



Forest Service  
U.S. DEPARTMENT OF AGRICULTURE

# Forest Vegetation Simulator Updates

**Updates From This Past Year**

**Ongoing Model Enhancements**

**Longer Term Vision**



**Mark Castle**

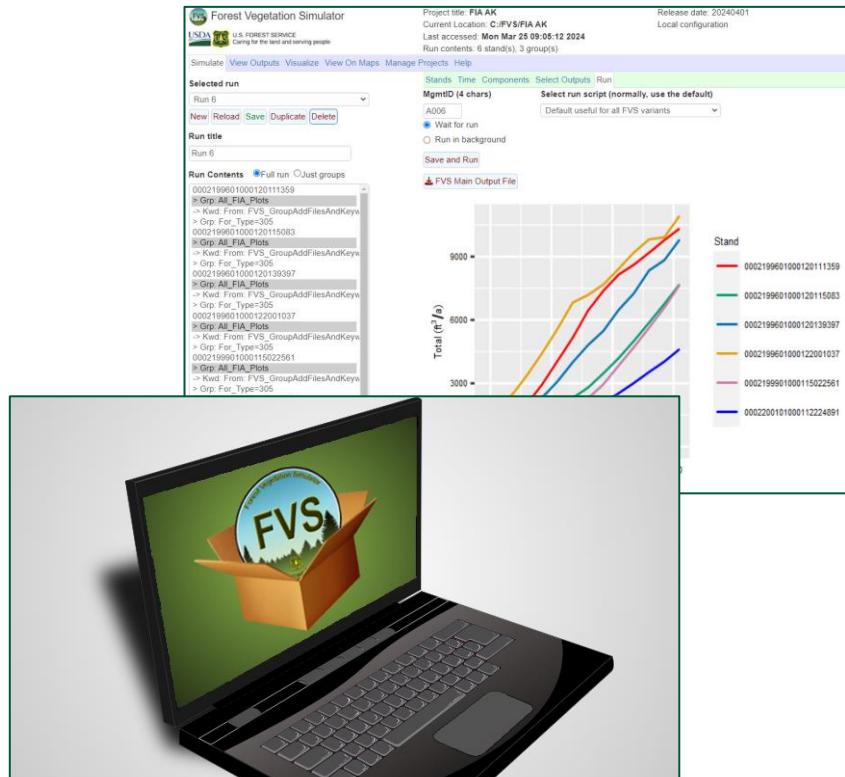
Forest Biometrician

April 10, 2024

## Updates From This Past Year

## Limited staffing but still an eventful year

- Held 6<sup>th</sup> FVS Conference in March 2023
- Addition of composite calibration statistics table to FVS interface
- Continued user support through in-person trainings and helpdesk



# 6<sup>th</sup> FVS Conference

90 Attendees in total

29 presentations and two panel sessions

- Model development
- Project application
- Model validation

Conference Proceedings will be available in spring or summer of 2024

THE 6<sup>TH</sup> FOREST VEGETATION SIMULATOR CONFERENCE

Hilton Hotel

Fort Collins, CO

March 7<sup>th</sup>- 9<sup>th</sup>



# Composite Calibration Statistics Table

MgmtID	Species	TreeSize	NumStands	MinSF	MaxSF	MeanSF	StDevSF	TotNumTrees
PN	ABAM	LG	78	0.291	2.088	0.826	0.337	1099
PN	ABAM	SM	1	2.083	2.083	2.083		6
PN	PSME	LG	1175	0.121	2.988	0.984	0.401	22314
PN	PSME	SM	3	1.235	7.585	3.457	3.578	16
PN	THPL	LG	173	0.146	4.234	0.999	0.593	1697
PN	THPL	SM	5	0.304	0.765	0.516	0.177	44
PN	TSHE	LG	522	0.178	5.491	0.862	0.484	8403
PN	TSHE	SM	28	0.187	5.2	1.312	1.362	264
PN	TSME	LG	9	0.398	1.608	0.942	0.419	111
PN	TSME	SM	1	0.851	0.851	0.851		14
WC	ABAM	LG	598	0.205	3.458	0.937	0.37	10198
WC	ABAM	SM	75	0.443	10.667	2.495	2.402	594
WC	PSME	LG	1885	0.132	3.777	1.046	0.422	32151
WC	PSME	SM	29	0.327	7.437	2.599	1.667	198
WC	THPL	LG	325	0.219	3.868	1.185	0.567	3089
WC	THPL	SM	7	0.324	0.839	0.529	0.187	38
WC	TSHE	LG	1047	0.19	3.409	1.04	0.486	14208
WC	TSHE	SM	52	0.344	8.656	1.334	1.342	370
WC	TSME	LG	255	0.213	2.983	1	0.41	3928
WC	TSME	SM	14	1.062	5.72	2.915	1.585	104

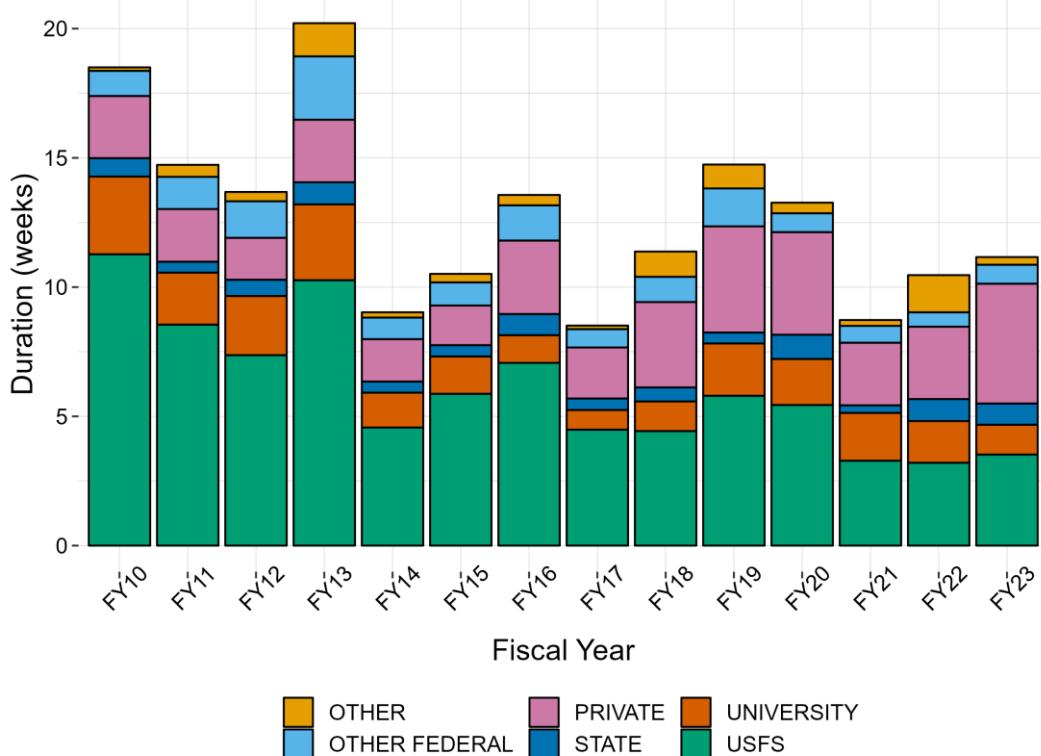
FVS can calibrate small tree height growth and large tree diameter growth

Scale factors are reported by species on stand-by-stand basis in FVS\_CalibStats

Composite calibration table summarizes scale factors across stands by MgmtID

- Minimum and maximum
- Mean
- Standard deviation
- Number of stands and tree observations

# FVS User Support



FVS staff continues to support diverse user base

Offered three in-person trainings in 2023-2024

- Fort Collins, Colorado
- Asheville, North Carolina
- Portland, Oregon

# Ongoing Model Updates

Integration of FIA volume, biomass, and carbon calculation methodology into FVS

- Nationally consistent estimation of volume, biomass, and carbon for non-woodland species
- System of equations accounts for spatial differences in volume/biomass/carbon
- Updated and more precise species –specific carbon content fractions
- Defect taken into consideration in calculation of volume, biomass, and carbon attributes



October 2023

IN PRESS

A National-Scale Tree Volume, Biomass, and Carbon Modeling System for the United States

# FIA Volume, Biomass, and Carbon

Invocation of NSVB methods would be done through method code in VOLUME (and possibly CARBCALC) keywords

National volume estimator library (NVEL) will be the engine for calculating NSVB volume, biomass, and carbon estimates



# FIA Volume, Biomass, and Carbon

United States  
Department of  
Agriculture

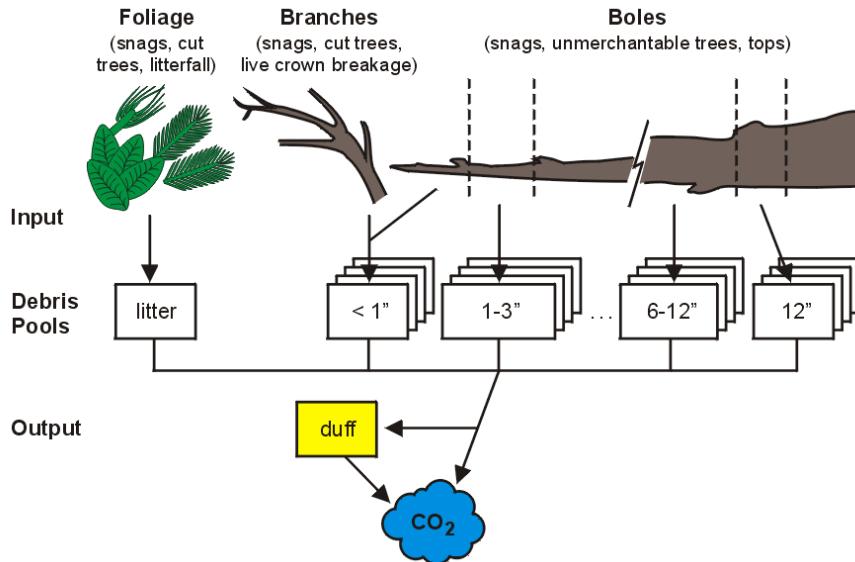
Forest Service

Forest Management  
Service Center

Fort Collins, CO

2010

## The Fire and Fuels Extension to the Forest Vegetation Simulator: Updated Model Documentation

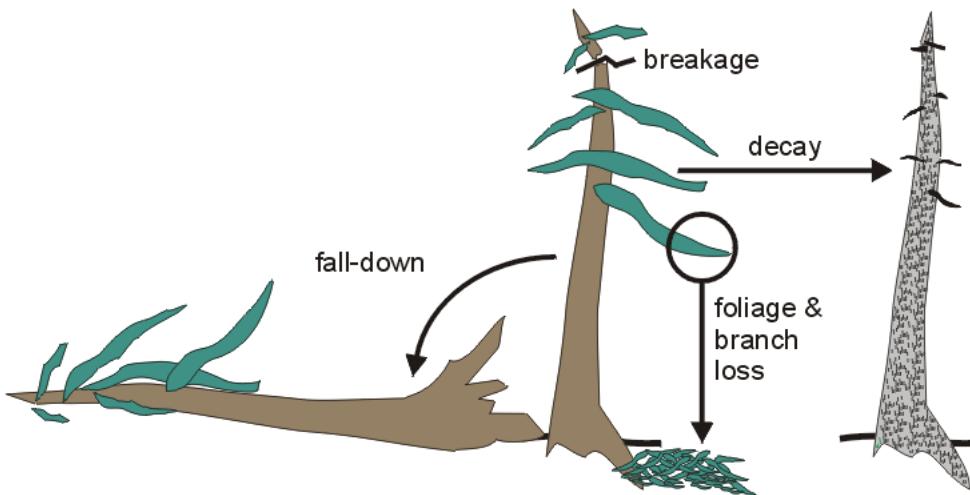


How do we get biomass and carbon?

- Currently all biomass and carbon estimation in FVS occurs within FFE
- Can NSVB relationships be used to estimate fuel loadings in FFE?
- If not, perhaps NSVB calculations can occur separately from the fuel estimation logic?
- More to come...

# FIA Volume, Biomass, and Carbon

Have we hit another snag?



FFE Snag dynamics

- NSVB takes cull, broken tops, and decay status into consideration
- Dead trees (inventory and future) get compressed into 2" DBH class snag records in FFE
- Snags have their own decay and breakage dynamics within FFE

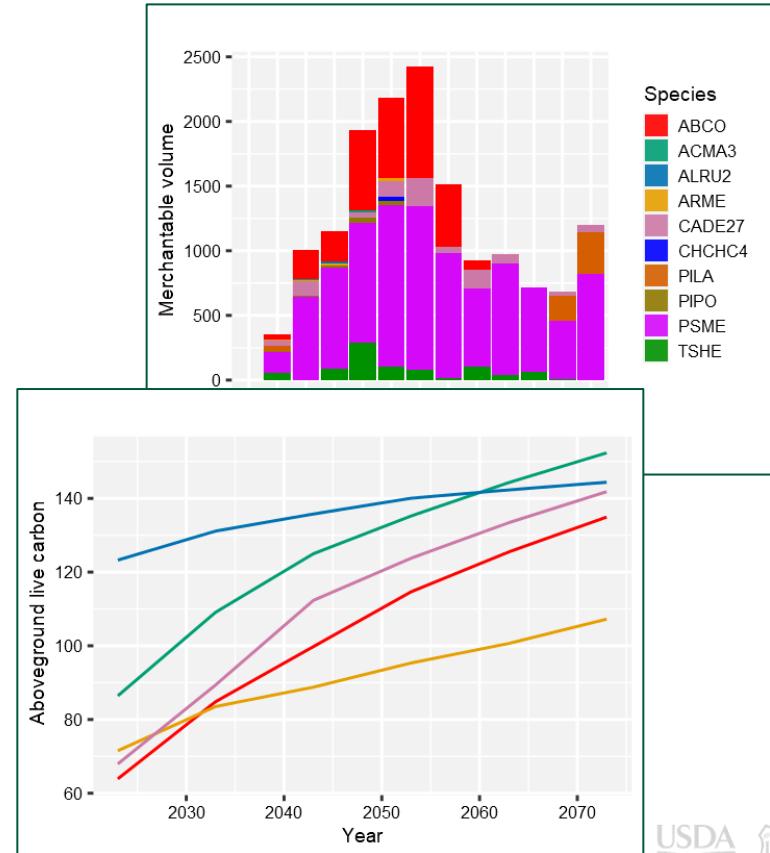
# FIA Volume, Biomass, and Carbon

## Volume outputs

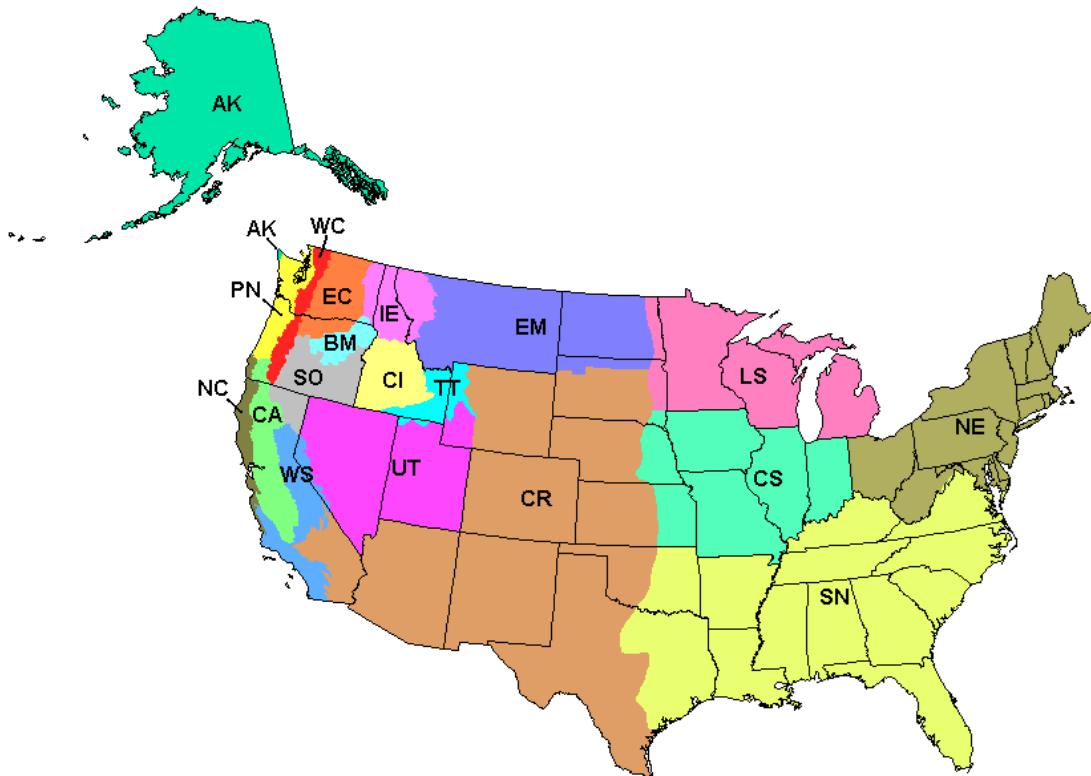
- FVS\_Summary and FVS\_TreeList tables...but...volume reporting differs by variant
- Why not standardize volume reporting across variants?

## Carbon and biomass outputs

- FVS\_Carbon/FVS\_Fuels are logical places to start...
- May need new output table(s) if FFE is not compatible
- Opportunities for inclusion in FVS\_Treelist?



# Longer Term FVS Vision



Is it time to Revamp  
the FVS Engine?

# Current Limitations



FVS variants are fit to what is now older data and utilize inconsistent modeling frameworks



Only a few variants have ability to automatically predict regeneration



No nationally consistent ability to integrate climate sensitivity into FVS simulations



Complicated code base and software system

# The FVS Wishlist



Nationally consistent growth, mortality and regeneration models developed from contemporary data sources and methodology



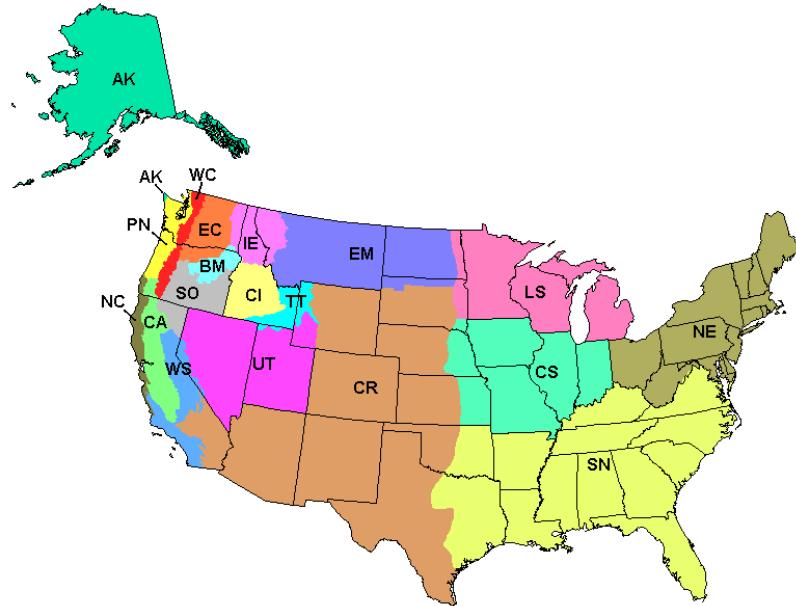
The ability to integrate climate sensitivity into base FVS relationships in a nationally consistent manner



A more easily maintainable and updatable code base and software system



# What To Do About Variants?



Source: Wikipedia

Control for geographic variation in models?

Programmatic necessity?

Linkage to other software components?

# Moving Forward

---



Build capacity



Elevate priority of FVS development



Formulate a development plan

**The End**

---

Thanks for listening!

Do you have any questions or comments?

[mark.castle@usda.gov](mailto:mark.castle@usda.gov)

