



Simulating ENC and SNC using the Forest Vegetation Simulator



2023 SNCC Annual Meeting
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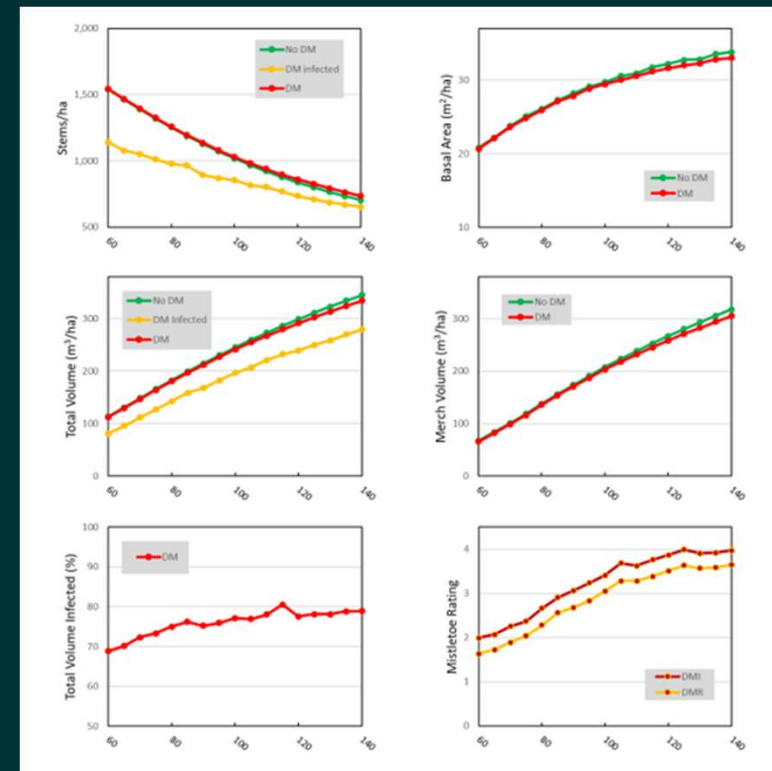
November 30, 2023

<https://essa.com>



Some background

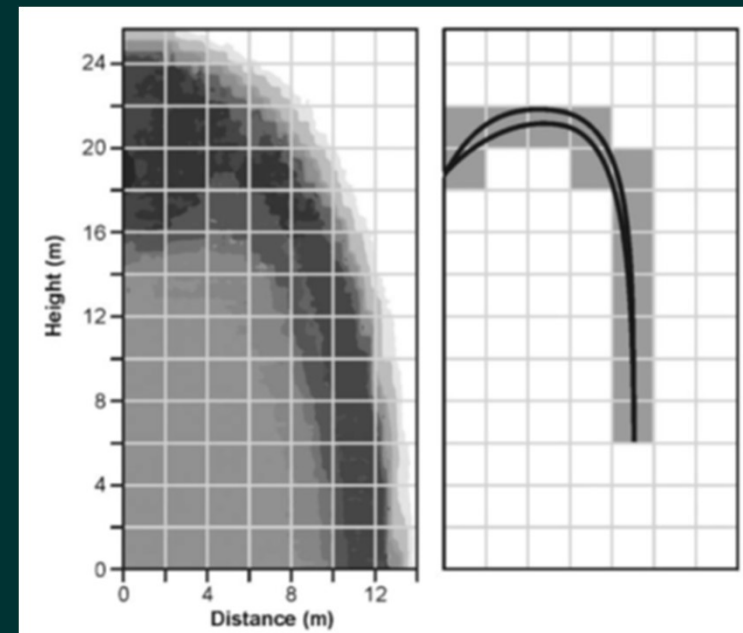
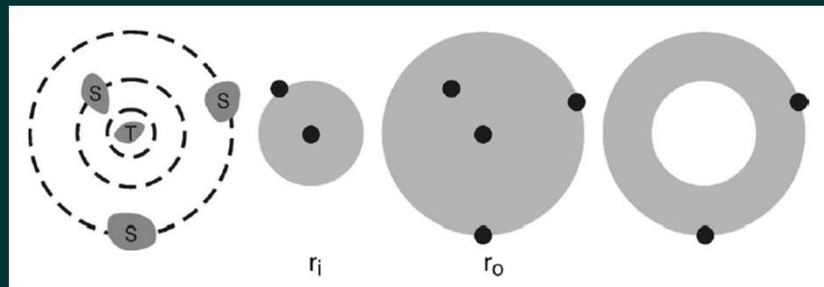
- It all began with dwarf mistletoe modeling with David Rusch, projecting infested lodgepole pine stands in north-central British Columbia
- Key questions: How is stand productivity affected? How does the DM state change
- We used a spatial statistical dwarf mistletoe model (SSDM) linked to the FVS-BC growth and yield model





Some background

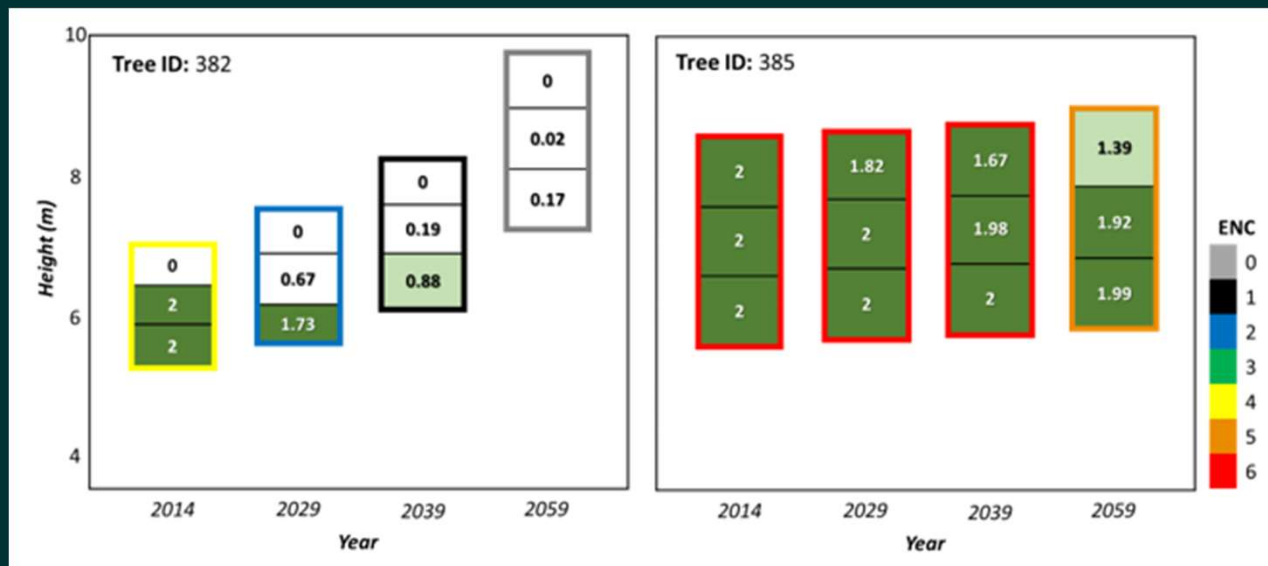
- The SSDM captures some key features of DM:
 - Life history stages
 - Role of light
 - Works at the crown third
 - Includes spatial pattern of the tree neighborhood
 - Includes autocorrelation of DM among neighbors
 - Includes simplified ballistics to spread DM





Some background

- After DM study we began thinking about whether the SSDM might be able to simulate **ENC**
 - Similar ways to measure DM and ENC in BC: Hawksworth-style at the crown third
 - ENC modifies growth and mortality
 - Trees can outgrow ENC in some situations





Is there a Path?

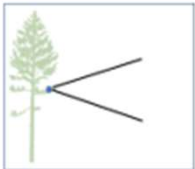
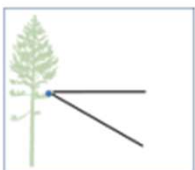

- ENC dispersal is remarkably different from DM, so we excluded any ENC spread in our study
- DM dispersal is complex but tractable when simplified
- Spore dispersal is complex and very hard to model
 - Depends on rain, humidity, season
 - May be a mix of splash- and wind-dispersal (“drip/drift”)
 - SNC and ENC differ in details of life history
- SNC paradoxes and conundrums
 - DNA is ubiquitous but not clearly tied to infection
 - Inoculation is not fully figured out or clear
 - Interaction between winter temperature and moisture is not clear





Showstopper?

- Can a simplified simulation be used to test dispersal hypotheses, comparing simulated and observed ENC or SNC outcomes in trees and stands?

| Pattern | Hypothesis |
|---|--|
|  | Spores travel away from the source tree in upward and downward directions. |
|  | Spores travel away from the source tree in a downward direction. |
|  | Spores travel away from the source tree in a downward direction, constrained to move only a fixed downward distance. |

- Are there general patterns?
- Given the complexity of transmission, is this “close enough to be useful”





Some Questions - 1

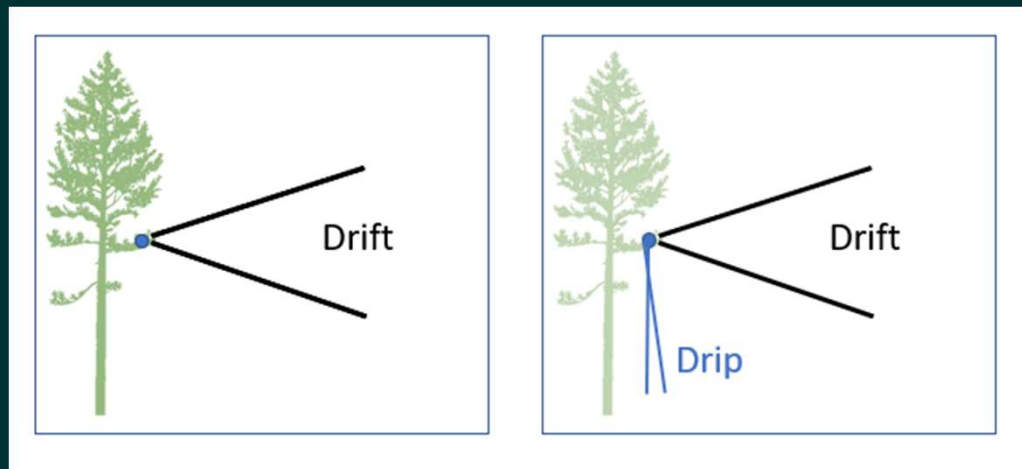
- Is there a need within the community of pathologists and foresters, for a simulation that would provide useful management guidance?
- Are there important differences in the life history of ENC or SNC that are missed?
- Are there possible biological control methods?





Some Questions - 2

- Are there processes that are missing but critical?



- Is there a consistent and accepted way to inventory SNC and ENC, that could be applied within FVS?





Thoughts - Comments - Questions?



Leap
boldly



Forage
deeply