Making Climate Projections Useful for Producers

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Contributions to this project:
- Oregon State University
- College of Agricultural Sciences
- Department of Applied Economics
- USDA-NIFA Award #2014-51181-22384
- USDA-NIFA Award #2011-68002-30191
- USDA Northwest Climate Hub
Climate Change Information is Complex

- EPA has developed a climate science glossary
  https://www3.epa.gov/climatechange/glossary.html

- With a variety of metrics
  - Radiative Forcing (W/m²) – watts per square meter, which is often converted to:
  - Atmospheric CO₂ Concentrations (ppm)
  - Carbon Emissions (Gtc), Tons of CO₂, or metric tons of carbon dioxide equivalent (MTCDE)

- Data presented at various temporal scales (Past, Present, Future)
Climate Change Modeling is even more Complex

The IPCC scenarios for future projections have evolved over time

<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
<th>IPCC Assessment Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>SA90</td>
<td>1\textsuperscript{st} (1990)</td>
</tr>
<tr>
<td>1992</td>
<td>IS92</td>
<td>2\textsuperscript{nd} (1995)</td>
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<tr>
<td>2009</td>
<td>RCP-Representative Concentration Pathways (RCP2.6, RCP4.5, RCP6, and RCP8.5)</td>
<td>5\textsuperscript{th} (2014)</td>
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</tbody>
</table>
Changes in key climate variables affecting agricultural productivity (2070-2099) compared to 1971-2000.

Excerpt from the 2014 National Climate Assessment Agriculture Chapter Figure 5.6

Projections based on an emissions scenario that assumes continued increases in heat-trapping gases (SRES A2).

(Figure source: NOAA NCDC/CICS-NC).
Changes in frost free season length (2070-2099) compared to 1971-2000

Excerpt from the 2014 National Climate Assessment Agriculture Chapter Figure 5.6
Changes in number of frost days (2070-2099) compared to 1971-2000

Excerpt from the 2014 National Climate Assessment Agriculture Chapter Figure 5.6
Change in number of consecutive dry days (2070-2099) compared to 1971-2000.

Excerpt from the 2014 National Climate Assessment Agriculture Chapter Figure 5.6
Change in number of hot nights (2070-2099) compared to 1971-2000.

Excerpt from the 2014 National Climate Assessment Agriculture Chapter Figure 5.6
How can we make climate data more useful?

Most climate data isn’t in a form that is useful for making management decisions or weighing the benefits of changing practices. **We wanted to change that, so we:**

- Consulted with producers and others in the industry to identify:
  - important climate variables (14)
  - possible adaptation strategies
- Worked with climate scientists to develop county level data
- Designed an online tool that incorporates this data and allows producers and researchers assess the farm level impacts
Important Climatic Variables

- Accumulated GDD
- Accumulated chilling hours
- Seasonal minimum temp
- Seasonal maximum temp
- # of nights below freezing/year
- # of warm nights per year
- # of heat wave events per year
- # of cold snap events per year
- Diurnal temp range
- Growing season length
- Accumulated water yr precip.
- Maximum # of consec. wet days
- Maximum # of consec. dry days
- # of very heavy precip. days
Heat waves and changes in GDD can decrease fruit quality and increase chemical costs.

**Heat Waves/Year**

<table>
<thead>
<tr>
<th>Heat Waves/Year</th>
<th>Wenatchee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modeled Historic Baseline (1976-2005)</td>
<td>2.5 ± 0.5</td>
</tr>
<tr>
<td>Modeled Low Future (2020-2049)</td>
<td>3.8 ± 0.8</td>
</tr>
<tr>
<td>Modeled High Future (2020-2049)</td>
<td>5.2 ± 0.6</td>
</tr>
</tbody>
</table>

**Accumulated GGD**

By the 2090s, accumulated growing degree days from April 1 to October 31 is expected to increase by 527 degree-hours for the low emissions future and by 627 degree-hours for the high emissions future compared with the historical baseline.
AgBiz Logic (ABL) is a suite of economic, financial, environmental, and climate change decision-support tools that enable producers, researchers, government agencies & NGO’s to assess profitability and feasibility of alternative management practices while assessing environmental
AgBiz Logic Platform

- **Enterprise Budgets**
- **Plans & Scenarios**
- **Farm Scale Data**

**Climate Data**

- AgBizClimate™
  - Climate indicators and metrics

- **Scenarios**
  - AgBizProfit™
  - AgBizLease™
  - AgBizFinance™
  - Net Returns, NPV, IRR, Cash Flows, Whole Farm Financial Ratios and Performance Measures

**Environmental Data**

- AgBizEnvironment™
  - Environmental outputs and metrics
How do the AgBiz Logic modules integrate with each other?

**AgBizClimate**: Access local climate data and assess before and after affects of climate change on net returns

**AgBizProfit**: Assesses if a grower can make money implementing a particular adaptation strategy

**AgBizFinance**: Assesses if the grower has the equity or ability to borrow funds to implement an adaptation strategy and how the investment will impact the liquidity and solvency of the business
Consult with growers, assess changes, develop adaptation strategies

- Changes
  - Fruit quality will
  - Pest pressure will

- Adaptation strategy
  - Increase chemical spraying to control pests
  - Invest in shade and exclusion netting
Data is always in season.

Welcome to AgBiz Logic!

AgBiz Logic is a suite of economic, financial, and environmental decision tools for businesses that grow, harvest, package, add value, and sell agricultural products.

Learn more
Welcome back, Laurie.houston

Thank you for choosing AgBiz Logic as your primary tool to manage your agriculture business. You now have access to the most advanced planning and analysis tools available, anywhere, on any internet-connected device. Let's get to work.

Did you know? You can combine two or more Budgets into a single Budget in the Budget Manager.

AgBizClimate

Create scenarios and analyze potential future impacts of climate change on your enterprises.

Budget Manager

Budgets represent your enterprises: whether you grow wheat or raise cattle. Budgets contain all the income and cost information for each enterprise. Use Budgets to build Plans and Scenarios to gain powerful insight by using them in AgBiz Logic modules.

Explore University Budgets

AgBizProfit

Coming Soon!

AgBizLease

Coming Soon!

AgBizFinance

Create an apple budget

Click here to start looking at Climate variables and create a climate change scenario.
Choose up to three weather variables

Enter a % change in yield or quality for each variable and later for an overall impact.
Enter an estimate of how you think these combined variables will change yields.
Example of Adaptation Scenarios to be Compared in AgBizProfit

- Plan 1: Net Returns **before climate change** Impacts
- Plan 2: Net Returns **After climate change** (no adaptation strategies) - 30% Reduction in No. 1 Grade Fruit
- Plan 3: Net Returns with **increased chemical spraying** – 20% Reduction in No. 1 Grade Fruit, 30% Increase in Chemical
- Plan 4: Net Returns with **shade netting** - 15% Reduction in No. 1 Grade Fruit, 30% Increase in Chemical Costs
- Plan 5: Net Returns with **shade netting and exclusion netting** - 10% Reduction in No. 1 Grade Fruit, 5% Increase in Chemical Costs
### AgBizProfit Results

**Climate Change Adaptations**

**Financial measure:** Net Returns

**Name of Scenario:**

<table>
<thead>
<tr>
<th>Plan 1</th>
<th>Plan 2</th>
<th>Plan 3</th>
<th>Plan 4</th>
<th>Plan 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before CC</strong></td>
<td><strong>After CC</strong></td>
<td><strong>Shade &amp; netting</strong></td>
<td><strong>Increase chemicals</strong></td>
<td><strong>Shade cloth</strong></td>
</tr>
</tbody>
</table>

**Notes for this Scenario:**

Observing the before and after effects of climate change on current Gala apple crop

View results as a:  
- Table
- Graph
AgBiz Logic Platform

Enterprise Budgets
Plans & Scenarios

Farm Scale Data

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AgBizFinance: Assesses if the grower has the equity or ability to borrow funds to implement an adaptation strategy and how it will impact liquidity and solvency
Key Takeaway

To make climate change data useful to producers we must:

- Translate climate data into weather and climatic variables at the field scale
- Provide a tool to assess how these changes will impact yields and net returns
- Provide a tool that will allow producers to look at the tradeoffs and feasibility of investing in adaptation strategies