Description of MOE model in Forecaster

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Leadership in forest and environmental management, innovation and research

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Outline

- Model scope
- Data sources
- Model construction/accuracy
- Model input/output
- Model limitations
- Model application/uses

Model scope

- Fitted to extensive national datasets
- Predicts MOE in 2 D
- Predicts across site, silviculture range
- Generic function used to determine velocity
- Requires no additional user input

Data sources

- Two national trial series
  - 25 year old trees – 17 sites (2 D data)
  - 6 year old trees – 30 sites
- Two stocking trials
- Total number of sites = 49

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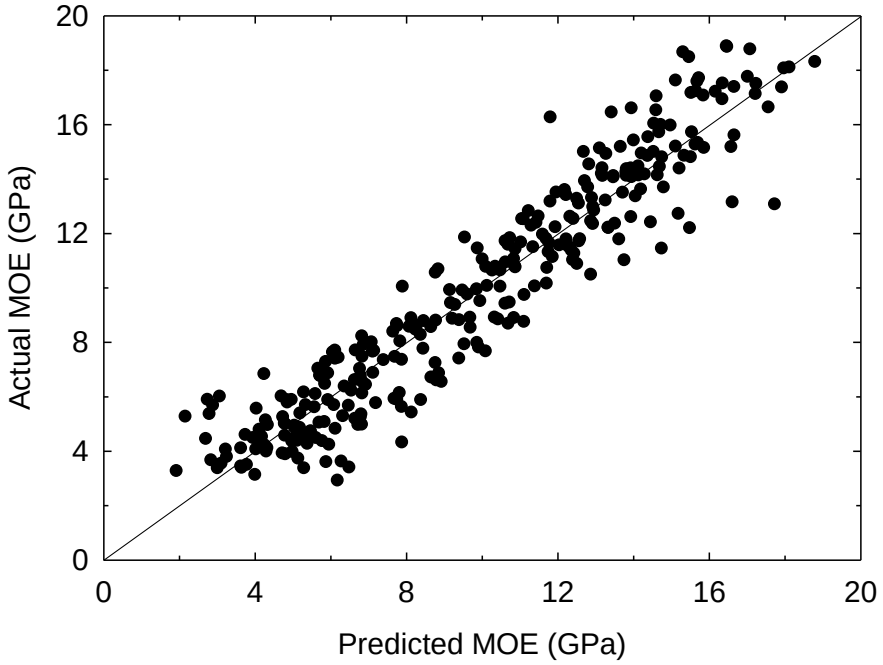
Approach

- Considerable research has shown the following
  - MOE is significantly related
    - Tree age
    - Tree height
    - Stem slenderness (tree height/dbh)
    - Air temperature
  - The model was constructed using the above variables

Data

- Radial MOE measurements taken from 0 to 20 m (Silviscan2)
- Past and present stem slenderness determined
- Air temperature obtained from long term splined surfaces
- Model constructed using the non-linear procedure in SAS, using plot level data

Results



- Model developed from tree age, height, slenderness and air temp.
- Predictions of MOE strongly correlated to actual MOE (R^2 = 0.90)

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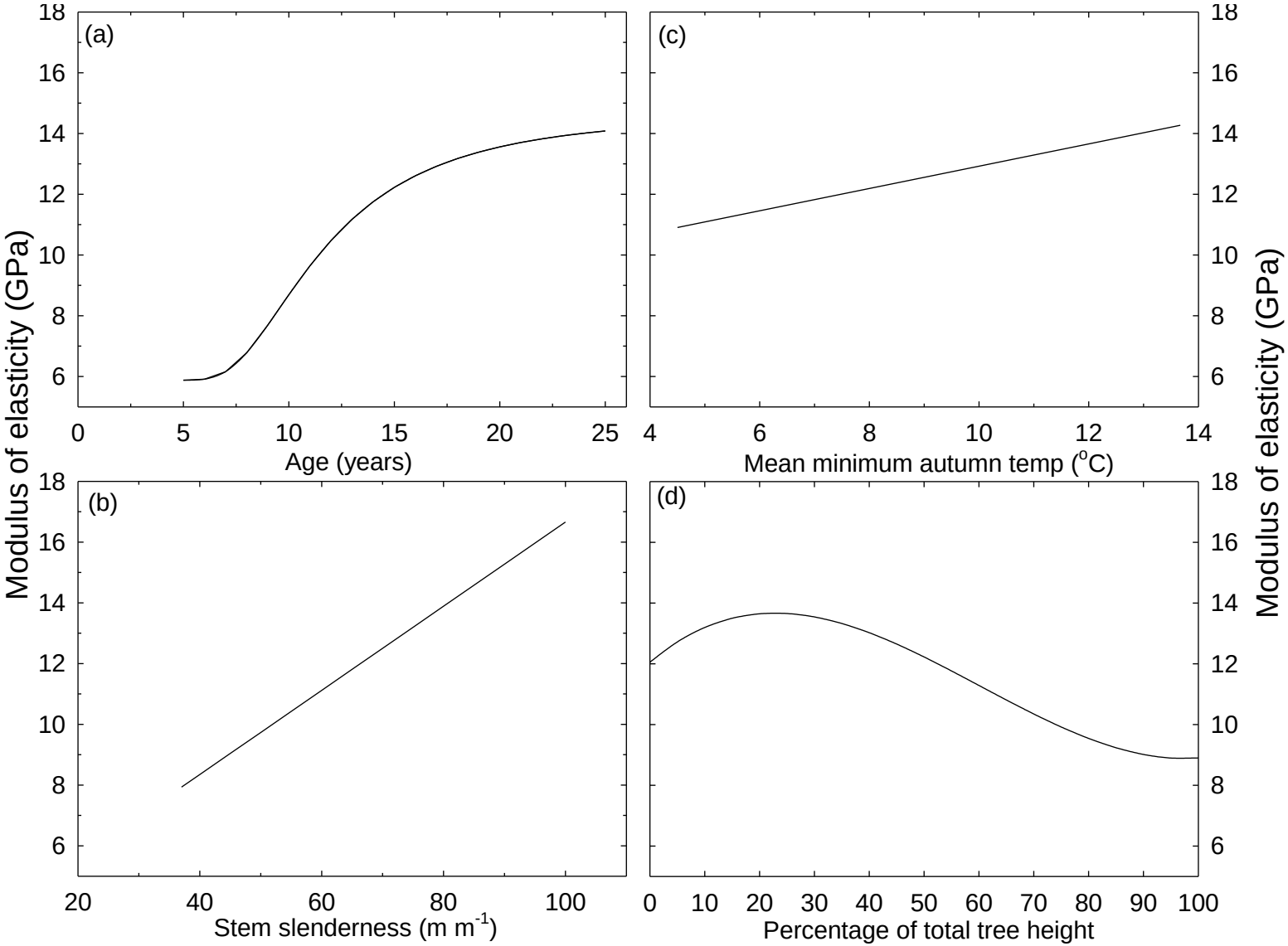
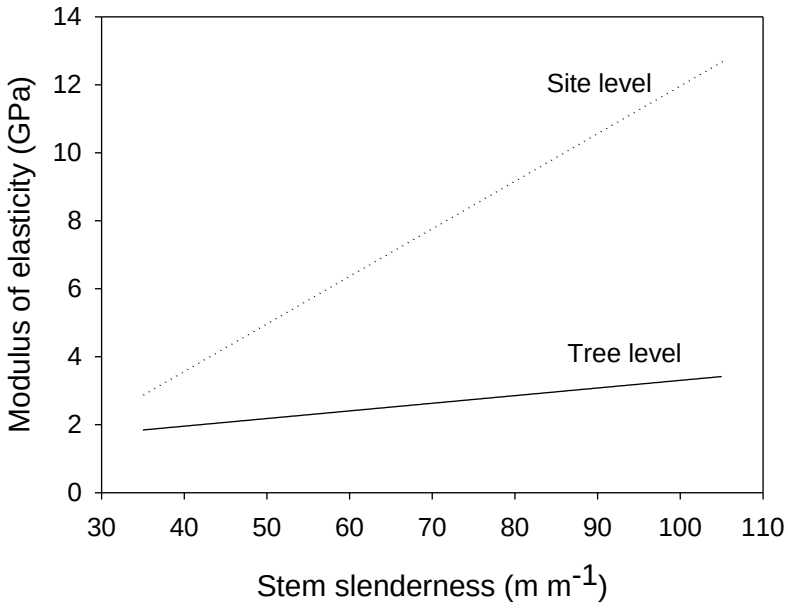
Partial responses



Accounting for tree level variation

- Previous research shows most of tree to tree variation in *E* attributable to slenderness
- Used function based on slenderness to modify site level mean estimates *E*
- Function derived from national dataset



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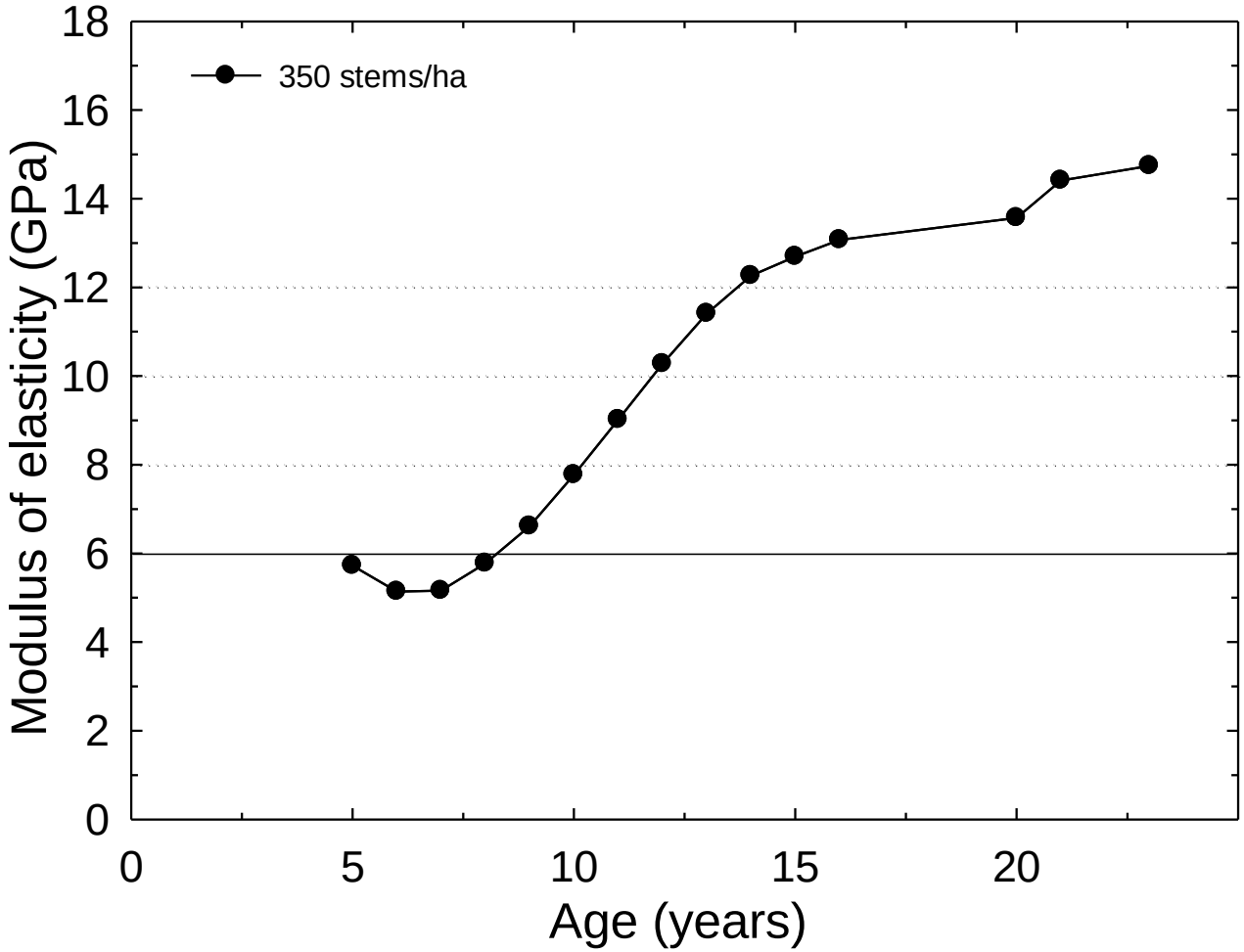
Conversion of MOE to velocity

- Conversion of dry MOE (7-8% MC) to wet velocity uses theoretical equation (Rob Evans/Mike Watt)
- As input uses dry MOE and dry density
- Dry density used to determine water fraction
- Velocity in both water (fixed) and dry wood then determined from water fraction and dry MOE
- Two component velocities then combined into overall green velocity

Limitations

- Tree level variation could use additional testing
  - Data from single age (6 years old)
  - No random effects, could underestimate MOE range
  - Assumptions used to implement
- Conversion of MOE to velocity has had restricted testing

Model application



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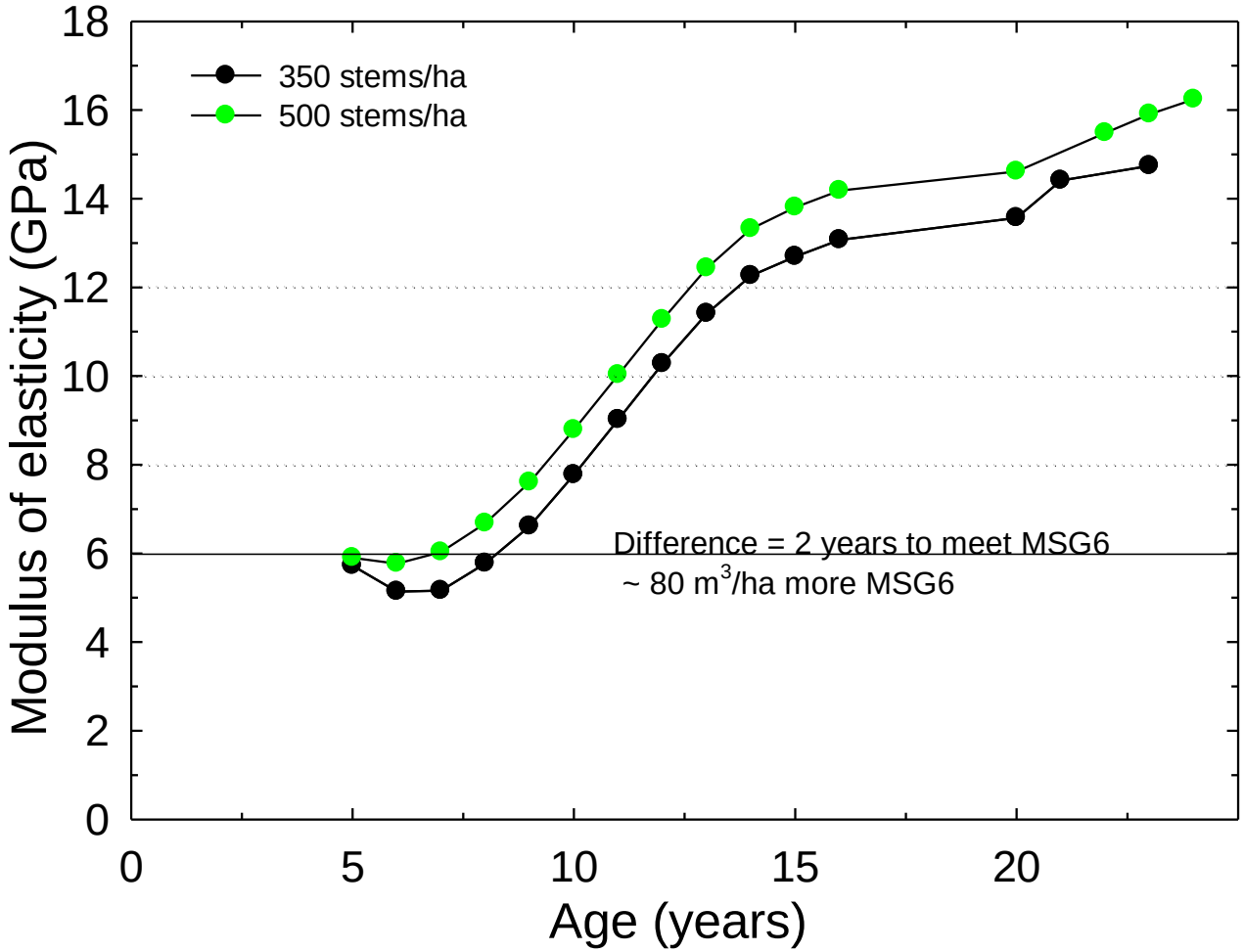
Model application



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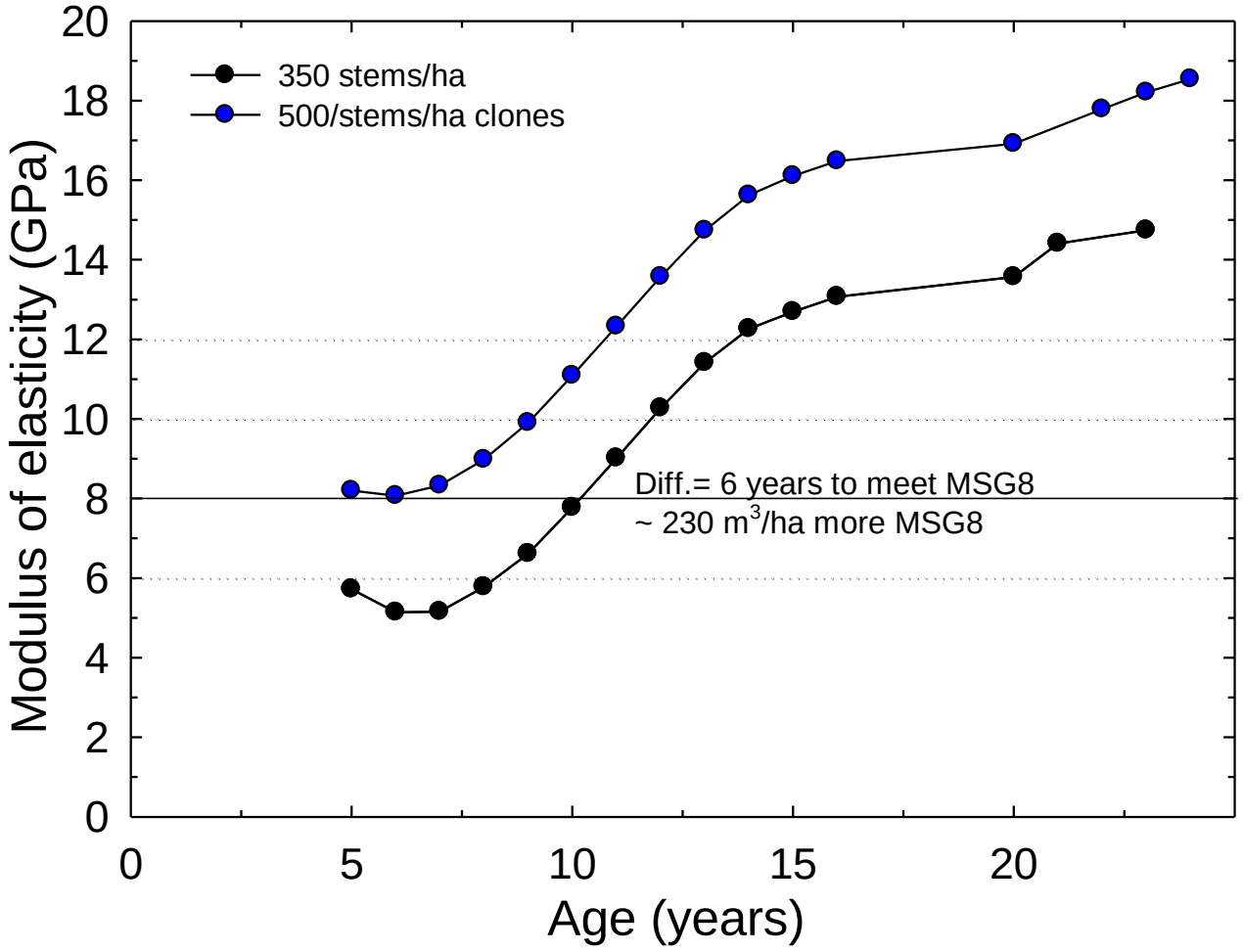
Model application



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Forecaster MOE Model Inputs

- Mean minimum autumnal air temperature
  - Extracted from spatial surface
- Annual Stand-average stem height and slenderness
  - calculated during growth simulation
- Annual DBHs and heights for all stems
  - calculated during growth simulation
- Density
  - Calculated using selected Density model

Forecaster Simulation Outputs

- Mean MOE and Acoustic Velocity for every log bucked
- Min, Max, Mean and Std Deviation of MOE and Acoustic Velocity for all log products
- Acoustic Velocity can also be used as a log product constraint when bucking

Incorporating model into Forecaster

- MOE model used to predict values at a sequence of heights on each stem
- At each height, an MOE value predicted for each ring, then area-weighted to disc-level
- Mean MOE value for a log derived by volume-weighting disc-level values across the log's height range

Utility to industry

- This model could be used to increase resource quality and value
- Provide growers with means of tailoring regimes to meet grading standards
- Highlight areas unlikely to meet structural grade
- Provide sawmillers with greater certainty of resource quality = higher timber value?
- Could see increase in highly stocked framing regimes, particularly if carbon forestry takes off

Further research

- Industry testing required, provide guidance for further research
- More data needed to more accurately describe tree-tree variation, possibly include random effects into model
- Further data collection/analysis needed to confirm MOE to velocity relationship robust
- Add in further modifiers to account for clonal effects

Acknowledgements

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