern Red Ash: light brownish green White Ash: light greyish green to greyish yellow Black Ash: very light green to yellow	Northern Red Ash: greyish orange White Ash: salmon beige Black Ash: pink	p. 81
American Beech	1 to 3	Irregular and less rounded crown than the other hardwoods, fuzzier crown than maples and birches	More brownish green than maples, birches and poplars, yellower and lighter than Northern Red Oak	More brownish pink than maples, birches and poplars, lighter than Northern Red Oak	p. 85

SPECIES	BIOCLIMATIC DOMAINS	SHAPE AND TEXTURE	COLOUR (RGB)	COLOUR (NIR)	PAGE
White Elm	1 to 3	The White Elm crown takes on a narrow parabolic shape on an aerial photograph. The texture is regular and clean-cut.	Dark green	Orangey red	p. 89
Eastern Hop-hornbeam	1 to 3	Fuzzy crown with small diameter	Dark green with tinges of blue	-	p. 93
Large-toothed Aspen	1 to 3	Generally taller than the other hardwoods in the stand; its crown is wide and sparser than the Trembling Aspen crown	Brownish green to pale brown	Darker orangey pink than Trembling Aspen	p. 97
Balsam Poplar	1 to 6	The Balsam Poplar crown is shaped like a flat semicircle. It is compact and fuzzy with a texture of bumps and hollows (pitted appearance).	Dark brown to greenish brown	Dark pink to dark orange	p. 101
Eastern Cottonwood	1 to 3	Very open crown with little density, highly visible ascending branches	Greenish brown	Rather beige	p. 105
Trembling Aspen	1 to 6	Taller crown than the other species in the stand, globular crown (like an electric light bulb)	Bluer green than maples and birches	More orangey pink than maples and birches	p. 109
Basswood	1 and 2	The Basswood crown can be recognized by its half-egg shape; its texture is regular and fuzzy	Dark green	Dark orange	p. 113





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