

Multi-Product Modeling

SOFAC

Atlanta, GA

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Evolution of Modeling Framework

- **South's Fourth Forest**
 - State Level Framework Linked to TAMM
 - Model Sub-Regional Supply Response Consistent with Aggregate Market Results
- **Economic Framework Linked to Inventory Models**
 - TRIM, ATLAS
 - GRITS
- **Develop Interface and Inventory Modules**

Evolution of Modeling Framework

- **SOFAC Projects**
 - link to GTM
 - link to TAMM
 - multi-product version

SINCE SRTS-SOFAC PROJECTS

- **Growing Stock Model**

- focus on integrated economic-ecological modeling
- links to growth physiology models and climate change
- links to land use models
- collaborative projects with RTI funded by DOE, EPA, NASA

- **Multi-Product Model**

- growth regressions
- binary search equilibrium
- 5 year age classes
- embedded goal program
- annual internal accounting

- **Further Development Limited By:**

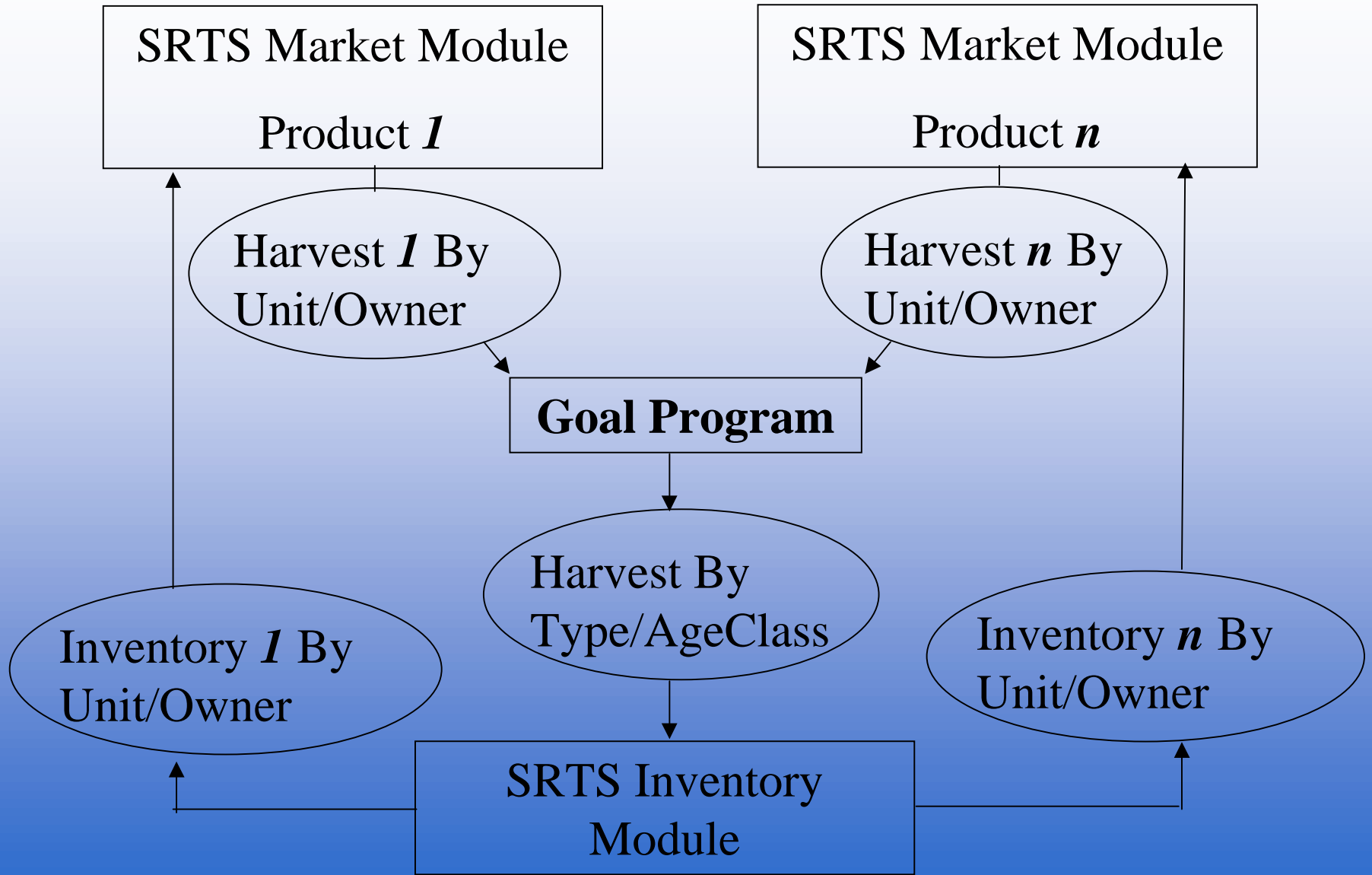
- time/resources
- biometric requirements

Evolution of Proposed SOFAC Framework

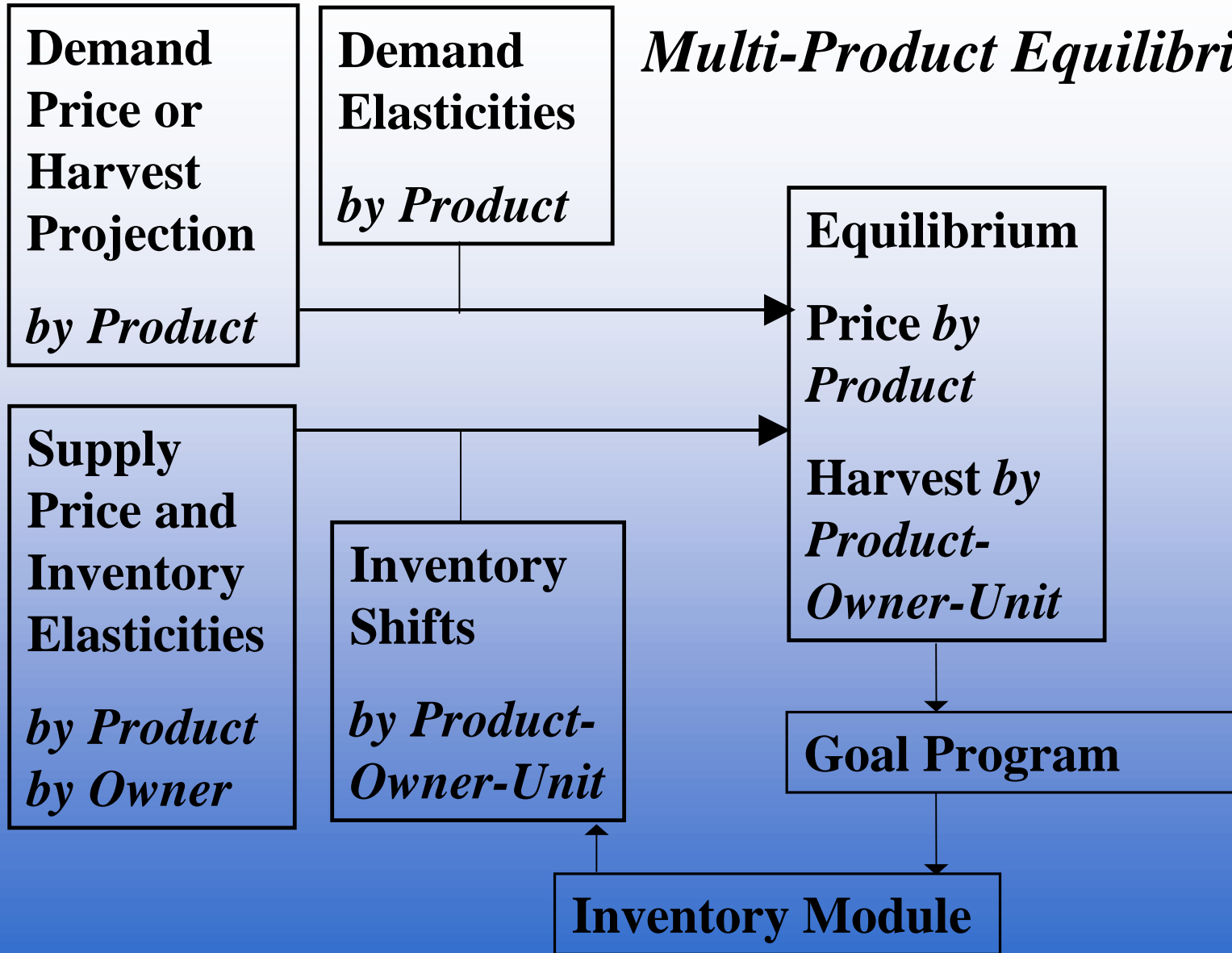
- **First Proposal**
 - extend and refine growing stock (gs) model
 - continue integration with other modules
 - eventually replace with cell-level based model
- **Feedback \Rightarrow multiple products**
- **Current Proposal**
 - integrate gs and multi-product frameworks
 - use as test bed for new components

What is Multi-Product SRTS?

- **Overview of current model as background**
- **Objectives for the integrated framework**



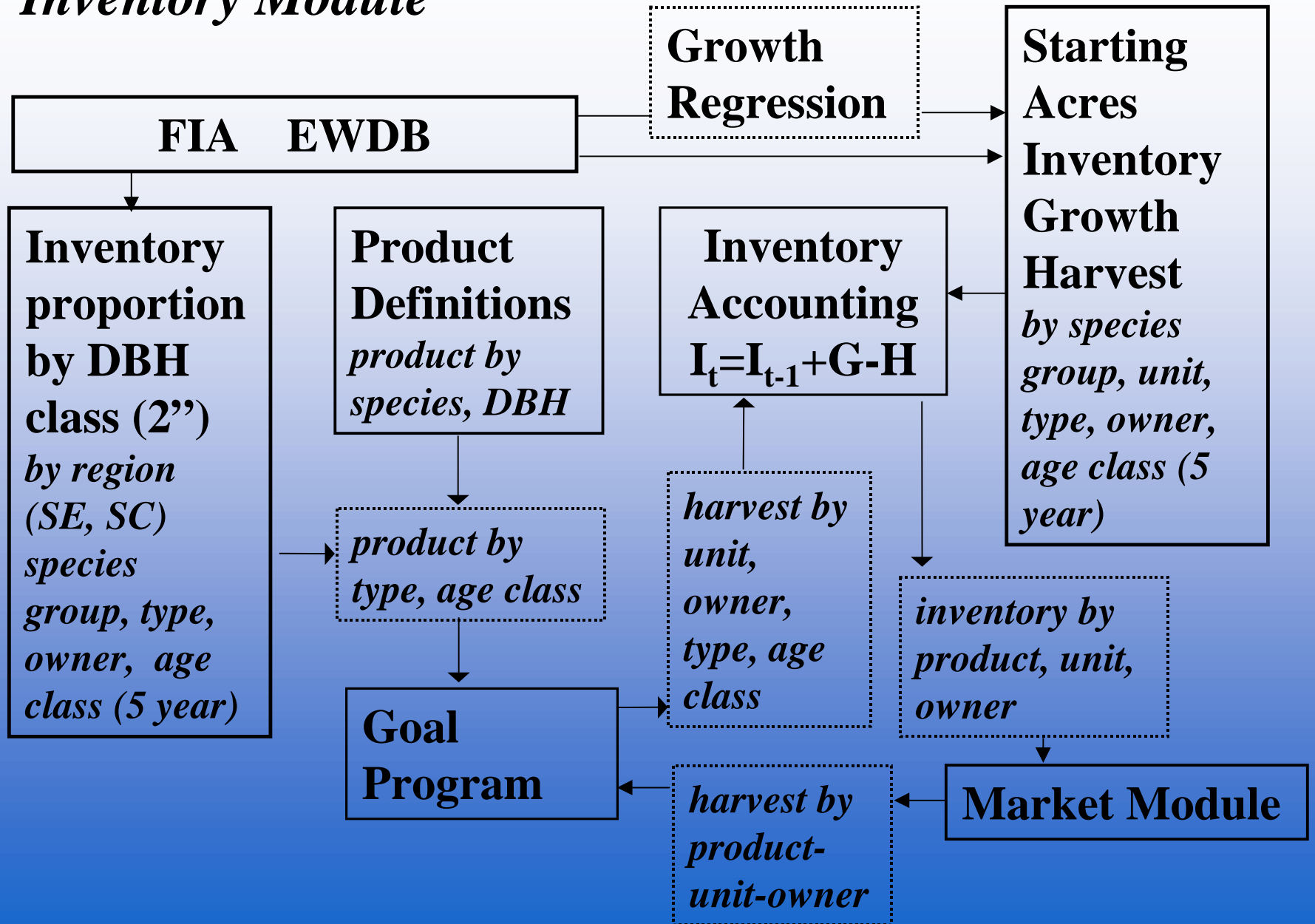
Multi-Product Equilibrium



Demand

- **SRTS demand module for each product**
 - harvest exogenous
 - products treated independently
- **Harvest Projection By Product**
 - Model provides starting point
 - (Product x DBH) x (DBH x Age Class) =
Product x Age Class

Inventory Module



Product Definition

- **User-defined products**
 - 3 species groups, SW,SH, HH
- **DBH range and Percent Pulpwood**
 - 2” DBH Classes
 - lowest 5-7
 - largest 21+

Product Definition

- **Product Input File**

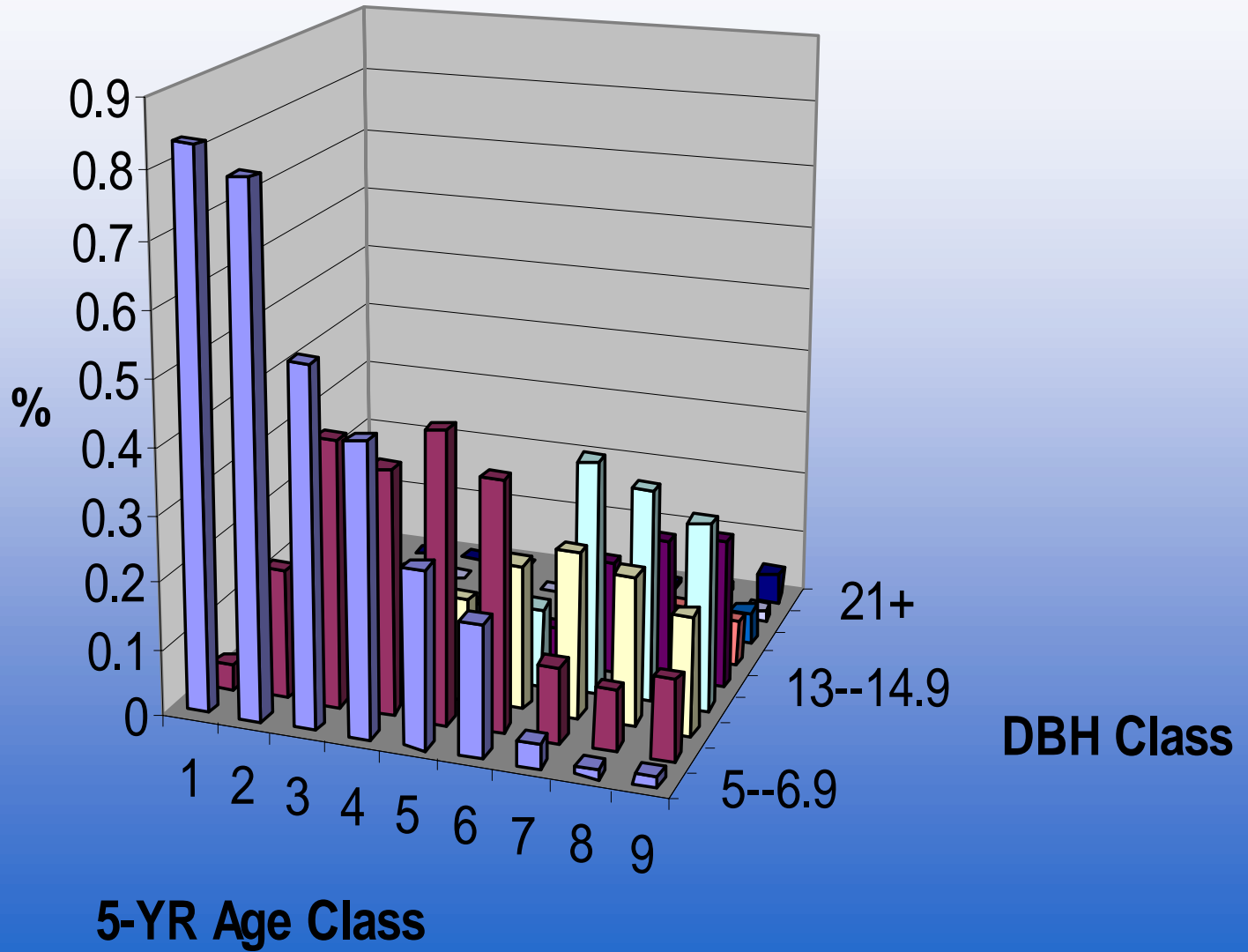
SP	PR	PROD LABEL	MINDBH	PCTPW
1	1	"PULPWOOD"	1	1.0 [<i><11" 100% PW</i>]
1	2	"SAWTIMBER"	4	.3 [<i>11" min dbh 30%PW</i>]
2	1	"PULPWOOD"	1	1.0
2	2	"SAWTIMBER"	5	.3
3	1	"PULPWOOD"	1	1.0
3	2	"SAWTIMBER"	5	.3

DBH Data

- Region (SE vs SC)
- Species (SW, SH, HH)
- Owner (FI, NIPF)
- Mgt Type (PP, NP, MP, UH, LH)
- Age Class (5 year)
- Input File

Reg	Sp	O	M	AC	5--6.9	7--8.9	9--10.9	11--12.9	13--14.9	15--16.9	17--18.9	19--20.9	21 Plus
1	1	1	1	1	0.501912	0.027544	0.386534	0.000000	0.000000	0.084010	0.000000	0.000000	0.000000
1	1	1	1	2	0.970731	0.019322	0.002377	0.003150	0.00743	0.002241	0.000000	0.000387	0.000000
1	1	1	1	3	0.757525	0.229125	0.010878	0.002272	0.000163	0.000016	0.000000	0.000000	0.000020

DBH x Age



Harvest Projection File

Period	Product 1	2	3	4	5	6
0	108639	81657	25929	9807	43512	28988
1	100028	75746	23874	9097	40064	26889
2	110822	72360	26450	8690	44387	25687
3	113999	84412	27209	10138	45659	29966
4	122022	80164	29123	9628	48873	28458
5	127187	80528	30356	9671	50941	28587
6	132352	80892	31589	9715	53010	28716
7	137518	81255	32822	9759	55079	28845
8	142683	81619	34054	9802	57148	28974
9	147848	81983	35287	9846	59216	29103
10	153013	82347	36520	9890	61285	29232
11	158178	82710	37753	9933	63354	29362
12	163343	83074	38986	9977	65423	29491
13	168509	83438	40218	10021	67492	29620

Goal Program

- **Purpose**
 - allocate unit-owner harvest across management types and age classes, while
 - maintaining consistency with target harvest, while
 - providing the equilibrium mix of products
- **Objective min weighted deviation from targets**

Goal Program

- Solved for each unit-owner
- Activities -
- Harvest Level (cuft or acres) by type-age
 - X_{ij} , $i=1$ to 5 types, $j=1$ to 11 age classes

Goal Program

- **Targets**
 - **target harvest by type-age**
 - inventory, starting point, , last period harvest, minimum opportunity cost
 - econometric results
 - **target product mix**
 - from equilibrium solution

Goal Program

- **Strengths:**
 - **Flexible**
 - **Minimizes “come along” problem**
 - **Easy to formulate the “clear-cut only” problem**
 - **Easy to control max or min harvest by cell**

Multi-Product Differences from SRTS

- **Needs LP DLL (license issue)**
- **Harvest exogenous only**
- **No interface (input files)**
- **Needs elasticities by product**
- **Needs harvest projections by product**
- **Currently runs only in VB environment**

Integrated (MP-GS) Modeling Framework

- Stumpage Market Equilibrium
- Management Type - Age Class Harvest
- Growth - Inventory
- Programming Strategy

Equilibrium Modeling Objectives

- Develop an integrated equilibrium module that will:
 - allow for simulation of either growing stock (one product per species group) or multi-product markets.
 - maintain the flexibility of having harvest, demand, or price driven projections (gs).
 - maintain the flexibility to solve for region-based or unit-owner-based harvests (gs).
 - maintain the owner-specific supply elasticity framework (mp).

Management Type-Age Class Modeling Objectives

- Develop an integrated type-age class harvest allocation module that will:
 - allow for simulation, optimization, or empirically based targets (mp).
 - incorporate thinning of plantations (gs).
 - reconcile product and harvest “targets” (mp).
 - allow harvested acres to be calculated on either a clearcut-only or target stocking basis

Inventory and Growth Modeling Objectives

- Develop an inventory module that will incorporate:
 - thinning of plantations (gs).
 - biometrically defensible dbh modeling
 - incorporate annual internal accounting (mp)

Programming Objectives

- Develop new well-documented code that will:
 - be written in Visual Basic.
 - de-emphasize graphical user interface development.
 - emphasize output formats that can be easily imported and graphed.
 - separate input, equilibrium, inventory, and acreage into modules that can be used independently.
 - incorporate an linear programming DLL internally.
 - automate the link between FIA data and input datasets.

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