



**Battelle**

*The Business of Innovation*

Impact of New Estimates of Water  
Availability for Agriculture Under  
Climate Change: Agricultural Impacts in  
the Yakima Basin of Washington State

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USCID Conference

Portland, Oregon — September 18, 2008

# Outline

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- North America and the 4<sup>th</sup> IPCC Report
- Water management challenges
- Effects of temperature and water on crops
- Risks of crop losses

# IPCC AR4 findings—North American Agriculture

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- Most agricultural impact studies project likely climate-related yield increases of 5 to 20% over the first decades of the century, with the overall positive effects of climate persisting through much or all of the 21st century
- Scenarios with decreased precipitation create important challenges, restricting the availability of water for irrigation and at the same time increasing water demand for irrigated agriculture and urban and ecological uses

# Climate impacts for irrigated agriculture

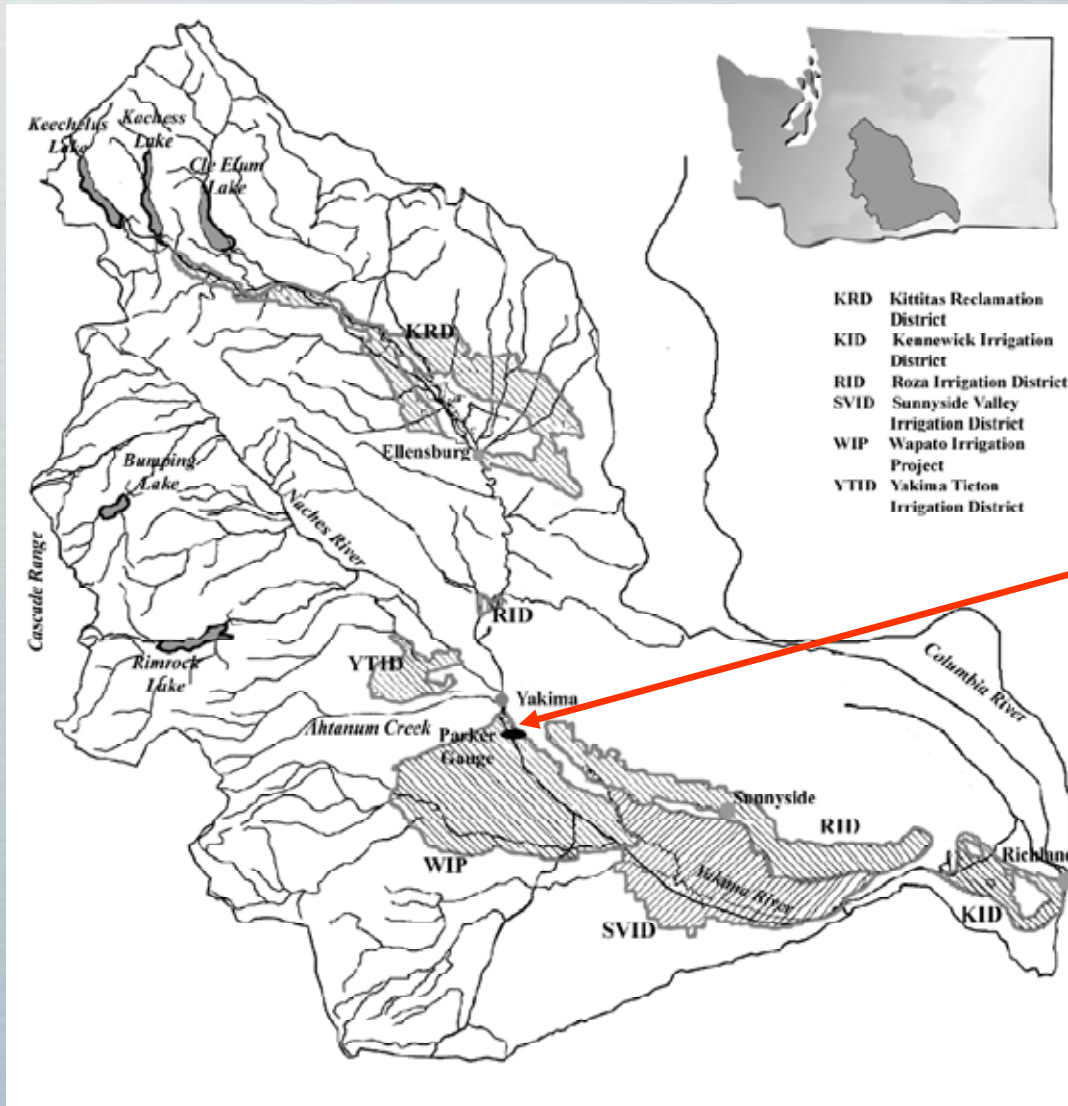
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- Growing weather is warmer
- CO<sub>2</sub> concentration increases
- Water supply amount and seasonality is altered

# Mid-Columbia water and crops

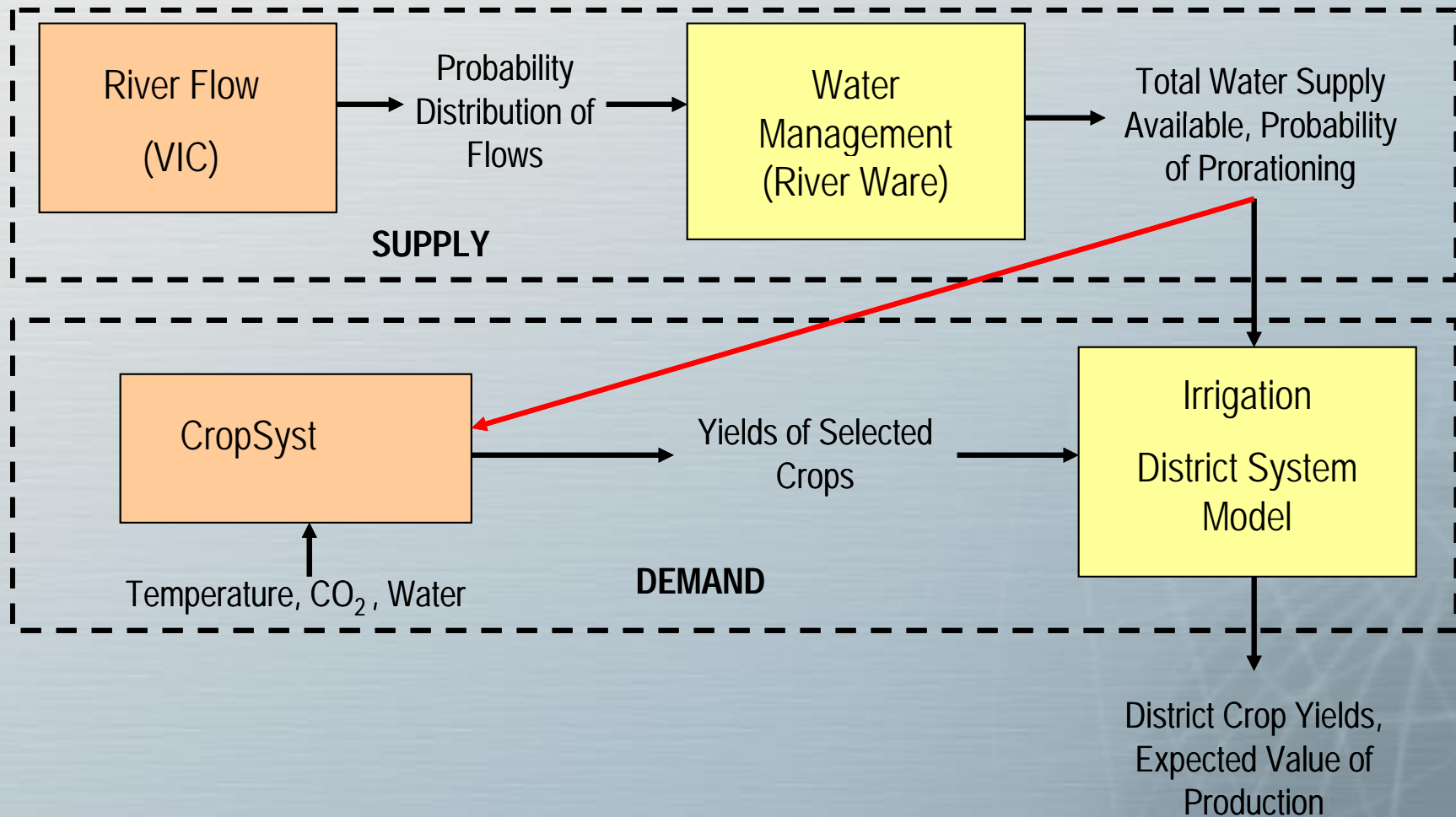
## Storage

- Keechelus
- Kachess
- Cle Elum
- Rimrock
- Bumping
- Snowpack

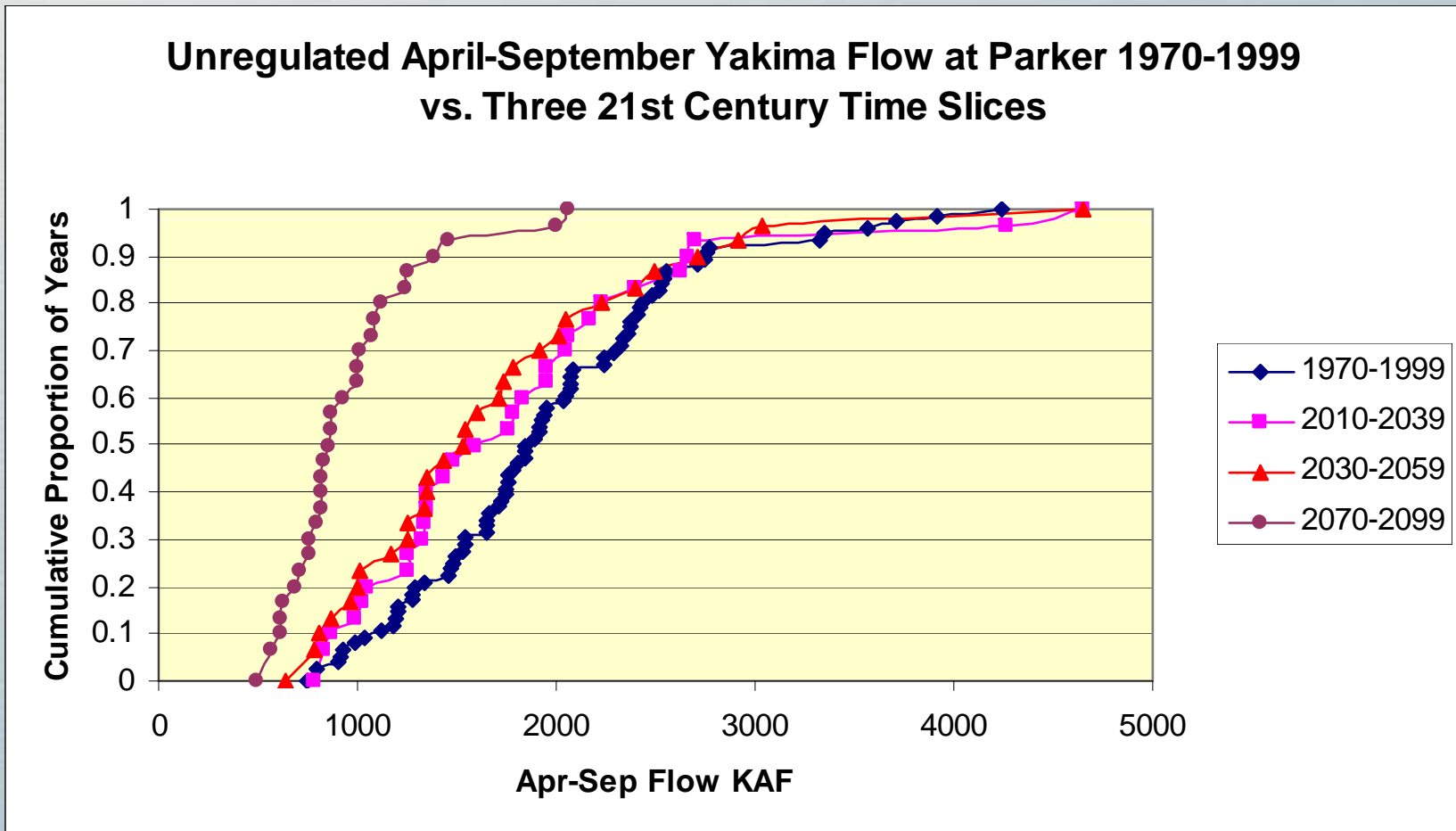


Parker Gauge

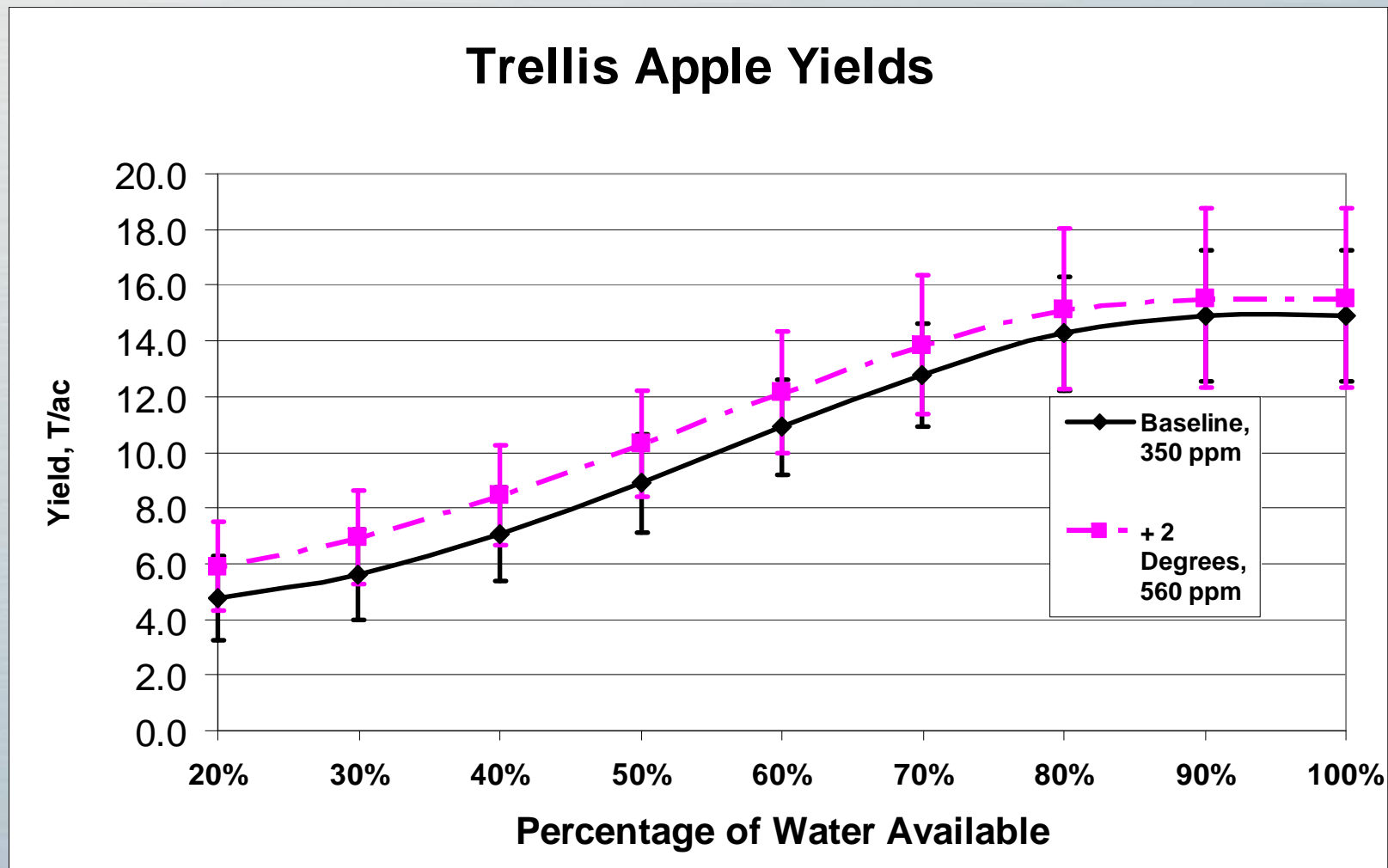
# Analysis done with linked models



# Warming reduces summer seasonal flow ECHAM 5 ("Middle Model")

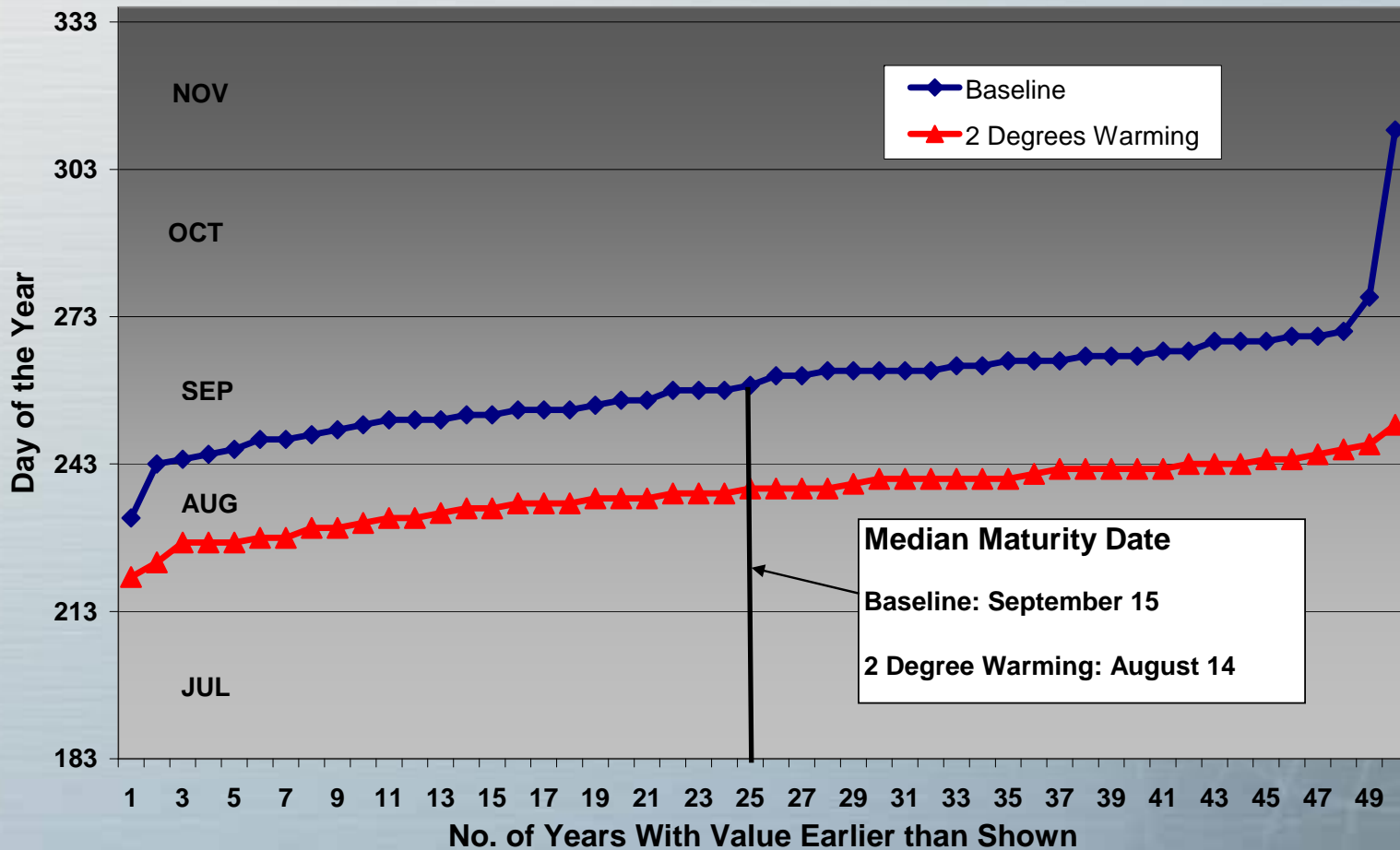


# Variation in irrigated crop yields in CROPSYST

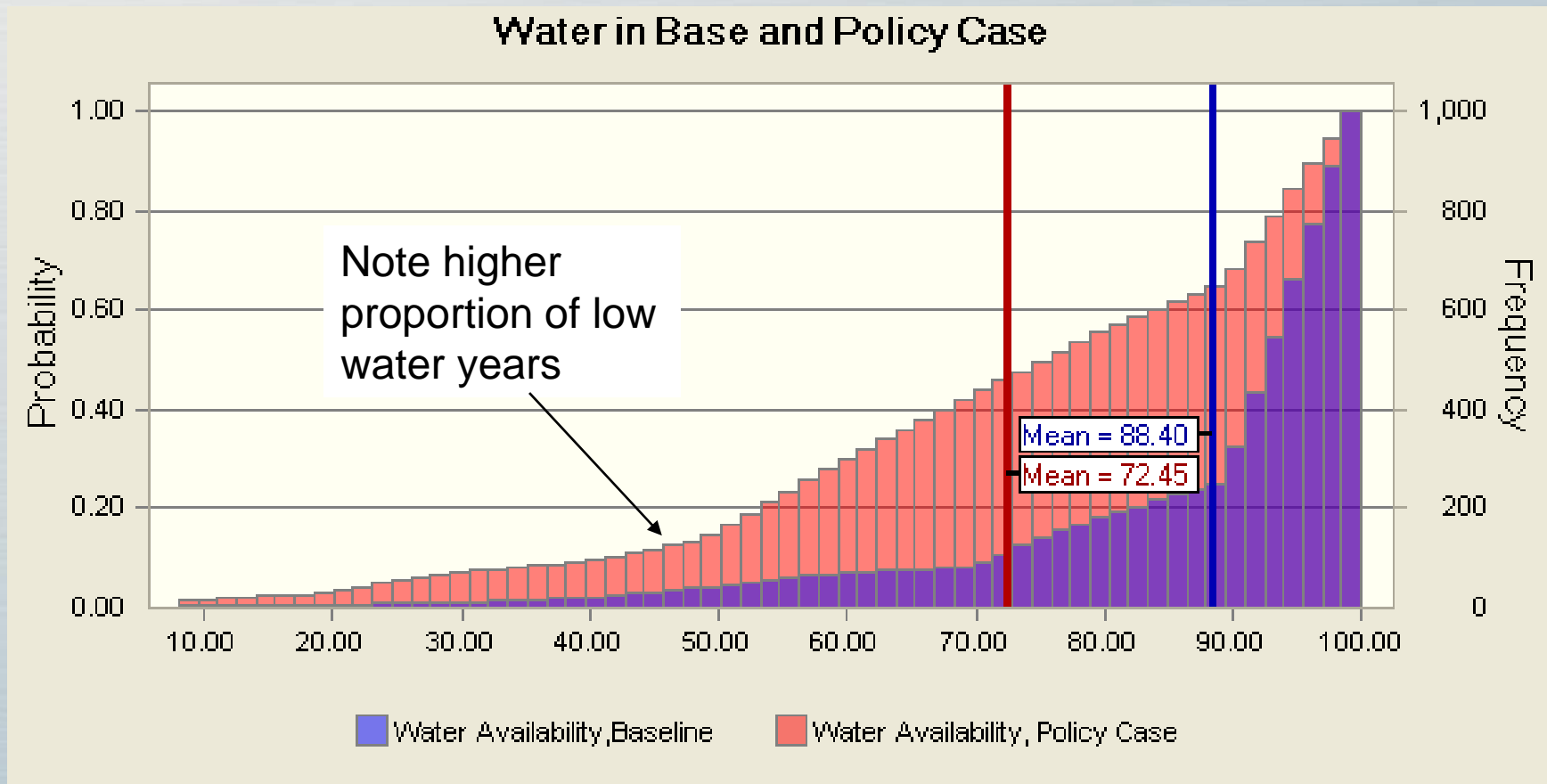


# Trellis apples maturity date

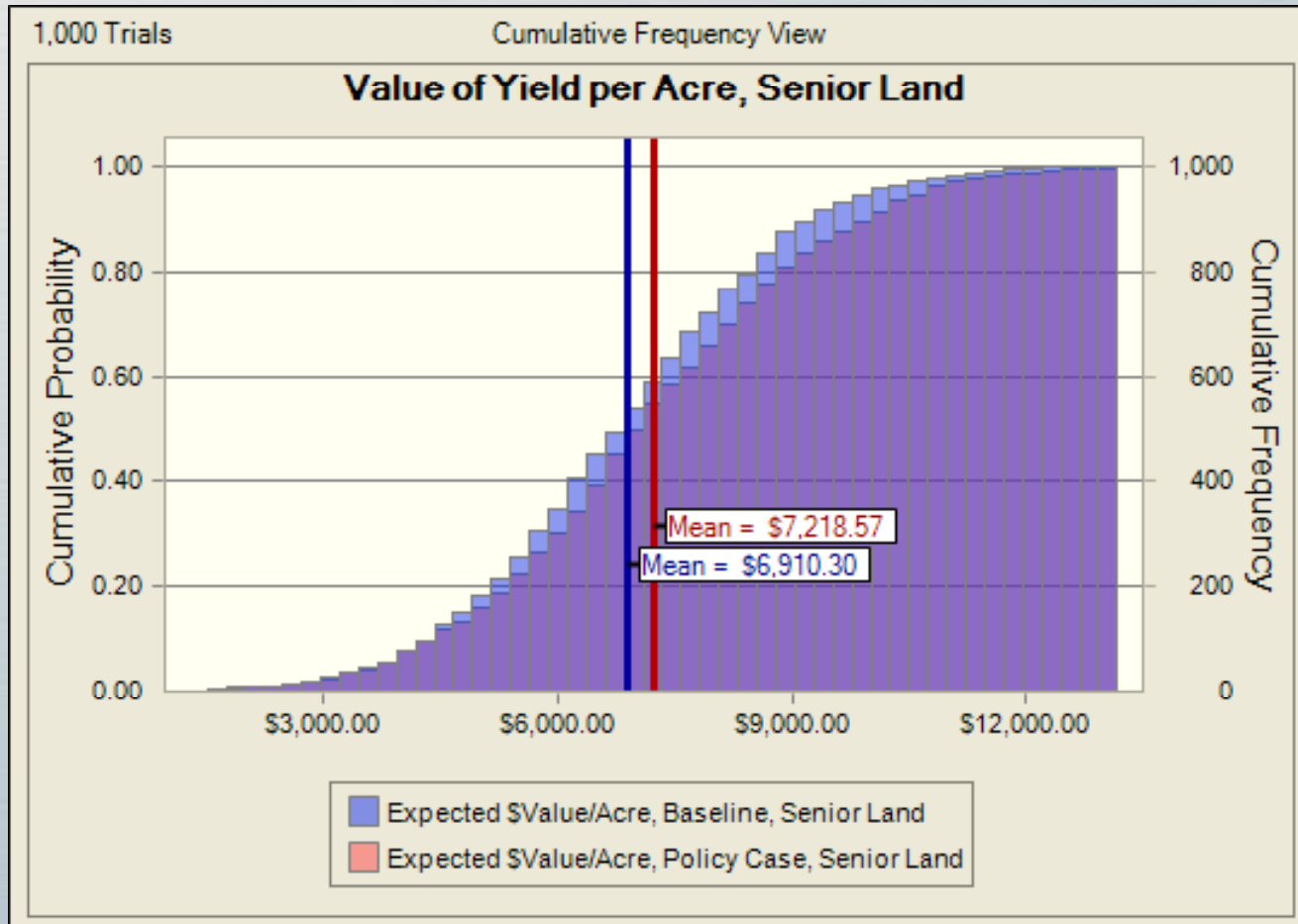
Maturity Date for Trellis Apples



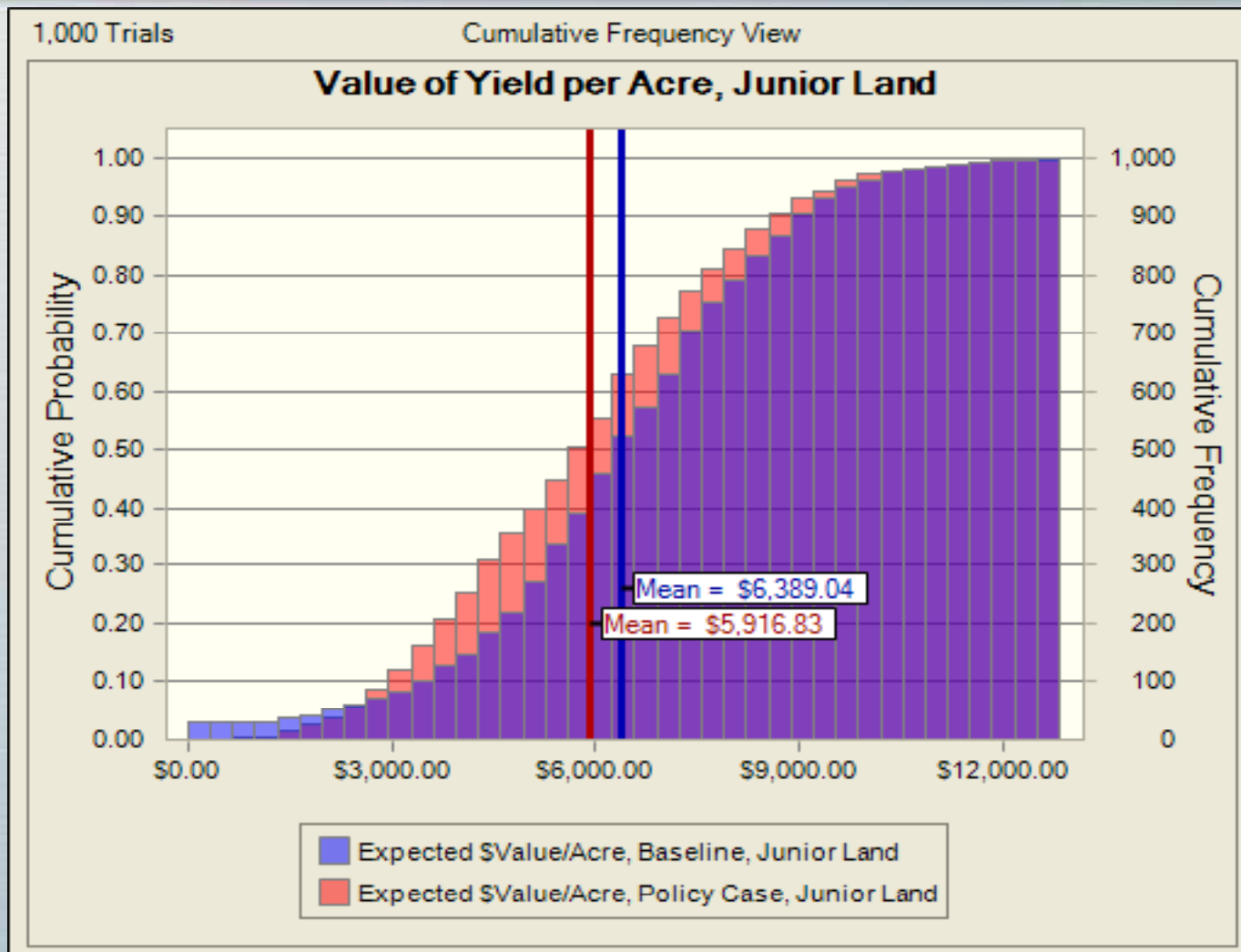
# Crystal Ball results: water availability with 2°C (Less supply than in baseline)



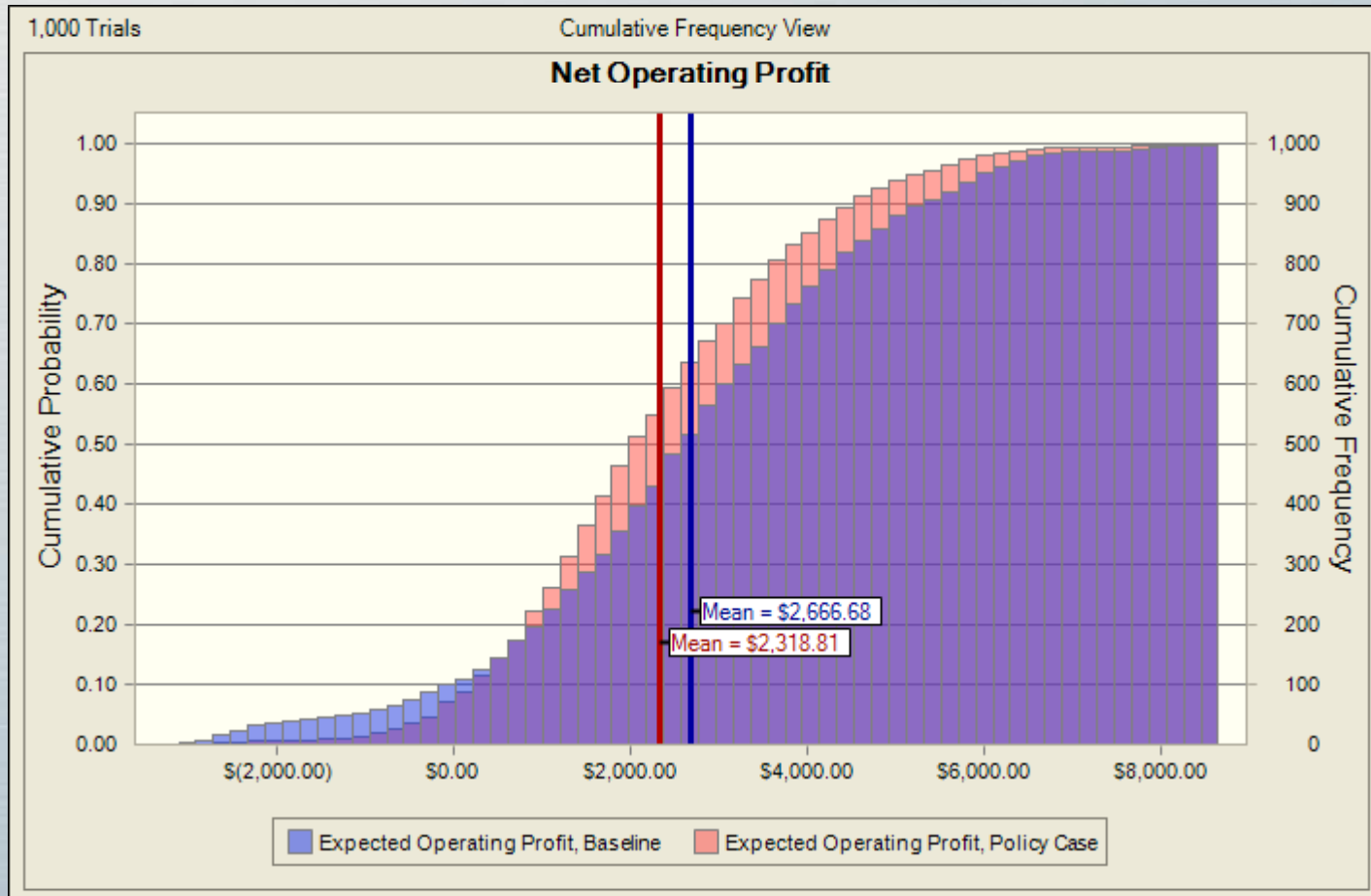
Value of senior land apple yield is slightly increased with 2°C warming (No lack of water plus positive temperature and CO<sub>2</sub> effects)



Value of junior land apple yield is lower with 2°C warming (Lack of water trumps positive effects)



Junior land apple operating profitability is lower with 2°C warming (although harvest cost is saved)



# Conclusions

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- Prices, yields, and profitability for irrigated crops are highly variable, even for a given water supply
- Water supply is not uniformly lower with climate change, but risks of low water are higher
- Climate warming generally improves yields if adequate water is available
- Increased probability of low water more than offsets positive effects of warming on profitability