

Who is Willian Vieira?

and what has he been doing?

Willian Vieira, Analyst

 [WV-Habitat/me](#)

 [@WillVieira90](#)



Outline

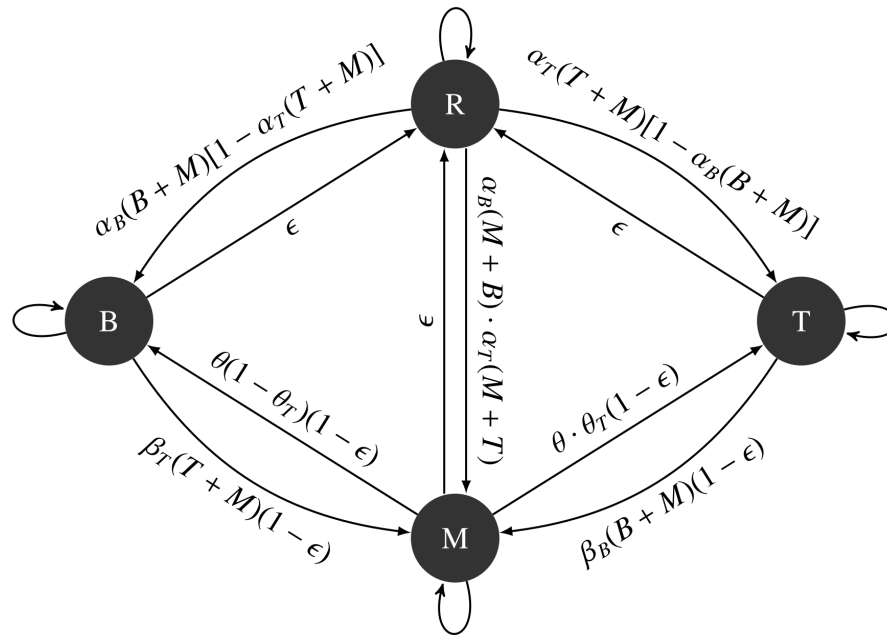
- My thesis project
- The ECCC project
- Side projects
- Future projects

My PhD thesis

How can we better predict tree species distribution?

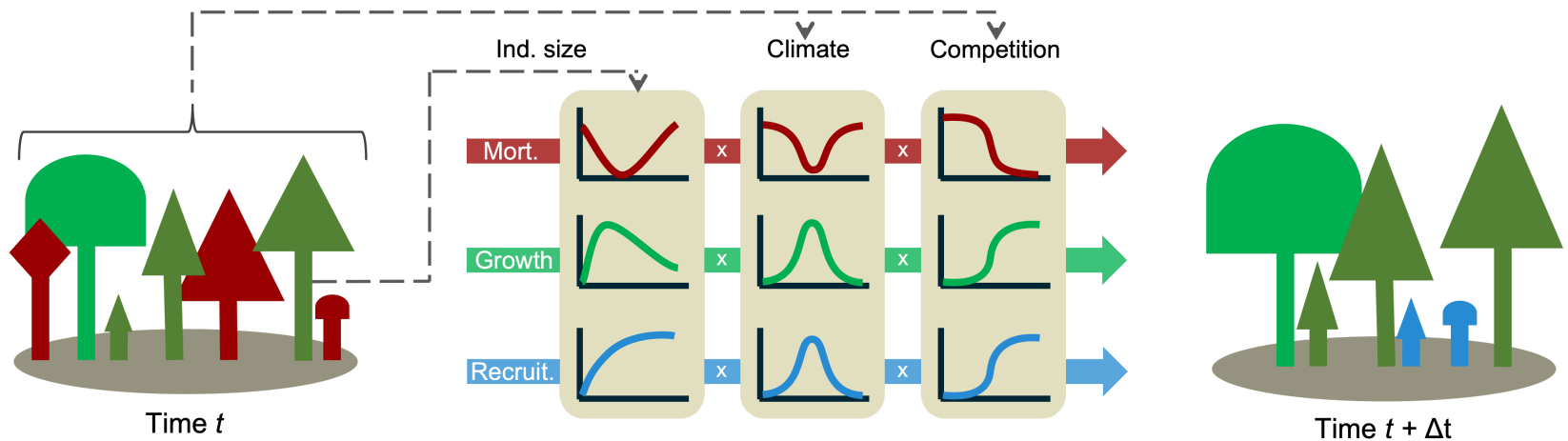
- Species Distribution Models (SDM) are not appropriated for trees
- But we can use *theory* to create **mechanistic models**
- What are the drivers of forest dynamics shaping tree distribution?
- Mathematical and statistical models to assess the effect of climate, competition, and forest management

Chapter 1: State Transition Model



- Derived from the metapopulation theory
- **B**oreal, **T**emperate, **M**ixed, and **R**egeneration ~ MAT + MAP
- Extension to include forest management practices
- Simple model -> analytically tractable -> transient dynamics
- Matrix algebra, Jacobian approximation
- [STM R package](#); [Shiny App](#)

Chapter 2 & 3: Integral Projection Model



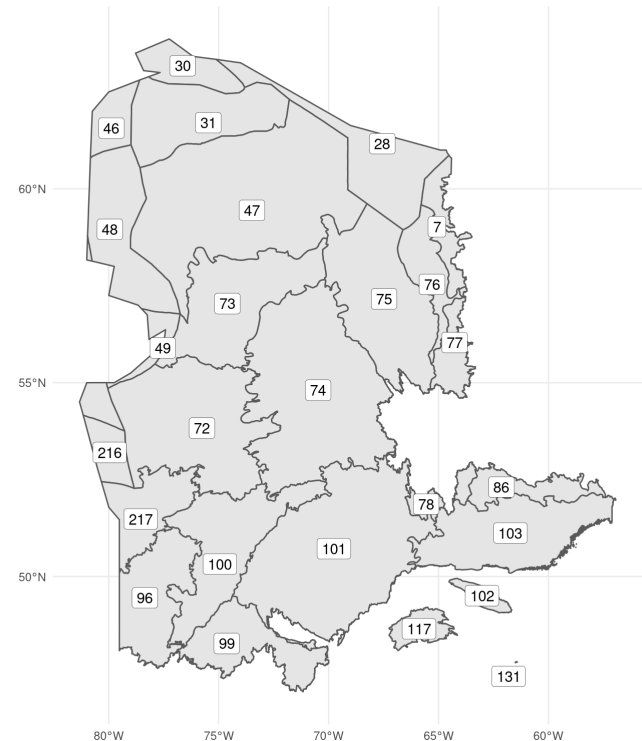
- Demographic models for 31 tree species from eastern North America
- $\lambda \sim [\text{Growth} + \text{mortality} + \text{recruit}] \sim \text{climate} + \text{competition}$
- Non-linear hierarchical Bayesian models
- stan: statistical programming language derived from c++
- High performance computing (HPC)
- C.2: Random forest for sensitivity analysis
- C.3: Scale integration - from individual performance to the metapopulation
- [Lab notebook](#)

The ECCC project

Sampling design for monitoring
boreal birds in Quebec

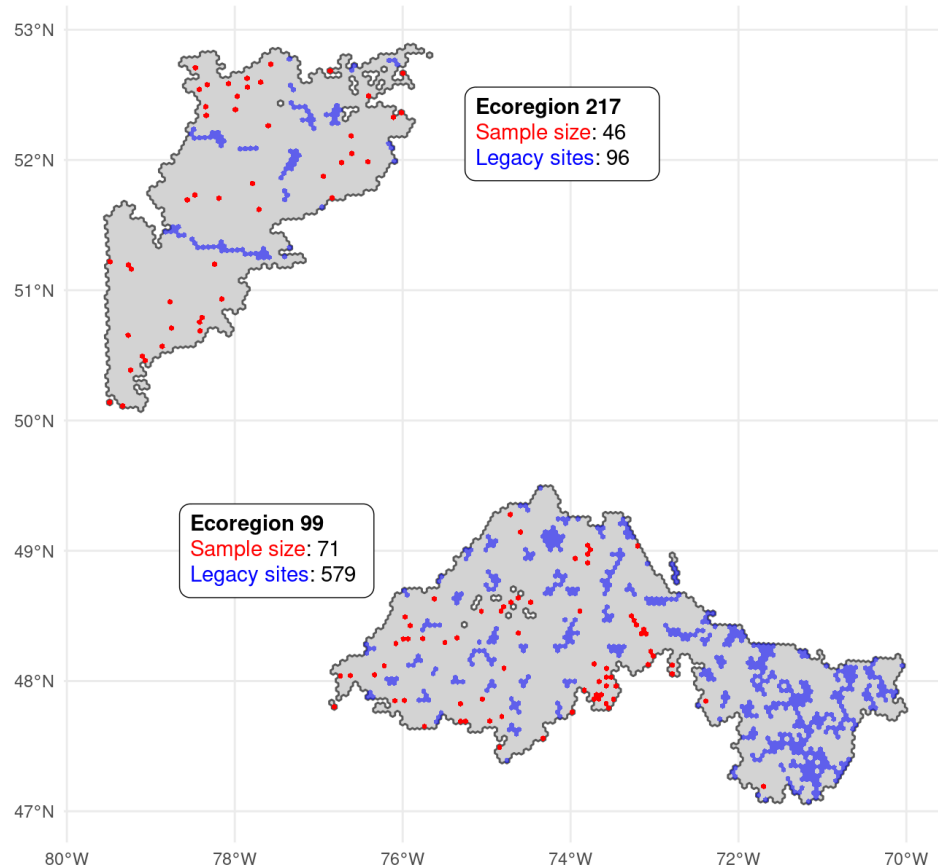
BMS project

- National effort to develop a protocol to sample boreal birds
- Adapt and implement national design for the Quebec region
- Spatially stratified sampling approach weighted by:
 - Habitat
 - Cost
 - Legacy sites
- Report



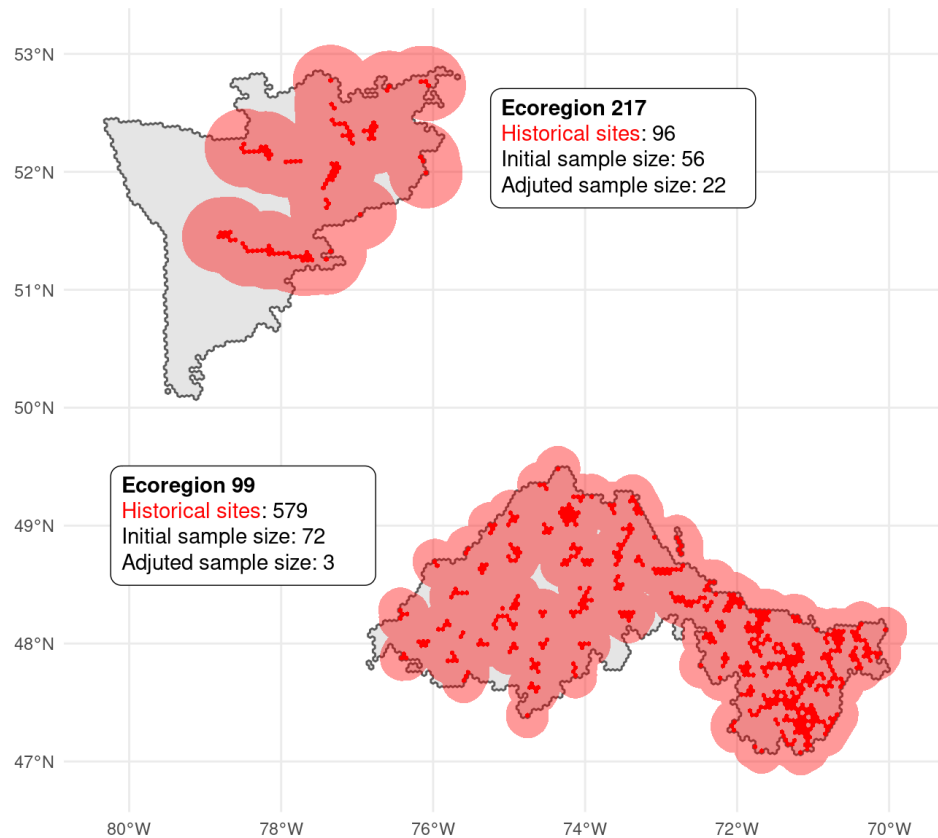
BMS project

R&D: A new approach to account for legacy sites



BMS project

R&D: A new approach to account for legacy sites



Side projects

*From learning useless programming languages to
automating unnecessary tasks*

Side projects

Reporting and templates

- [Manuscript template](#) (using markdown, LaTeX, Pandoc, Lua and yaml)
- [Presentation template](#) (this presentation, some CSS and JavaScript)
- Books (Lab notebook, ECCC report)

Task automation

- Make (reproducibility of manuscripts)
- Crontab ([Kijiji scraper R package](#))
- GitHub Actions to automatically:
 - Test and build R packages
 - Reproduce analysis
 - Deploy reports and websites

Future projects

Or what I would like to explore

Future projects

Modeling

- Statistical models (spatiotemporal autocorrelation, time series)
- Machine learning beyond random forest

Development tools

- Modularization (Packages, unity test, deployment, versioning, code review)
- Containerization (Docker)
- Data engineering
- Cloud computing

Cloud-based geospatial technologies

Cloud-based geospatial technologies

Cloud Optimized GeoTIFF (COG)

It is based on two complementary frameworks:

1. Optimal GeoTIFF storage (store and organize each pixel information)
 - Tiling
 - Overviews
2. HTTP GET range requests (extract only a portion of the GeoTIFF file)

STAC catalog

-
-