WASHINGTON
DEPARTMENT OF NATURAL RESOURCES

Eastern Washington Sustainable Harvest Calculation Model Project – Operating Environment

December 2, 2025

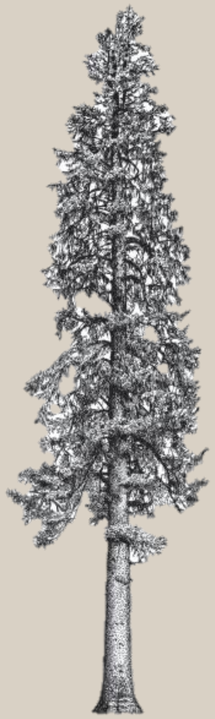
A Presentation to the Board of Natural Resources

By Cameron Crump, Forest Resources Division Manager

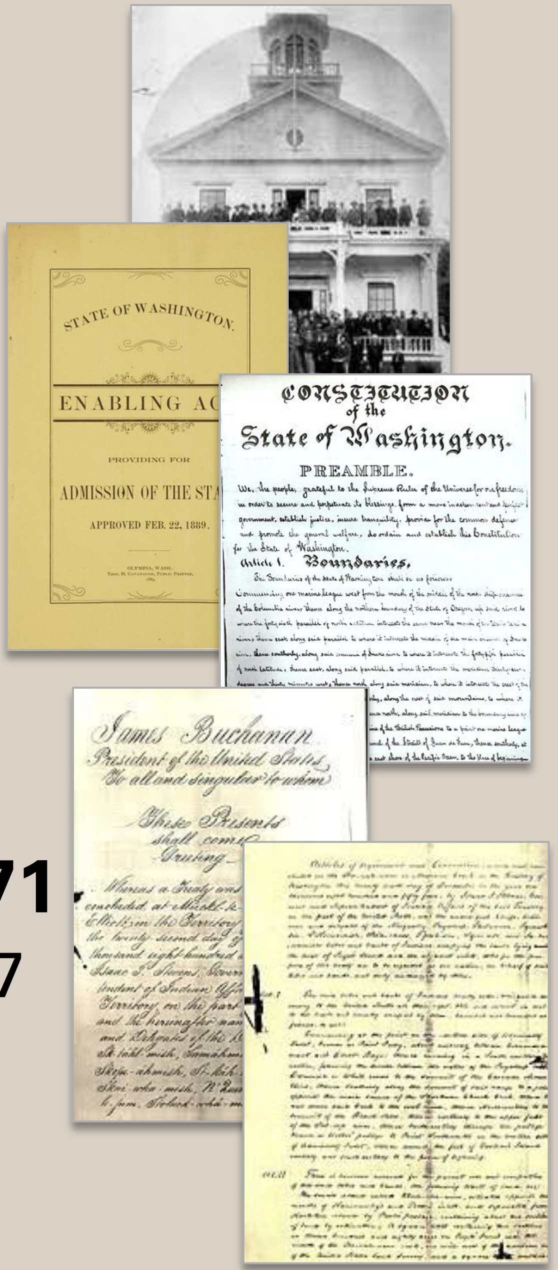
Outline

- Authorizing Framework
  - Sustainable Harvest Calculation RCWs
- Policy for Sustainable Forests
  - Sustainable Harvest Calculation Components
- Operating Environment

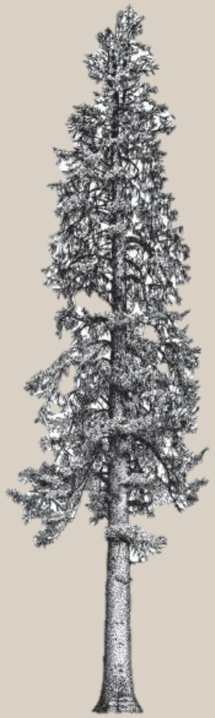
DNR's Authorizing Framework



- Enabling Act 1889, Constitution1889
- Federal Laws, e.g. Endangered Species Act, 1973
- Tribal Treaties 1854-56
- Powers of the Board (RCW 43.30.215), 1957
- Multiple Use (RCW 79.10.100 - .120), 1971
- Natural Area Preserves (RCW 79.70), 1972
- **Sustainable Harvest (RCW 79.10.300 - .340), 1971**
- Natural Resource Conservation Areas (RCW 79.71), 1987
- Laws of General Applicability



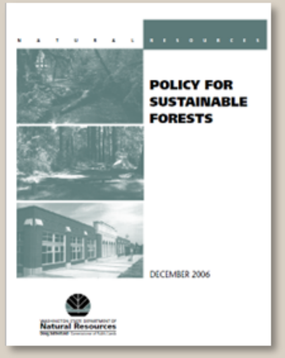
Sustainable Harvest (RCW 79.10.300-340)

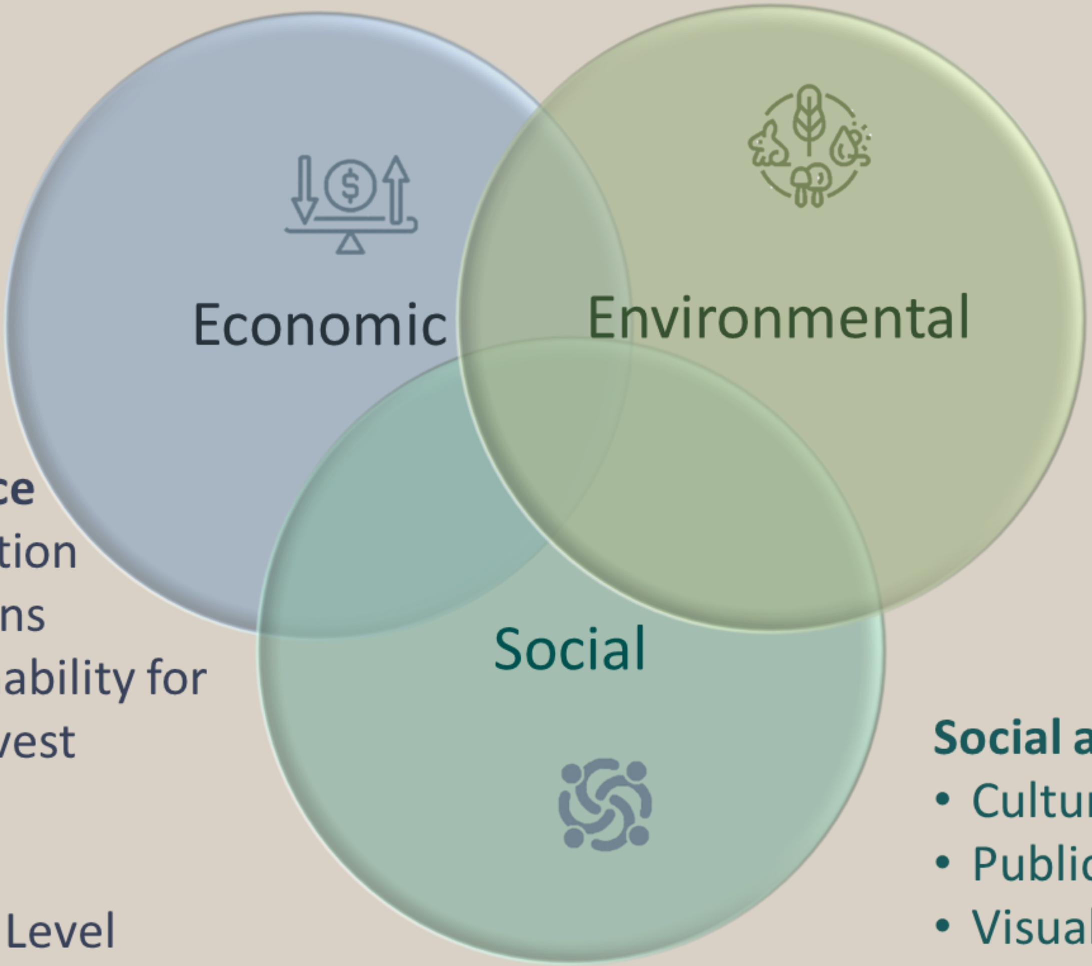


- RCW 79.10.300(5) defines the "Sustainable harvest level" as "the **volume of timber** scheduled for sale from state-owned lands during a **planning decade** as **calculated** by the department and approved by the board."

- RCW 79.10.310 defines "sustained yield plans" as "management of the forest to provide **harvesting on a continuing basis** without major prolonged curtailment or cessation of harvest."

Policy for Sustainable Forests (2006)





Forest Ecosystem Health and Productivity

- Forest Health
- Catastrophic Loss Prevention
- Old-Growth Stands in Western Washington
- Wildlife Habitat
- Watershed Systems
- Riparian Conservation
- Special Ecological Features
- Genetic Resource

Economic Performance

- Financial Diversification
- Financial Assumptions
- Definition of Sustainability for the Sustainable Harvest Calculation
- Recalculation of the Sustainable Harvest Level
- Harvest Deferral Designations

Social and Cultural Benefits

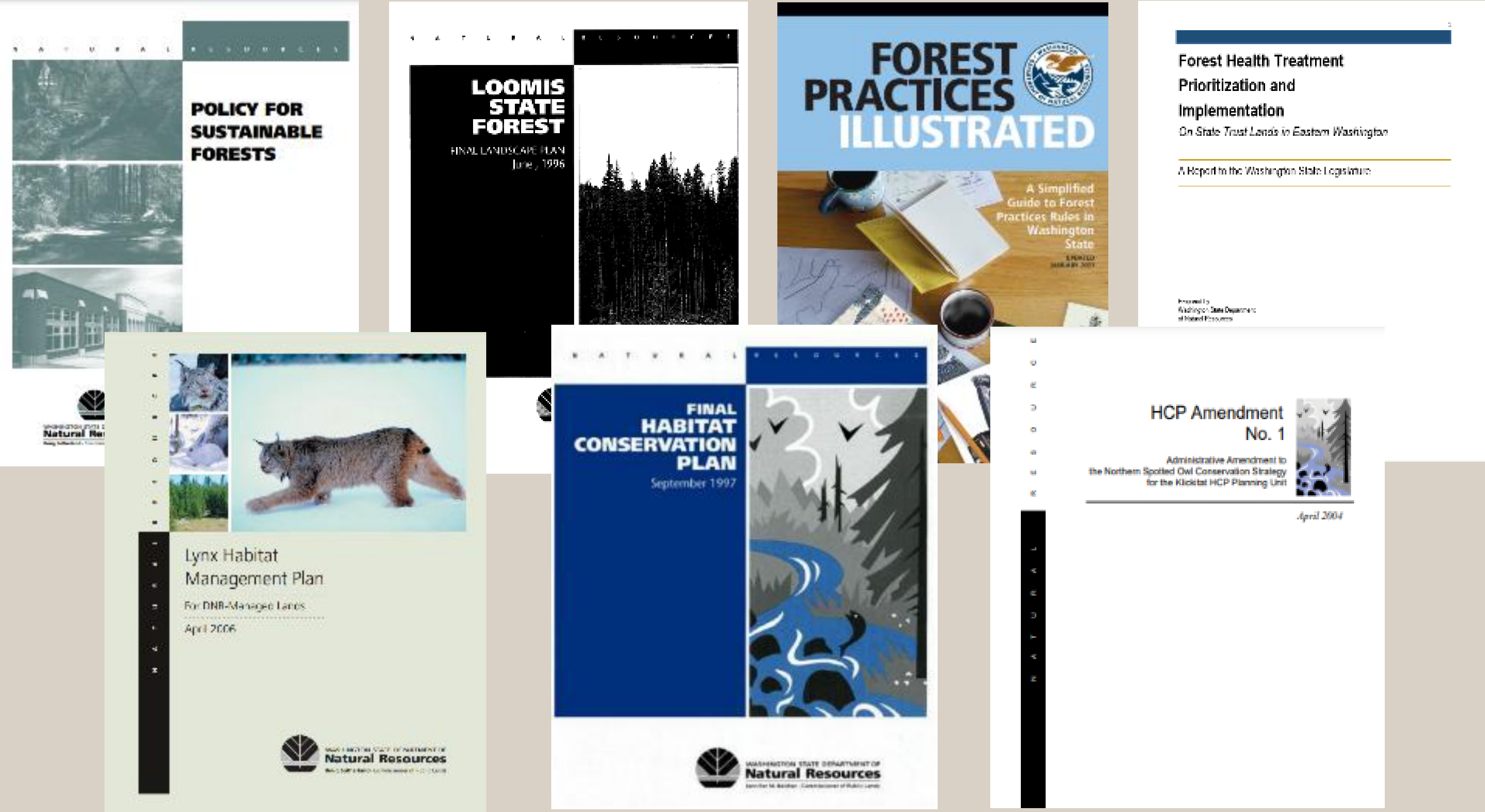
- Cultural Resources
- Public Access and Recreation
- Visual Impacts
- Local Economic Vitality

Policy for Sustainable Forests – Sustainable Harvest Calculation

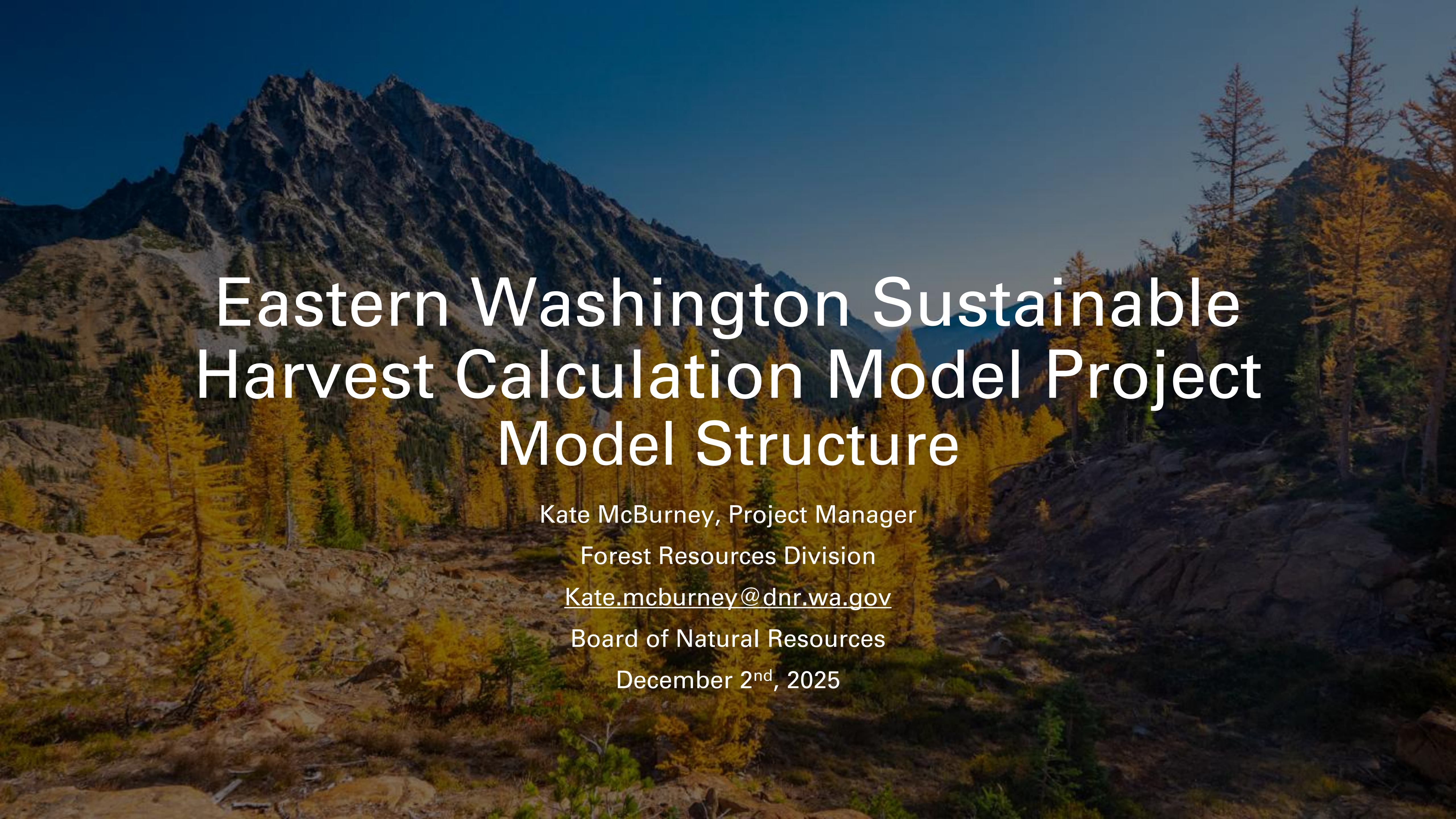
Policy on Definition of Sustainability for the Sustainable Harvest Calculation Excerpts

- "…a **separate** long-term decadal sustainable harvest level for each of several distinct sustainable harvest units."
- "…mean annual timber volume for any decade **should not vary** up or down **more than 25 percent** from the level of the preceding decade…"
- "…**optimize the economic value** of forest stands and timber production over time, in calculating the sustainable harvest level…"

DNR’s Eastside Operating Environment Examples



Subject to Changes and Amendments Over Time



Eastern Washington Sustainable Harvest Calculation Model Project Model Structure

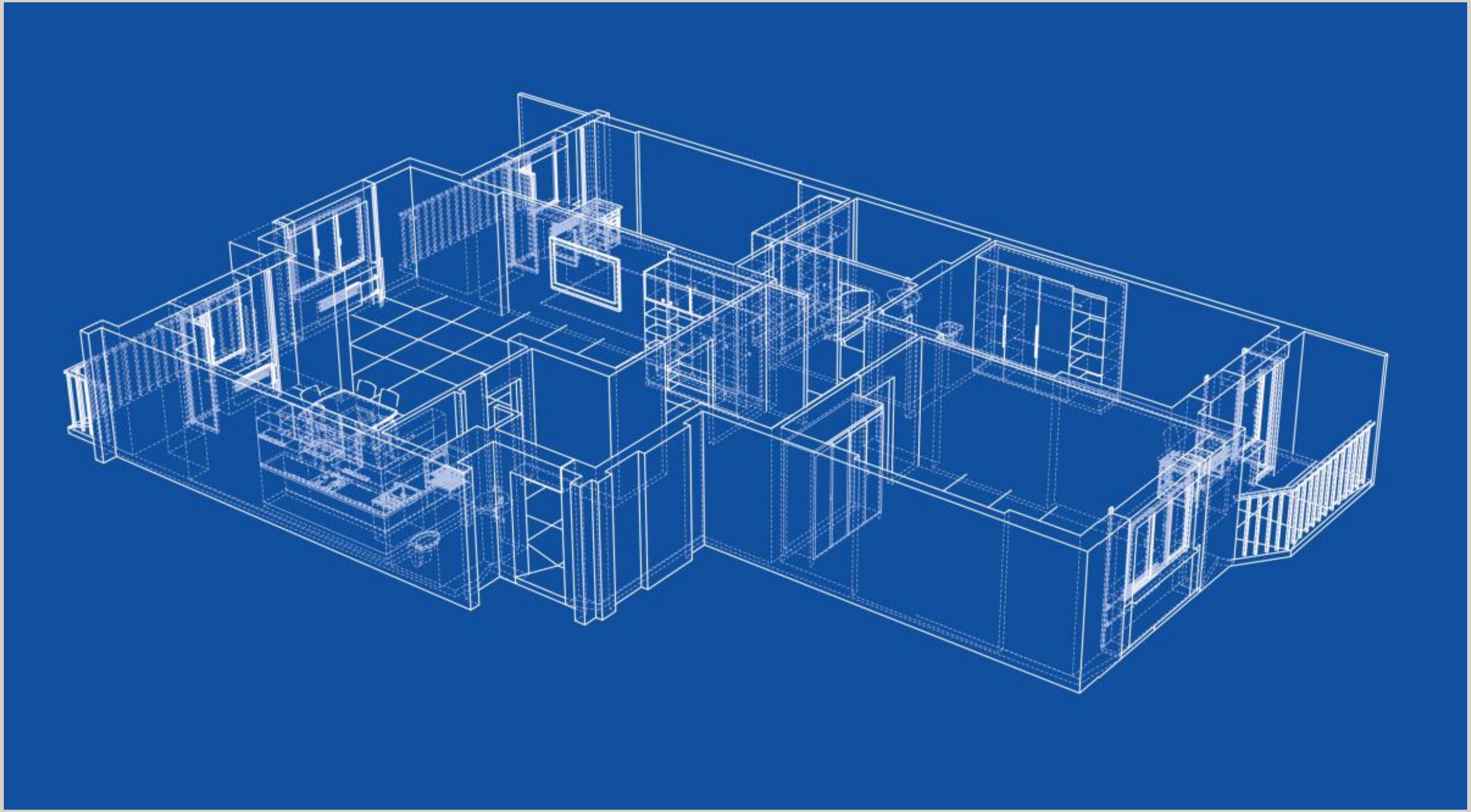
Kate McBurney, Project Manager

Forest Resources Division

Kate.mcburney@dnr.wa.gov

Board of Natural Resources

December 2nd, 2025



Outline

Part 1: The foundation

Project Scope

Part 2: What are we building?

Project Questions and Approach to Answering

Part 3: Draft blueprints

Model Architecture

Part 4: Detailed layout plans and resource orders

Model Requirements Gathering

Sustainable Harvest Calculation (SHC) Project

- Responsive to trust obligations and operating environment requirements
- Sets a sustainable harvest level for forested trust lands for a planning decade
  - Repeats this no less frequently than every 10 years
- Responsive to needs of the State Environmental Policy Act
  - Compares harvest level alternatives
  - Environmental Impact Statement
- Other project requirements
  - Environmental Justice report
  - Financial report

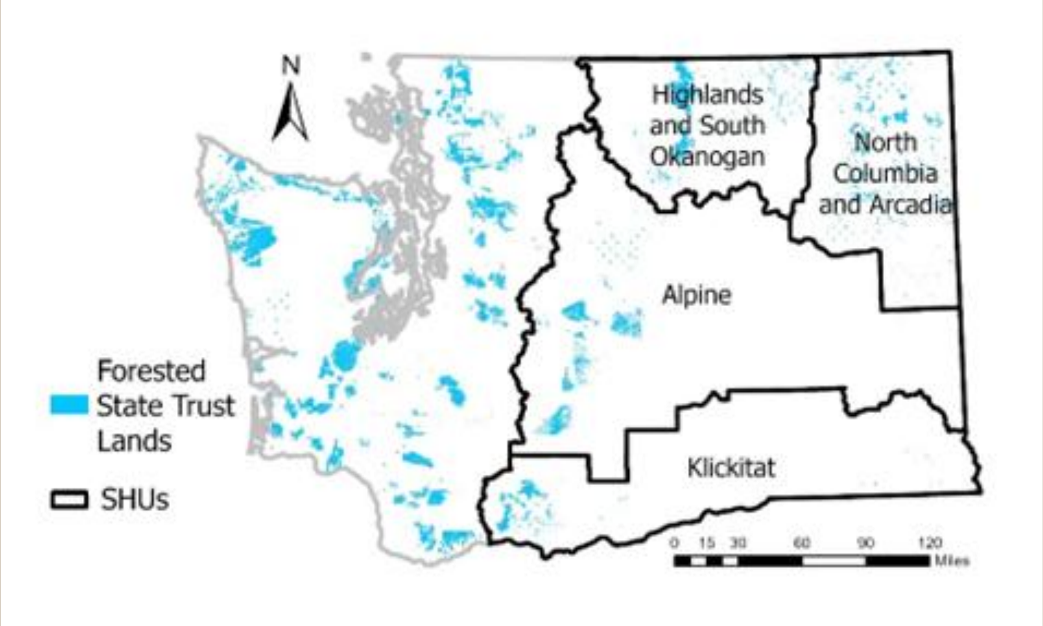
Sustainable Harvest Calculation (SHC) Project Scope for modeling

A model that:

- Adheres to the operating environment
- Optimizes economic value (net present value)
- Estimates sustainable yields over time
- Estimates sustainable harvest levels for each sustainable harvest unit for the planning decade
- As directed, model alternative harvest levels
    - Modify the operating environment
    - Explore implications of multi-objective optimization
- Provide data to compare alternatives in the Environmental Impact Statement

EWA SHC Model Project Objective

Develop models that will provide solution(s) that optimize economic value by estimating harvest volumes over time, within sustainable harvest units (SHUs), across eastern Washington state trust lands that is restricted by the operating environment requirements.



Responsive to key words:

Optimize

Sustainable yields

Sustainable harvest level

Sustainable harvest units

Sustained Yield Plan - is defined ([RCW 79.10.310]) as harvesting on a continuing basis without major prolonged curtailment or cessation of harvest

SHC Model Project Organization

To rise to the technical and analytical needs of the SHC Project, the SHC Model Project uses:

- Project Structure
- Scientific Process
- Technology Stewardship
- Targeted Involvement
- Documentation
- Oversight

Outline

Part 1: The foundation

Project Scope

Part 2: What are we building?

Project Questions and Approach to Answering

Part 3: Draft blueprints

Model Architecture

Part 4: Detailed layout plans and resource orders

Model Requirements Gathering

?

SHC Environmental Impact Statement Questions

Question Topics

1. Current conditions and baseline summaries
2. Projected forest conditions and harvest levels over the short and long term
3. Harvest impacts to the environment in the short and long term
   - Questions posed are qualitative and quantitative

Elements of the Environment

Earth
Air
Water
Plants and Animals
Energy and Natural Resources
Built Environment

SHC Model project can provide quantitative answers

- Strategic harvest models can address harvest levels questions over time
- SHC Model project database can address summaries that relate to the elements of the environment

What is this strategic harvest model?

Foundation

- Adhering to the operating environment rules, models need to optimize economic value and estimate sustainable yields (harvest levels)

Model type

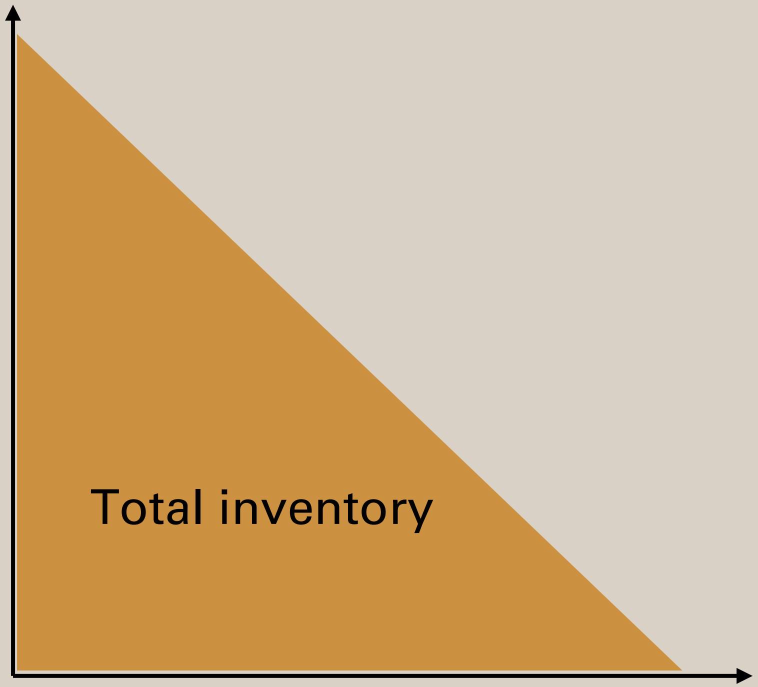
- Linear programming model
  - Looks at many solutions over many iterations to choose an ‘optimal’ solution
  - Iterations involve every option available, for every decade analyzed, for the entire area examined

Let’s look at a simplified example

What is this strategic harvest model?

Simple example

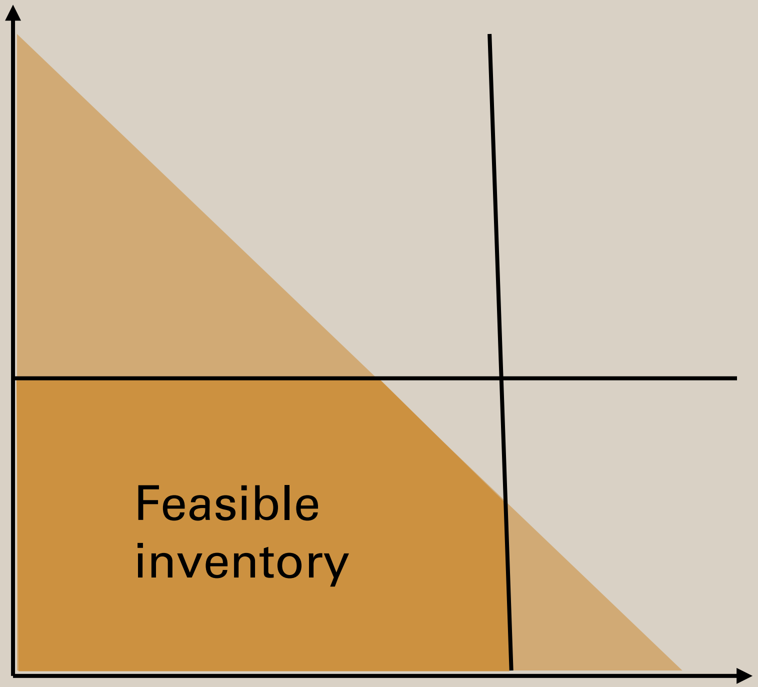
- Inventory available



What is this strategic harvest model?

Simple example

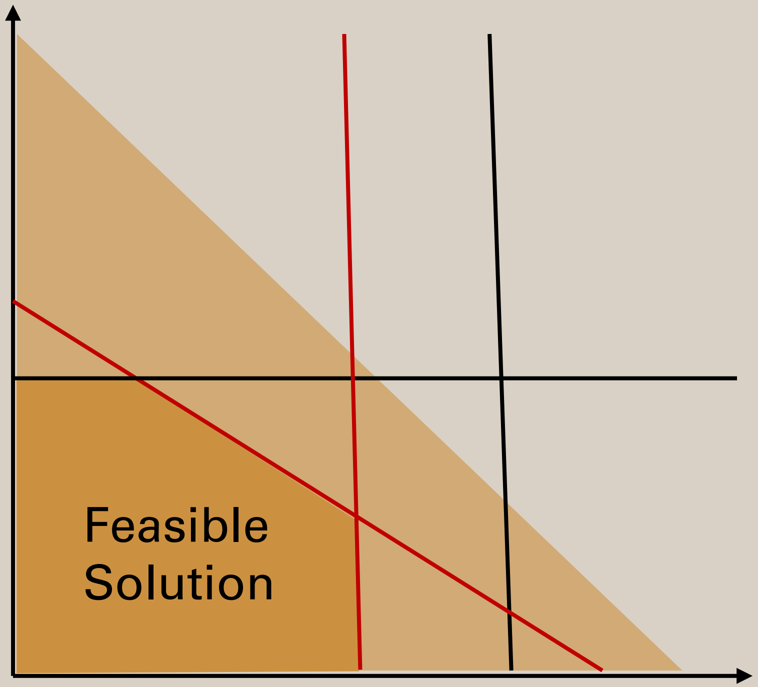
- Inventory available
- Restrictions of that inventory (if harvest happens, value > cost)



What is this strategic harvest model?

Simple example

- Inventory available
- Restrictions of that inventory (if harvest happens, value > cost)
- Operating environment rules and regulations introduce constraints (red lines) to the feasible solution space

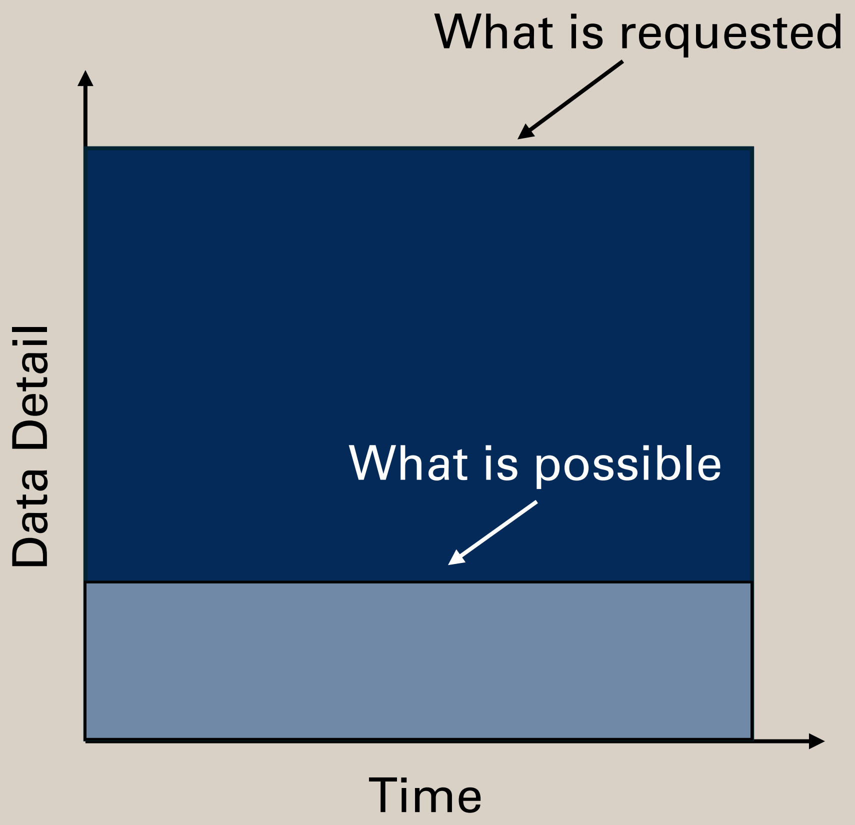


Design Concepts: Avoiding False Precision

Design strategic harvest models to answer quantitative questions while acknowledging data and technology capabilities

Example: High data detail over long periods of time

- Leads to issues around data uncertainty, feasibility and technical capabilities
- **False precision**: more data is not always better
- Confuses and detracts from the main strategic question

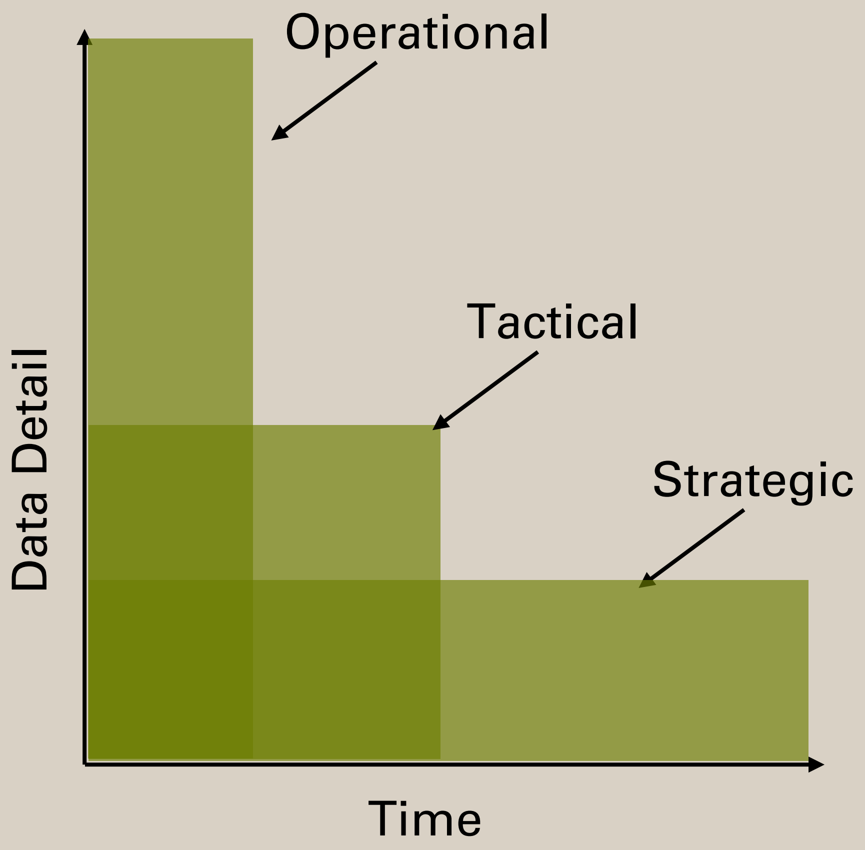


Design Concepts:
Models to address different questions

Hierarchical planning

- Common in forestry and land management
- Each level of model can address questions and detail of requirements
- Overlap between plans

Provides the structure to develop the model architecture



P. Ulvdal et al. 2023. Handling uncertainties in forest information: the hierarchical forest planning process and its use of information at large forest companies. [Forestry: An International Journal of Forest Research 96 (1), 62-75.]

Outline

Part 1: The foundation

Project Scope

Part 2: What are we building?

Project Questions and Approach to Answering

Part 3: Draft blueprints

Model Architecture

Part 4: Detailed layout plans and resource orders

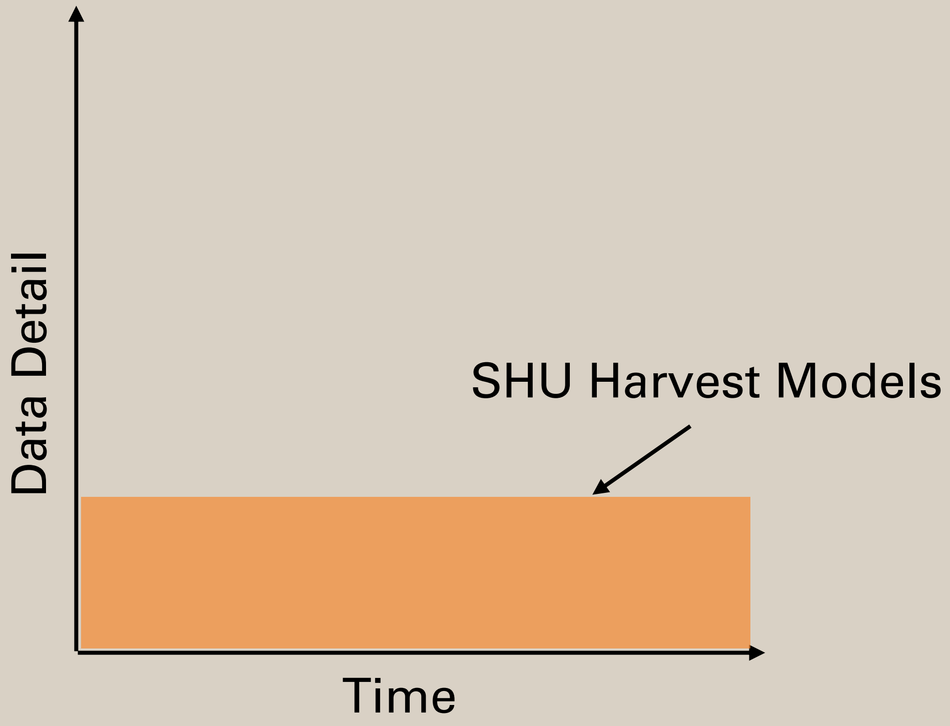
Model Requirements Gathering

Strategic Harvest Model Architecture

Sustainable Harvest Unit (SHU) Harvest Models

- Optimizes for economic value (net present value)
- Estimates harvest yields over time
- 4 total models, one for each SHU
- Operating environment requirements <u>accounted for prior</u> to model formulation
- Longer time scale, lower data detail

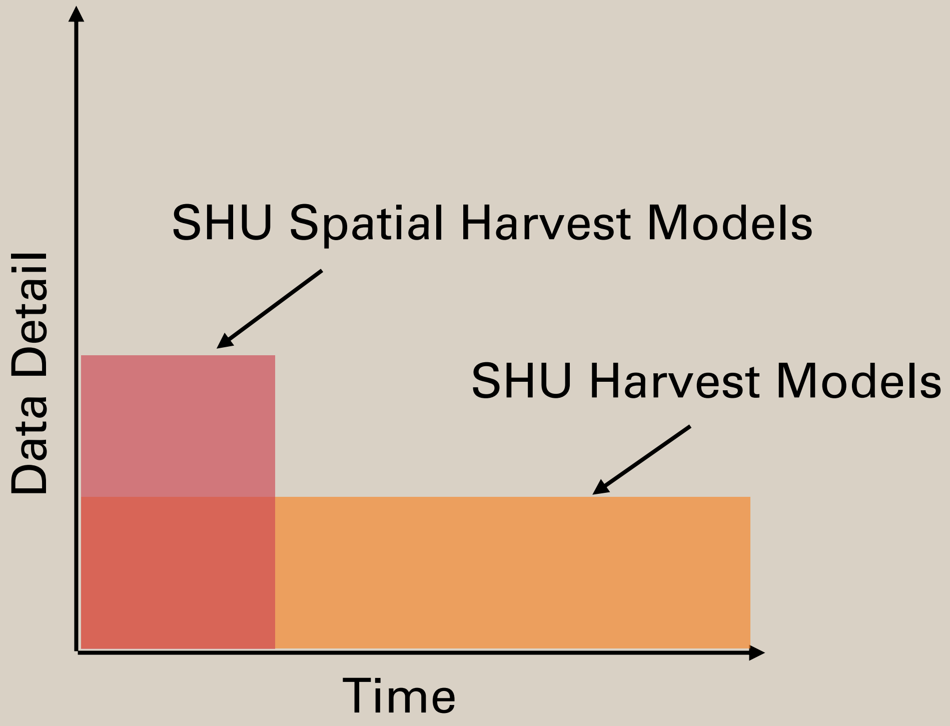
- This model is not a spatial or habitat model
- This model cannot provide solutions at a small spatial or time scales



Strategic Harvest Model Architecture

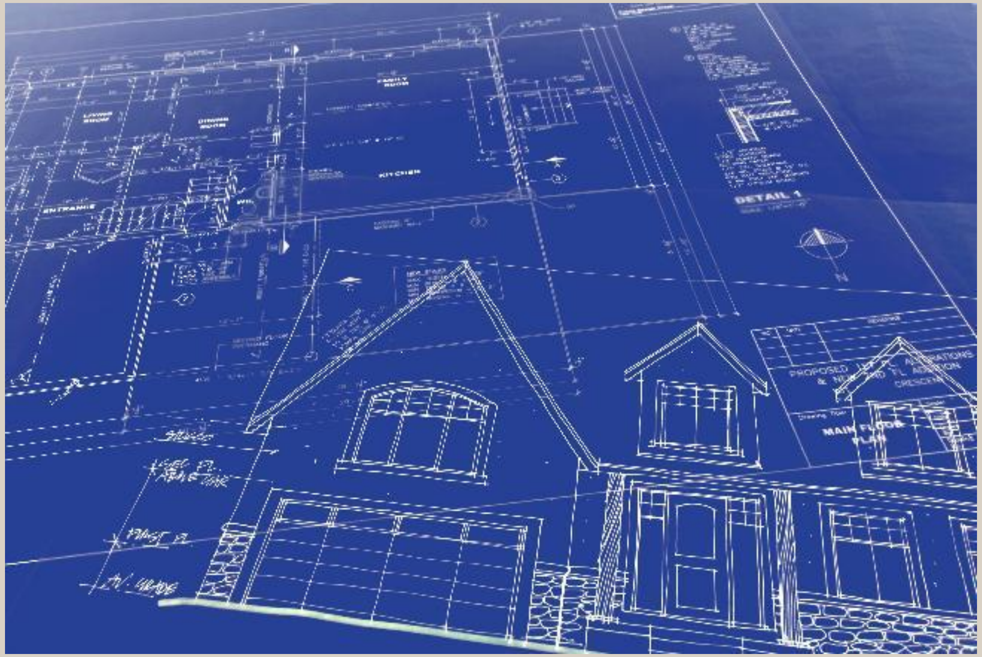
SHU Spatial Harvest Models

- Applies spatial requirements
  - Fully representing the operating environment
- Uses outputs from the SHU Harvest Models
- 4 total models, one for each SHU
- Short time scale, limited data detail
- **Produces estimated sustainable harvest levels for decision by the Board of Natural Resources**



Part 1 – 3 Summary

1. Foundation poured
   - Clear SHC Project scope
   - Outline for SHC Model Project approach
2. We know what we are building
   - Answers harvest level questions over time
   - Uses forest planning design concepts to answer questions
3. Blueprints drafted
   - Designing two types of harvest models
   - Total of 8 models for the ‘no action alternative’



Outline

Part 1: The foundation

Project Scope

Part 2: What are we building?

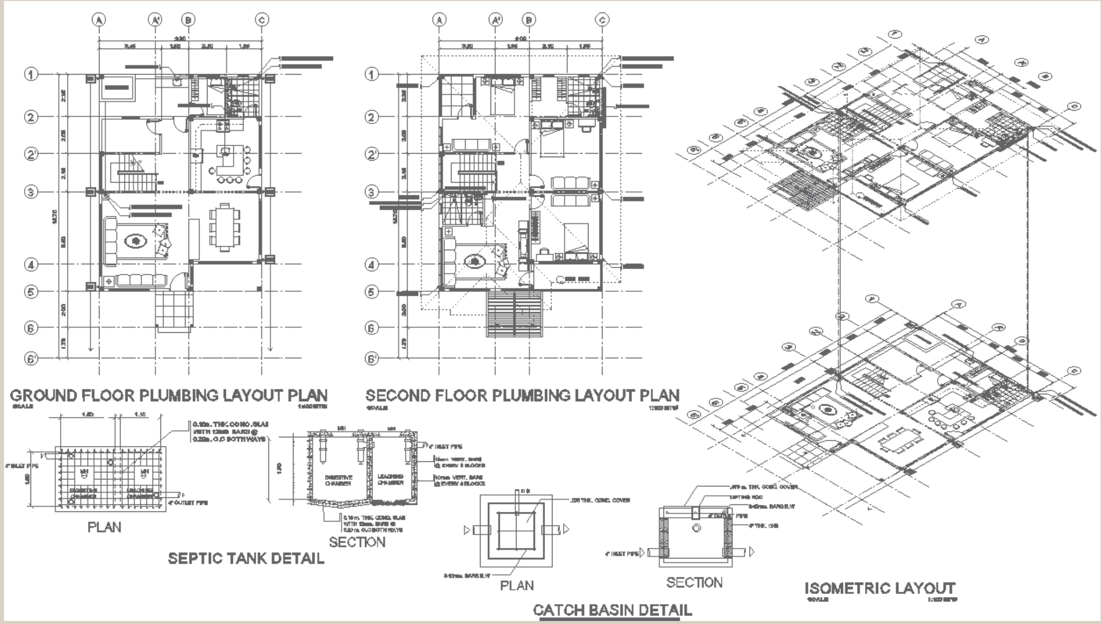
Project Questions and Approach to Answering

Part 3: Draft blueprints

Model Architecture

Part 4: Detailed layout plans and resource orders

Model Requirements Gathering



Background for Requirements

Requires adherence and awareness of

- Project scope
- SHC Model Project Elements
- Project questions
- Chosen model architecture
- Framework and needs of the strategic harvest models
    1. Acres of the land base
    2. Growth projections of the forest
    3. Harvest options and yields
    4. Model design and considerations

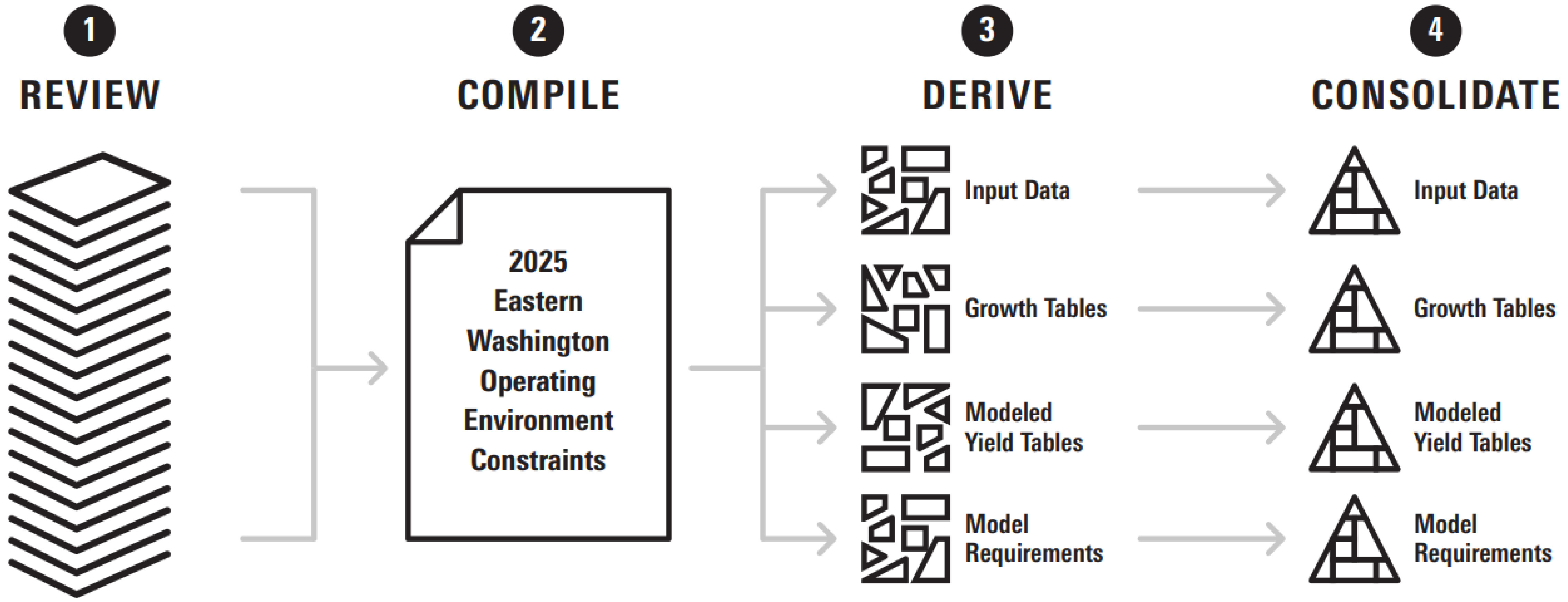
Gathering Requirements

Develop a process to capture operating environment restrictions

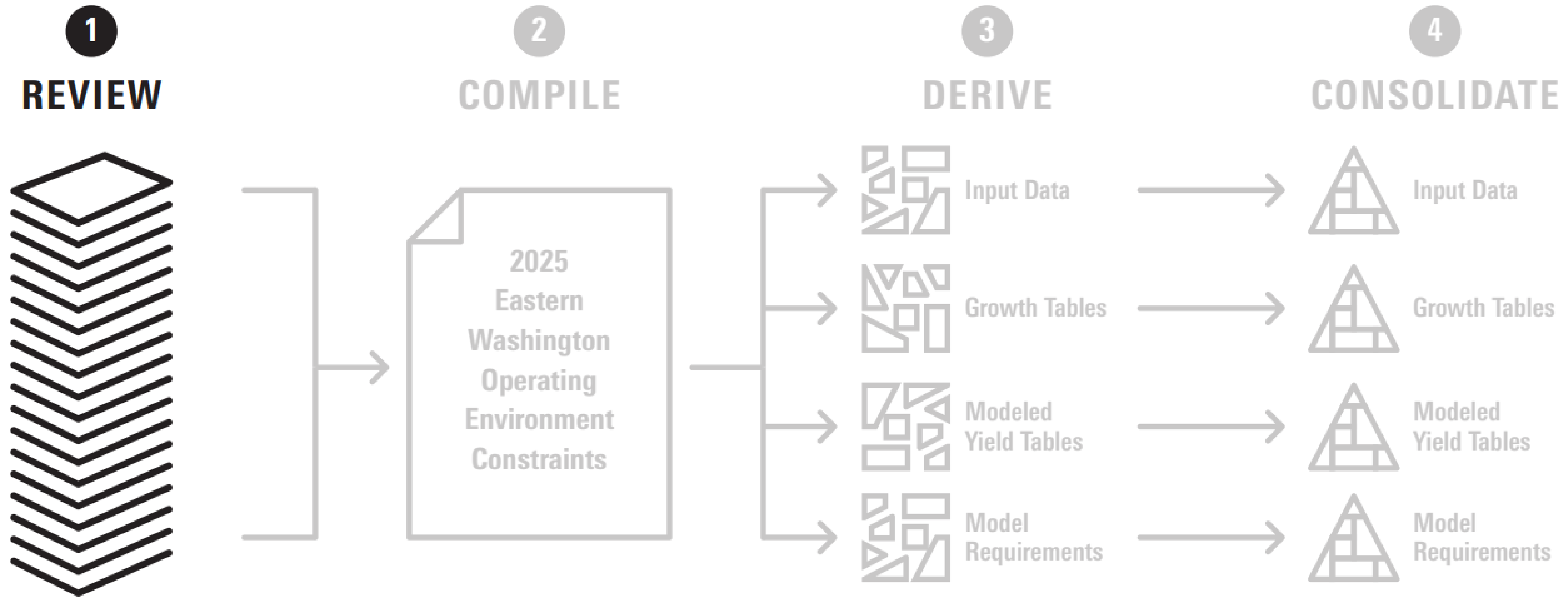
1	Review	Organize all the relevant documents
2	Compile	Summarize management impacts and provide interpretations
3	Derive	Translating constraints into model requirements
4	Consolidate	Consolidate requirements to fit the SHC project scope

Available to use in future projects

Accountable, documented and transparent



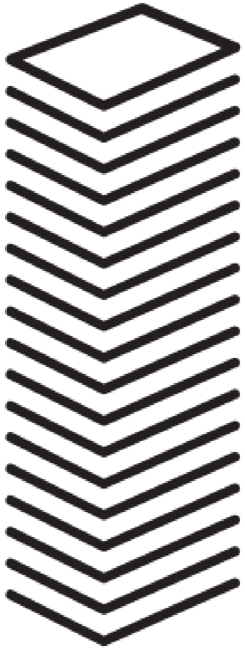
1
REVIEW
2
COMPILE
2025
Eastern
Washington
Operating
Environment
Constraints
3
DERIVE
Input Data
Growth Tables
Modeled
Yield Tables
Model
Requirements
4
CONSOLIDATE
Input Data
Growth Tables
Modeled
Yield Tables
Model
Requirements



We reviewed all laws, regulations, policies, management plans, procedures, reports, resolutions, court rulings, guidance, memorandums and worksheets

1

REVIEW



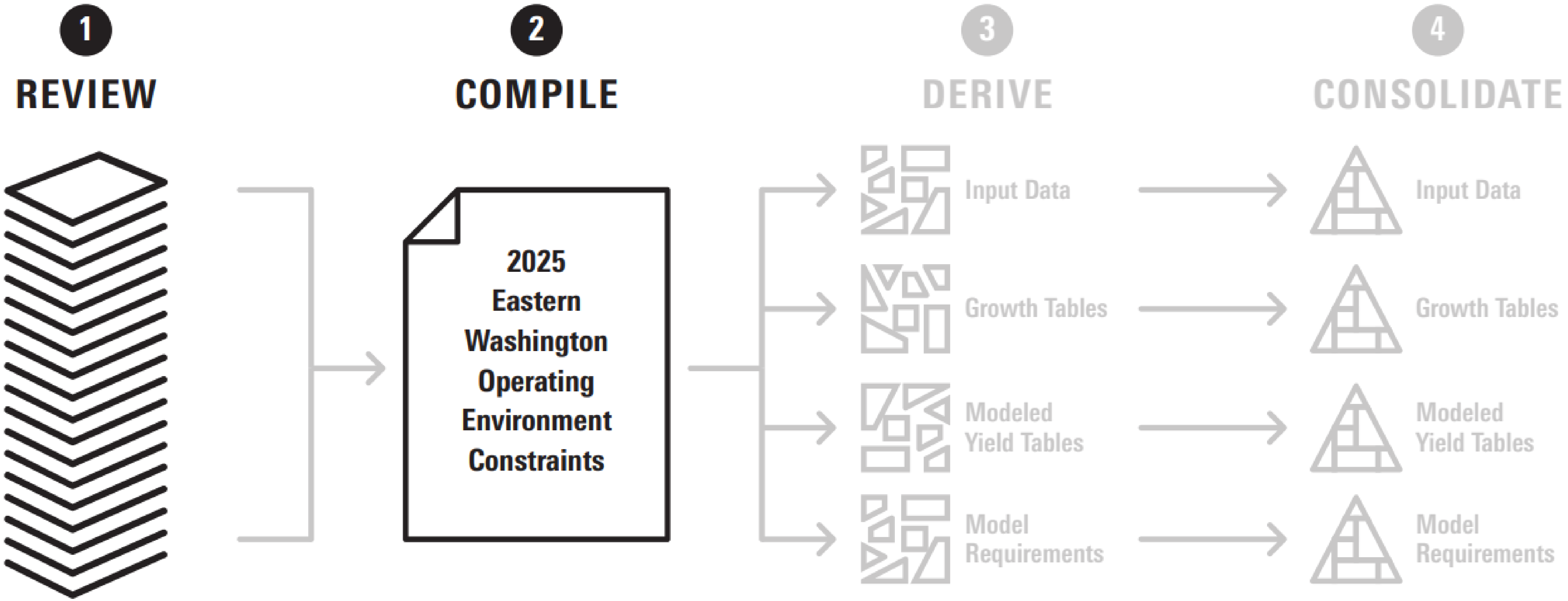
2,342 PAGES OF DOCUMENTATION

INCONSISTENT SCALE AND COMPLEXITY

NO INTERPRETATION

6 MONTHS TO CONSUME

ANALYZE, ASSESS, AND EXTRACT



We compiled a single ~ 80-page document that describes not only the operating environment in plain-language but also contains the projects interpretations on the operating environment

2

COMPILE

2025 Eastern Washington Operating Environment Constraints

83

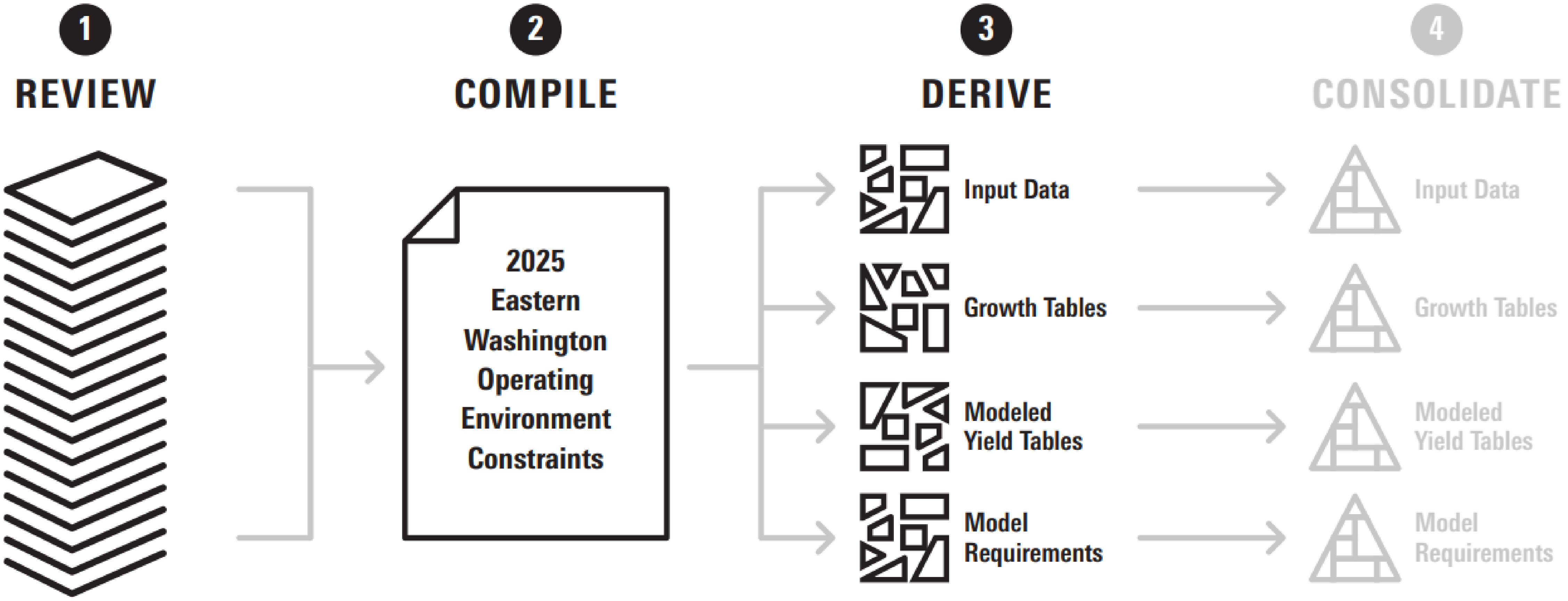
PAGES

INCLUDES INTERPRETATIONS

1 YEAR TO COMPLETE

1,073

REFINEMENTS



The modeling team derives hundreds of individual requirements for the model project
These requirements fall into the four main categories

3

DERIVE

Input Data

Growth Tables

Modeled Yield Tables

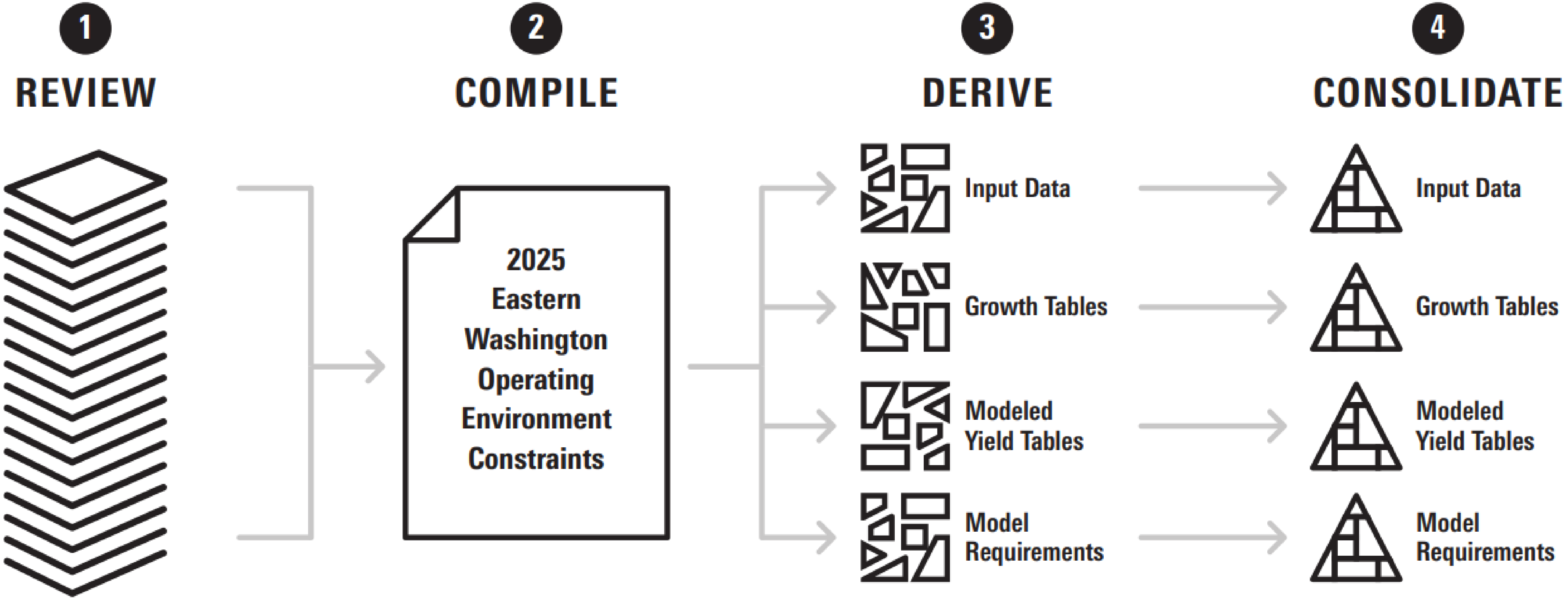
Model Requirements

170 DATASETS

300 MILLION TREES GROWN FOR 15 DECADES

130 MODELED HARVESTS

209 MODEL REQUIREMENTS (8+ months of iterative work)



We work to consolidate those requirements into something that is both congruent with the project scale and feasible (i.e., data limitations)

4

CONSOLIDATE

- Input Data
- Growth Tables
- Modeled Yield Tables
- Model Requirements

170 DATASETS	→	50 DATASETS
300 MILLION TREES	→	4 FOREST TYPES
130 MODELED HARVESTS	→	22 MODELED HARVESTS
209 REQUIREMENTS	→	98 REQUIREMENTS*

Harvest Model (86)
Spatial Model (12)

30 Workshops

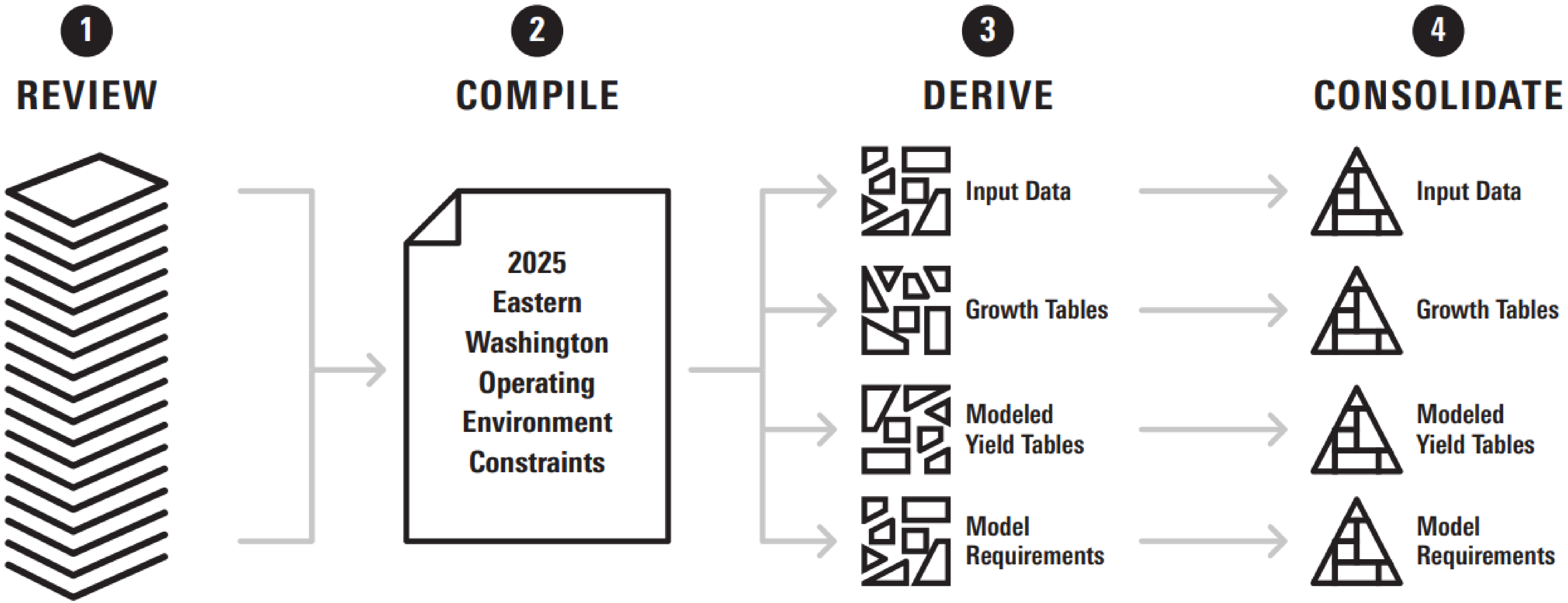
4

CONSOLIDATE

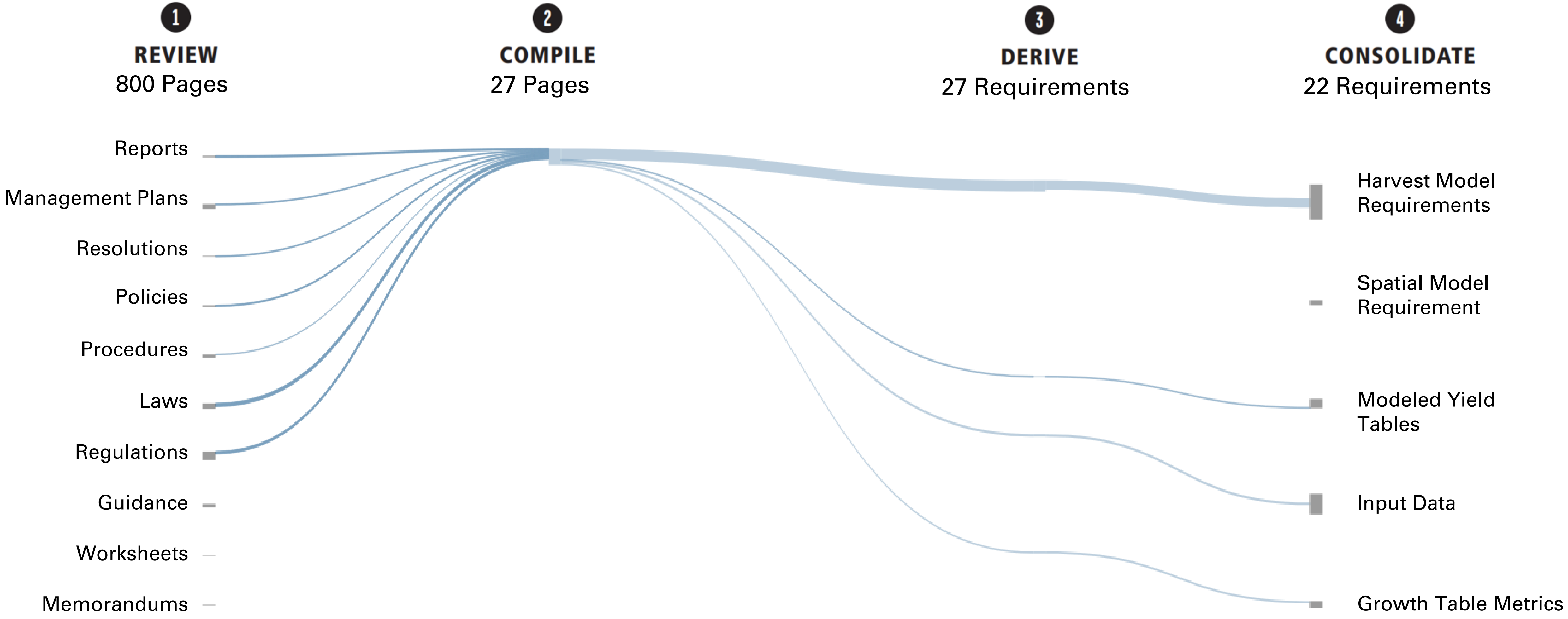
- Input Data
- Growth Tables
- Modeled Yield Tables
- Model Requirements

170 DATASETS	→	**50 DATASETS**
300 MILLION TREES	→	**4 FOREST TYPES**
130 MODELED HARVESTS	→	**22 MODELED HARVESTS**
209 REQUIREMENTS	→	**98 REQUIREMENTS*** Harvest Model (86) Spatial Model (12)

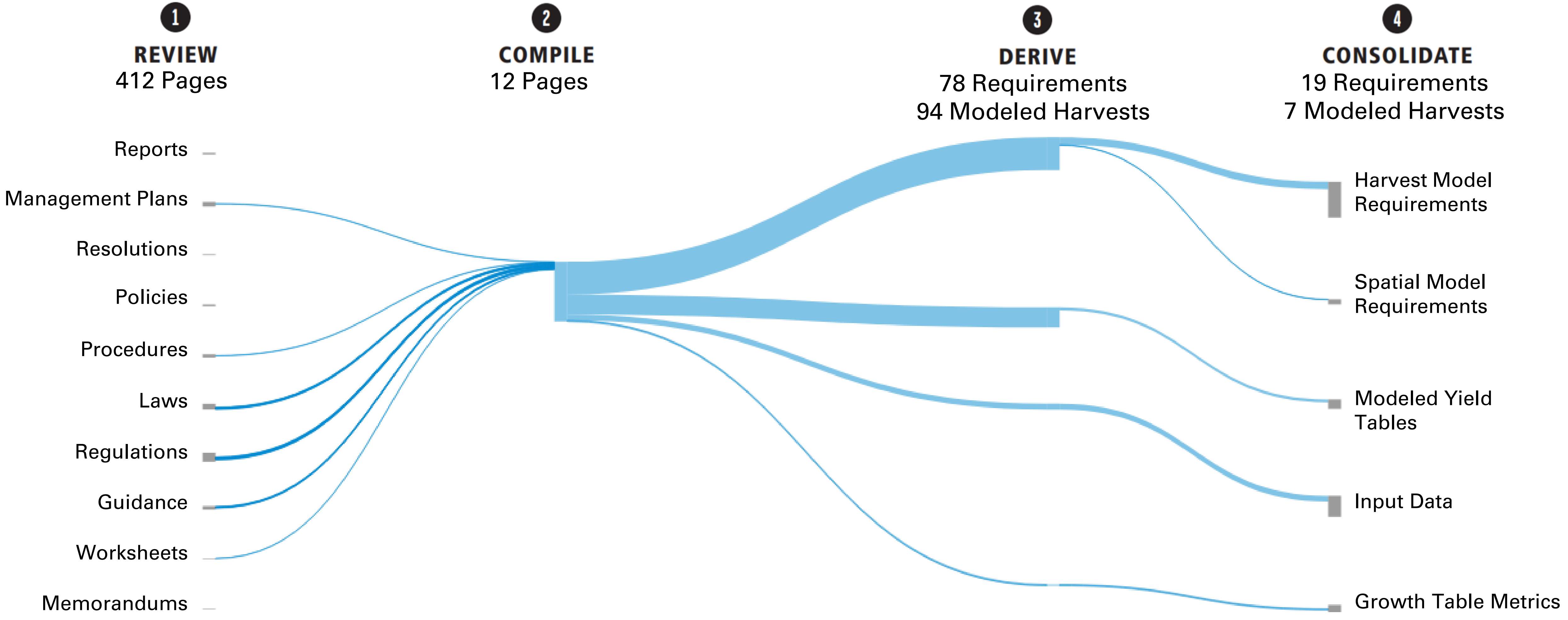
**30 Workshops*


1
REVIEW
2
COMPILE
2025
Eastern
Washington
Operating
Environment
Constraints
3
DERIVE
Input Data
Growth Tables
Modeled
Yield Tables
Model
Requirements
4
CONSOLIDATE
Input Data
Growth Tables
Modeled
Yield Tables
Model
Requirements

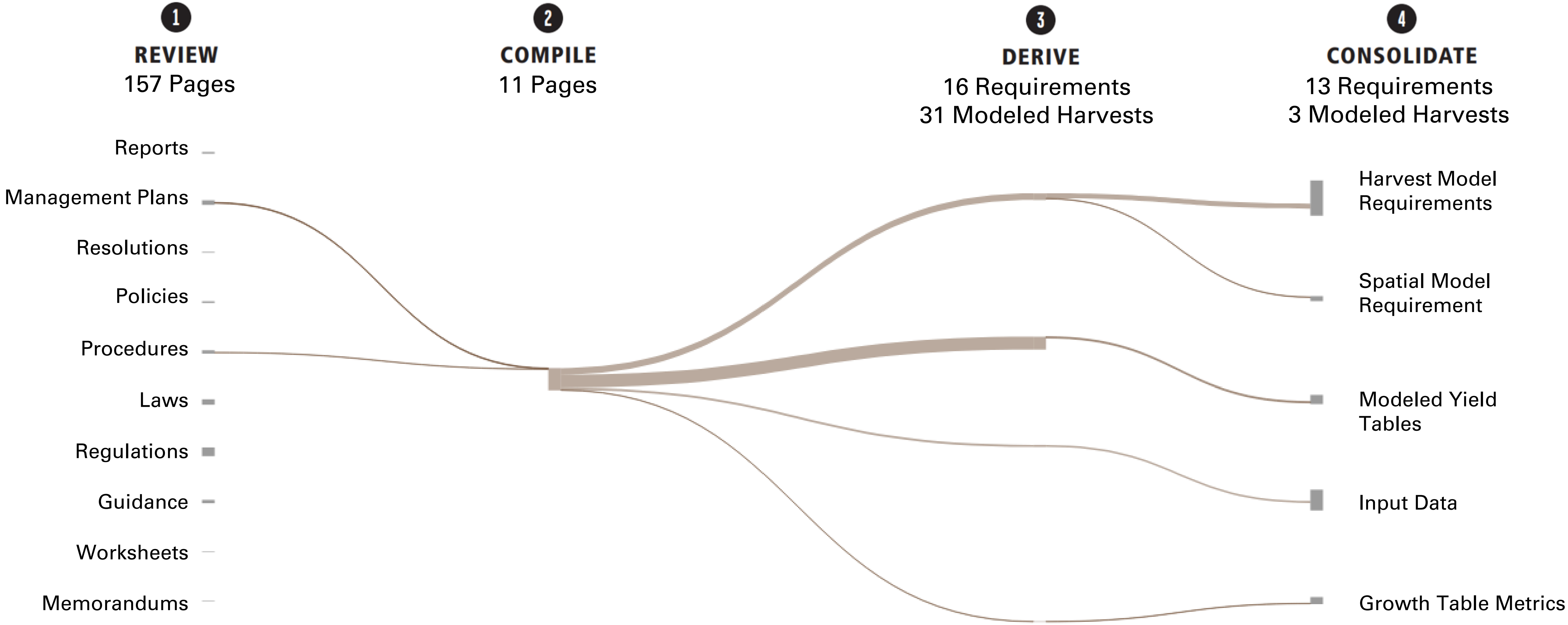
Model Design Requirements Flow

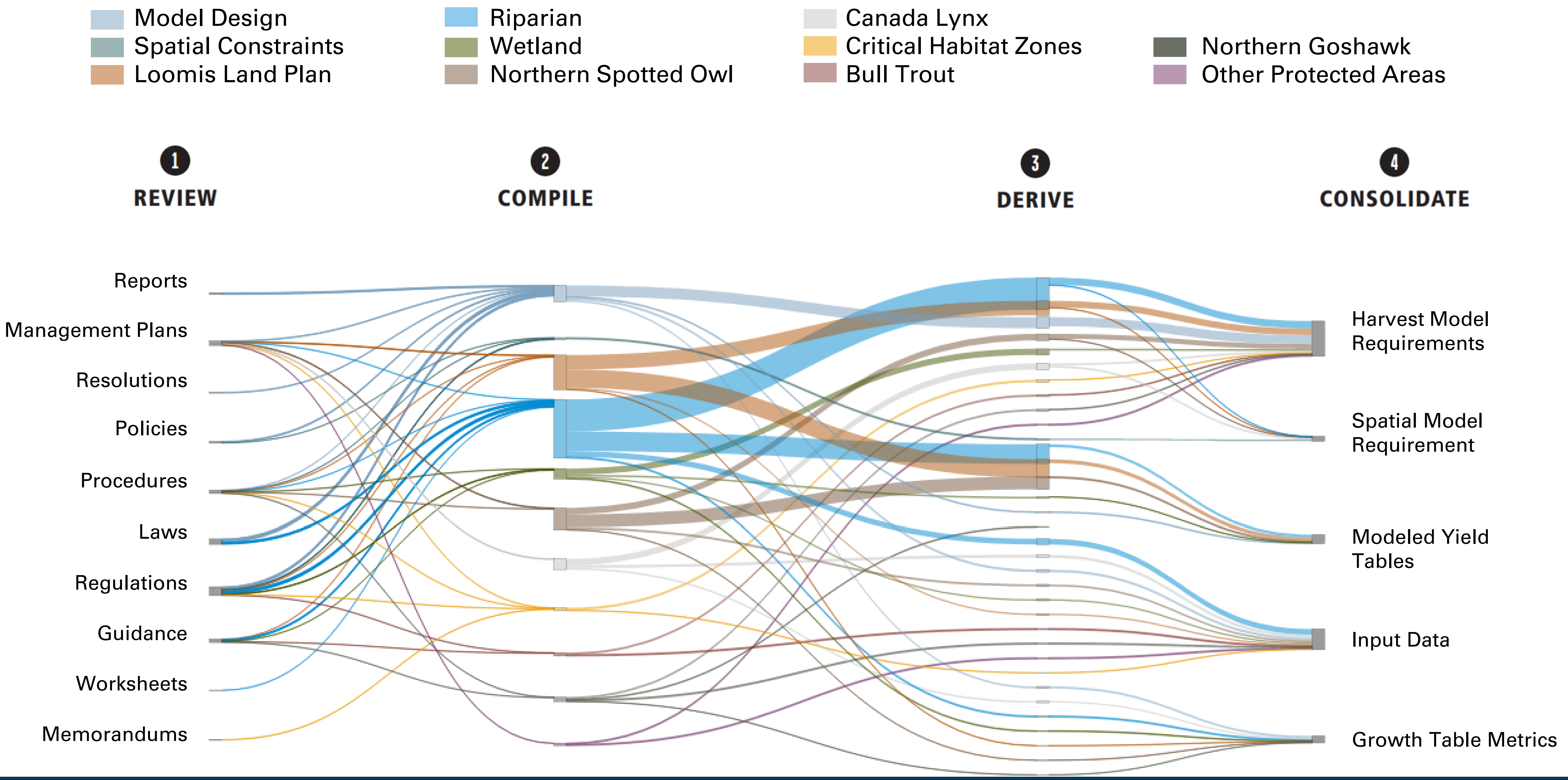


Riparian Requirements Flow

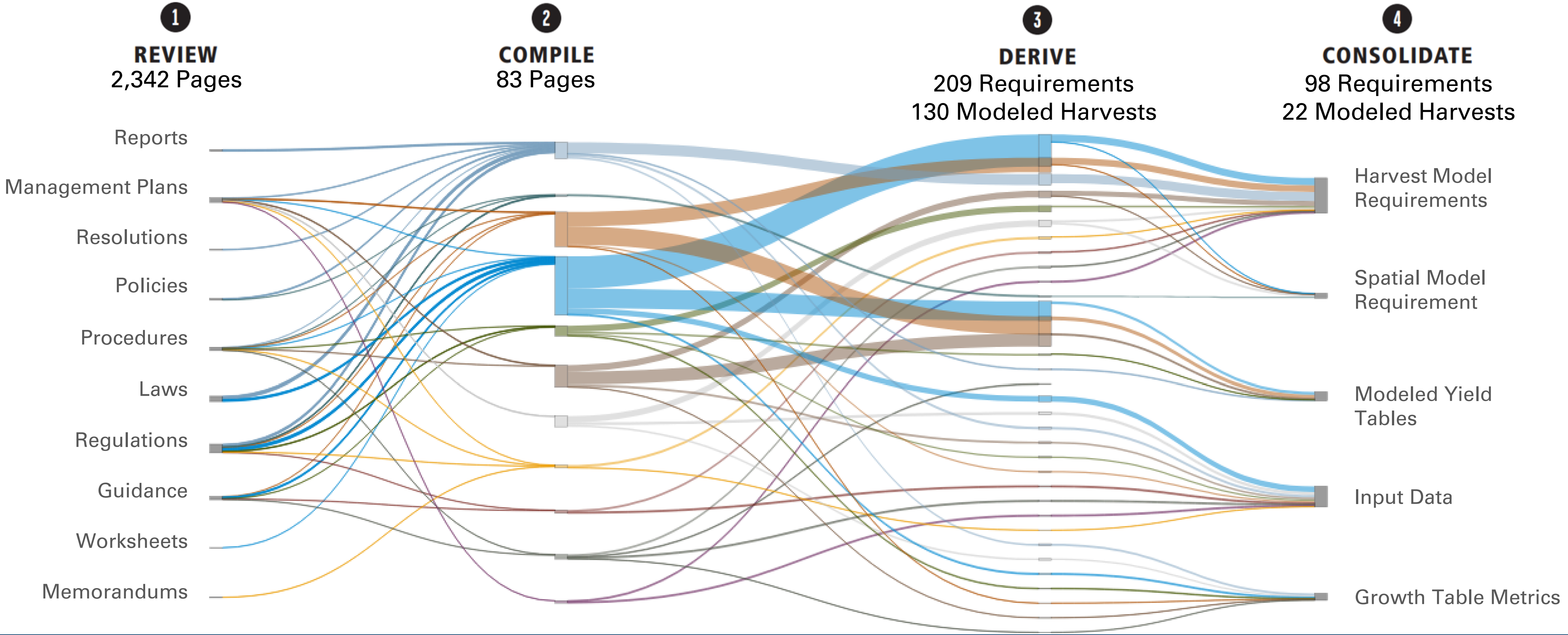


Northern Spotted Owl Requirements Flow




Model Design
Spatial Constraints
Loomis Land Plan
Riparian
Wetland
Northern Spotted Owl
Canada Lynx
Critical Habitat Zones
Bull Trout
Northern Goshawk
Other Protected Areas
1
REVIEW
2
COMPILE
3
DERIVE
4
CONSOLIDATE
Reports
Management Plans
Resolutions
Policies
Procedures
Laws
Regulations
Guidance
Worksheets
Memorandums
Harvest Model Requirements
Spatial Model Requirement
Modeled Yield Tables
Input Data
Growth Table Metrics

Requirements Process Flow



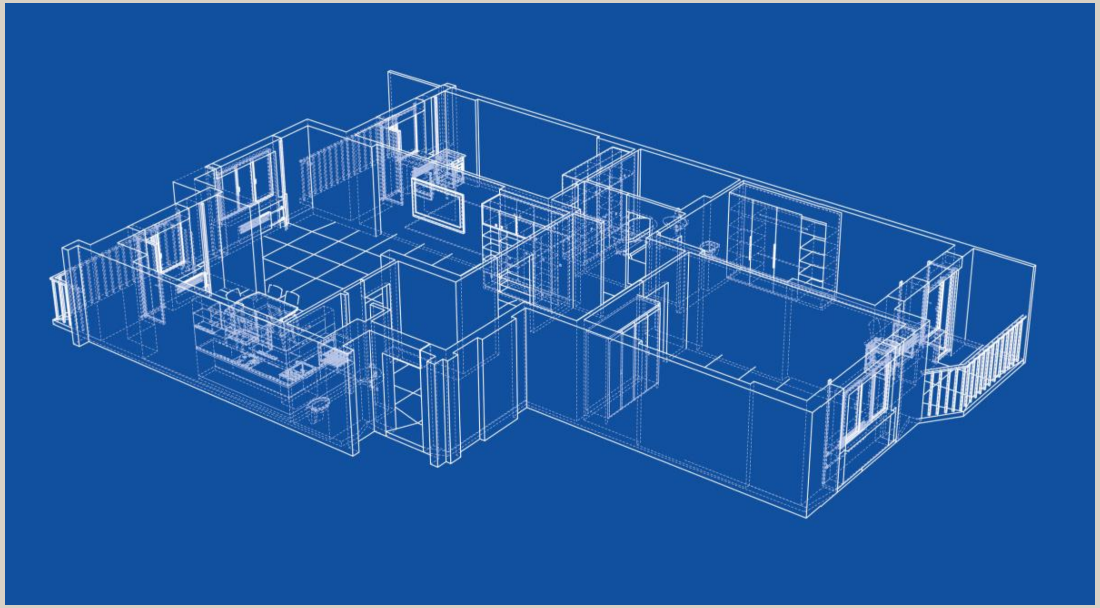
Model Structure Impacts for SHC Project

A model that:

- ✓ Adheres to the operating environment
- ✓ Optimizes economic value (net present value)
- ✓ Estimates sustainable yields over time
- ✓ Estimates sustainable harvest levels for each sustainable harvest unit for the planning decade
- ✓ As directed, model alternative harvest levels
    - ✓ Modify the operating environment
    - ✓ Explore implications of multi-objective optimization
- ✓ Provide data to compare alternatives in the Environmental Impact Statement

Model Structure Impacts for SHC Modeling

- Models chosen to answer project questions and fit within scope
- Effective project hierarchy
- Clear process for requirement gathering
- Documentation of operating environment rules and regulations with project-focused interpretations
- Organized model requirements and inputs



Ready to build models

Questions?

WASHINGTON DEPARTMENT OF NATURAL RESOURCES