A Bottom-up Approach for National-devel Projections of Forest Growth in Canada

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Overview:

- In Canada, empirical models of forest growth have been developed by provincial and territorial agencies, with FVS being used in Ontario and British Columbia.
- Given the diversity of models, it is difficult to obtain regional or national forest growth projections.
- The Canadian Forest Service has launched an initiative with the aim of integrating the different models into a common framework to enable regional and national projections of forest growth.

Summary:

Canada has a large proportion of public lands whose management falls under the jurisdiction of provincial and territorial governments. Since the 1970s, provincial and territorial agencies have been developing growth models for their own needs, making the Canadian modelling landscape a diversified one (fig. 1). Two variants of FVS are currently being used, one in Ontario and the other in British Columbia.

While this diversity can be seen as beneficial, it poses a major challenge when it comes to producing national or regional forest growth projections. These national projections are critical to carbon estimation and reporting, the national forest inventory, and the evaluation of climate change mitigation options.

Since 2020, the Canadian Forest Service has undertaken a project with the aim of integrating the different models into a framework that would allow for national and regional growth projections. This framework is based on a bottom-up approach. The growth models are used to produce predictions for different management units. Localized meta-models are then fitted to these predictions (Fortin and Lavoie 2022) and made available in a repository. This framework is based on multiple components that interact with each other through Web Application Programming Interfaces (API, see fig. 2).

So far, three models, FVS-BC, OSM and ARTEMIS, have been integrated into this framework allowing for projections in Quebec, New Brunswick, Nova Scotia, and British Columbia. As new models come into this framework and more meta-models become available, users will

eventually be able to retrieve all the meta-models that apply in a particular region to produce large-area projections of forest growth.

Key Concepts for FVS Users:

- In our framework, the FVS model (BC variant) is wrapped into a C# Web API and will be deployed on the Web in the months to come.
- A client for this Web API will be available in an R package on GitHub. It will make it possible to send a list of trees to FVS, which will predict growth and return the results to the client.
- In this first step, these simulations will be run without any consideration for human-made or natural disturbances.

Management Applications/Future Directions:

- Using plot- and tree-level models, such as FVS, for large-area projections is challenging because the model input information, typically the tree lists, is not available wall-to-wall. Using a meta-model instead of the original model enables generation of a simpler model based on available wall-to-wall data inputs, while still capturing the behavior of the original model.
- Given their simplicity, meta-models are compatible with forest management applications such as linear programming.
- Climate-sensitive models will be integrated into this framework in the years to come. This will increase the spatial coverage of growth projections and enable climate-sensitive projections.

Figure 1—Some of the empirical growth models used in Canada. Each box represents a single model and its location on the map represents the province and territory where it is being used. This is not an exhaustive list.

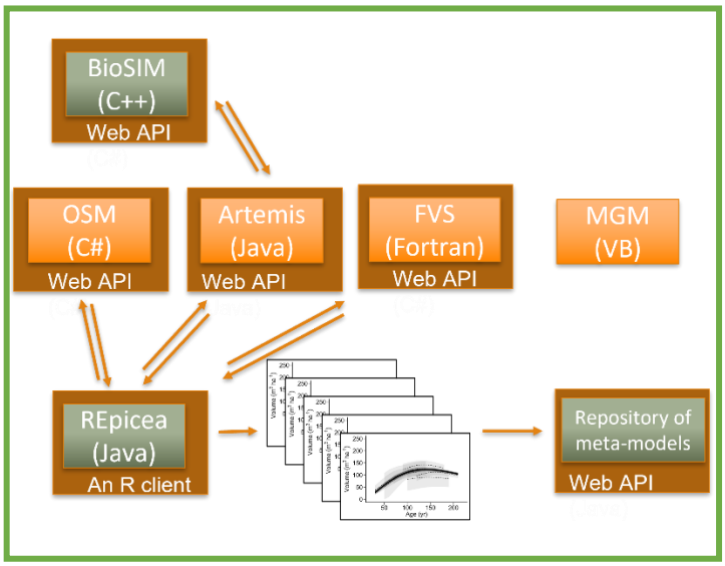

Figure 2—Flowchart of the framework under development. The orange boxes stand for the empirical growth models. The green boxes are pre- and post-processing tools. The brown boxes represent Web APIs or clients.

References:

Fortin, M.; J.-F. Lavoie. 2022. Reconciling individual-based forest growth models with landscape-level studies through a meta-modelling approach. Canadian Journal of Forest Research. 52: 1140-1153. https://doi.org/10.1139/cjfr-2022-0002 [Accessed 25 October 2024]