

Past and Upcoming Dynamics of Red Oak at its Northern Range Limit, in Eastern Quebec, Canada

Ariane Tremblay-Daoust¹, Mathieu Côté², Luc Sirois¹

Université du Québec à Rimouski

 UQAR¹

 CFC²
Consortium en foresterie
Gaspésie-Les-Îles



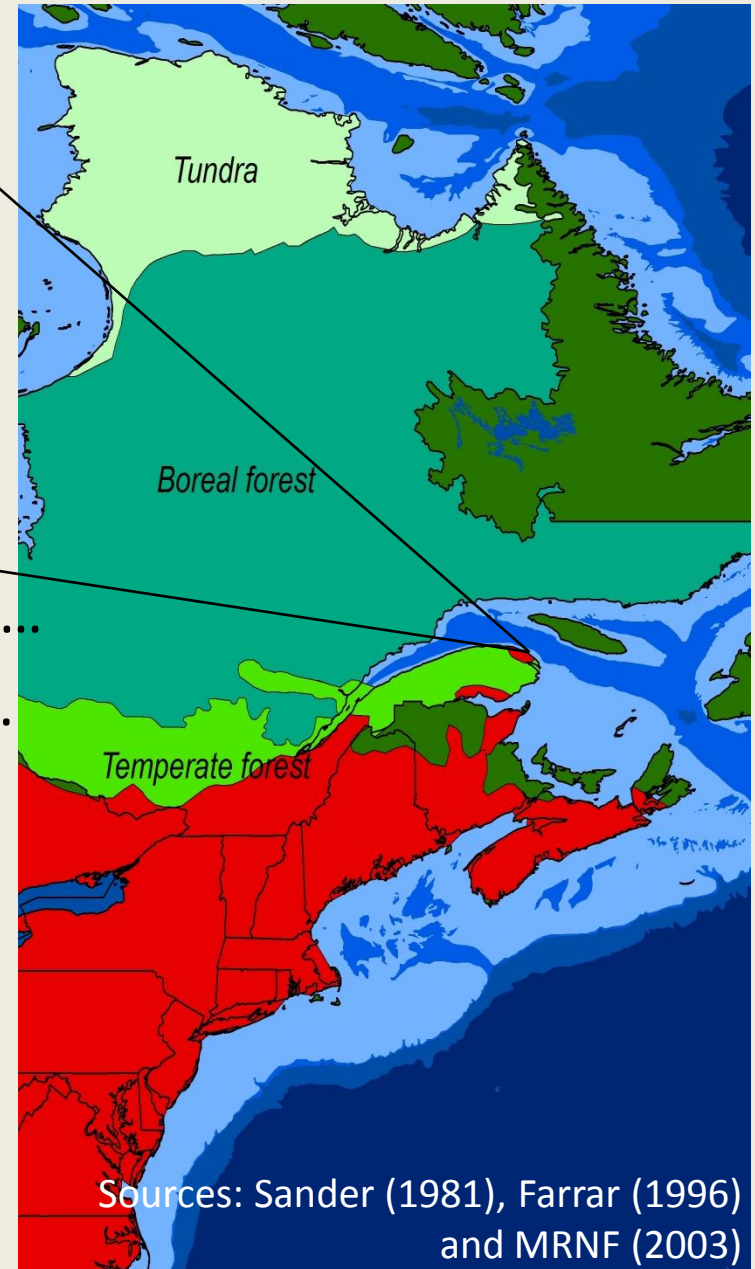
Parcs Canada Parks
Canada Canada

 cef

Introduction



Forillon National Park (FNP)



Northern limit of the temperate forest...

Northern limit of red oak distribution...

...Rigorous climat conditions

...Different dynamic status

Sources: Sander (1981), Farrar (1996)
and MRNF (2003)

Red oak pollen influx from 9 000 B.P.

(Asnong et Richard, 2003)

- Semi-tolerant species
- Take advantage of disturbances
 - Reduce competition
 - Stimulate germination
 - Promote vegetative regeneration




Particular combination of disturbances allowed the continuation of the species.

The absence of such disturbances could induce a decline of the species in the landscape.



(1) Establish the structure of the **current populations**

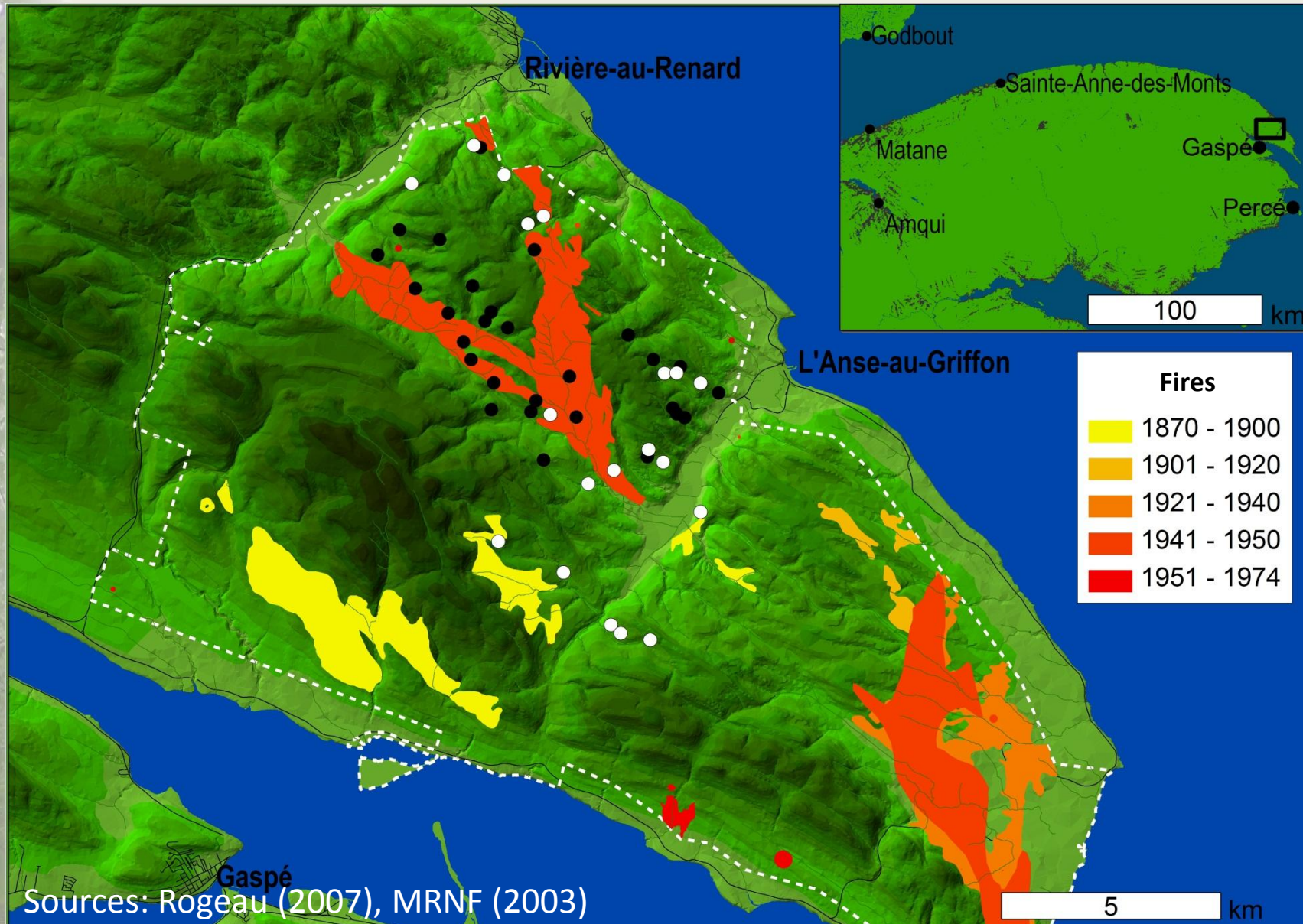


(2) Characterize the **recent dynamics** of the populations



(3) Forecast **demographic trends**

47 sites; 19 selected



Results

Structure of the current populations

- Diametral distribution
- Age structure

Recent dynamics of the populations

- Interaction with other species
- Past disturbances impact

Forecast of demographic trends

- Near future modelling

(1) Structure of the current populations

Location : South-west face of the mountains;
Average slope: 40%

Number: 519 mature individuals in 19 sites

Origin: 50% with more than one stem

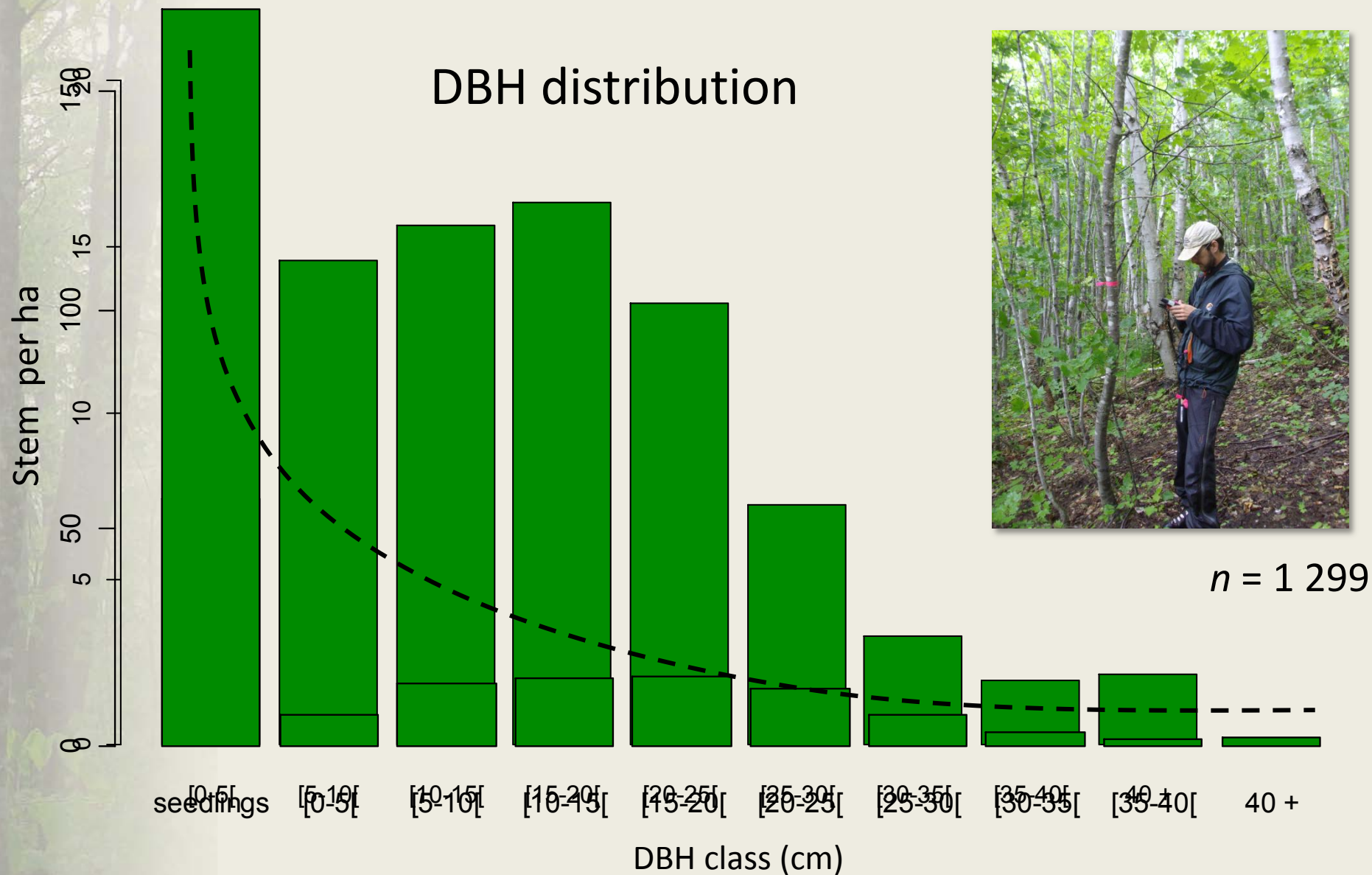
Sexual origin : 519 stems

Vegetative origin: 780 stems

Total: 1 299 stems

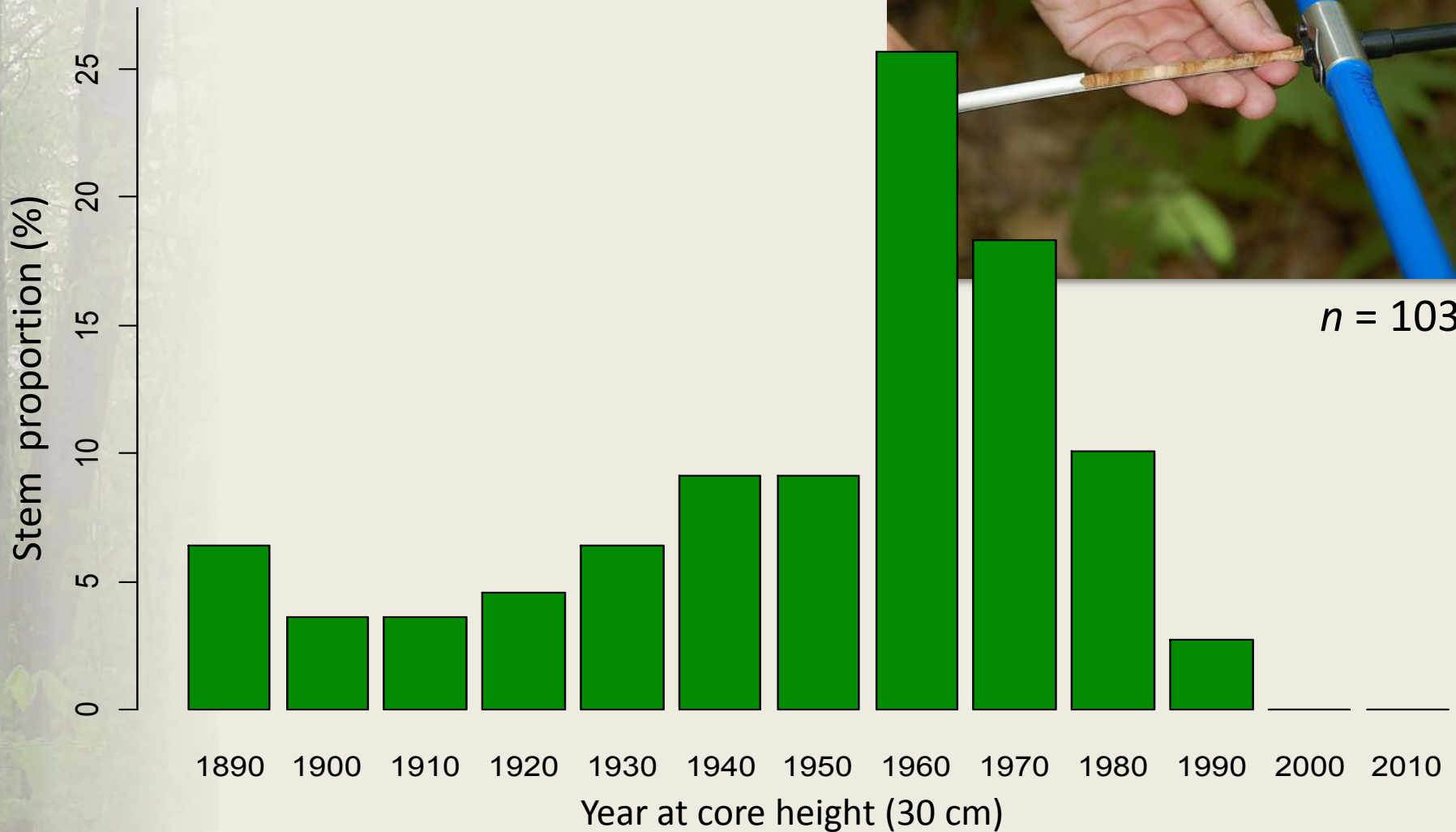


(1) Structure of the current populations



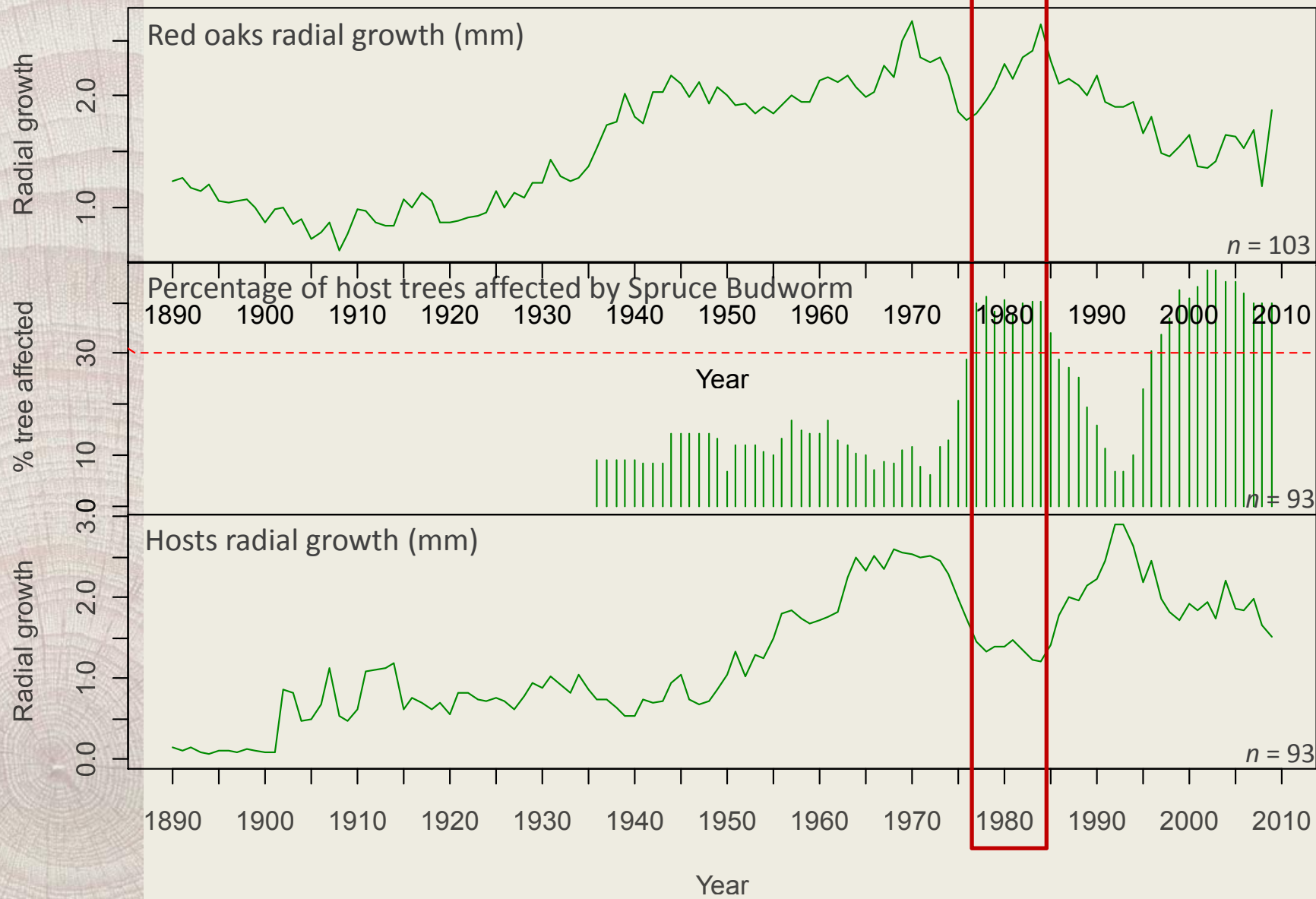
(1) Structure of the current populations

Age structure



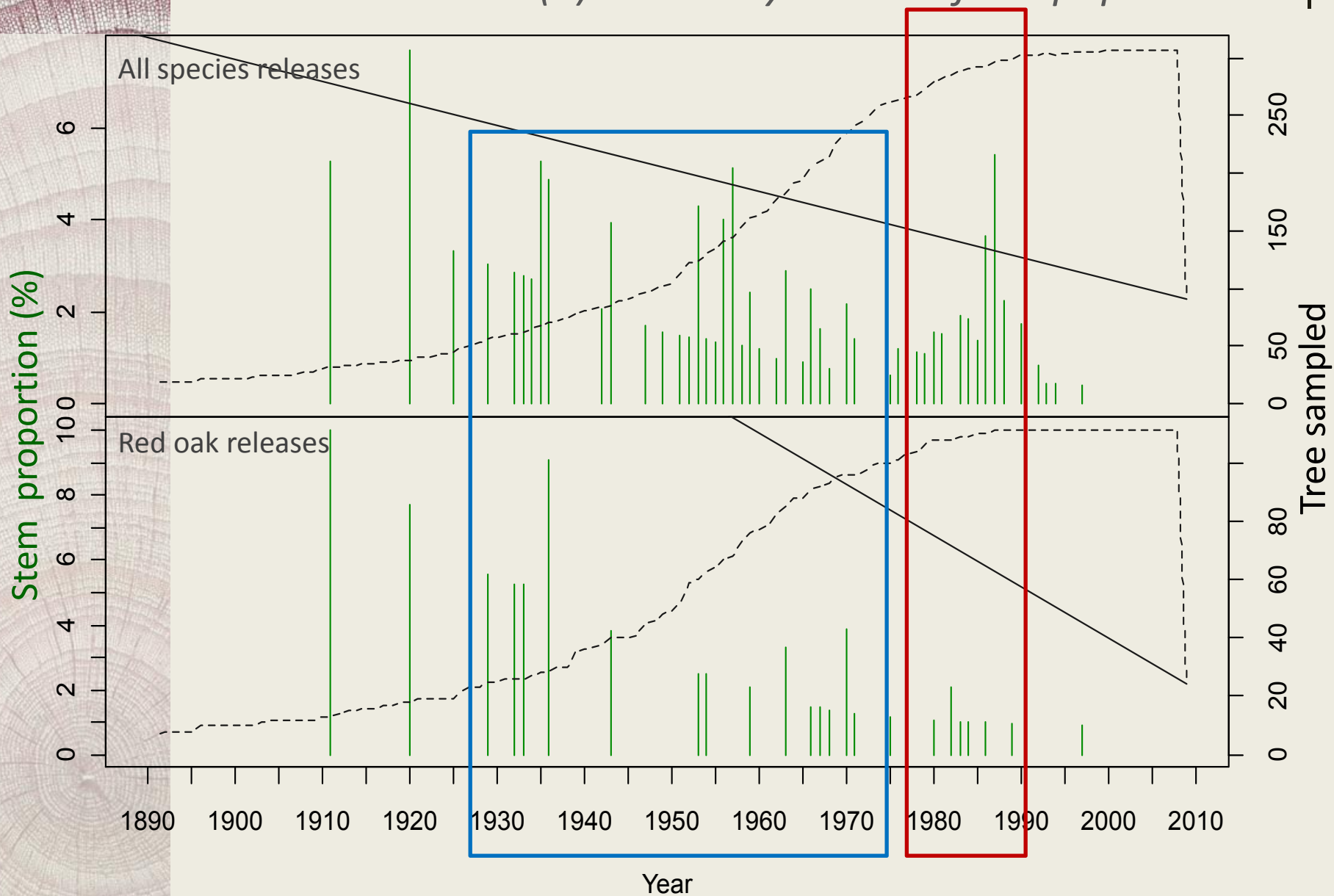
Results

(2) Recent dynamics of the populations



Results

(2) Recent dynamics of the populations

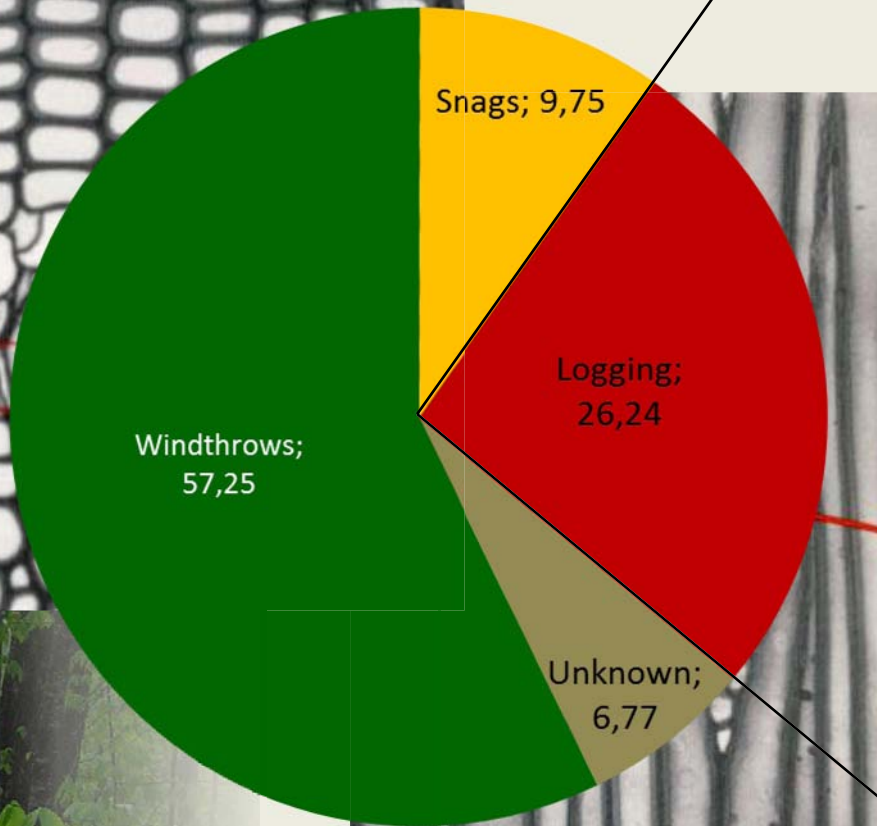


Results

(2) Recent stand dynamics

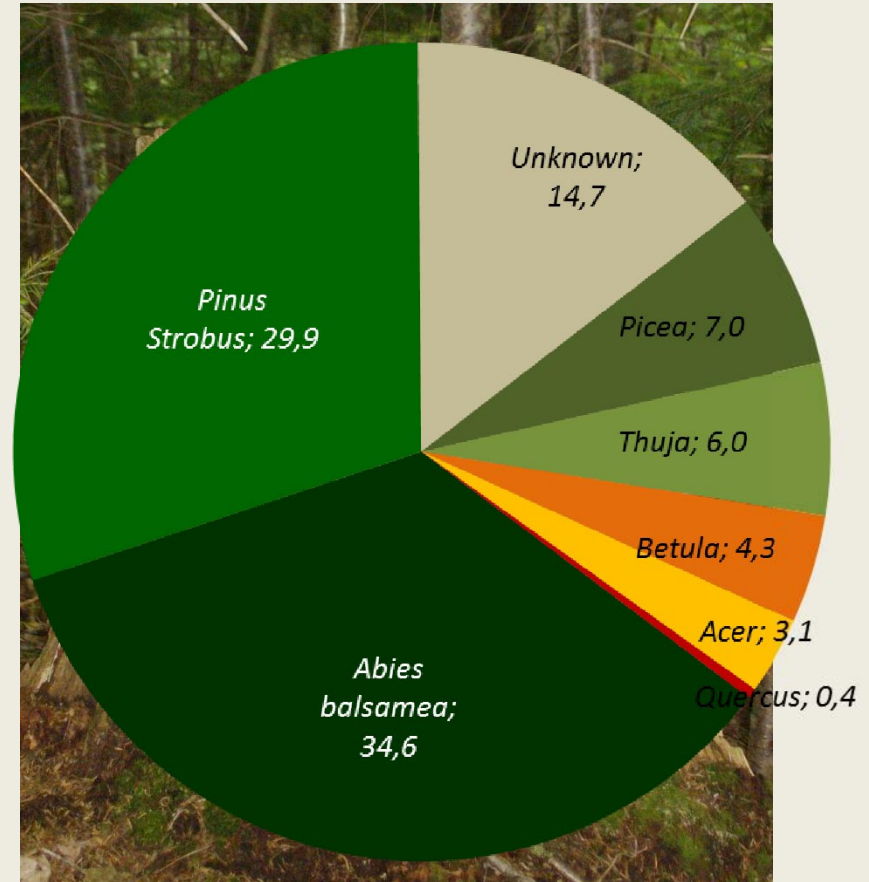
Type of disturbances

$n = 2912$



Logged species

$n = 748$



10% of the artefacts were charred

(3) Forecasts of demographic trends

- Past disturbances likely influenced the structure of the current red oak populations
- *Is this red oak's dynamics will continue in the near future ?*

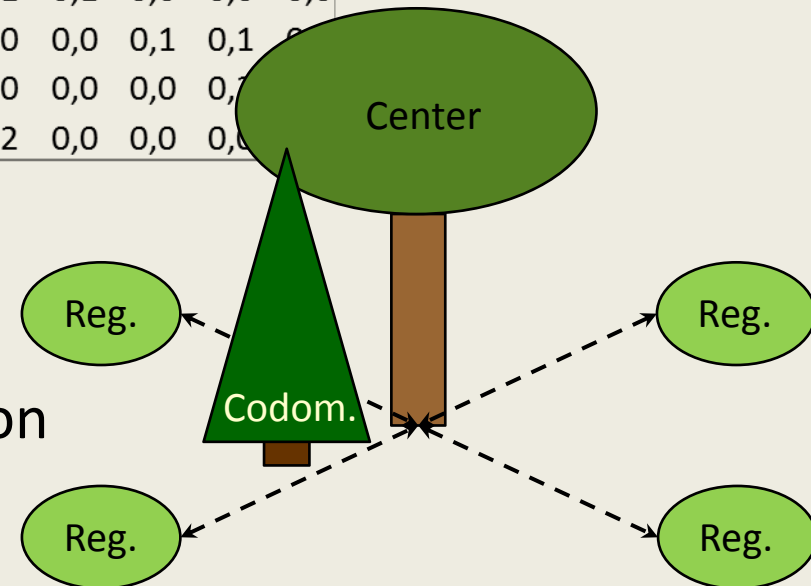


(3) Forecasts of demographic trends

Transition matrices

$$n_{(t+1)} = n_{(t)} P$$

T_1		T_0		Codominant (j)											
				CHR	ERS	ERR	SAB	BOP	BOJ	EPB	EPN	PIB			
0,016	=	0,044	X	center (i)	CHR	0,3	0,1	0,3	0,2	0,1	0,0	0,0	0,0	0,0	0,0
0,156		ERS		0,0	0,5	0,3	0,2	0,1	0,0	0,0	0,0	0,0	0,0	0,0	
0,292		ERR		0,0	0,1	0,6	0,1	0,1	0,0	0,1	0,0	0,0	0,0		
0,329		SAB		0,0	0,1	0,2	0,6	0,1	0,0	0,0	0,0	0,0	0,0		
0,143		BOP		0,0	0,2	0,2	0,1	0,5	0,1	0,0	0,0	0,0	0,0		
0,014		BOJ		0,0	0,4	0,1	0,2	0,1	0,1	0,0	0,0	0,0	0,0		
0,023		EPB		0,0	0,1	0,4	0,4	0,0	0,0	0,1	0,1	0,0	0,0		
0,018		EPN		0,1	0,0	0,3	0,5	0,0	0,0	0,0	0,0	0,0	0,0		
0,010		PIB		0,0	0,0	0,2	0,4	0,2	0,0	0,0	0,0	0,0	0,0		

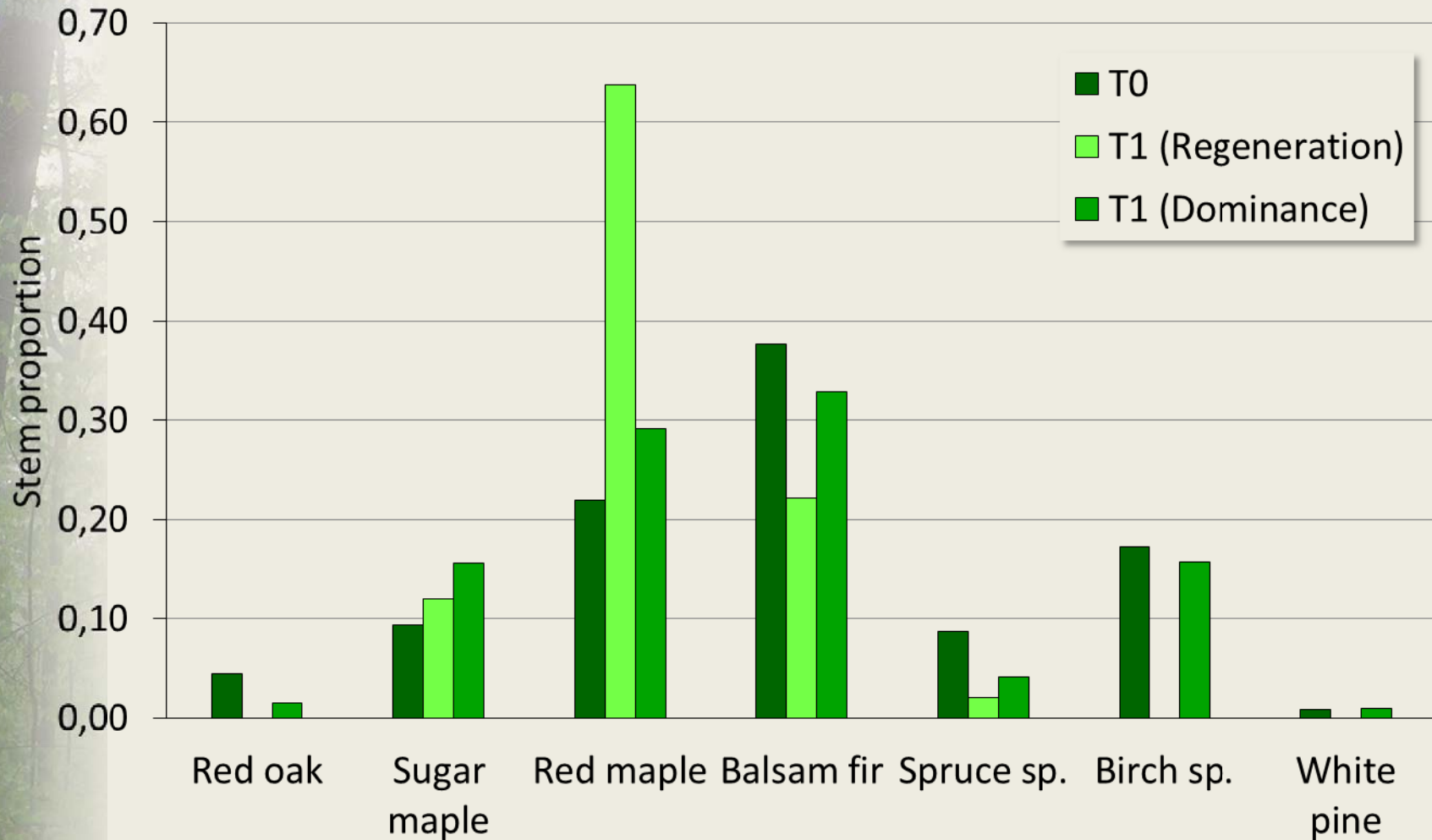


Model 1 : Regeneration

Model 2 : Dominance

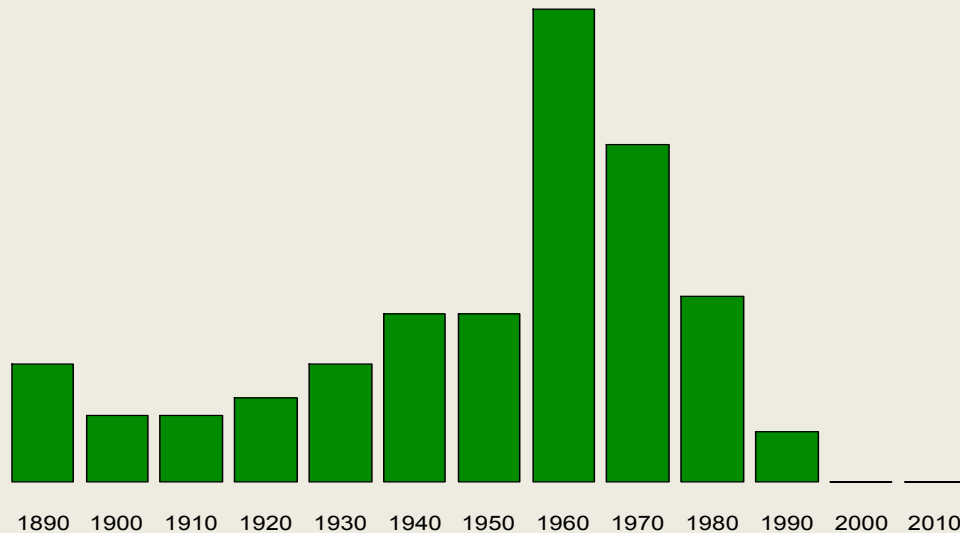
Results

(3) Forecasts of demographic trends



Preliminary conclusions

- In the past century, several disturbances (outbreaks, loggings, fires) seem to have governed the red oak's dynamics
- A particular combination of disturbances have prompted a recruitment pulse of new stems between 1960 and 1970.



- In the absence of a suitable disturbance regime, red oak will likely decline in the future.

Questions?

Thank you!



References

- Asnong, H. et Richard, P. J. H. 2003. La végétation et le climat postglaciaires du centre et de l'est de la Gaspésie, au Québec. *Géographie physique et Quaternaire* **57**(1): 37-63.
- Farrar, J.L. 1996. Les arbres du Canada. Fides et les Service canadien des forêts, 502 p.
- Fortin, S., Côté, M. et Brodeur, S. 2009. Le chêne rouge à Forillon : découverte de nouveaux sites. *Le Naturaliste canadien* 133(1) : 12-17.
- Kafka, V. et Quenneville, R. 2006. Cadre pour la restauration écologique du pin blanc et du chêne rouge, Parc National du Canada Forillon. Service de la conservation des écosystèmes. 76 p.
- Grissino-Mayer, Henri D. 2010. The Uitimate Tree-Ring Web Pages. [En ligne] URL: <http://web.utk.edu/~grissino/>
- Rogeau, M.-P. 2006. Synthèse préliminaire du régime des feux. Parc National du Canada Forillon. Rapport préparé pour Parcs Canada. Wildland Disturbance Consulting. Banff. 31 p.
- Sander, I. L. 1990. *Quercus rubra* L. Northern red oak. Dans: *Silvics of North America. Volume 2. Hardwoods. Agric. Handb. 654.* Washington, DC: U.S. Department of Agriculture, Forest Service: 727-733.
- Team, R.D.C. 2008. R: A language and environment for statistical computing. *Édité.* R Foundation for Statistical Computing, Vienna, Austria.
- Van Lear, D.H. et Watt, J.M. 1993. The role of fire in oak regeneration. Dans: Loftis, D.L. et McGee, C.E., eds. *Proceedings of the Symposium on Oak Regeneration: Serious Problem, Practical Recommendations.* Gen. Tech. Rep. SE-84. U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station, Asheville, NC: 66-78.