

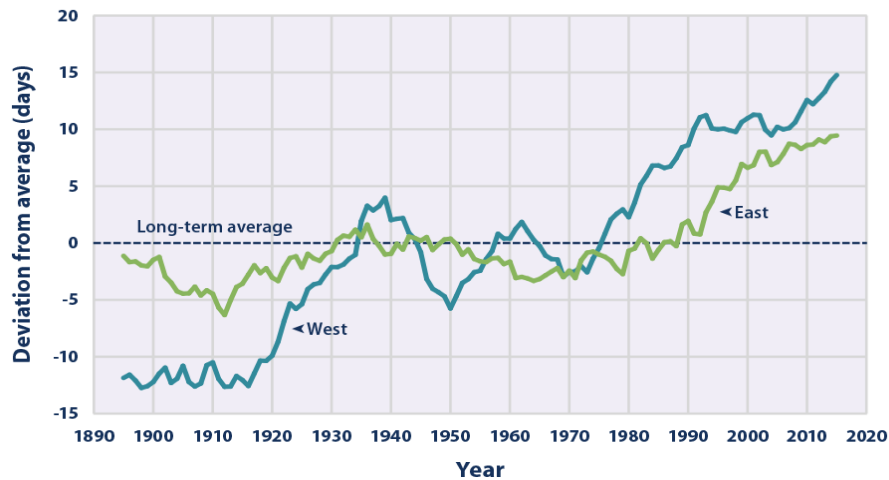
Module 1: Potential water use implications of double cropping

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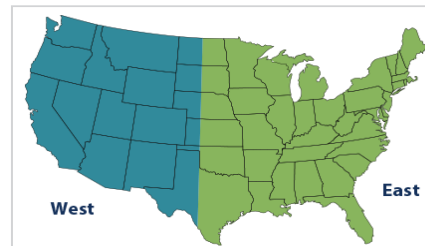
Climate change and potential for increased use of double cropping

Length of Growing Season in the Contiguous 48 States, 1895–2015: West Versus East



Data source: Kunkel, K.E. 2016 update to data originally published in: Kunkel, K.E., D.R. Easterling, K. Hubbard, and K. Redmond. 2004. Temporal variations in frost-free season in the United States: 1895–2000. *Geophys. Res. Lett.* 31:L03201.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climate-indicators.



Motivation

- A longer growing season could increase double cropping and total water use as a result.
- Or, maybe not:
 - Many areas don't have adequate water allocations for irrigating two crops.
 - As climate warms, it may be more profitable to switch to a single other crop (e.g. tomatoes) than double crop.
- Our approach:
 - Get best estimate of current double cropping extent in WA.
 - Look to warmer places (e.g. California) to make projections about Washington.

Double Cropping Tasks

- 1. Empirical analysis of counties to forecast change in double cropping intensity.**
 - Analysis of “fruitful rim” counties on the West Coast.
- 2. Current practices in Washington**
 - Targeted calls and interviews with producers/WSU Extension in Walla Walla, Horse Heaven Hills, Wenatchee, and Columbia Basin Project.
 - WSDA Cropland Layer
- 3. Translate changes in double cropping intensity to changes in water demand.**
 - Forecast a new crop mix for double cropping for WA.
 - Set up VIC-CropSyst to model double cropping.

Quantifying Double Cropping

- **Crop Harvesting Frequency (CHF) = Harvested Area/Standing Cropland**
 - Maximum Potential CHF
 - Harvest Gap = Potential CHF – Actual CHF
- Current global average is 89.2% compared to 78% in 1961.
- Tend to be higher in warm countries, but not necessarily. Lots of factors at play.
 - Bangladesh: 1.67
 - China: 1.29
 - Egypt: 1.75
 - Vietnam: 1.39
 - Costa Rica: 0.99
 - Belgium: 1.2
 - Germany: 1.66
- CHF has been increasing ~ 1%/year in the U.S., Brazil, and Chile.
- No studies yet looking in adequate detailed at irrigated areas of the U.S.

WSDA Layer Information on Double Cropping

The screenshot shows the ArcMap interface with the following components:

- Table of Contents:** Lists layers including hssrfy, Cities, County, WSDACrop_2018, TownshipRangeSec, WA_Clip, ortho_1-1_in_s_wad, RGB (Red: Band_1, Green: Band_2, Blue: Band_3), and wa_90k_hill.
- Map:** Aerial imagery with colored overlays representing different agricultural layers.
- Identify Window:** Opened over a field, showing the following metadata:

Field	Value
OBJECTID	101113
Shape	Polygon
CropType	Bluegrass Seed
Acres	62
Irrigation	Center Pivot
InitialSurveyDate	8/15/2005
LastSurveyDate	10/25/2018
DataSource	WSDA
Notes	2018 buckwheat double cropped after bluegrass
TRS	T13R30E27
County	Franklin
RotationCropType	Buckwheat
Cover Crop	
ExactAcres	62.110759
Shape_Length	2036.698859
Shape_Area	251353.325209
CropGroup	Seed

Current double cropping in WA

- **WSDA 2016 layer**
 - ~ 33,000 acres total are identified as double cropped.
 - ~ 2,000 have a cover crop.



Double Cropping Deliverables

- **Projected changes in double cropping intensity and associated water use for Washington.**
- **Projections based on:**
 - Variation across regions
 - Crop water use and hydrology modeling
 - Expert knowledge
 - Climate forecasts