Natural Resource Issues in the Pacific Northwest: The Next Century

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Centennial Lecture Series: Sustaining our Northwest World

Centennial Lecture Series

- History of forestry and natural resource management (Lecture One)
- Current situation in Washington State (Lecture Two)
- The future of natural resource management in the PNW (Lecture Three)

Topical Outline

- Shifting paradigm of natural resource management
- Forces that are driving future change
- Future of Washington's Forests Study
- Creating future leaders

Shifting Management Philosophy

- 20th Century
- Agricultural Model
- Utilitarian
- Output oriented
- Stand level
- Timber primacy (sustained yield)
- Multiple use

- 21st Century
- Ecosystem Model
- Naturalistic
- State oriented
- Landscape view
- Multi-resource (sustainability)
- Integrated use

21st Century Decision Environment

- New complexities due to uncertainties
  - Bio-physical systems (environmental change)
  - Socio-economic systems (unpredictable political institutions and market situations)
- Global climate change
- Global market for ideas
- Information age (internet, mobile devices, cable TV, etc.)

21st Century Decision Environment

- Reducing forest risk may replace productivity as principal concern of managers
- Increasing forest resiliency for sustainability will grow stronger
- Organizational networks and collaborative institutions may replace top-down hierarchical structures

Effect of Global Climate Change on Northwest Forest Ecosystems

- Examples of estimated climate impacts:
  - Average global temperatures might warm 2-5 degrees (C) over next Century
  - Drier summers and wetter winters might occur across PNW
  - CO_2 (the principal green house gas) levels will likely increase

Effect of Global Climate Change on Northwest Forest Ecosystems

- How will trees and forests react to these estimated changes?
  - Species distributions may change
  - Increased physiological stress may occur
  - Forest fires may occur more frequently and be more intense
  - Biodiversity might be adversely affected
  - Forest productivity may increase or decrease
- Much uncertainty surrounds these possibilities

Effect of Global Climate Change on Northwest Forest Ecosystems

- Range and population sizes of tree species may change dramatically
- Natural and managed forests differ significantly in their responses
- Wildlife effects are poorly understood, but nature reserves may be adversely affected

Effect of Global Climate Change on Northwest Forest Ecosystems

- Significant changes in hydrological cycles may occur (snow fall, rain, floods, drought)
- Increased vulnerability to invasive species

Water Supply Issues in the PNW

- Possible changes in the PNW climate as a consequence of global climate change
  - Warmer temperatures
  - Wetter winters
  - Reductions in snow pack
  - Earlier peak spring run off

Source: UW Climate Impacts Group

Water Supply Issues in the PNW

- Possible implications of climate change on PNW water resources
  - Many rivers will see changes in peak flows between winter and summer
  - Salmon will suffer if summer flows decrease and water temperatures rise
  - Low lying coastal areas may be flooded as rivers and oceans rise

Source: UW Climate Impacts Group

Water Supply Issues in the PNW

- Increased conflicts over water rights and usage
- Increased urban demand for water relative to agriculture

Source: UW Climate Impacts Group

Effect of Global Climate Change on Northwest Forest Ecosystems

- Forests may help mitigate these effects
  - Carbon sequestration (carbon sinks)
    - ecosystem strategies that maintain and preserve existing forests
    - strategies that aim to increase the area of land under forest
    - strategies that increase the tree density on forest land (C/ac)
  - Use of bio-mass in place of fossil fuels
  - Use of wood in place of steel, cement, aluminum, and plastics

Why a Paradigm Shift?

- Changing societal values of a growing and urbanizing population
- Growing awareness of the ecological and environmental implications of climate change
  - loss of biodiversity in managed forests, invasives, endangered species, wildfire, water, and forest health (insects and diseases)

21st Century Concerns

- Societal emphasis on:
  - protection vs. production forests
  - natural vs. plantations forests
  - preservation vs. conservation (for recreation and solitude)
  - use vs. exchange value
  - desire for passive vs. active management

21st Century Concerns

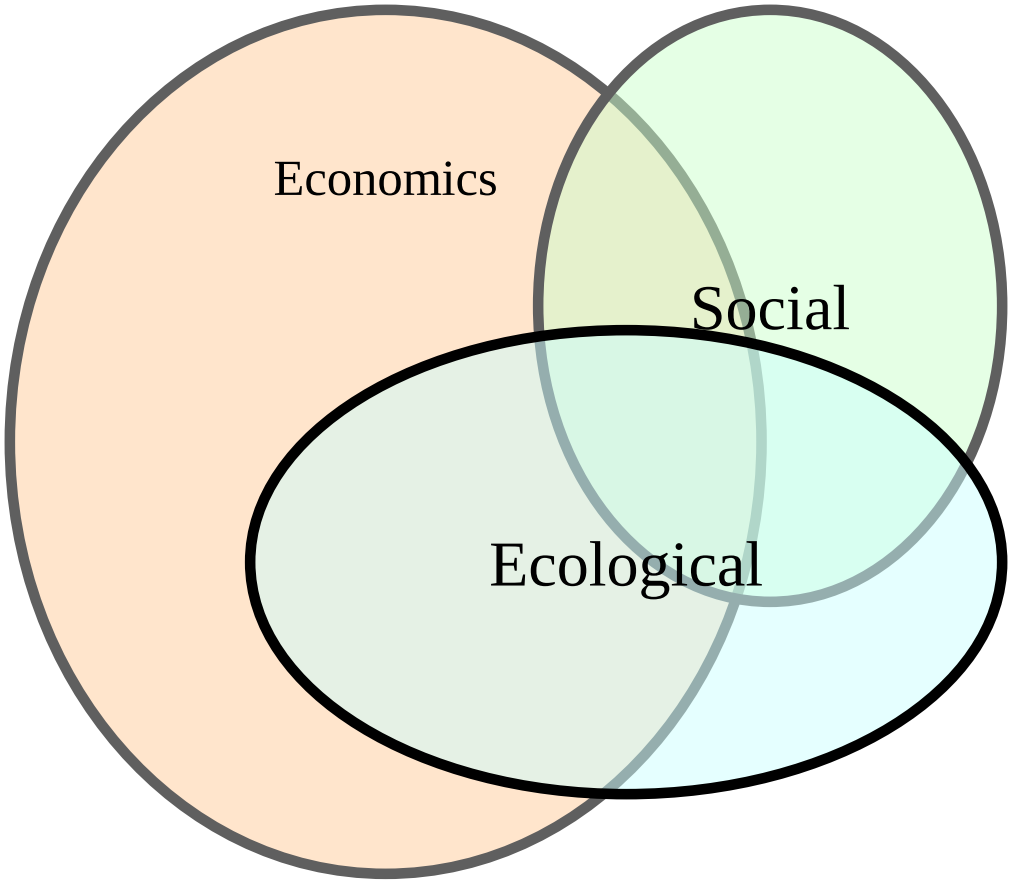
- Additional issues –
  - ecosystem fragmentation
  - loss of habitat connectivity
  - forest land conversion
  - loss of ecosystem services
  - financial incentives which promote land development and conversion to HBU
  - Tremendous change in private forest land ownership patterns

Sustainable Forestry

- A type of management that views the forest not as the source of any one economic product or service, but as an integrated whole
- Respects the full range of environmental, social, and economic values of the forest and attempts to integrate these diverse values

Source: Roundtable on Sustainable Forests

Defining Sustainability



Sustainability

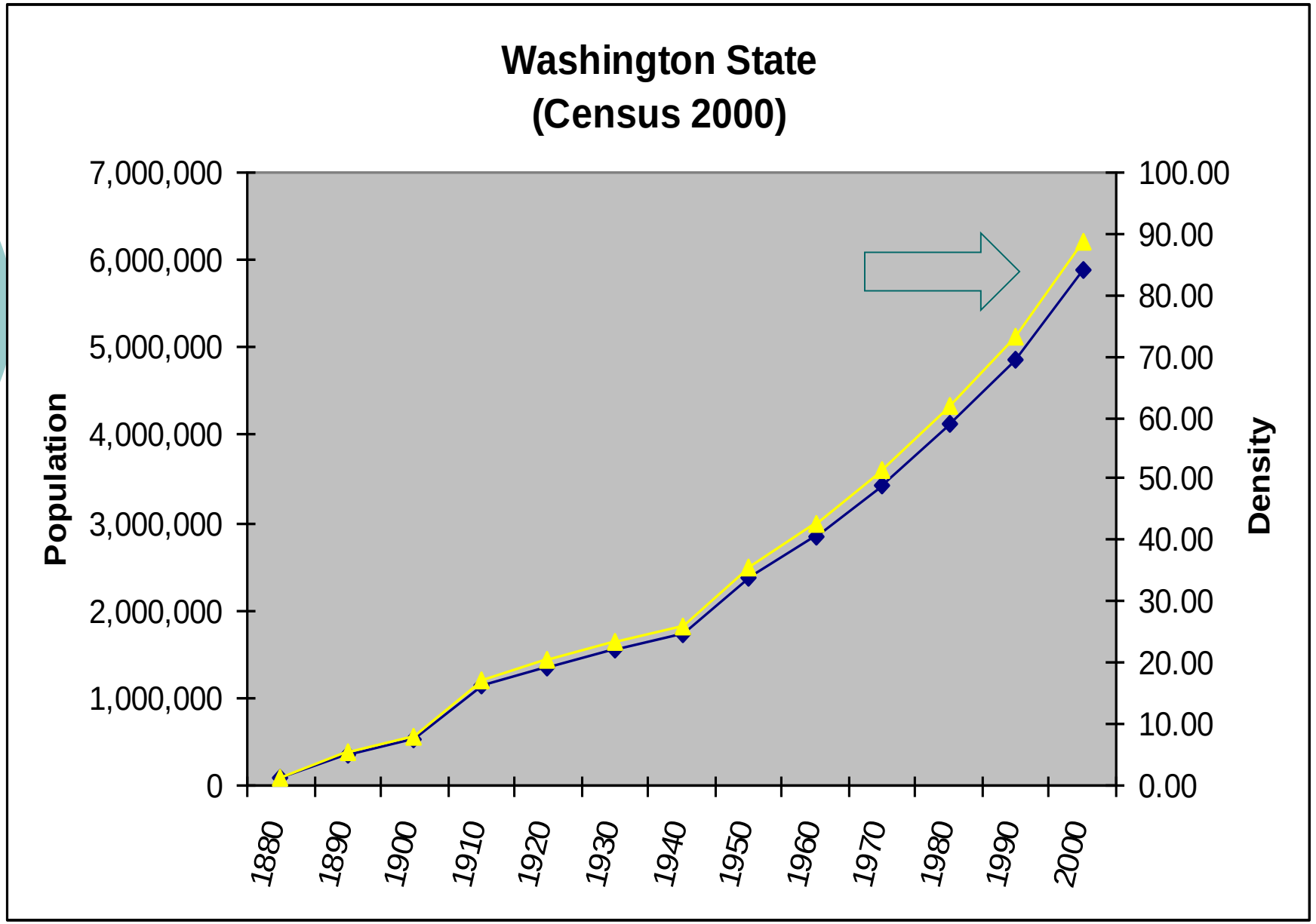
- Sustainability relates to all natural resources
- Considers the needs of future generations as well as those of the present
- Dynamic equilibrium that balances ecological functions and conditions with social and economic factors

Sustainability

- Sustainable forests : Managed and natural
  - Plantations, parks, reserves, watersheds
- Sustainable urban environments
  - Urban forestry, horticulture, restoration ecology, water and wildlife in public gardens, green belts, open spaces
- Sustainable forest enterprises
  - Pulp, paper and saw mills, precision forestry technologies, tourism, recycling, nurseries, non-timber forest products, bio-refineries

Topical Outline

- Shifting paradigm of natural resource management
- Forces that are driving future change
- Future of Washington's Forests Study
- Creating future leaders


Washington State
(Census 2000)
Population
Density
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6,000,000
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4,000,000
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2,000,000
1,000,000
0
100.00
90.00
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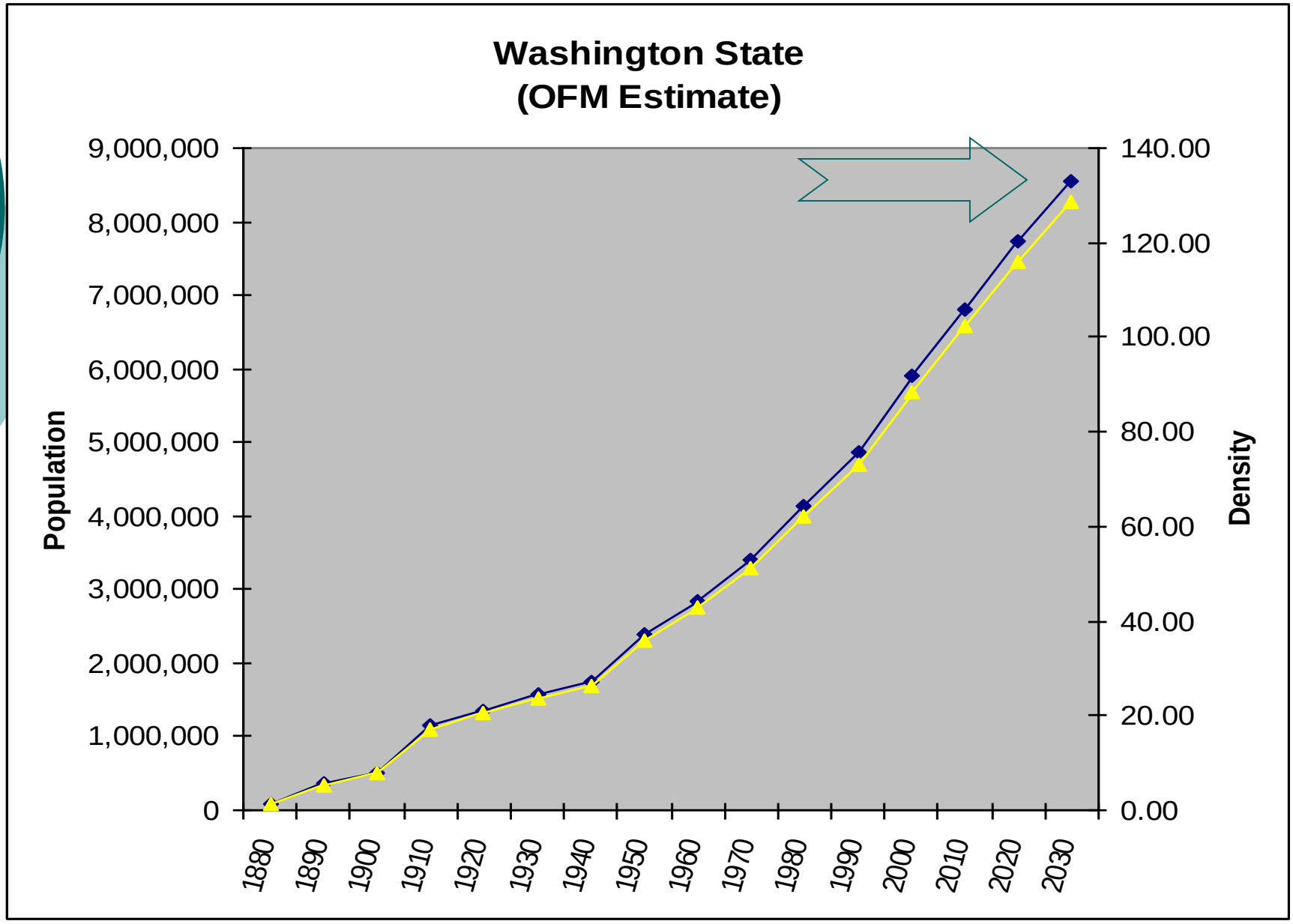
Washington State
(OFM Estimate)
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Density
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7,000,000
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4,000,000
3,000,000
2,000,000
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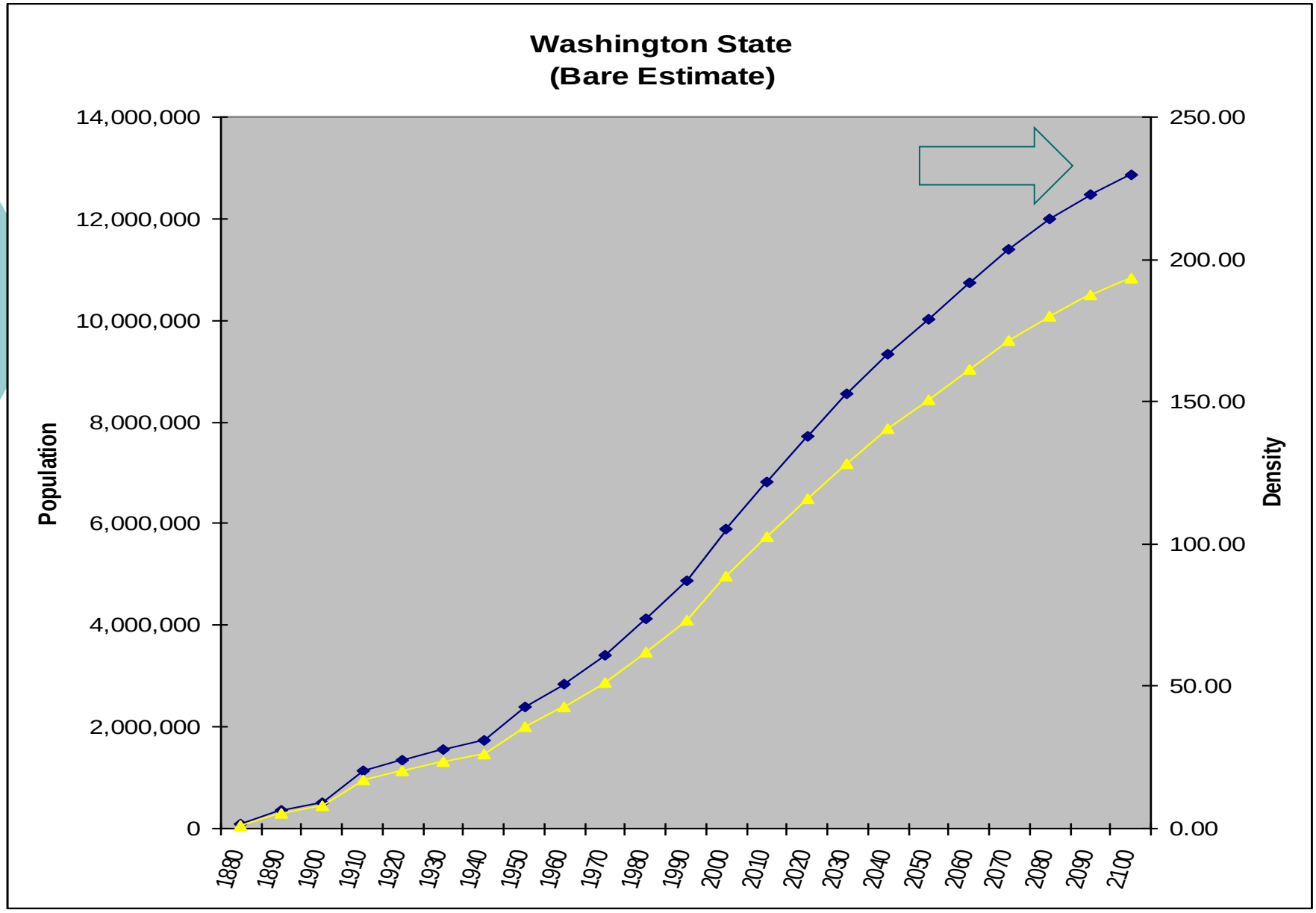
Washington State
(Bare Estimate)
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Density
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6,000,000
4,000,000
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200.00
150.00
100.00
50.00
0.00
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1900
1910
1920
1930
1940
1950
1960
1970
1980
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2020
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2070
2080
2090
2100

Forces Driving Change

- Affluent population with leisure time and disposable income
- Global climate
- Global economy
- Renewable energy
- Forest health
- Enhance biodiversity

Topical Outline

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Washington Commercial Timberland

- Western Washington – 9.6 million acres (60%)
- Eastern Washington – 6.5 million acres (40%)
- Total -- 16 million acres (unreserved)*

* 2 million acres reserved

Washington Commercial Timberland Ownership

- 29% national forest
- 15% other public

- 29% forest industry
- 27% other private

Washington Timber Inventory

- 34% national forest
- 19% other public

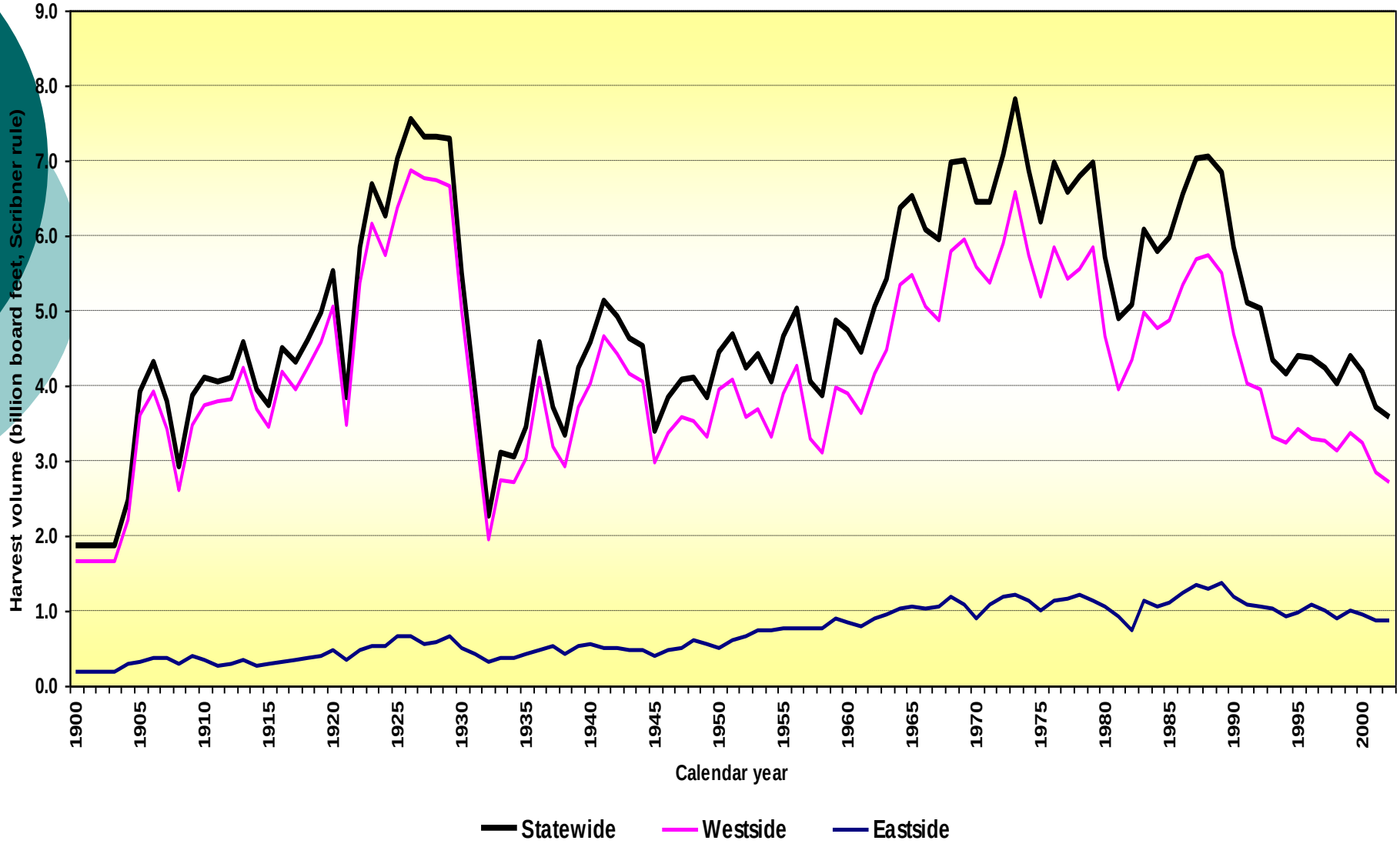
- 26% forest industry
- 21% other private

Washington timber harvest (2002)

- 2.0% national forest
- 12.7% WA DNR
- 1.5% other public
- 36.5% forest industry
- 47.3% other private*

* Includes NA and private owners w/o conversion facilities (TIMOs, REITs, MLPs)

Total timber harvest in Washington state by region, 1900 to present



Source: WA DNR

Future of Washington's Forests

The 2005 State Legislature appropriated $1 million to WA DNR to contract with College

- Outgrowth of College's Northwest Environmental Forum (2004) on Saving our Working Forests

The Changing Northwest Forest Landscape: Keeping It Green

- What is a working forest?
  - well-managed sustainable forest as measured in ecological, economic and social terms
  - permanent, non-fragmented land base over time

The Changing Northwest Forest Landscape: Keeping It Green

- *actively managed* for commodity production (e.g., carbon, floral greenery, timber, hunting rights, etc.) as well as ecological resource values (e.g., wildlife habitat, surface water, biological diversity, etc.) and social values (e.g., cultural, historic, aesthetic, etc.)

The Changing Northwest Forest Landscape: Keeping It Green

- *conserve* and *enhance* soil productivity and other conservation values

The Changing Northwest Forest Landscape: Keeping It Green

- Why working forests matter –
  - offer commodity values demanded by society (e.g., timber, floral greenery)
  - produce a large array of environmental services (e.g., water, biological diversity, aesthetics, habitat)
  - a healthy and high quality of life in Washington includes productive working forests

The Changing Northwest Forest Landscape: Keeping It Green

- Must discover new ways to protect our working forest resource base:
  - without over reliance on governmental regulations
  - by expanding the revenue base of landowners
  - rewarding landowners for the public benefits they produce

Future of Washington's Forests Studies

- Future timber supply and forest biodiversity
- Washington's position in national and global forest products marketplace
- Contribution of forest sector to State's economy
- Pattern of land conversion to non-forest uses
- Financial returns from state forest trust lands

Future of Washington's Forests

- Summary findings:
  - Eastern Washington forest health
  - Western Washington forest land conversion
  - Forest biodiversity and regulations
  - Competition and productivity
  - New markets for environmental services

Eastern Washington Forest Health

- Climate change -- outside range of last century
- High temperatures – low moisture
- Over stocked forests
- Large mountain pine beetle mortality
- Increased forest fire risk
- Thinning needed to improve health

Wildfire in the Inland West

Decades of effective fire suppression have created overly dense forests

- Small diameter trees of shade tolerant species
- Loss of tree vigor has led to increased susceptibility to insect and disease attack – increased amounts of tree mortality - heavy fuel loads and increased risk of wild fire

Wildfire in the Inland West

- Protection and restoration of our forested ecosystems is essential to a sustainable environment
- Managing the high fuel loads through repetitive cycles of thinning and prescribed fire is a critical element to regaining the desired balance we seek

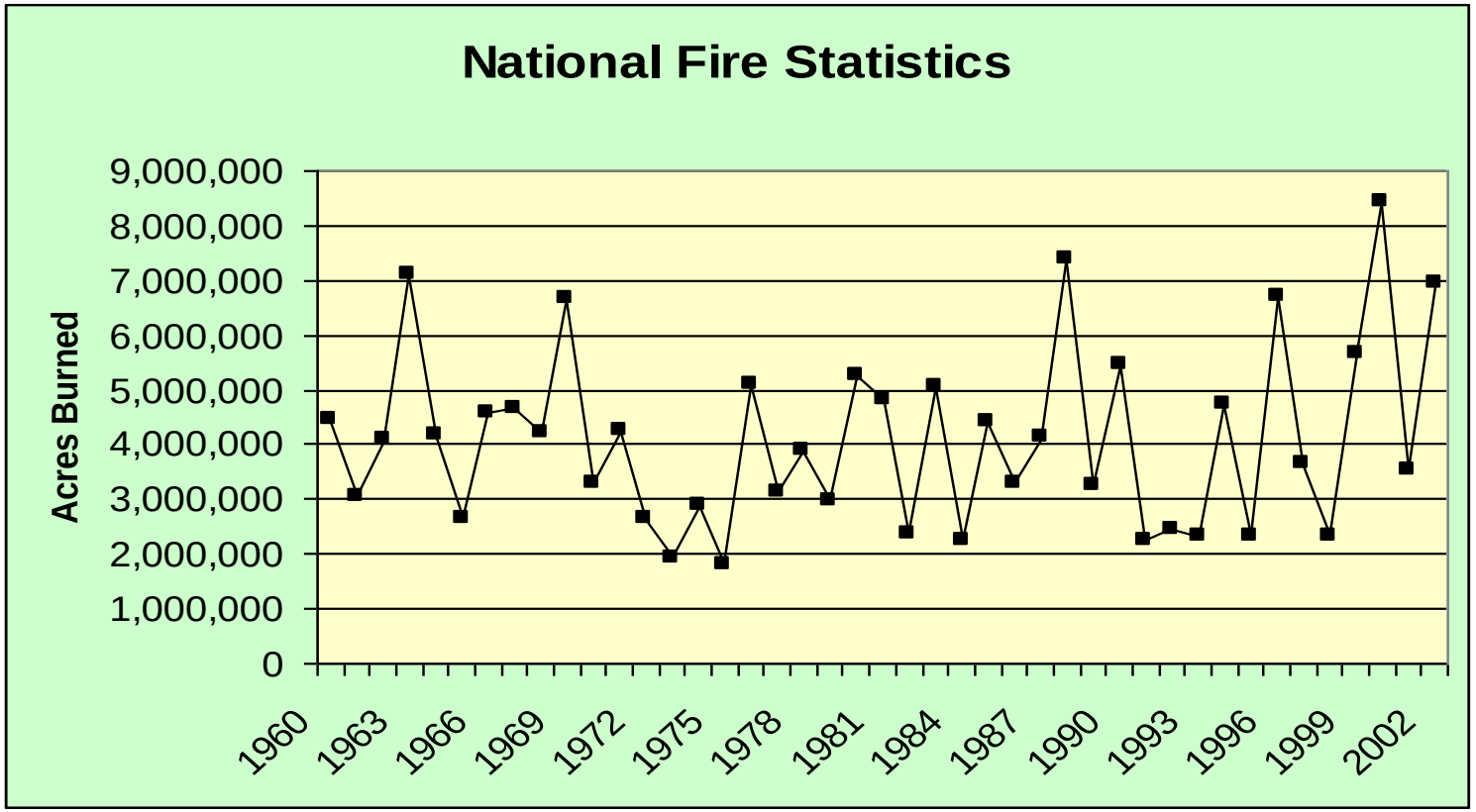
Wildfire in the Inland West

- Forest Service Chief Dale Bosworth has identified four major issues:
  - Fire and fuels
  - Invasive species
  - Loss of open space
  - Unmanaged outdoor recreation
  - Bio-fuels and bio-energy*

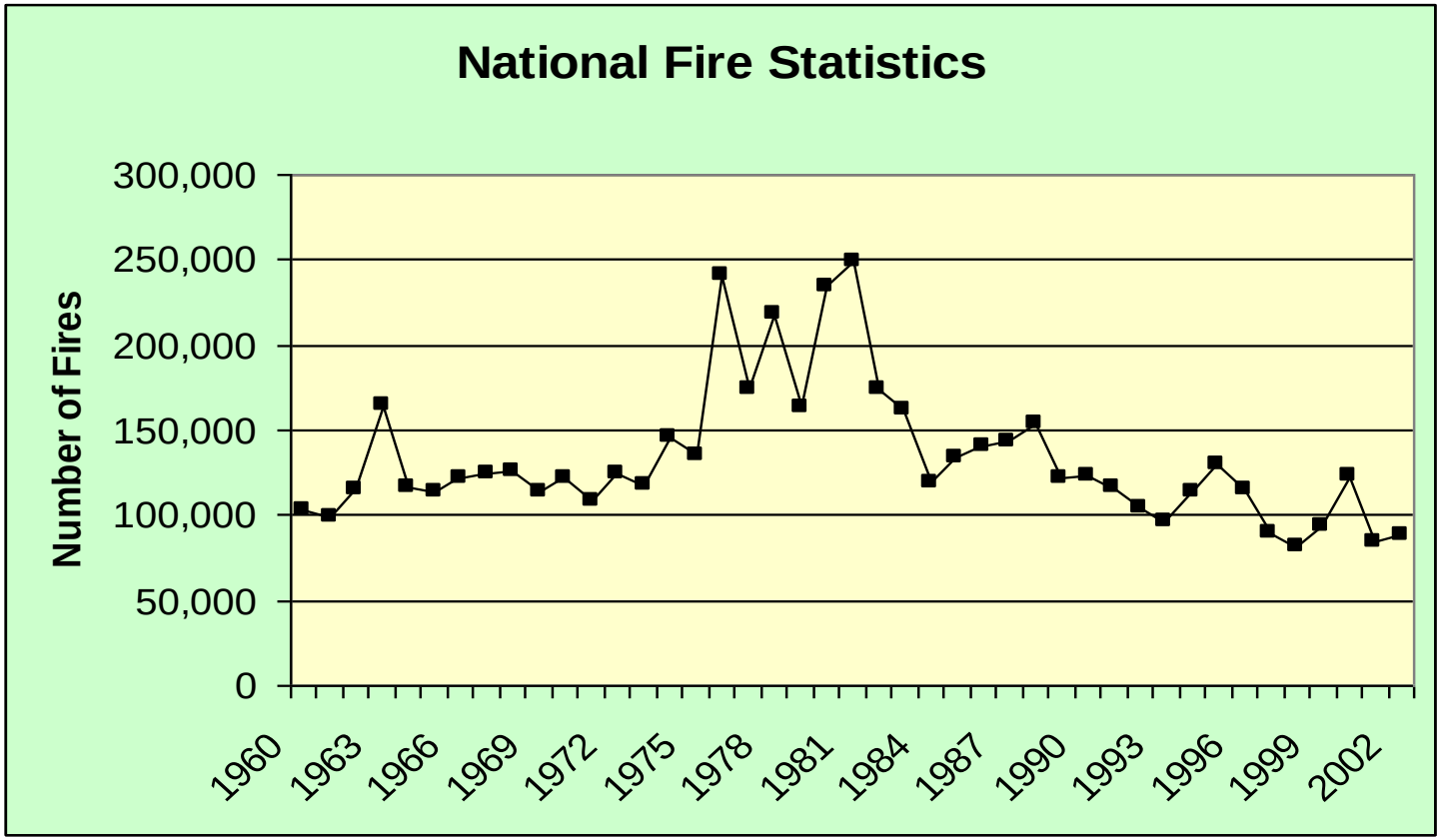
  Source: Changing the Debate on Managing National Forests and Grasslands, Society of Environmental Journalists, New Orleans, September 12, 2003

  * Added since 2003

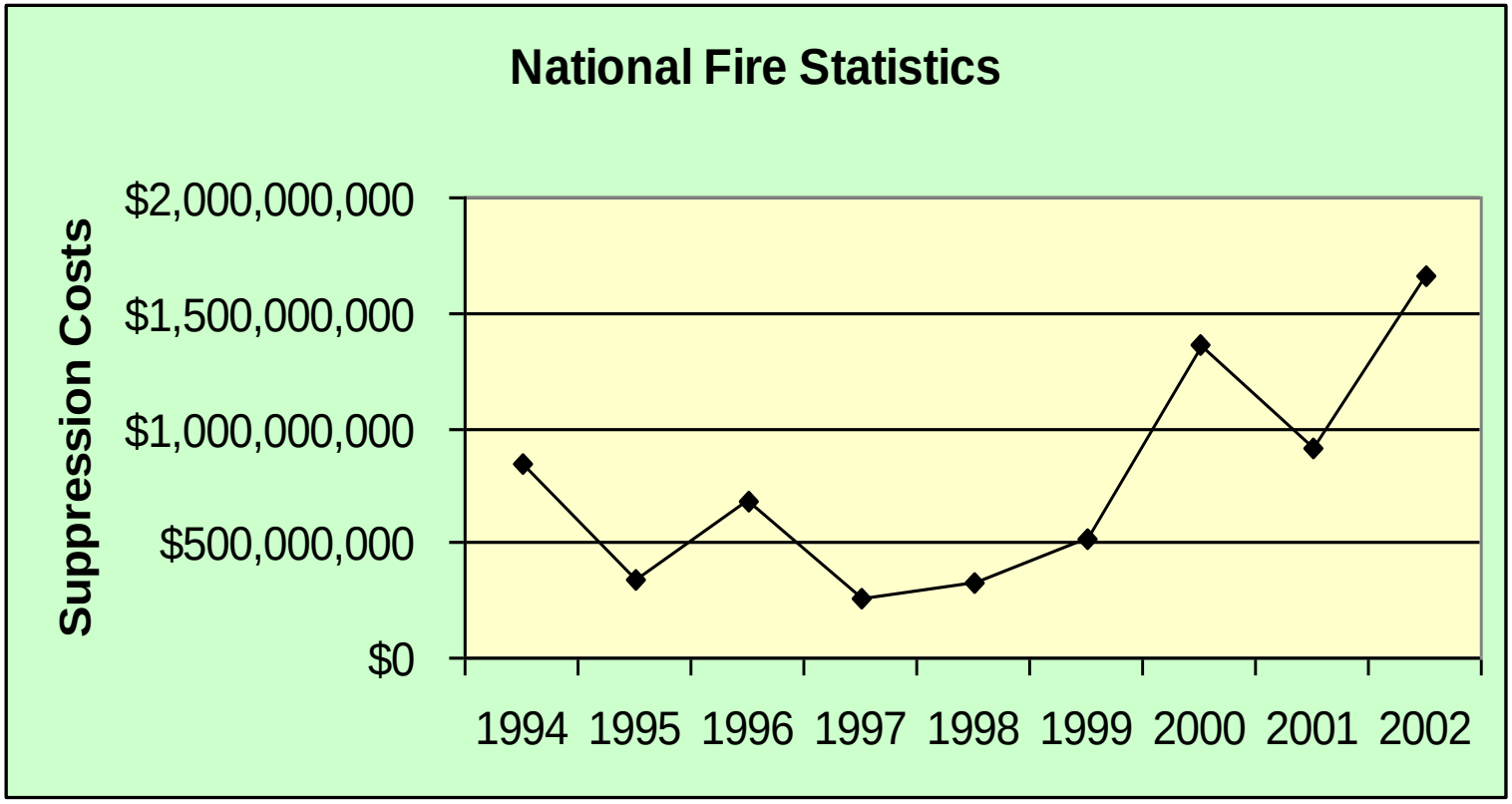
Wildfire in the Inland West

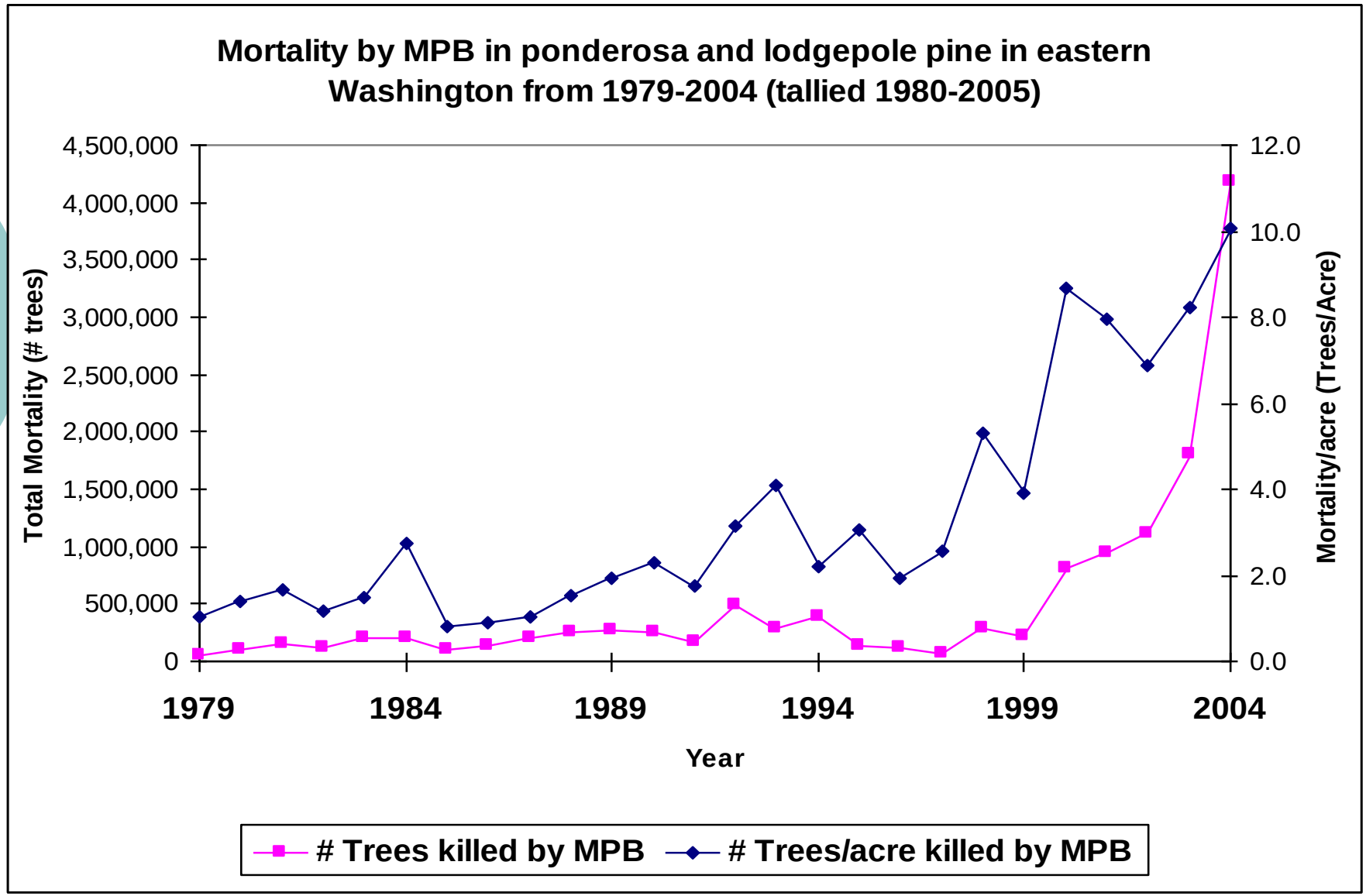


Wildfire in the Inland West

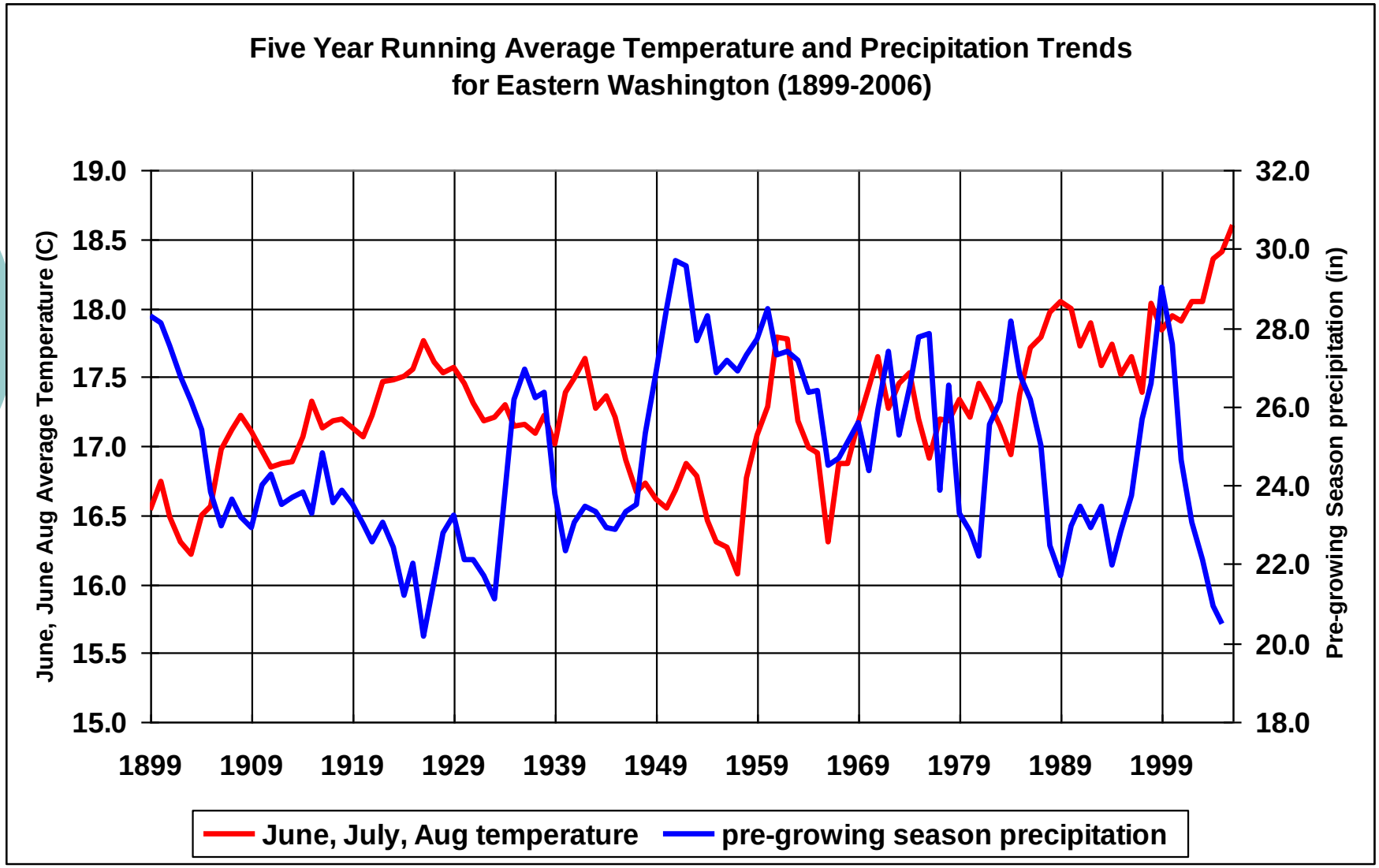


Wildfire in the Inland West

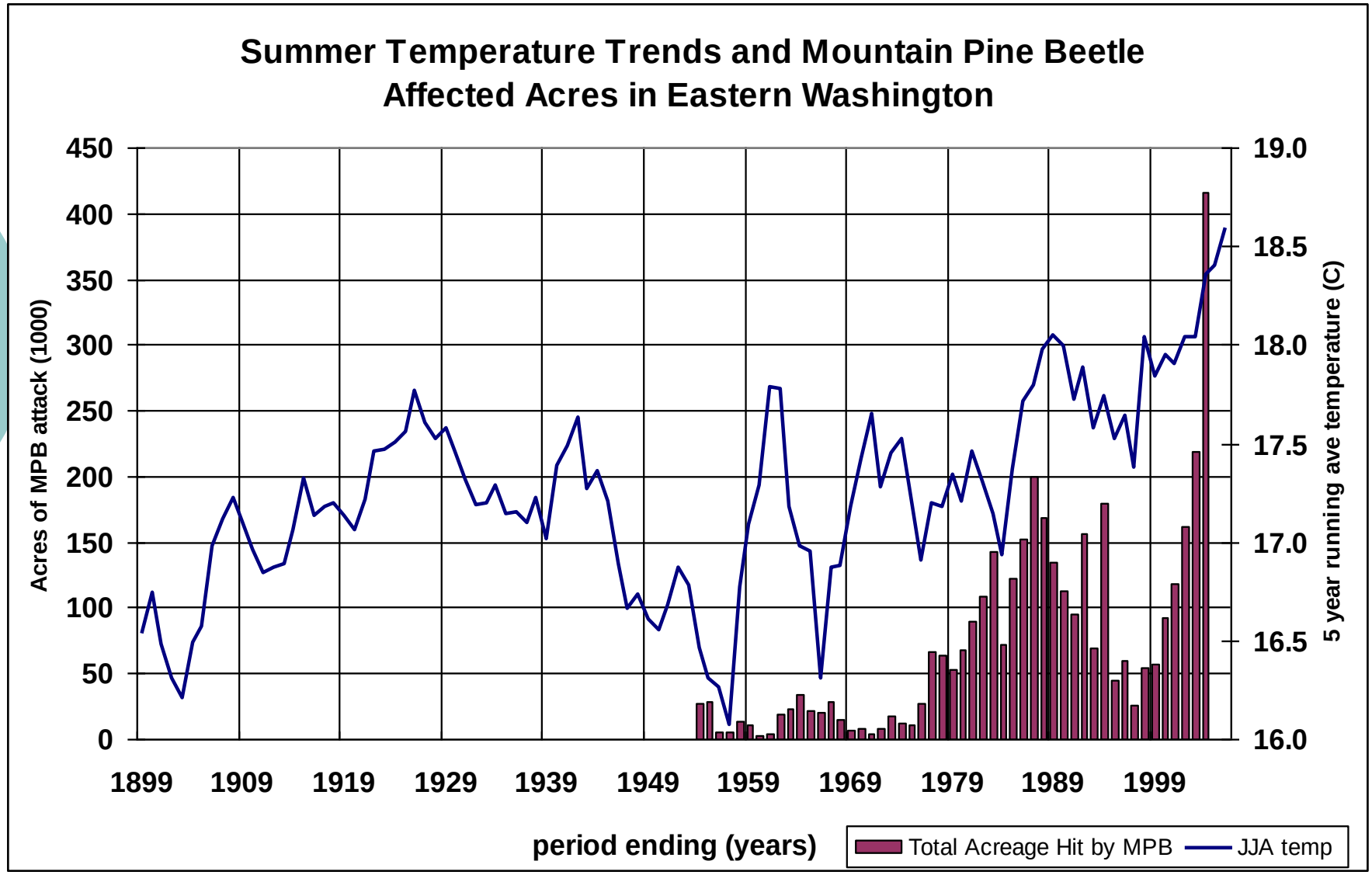




Time Series of Mortality from MPB in Eastern Washington (Source: UW RTI)



Maxima and Minima of Temperature and Precipitation for Eastern Washington over the Past 110 Years (Source: UW RTI)



Temperature Trends and MPB Activity in Eastern Washington in PP and LLP Forests (Source: UW RTI)

Eastern Washington Forest Health

- Declining infrastructure
- Low wood prices of small diameter trees
- Cost avoidance of future fires is large
- Bio-fuel, bio-energy feasibility

Western Washington Forest Land Conversion

- One percent of private forests being converted each year
- 300,000+ acres of industrial forest land could be converted to HBU in coming decade
- Since 1988, about 17% of Washington's commercial forest have converted to HBU
- Transfer of development rights to direct building into "rural villages" or existing towns

Forest Biodiversity and Regulations

- Use of "biodiversity pathways" to improve forest structures
- To provide economic incentives, ecosystem services could be valued
- Re-examine riparian buffer regulations which produce unintended dis-incentives

Forest Biodiversity and Regulations

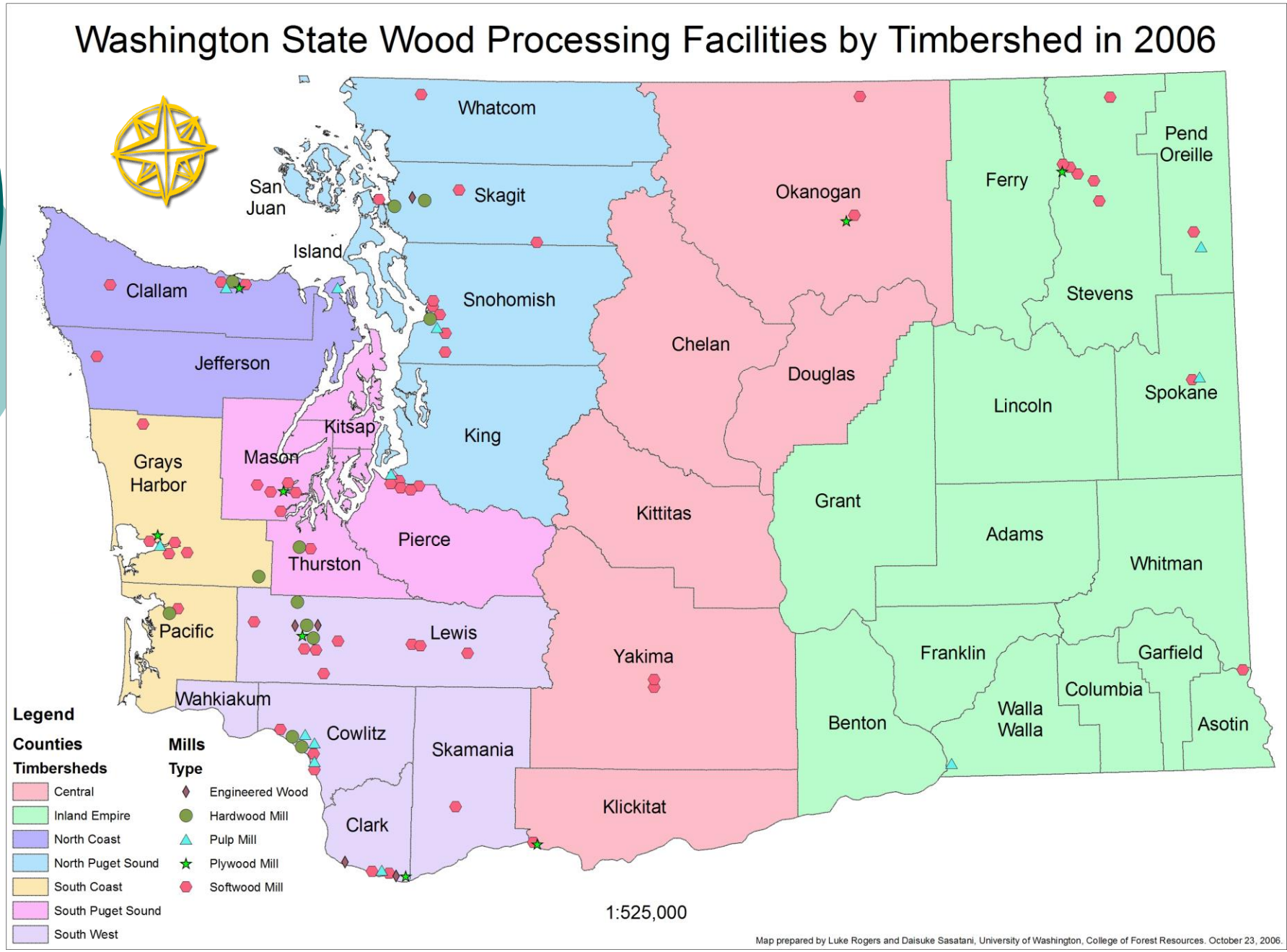
- Industrial landowners intensifying management but less thinning
- Most old-growth is set-aside, but second growth forests are over-crowded and need thinning

Competition and Productivity

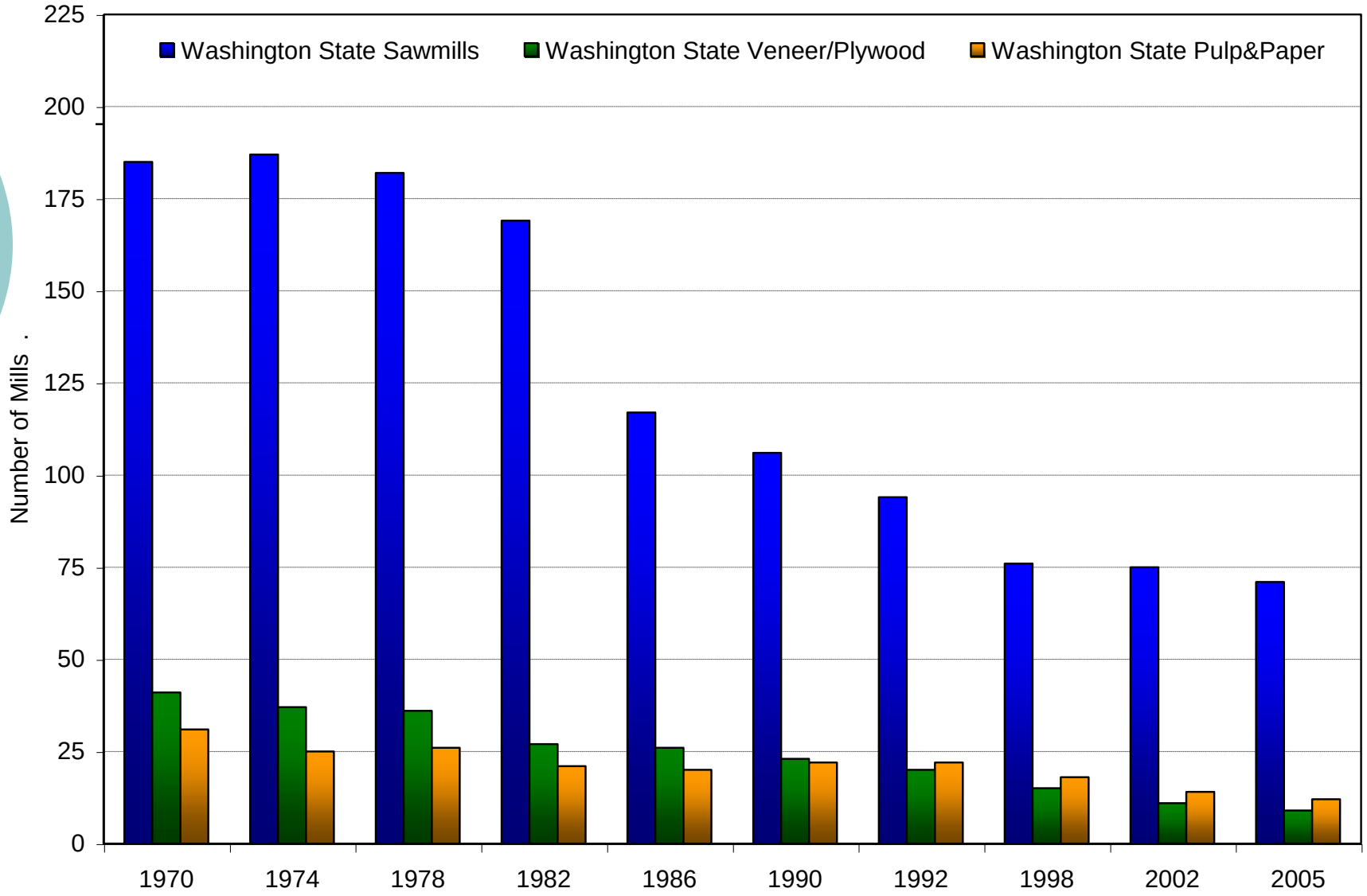
- Washington produces commodity wood products and is a high cost producer (61% of harvest for sawmills)
- Timber harvest levels are down 40% relative to 1990 across all ownership groups
- Private lands provide about 84% of the state-wide timber harvest

Competition and Productivity

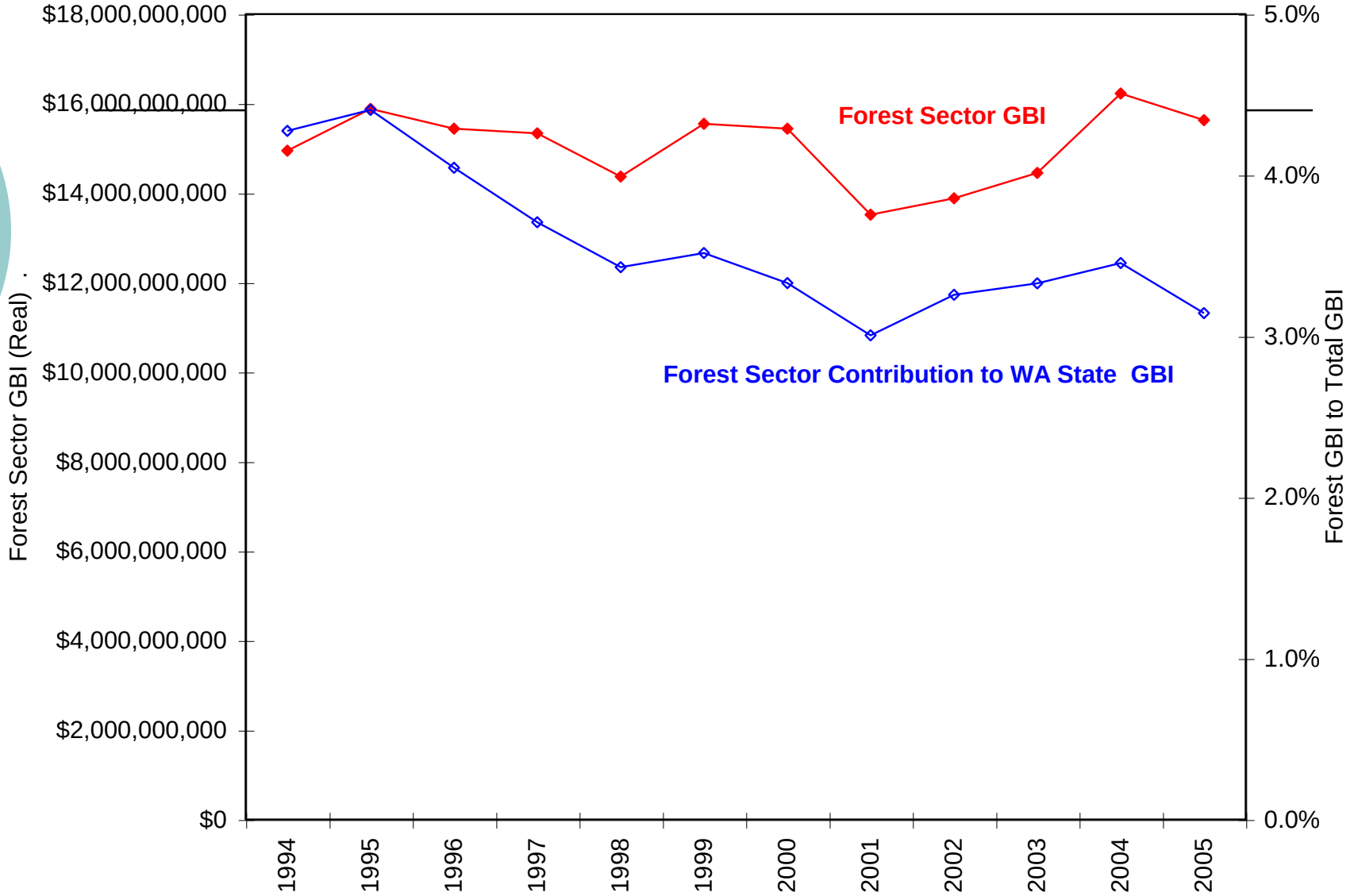
- Old sawmills have closed, but new, efficient mills have opened – fewer employees
- Washington's forest products industry represents about 15% of manufacturing sector jobs


Washington State Wood Processing Facilities by Timbershed in 2006
Whatcom
Skagit
San Juan
Island
Snohomish
Clallam
Jefferson
Kitsap
Mason
King
Grays Harbor
Pierce
Thurston
Pacific
Lewis
Wahkiakum
Cowlitz
Skamania
Clark
Okanogan
Ferry
Pend Oreille
Stevens
Chelan
Douglas
Lincoln
Spokane
Kittitas
Grant
Adams
Whitman
Yakima
Franklin
Garfield
Columbia
Walla Walla
Asotin
Benton
Klickitat
Legend
Counties
Timbersheds
Central
Inland Empire
North Coast
North Puget Sound
South Coast
South Puget Sound
South West
Mills
Type
Engineered Wood
Hardwood Mill
Pulp Mill
Plywood Mill
Softwood Mill
1:525,000
Map prepared by Luke Rogers and Daisuke Sasatani, University of Washington, College of Forest Resources. October 23, 2006.

Primary Mill Trends, 1970-2005



Forest Sector Contribution to State GB I



New Markets for Environmental Services

- carbon storage
- clean water
- clean air
- habitat

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The Future of Forestry (C S Lewis)

"How will the legend of the age of trees
Feel, when the last tree falls in England?
When the concrete spreads and the town conquers
The country's heart; when contraceptive
Tarmac's laid where farm has faded,
Simplest tales will then bewilder
The questioning children, 'What was a chestnut?
Say what it means to climb a Beanstalk.
Tell me, grandfather, what an elm is.
What was Autumn? They never taught us.' .."

Future of the College

- Reinforce UW's vision of:
  - Excellence
  - Engagement
  - Transformative
- College programs must be high quality with high impact

Branding of the College

- Mission
- Vision
- Goals
- Strategies
- Academic programs

College Mission

- Study and investigate the functionality and sustainability of natural resource systems
- Natural and managed environments
- Interdisciplinary approach across multiple scales of urban and wild land landscapes
- Generate and disseminate information through our teaching, research and outreach programs

College Vision

- The College of Forest Resources will be a world-class internationally recognized source of knowledge relevant to environmental and natural resource issues

Our Academic and Research Programs

- Stress key principles and processes that explain the behavior and interaction of biotic and social systems along gradients from highly to minimally impacted terrestrial ecosystems
- Focus on the interaction between nature and humans with a synthesis of scientific knowledge related to natural resources and environmental sustainability

Our Academic and Research Programs

- Emphasize:
  - Integration
  - Interdisciplinarity
  - Collaboration (on and off campus)
  - Team-approach
  - Operate across multiple scales, and
  - Across a gradient from urban to rural

Characteristics Of Our Research Agenda

- Emphasize coupled human and bio-physical systems
- Supports development of a new science of sustainability to integrate ecological and economic approaches in a socially acceptable manner
- Develops technology; discovers new scientific knowledge; and transfers knowledge to the user community

Assumptions Relevant to Our Research Mission

- Build strong partnerships with external collaborators
- Our research agenda must align with the priorities and expectations of both society and government funders
- To prosper in this climate, we must proactively seek research funds to support our agenda

Possible Research Mission

- To discover and understand ecosystem processes, develop new approaches for the use and protection of natural resources and environmental services, and understand human behavior and decisions about natural resources

Source: Don DeHayes, President, NAPFSC

Possible Research Questions

- How does the natural world work?
- How do people use the natural world?
- How do such uses change the way the world works?
- How do these uses and changes affect people?

Source: Don DeHayes, President, NAPFSC

Emerging Research Areas

- Landscape analysis
- Spatial analysis and information management
- Watershed science and planning
- Forest ecosystem health and restoration
- Risk analysis (ecological and economic components)

Source: National Graduate Education Needs and Priorities, NAPFSC

New Academic Programs

- Undergraduate (ESRM, PSE)
- Graduate [MFR (FM), MEH, MS and PhD]
- New research areas

Suggested Research Themes

1. Ecosystem Structure and Function
   - Productivity
   - Health
   - Function
   - Management

- NEON

Suggested Research Themes

2. Social and Human Systems Interactions
   - Environmental valuation
   - System integration (ecosystem, and socio-economic)
   - Natural and human system interactions (land use, watershed planning, open space, and parks)
   - Communication and negotiation

Suggested Research Themes

3. Cutting Edge Technology
   - Bio-resource sciences
   - Information and communication technology
   - Remote imagery and analysis

Summary

- Shifting paradigm of natural resource management implies that the 21st Century will be different from the 20th Century in many ways
- Forces driving future change (population, global economy, renewable energy, forest health, biodiversity)
- Future of Washington's Forests Study (UW CFR lead effort) identified many issues that require additional research and investigation

Summary

- UW CFR creating future leaders for 100 years and will continue
- New knowledge from our universities coupled with new organizational arrangements gives us great hope that we will solve the problems that confront to ensure a sustainable future for our forests and natural resources