Background

- This is my last SOFAC presentation as NC State faculty. I've technically been retired for the last two years, but hired back as half-time. My 3 year half-time stint ends next July 1.
- I will continue working with Justin, David, Jesse, and Ray till next summer, so I may have something to offer at the next meeting.

SRTS Model Evolution In Context

Objectives, Methods, Applications

Bob Abt

SOFAC Co-Founder and author of SRTS 1.0
Retiring Next July 1

Outline

- Background
- SRTS Model
  - My Objective
  - Brief Model Description
    - The goal program module and “harvest misses”
- A retrospective look at topics we’ve addressed with SRTS
  - The recession, “wall of wood”, timber famine
  - Pellets/Bioenergy “biomass mode”
  - Hurricanes
  - Carbon
- My use of batch mode, SRTS assistant, and scenario comparisons

The Modeling Gap I was Trying to Address

- I was fortunate to be part of designing processes within the national RPA models that recognized some of the diversity in forest management and markets across the South (*Fourth Forest Study*), but:
- I knew from experience that SE GA was different from SW GA, and that SW GA was different from north Florida (and the GA piedmont).
- I also didn't think that we could ever do a good job predicting medium to long-term demand.
- I did think that given FIA had detailed growth and removal data by forest type and age class, we should be able to get the inventory trend at least directionally correct for a decade or so.
- I saw the south as a market driven forest economy, where we could take advantage of our richer FIA data to project medium run supply at a "local" scale.

My Modeling Objective

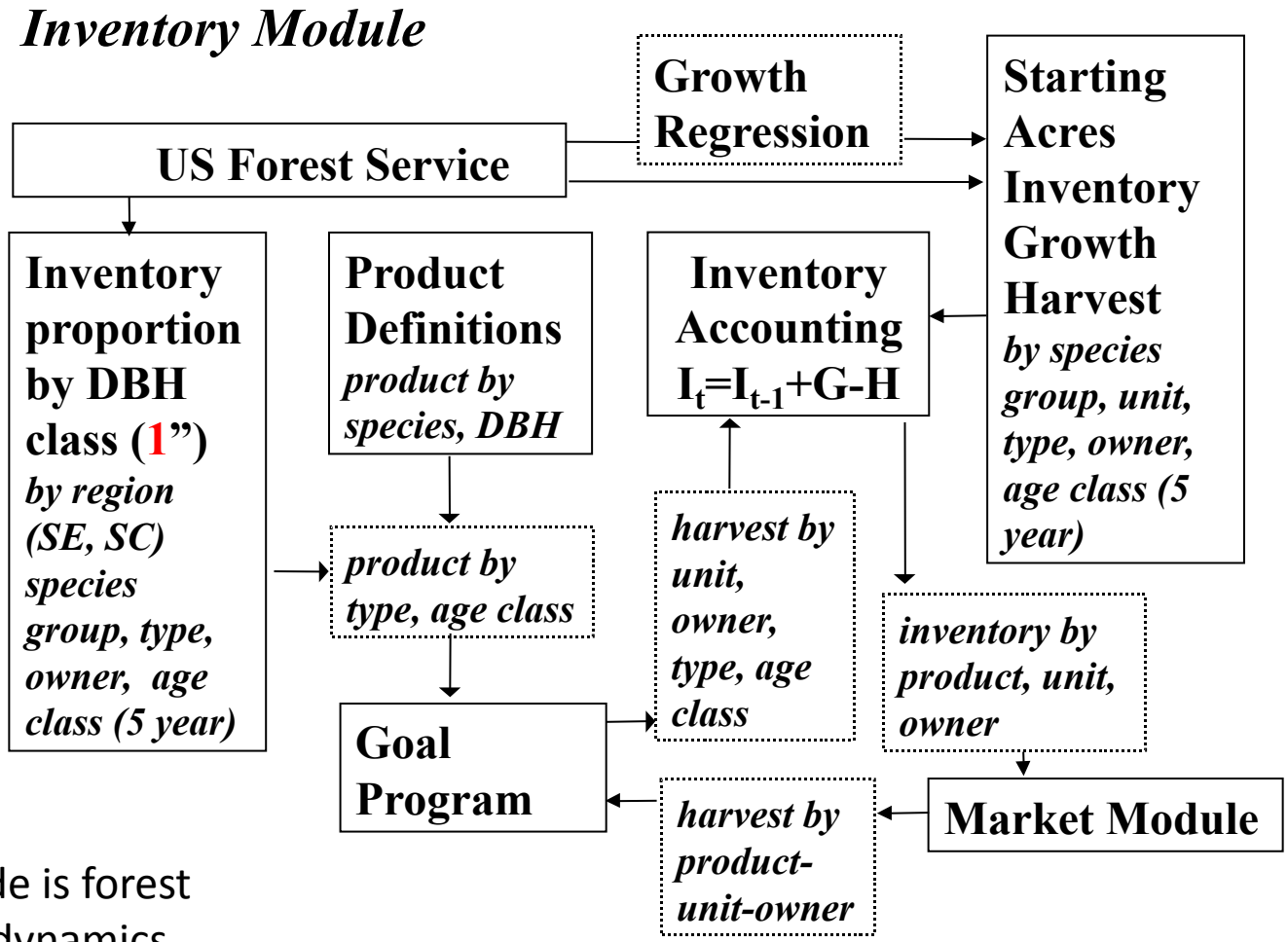
- My goal was to develop a tool for strategic planning by the states and industry that would allow private land managers to explore the impact of different demand points of view on an up-to-date detailed timber supply database; by owner-type, forest-type and physiographic region.

- I did not want the model to be a black box, econ 101 applied to detailed biological data. Of course Econ 101 and FIA data can be black boxes. But using the model should be an opportunity to understand both the data and the results better, not just “trust the model”.

- Not so much to forecast future markets, but to understand 1) the underlying forest structure, 2) its implications for the next 20 year of supply, and 3) how sensitive future market outcomes are to various demand scenarios.

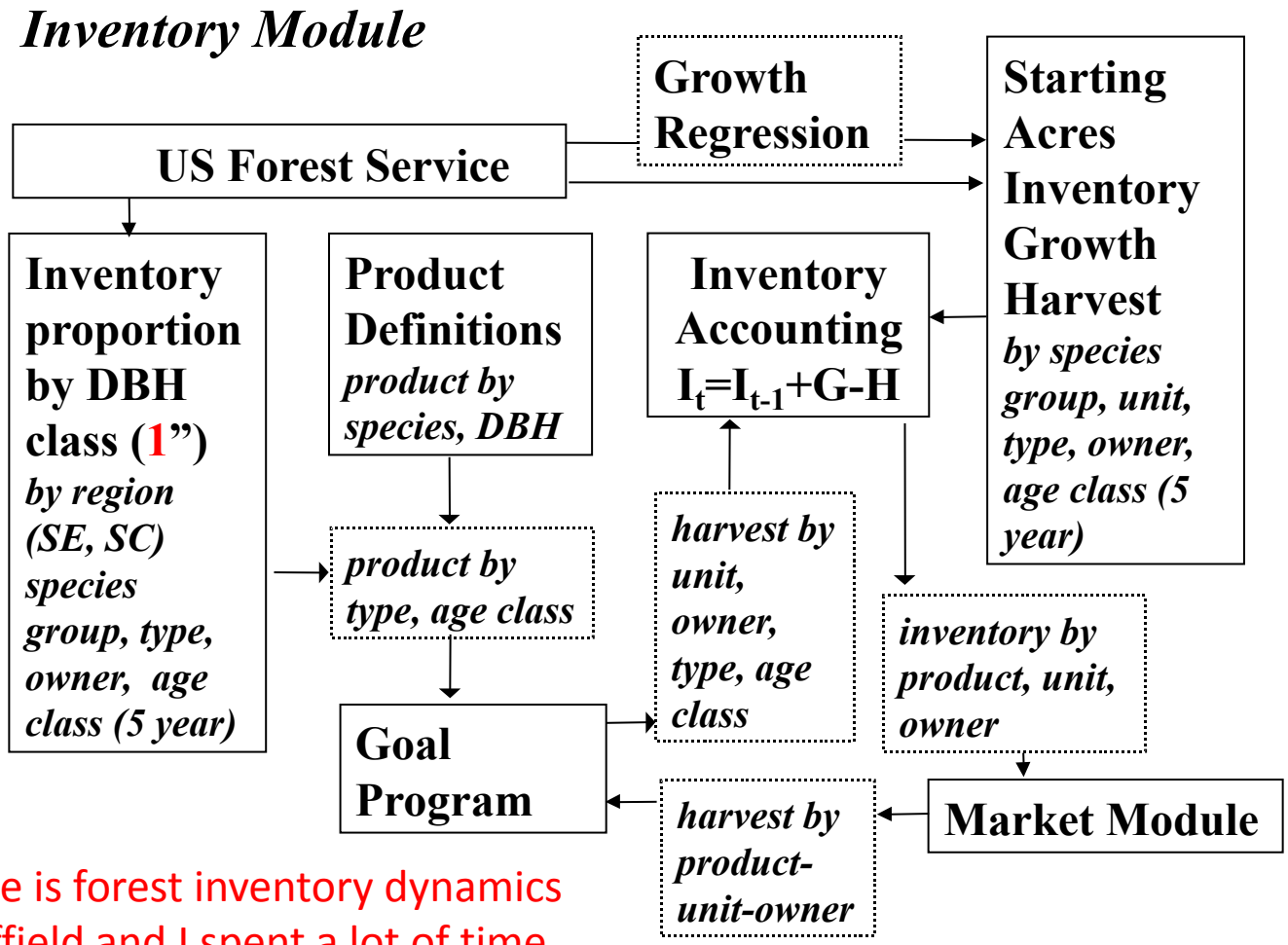
- Success would be measured by its status as an information source in the decision space of forest industry wood consumers and private forest landowners.

SRTS-Inventory Module – the supply shifter



90% of code is forest inventory dynamics

SRTS-Inventory Module – the supply shifter

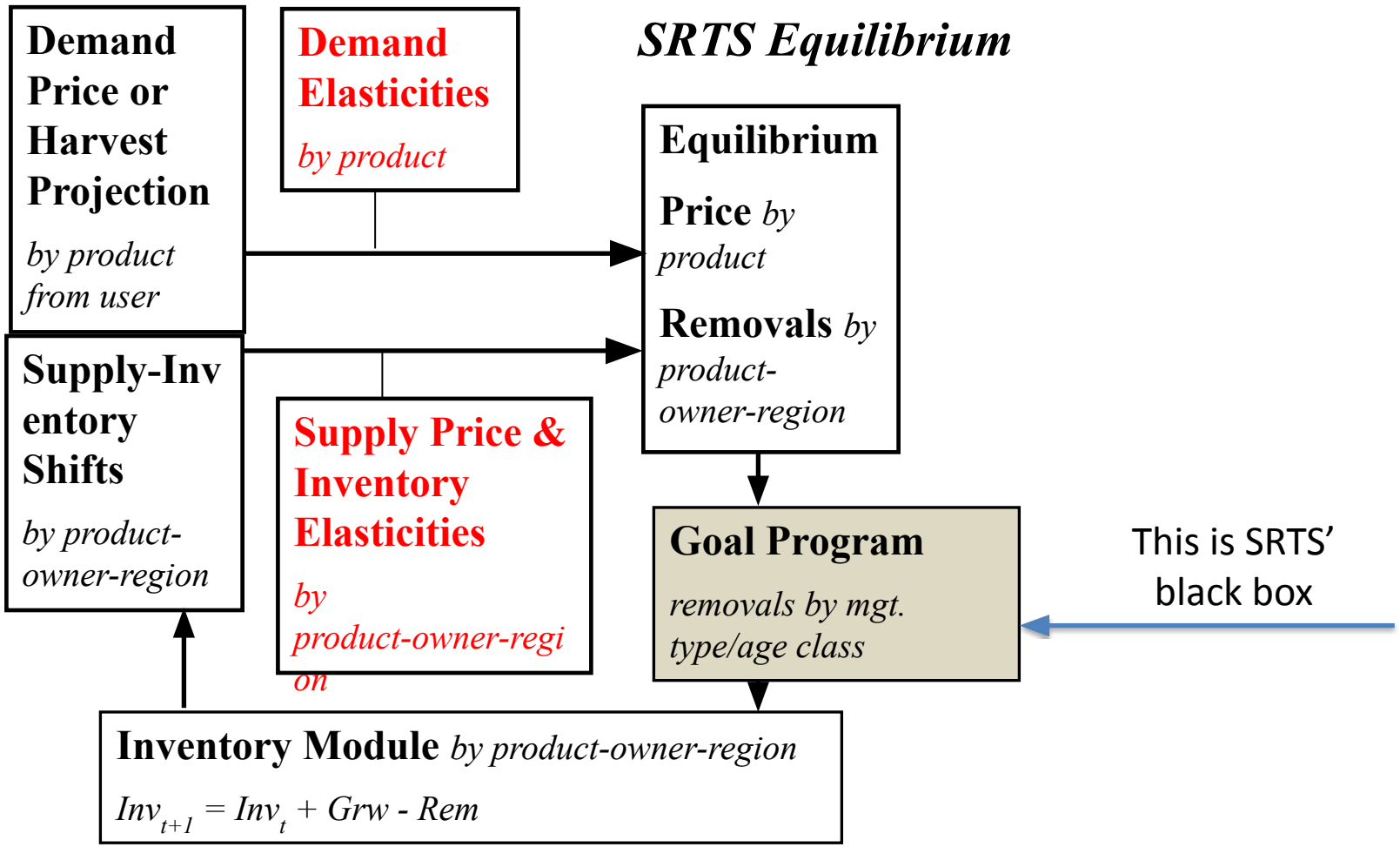


Why is USFS Region (SE/SC) important?

90% of code is forest inventory dynamics – Ray Sheffield and I spent a lot of time translating plot data into SRTS input.

Abt

How SRTS Works



How the Model Works
Misses from the Goal Program

	SW	SW	SW	HW	HW	
Products Defind by:	Product1	Product2	Product3	Product4	Product5	
DBH Range and degrade to PW%	100	100	100	100	100	Comes from Market Equilibrium

For Each Product - the goal program chooses what forest type and age class to harvest

5 forest types - Plantation has 9 5yr age classes, the other 4 have 11 5yr age classes= 53 activities

Based on the product definition, this years volume/age class distribution the model has % of each product produced by a harvest.

The primary goal is to get the equilibrium product mix

BUT:
1. there are lower and upper bounds on harvest
2. there are target harvest intensities (rem/inv%) based on the FIA data
   for example, age 10-15 and 20-25 plantations have a high harvest intensity
   lowland hardwoods usually has a very low harvest intensity

There is a "Product Weights" option file to set individual product weights (penalty for missing)

There is a lot of flexibility possible in the goal program, e.g. carbon harvest penalties, faustmann based penalties etc.

I often manipulate the weights in the code or redefine products to either minimize misses or to favor/penalize certain products. Working with David this year to streamline modifying the goal program and add user friendly flexibility.

So does having harvest misses means there's a "timber shortage"? Not necessarily, it just means that as the inventory evolves over time, it is not possible to get the exact combination of products that comes out of the market equilibrium routine given the product definitions and upper and lower bounds by "region,mtype, owner, age class" bucket.

Easy example is hardwood pulpwood which may be be defined as 35% cull from hardwood sawtimber. If you ask for a lot of HPW but not much HST, you'll get misses.

rs'
x

But remember there is a "dynamic" cull factor option.

Inventory Module *by product-owner-region*

$$Inv_{t+1} = Inv_t + Grw - Rem$$

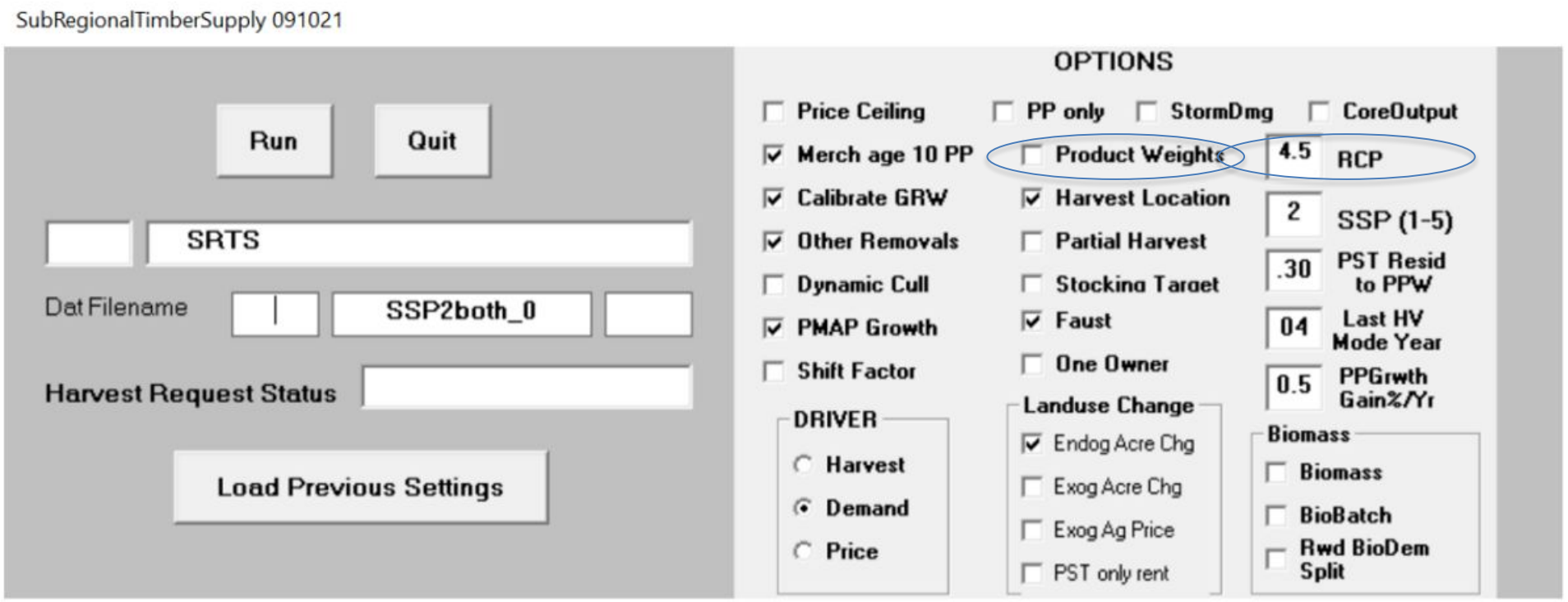
How the Model Works
Misses from the Goal Program
.hvmisspct file has this info

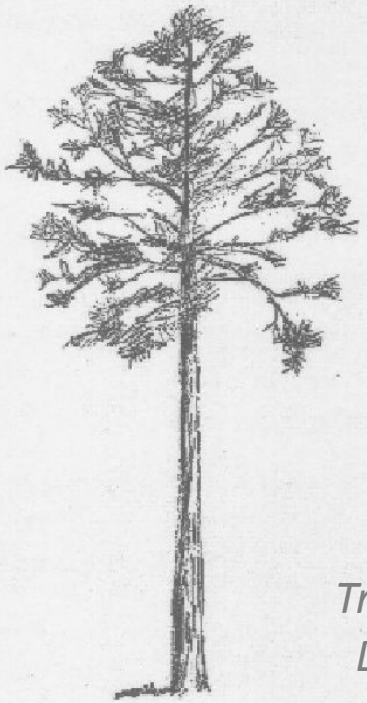
YR	REG	OWN	PRODUCT	REM_REQ	REM_MISS	REMACT/REMREQ	ADJ_REM	YR	REG	OWN	PRODUCT	REM_REQ	REM_MISS	REMACT/REMREQ	ADJ_REM
2033	0	0	1	3400448	0	1	3400448	2033	0	0	2	3248821	0	1	3248821
2034	0	0	1	3429116	0	1	3429116	2034	0	0	2	3251002	0	1	3251002
2035	0	0	1	3430180	0	1	3430180	2035	0	0	2	3244272	910	1	3243362
2036	0	0	1	3443293	0	1	3443293	2036	0	0	2	3228910	**9926**	**0.997**	3218984
2037	0	0	1	3445791	0	1	3445791	2037	0	0	2	3216657	**12200**	**0.996**	3204457
2038	0	0	1	3443915	0	1	3443915	2038	0	0	2	3211005	**62322**	**0.981**	3148683
2039	0	0	1	3429997	0	1	3429997	2039	0	0	2	3207866	**175908**	**0.945**	3031958
2040	0	0	1	3442452	0	1	3442452	2040	0	0	2	3203328	**193210**	**0.94**	3010118
2041	0	0	1	3458034	0	1	3458034	2041	0	0	2	3202173	**202575**	**0.937**	2999598
2042	0	0	1	3462090	0	1	3462090	2042	0	0	2	3196248	**207372**	**0.935**	2988876
2043	0	0	1	3444839	0	1	3444839	2043	0	0	2	3205505	**232051**	**0.928**	2973454
2044	0	0	1	3417592	0	1	3417592	2044	0	0	2	3213823	**263302**	**0.918**	2950521
2045	0	0	1	3413166	0	1	3413166	2045	0	0	2	3214485	**252884**	**0.921**	2961601
2046	0	0	1	3410769	0	1	3410769	2046	0	0	2	3214436	**251262**	**0.922**	2963174
2047	0	0	1	3405072	0	1	3405072	2047	0	0	2	3208792	**252823**	**0.921**	2955969
2048	0	0	1	3385053	**-3422**	**1.001**	3388475	2048	0	0	2	3204429	**268116**	**0.916**	2936313
2049	0	0	1	3366983	**-11978**	**1.004**	3378961	2049	0	0	2	3199403	**273433**	**0.915**	2925970
2050	0	0	1	3364668	**-8597**	**1.003**	3373265	2050	0	0	2	3201749	**269136**	**0.916**	2932613
2051	0	0	1	3367559	**-904**	**1**	3368463	2051	0	0	2	3210048	**133997**	**0.958**	3076051
2052	0	0	1	3367083	0	1	3367083	2052	0	0	2	3214593	**46752**	**0.985**	3167841
2053	0	0	1	3359613	0	1	3359613	2053	0	0	2	3212424	**49750**	**0.985**	3162674
2054	0	0	1	3357076	0	1	3357076	2054	0	0	2	3206056	**54899**	**0.983**	3151157

Slightly Over Harvesting PPW

Under harvesting CNS

Interface


SubRegionalTimberSupply 091021
Run
Quit
SRTS
Dat Filename
SSP2both_0
Harvest Request Status
Load Previous Settings
OPTIONS
Price Ceiling
PP only
StormDmg
CoreOutput
Merch age 10 PP
Product Weights
4.5
RCP
Calibrate GRW
Harvest Location
2
SSP (1-5)
Other Removals
Partial Harvest
.30
PST Resid to PPW
Dynamic Cull
Stocking Target
PMAP Growth
Faust
04
Last HV Mode Year
Shift Factor
One Owner
0.5
PPGrwth Gain%/Yr
DRIVER
Harvest
Demand
Price
Landuse Change
Endog Acre Chg
Exog Acre Chg
Exog Ag Price
PST only rent
Biomass
Biomass
BioBatch
Rwd BioDem Split



SOFAC

Organizational Meeting

March 28, 2007

Fun Fact
Tree was drawn by Dave Wear's son

The Southern Forest Resource Assessment Consortium

Note: the "R" is silent, SFRAC didn't sound right.

timber harvesting algorithms based on endogenous price response behavior and empirical data by forest ownership class; (6) enhance endogenous land use components of the model; and (7) incorporate foreign trade and competition effects in to the model.

The following table shows the approximate duration of the methodological approaches that will be performed in the MP SRTS timber supply modeling enhancements.

Activity	2007	2008	2009	2010	2011
1) Multiproduct goal programs	X	X			
2) SAS / FIA linkage	X	X			
3) SAFIS – ownership data	X	X	X		
4) Forest biometrics yields			X	X	
5) Endogenous price response		X	X		
6) Endogenous land use		X	X		
7) International trade				X	X

Land Ownership Trends and Impacts

Several primary timberland ownership trends have impacted the South over the past 20 years including, but not limited to (1) significantly decreasing industrial ownership and increasing institutional ownership, (2) the timberland base becoming increasingly fragmented, and (3) timberland being converted to other uses, particularly at the urban / rural fringe. We will continue to track these and other changes to the timberland base as such changes occur and include these trends in future MP-SRTS simulations.

An important component of any inventory projection system is the land use change model. Initially these trends were exogenous to MP-SRTS. Recently, however, a land use change component has been added to the simulation system thus allowing for dynamic land use trends over a simulation time horizon. We plan to continue to validate and enhance the land use change component of during phase three of SOFAC. The following table shows the approximate duration of the methodological approaches that will be employed in the land ownership trends and implications research.

At this point, SRTS was a growing stock model. Goal 1 was to implement multiple products with a goal program. Goal 5 was endogenous LU Change

No research staff until we hired Jesse in 2014, depended on faculty time and funding grad students

SRTS Applications

- 2009 Recession - Wall of Wood vs Timber Famine
- Pellets/Bioenergy “biomass mode”
- Hurricanes
- Carbon*
- Most common requests
  - Where to locate new capacity
  - Impact of neighboring new capacity
  - Hurricane impact on future supply

Timber Famine Meets Wall of Wood:

The Plot: *First, plant a lot of trees, then stop planting trees. Next, have a big housing recession when all those trees we planted reach sawtimber size, then start using biomass when the trees we didn't plant reach pulpwood size*.

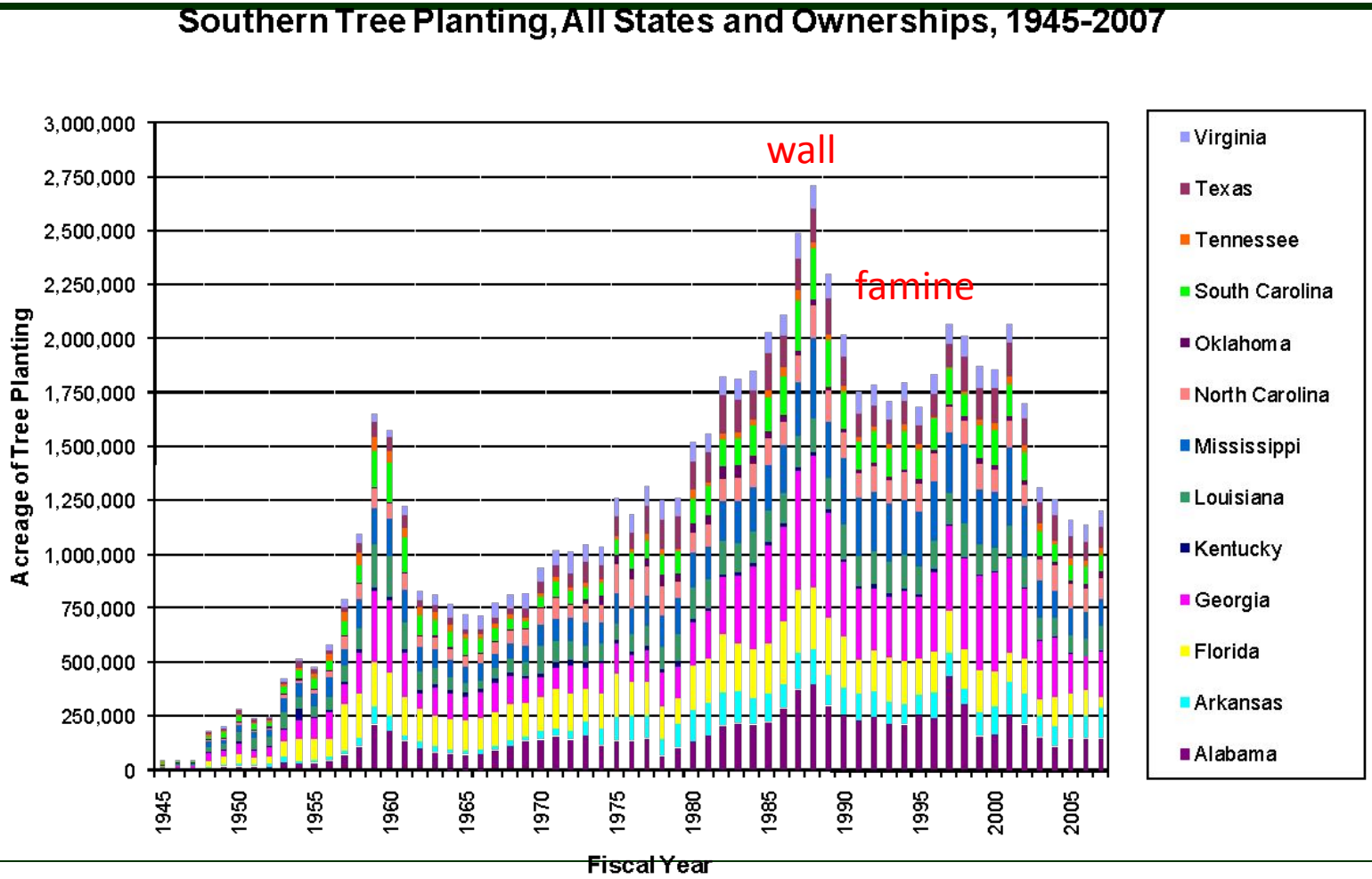
Bob AbtKaren Abt

Ray Sheffield Mac Lupold

Two Classic Themes

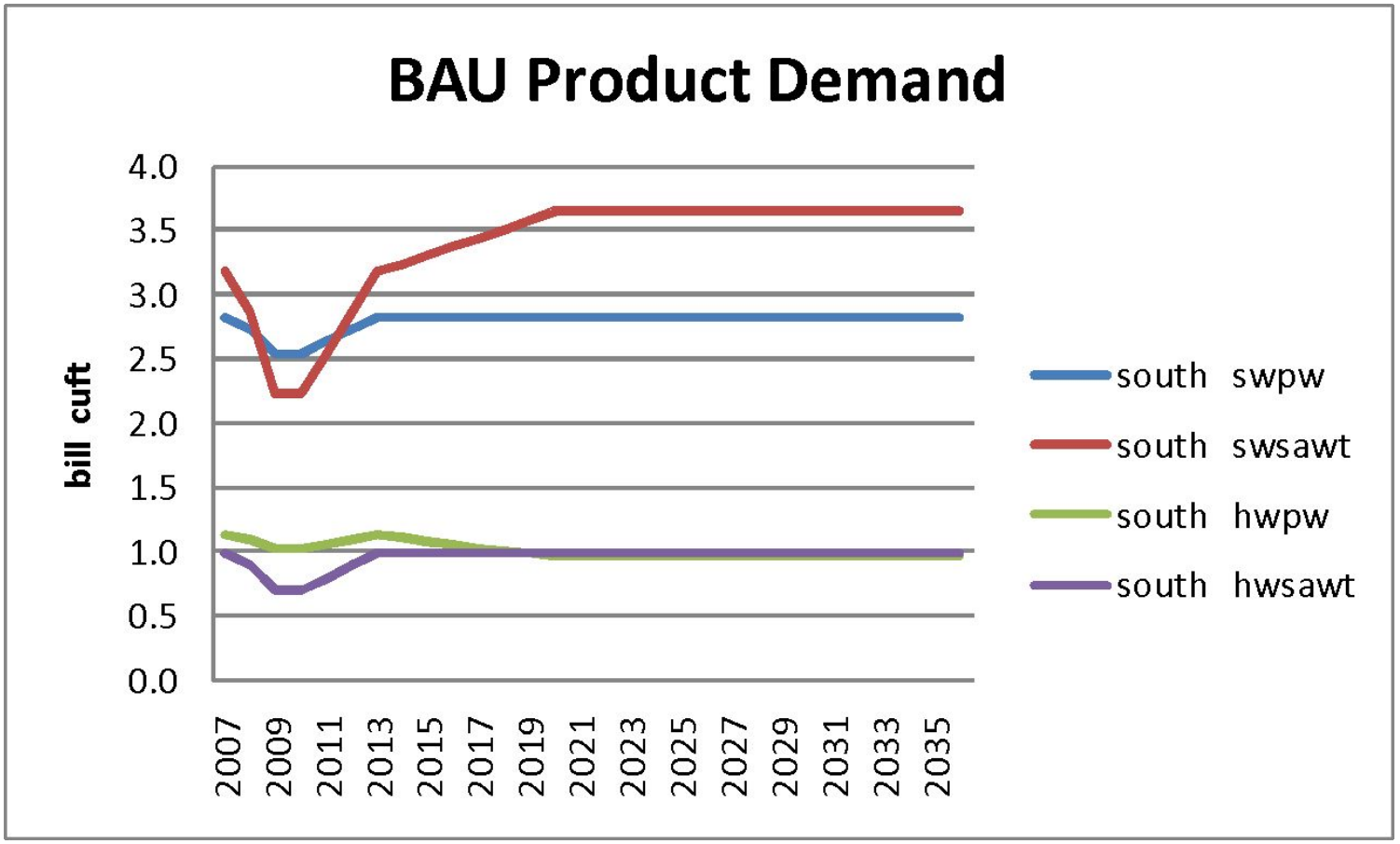
- "Timber Famine"
  - Term associated with old USFS timber gap assessments that always showed future demand > future supply
  - And lack of planting after 1985 peak
- "Wall of Wood"
  - Associated with historic increases in planting in the South
  - Hugo effect in South Carolina

Tree Planting in the South



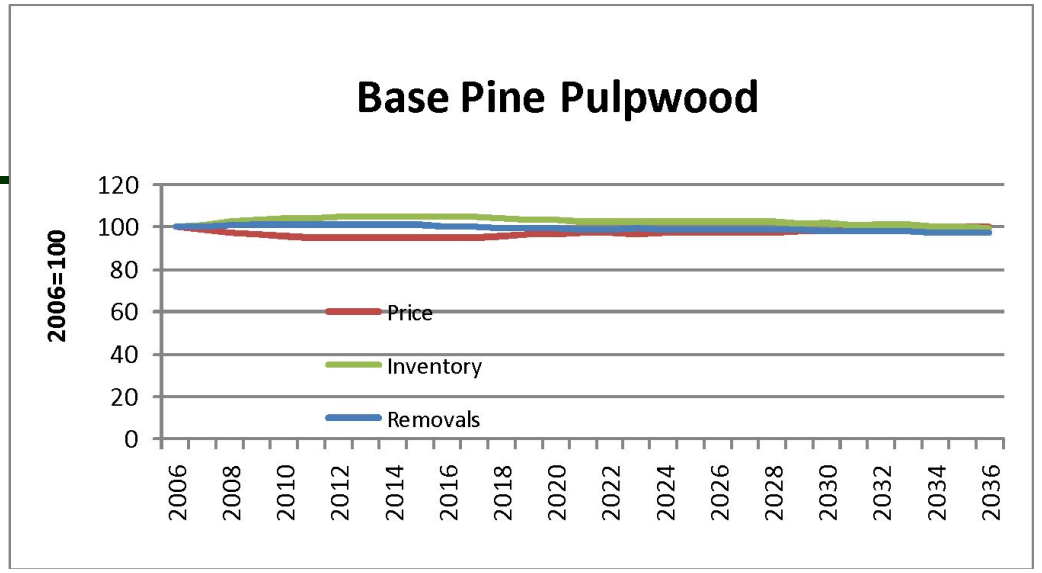
Source: USFS, GFC, TMS

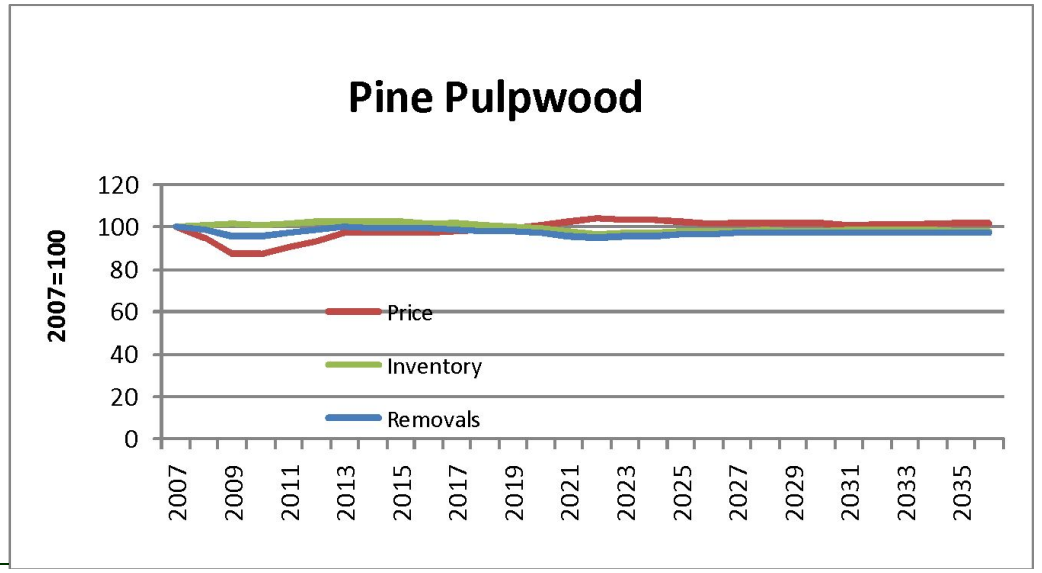
Baseline High Demand Trends



Southwide

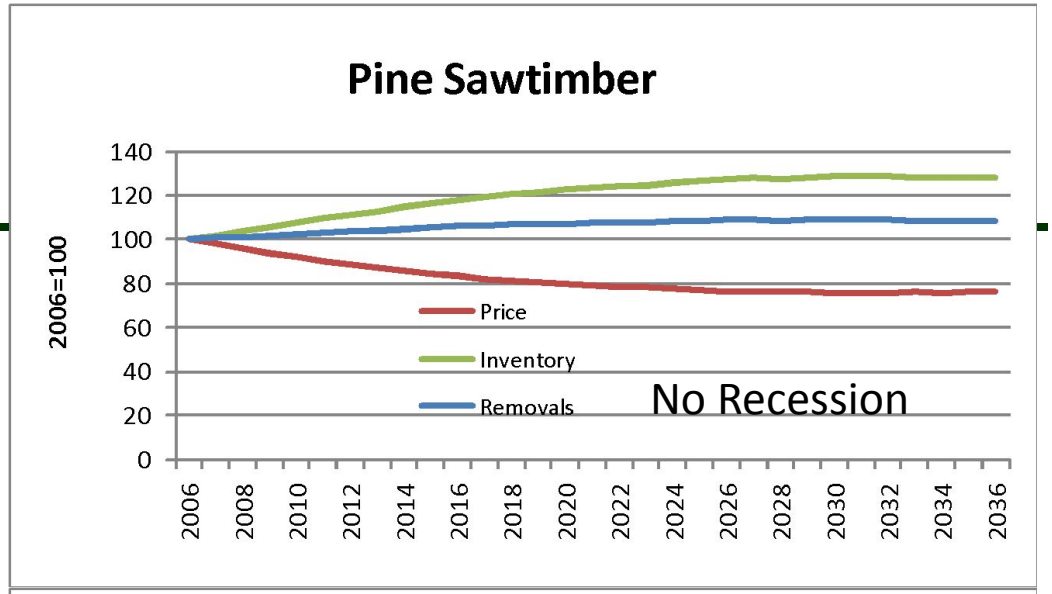
Pine Pulpwood

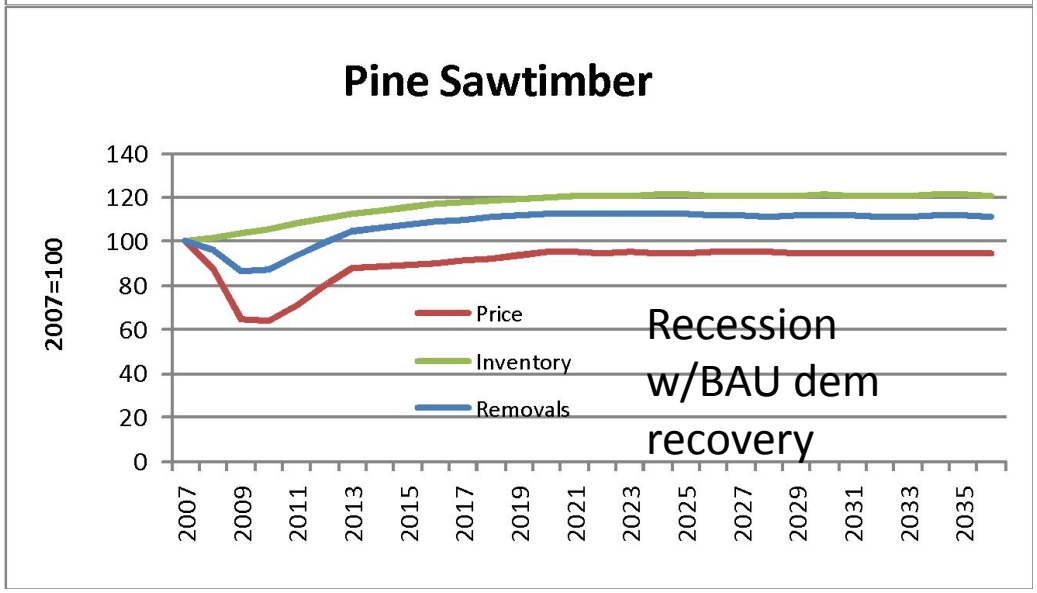




Pine Sawtimber

WoW 20+% Inv Inc
Recession had little impact on accumulated inventory.





SRTS

PELLET CARBON IMPACTS

At the Beginning of the Pellet Discussions:

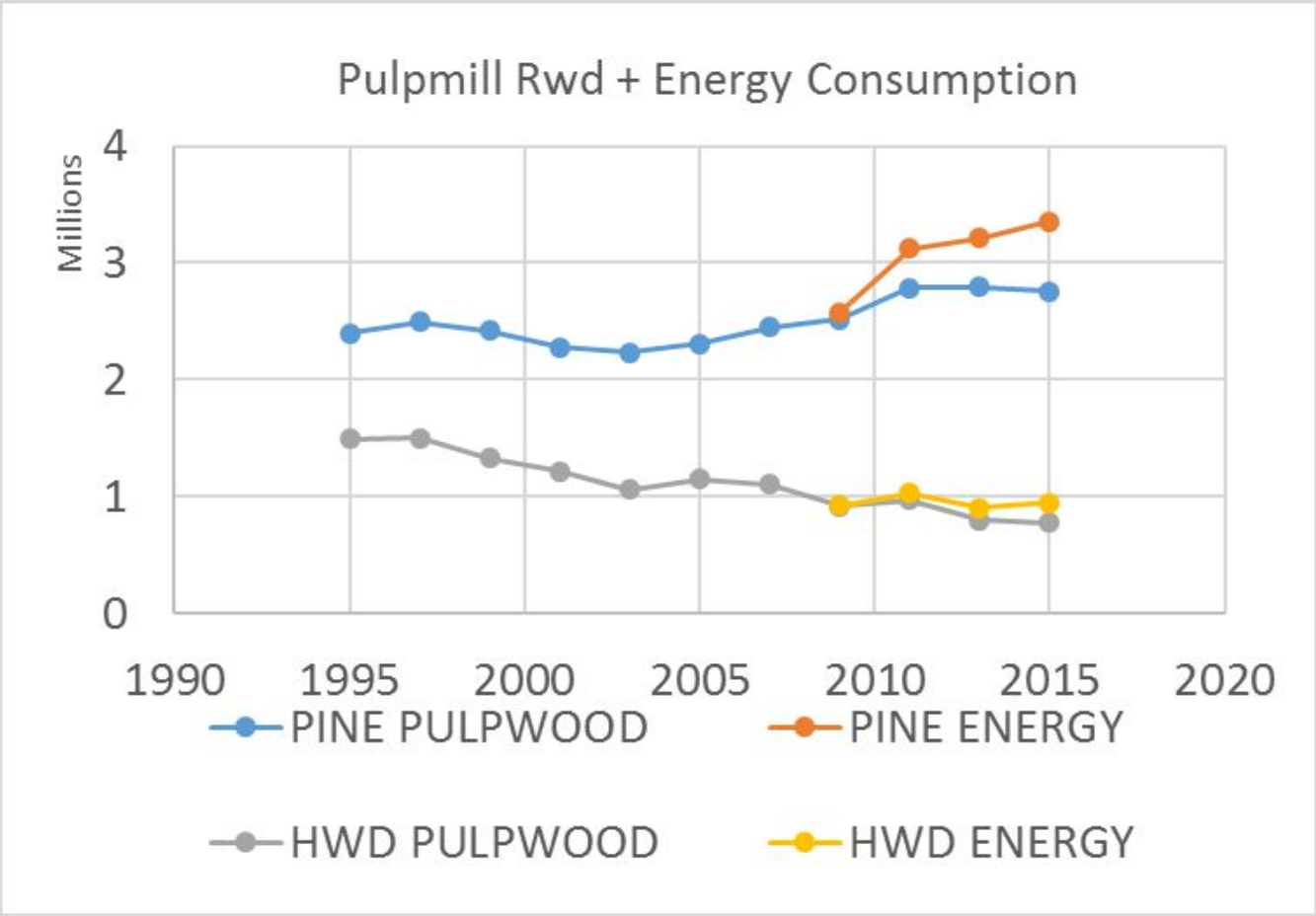
- USIPA (Industrial Pellet Association) Claimed
  - Pellets would only be offsetting demand from a declining pulp industry
  - Pellets would be using only harvest residues
  - Pellet mills could never compete with pulp and paper due to low profit margins
- Most pellet mills had 100% offtake commitments to purchase their pellet production when they opened. The pellet mills weren't competing with pulpmills for pulpwood. DRAX was competing in the pulp market for biomass.
- We built a harvest residue demand offset function into SRTS based on the early statements, but turns out we seldom used it since their procurement was mostly pulpwood. Both pulp mills and pellet mills used dirty chips for energy.

At the Beginning of the Pellet Discussions:

- US pulp industry was declining mainly due to loss of hardwood pulping capacity outside the South. Southern pine pulp capacity was at all time highs.
- SRTS runs showed that expected pellet consumption would have a price impact. Which could be a good thing in terms of indirect LU change, especially with low PST prices.

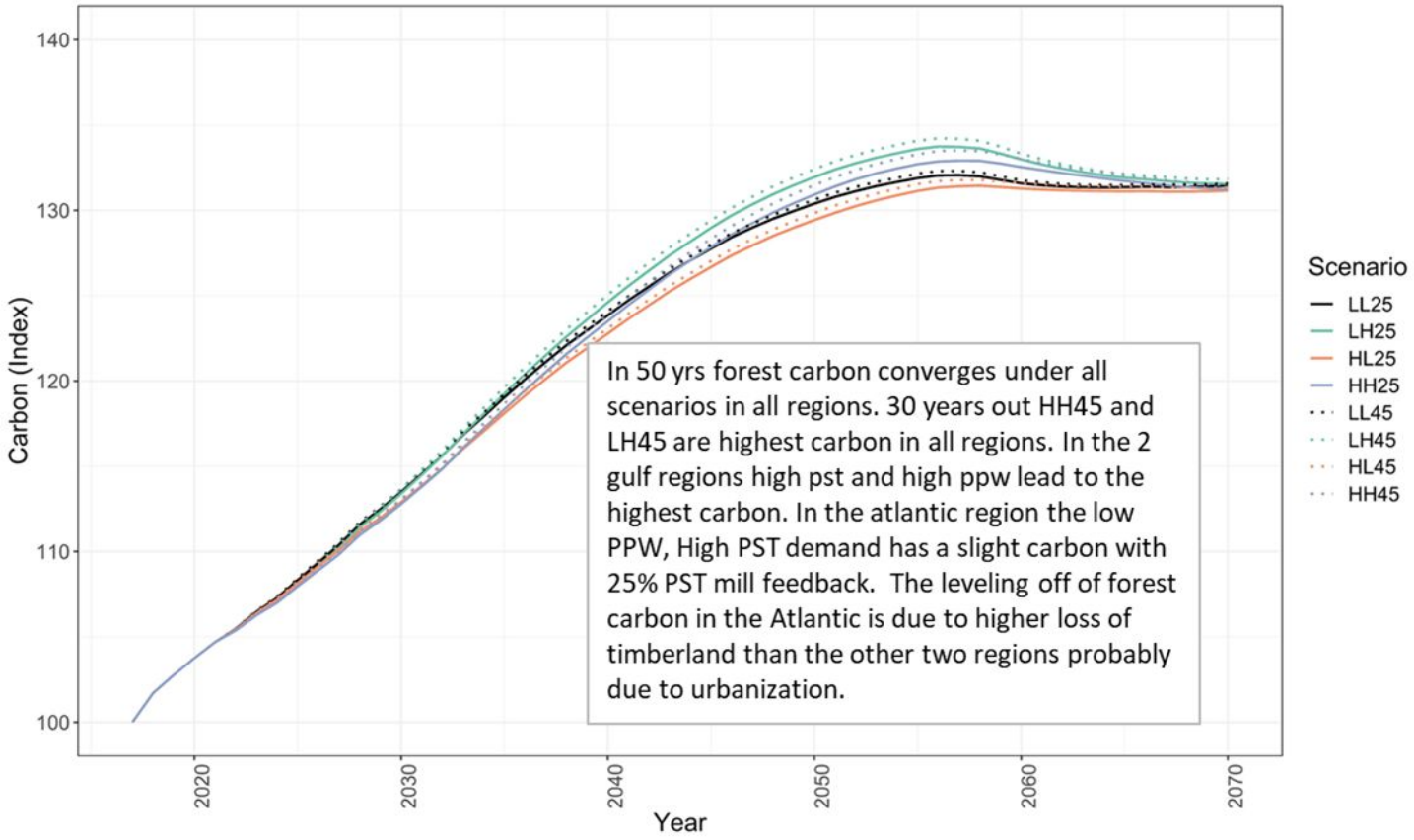
Small Proportion but Changes Trend

TPO
MCF



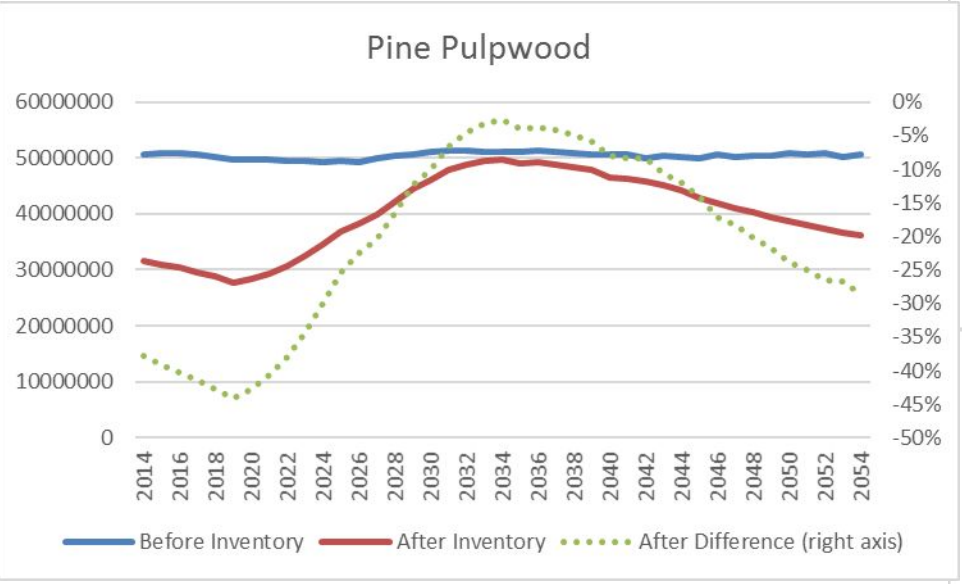
Energy consumption of pine pulpwood is only about 15% of total, but it is the marginal 15% on top of the highest pine pulpwood consumption ever.

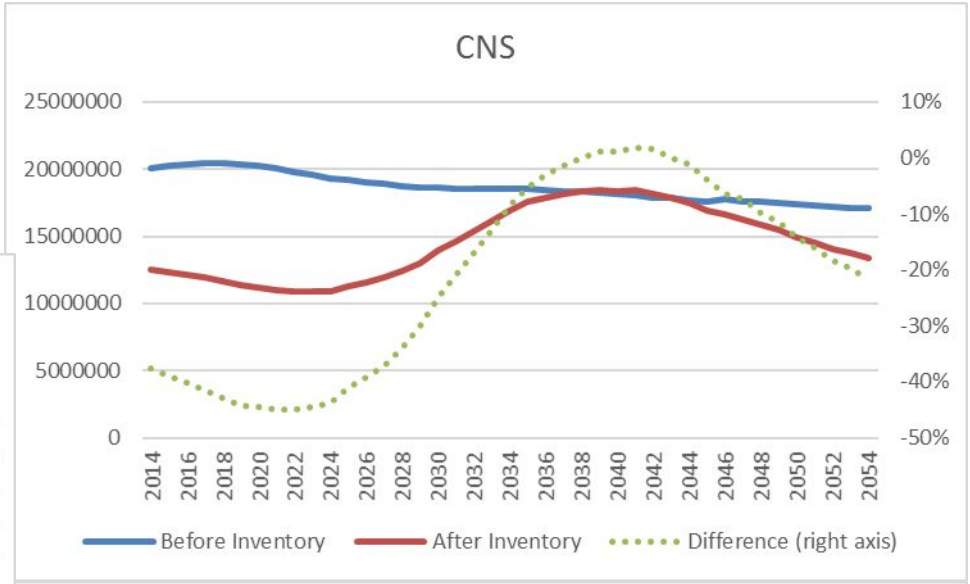
Forest Carbon Bioenergy Jesse's Latest Runs w/new LU model

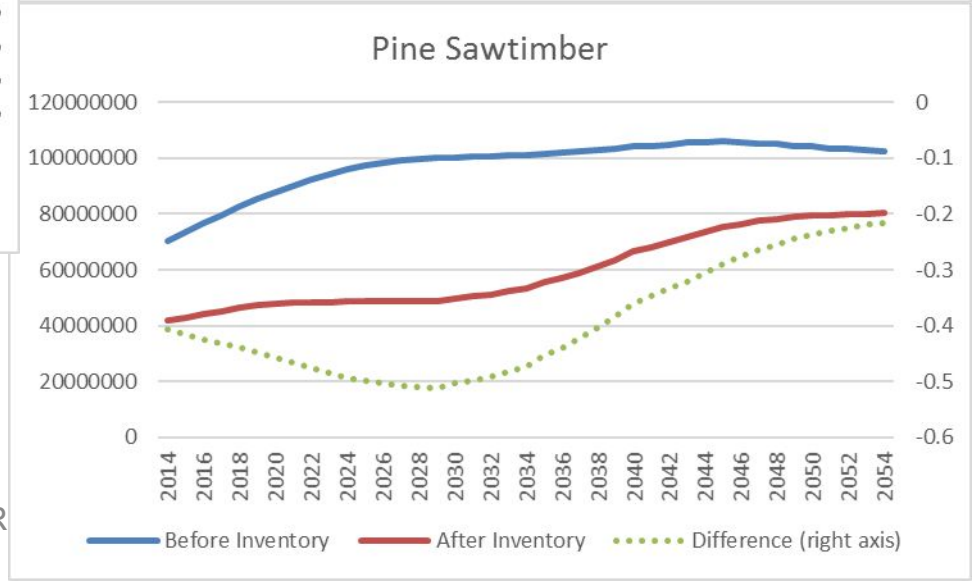


Hurricane Michael Inventory Change Combined Region Based on Ray's Hugo Hurricane Analysis and State Summaries

Note 40+% initial INV loss







Jesse has moved the hurricane modeling to a much more sophisticated level. Near real time assessment using remote sensed data is one goal.

Bob, David, Jesse

HOW WE RUN SRTS THESE DAYS

Running SRTS in Batch Mode

- Recall that Jesse developed the Research Assistant to simplify building .dat and .ini files.
- As you will see in Jesse's and David's presentations, you can easily explore sets of assumptions simultaneously with fewer errors and can compile results to look at output changes across scenarios.
- We each use a slightly different process, but I think this is headed to less dependence on the interface for single basin runs.
- Karen and I have a contract to do a deep dive on carbon impacts from increased pulpwood demand in the AR/LA area.
- They specifically asked for a monte-carlo assessment of the range of solutions and key drivers.
- I'll emphasize our process and describe some of the preliminary results.

My Batch Process

- For a single basin we want to explore forest carbon impacts. In phase 1, we are focusing on the impact of 3 variables on projected forest carbon. This gives us a set of 8 “core” runs.
  - Presence or absence of mill demand (BS/ML)
  - High or low PST demand (which affects mill residue PPW offsets, Hi/Lo)
  - Endogenous LU or no change in forest area (LU/NL)
- In Phase 2 we are doing a comprehensive monte-carlo analysis to explore the impact of most of the model assumptions, including
  - Elasticities (all of them)
  - SSP choice
  - PST Feedback %

Phase 1 8 runs
All .dat and .ini parameters in this .csv file

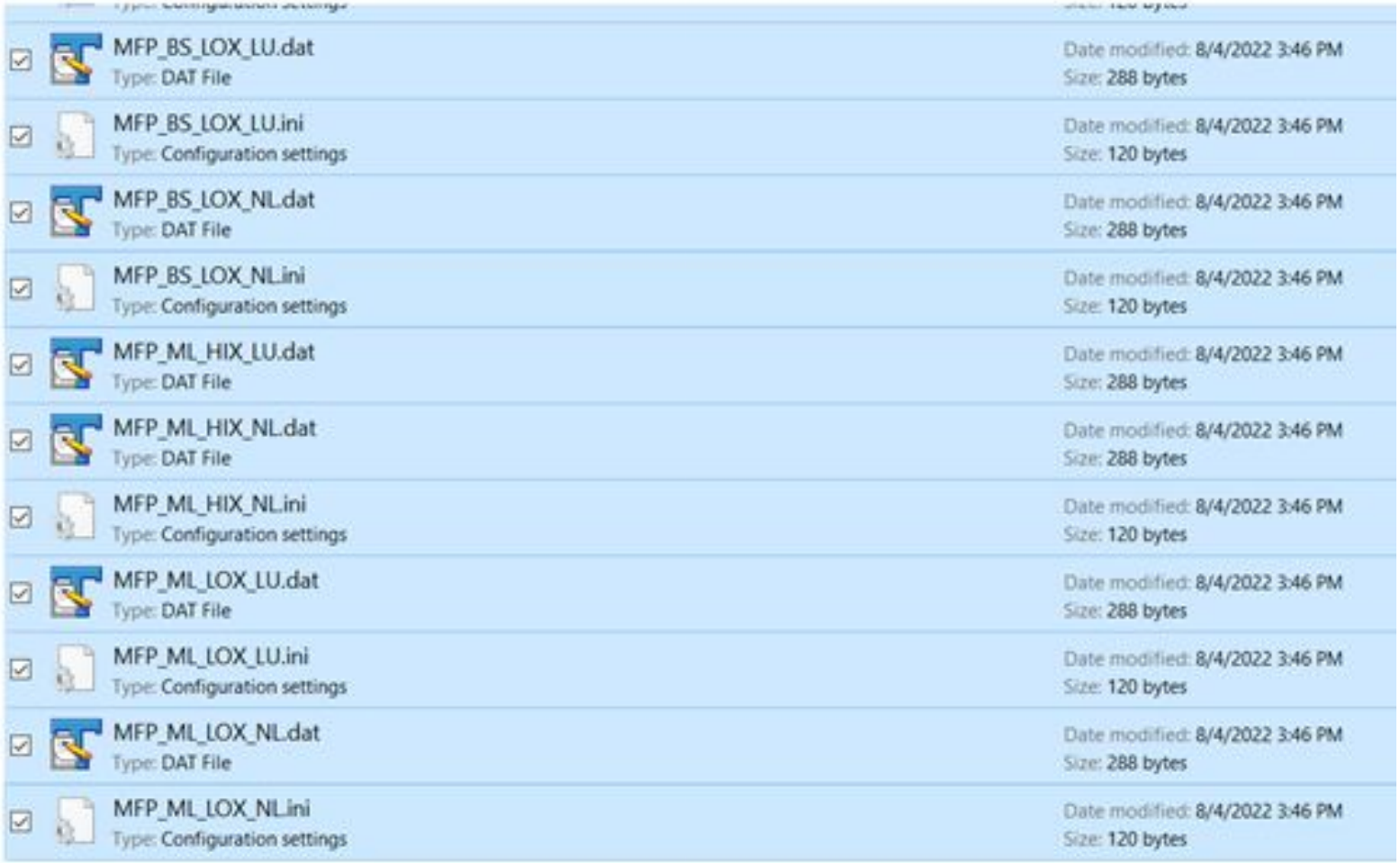
RunNum	NAME	PRD	PRJ	DBH	INV	OUTPUT	RgNum	PrdNum	StrtYr	PrjYr	Rpt	SRTSNum	RgLbl	OptFile
1	MFH_BS_LOX_LU	Stand5_912x.prd	MH_BS_LOX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_BS_LOX_LU	1	5	2015	45	1	9	MRH	none
2	MFH_ML_LOX_LU	Stand5_912x.prd	MH_ML_LOX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_ML_LOX_LU	1	5	2015	45	1	9	MRH	none
3	MFH_BS_HIX_LU	Stand5_912x.prd	MH_BS_HIX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_BS_HIX_LU	1	5	2015	45	1	9	MRH	none
4	MFH_ML_HIX_LU	Stand5_912x.prd	MH_ML_HIX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_ML_HIX_LU	1	5	2015	45	1	9	MRH	none
5	MFH_BS_LOX_NL	Stand5_912x.prd	MH_BS_LOX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_BS_LOX_NL	1	5	2015	45	1	9	MRH	none
6	MFH_ML_LOX_NL	Stand5_912x.prd	MH_ML_LOX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_ML_LOX_NL	1	5	2015	45	1	9	MRH	none
7	MFH_BS_HIX_NL	Stand5_912x.prd	MH_BS_HIX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_BS_HIX_NL	1	5	2015	45	1	9	MRH	none
8	MFH_ML_HIX_NL	Stand5_912x.prd	MH_ML_HIX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_ML_HIX_NL	1	5	2015	45	1	9	MRH	none

0DemPrc1	0DemPrc2	0DemPrc3	0DemPrc4	0DemPrc5	1SupPrc1	1SupPrc2	1SupPrc3	1SupPrc4	1SupPrc5	1SupInv1	1SupInv2	1SupInv3	1SupInv4	1SupInv5	2SupPrc1	2SupPrc2	2SupPrc3	2SupPrc4	2SupPrc5	2SupInv1	2SupInv2	2SupInv3	2SupInv4	2SupInv5
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7

HarvMode	DemMode	PrcMode	Exog Acre Chg	Price Ceiling	Harvest Location	Product Weights	Calibrate GRW	Merch age 10 PP	One Owner	Endog Acre Chg	Exog Ag Price	Biomass	Other Removals
0	-1	0	0	0	0	0	1	1	0	1	0	0	1
0	-1	0	0	0	0	0	1	1	0	1	0	0	1
0	-1	0	0	0	0	0	1	1	0	1	0	0	1
0	-1	0	0	0	0	0	1	1	0	1	0	0	1
0	-1	0	0	0	0	0	1	1	0	0	0	0	1
0	-1	0	0	0	0	0	1	1	0	0	0	0	1
0	-1	0	0	0	0	0	1	1	0	0	0	0	1
0	-1	0	0	0	0	0	1	1	0	0	0	0	1

Sorry, wasn't willing to risk opening excel "live"

Using my version of Res Asst – instantly creates all the .dat and .ini files



This is your batch file to make the 8 runs

Phase 1 8 runs
All .dat and .ini parameters in this .csv file

RunNum	NAME	PRD	PRJ	DBH	INV	OUTPUT	RgNum	PrdNum	StrtYr	PrjYr	Rpt	SRTSNum	RgLbl	OptFile
1	MFH_BS_LOX_LU	Stand5_912x.prd	MH_BS_LOX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_BS_LOX_LU	1	5	2015	45	1	9	MRH	none
2	MFH_ML_LOX_LU	Stand5_912x.prd	MH_ML_LOX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_ML_LOX_LU	1	5	2015	45	1	9	MRH	none
3	MFH_BS_HIX_LU	Stand5_912x.prd	MH_BS_HIX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_BS_HIX_LU	1	5	2015	45	1	9	MRH	none
4	MFH_ML_HIX_LU	Stand5_912x.prd	MH_ML_HIX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_ML_HIX_LU	1	5	2015	45	1	9	MRH	none
5	MFH_BS_LOX_NL	Stand5_912x.prd	MH_BS_LOX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_BS_LOX_NL	1	5	2015	45	1	9	MRH	none
6	MFH_ML_LOX_NL	Stand5_912x.prd	MH_ML_LOX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_ML_LOX_NL	1	5	2015	45	1	9	MRH	none
7	MFH_BS_HIX_NL	Stand5_912x.prd	MH_BS_HIX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_BS_HIX_NL	1	5	2015	45	1	9	MRH	none
8	MFH_ML_HIX_NL	Stand5_912x.prd	MH_ML_HIX.prj	v35b_1in_dbh_gs.csv	DRX_MRH_35b_gs.csv	MFH_ML_HIX_NL	1	5	2015	45	1	9	MRH	none

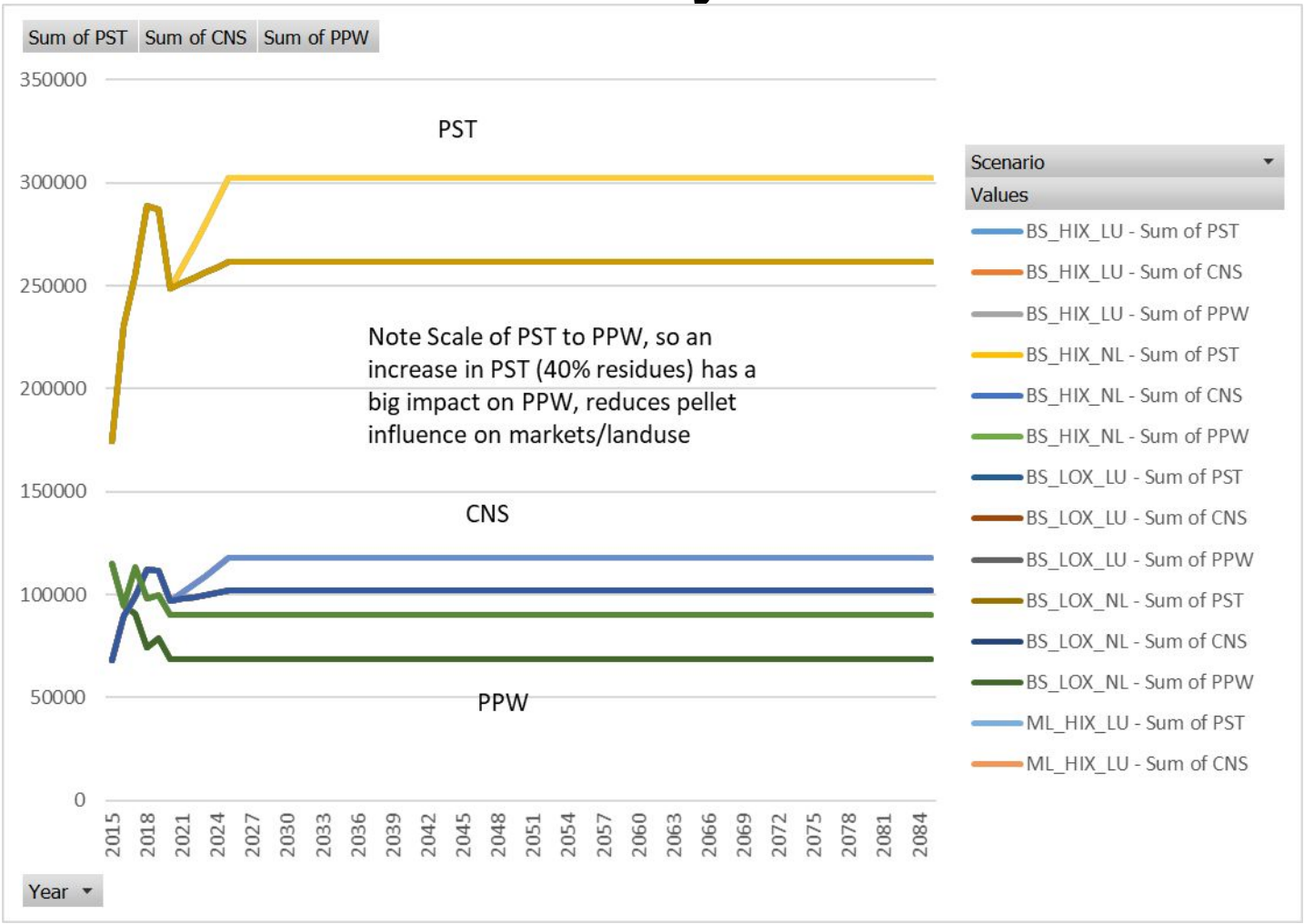
0DemPrc1	0DemPrc2	0DemPrc3	0DemPrc4	0DemPrc5	1SupPrc1	1SupPrc2	1SupPrc3	1SupPrc4	1SupPrc5	1SupInv1	1SupInv2	1SupInv3	1SupInv4	1SupInv5	2SupPrc1	2SupPrc2	2SupPrc3	2SupPrc4	2SupPrc5	2SupInv1	2SupInv2	2SupInv3	2SupInv4	2SupInv5
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7
0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7	0.3	0.4	0.5	0.3	0.5	0.9	0.9	0.9	0.7	0.7

HarvMode	DemMode	PrcMode	Exog Acre Chg	Price Ceiling	Harvest Location	Product Weights	Calibrate GRW	Merchage 10 PP	One Owner	Endog Acre Chg	Exog Ag Price	Biomass	Other Removals
0	-1	0	0	0	0	0	1	1	0	1	0	0	1
0	-1	0	0	0	0	0	1	1	0	1	0	0	1
0	-1	0	0	0	0	0	1	1	0	1	0	0	1
0	-1	0	0	0	0	0	1	1	0	1	0	0	1
0	-1	0	0	0	0	0	1	1	0	0	0	0	1
0	-1	0	0	0	0	0	1	1	0	0	0	0	1
0	-1	0	0	0	0	0	1	1	0	0	0	0	1
0	-1	0	0	0	0	0	1	1	0	0	0	0	1

Sorry, wasn't willing to risk opening excel "live"

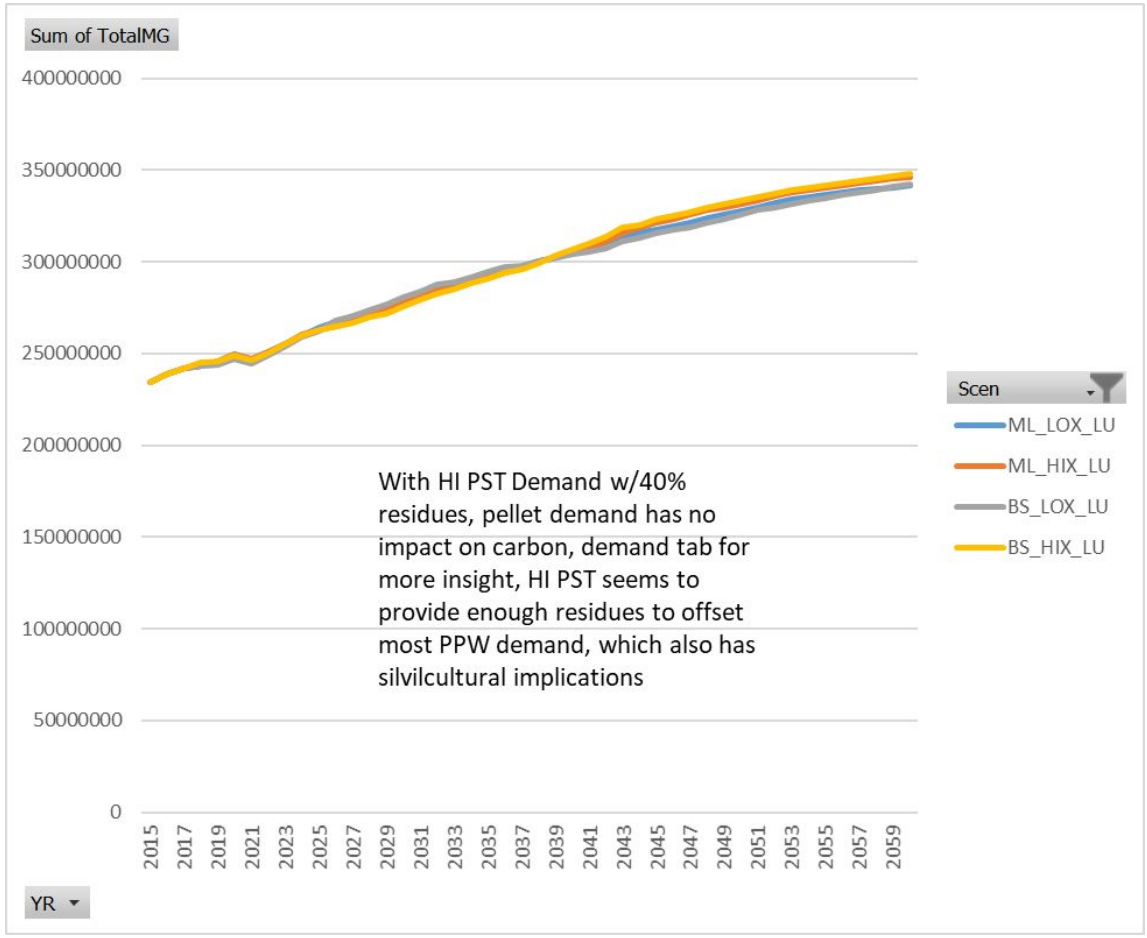
Key Result
In this basin, PST dominates PPW, so PST residue feedback to PPW essentially drives PPW to near zero

MCF Demand



Key Result
In this basin, PST dominates PPW, so PST residue feedback to PPW essentially drives PPW to near zero

Forest carbon



Phase 2

MONTE CARLO

								Mean					S.D.						
							Species	1	1	1	2	2	1	1	1	2	2		
							Product	1	2	3	1	2	1	2	3	1	2		
							Dem	0.3	0.3	0.3	0.3	0.3	0.05	0.05	0.05	0.05	0.05		
						0DemPrc	1	0.3	0.3	0.3	0.3	0.3	0.05	0.05	0.05	0.05	0.05		
						1SupPrc	1	0.3	0.4	0.5	0.3	0.5	0.05	0.05	0.05	0.05	0.05		
						1SupInv	1	0.9	0.9	0.9	0.7	0.7	0.05	0.05	0.05	0.05	0.05		
		Paste Pairs				2SupPrc	2	0.3	0.4	0.5	0.3	0.5	0.05	0.05	0.05	0.05	0.05		
						2SupInv	2	0.9	0.9	0.9	0.7	0.7	0.05	0.05	0.05	0.05	0.05		
			PRJ	PRJ	INI	INI	INI	Prd1	Prd2	Prd3	Prd4	Prd5	Prd1	Prd2	Prd3	Prd4	Prd5	Prd1	Prd2
Odd/Even	Number	Prefix	BASIN	PST	LU	SSP	PSTFdBck	0DemPrc1	0DemPrc2	0DemPrc3	0DemPrc4	0DemPrc5	1SupPrc1	1SupPrc2	1SupPrc3	1SupPrc4	1SupPrc5	1SupInv1	1SupInv2
1	1	MF_	BS_	LO_	LU	4	0.43	0.2849	0.2833	0.2335	0.3847	0.2680	0.2854	0.3444	0.3896	0.2524	0.5490	0.9161	0.8482
0	2	MF_	ML_	LO_	LU	4	0.35	0.2178	0.3993	0.2467	0.3278	0.4211	0.2971	0.3584	0.4689	0.2360	0.5188	0.5016	0.9464
1	3	MF	ML	LO	LU	5	0.29	0.2885	0.1944	0.3106	0.3195	0.2607	0.3702	0.3865	0.3990	0.3667	0.3863	0.5212	0.9446
0	4	MF_	BS_	LO_	LU	5	0.29	0.2518	0.3063	0.3328	0.2880	0.3673	0.2623	0.4062	0.5464	0.3917	0.5800	0.5399	0.8484
1	5	MF_	ML_	LO_	LU	5	0.34	0.3103	0.2425	0.3020	0.2101	0.3246	0.3524	0.5138	0.5188	0.3283	0.4561	0.5277	0.9044
0	6	MF_	BS_	LO_	LU	5	0.35	0.2726	0.3310	0.2731	0.2947	0.2418	0.2910	0.4187	0.4848	0.3619	0.4843	0.5524	0.8465
1	7	MF_	BS_	HI_	LU	4	0.32	0.2897	0.2663	0.2897	0.3042	0.3139	0.3437	0.3474	0.5285	0.2482	0.5266	0.5115	0.9867
0	8	MF	ML	HI	LU	4	0.31	0.2896	0.2506	0.3261	0.2619	0.3532	0.2701	0.4233	0.6132	0.1950	0.4777	0.5144	0.9213
1	9	MF_	BS_	HI_	LU	3	0.28	0.3321	0.3509	0.2988	0.2697	0.2785	0.3211	0.4225	0.5681	0.2912	0.5825	0.5703	0.8842
0	10	MF_	ML_	HI_	LU	3	0.33	0.2694	0.3023	0.3224	0.3549	0.3586	0.3191	0.4631	0.5304	0.2601	0.4591	0.4870	0.8802
1	11	MF_	ML_	LO_	LU	5	0.35	0.2958	0.3565	0.2781	0.2663	0.1876	0.2783	0.4298	0.4842	0.2850	0.5517	0.5119	0.8695
0	12	MF	BS	LO	LU	5	0.33	0.3106	0.3258	0.2599	0.3823	0.2152	0.3568	0.3546	0.5245	0.3327	0.5082	0.4907	0.9537
1	13	MF_	ML_	LO_	LU	1	0.42	0.3156	0.2996	0.2913	0.3098	0.3104	0.1879	0.3336	0.4838	0.2947	0.5401	0.4402	0.9433
0	14	MF_	BS_	LO_	LU	1	0.35	0.2116	0.2752	0.2791	0.2041	0.2984	0.3029	0.4224	0.4461	0.1834	0.5673	0.5457	0.9460
1	15	MF_	BS_	HI_	LU	2	0.37	0.4405	0.3164	0.3057	0.3200	0.3755	0.1848	0.3574	0.5544	0.2032	0.4277	0.5289	0.9030
0	16	MF	ML	HI	LU	2	0.41	0.2718	0.2676	0.2693	0.3041	0.3631	0.2663	0.3619	0.5418	0.2566	0.5829	0.5145	0.9186
1	17	MF_	ML_	HI_	LU	4	0.32	0.3489	0.3011										
0	18	MF_	BS_	HI_	LU	4	0.36	0.3340	0.3129										
1	19	MF	BS	HI	LU	2	0.32	0.3455	0.3117										
0	20	MF_	ML_	HI_	LU	2	0.31	0.2795	0.3737										
1	21	MF_	BS_	HI_	NL	0	0.38	0.2764	0.3304										
0	22	MF_	ML_	HI_	NL	0	0.38	0.2411	0.2877										
1	23	MF_	ML_	LO_	NL	0	0.37	0.3249	0.3329										
0	24	MF	BS	LO	NL	0	0.20	0.2968	0.3289										
1	25	MF_	ML_	LO_	NL	0	0.37	0.3457	0.3260										
0	26	MF_	BS_	LO_	NL	0	0.30	0.3317	0.2496										
1	27	MF_	ML_	HI_	LU	3	0.38	0.3060	0.3415										

Same idea as before, but 1000 runs with random draws on many variables. The only time I used the SRTS interface was to call up the 1000 line batch file and watch the run numbers go by.

Using Regression to Interpret MC Resutls Working with David on This

				Morehouse		MT=1	**Pine Plantations**			
Intercept	282.9297		**Hi Positive Response to:**			% Chg in Forest Carbon (intercept shift)				
LN_0DemPrc5	10.93047		Increasing Hwd Sawtimber Demand Price Response	ML_Dmy	1	1.99086	ML_	Pellet Mill vs No Pellet Mill 2% Increase in Plantation Carbon		
LN_2SupPrc4	4.4759		Increasing NonCorp Hwd Pulpwood Supply Reponse	SSP4_Dmy	1	-0.68876	SSP4	Compared to SSP2		
LN_1SupPrc3	4.11582		Increasing Corp PST Supply Price Response	SSP3_Dmy	1	-0.7043	SSP3	Compared to SSP2		
LN_1SupPrc4	3.7433		Increasing Corp PST Hwd Pulpwood Supply Price	SSP5_Dmy	1	-1.26145	SSP5	Compared to SSP2		
LN_1SupInv5	2.86326		Increasing Corporate Hwd Sawtimber Supply Response	SSP1_Dmy	1	-1.46093	SSP1	Compared to SSP2		
LN_2SupInv3	2.52682		Increasing NonCorp PST Supply Response	LU_Dmy	1	-1.93969	LU	Endogenous LandUse Chg Lowers Plantation Carbon by 1.9%		
LN_0DemPrc3	1.69845		Increasing PPW and PST Dem Response	PST_Dmy	1	-3.88131	PST_	High Pst Demand vs Low Pst Demand Lowers Plantation Carbon by 3.9		
LN_0DemPrc1	1.6778		Incrreasing Pine Pulpwoood Demand Response							
LN_1SupInv1	1.50776		Increasing Corp Pine Pulpwood Supply Inventory				**Upland Hardwoods**			
LN_2SupInv5	0.9772			SSP3_Dmy	1	5.09963	0.26929	18.94	<.0001	
LN_1SupPrc2	0.8118			PST_Dmy	1	-0.48782	0.16277	-3	0.0027	
LN_2SupPrc3	0.55784			SSP1_Dmy	1	-0.71908	0.27442	-2.62	0.0088	
LN_2SupInv1	0.26922		Lower Response	SSP4_Dmy	1	-0.88452	0.27459	-3.22	0.0013	
LN_2SupPrc2	0.18636			ML_Dmy	1	-2.49537	0.16023	-15.57	<.0001	Pellet Mill lowers Upl Hwd Carbon
YRIdxSq	0.01975			SSP5_Dmy	1	-6.02412	0.27598	-21.83	<.0001	
LN_2SupPrc1	-0.05315			LU_Dmy	1	-12.9233	0.27756	-46.56	<.0001	Endog Land Use
LN_2SupInv4	-0.4539									
LN_1SupPrc1	-0.91498									
YRIdx	-0.96058									
LN_2SupInv2	-1.08888		Increasing NonCorp SmSawtimber Inventory Response							
LN_0DemPrc2	-1.19234		Increasing SmSawtimber Demand Price Respone							
LN_1SupInv2	-1.78531		Increasing Corp PPW Supply Inventory Response							
LNPst_Resid	-2.16684		Increase PST Feedback							
LN_1SupInv4	-2.52193		Increasing Corp HPW Supply Inventory Response							
LN_1SupInv3	-2.97292		Increasing Corp PST Supply Inventory Response							
LN_2SupPrc5	-3.12989		Increasing NonCorp Hardwood Sawtimber Supply Response							
LN_1SupPrc5	-5.36685		Increasing CorpHardwood Sawtimber Supply Response							
LN_0DemPrc4	-10.1052		Increasing Hardwood Pulpwood Demand Response							
			Hi Negative Response to:							

Conclusions

- There are currently 3 active SRTS programmers (me, David, Jesse).
- It makes a huge difference in individual and group productivity to have a team focused on a model that needs some work to reach it's potential.
- Questions, processes, and discussion of topic/methods is at an all time high.
- Justin, David, and Jesse are creating momentum across a wide spectrum of topics and modeling approaches.
- I'm learning a lot and enjoying myself
- I'm excited about the future of SOFAC and SRTS

- Thanks for your support