University of Idaho
Extension

FHB NOW WESTWARD BOUND, AND NEW STRUGGLES TO KEEP DON DOWN

JULIET M. MARSHALL

Fusarium Head Blight in Idaho — What, Me Worry?

By Juliet M. Windes,
Cereals Agronomist and
Pathologist, University of Idaho

Cropping systems and crops vary tremendously in Idaho. In cooler, upper elevation areas of Soda Springs, continuous grain has been grown for decades. In the areas around the Treasure Valley, a tremendous diversity of crops from onions to sweet corn flourish under controlled irrigation. The fertile grounds of the Palouse are a perfect niche for soft white winter wheat, legumes and grass seed production. But times they are a'changin'.

Hard red winter wheat is gaining in acreage in the northern areas. In the Treasure Valley, the TVRR will require at least 80,000 acres of high beta-glucan barley. Currently, only about 9,000 acres of feed barley are grown. The Magic Valley is becoming the Wallace and Gromit Valley. ("Cheese, please Gromit – is it Wensleydale?") While in Southeastern Idaho, corn tassels bounce in the wind all the way up the valley to St. Anthony and Ririe.

Change is good. Rotation is good. Diversity is good. I know corn is an excellent feed stock for cattle. However, I want to see ***less*** of it.

I am a plant pathologist. What do plant pathologists like? Why, a great plant disease epidemic, of course! Well, yes, within reason. Some plant diseases are especially frightening; (1) because once they take hold in an area, it is hard to rid ourselves of the scourge; (2) some diseases will spread rapidly in the air when the right weather conditions occur; (3) some diseases result in accumulation of vile toxins that make grain fit for neither man nor beast, bread nor beer; (4) some diseases thrive on multiple crops, causing problems over many growing seasons.

I am not worried about "some" diseases. I am worried about one disease. One disease that can be characterized by all of the descriptions above. One disease that can increase under corn production. That disease is Fusarium Head Blight (FHB), aka, Scab.

Environmental Impacts

Conditions in Idaho produce high quality, toxin free grain that meets the needs of many industries – food, feed, fuel, and malt, mainly. The environmental conditions here favor healthy plants, and we usually have minimal disease problems, especially if you compare us with the Midwest or eastern production areas.

Meet *Fusarium graminearum*, the causal organism for Fusarium head blight of wheat and barley. You can find him almost wherever wheat, barley and corn are grown. But not in Idaho - Yet.

Previous studies have found that the most commonly isolated Fusarium found in southern Idaho is *Fusarium culmorum* and it prefers cooler climates. Usually, this fungus causes foot and crown rot in dryland grain. However, over the past five years, it is occurring with higher frequency in irrigated production, and sometimes can be found causing head blight. *F graminearum*, on the other hand, causes head blight in lower elevation areas throughout the world where wheat and barley are grown in more humid areas.

The conditions that promote Fusarium head blight in wheat and barley are well documented: humid and rainy environmental conditions at and after flowering, a source of inoculum of various *Fusarium* species, and susceptible host cultivars.

Changing Conditions

While FHB occurs sporadically and at limited incidence, epidemics have occurred in only a few years in south central and eastern Idaho. There are several factors that may substantially be increasing the risk of FHB occurrence.

1) Increasing temperatures and precipitation.

F. culmorum is favored by cooler climates and is the most frequently isolated pathogen causing foot and crown rot and FHB in southeastern Idaho. Under very similar environments, Montana has regularly occurring FHB outbreaks in wheat and barley production caused by *F. graminearum*, while southeast Idaho maintains relatively FHB free.

Scab in Wheat.

Environmental conditions, such as very dry southwesterly winds coming off the high plains desert, may effectively prevent infection in southeast Idaho. Various climate models are predicting an increase in temperatures in the Pacific Northwest and Intermountain West regions. Precipitation may increase 20%, with a decrease in snowpack duration. This changing environment may enhance the potential for FHB development, with conditions in Idaho becoming more similar to Montana, where estimates of FHB related damage occurred on up to 250,000 acres in 2006.

2) Increasing acreage of corn production.

The dairy industry in Idaho has continued to expand and ranked 4th in the nation for production in 2006. As a result, the corn acreage planted in the last ten years has more than doubled.

Corn acreage in Montana has been rising, and is predicted to keep

October 2007

Idaho Grain
Producers Magazine

FHB Impacts:

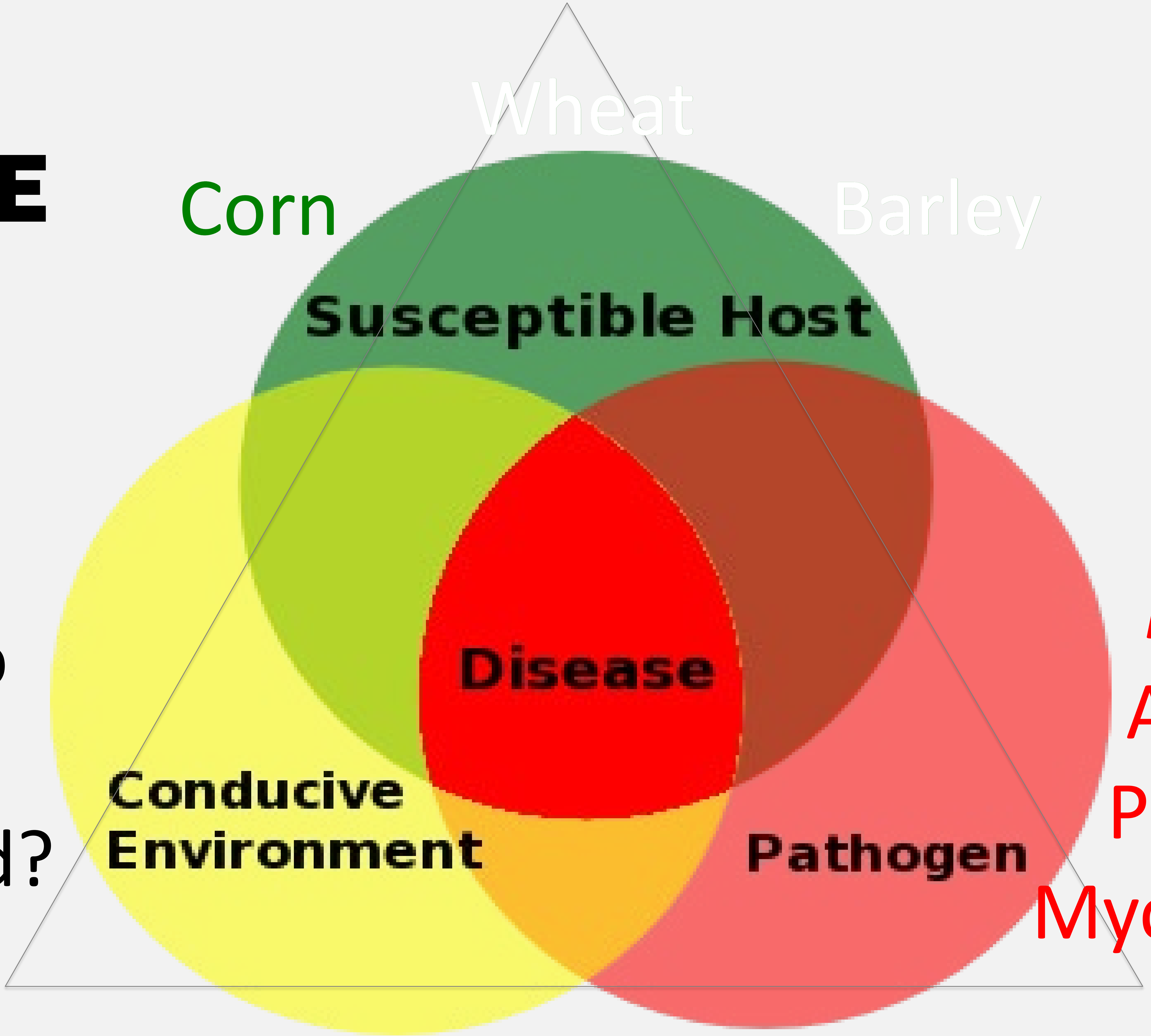
- Yield loss
- Test weight reduced
- Quality impacts
- Toxin contamination

DISEASE TRIANGLE

Wheat

Corn

Barley



Idaho

Warm

Humid?

FHB

Aggressive

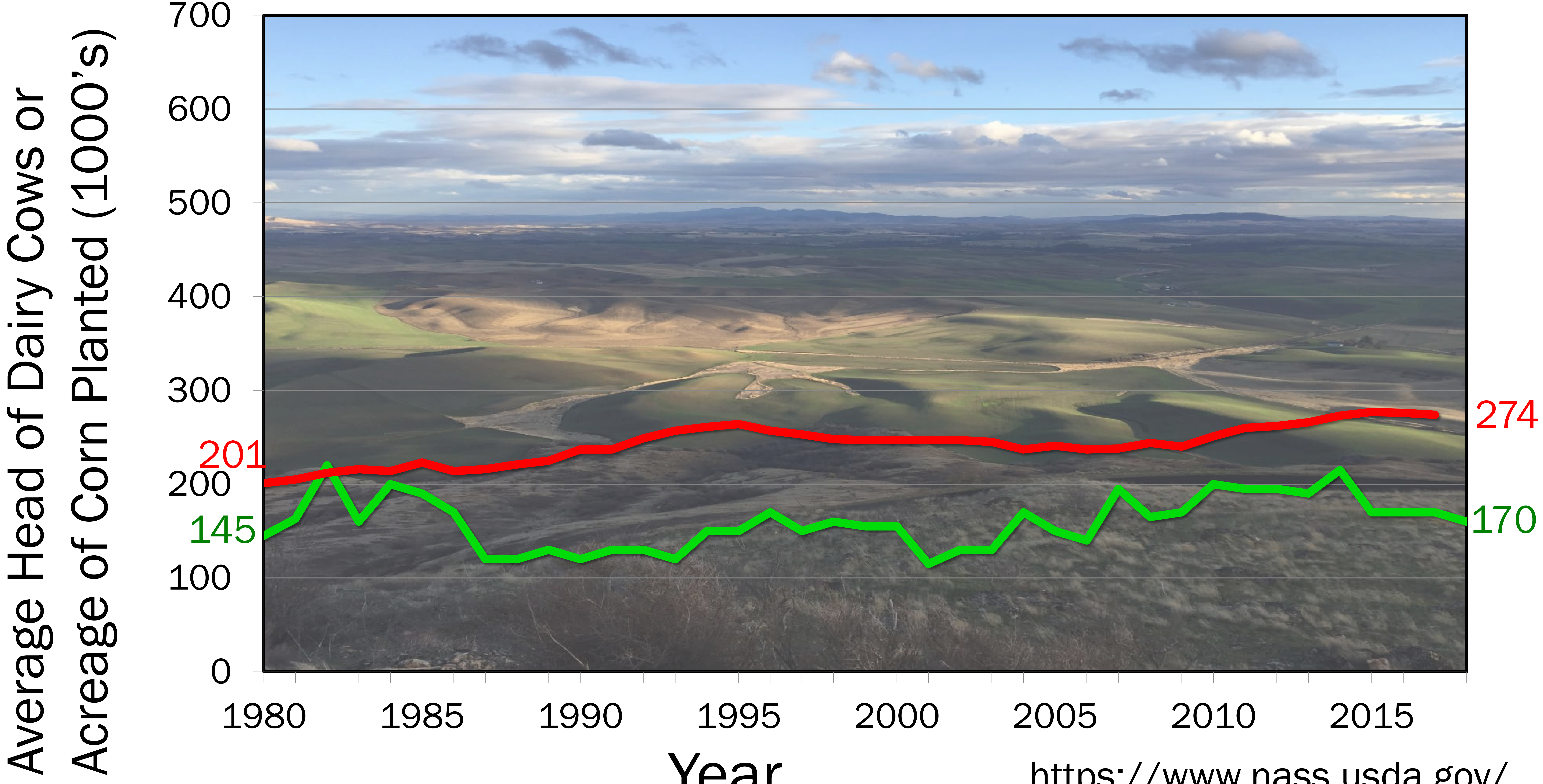
Population

Mycotoxins

teedandbrown.com/disease-triangle/

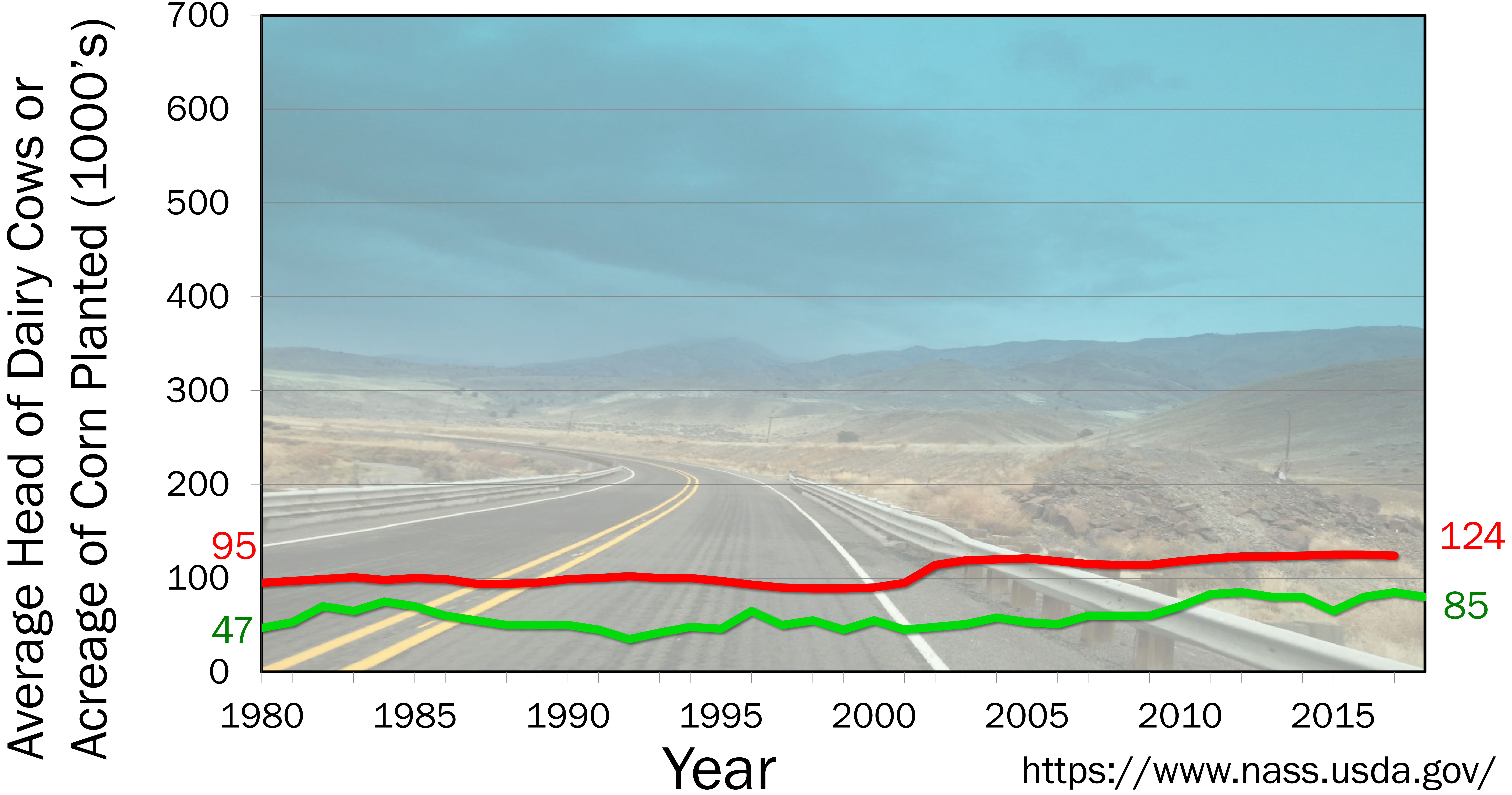
Crop Rotation – Corn and Dairy in Southern Idaho

Crop Rotation – Corn and Dairy in Washington



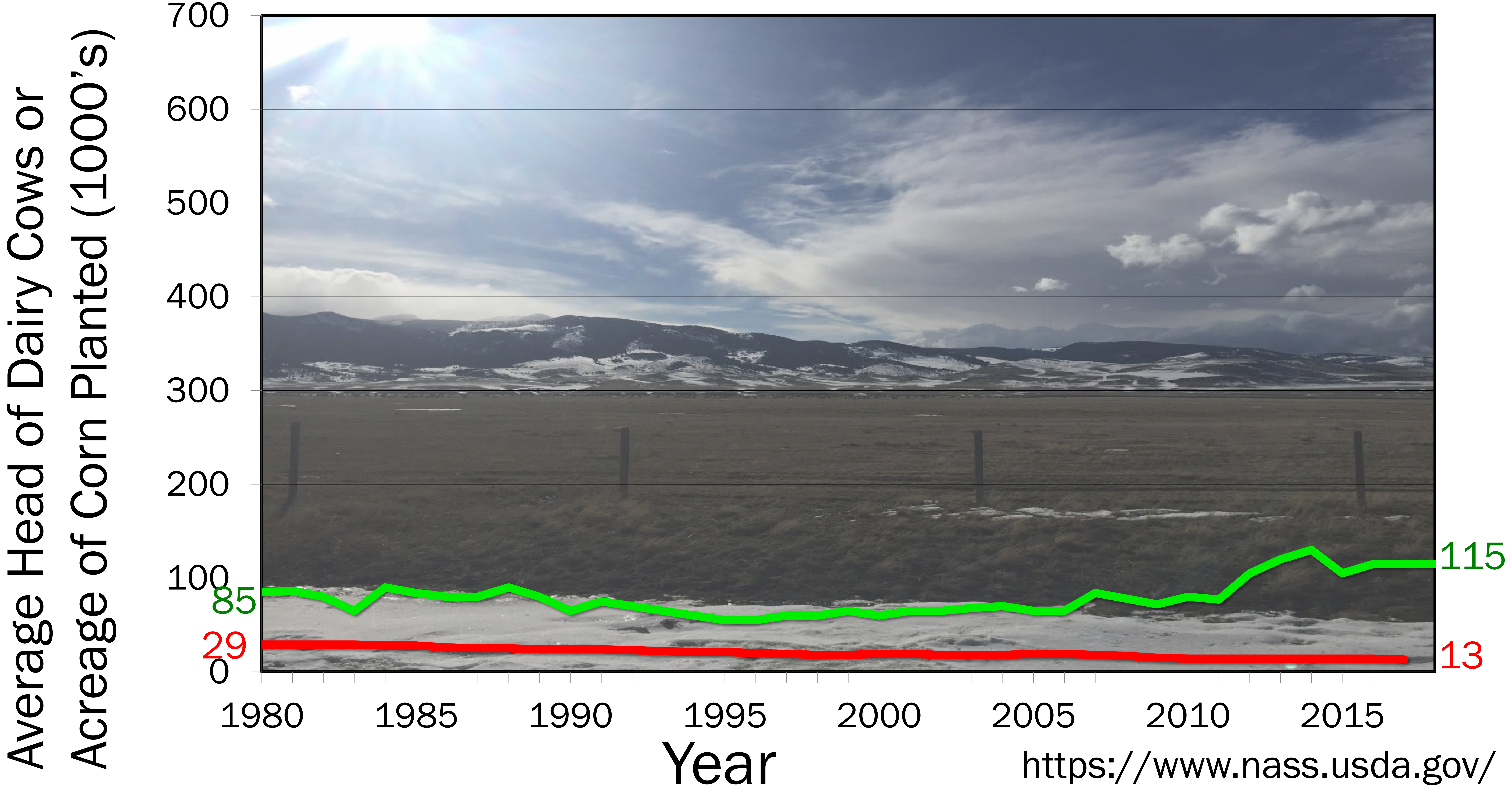
https://www.nass.usda.gov/

Crop Rotation – Corn and Dairy in Oregon



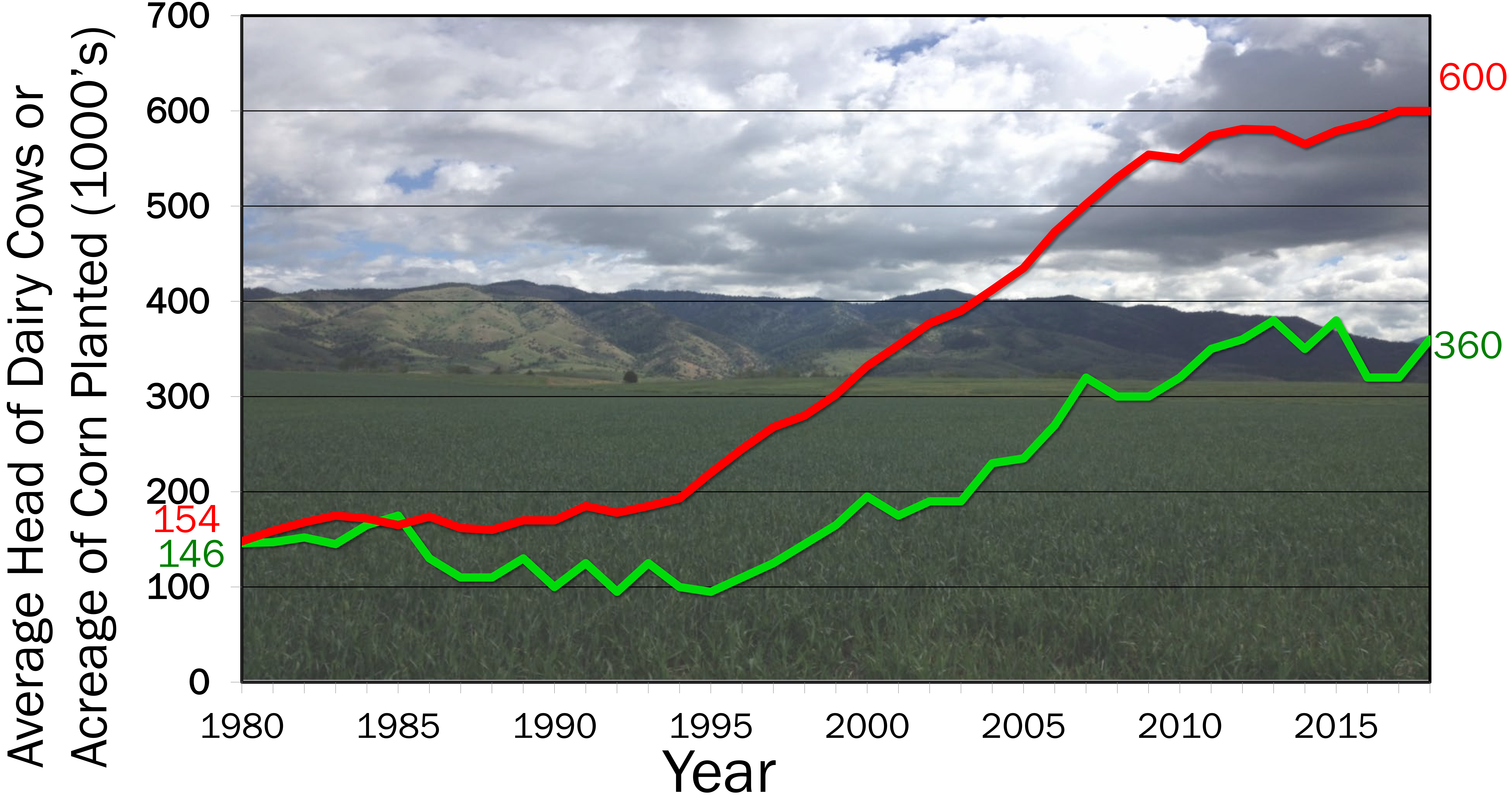
https://www.nass.usda.gov/

Crop Rotation – Corn and Dairy in Montana



https://www.nass.usda.gov/

Crop Rotation – Corn and Dairy in Southern Idaho



FHB in IDAHO:

THEN and NOW

F. graminearum

F. culmorum

Plant Health Progress ◆ 2018 ◆ 19:125–127

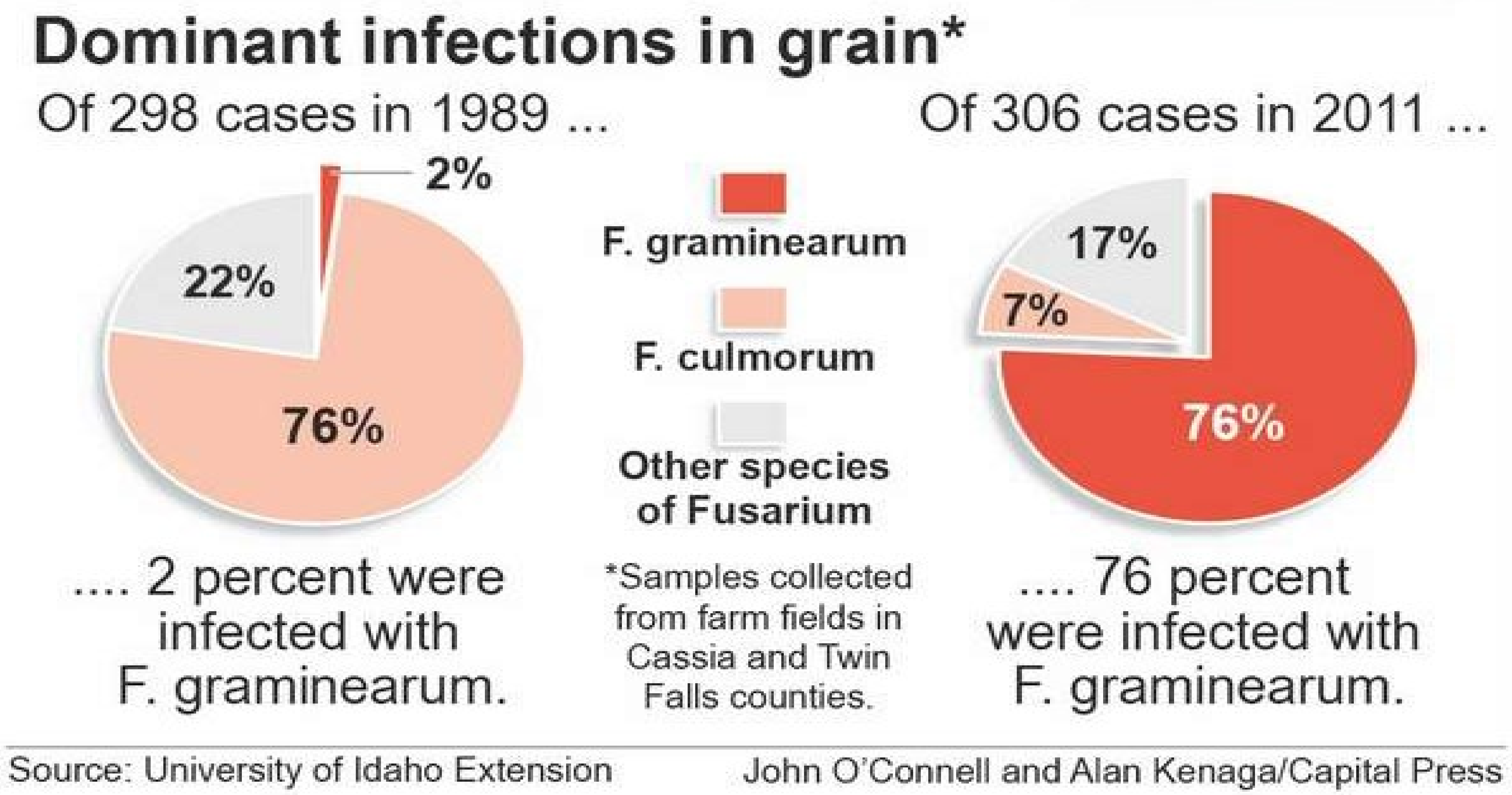
https://doi.org/10.1094/PHP-10-17-0066-S

Plant Health Survey

Survey of *Fusarium* Species Associated with Fusarium Head Blight of Spring Wheat (*Triticum aestivum*) in Southeastern Idaho

Kaitlyn M. Bissonnette, Department of Entomology, Plant Pathology, and Nematology, University of Idaho, Idaho Falls, 83402; **Philip Wharton** and **Jianli Chen,** Department of Entomology, Plant Pathology, and Nematology, University of Idaho, Aberdeen, 83210; and **Juliet M. Marshall,**[†] Department of Entomology, Plant Pathology, and Nematology, University of Idaho, Idaho Falls, 83402

Accepted for publication 2 March 2018.

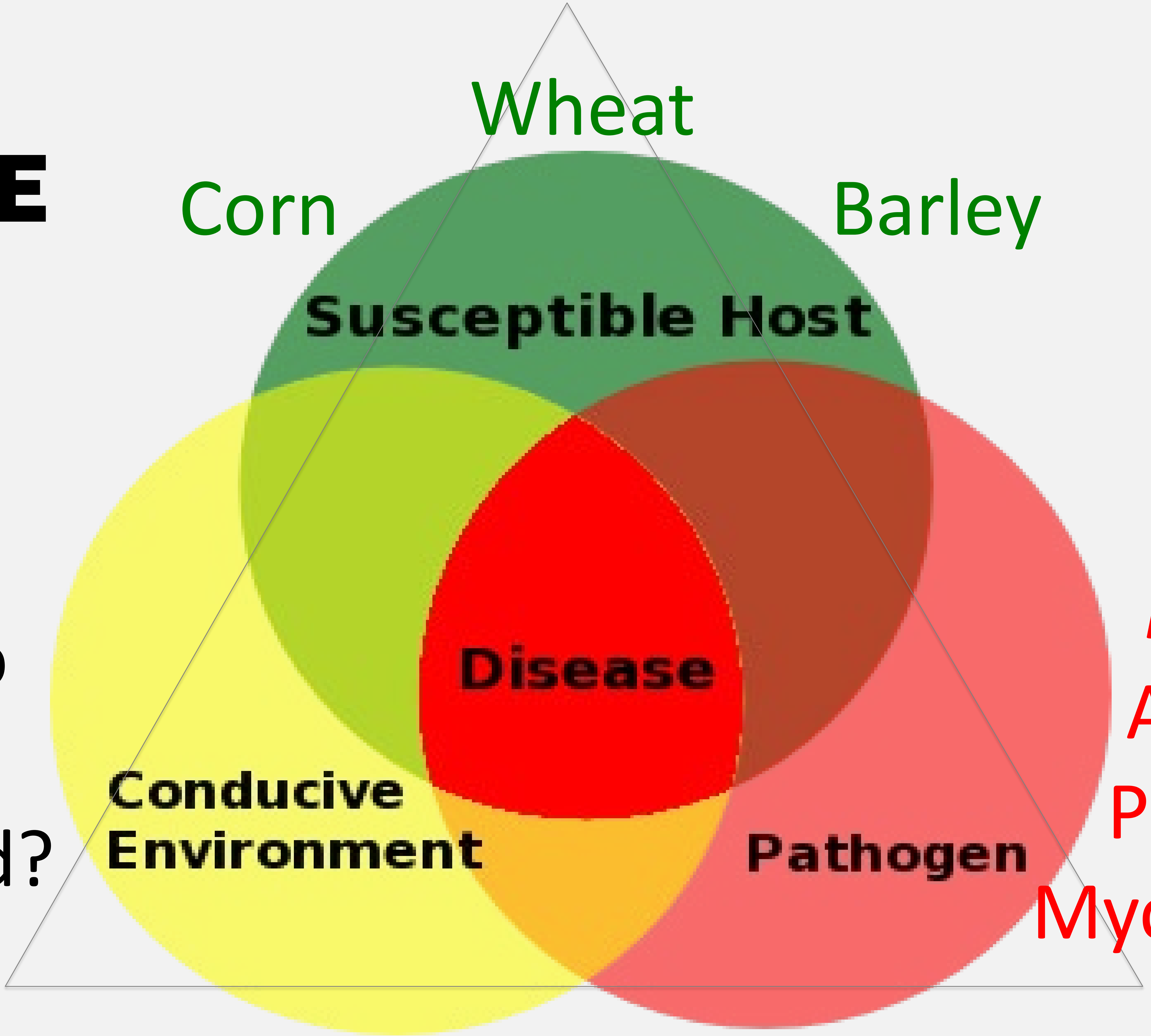


DISEASE TRIANGLE

Wheat

Corn

Barley



Idaho

Warm

Humid?

FHB

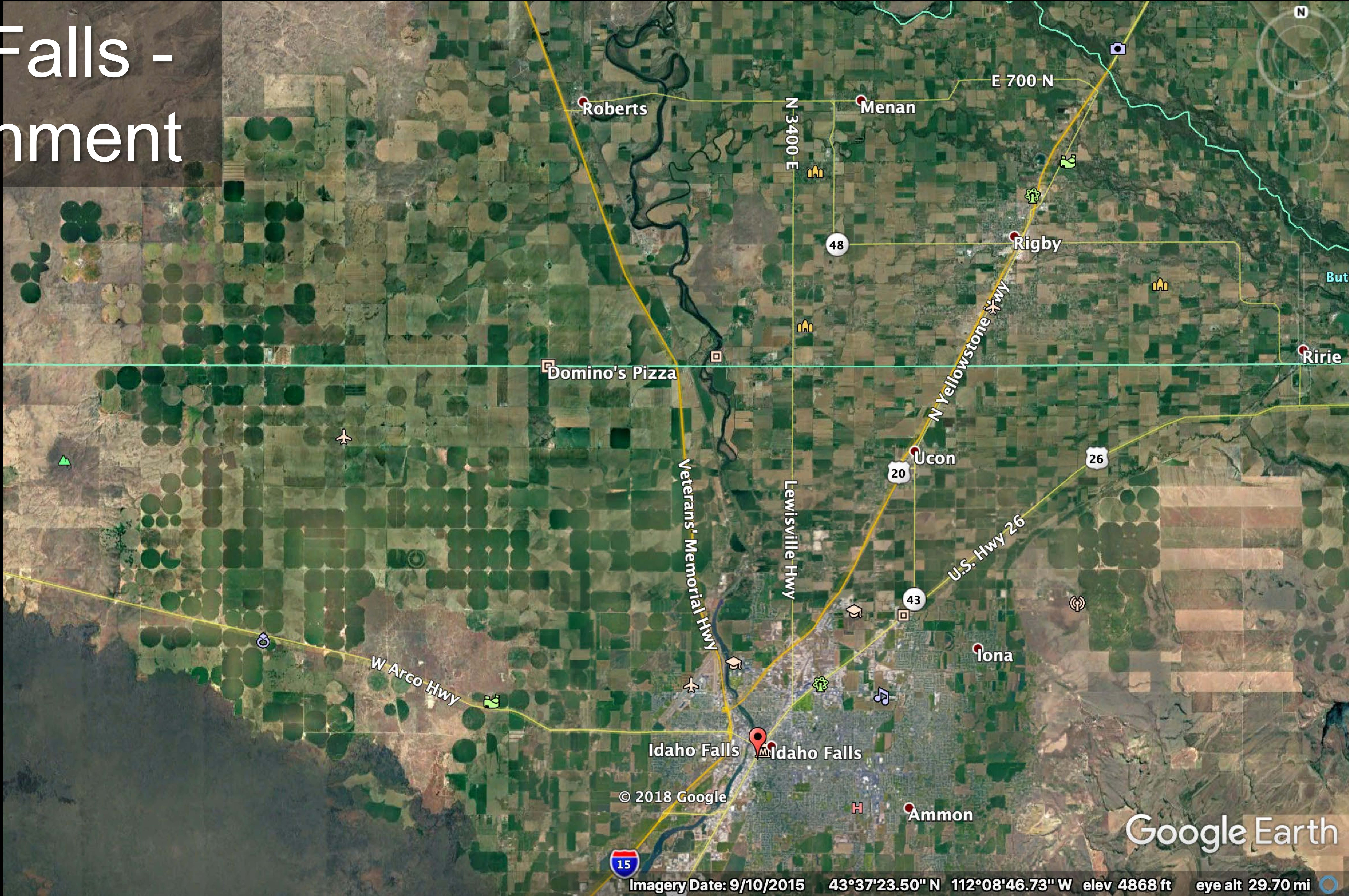
Aggressive

Population

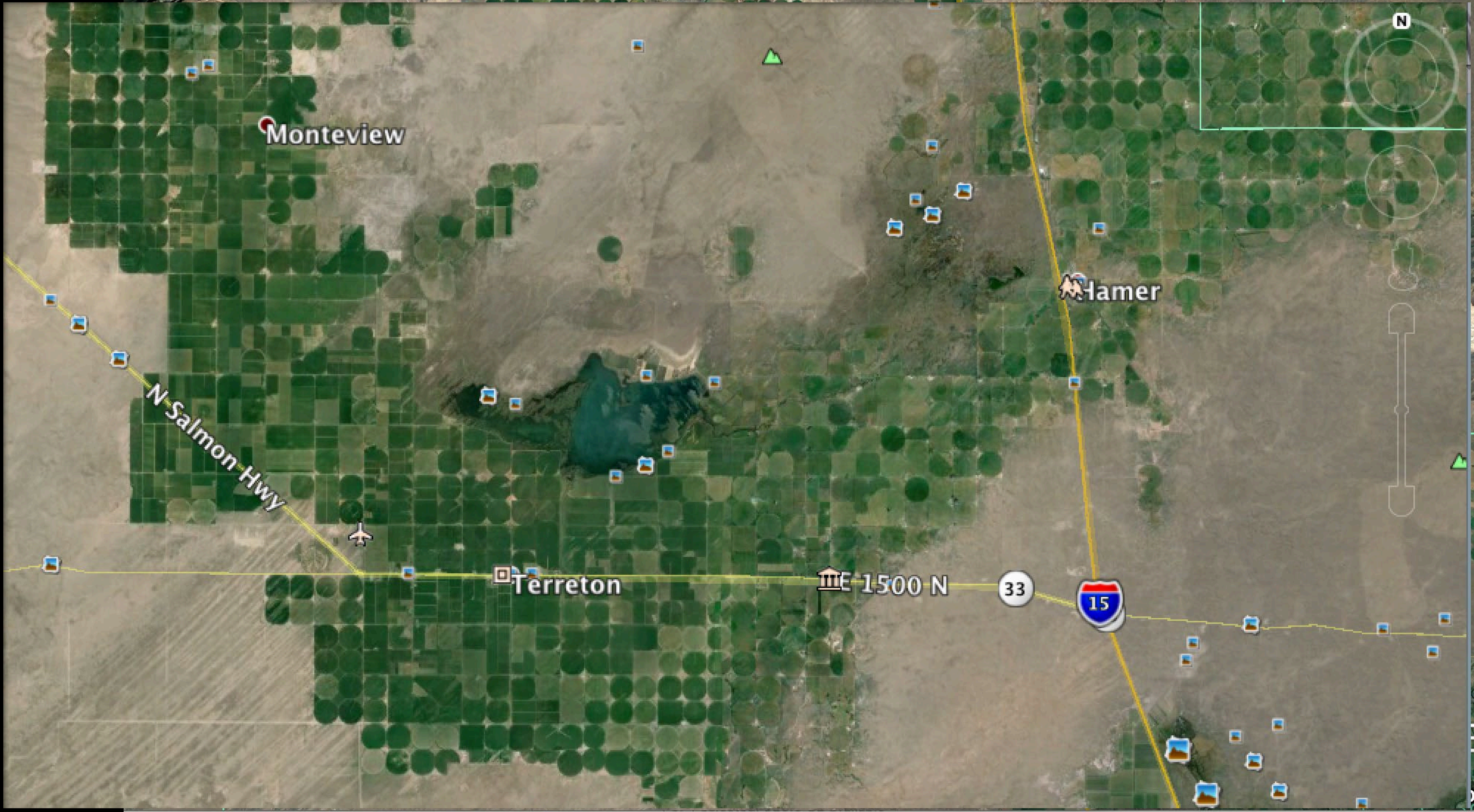
Mycotoxins

teedandbrown.com/disease-triangle/

Idaho Falls - Environment

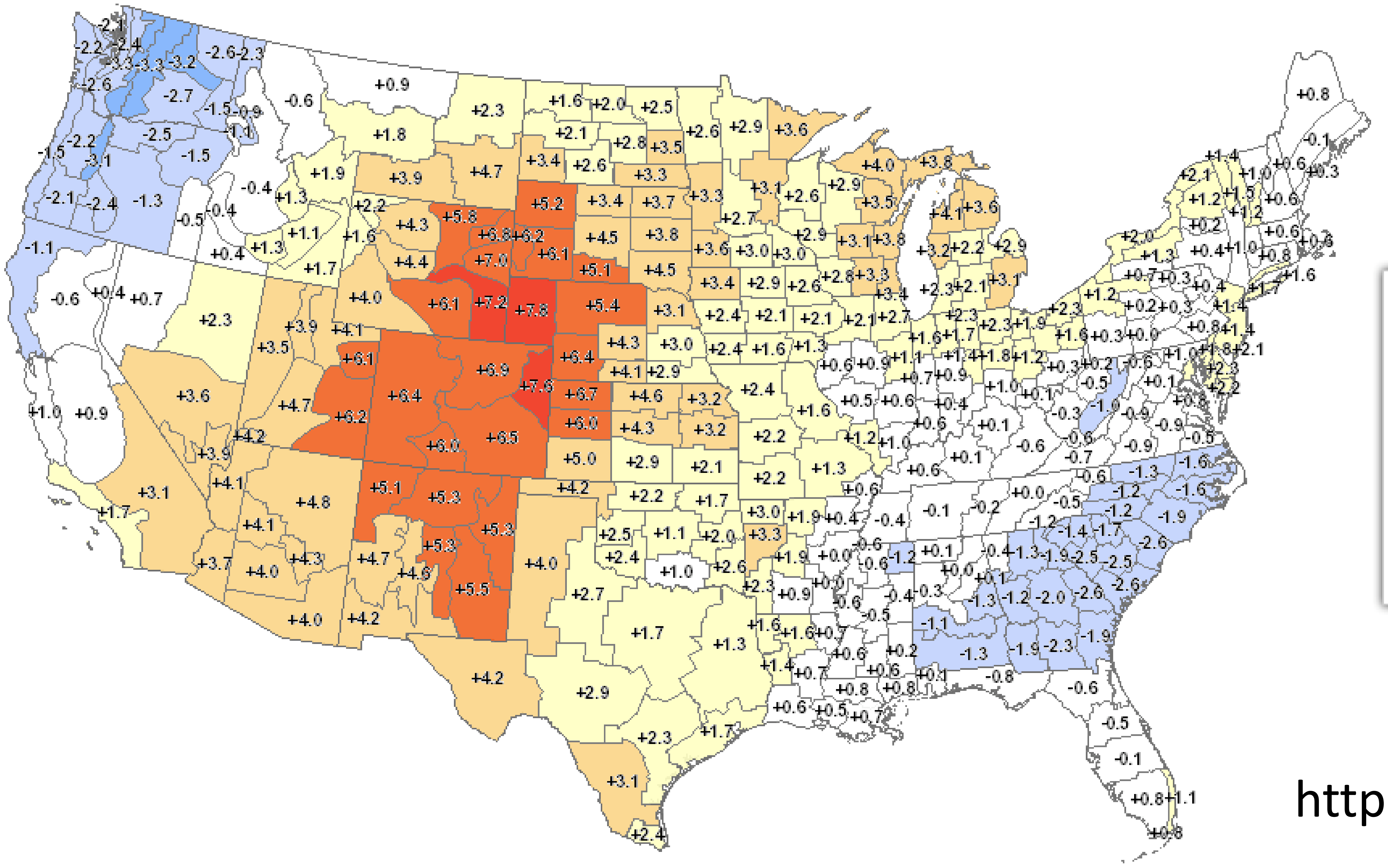


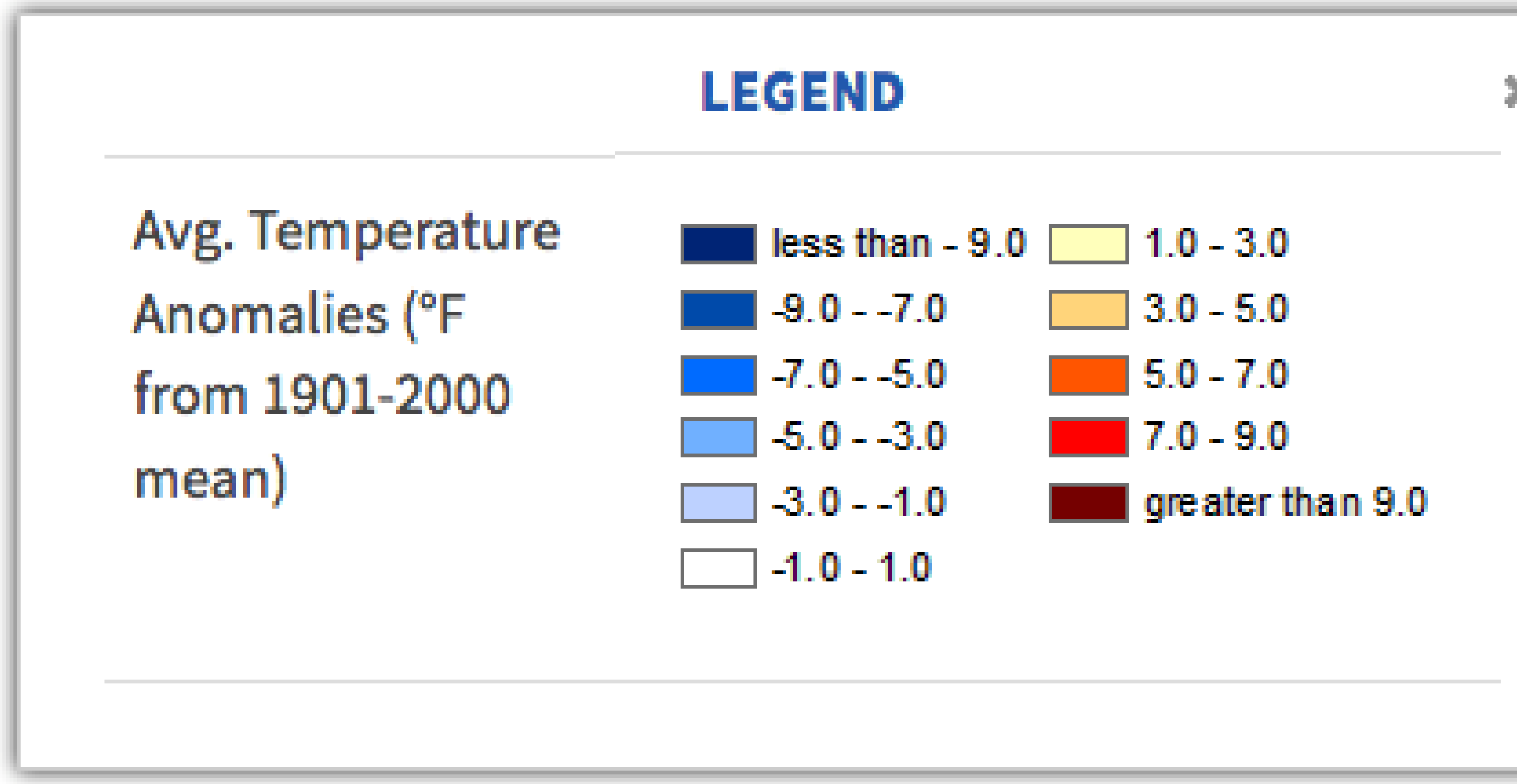
North of Idaho Falls – Terreton / Hamer



Moses Lake, Columbia Basin, WA

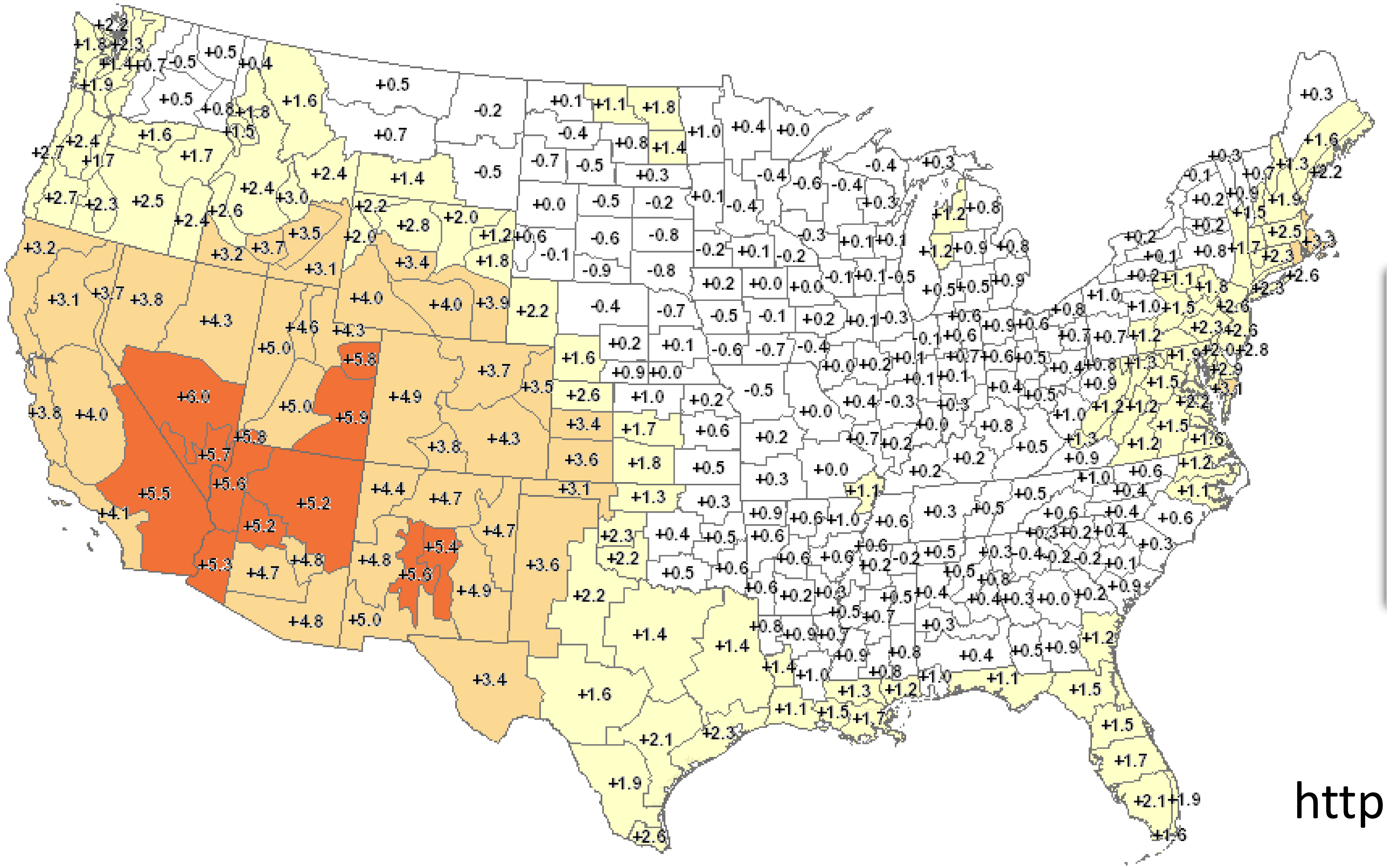
2012 TEMPERATURE ANOMALIES JUNE





https://www.ncdc.noaa.gov/cag/

2013 TEMPERATURE ANOMALIES JUNE



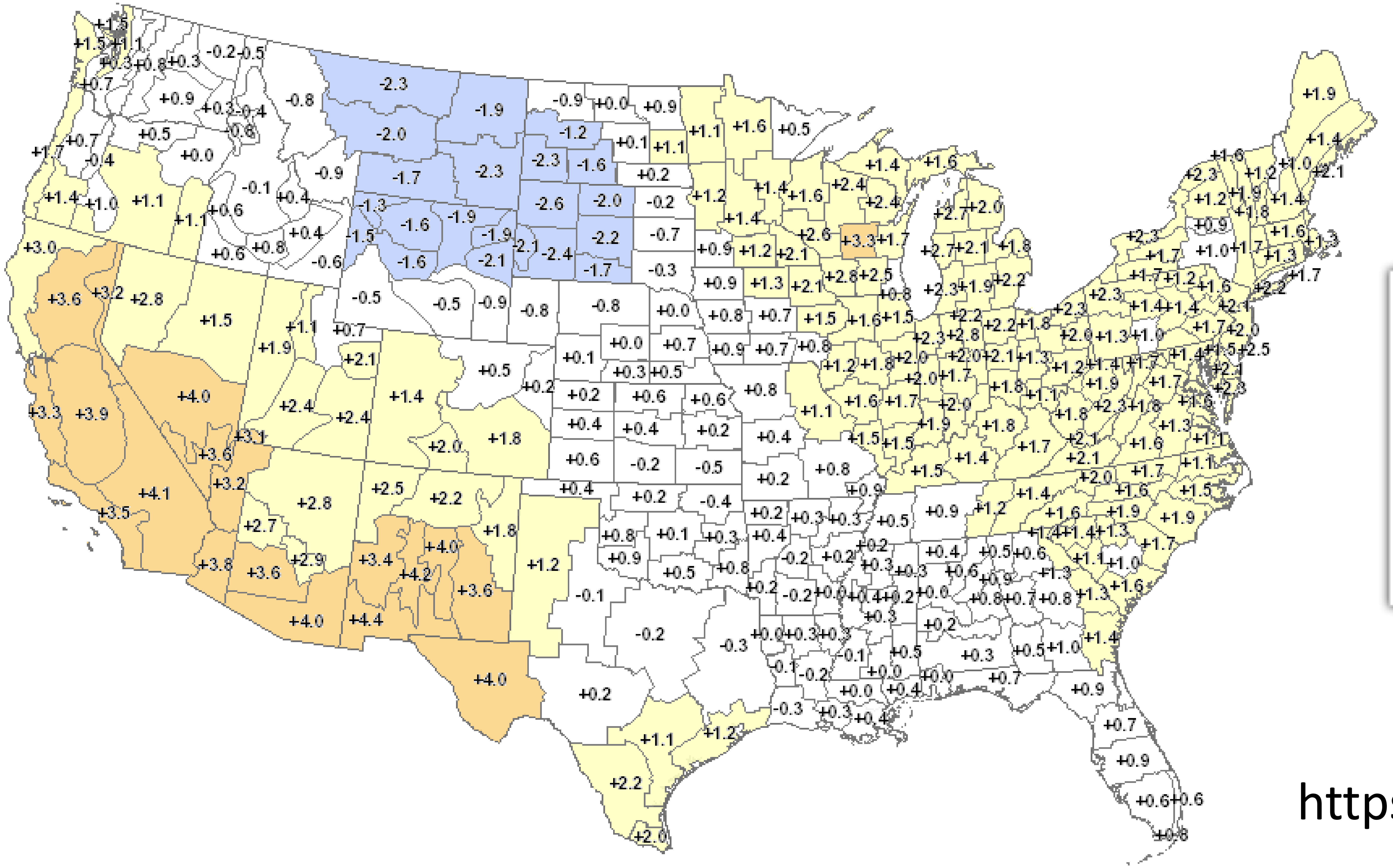
LEGEND

Avg. Temperature Anomalies (°F from 1901-2000 mean)

- less than - 9.0
- -9.0 - -7.0
- -7.0 - -5.0
- -5.0 - -3.0
- -3.0 - -1.0
- -1.0 - 1.0
- 1.0 - 3.0
- 3.0 - 5.0
- 5.0 - 7.0
- 7.0 - 9.0
- greater than 9.0

https://www.ncdc.noaa.gov/cag/

2014 TEMPERATURE ANOMALIES JUNE



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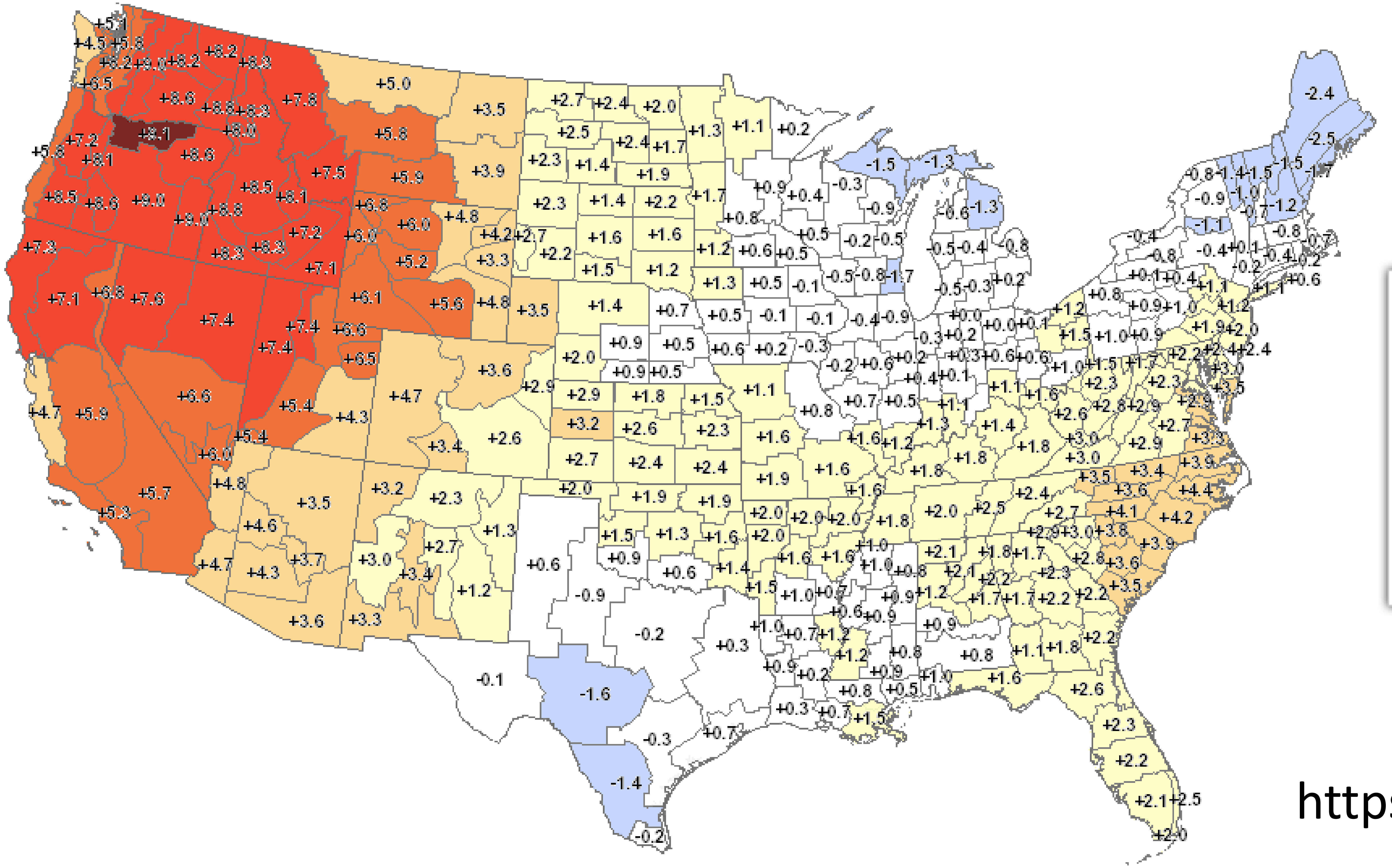
https://www.ncdc.noaa.gov/cag/

2015 TEMPERATURE ANOMALIES JUNE



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- 7.0 - 9.0
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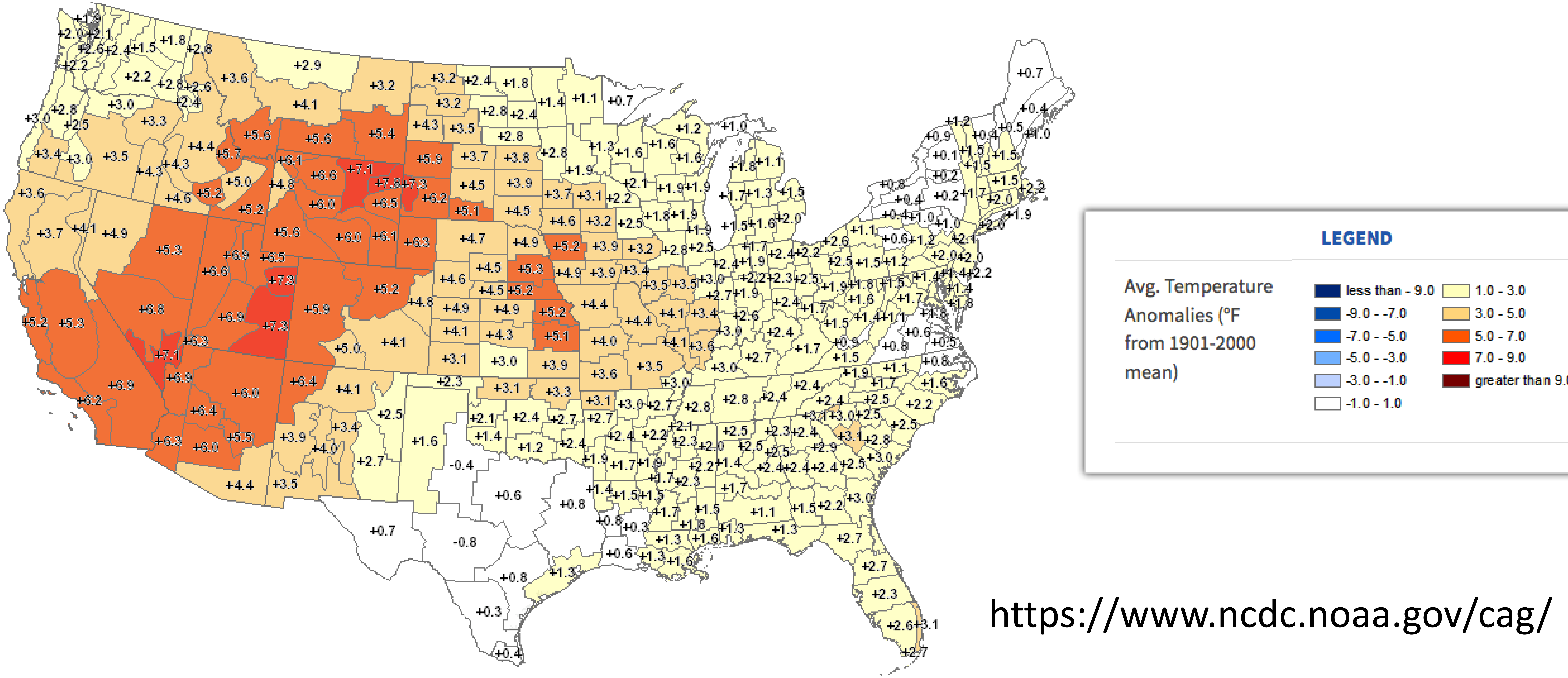
https://www.ncdc.noaa.gov/cag/

2016 TEMPERATURE ANOMALIES JUNE



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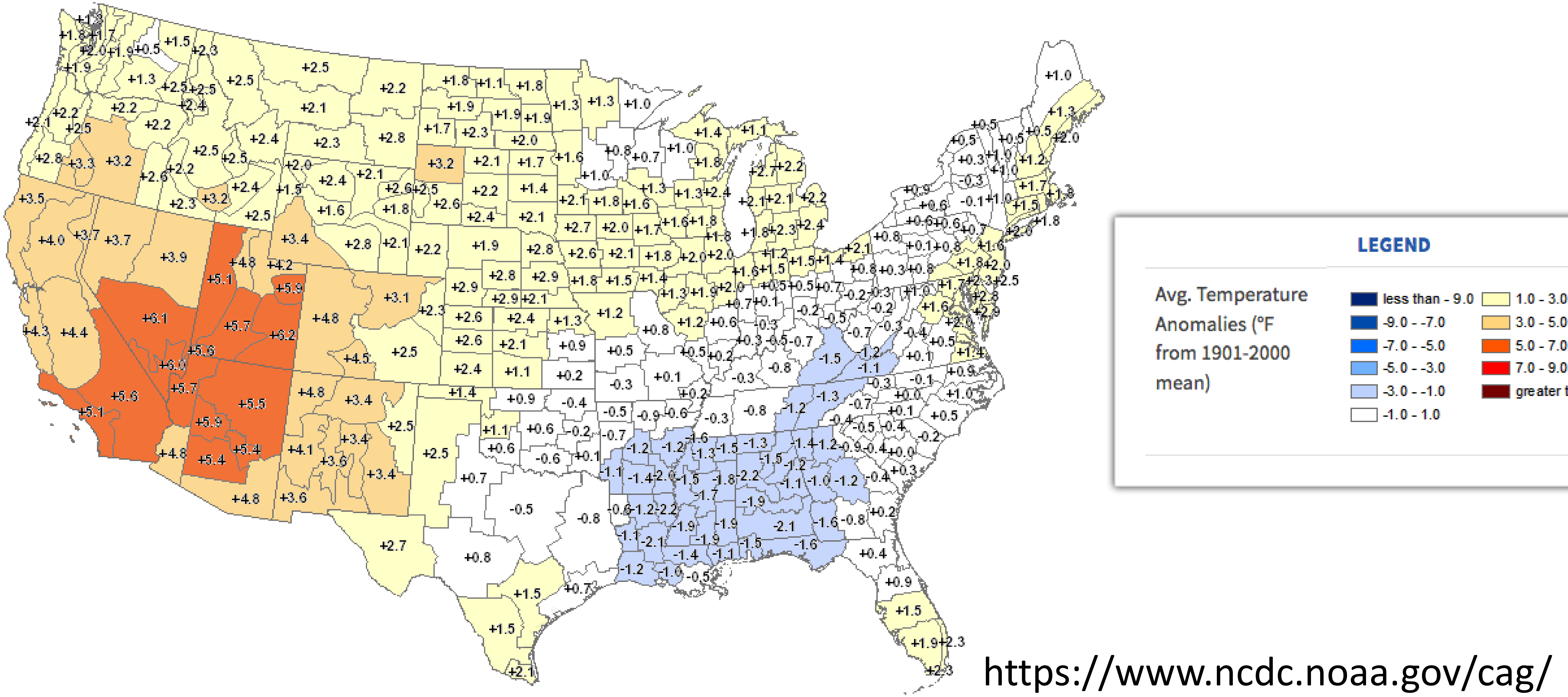
2017 TEMPERATURE ANOMALIES JUNE



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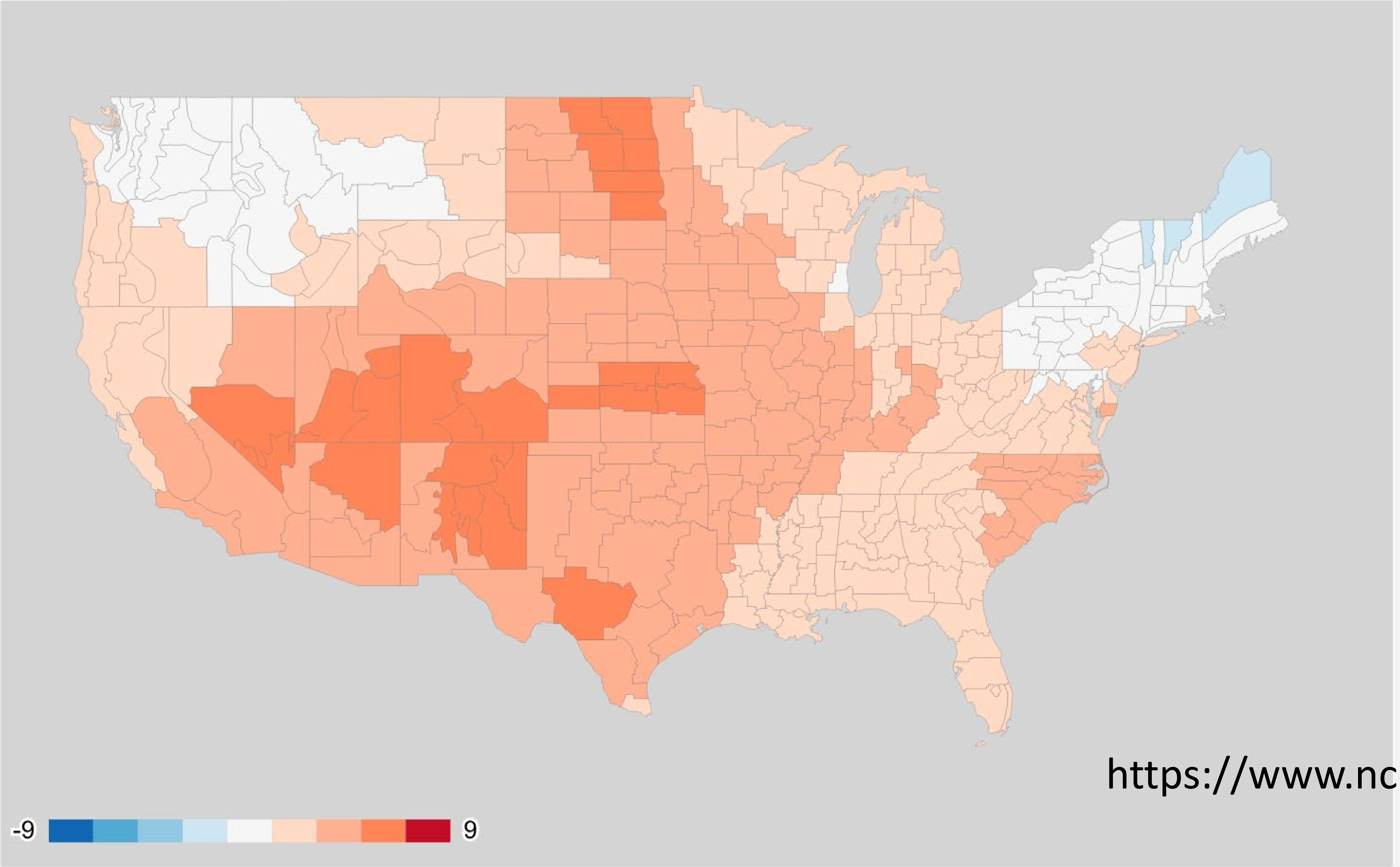
2018 TEMPERATURE ANOMALIES JUNE



https://www.ncdc.noaa.gov/cag/

THE WALL STREET JOURNAL.

SIGN IN

JOIN NOW

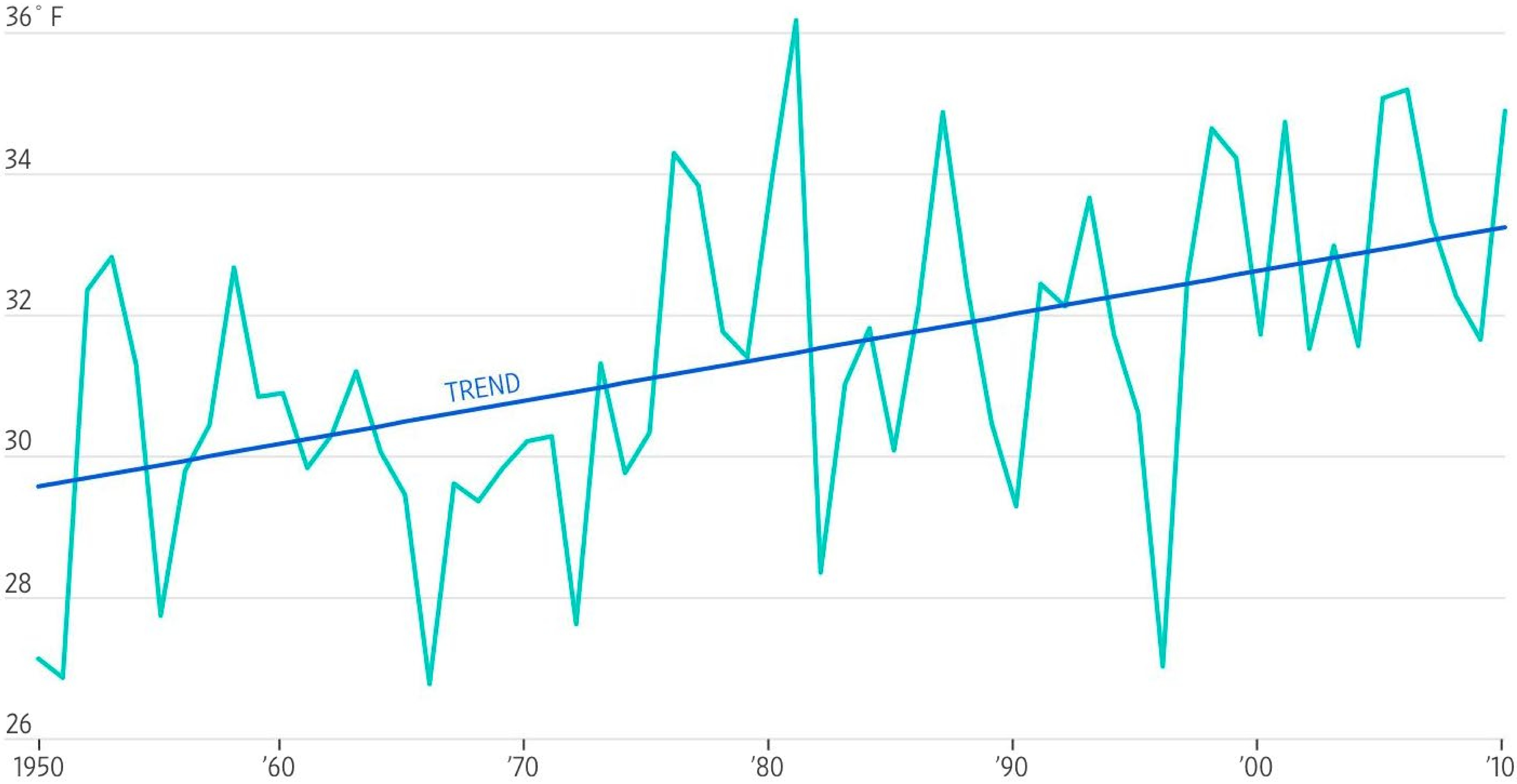
A Bayer researcher readies a combine to harvest test plots of corn in Manitoba, Canada, in October. TIM SMITH FOR THE WALL STREET JOURNAL

By Jacob Bunge

Nov. 25, 2018 12:59 p.m. ET

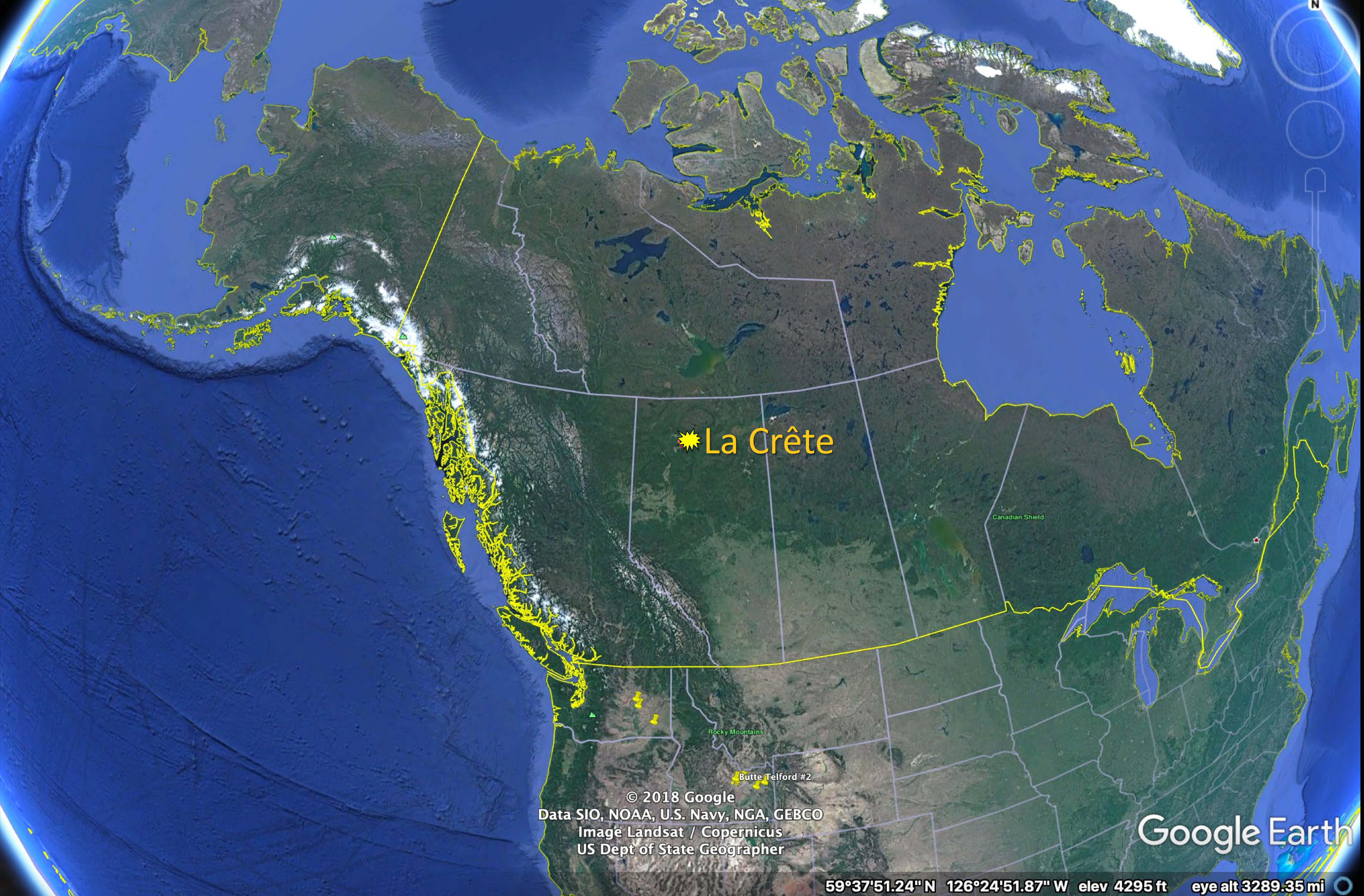
https://www.wsj.com/articles/a-warming-climate-brings-new-crops-to-frigid-zones-1543168786

AVERAGE ANNUAL TEMPERATURE IN LA CRETE, ALBERTA

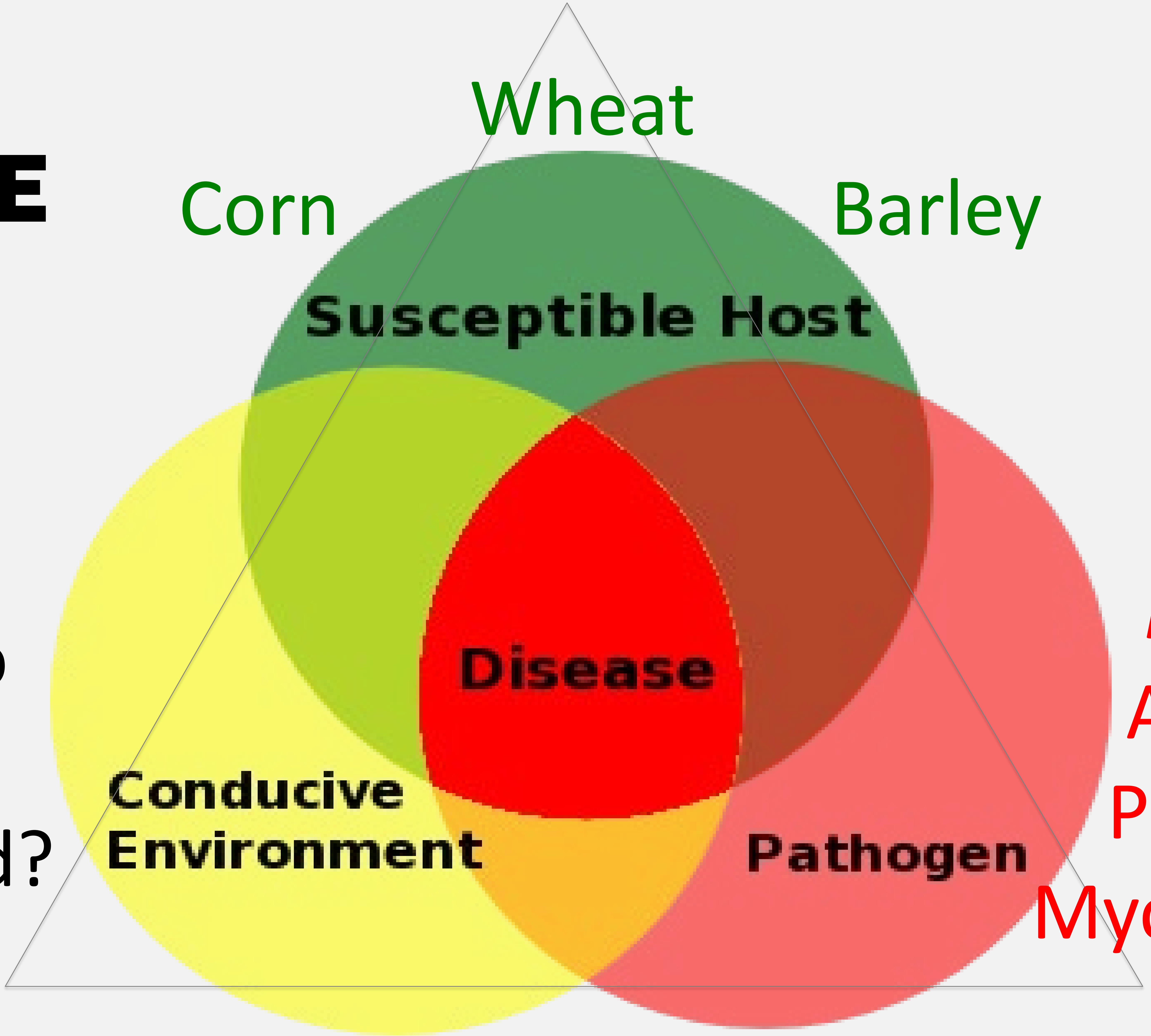


Source: Alberta Climate Records/University of Lethbridge

CANADIAN CORN PRODUCTION
30 million metric tons
25
20
15
10
5
0
1990
'92
'94
'96
'98
2000
'02
'04
'06
'08
'10
'12
'14
'16
CORN FOR FODDER
CORN FOR GRAIN
Source: Statistics Canada


La Crête
Canadian Shield
Rocky Mountains
Butte Telford #2
© 2018 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
US Dept of State Geographer
Google Earth
59°37'51.24" N 126°24'51.87" W elev 4295 ft eye alt 3289.35 mi

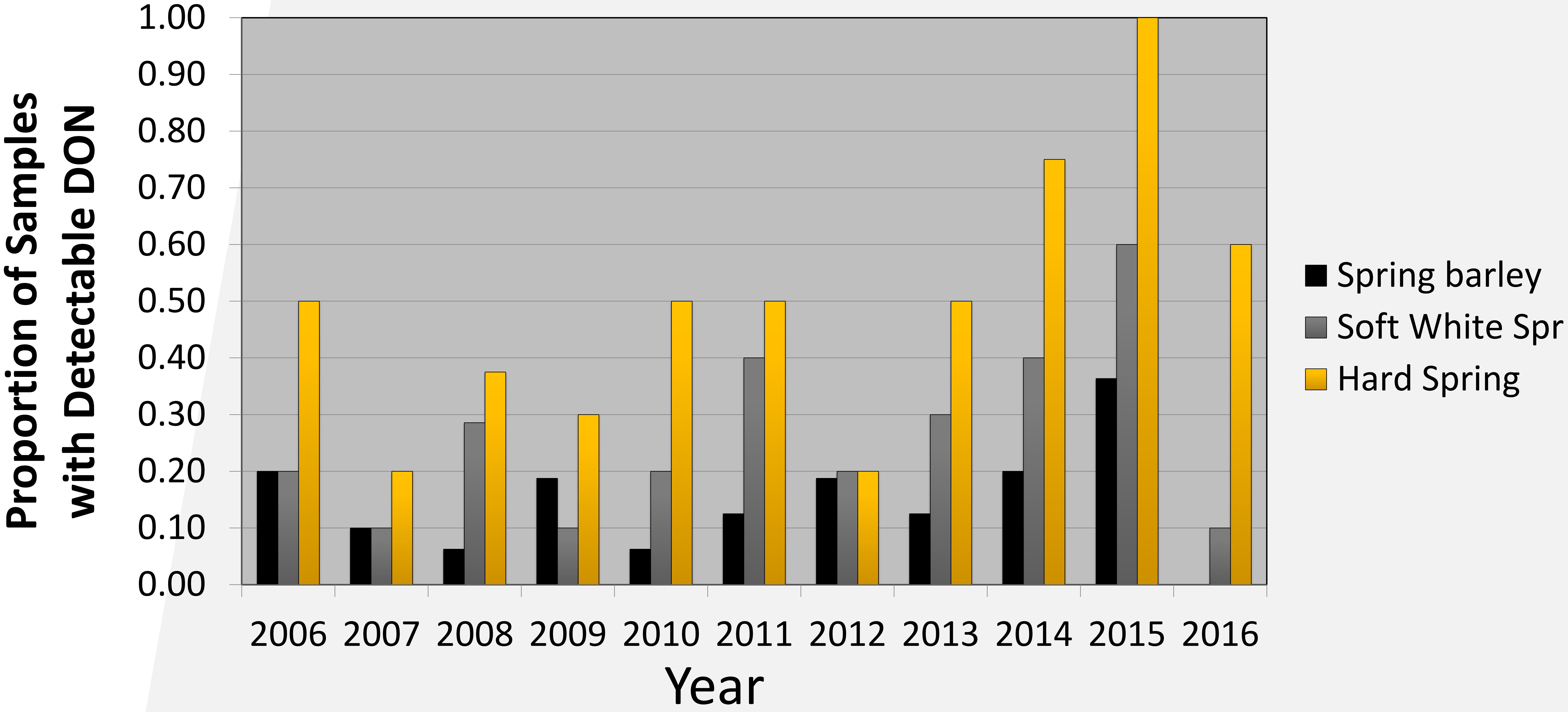
DISEASE TRIANGLE

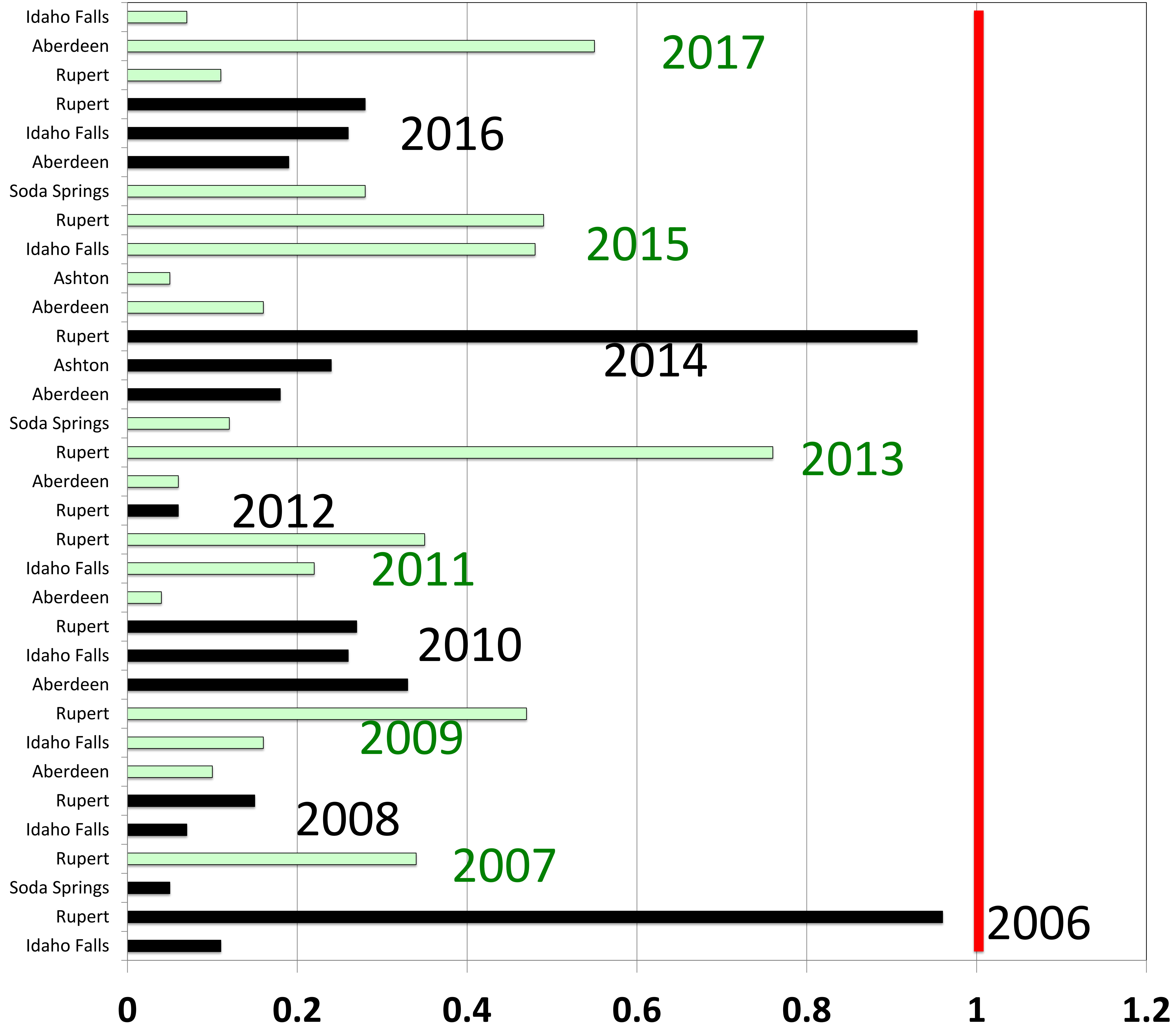


teedandbrown.com/disease-triangle/

RESEARCH IN THE WEST

MONITORING DON TOXINS IN EXTENSION VARIETY TRIALS





MONITORING DON TOXINS IN EXTENSION VARIETY TRIALS

KLASIC

HARD WHITE SPRING

DON (PPM)

RUPERT ABERDEEN

IDAHO FALLS ASHTON

SODA SPRINGS

RESEARCH IN THE WEST

SCREENING WHEAT AND BARLEY VARIETIES AND ADVANCED LINES

Table 1. FHB Index (IND), Fusarium-damaged kernels (FDK) and deoxynivalenol content (DON) of 29 wheat varieties tested from 2015 to 2017.

Year	IND (%)		FDK (%)		DON (ppm)	
	Min	Max	Min	Max	Min	Max
2015	12.9	56.1	1.5	9.5	1.2	31.9
2016	0	18.7	0.6	6.8	0.4	9.8
2017	3.8	50.1	0.3	10.2	0.4	28.1

Table 2. FHB Index (IND) and deoxynivalenol content (DON) of 40 barley varieties tested from 2015 to 2017.

Year	IND (%)		DON (ppm)	
	Min	Max	Min	Max
2015	1.3	23.1	0.6	6.1
2016	0	5.6	0.1	1.4
2017	0.6	21	2.3	29.1

Poster 49. Arcibal et al

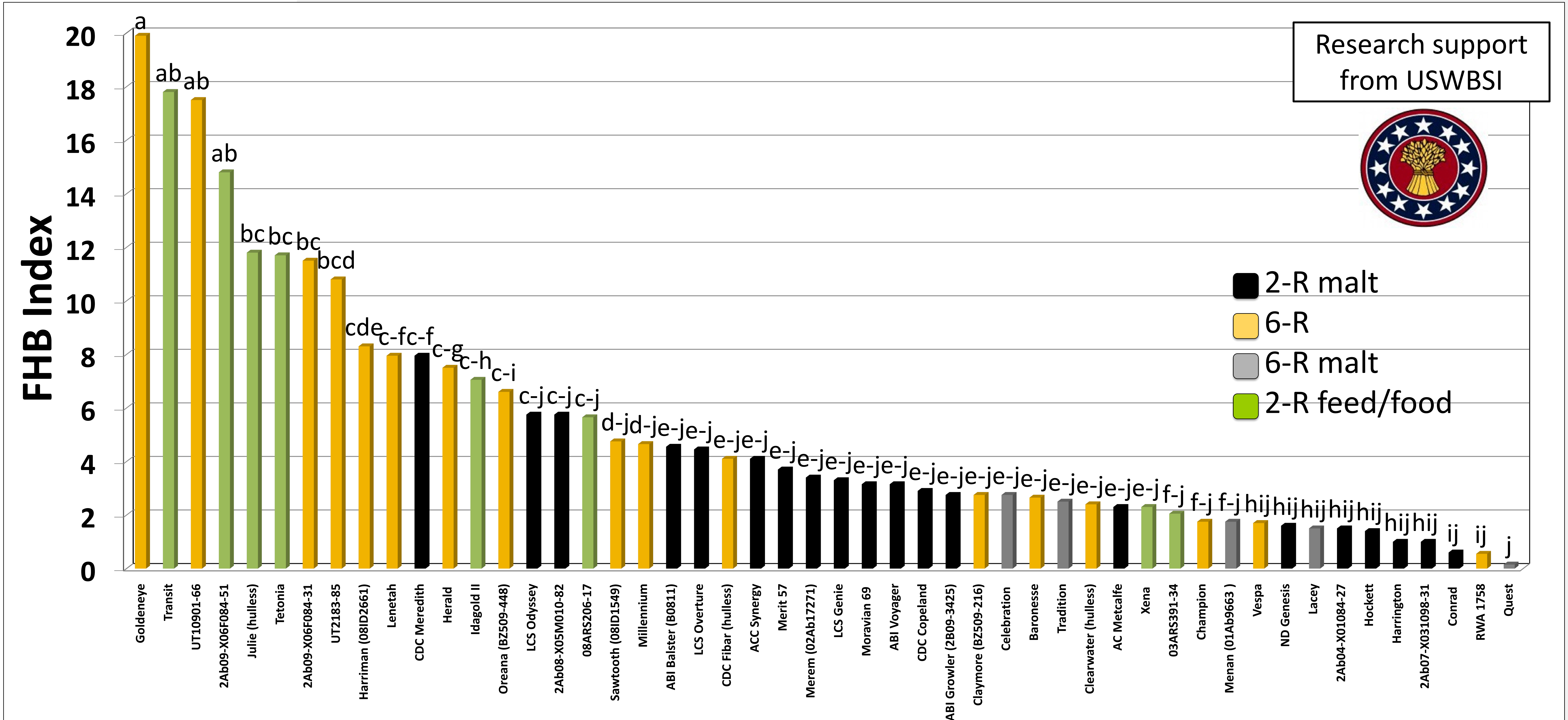
Screening nurseries - 2014-2018

RESEARCH IN THE WEST

SCREENING WHEAT VARIETIES AND ADVANCED LINES - 2015

RESEARCH IN THE WEST

SCREENING BARLEY VARIETIES AND ADVANCED LINES - 2015



RESEARCH IN THE WEST

PARTICIPATION IN UNIFORM FUNGICIDE TRIALS AND INTEGRATED MANAGEMENT TRIALS

- **Experimental Design**

➢ RCBD with a split plot arrangement

➢ 4 replications

- **Variety(whole-plot)**

Variety	Class	R
Diva	sws	MS
IDO1202S	hws	MS
IDO851	sws	MR
Klasic	hws	VS

➢ Planting Date: May 8

- **Fungicide Treatment (sub-plot)**

	Fungicide	Rate	Timing
1	Untreated inoculated check		
2	Prosaro	6.5 fl. oz/A	Anthesis
3	Prosaro + Caramba	6.5 fl. oz/A + 14 fl.oz/A	Anthesis + 4 days
4	Caramba + Folicur	14 fl. oz/A + 4 fl.oz/A	Anthesis + 4 days
5	Proline + Folicur	5.7 fl. oz/A + 4 fl. oz/A	Anthesis + 4 days
6	Untreated, non-inoculated check		

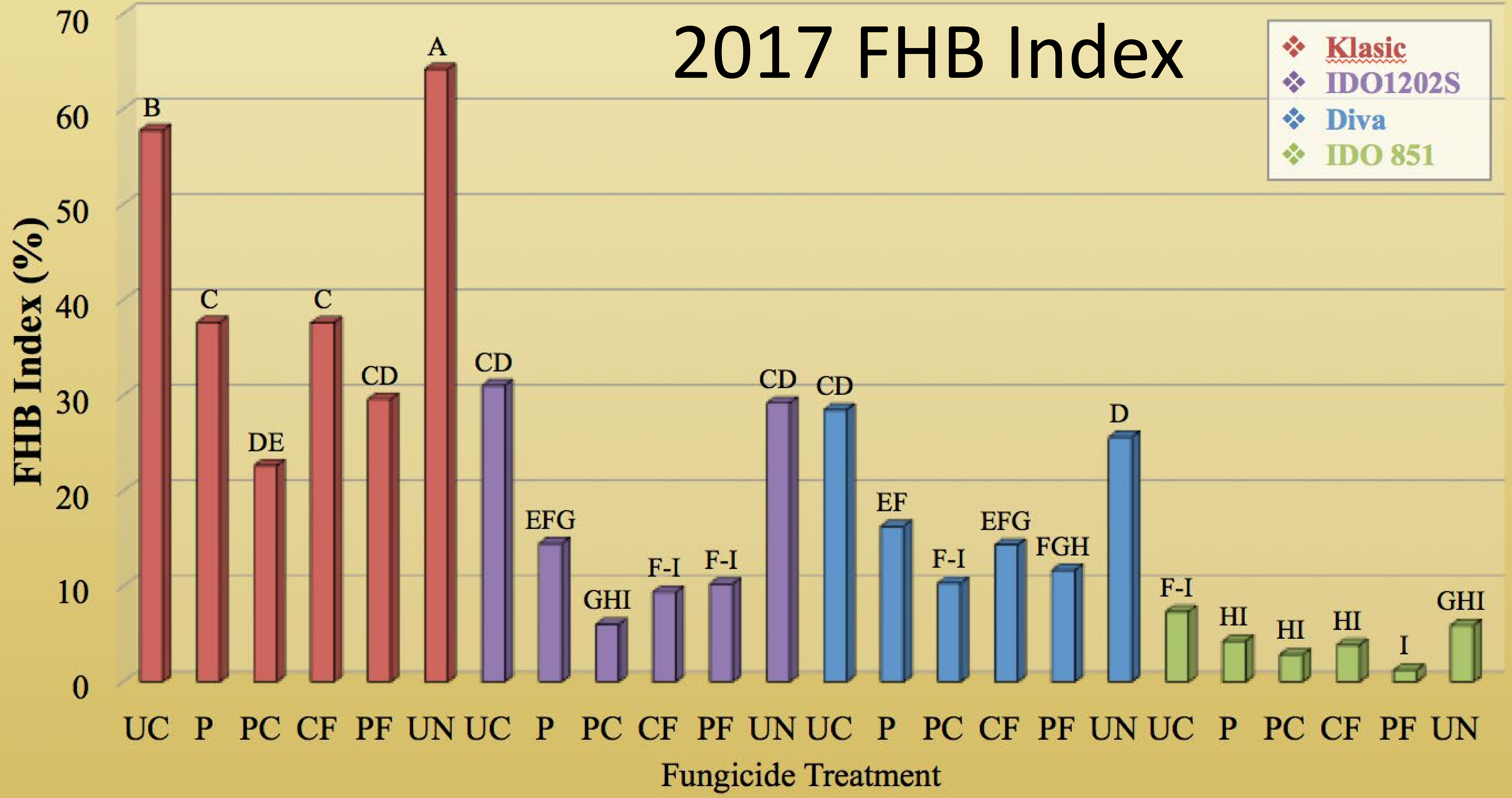


Figure 1. FHB index (%) of 4 varieties with 6 different treatments

Means followed by the same letter within a column did not differ significantly at α=0.05.

2017 FHB DON

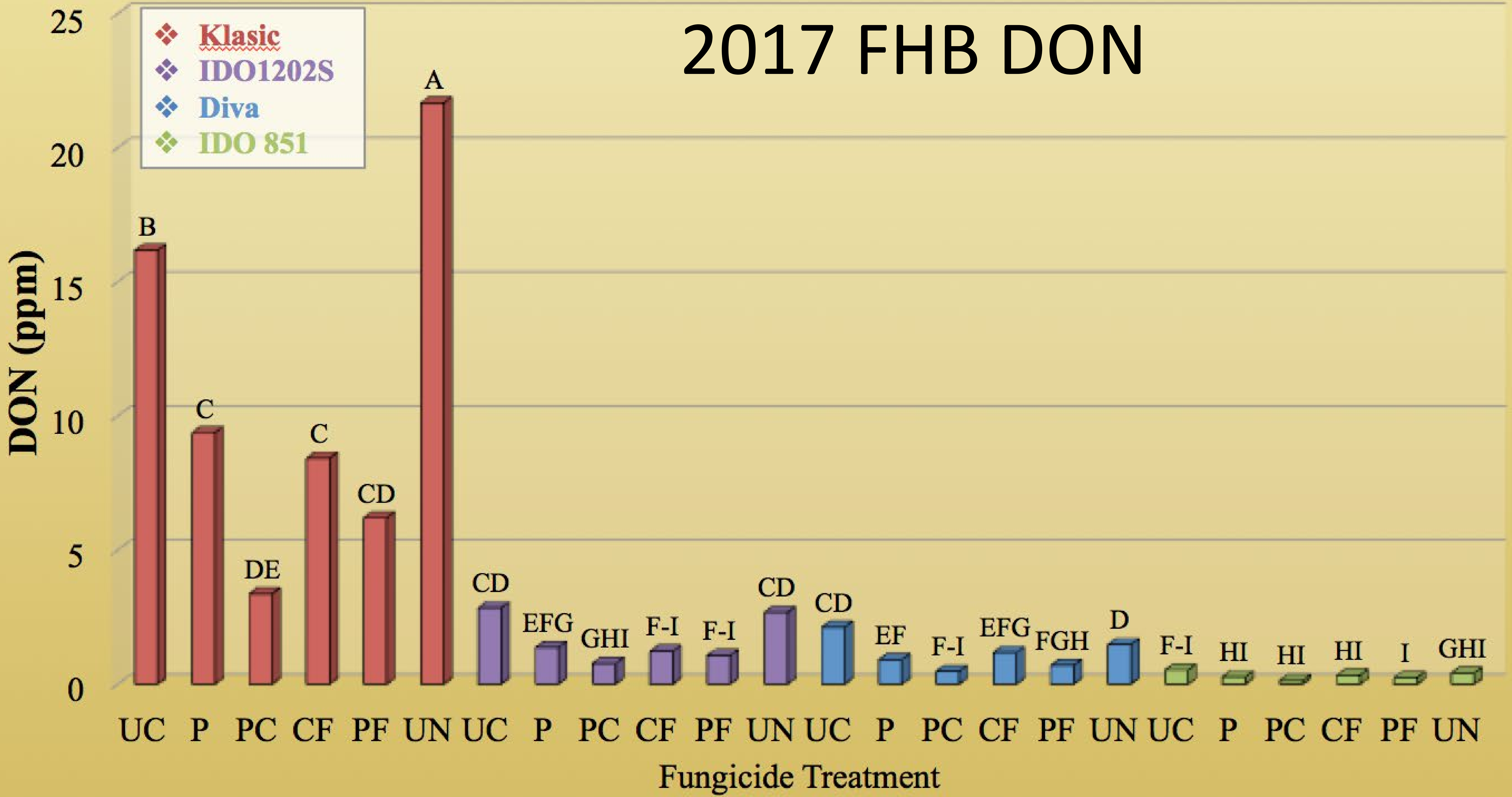


Figure 3. DON (ppm) of 4 varieties with 6 different treatments

Means followed by the same letter did not differ significantly at α=0.05

RESEARCH IN THE WEST

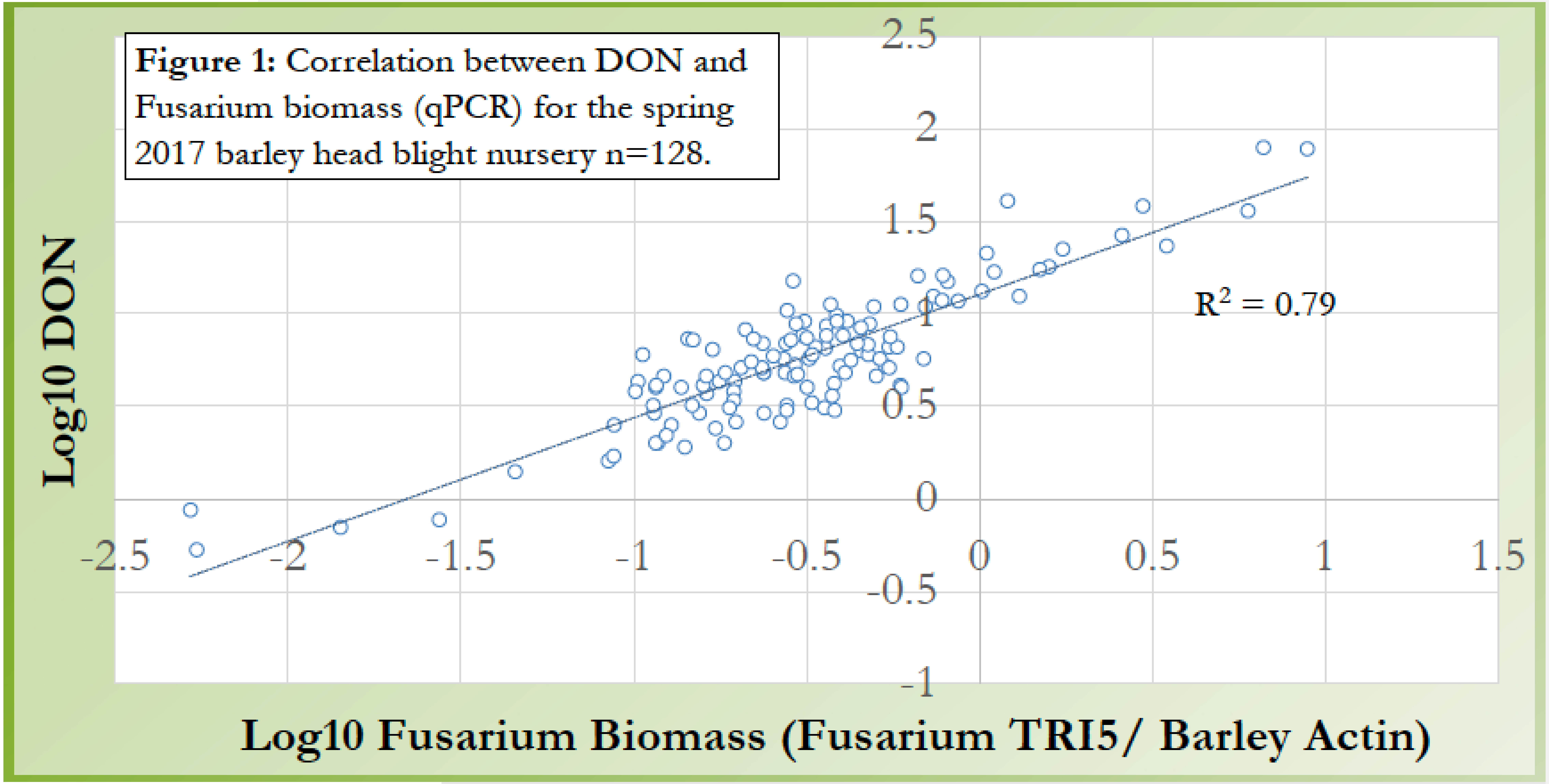
POSTER 52. FUSARIUM BIOMASS MEASUREMENTS EVALUATED AS A SELECTION TOOL

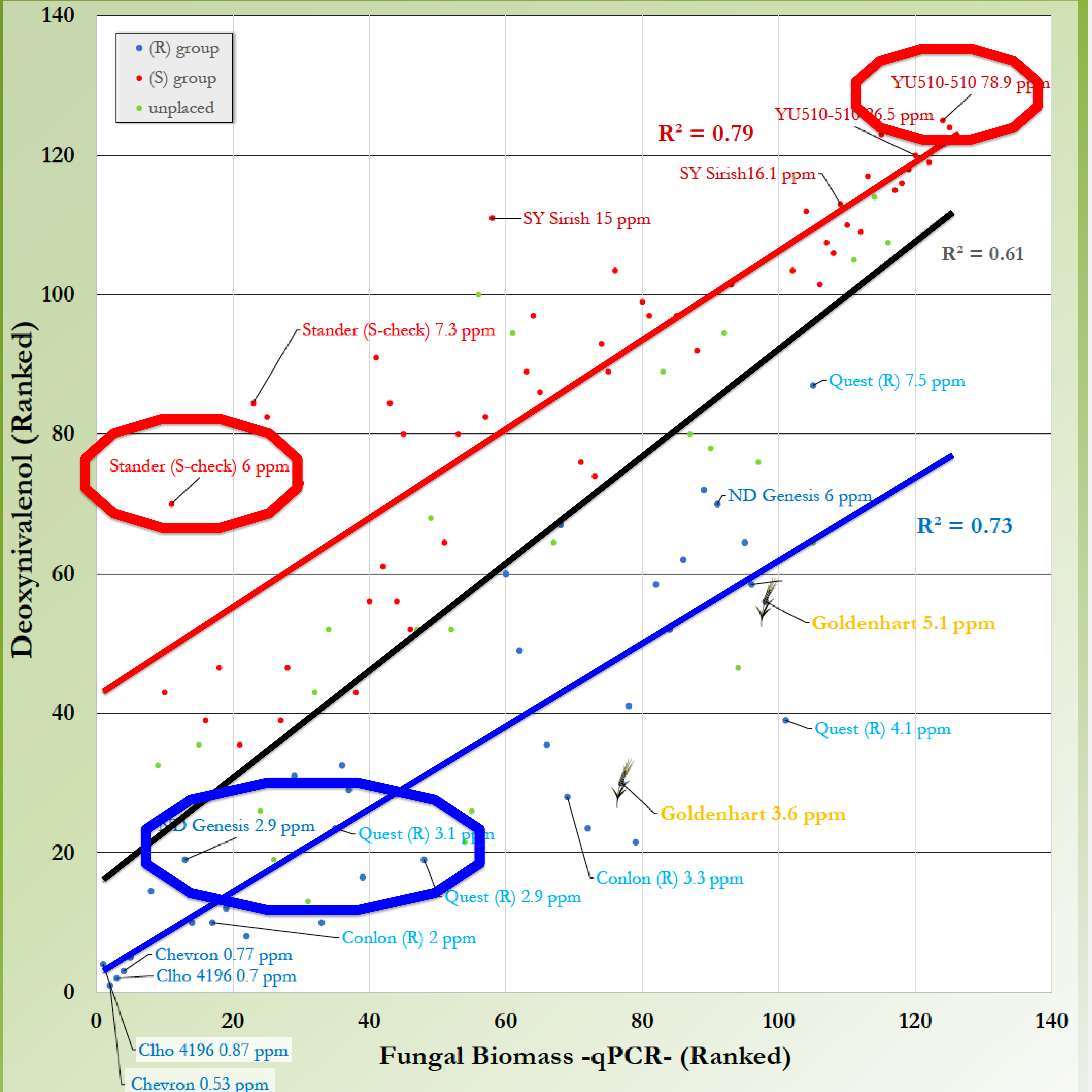
Table 1: Log10 Comparison of R^2 values for *Fusarium* infection in grain grown at Aberdeen, 2017, estimated via qPCR vs IND

DON level (ppm)	≤5	≤10	≤20	≤40	≤80
No. of Cultivars	55	100	118	126	128
visual (IND) R^2	**0.23**	**0.32**	**0.46**	**0.51**	**0.56**
qPCR R^2	0.66	0.60	0.68	0.76	0.79

RESEARCH IN THE WEST

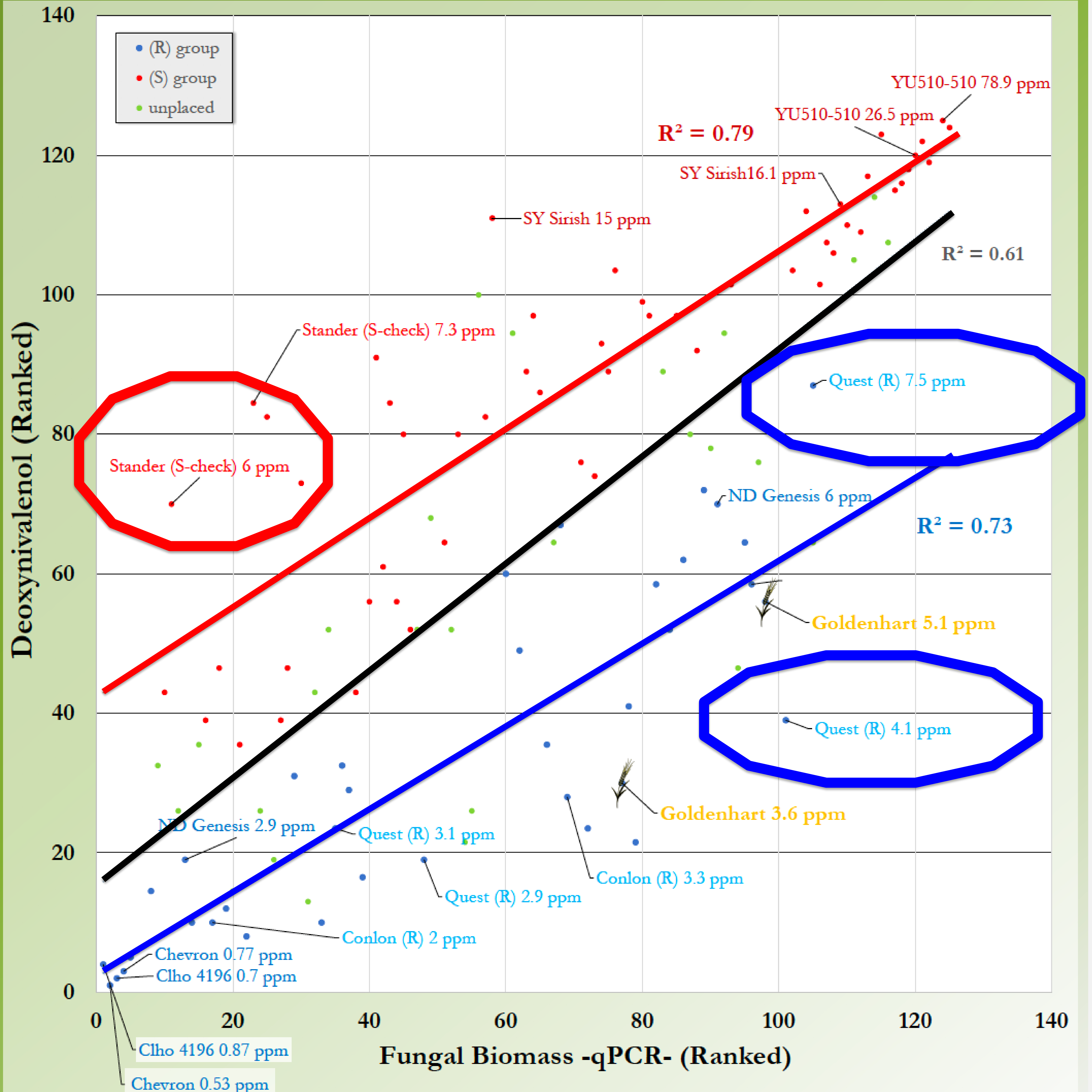
POSTER 52. FUSARIUM BIOMASS MEASUREMENTS EVALUATED AS A SELECTION TOOL





Poster 52. Fusarium Biomass Measurements Evaluated as a Selection Tool

- Standardize characterization of resistance and susceptibility with ratio of DON : Fungal Biomass
- Resistant varieties have lower DON to biomass ratios
- Susceptible varieties have higher DON to fungal biomass ratios



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USDA-ARS

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DR. GONGSHE HU

KATHY SATTERFIELD

CHRIS EVANS

OHIO STATE UNIVERSITY

DR. PIERCE PAUL

DR. JORGE SALGADO

KANSAS STATE UNIVERSITY

DR. ERICK DE WOLFE

FUTURE GOALS

1) Improve nurseries and consistency of infections
2) Increase number of nurseries
   - Winter and Spring

FUTURE GOALS

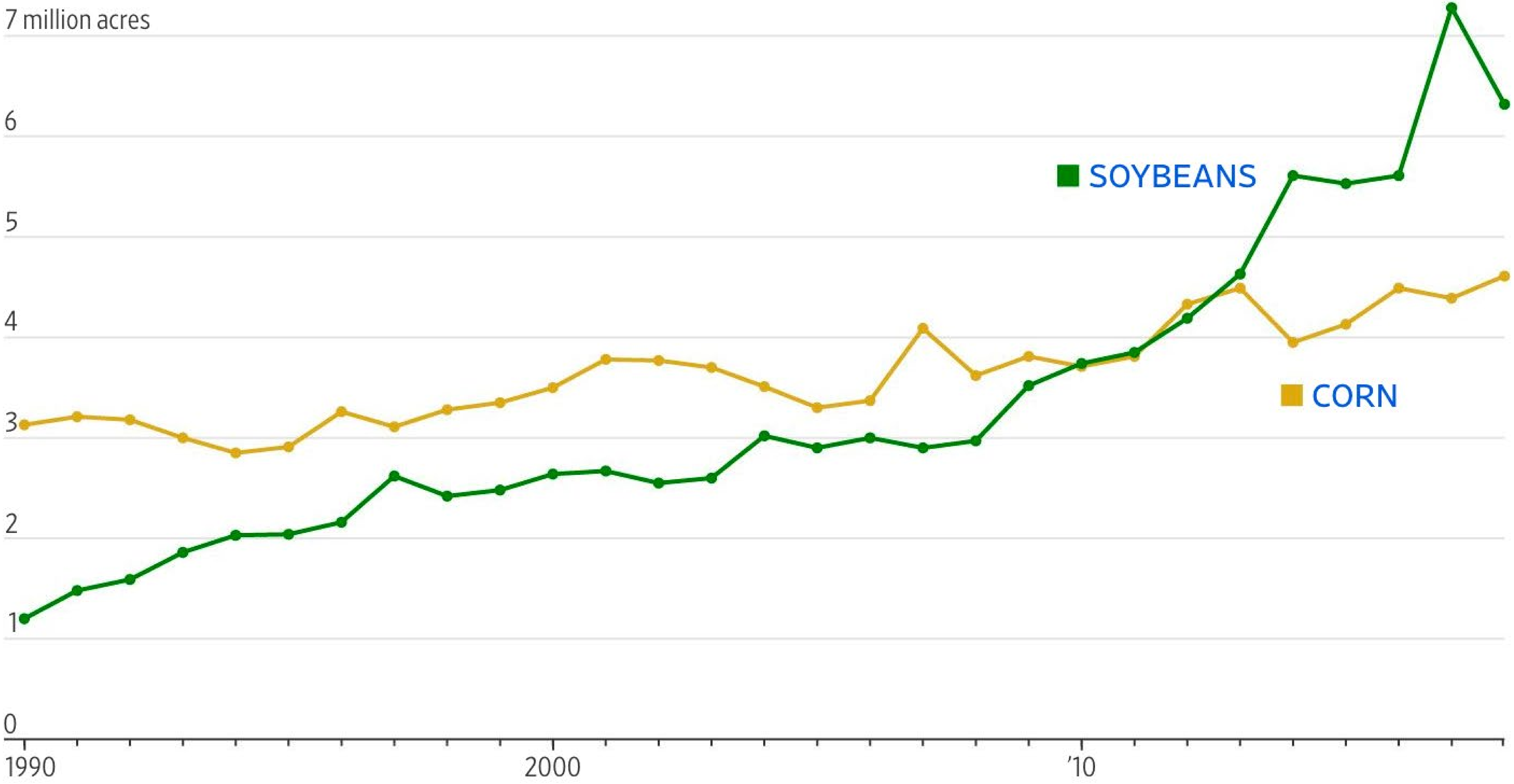
3) Develop weather/irrigation models

4) Determine Pi source and spread

2018

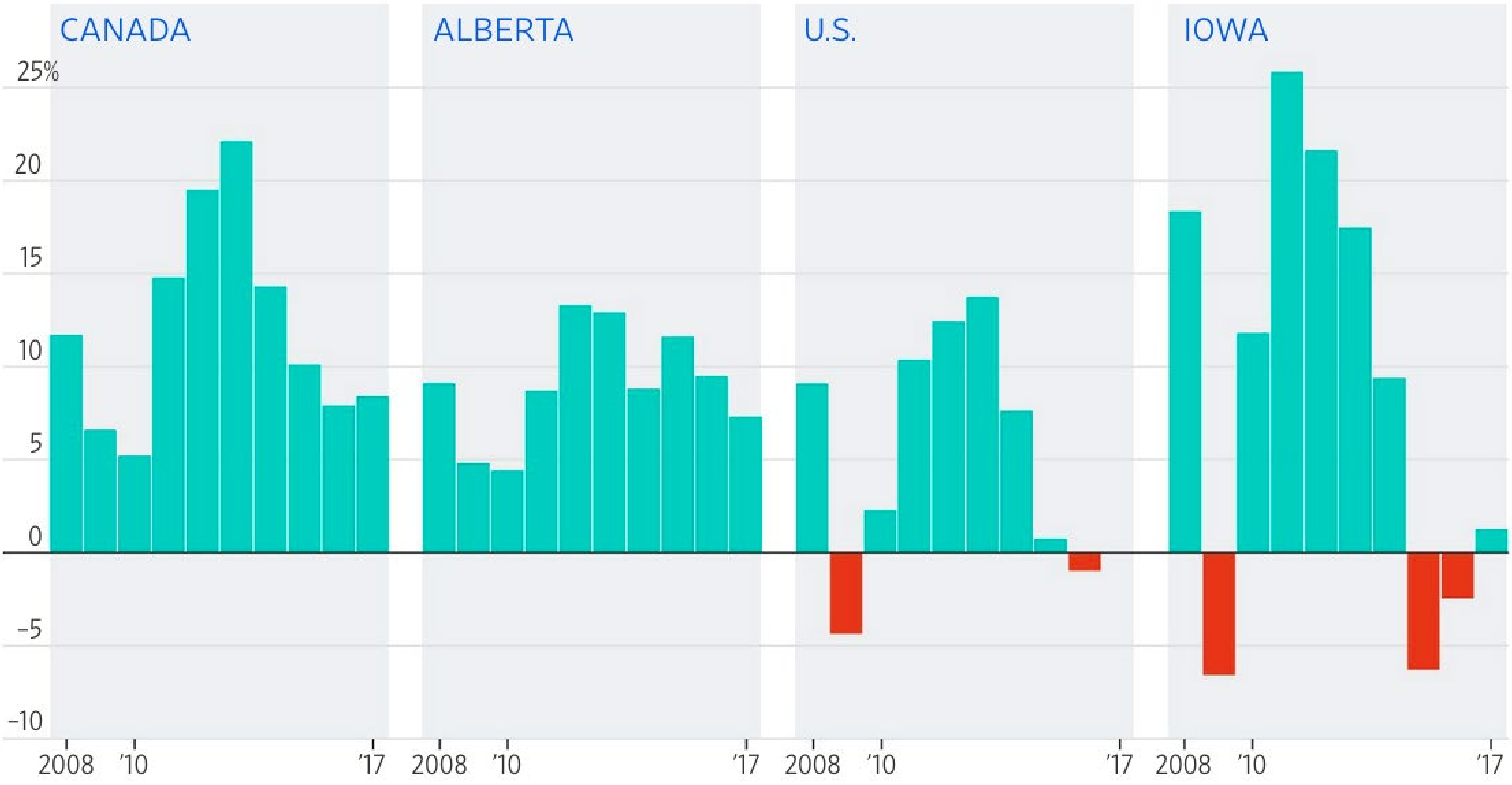
2018

CANADIAN FARMLAND SEEDED, BY CROP



Source: Statistics Canada

LAND VALUE, CHANGE FROM PREVIOUS YEAR



Sources: Farm Credit Canada (Canada, Alberta); USDA (U.S., Iowa)