UBC Strategic Forest Planning Review and Technical Analysis:
North Cowichan Municipal Forest Reserve

Drs. Brad Seely & Clive Welham
3GreenTree Ecosystem Services Ltd.
& Faculty of Forestry, UBC

Dr. Peter Arcese, Prof./FRBC Chair
Forest & Conservation Sciences, UBC

Dr. Stephen Sheppard, Prof.
Forest Resources Management, UBC

3greentree

MUNICIPALITY OF NORTH Cowichan

UBC Forestry
University of British Columbia

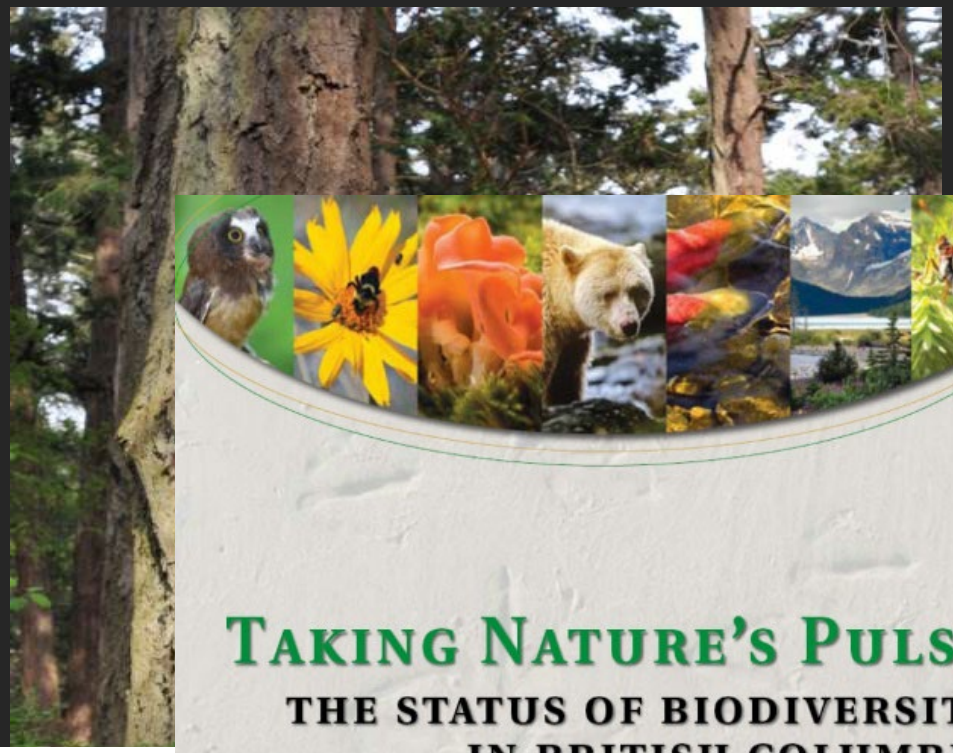
Goals & Objectives

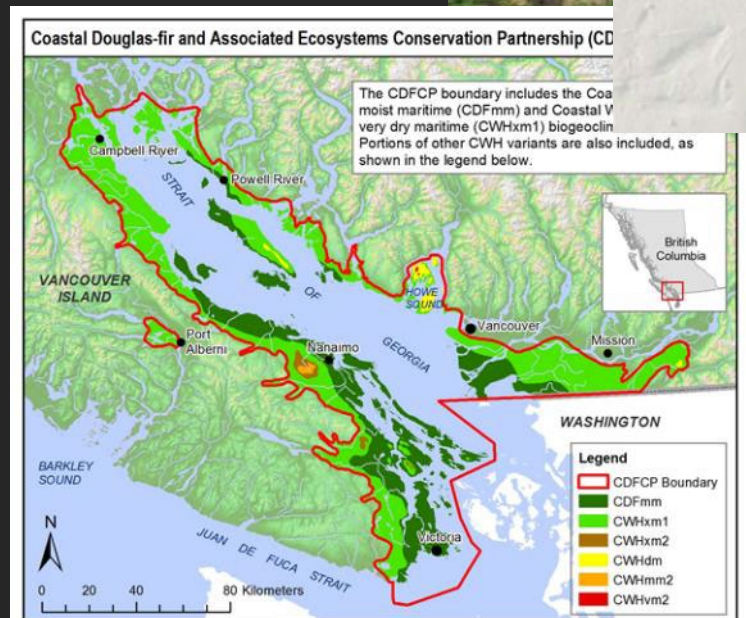
1. Review past management activities & regional context
2. Develop spatial data resources
3. Understanding management goals and evaluating outcomes
4. Multi-objective scenario analysis
5. Assess feasibility of developing a C project
6. Support for development of forest management plans

Regional Context:

Coastal Douglas-fir Forests of the Georgia Basin

- 49% Converted to Human Use
- < 3% Pre-settlement Forest Intact
- > 80% Privately-owned
- >153 Species At Risk
- Most Imperiled Ecosystem in BC





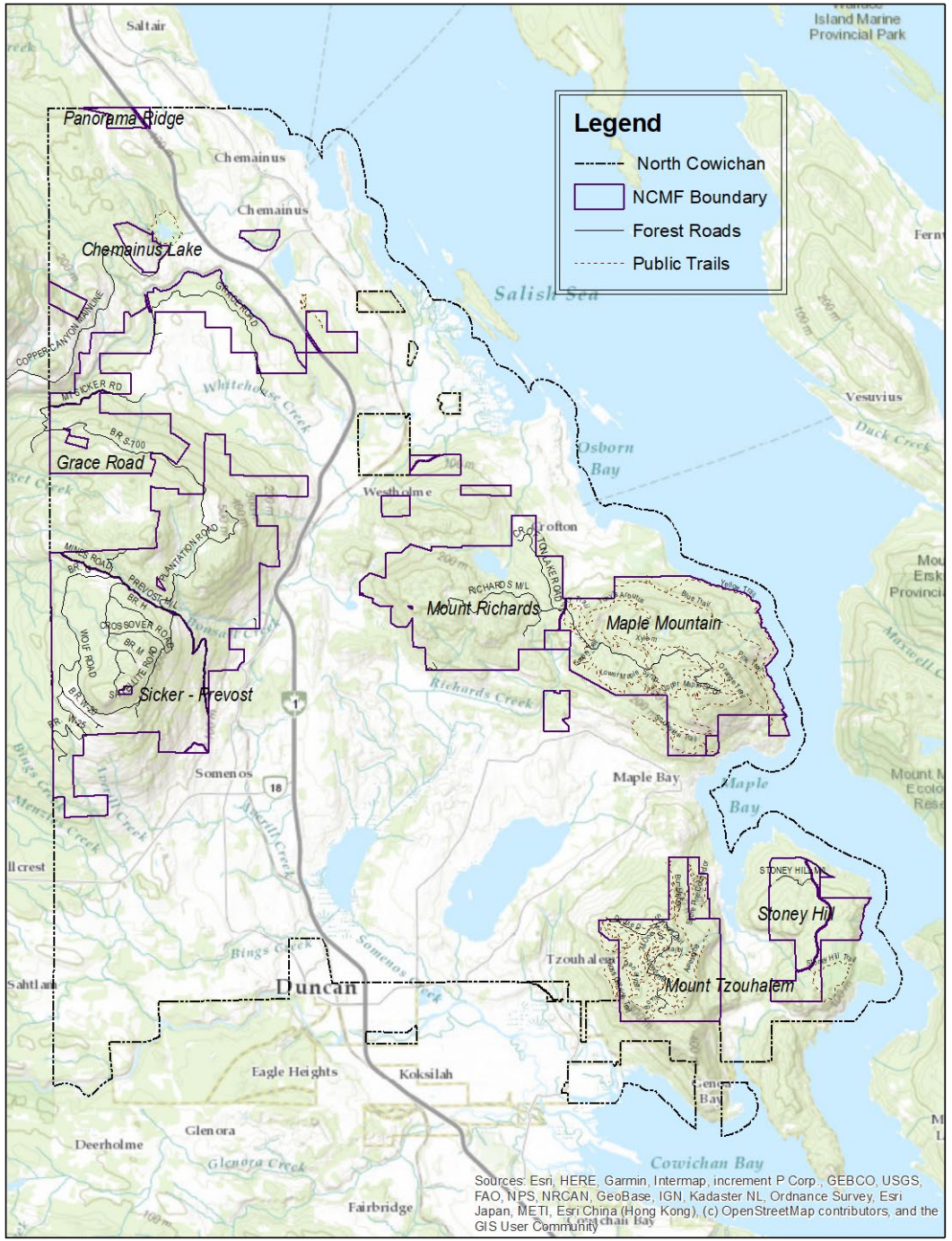
CDFCP

COASTAL DOUGLAS-FIR & ASSOCIATED ECOSYSTEMS CONSERVATION PARTNERSHIP

Evaluation and Development of Spatial Data Resources

Location of North Cowichan Municipal Forest Reserve

- Consists of 6 main holdings around local mountains
- ~ 5,470 ha
- Multi-objective management
- Annual logging allowance of 20,000 m^3 per year



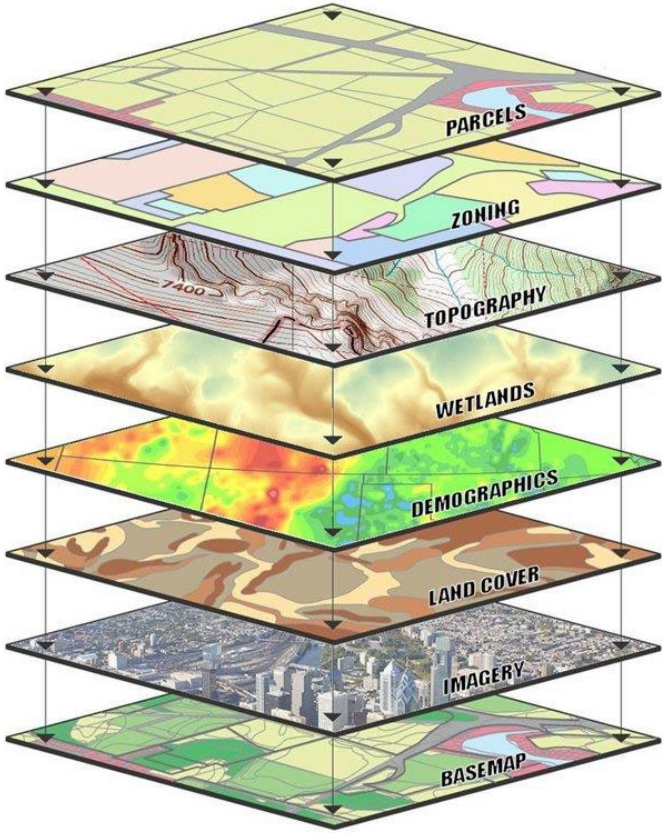
Evaluation and Development of Spatial Data Resources

Mapping Key Forest Resources

- Ownership boundary layers
- Forest vegetation mapping (stratified by tree species & stand age)
- Past management (harvest blocks)

- Streams and water bodies
- Important watersheds
- Sensitive ecosystems and habitats

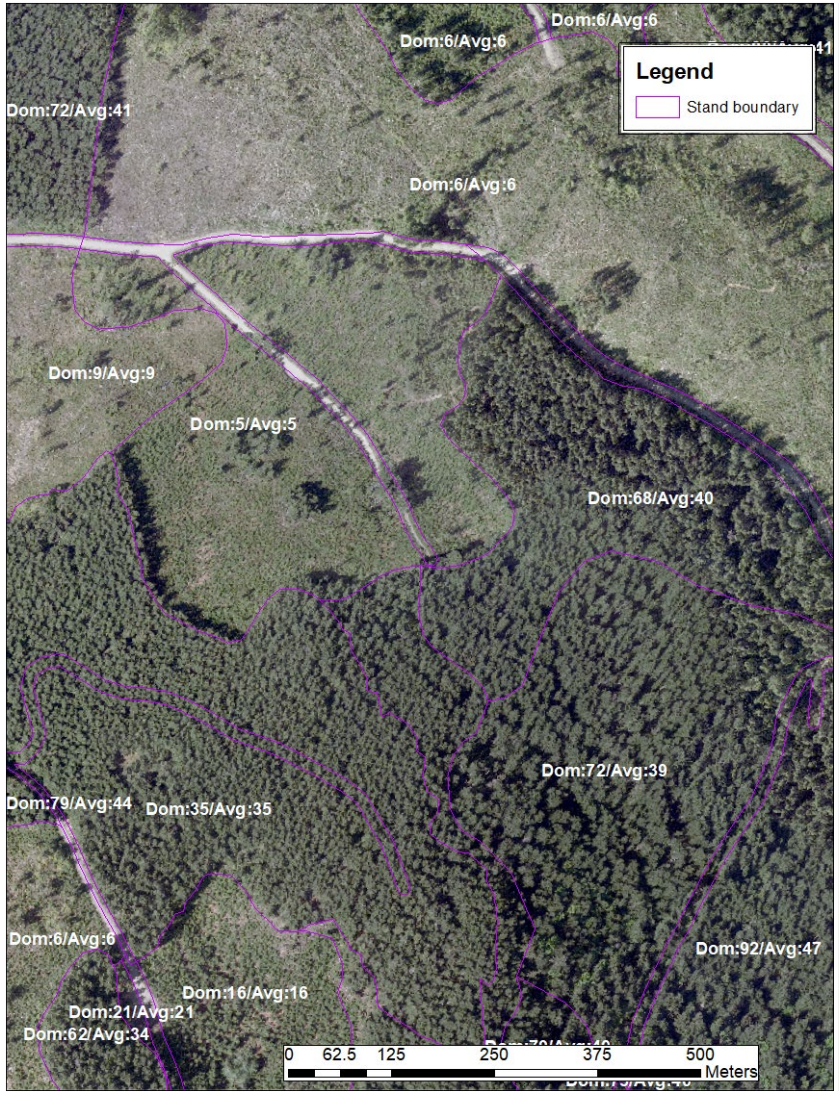
- Visually sensitive areas
- Roads and trails
- Protected and Culturally important areas

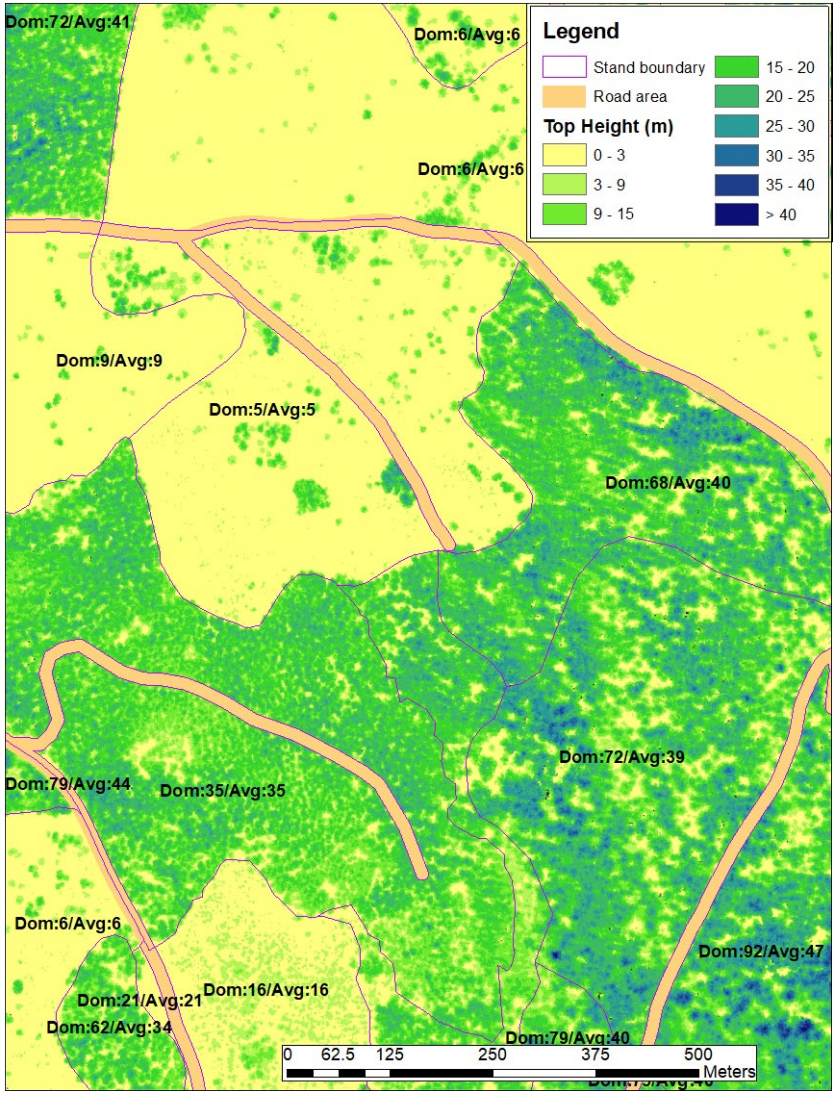


Evaluation and Development of Spatial Data Resources

Forest Vegetation Mapping

- Methods for verifying forest cover and estimating age
  - High resolution orthophotos
  - Laser-measured canopy height
  - Tree height is a good predictor of age



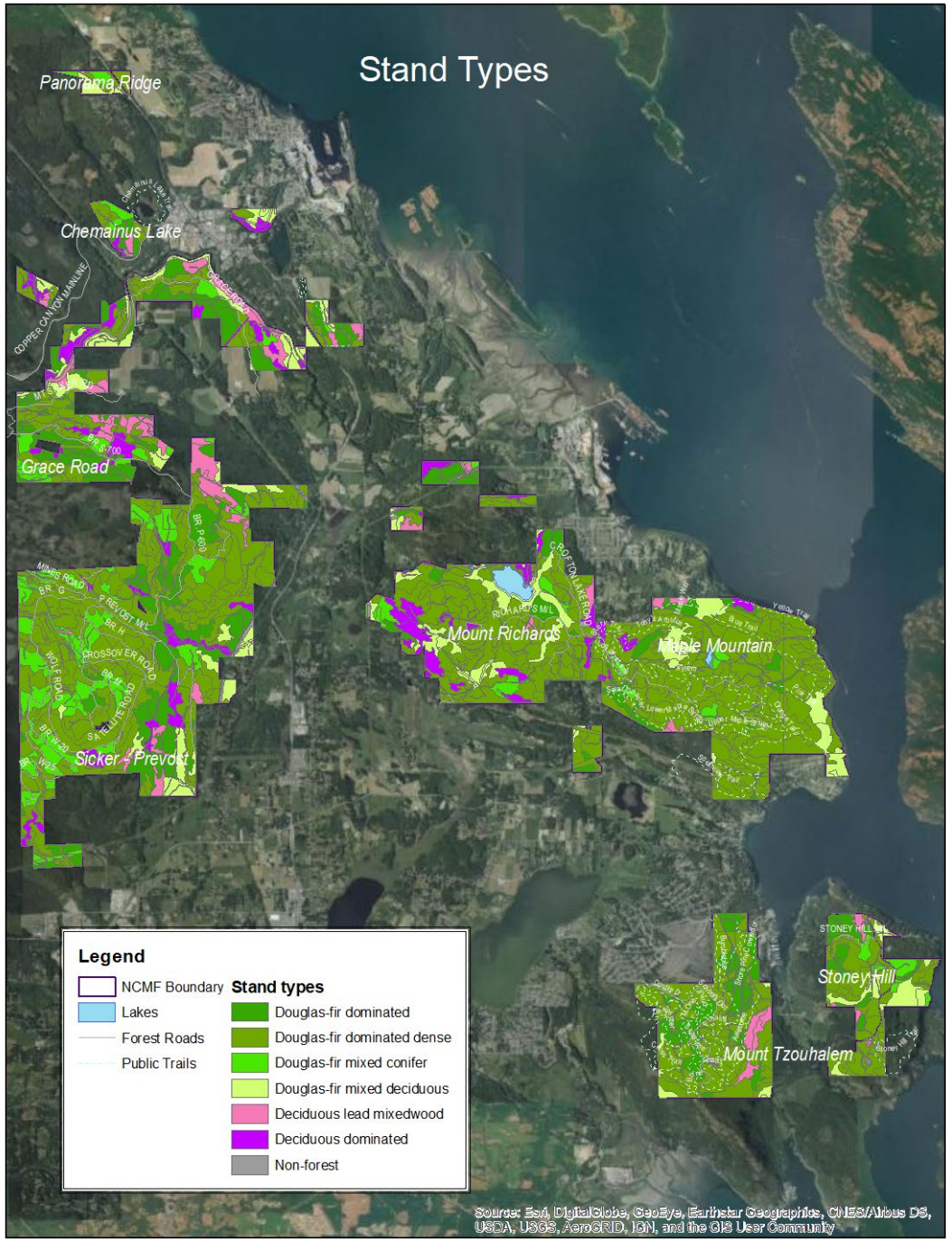


Evaluation and Development of Spatial Data Resources

Forest Vegetation Mapping

- Stand Age Class
- Age correlated with many stand features
  - Harvestable volume
  - Stand structure
  - Biomass and Carbon
  - Biodiversity

- Stand Types (species groups)



Multi-objective Scenario Analysis

Modelling Tools

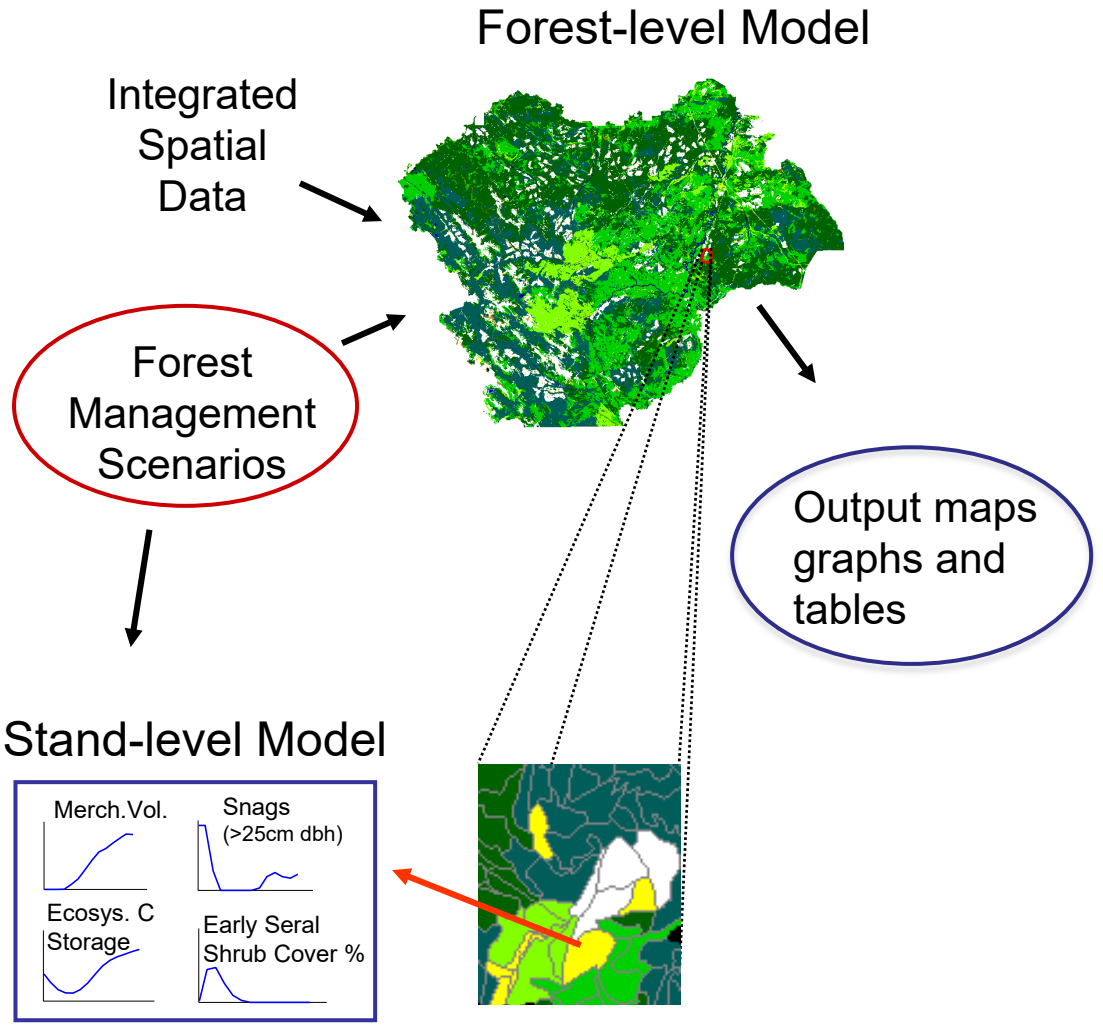
- Spatially explicit forest-level model (Forest Planning Studio -- FPS)
- Stand-level model (FORECAST)

Scenarios

1. Status Quo
2. Reduced Harvest
3. Active Conservation
4. Passive Conservation

Output

- Wide variety of descriptive variables at the stand and landscape level
- Used to evaluate impacts of management choices on selected C&I



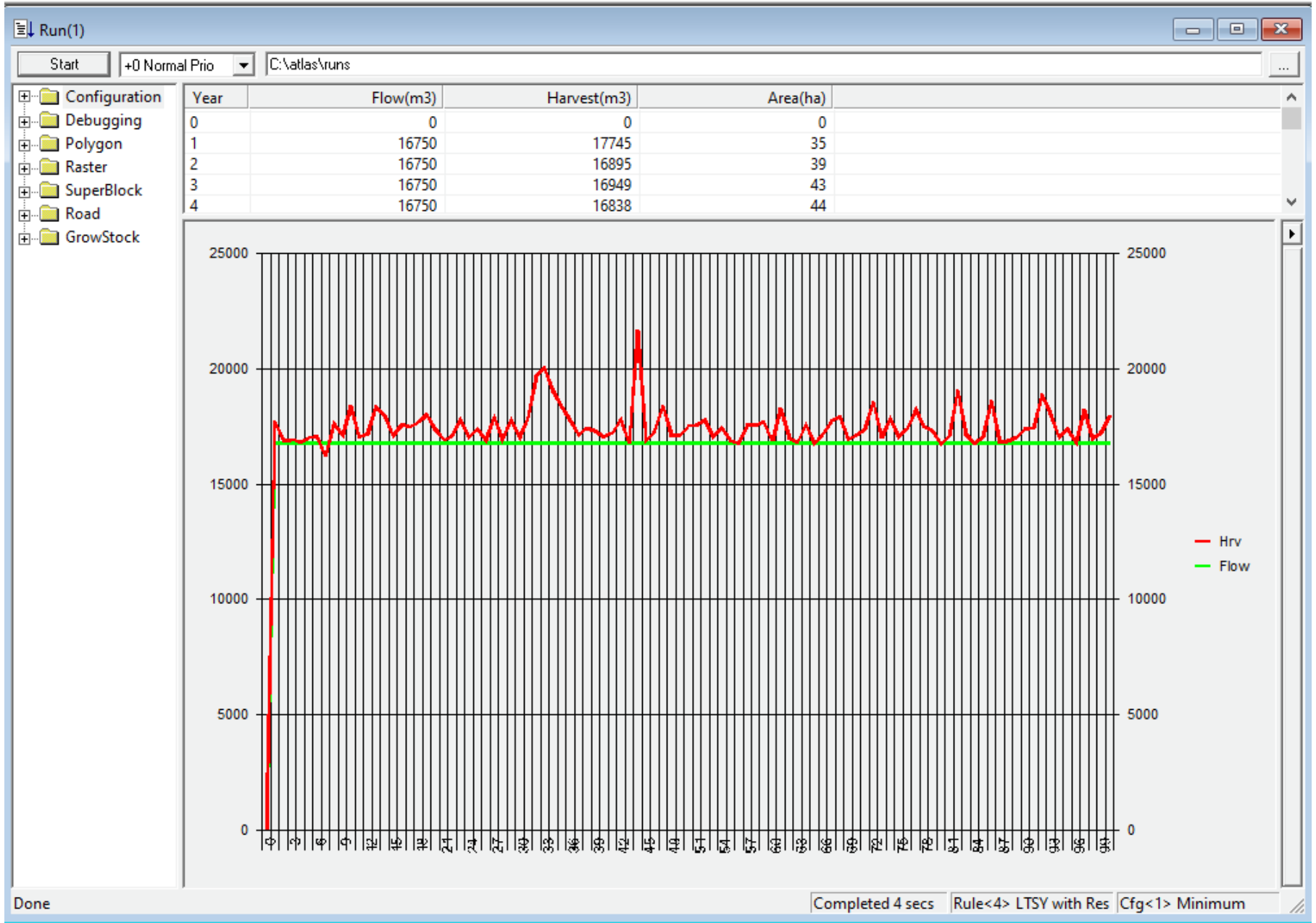
Scenario Descriptions

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	Status Quo	Reduced Harvest	Active Conservation	Passive Conservation
FPS Harvest Target (m3/yr)	16,750	6,750	Selected areas	None
Actual Avg Harvest (m3/yr)	17,509	7,421	1300	0
Actual Avg Area Harvest (ha/yr)	43.7	20.3	3.9	0
Preserve Ret(%) (E. Maple Mtn)	100	100	100	100
General THLB Block Retention (%)	15	35	na	na
Selective thinning to promote development of old forest features (% ret)	na	na	65	na
Woodland restoration (% ret)	na	na	45	na
VQO Retention Areas (% actual retention)	55	**80**	100	100
VQO Partial Retention Areas (% actual retention)	35	**50**	100	100

Scenario Simulation: FPS - Scenario 1: Status Quo

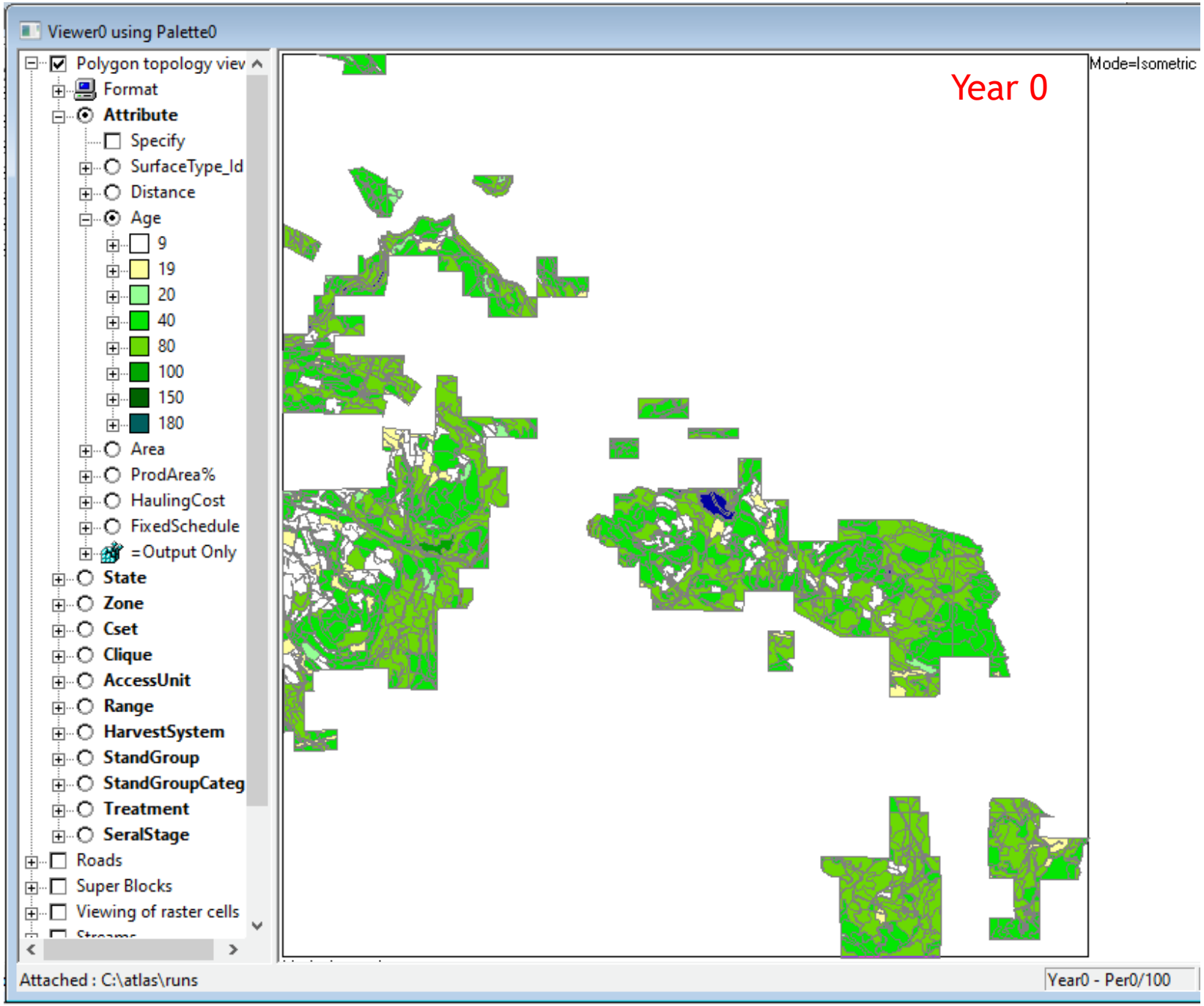
Key Features:

- 17,500 m3/yr flow target
- Sorts eligible stands based on oldest first
- Min 15% in-block retention
- Increased retention in VQO areas
- In-block retention areas tracked separately
- Regenerates as same stand type after harvest
- Standard netdown



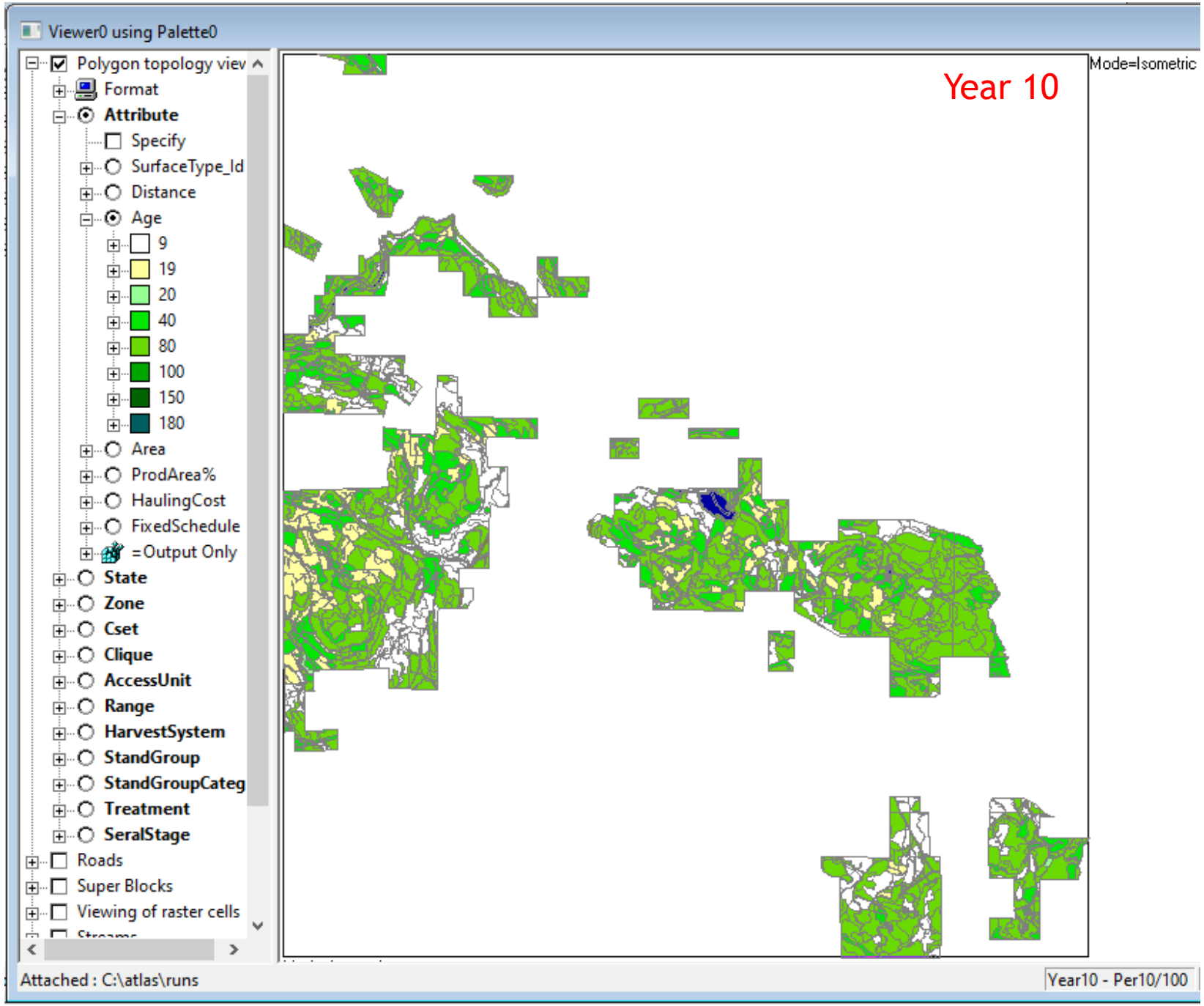
Scenario Simulation: FPS

Scenario 1: Status Quo



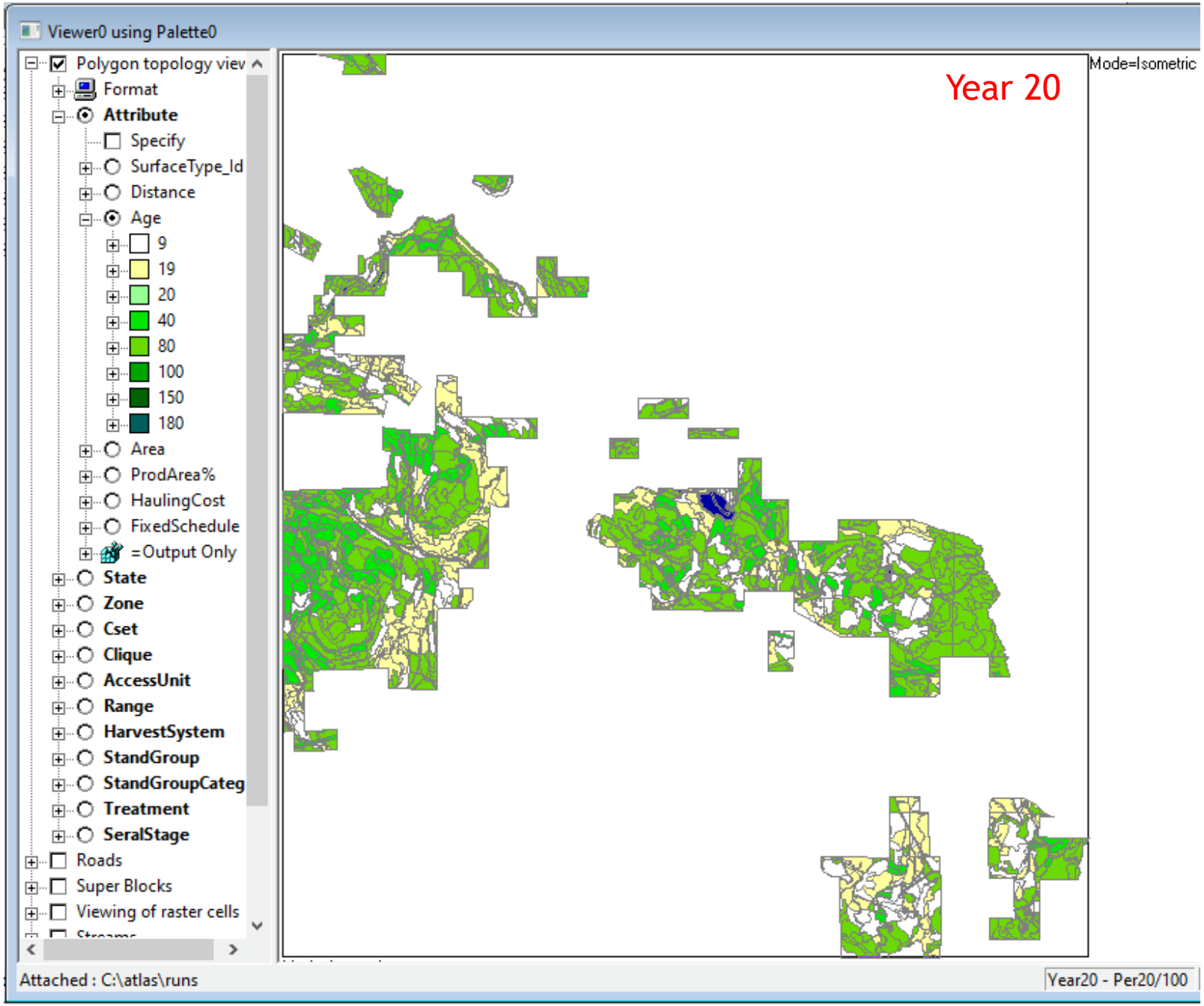
Scenario Simulation: FPS

Scenario 1: Status Quo



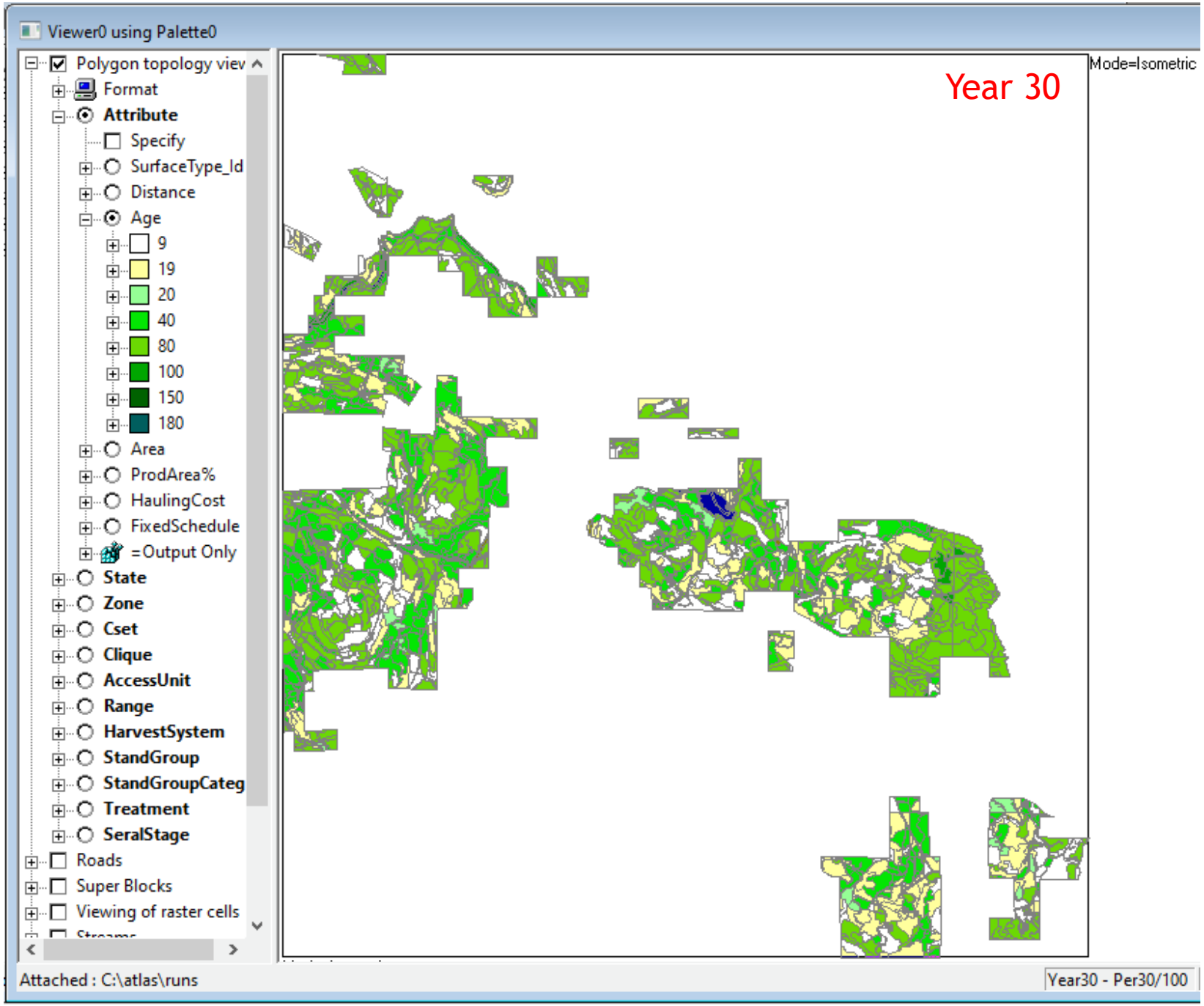
Scenario Simulation: FPS

Scenario 1: Status Quo



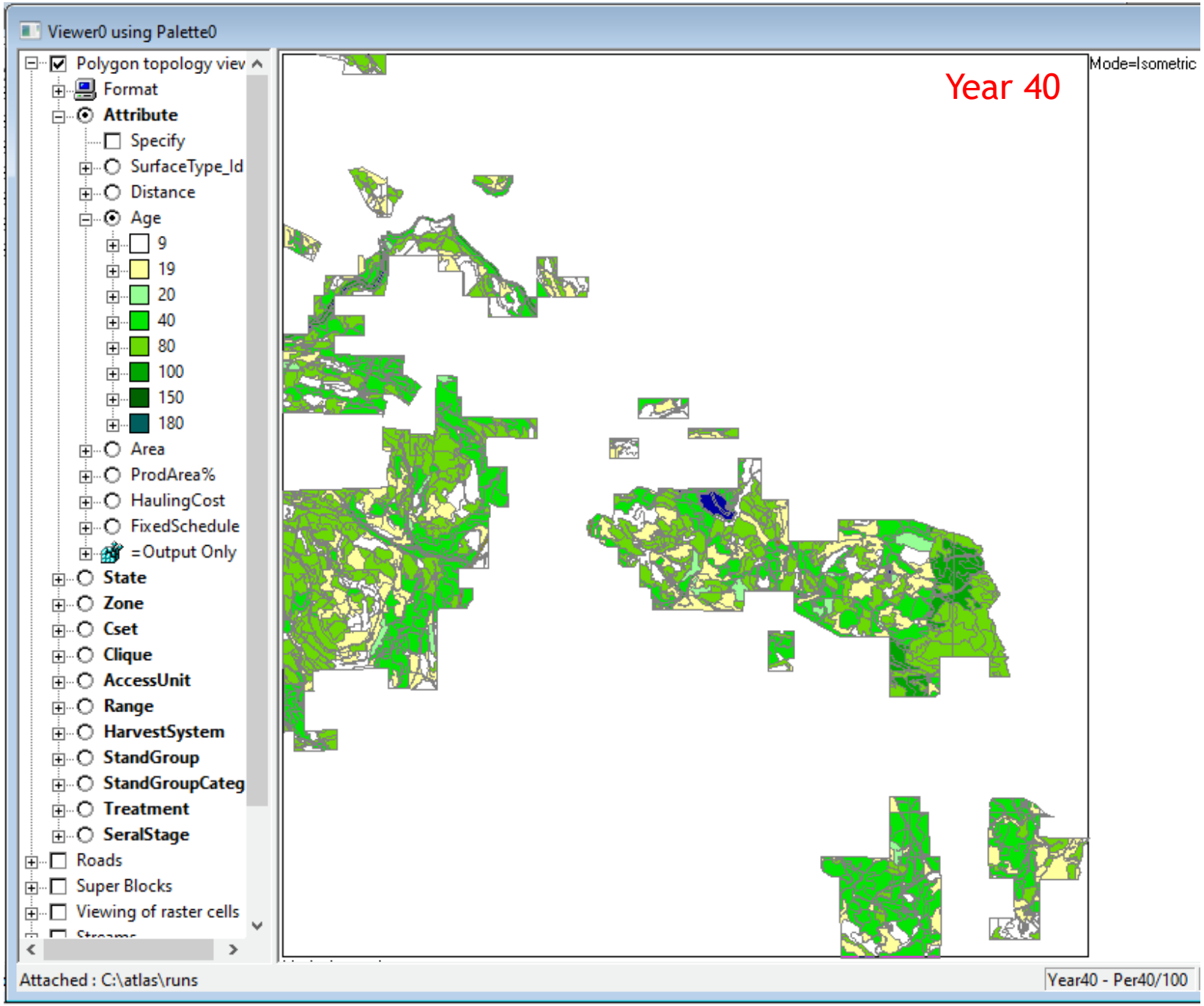
Scenario Simulation: FPS

Scenario 1: Status Quo



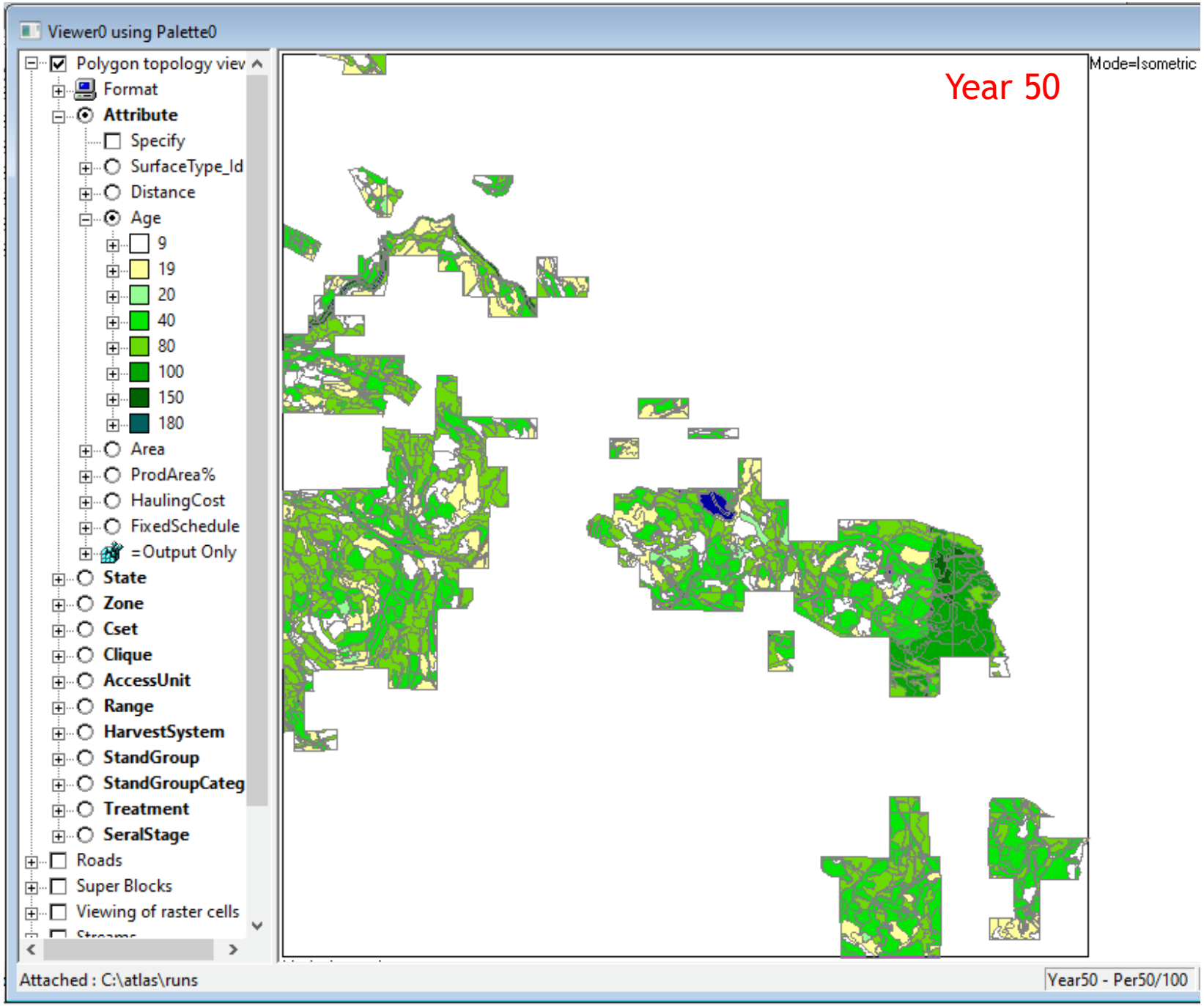
Scenario Simulation: FPS

Scenario 1: Status Quo



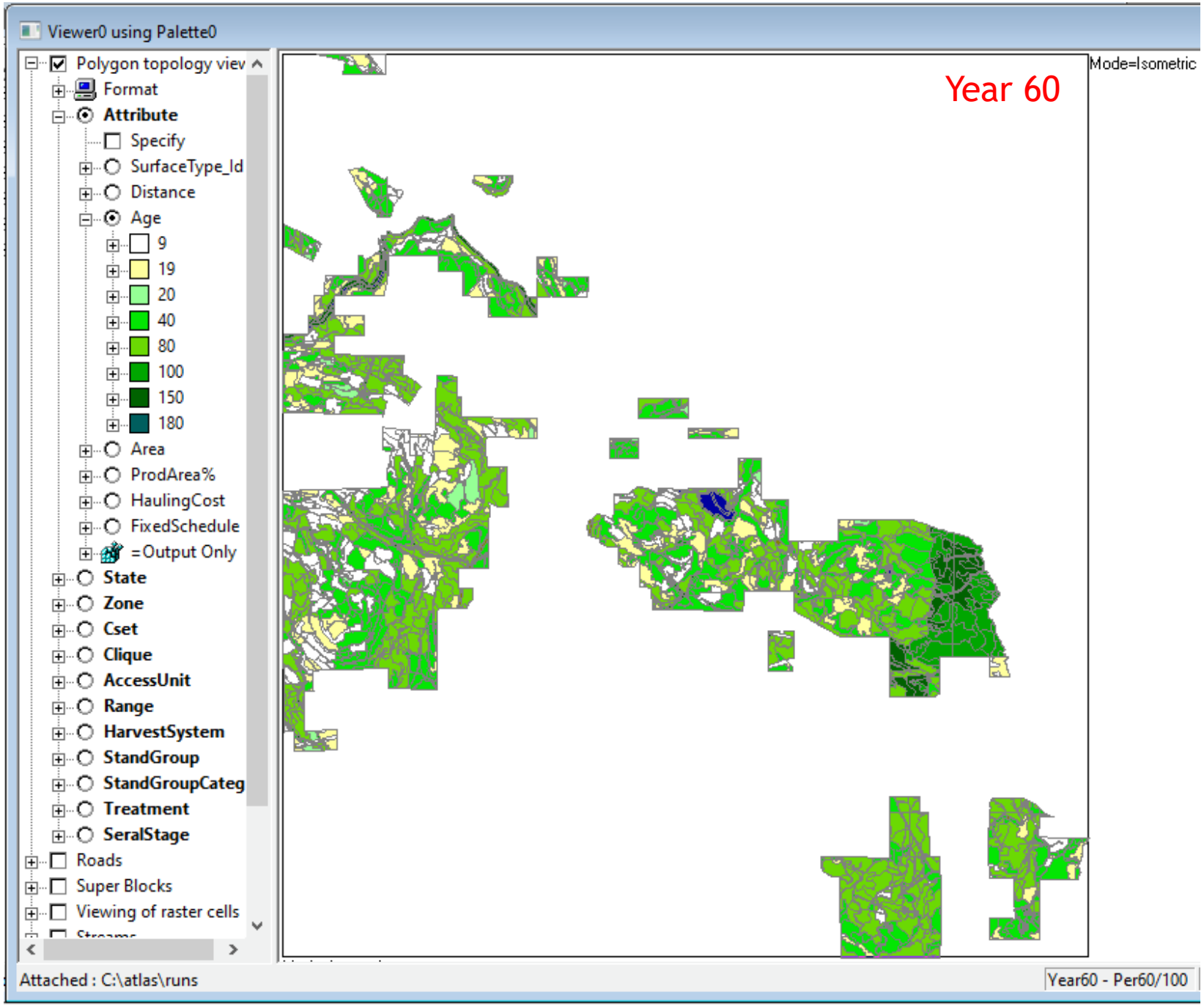
Scenario Simulation: FPS

Scenario 1: Status Quo



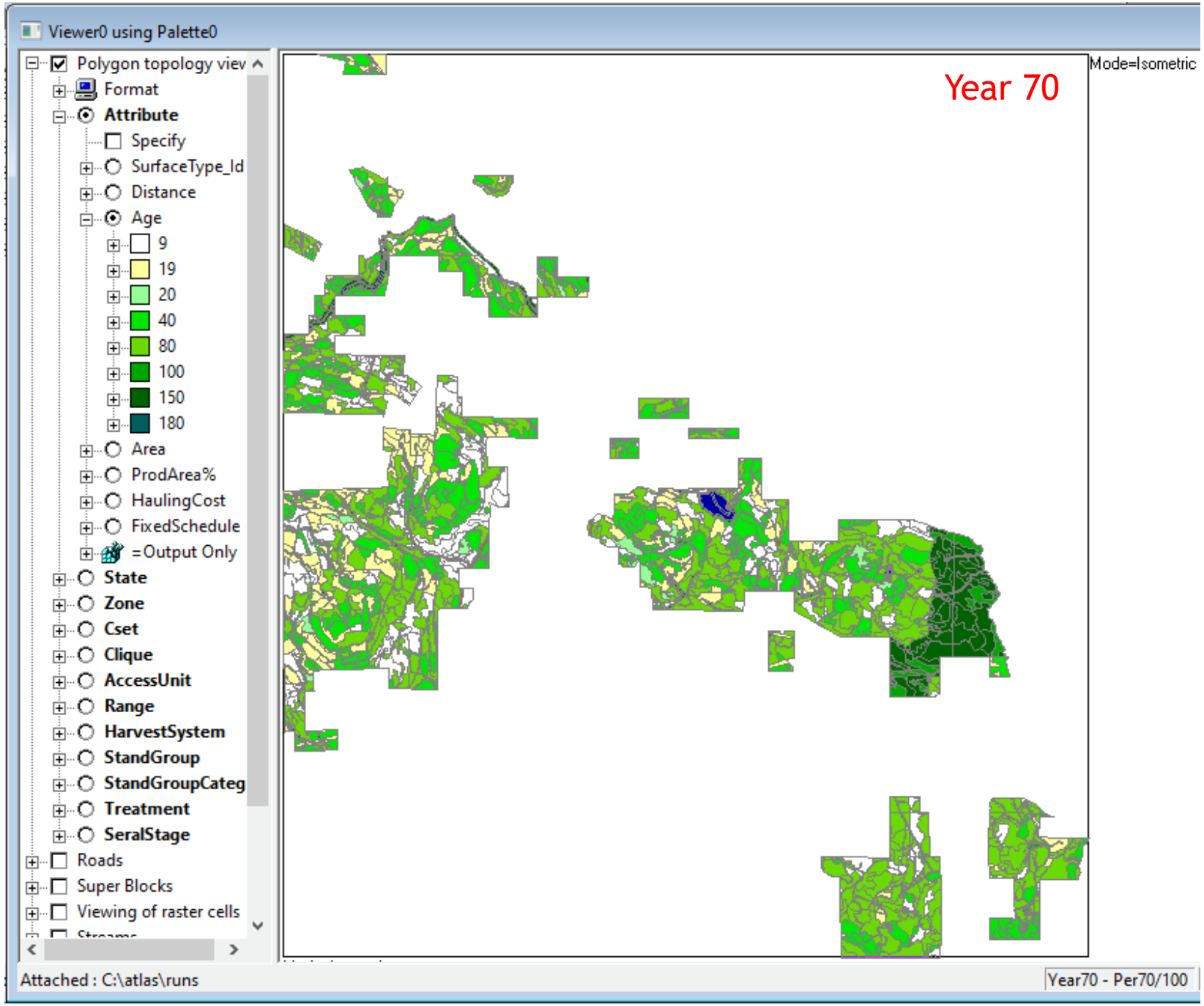
Scenario Simulation: FPS

Scenario 1: Status Quo



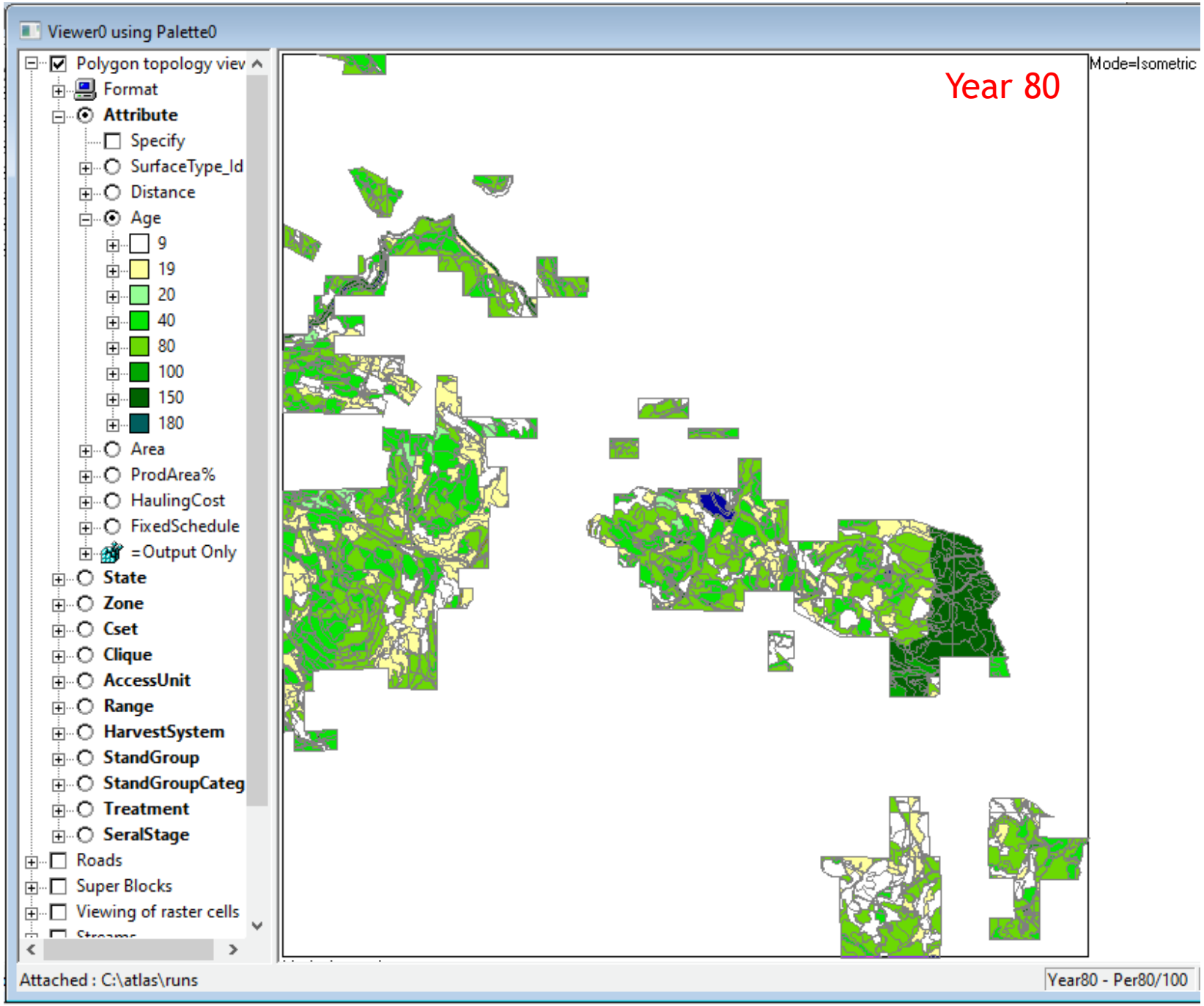
Scenario Simulation: FPS

Scenario 1: Status Quo



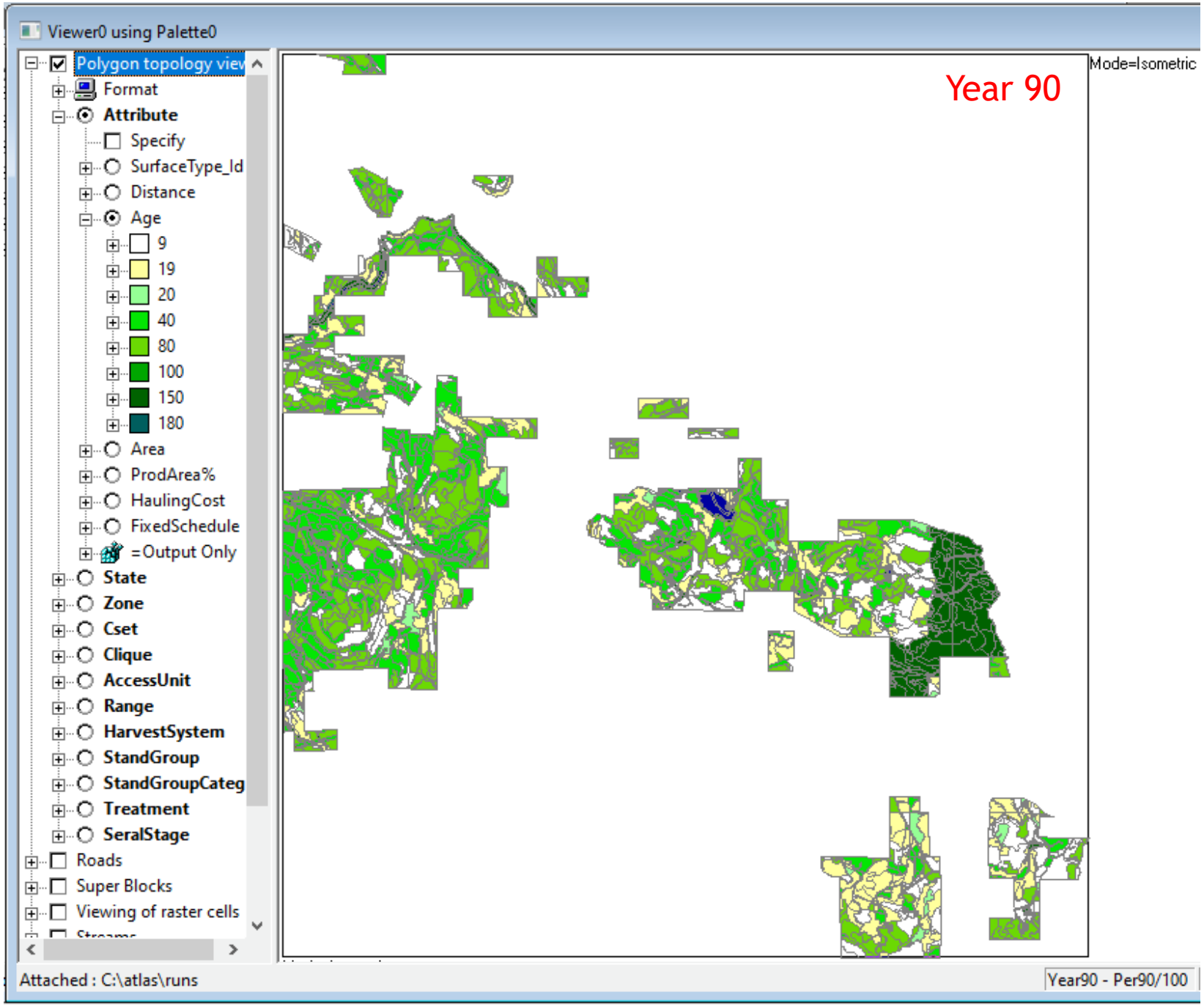
Scenario Simulation: FPS

Scenario 1: Status Quo



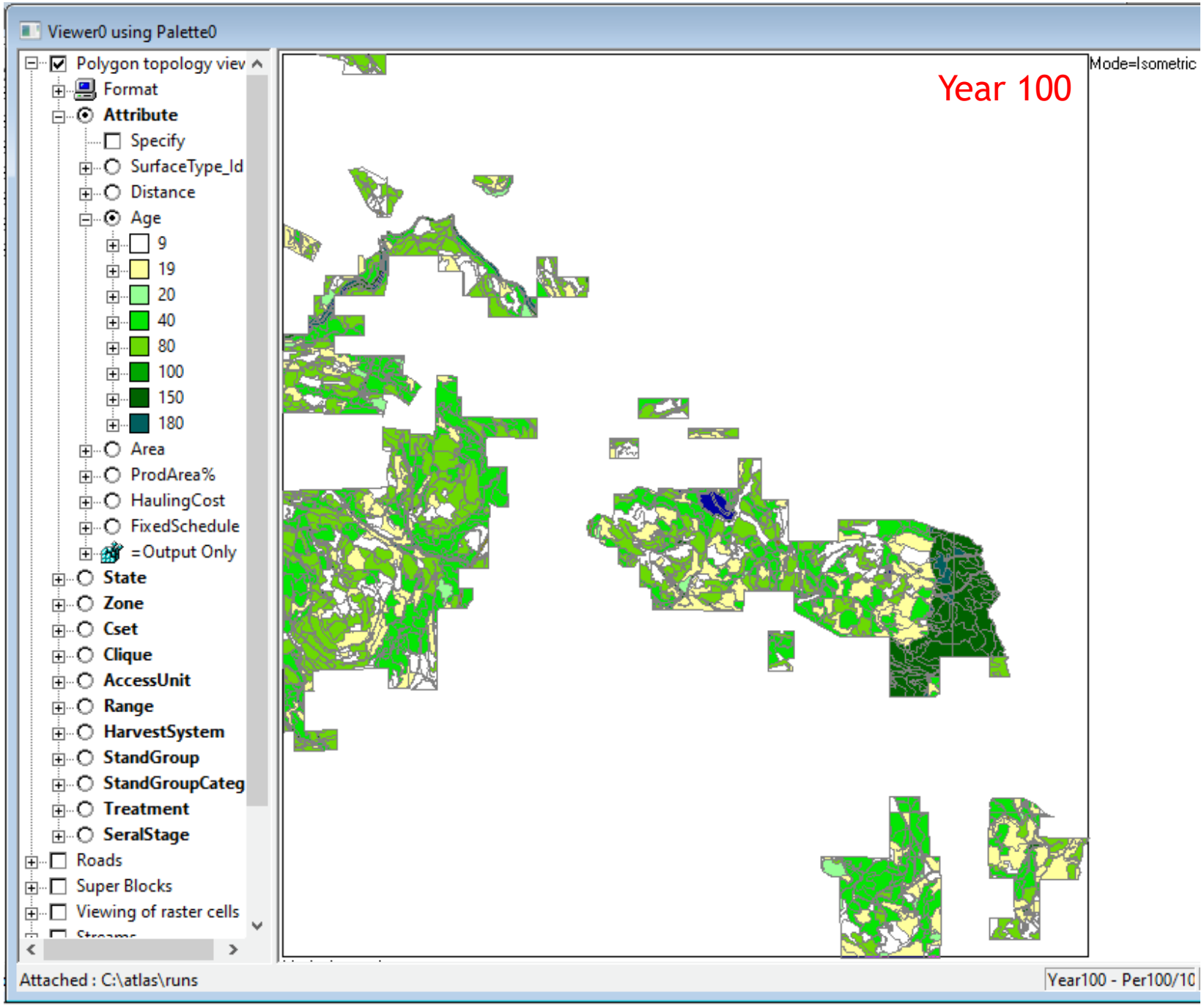
Scenario Simulation: FPS

Scenario 1: Status Quo



Scenario Simulation: FPS

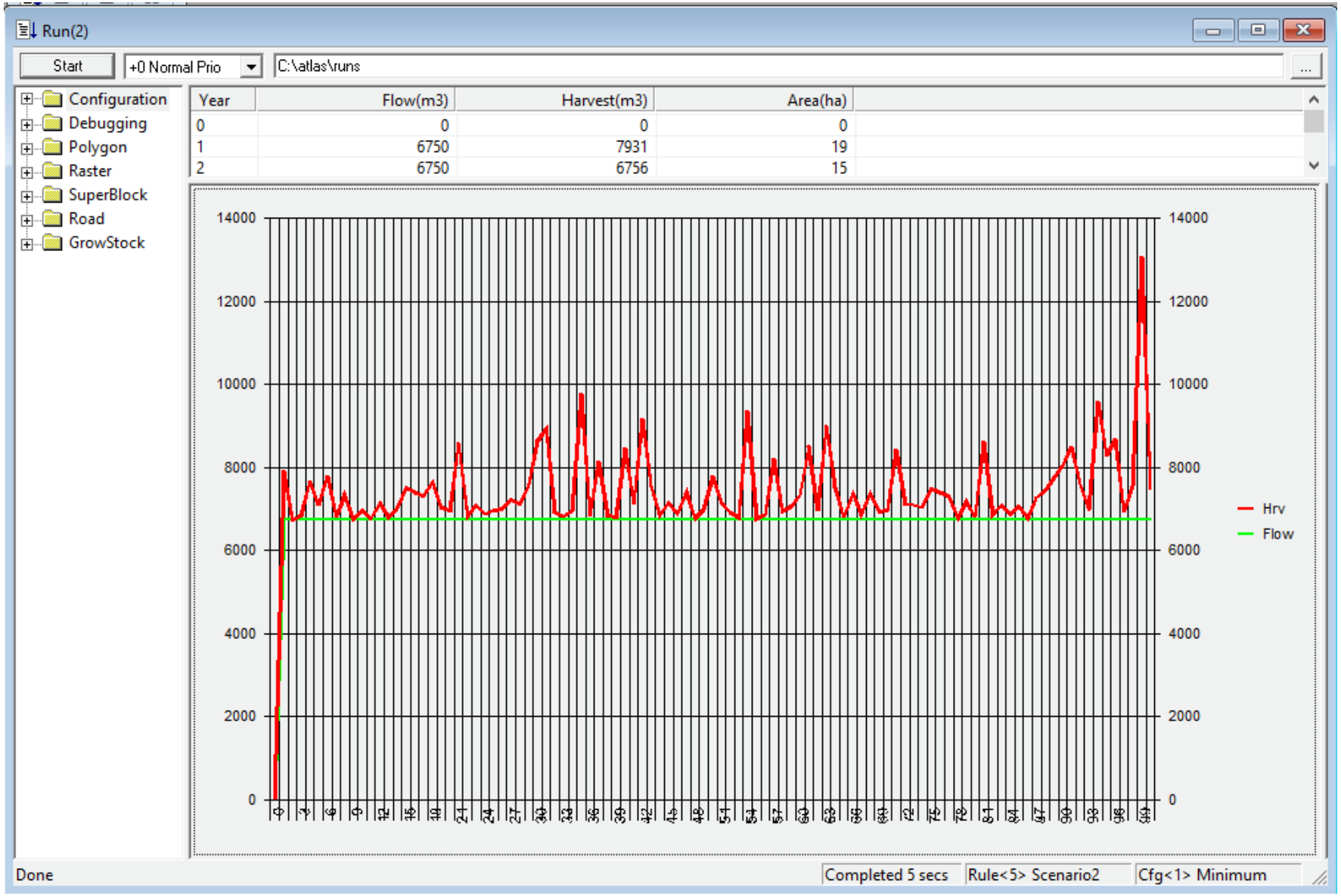
Scenario 1: Status Quo



Scenario Simulation: FPS - Scenario 2: Rduced Harvest

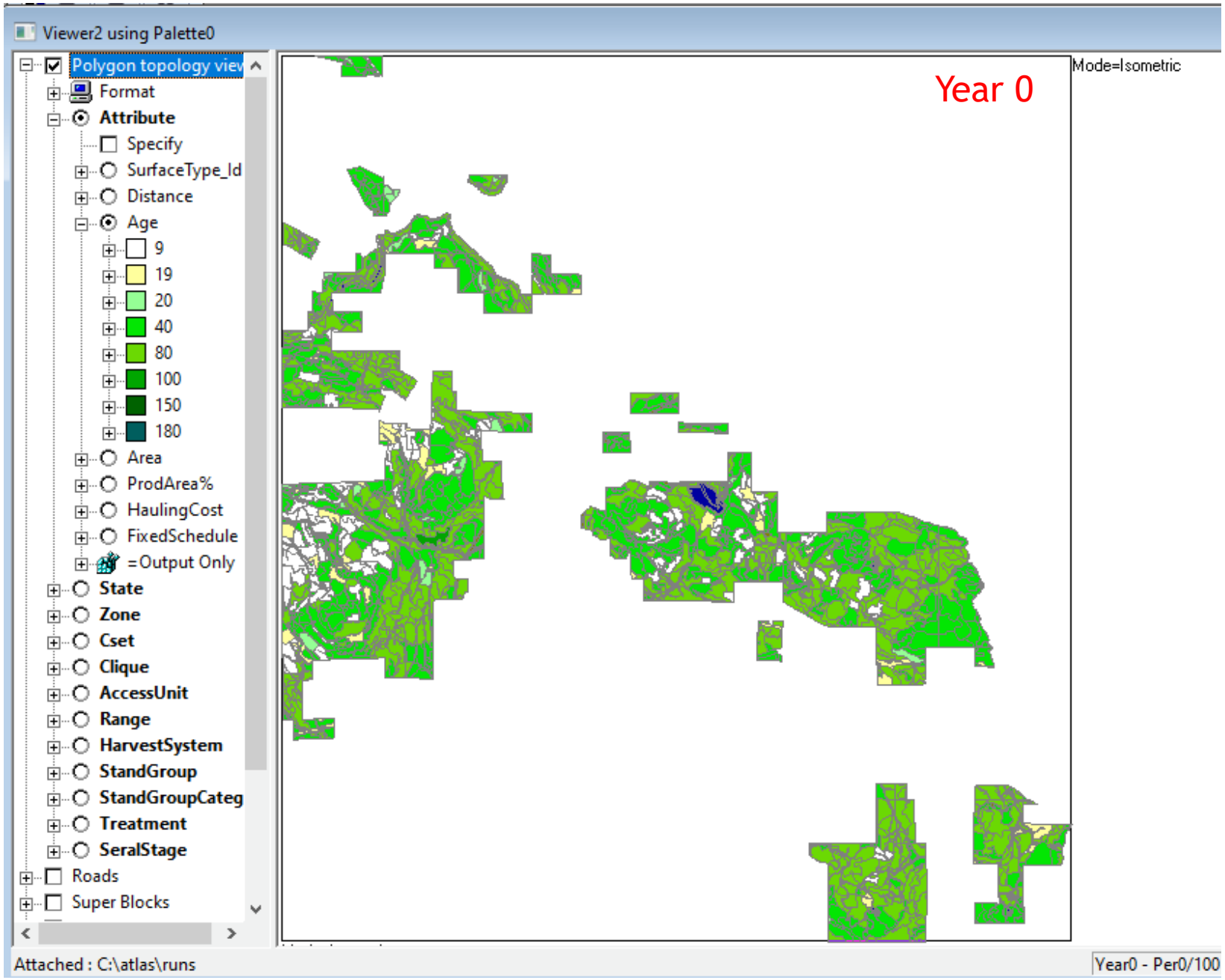
Key Features:

- 7,400 m3/yr flow target (~ 40% of Status Quo)
- Sorts eligible stands randomly
- Small openings / variable retention
- Minimum 35% in-block retention
- Increased harvest costs per unit/m3



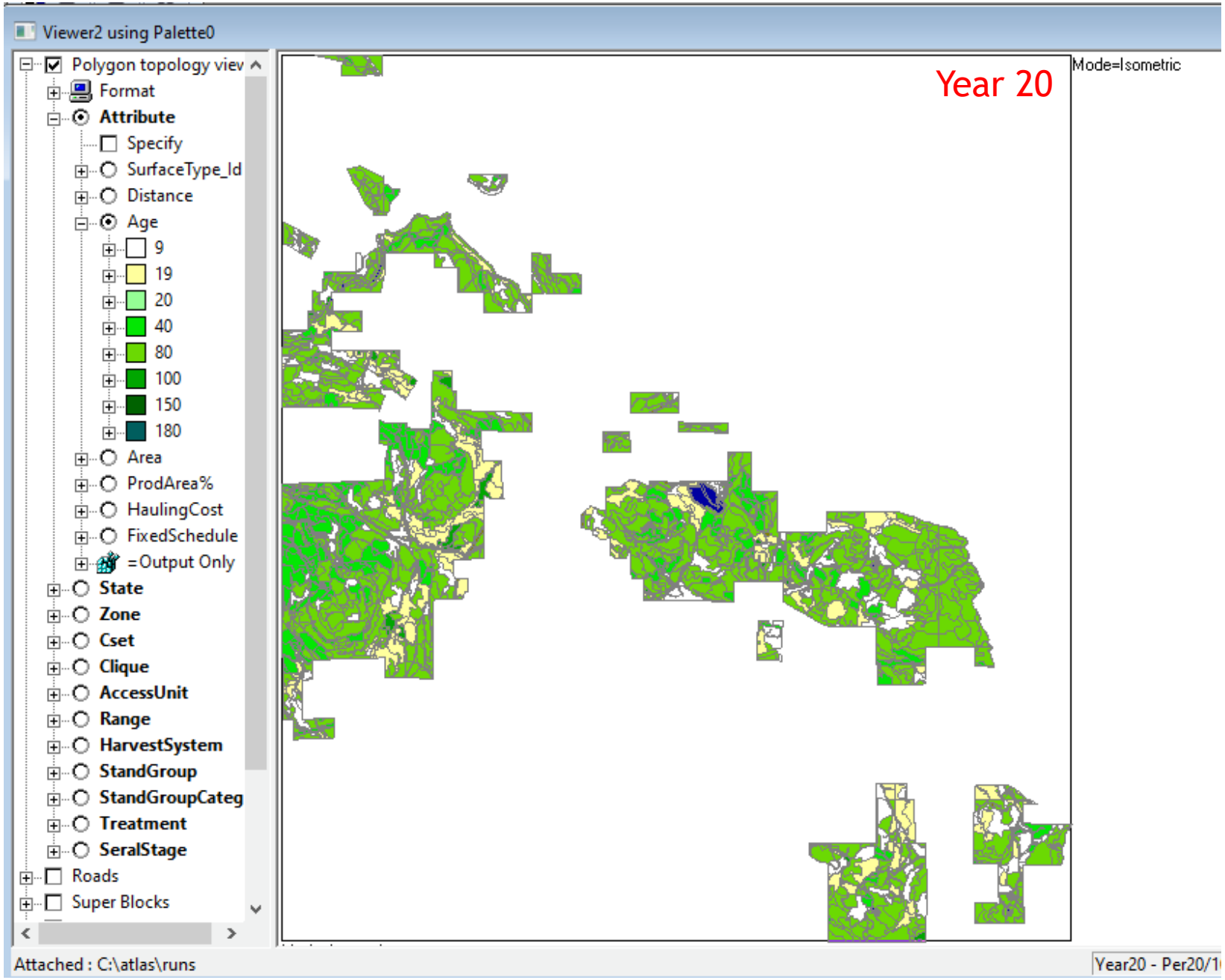
Scenario Simulation: FPS

Scenario 2: Reduced Harvest



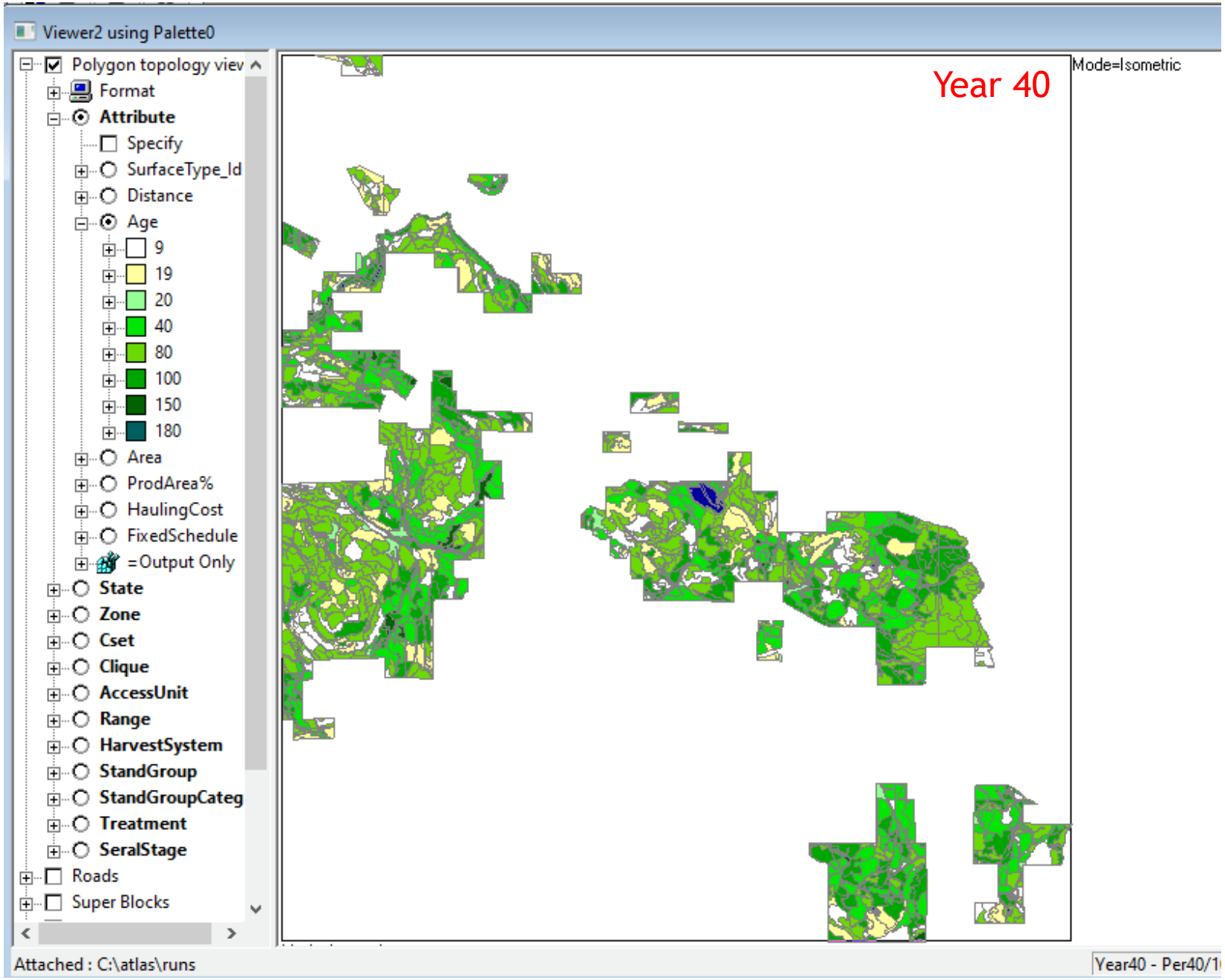
Scenario Simulation: FPS

Scenario 2: Reduced Harvest



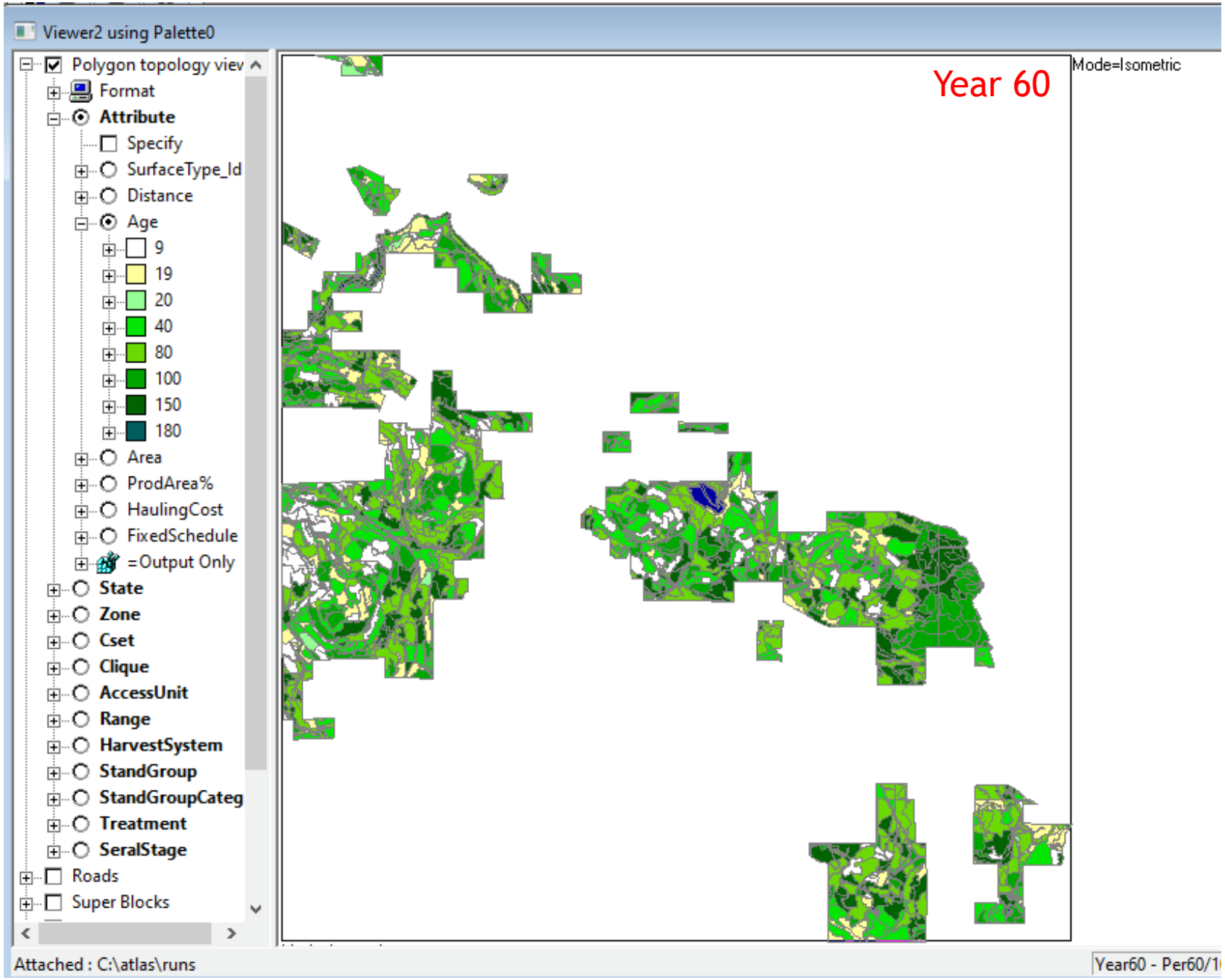
Scenario Simulation: FPS

Scenario 2: Reduced Harvest



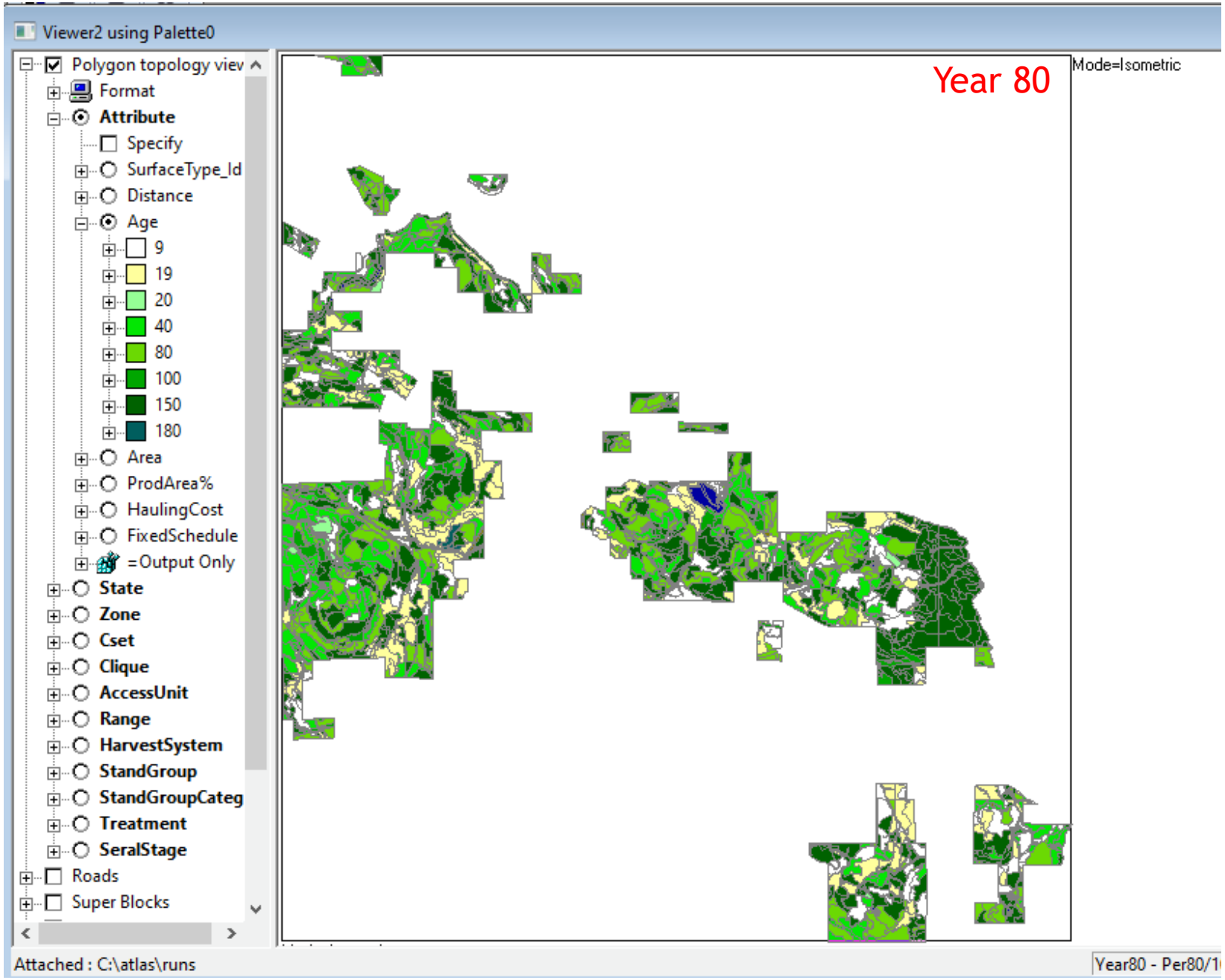
Scenario Simulation: FPS

Scenario 2: Reduced Harvest



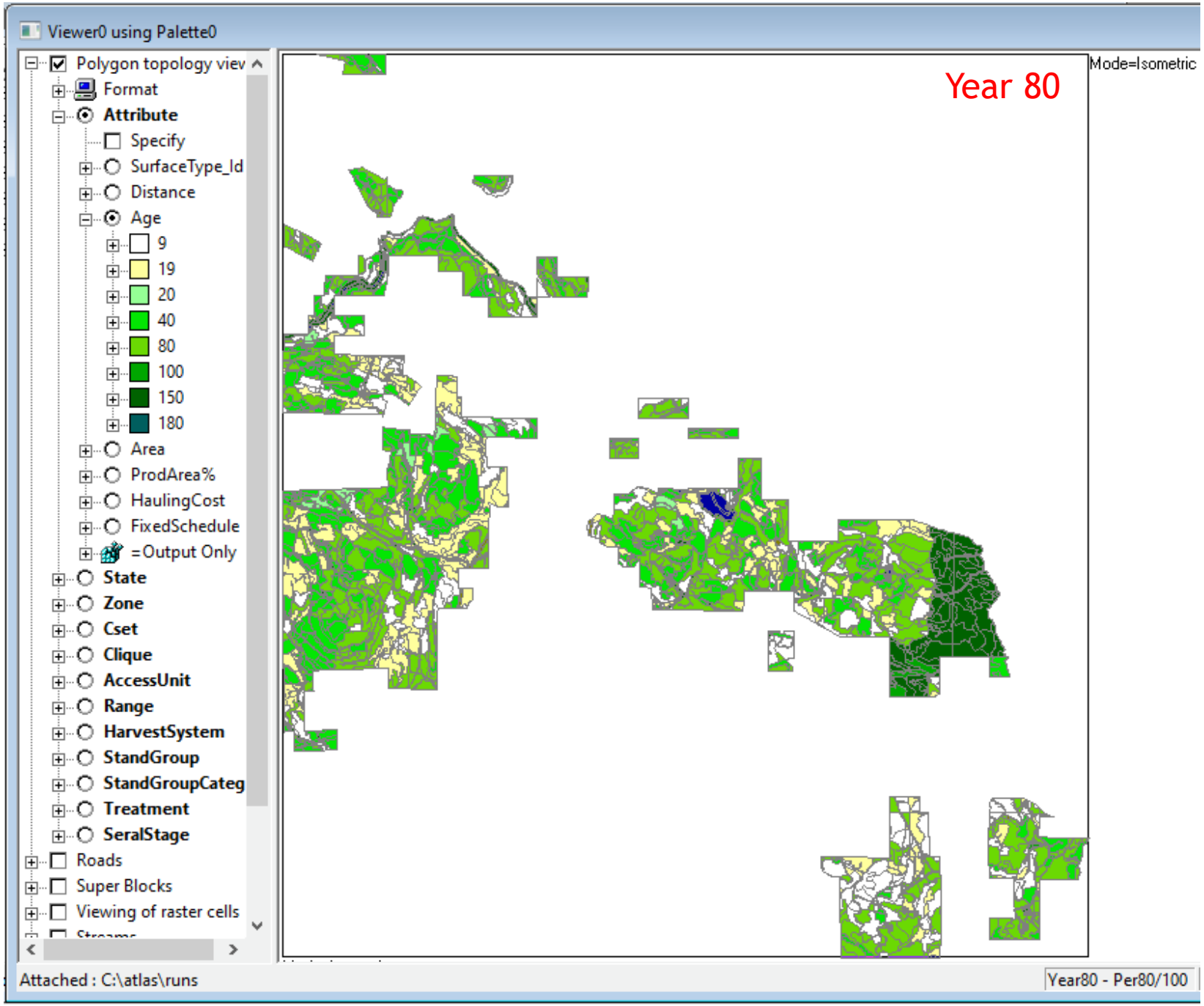
Scenario Simulation: FPS

Scenario 2: Reduced Harvest



Scenario Simulation: FPS

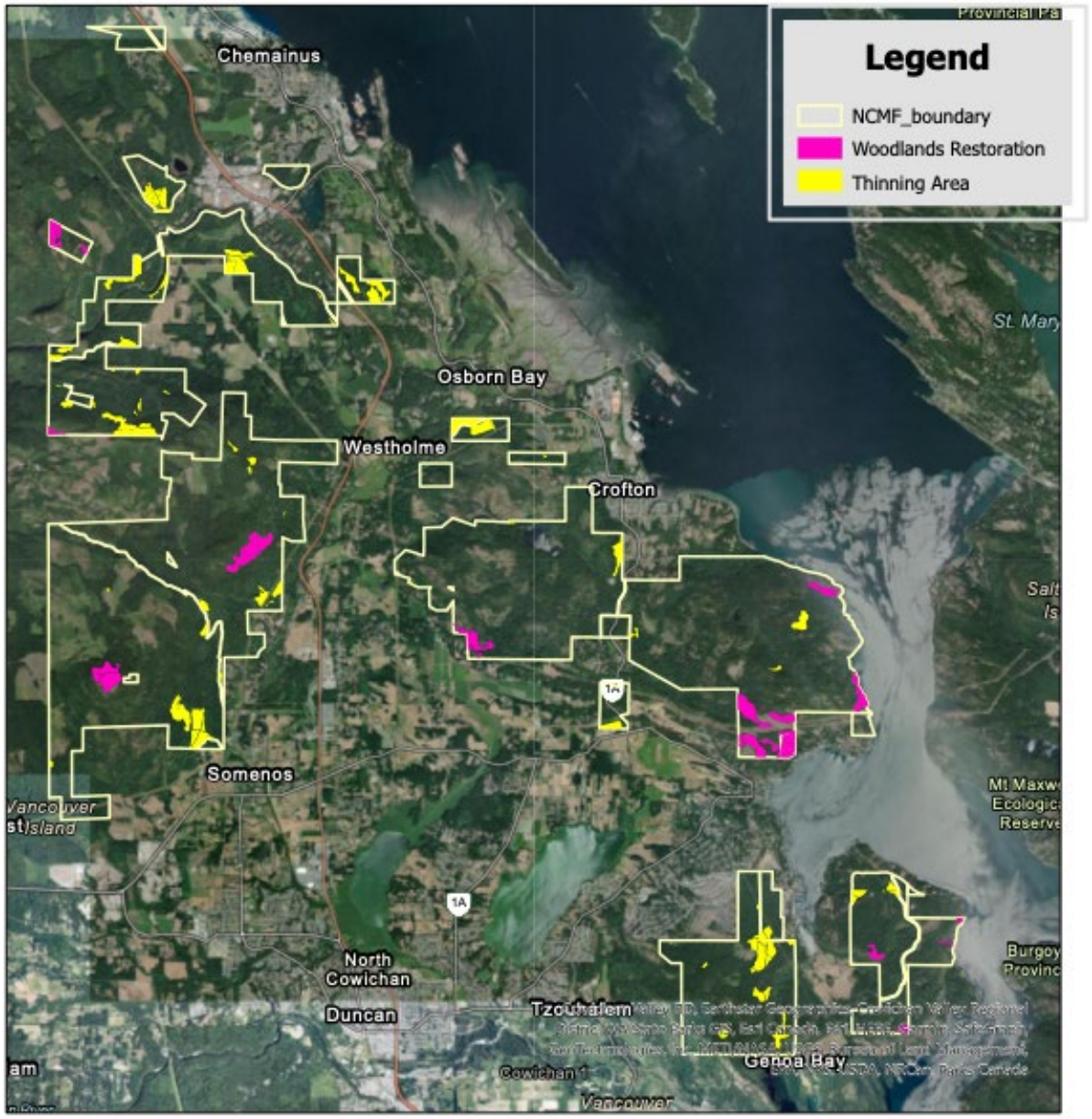
Scenario 1: Status Quo



Scenario Simulation: FPS - Scenario 3: Active Conservation

Key Features:

- Remove conifers from selected woodlands areas
- Thinning dense 40-60 yr old Fd stands to promote development of old stand features
- Increased harvest costs per unit/m3
- Reduced value of harvested volume relative to Scenarios 1&2
- Roughly 4ha treated per yr for first 30 years
- ~ 1,300 m3 per yr harvested for firsth 30 years then 0



Scenario Simulation: FPS - Scenario 4: Passive Conservation

Key Features:

- Only fire smart activity included
- Only harvest would be related to windthrow or other disturbance where safety is an issue

Evaluating Outcomes of Scenarios

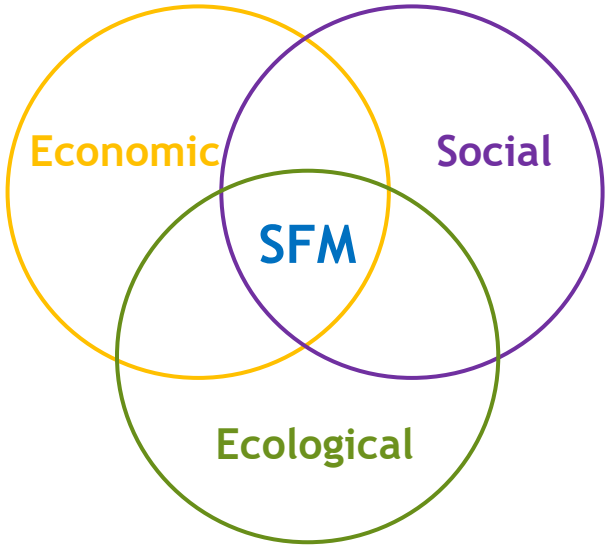
Criteria and Indicators

- Criteria used to define specific services and values associated with forest resource
- Indicators used to evaluate degree to which specific criteria have been achieved

Notes

- Developed with input from public engagement
- Evaluated using model ouput and past experience

Sustainable Forest Management (SFM)



Evaluating Outcomes of Scenarios

Economic Indicators

Criterion	Indicator
2.1 Timber Revenue	2.1.1 Total annual harvested volume (m3) 2.1.2 Estimated net revenue after accounting for expenses ($)
2.2 Carbon Revenue	2.2.1 Estimated annual revenue from C credit sales ($)
2.3 Recreation Revenue	2.3.1 Estimated annual revenue from recreation ($) - Not able to distinguish among scenarios

Evaluating Outcomes of Scenarios

Ecological Indicators

Criterion	Indicator
1.1 Sensitive Ecosystems	1.1.1 Area of sensitive ecosystems (SEI) impacted by harvest (ha or %)
1.2 Protection/Enhancement of Mature & Old Forest and Associated Bird Habitat	1.2.1 Recruitment of old forest (ha) 1.2.2 Quantification of bird habitat by species or groups (ha)
1.3 Ecosystem Carbon Storage / Emissions	1.3.1 Total ecosystem C storage within the Municipal Forest (MT C) 1.3.2 Quantification of net CO2 emissions (reductions) associated with forest management (t CO2e)
1.4 Water Services	1.4.1 Total disturbed area in key watersheds (ha or %)
1.5 Regional Habitat Connectivity	1.5.1 Mature forest habitat connectivity analysis incorporating adjacent forest areas (calculated index)

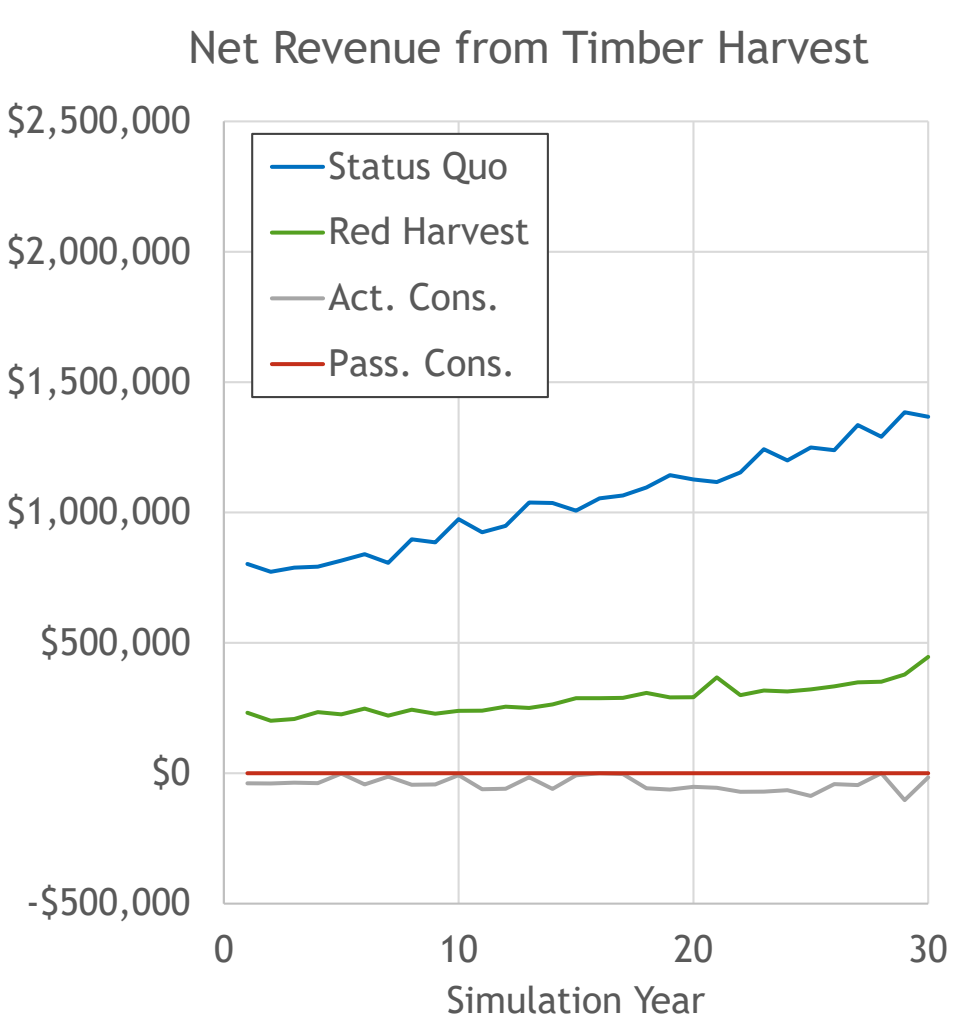
Evaluating Outcomes of Scenarios

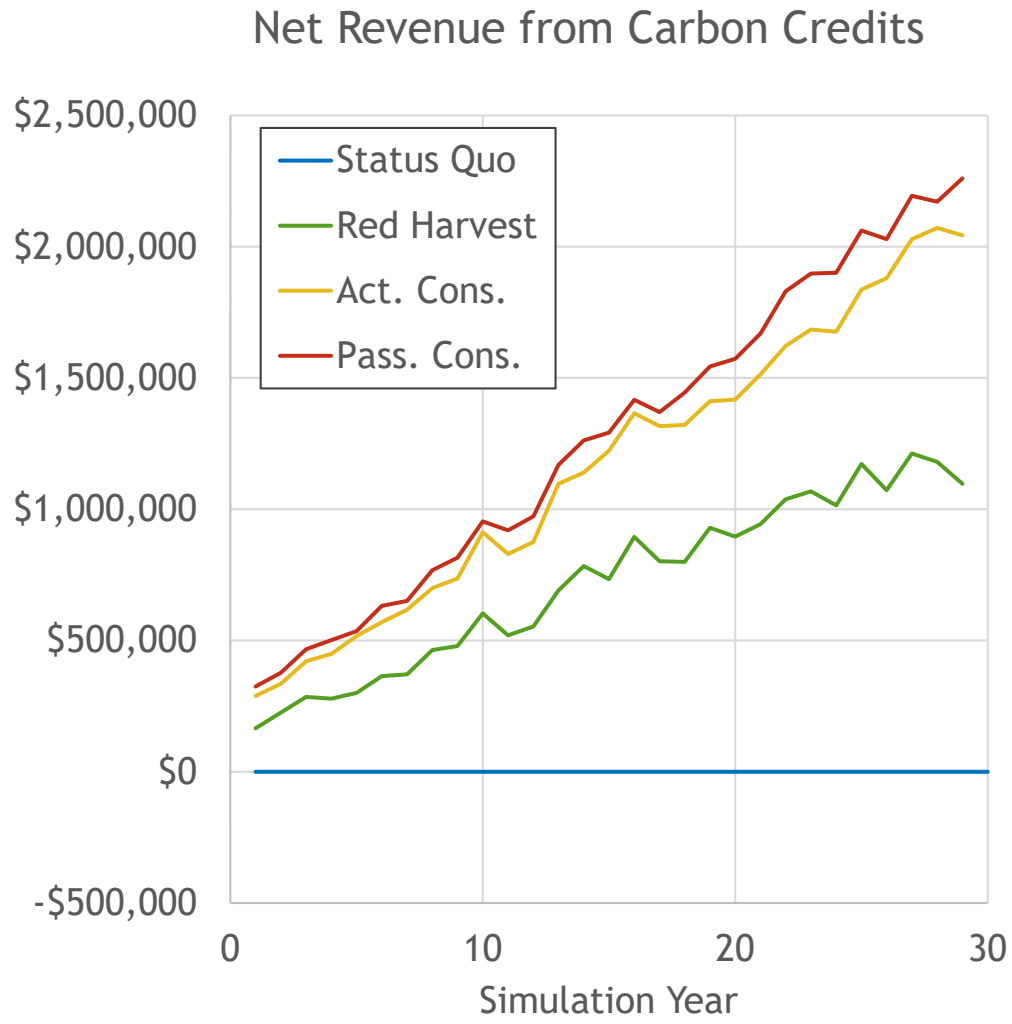
Social Indicators

Criterion	Indicator
3.1 Visual Quality	3.1.1 Degree to which visual quality objectives are met (%)
3.2 Wilderness Recreation	3.2.1 Disturbed area surrounding (200m buffer) sanctioned trail network (%)
3.3 Trail Access	3.3.1 Not able to distinguish among scenarios
3.4 Fire Risk	3.4.1 Area with different fire risk rankings (%)

Evaluating Outcomes of Scenarios: Results

Economic Indicators: Timber vs. Carbon Revenue





Evaluating Outcomes of Scenarios: Results

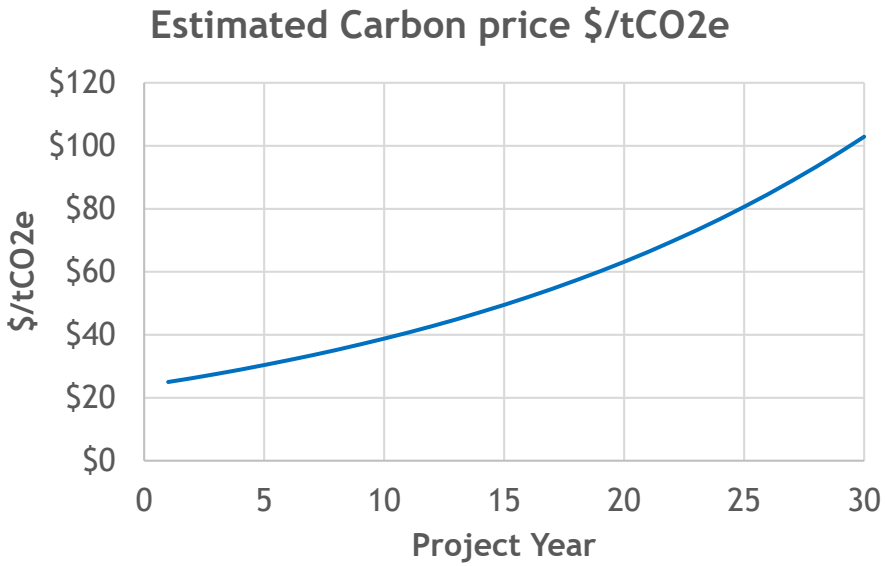
Economic Indicators: Timber vs. Carbon Revenue

Timber assumptions

Scenario	Cost $/m3	Price $/m3	Net $/m3
1	$44	$90	$46
2	$60	$90	$30
3	$80	$56	-$24
4	$0	$0	$0

- Assumes 2% increase in net timber value per year

Carbon assumptions



- Assumes 5% annual increase in carbon price
- Includes startup cost of $175,000
- Annual maintenance of $20,000

Evaluating Outcomes of Scenarios: Results

Ecological Indicators:

Sensitive Ecosystem Areas Impacted by harvest (1.1.1)

Scenario	SEI Area with nearby harvest (ha)*
Status Quo	399.5
Reduced Harvest	152.5
Active Conseravation	0.0
Passive Conservation	0.0

* Any polygon with >= 25% SEI

Disturbed Area in key watersheds* (1.5.1)

Scenario	Average hydrologically disturbded (ha)**
Status Quo	333.8 (15%)
Reduced Harvest	171.8 (8%)
Active Conseravation	11.0 (1%)
Passive Conservation	0.0 (0%)

* Based on average disturbed area (Includes Chemainus and Bonsall)
** Assumes it takes 30yrs to recover hydrologically following harvest

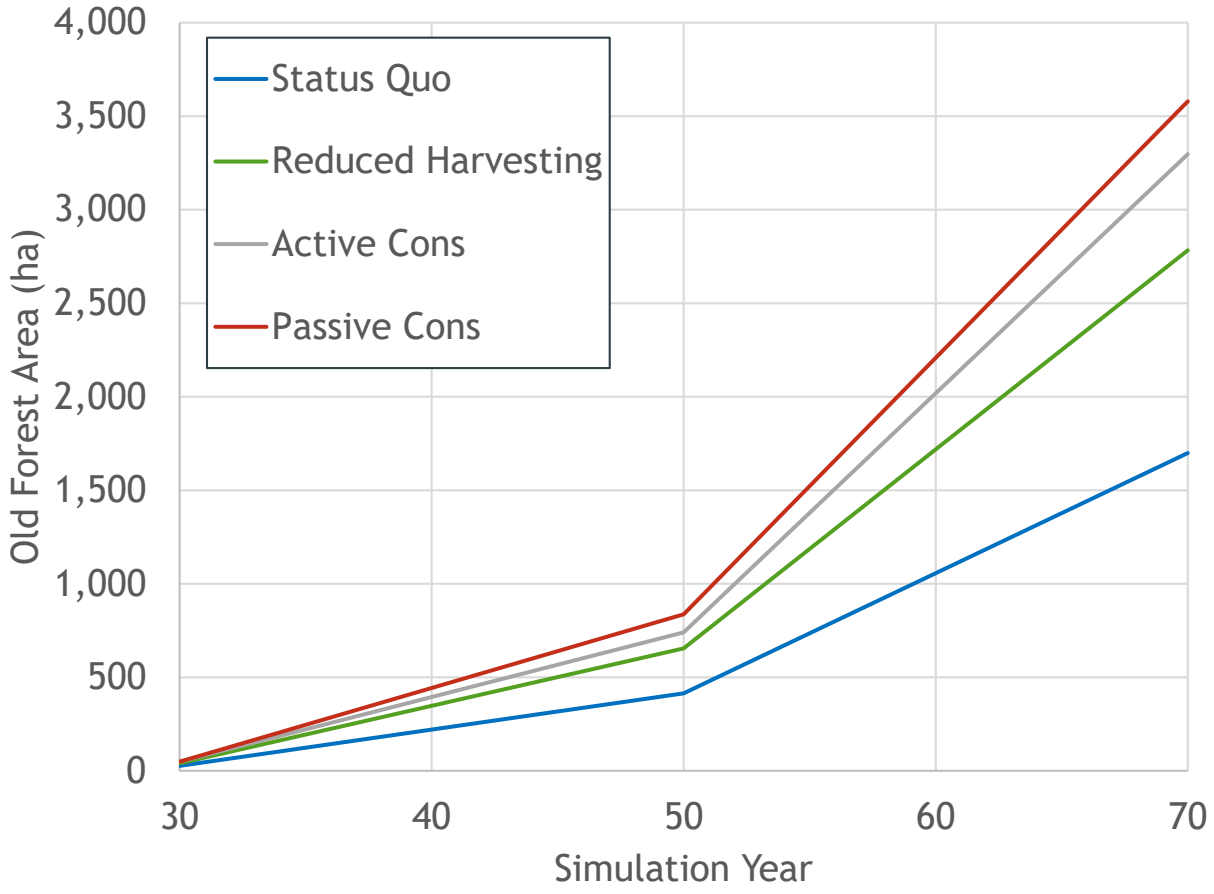
Evaluating Outcomes of Scenarios: Results

Ecological Indicators:

Recruitment of old forest (1.2.1)

Scenario	Rate of increase in forest > 100yr (ha/yr)*
Status Quo	42
Reduced Harvest	69
Active Conseravation	81
Passive Conservation	88

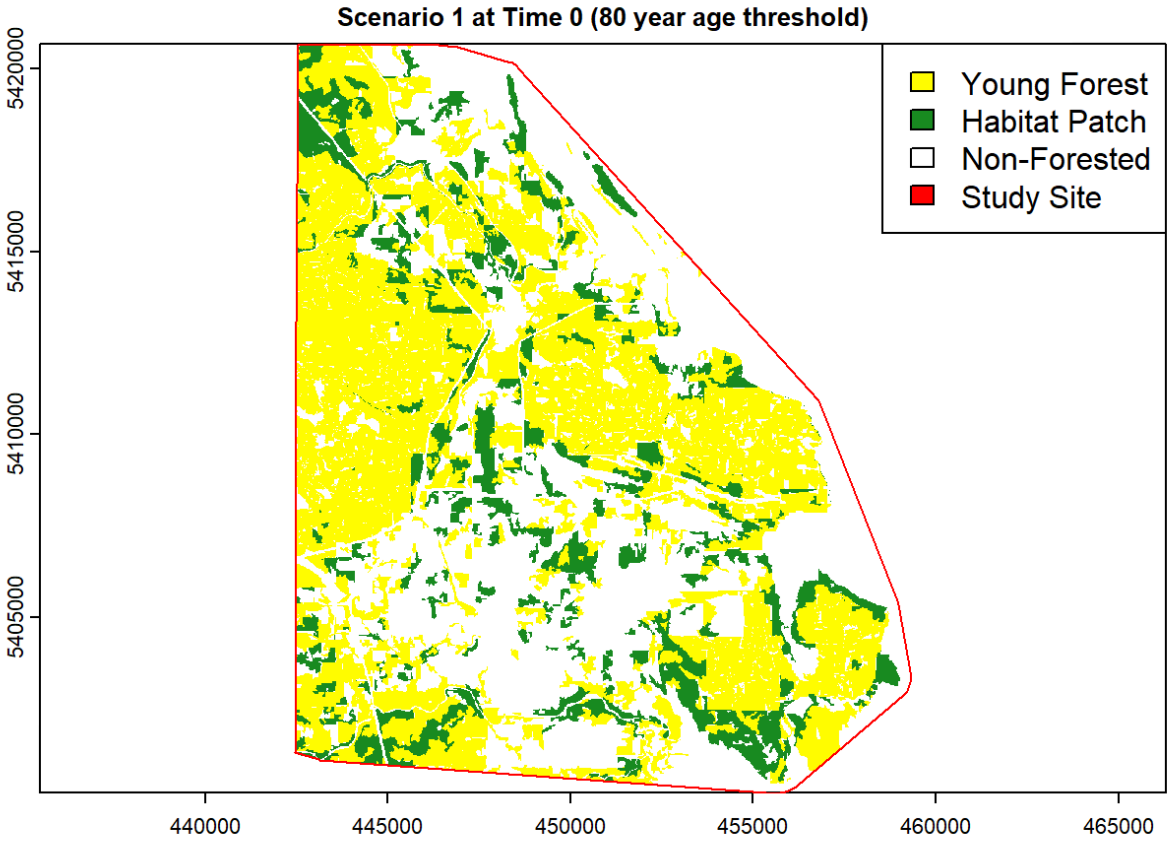
* From year 30 to 70

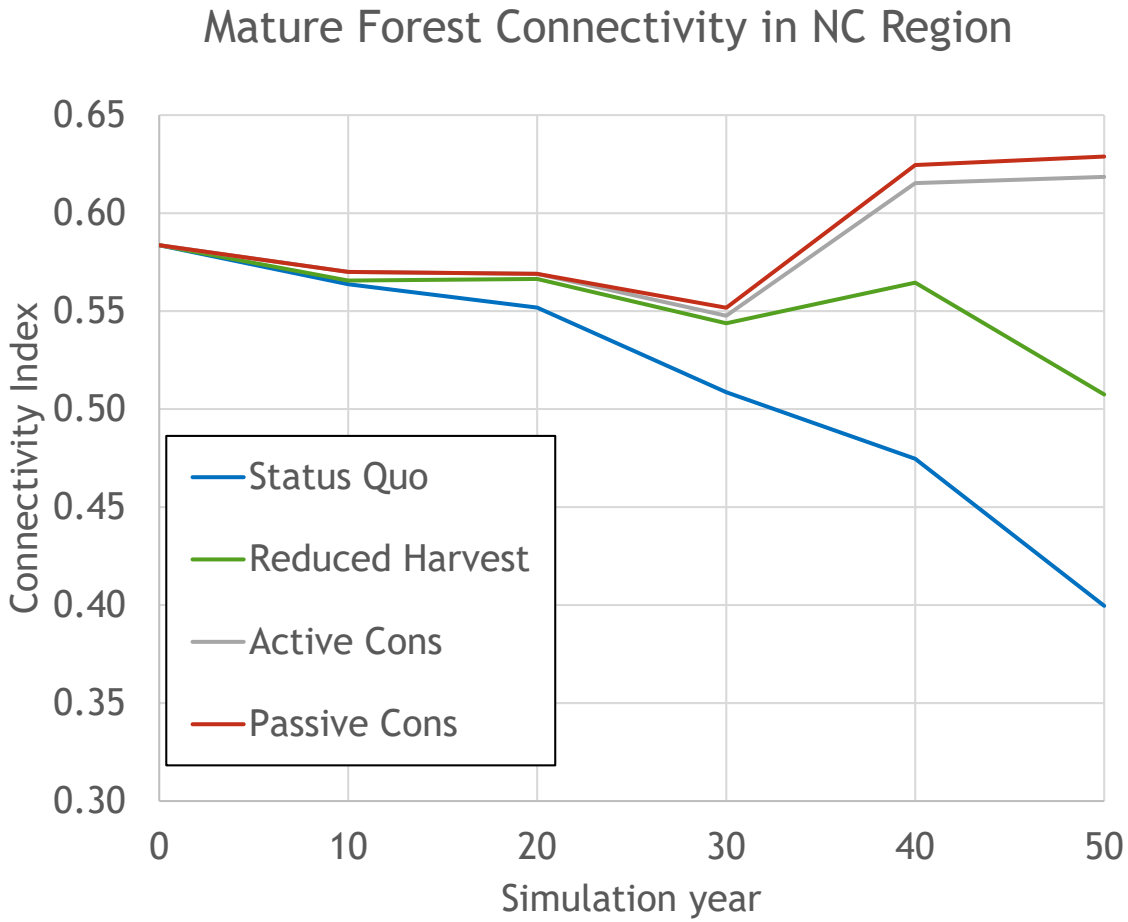


Evaluating Outcomes of Scenarios: Results

Ecological Indicators:

Habitat Connectivity of Mature Forest (> 80yrs) (1.5.1)



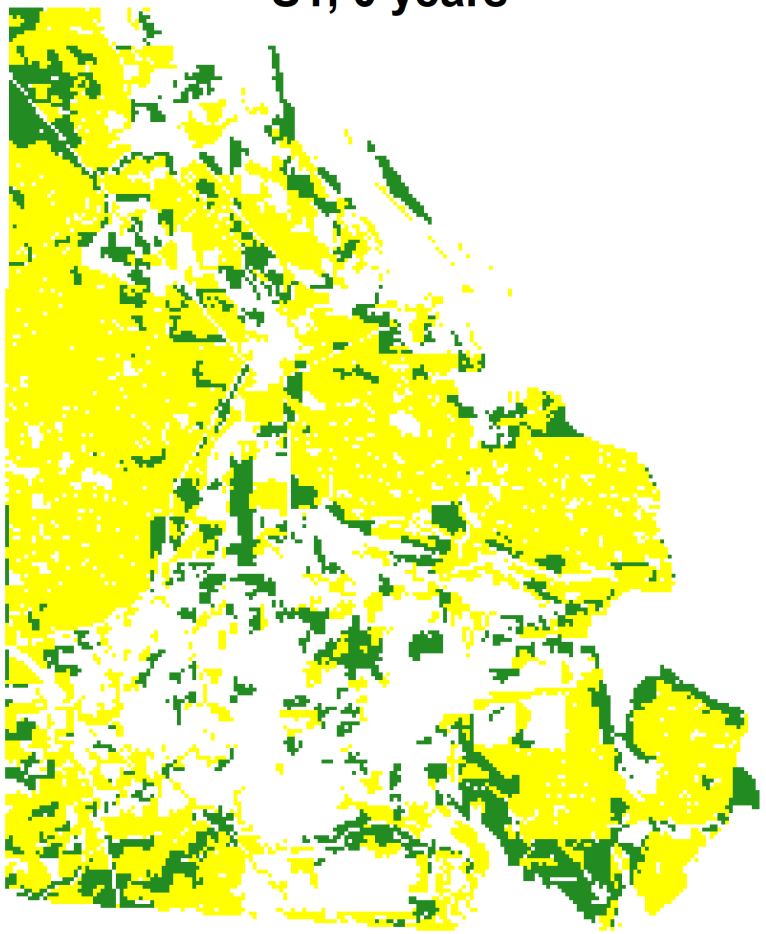


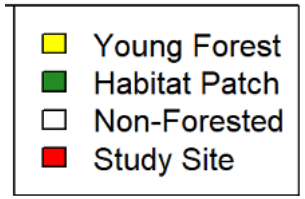
Evaluating Outcomes of Scenarios: Results

Ecological Indicators:

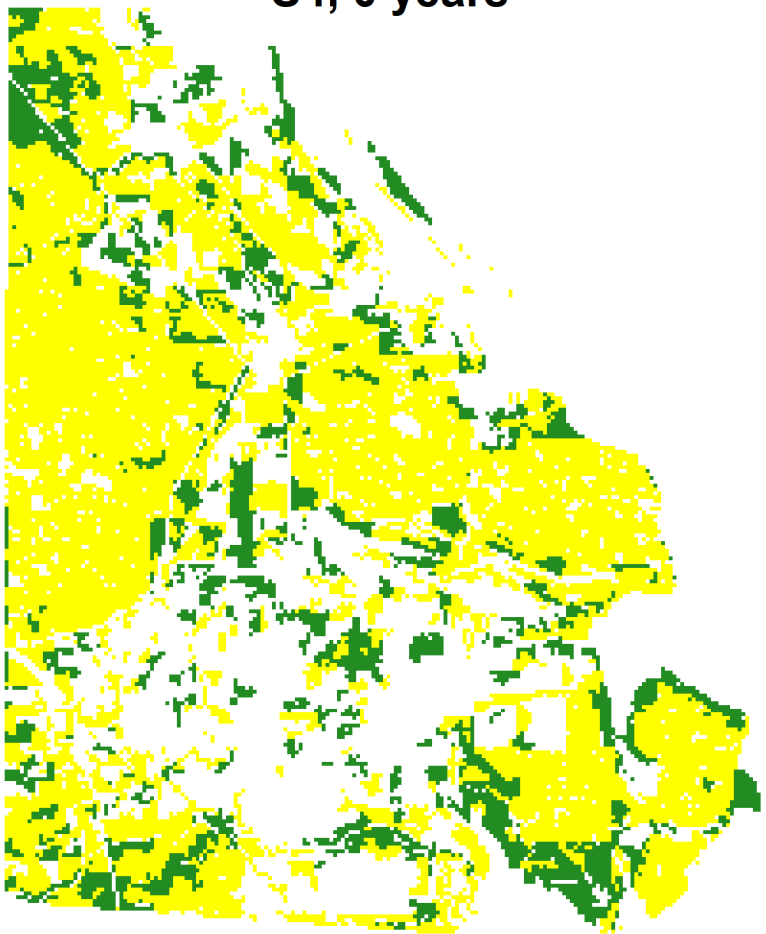
Habitat Connectivity of Mature Forest (> 80yrs) (1.6.1)

S1, 0 years





S4, 0 years



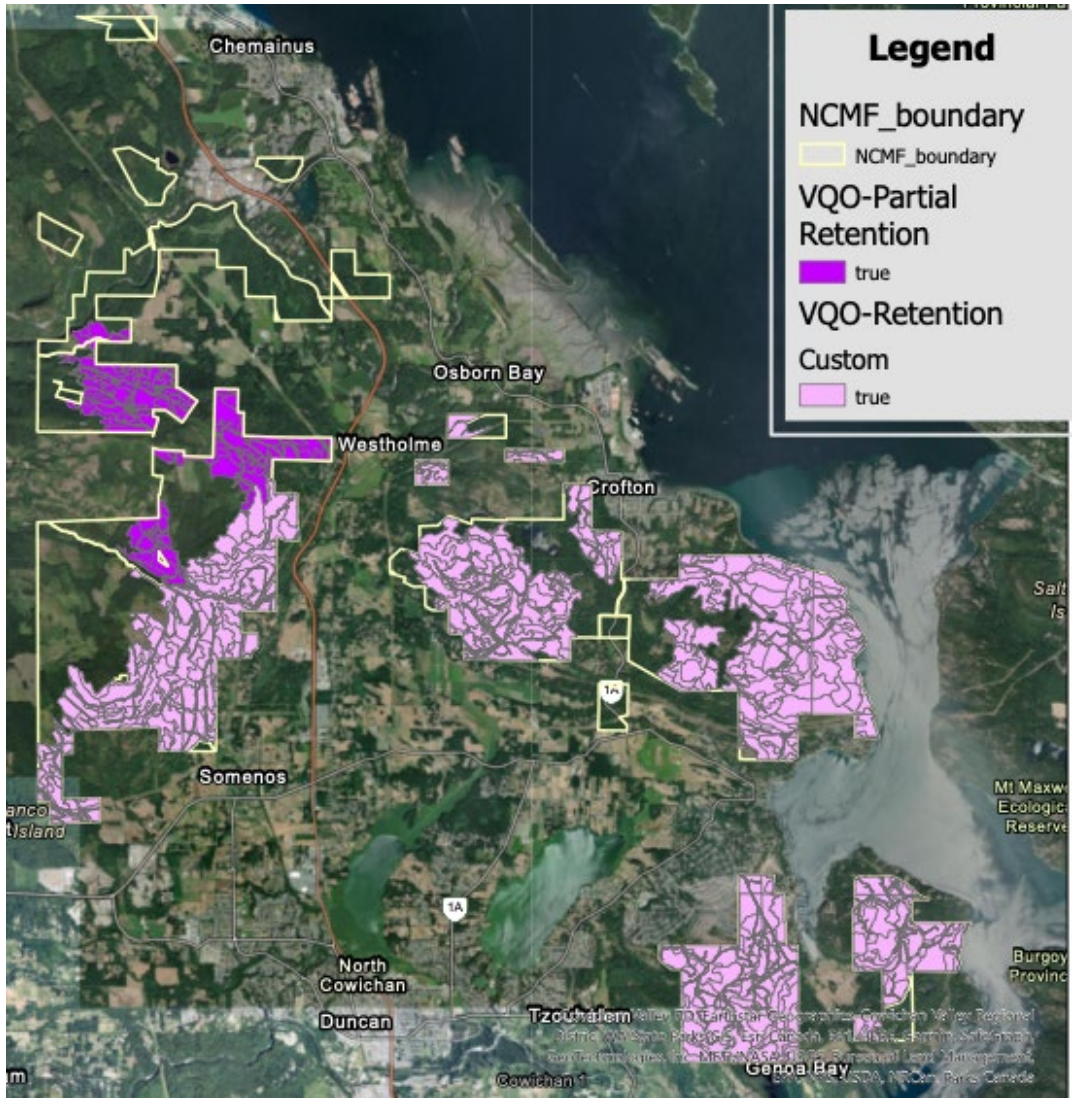
Evaluating Outcomes of Scenarios: Results

Social Indicators: Visual Quality Objectives (3.1.1)

- VQ Study conducted for MFR
- Considerable area identified as both Retention (R) & Partial Retention(PR) requirements
- **Implications for timber availability in Scenario 1**

VQO CLASS	Ideal* % Ret	Actual % Ret	
Scenario		**1. Status Quo**	**2. Red Harvest**
Retention	85	55	85
Partial Retention	50	35	50

**Based on BC VQO guidelines*



Evaluating Outcomes of Scenarios: Results

Social Indicators: Visual Quality Objectives (3.1.1)

- VQ Study conducted for MFR
- Considerable area identified as both Retention (R) & Partial Retention(PR) requirements
- **Implications for timber availability in Scenario 1**

VQO CLASS	Ideal*	Actual	
	% Min Ret	% Min Ret	
Scenario		**1. Status Quo**	**2. Red Harvest**
Retention	85	55	85
Partial Retention	50	35	50

**Based on BC VQO guidelines*

Scenario	Average VQO Score* (0-1)
Status Quo	**0.69**
Reduced Harvest	**0.90**
Active Conseravation	**0.95**
Passive Conservation	**1.00**

*Where ratio actual/target ret is used to determine score

Scoring
>0.8 = Exceeds min retention
0.8 = Meets min retention objectives
<0.8 = does not meet min retention objectives

Evaluating Outcomes of Scenarios: Results

Social Indicators: Fire Risk (3.4.1)

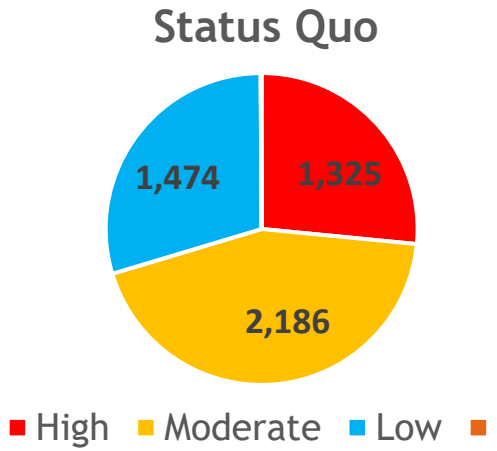
District of North Cowichan Community Wildfire Protection Plan

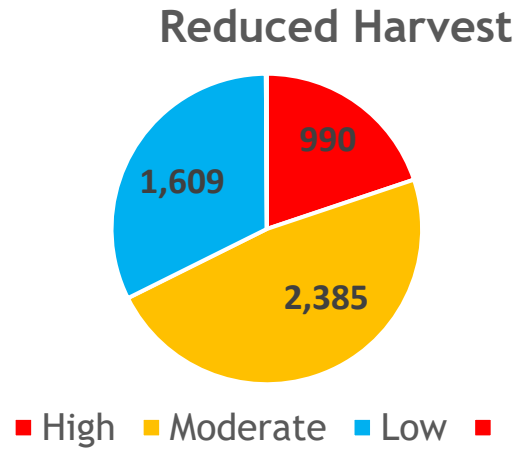
Fuel type	Descrption	Fire Risk
C-2	Young conifer (Fd) stands (5-20yrs)	High
C-3	Young conifer (Fd) stands (40-80 yrs)	Moderate
C-4	Pole sapling stand (Fd) (20-40 yrs)	High
C-5	Mature conifer (Fd) > 80yrs	Low
M-2	Mix of deciduous and conifer	Low
S03	Slash from recently harvested	Low

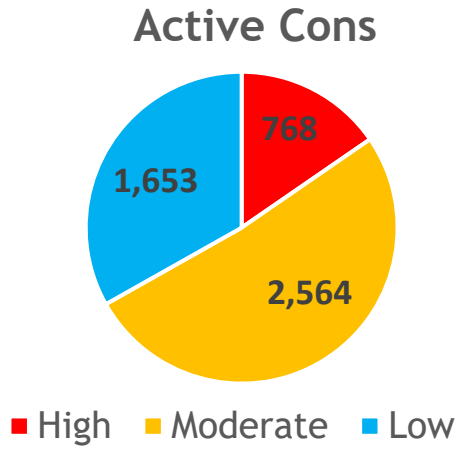
Evaluating Outcomes of Scenarios: Results

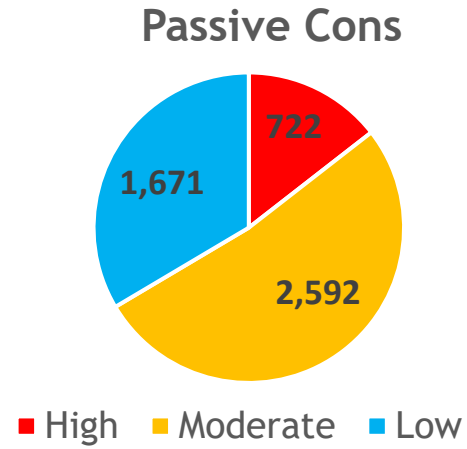
Social Indicators: Fire Risk (3.4.1)

		Scenario			
		1	2	3	4
Risk	**Risk Score**	Avg area in each risk category			
High	10	1,325	990	768	722
Moderate	5	2,186	2,385	2,564	2,592
Low	2	1,474	1,609	1,653	1,671
Score		5.4	5.0	4.8	4.7









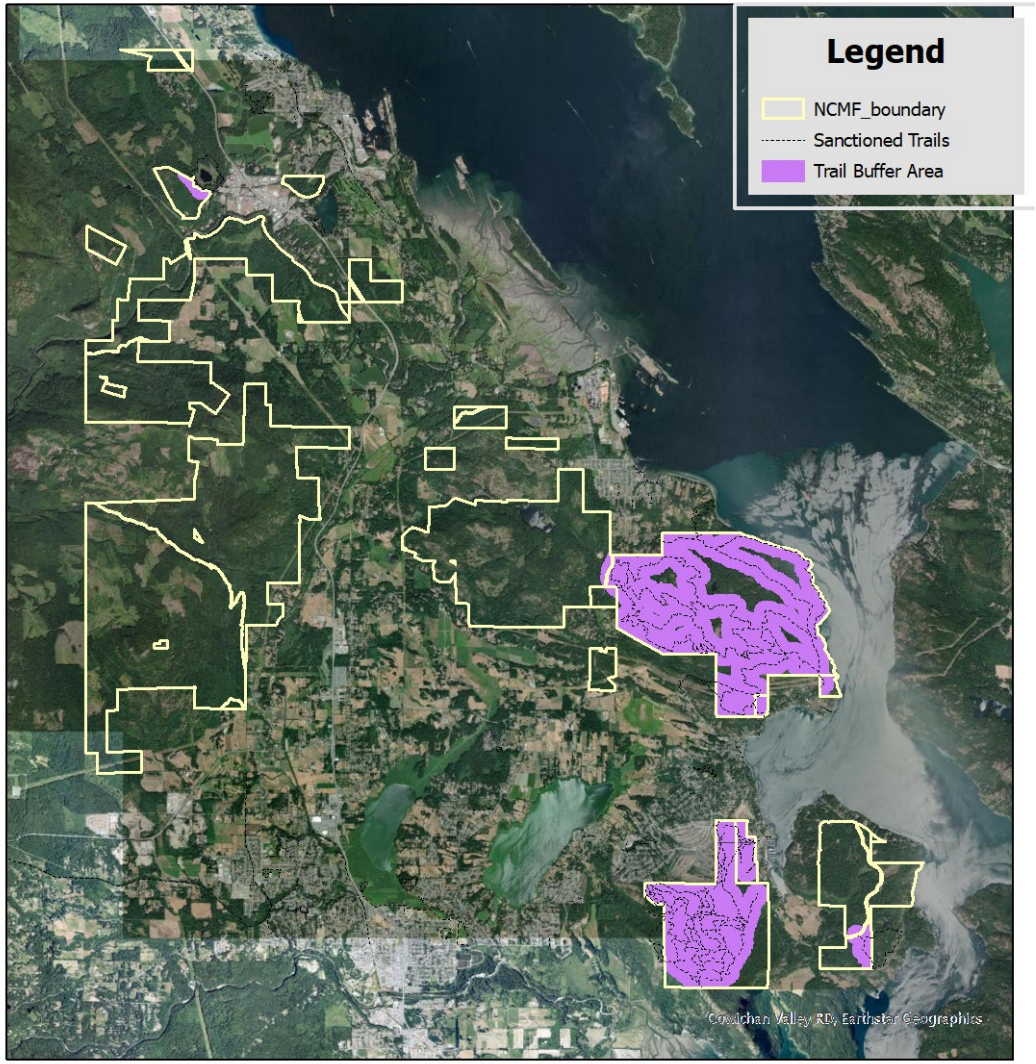
Evaluating Outcomes of Scenarios: Results

Social Indicators: Wilderness Recreation Opportunity (3.2.1)

3.2.1 Disturbed area surrounding (200m buffer) sanctioned trail network (%)

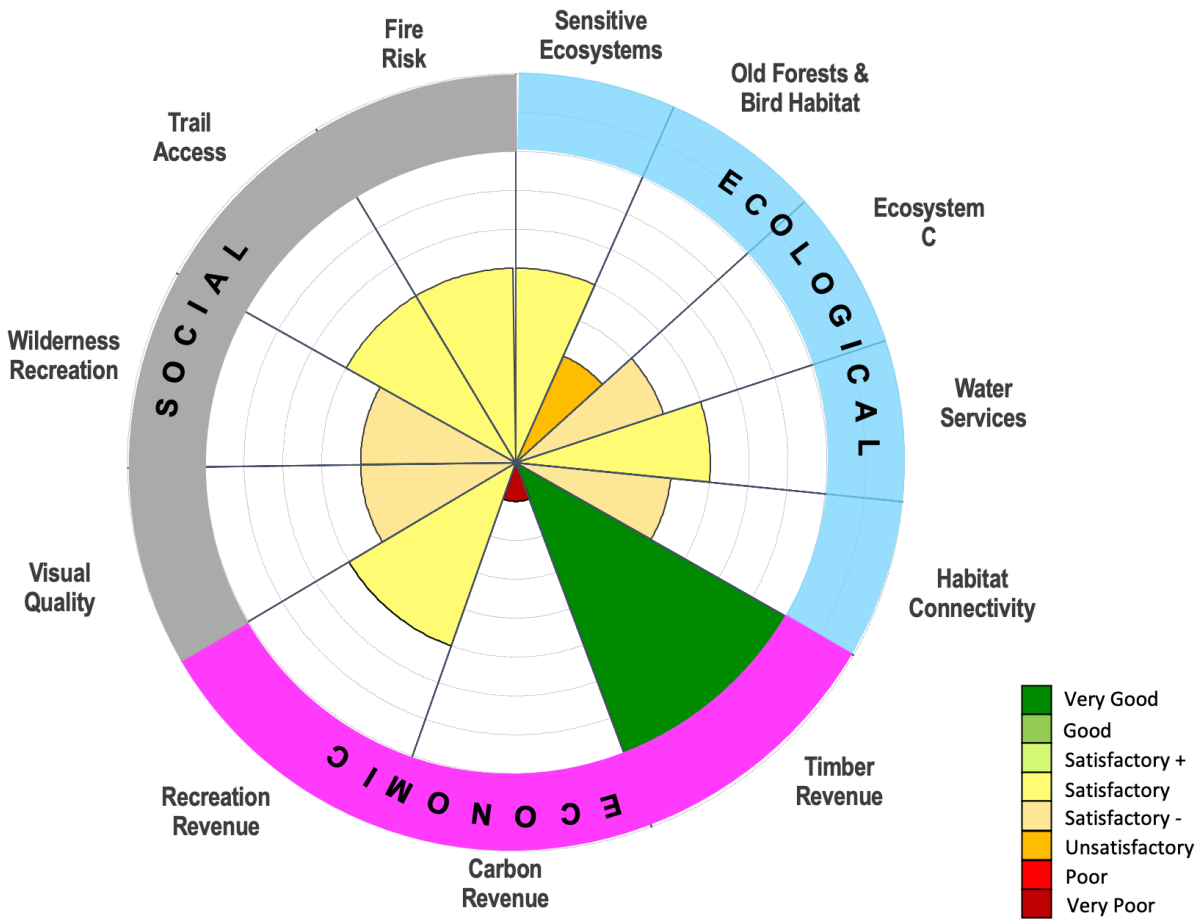
Scenario	Average disturbed area within trail buffer (ha, %)*
Status Quo	233.6 (16.5%)
Reduced Harvest	85.3 (6.0%
Active Conseravation	0 (0%)
Passive Conservation	0 (0%)

* For first 50 years of simulations

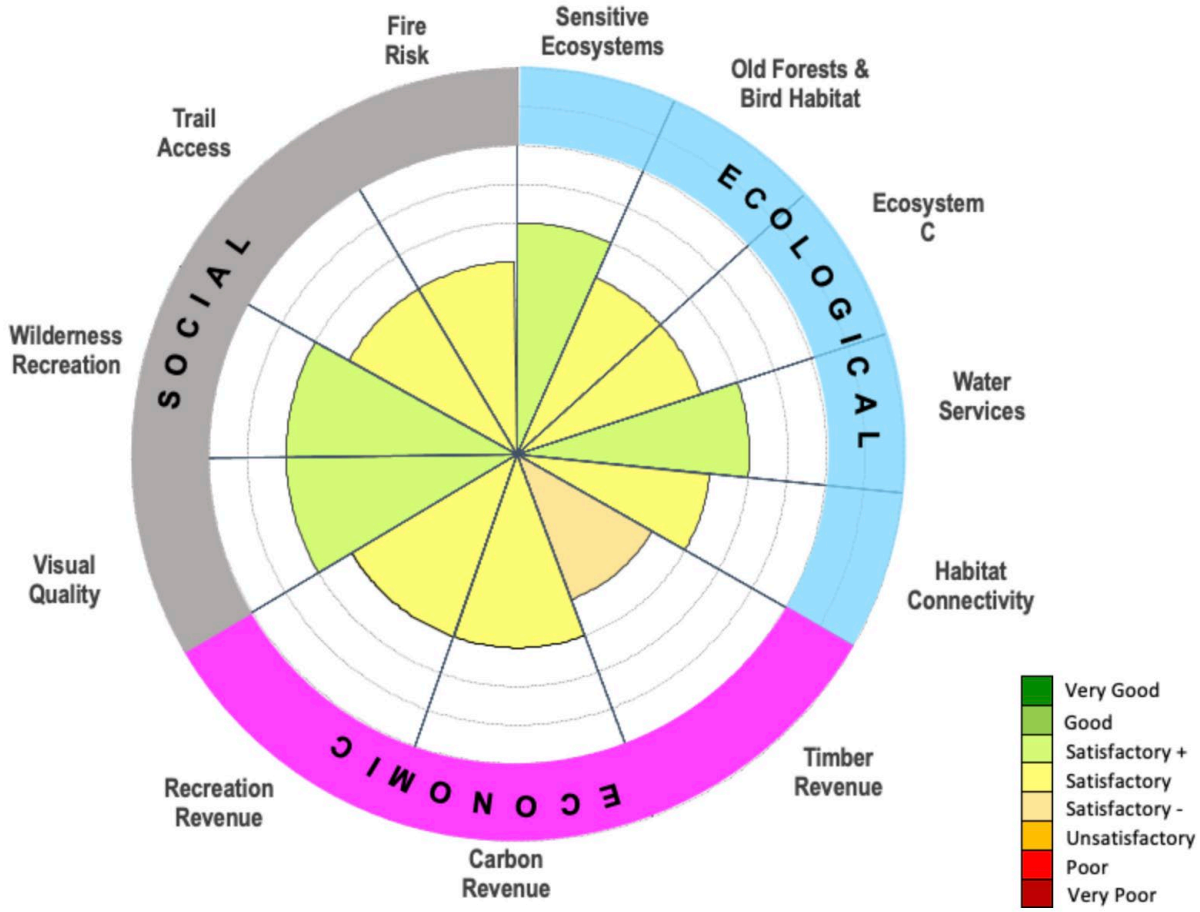


Evaluating Outcomes of Scenarios: Results

Status Quo

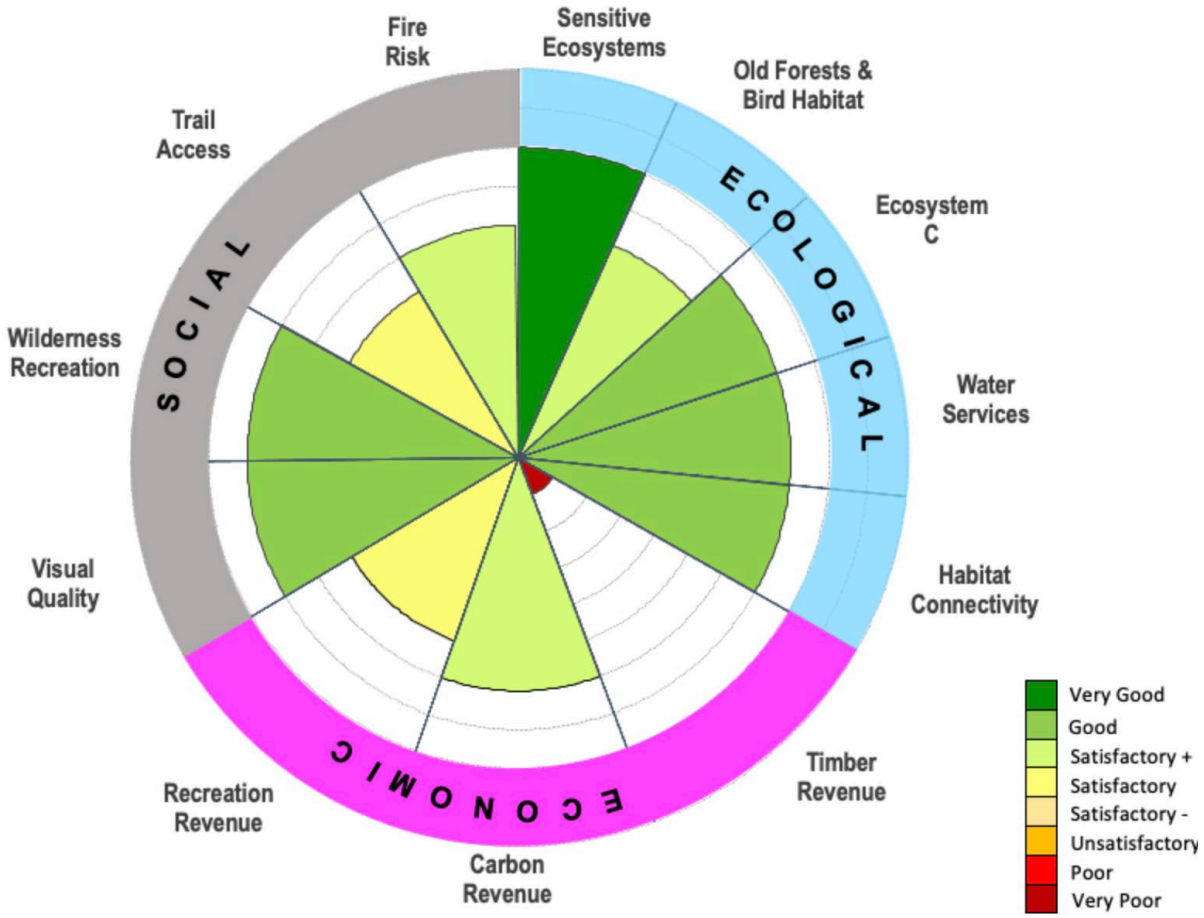


Reduced Harvest

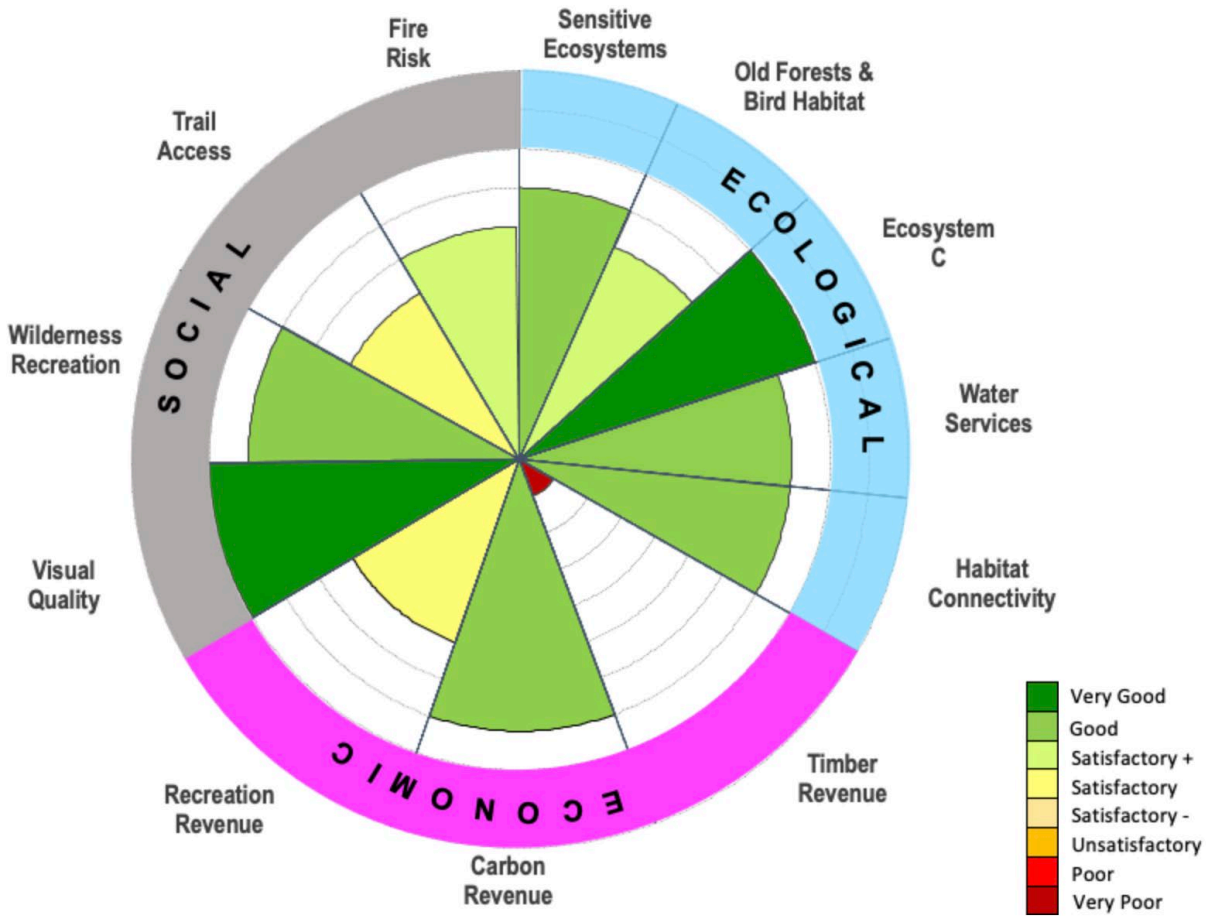


Evaluating Outcomes of Scenarios: Results

Active Conservation



Passive Conservation



Evaluating Outcomes of Scenarios: Results

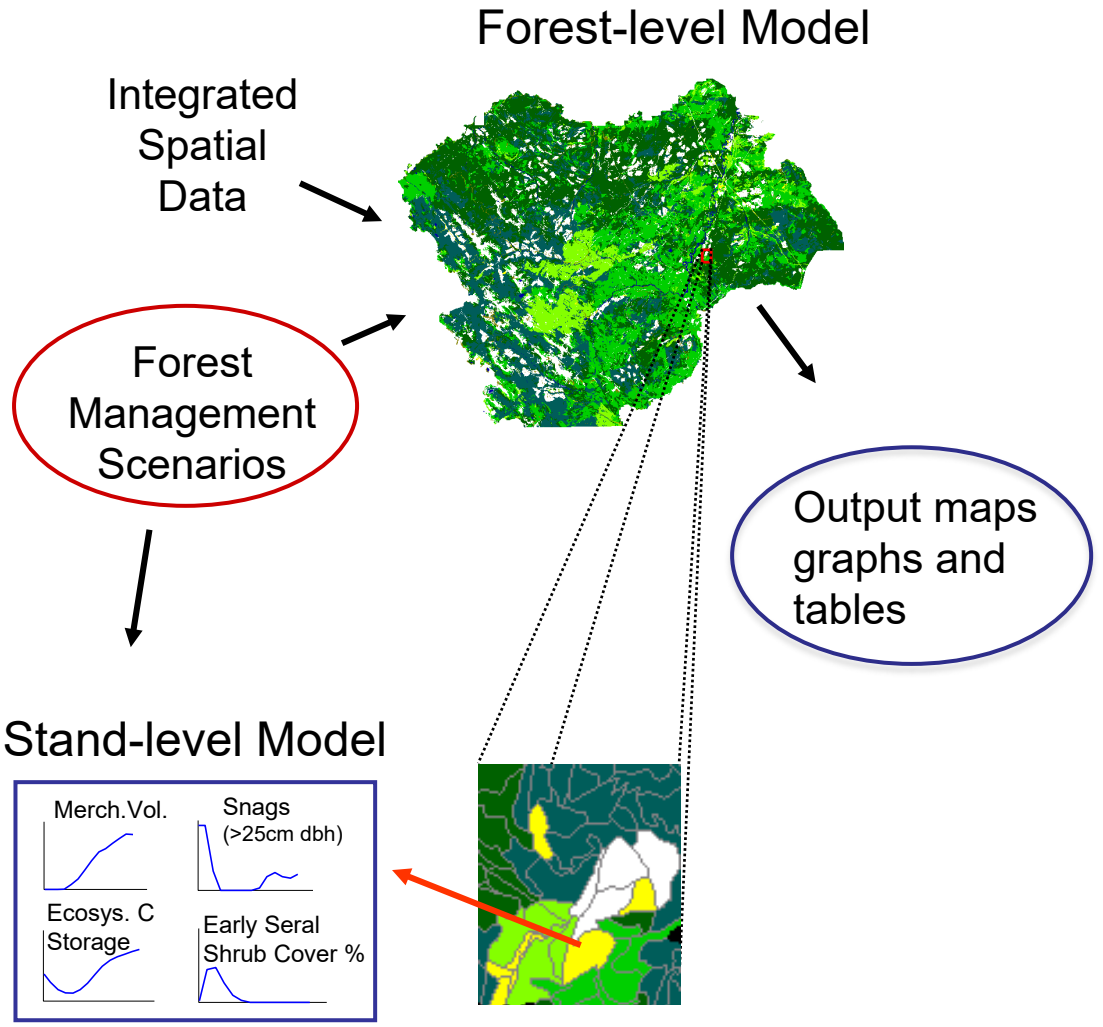
Scenario Ranking Option

- Assign numerical score based on categorical ranking
- Calculate average score of indicators in each component

Category	Score
Very Good	8
Good	7
Satisfactory +	6
Satisfactory -	5
Satisfactory	4
Unsatisfactory	3
Poor	2
Very Poor	1

	Status Quo	Reduced Harvest	Active Conservation	Passive Conservation
Ecological Score	4.2	5.4	7.0	7.0
Economic Score	4.7	4.7	4.0	4.3
Social Score	4.5	5.5	6.3	6.5
Overall Score	4.5	5.2	5.8	5.9

Multi-objective Scenario Analysis

Next Steps

- Help prepare summaries for public engagement process
- Consider running additional scenarios
- Prepare report for NC to aid in development of future forest planning
- Transfer materials/data to NC