

Climate Change Adaptation Plan

Paul Smiths College Woodlands, Creighton Compartment

March 7, 2017

Prepared by David Falkenham

Prepared using the Adaptation Workbook - AdaptationWorkbook.org



Property details

Acres: 800

Ownership: Private Non-Industrial

The Creighton Compartment is one compartment within the 12,000 acre Paul Smiths College ownership. The property currently has an outdated management plan, and a new one is being written for the whole property using the adaptation workbook as a guide. The property will be inventoried compartment by compartment for 15 years. The inventory will be performed by the Paul Smiths College senior silviculture class. The class will provide maps and stand data and climate change considerations. Silvicultural recommendations will also be given. This information will be compiled and revised by the forest manager to meet the forest stewardship goals of the college and silvicultural recommendations will be administered using a combination of commercial timber sales, curriculum timber sales and the Paul Smiths College logger training school.

Climate Adaptation Plan	Paul Smiths College Woodlands, Creighton Compartment
Project Details	<p>800 acres</p> <p>Private Non-Industrial ownership</p> <p>The Creighton Compartment is one compartment within the 12,000 acre Paul Smiths College ownership. The property currently has an outdated management plan, and a new one is being written for the whole property using the adaptation workbook as a guide. The property will be inventoried compartment by compartment for 15 years. The inventory will be performed by the Paul Smiths College senior silviculture class. The class will provide maps and stand data and climate change considerations. Silvicultural recommendations will also be given. This information will be compiled and revised by the forest manager to meet the forest stewardship goals of the college and silvicultural recommendations will be administered using a combination of commercial timber sales, curriculum timber sales and the Paul Smiths College logger training school.</p>
Management area(s)	<p>Northern hardwood</p> <p>Lowland and riparian forest</p> <p>Low-elevation spruce-fir</p> <p>Lowland mixed conifer</p> <p>Transition hardwood</p>
Regional Climate Change Impacts & Property-Level Considerations	<p>The following climate change impacts are regional expectations drawn from published resources. Under each regional climate change impact statement, property-level considerations describe how the general trend might be meaningful at the scale of the property.</p> <p>Temperatures in New England are projected to increase 3.5 to 8.5 °F by the end of the century, with the greatest warming expected to occur during winter.</p> <p>Property considerations: These first three facts will have a huge impact on forest management operations (among many other things). My overall hope with the property is to use group selection/patch clearcut harvesting to maximize plant species diversity. This is one thing that i have some level of control over. However mild winters may become a deterrent to winter harvesting which will impact marketing, land ownership economics and the ability to elicit some control over species diversity on the landscape.</p> <p>The growing season in New England and northern New York is generally expected to increase by 20 days or more by the end of the century, due to fewer days with a minimum temperatures below 32°F.</p> <p>The winter season will be shorter and milder across New England and northern New York, with less precipitation falling as snow and reduced snow cover and depth.</p> <p>Precipitation patterns will be altered, with projected increases in annual precipitation and potential for reduced growing season precipitation in New England and northern New York.</p> <p>Property considerations: Altered precipitation will have a dramatic affect on management activities that strive to increase plant diversity through logging. Summer logging operations have already experienced intense rainfall that shortens logging activity. on the other hand dramatic dry spells may increase the logging season but decrease plant/tree germination and growth rates thus diminishing the positive impacts of harvesting operations. On the other end, winters of high snowfall and warm temperatures will insulate the ground and decrease freezing potential for winter harvesting operations.</p> <p>Intense precipitation events will continue to become more frequent in New England and northern New York.</p> <p>Warmer temperatures and altered precipitation in New England and northern New York will interact to change soil moisture patterns throughout the year, with the potential for both wetter and drier conditions depending on the location and season.</p>

Forest vegetation in New England and northern New York may face increased risk of moisture deficit and drought during the growing season.

Many invasive plants will increase in extent or abundance in New England and northern New York.

Property considerations: This will make partial and single tree removal operations difficult as many invasive plants are extremely shade tolerant.

Many northern and boreal tree species will face increasing stress across much of New England and northern New York.

Shifts in forest composition in New England and northern New York will take at least several decades to occur in the absence of major disturbance.

Property considerations: Will timber harvesting actually increase the rate of forest composition changes???

Conditions affecting tree regeneration and recruitment will change in New England and northern New York.

Property considerations: This may negate some of the positive effects of active forest management.

Forest productivity in New England and northern New York will increase during the next several decades in the absence of significant stressors.

Property considerations: growth rates may increase thus lowering rotation ages of certain timber species.

Low-diversity systems are at greater risk from climate change.

Property considerations: All forest management activities need to strive to maximize plant/tree diversity.

Systems that are limited to particular environments will have less opportunity to migrate in response to climate change.

Systems that are more tolerant of disturbance have less risk of declining on the landscape

Climate Adaptation Plan for Individual Management areas

The following plan details the management goals and objectives for a particular component of the project. Included below is a detailed review of potential climate impacts and site level considerations, along with an evaluation of objectives, potential adaptation responses (tactics) and monitoring variables to assess success over time.

<p>Plan for specific Management area</p>	<p>Northern hardwood</p> <p>Northern hardwood forests are widely distributed over a variety of sites with dry-mesic to wet-mesic conditions and nutrient-poor to rich soils. This forest type is generally found at low to moderate elevations. Species that are commonly dominant include sugar maple, yellow birch, American beech, eastern hemlock, and red spruce.</p>
<p>Management Goal</p> <p>Management Objective(s)</p>	<p>The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.</p> <p>Maintain, enhance and expand maple syrup production on the property as an educational resource and employment training for the maple production industry <i>(5 years)</i></p> <p>Inventory all compartments over a 15-year period using senior silviculture classes. <i>(15 years)</i></p> <p>Use paid student marking crews to accomplish production marking. <i>(15 years)</i></p> <p>Involve all natural resource classes with integrated learning associated with active timber harvesting. <i>(15 years)</i></p>
<p>Management Goal</p> <p>Management Objective(s)</p>	<p>Desired broad forest condition is uneven aged, using mostly disturbance style forestry such as group selection (0-2 acre clearcuts), patch clearcuts (2-5 acre clearcuts) and larger block clearcuts (up to 25 acres) and overstory removals where desired regeneration is established.</p> <p>Diversify age and size structure of current forest condition. <i>(15 years)</i></p> <p>Diversify plant and animal species composition on the property <i>(15 years)</i></p> <p>Improve wildlife habitat specifically nesting and brooding habitat for migrant songbirds and ruffed grouse</p>
<p>Potential identified impacts for Northern hardwood</p>	<p>Several dominant tree species are at risk of declining by the end of the century, including red spruce and balsam fir.</p> <p>Property considerations: Sugar Maple vigor may decrease, reducing sawlog quality and possibly sap and syrup production. Markets for products for declining species need to be flexible and managing forests for maximum natural diversity will help buffer potential revenue and ecological losses</p> <p>Some tree species may be more likely to persist or increase through the end of the century , such as red maple.</p> <p>Property considerations: Currently the Paul Smiths Property and the northern adirondacks grows surprisingly nice black cherry. This species may actually increase over time which will open timber marketing options in this area. Opportunities to regenerate cherry should be taken at all times.</p> <p>Northern hardwood forests are widely distributed across a variety of sites, increasing adaptive capacity.</p> <p>High levels of diversity may increase the ability of forests to adapt to climate change.</p> <p>Property considerations: This (among other things), solidifies the strategy to use group selection and patch clearcuts during forest operations to maximize species and age class diversity across the landscape. Individual tree removals limit sunlight and often limit forest diversity.</p>

	<p>Insect pests and forest diseases could become more problematic in northern hardwood forests under a warmer climate.</p> <p>Invasive species such as buckthorn, honeysuckle, and garlic mustard are expected to become more problematic under climate change.</p> <p>Changes in herbivore populations may also have substantial effects on forest growth and composition in northern hardwood forests.</p> <p>Property considerations: Deer over-browsing is likely to increase, with warmer winters. This could have the largest impact on our ability to regenerate diverse forests with timber harvesting operations.</p>
Potential impact of climate change on health and function of system	Disruptive
Adaptive Capacity of system to climate change impacts or disturbances	Moderate-High
Vulnerability determination	Moderate

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

Management Goal	The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.
Management Objective	Maintain, enhance and expand maple syrup production on the property as an educational resource and employment training for the maple production industry (<i>5 years</i>)
Challenges	Abundance of Sugar Maple may decline in the future. This loss of the resource may limit sap yields or it simple may cause more tapping in red maple stands, a species that is currently on the increase. Also fluctuations in winter and spring temperatures may cause unexpected early sap runs and earlier than normal end of season. Sugar makers will have to be ready to collect sap starting in February and finish as early as March. The Paul Smiths sugar bush will likely have to be tapped and ready by February. Since much of this is done with student help it will be challenging to get going immediately after they get back from Christmas Break. This could also shift coursework emphasis on tapping to much earlier in the spring semester than has traditionally been done.
Opportunities	This issue brings the potential for the Paul Smiths sugar bush to be a research site for climate change studies in maple production with Cornell University. An early season is not a bad thing. We may wrap up production early and focus on other things in the later spring. This will require a schedule shift in the curriculum and being ready to tap as soon as students get back from Christmas Break.
Feasibility of meeting	High

objectives after evaluation of climate impacts on system	Comments: This objective is quite feasible and will hopefully require a simple shift in scheduling of tree tapping. it may also open some doors for collaborative work in maple research.
Other Considerations	Comments: Our sugar bush is currently under a large upgrade to the tubing system that will take a few years. for that reason our normal seasonal priorities will be upgrades and expansion first, followed by tapping a and production second. This will have to change, and possibly reverse the order so that tapping can get done sooner.

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Management Goal	The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.
Management Objective	Inventory all compartments over a 15-year period using senior silviculture classes. <i>(15 years)</i>
Challenges	There should be no climate change related challenges in achieving this objective.
Opportunities	This will give an opportunity to involve students in thinking about climate change adaptation in land management scenarios.
Feasibility of meeting objectives after evaluation of climate impacts on system	High Comments: This objective has a high feasibility.
Other Considerations	Comments: the challenges for this objective will be mostly institutional. Right now the senior silviculture students are inventorying the compartments on a schedule and writing portions of the management plans as part of their final project in Advanced silviculture. If new faculty teaching this class don't want to do this than this project will have a hard time going anywhere, ie, the faculty that teach advanced silviculture must be 100% on board with this objective.

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	
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	<p>Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.</p> <p>Strategy Reduce the risk and long-term impacts of severe disturbances</p> <p>Approach Alter forest structure to reduce severity or extent of wind and ice damage</p> <p>Benefits of this tactic This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.</p> <p>Drawbacks and barriers of this tactic The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. it would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.</p> <p>Timeframe to implement 15 years</p> <p>Practicability <i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i></p> <p>... practicability of tactic? High</p> <p>Recommendation for implementation <i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i></p> <p>... recommend tactic? Yes</p>
<p>Adaptation Tactic</p> <p>Strategy</p> <p>Approach</p>	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p> <p>Maintain and enhance species and structural diversity</p> <p>Promote diverse age classes</p> <p>Benefits include: greater species diversity, greater diversity of age structure, improved</p>

Benefits of this tactic	wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

Monitoring variables used to evaluate if tactic is achieving desired management objective(s)	Create a CFI plot monitoring system that measures growth and regeneration on a 5 year rotation throughout the property. This is a bit of a dream for the faculty at PSC, but the information would be extremely valuable.
Monitoring Variable 1	
Threshold or Criteria for Evaluation of adaptation tactic	No real criteria, just a good way to keep track of growth on the property to see if climate change is having an impact on growth over time.
Implementing monitoring efforts (frequency, time of year, etc)	This would be performed by student summer crews annually on 5 year rotations

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Management Goal	The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.
Management Objective	Use paid student marking crews to accomplish production marking. <i>(15 years)</i>
Challenges	The only challenges to this objective will be institutional
Opportunities	There is a great opportunity here to involve students with climate change adaptation. Most of the timber sales they mark will be geared towards regenerating diverse stands as a buffer against climate change, and they have an opportunity to be involved in this.
Feasibility of meeting objectives after evaluation of climate impacts on system	High Comments: This objective has a high feasibility
Other Considerations	Comments: Roadblocks will be entirely institutional. if the Administration is not 100% in favor of using student workers for this task, many of the management plan objectives will be at risk.

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.
Strategy	Reduce the risk and long-term impacts of severe disturbances
Approach	Alter forest structure to reduce severity or extent of wind and ice damage
Benefits of this tactic	This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.
Drawbacks and barriers of this tactic	The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. it would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.
Timeframe to implement	15 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	High
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	

	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p>
Strategy	Maintain and enhance species and structural diversity
Approach	Promote diverse age classes
Benefits of this tactic	Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
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Management Goal	The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.
Management Objective	Involve all natural resource classes with integrated learning associated with active timber harvesting. <i>(15 years)</i>
Challenges	none known
Opportunities	Another great way to involve students in climate change adaptation planning.
Feasibility of meeting objectives after evaluation of climate impacts on system	High Comments: A very feasible objective.
Other Considerations	Comments: Even the institution won't get in the way of this one!

Responding to climate change impacts

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Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	
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	<p>Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.</p>
Strategy	<p>Reduce the risk and long-term impacts of severe disturbances</p>
Approach	<p>Alter forest structure to reduce severity or extent of wind and ice damage</p>
Benefits of this tactic	<p>This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.</p>
Drawbacks and barriers of this tactic	<p>The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. It would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.</p>
Timeframe to implement	<p>15 years</p>
Practicability	<p><i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i></p>
... practicability of tactic?	<p>High</p>
Recommendation for implementation	<p><i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i></p>
... recommend tactic?	<p>Yes</p>
Adaptation Tactic	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p>
Strategy	<p>Maintain and enhance species and structural diversity</p>
Approach	<p>Promote diverse age classes</p> <p>Benefits include: greater species diversity, greater diversity of age structure, improved</p>

Benefits of this tactic	wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
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Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 1</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Species diversity of regeneration 5 and 10 years post harvest</p> <p>Rather than a threshold for evaluations, this would be more of a simple monitoring tool to see how our management is working not necessarily to see if it is working. Just a tally of what species are coming into the harvest area and possibly an early detection system for new arrivals</p> <p>This would be done by students, either paid student crews or by mensuration labs. It may also be incorporated into a capstone senior project..</p>
<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 2</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Improve habitat for migrant songbirds and create conditions conducive to new arrivals. Songbirds are extremely sensitive to rapid habitat changes (good and bad) and should be a good indicator of the species richness of an area 1-10 years post harvest. Songbirds are also sensitive to climate change and this may offer opportunities for early detection of new arrivals or possibly losses of boreal species. This work can include grouse drumming surveys as well simply to see if habitat work is successful in the harvest areas.</p> <p>increases or decreases of baseline species richness of songbird species. Essentially a simple count.</p> <p>This would be done by wildlife students and ornithology classes on an annual basis if possible.</p>
<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 3</p> <p>Threshold or Criteria for Evaluation of adaptation</p>	<p>Create a CFI plot monitoring system that measures growth and regeneration on a 5 year rotation throughout the property. This is a bit of a dream for the faculty at PSC, but the information would be extremely valuable.</p> <p>No real criteria, just a good way to keep track of growth on the property to see if climate change is having an impact on growth over time.</p>

tactic	
Implementing monitoring efforts (frequency, time of year, etc)	This would be performed by student summer crews annually on 5 year rotations

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

Management Goal	Desired broad forest condition is uneven aged, using mostly disturbance style forestry such as group selection (0-2 acre clearcuts), patch clearcuts (2-5 acre clearcuts) and larger block clearcuts (up to 25 acres) and overstory removals where desired regeneration is established.
Management Objective	Diversify age and size structure of current forest condition. <i>(15 years)</i>
Challenges	The greatest challenge here will be physical logging access on the property due to warm winters and intense rain storms in the summer which may limit logging capacity that is the primary tool for this activity.
Opportunities	if we are successful in diversifying the age, size and species composition of the property, this gives an opportunity to study the use of this approach to buffer climate change alterations on a landscape scale.
Feasibility of meeting objectives after evaluation of climate impacts on system	Medium Comments: This has a moderate feasibility simply because it is entirely based on our ability to get on the land for management activities which could change annually.
Other Considerations	Comments: This objective is met with similar challenges with our spring and summer logging classes. These classes will be challenged with summer weather access issues.

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	
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	<p>Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.</p>
Strategy	<p>Reduce the risk and long-term impacts of severe disturbances</p>
Approach	<p>Alter forest structure to reduce severity or extent of wind and ice damage</p>
Benefits of this tactic	<p>This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.</p>
Drawbacks and barriers of this tactic	<p>The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. It would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.</p>
Timeframe to implement	<p>15 years</p>
Practicability	<p><i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i></p>
... practicability of tactic?	<p>High</p>
Recommendation for implementation	<p><i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i></p>
... recommend tactic?	<p>Yes</p>
Adaptation Tactic	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p>
Strategy	<p>Maintain and enhance species and structural diversity</p>
Approach	<p>Promote diverse age classes</p> <p>Benefits include: greater species diversity, greater diversity of age structure, improved</p>

Benefits of this tactic	wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

Monitoring variables used to evaluate if tactic is achieving desired management objective(s)	Species diversity of regeneration 5 and 10 years post harvest
Monitoring Variable 1	
Threshold or Criteria for Evaluation of adaptation tactic	Rather than a threshold for evaluations, this would be more of a simple monitoring tool to see how our management is working not necessarily to see if it is working. Just a tally of what species are coming into the harvest area and possibly an early detection system for new arrivals
Implementing monitoring efforts (frequency, time of year, etc)	This would be done by students, either paid student crews or by mensuration labs. It may also be incorporated into a capstone senior project..

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

Management Goal	Desired broad forest condition is uneven aged, using mostly disturbance style forestry such as group selection (0-2 acre clearcuts), patch clearcuts (2-5 acre clearcuts) and larger block clearcuts (up to 25 acres) and overstory removals where desired regeneration is established.
Management Objective	Diversify plant and animal species composition on the property (<i>15 years</i>)
Challenges	Objective 6 is directly related to objective 7. Access to the land will be the primary issue
Opportunities	If we are successful it gives the opportunity to study the benefits of diversification in the face of climate change.
Feasibility of meeting objectives after evaluation of climate impacts on system	Medium Comments: Feasibility is moderate, based entirely on seasonal weather fluctuations.
Other Considerations	Comments: Same as above, logging classes with limited time will be affected by intense rain events

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.
Strategy	Reduce the risk and long-term impacts of severe disturbances
Approach	Alter forest structure to reduce severity or extent of wind and ice damage
Benefits of this tactic	This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.
Drawbacks and barriers of this tactic	The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. it would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.
Timeframe to implement	15 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	High
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	

	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p>
Strategy	Maintain and enhance species and structural diversity
Approach	Promote diverse age classes
Benefits of this tactic	Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>

... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 1</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Species diversity of regeneration 5 and 10 years post harvest</p> <p>Rather than a threshold for evaluations, this would be more of a simple monitoring tool to see how our management is working not necessarily to see if it is working. Just a tally of what species are coming into the harvest area and possibly an early detection system for new arrivals</p> <p>This would be done by students, either paid student crews or by mensuration labs. It may also be incorporated into a capstone senior project..</p>
<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 2</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Improve habitat for migrant songbirds and create conditions conducive to new arrivals. Songbirds are extremely sensitive to rapid habitat changes (good and bad) and should be a good indicator of the species richness of an area 1-10 years post harvest. Songbirds are also sensitive to climate change and this may offer opportunities for early detection of new arrivals or possibly losses of boreal species. This work can include grouse drumming surveys as well simply to see if habitat work is successful in the harvest areas.</p> <p>increases or decreases of baseline species richness of songbird species. Essentially a simple count.</p> <p>This would be done by wildlife students and ornithology classes on an annual basis if possible.</p>

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

Management Goal	Desired broad forest condition is uneven aged, using mostly disturbance style forestry such as group selection (0-2 acre clearcuts), patch clearcuts (2-5 acre clearcuts) and larger block clearcuts (up to 25 acres) and overstory removals where desired regeneration is established.
Management Objective	Improve wildlife habitat specifically nesting and brooding habitat for migrant songbirds and ruffed grouse
Challenges	Migration habits of birds may change as the climate changes. this may make it difficult to see if our management is having and a positive impact.
Opportunities	AS the climate changes and migration patterns change, it will be interesting to see what species of birds are attracted to our work.
Feasibility of meeting objectives after evaluation of climate impacts on system	Medium Comments: Moderate based on solely on our access to the land for logging and the changes in migration patterns that may skew results of habitat work..
Other Considerations	Comments: We may actually attract a lot more birds than we expected due to shifts in migration over time.

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.
Strategy	Reduce the risk and long-term impacts of severe disturbances

Approach	Alter forest structure to reduce severity or extent of wind and ice damage
Benefits of this tactic	This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.
Drawbacks and barriers of this tactic	The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. It would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.
Timeframe to implement	15 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	High
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.
Strategy	Maintain and enhance species and structural diversity
Approach	Promote diverse age classes
Benefits of this tactic	Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>

... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

Monitoring variables used to evaluate if tactic is achieving desired management objective(s)	Improve habitat for migrant songbirds and create conditions conducive to new arrivals. Songbirds are extremely sensitive to rapid habitat changes (good and bad) and should be a good indicator of the species richness of an area 1-10 years post harvest. Songbirds are also sensitive to climate change and this may offer opportunities for early detection of new arrivals or possibly losses of boreal species. This work can include grouse drumming surveys as well simply to see if habitat work is successful in the harvest areas.
Monitoring Variable 1	
Threshold or Criteria for Evaluation of adaptation tactic	increases or decreases of baseline species richness of songbird species. Essentially a simple count.

Implementing
monitoring efforts
(frequency, time of year,
etc)

This would be done by wildlife students and ornithology classes on an annual basis if possible.

Climate Adaptation Plan for Individual Management areas

The following plan details the management goals and objectives for a particular component of the project. Included below is a detailed review of potential climate impacts and site level considerations, along with an evaluation of objectives, potential adaptation responses (tactics) and monitoring variables to assess success over time.

Plan for specific Management area	<p>Lowland and riparian forest</p> <p>Diverse forested wetlands are found in depressions and low-lying areas, along waterways, and in floodplains. Dominant species may include ash, red or silver maple, swamp white oak, sycamore, American elm, and river birch.</p>
Management Goal	The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.
Management Objective(s)	<p>Maintain integrity of riparian ecosystems using buffers and limited harvesting (<i>15 years</i>)</p> <p>Integrate other natural resource curriculum such as wildlife management and ecological studies</p>
Potential identified impacts for Lowland and riparian forest	<p>Lowland and riparian forests may have limited tolerance to changes in precipitation and water tables.</p> <p>Many tree species could tolerate limited increases in flooding and drought under climate change.</p> <p>Many of the dominant tree species are projected to have similar or increased habitat, including American elm, eastern cottonwood, and silver maple.</p> <p>Some tree species in lowland and riparian hardwood forests are expected to decline by the end of the century (northern white-cedar, black ash, balsam fir, yellow birch, and paper birch).</p> <p>Insect pests and forest diseases could become more problematic these forests under a warmer climate.</p>
Potential impact of climate change on health and function of system	Disruptive
Adaptive Capacity of system to climate change impacts or disturbances	Moderate
Vulnerability determination	Moderate

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

Management Goal	The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.
Management Objective	Maintain integrity of riparian ecosystems using buffers and limited harvesting (<i>15 years</i>)
Challenges	My plan with riparian habitats is to stay out of them completely and let them evolve un touched which i hope will improve their resilience to climate change. There shouldn't be a challenge here.
Opportunities	This gives an opportunity for students to study the effects of climate change on riparian areas without influence from active management.
Feasibility of meeting objectives after evaluation of climate impacts on system	High Comments: This has a high feasibility.
Other Considerations	Comments: If riparian areas begin to shrink, there may be pressure from administration for more timber harvesting in this area. It must be clearly stated in the management plan that riparian areas will receive no - cut buffers for intended purposes.

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

Management Goal	The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.
Management Objective	Integrate other natural resource curriculum such as wildlife management and ecological studies
Challenges	None!
Opportunities	An opportunity for students to be involved and study climate change affects on these ecosystems.
Feasibility of meeting objectives after evaluation of climate impacts on system	High Comments: There should be no feasibility issues.
Other Considerations	Comments: Sill need to work to keep the administration on board with protecting these areas. Administrations change quickly!

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.
Strategy	Reduce the risk and long-term impacts of severe disturbances
Approach	Alter forest structure to reduce severity or extent of wind and ice damage
Benefits of this tactic	This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.
Drawbacks and barriers of this tactic	The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. it would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.
Timeframe to implement	15 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	High
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	

	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p>
Strategy	Maintain and enhance species and structural diversity
Approach	Promote diverse age classes
Benefits of this tactic	Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>

... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

Monitoring variables used to evaluate if tactic is achieving desired management objective(s)	Improve habitat for migrant songbirds and create conditions conducive to new arrivals. Songbirds are extremely sensitive to rapid habitat changes (good and bad) and should be a good indicator of the species richness of an area 1-10 years post harvest. Songbirds are also sensitive to climate change and this may offer opportunities for early detection of new arrivals or possibly losses of boreal species. This work can include grouse drumming surveys as well simply to see if habitat work is successful in the harvest areas.
Monitoring Variable 1	
Threshold or Criteria for Evaluation of adaptation tactic	increases or decreases of baseline species richness of songbird species. Essentially a simple count.
Implementing monitoring efforts (frequency, time of year, etc)	This would be done by wildlife students and ornithology classes on an annual basis if possible.

Climate Adaptation Plan for Individual Management areas

The following plan details the management goals and objectives for a particular component of the project. Included below is a detailed review of potential climate impacts and site level considerations, along with an evaluation of objectives, potential adaptation responses (tactics) and monitoring variables to assess success over time.

Plan for specific Management area	<p>Low-elevation spruce-fir</p> <p>These forests are dominated by northern species that include red spruce, white spruce, and balsam fir. Site are typically at lower elevations in cold pockets, depressions, or valley bottoms. Hardwood species, such as yellow birch and red maple, may also be present.</p>
<p>Management Goal</p> <p>Management Objective(s)</p>	<p>The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.</p> <p>Inventory all compartments over a 15-year period using senior silviculture classes. <i>(15 years)</i></p> <p>Use paid student marking crews to accomplish production timber marking. <i>(15 years)</i></p> <p>Involve all natural resource classes with integrated learning associated with active timber harvesting.</p>
<p>Management Goal</p> <p>Management Objective(s)</p>	<p>Desired broad forest condition is uneven aged, using mostly disturbance style forestry such as group selection (0-2 acre clearcuts), patch clearcuts (2-5 acre clearcuts) and larger block clearcuts (up to 25 acres) and overstory removals where desired regeneration is established.</p> <p>Maintain and increase stocking of coniferous species. <i>(15 years)</i></p> <p>Diversify age and size structure of current forest condition. <i>(15 years)</i></p> <p>Diversify plant and animal species composition on the property <i>(15 years)</i></p> <p>Improve wildlife habitat specifically snowshoe hare habitat, nesting and brooding habitat for migrant songbirds and ruffed grouse</p>
Potential identified impacts for Low-elevation spruce-fir	<p>Climate change may lead to decreased habitat or altered species composition in low-elevation spruce-fir forests.</p> <p>Many of the dominant tree species are expected to decline by the end of the century, including red spruce and balsam fir.</p> <p>Property considerations: where possible we should strive to regenerate all species, maintaining high diversity and adaptability. Species that may decline should be regenerated in with the mix so that their progress over time can be observed.</p> <p>Some tree species may be more likley to persist or become more competative through the end of the century , including white pine, red maple, and some northern hardwood species.</p> <p>Property considerations: This may increase markets for these species, it should also be noted that the insects and diseases that attack these species may also increase over time.</p> <p>Changes in herbivore populations may also have substantial effects on forest growth and composition.</p> <p>Low species diversity may reduce the ability of forests to adapt to climate change.</p> <p>Low-elevation spruce-fir forests are widely distributed across a variety of sites, increasing adaptive capacity.</p>
Potential impact of	Disruptive

climate change on health and function of system	
Adaptive Capacity of system to climate change impacts or disturbances	Low-Moderate
Vulnerability determination	High

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

Management Goal	The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.
Management Objective	Inventory all compartments over a 15-year period using senior silviculture classes. <i>(15 years)</i>
Challenges	Challenges and opportunities here are exactly the same as the challenges and opportunities in Goal 2 for northern hardwoods
Opportunities	Challenges and opportunities here are exactly the same as the challenges and opportunities in Goal 2 for northern hardwoods
Feasibility of meeting objectives after evaluation of climate impacts on system	High Comments: high
Other Considerations	Comments: the challenges for this objective will be mostly institutional. Right now the senior silviculture students are inventorying the compartments on a schedule and writing portions of the management plans as part of their final project in Advanced silviculture. If new faculty teaching this class don't want to do this than this project will have a hard time going anywhere, ie, the faculty that teach advanced silviculture must be 100% on board with this objective.

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	<p>Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.</p>
Strategy	<p>Reduce the risk and long-term impacts of severe disturbances</p>
Approach	<p>Alter forest structure to reduce severity or extent of wind and ice damage</p>
Benefits of this tactic	<p>This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.</p>
Drawbacks and barriers of this tactic	<p>The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. It would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.</p>
Timeframe to implement	<p>15 years</p>
Practicability	<p><i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i></p>
... practicability of tactic?	<p>High</p>
Recommendation for implementation	<p><i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i></p>
... recommend tactic?	<p>Yes</p>
Adaptation Tactic	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p>
Strategy	<p>Maintain and enhance species and structural diversity</p>
Approach	<p>Promote diverse age classes</p> <p>Benefits include: greater species diversity, greater diversity of age structure, improved</p>

Benefits of this tactic	wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

Monitoring variables used to evaluate if tactic is achieving desired management objective(s)	Create a CFI plot monitoring system that measures growth and regeneration on a 5 year rotation throughout the property. This is a bit of a dream for the faculty at PSC, but the information would be extremely valuable.
Monitoring Variable 1	
Threshold or Criteria for Evaluation of adaptation tactic	No real criteria, just a good way to keep track of growth on the property to see if climate change is having an impact on growth over time.
Implementing monitoring efforts (frequency, time of year, etc)	This would be performed by student summer crews annually on 5 year rotations

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

Management Goal	The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.
Management Objective	Use paid student marking crews to accomplish production timber marking. <i>(15 years)</i>
Challenges	If logging becomes impossible then these marking crews will not be necessary.
Opportunities	There is a great opportunity here to involve students with climate change adaptation. Most of the timber sales they mark will be geared towards regenerating diverse stands as a buffer against climate change, and they have an opportunity to be involved in this.
Feasibility of meeting objectives after evaluation of climate impacts on system	High Comments: High
Other Considerations	Comments: Roadblocks will be entirely institutional. if the Administration is not 100% in favor of using student workers for this task, many of the management plan objectives will be at risk.

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.
Strategy	Reduce the risk and long-term impacts of severe disturbances
Approach	Alter forest structure to reduce severity or extent of wind and ice damage
Benefits of this tactic	This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.
Drawbacks and barriers of this tactic	The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. it would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.
Timeframe to implement	15 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	High
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	

	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p>
Strategy	Maintain and enhance species and structural diversity
Approach	Promote diverse age classes
Benefits of this tactic	Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>

... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

Management Goal	The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.
Management Objective	Involve all natural resource classes with integrated learning associated with active timber harvesting.
Challenges	None known
Opportunities	Another great way to get natural resources students involved with climate change adaptation.
Feasibility of meeting objectives after evaluation of climate impacts on system	High Comments: very feasible, this is what the school and the program are all about
Other Considerations	Comments: Only institutional, which should not be a problem

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	
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Benefits of this tactic	wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 1</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Species diversity of regeneration 5 and 10 years post harvest</p> <p>Rather than a threshold for evaluations, this would be more of a simple monitoring tool to see how our management is working not necessarily to see if it is working. Just a tally of what species are coming into the harvest area and possibly an early detection system for new arrivals</p> <p>This would be done by students, either paid student crews or by mensuration labs. It may also be incorporated into a capstone senior project..</p>
<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 2</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Improve habitat for migrant songbirds and create conditions conducive to new arrivals. Songbirds are extremely sensitive to rapid habitat changes (good and bad) and should be a good indicator of the species richness of an area 1-10 years post harvest. Songbirds are also sensitive to climate change and this may offer opportunities for early detection of new arrivals or possibly losses of boreal species. This work can include grouse drumming surveys as well simply to see if habitat work is successful in the harvest areas.</p> <p>increases or decreases of baseline species richness of songbird species. Essentially a simple count.</p> <p>This would be done by wildlife students and ornithology classes on an annual basis if possible.</p>
<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 3</p> <p>Threshold or Criteria for Evaluation of adaptation</p>	<p>Create a CFI plot monitoring system that measures growth and regeneration on a 5 year rotation throughout the property. This is a bit of a dream for the faculty at PSC, but the information would be extremely valuable.</p> <p>No real criteria, just a good way to keep track of growth on the property to see if climate change is having an impact on growth over time.</p>

tactic	
Implementing monitoring efforts (frequency, time of year, etc)	This would be performed by student summer crews annually on 5 year rotations

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

Management Goal	Desired broad forest condition is uneven aged, using mostly disturbance style forestry such as group selection (0-2 acre clearcuts), patch clearcuts (2-5 acre clearcuts) and larger block clearcuts (up to 25 acres) and overstory removals where desired regeneration is established.
Management Objective	Maintain and increase stocking of coniferous species. <i>(15 years)</i>
Challenges	If coniferous/boreal species lose footing in the northeast due to climate change this will be a difficult objective.
Opportunities	This is an opportunity to see if our attempts to increase coniferous species might work or if other species move in. possibly a good student project
Feasibility of meeting objectives after evaluation of climate impacts on system	Comments: Moderate feasibility due to the potential that coniferous species may be in decline
Other Considerations	Comments: Spruce/fir/pine are critical species for the ecology of this area and for the economy of selling timber from this property. Forest regeneration considerations may have to be altered over time.

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	
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	<p>Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.</p>
Strategy	<p>Reduce the risk and long-term impacts of severe disturbances</p>
Approach	<p>Alter forest structure to reduce severity or extent of wind and ice damage</p>
Benefits of this tactic	<p>This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.</p>
Drawbacks and barriers of this tactic	<p>The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. It would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.</p>
Timeframe to implement	<p>15 years</p>
Practicability	<p><i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i></p>
... practicability of tactic?	<p>High</p>
Recommendation for implementation	<p><i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i></p>
... recommend tactic?	<p>Yes</p>
Adaptation Tactic	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p>
Strategy	<p>Maintain and enhance species and structural diversity</p>
Approach	<p>Promote diverse age classes</p> <p>Benefits include: greater species diversity, greater diversity of age structure, improved</p>

Benefits of this tactic	wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 1</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Species diversity of regeneration 5 and 10 years post harvest</p> <p>Rather than a threshold for evaluations, this would be more of a simple monitoring tool to see how our management is working not necessarily to see if it is working. Just a tally of what species are coming into the harvest area and possibly an early detection system for new arrivals</p> <p>This would be done by students, either paid student crews or by mensuration labs. It may also be incorporated into a capstone senior project..</p>
<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 2</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Create a CFI plot monitoring system that measures growth and regeneration on a 5 year rotation throughout the property. This is a bit of a dream for the faculty at PSC, but the information would be extremely valuable.</p> <p>No real criteria, just a good way to keep track of growth on the property to see if climate change is having an impact on growth over time.</p> <p>This would be performed by student summer crews annually on 5 year rotations</p>

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

<p>Management Goal</p> <p>Management Objective</p>	<p>Desired broad forest condition is uneven aged, using mostly disturbance style forestry such as group selection (0-2 acre clearcuts), patch clearcuts (2-5 acre clearcuts) and larger block clearcuts (up to 25 acres) and overstory removals where desired regeneration is established.</p> <p>Diversify age and size structure of current forest condition. (15 years)</p>
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Challenges	none known
Opportunities	Many the same as mentioned before
Feasibility of meeting objectives after evaluation of climate impacts on system	Comments: very feasible, but species composition may change with fewer boreal conifers.
Other Considerations	Comments: Pretty much related to our ability to get on the landscape to do the work or will strange weather patterns limit this.

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.
Strategy	Reduce the risk and long-term impacts of severe disturbances
Approach	Alter forest structure to reduce severity or extent of wind and ice damage
Benefits of this tactic	This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.
Drawbacks and barriers of this tactic	The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. it would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.
Timeframe to implement	15 years

Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	High
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.
Strategy	Maintain and enhance species and structural diversity
Approach	Promote diverse age classes
Benefits of this tactic	Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do

Drawbacks and barriers of this tactic	have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting. The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

Monitoring variables used to evaluate if tactic is achieving desired management objective(s)	Species diversity of regeneration 5 and 10 years post harvest
Monitoring Variable 1	
Threshold or Criteria for Evaluation of adaptation tactic	Rather than a threshold for evaluations, this would be more of a simple monitoring tool to see how our management is working not necessarily to see if it is working. Just a tally of what species are coming into the harvest area and possibly an early detection system for new arrivals
Implementing monitoring efforts (frequency, time of year, etc)	This would be done by students, either paid student crews or by mensuration labs. It may also be incorporated into a capstone senior project..

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

Management Goal	Desired broad forest condition is uneven aged, using mostly disturbance style forestry such as group selection (0-2 acre clearcuts), patch clearcuts (2-5 acre clearcuts) and larger block
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Management Objective	clearcuts (up to 25 acres) and overstory removals where desired regeneration is established.
Challenges	Diversify plant and animal species composition on the property (15 years)
Opportunities	only based on physical ability and the possible change with boreal species
Feasibility of meeting objectives after evaluation of climate impacts on system	may be an opportunity for students to study the rate of loss or gains of certain species on the landscape as we regenerate it.
Other Considerations	Comments: very feasible
	Comments: none known.

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.
Strategy	Reduce the risk and long-term impacts of severe disturbances
Approach	Alter forest structure to reduce severity or extent of wind and ice damage
Benefits of this tactic	This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.
Drawbacks and barriers of this tactic	The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. it would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of

<p>Timeframe to implement</p> <p>Practicability</p> <p>... practicability of tactic?</p> <p>Recommendation for implementation</p> <p>... recommend tactic?</p>	<p>an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.</p> <p>15 years</p> <p><i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i></p> <p>High</p> <p><i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i></p> <p>Yes</p>
<p>Adaptation Tactic</p> <p>Strategy</p> <p>Approach</p> <p>Benefits of this tactic</p> <p>Drawbacks and barriers of this tactic</p> <p>Timeframe to implement</p> <p>Practicability</p> <p>... practicability of tactic?</p> <p>Recommendation for implementation</p> <p>... recommend tactic?</p>	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p> <p>Maintain and enhance species and structural diversity</p> <p>Promote diverse age classes</p> <p>Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)</p> <p>I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.</p> <p>15-30 years</p> <p><i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i></p> <p>Medium</p> <p><i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i></p> <p>Yes</p>
<p>Adaptation Tactic</p>	<p>My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.</p>

Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

Monitoring variables used to evaluate if tactic is achieving desired management objective(s)	Species diversity of regeneration 5 and 10 years post harvest
Monitoring Variable 1	
Threshold or Criteria for Evaluation of adaptation tactic	Rather than a threshold for evaluations, this would be more of a simple monitoring tool to see how our management is working not necessarily to see if it is working. Just a tally of what species are coming into the harvest area and possibly an early detection system for new arrivals
Implementing monitoring efforts (frequency, time of year, etc)	This would be done by students, either paid student crews or by mensuration labs. It may also be incorporated into a capstone senior project..
Monitoring variables used to evaluate if tactic is achieving desired	Improve habitat for migrant songbirds and create conditions conducive to new arrivals. Songbirds are extremely sensitive to rapid habitat changes (good and bad) and should be a good indicator of the species richness of an area 1-10 years post harvest. Songbirds are also sensitive to climate change and this may offer opportunities for early detection of new

management objective(s)	arrivals or possibly losses of boreal species. This work can include grouse drumming surveys as well simply to see if habitat work is successful in the harvest areas.
Monitoring Variable 2	
Threshold or Criteria for Evaluation of adaptation tactic	increases or decreases of baseline species richness of songbird species. Essentially a simple count.
Implementing monitoring efforts (frequency, time of year, etc)	This would be done by wildlife students and ornithology classes on an annual basis if possible.

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

Management Goal	Desired broad forest condition is uneven aged, using mostly disturbance style forestry such as group selection (0-2 acre clearcuts), patch clearcuts (2-5 acre clearcuts) and larger block clearcuts (up to 25 acres) and overstory removals where desired regeneration is established.
Management Objective	Improve wildlife habitat specifically snowshoe hare habitat, nesting and brooding habitat for migrant songbirds and ruffed grouse
Challenges	Will snowshoe hare and ruffed grouse be limited on the landscape with changing climate?? What about boreal bird species
Opportunities	possible opportunities to study new species as they populate the area
Feasibility of meeting objectives after evaluation of climate impacts on system	Comments: very feasible.
Other Considerations	Comments: This should not be a problem

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	
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Benefits of this tactic	wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p>	<p>Improve habitat for migrant songbirds and create conditions conducive to new arrivals. Songbirds are extremely sensitive to rapid habitat changes (good and bad) and should be a good indicator of the species richness of an area 1-10 years post harvest. Songbirds are also sensitive to climate change and this may offer opportunities for early detection of new arrivals or possibly losses of boreal species. This work can include grouse drumming surveys as well simply to see if habitat work is successful in the harvest areas.</p>
<p>Monitoring Variable 1</p>	
<p>Threshold or Criteria for Evaluation of adaptation tactic</p>	<p>increases or decreases of baseline species richness of songbird species. Essentially a simple count.</p>
<p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>This would be done by wildlife students and ornithology classes on an annual basis if possible.</p>

Climate Adaptation Plan for Individual Management areas

The following plan details the management goals and objectives for a particular component of the project. Included below is a detailed review of potential climate impacts and site level considerations, along with an evaluation of objectives, potential adaptation responses (tactics) and monitoring variables to assess success over time.

Plan for specific Management area	<p>Lowland mixed conifer</p> <p>These forests typically have saturated soils, which may also be acidic or nutrient-poor. Conifer or mixed conifer-hardwood species include black spruce, red spruce, tamarack, balsam fir, eastern hemlock, and red maple.</p>
<p>Management Goal</p> <p>Management Objective(s)</p>	<p>The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.</p> <p>Inventory all compartments over a 15-year period using senior silviculture classes. <i>(15 years)</i></p> <p>Use paid student marking crews to accomplish production timber marking. <i>(15 years)</i></p> <p>Involve all natural resource classes with integrated learning associated with active timber harvesting. <i>(15years)</i></p>
<p>Management Goal</p> <p>Management Objective(s)</p>	<p>Desired broad forest condition is uneven aged, using mostly disturbance style forestry such as group selection (0-2 acre clearcuts), patch clearcuts (2-5 acre clearcuts) and larger block clearcuts (up to 25 acres) and overstory removals where desired regeneration is established.</p> <p>Maintain and increase stocking of coniferous species. <i>(15 years)</i></p> <p>Diversify age and size structure of current forest condition. <i>(15 years)</i></p> <p>Diversify plant and animal species composition on the property <i>(15 years)</i></p> <p>Improve wildlife habitat specifically snowshoe hare habitat, nesting and brooding habitat for migrant songbirds and ruffed grouse <i>(15 years)</i></p>
Potential identified impacts for Lowland mixed conifer	<p>Lowland conifer forests may have limited tolerance to changes in precipitation and water tables.</p> <p>Organic soils may be more vulnerable to change in lowland mixed conifer forests. Property considerations: All soils may be affected. These lowland forests are often winter harvesting sites and with warming winters, using timber harvesting to increase diversity will be difficult.</p> <p>Many of the dominant tree species are expected to decline by the end of the century, including black spruce, red spruce, northern-white cedar and balsam fir. Property considerations: We should still manage to regenerate these species so that we have them around to observe their progress over time.</p> <p>Warmer temperatures may allow balsam woolly adelgid to increase, while dampening the effects of the eastern spruce budworm in the northern New England and New York.</p> <p>Changes in herbivore populations may also have substantial effects on forest growth and composition, especially in regard to northern-white cedar.</p>
Potential impact of climate change on health and function of system	Disruptive

Adaptive Capacity of system to climate change impacts or disturbances	Low-Moderate
Vulnerability determination	High

Evaluation of climate change impacts on goals and objectives

Climate change might make management objectives for this property harder or easier to achieve, presenting challenges and opportunities. This section also includes a simple rating and description for the feasibility of meeting management objectives under current management. This is a critical step to evaluate whether management objectives are robust, or whether any might need to be changed.

Management Goal	The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.
Management Objective	Inventory all compartments over a 15-year period using senior silviculture classes. <i>(15 years)</i>
Challenges	This should not be a problem
Opportunities	same as before
Feasibility of meeting objectives after evaluation of climate impacts on system	High

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	
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Benefits of this tactic	wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 1</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Improve habitat for migrant songbirds and create conditions conducive to new arrivals. Songbirds are extremely sensitive to rapid habitat changes (good and bad) and should be a good indicator of the species richness of an area 1-10 years post harvest. Songbirds are also sensitive to climate change and this may offer opportunities for early detection of new arrivals or possibly losses of boreal species. This work can include grouse drumming surveys as well simply to see if habitat work is successful in the harvest areas.</p> <p>increases or decreases of baseline species richness of songbird species. Essentially a simple count.</p> <p>This would be done by wildlife students and ornithology classes on an annual basis if possible.</p>
<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 2</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Create a CFI plot monitoring system that measures growth and regeneration on a 5 year rotation throughout the property. This is a bit of a dream for the faculty at PSC, but the information would be extremely valuable.</p> <p>No real criteria, just a good way to keep track of growth on the property to see if climate change is having an impact on growth over time.</p> <p>This would be performed by student summer crews annually on 5 year rotations</p>

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

<p>Adaptation Tactic</p>	
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<p>Strategy</p> <p>Approach</p> <p>Benefits of this tactic</p> <p>Drawbacks and barriers of this tactic</p> <p>Timeframe to implement</p> <p>Practicability</p> <p>... practicability of tactic?</p> <p>Recommendation for implementation</p> <p>... recommend tactic?</p>	<p>Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.</p> <p>Reduce the risk and long-term impacts of severe disturbances</p> <p>Alter forest structure to reduce severity or extent of wind and ice damage</p> <p>This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.</p> <p>The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. It would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.</p> <p>15 years</p> <p><i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i></p> <p>High</p> <p><i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i></p> <p>Yes</p>
<p>Adaptation Tactic</p> <p>Strategy</p> <p>Approach</p>	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p> <p>Maintain and enhance species and structural diversity</p> <p>Promote diverse age classes</p> <p>Benefits include: greater species diversity, greater diversity of age structure, improved</p>

Benefits of this tactic	wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Responding to climate change impacts

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Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.
Strategy	Reduce the risk and long-term impacts of severe disturbances
Approach	Alter forest structure to reduce severity or extent of wind and ice damage
Benefits of this tactic	This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.
Drawbacks and barriers of this tactic	The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. it would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.
Timeframe to implement	15 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	High
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	

	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p>
Strategy	Maintain and enhance species and structural diversity
Approach	Promote diverse age classes
Benefits of this tactic	Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>

... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 1</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Species diversity of regeneration 5 and 10 years post harvest</p> <p>Rather than a threshold for evaluations, this would be more of a simple monitoring tool to see how our management is working not necessarily to see if it is working. Just a tally of what species are coming into the harvest area and possibly an early detection system for new arrivals</p> <p>This would be done by students, either paid student crews or by mensuration labs. It may also be incorporated into a capstone senior project..</p>
<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 2</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Improve habitat for migrant songbirds and create conditions conducive to new arrivals. Songbirds are extremely sensitive to rapid habitat changes (good and bad) and should be a good indicator of the species richness of an area 1-10 years post harvest. Songbirds are also sensitive to climate change and this may offer opportunities for early detection of new arrivals or possibly losses of boreal species. This work can include grouse drumming surveys as well simply to see if habitat work is successful in the harvest areas.</p> <p>increases or decreases of baseline species richness of songbird species. Essentially a simple count.</p> <p>This would be done by wildlife students and ornithology classes on an annual basis if possible.</p>
<p>Monitoring variables</p>	<p>Create a CFI plot monitoring system that measures growth and regeneration on a 5 year</p>

used to evaluate if tactic is achieving desired management objective(s)	rotation throughout the property. This is a bit of a dream for the faculty at PSC, but the information would be extremely valuable.
Monitoring Variable 3	
Threshold or Criteria for Evaluation of adaptation tactic	No real criteria, just a good way to keep track of growth on the property to see if climate change is having an impact on growth over time.
Implementing monitoring efforts (frequency, time of year, etc)	This would be performed by student summer crews annually on 5 year rotations

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.
Strategy	Reduce the risk and long-term impacts of severe disturbances
Approach	Alter forest structure to reduce severity or extent of wind and ice damage
Benefits of this tactic	This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.
Drawbacks and barriers of this tactic	The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. It would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustainably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of

<p>Timeframe to implement</p> <p>Practicability</p> <p>... practicability of tactic?</p> <p>Recommendation for implementation</p> <p>... recommend tactic?</p>	<p>an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.</p> <p>15 years</p> <p><i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i></p> <p>High</p> <p><i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i></p> <p>Yes</p>
<p>Adaptation Tactic</p> <p>Strategy</p> <p>Approach</p> <p>Benefits of this tactic</p> <p>Drawbacks and barriers of this tactic</p> <p>Timeframe to implement</p> <p>Practicability</p> <p>... practicability of tactic?</p> <p>Recommendation for implementation</p> <p>... recommend tactic?</p>	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p> <p>Maintain and enhance species and structural diversity</p> <p>Promote diverse age classes</p> <p>Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)</p> <p>I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.</p> <p>15-30 years</p> <p><i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i></p> <p>Medium</p> <p><i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i></p> <p>Yes</p>
<p>Adaptation Tactic</p>	<p>My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.</p>

Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

Monitoring variables used to evaluate if tactic is achieving desired management objective(s)	Species diversity of regeneration 5 and 10 years post harvest
Monitoring Variable 1	
Threshold or Criteria for Evaluation of adaptation tactic	Rather than a threshold for evaluations, this would be more of a simple monitoring tool to see how our management is working not necessarily to see if it is working. Just a tally of what species are coming into the harvest area and possibly an early detection system for new arrivals
Implementing monitoring efforts (frequency, time of year, etc)	This would be done by students, either paid student crews or by mensuration labs. It may also be incorporated into a capstone senior project..
Monitoring variables used to evaluate if tactic is achieving desired	Create a CFI plot monitoring system that measures growth and regeneration on a 5 year rotation throughout the property. This is a bit of a dream for the faculty at PSC, but the information would be extremely valuable.

management objective(s)	
Monitoring Variable 2	
Threshold or Criteria for Evaluation of adaptation tactic	No real criteria, just a good way to keep track of growth on the property to see if climate change is having an impact on growth over time.
Implementing monitoring efforts (frequency, time of year, etc)	This would be performed by student summer crews annually on 5 year rotations

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Timeframe to implement	15 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	High
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
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Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
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Approach	
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<p>Strategy</p>	<p>Reduce the risk and long-term impacts of severe disturbances</p>
<p>Approach</p>	<p>Alter forest structure to reduce severity or extent of wind and ice damage</p>
<p>Benefits of this tactic</p>	<p>This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.</p>
<p>Drawbacks and barriers of this tactic</p>	<p>The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. it would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.</p>
<p>Timeframe to implement</p>	<p>15 years</p>
<p>Practicability</p>	<p><i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i></p>
<p>... practicability of tactic?</p>	<p>High</p>
<p>Recommendation for implementation</p>	<p><i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i></p>
<p>... recommend tactic?</p>	<p>Yes</p>
<p>Adaptation Tactic</p>	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p>
<p>Strategy</p>	<p>Maintain and enhance species and structural diversity</p>

Approach	Promote diverse age classes
Benefits of this tactic	Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
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Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 1</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Species diversity of regeneration 5 and 10 years post harvest</p> <p>Rather than a threshold for evaluations, this would be more of a simple monitoring tool to see how our management is working not necessarily to see if it is working. Just a tally of what species are coming into the harvest area and possibly an early detection system for new arrivals</p> <p>This would be done by students, either paid student crews or by mensuration labs. It may also be incorporated into a capstone senior project..</p>
<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p> <p>Monitoring Variable 2</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>Improve habitat for migrant songbirds and create conditions conducive to new arrivals. Songbirds are extremely sensitive to rapid habitat changes (good and bad) and should be a good indicator of the species richness of an area 1-10 years post harvest. Songbirds are also sensitive to climate change and this may offer opportunities for early detection of new arrivals or possibly losses of boreal species. This work can include grouse drumming surveys as well simply to see if habitat work is successful in the harvest areas.</p> <p>increases or decreases of baseline species richness of songbird species. Essentially a simple count.</p> <p>This would be done by wildlife students and ornithology classes on an annual basis if possible.</p>

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	<p>Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.</p>
Strategy	<p>Reduce the risk and long-term impacts of severe disturbances</p>
Approach	<p>Alter forest structure to reduce severity or extent of wind and ice damage</p>
Benefits of this tactic	<p>This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.</p>
Drawbacks and barriers of this tactic	<p>The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. It would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.</p>
Timeframe to implement	<p>15 years</p>
Practicability	<p><i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i></p>
... practicability of tactic?	<p>High</p>
Recommendation for implementation	<p><i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i></p>
... recommend tactic?	<p>Yes</p>
Adaptation Tactic	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p>
Strategy	<p>Maintain and enhance species and structural diversity</p>
Approach	<p>Promote diverse age classes</p>

Benefits of this tactic	Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
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Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
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Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

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<p>Monitoring variables used to evaluate if tactic is achieving desired management objective(s)</p>	<p>Improve habitat for migrant songbirds and create conditions conducive to new arrivals. Songbirds are extremely sensitive to rapid habitat changes (good and bad) and should be a good indicator of the species richness of an area 1-10 years post harvest. Songbirds are also sensitive to climate change and this may offer opportunities for early detection of new arrivals or possibly losses of boreal species. This work can include grouse drumming surveys as well simply to see if habitat work is successful in the harvest areas.</p>
<p>Monitoring Variable 1</p>	
<p>Threshold or Criteria for Evaluation of adaptation tactic</p>	<p>increases or decreases of baseline species richness of songbird species. Essentially a simple count.</p>
<p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>This would be done by wildlife students and ornithology classes on an annual basis if possible.</p>

Climate Adaptation Plan for Individual Management areas

The following plan details the management goals and objectives for a particular component of the project. Included below is a detailed review of potential climate impacts and site level considerations, along with an evaluation of objectives, potential adaptation responses (tactics) and monitoring variables to assess success over time.

Plan for specific Management area	<p>Transition hardwood</p> <p>These forests are transitional between central hardwood and northern hardwood forests. Common species may include sugar maple, yellow birch, American beech, eastern hemlock, white pine, red maple, and red oak.</p>
<p>Management Goal</p> <p>Management Objective(s)</p>	<p>The overall goal of the Paul Smiths College woodlands is to integrate students in the forestry and natural resource curriculum with active commercial forest management on the property. This includes commercial and educational timber harvesting and maple syrup production.</p> <p>Maintain, enhance and expand maple syrup production on the property as an educational resource and employment training for the maple production industry <i>(15 years)</i></p> <p>Inventory all compartments over a 15-year period using senior silviculture classes. <i>(15 years)</i></p> <p>Use paid student marking crews to accomplish production marking. <i>(15 years)</i></p> <p>Involve all natural resource classes with integrated learning associated with active timber harvesting. <i>(15 years)</i></p>
<p>Management Goal</p> <p>Management Objective(s)</p>	<p>Desired broad forest condition is uneven aged, using mostly disturbance style forestry such as group selection (0-2 acre clearcuts), patch clearcuts (2-5 acre clearcuts) and larger block clearcuts (up to 25 acres) and overstory removals where desired regeneration is established.</p> <p>Diversify age and size structure of current forest condition. <i>(15 years)</i></p> <p>Diversify plant and animal species composition on the property <i>(15 years)</i></p> <p>Improve wildlife habitat specifically nesting and brooding habitat for migrant songbirds and ruffed grouse <i>(15 years)</i></p> <p>Maintain and increase stocking of coniferous species.</p>
Potential identified impacts for Transition hardwood	<p>Some of the common tree species in transition hardwood forests are projected to have similar or increased habitat, including black cherry and yellow-poplar.</p> <p>Property considerations: This could have a profound impact here as we already have a good mix of Black Cherry in the Adirondack Forest. We are currently at the northern edge of BC range so this may be an opportunity in marketing and wildlife habitat.</p> <p>Some tree species may decline by the end of the century, including red spruce and balsam fir.</p> <p>Property considerations: we still need to manage for these species!! Hence focus on diversity/disturbance silviculture.</p> <p>High levels of diversity in transition hardwood forests may increase the ability of forests to adapt to climate change.</p> <p>Invasive species such as buckthorn, honeysuckle, and garlic mustard are expected to become more problematic under climate change.</p> <p>Insect pests and forest diseases could become more problematic in transition hardwood forests under a warmer climate.</p> <p>Changes in herbivore populations may also have substantial effects on forest growth and composition.</p>

Potential impact of climate change on health and function of system	Mixed/Neutral
Adaptive Capacity of system to climate change impacts or disturbances	Moderate-High
Vulnerability determination	Moderate

Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

Adaptation Tactic	Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.
Strategy	Reduce the risk and long-term impacts of severe disturbances
Approach	Alter forest structure to reduce severity or extent of wind and ice damage
Benefits of this tactic	This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.
Drawbacks and barriers of this tactic	The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. It would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.

Timeframe to implement	15 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	High
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
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Strategy	Maintain and enhance species and structural diversity
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Benefits of this tactic	Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
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Strategy	Increase ecosystem redundancy across the landscape Manage habitats over a range of sites and conditions

Approach	
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
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Monitoring Variable 1	
Threshold or Criteria for Evaluation of adaptation tactic	increases or decreases of baseline species richness of songbird species. Essentially a simple count.
Implementing monitoring efforts (frequency, time of year, etc)	This would be done by wildlife students and ornithology classes on an annual basis if possible.
Monitoring variables used to evaluate if tactic is achieving desired management objective(s)	Create a CFI plot monitoring system that measures growth and regeneration on a 5 year rotation throughout the property. This is a bit of a dream for the faculty at PSC, but the information would be extremely valuable.

Monitoring Variable 2	
Threshold or Criteria for Evaluation of adaptation tactic	No real criteria, just a good way to keep track of growth on the property to see if climate change is having an impact on growth over time.
Implementing monitoring efforts (frequency, time of year, etc)	This would be performed by student summer crews annually on 5 year rotations

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Timeframe to implement	15 years

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<p>Adaptation Tactic</p> <p>Strategy</p> <p>Approach</p> <p>Benefits of this tactic</p> <p>Drawbacks and barriers of this tactic</p> <p>Timeframe to implement</p> <p>Practicability</p> <p>... practicability of tactic?</p> <p>Recommendation for implementation</p> <p>... recommend tactic?</p>	<p>As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.</p> <p>Maintain and enhance species and structural diversity</p> <p>Promote diverse age classes</p> <p>Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)</p> <p>I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.</p> <p>15-30 years</p> <p><i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i></p> <p>Medium</p> <p><i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i></p> <p>Yes</p>
<p>Adaptation Tactic</p>	<p>My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.</p>

Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes

Monitoring adaptation actions

Monitoring is critical for understanding if management actions are effective or if management should be altered in the future to account for new information. The following monitoring variables were described for this particular management objective and adaptation tactics.

Monitoring variables used to evaluate if tactic is achieving desired management objective(s)	Species diversity of regeneration 5 and 10 years post harvest
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Implementing monitoring efforts (frequency, time of year, etc)	This would be done by students, either paid student crews or by mensuration labs. It may also be incorporated into a capstone senior project..
Monitoring variables used to evaluate if tactic is achieving desired	Create a CFI plot monitoring system that measures growth and regeneration on a 5 year rotation throughout the property. This is a bit of a dream for the faculty at PSC, but the information would be extremely valuable.

<p>management objective(s)</p> <p>Monitoring Variable 2</p> <p>Threshold or Criteria for Evaluation of adaptation tactic</p> <p>Implementing monitoring efforts (frequency, time of year, etc)</p>	<p>No real criteria, just a good way to keep track of growth on the property to see if climate change is having an impact on growth over time.</p> <p>This would be performed by student summer crews annually on 5 year rotations</p>
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Responding to climate change impacts

The following adaptation actions (tactics) were identified to help prepare for climate change impacts. Each adaptation tactic is linked to one or more Adaptation Strategies and Approaches, providing connections to climate change adaptation and forest management and conservation. Refer to the Adaptation Workbook for a complete list of Adaptation Strategies and Approaches.

Note - Tactics that are recommended can be implemented or explored further. However, some adaptation tactics might not be recommended for implementation on this property, which may be due to a combination of barriers and drawbacks or external factors.

<p>Adaptation Tactic</p>	<p>Across the Paul Smiths Property, there are many timber stands that have large crowned, large diameter trees that are at risk of severe wind and ice damage. This is a result of past management that favored large trees at very low densities (less than 50 sq/feet to the acre). Many of these trees are suffering crown dieback related to logging damage (root compaction and severe basal scarring). This is true across the spectrum of species, hardwoods and conifers. Past management has left a two age class property that has stand after stand of beech under story and huge overstory trees. Effectively all the eggs are in one basket and a huge catastrophic event could result in a lot of wood on the ground. This is not an all bad thing, except that the college does view their forest as a financial asset as well as an educational asset. My objective with timber harvesting is to promote group selection/ patch and block clearcutting (patch = 5 acres, block = 5-20 acres) and overstory removal to try to reduce the actual stocking of large at-risk trees in low density stands.</p>
<p>Strategy</p>	<p>Reduce the risk and long-term impacts of severe disturbances</p>
<p>Approach</p>	<p>Alter forest structure to reduce severity or extent of wind and ice damage</p>
<p>Benefits of this tactic</p>	<p>This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.</p>
<p>Drawbacks and barriers of this tactic</p>	<p>The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. It would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.</p>

Timeframe to implement	15 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	High
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.
Strategy	Maintain and enhance species and structural diversity
Approach	Promote diverse age classes
Benefits of this tactic	Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
Timeframe to implement	15-30 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	Medium
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
... recommend tactic?	Yes
Adaptation Tactic	My understanding is that we want to DEcrease ecosystem redundancy by increasing species diversity and diversifying age structure across the landscape? My hope is to do this as much of the property is currently very redundant and potentially at risk of severe weather events and changing conditions. My harvesting plan should help with decreasing redundancy.
Strategy	Increase ecosystem redundancy across the landscape Manage habitats over a range of sites and conditions

Approach	
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
Drawbacks and barriers of this tactic	The greatest drawbacks and barriers remain access to the land for harvesting due to summer storm events and mild winters.
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Strategy	Reduce the risk and long-term impacts of severe disturbances
Approach	Alter forest structure to reduce severity or extent of wind and ice damage
Benefits of this tactic	This approach should increase plant diversity and also diversify the age structure of the forest which is currently only two aged (very old and very young). This should mitigate our forest resource against catastrophic events and hopefully at some point lead to a sustained yield of products off the property.

Drawbacks and barriers of this tactic	The largest drawback to this approach is that so much of the forest is in this state of being that dealing with it in a systematic and sustained manner is difficult. it would be easy to simply march across the property clearcutting a certain percentage every year. This is, in a small way my plan. However this needs to be done sustain-ably so a steady yield of timber can be harvested every year or every other year. Essentially my plan is to harvest 1/4 - 1/3 of an area each year based on my inventory and harvest schedule. The key is to not panic and feel that i need to do it all at once (which would also be un-sustainable. It is going to require some luck with the weather as well.
Timeframe to implement	15 years
Practicability	<i>An adaptation tactic is practicable if it is both effective & feasible to implement and to ultimately achieve desired intent.</i>
... practicability of tactic?	High
Recommendation for implementation	<i>The decision to recommend a tactic may be based on the likelihood of success, potential tradeoffs, cost, and other factors.</i>
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Adaptation Tactic	As mentioned, this property has been managed using low density shelterwood, regardless of the stand conditions that prevailed before a harvest. This has lead to essentially 12,000 acres of two aged stands (young trees and very old trees). My plan (generally) is to harvest 1/4 - 1/3 of the managed acreage every 15 years using group selection, clearcutting and overstory removals. This should result in more diverse age structure and hopefully a greater species composition across the property.
Strategy	Maintain and enhance species and structural diversity
Approach	Promote diverse age classes
Benefits of this tactic	Benefits include: greater species diversity, greater diversity of age structure, improved wildlife habitat, improved educational opportunities for PSC students, steady flow of revenue, buffering of severe climate conditions (assumed)
Drawbacks and barriers of this tactic	I must remain systematic and logical and i have to follow a management plan that i put into action. Otherwise it will simply look like i am performing a clearcut march across the property. Also the largest Barrier will be severe summer storms and soft winters that limit logging access.
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Adaptation Tactic	

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Strategy	Increase ecosystem redundancy across the landscape
Approach	Manage habitats over a range of sites and conditions
Benefits of this tactic	Our property is VERY redundant when it comes to age structure diversity. Fortunately we do have good natural species diversity (despite past management) and also have the potential for greater species diversity with applied silvicultural techniques, specifically group selection and patch cutting.
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Monitoring variables used to evaluate if tactic is achieving desired management objective(s)	Species diversity of regeneration 5 and 10 years post harvest
Monitoring Variable 1	
Threshold or Criteria for Evaluation of adaptation tactic	Rather than a threshold for evaluations, this would be more of a simple monitoring tool to see how our management is working not necessarily to see if it is working. Just a tally of what species are coming into the harvest area and possibly an early detection system for new arrivals
Implementing monitoring efforts	This would be done by students, either paid student crews or by mensuration labs. It may also be incorporated into a capstone senior project..

(frequency, time of year, etc)	
Monitoring variables used to evaluate if tactic is achieving desired management objective(s)	Improve habitat for migrant songbirds and create conditions conducive to new arrivals. Songbirds are extremely sensitive to rapid habitat changes (good and bad) and should be a good indicator of the species richness of an area 1-10 years post harvest. Songbirds are also sensitive to climate change and this may offer opportunities for early detection of new arrivals or possibly losses of boreal species. This work can include grouse drumming surveys as well simply to see if habitat work is successful in the harvest areas.
Monitoring Variable 2	
Threshold or Criteria for Evaluation of adaptation tactic	increases or decreases of baseline species richness of songbird species. Essentially a simple count.
Implementing monitoring efforts (frequency, time of year, etc)	This would be done by wildlife students and ornithology classes on an annual basis if possible.

Responding to climate change impacts

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Monitoring Variable 2	
Threshold or Criteria for Evaluation of adaptation tactic	No real criteria, just a good way to keep track of growth on the property to see if climate change is having an impact on growth over time.
Implementing monitoring efforts (frequency, time of year, etc)	This would be performed by student summer crews annually on 5 year rotations

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