Long-range U.S. timber market projections (2020-2060) based on USFPM/GFPM model and alternative global scenarios

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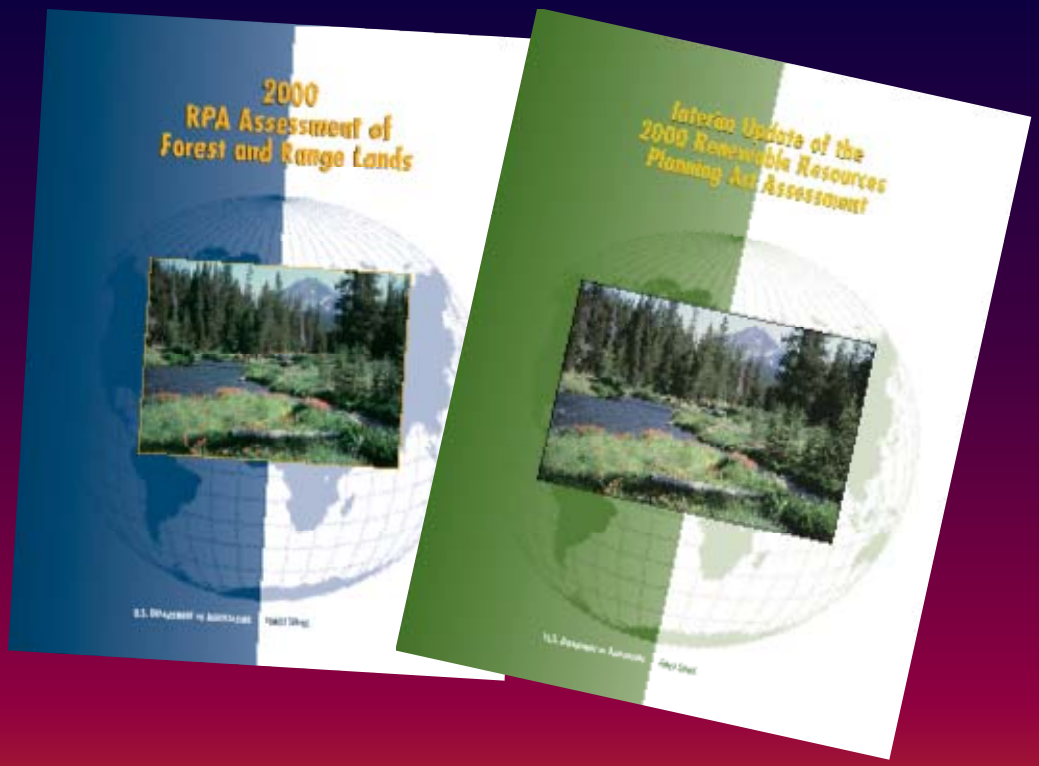
WFE, MAY 2011

Forest Service provides 50-year projections of forest resource trends every five years:

Recent Reports

(2002, 2007)



RPA ASSESSMENT

Why be concerned about the long-range U.S. timber market outlook ?

- U.S. timber harvest has trended downward since the 1980s
- Harvest in 2009 was lower than at any time since 1960s (30% lower than mid-80's peak)
- Global trends drive forest economics & management

Another concern . . .

Global crude oil production will not be able to keep pace with growing demand according to various global energy studies (IEA[1], NIC[2], IPCC[3])

This is expected to result in expanded output of energy alternatives, including biomass energy

[1] International Energy Agency. 2010. World Energy Outlook 2010. [http://www.worldenergyoutlook.org/2010.asp]
[2] National Intelligence Council. 2005. Global Trends 2025: A Transformed World. 99 p. [http://www.dni.gov/nic/NIC_2025_project.html]
[3] Intergovernmental Panel on Climate Change. 2000. Special Report on Emissions Scenarios [http://www.grida.no/publications/other/ipcc_sr/?src=/climate/ipcc/emission/]

Therefore, three alternate global scenarios were selected from IPCC SRES, with varied assumptions about economic growth, energy production and climate change . . .

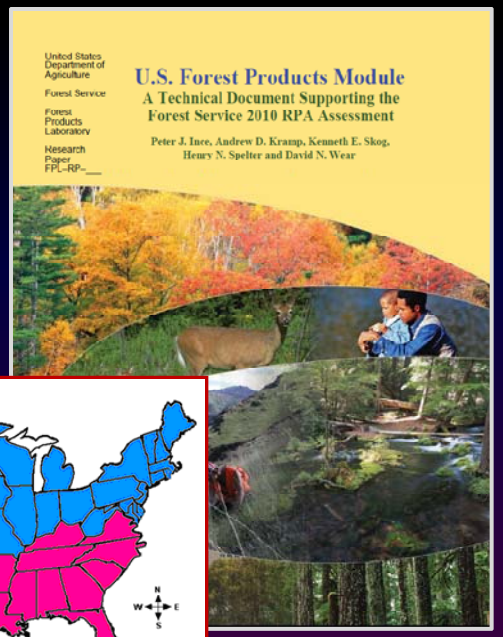
IPCC SRES scenarios provide coordinated global outlook for climate change and energy production, as well as global GDP and population assumptions

Intergovernmental Panel on Climate Change (IPCC). 2000. Special Report on Emissions Scenarios (SRES)
[http://www.grida.no/publications/other/ipcc_sr/?src=/climate/ipcc/emission/]

Three Alternate RPA Scenarios (with different assumption about global economic growth, population growth and biomass energy, based on IPCC/SRES) . . .

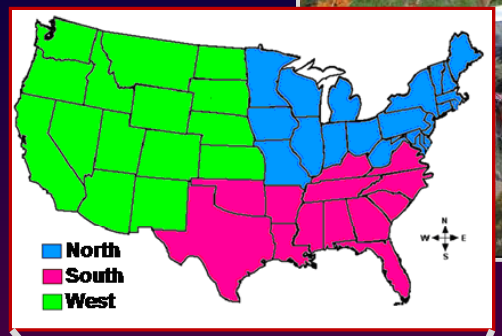
Scenario:	A1B	A2	B2
General Description	Globalization, Economic Convergence	Regionalism, Less Trade	Slow Change, Localized Solutions
Social Development Themes	Economic Growth	Self-Reliance	Sustainable Development
Global Real GDP Growth (2010-2060)	Highest (6.2X)	Lowest (3.2X)	Medium (3.5X)
Global Population Growth (2010-2060)	Medium (1.3X)	High (1.7X)	Medium (1.4X)
U.S. GDP Growth (2006-2060)	Highest (3.3X)	Low (2.6X)	Lowest (2.2X)
U.S. Population Growth (2006-2060)	Medium (1.5X)	Highest (1.7X)	Lowest (1.3X)
Global Expansion of Primary Biomass Energy Production	High	Medium	Medium

To analyze RPA global scenarios, we developed the "U.S. Forest Products Module" (USFPM) within the Global Forest Products Model (GFPM):



U.S. Forest Products Module (USFPM),

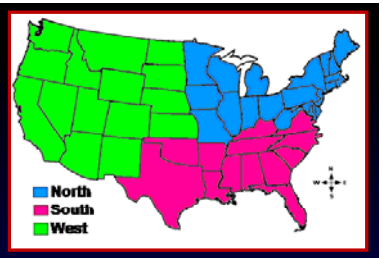
3 U.S. sub-regions, expanded market detail, *built within* . . .



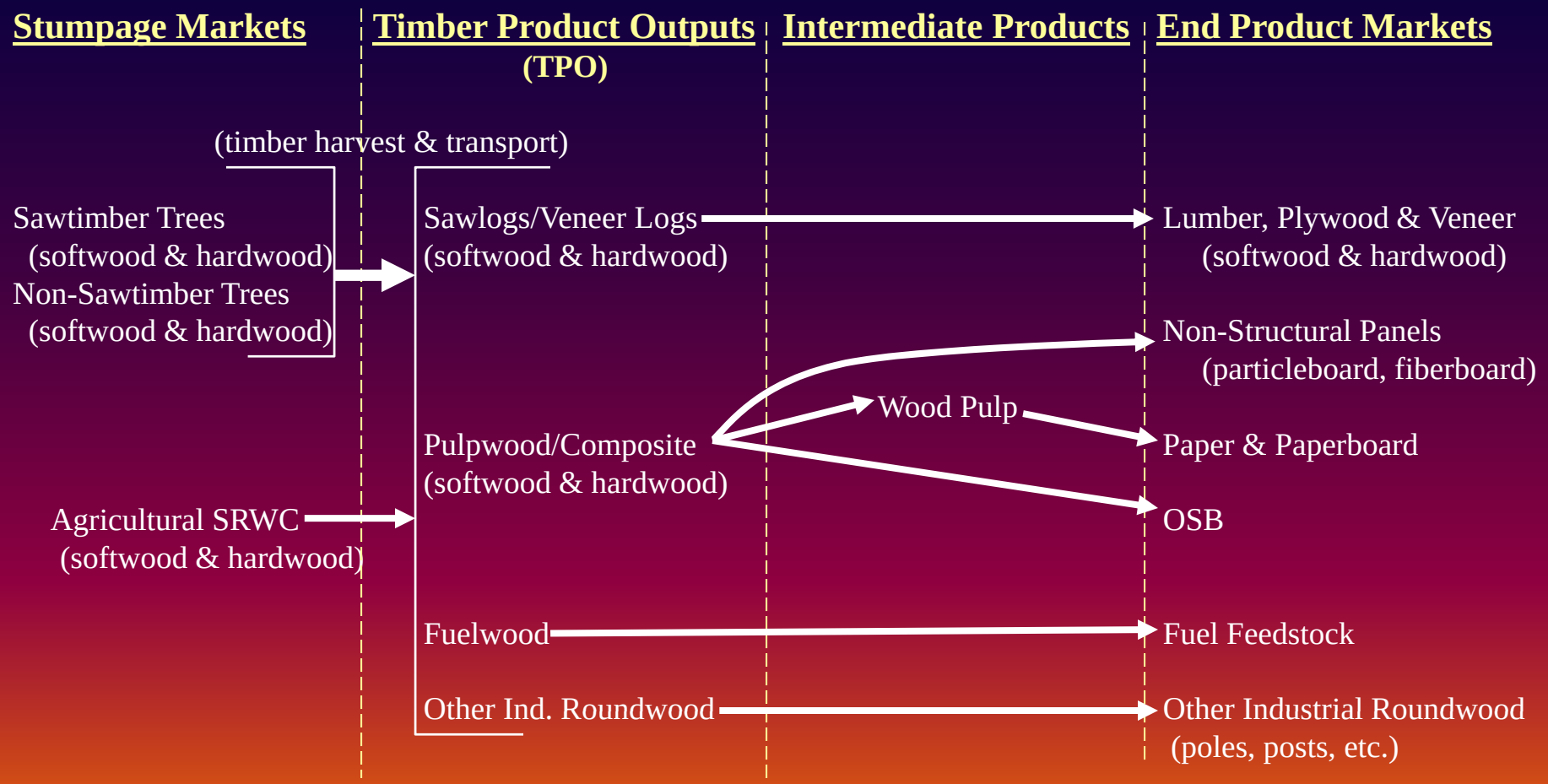
The Global Forest Products Model (GFPM)

(dynamic spatial market equilibrium, 180 countries, PELPS modeling system)

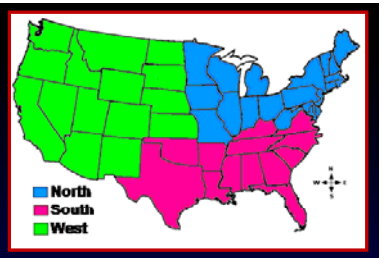
Structural features of USFPM:



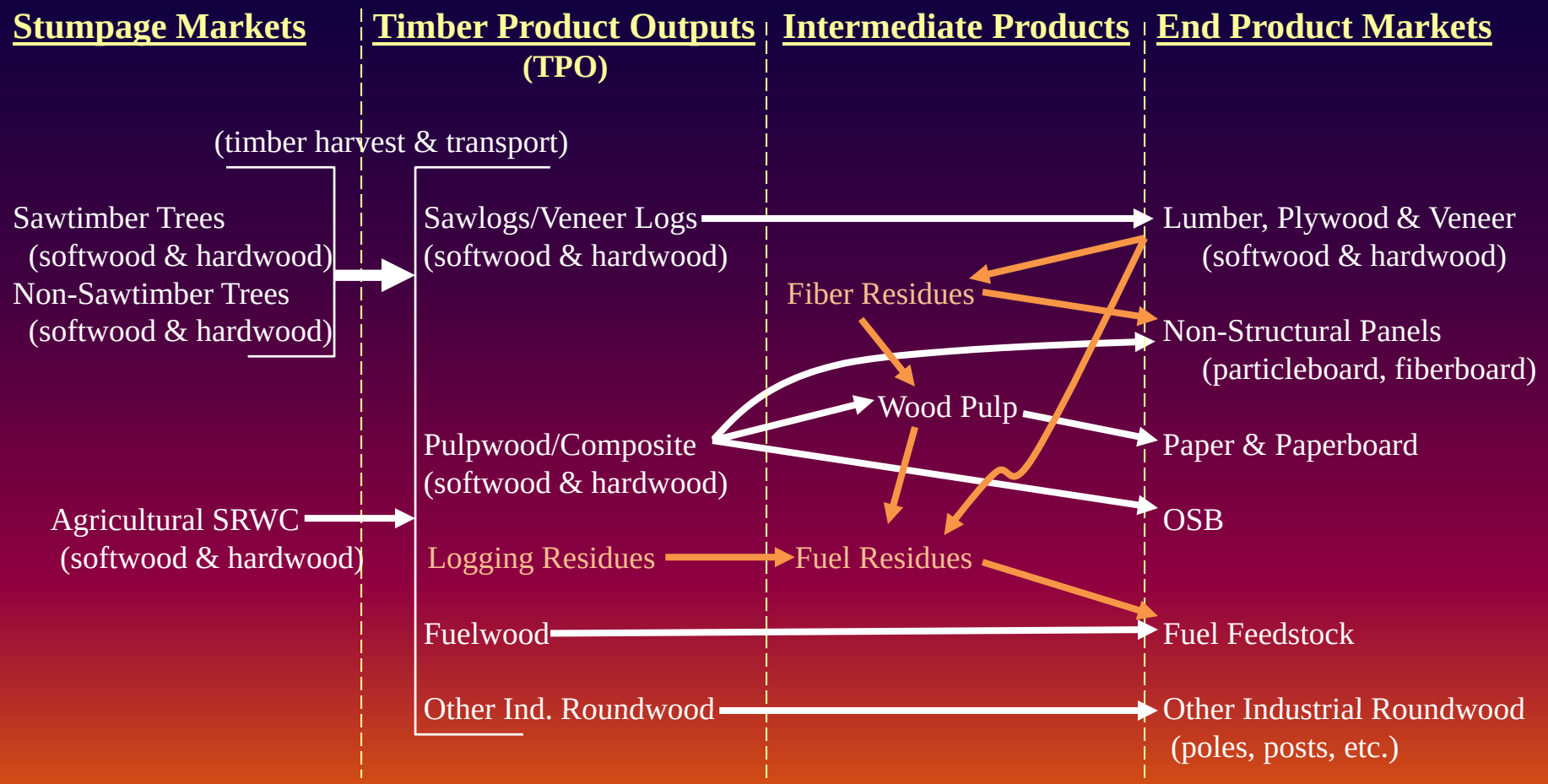
USFPM models regional U.S. timber stumpage markets, timber products, intermediate and end product markets:



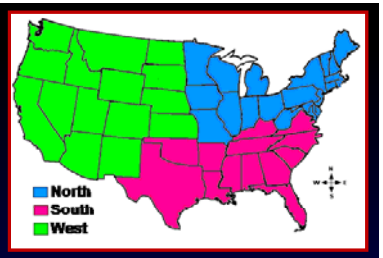
Structural features of USFPM:



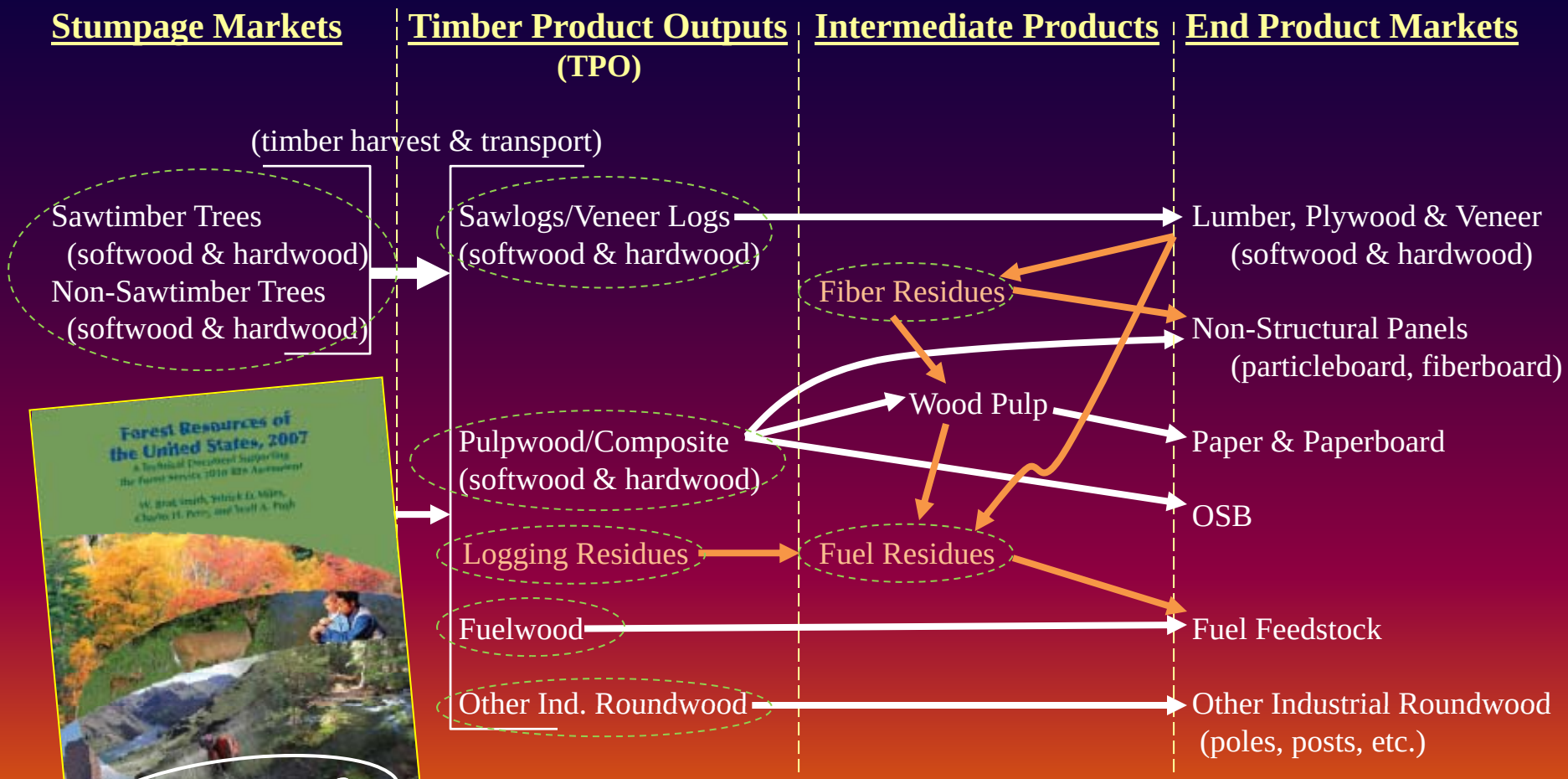
USFPM models also wood residue markets, including supply & demand for *mill residues* & *logging residues*:

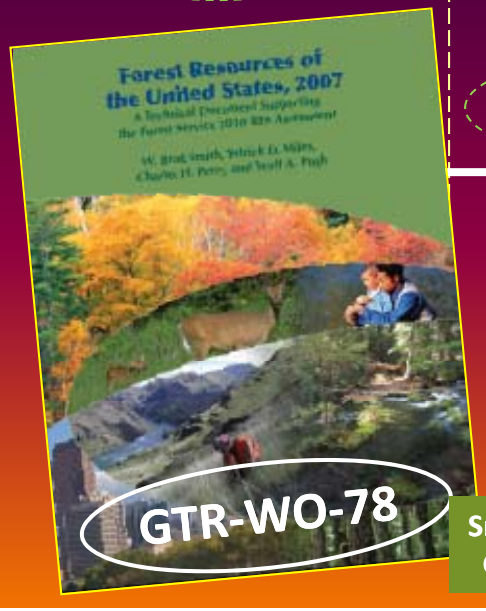


Structural features of USFPM:



USFPM timber harvest, timber output & wood residue data were all calibrated to match FIA/TPO data (GTR-WO-78):

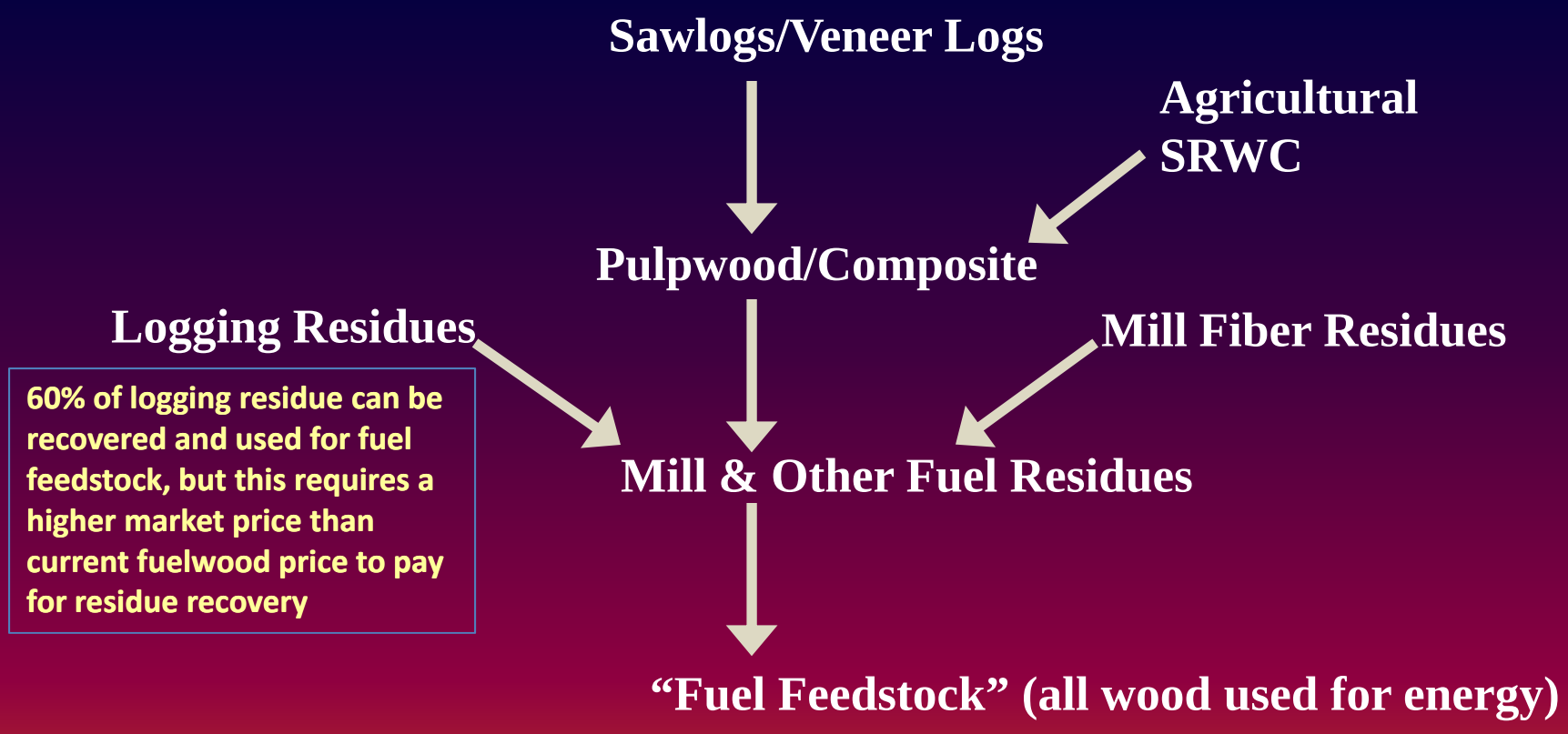




Smith et al. 2009. Forest Resources of the United States, 2007. U.S. Forest Service. General Technical Report. GTR-WO-78.

Another feature . . .

USFPM and GFPM allow "cascading" wood substitution . . .
(industrial roundwood will substitute for fuelwood at higher prices)



60% of logging residue can be recovered and used for fuel feedstock, but this requires a higher market price than current fuelwood price to pay for residue recovery

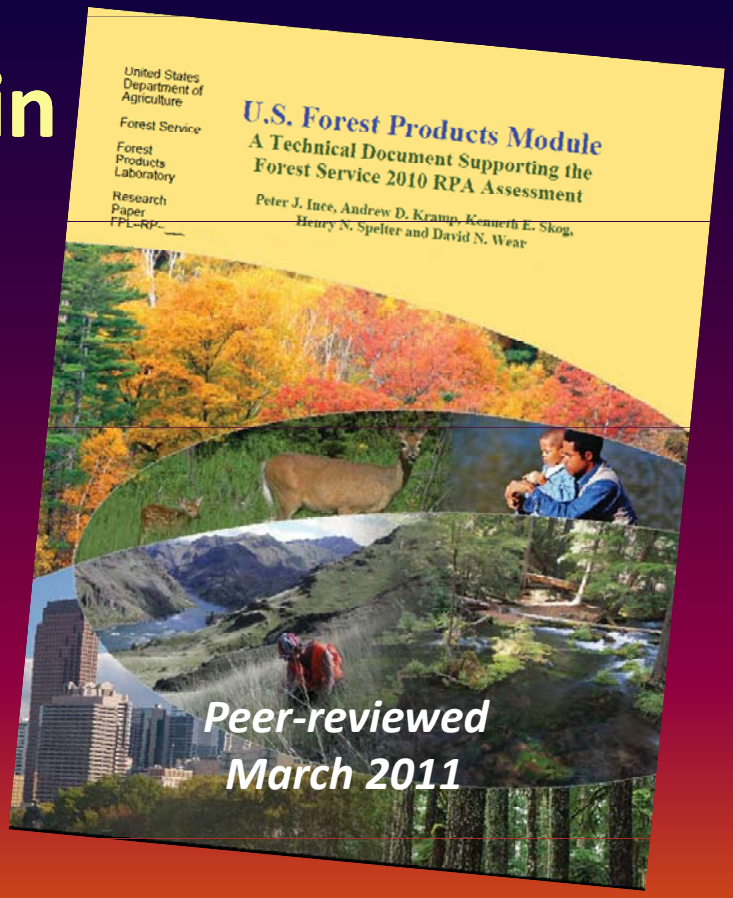
The substitution possibility means wood energy markets can drive global timber demands and prices in high wood energy demand scenarios

A caveat:

Projections here are *preliminary* for RPA

These projections will be in the USFPM Report, to be published in August

Projections may be revised before RPA Assessment Summary Report is published



Key aspects of the three selected global scenarios . . .

A1B – Globalization, Convergence & Economic Growth

- Countries converge on common consumption rates
- Most competitive advantage for U.S. (highest exports)
- Highest U.S. and global biomass energy demand from forests

A2 – Regionalism & Self Reliance (Less Convergence)

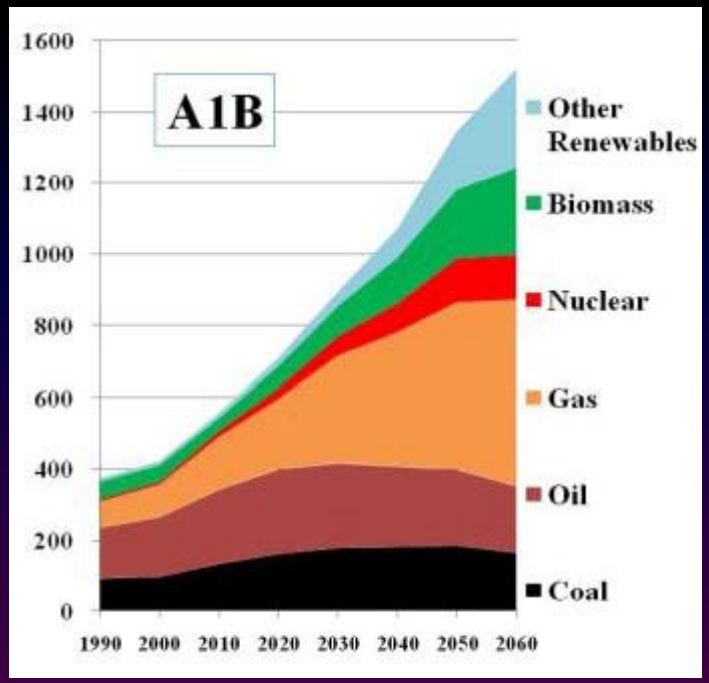
- Highest U.S. population growth, weaker economic growth
- Least competitive advantage for U.S. (highest imports)
- Lowest global biomass energy demand from forests

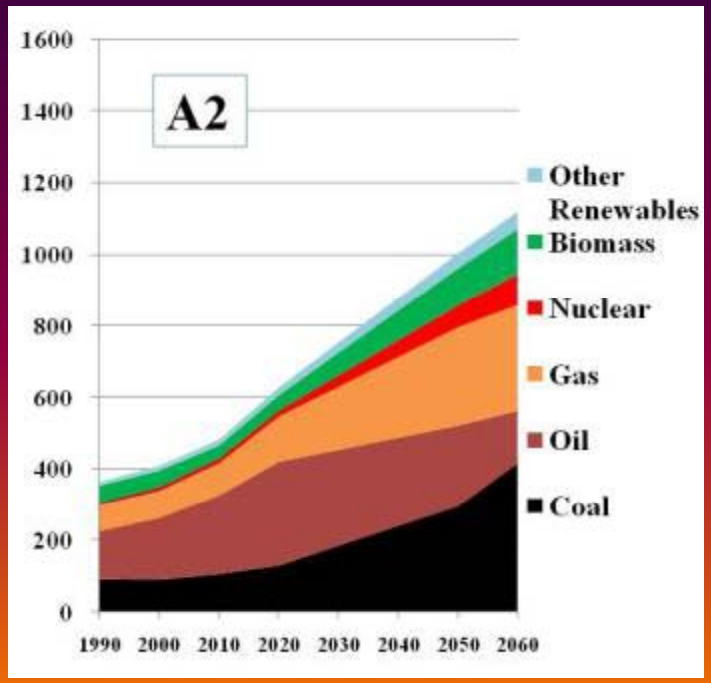
B2 – Localized Solutions & More Sustainable Development

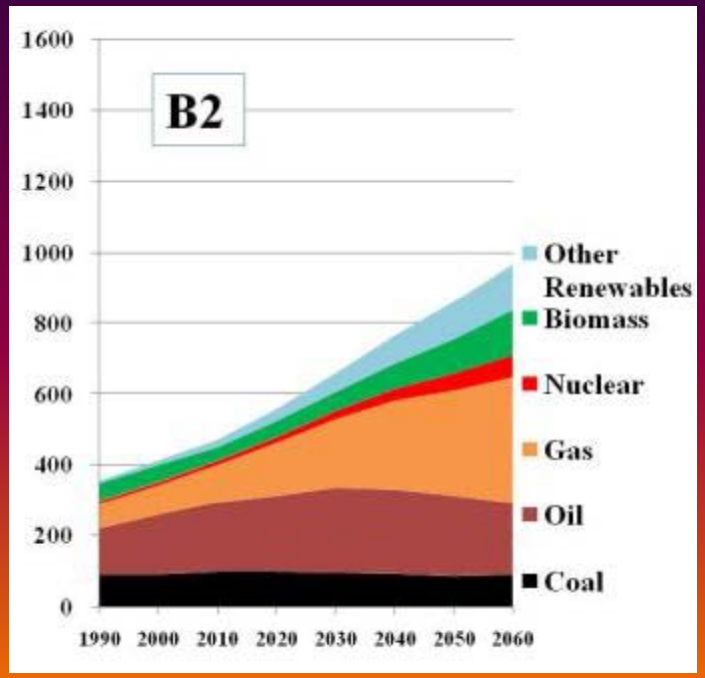
- Lowest U.S. population and lowest U.S. GDP growth
- Increasing trade advantage for U.S. (rising exports)
- Lowest U.S. biomass energy demand from forests

Global Energy Production (EJ):

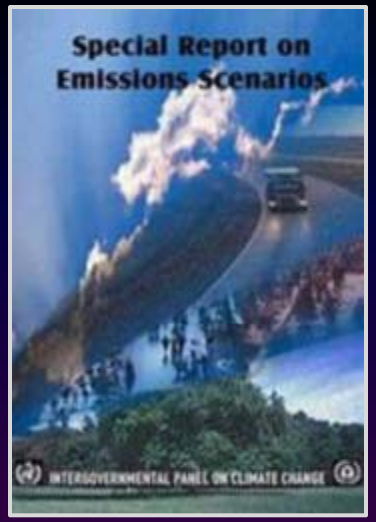
Oil production peaks in all scenarios around 2020-2030, leading to expanded renewables.

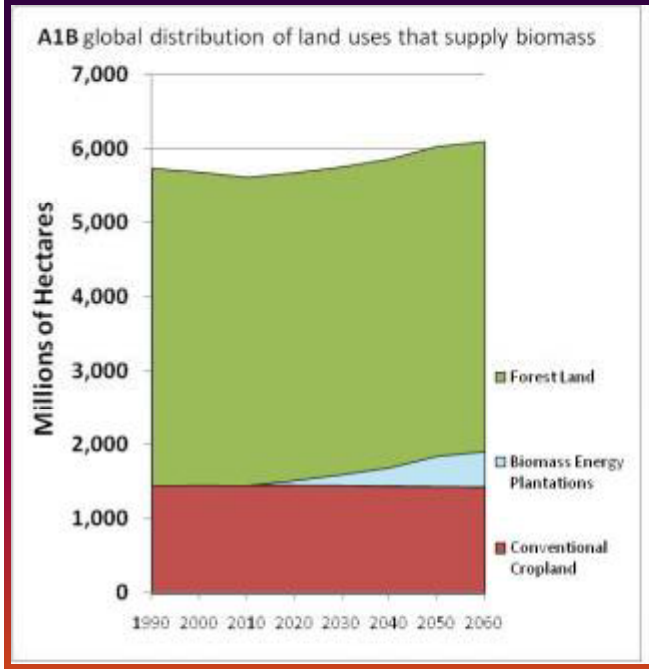


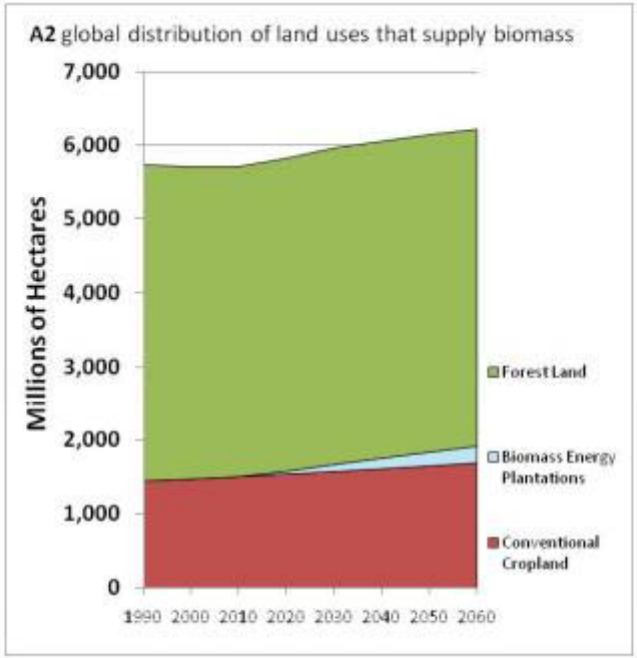


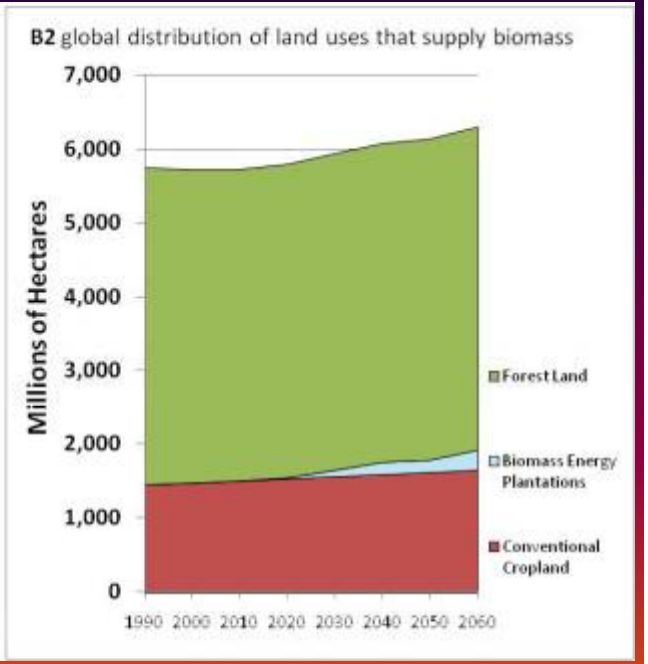


Global forest land area does not decline significantly in any of the three scenarios, but biomass energy output and biomass energy plantations expand to varying degrees . . .

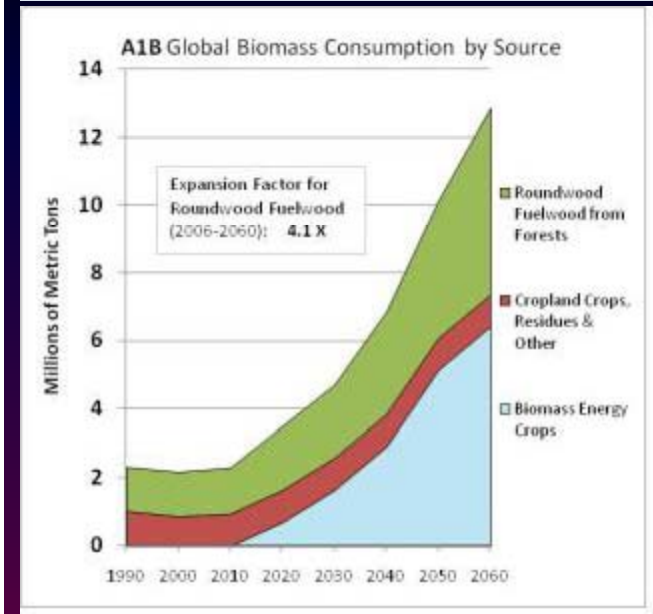


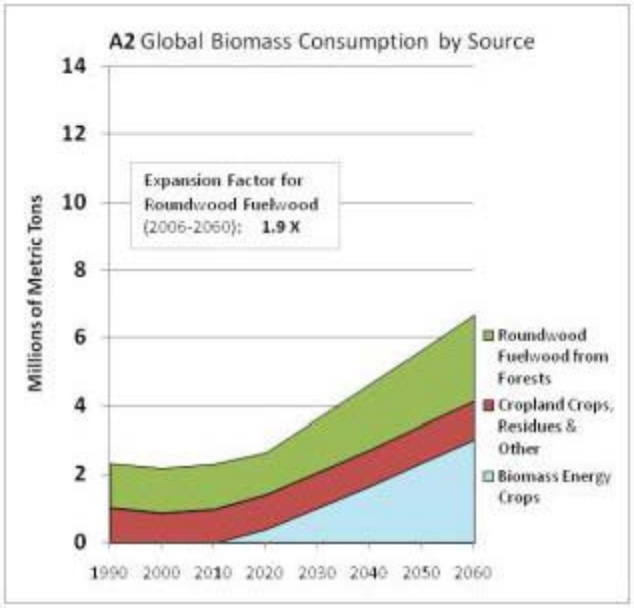


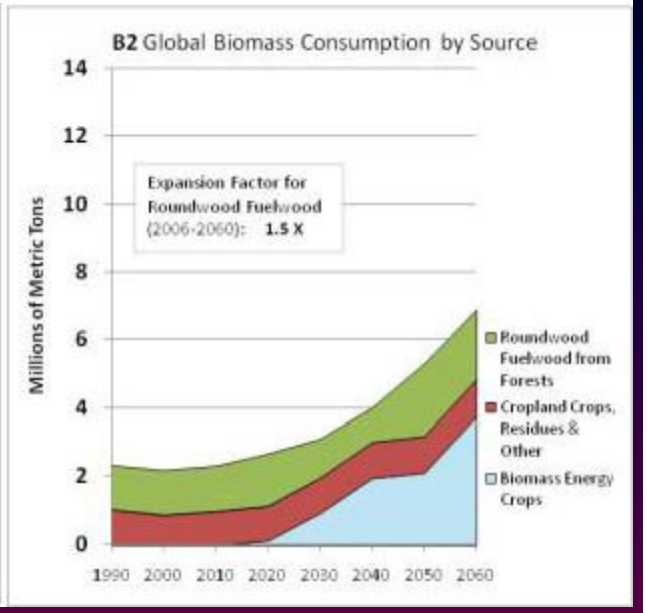


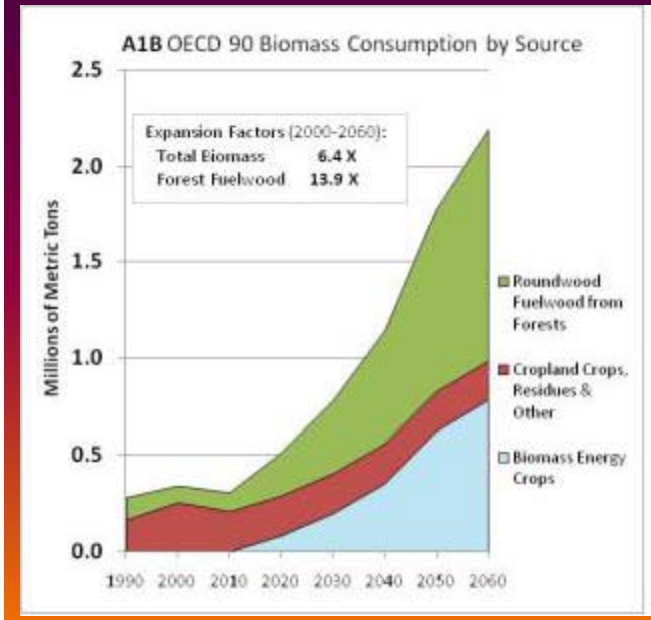


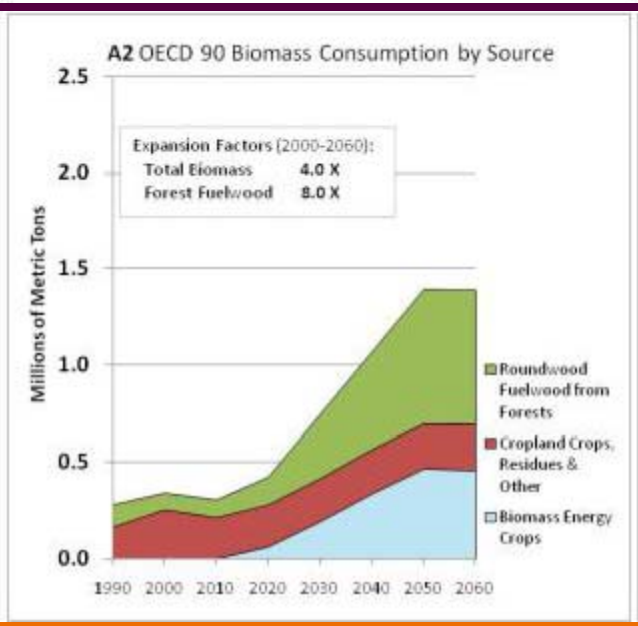
Scenarios vary in global biomass consumption by source, and <u>forest</u> biomass plays a larger role in OECD90:

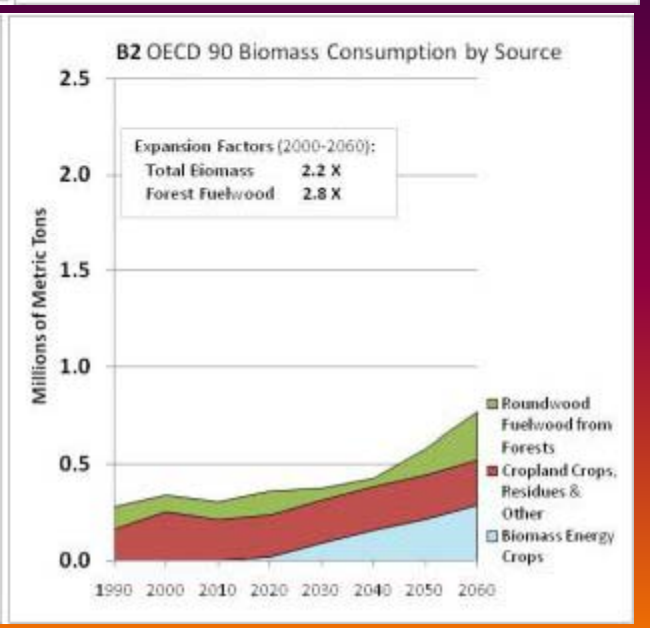






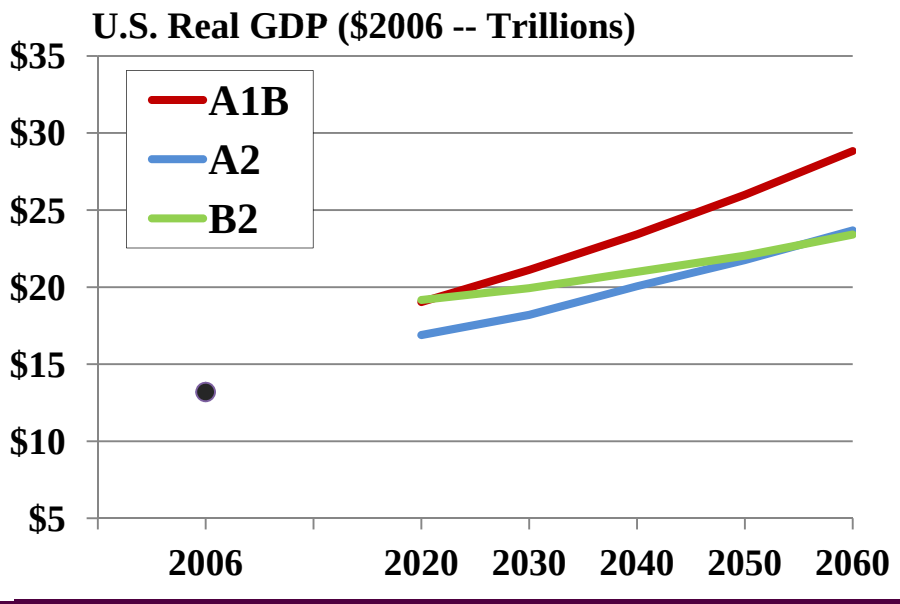






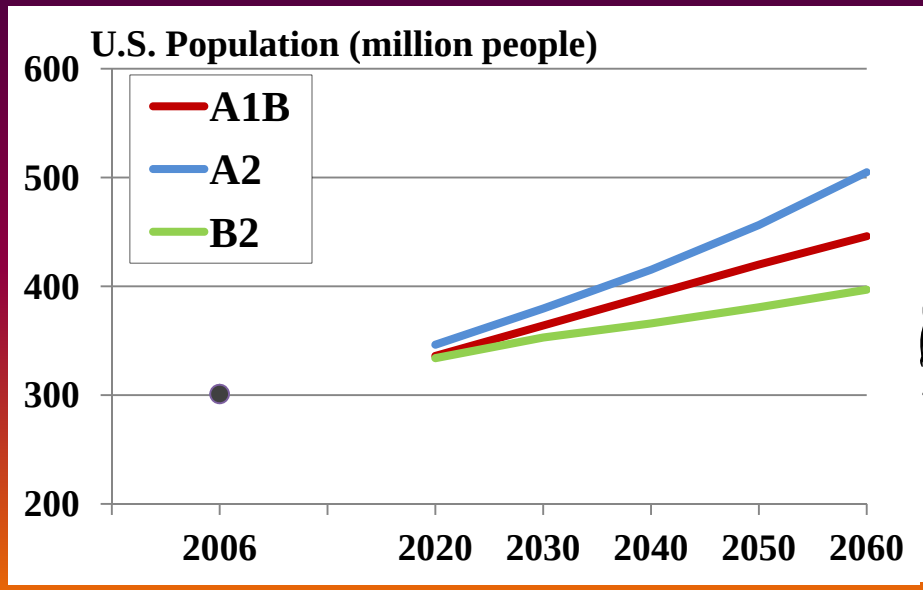
Basic Scenario Assumptions for USA . . .

U.S. Real GDP



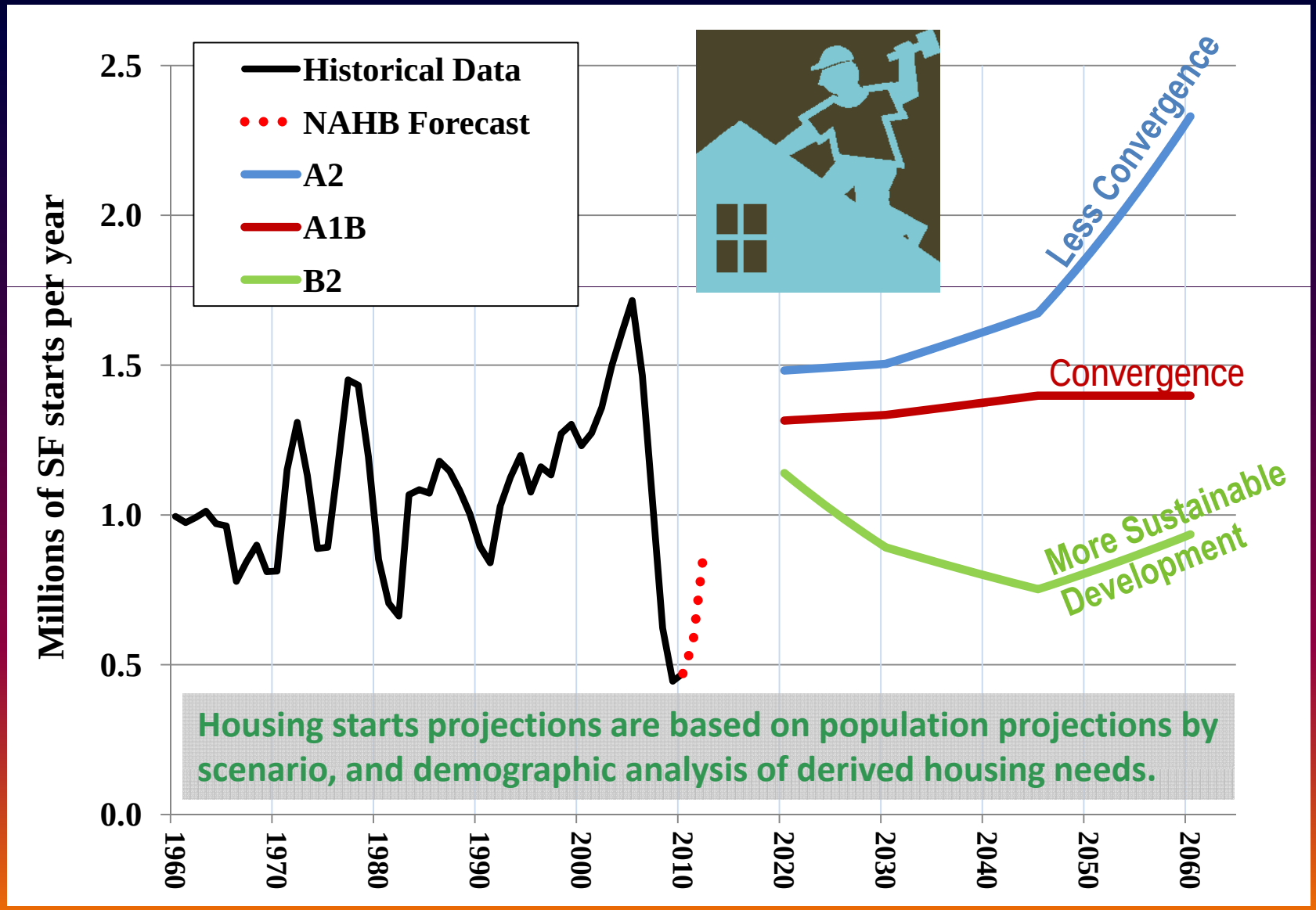
A1B follows historical U.S. GDP trend of past 50 years, while A2 and B2 follow lower trajectories.

A2 has the highest U.S. population growth, followed by A1B and B2.



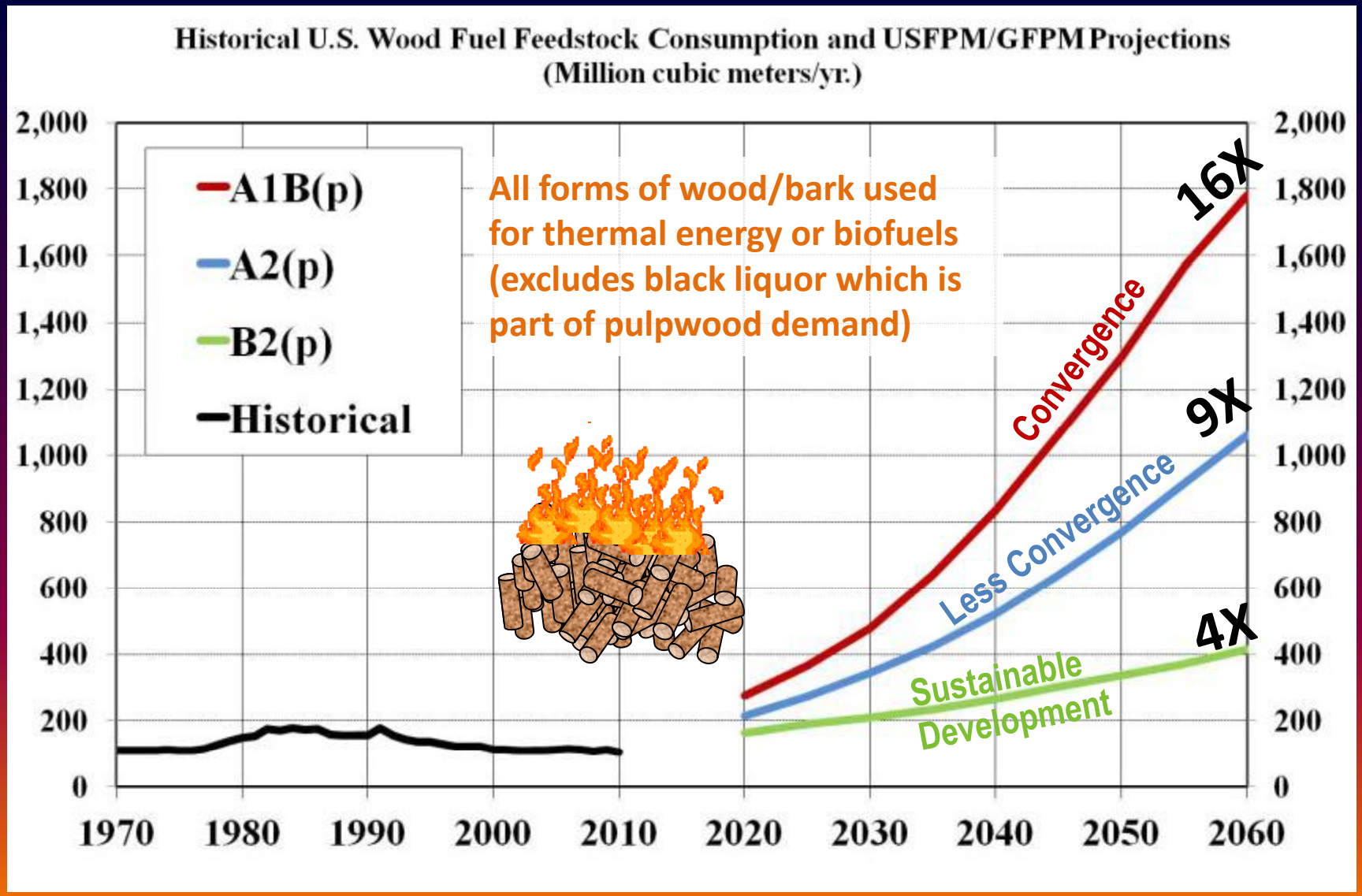
U.S. Population

U.S. single-family housing starts – a key driver of demands for lumber and wood panels . . .



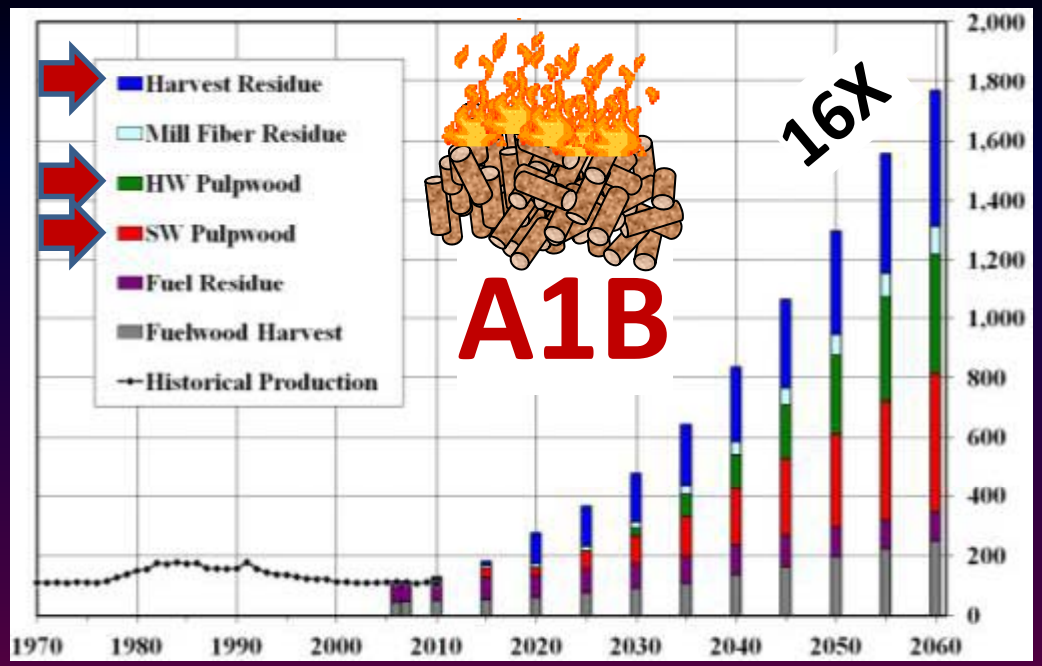
USFPM/GFPM Projections:

Projected U.S. Wood fuel feedstock consumption:

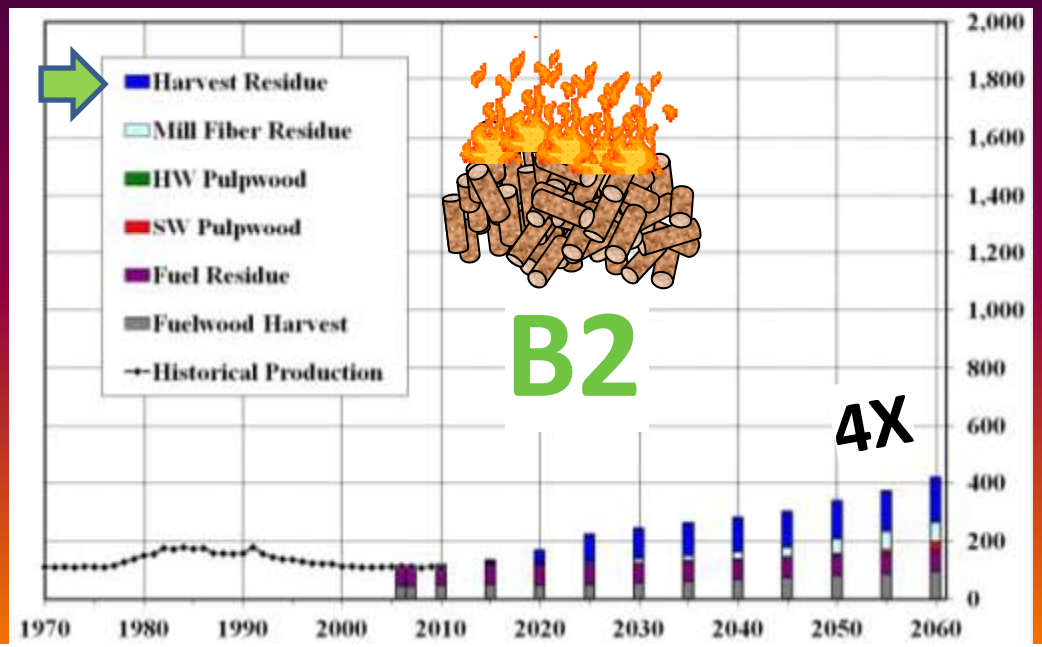


Wood Fuel Feedstock Production *by source* (MM cu. m.):

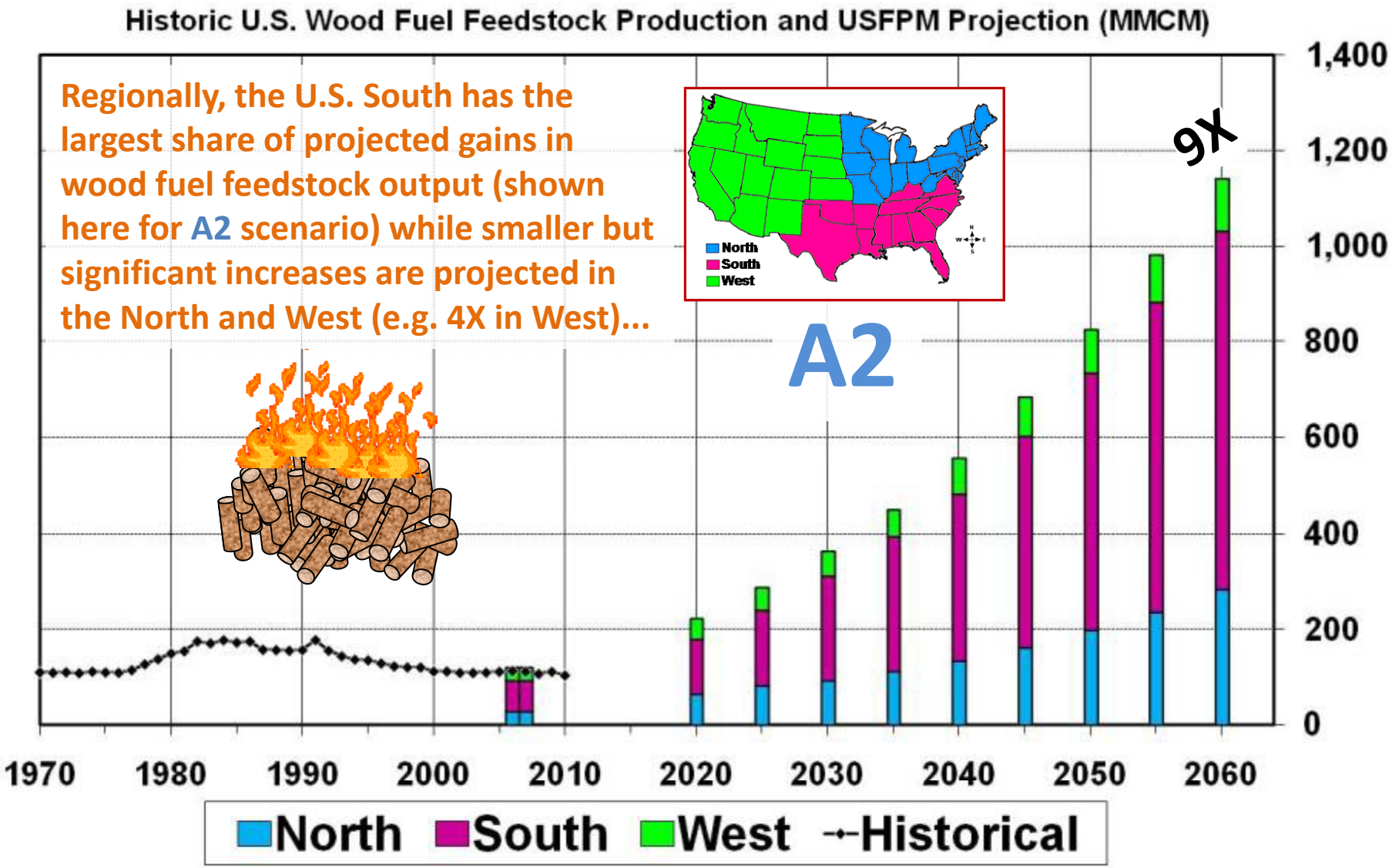
In A1B, with a *16-fold* increase in U.S. wood fuel feedstock consumption, *industrial roundwood* (pulpwood) becomes a major source of wood for energy along with harvest residues and other residues



In B2, with only a *4-fold* increase in U.S. wood fuel feedstock consumption, energy needs are met by use of logging residues and some mill fiber residues . . .

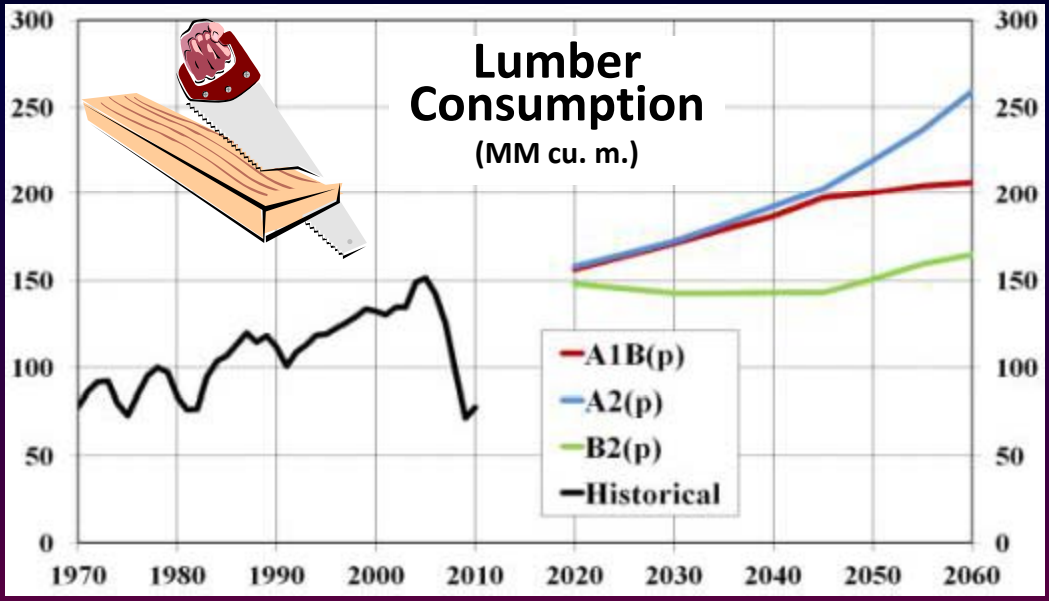


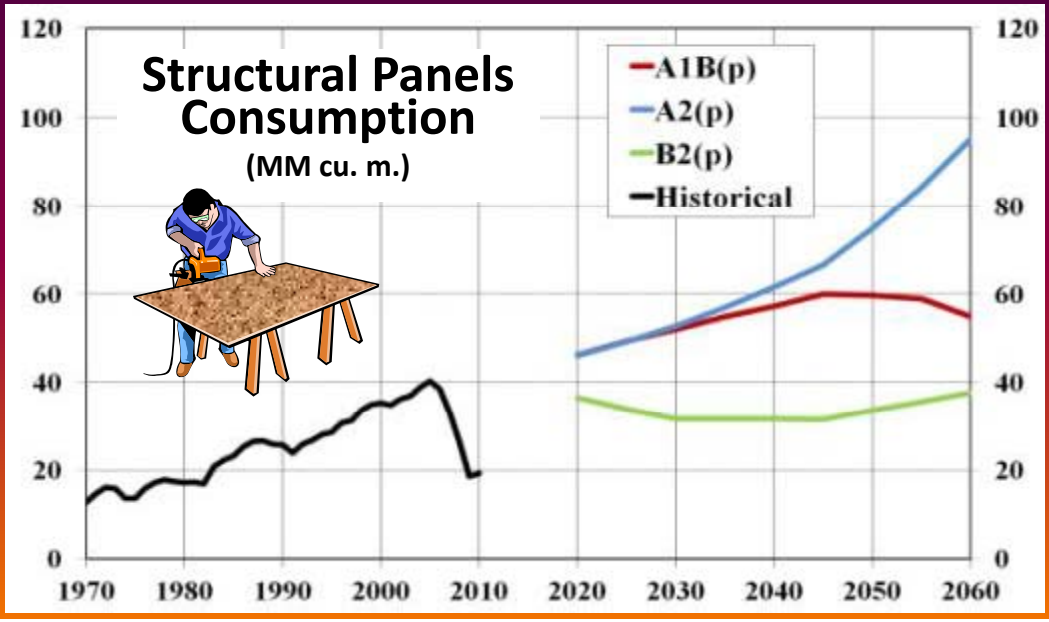
Fuel Feedstock Production *by U.S. sub-region* . . .



Solid-wood product consumption diverges because of divergent U.S. housing and GDP assumptions:

The **A2** has highest projected U.S. consumption of lumber and wood panels with highest U.S. population growth and highest demographic housing needs, but **A1B** also has high consumption with highest U.S. GDP growth. Consumption is lowest in the **B2**, with the lowest housing starts and lowest GDP growth.





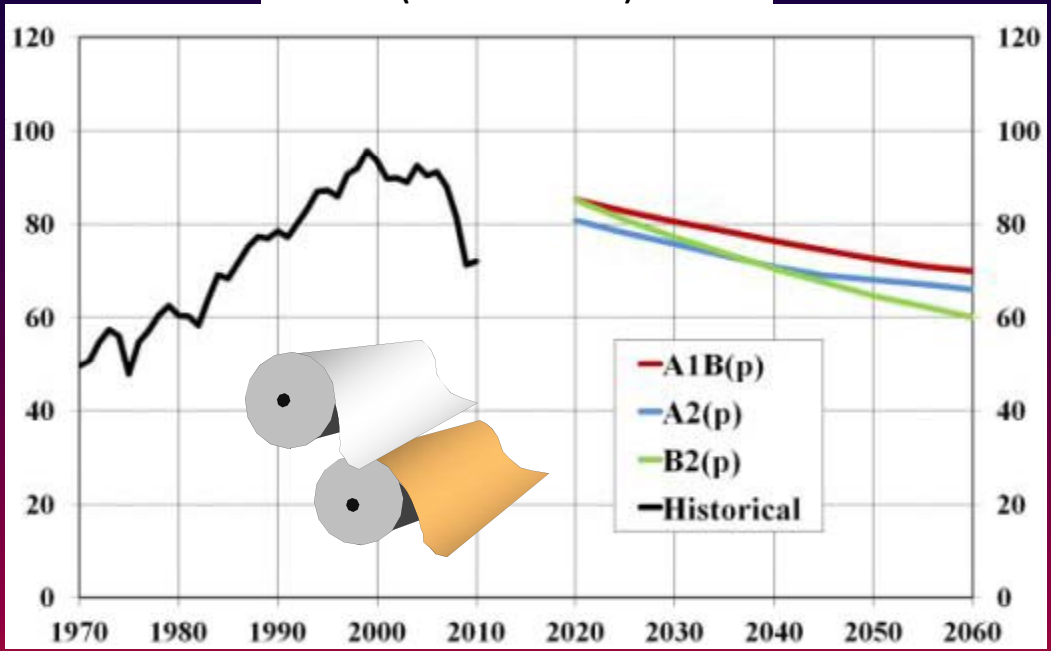
U.S. paper & board consumption is driven by economic assumptions and raw material supply markets:

Demands driven by GDP but consumption per GDP is declining, particularly for newsprint and printing & writing paper . . .

A1B has highest U.S. GDP growth (⇔highest paper and board demands)

But wood energy competition for pulpwood dampens paper & board consumption.

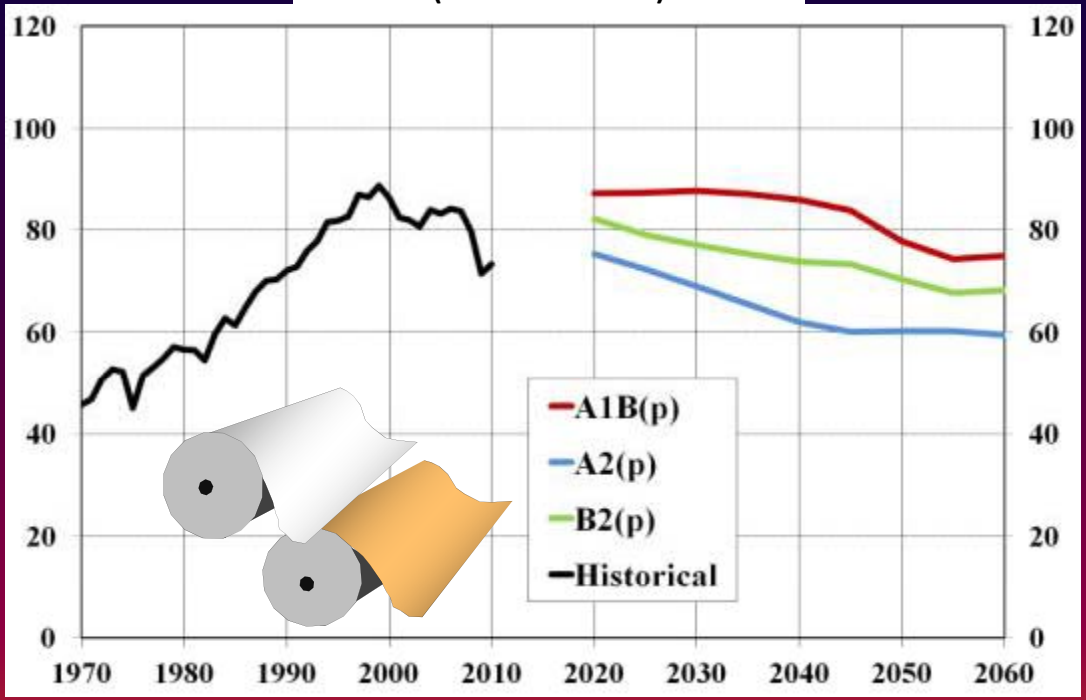
Paper & Paperboard Consumption
(MM metric tons)



However, there is greater variation in U.S. *production* of forest products, largely because of trade responses:

U.S. production is *higher* in **A1B** and **B2**, because the USA gains trade advantages and higher exports in those scenarios.

Paper & Paperboard Production
(MM metric tons)



Trade Advantages & Wood Energy:

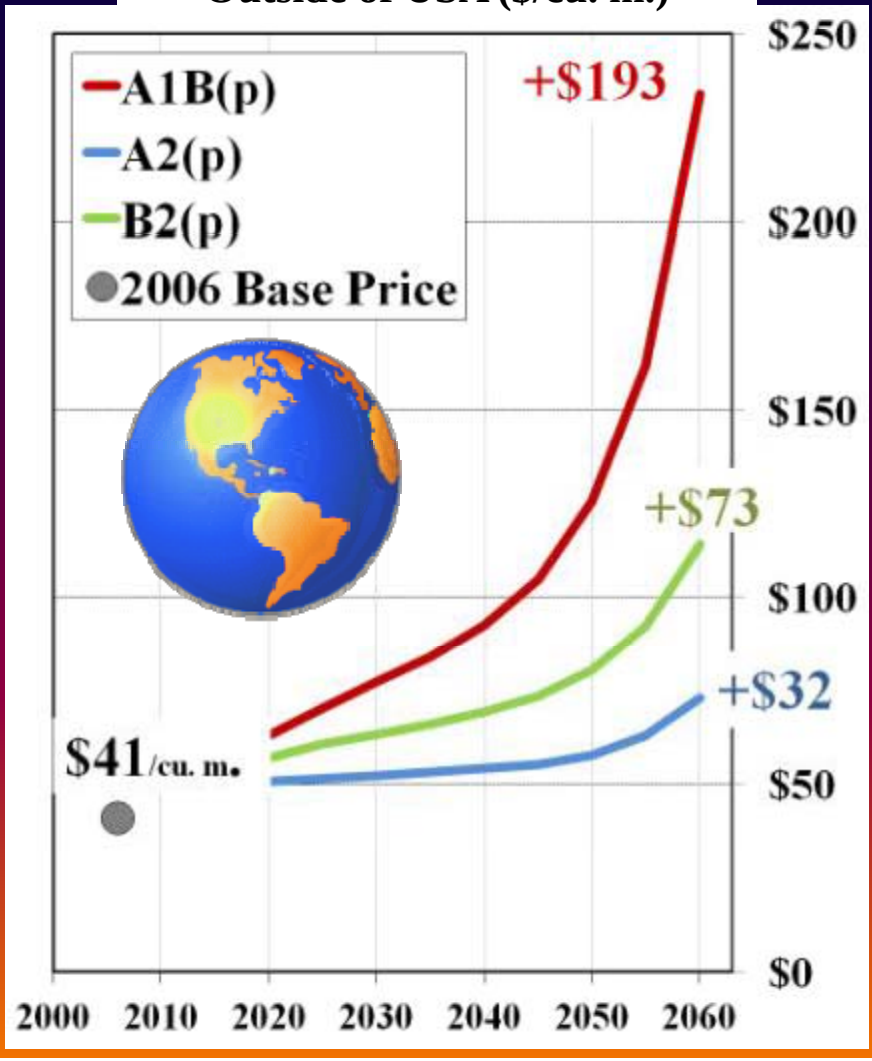
Countries gain trade advantages when they obtain relatively lower costs for producing the same goods.

With "cascading" substitution of industrial wood for energy, the wood fuel demands drive global industrial roundwood prices in high energy demand scenarios.

←→ *Both U.S. and global wood raw material prices will increase with high wood energy demand, but the United States gains trade advantages in scenarios where global wood prices increase more than in the United States.*

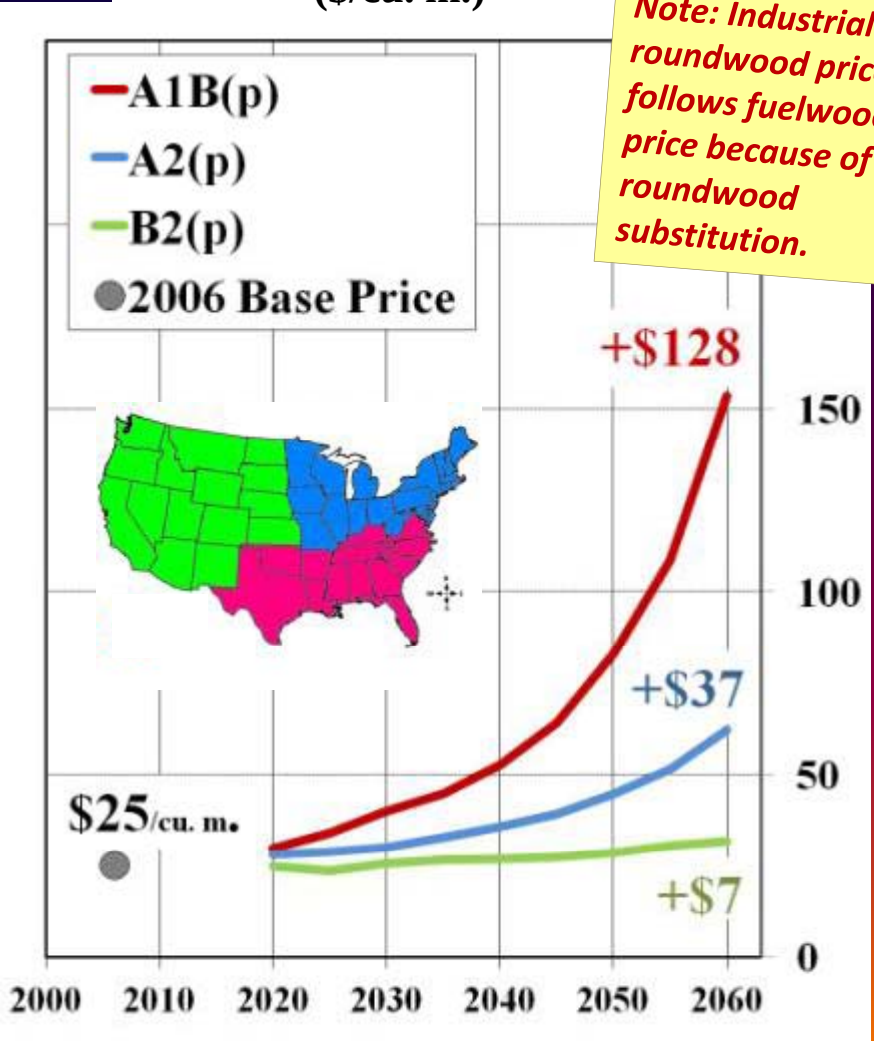
U.S. and global wood prices differ historically and as projected by USFPM/GFPM – Competitive advantages will arise with diverging wood price trends driven by wood energy demands:

World Average Fuelwood Price Outside of USA ($/cu. m.)

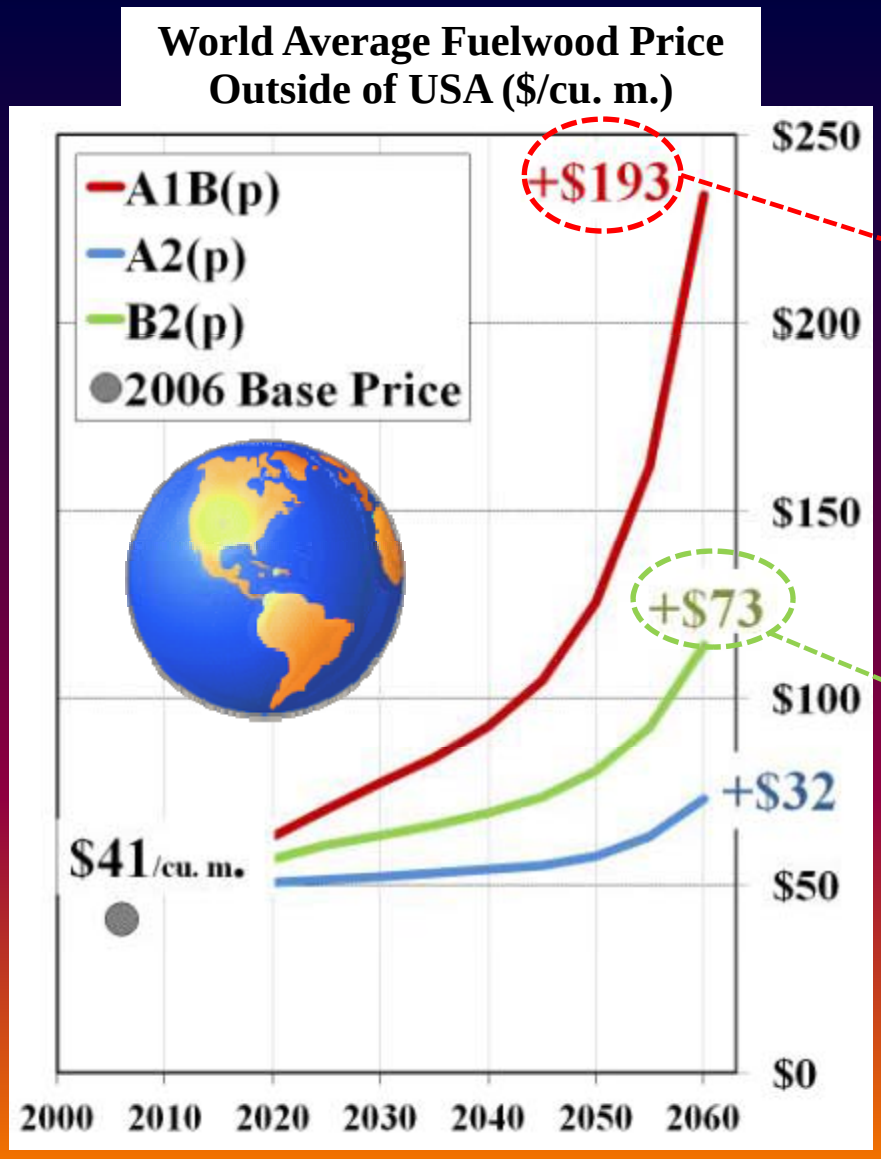


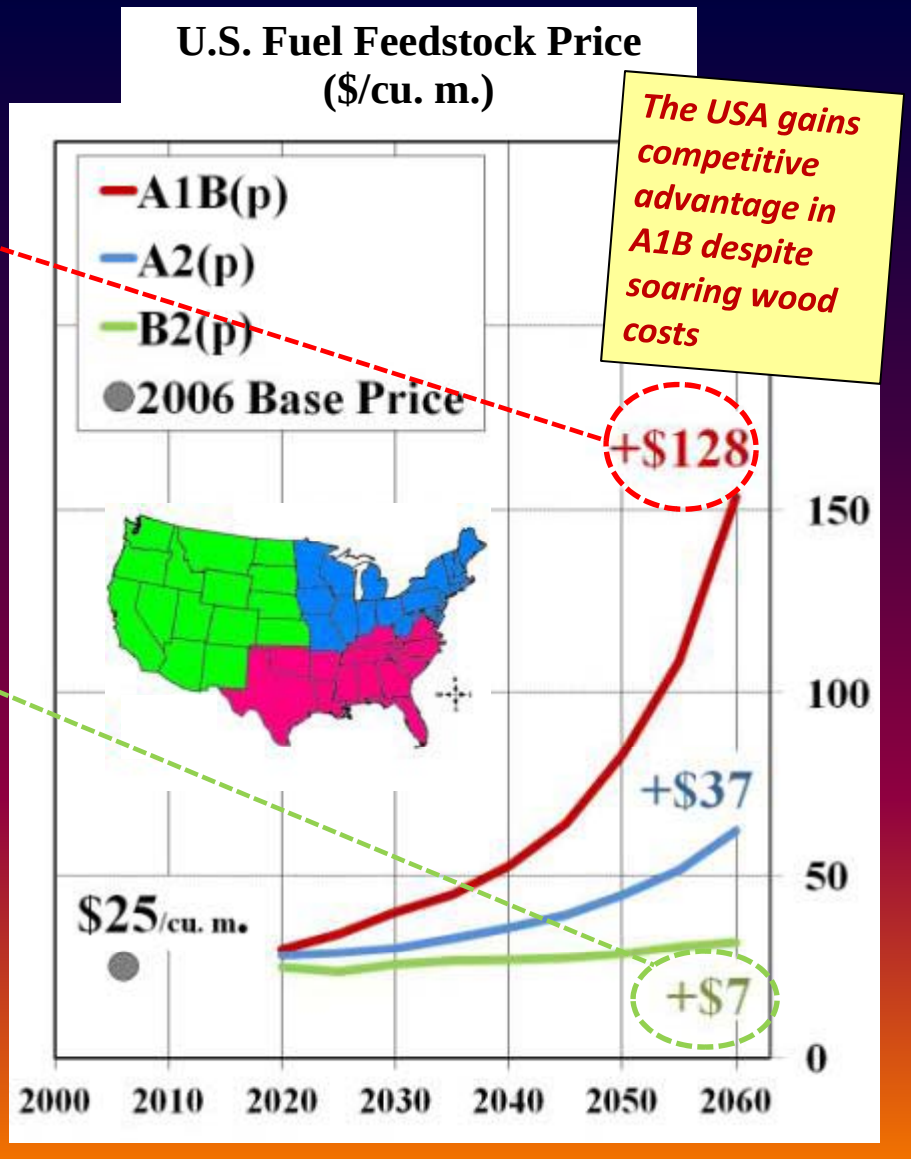
U.S. Fuel Feedstock Price ($/cu. m.)

Note: Industrial roundwood price follows fuelwood price because of roundwood substitution.



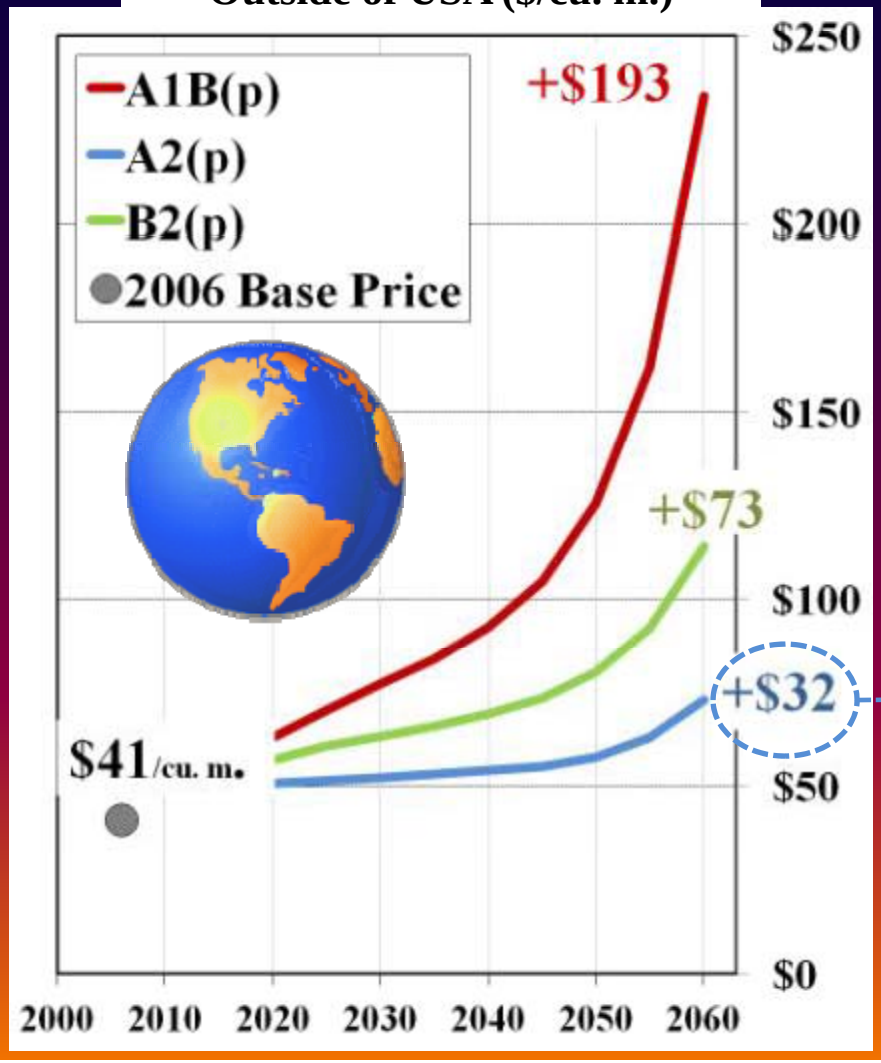
In A1B and B2 scenarios, the United States gains competitive advantage when global wood price increases more than U.S. wood price:



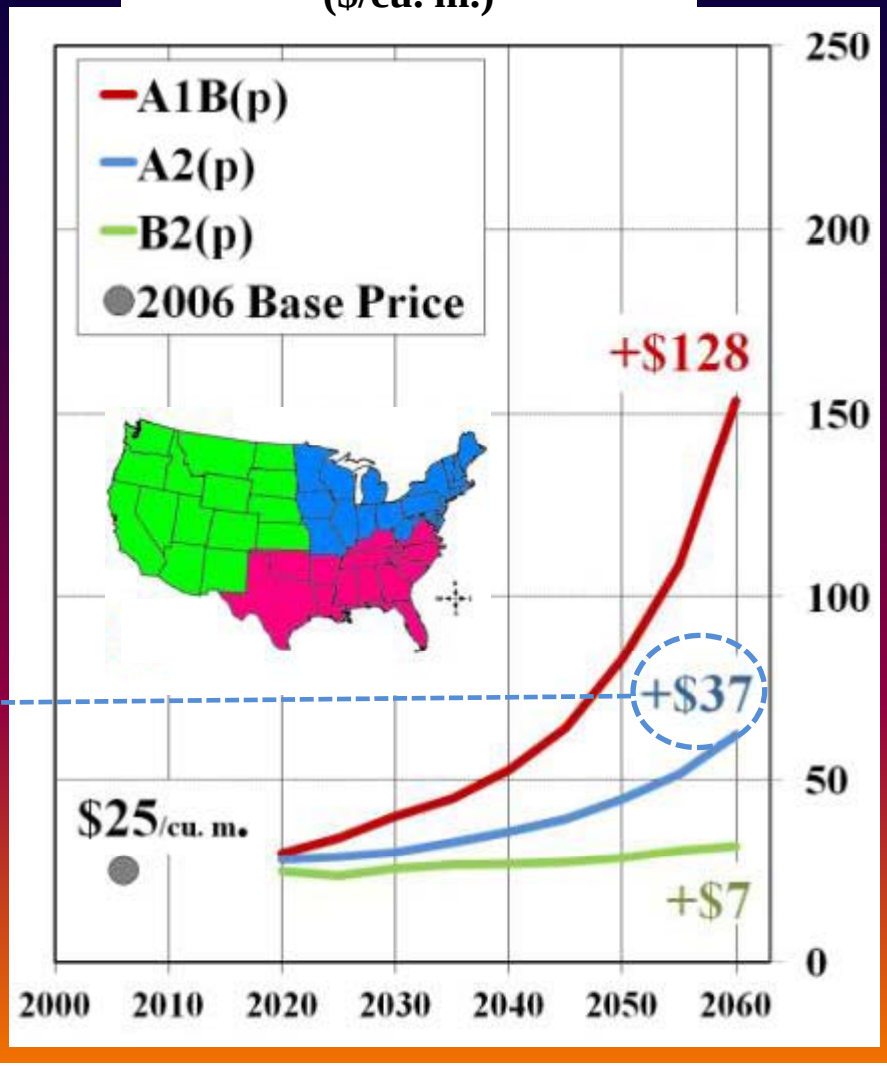


But, in A2 the increase in U.S. wood price is *higher* than world average, yielding no gain in U.S. competitive advantage:

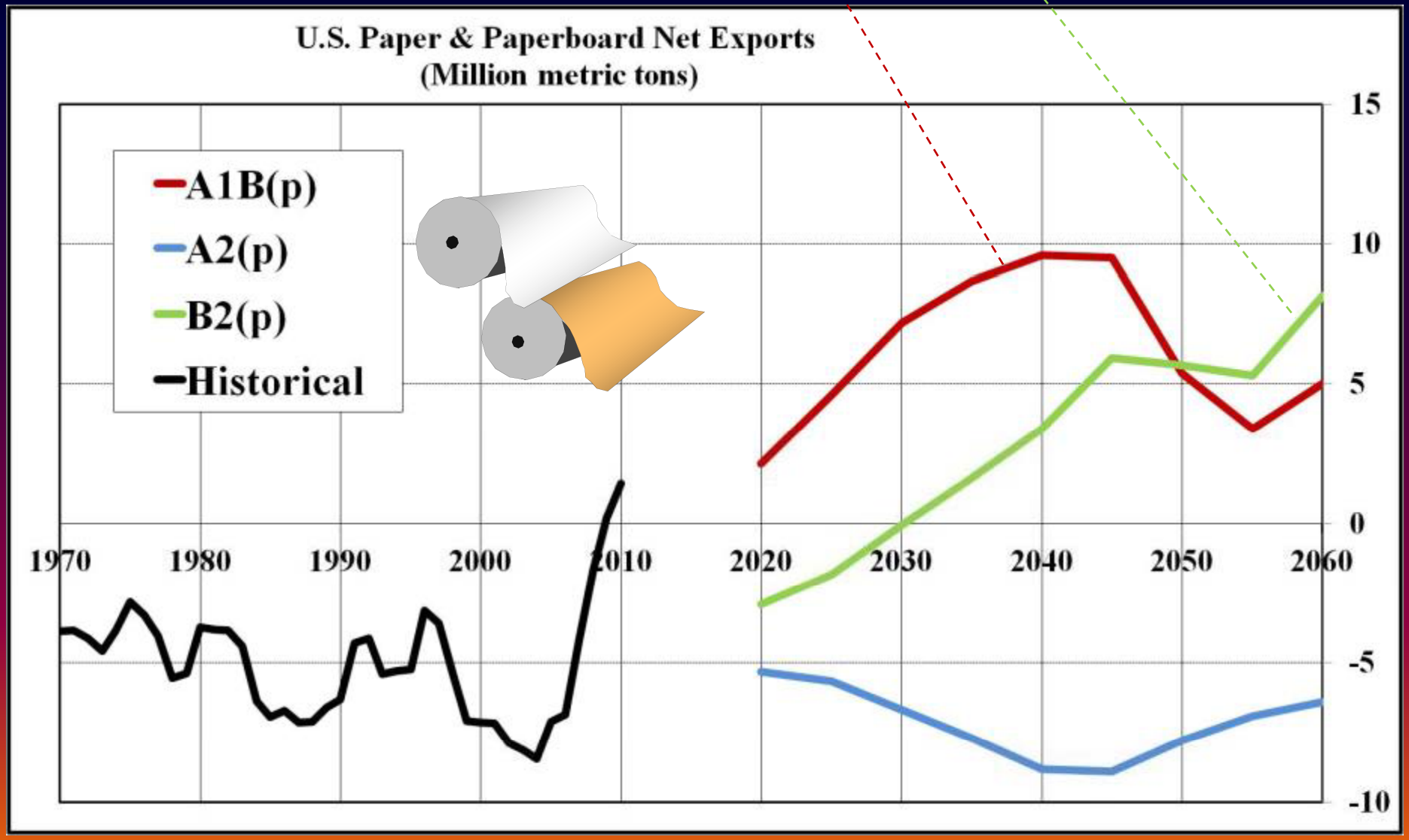
World Average Fuelwood Price Outside of USA ($/cu. m.)



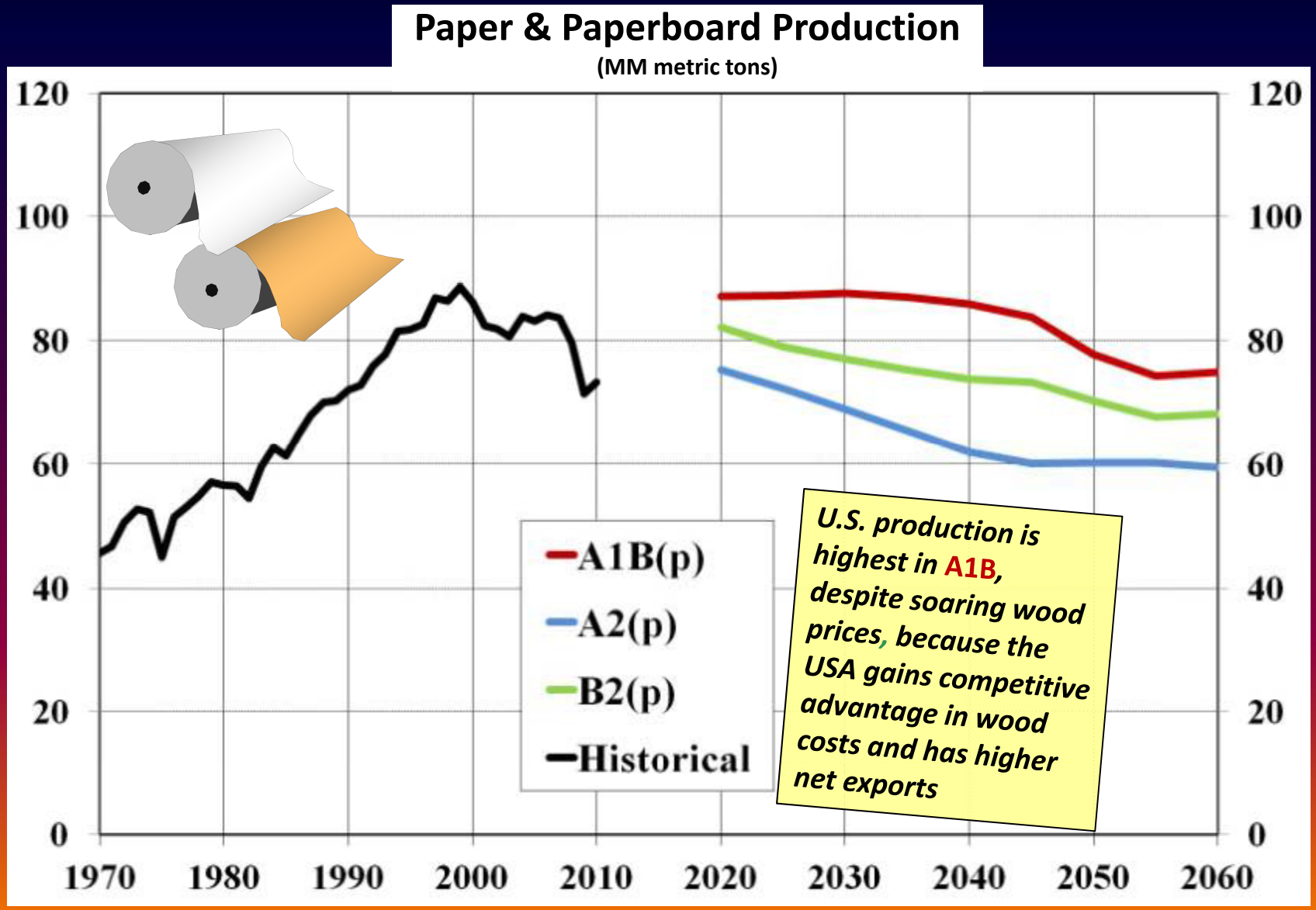
U.S. Fuel Feedstock Price ($/cu. m.)



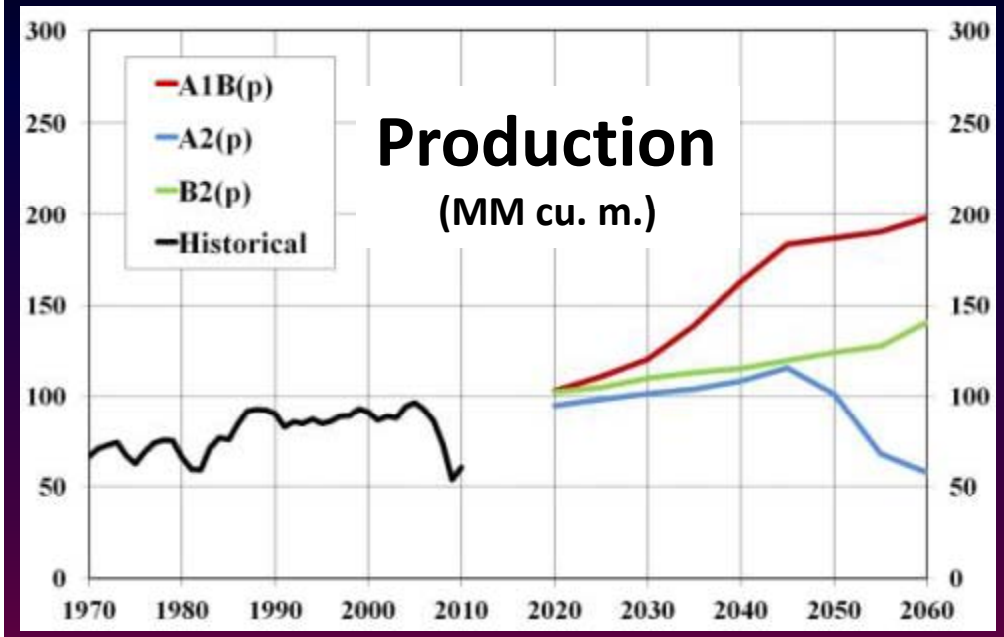
U.S. net exports are favored in A1B and B2, because wood price trends afford U.S. competitive trade advantages . . .

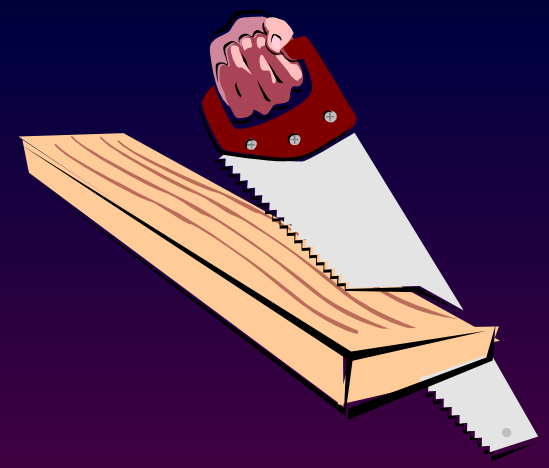


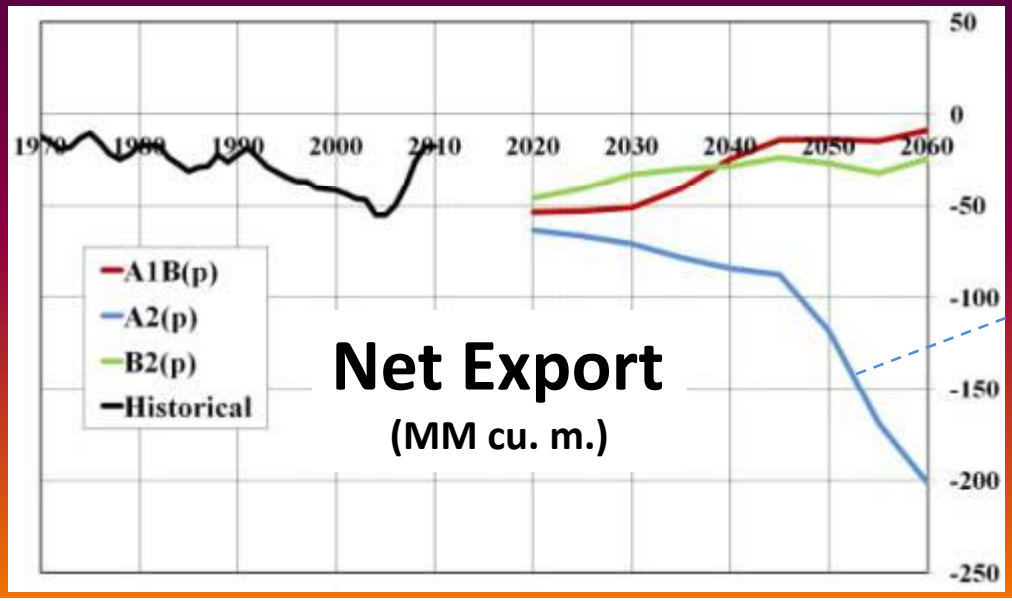
And, as shown previously, U.S. production of paper and board is higher (with higher net exports) in A1B and B2:



Similarly, U.S. lumber production and net export is highest in A1B and B2, due to gains in U.S. competitive advantage in wood costs:

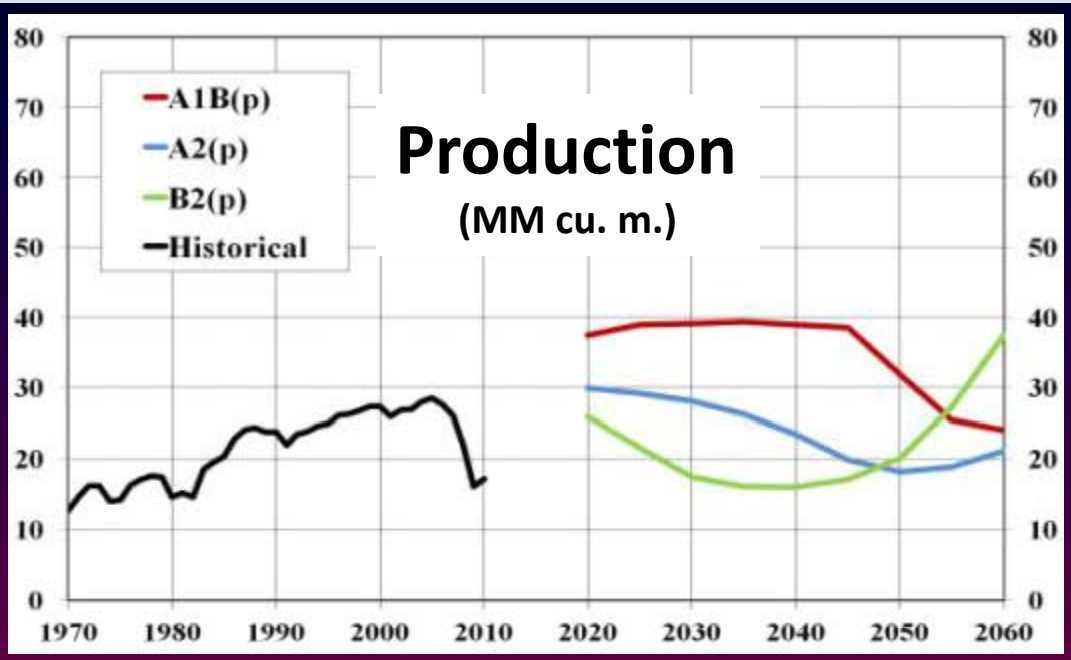


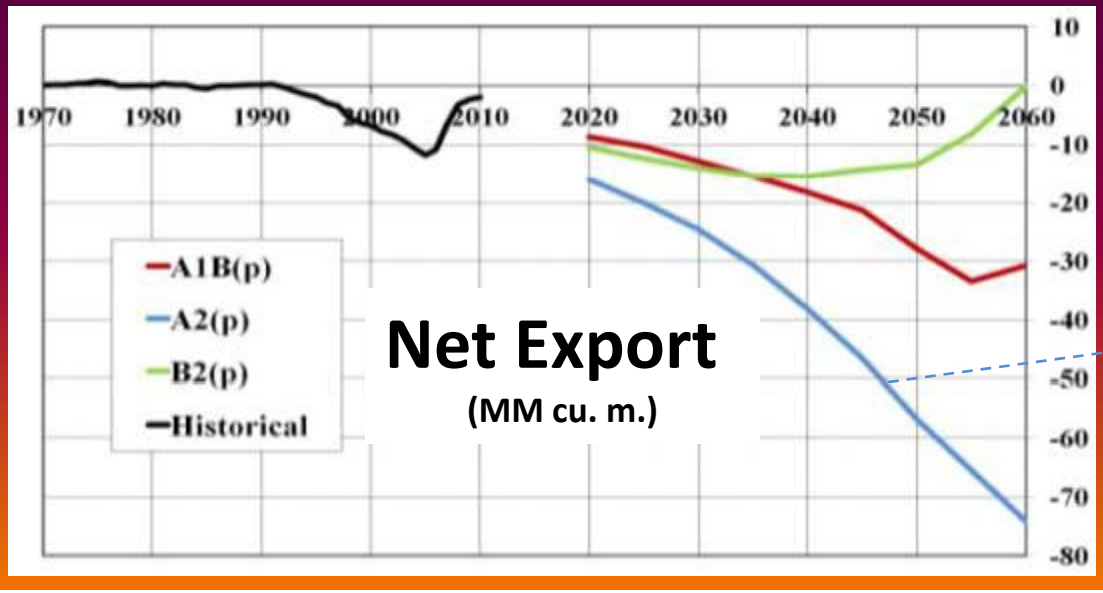




But with high housing starts and no gains in trade advantage in the A2, there's an unabated flood of cheaper lumber imports (with declining long-term U.S. production).

Likewise, for structural panels, output is highest in A1B, again largely due to gains of U.S. trade advantages in wood costs:





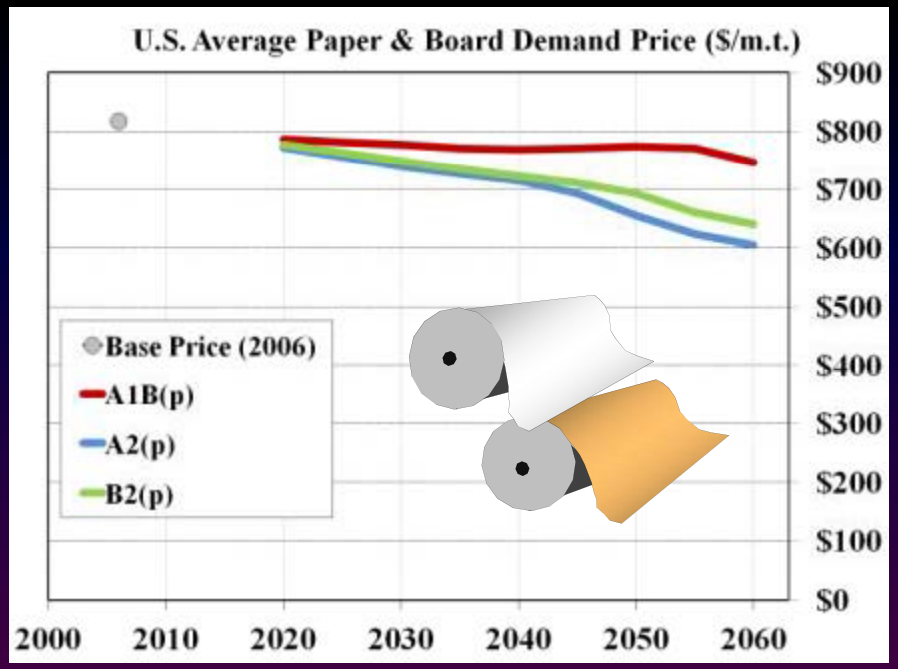
And with highest U.S. housing starts (high import demands) but no gains in comparative advantage in wood costs the A2 results in a flood of cheaper wood panel imports (and lower long-term U.S. production).

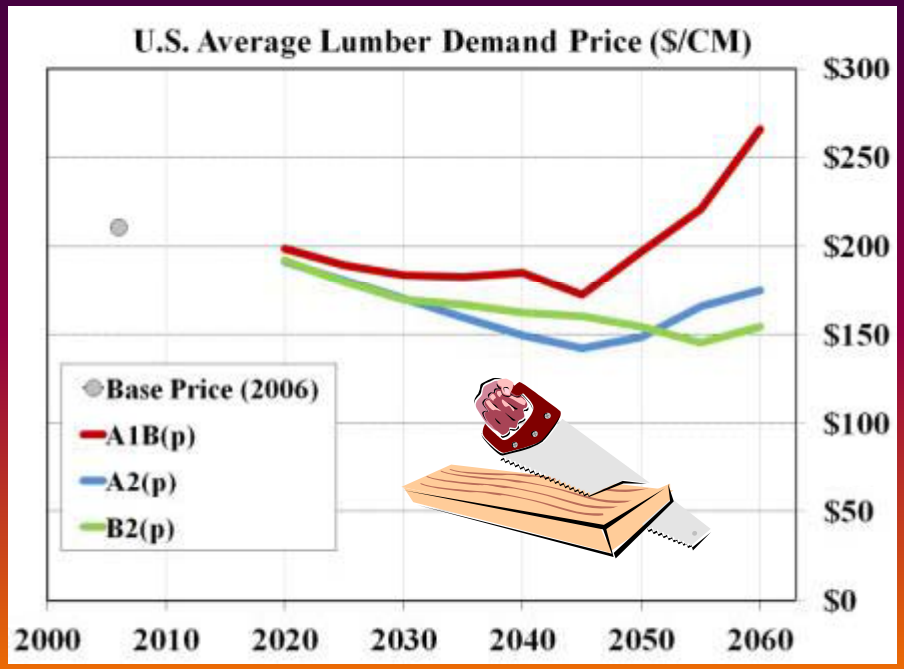
Real Prices for Products:

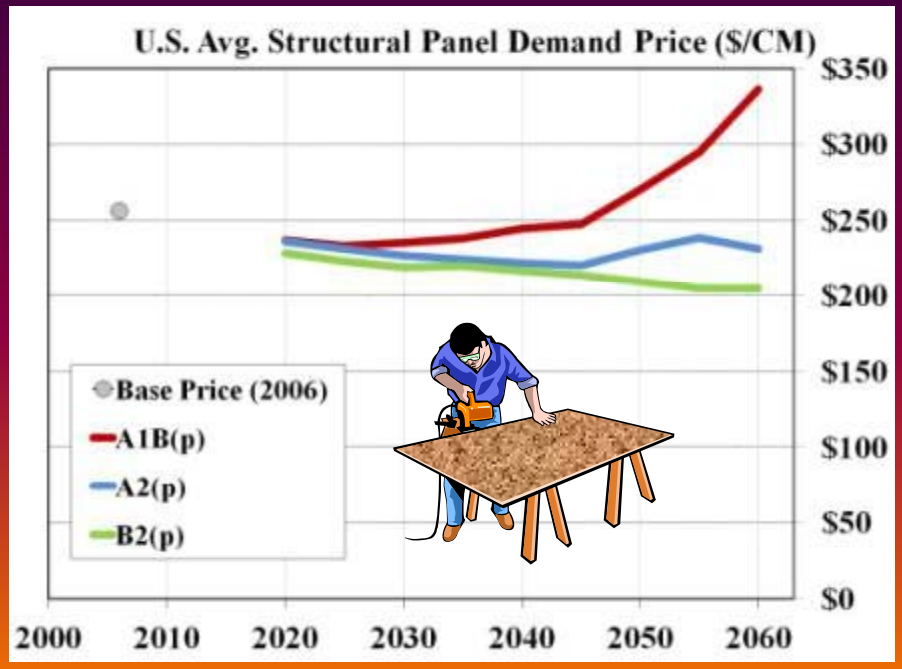
The **A1B** scenario features the highest projected real prices for products (as well as highest production and net exports), and hence highest forest product revenues.

The **A2** and **B2** both feature lower product prices, with generally lower wood prices.

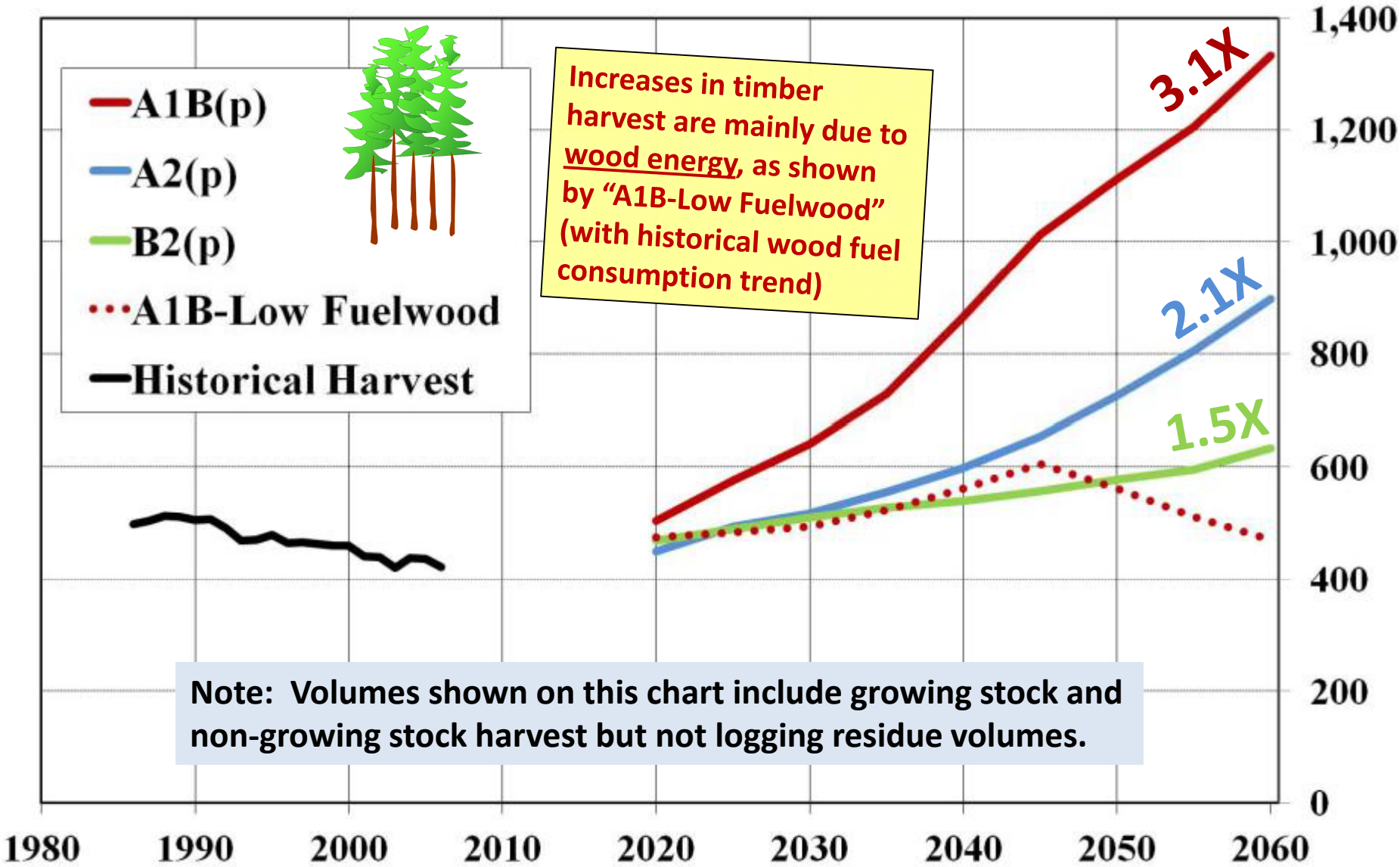
All scenarios have wood productivity gains.





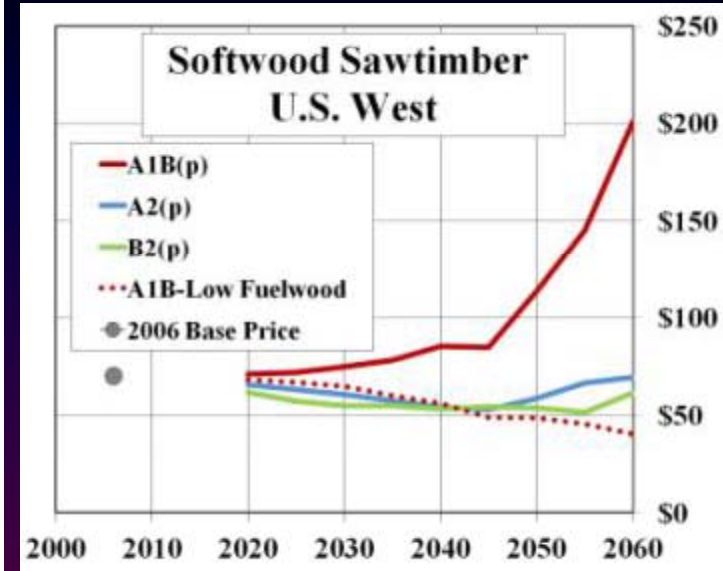


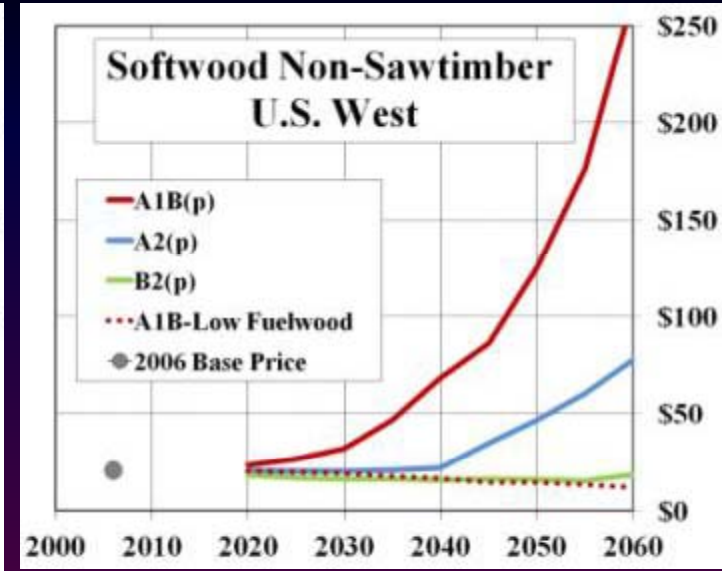
Total U.S. timber harvest (MM cu. m.): Projected increases in harvest range from 50% in B2, to over 2-fold in A2, and over 3-fold in A1B (2006-60):

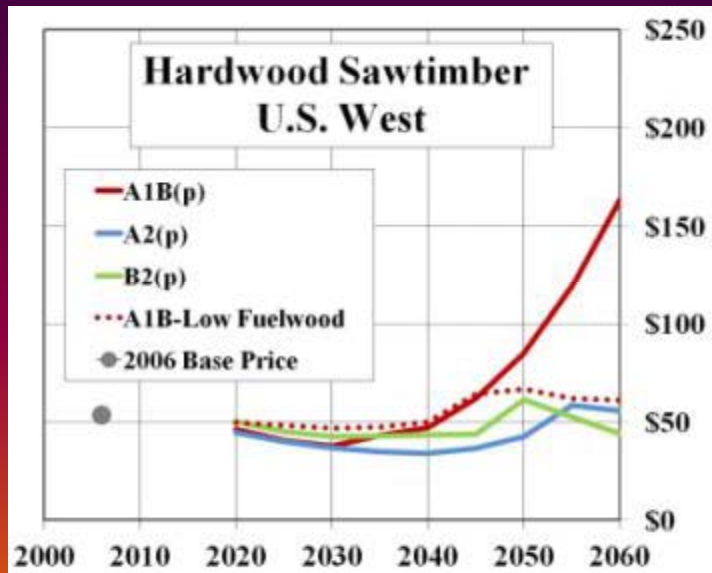


Note: Volumes shown on this chart include growing stock and non-growing stock harvest but not logging residue volumes.

Projected U.S. West real timber prices (2006 $):



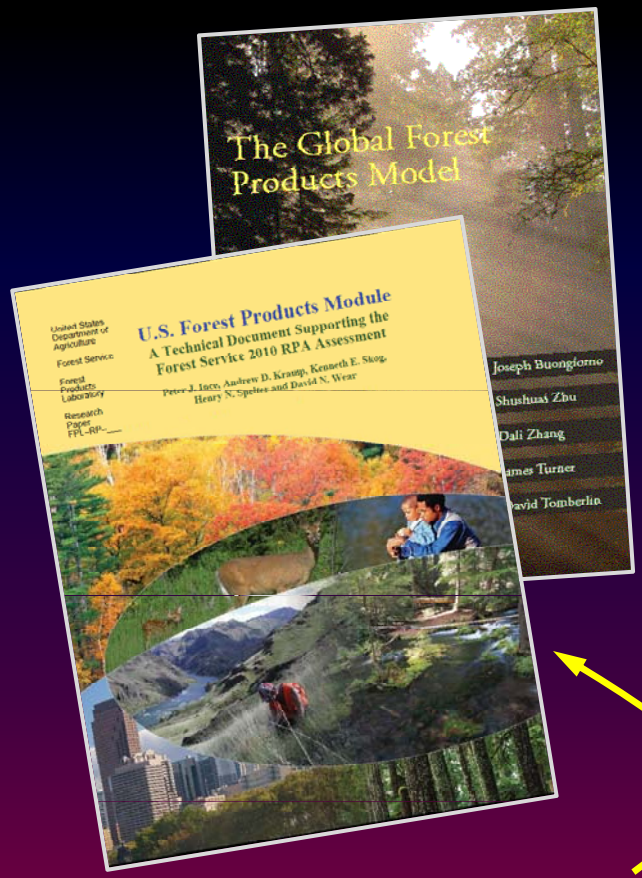


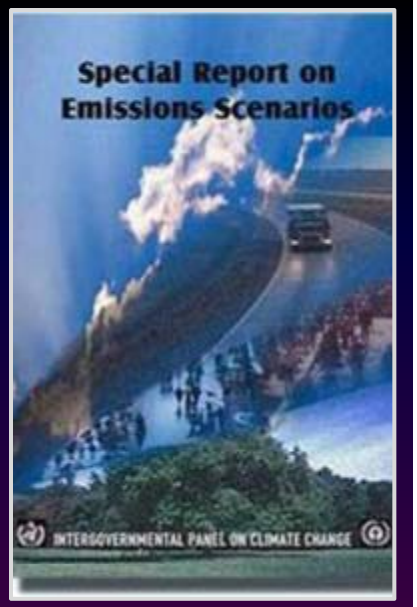


With only 4-fold expansion in US wood energy output, the **B2** has *declining sawtimber prices and flat non-sawtimber prices*.

With a 16-fold expansion in US wood energy production, the **A1B** has *soaring timber prices*.

In summary, we have developed a long-range forest sector modeling system for RPA involving these elements . . .

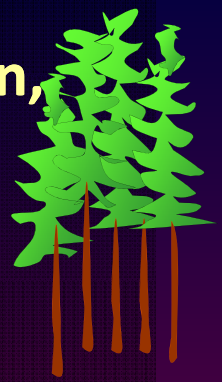




- U.S. Forest Products Module (USFPM): detailed U.S. timber model built into the GFPM
- RPA global scenarios based on IPCC SRES

General Findings:

- Expansion of wood energy consumption has price impacts on U.S. forest product competitiveness, trade and output

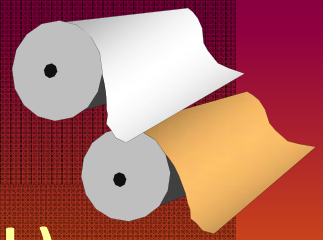


- With modest expansion in U.S. wood energy output (4-fold by 2060 in B2), logging residues supply most of U.S. expansion, so projected U.S. real timber prices remain flat to declining

- With much larger expansion in U.S. wood energy output (16-fold in A1B) pulpwood is used heavily for energy; Real wood prices soar, but even more so globally than in the USA

- U.S. solid-wood product output, prices and revenues are low in A2 with cheaper imports, despite highest housing starts

- U.S. paper & board consumption is projected to decline, but net exports increase in scenarios with trade advantages, even in A1B despite soaring U.S. and global wood prices



- U.S. forest product production, net exports, prices and revenues are all highest in A1B (with high economic growth), and next highest in B2 (with sustainable development theme)


Questions?