

Western Forest Economists

May 2, 2006

Carbon and Fire Risk:

Alternative Treatments and the Probability of Fire

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Consortium for Research on Renewable
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*A non-profit corporation formed by 15 research
institutions to conduct cradle to grave
environmental studies of wood products*

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Research Scientist

ONRC

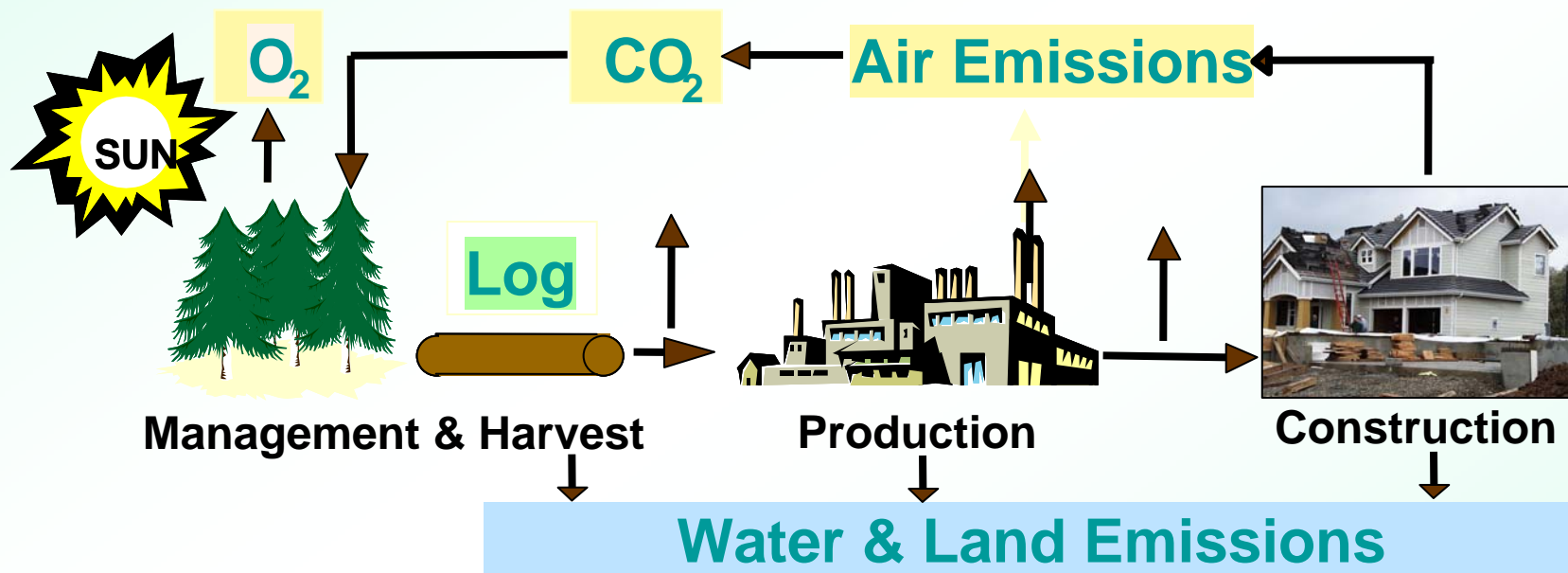
Olympic Natural Resources Center

College of Forest Resources,
University of Washington

Background

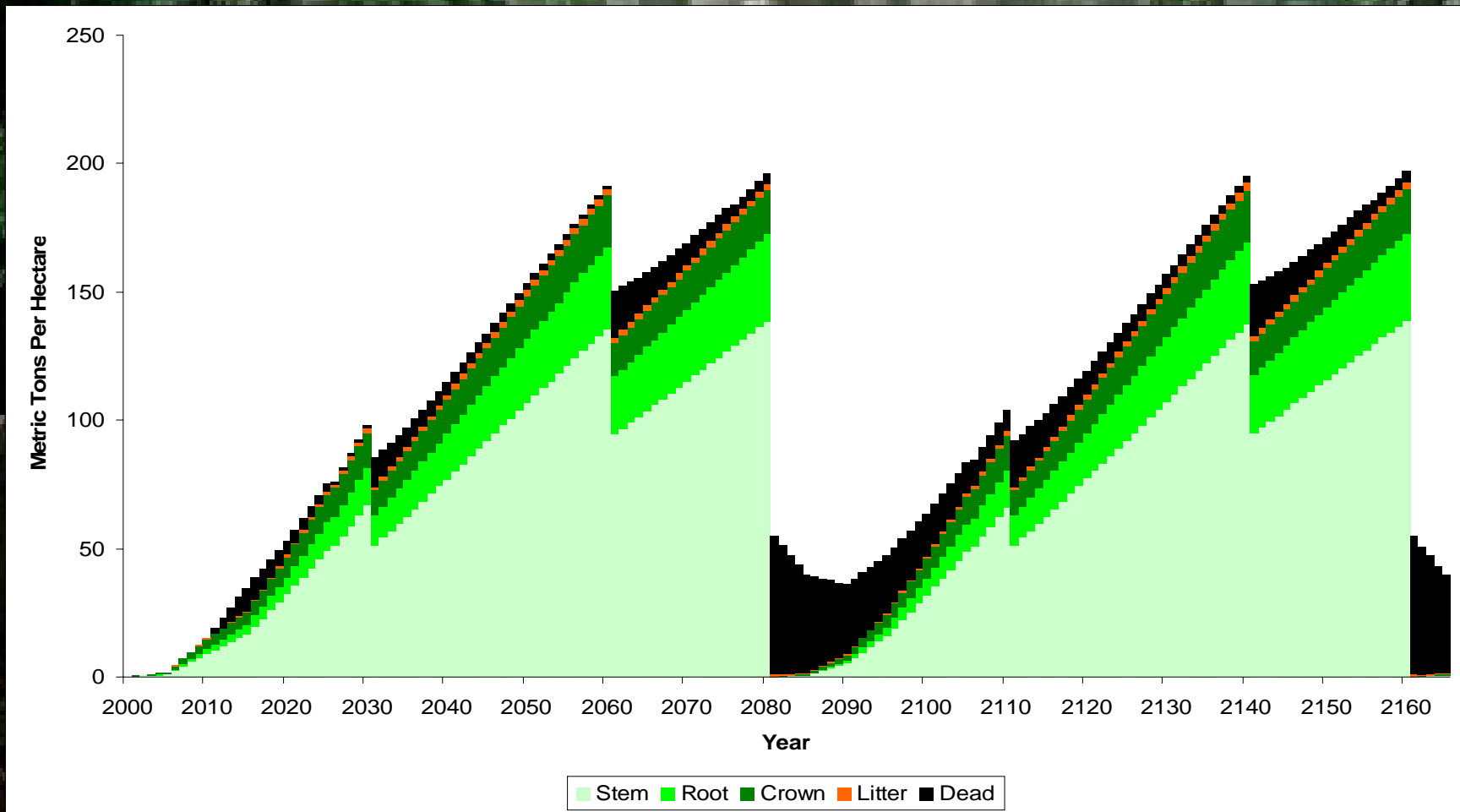
- The CORRIM report estimated the carbon storage contribution from three pools linked to the forest
 1. In the Forest pool
 2. In wood products pool (net of energy used and biofuel produced)
 3. Avoided fossil intensive product pool
- A major conclusion was that the highest leverage use of wood is in long lived products that substitute for fossil intensive products
- A second conclusion was the shortest and most intensive rotations that produce long lived products stores the most carbon

Life Cycle Assessment of Wood Products & Buildings



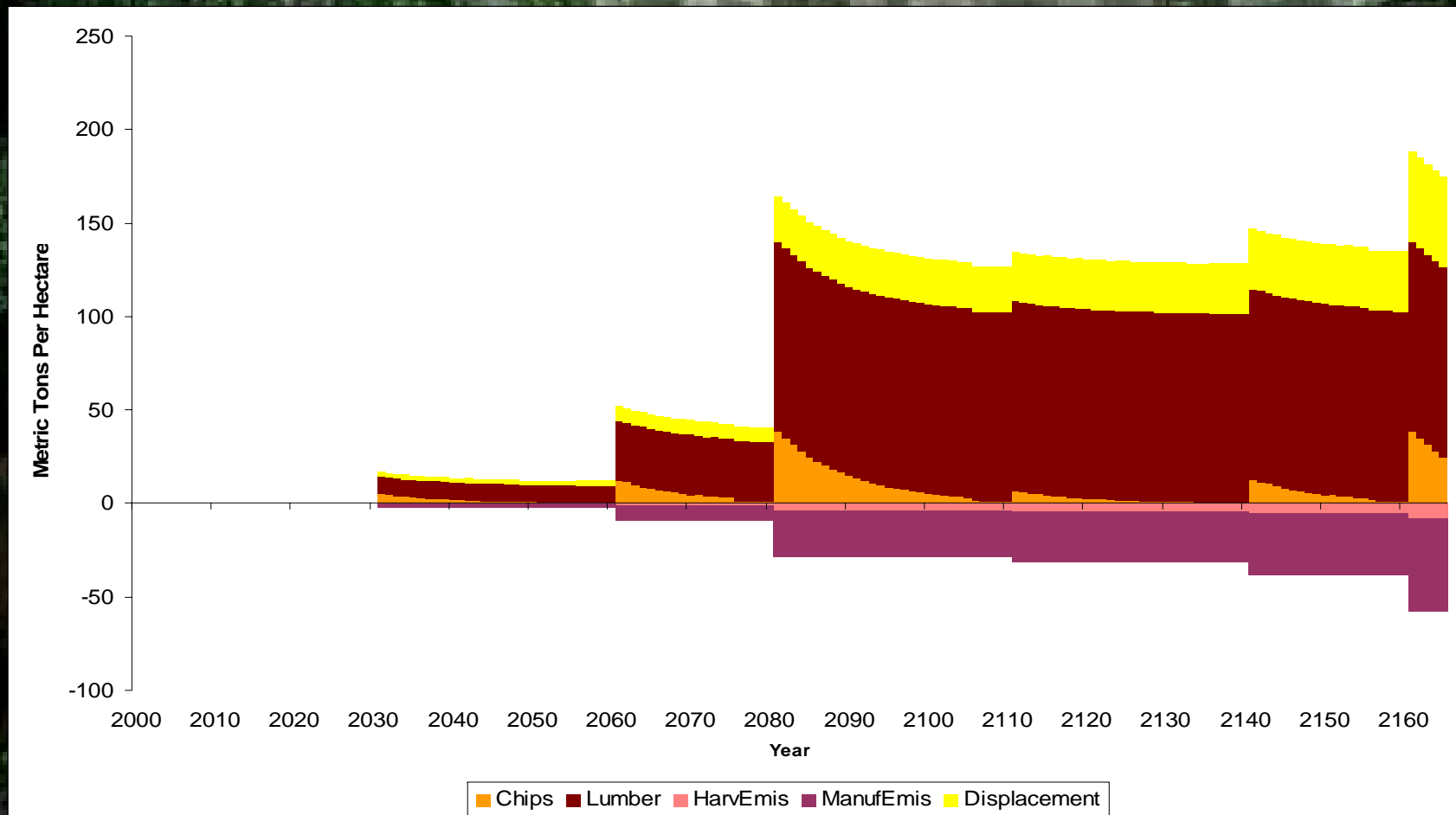
Carbon in PNW Forest Pools

80-Year Rotation with Two Thinnings

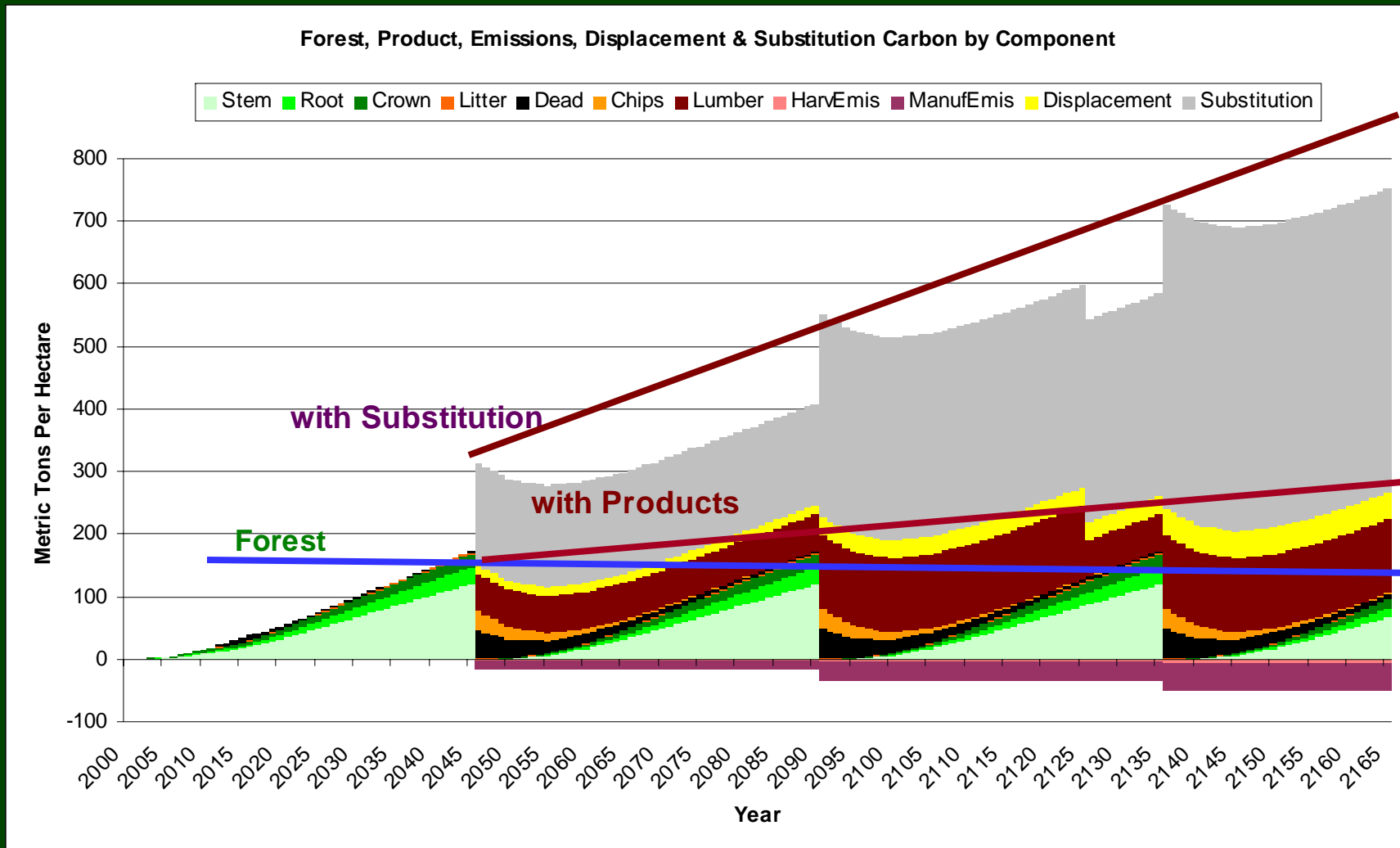


Carbon in Product Pools

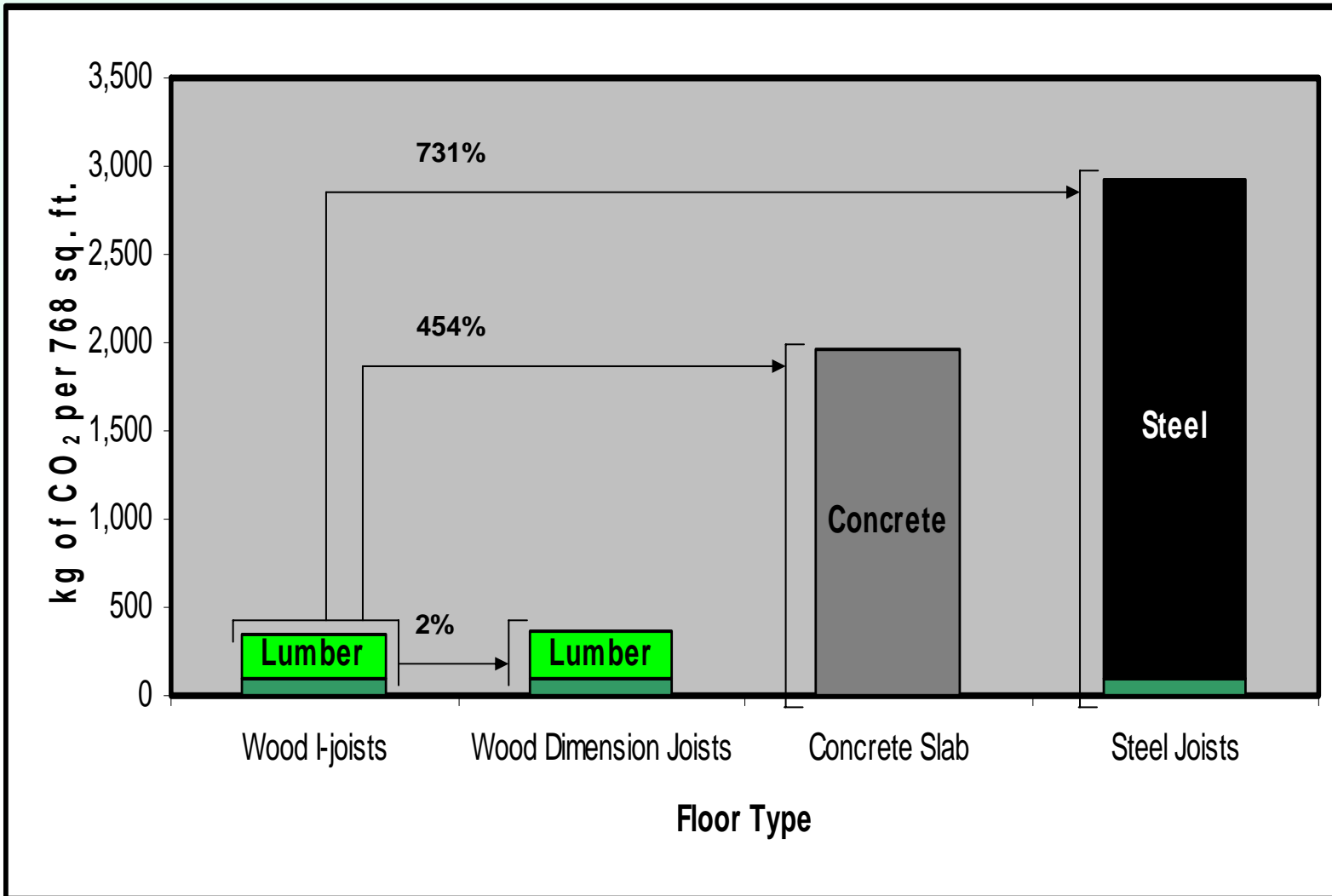
Processing Energy and Displacement



Forest, Product and Substitution Pools



Floors: GWP per component



Problem

- This raises several interesting questions for carbon strategy in the Inland West.
 - What is the impact of fire which eliminates the opportunity to produce products and also impedes regeneration and productivity.
 - Should the Inland West produce long lived product or biofuels
- Knowing the carbon impact after a range of fire risk reduction treatments (NA, BA45, 9&Under, 12&Up, & Wildfire) is not sufficient.
- We need to know the expected value of carbon which depends upon the probability of fire as a function of the treatment.
- We also need to know the likelihood of producing long lived engineered products vs. biofuel

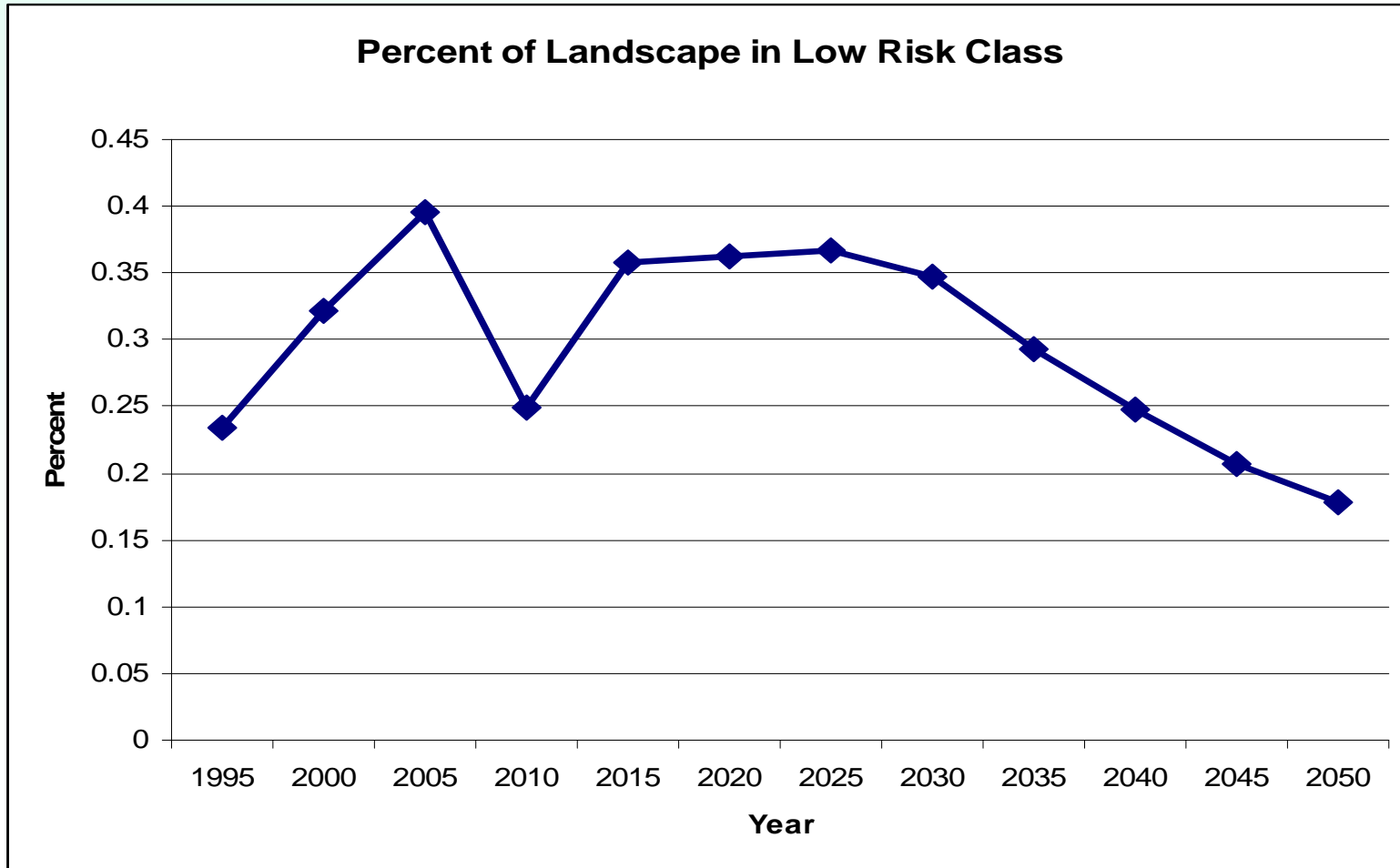
Methods applied to Okanogan FIA data

- Average per acre metric tons of carbon were simulated for each 5-year time period from 1995 to 2030 for NoAction(NA), BA45, 9&Under, 12&Up, and Wildfire treatments.
- Fire risks were estimated using the FVS Fire and Fuel Extension (FFE model) and categorized as Hi, Moderate or Low risk.
- Probability of fire on Hi Risk acres was calibrated to reach 15% unburned refugia after 50 years (from other studies), a rate of 17% in 5 years (conservatively set for high risk stands rather than all stands)
- 17% of the acres at high risk were burned each period, 8% at moderate risk and 0 % for low risk.
- Composite carbon totals through time were simulated as a percentage of acres treated and whether unburned or burned.
- Initial treatments (in 2000) were examined and then phased in over 25 years with fires occurring each period.

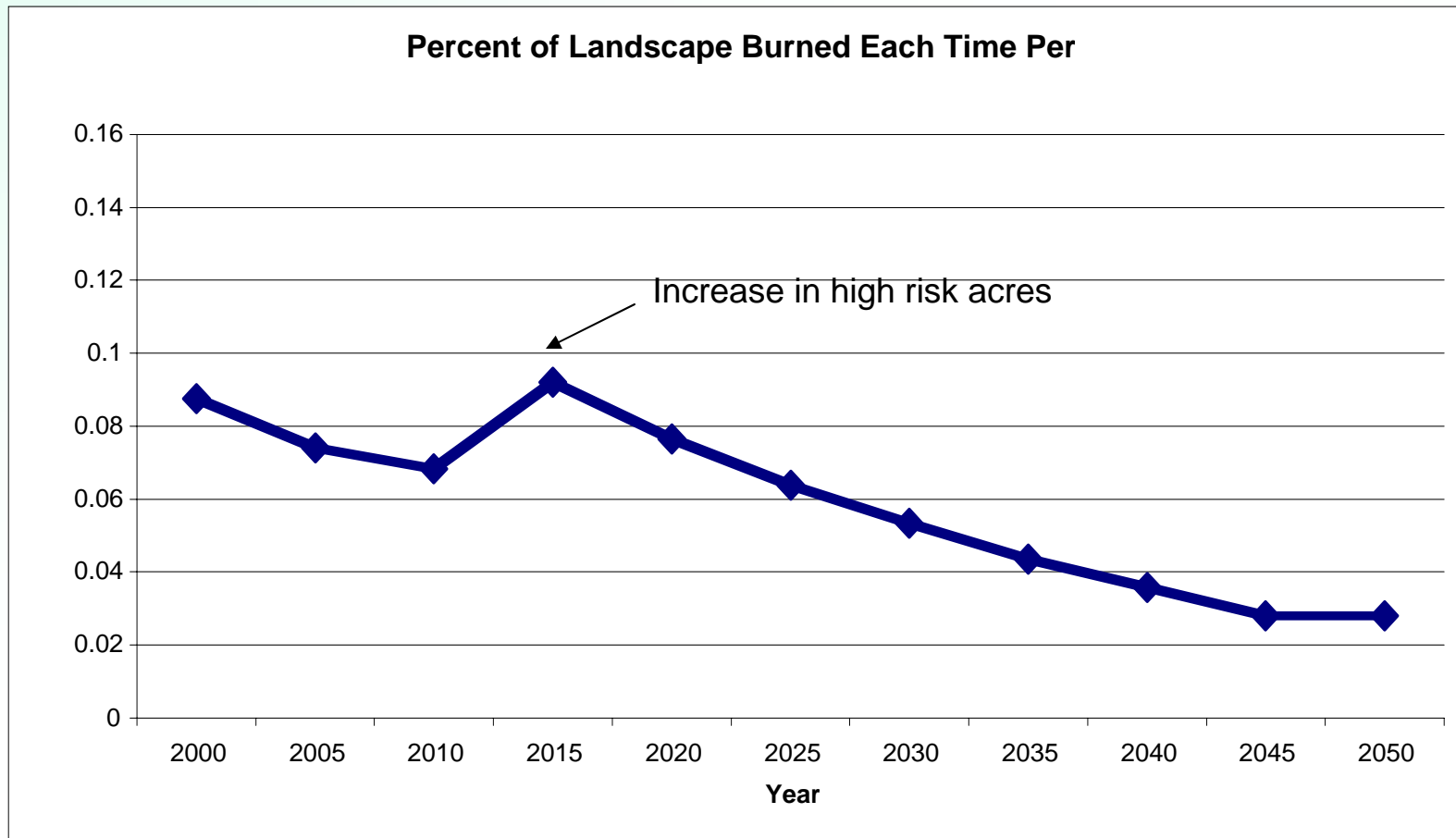
Assumptions

- High and Moderate risk acres can only burn once in the period (Lo risk acres don't burn)
- After a fire on High and Moderate risk acres the carbon remaining is estimated from post-fire residual stands:
 - higher in the north (Okanogan)
 - lower in the south (Fremont)
- Regeneration is assumed *and may be excessive* (many burned stands may actually be ready for a second burn)
- Snags are decayed (no salvage)

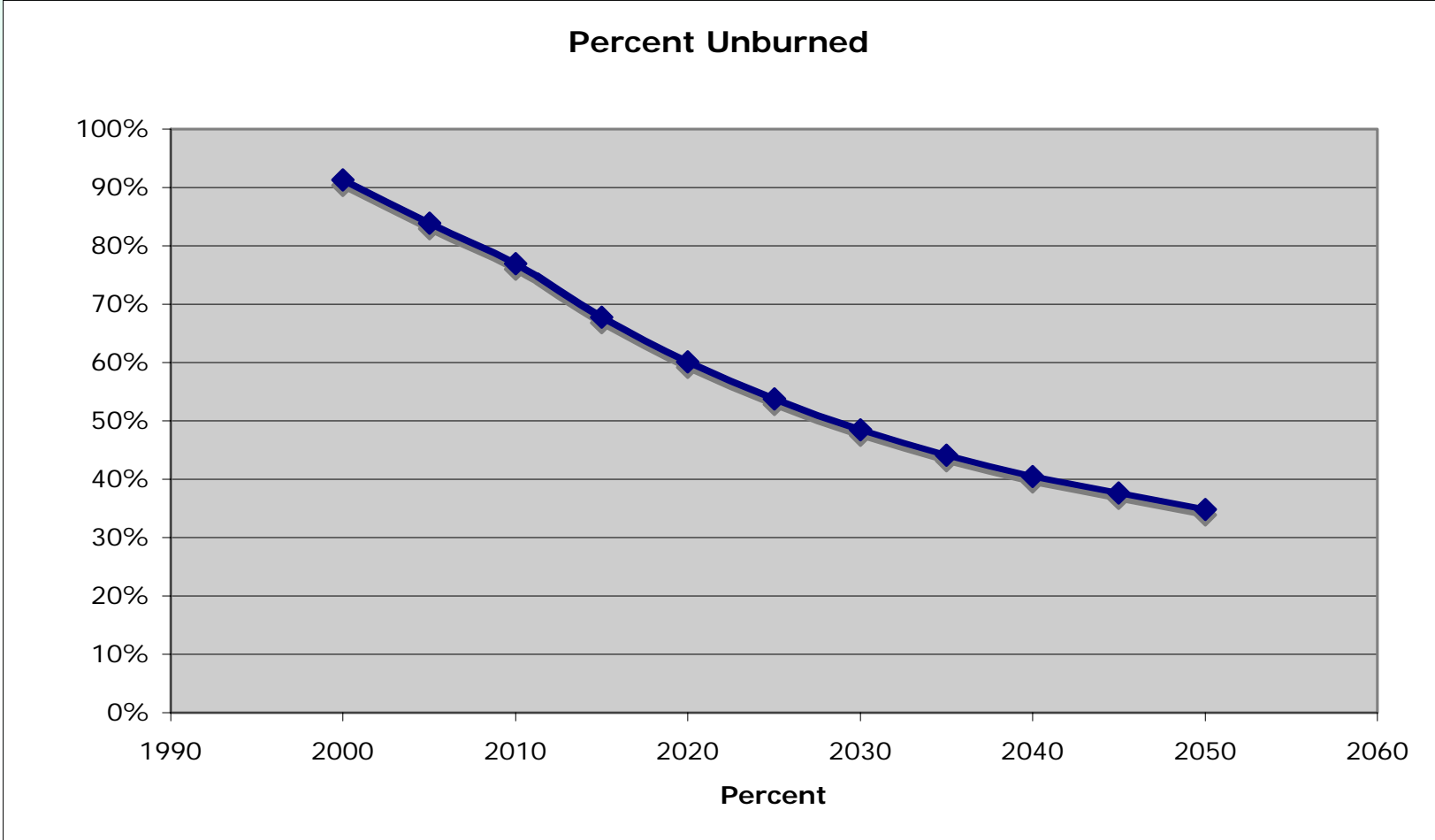
Acres in Low Risk Class - no fire



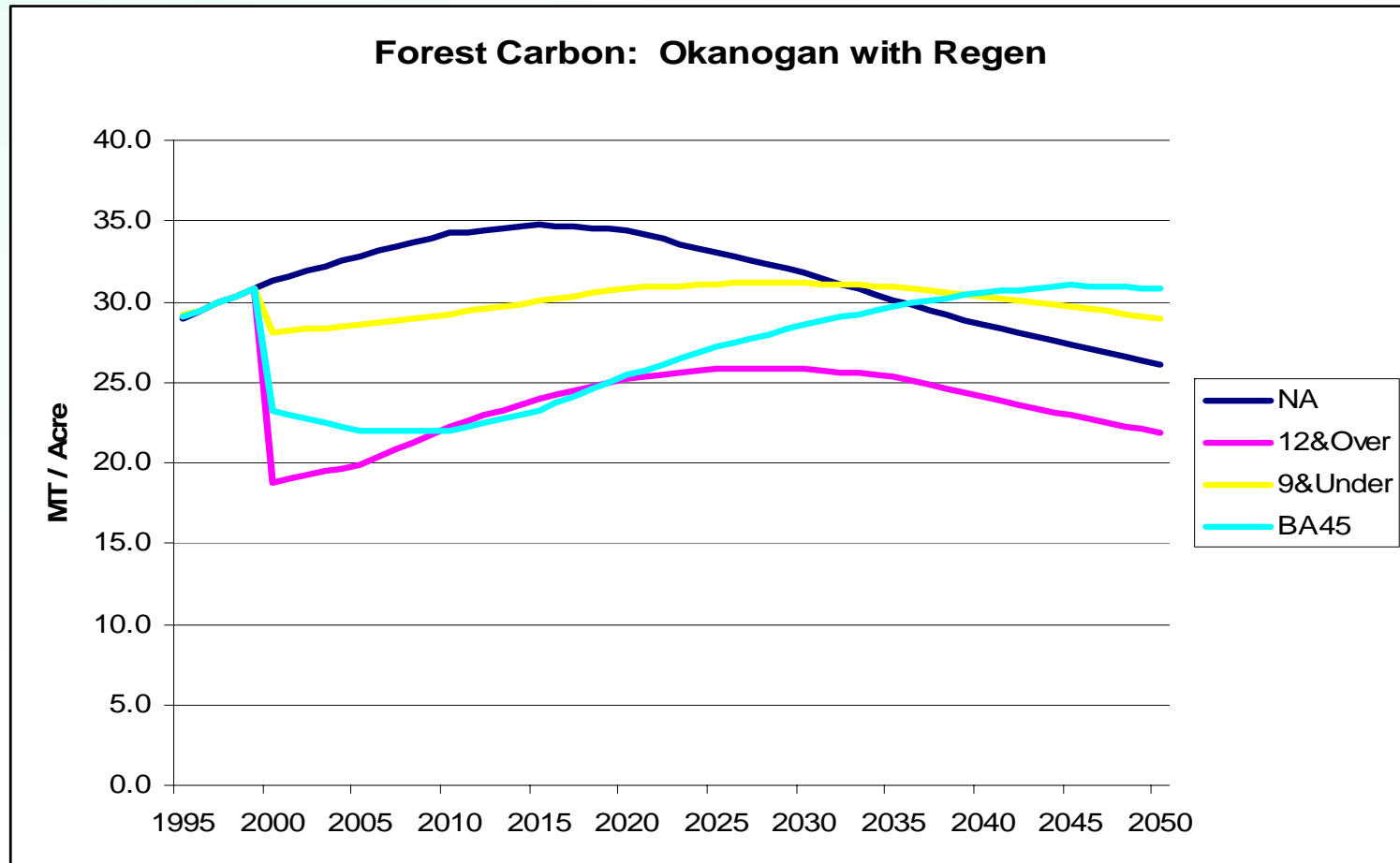
Acres burned each period: **Okanogan with Regeneration**



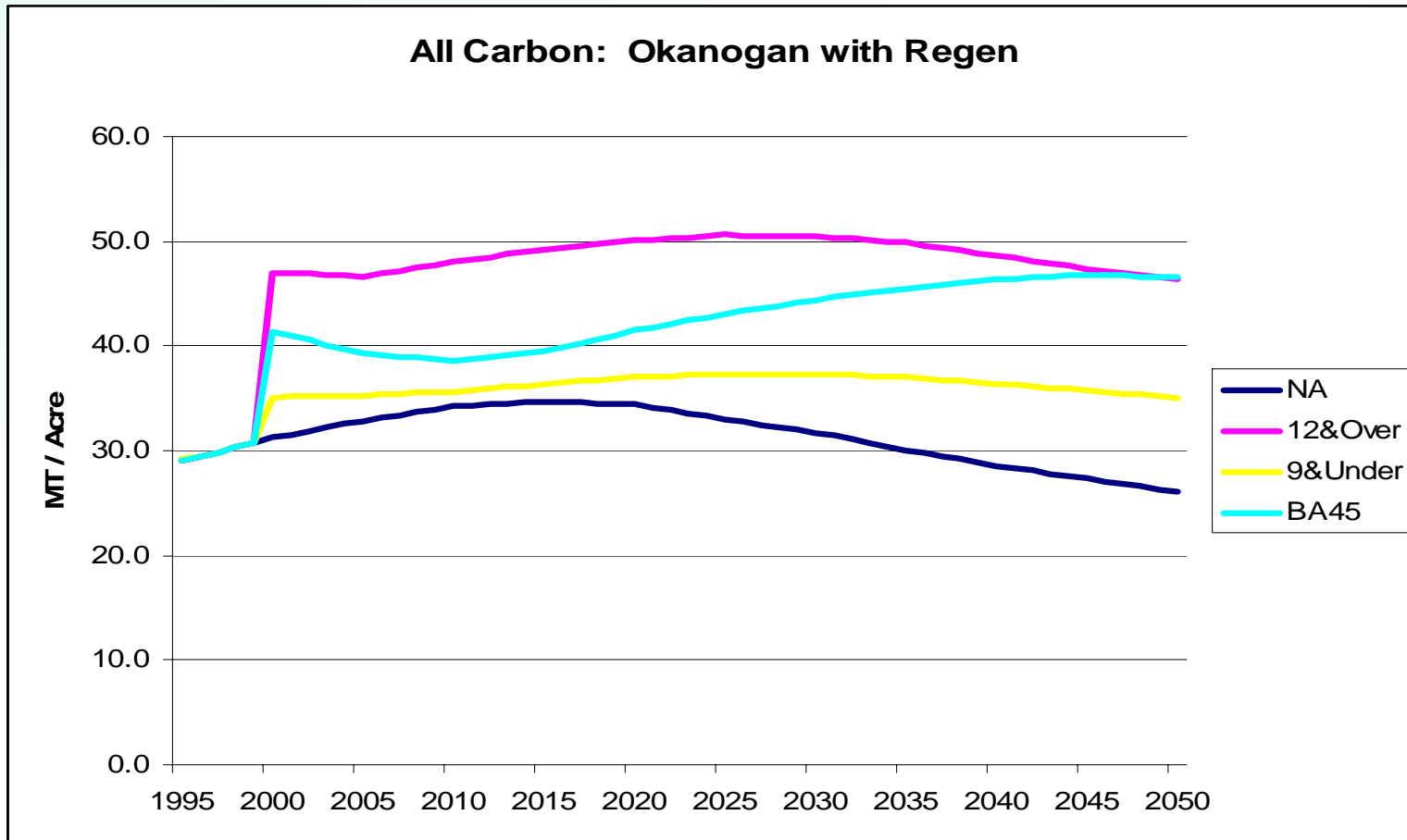
Acres unburned : **Okanogan with Regeneration**

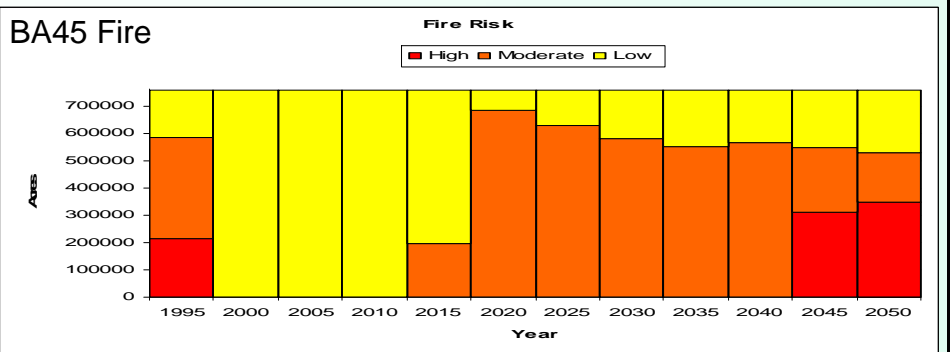
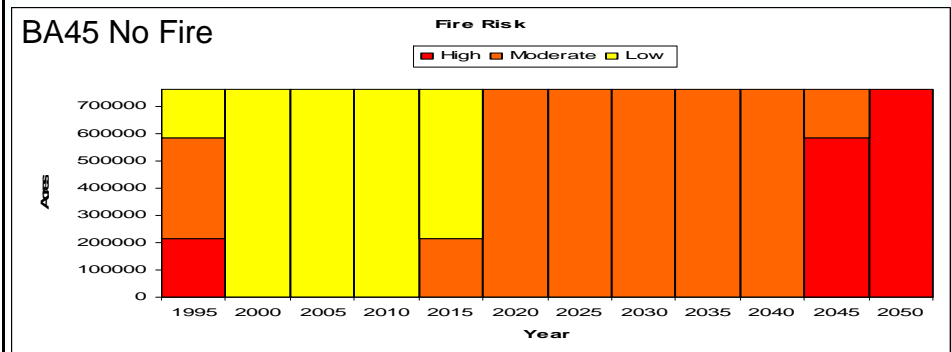
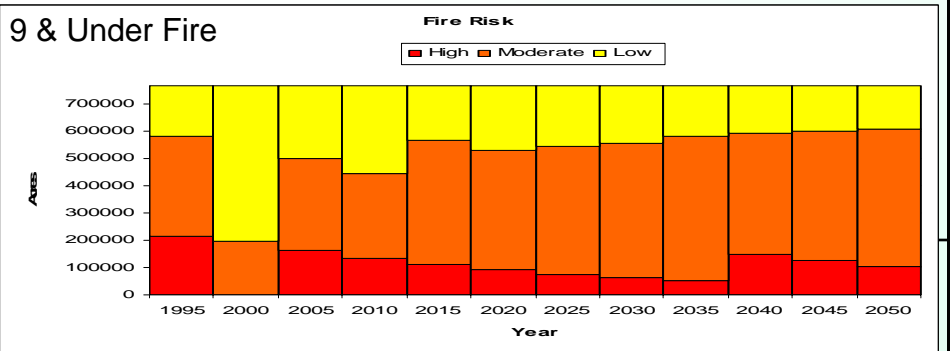
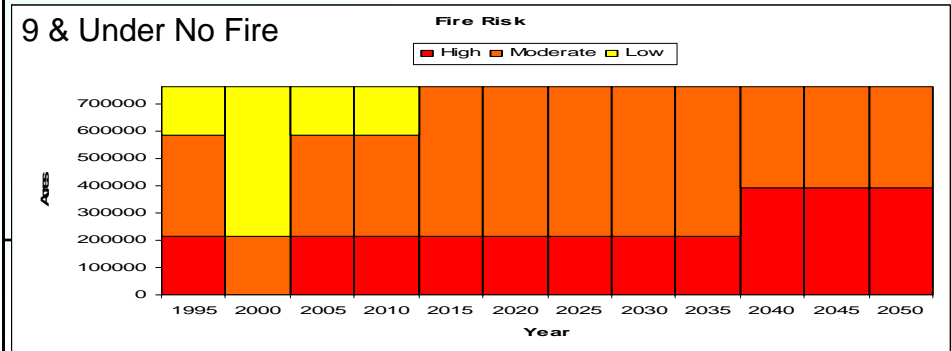
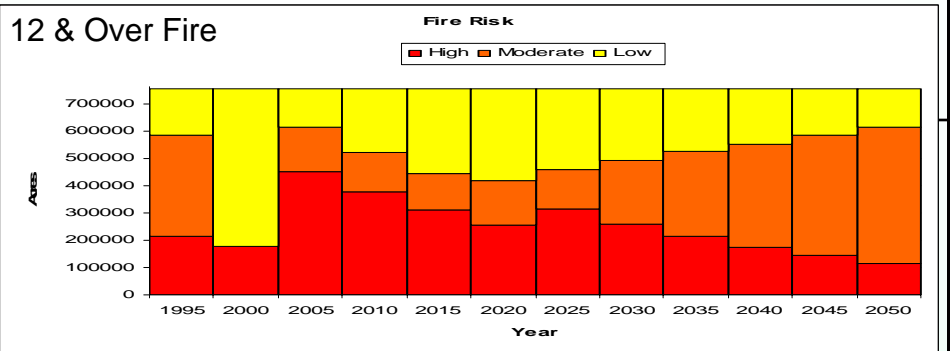
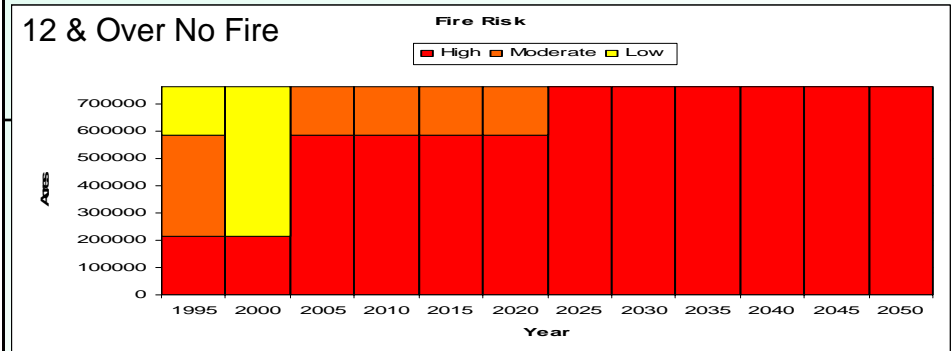
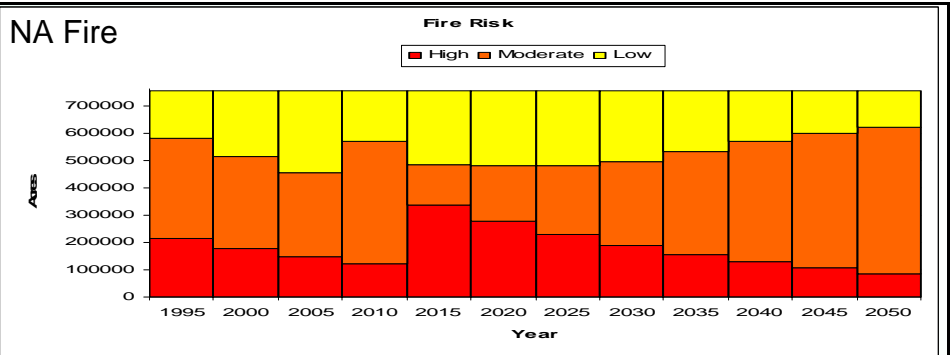
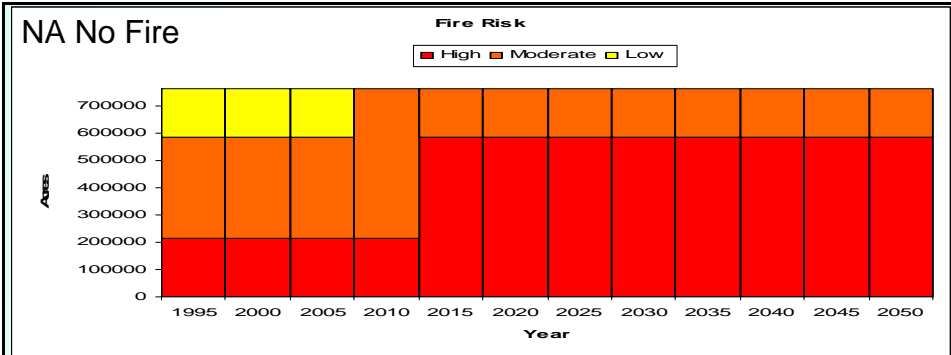


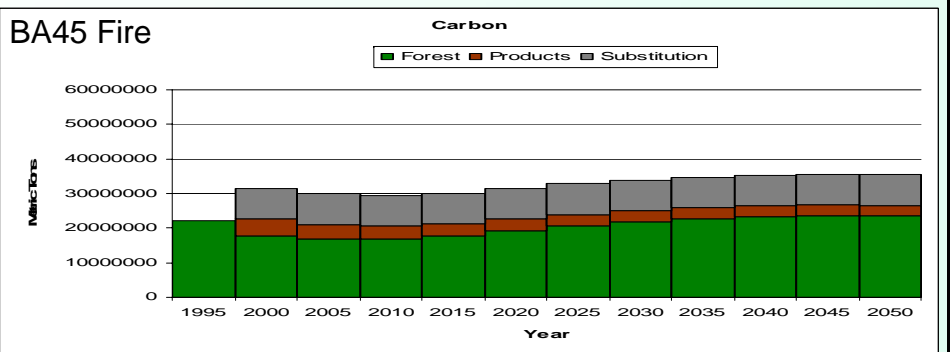
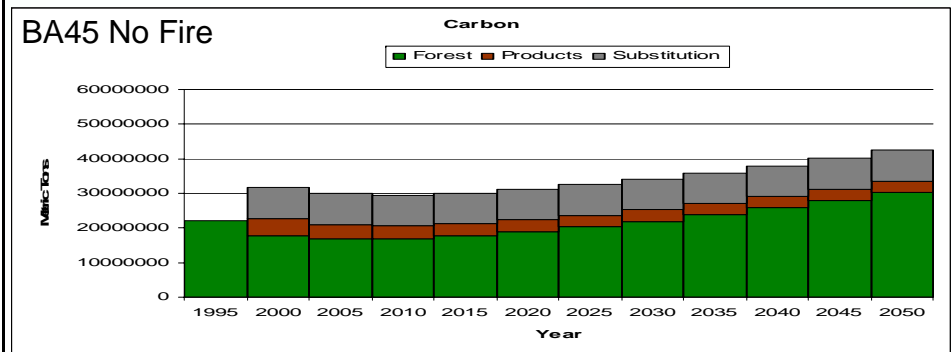
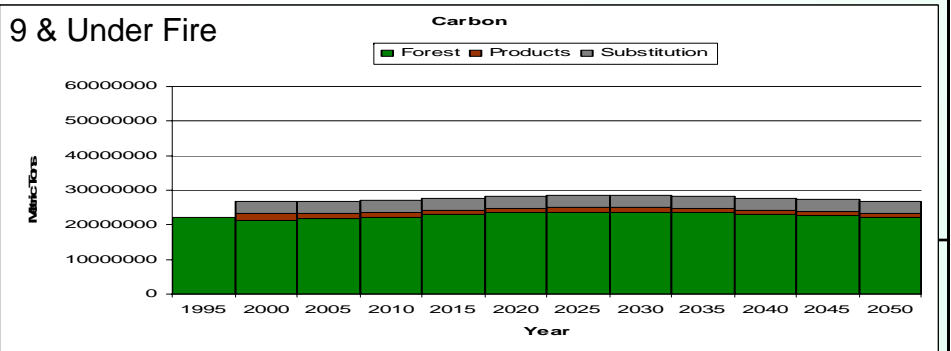
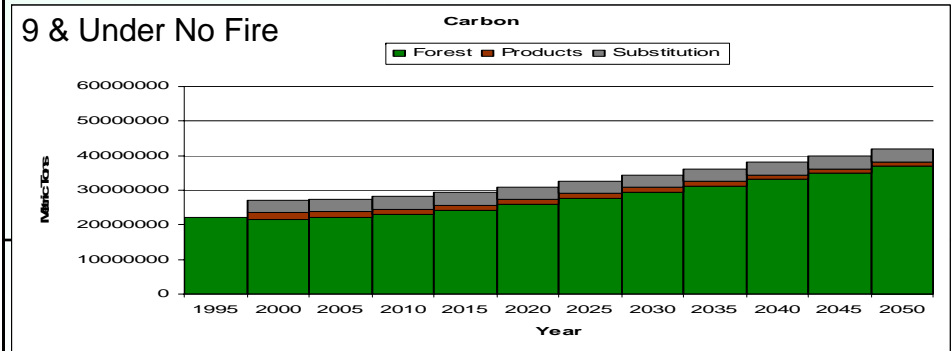
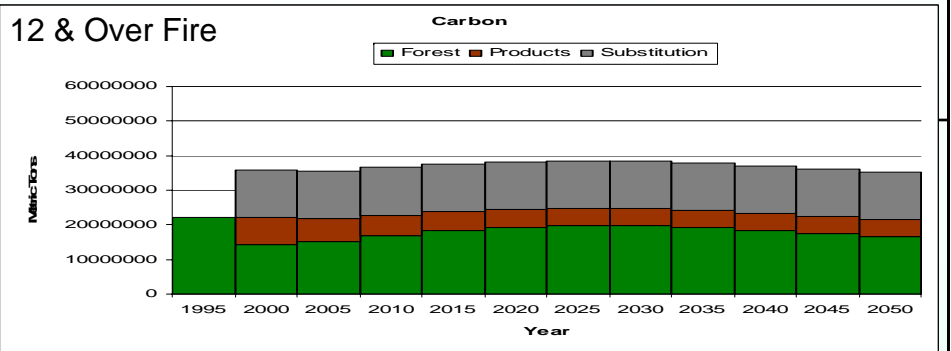
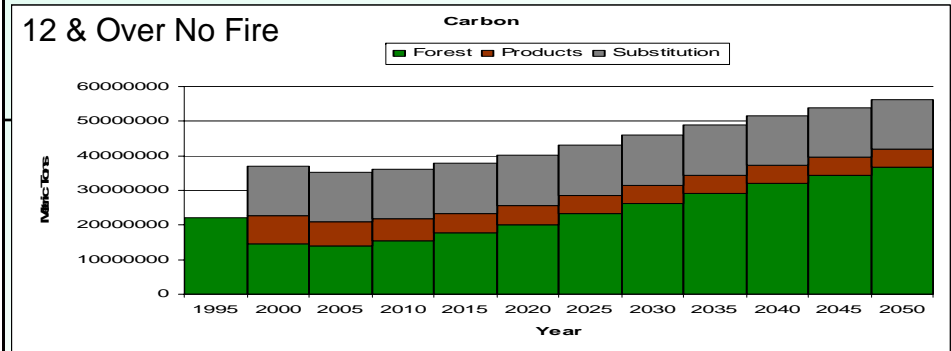
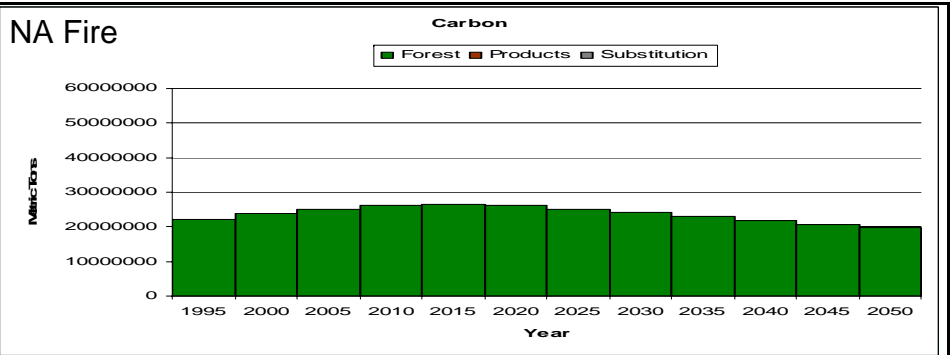
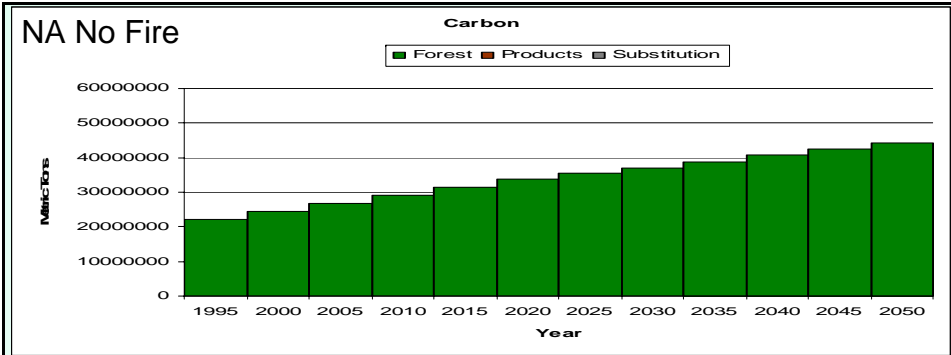
Forest Carbon with Fire: Okanogan with Regeneration



ALL Carbon: Okanogon with Regeneration

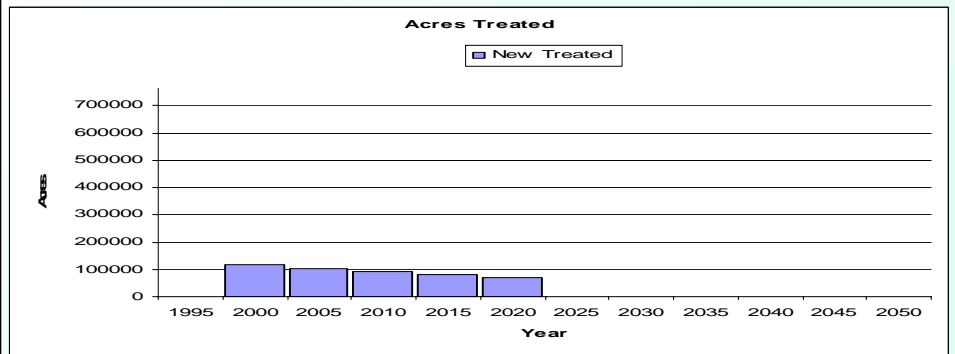
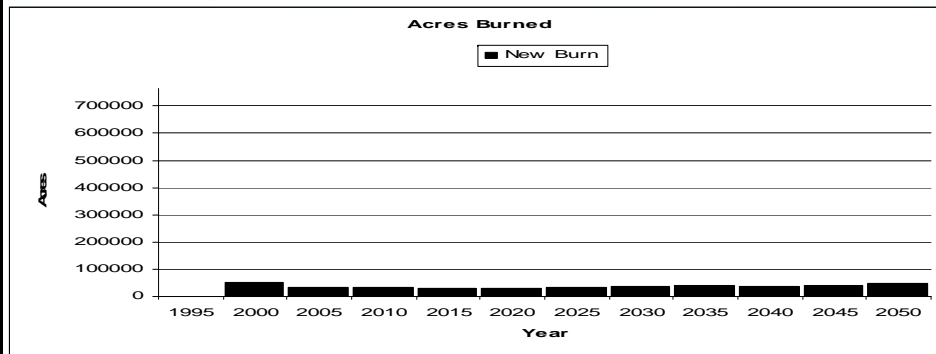
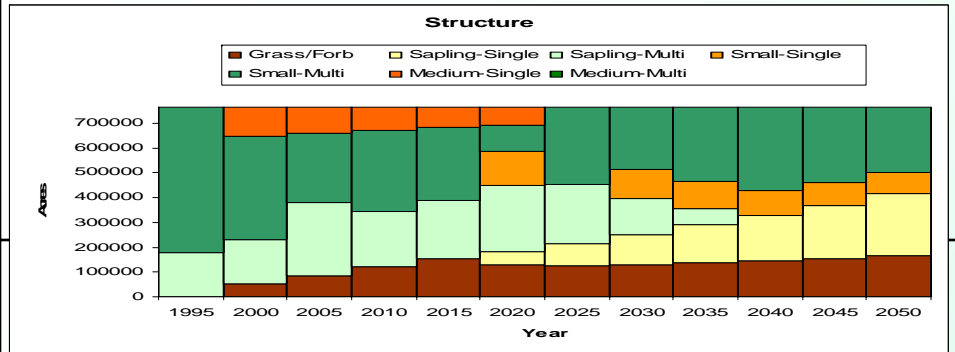
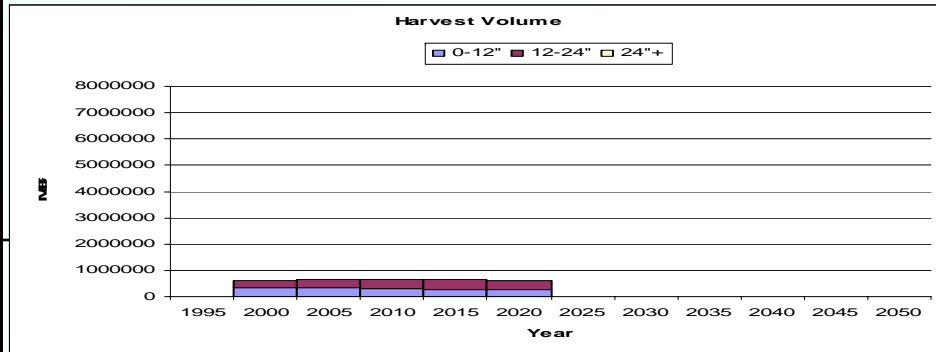
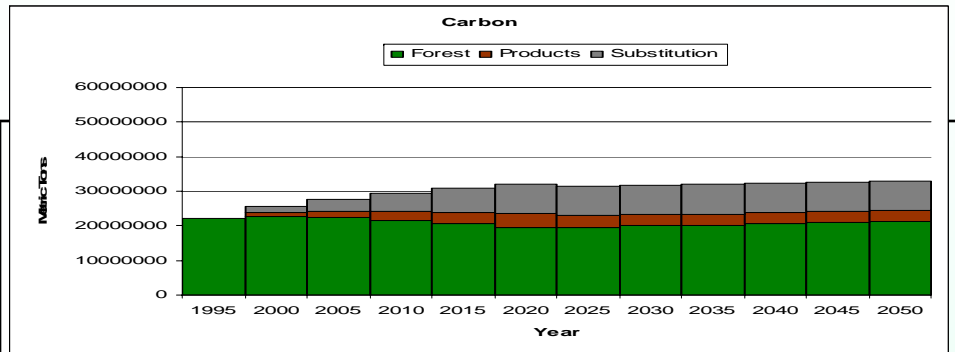
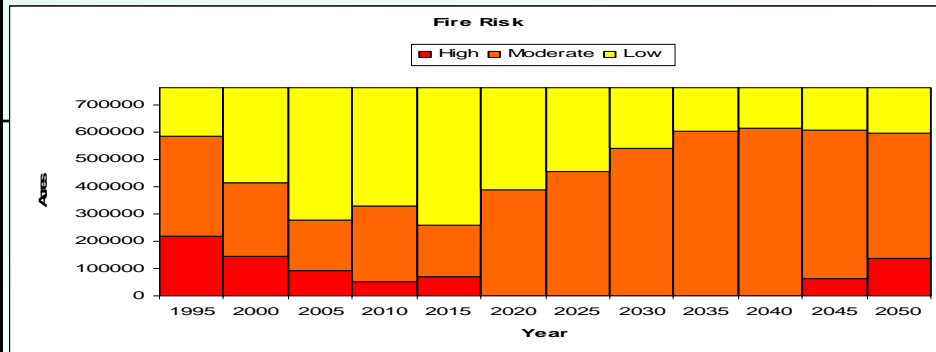






BA45:

20% of Initially High and Moderate groups treated during each of first 5 periods (2000 – 2020)



Treatments phased in over 25 years

| | Treatments: | Fire | 9"- | 12"+ | 45sfBA |
|----------------|--------------------|-------------|-------------|-------------|---------------|
| Carbon | mil. Tonnes | 23.9 | 26.8 | 33.1 | 31.4 |
| | | | | | |
| Burn | 000's acres | 557 | 471 | 562 | 377 |
| | | | | | |
| Harvest | mil bft | 0 | 495 | 5084 | 3213 |
| | | | | | |

Treatment Costs and Revenues

| \$mils | Treatments: | Fire | 9"- | 12"+ | 45sfBA |
|-------------------------------------|-------------|-----------------|-------------------|----------------|-------------------|
| Carbon Value @ \$20/ton | | \$480 | \$540 | \$660 | \$630 |
| Rel Carbon Rev | | \$0 | \$60 | \$180 | \$150 |
| Fire Dept Cost @ \$2000/acre | | \$1,114 | \$942 | \$1,124 | \$754 |
| Harvest Value @ \$200/mbf | | \$0 | -\$30 | \$1,017 | \$573 |
| removal of non-mkt mat'l | | | \$300/acre | | \$150/acre |
| Net Rev-Cost | | -\$1,114 | -\$912 | \$73 | -\$31 |

Conclusions

- Fire risk reduction treatments do increase carbon stored
 - 12 tonnes/acre but the accounting is complex
- Treatment response time reduces benefits (limits reduction in acres burned & delays product carbon)
- 9" & under barely reduces fire risk or cost
- 12+ & over produces highest net revenue but maintains high fire risk
 - Other non-mkt values (avoided costs) would reduce benefit
- 45sfBA almost as good with fire fighting cost included
 - Better with other non-mkt benefits included

Support Acknowledgements

- CORRIM- Consortium for Research on Renewable Industrial Materials
 - 15 research institutions and 23 authors
 - DOE & 5 companies funded the Research Plan
 - USFS/FPL, 10 companies & 8 institutions funded Phase I
- PNW & SE product manufactures surveyed
- USDA/CSREES National Research Initiative competitive grants program
- EPA & Special grants for carbon links

The Details

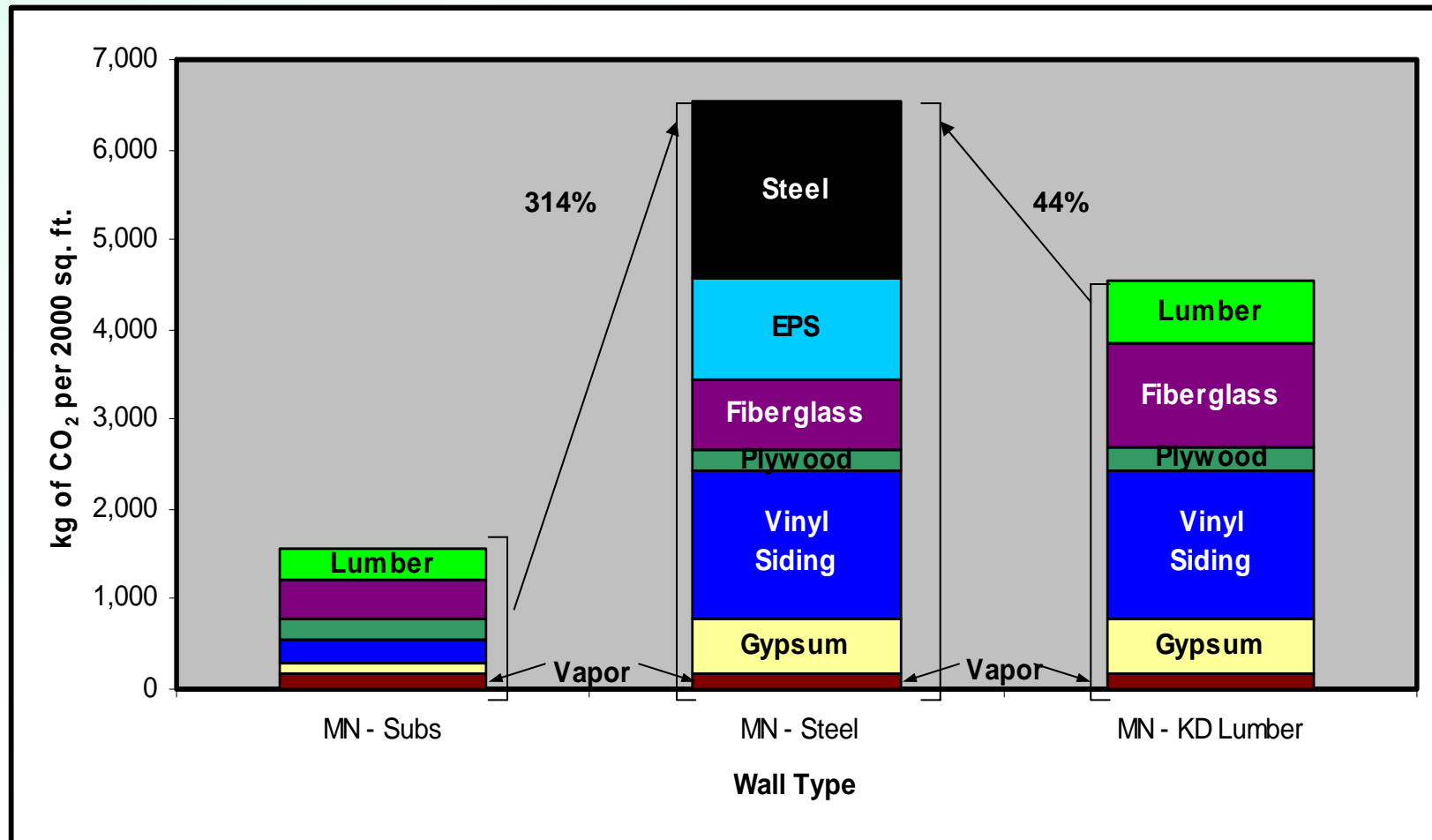
CORRIM: www.CORRIM.ORG

Athena: www.athenaSMI.ca

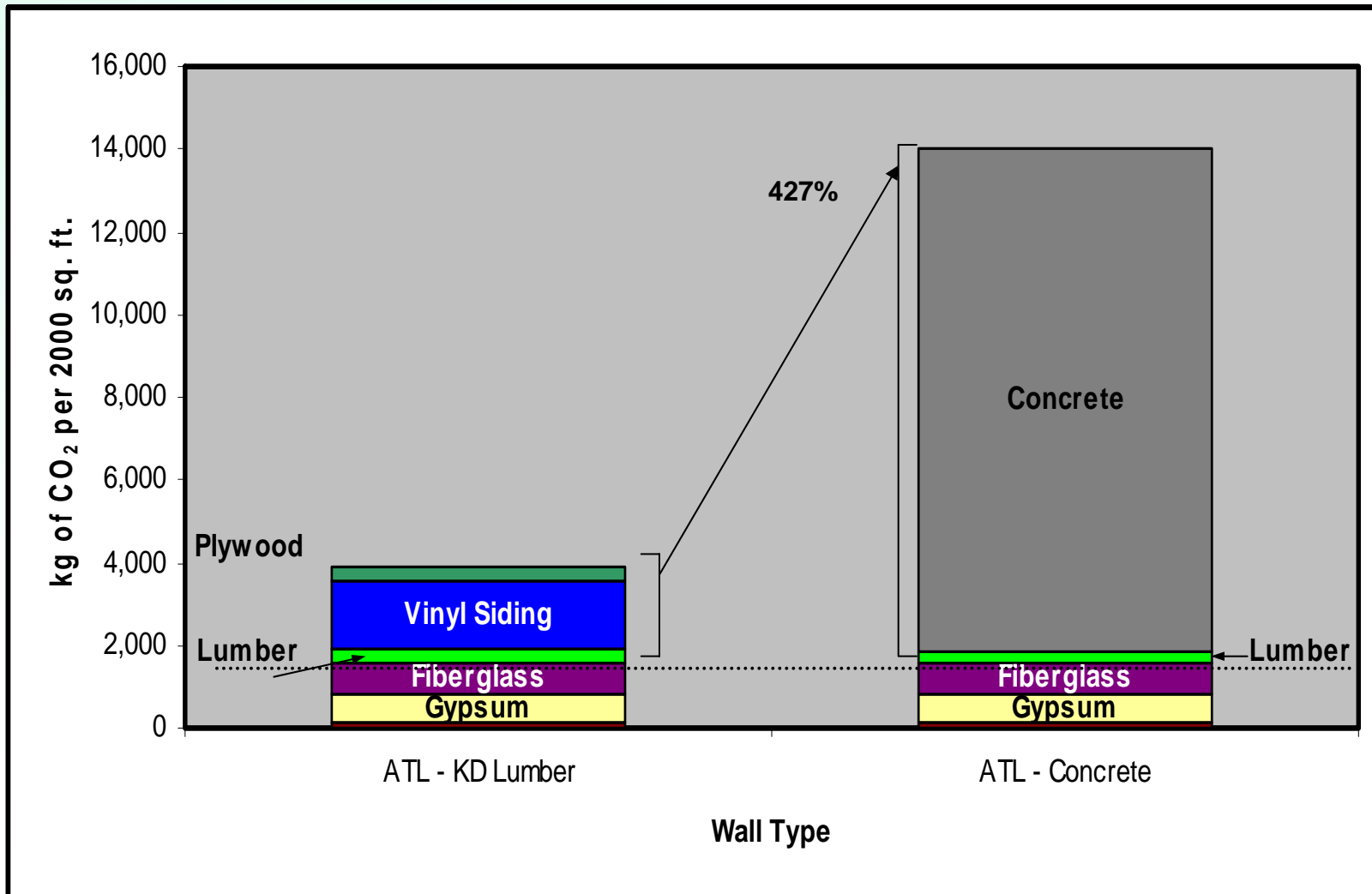
LMS: <http://LMS.cfr.washington.edu>

USLCI database: www.nrel.gov/lci

Minneapolis Walls: GWP per component

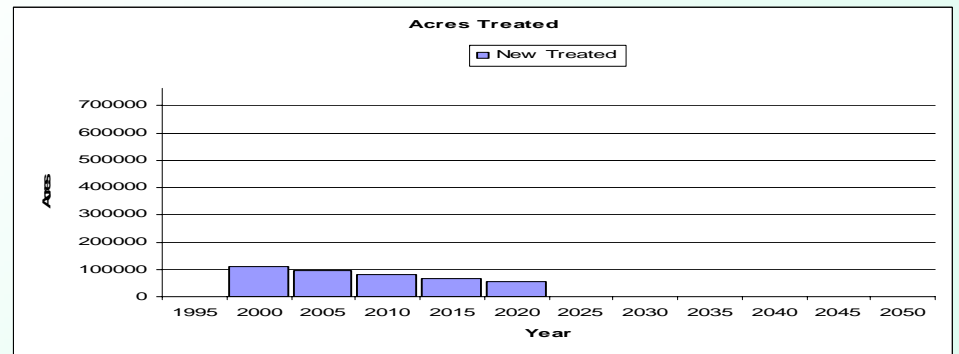
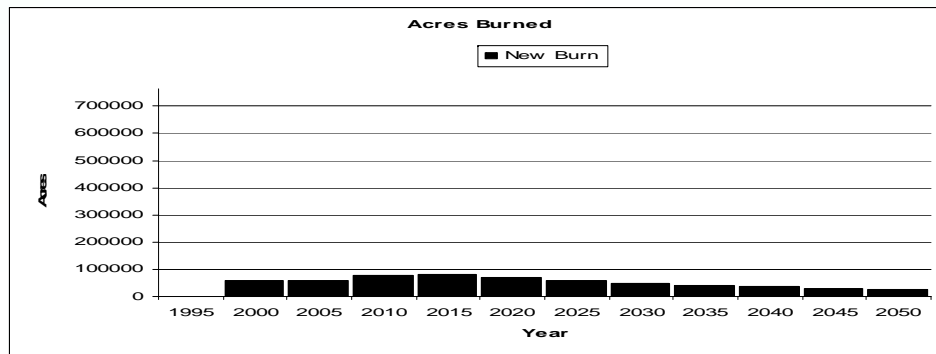
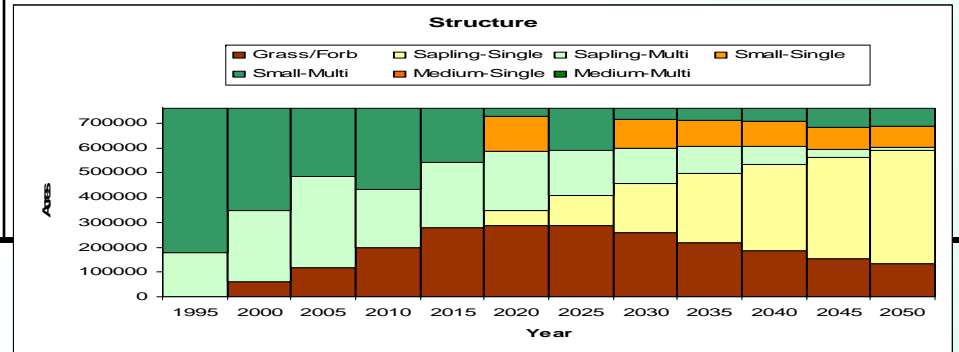
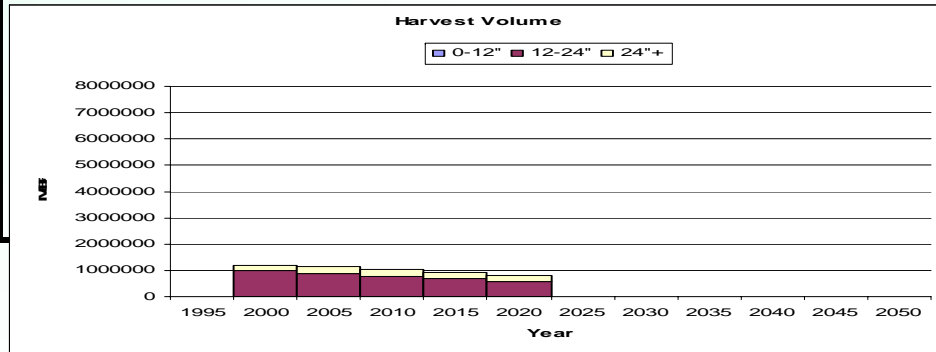
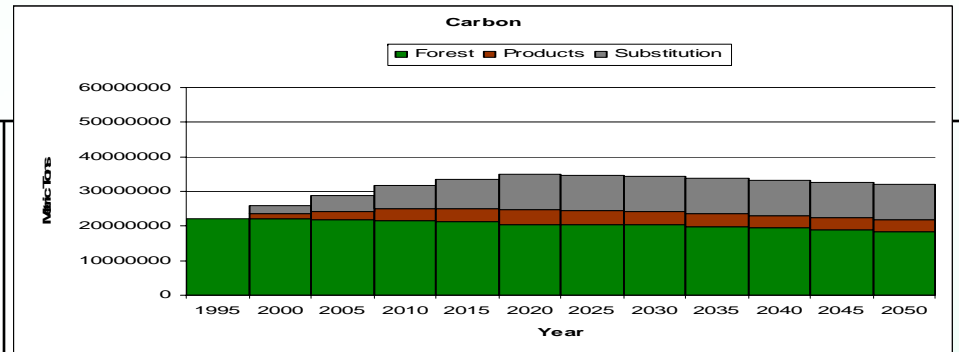
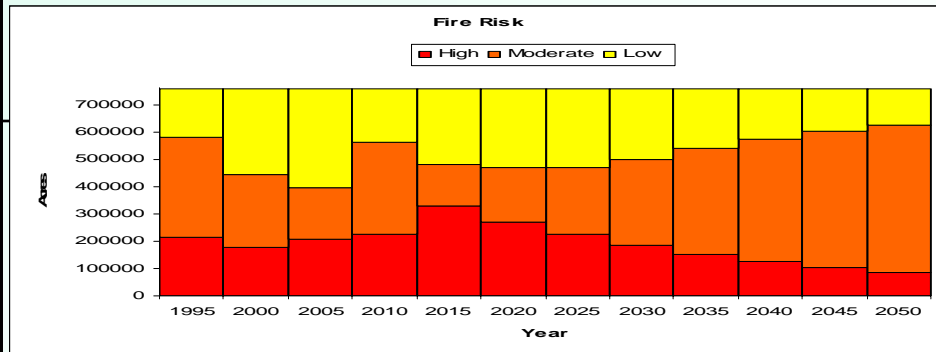


Atlanta Walls: GWP per component



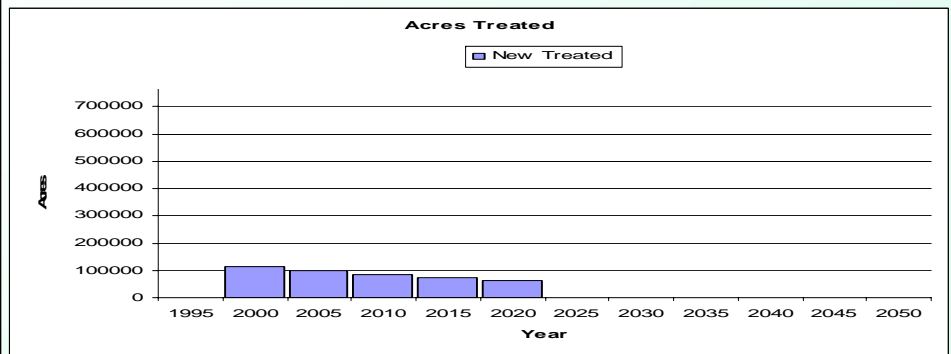
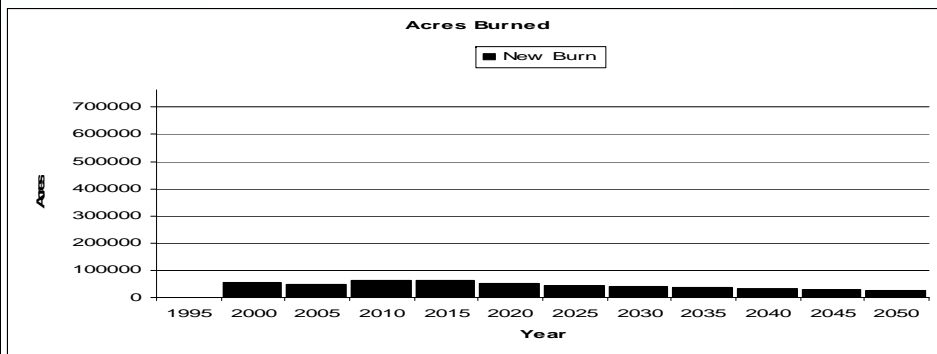
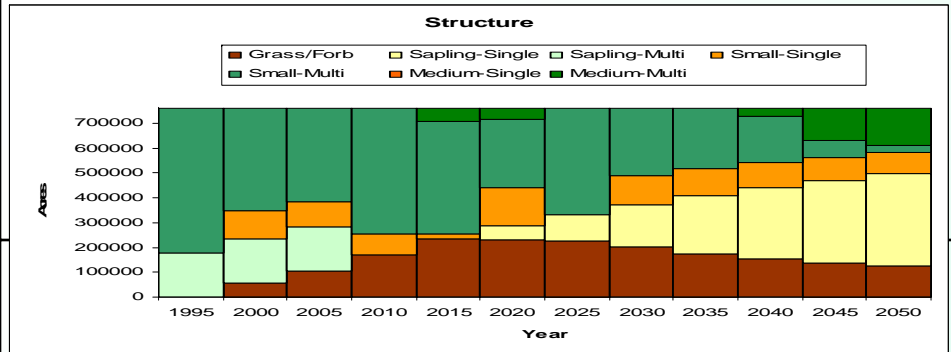
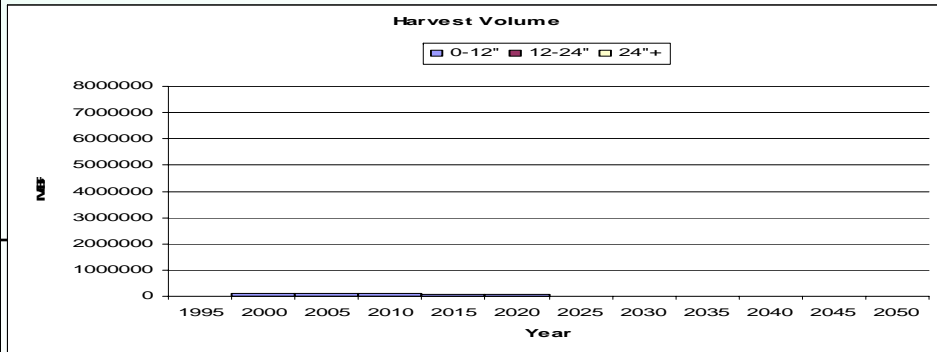
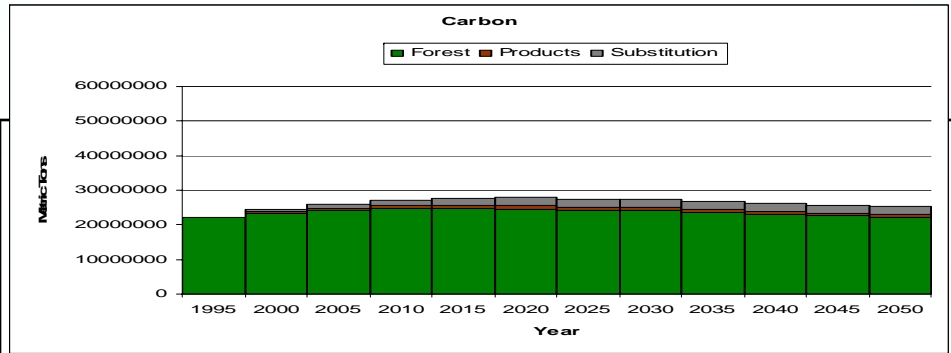
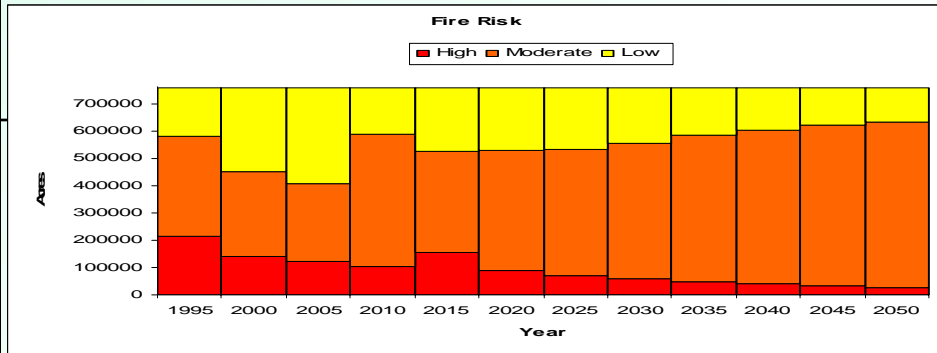
12 & Over:

20% of Initially High and Moderate groups treated during each of first 5 periods (2000 – 2020)

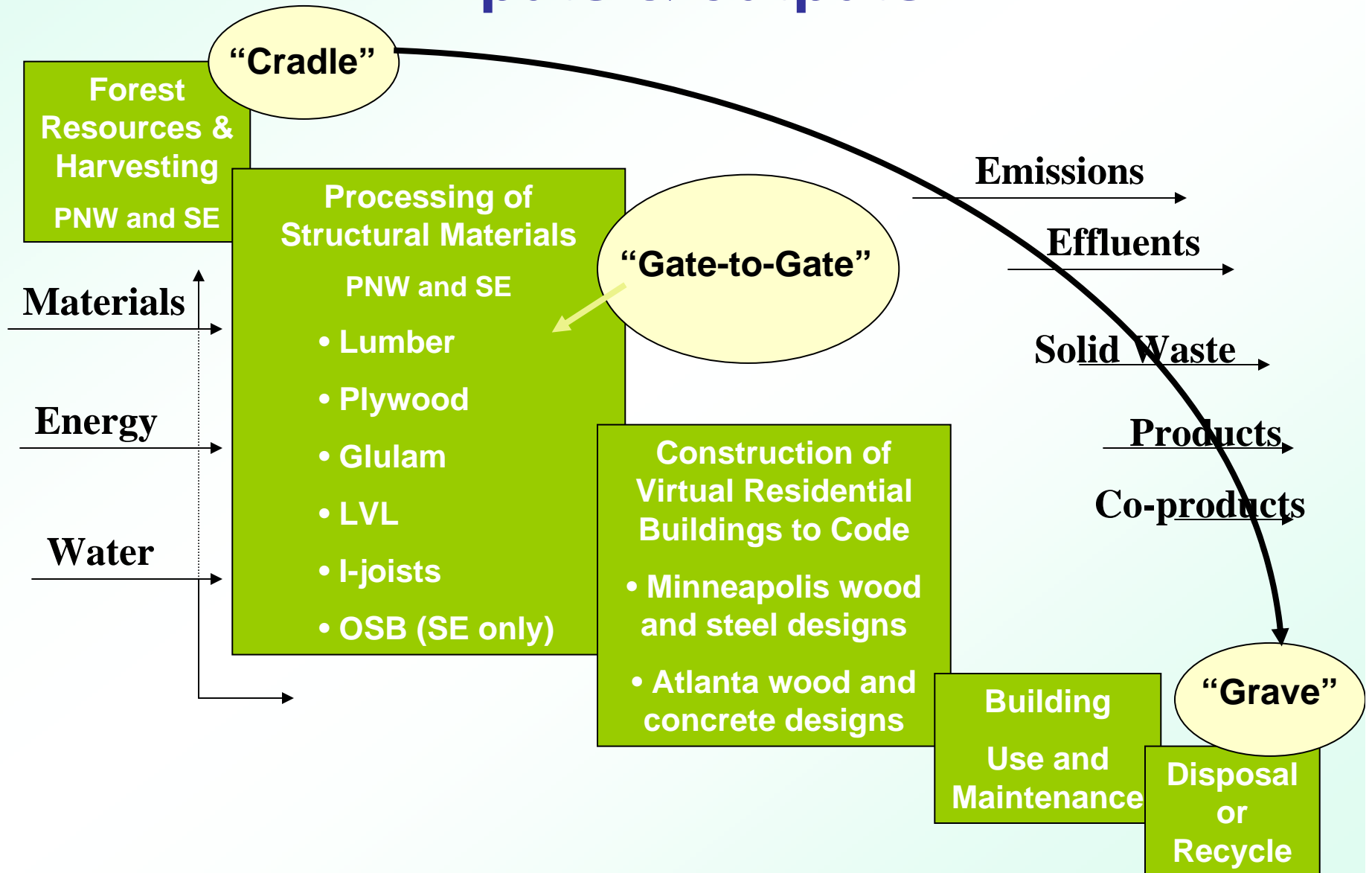


9 & Under:

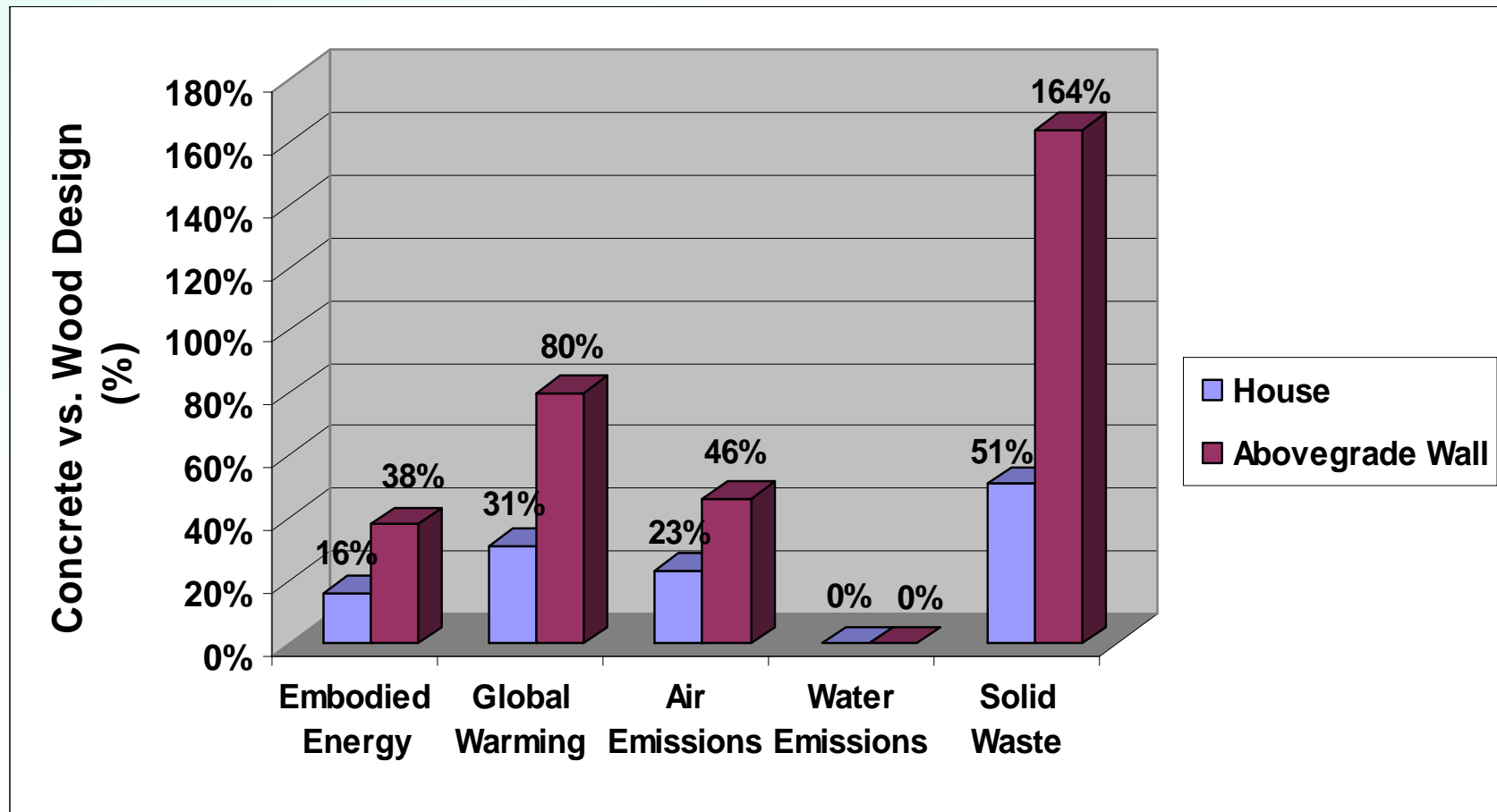
20% of Initially High and Moderate groups treated during each of first 5 periods (2000 – 2020)



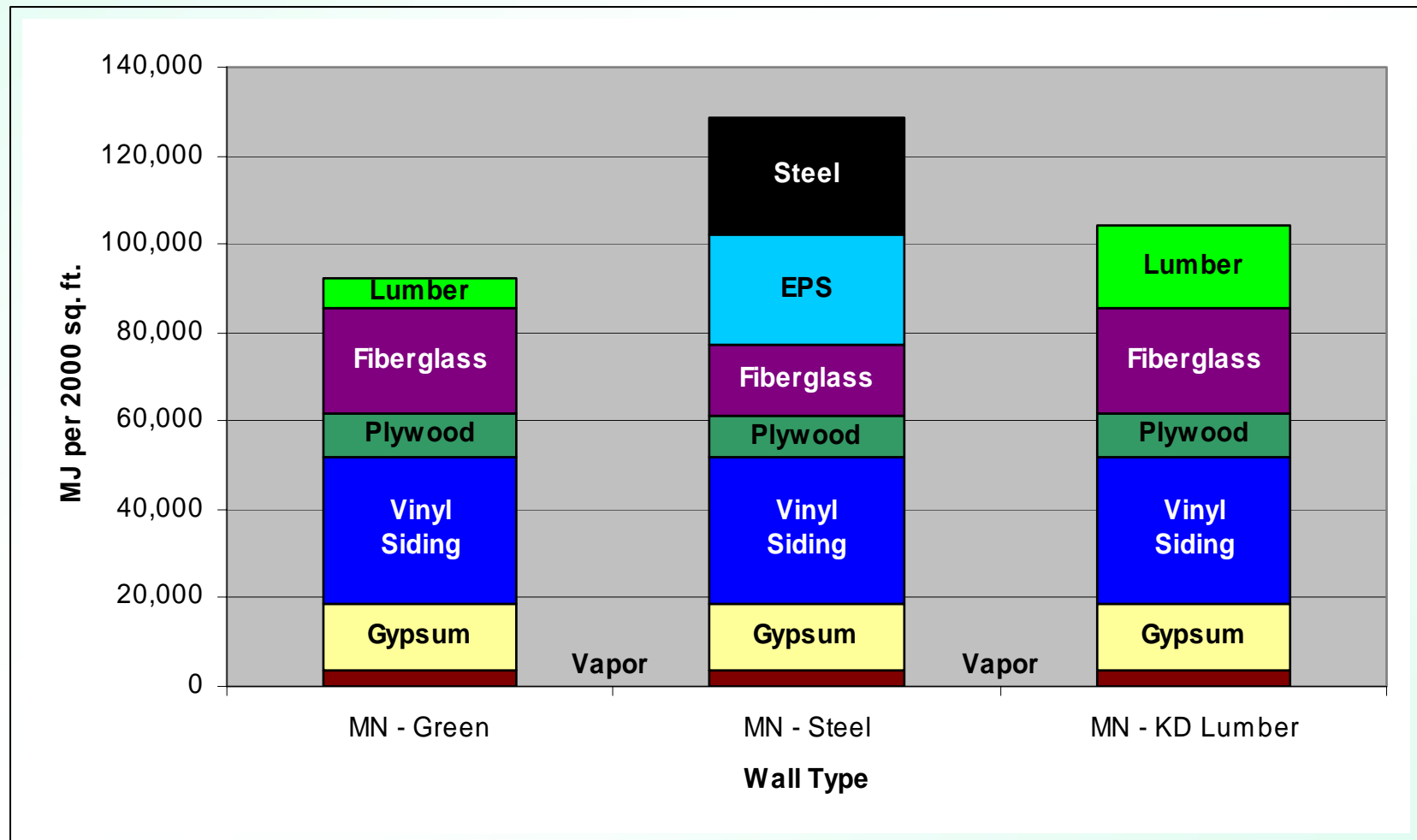
Life Cycle Inventories: measure all inputs & outputs



Summary Performance Indices Atlanta House vs. Above-grade Wall



Total energy for cold climate exterior walls (Minneapolis)



Carbon in Forests, Products and Concrete Frame Substitutes

