

Adapting to Climate Change – Irrigation Benefits the Intervale Community Farm

Northeast Specialty Crop Water Symposium 2019

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United States Department of Agriculture
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What we'll cover this afternoon

- **Who we are: USDA Climate Hub & UVM Extension Center for Sustainable Agriculture**
- **Climate change impacts and effects on Vermont Farms**
- **Case study – Intervale Community Farm**
- **Methods – partial budget analysis and cost effectiveness**
- **Overview of Costs and Benefits of adaptation practices**
- **Key Findings**





Impacts of Climate Change on Farming in Vermont

Impacts are visible now, including:

- **More severe precipitation events**
- **Variable rainfall**
- **Higher temperatures**
- **More pests**

What we don't know are the costs and benefits of adapting to these impacts on Vermont farms



Intervale Community Farm (ICF)



- Certified Organic Vegetable Farm
- Location: Winooski floodplain, Burlington Vermont
- Size: 25 acres (2017)
- In business since 1990
- Farm Manager – Andy Jones



Issue:



Farm manager Andy says, “On a 100-year floodplain, ICF soils have long been recognized as productive farmland, albeit subject to flooding. The irony is that much of the floodplain that ICF farms is composed of sandy soils, which drain well but need to be irrigated during dry periods.”



Key Question:



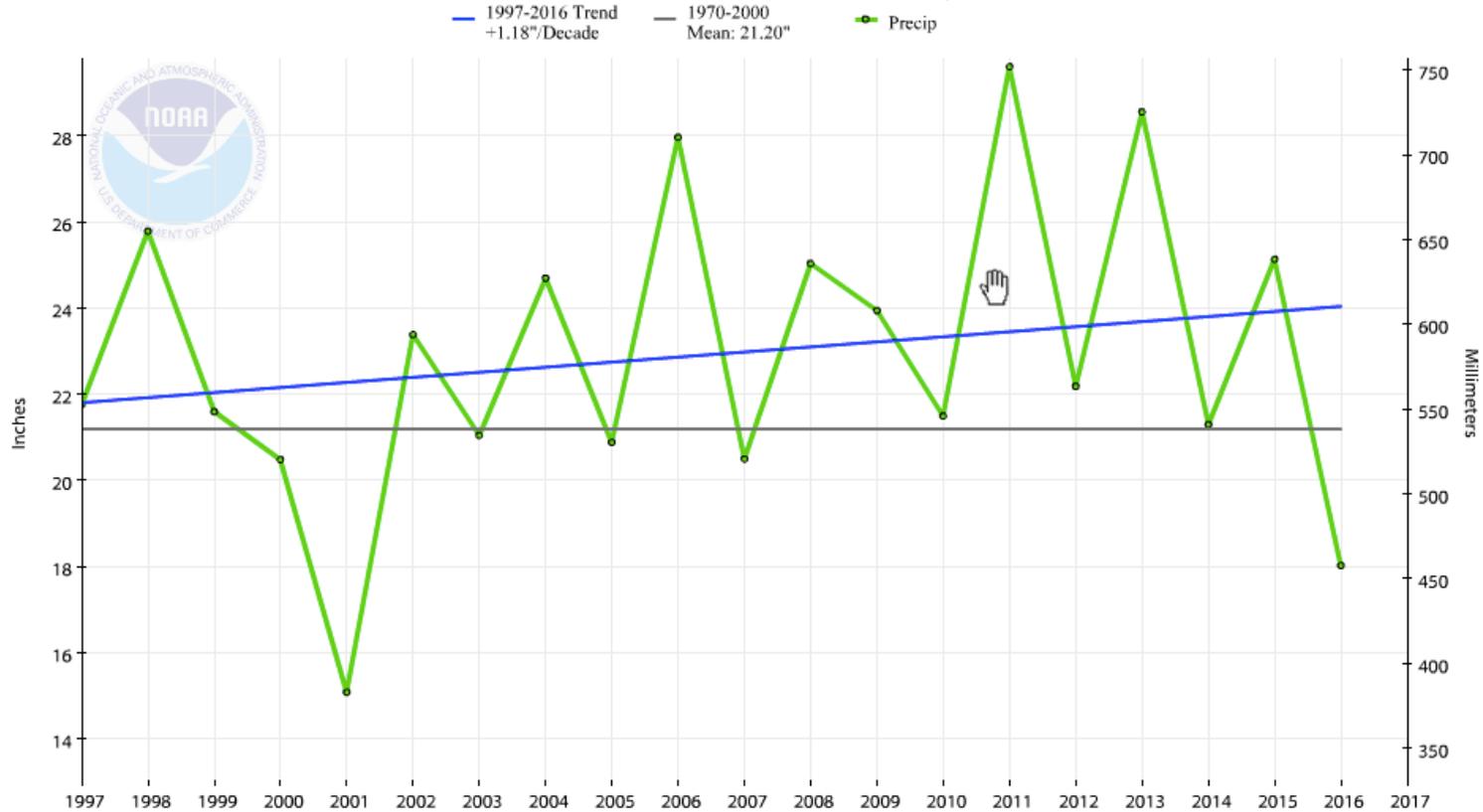
ICF Lettuce crop, Summer 2017

“Does field crop irrigation make sense as a farm strategy given the number of wet summers in the Northeast?”

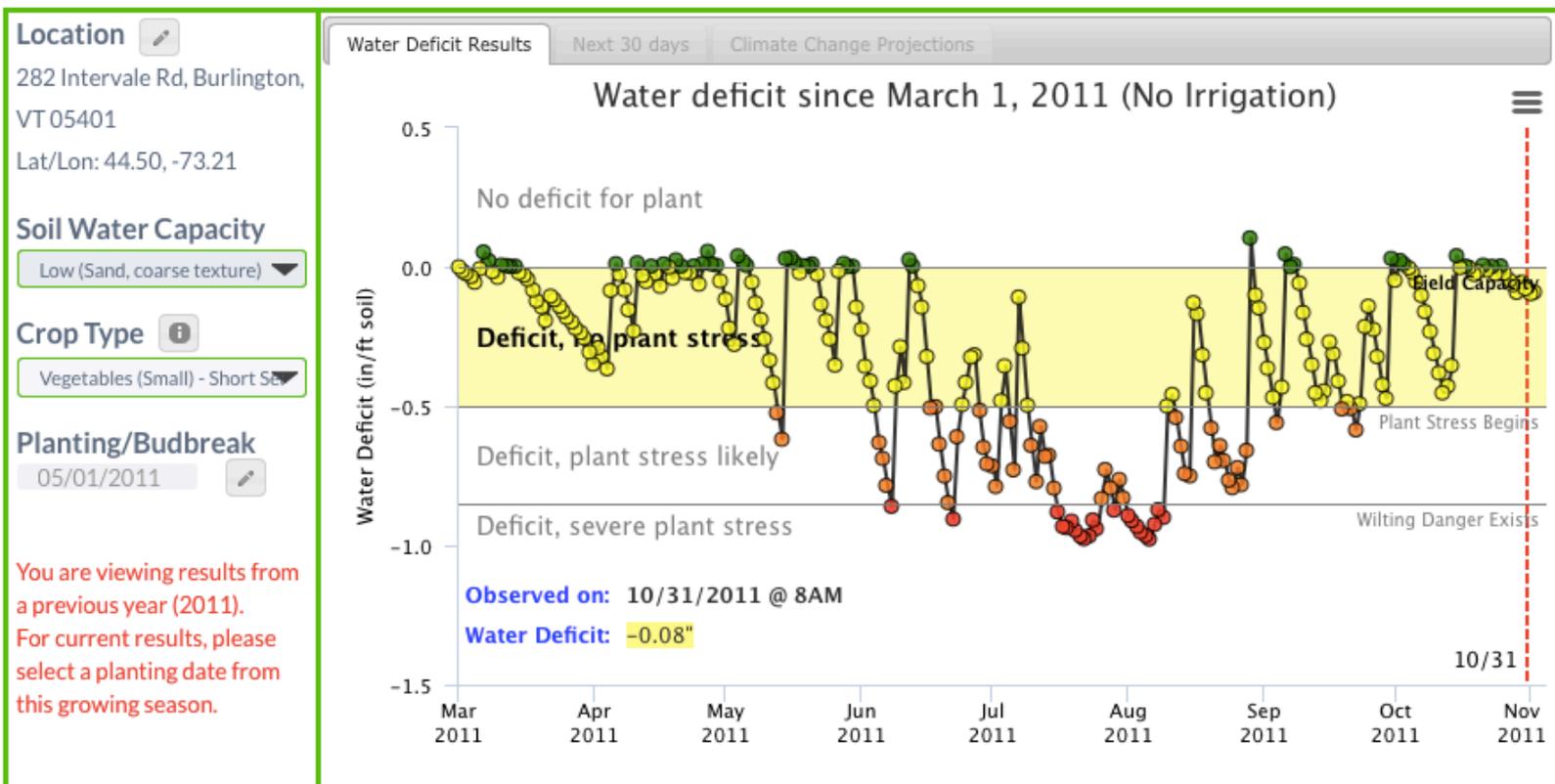


Burlington Precipitation Trends 1997 to 2017 - National Weather Service

Vermont, Climate Division 1, Precipitation, May-September



Water Crop Deficit at Intervale Summer of Tropical Storm Irene



Source: Cornell Water Deficit Calculator



Cost Benefit Methods for ICF

- Available data
- Assumptions
- Using Cornell water deficit calculator
- Partial budget analysis using net present value
- Sensitivity analysis



Partial Budgeting

Definition

Analysis that estimates the expected **change** in profit (available cash, other measures of economic performance) associated with a proposed **change** in the farm business

Partial Budget Answers

What new or additional income will be received?

What current costs will be reduced or eliminated?

What current income will be lost or reduced?

What new or additional costs will be incurred?

Characteristics

- Analyzes a proposed change compared to the present farm business
- Includes only the changes in revenues and costs -- not the total values -- marginal analysis
- Provides an estimate of the increase, or decrease in profit (or cash income above cash costs)
- Says nothing about the change relative to alternative uses of resources





Partial Budget Format – Profit

All in consistent units (such as \$/acre/year)

Items that Increase Profit	Items that Decrease Profit
Increased Revenues	Decreased Revenues
Reduced Costs	Increased Costs
Sum of Items that Increase Profit (A):	Sum of Items that Decrease Profit (B):
	Expected Change in Profit (A) minus (B) =



ICF Irrigation Benefits and Costs over 11 years - in net present value (NPV) terms



Estimated per acre benefits and costs in 2016 dollars, 2006-2016.

YEAR	AVOIDED LOSSES	Equipment Fixed Costs	Material Ann. Cost	Labor & Diesel	Maint.	Total Costs	Net Benefits
2006	\$4,642	\$1,138	\$348	\$321	\$57	\$1,864	\$2,778
2007	\$7,695	\$0	\$326	\$534	\$0	\$859	\$6,836
2008	\$3,792	\$389	\$238	\$244	\$19	\$892	\$2,900
2009	\$1,140	\$843	\$179	\$190	\$42	\$1,254	-\$114
2010	\$5,405	\$130	\$365	\$307	\$6	\$808	\$4,597
2011	\$4,975	\$132	\$177	\$299	\$7	\$615	\$4,360
2012	\$4,224	\$61	\$203	\$257	\$3	\$523	\$3,701
2013	\$1,106	\$153	\$211	\$172	\$8	\$543	\$563
2014	\$2,556	\$82	\$158	\$164	\$4	\$407	\$2,148
2015	\$2,464	\$92	\$172	\$153	\$5	\$421	\$2,046
2016	\$3,717	\$115	\$125	\$165	\$6	\$410	\$3,306
AVG	\$3,793	\$285	\$227	\$255	\$14	\$782	\$3,011



NPV of Benefits & Costs of Irrigation

Partial Budget

Intervale Community Farm Irrigation Partial Budget in 2016 dollars (average \$/acre/year)

Increases in Net Income		Decreases in Net Income	
Average Increase in Income		Average Increase in Cost	
Item		Item	
Avoided Production Losses	\$3,793	Irrigation Equipment	\$285
		Annual Material (plastic, drip tape, etc.)	\$227
		Annual Operation Costs (Labor & Fuel)	\$269
Total Increased Net Income/Acre/year	\$3,793	Total Decreased Net Income/Acre/year	\$782
Total Net Benefit per Acre per Year		\$3,011	
Total Farm Net Benefits per acre over 11 years		\$33,121	
Total Irrigation NET FARM BENEFITS (based upon all acres receiving supplemental irrigation)		\$508,705	

Total Acres Irrigated 10 to 25 acres

Years of data (2006-2016) 11



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Key Findings ICF Irrigation Case Study

- **Benefits of avoided crop loss > costs of irrigation in all but one year.**
- **If ICF can protect at least 3.5% of its crop revenues with irrigation, it will cover its costs of irrigation.**
- **If all years “dry”, farm benefits > \$800,000**



Surprises in ICF findings

- If all years were “wet”, net farm benefits almost \$70,000 each year.
- Benefits of irrigation > costs even if every year is “wet” given that rainfall does not always coincide with crop production needs.
- Wet years still have dry periods during critical crop growth stages when irrigation provides significant benefits.



Next Steps & Lesson Learned



"I'm starting to get concerned about global warming."

