



## **Adapting to climate change – reducing risk through diversity**

### **Examples for the Merritt TSA**

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A changing climate could contribute to increased losses of timber through a variety of forest health agents.

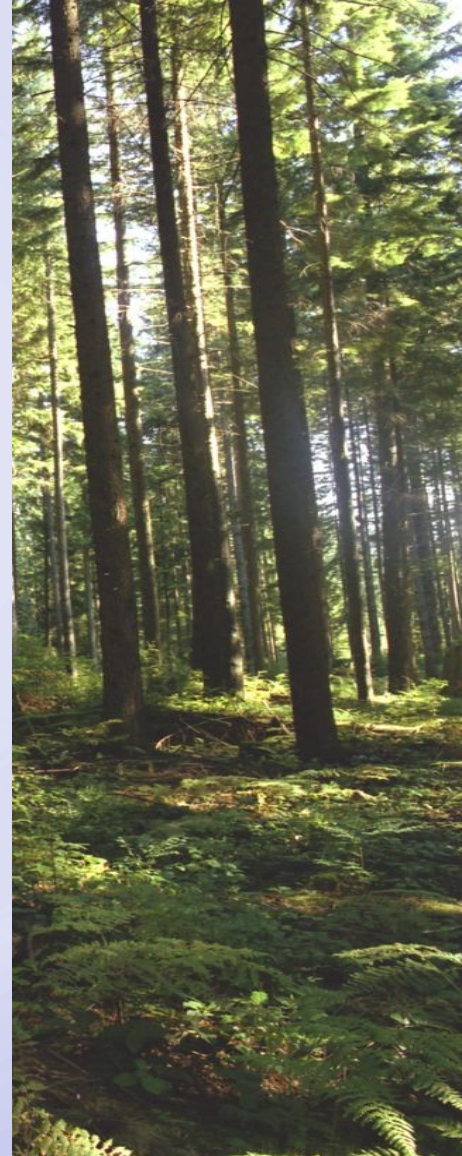
Can we manage forests in a more strategic way to minimize any losses?

Forest management objectives:

- increase diversity,
- reduce risk, and
- maintain benefits.

How to incorporate the results into forest management?

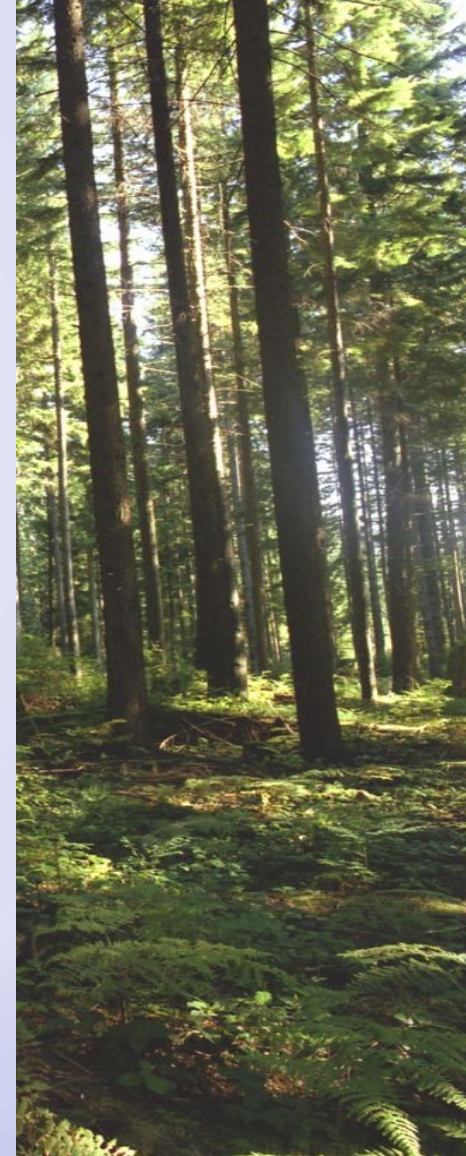
- Diversity of species – diversity of approach



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- A more diverse forest will have a lower risk to large scale disturbance.
- The magnitude of the MPB impact is climate related and provides an actual disturbance to model.
- Two management changes considered:
  - Increase landscape diversity of tree species,
  - Targeted removal of high risk species.

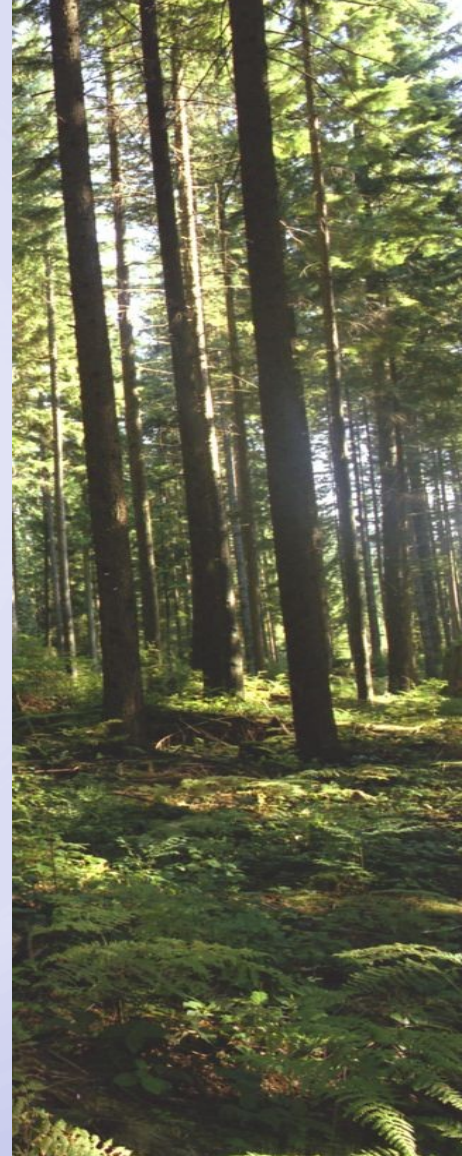




## Methods

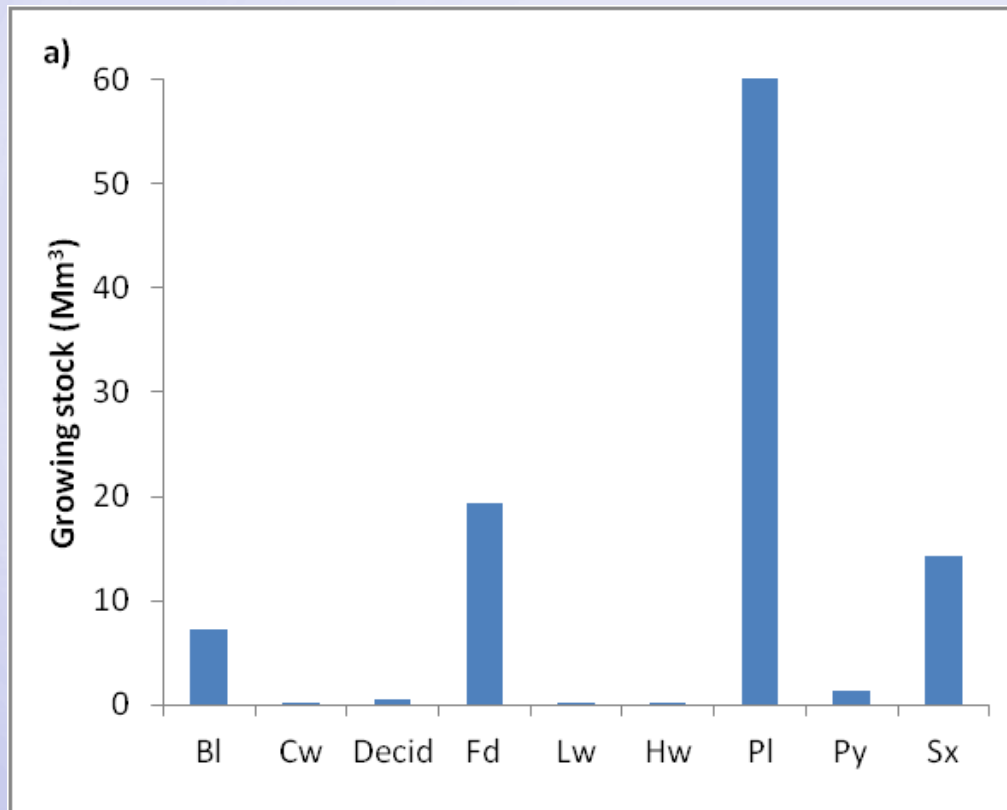
- **Simulation of a forest estate 1980 – 2060**
  - **CASH6 model,**
  - **similar to TSR or silviculture strategy approaches**
- **Different management regimes**
  - **Business as usual;**
  - **Mixed planting;**
  - **Early pine cut, mixed planting, more natural regeneration through partial harvesting.**

**Modelling supported by Ecora**

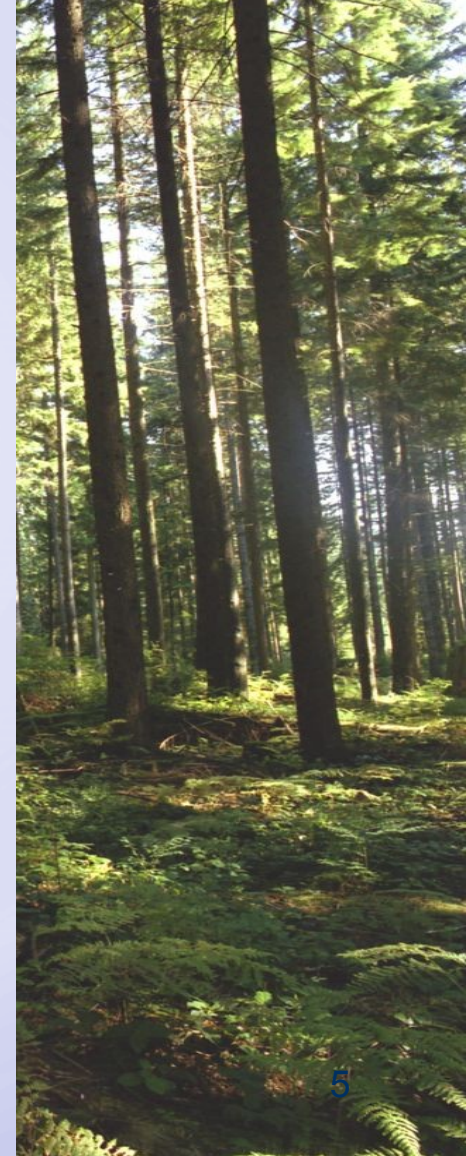




## 1980 Species distribution

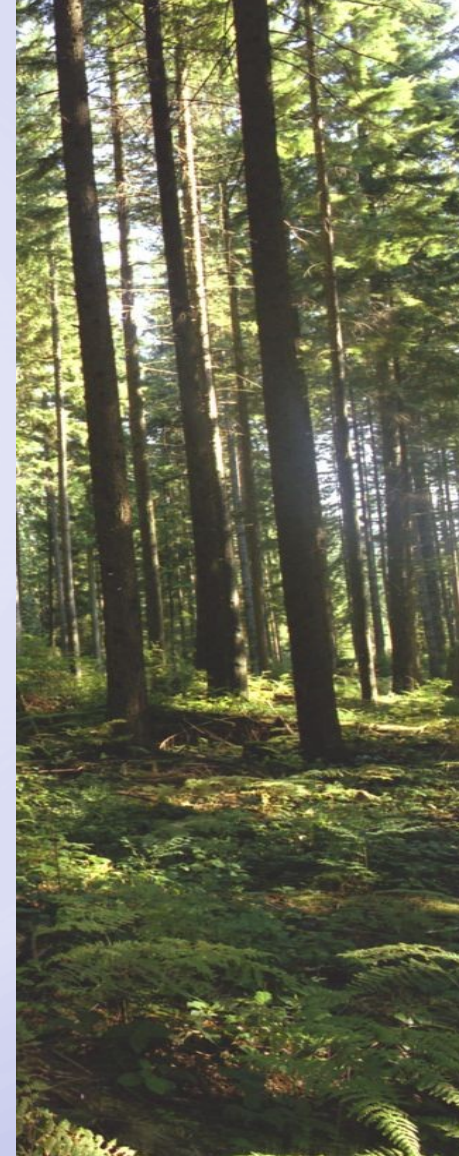
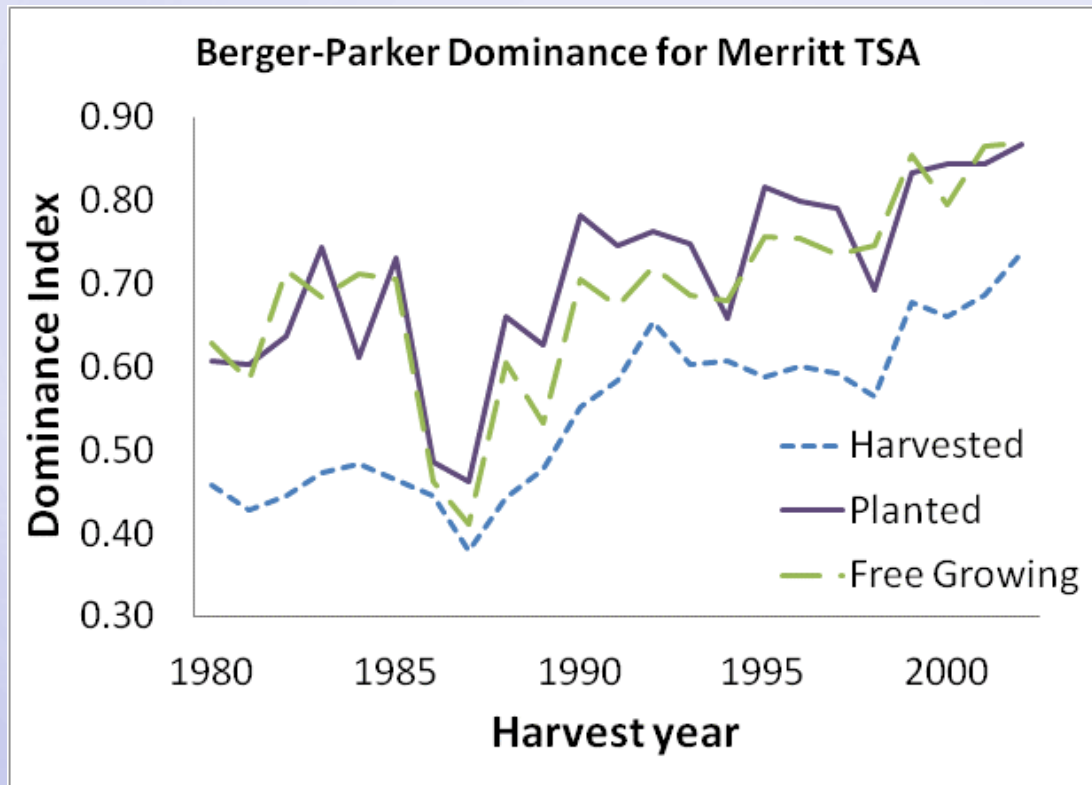


**Objective: increase diversity of tree species across the landscape**





## Dominance index from Species Monitoring Report



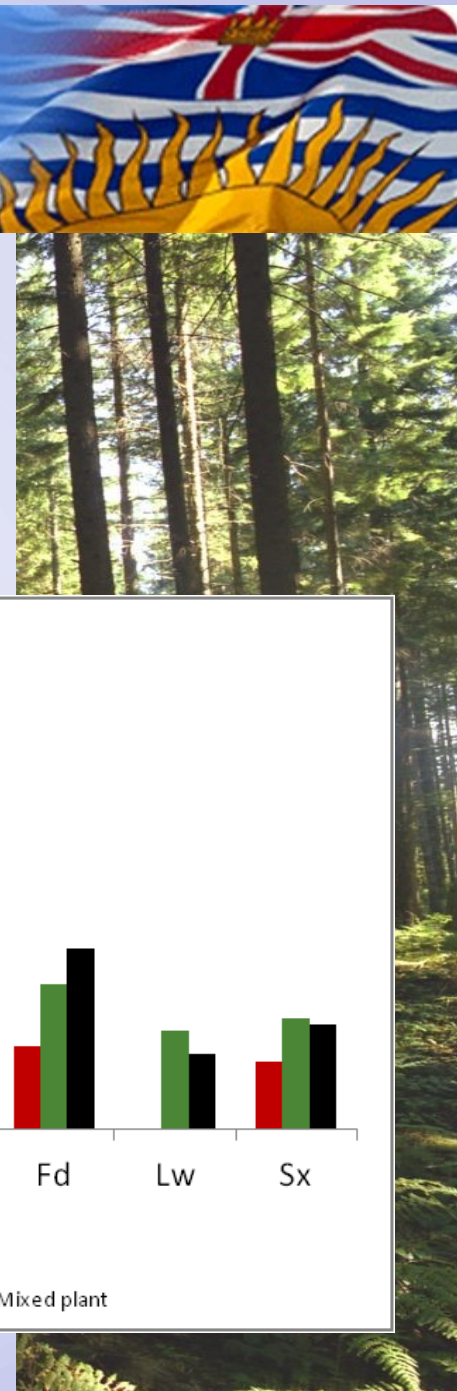
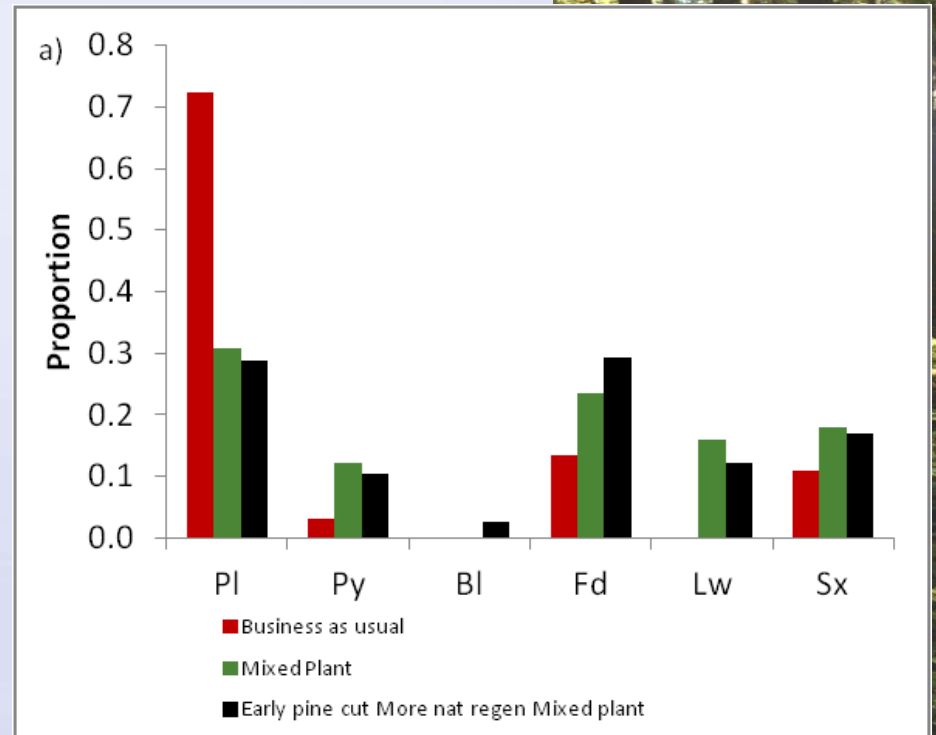
## Merritt TSA: Modelling implementation

Harvest

– historical volume 1980-2009

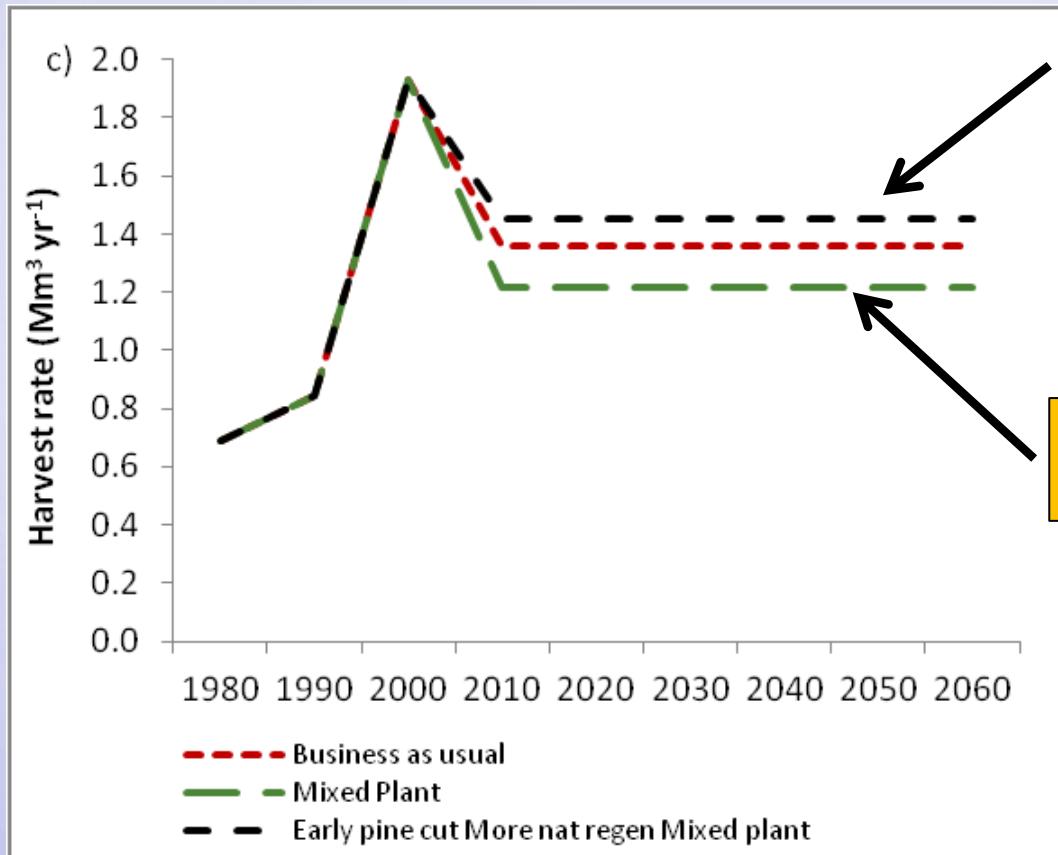
Percent pine	1980-89	1990-99	2000-09
Business as usual	40%	72%	88%
Mixed planting	40%	72%	88%
EMR	96%	92%	90%

Regeneration





## Merritt Results – Harvest Rates



A higher harvest rate than BAU because more trees survived the beetle

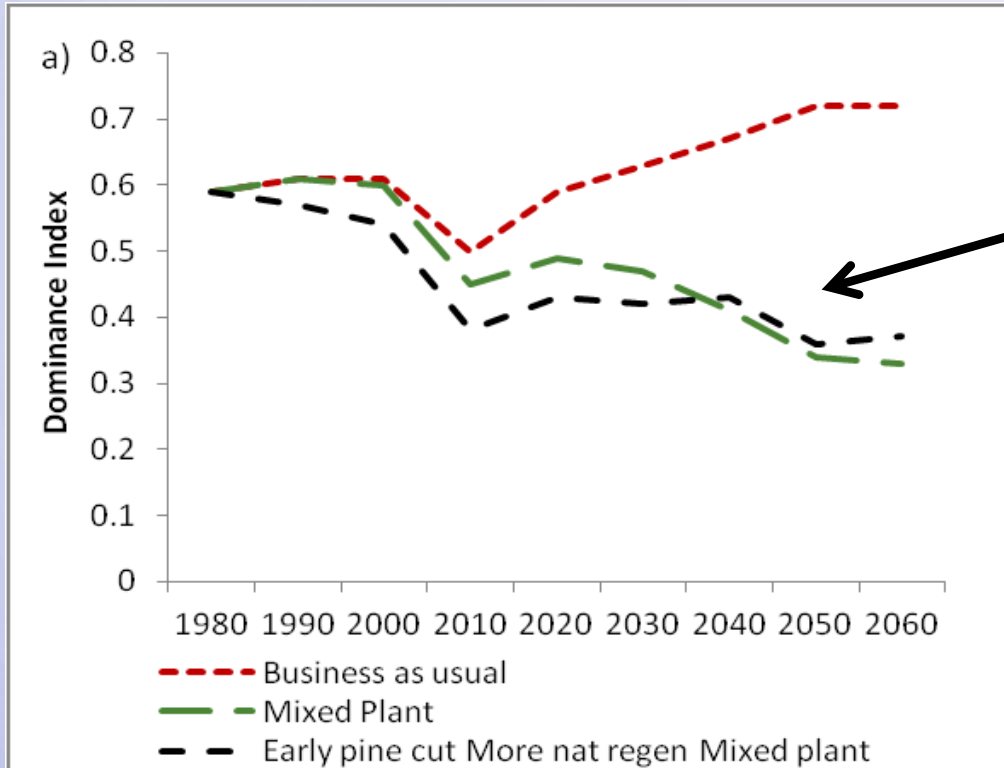
Not enough to just have different regeneration







# Merritt Results – Dominance Index

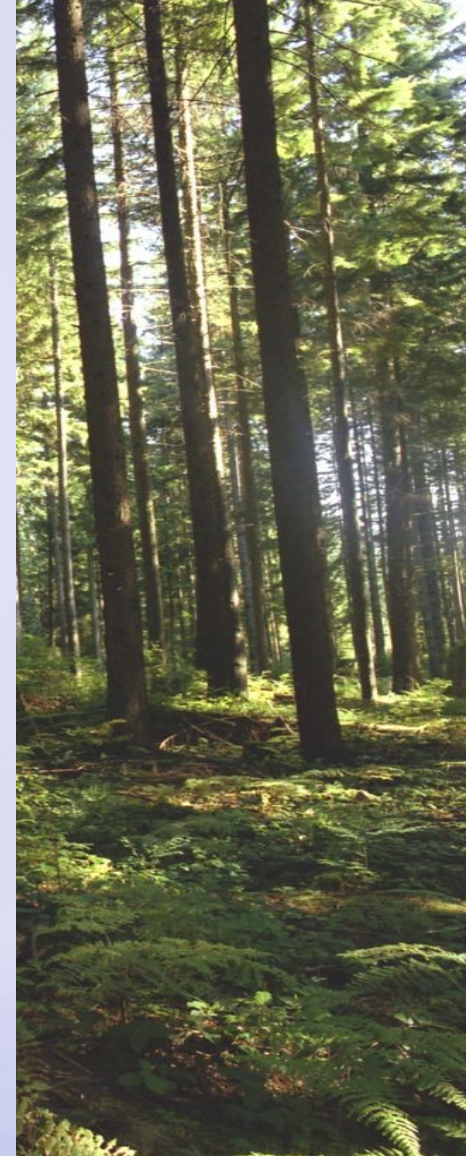
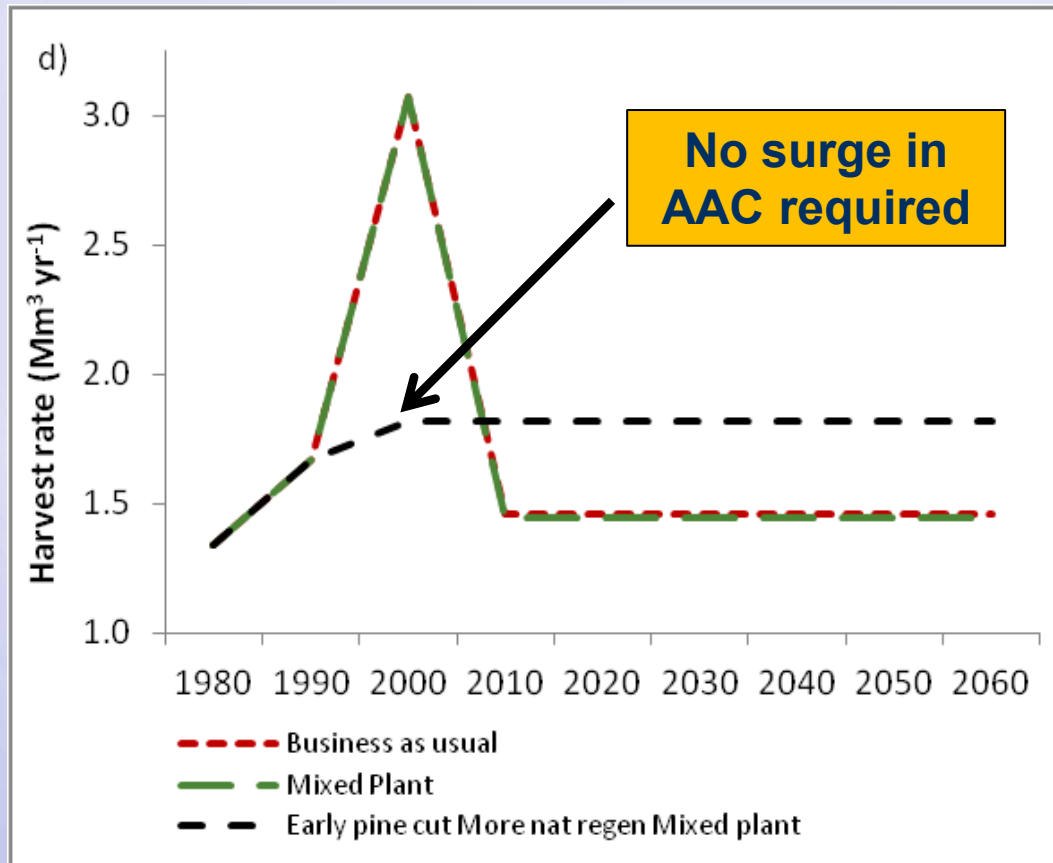


**Greater  
balance in  
diversity**





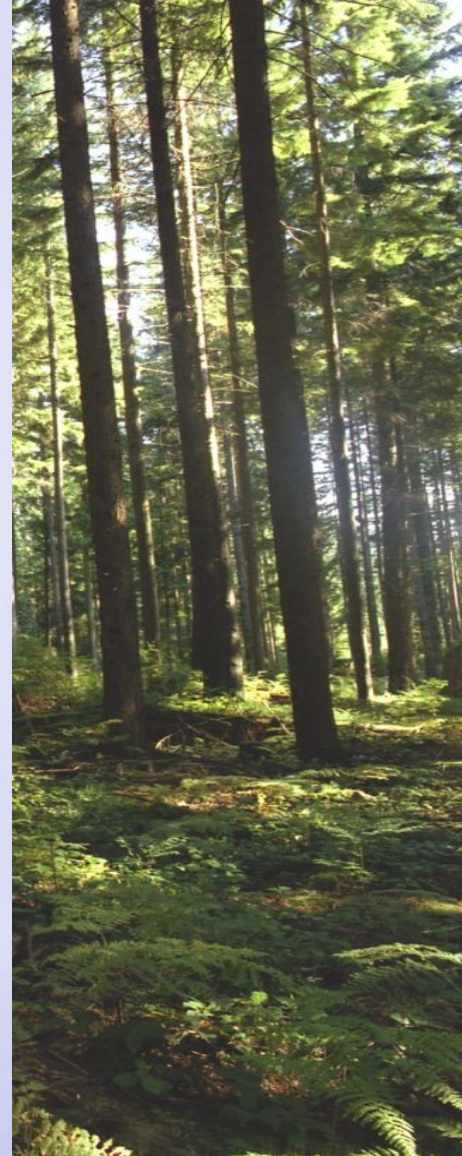
# Kamloops Results – Harvest Rates



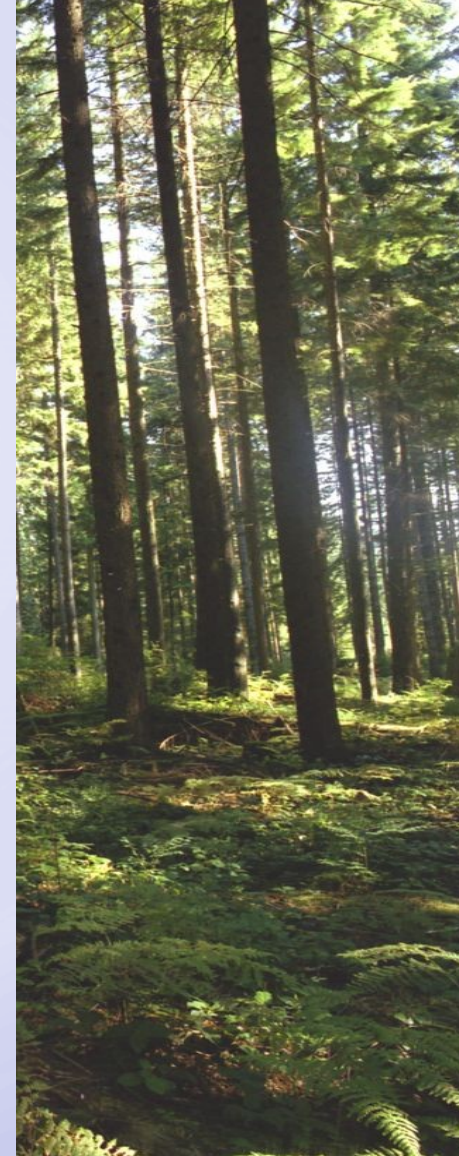
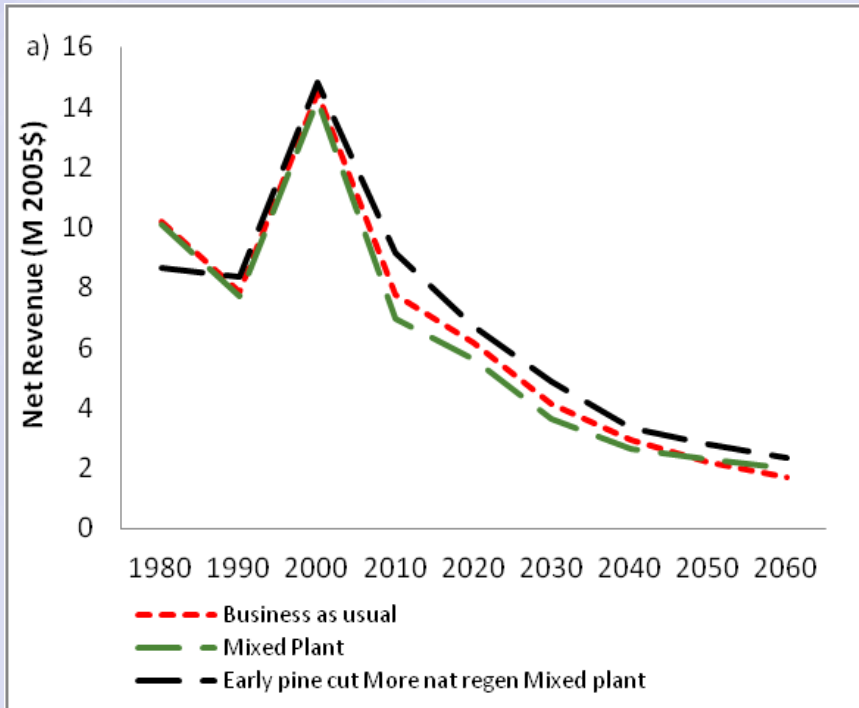


## **Economic analysis**

- **Landscape scale**
- **Forested not bare land**
- **Existing harvesting operations**
  
- **Discount rates: 0, 1, 3, 5%**
  
- **Costs = harvesting, overhead, hauling, silviculture**
  
- **Log prices = Average monthly variable prices by species 2003-2011**



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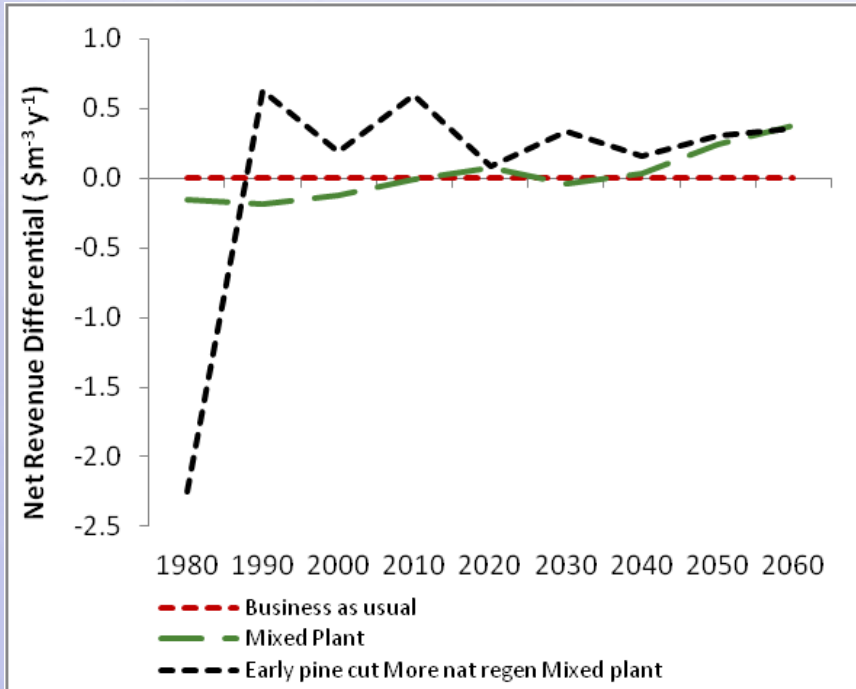


	Net present value (\$millions) by discount rate			
	0%	1%	3%	5%
Business as usual	1,569	1,061	574	372
Mixed planting	1,524	1,023	552	359
EMR	<b>1,790</b>	<b>1,181</b>	<b>611</b>	<b>380</b>

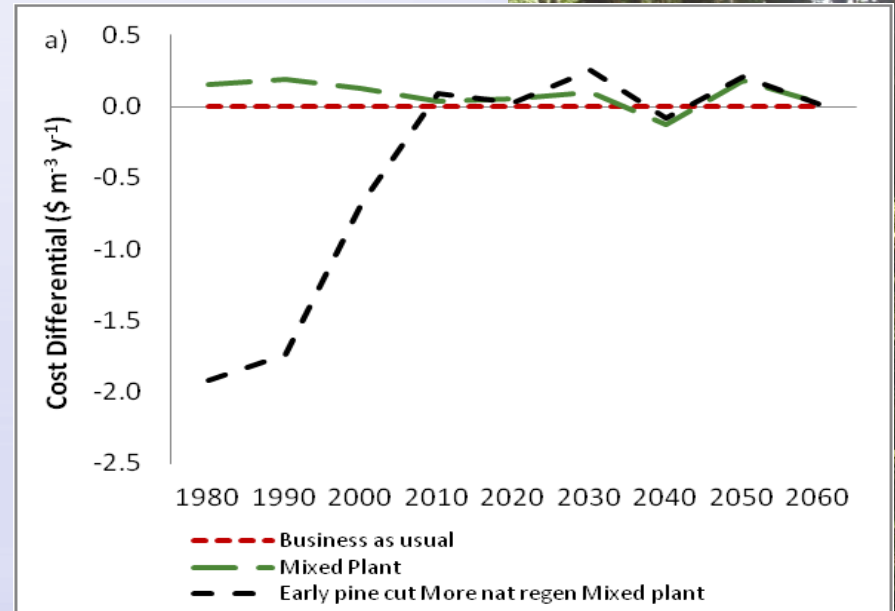


## Net revenue and costs per cubic metre

### Annual net revenue / m<sup>3</sup>



### Annual costs / m<sup>3</sup>

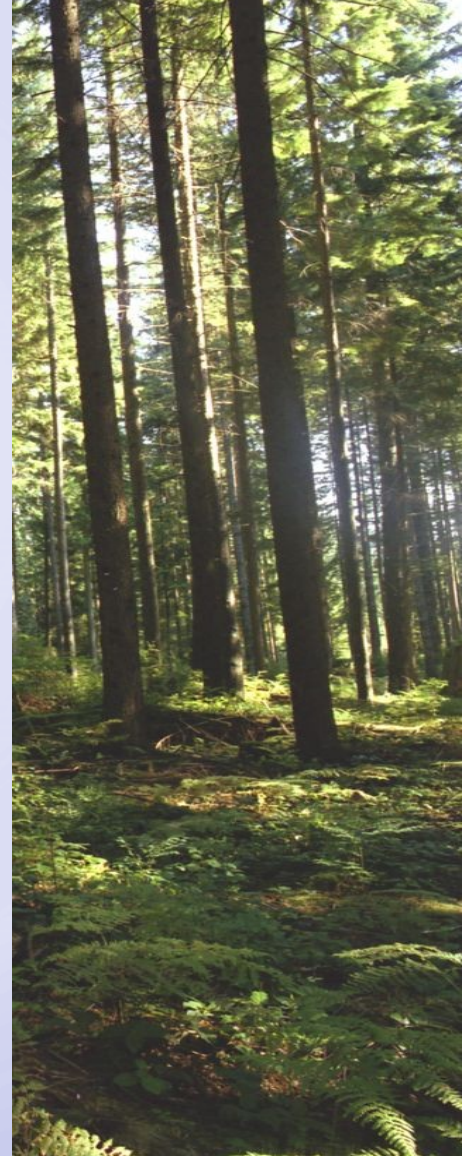




## Beneath the pictures

If the harvest was the same at the start for BAU and EMR, why wasn't the net present value?

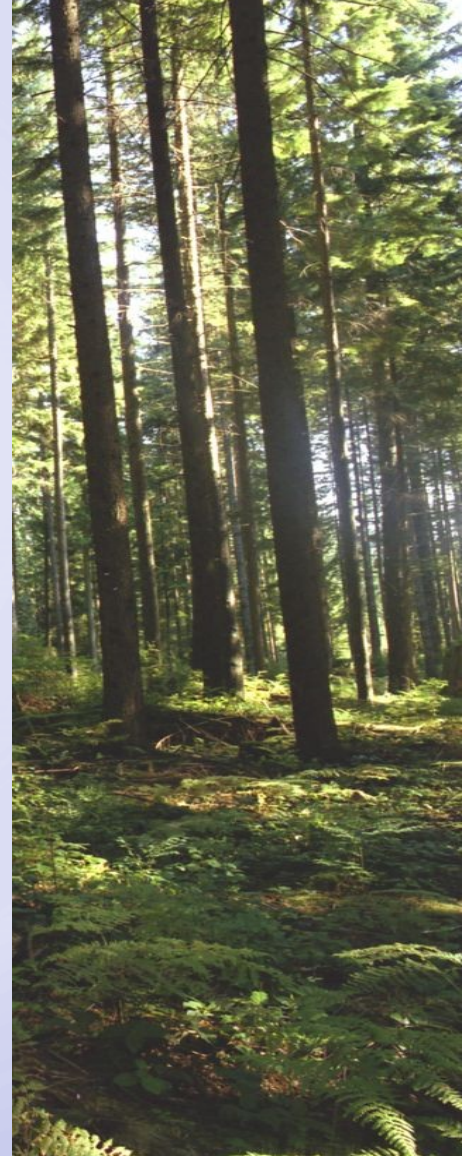
- Average Revenues:
  - EMR lower by \$2 million/year (or \$4/m<sup>3</sup>)
- Average Costs:
  - EMR lower by \$1.3 million/year (or \$2/m<sup>3</sup>)
- Is this enough information to inform decision making?





## Beneath the pictures

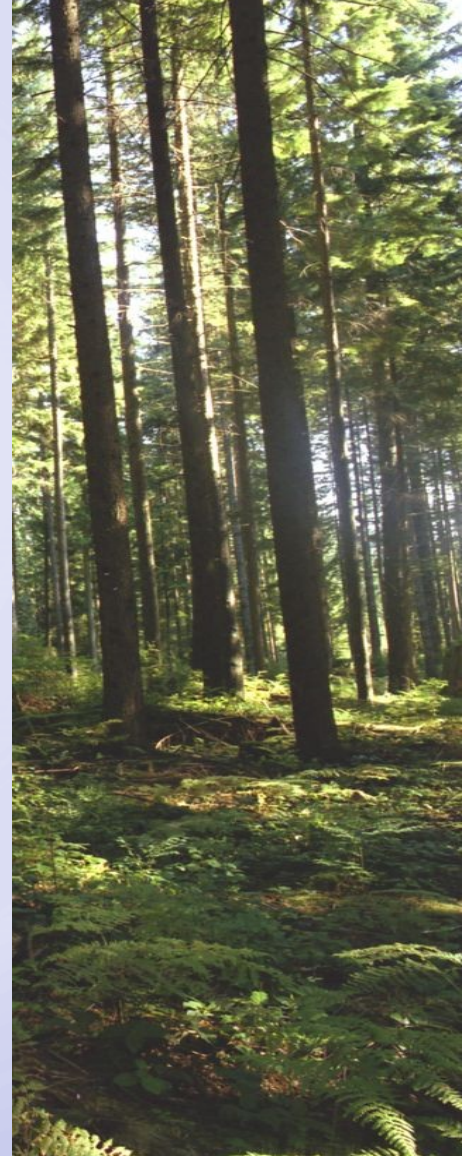
- Cost categories: decade 1
  - For EMR, the hauling and harvesting costs were up \$350 thousand/year, but silviculture costs were down by \$1.7 million/year.
- Area harvested: decade 1
  - BAU = 4,344 ha/year
  - EMR = 3,310 ha/year
- Species breakdown: decade 1
  - BAU harvested 34% Df and 40% pine
  - EMR harvested 2% Df and 96% pine
  - Df = \$67/m<sup>3</sup>; pine = \$49/m<sup>3</sup>



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- Sensitivity analysis
  - Df productivity
  - 20% price change
- Alternative decade 1 harvest schedules
- Discount rates
- Other implications? Veneer/plywood sector...







## **Conclusion**

### **What does it all mean for managers today?**

- **These results indicate a more aggressive approach to adaptation does not necessarily lead to ruin.**
- **We may need to think beyond current practices, adapting to individual areas and conditions. Diversity needs a diverse approach.**
- **The decision maker and decision points are critical. Public versus private**
- **Less risk does not mean no risk.**





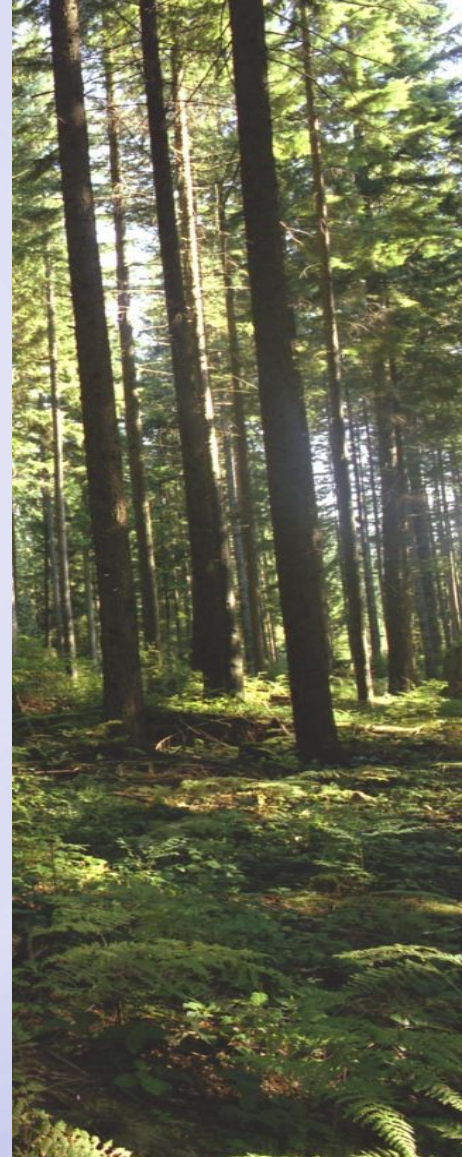
**Thank you**

**Sinclair Tedder**

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**Caren Dymond**

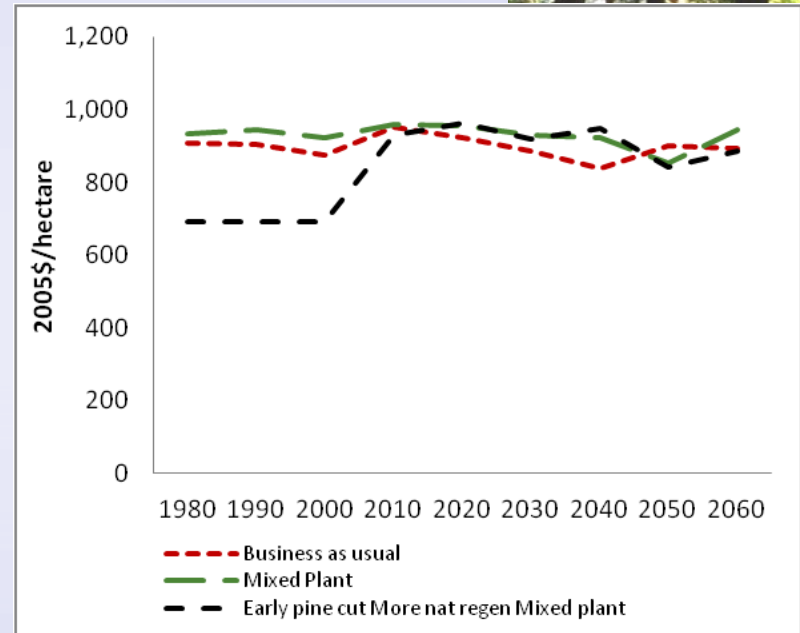
**[Caren.dymond@gov.bc.ca](mailto:Caren.dymond@gov.bc.ca)**



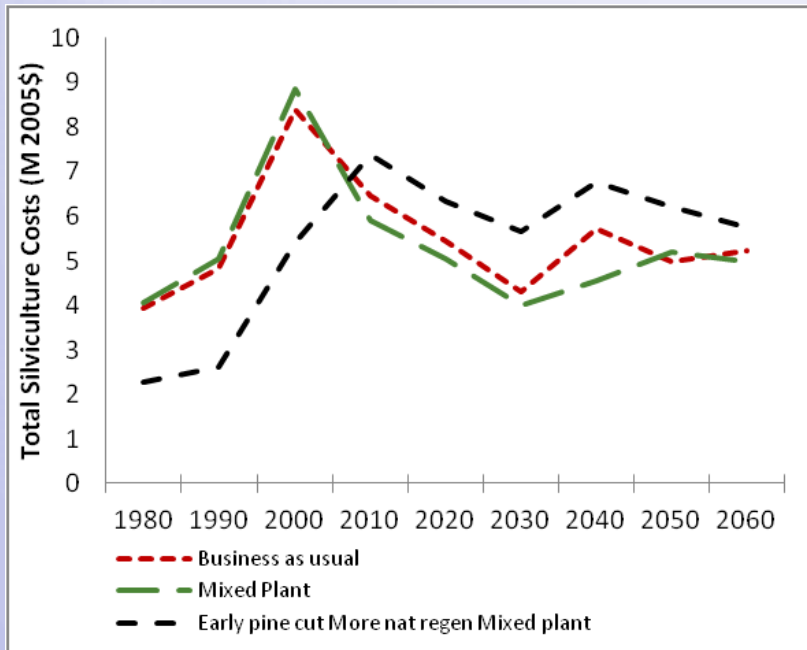
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## Silviculture costs per hectare



## Merritt forest district total silviculture costs





## Merritt area harvested annually

### Standing Volume for Merritt TSA

