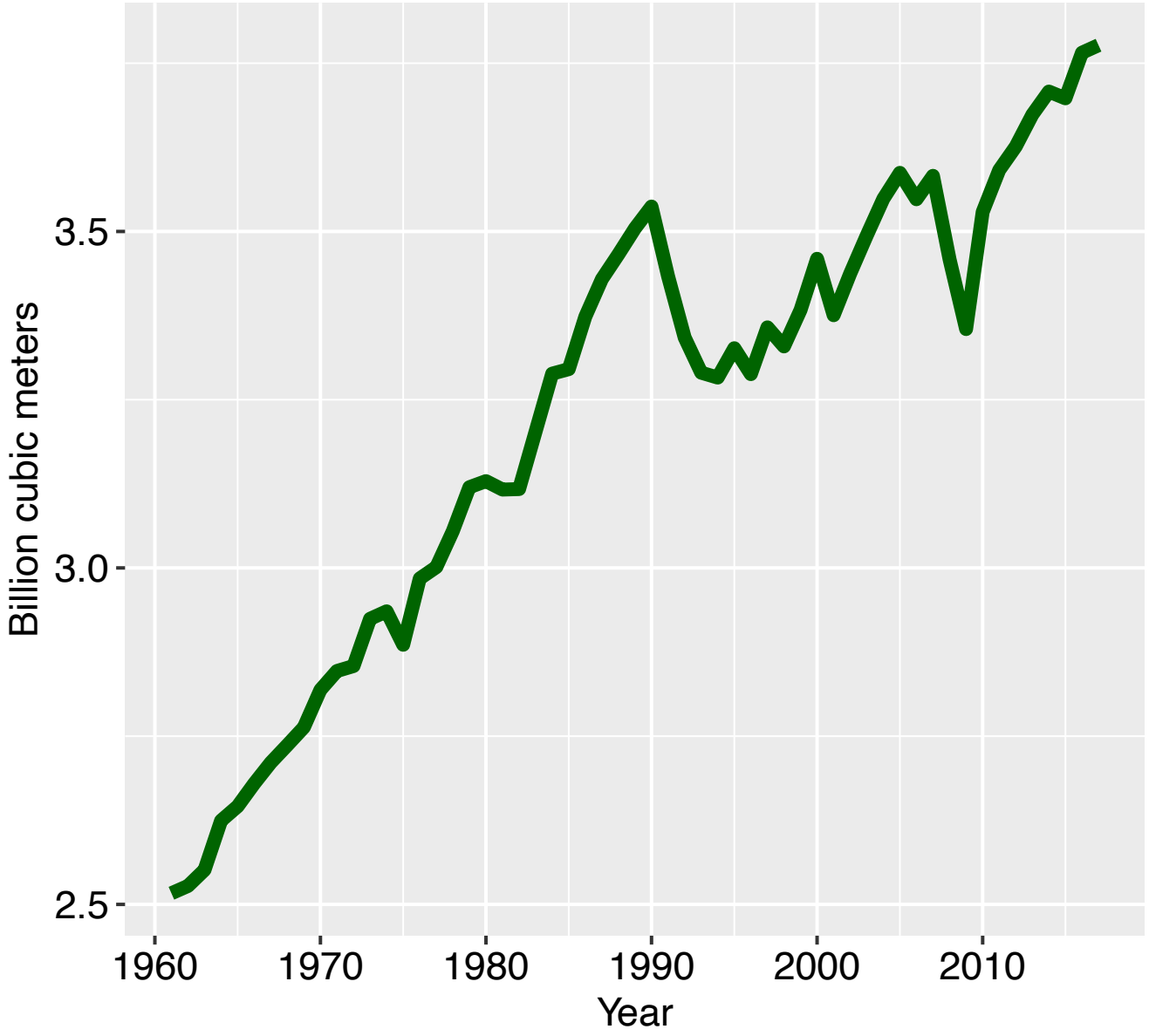
Forest management, herbicides and biodiversity in New Brunswick: a science-based approach

Matt Betts, Ph.D.

Oregon State University

Presentation to the Standing Committee on Climate Change and Environmental Stewardship

Global roundwood production



Source: FAO

Biodiversity conservation

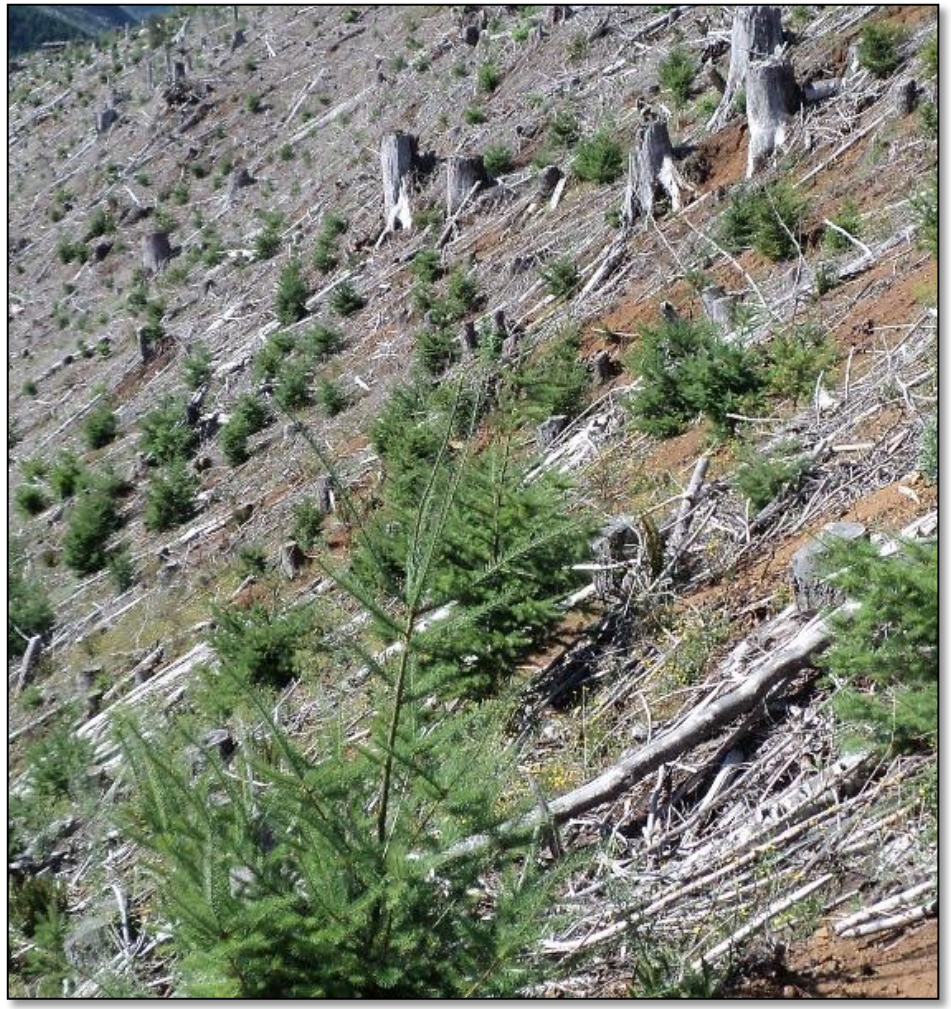
Today:

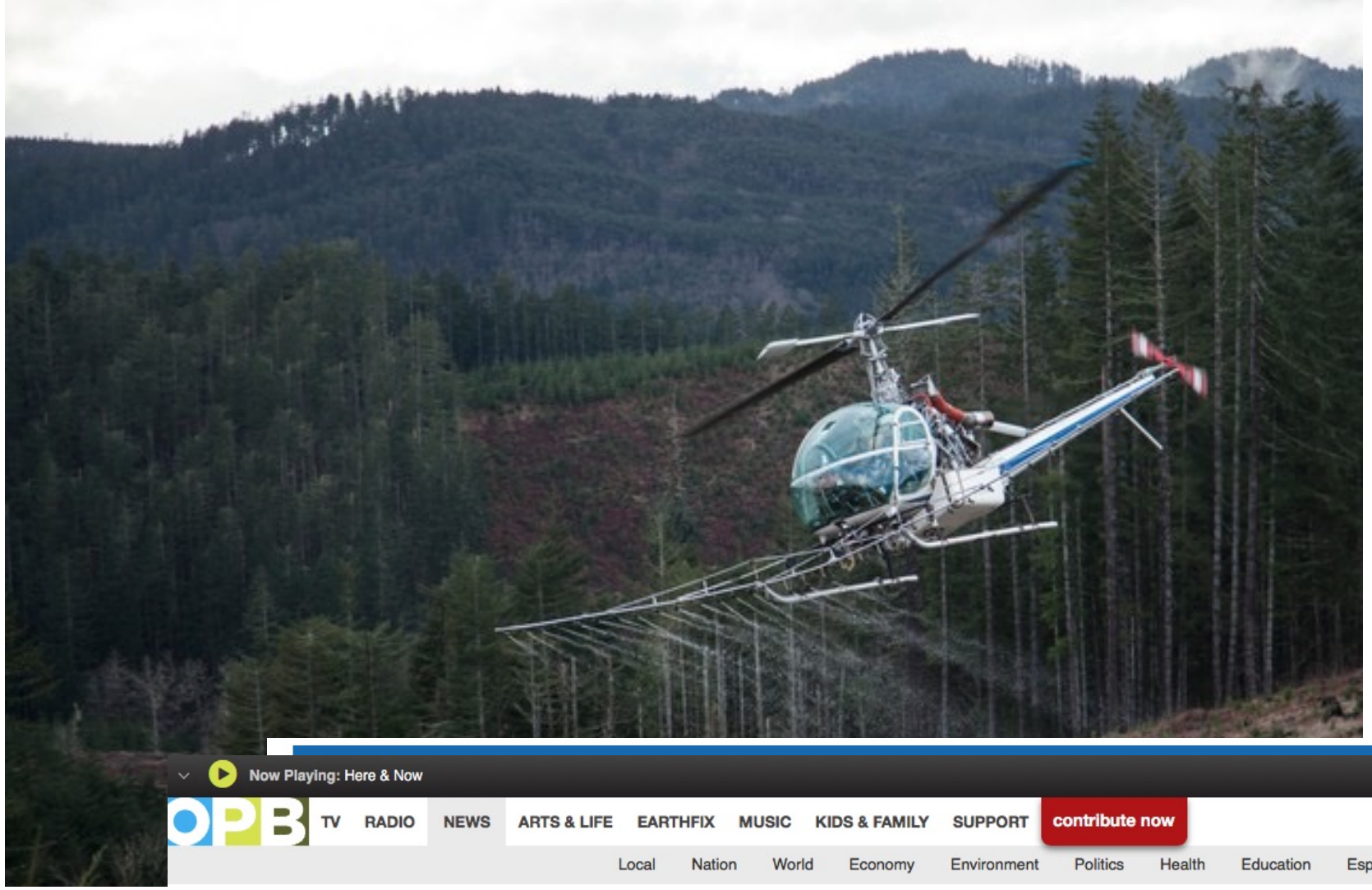
1. Herbicides, wood production, and biodiversity in Oregon

2. NB forest ecology: a brief intro (or reminder)

3. Forest management and biodiversity in NB

1. Herbicides, wood production, and biodiversity in Oregon





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Study: Roundup Weed Killer Could Be Linked To Widespread Bee Deaths

by **Vanessa Romo** NPR Sept. 25, 2018 5:06 p.m.

JUNE 2, 2021

Study Question:

- **How is biodiversity affected by herbicide use in Oregon forests**?


2011 Control
2011 Light
2011 Moderate
2011 Intensive

Study treatment	Season & Year	Prescription	Chemical	Quantity/Ha
Control	Spring 2011	Planting	NA	1075 trees
Light	Spring 2011	Planting		1075 trees
	Spring 2011	Herbaceous	Velpar	2.96 kg
			2-4-D	2.37 L
Moderate	Late Summer 2010	Site Preparation	Escort	0.11 L
			Accord	7.04 L
			Chopper	1.78 L
			Oust	0.22 L
			MSO	1.78 L
	Spring 2011	Planting		1075 trees
	Spring 2011	Herbaceous	Velpar	2.96 kg
			2-4-D	2.37 L
Intensive	Late Summer 2010	Site Preparation	Escort	0.11 L
			Accord	7.04 L
			Chopper	1.78 L
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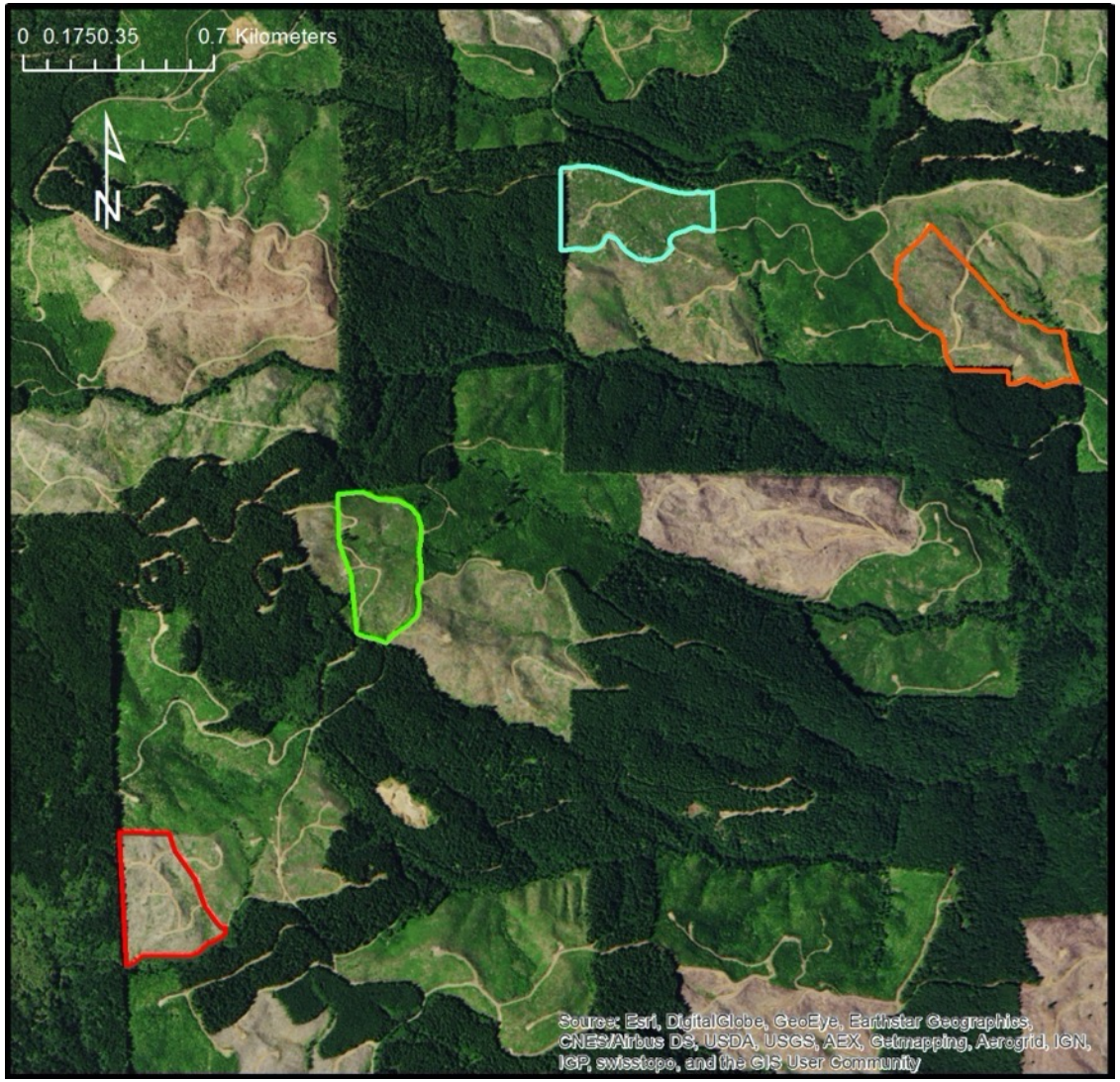
	Spring 2011	Herbaceous	Velpar	2.96 kg
			2-4-D	2.37 L
	Spring 2012	Herbaceous	Velpar	2.96 kg
			2-4-D	2.37 L

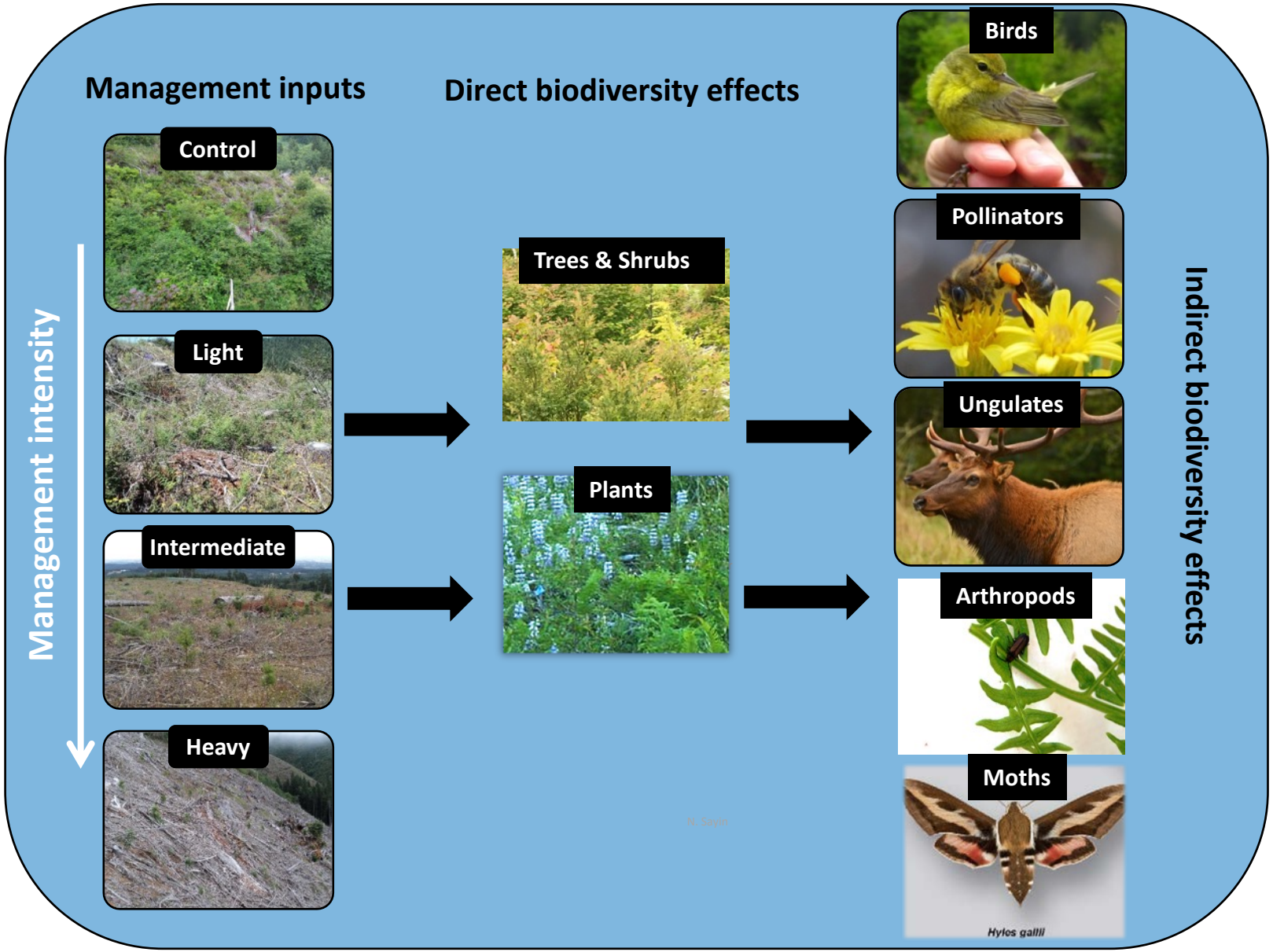
Glyphosate

Study Design

8 blocks, 4 treatments per block (*n*=32)



Intensive management and biodiversity



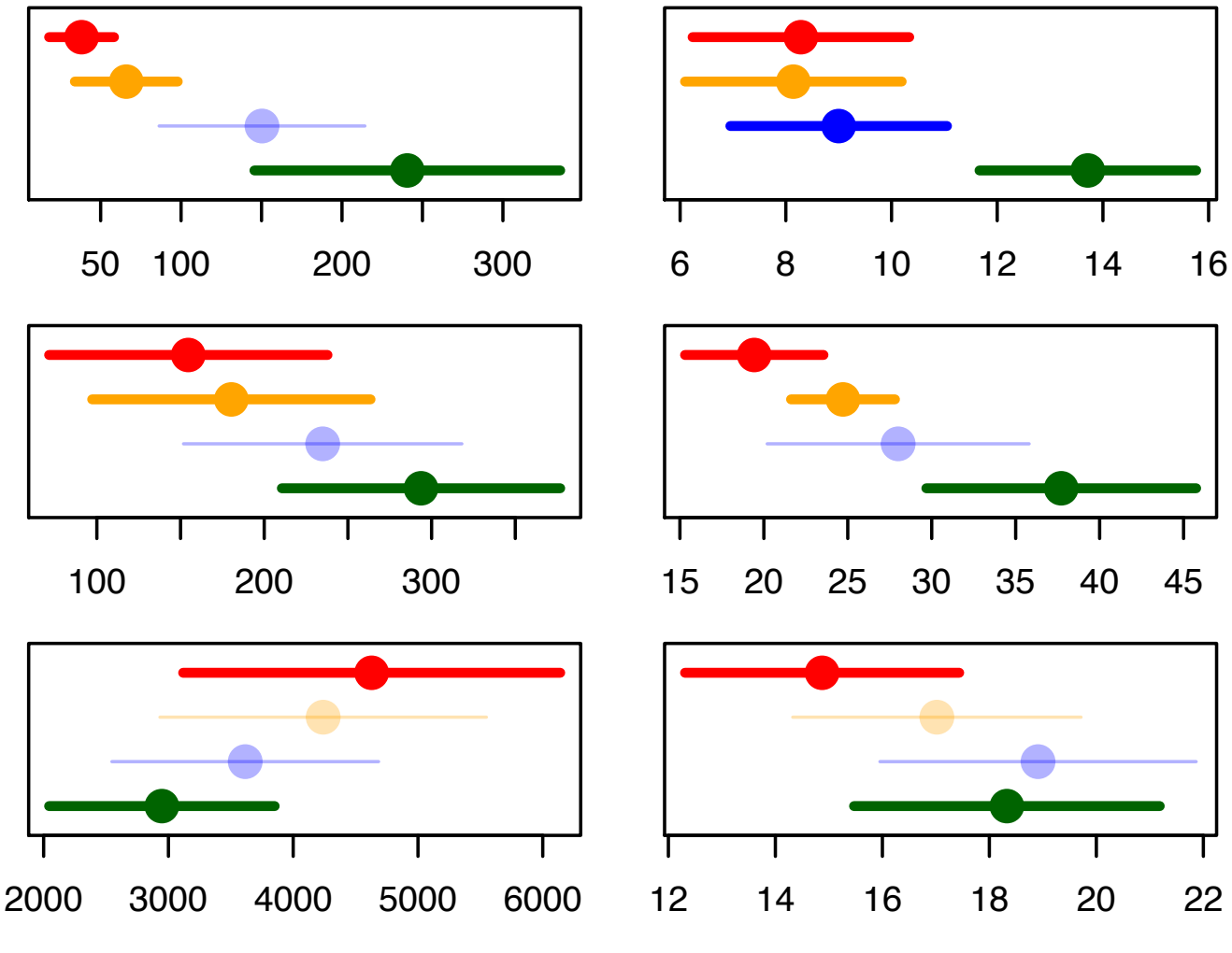
140,408 detections
835 taxa

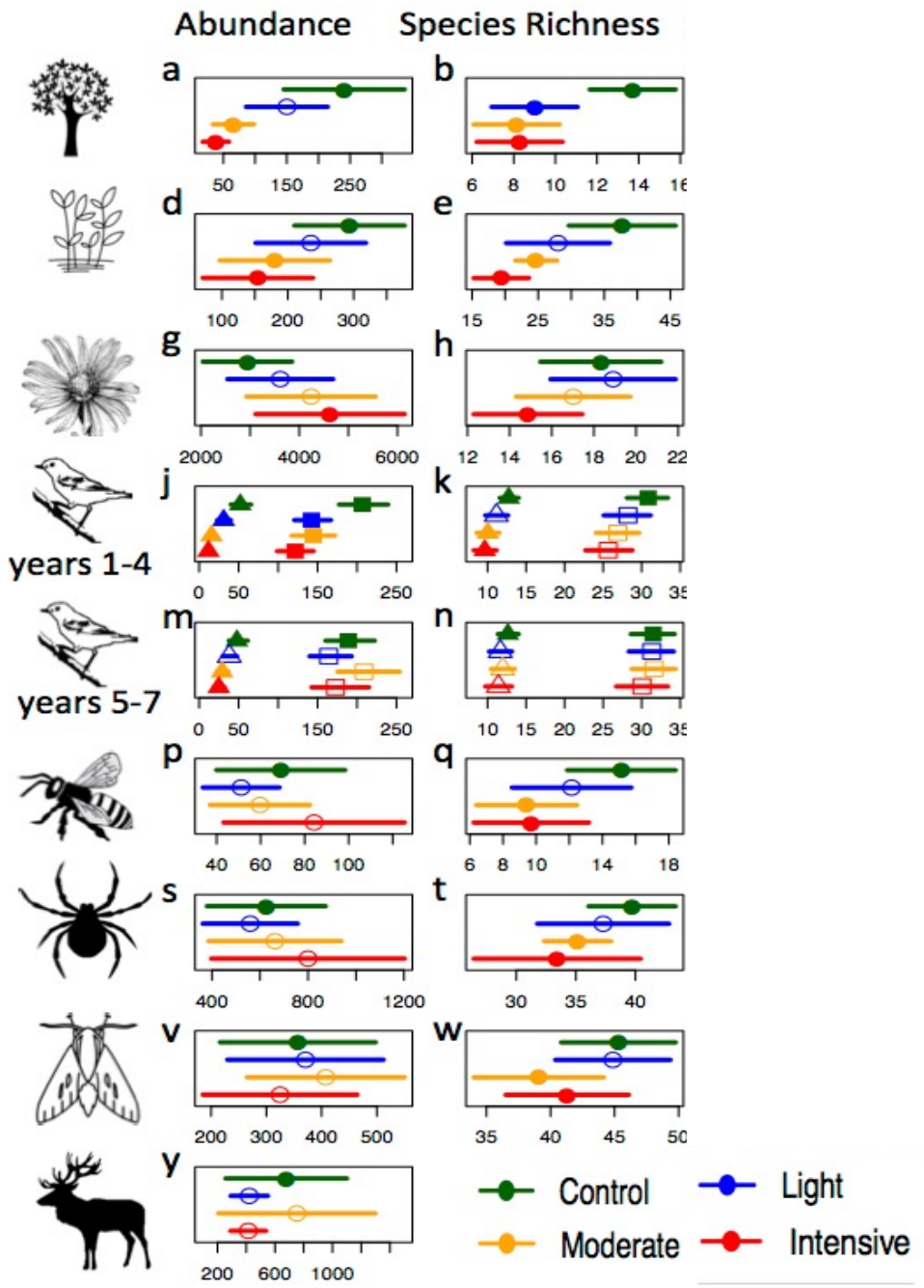
Intensive forest management effects on biodiversity

Woody plants
(46 species)

Herbs
(180 species)

Flowers
(92483 flowers; 61 species)



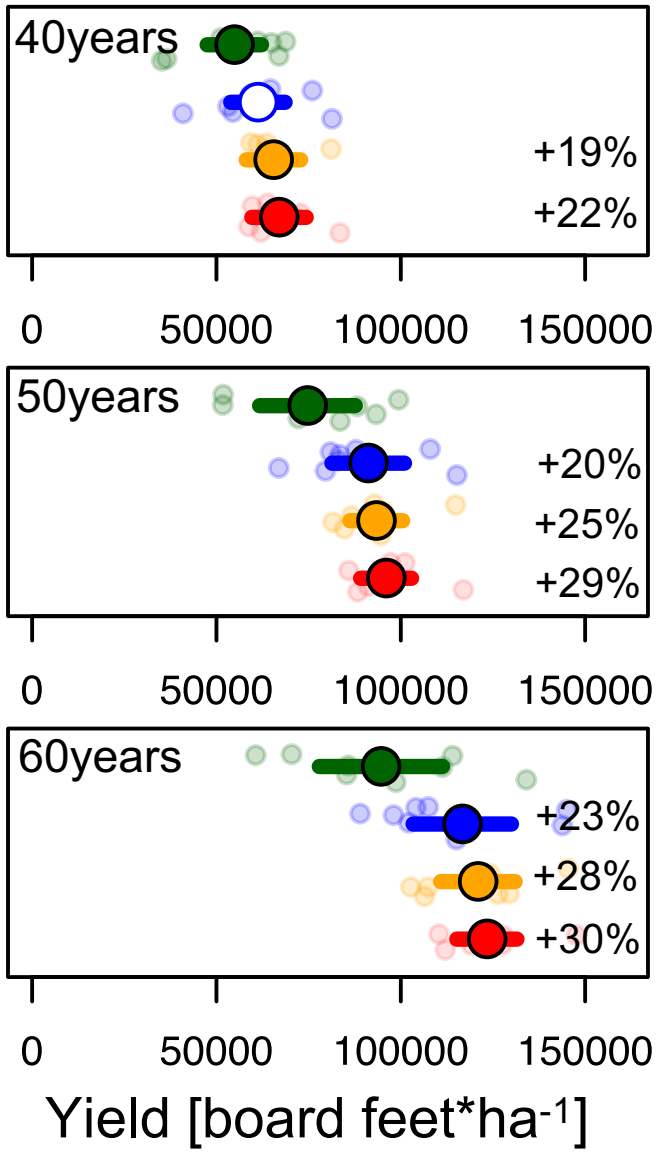


Overall:

18% fewer species

(primarily plants, pollinators and birds)

Intensive forest management effects on yield



Economic Revenue ($)

Discounted: plantation costs, herbicide costs, harvest costs, harvest income to calculate **NPV** and **Land Expectation Value (LEV)**

Discount rates

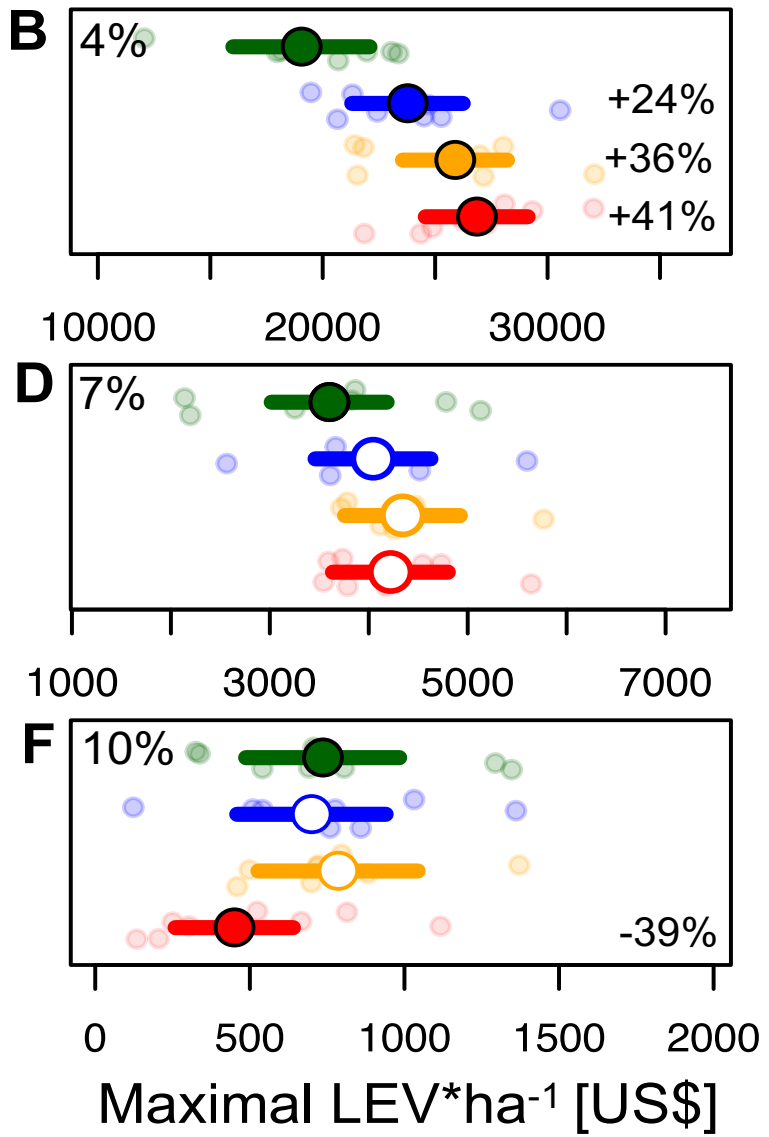
$200/ ha (2018)

Discount rate over 40 years = 6%: $2057/ ha

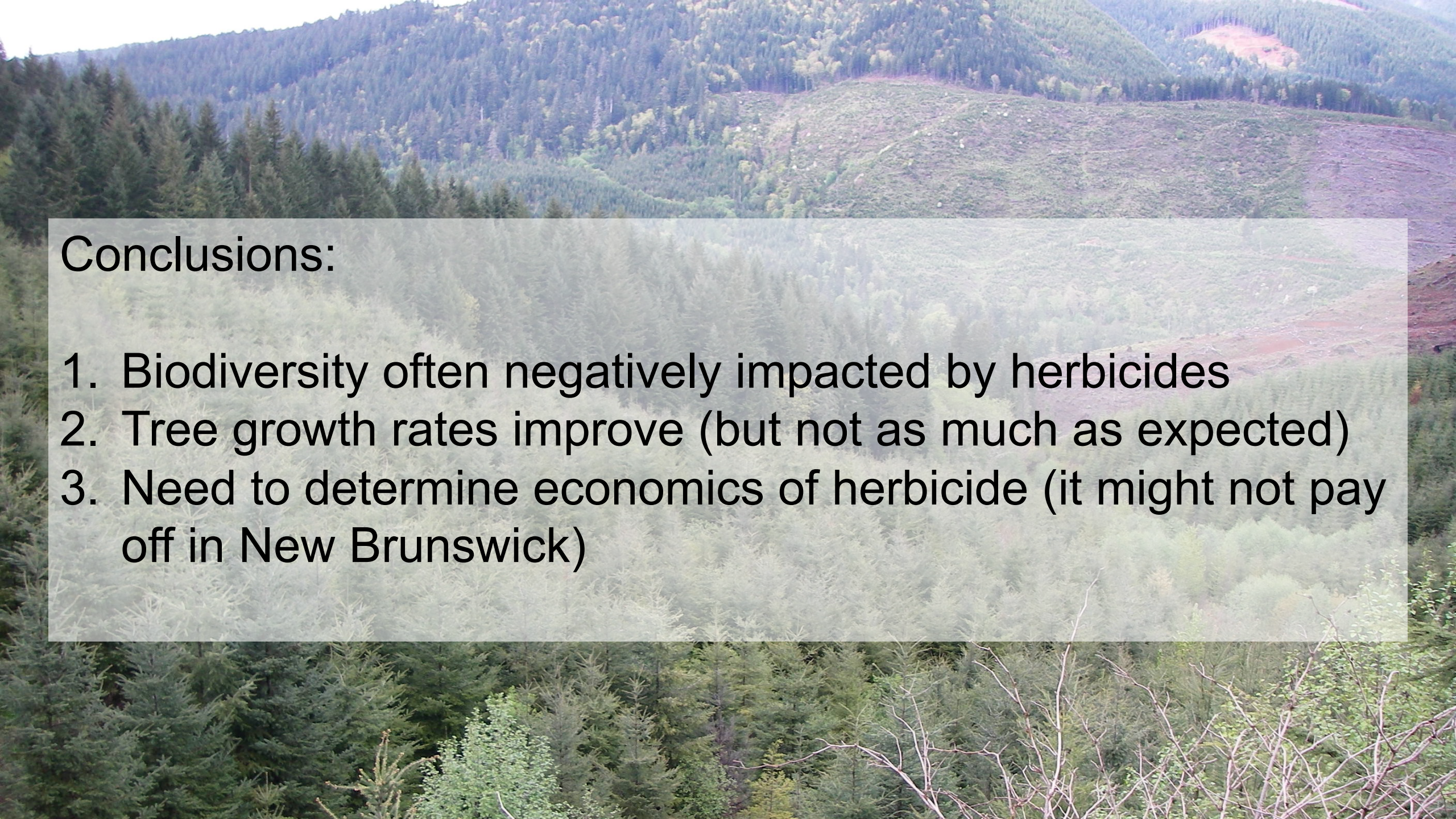
$200 (2018)

Nominal discount rates: **4, 5, 6, 7, 8, 9, and 10%**

Intensive forest management effects on revenue



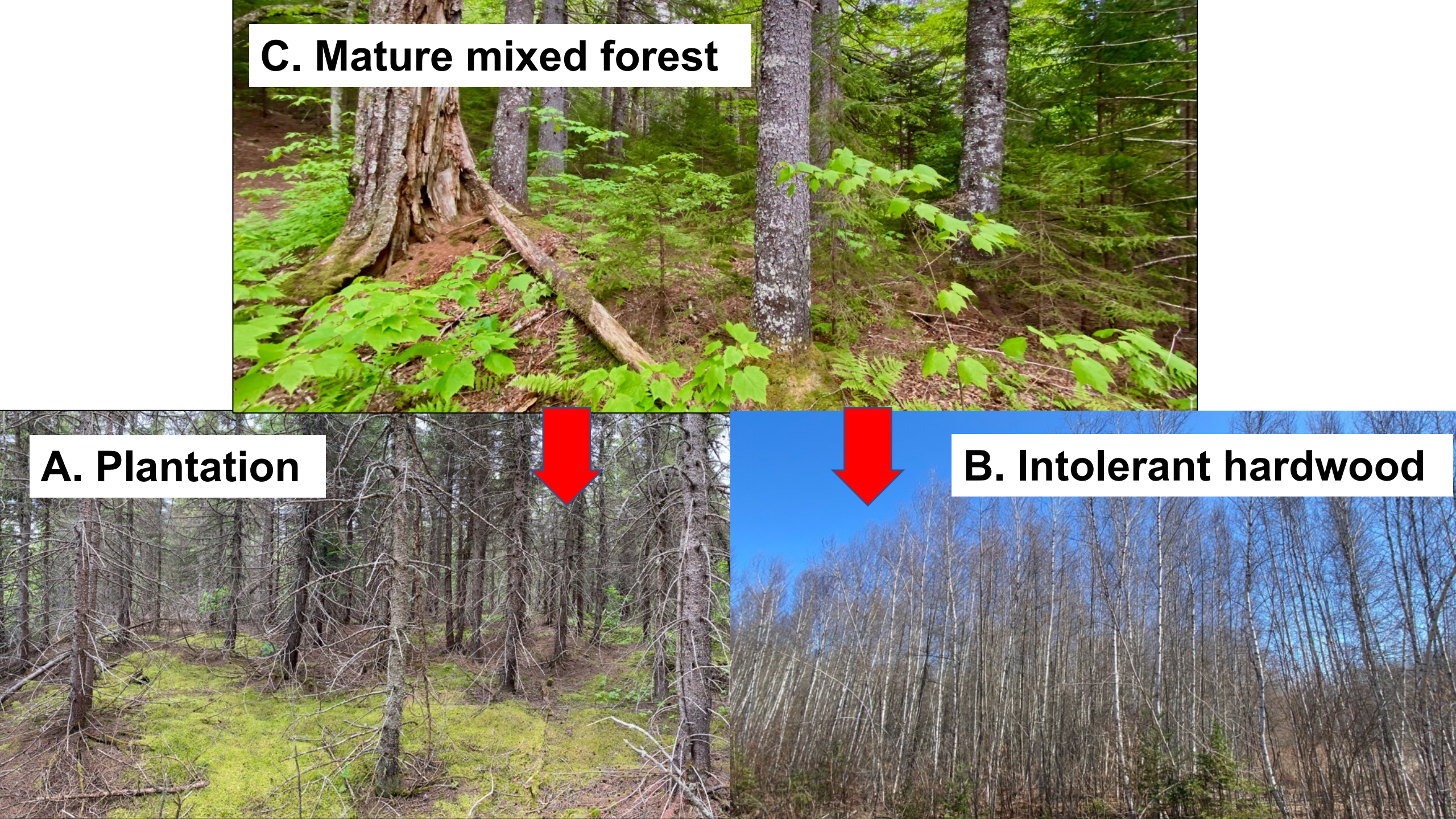
Kormann et al. 2021. *Ecological Applications*



Conclusions:

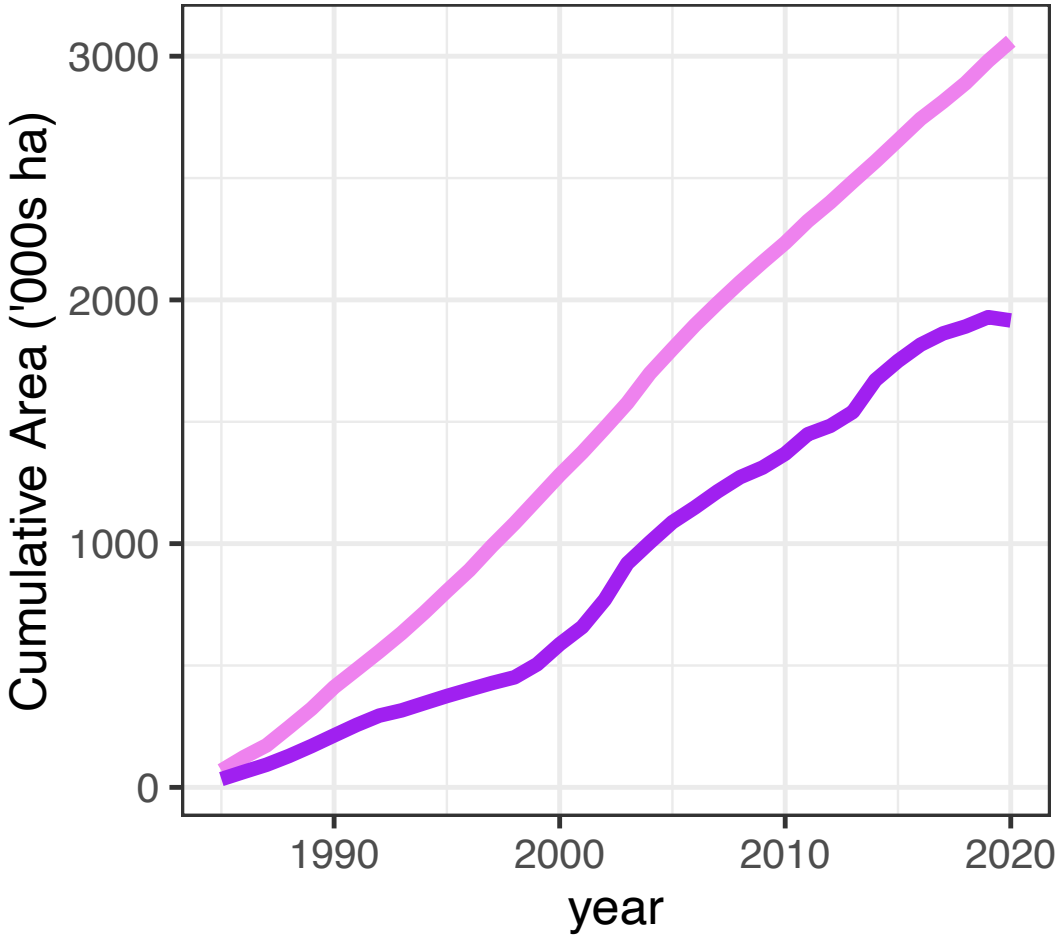
1. Biodiversity often negatively impacted by herbicides
2. Tree growth rates improve (but not as much as expected)
3. Need to determine economics of herbicide (it might not pay off in New Brunswick)

2. New Brunswick forest ecology:
   a brief intro (or reminder)


C. Mature mixed forest
A. Plantation
B. Intolerant hardwood

3. Forest management and biodiversity in NB

Clearcuts and plantations in the Maritime Provinces since 1985



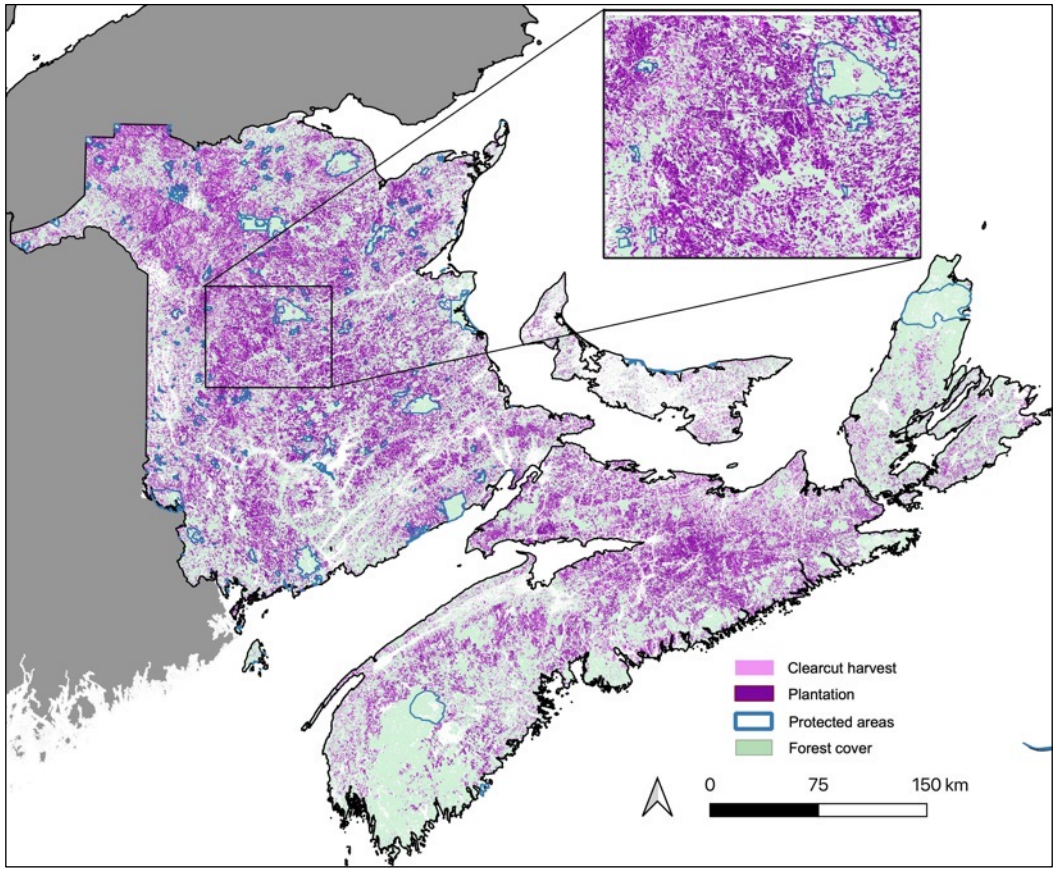
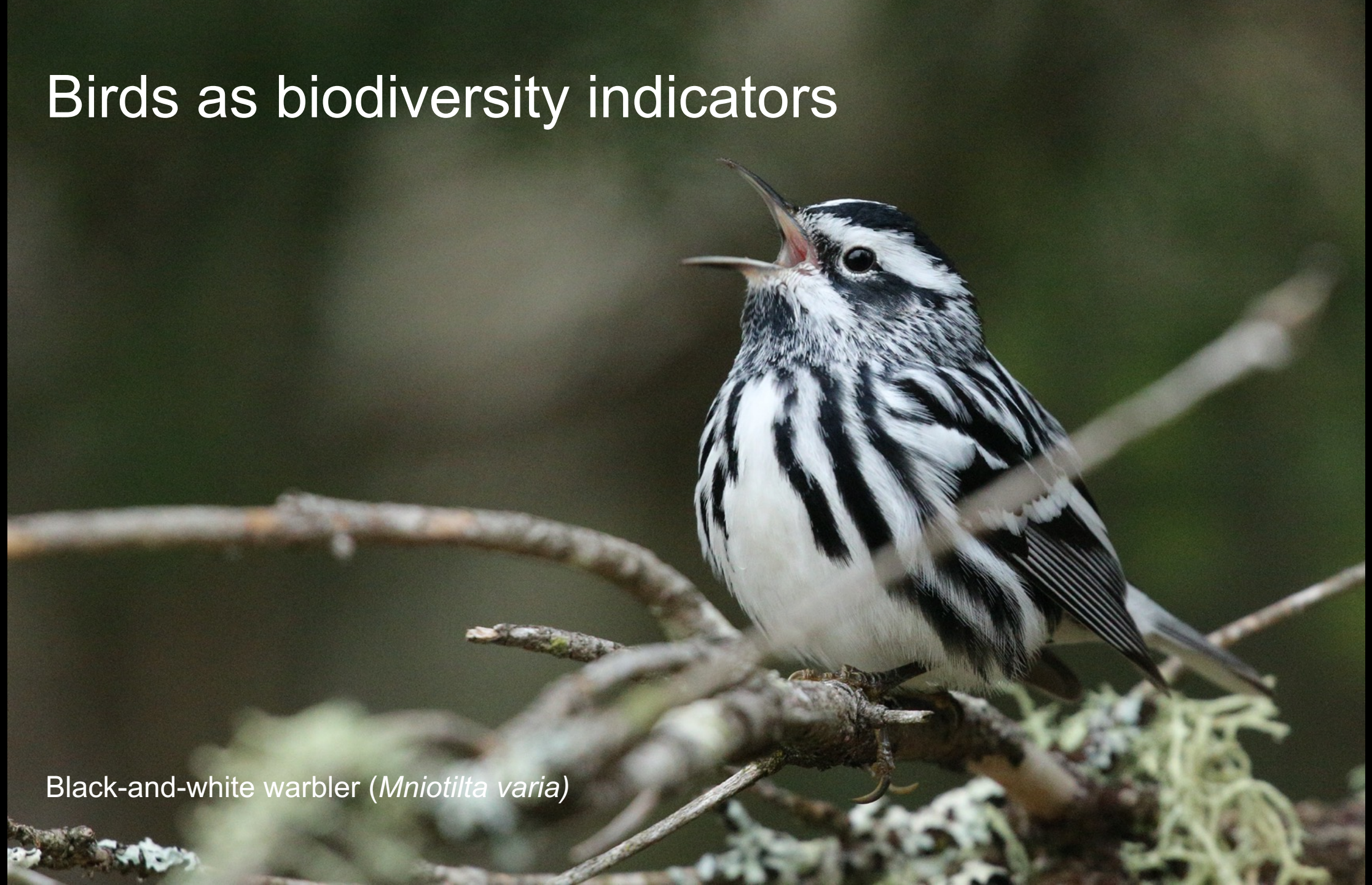



Photo: Deborah Carr

Birds as biodiversity indicators



Black-and-white warbler (*Mniotilta varia)*

Birds, biodiversity and human wellbeing

nature

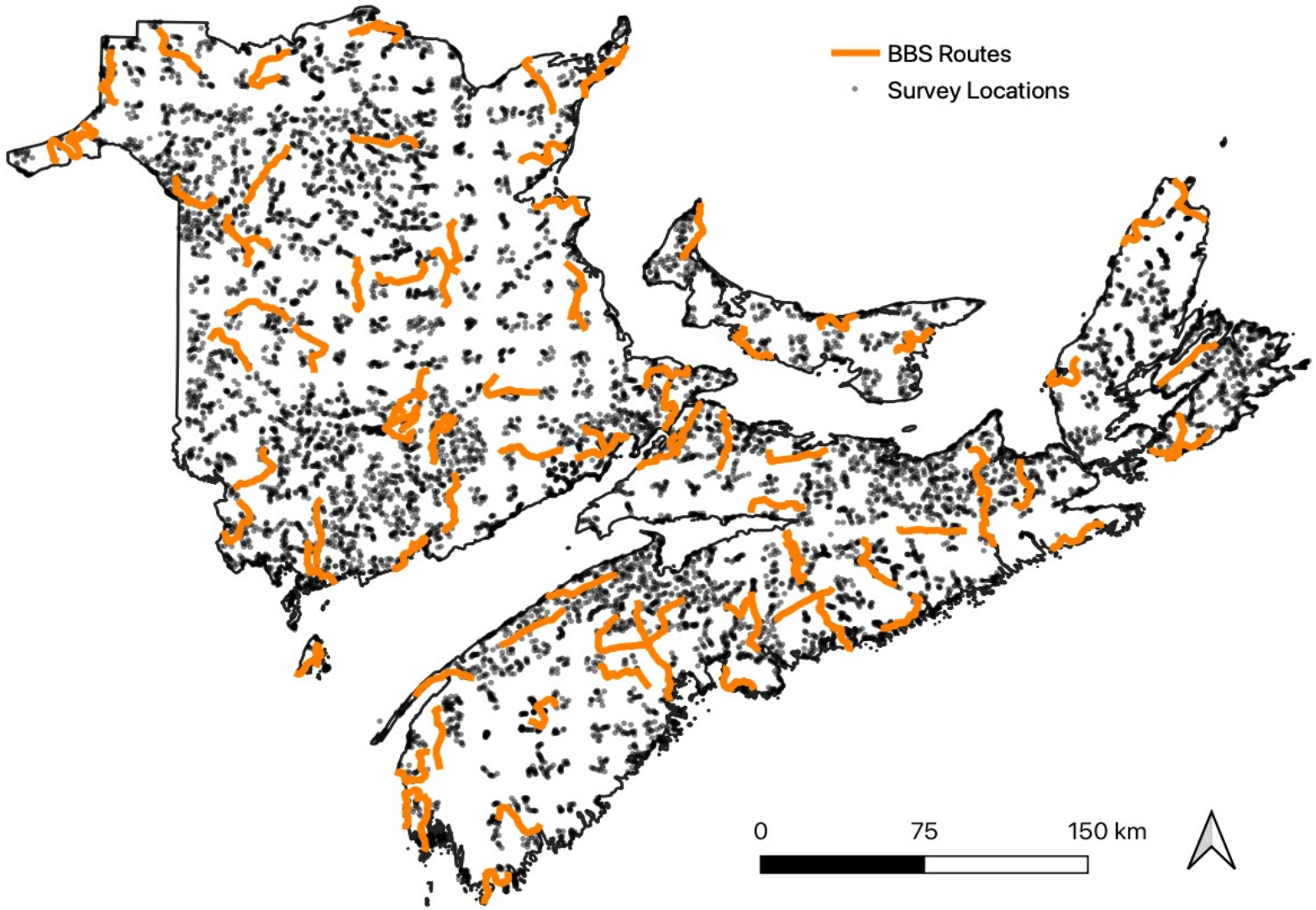
NATURE | VOL 399 | 20 MAY 1999 | www.nature.com

scientific correspondence

Birds extend their ranges northwards

Bay-breasted warbler (*Setophaga castanea*): budworm specialist

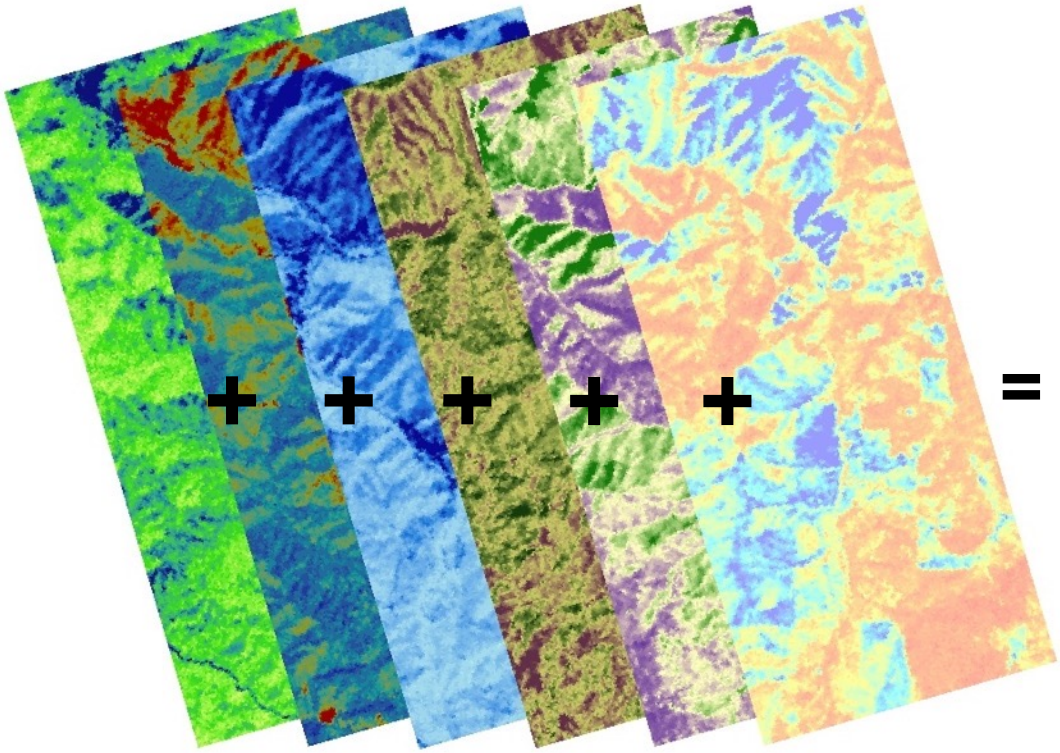
Birds are the only species group (aside from trees & deer) that are sampled well over the long-term



Study Question:

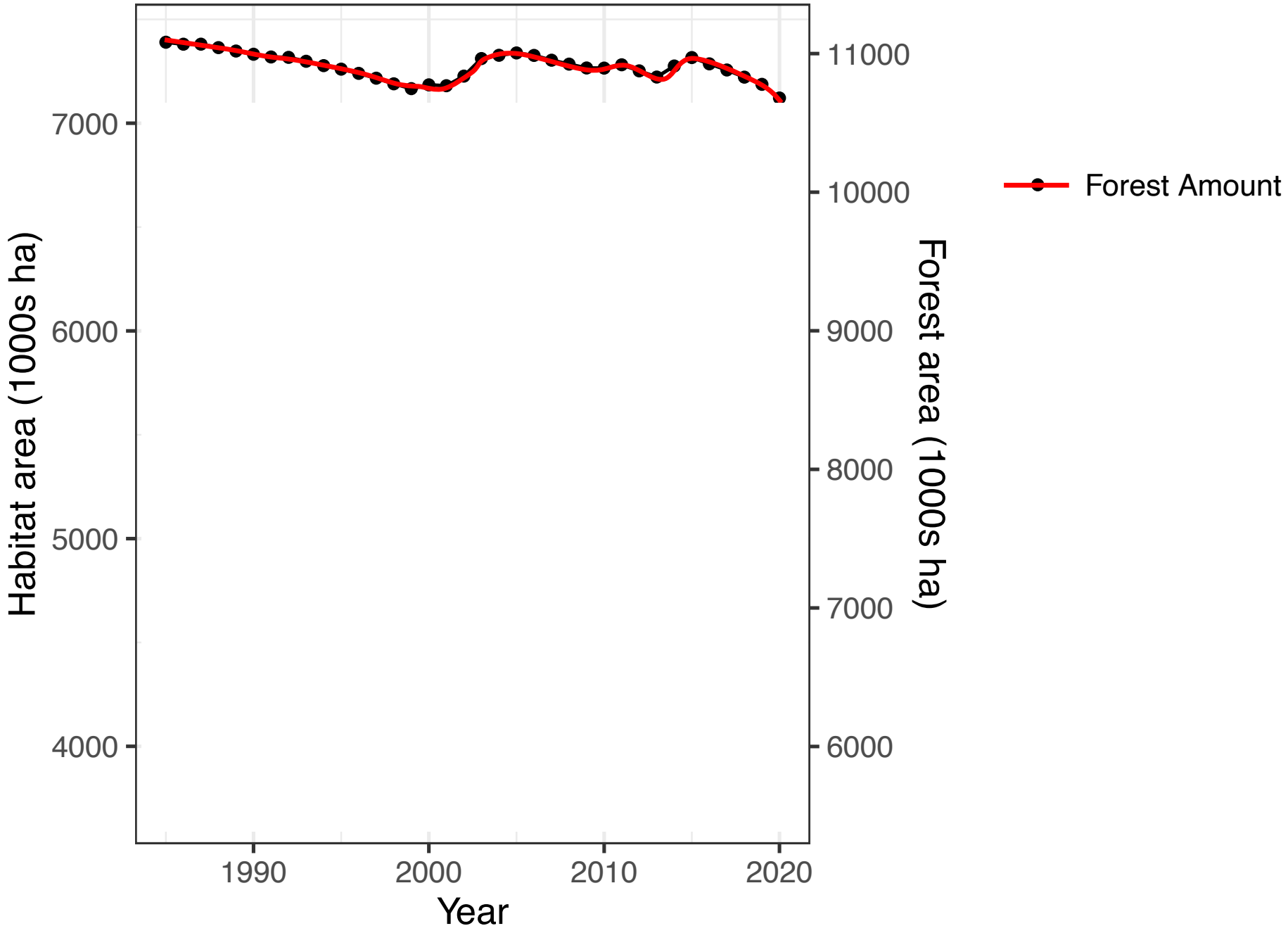
- **How are bird populations affected by intensification of forest management in New Brunswick**?

Bird habitat measured from space (then back-cast through time)



54 most common forest bird species

Shirley et al. 2013 *Diversity and Distributions*

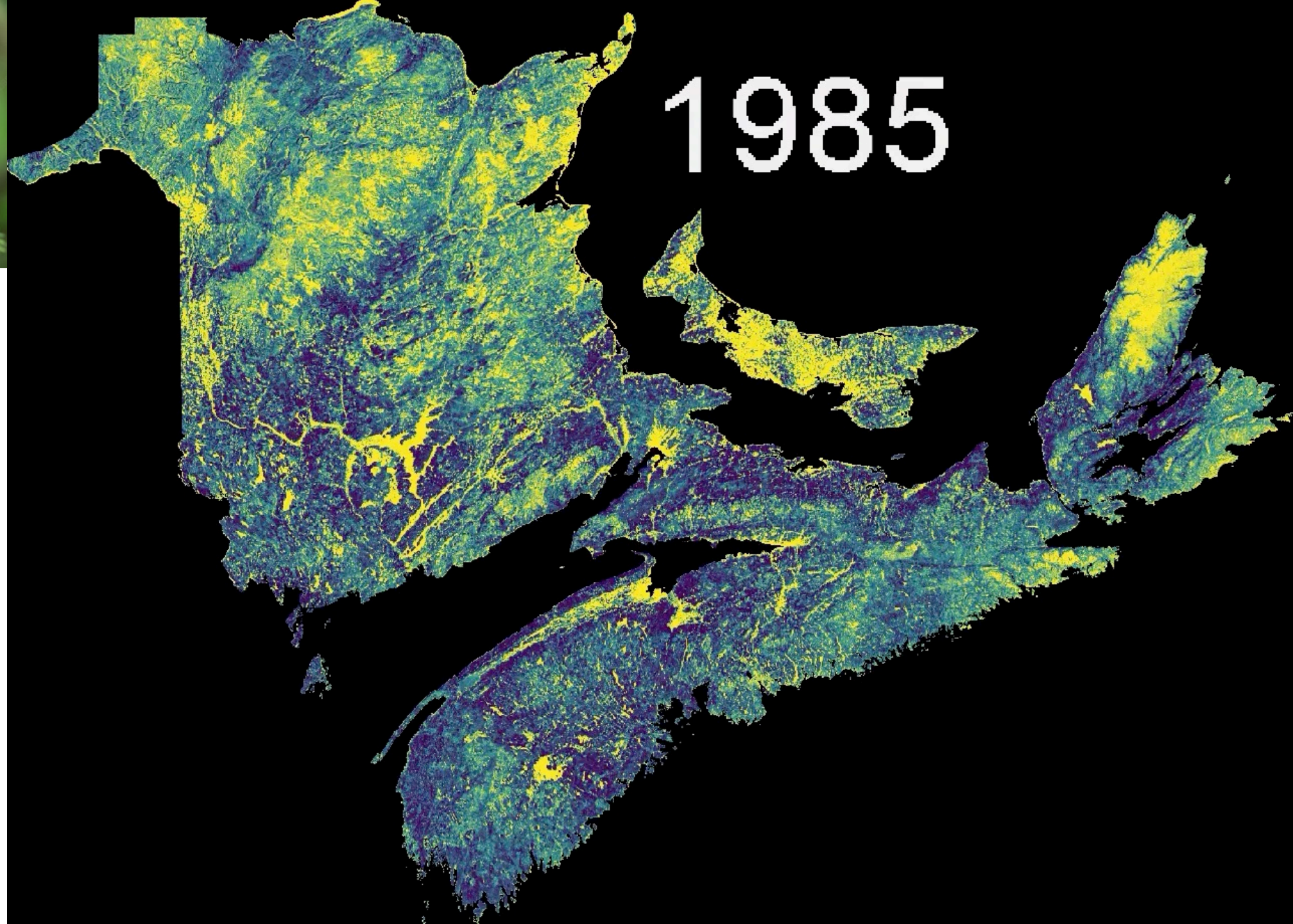

Habitat area (1000s ha)
7000
6000
5000
4000
1990
2000
2010
2020
Year
Forest area (1000s ha)
11000
10000
9000
8000
7000
6000
Forest Amount

Blackburnian warbler (*Setophaga fusca*)

Predicted Blackburnian warbler distribution

1985-2020

= 40% habitat loss over 35 years



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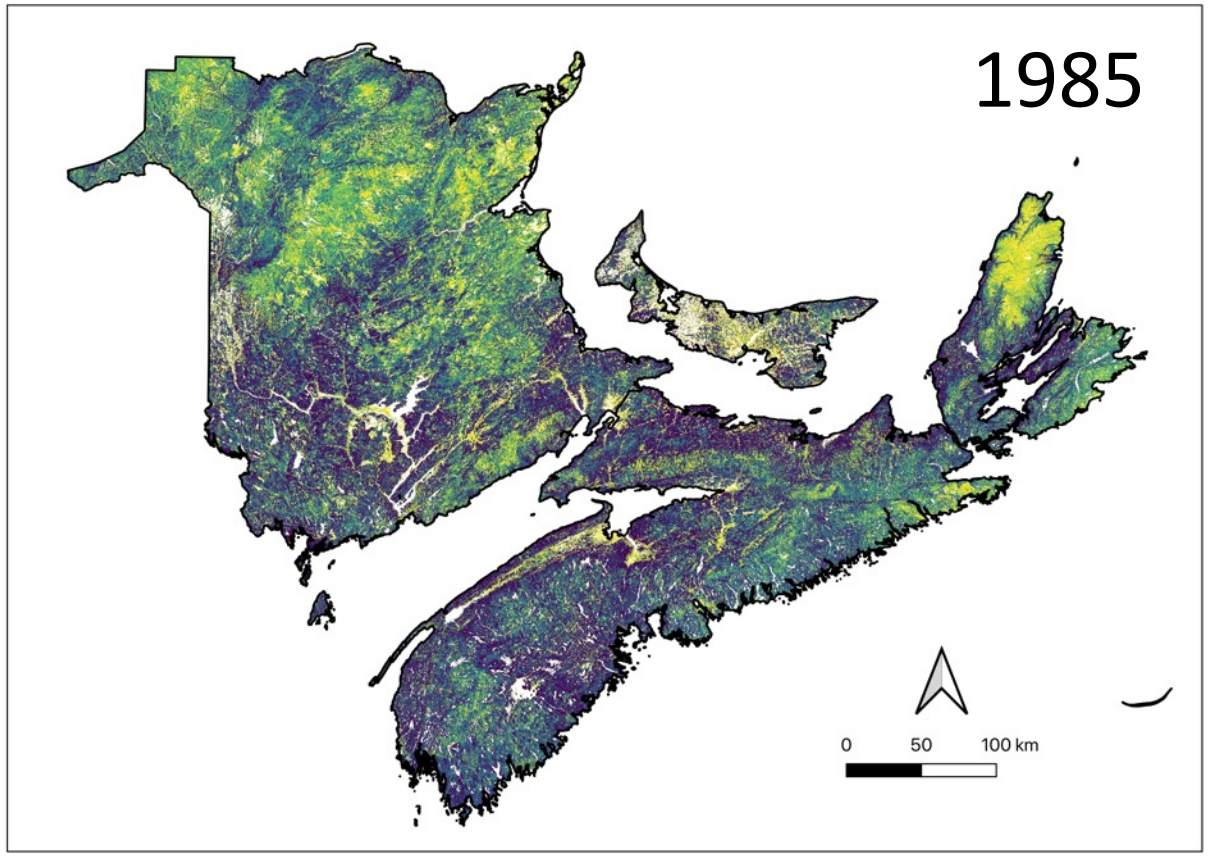
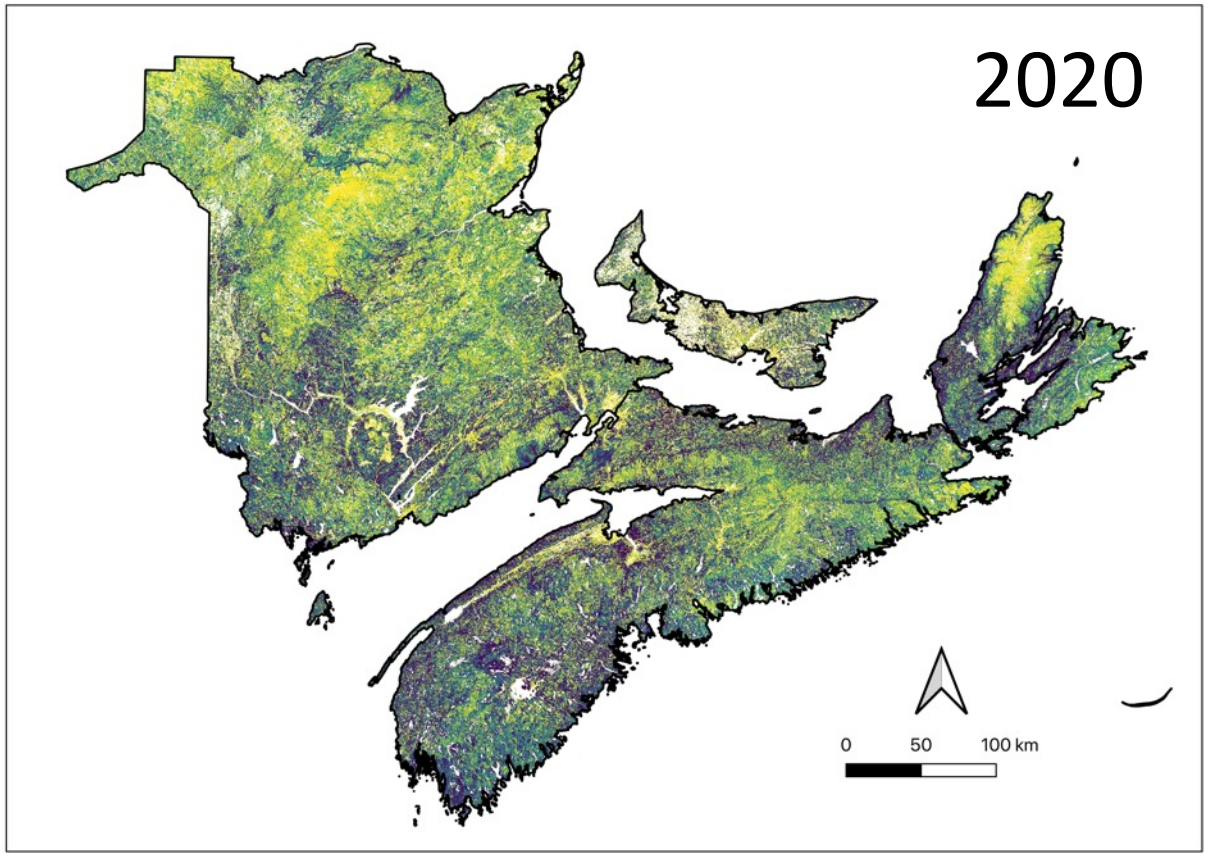
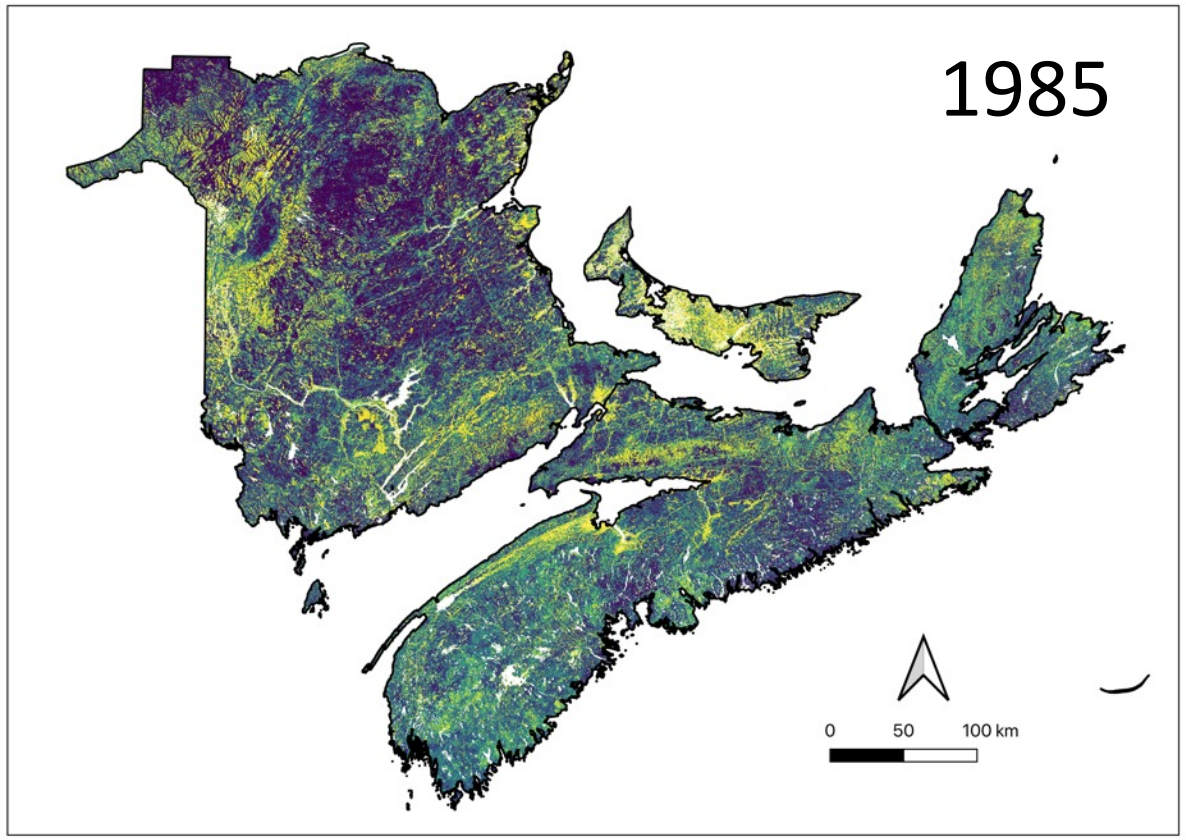
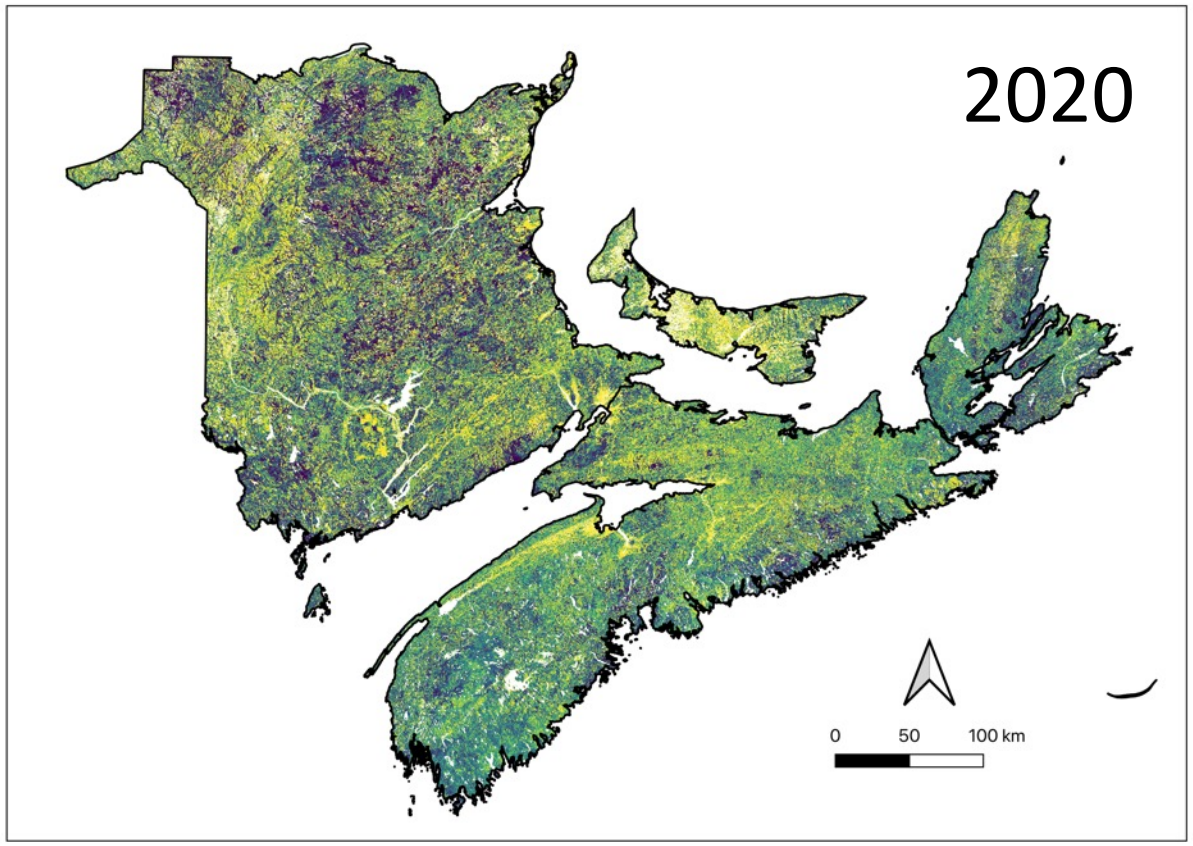




Predicted golden-crowned kinglet habitat 1985-2020

= 35% habitat loss over 35 years

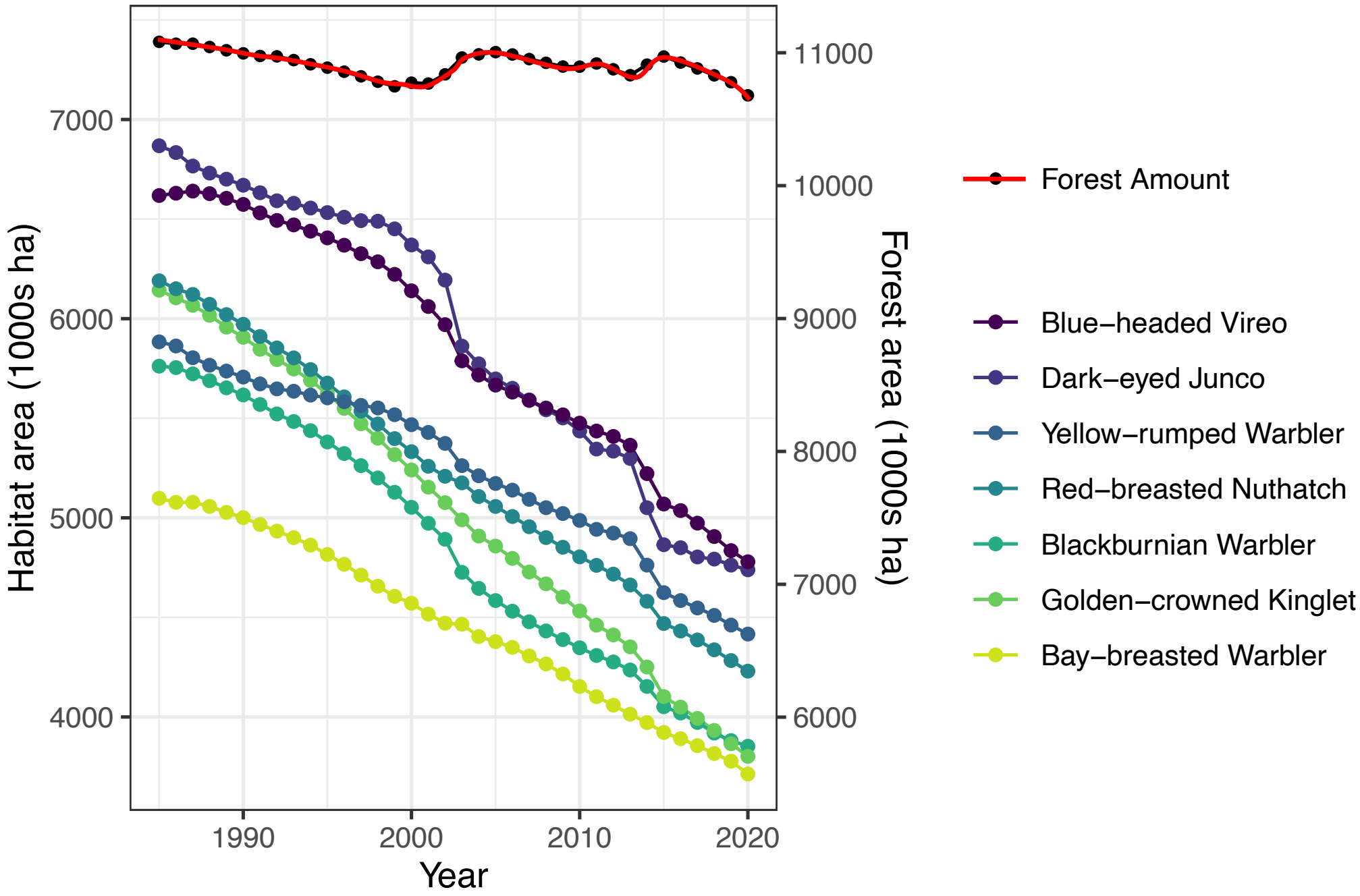




NEW BRUNSWICK

Predicted habitat amount changes across all 54 forest-associated species

66% of species show net habitat loss since 1985, 94% since 2010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1990
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10000
9000
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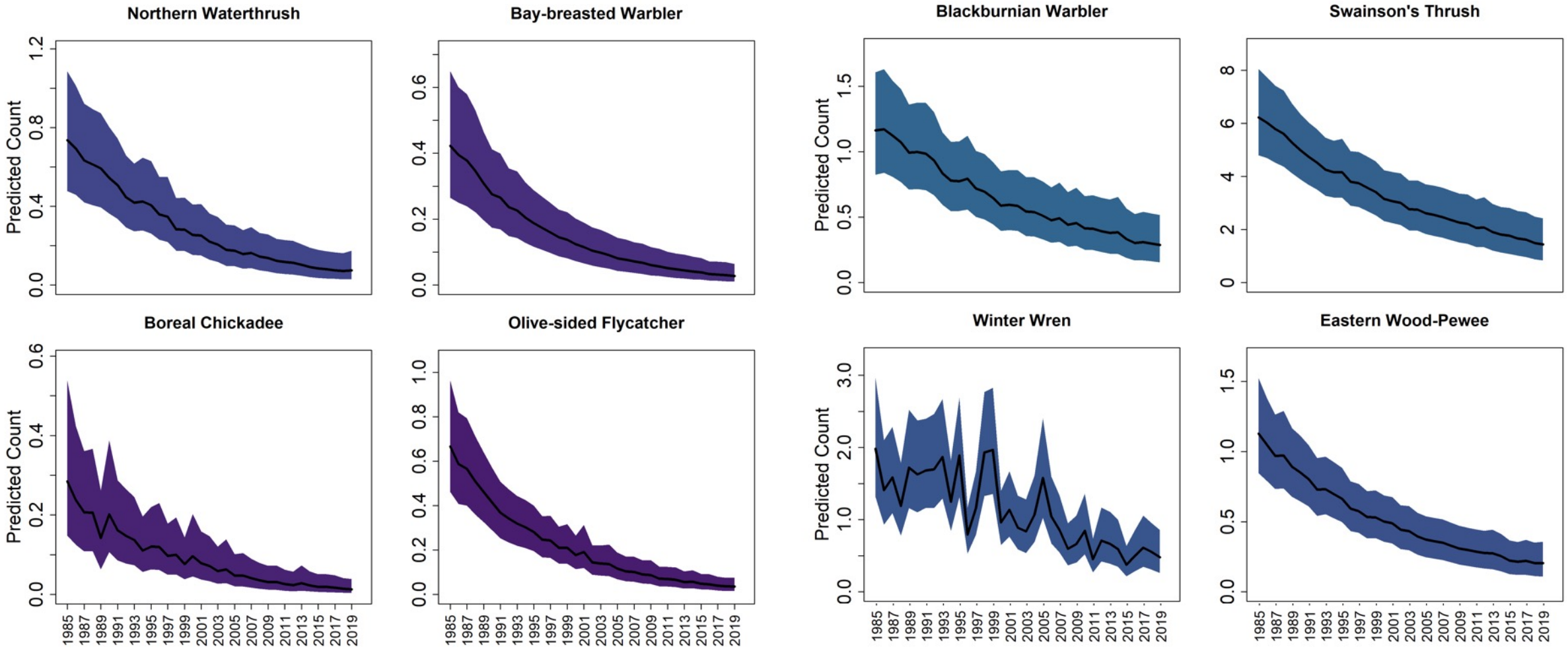
6000
Forest area (1000s ha)
Forest Amount
Blue−headed Vireo
Dark−eyed Junco
Yellow−rumped Warbler
Red−breasted Nuthatch
Blackburnian Warbler
Golden−crowned Kinglet
Bay−breasted Warbler

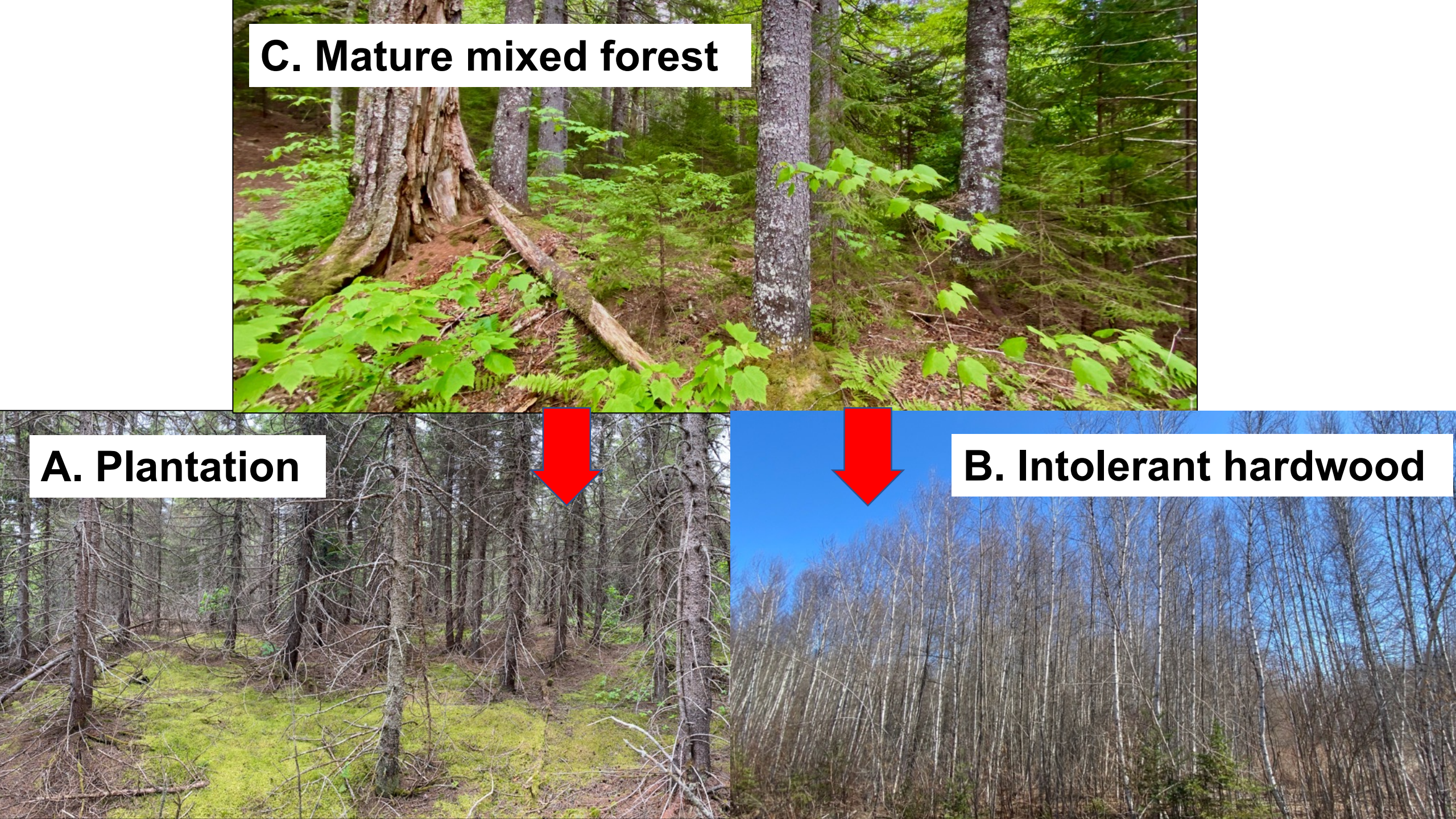
Does habitat loss result in bird population declines?



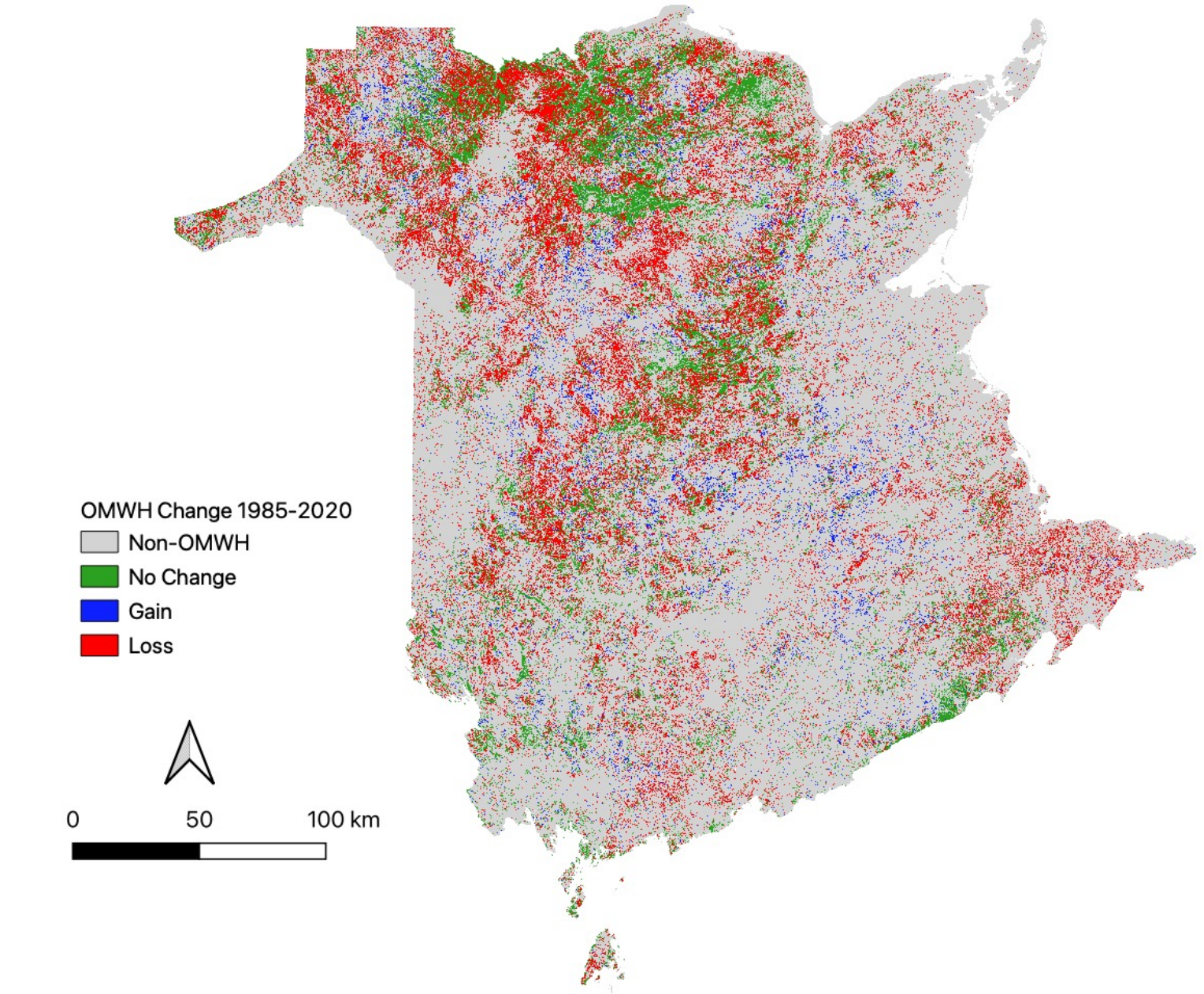
For 50/54 species, habitat loss is strongly associated with bird population change

Net forest bird declines (most common 54 species) 1985-2019

33-104 million birds


C. Mature mixed forest
A. Plantation
B. Intolerant hardwood

Old Mixedwood Habitat Change 1985-2020



Conclusions: Forest management and biodiversity in NB

1. Intensive forest management is increasing plantation and clearcut area
2. This is driving habitat loss for the 54 most common forest bird species
3. Habitat loss is associated with substantial population declines

What should be the future of NB Forests?

Do we need to trade biodiversity for wood and jobs?

Initial Recommendations

Herbicides

- Experimental study on biodiversity (and wood) responses to herbicide treatments in NB
- Immediately conduct research on the economic aspects of intensive management. *Do herbicides "pay" even in terms of revenue generated and jobs created?*

Habitat and Biodiversity

- Maintain (do not convert) remaining old hardwood, mixedwood, and softwood forest
- This would require (1) ecologically based forestry, (2) additional PNAs (reserves)

Acknowledgements

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Co-authors (bird habitat changes paper): Zhiqiang Yang (USFS), Brian Gerber (URI), Joe Northrup (OMNR), Joe Nocera (UNB), Josée Rousseau (Cornell), Noel Gorelick (Google), Adam Hadley (NBDNRED). Funding: NBDNRED. Submitted to: *Science Advances*