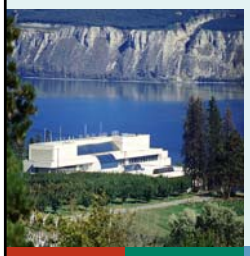
Agricultural water supply in the Okanagan Basin – adapting to climate variability and change

Denise Neilsen, Scott Smith
Pacific Agri-Food Research Centre, Summerland, B.C.
Stewart Cohen
Environment Canada, AIRG – Vancouver, B.C.



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Canada

Water Management & Climate Change in the Okanagan

- Mark Barton, Bill Taylor EC-PYR
- Jeff Carmichael, James Tansey SDRI/UBC
- Andrew Reeder RDOS
- Brian Symonds BCMWLAP
- Younes Alila, Wendy Merritt Forestry/UBC

Supported by a grant from the Climate Change Action Fund (#A463/433), Natural Resources Canada, Ottawa.

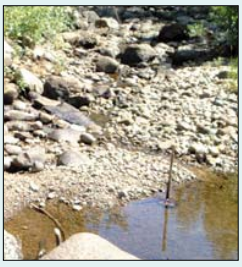
Okanagan water supply

'The Okanagan Basin has the lowest, per capita availability of freshwater in Canada'

Statistics Canada. 2003.

Human activity and the environment. Annual Statistics 2003. Cat. No. 11-509x XPE

2002/2003 drought



Water Showdown

By S. PAUL VARGA

***Penticton Herald* (2003/08/07)**

Summerland Mayor and councillors face fines of up to $1 million per day, per person as water for fish flows cut-off. Farmers, orchardists and grape growers in the area could also lose a significant amount of money if the water runs out and their crops are damaged as a result.

Water Restrictions already in effect in some areas

By J.P. SQUIRE

***The Daily Courier* (2003/06/17)**

As a summer heat wave hits the Okanagan, homeowners are pouring millions of litres of water a day on their lawns and gardens, prompting restrictions in many areas.

Okanagan water supply

- 1880s first land titles and water licences for tree fruits
- associated with large tracts of former ranchland
- 1910 –1925 land development companies introduced first irrigation schemes
- marketed fully serviced properties to E. Canada and Europe

Okanagan water supply

- 1920s and 1930s land development companies felt effects WW1, drought and depression
- Government recognized importance of tree fruit industry in developing Interior
- Province assumed responsibility for bankrupt companies
- Incorporated irrigation and improvement districts under the B.C. Water Act

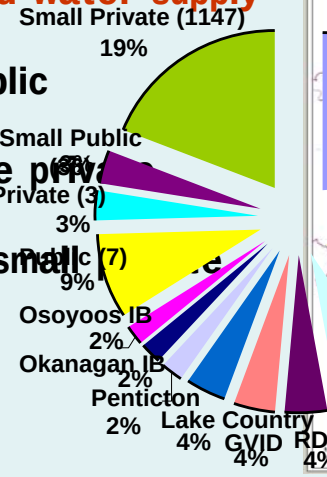
Construction and tarring irrigation flumes, May 1930

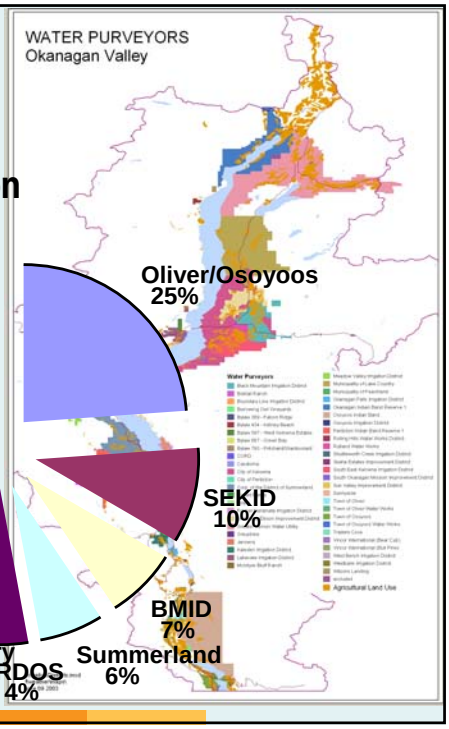
Water Purveyors

Water allocation

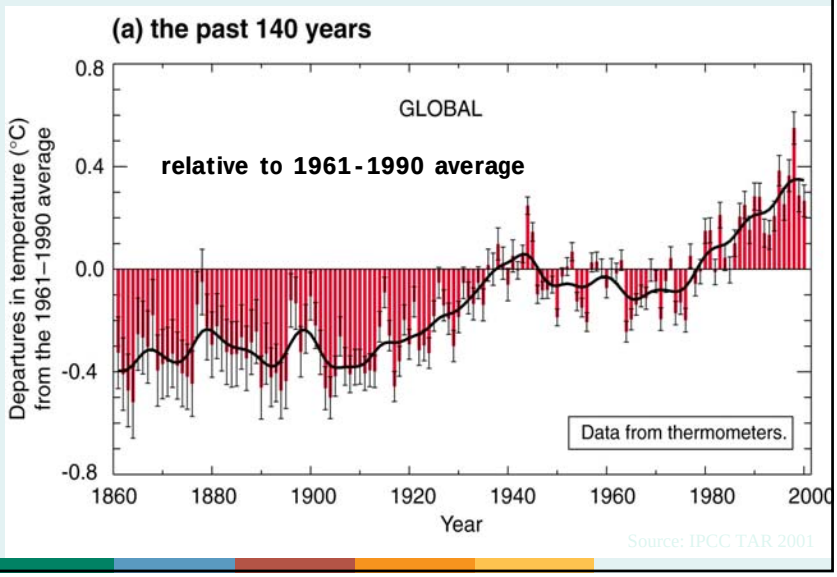
Fragmented water supply

- **53 public**
- **3 large priva**
- **1147 small p**

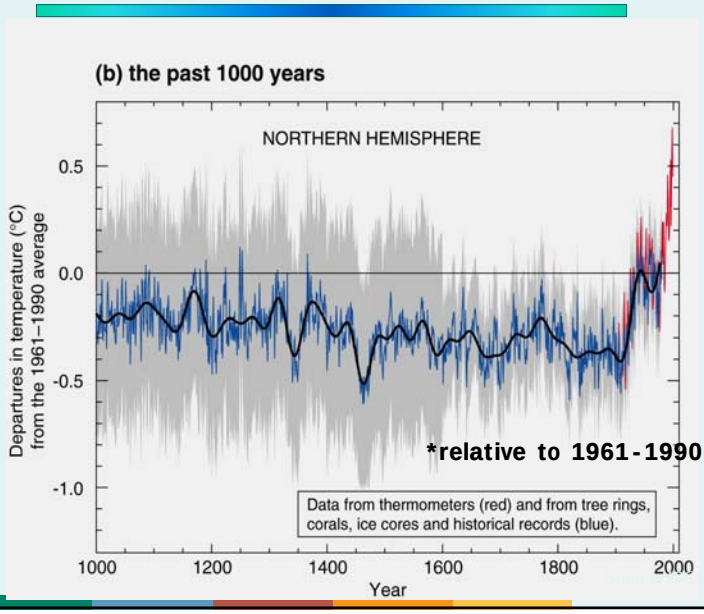




Is the Earth getting warmer?

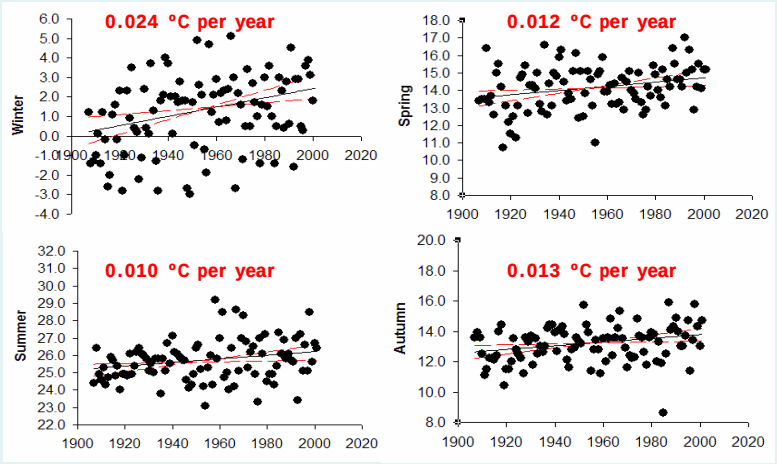


Is the Earth getting warmer?



*relative to 1961-1990 average

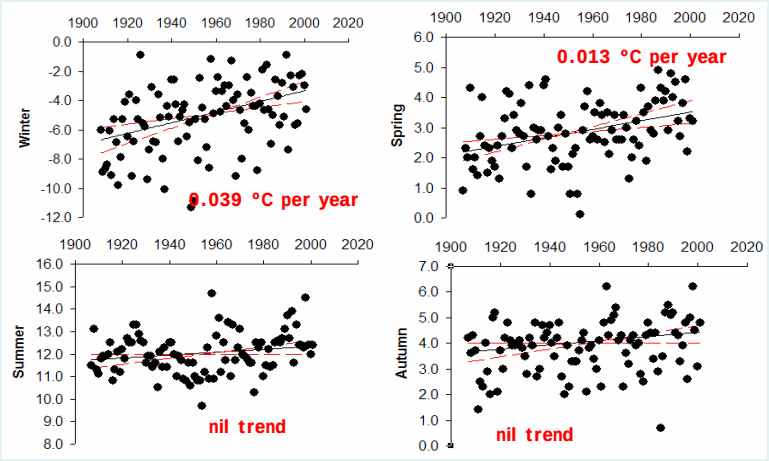
Trends in Daily Maximum Temperature



Daily Maximum Temperature - Summerland

Source: Bill Taylor and Mark Barton –Environment Canada -PYR

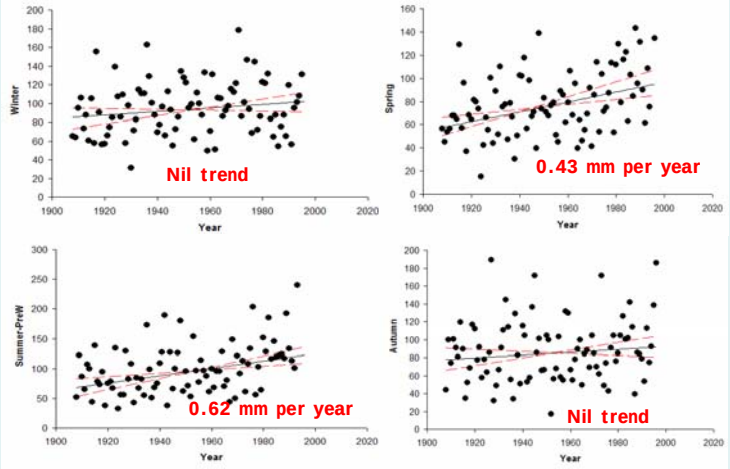
Trends in Daily Minimum Temperature



Daily Minimum Temperature - Summerland

Source: Bill Taylor and Mark Barton –Environment Canada -PYR

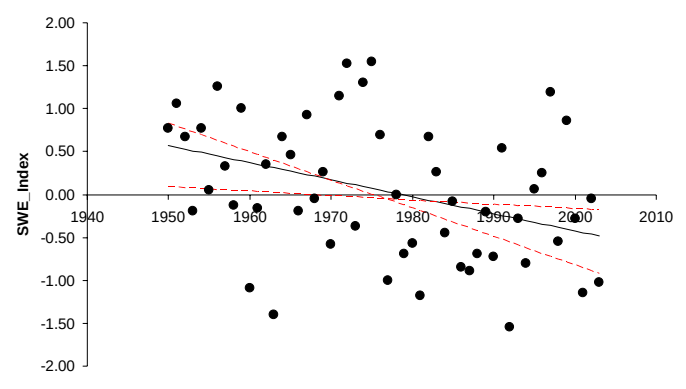
Precipitation Trends



Precipitation – Area Average (Vernon CSR, Summerland, Kelowna A, Penticton A)

Source: Bill Taylor and Mark Barton –Environment Canada -PYR

Trends in Snow Water Equivalent



Standardized SWE for Thompson and Okanagan Basins (13 Stations)

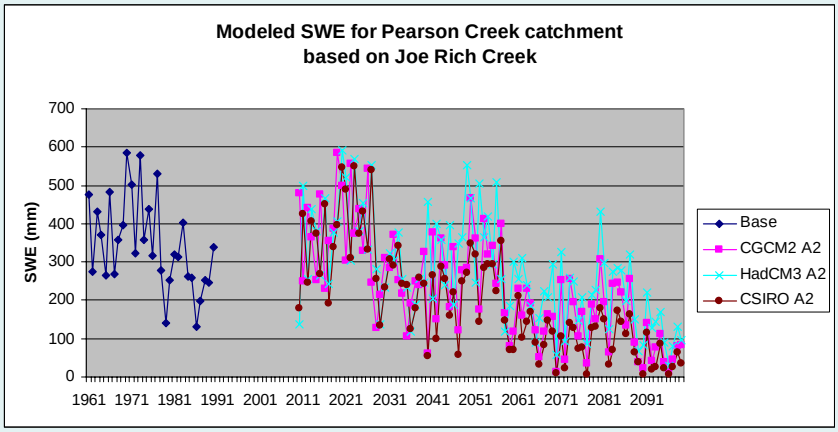
Source: Bill Taylor and Mark Barton –Environment Canada -PYR

Climate change models

- **Three global circulation models (Canadian, Australian British)**
- **Two green house gas emissions scenarios**
- **Three time slices 2020s, 2050s, 2080s compared to 1961-1990**

Impacts on Water Supply

- **Reduction in snow pack**

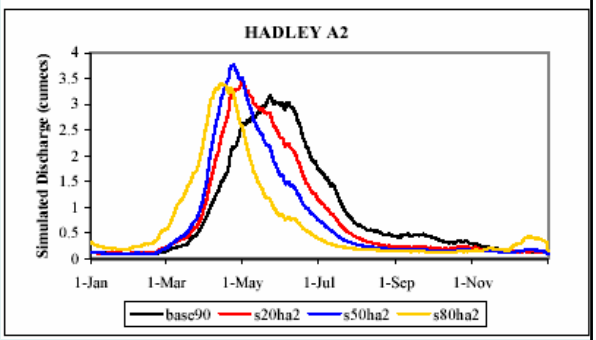


Source: Wendy Merritt & Younes Alila, UBC – UBC Watershed Model

Impacts on Water Supply

- **Change in volume of peak flows**
- **Earlier peak flows**
- **Earlier recession**

- **Implications for water users –**
- **earlier withdrawal from storage**
- **less in-stream flow**

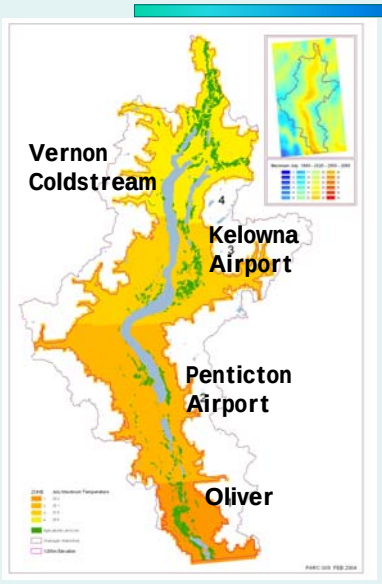


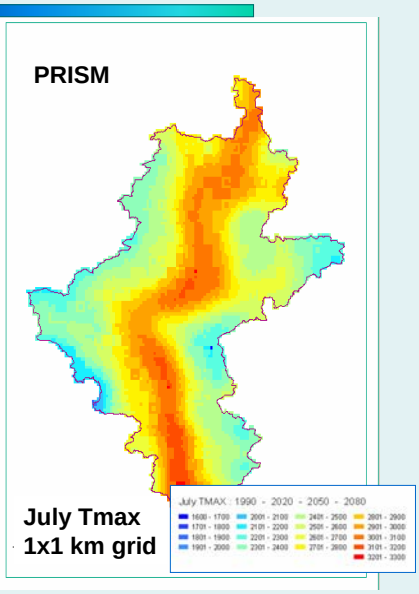
Source: Wendy Merritt & Younes Alila, UBC – UBC Watershed Model

Factors required for estimating crop water demand at the regional scale

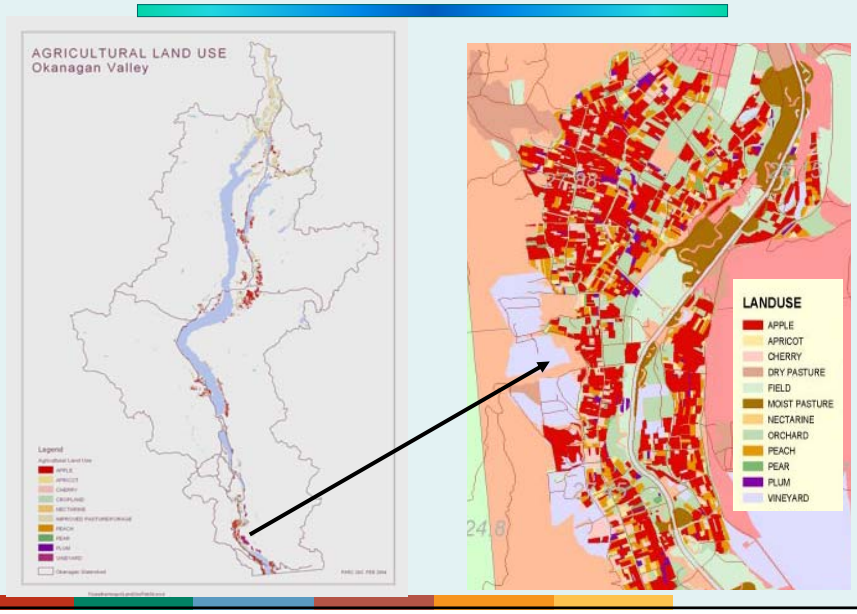
- Extrapolation of climate variables across the landscape
- Spatial distribution of land use
- Models relating climate to crop water demand

Spatial distribution of climate data in relation to topography





Land Use - Irrigated Agriculture



Crop water demand

Solar radiation

Wind

Transpiration from leaf stomates

Evaporation from the leaf surface

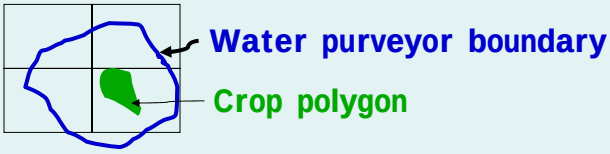
Evaporation from the soil surface

Model relating climate to crop water demand

- Estimate of potential evapo-transpiration based on daily max.temperature and solar radiation
- Estimate of actual evapo-transpiration from crop-coefficient curves
- Estimate of length of growing season based on time of bloom (fruit trees) and growing degree day accumulation

Model Structure

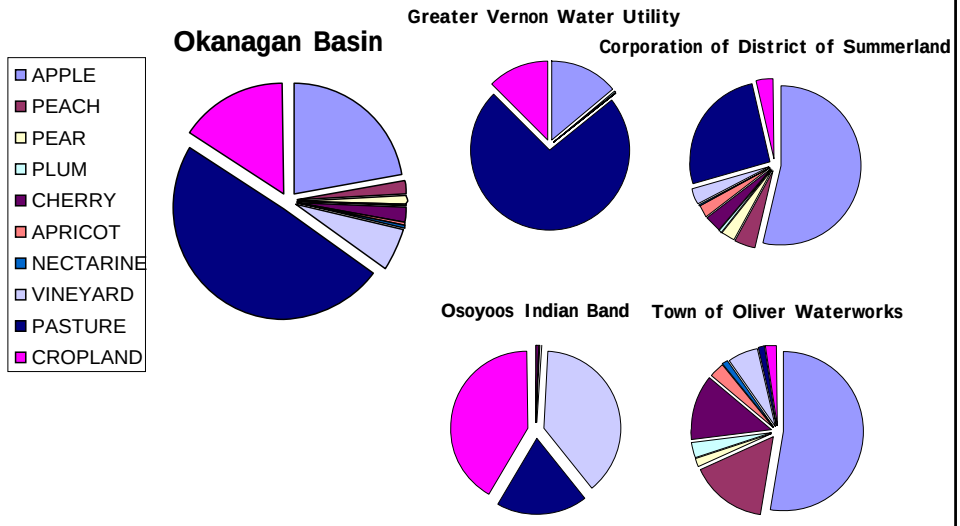
Prism grid 1 x 1km



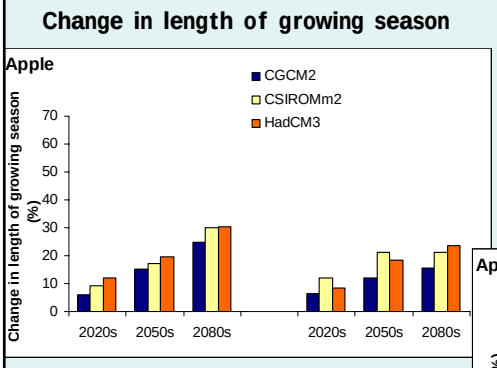
<u>Accumulation of crop water use</u>

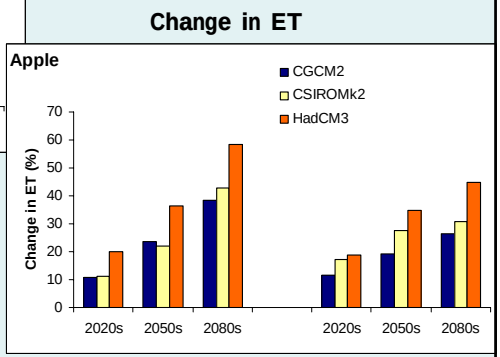
1. Crop polygon
   - mm water use x polygon area (ha) = m^3 x 10
2. Sub-watershed
   - Sum of crop polygons
3. Water Purveyor
   - Sum of crop polygons
4. Basin
   - Sum of crop polygons

Landuse (% distribution)

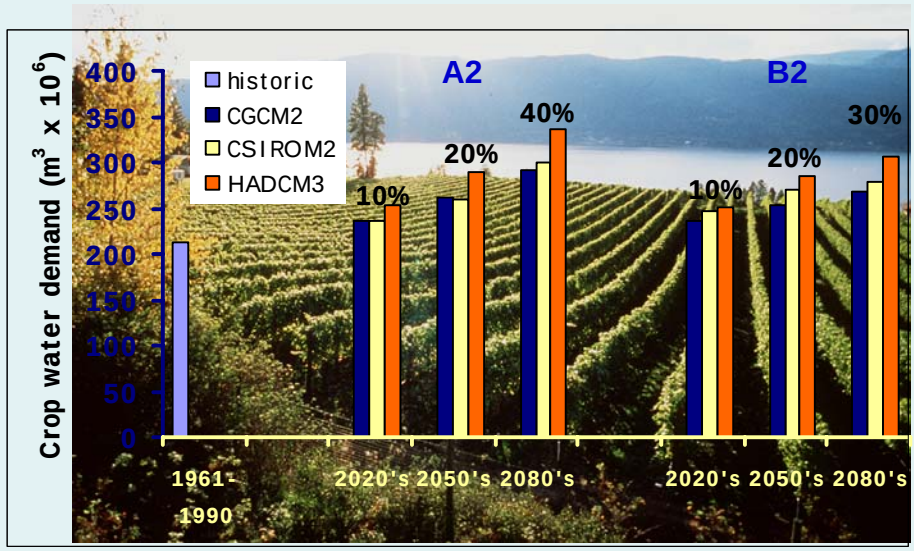


Change in growing season and ET on average

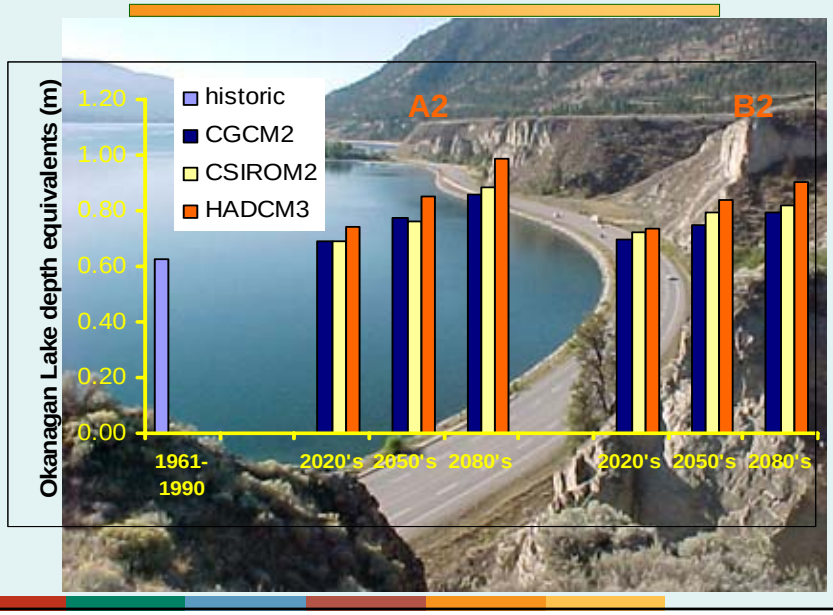




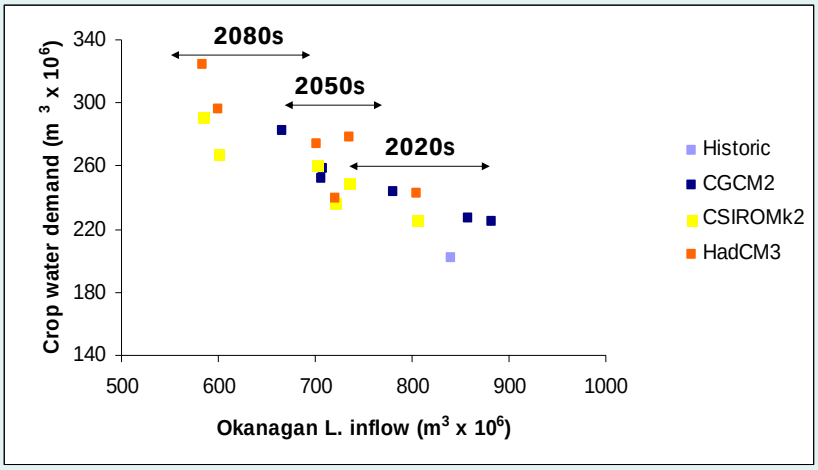
Okanagan Basin – change in total crop water demand in response to climate change



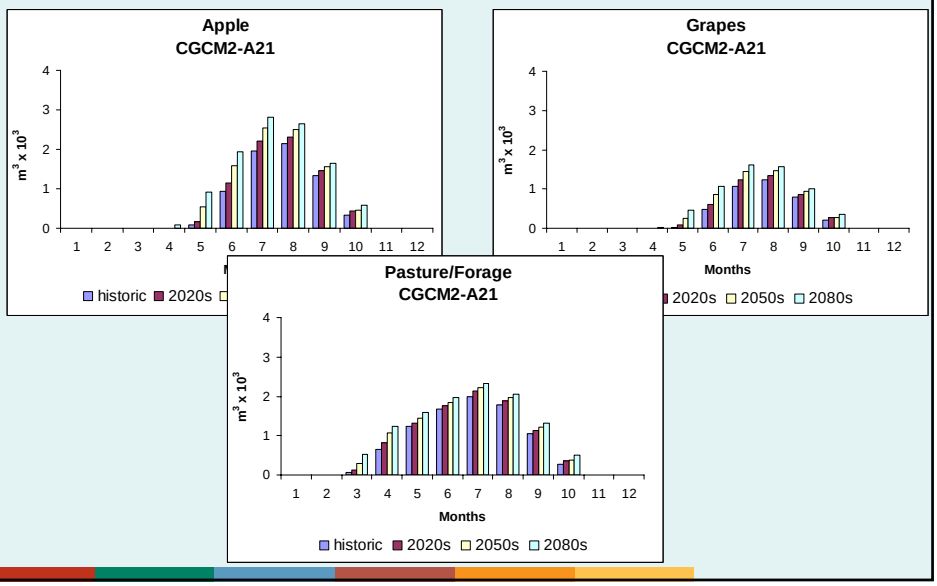
Depth of water required from Okanagan Lake to meet Basin crop water demand



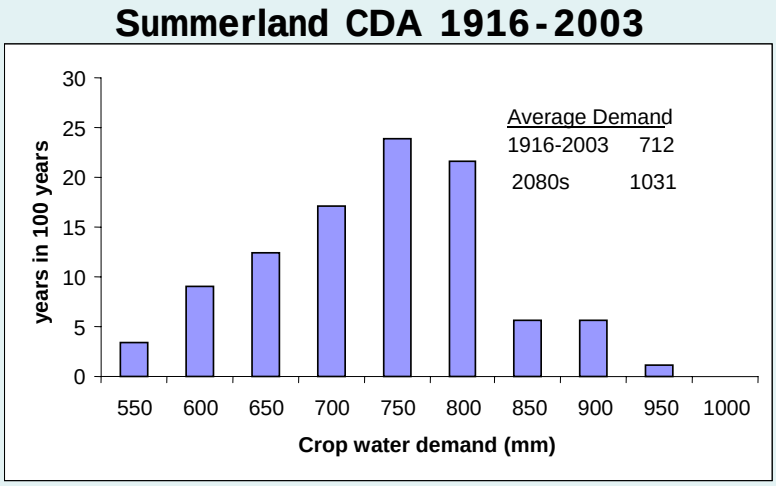
Average basin water supply/demand response to climate change



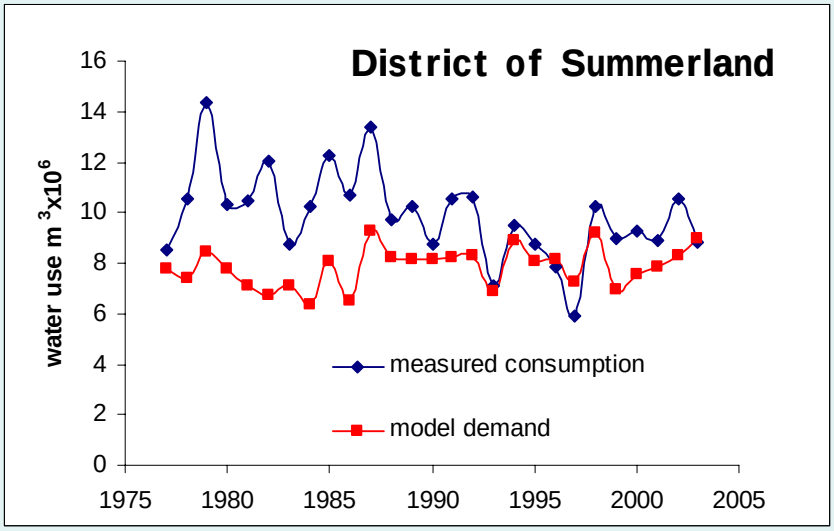
Average water use in response to climate change – crop



Year to year variation in crop water demand

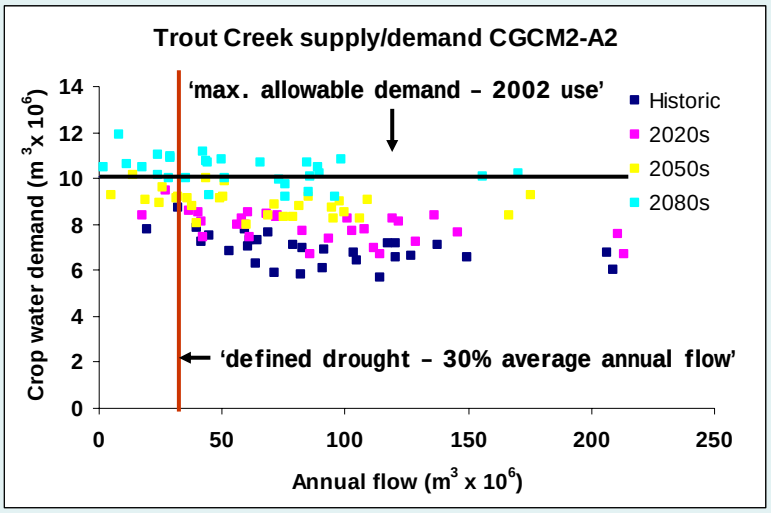


Crop water demand compared with measured consumption

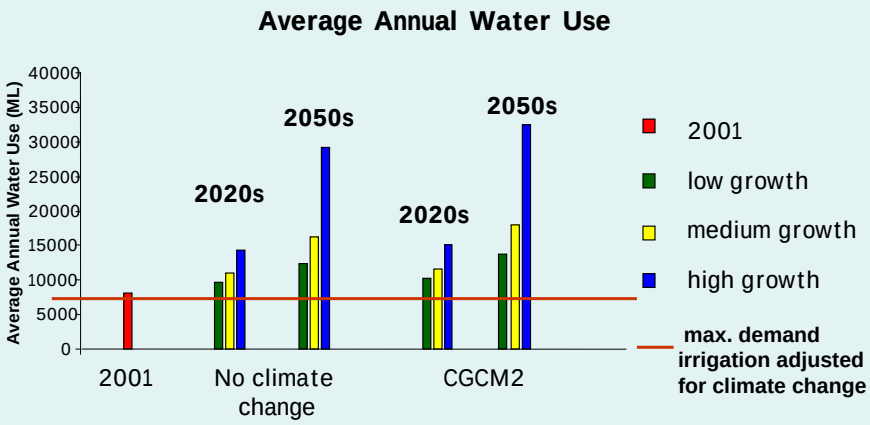


Variation in crop water demand and Trout Creek flows in response to climate change

Summerland Case study

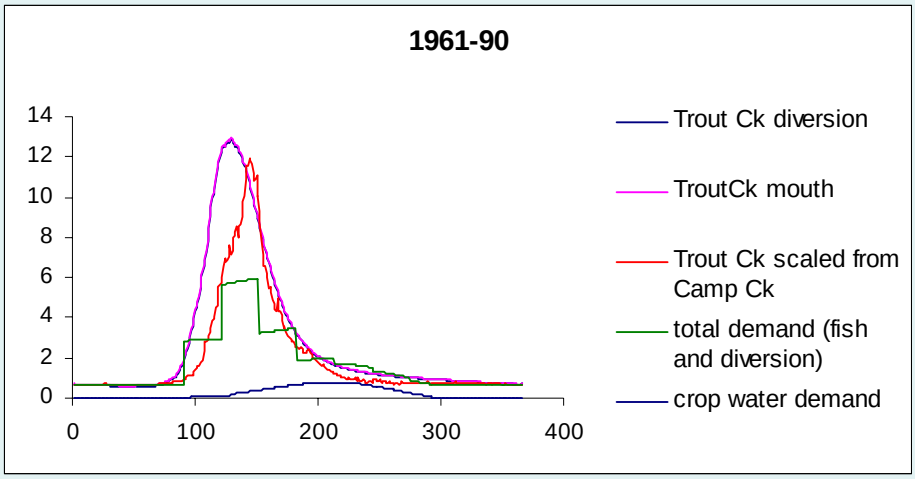


Residential water demand in Penticton - population growth and climate change



Source: Jeff Carmichael, Tina Neale, UBC – Population case study

Average water supply/demand in Summerland



Climate change: We are at risk

Report to the standing committee on Agriculture and Forestry, 2003

Seven recommendations were made

- No. 3:

  'Research on water be made a national priority, with a special focus on "supply and demand" scenarios, water management and planning at the local level, and adaptation options including infrastructures'

Thankyou