

Climate Impact on Agricultural Efficiency

Analysis on counties in Nebraska along the 41st parallel

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Introduction:

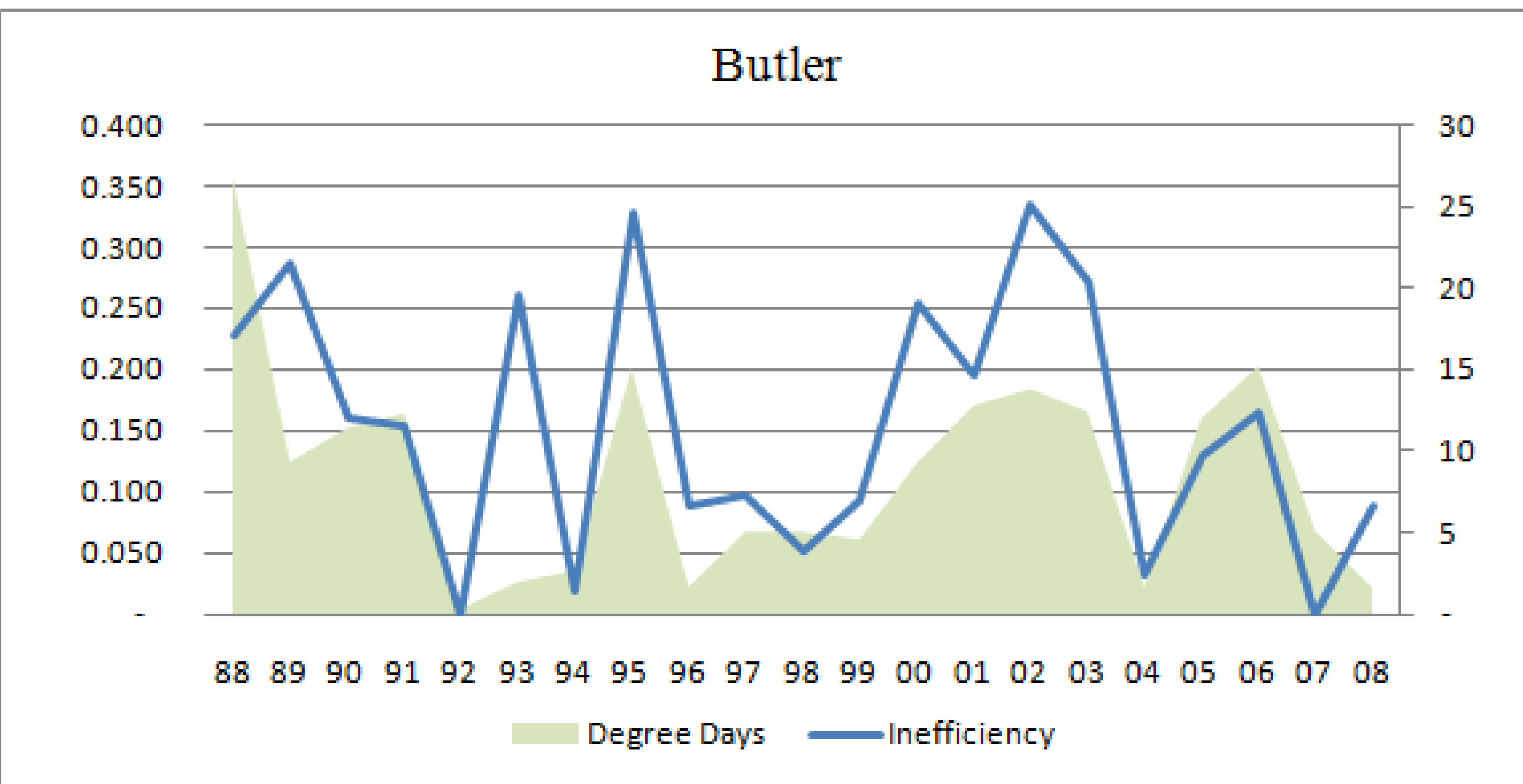
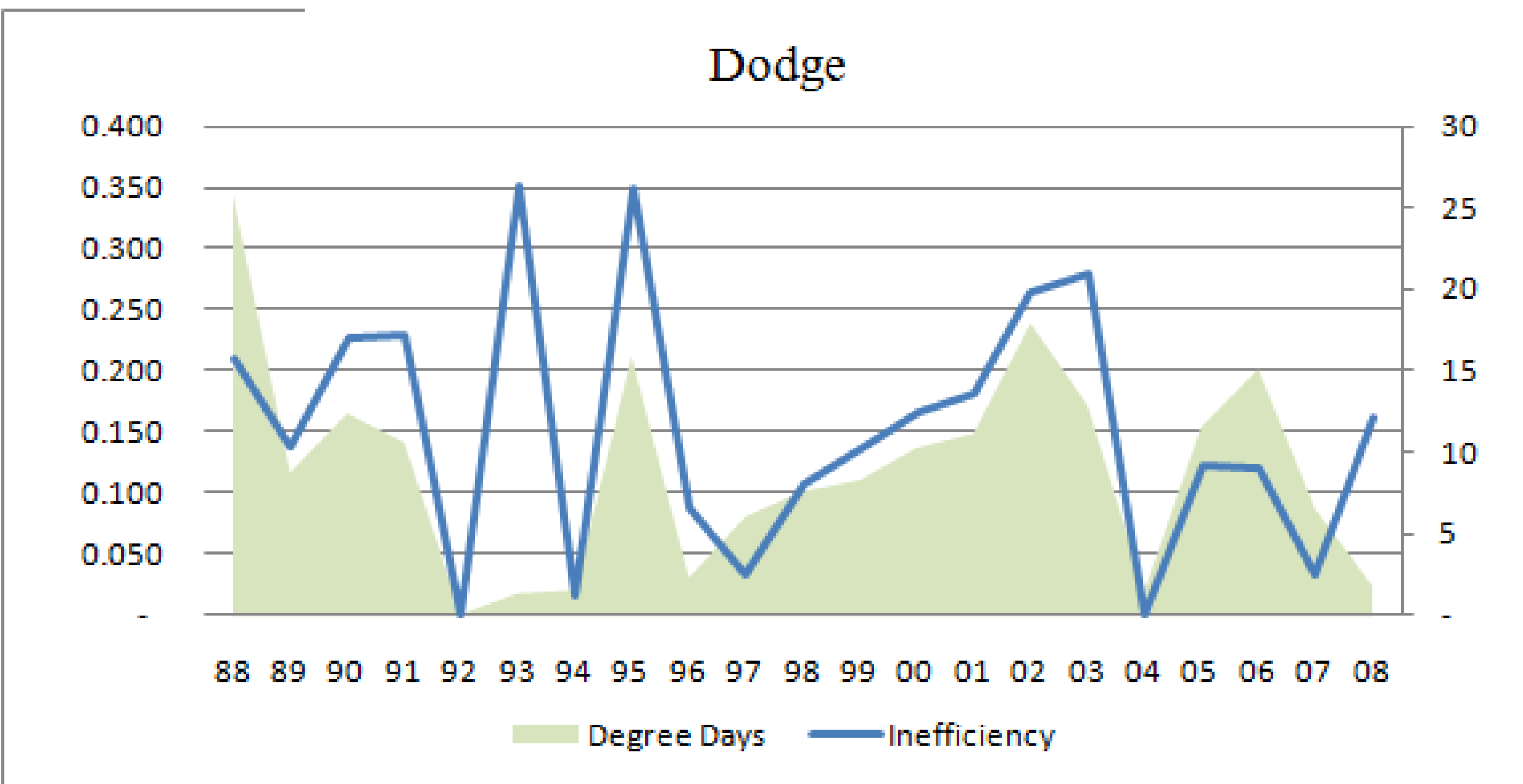
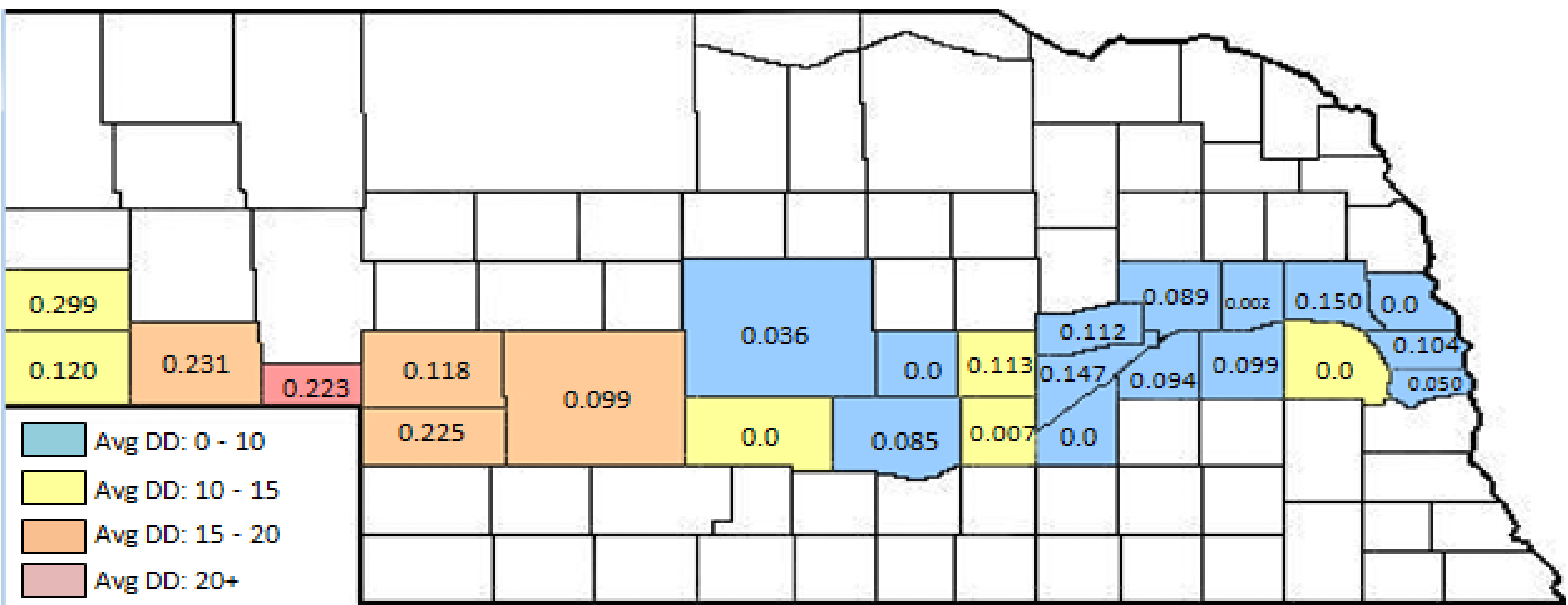
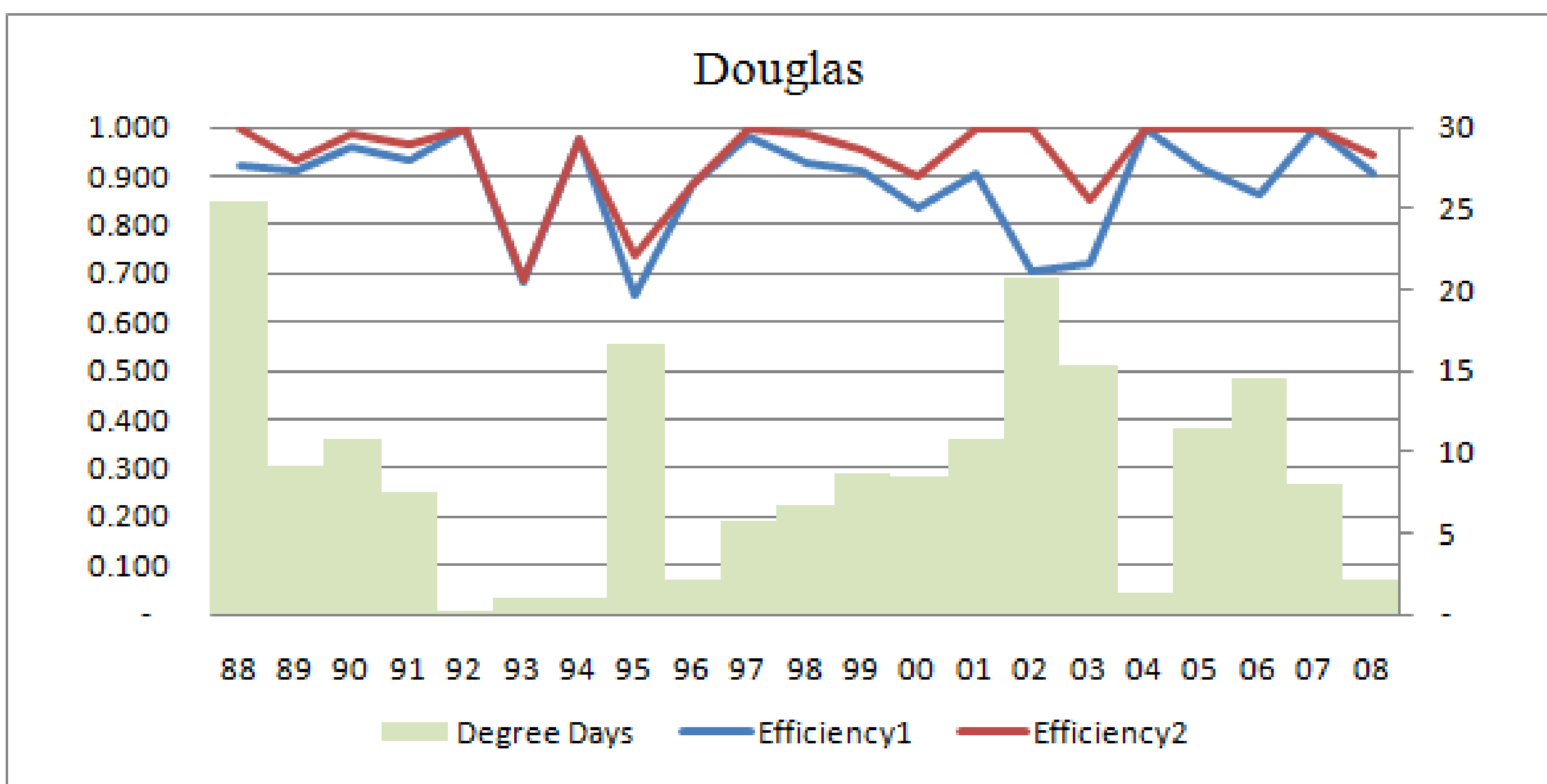
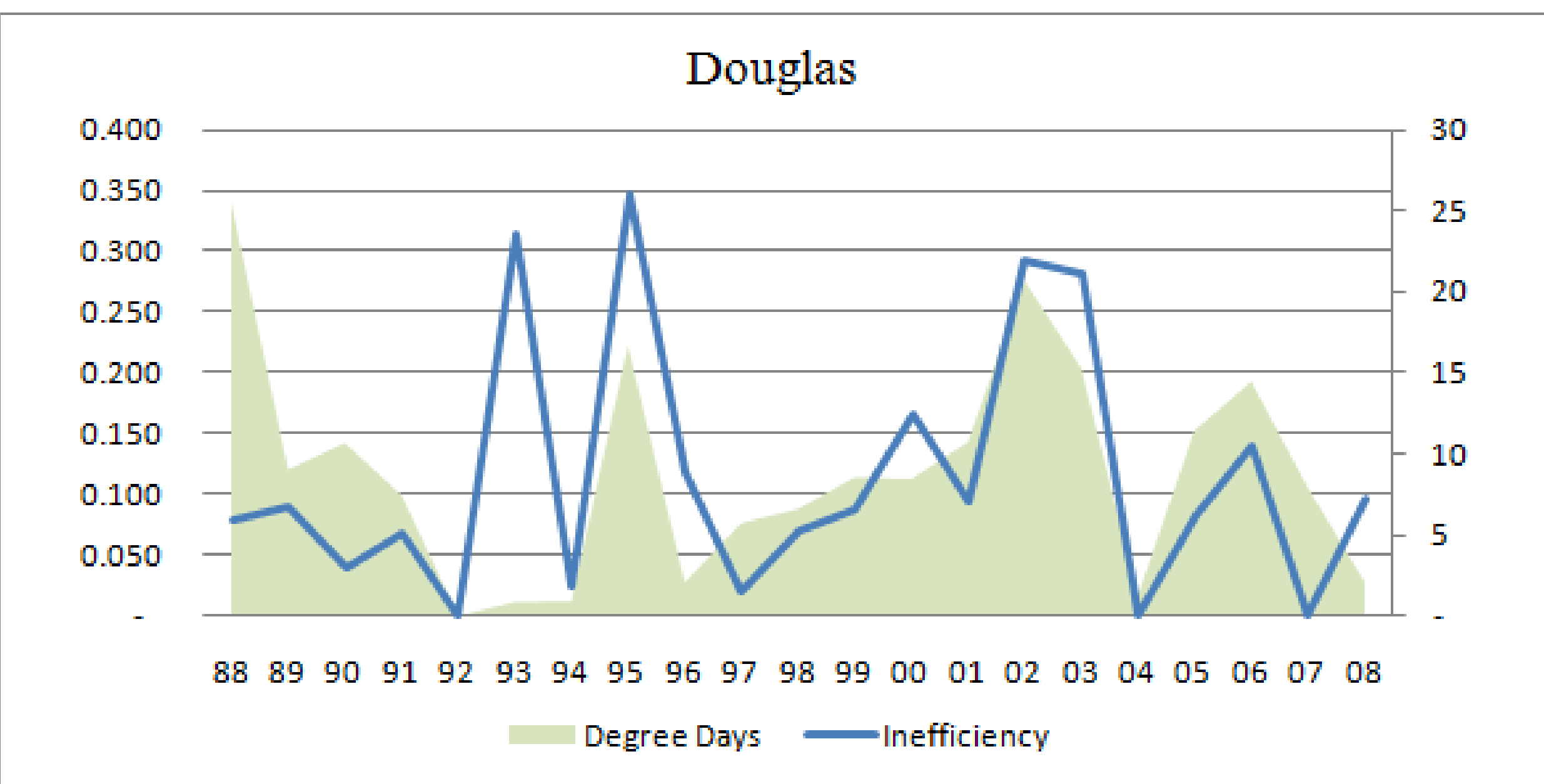
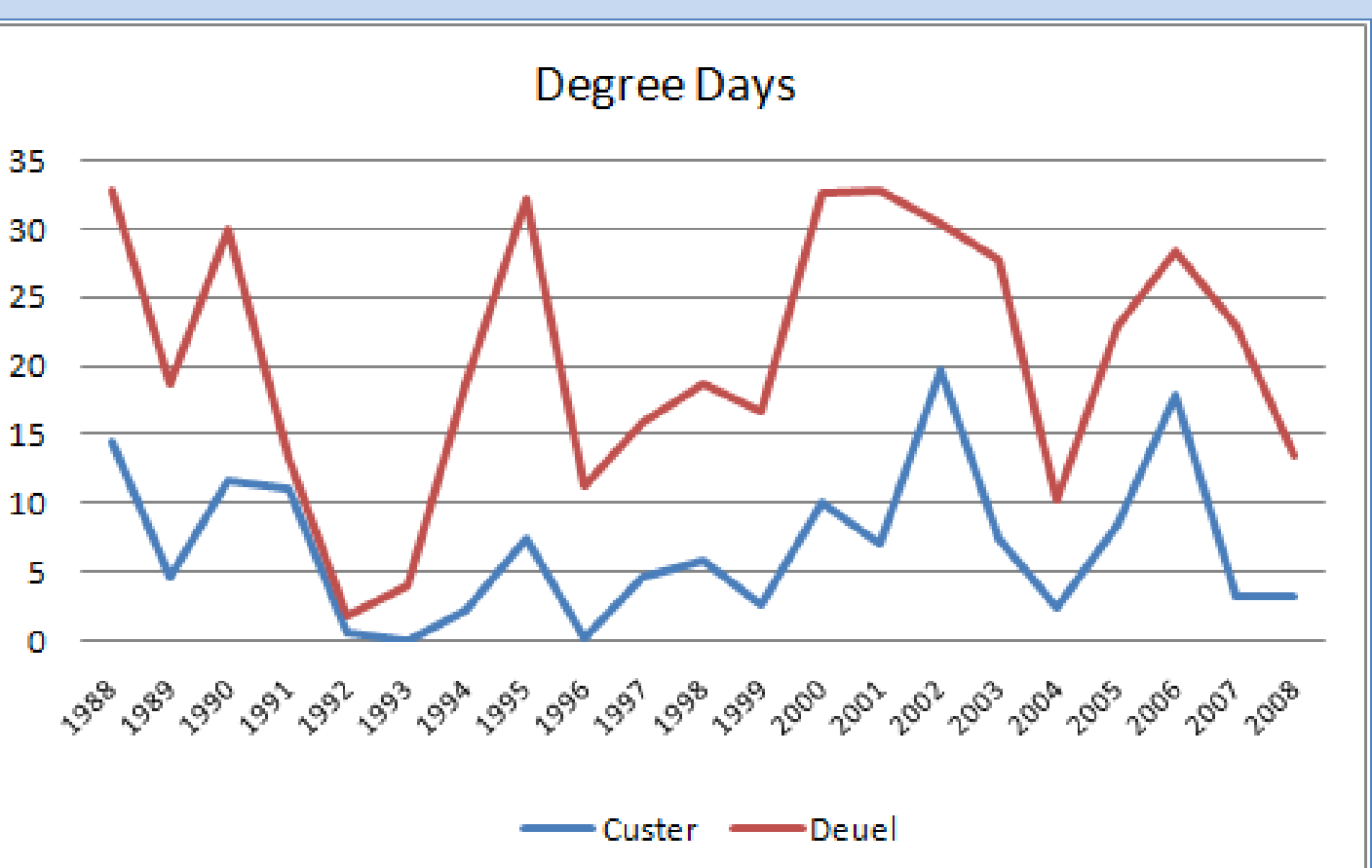
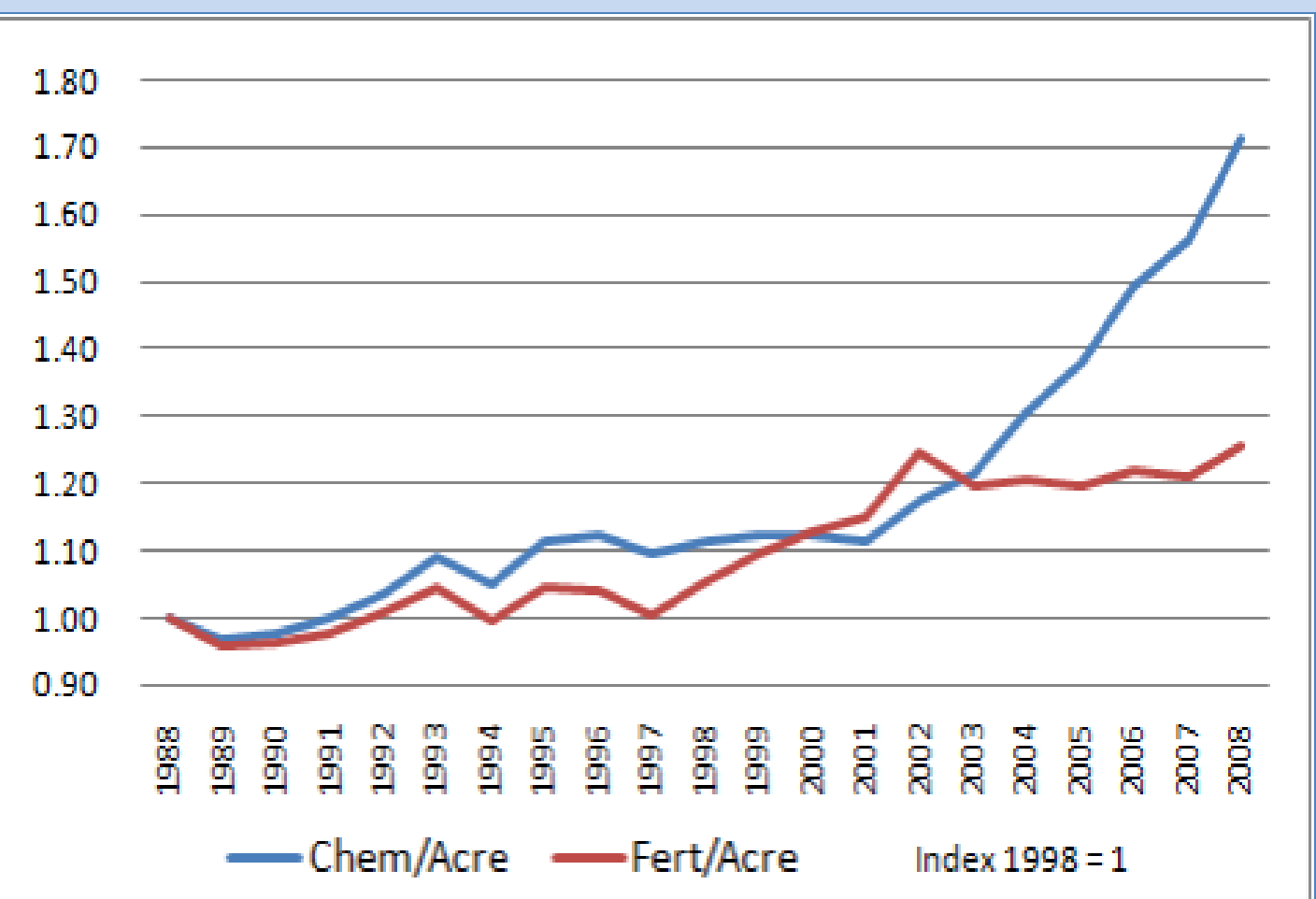
To shed some light over future perspectives of agriculture with a possible different climatic scenario. I studied the impact that high temperatures have over the agricultural sector's performance of counties in Nebraska. I have found that there is an important negative incidence of temperatures over 32° Celsius during the growing season over agricultural performance on most counties.

Method:

The method of analysis is Data Envelopment Analysis (DEA), which I use to infer the boundaries of a possible feasible technology set from the observed points in the data. With this, I estimate a (C,S) Graph Measure of Technical Efficiency (GMTE) for each.

Inputs: Harvested Area, Irrigated Area, Fertilizers, Chemicals, and weather variables (degree days).

Output: biomass production.



County	Biomass	Harv. Acres	Irrig. Harv. Acres	Fert/HarvAcr	Chem/HarvAcr	DDs (Apr/Ago)
Banner	98,488	66,300	8,100	1.34	1.33	5.60
Buffalo	1,105,733	314,600	226,600	3.22	2.16	3.17
Butler	741,895	264,200	112,500	1.88	1.85	1.64
Cheyenne	365,489	222,800	23,900	1.51	1.39	11.60
Colfax	550,826	193,000	64,400	2.09	1.44	1.86
Custer	1,371,651	401,400	221,900	3.39	2.43	3.29
Dawson	1,207,407	310,400	240,800	3.02	1.90	3.14
Deuel	149,071	88,500	2,600	1.71	1.35	13.50
Dodge	692,733	266,000	108,700	2.26	1.71	1.86
Douglas	101,839	51,400	5,600	2.68	2.50	2.17
Hall	894,400	233,600	201,600	3.41	2.05	3.11
Hamilton	1,130,783	292,800	257,700	2.35	2.41	2.65
Howard	543,086	159,800	110,100	3.09	1.76	3.73
Keith	569,170	177,200	75,200	3.33	2.54	10.26
Kimball	165,895	128,200	22,100	1.26	1.46	5.61
Lincoln	1,147,046	356,200	165,400	3.95	2.76	11.39
Merrick	625,559	200,600	173,600	2.98	1.71	2.11
Nance	441,757	141,100	71,700	2.55	1.67	1.93
Perkins	891,040	313,100	107,400	2.65	1.89	11.39
Platte	1,070,181	333,100	198,400	2.60	1.86	1.40
Polk	662,529	217,000	159,000	2.14	1.99	2.32
Sarpy	172,093	72,100	7,400	2.22	2.26	1.85
Saunders	828,263	347,600	99,400	1.39	1.47	2.72
Sherman	440,412	122,700	74,100	2.53	1.66	2.91
Washington	444,589	179,000	9,300	1.52	1.42	1.68

Degree Days:

One DD is defined as one degree above 32° Celsius temperature during 24 hours.

From the 5 closest weather stations to each county a maximum and minimum temperature for each day was estimated.

A single sine wave method was used to estimate how many hours during each day the temperatures were over 32° Celsius

Results:

For most counties, in most years, increases in the degree days are corresponded with increases in inefficiency.

Absolute value of the change in inefficiency will depend on the county.

Counties on the west have higher degree days values but the effects per degree day over inefficiency is smaller than in the east.

Conclusions:

The quantity of days during the growing season where the maximum temperatures were over 32 degrees Celsius (89.2 °F) was found significant to explain decreases in crop yields for most of the counties.

For 14 of the 25 counties analyzed the degree days were found to be very significant to explain inefficiencies on agricultural production.

Further information:

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