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Development of a price visualization procedure of cash grain markets using GIS

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Development of a price visualization procedure of cash grain markets using GIS

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Signatures have been redacted for privacy

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1. GENERAL INTRODUCTION

1.1. The Need for a Price Visualization Tool

Grain merchandisers have known for many years that cash grain prices differ from town to town on any given day. One daily responsibility of the merchandiser is to identify these price differences so that they can purchase grain at the best available price. In Iowa, it has long been noted that the river barge terminal prices for corn and soybeans tend to be higher than prices further away from the Mississippi and Missouri rivers. Furthermore, prices at U.S. export terminals, such as in New Orleans, Louisiana, tend to be higher than average prices in Iowa. Moreover, because transportation costs figure into the price of grain, the distance from the producer to the buyer is an important factor in determining the cash bid. Considering the speed with which grain merchandisers must make purchasing decisions, a means for rapidly visualizing geographic differences in price would be helpful. Furthermore economists have long been interested in supply and demand effects on a local economy. For example, the location of a grain processing plant (demand for grain) would likely have an effect on grain prices in the surrounding area (supply). In this case a benefit to the producer is often seen in that higher prices are offered for their grain. It would be valuable for economists to have a tool to evaluate these observations.

Economists also work in the analysis of production sites and site selection. The consideration of the effect of a large processing plant on local communities is important. Knowledge of the economic value created in one area by a processing plant might be transferred to another area. From the perspective of the processor/buyer, the evaluation of a site should consider the local supply of grain and local price trends. A tool for the geographic visualization of price would be beneficial to economists.

1.2 Purpose of the Study

The purpose of this study was to develop a method that would allow computer visualization of geographic cash price differences. The goal was to provide a unique tool which can be used to derive conclusions that demonstrate the importance of location in grain marketing. This tool was designed to be utilized by grain industry professionals and agricultural economists. In order to be useful, the visualization must be readily available and timely.

1.3 Research Questions

In the course of undertaking this research, several important questions guided the work. Whether:

(a) economic theory corresponds with reality in the grain market,

(b) grain prices show an increasing trend towards the Mississippi and Missouri Rivers,

(c) the effect of the new processing plant and feedlot grain purchasing activity can be detected,

(d) price patterns change over time,

(e) grain movement directions can be identified,

(f) cash grain markets are efficient,

(g) the transportation system in Iowa and in the Midwest is efficient.

1.4 Organization of the Thesis

In Chapter 2, a thorough literature review is provided. This includes a description of the cash grain market, transportation economics theories and an overview of the Geographic Information Systems technology that enabled the construction of the geographic price visualization model. Chapter 3 contains a detailed description of the materials and methods used in constructing the price visualization for Iowa and for the Cornbelt states. Here, data sources, gathering methods and processing methods are discussed. All programs and algorithms used in constructing the model are given with detailed descriptions. A description of the surface maps is given for guiding users in reading the two and three dimensional price maps. In Chapter 4 price maps are used for non-traditional economic analysis and description of grain markets and transportation systems. In the final chapter of the thesis, Chapter 5, an evaluation of the study along with suggestions for continuing this work are given. Price maps discussed in Chapter 4 were enclosed in Appendix IV.

2. LITERATURE REVIEW

2.1 The Cash Grain Market

According to Marshall (1989), cash markets exist where only the buyer and the seller decide the details of the contract. These details include: price; quantity; grade; method, location, and time of delivery; and payment method. Flexibility and informality are important aspects of this market because these enable the parties to agree on contract terms which fit both of their needs. In contrast to futures and forward markets, trades in cash markets are destined for immediate delivery within a few business days through regular business channels. Furthermore, governmental regulation of the cash grain market is minimal.

The cash grain market exists at the level of the country elevator and at some grain processing plants. Here, the manager quotes a daily price which a producer can receive for delivering grain. This daily cash price is derived from the bids received from potential buyers, minus handling, storage and transportation costs. Buyers might include large terminal elevators, processing plants, commercial feedlots or barge line operators who are the direct participants in this market (Chicago Board of Trade, 1990). Buyers make offers considering their need for grain. Transportation costs at the country elevator level depend in a great deal on special contracts between the railroad and the elevator as well (Hanson, Baumel, and Schnell 1989) . Then producers can make important selling and storage decisions about their crop, size of shipment and mode of transportation in anticipation of possible increases or decreases in market prices.

Cash prices differ significantly from location to location. These price differences are mostly due to transportation costs and therefore are a function of distance from the seller to the buyer Ullestad (1996). As a result, sellers at some communities have an advantage (or disadvantage) in terms of location and can receive a higher (lower) price over sellers in other communities. Proximity to railroads effect prices recived by producers also. Research (Hanson, Baumhover, and Baumel 1990) indicates that farmers received higher grain prices as a result of contracts between railroads and country elevators. The exploitation of these price differences is the reason for existence of the grain merchandising industry. (Ullestad, 1996)

2.2 Iowa and Cornbelt Cash Bid Data

DTN (Data Transmission Network) and Farmdayta are two cash bid reporting services widely available in Iowa. According to Cecelia Adamy (1995) DTN, cash bids were collected via phone calls to individual elevators and processing plants in Iowa and other states. DTN and Farmdayata conduct cash bid collecting daily in the late afternoon hours from 2pm to 5pm. Some elevators and processing plants fax their cash bids to DTN and Farmdayta voluntarily. Following this, they process and broadcast cash bids among other important market news through a satellite system to subscribers of the service. Therefore, the bids for that day usually appear on the system in the late afternoon around 5pm. Thus bids were recorded early on the next business day.

2.3 Transportation costs, grain production and the cash grain market

2.3.1 Importance of transportation in the cash grain market

Transportation costs play an important role in the economics of agricultural commodity markets, especially cash grain markets. The greater the distance between the grain producer and the end user, the lower the price received because the cost of transportation must be discounted from the price offered. The highest prices offered should be at the location of the end user.

High shipping (transportation) rates mean higher prices for the goods brought into the market (Locklin, 1972). For the profit maximizing producer, the price offered for delivering grain to any buyer must be high enough to cover costs of production, storage, and transportation expenses and still yield a profit. A producer which must transport grain a distance of 20 miles will receive the same price upon delivery to the processor as someone who must transport grain 80 miles. However, the profit will be greater for the individual delivering the shorter distance.

Theoretically, the price in any market, in time of shortage of local supplies should not rise more than the cost of processing, storage, and transportation. Therefore, a good transportation system lends price stability to most market areas (Sampson et al., 1990). Transportation not only influences the overall price level, it also has a positive effect on prices due to the regional specialization and division of labor. These affects tend to lower prices of goods in the economy. Furthermore, a well developed transportation system opens distant markets for producers and thereby promotes greater competition and broader consumer choice (Lieb, 1985).

2.3.2 Transportation Costs Considered as a Unit Tax

Transportation costs can determine the total quantity of goods sold, the price of these goods and the spatial distribution of the output, assuming the locations of the seller and buyer are known. Button (1993) developed a simple supply-demand framework which considers the transportation costs as a unit tax. Here, demand for transportation is a result of the demand for the final product, assuming both the supply and demand curves are linear. In this model (modified here to apply to the grain market), a producer grows a homogeneous product and supplies a single customer who is located some distance from the producer. In this model, P_S is the supply price of the commodity; P_D is the demand price of the commodity; Q_S is the quantity of the commodity supplied; Q_D is the quantity of the commodity demanded; and P_t is a constant transport cost per unit carried to the customer and treated as a cost borne by the supplier. Hence, he model is:

$$S = a_0 + a_1Q_S + P_t \quad (2.1)$$

$$D = b_0 - b_1Q_D \quad (2.2)$$

$$Q_D = Q_S \quad (2.3)$$

$$P_D = P_S \quad (2.4)$$

Thus the profit maximizing supply, Q_E is,

$$Q_E = (b_0 - a_0)/(a_1 + b_1) - Pt/(a_1 + b_1) \quad (2.5)$$

and the equilibrium price P_E would be:

$$P_E = (a_1\, b_0 - a_0\, b_1)/(a_1 + b_1) + b_1\, P_t\, /(a_1 + b_1) \quad (2.6)$$

If transport cost P_t is non-zero, it has a negative effect on the output of the profit maximizing firm. It decreases the ideal output by $Pt/(a_1+ b_1)$. The transport cost component on the other hand increases price P_E, which should be charged to the customer. The effect of price increase to P_E, together with the effect of transportation cost on Q_E are illustrated in Figure 1. Here, the vertical axes represents the price per unit paid by the customer and the horizontal axes the quantity if goods sold. The introduction of transportation cost shifts the supply curve from S_1 to S_2. It can be seen from the figure, that as transportation cost increases, quantity sold decreases. The figure also illustrates who will pay the transportation cost. The exact impacts however, will depend on the elasticity's of supply and demand.

2.3.3 Price sensitivity effects

If grain supply (corn and soybeans) in Iowa is assumed to be price sensitive this tax would be paid partly by the producer and partly by the buyer. The more inelastic the grain supply is the more of this cost burden is carried by the grain producers. The relative sizes of these payments are illustrated in Figure 1 as shaded areas. Assuming grain supply S is the total quantity of corn and soybean produced in Iowa and since corn and soybeans are the primary crops produced in Iowa, the total quantity produced is relatively constant (assuming year-to-year and place-to-place yields of corn and soybeans do not change). If we assume the total grain supply (corn and soybeans jointly) in Iowa being perfectly insensitive to prices, the producer would carry the burden of all transportation costs by receiving significantly lower

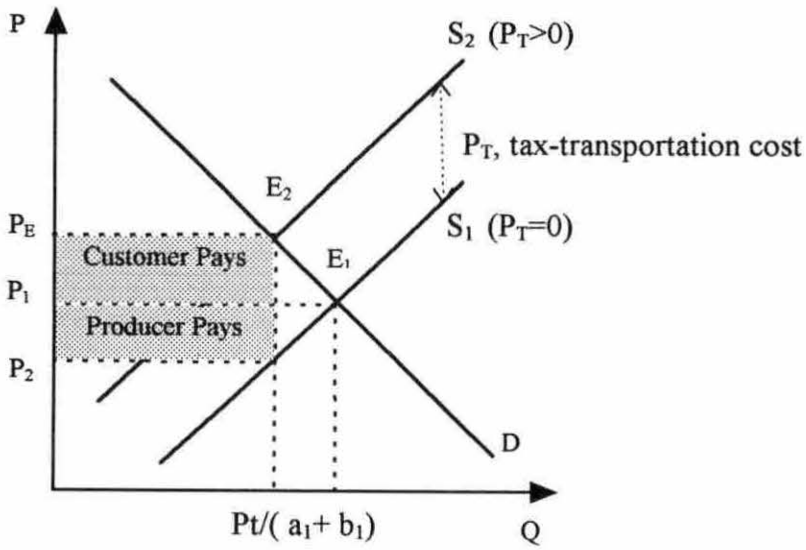


Figure 1. Effect of unit tax as transportation cost on price and output

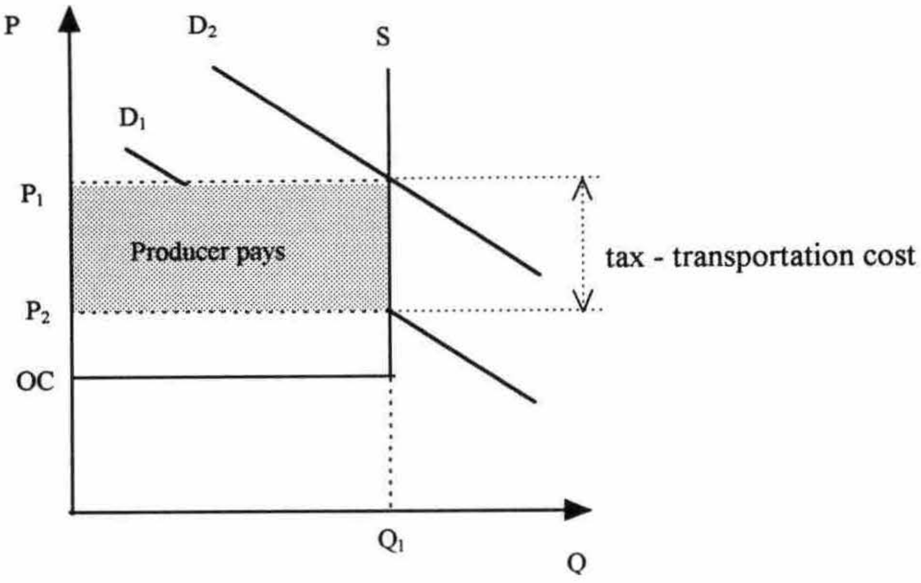


Figure 2. Perfectly price sensitive supply

prices for his grain. This is shown in Figure 2, where the grain demand decreases from D_1 to D_2. The producer would decide to grow either corn or soybeans depending on which one was more profitable. He would do so until the received price would cover the opportunity costs of production (OC).

Moreover, due to the price insensitive supply, any demand change would be absorbed by the producer alone. If the demand for grain would decrease, only the producer would suffer from the resulting lower prices. Respectively, any demand increase would benefit only the producer. The effect of this was seen the recent 1996 spring and summer when corn and soybean prices reached record highs - prices were high because grain demand was high and carryover stock was low.

2.3.4 Theoretical transportation cost model

To estimate the market area served when producers are spread evenly around the processing plant or grain elevator it is necessary to assume that identical producers are located equal distances along a straight road from the production site to the buyer. The suppliers will receive prices which are composed of a fixed price and a variable transport cost dependent upon the distance they are located from the buyer. Since each supplier - by assumption -

exhibits a similar supply response it is, therefore, the transport component which determines the amount each producer will supply. At the outer limit of the buyer's market area, the amount supplied by the marginal producer vanishes to zero (this will be when $P_T = b_0 - a_0$). If j producers supply before this limit is reached, then from equation 2.5, the total quantity supplied Q_T to the buyer (grain processor, country elevator) will be:

$$Q_T = \sum_j Q_{Ej} = j\left[\frac{b_0 - a_0}{a_1 + b_1}\right] - \left[\sum_j P_{Ej}\left[\frac{1}{a_1 + b_1}\right]\right] \tag{2.7}$$

where Q_{Ej} represents quantity supplied by producer j and P_{Ej} represents the equilibrium price received by supplier j.

This approach can be extended to show the entire geographical area which supplies a grain processing or grain elevator firm and is shown in Figure 3. While this approach was developed in Button (1993) for one producer and many customers, as was demonstrated it is applicable for a model of many producers and one customer. However, this approach is also theoretical and relies upon many abstractions from reality, it can be proven empirically using tools developed in this thesis.

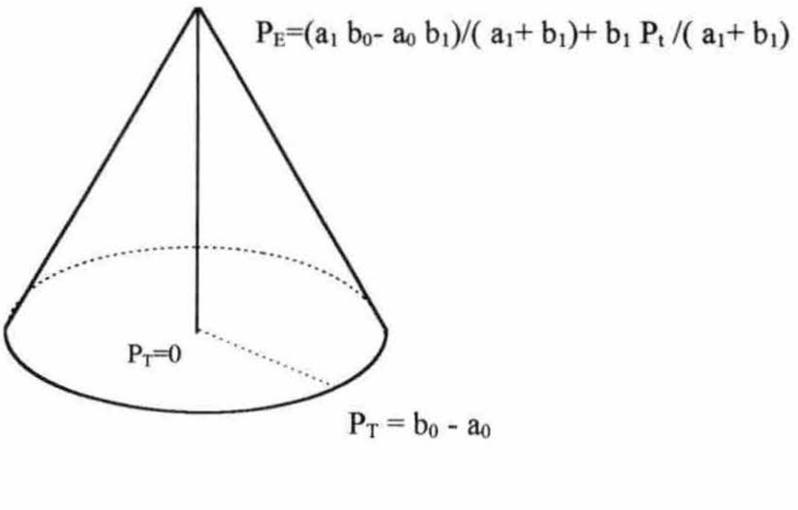


Figure 3. The influence of transportation costs on market area

2.4 Geographic Information Systems (GIS)

Knowing the spatially extensive, land based nature of agriculture, and the existence of both environmental and socio-economic networks, there is a great opportunity for agricultural economists to exploit the advantages of Geographic Information Systems (GIS) and apply traditional theoretical and empirical models. The first GIS were developed in the middle 1960s by governmental agencies in response to a new awareness and urgency in dealing with complex environmental and natural resource issues. Geographic information has two basic components. These are: (a) the actual phenomenon or characteristic (the variable, its classification, value, name, etc.) and (b) its spatial location. A third characteristic which is particularly relevant to GIS is the characteristic of time. Effective spatial data management requires that location data (i.e. town point coordinates) and nonlocational data (i.e., corn prices at those towns) be independent of one another. In other words attributes can change character over time but retain the same spatial location. (Star and Estes, 1990)

According to Peuquet and Marbel (1990) there are three basic notations used for representing the spatial location of geographic phenomena: points, lines and polygons. Points, lines and polygons are most commonly defined on maps using x-y Cartesian coordinates (longitude-latitude) based on the principles of Euclidean geometry. An alternative method is the use of topological quoting, which defines a location of geographic phenomena relative to other phenomena, but does not require the use of the concept of distance in defining these relationships. A second technique which also applies some of the relationship principles, involves the use of a grid mesh to define a regular but arbitrary polygon framework for representing geographic data. It uses an i, j matrix for representing variations of geography to the computer (Fotheringham and Rogerson, 1994). Availability and gathering of data are the most crucial parts of modeling with GIS. In order to successfully construct a Digital Elevation Model (DEM) of agricultural commodity prices several essential elements are needed. These are (a) regularly or randomly distributed spatial price data and (b) geographical coordinates of reporting locations. Since all GIS software's are based on two dimensional data models where the third dimension "z" coordinates are attributes, the reporting location "x, y" coordinates will be embedded in the system and the elevations "z" coordinates will be added later as attributes.

The data of this type is non-typical for economists who are accustomed to analyzing time series data from few locations or averages from several locations. Most of the time they search for relationships over time and not over space. Spatial relationships are the study area of spatial statistics and spatial econometrics where GIS is fully utilized.

Moxey (1996) defines GIS as computer software packages designed to deal with spatially referenced datasets. For example river networks, transport networks or population densities. GIS are ideally suited to the visual display and modeling of spatial datasets. Another possible application of GIS may be in combining various spatial datasets to enhance researchers abilities to model agricultural land use change. GIS also offers good opportunities for disseminating research results to non-experts. However, as with any spatial statistical analysis, users of GIS need to be alert to possible dataset problems. These could be spatial autocorrelation due to neighboring sites influencing each other, spatial non-stationarity due to geographical variation (spatial heterogeneity), and scale effects due to variation in aerial units for which different variables are recorded and reported (spatial aggregation). Additionally there may be problems with GIS displayed information and resulting interpretation. In particular, analytical inadequacies may be disguised by impressive graphics.

Bateman, et al. (1996) used GIS to measure travel time and distance to provide a more accurate and realistic basis for valuation. Jain, et al. (1995) used GIS for designing a spatial decision support system for planning sustainable livestock production sites. They intend to demonstrate the use of GIS taking into account several environmental, aesthetic, and economic constraints.

3. MATERIALS AND METHODS

3.1. Materials

Computer hardware and software that were used during the completion of this study are listed below. These will be referred to in the Methods section which follows.

3.1.1. Computer hardware

a) Generic portable laptop compatible personal computer

b) Data Transmission Network (DTN) terminal

c) Farmadayta analog computer terminal

d) DEC workstation

e) Color printer

f) Null modem cable

3.1.2. Computer software

a) Procomm communication software (Datastorm, Columbia, MO)

b) Instant Access (1990-5, Advanced Marketing Systems, Manhattan, KS)

c) Microsoft Excel 5.0 (Microsoft Inc, Seattle, WA)

d) ARC/INFO (1990, Environmental Systems Research Institute, Inc., Redlands, CA)

e) XESS (spreadsheet program available on the Vincent Network at Iowa State University, Ames, IA)

3.2. Methods

There are five main activities required for taking the cash price data from Iowa to the final price maps. These are: (a) collecting of data, (b) editing the data, (c) developing procedures for mapping, (d) running the ARC/INFO macro with the data, and (e) plotting of price maps.

3.2.1. Collection of data

This section will describe the steps taken in obtaining the locational cash bids and the ARC/INFO base coverages.

3.2.1.1 Collection of cash bids

The daily cash bids for different elevators were gathered by two corporations: DTN and Farmdayta. These companies gather the cash bids and report them daily on their analog computer terminals but do not record them for further use. After broadcasting, the data are not retrievable anymore. Data collection was carried out daily from the middle of July 1995 until the end of November 1995. The period from December 1995 through July 1996 was recorded irregularly. The data set used in this study is unique because this data are not recorded at any other location. A newspaper publishing company recorded similar price and location information daily for the past three years, but the format and completeness of that recording is not known. The complete data set is included in Appendix I on a computer disk.

Due to the large number of data involved, the data recording process was partly computerized and automated. A laptop personal computer and the Farmdayta unit were connected through their serial ports with the use of a null modem cable. Communication parameters were set to the standard 9600,8,n,1. The Farmdayta units required serial port activation by the sender and Instant Access software. This software allows the user to save information displayed on the screen as an ASCII text file (each screen saved as a different file). An example of this format is shown in Table 1 of Appendix I. Detailed instructions about serial port activation and downloading can be found in the users manual accompanying Instant Access software.

The DTN unit enables users to download pages from the screen to a single ASCII text file. Any communication program can be used; for this work Procomm was used. An example of the ASCII text format is shown in Table 2 of Appendix I. DTN data was also downloaded to a laptop computer through the null modem cable. Change of the system setting to serial port and ASCII dump printer type was required. The communication parameters were again set to standard 9600,8,n,1.

3.2.1.2 Obtaining ARC/INFO base coverages

In order to display the price reporting towns, a point coverage with digital coordinates of the towns was needed. A comprehensive digitized map of all towns in Iowa was obtained through the Internet (http://www.igsb.uiowa.edu/htmls/nrgis/gisstate.htm in data interchange places.e00 format).

The PLACES coverage was imported from the places.e00 file into Arc using the IMPORT command. The plot of this coverage can be found in Appendix II as "Plot of all populated places, railroad lines and counties in Iowa". Attribute items in the PLACES.PAT file are described in Table 1. The town names are stored in the item named NAME_CAPS, therefore this item name will be adopted for use in this study.

Table 1. PLACES.PAT attribute items and their descriptions

COLUMN	ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC
1	AREA	4	12	F	3
5	PERIMETER	4	12	F	3
9	PLACES#	4	5	B	-
13	PLACES-ID	4	5	B	-
17	PLACE_NAME	30	30	C	-
47	NAME_CAPS	30	30	C	-
77	OTHER_NAME	22	22	C	-
99	CO_NAME	14	14	C	-
113	CO_SEAT	1	1	C	-
114	QUAD_NAME	34	34	C	-
148	TYPE	4	4	I	-
152	X_COORD	4	12	F	3
156	Y_COORD	4	12	F	3

3.2.1.3 Obtaining cash bids and Arc/Info base coverages for the Cornbelt

The collection process for the Cornbelt states was similar to the Iowa price collection methods. However, bids were only available from DTN. These were downloaded in the same fashion as the Iowa bids (Section 3.2.1.1). A sample ASCII page can be found in Table 3 of Appendix I. The comprehensive coverage containing town names, zip codes and locational coordinates was obtained from the Internet (http://tiger.census.gov/places.html in ASCII text format). Complete details and coverage metadata can be found in Appendix II. The ASCII file obtained from the Web site was imported to ARC/INFO as BPLACES coverage using the GENERATE command as listed below.

```
Arc: generate bplaces
Copyright (C) 1982-1995 Environmental Systems Research Institute, Inc.
All rights reserved.
GENERATE Version 7.0.3  (Mon Mar 13 22:21:55 PST 1995)
Generate: input /afs/..path../bplaces.csv
Generate: points
Creating points with coordinates loaded from /afs/..path../bplaces.csv
Generate: quit
Externalling BND and TIC...
To create coverage topology:
Arc: build bplaces point
```

The coverage obtained from the above process is in geographic projection which is not consistent with previously used Universal Transverse Mercator (UTM) geographic map projection. Therefore, the projection was changed using the PROJECT command. For a detailed description of the command subsystem refer to ESRI (1992). The GENERATE command imported the BPLACES coverage. Zip codes (ZIP) served as "ID" numbers. The digital coordinates were embedded in the system. Town names and state codes were added as attribute items from a lookup table containing names, state abbreviations and zip codes, where zip codes served as the primary key. The plot of the BPLACES coverage can be found in Appendix II as "Populated places in the Cornbelt states".

3.2.2. Editing of data

ARC/INFO software requires ASCII data files to be in comma delimited format. Therefore, editing of the "raw" downloaded DTN and Farmdayta data was required. This was accomplished with the use of Microsoft Excel. The relevant data from BNS (soybeans) and CRN (corn) columns were copied into a more accessible tabular database format organized based on date and town name in an alphabetical and chronological order as can be found in Table 2. The NEW columns contain bids for the new crop, i.e., expected future prices. The complete dataset can be found in the enclosed disk in Microsoft Excel spreadsheet format.

When price bids for corn and soybeans for various days were edited and organized on separate spreadsheets, the files were saved is a comma delimited format (CSV file). One problem arose from this for the case of two word character items without specific text

Table 2. Sample spreadsheet format of edited corn price data

NAME	14-Jul95	15-Jul95	16-Jul95	17-Jul95	....	19-Jul96	23-Jul96	25-Jul96	30-Jul96
ADAIR	268	273	267	269	....	428	416	416	423
ADEL	261	267	263	267	....	435	429	419	425
AKRON	259	264	260	264	....	424	420	408	414
ALBERT CITY	258	262	256	259	....	0	0	0	0
....	....	....	....	....	....	....	....	....	....
WOODBINE	266	272	268	271	....	0	0	0	0
WOODWARD	259	264	260	266	....	429	421	411	418
WOOLSTOCK	0	0	0	0	....	430	419	408	423
YALE	260	267	263	266	....	427	427	408	419

qualifiers. For two word town names such as Cedar Rapids, ARC/INFO requires a format like "Cedar Rapids", which cannot be generated from Microsoft Excel. Therefore, the CSV files were imported into a UNIX operating system based spreadsheet program, XESS. Upon saving, this program adds quotation marks to the character items. The quatation marks define characters in the process of data importing to ARC/INFO (format shown in Table 3 of Appendix I).

The editing process for the corn belt states is similar to process described above. However, due to the larger number of towns and states, the data were organized based on state names and recording dates in Microsoft Excel. The complete Cornbelt price dataset is included in the enclosed computer disk in Appendix V. Due the occurrence of certain town names in more than one state an additional column was used to distinguish them from each other by their U.S. Postal Service state code.

The Cornbelt BPLACES coverage was customized to fit the needs of this study. Towns not from the corn belt region were deleted using Arcedit. The remaining states include Iowa, Minnesota, Nebraska, Missouri, Illinois, Indiana, Ohio, Wisconsin, Michigan. The components of the BPLACES.PAT file are shown in Table 3.

Table 3. Items and descriptions of the BPLACES.PAT file

COLUMN	ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC
1	AREA	4	12	F	3
5	PERIMETER	4	12	F	3
9	BPLACES#	4	5	B	-
13	BPLACES-ID	4	5	B	-
17	NAME	25	25	C	-
42	STATE	2	2	C	-

3.2.3. Development of the map generating procedure

This phase was completed in several steps.

Step 1a: Development of lookup tables for Iowa prices

Six lookup tables were created containing daily Iowa corn prices, daily Iowa soybean prices, weekly averages of daily Iowa corn prices, weekly averages of daily Iowa soybean prices, Cornbelt states monthly averages of daily corn prices and corn belt states monthly averages of daily soybean prices. These lookup tables were called DCORN.LUT, DBEAN.LUT, WCORN.LUT, WBEAN.LUT, BCORN.LUT and BBEAN.LUT, respectively. The first letters "d", "w" and "b" are global variables and their importance is explained in Section 3.2.4. The weekly or monthly prices are arithmetic averages of the daily price bids on that week or month.

ARC/INFO imports a columnar ASCII data file into its database structure so that columns are items. Therefore, a database structure needs to be defined in ARC/INFO for correct data importing. Prices for individual days were stored in five-character-long strings. The first three characters indicate the month and the last two indicate the day. For example, November 6th is stored as NOV06. The dates in 1995 were stored in five character items, but in 1996, year characters were added. For example July 30, 1995 was stored as JUL30 and July 30, 1996 was stored as JUL30-96. In the case of weekly price items, the first character was always "w", the next two characters were the year, the last two were week numbers in that year. The lookup table format used in this research is shown in Table 4. The lookup tables

Table 4. Format and name of lookup tables

Lookup Table	Town name items	Date items				
DCORN.LUT	*NAME_CAPS*	JUL14	NOV06	"	"	JUL30-96
DBEAN.LUT	*NAME_CAPS*	JUL14	NOV06	"	"	JUL30-96
WCORN.LUT	*NAME_CAPS*	W95-33	W95-43	"	"	W96-33
WBEAN.LUT	*NAME_CAPS*	W95-33	W95-43	"	"	W96-33

were defined in the TABLES subsystem of ARC/INFO. The following example illustrates commands for defining a lookup table for daily corn prices for the period from July 14, 1995 through July 14, 1996:

```
DEFINE DCORN.LUT

NAME_CAPS,25,25,C

JUL14,5,5,I
JUL14,5,5,I
:
JUL10-96,5,5,I

JUL14-96,5,5,I
```

Import of the tabular data into the INFO database was completed by using the following commands:

```
SEL DCORN.LUT

ADD FROM  /..whole path/DCORN.CSV

SEL DBEAN.LUT

ADD FROM  /..whole path/DBEAN.CSV

SEL WCORN.LUT

ADD FROM  /..whole path/WCORN.CSV

SEL WBEAN.LUT

ADD FROM  /..whole path/WBEAN.CSV
```

At this point the town names were in item NAME_CAPS and the cash bids for different dates were in the corresponding date items.

Step 1b: Development of lookup tables for corn beltprices

Lookup tables for Cornbelt prices had similar database structure as lookup tables for Iowa prices. However, some town names occurred in more than one state, therefore state and Zip Codes were used for complete identification. The format for the lookup table used in this

Table 5. Lookup tables containing corn belt prices

Lookup table	Zip codes	Town names	State code	Date item	Date item
BCORN.LUT	ZIP	NAMES	STATE	AUG	SEP
BBEAN.LUT	ZIP	NAMES	STATE	AUG	SEP

research is shown in Table 5. Data were imported to the lookup table in a same manner as described in Step 1a.

Step 2a: Town selection and linking for the Iowa price maps

Although digital coordinates for 2346 Iowa towns were available, only 240 town names and their coordinates were needed. In order to select the appropriate town coordinates from the PLACES coverage, based on price availability for a particular town, a PRICE item was added to the .PAT file of the PLACES coverage in the TABLES subsystem. This was accomplished in the following manner:

```
ENTER COMMAND: SEL PLACES.PAT

ENTER COMMAND: ADDITEM PLACES.PAT PRICE,5,5,I
```

Since the INFO database has a relational structure that allows linking of databases, a relation was created to link the PLACES. PAT file with the lookup tables containing town names and prices. Four relations were created and saved under the following file names: DCORN.REL, DBEAN.REL, WCORN.REL, WBEAN.REL, following similar naming protocol as described in section 3.2.3. Step 1a. The following commands were used to create a relation for daily corn prices:

```
ENTER COMMAND: SEL PLACES.PAT

ENTER COMMAND: RELATE ADD

RELATION NAME: DCORN.REL

TABLE IDENTIFIER: DCORN.LUT

DATABASE NAME: INFO
```

```
INFO ITEM: NAME_CAPS
RELATE COLUMN: NAME_CAPS
RELATE TYPE: LINEAR
RELATE ACCESS: RO
ENTER COMMAND: RELATE SAVE DCORN.REL
```

After the relation links have been established the INFO database is instructed to put the prices from the lookup tables to the PLACES.PAT file PRICE item based on the primary key NAME_CAPS. If a town's name in the comprehensive PLACES coverage does not have an identical pair in the appropriate lookup table, a value of zero was assigned to the PRICE attribute item of that record. The following example demonstrates that corn prices from November 6th will be assigned based on the saved and restored relational link in the selected PLACES.PAT file:

```
ENTER COMMAND: SEL PLACES.PAT
ENTER COMMAND: RELATE RESTORE DCORN.REL
ENTER COMMAND: CALC PRICE = DCORN.REL//NOV06
```

The assignment of price values is a time consuming operation. For the Iowa maps it can take from 2 to 10 minutes to process, for the Cornbelt maps at least 2 to 4 hours depending on the number of CPU intensive jobs on the workstation.

Step 2b: Town selection and linking for the Cornbelt price maps

As mentioned earlier, identical town names occurred in different states. Therefore, town names could not be used as the primary key to create a link between BPLACES.PAT and the lookup tables containing prices for the Cornbelt maps. Zip codes were used instead as a primary key since they are different for different U.S.towns. The relational link connecting databases was established in the following manner:

```
ENTER COMMAND: SEL BPLACES.PAT
ENTER COMMAND: RELATE ADD
```

```
RELATION NAME: BCORN.REL

TABLE IDENTIFIER: BCORN.LUT

DATABASE NAME: INFO

INFO ITEM: BPLACES-ID

RELATE COLUMN: ZIP

RELATE TYPE: LINEAR

RELATE ACCESS: RO

ENTER COMMAND: RELATE SAVE BCORN.REL
```

After the relational link has been established, the next procedures were the same as in the case of Iowa maps described in Step 2a.

Step 3: Town selection and coverage editing

In this step the ARCEDIT subsystem of ARC/INFO was utilized to select and delete towns that contain zero values in their price attribute item. The remaining towns with price data were saves as a new coverage in a different workspace (directory). This was accomplished in the following manner for November 6th corn prices:

```
Arcedit: ec places

Arcedit: ef point

Arcedit: sel price = 0

Arcedit: delete

Arcedit: save /home/cornbelt/places/places.com.date/places.nov06corn
```

Step 4: Generating floating point grids

The GRID module of ARC/INFO was used to create floating point grids based on a digital elevation model (DEM) from the edited PLACES coverage. The price attribute item values served as the "z" coordinates for the DEM. The process divided the state of Iowa into gridcells with size 1500m x 1500m. The values at gridcells that did not contain town coordinate points were interpolated based on a sample of the four closest points using the inverse distance weighting (IDW) technique. For better visualization the grid cells that lie outside of the state boundary were assigned values of zero . The following commands were used to generate the floating point grids:

```
Grid: nov06corn = idw(/.../PLACES.nov06corn,price,#,2,sample,4,#,1500)

Grid: setwindow BORDERGRID

Grid: setmask   BORDERGRID

Grid: nov06corng = con(isnull(BORDERGRID),0,nov06corn)

Grid: kill nov06corn
```

3.2.4. Running the ARC/INFO macro with the data

An Arc Macro Language (AML) program was developed to automate the process of map creation. Gnerally, AMLs provide high-level, algorithmic language for full-programming capabilities and a set of tools for building menus to tailor user interfaces for specific applications. The AML program utilizes several modules of ARC/INFO in the following sequence: TABLES, ARCEDIT, GRID, ARCPLOT. The use of global variables allowed the process to run automatically and to sequentially call the databases, lookup tables, coverages, edited PLACES coverages and grids. Furthermore, they allowed for organization of the plotted maps and Postscript files. For example global variable %.date% was used to define dates, %.com% was used to define the studied commodity (corn or soybean), and %.type% was used to define the type of data (daily, weekly or monthly cornbelt prices).

The following example demonstrates the creation of a daily corn price map for November 6th, 1995. In this case the global variables were arranged as: %.date% = nov06, %.com% = corn and %.type% = d. The following map.aml macro serves as a routing program executing several subprograms in ARC/INFO:

```
&echo &on

ws /home/konkoly

/* SETTING GLOBAL VARIABLES FOR DATE, COMMODITY, TYPE
```

```
&sv .date = nov06
&sv .com  = corn
&sv .type = d
/* ENETERING TABLES FOR RELATE AND TO CALCULATE PRICE ITEM
&r tables-map.aml
/* ENTERING ARCEDIT TO SELECT THE APPROPRIATE PLACES
&r ae-map.aml
/* ENTERING GRID TO CREATE THE APPROPRIATE GRID
&r grid-map.aml
/* IN ARC AGAIN
ws /home/konkoly
&echo &off
&return
```

Sections 3.2.4.1-3 include all the AMLs developed in this research. The subprograms are listed in the order of execution.

3.2.4.1. tables-map.aml subprogram

```
/* ENTERING TABLES TO CALCULATE PRICE ATTRIBUTE VALUES
ws /home/cornbelt/places
tables
select places.pat
/*CHOOSING THE APPROPRIATE RELATE FOR CORN OR BEAN
relate restore %.type%%.com%.rel
calc price = %.type%%.com%.rel//%.date%
sel
q
ws /home/konkoly
```

```
&return
```

3.2.4.2. ae-map.aml subprogram

```
/* Entering Arcedit to select the appropriate places
ws /home/cornbelt/places/places.com.date/
&if ( [exists places.%.date%%.com% -cover] ) &then &do
&type Coverage, places.%.date%%.com% , exists. Deleting ...
kill places.%.date%%.com%
&end
ws /home/cornbelt/places
ae
/*add %.type% for places if doing cornbelt
ec places
ef point
sel price = 0
delete
/*add %.type% for places if doing cornbelt
save /home/cornbelt/places/places.com.date/places.%.date%%.com%
quit
ws /home/konkoly
&return
```

3.2.4.3. grid-map.aml subprogram

```
/* ENTERING GRID TO CREATE THE APPROPRIATE GRID
&echo &on
/*&sv .date = nov
/*&sv .com = bean
ws /home/cornbelt/grids
```

```
&if ( [exists %.date%%.com%g -grid] ) &then &do
&type Grid, %.date%%.com%g already exists. Deleting ...
kill %.date%%.com%g
&end
grid
&type Performing IDW
/* add %.type% for cornbelt maps.
%.date%%.com% =       idw(/home/cornbelt/places/places.com.date/
                PLACES.%.date%%.com%,price,#,2,sample,4,#,1500)
/*setwindow /afs/iastate.edu/users/03/02/konkoly/BORDERGRID
setmask   BORDERGRID
&type Performing Condition Statement
%.date%%.com%g = con(isnull(BORDERGRID),0,%.date%%.com%)
kill %.date%%.com%
ws /home/konkoly
quit
&echo &off
&return
```

3.2.5. Plotting of price maps

Two standard plotting programs were used to generate maps and save them in Postscript format. They were modified to generate two- and three-dimensional maps and therefore, named as 2-dgridplot.aml and 3-dgridplot.aml. Programs can be found in Appendix III. Plotting sources were the grid coverages of the corn and soybean prices generated by using the GRID module (see Step 4 in section 3.2.3).

Remap tables were used to represent ten cents intervals with different colors on the plotted surface. The remap tables contain the interval and a color code from the ARCPLOT colorshades set. The remap tables used for corn and soybean prices are shown in Table 1 of Appendix III. These legends of price intervals and color codes are displayed at the bottom of the page on the three-dimensional maps. Cornlegend.aml and beanlegend.aml, summarized in Table 2 of Appendix III, were used to create the legends which help viewers understand and interpret the maps. Seperate legends and global variables were used for the corn and soybean price maps

3.2.5.1. Components of three-dimensional maps

The three-dimensional price surface is in the center of the page. Here, the surface image was enhanced by fishnet lines where the actual distance between the lines is 5 km. Blue dots on the surface map represent the major corn markets. For the Iowa and Cornbelt price maps, these markets are at Des Moines, Edyville, Cedar Rapids, Clinton, Dubuque, Keokuk, Council Bluffs and Sioux City. Some of these locations are not observable on the surface map because they may be behind a "price mountain".

The absolute price differences were relatively small in comparison with the absolute geographical distance differences. This was compensated for by multiplying the *z* values by six and setting the zscale at 600 (detailed description of the zscale function can be found in ESRI, 1992). The surface options were further set for a view from the South (azimuth 180 degrees) from a distance of 450 kilometers at a 13 degree angle. These settings are always displayed in the third line of the price map title. The first line of the msp title is the date and commodity; the second line gives the minimum, maximum price, average price and standard deviation of prices for the displayed day. Furthermore standard deviation of prices is also included in the title. These values can be easily obtained by using the DESCRIBE command in the GRID module that displays the contents of the ***.STA files.

The legends at the bottom of the page contain price intervals in cents followed by the color representation of price levels. For example, on the November 6th corn price map, line "290-300: Red" means that over the region plotted by red, prices were between $2.9 and $3.0

dollars (290 and 300 cents). For the 1995-96 crop year an unusually wide spread in the price of corn and soybeans was observed. Because it was not possible to format the legend to include only the prices needed for the map, the legend had to contain the entire price scheme for the whole crop year. Therefore, the legeng ranged from $2.3 to $5.4 for corn prices and from $5.2 to $8.2 for soybean prices.

3.2.5.2. Components of two-dimensional maps

In order to enhance the interpretation of the two-dimensional maps, county boundary lines, railroad, major grain markets, and all the price reporting elevators were added to the map after the prices have been plotted. The railroad and county coverages were obtained from the Iowa State University GIS Research and Support Facility database. The metadata describing the coverages can be found in Appendix IV. However, the railroad coverage needed to be edited. The coverage contains railroad lines for the whole United States as of 1978. Since that time many railroad lines were discontinued. Thus, based on the recent 1995 railroad map (enclosed in Appendix IV) obtained from the Department of Transportation, the coverage was manually edited and the discontinued lines were deleted. The blue dots signifying major grain markets as described in Section 3.2.5.1 are also shown on the two dimensional price maps.

4. RESULTS AND DISCUSSION

4.1 Reading price maps

The price surface maps convey important information about cash grain markets by utilizing a non-conventional way of displaying economic data. The user of the map must understand how to read it in order to identify the important points. Some aids have been provided for reading these maps. On the two- and three-dimensional maps, different colors were used to represent price levels. The colors which represent price intervals are explained in the legend which is located at the bottom of the three-dimensional maps. Large blue dots can be seen on both the two- and three-dimensional Iowa and Cornbelt maps for indication of the major Iowa grain market locations (described in section 3.2.5).

4.2 Price differences

The price difference for a given day can be calculated in two ways. The first method is to subtract the minimum price from the maximum price; this information is given in the title of the maps. Another way of calculating the price difference is to count the number of different colors on the map. This provides a rapid way for determining the approximate difference because each price interval can be easily seen on the map. Each color represents a 10-cent increment and therefore counting five different colors would suggest a 50-cent price difference.

For any one map, calculated price differences between the lowest and highest corn prices in Iowa were typically found to be 50 cents. Price differences on the Cornbelt maps were larger. For example on the August 1996 Cornbelt corn price map, the maximum price reported was $5.07 and the minimum was $3.62 which gives a difference of $1.45. This large price differential can be attributed to the unusual 1995-96 crop year. The price differences decreased in October as the harvest of the new crop began and provided new grain supplies.

4.3 Economic theory and reality in the cash grain market

From observation of the maps, one can see many differences in price with (1) location in Iowa or in the Cornbelt and (2) from day-to-day or from week-to-week. Therefore, these price surface maps and the introduced non-conventional method of economic analysis proved the economic theory about the locational price differences in the cash grain markets correct. With the use of the price surface maps, price advantages (locations of high prices) and disadvantages (locations of low prices) in different communities can be illustrated. Moreover, the price surface maps demonstrate economic values in received higher prices for many communities.

4.4 Cash grain price surface trends

Economic theory suggests that cash grain prices should show an increasing trend towards large river terminals. This is due to the increased demand for grain at river terminals and to transportation cost differentials which increase as the distance from the producer to the river loading terminals increases. For these reasons, it is expected that the grain price surface map of Iowa will be a large "bowl" with higher prices along the Mississippi and Missouri rivers and lower prices in the central regions of the state. Many of the developed price surface maps demonstrate this pattern. One example of this is the April 24th, 1996 Iowa corn price surface map. A line of high prices, or "price-mountains", are noticeable on the Iowa map along the Missouri river at Sioux City and Council Bluffs, and along the entire Iowa border of the Mississippi river.

Theory also has suggested the existence of an increasing trend in prices from North-Western towards South-Eastern Iowa. This can be seen on the Iowa soybean price surface map from March 6th, 1996. The Iowa corn price map from November 6th, 1995 could also serve as an example of a typical price surface where prices increase as one moves from the north-west to the south-east.

A typical price surface for the Cornbelt map has a line of high prices, a "price-mountain ridge", along the major river transportation routes. On the August, September and October 1996 Cornbelt soybean price maps, high prices can be seen along the Mississippi, Illinois, and Ohio rivers.

4.5 Effects of increased local grain demands

Several regions of higher prices are observable at and around major corn loading terminals and processing plants in Iowa such as at Council Bluffs, Sioux City, Eddyville, Cedar Rapids, Clinton, Davenport and Keokuk. This is due to increased demand at these locations.

Moreover, a sudden increase in buying activity of the large feedlots in North-Central and North-Western Iowa are observable as high price mountains "on the plain". This increase in activity can be interpreted from the increased prices because grain is known to move in the direction of high prices. The effect of this activity is evident in the corn and soybean price surface maps from November 6th 1995, January 30th, March 6th, March 14th, April 24th, April 25, April 29th, May 29th, May 31st and all the following days in 1996. The large feedlot operations were new to the area and were likely attracted by historically low corn and soybean prices in the area, among other agricultural production factors (Jain, 1995). The reason for low grain prices in North-Western and North-Central Iowa is that these areas are a considerable distance from areas of high grain demand and from the river loading terminals. Historically, producers in these regions were indifferent to shipping their grain by rail and barge to New Orleans export terminals or shipping by rail only to the Pacific north-west export terminals in Washington state (Borrough 1973). The low grain prices therefore, recently attracted many hog and cattle feeding operations to these areas; their need for grain introduced a new and significantly larger demand for grain in the area. These areas of increased demand are observable as "price mountains" and usually have prices which are 10 to 15 cents higher than in the surrounding area. The appearance of the mountains is somewhat irregular; this may be due to the irregular buying activity of these feedlots or grain processing plants. Alternatively, large corn processing plants in Cedar Rapids and Eddyville and a soybean processing plant in Des Moines can always be located on the Iowa surface maps as high "price mountains" because their purchasing activity and grain demand is regular.

The large grain processors have a demand for grain which is greater than the amount of grain produced in close proximity. To attract the amount of grain needed, processors can signal to the producers through the cash bid. However, only one bid can be posted per day. Therefore, if the processor wants to attract grain from more distant areas, he has to offer more for the grain, so it will be profitable for the producer to deliver. As elevators are informed about the bids, they offer the same price, minus transportation costs. Since the grain cash market is efficient, competitive and profit margins are low, the only difference between the large processor bid and the elevator bid is the transportation cost. The "price mountains" at large processing plants have a wide base with a rounded surface (as opposed being a narrow, sharp spike). This phenomena is visible on the April 12th, 1996 corn price map as price mountains in Edyville and Cedar Rapids both marked by large blue dots. These observed "price mountains" are consistent with the transportation cost theory described in section 2.3.4. The sharp spikes seem to appear irregularly and might demonstrate a high local demand which is not long standing. An example of this is shown on the May 29th and May 31st Iowa corn price maps where a number of high price spikes are seen on the former map, but the latter map shows a leveling of the prices.

4.6 Effect of Grain Supply Decrease

As the stock of grain depletes late (May through the new harvest) in the crop year, processor demand changes are much more visible on the price maps as progressively high peaks. A very good example of this activity can be found on the corn price maps beginning May 29th 1996 through August 16th, 1996. High price mountains emerged as other significant processor's trading activity became more aggressive in attracting more grain to satisfy processing or hog and cattle feeding needs.

4.7 Price surface pattern changes over time demonstrate the unusual 1995-96 crop year

Price level increases over time are easy to follow using the two-dimensional price maps by comparing the color shifts over certain regions. By the joint use of the two- and three-dimensional price maps, local and overall price increases and decreases can be detected and studied. The 1995-96 crop year gave excellent opportunity for the price maps to illustrate and study the extreme conditions that occur in the cash grain market. Grain prices reached historically high levels ($2 above past averages), therefore no one was able to predict what effect such high prices would have on the grain cash market. This research was undertaken during this period, therefore the recorded data and price maps are unique and important in modeling and studying grain price changes and the factors that initiate and influence them.

Beginning April 29th, an unusual event occurred in North Western Iowa; the corn stock began to deplete due to high corn export in the Fall 1995. The demand from the regions' operating feedlots remained approximately constant during the crop year but the corn supplies were lower than normal. The low corn supplies were also due to the low carryover from the past crop year and to certain extent to the phase-out of the governmental price support mechanism. Thus the lower supply and unchanged demand resulted in increased prices in the north-western region of the state. On the price maps this event is illustrated as high mountains in the region. The effect became significant on the May 29th and all June and July corn price maps. At the end of July the corn supplies reached a such a low level that the prices in the North-Western region were the same or higher as at the Mississippi river terminals. The usual price surface pattern became inverted. This inverted price surface can be better illustrated by comparing price surface maps from July, August 1995 and July, August 1996. The difference is evident.

4.8 Grain movement directions

The use of the price surface maps makes it possible to record and track grain movements, because grain tends to move to the direction of higher prices. If one follows price changes over geographic regions, deductions can be made about grain movements. Grain movement directions can be observed on Iowa price maps. High price regions at the Mississippi river grain terminals and grain processing plants in Eddyville, Des Moines and Cedar Rapids attract grain from regions of lower grain price.

As the 1996 corn harvest progressed in the southern corn growing regions of the United States, a historical event occurred. The high cash corn prices in Iowa and Illinois attracted the newly harvested corn from the South and grain began to move from the south to the north on the Mississippi river towards the high price region. The August 1996 corn price maps for the Cornbelt region and Iowa serve as evidence for this historic event. The prices were much lower around the Mississippi river due to the inverted movement of the earlier harvested corn in the Southern growing region of the U.S. This event is illustrated as a "price valley" along the Mississippi River in the middle of the Cornbelt corn price surface map.

4.9 Transportation system efficiency

Using price surface maps some implications can be made about the efficiency of the transportation system in Iowa and in the Midwest. Observing certain price patterns may lead to conclusions about inefficiencies in the transportation system. These price patterns might include steep slopes (rapid change in price over a short distance) or low price "pits".

Steep slopes can be seen on the three-dimensional corn price maps from December 7th, 1995 and January 18th and 25th, 1996, where the elevation towards the Mississippi River is rather steep. This effect is seen on the two-dimensional maps for these dates as a rapid change in colors. The price difference over a relatively short 70-mile distance increases by approximately 50 cents. This price difference is more than the cost of grain transportation over that distance. Thus, the organization of the transportation system did not allow for the free movement of grain to the higher price region; and arbitrage to exploit the profit opportunities could not occur.

Furthermore, if "price pits" are seen over a few day period at the same location, that could also indicate transportation inefficiencies such as difficulties to move grain out of that location. Corn price maps from February 14th, 22nd, and 27th, 1996 contain price “pits” in the south-western part of the state. Those pits could have occurred because of transportation system inefficiencies. Observation of the two-dimensional maps where the rail system is also displayed show that a short rail line lies along that pit.

5. CONCLUSIONS AND SUGGESTIONS

The results of this study and the accuracy of the innovative price surface maps should not be taken as numerically accurate estimates of grain prices for areas without grain price reporting locations. The price surface values were interpolated based on four nearest elevator corn and soybean bids. However, the three and two dimensional maps jointly can provide valuable information to any participant in the grain industry. The simplicity and ease of interpretation of price surface maps have already proved to be a great value in education, consulting, production site selection, economic and policy analysis. This price visualization tool can capture and help explain events and information that are difficult to analyze using traditional methods.

Availability and timeliness of price surface maps is an important factor in their usefulness. Moreover, the price surface maps will be used for a study of transportation cost distribution and their impacts on Iowa grain producers. Further research will take place in development of an automated user friendly environment for price map generation and data acquisition.

APPENDIX I
RAW AND EDITED DATA

Table I-1a. Raw data from Farmdayta - Iowa

Iowa Grain Bids (A thru B) 10/17 17:02

Location	BNS	JAN	CRN	JAN	OAT	MEAL4
ADAIR	6.36	6.40	2.56	2.55		
ADEL	6.56	6.58	2.61	2.61		
AKRON	6.36	6.39	2.51	2.54	1.75	
ALLEMAN						
ALTA	6.45	6.49	2.53	2.57		
ALTON	6.47	6.48	2.68	2.59		
ARCADIA	6.55	6.55	2.63	2.65		
ARMSTRONG	6.49	6.50	2.54	2.55		
ASHTON	6.44	6.50	2.50	2.55		
AUDUBON						
BAYARD	6.55	6.57	2.60	2.60		
BEAMAN	6.55	6.55	2.60	2.61		
BELMOND	6.57	6.47	2.57	2.61		

Table I-2a. Raw DTN data - Iowa

Date/Time: 09/20/96 14:28 Page Number: 12
Segment: Bids/Auctions
Page: Iowa (A-C) Cash Grain

IOWA (A-C) (POSTED 09/19 PM)

	BNS NEW CRN NEW OAT MEAL					
ADAIR	775	744	320	284	190	
AKRON	762	734	350	276		
ALGONA	772	738	327	280		
ALLEMAN	782	744	334	285		
ALLENDRF	762	734	340	274		
ALTA	764	742	333	280		
ALTON	764	739		280	225	
ARCADIA	777	747	354	280		
ARCHER	766	739	338	280		
ARMSTRONG	740	733	291	281		
AUDUBON	775	744	320	279	190	
AVON						
BAYARD	778	744	322	284		
BELMOND	779	737	329	283		
BLARSBRG	778	739	329	280		
BLENCOE						
BLOCKTON	763		330			
BOONE	777	744	322	286	190	
BOXHOLM	777	737	321	282		
BRADFRD	785	735	348	283		
BREMER	772	746	337	286		
BRITT	770	739	308	277		
BUCKEYE	783	740	370	284		
BUFFALO C	765	735	319	279		
BURCHINAL	775	740	350	281		
BURLINGTN	798	779	327	313		
BURT			291	291		
CASY/MENL	772		336			
CEDAR RPD						26850
CHARITON	774		374		190	
CHESTER						
CLARENCE	788	768	376	317	181	
CLARINDA	770	741	304	284		
CLARION	777	746	323	284		
CLEGHORN	768	739	363	275		
CLINTON	797	779	326	312		
COLO	776		347			

Table I-2b. Raw DTN data - Illinois

Date/Time: 10/16/96 14:41 Page Number: 4
Segment: Bids/Auctions
Page: Illinois (A-C) Cash Grains
ILLINOIS (A-C) (POSTED 10/15 PM)
BNS JAN CRN JAN WHT JAN MEAL4 BNS JAN CRN JAN WHT JAN
MEAL8
ADAIR 674 688 286 299
ADWELL 678 692 284 287
ALBANY 687 689 293 283
ALMA 675 676 272 270 392 393
ALTON
ALTONA 668 682 282 279
ANCHOR 683 686 279 278
ANCONA 679 684 279 281
ARCOLA 683 689 283 282
ASUMPTION 684 689 285 284
ATTRBERRY 671 685 280 282
AVON 687 701 295 297
BEARDSTON 688 703 292 298
BEECHER 675 677 285 275
BELLFLOWR 684 687 281 280
BEMENT 681 689 279 286
BENSON 674 681 282 283
BENTON 678 688 287 291
BLOOMINTN 700 702 22730
BRIDGEPRT 683 696 295 293 404 401
BRIMFIELD 674 689 289 287
BROWNWOOD 677 687 281 287
BRNS HRBR 690 699 284 289 372
BUSHNELL 672 685 284 286
CADWELL 686 690 287 287
CAHOKIA 697 716 301 310
CAIRO 705 713 25510
CASEY 686 697 279 287 413 411
CERRO GRD 686 690 286 287
CHAMP A 687 690 286 285
CHARLOTTE 683 686 279 278
CHEBANSE 678 692 286 292
CHENOA 680 685 283 283
CHERRY VL 670 679 270 274
CHESTER
CHESTNUT 684 688 286 285
CHICAGO 695 301 411
COOKSVLE 280 280

Table I-3. Data set contaning corn cash bids in Iowa

"ADAIR",268,273,267,269,269,268,260,257,248,243,240,246,245,247,249,248,248,249,249,253,252,249,251
,254,257,253,256,255,253,255,256,255,261,261,262,266,276,272,271,271,270,267,266,268,278,281,286,284,
287,291,289,289,288,300,297,298,298,298,297,297,303,312,309,308,306,304,303,300,296,295,297,302,302,3
01,298,299,301,302,306,307,309,310,311,310,325,331,345,344,358,353,366,363,372,368,0,376,395,407,433,
458,469,440,434,449,446,466,462,470,452,488,492,518,428,416,416,423
"ADEL",261,267,263,267,267,267,262,254,252,248,244,248,247,247,248,248,248,247,247,251,252,251,252,
255,257,257,259,256,258,255,256,255,260,260,260,263,274,268,268,269,268,266,266,267,275,280,286,286,2
91,293,291,294,301,302,300,302,302,302,301,301,305,309,305,308,306,305,303,301,297,297,299,304,304,30
2,299,301,302,302,306,307,310,311,310,309,320,327,338,341,354,352,361,358,369,364,364,369,389,405,432
,457,467,455,437,448,454,469,466,472,454,489,493,521,435,429,419,425
"AKRON",259,264,260,264,263,260,251,247,242,239,233,238,237,238,240,240,241,242,243,248,248,246,24
8,250,253,251,255,254,250,253,253,251,256,253,253,256,265,261,262,264,263,259,259,261,268,272,276,274
,279,281,279,280,286,288,285,285,287,288,288,290,295,298,294,294,290,292,289,286,282,280,284,287,289,
287,285,288,284,282,289,294,295,297,298,295,312,322,334,331,343,344,357,352,363,358,358,364,385,397,4
22,451,463,0,0,441,456,464,460,466,446,480,486,515,424,420,408,414
"ALBERT
CITY",258,262,256,259,259,260,255,247,245,241,238,242,241,242,245,243,242,242,242,247,247,245,247,25
0,254,252,254,253,251,253,252,251,256,257,257,260,269,265,264,266,265,261,261,261,269,272,277,275,280
,280,280,281,286,286,286,286,286,286,285,288,290,294,293,294,293,292,289,287,285,284,287,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
"ALGONA",256,260,257,260,260,259,256,249,247,241,238,242,242,243,245,243,243,244,244,247,248,246,2
47,250,253,252,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,269,273,278,276,280,283,280,281,287,288,286,287,289,29
0,289,291,293,296,295,294,293,293,291,289,288,286,288,288,292,290,287,293,290,290,294,297,297,300,300
,300,314,319,329,332,345,345,355,353,363,359,0,366,384,398,421,448,448,442,424,439,457,455,453,460,44
1,476,480,504,426,425,412,419
"ALLEMAN",260,264,261,266,266,267,261,253,250,246,242,246,245,247,248,248,248,248,247,251,251,250
,251,254,256,254,258,256,254,256,257,256,261,262,262,266,274,270,270,271,270,267,266,268,275,280,286,
284,288,292,289,283,297,297,295,296,297,298,300,301,304,308,306,305,303,303,300,292,296,295,297,300,3
02,301,298,301,299,300,304,305,307,308,309,308,323,329,341,342,354,353,365,362,372,368,368,372,392,40
7,430,454,469,0,434,447,450,469,465,473,455,486,490,519,429,423,412,428
"ALLENDORF",256,264,260,264,263,264,256,249,249,245,242,245,244,246,248,241,241,241,241,245,244,2
42,244,247,249,247,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,263,268,273,271,275,278,275,284,282,282,280,280,27
8,279,281,282,285,289,288,286,284,285,283,280,277,276,279,279,281,282,279,283,280,280,286,288,289,293
,294,292,304,315,325,327,340,338,350,348,357,352,0,359,379,392,415,440,440,440,422,432,465,464,460,46
6,438,464,483,498,416,410,399,406
"ALTA",256,263,260,263,262,263,256,249,246,242,239,243,242,244,246,246,246,246,246,250,250,248,250,
252,255,254,257,256,254,256,255,253,257,259,259,263,271,267,265,265,264,260,260,261,269,274,279,277,2
81,284,281,283,287,291,288,287,286,287,287,288,290,295,292,293,291,290,288,286,283,282,284,287,289,28
7,284,288,287,287,292,296,298,299,300,299,311,318,328,334,347,345,355,352,363,359,354,363,383,402,422
,448,460,446,427,438,448,459,456,462,444,471,479,507,430,423,415,422
"ALTON",254,261,259,262,261,260,251,245,241,239,236,241,240,241,243,243,243,245,243,245,245,244,24
5,247,250,248,252,251,249,250,251,250,256,257,257,261,267,263,262,262,261,258,257,259,264,269,274,272
,276,279,276,278,286,287,285,284,289,289,288,285,289,295,294,294,293,291,288,285,283,282,284,287,289,
288,286,290,289,289,294,296,297,299,300,298,313,321,332,329,343,340,353,348,359,355,355,359,377,395,4
18,450,459,435,0,439,454,464,460,467,450,481,483,0,439,437,436,433

APPENDIX II
ARC/INFO BASE COVERAGES

Metadata describing the comprehensive Iowa populated places coverage

NATURAL RESOURCES GEOGRAPHIC INFORMATION SYSTEM

COVERAGE DOCUMENTATION

COVERAGE NAME: PLACES DOCUMENTATION REVISION: 2/22/93

DESCRIPTIVE NAME: Populated Places in Iowa

STATUS: Complete

DESCRIPTION: This coverage contains points that represent populated places, ie. cities, towns, villages or any other named place where people live. The coverage was developed from the USGS Geographic Names Information System (GNIS) database for Iowa. There were many errors in the original GNIS data, including missing points or mislocated points. The GNIS points were compared to two reference sources: USGS 100k scale county maps and Iowa DOT county highway maps. Mislocated and missing point were fixed and each town was designated as having been verified from one or the other reference sources or both. Some GNIS points were not verified from either source and are so designated (use these with caution).

GEOGRAPHIC EXTENT: Iowa

COVERAGE TYPE(S): Point

COVERAGE SIZE:
Arcs: 0
Polygons: 0
Labels: 2346
Tics: 4
Annotations: 0
File size: 652 Kb

MAP PROJECTION: Universal Transverse Mercator (UTM), Zone 15.

MAP UNITS: Meters

DATUM: NAD27

SOFTWARE/VERSION: PC ARC/INFO 3.4D Plus

COVERAGE CREATED: 2/19/93

COVERAGE DEVELOPER: James D. Giglierano

COVERAGE MODIFICATIONS: none

DNR CONTACT: James D. Giglierano, Iowa Department of Natural Resources, Geological Survey Bureau, 109 Trowbridge Hall, Iowa City, Iowa 52242-1319 Phone: (319) 335-1575

ORIGINAL SOURCE INFORMATION:
Media: Electronic file
Title: GNIS.DBF
Author/Agency: US Geological Survey
Published Date: 1990
Compiled Date: 1990?
Scale: unknown
Projection: Latitude/longitude
Geographic Control: unknown
Data Conversion: Locations were converted from lat/lon to UTM using ARC/INFO PROJECT command. Other GNIS attributes were joined to .PAT file.
References: "Geographic Names Information System: Data Users Guide 6", US Geological Survey, 1987.

ACCURACY ASSESSMENT: The positional accuracy of the original GNIS data is 5 seconds of latitude or longitude. In Iowa, this translates to 100 to 150 meters. All data points were examined and those that were obviously mislocated were moved. A small number were found to be outside of their incorporated boundary line and were moved inside.

ASSOCIATED COVERAGES: INCORP is a coverage of incorporated boundaries for 953 cities and towns in Iowa (corresponds to type = 1 in this coverage).

ASSOCIATED FILES:

COMMENTS:

ARC ATTRIBUTE FILE ITEMS (AAT): none

POLYGON ATTRIBUTE FILE ITEMS (PAT): none

POINT ATTRIBUTE FILE ITEMS (PAT):
PLACES_: Internal label point identifier
PLACES_ID: User defined label point identifier
PLACE_NAME: Proper name of city or town, including punctuation. First letter only is capitalized. Saint and Mount are abbreviated St. and Mt. respectively, if normally used that way.
NAME_CAPS: Name of city or town in all capitalized letters. No punctuation or abbreviated words.
OTHER_NAME: Alternate name for town, from other maps or sources
CO_NAME: County name
CO_SEAT: If town is county seat, it is designated with 'Y' character
QUAD_NAME: Name of USGS 1:24,000 topo quad map
TYPE: Type of place and reference source
1 Incorporated city or town--found on both USGS and IDOT maps
2 Different place name within incorporated boundary--found only on USGS maps
3 Unincorporated town or place name--found on both USGS and IDOT maps
4 Unincorporated town or place name--found only on IDOT map
5 Unincorporated town or place name--found only on USGS map
10 GNIS place name NOT found on either USGS or IDOT map
X_COORD: UTM x coordinate for label point
Y_COORD: UTM y coordinate for label point

ANNOTATIONS: none

TICS: There are 4 tics a coverage boundaries.

****NOTICE****
This digital, geographically referenced data set was developed by the Iowa Department of Natural Resources to carry out agency responsibilities related to management, protection, and development of Iowa's natural resources. It resides in the Natural Resources Geographic Information System library. Although efforts have been made to make it useful to the Department, the Department assumes no responsibility for errors in the information. Similarly the Department assumes no responsibility for the consequences of inappropriate uses or interpretations of the data made by anyone to whom this data has been made available. The Department bears no responsibility to inform users of any changes made to this data. Anyone using this data is advised that precision implied by the coverage may far exceed actual precision. Comments on this data are invited and the Department would appreciate that documented errors be brought to staff attention

Metadata describing the Iowa state and county boundary coverage

NATURAL RESOURCES GEOGRAPHIC INFORMATION SYSTEM

COVERAGE DOCUMENTATION

COVERAGE NAME: COUNTY DOCUMENTATION REVISION: 1/29/1993

DESCRIPTIVE NAME: State/County boundaries of the state of Iowa

STATUS: Complete

DESCRIPTION: This coverage contains polygons representing the county boundaries of the state of Iowa. COUNTY was developed from a set of 99 individual coverages of the Public Land Survey System (PLSS) for each county in the state. The PLSS coverages were digitized from paper copies of 7.5' topographic quadrangle maps. River boundaries were also digitized from 7.5' maps

GEOGRAPHIC EXTENT: State of Iowa

COVERAGE TYPE(S): Polygons

COVERAGE SIZE:
Arcs: 296
Polygons: 100
Labels: 99
Tics: 167
Annotations: 198
File size: 433 Kb

MAP PROJECTION: Universal Transverse Mercator (UTM), Zone 15.

MAP UNITS: Meters

DATUM: NAD 27

SOFTWARE/VERSION: PC ARC/INFO 3.4D

COVERAGE CREATED: 11/90

COVERAGE DEVELOPER: James D. Giglierano and Madhukar Mohan

COVERAGE MODIFICATIONS: Intersection of South Dakota border, Sioux and Lyon

Counties modified; fixed location of tic #13: J. Giglierano, 11/10/92.
Added CO_FIPS (county FIPS code) to .PAT file, changed COUNTY_ID to CO_NUMBER, and changed NAME to CO_NAME: J. Giglierano, 11/12/92.
Added ACRES_SF to .PAT: J. Giglierano, 12/03/92.

DNR CONTACT: James D. Giglierano, Iowa Department of Natural Resources, Geological Survey Bureau, 109 Trowbridge Hall, Iowa City, Iowa 52242-1319 Phone: (319) 335-1575

ORIGINAL SOURCE INFORMATION:
Media: Paper copies of 7.5' topographic quadrangle maps
Title: Varies
Author/Agency: U.S. Geological Survey
Published Date: Varies
Compiled Date: Varies
Scale: 1:24,000
Projection: Varies
Geographic Control: Latitude/longitude tics at corners of 7.5' maps
Data Conversion: Original map coordinate units were reprojected using in-house digitizing software to UTM units.

ACCURACY ASSESSMENT: Based on NMAS accuracy standards for USGS 1:24,000 scale maps, digitizer resolution, ARC/INFO fuzzy tolerances, and estimated operator error, the positional accuracy of this coverage is estimated to be around 22 meters. Positional error was estimated using a root-sum-squared error calculation.

ASSOCIATED COVERAGES:
Each county in the state has a coverage of PLSS asections digitized from 7.5' topo quads. These are named using the first 8 characters in the county name.
TOWNSHIP: This coverage has Iowa PLSS township boundaries developed from individual county PLSS section coverages.
WCOUNTY: This is the same as COUNTY with vertices weeded to 500 meters. Used for plotting county outlines at small scales.

ASSOCIATED FILES:
ADD_UTM: A dBASE application that uses PLSS section corner data to convert PLSS legal descriptions (up to 4 quarter sections) into UTM or latitude/longitude.

COMMENTS: Label points for polygons are placed at the locations of county seats.

ARC ATTRIBUTE FILE ITEMS (AAT):
LENGTH: Length of arcs in meters
COUNTY_: Internal arc identifier
COUNTY_ID: Sequential arc identifier

POLYGON ATTRIBUTE FILE ITEMS (PAT):
AREA: Area of county in square meters
PERIMETER: Length of county perimeters in meters
COUNTY_: Ineternal polygon identifier
COUNTY_ID: Sequential polygon identifier
CO_NUMBER: County number (1-99_
CO_FIPS: County FIPS code (1-197)
ACRES_SF: Area of county in acres using the US survey foot standard of 4046.873 sq. meters per acre
ACRES: Area of county in acres using the international metric (SI) standard of 4046.856 sq. meters per acre.

POINT ATTRIBUTE FILE ITEMS (PAT): None

ANNOTATIONS:
LEVEL 1: County names placed in upper left corner of county
LEVEL 2: Names of county seats placed at upper right of county seat location

TICS: There are 167 tics placed at corners of county boundaries

****NOTICE****
This digital, geographically referenced data set was developed by the Iowa Department of Natural Resources to carry out agency responsibilities related to management, protection, and development of Iowa's natural resources. It resides in the Natural Resources Geographic Information System library. Although efforts have been made to make it useful to the Department, the Department assumes no responsibility for errors in the information. Similarly the Department assumes no responsibility for the consequences of inappropriate uses or interpretations of the data made by anyone to whom this data has been made available. The Department bears no responsibility to inform users of any changes made to this data. Anyone using this data is advised that precision implied by the coverage may far exceed actual precision. Comments on this data are invited and the Department would appreciate that documented errors be brought to staff attention.

Metadata describing the railroad coverage
us_rr_2m

* Identification Information
  - o Data Set name: us_rr_2m
  - o Location: /home/gis/trans
  - o Description: Railroad lines in the U.S.
  - o Geographic extent (in latitude/longitude degrees): 23 21 11 N to 48 15 25 N , 118 39 27 W to 65 42 21 W
  - o Originator: USGS
  - o Original data series: USGS 1:2,000,000 Digital Line Graphs
  - o Date of creation: 1989
  - o Reference:"Digital Line Graphs from 1:2,000,000-Scale Maps Data Users Guide 3", USGS, 1990.
* Spatial Data Organization Information
  - o Software: ARC/INFO
  - o Feature type: arc
  - o Number of features:
    - + arcs: 12182
* Data Quality Information
  - o Attribute accuracy:Unknown. The USGS uses a manual process involving the correlation of formatted listings with proof plots.
  - o Consistency: Validated by software for internal consistency of arc node topology.
  - o Completeness: Completeness is checked by visually comparing proof plots with original stable base source material for the feature of interest.
  - o Positional accuracy: Unknown. Positional accuracy is checked by visually comparing proof plots with original stable base source material.
  - o Lineage:
    - + Source citation: National Atlas of the United States of America 1:2,000,000 Sectional maps, 1970, USGS. Interstate Commerce Comission 1979.
    - + Source scale or resolution: 1:2,000,000
    - + Source date: 1970, 1979
    - + Source media: Paper
    - + Processing steps:

      1. Data digitized by USGS

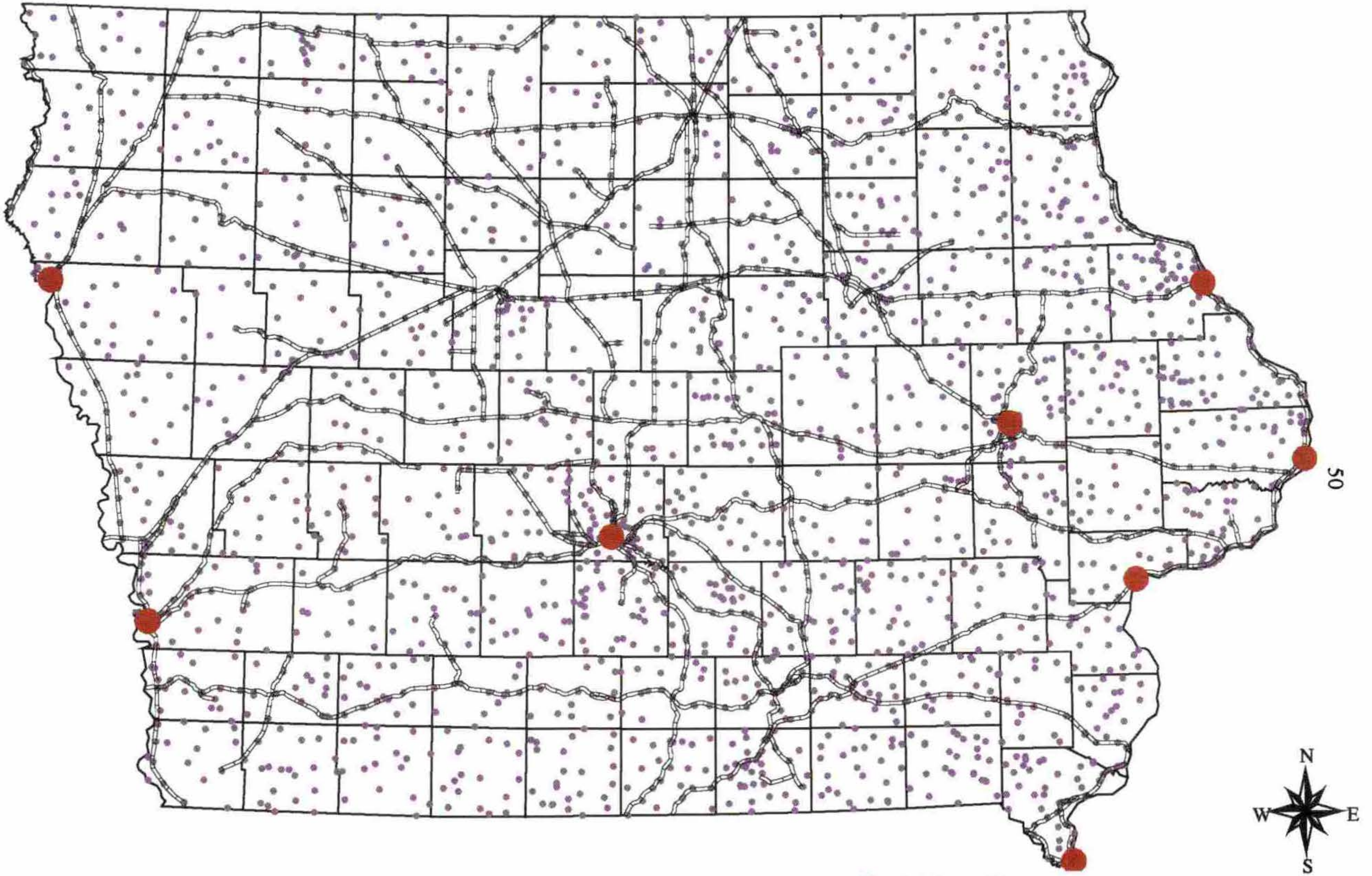
         The arcs representing major highways were digitized from 1:2,000,000 source documents by the USGS and stored as coordinates in the DLG files.

Files completed 1990.

2. Coverage created at GIS Support Facility from DLG data

Process undocumented.

* Spatial Reference Information
  o Projection: ALBERS
  o Units: METERS
  o Parameters:
    + 29 30 0.000 /* 1st standard parallel
    + 45 30 0.000 /* 2nd standard parallel
    + -96 0 0.000 /* central meridian
    + 23 0 0.000 /* latitude of projection's origin
    + 0.00000 /* false easting (meters)
    + 0.00000 /* false northing (meters)
  o Spheroid: CLARKE1866
* Metadata Reference Information
  o Date: November 11, 1994
  o Update: January 31, 1996
* Attribute Information
  o File: AAT
    + FNODE# ; type: B ; desc: Internal node number for beginning of arc(from-node)
    + TNODE# ; type: B ; desc: Internal node number for end of arc(to-node)
    + LPOLY# ; type: B ; desc: Internal number for the left polygon
    + RPOLY# ; type: B ; desc: Internal number for the right polygon
    + LENGTH ; type: F ; desc: Length of arc (measured in coverage units)
    + US_RR_2M# ; type: B ; desc: Internal arc number (assigned by ARC/INFO)
    + US_RR_2M-ID ; type: B ; desc: User-id (assigned by the user)
    + TYPE ; type: I ; desc:
    + RAIL_TYPE ; type: C ; desc:
    + STATE_FIPS ; type: I ; desc:
    + STATE_NAME ; type: C ; desc:
    + SUB_REGION ; type: C ; desc:



Plot of all populated places, railroad lines and counties in Iowa

Metadata describing the corn belt towns coverage.

U.S. Gazetteer Place and Zipcode Files

As part of the Tiger Mapping Service, we provide a gazetteer of counties, places and zipcodes in the United States, so you can find a place by name without having to know the LAT/LON coordinates. This is done using a simple text database condensed from Census data files. We are making this file available to the public. There are three files:

Places (23655 records): 3359010 bytes
Counties (3141 records): 446022 bytes
Zips (34265 records): 2672670 bytes

FTP compressed versions of:

places.zip 772557 bytes
counties.zip 114915 bytes
zip.zip 647438 bytes
places.txt.gz 776342 bytes
counties.txt.gz 115627 bytes
zip.gz 660119 bytes

The Place and County files are plain ASCII text, one line per record. The fields are laid out as follows:

Columns 1-2: State FIPS Code
Columns 4-6: County FIPS Code (for counties.txt file Columns 7-8 zero padded)
Columns 4-8: Place FIPS Code (for places.txt unique ID for each place)
Columns 10-75: Name. Includes name of place/county and type of place (either city, town, borough, village, or CDP). Counties don't have a type, but do have the word "County" as part of the name.
Columns 77-78: State Abbreviation
Columns 80-88: Total Population (1990)
Columns 90-98: Number of Housing Units (1990)
Columns 100-109: Land area included (in thousands of a square kilometer)
Columns 111-120: Water area included (in thousands of a square kilometer)
Columns 122-130: Latitude (millionths of a degree: 10^6 units=1 deg). First character is + or -, denoting N or S latitude, respectively.
Columns 132-141: Longitude (millionths of a degree). First character is + or -, denoting E or W longitude, respectively.

Source: Census STF-1A files.

The Zip Code file is delimited ASCII text, one record per line. The field/record layout is as follows:

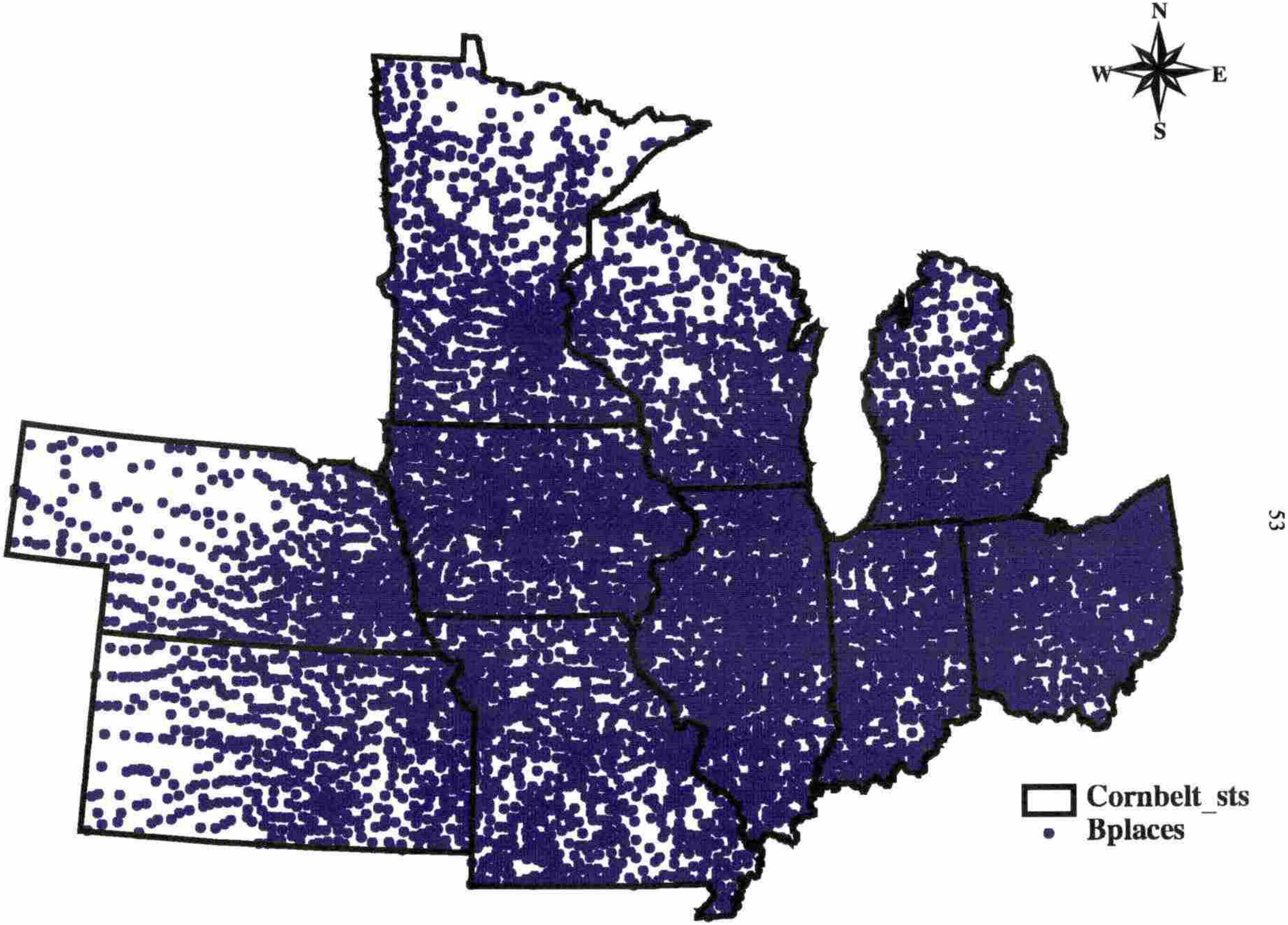
Field 1 - Zip Code

Field 2 - Latitude (millionths of a degree: 10^6 units=1 deg). First Character is a + or -, denoting N or S latitude, respectively.
Field 3 - Longitude (millionths of a degree). First character is a + or -, denoting E or W longitude, respectively.
Field 4 - Place Name
Field 5 - FIPS State Code
Field 6 - FIPS County Code

Source: Landview II

Back to the U.S. Gazetteer

Please email comments to: TMS@Census.GOV
Last Revised: Monday, 05-Feb-96 14:17:10



Populated places in the Cornbelt states

APPENDIX III
ARC/INFO PLOTTING PROGRAMS

2-dgridplot.aml

```
clear
&echo &on
&sv .date = nov06
&sv .com = corn
&sv mapname %.date%%.com%
&sv .type = b
startmap %mapname%
pageunits inch
pagesize 11 8.5
maplimits 0.3 0.5 10.5 7.5
lineset plotter.lin
linesymbol 2
clipmapextent on
box 0 0 11 8.5
box 0.4 0.2 10.8 8.1
mapunits meters
textset font
textsymbol 16
shadeset colornames.shd
markerset north.mrk
/*"Plotting 2-D colormaps with railroad"
mape /home/cornbelt/grids/%.date%%.com%g
gridshades /home/cornbelt/grids/%.date%%.com%g value %.com%color.lut
lineset plotter.lin
linesymbol 9
arcs /home/cornbelt/borders/railroad_1995
lineset carto
linesymbol 133
arcs /home/cornbelt/borders/county
/*arcs /home/cornbelt/borders/cornbelt_sts
markerset water.mrk
markersymbol 408
markersize .35 .35
points /home/cornbelt/places/%.com%_MAJCITY
markersize 0.12 0.12
points /home/cornbelt/places/places.com.date/places.%.date%%.com%
lineset plotter.lin
linesymbol 4
textsize 0.12 0.12
textcolor red
```

```
scalebar 7 0.7 2
markersymbol 12
marker 10.2 7.5
shadeset color.shd
move 0.9 0.7
textcolor 2
textsize 0.18 0.18
text 'November 6, 1995 Iowa Corn Prices; (min = 281, max = 334)'
textcolor 2
move 0.9 0.5
textcolor 4
textsize 0.16 0.16
text 'Iowa Countylines and Railroads'
move 0.9 0.3
textcolor 1
textsize 0.15 0.15
text 'Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/'
map end
&mess &pop
&if [query 'Okay to make a graphic file'] &then &do
  &if [exists %mapname%.ps -file] &then &do
    &s status [delete %mapname%.ps]
  &end
  mkgraphic %mapname% # 2
  &sys rotate %mapname%.ps %mapname%2d.ps
  &sys rm -r %mapname%.ps
  &sys rm -r %mapname%.map
/* &sys gs261 -q -sDEVICE=gif8 -sOutputFile=%mapname%2d.gif -dNOPAUSE
%mapname%2d.ps
  &end
&mess &on
&return
&echo &off
&return
```

3-dgridplot.aml

```
clear
&echo &on
/* VARIABLES
&sv .date = feb27
&sv .com = corn
&sv mapname %.date%%.com%
startmap %mapname%
/* PAGE SETUP
pageunits inch
pagesize 11 8.5
mappos cen cen
mapscale automatic
maplimits 0 0 10.5 8.2
lineset plotter.lin
linepattern 102
linecolor 1
clipmapextent on
box 0.4 0.18 10.8 8.1
mapunits meters
textset font
textsymbol 16
lineset plotter.lin
shadeset colornames.shd
markerset north.mrk
surfacedefaults
surfacelimits 0.5 1.3 10.7 8.1
/* 3-D PRICE SURFACE PLOT
surface lattice /home/cornbelt/grids/%.date%%.com%g 6
surfaceobserver relative 180 0.13 450000
surfacezscale 600
/*shadecolorramp 1 256 green red
shadeset colornames.shd
surfacedrape gridshades /home/cornbelt/grids/%.date%%.com%g value %.com%color.lut
linesymbol 1
surfacedrape mesh fishnet 5000
/* LEGEND PLOTS
markerset water.mrk
markersymbol 408
markersize .35 .35
surfacedrape points /home/cornbelt/places/%.com%_MAJCITY
markersymbol 12
marker 10 7.4
shadeset color.shd
```

```
move 3 7.5
textcolor 2
textsize 0.18 0.18
text 'February 27, 1996 Iowa Corn Prices'
move 3 7.35
textcolor 4
textsize 0.15 0.15
text 'Min = 345, Max = 393, Mean = 365, Std = 9'
 move 3 7.2
textcolor 11
textsize 0.15 0.15
text 'Zscale 600-6, Azimuth 180 0.13 450km'
move 0.45 0.5
textcolor 1
textsize 0.17 0.15
text 'Source: Attila Konkoly; (515)296-7552'
move 0.45 0.3
text 'http://www.public.iastate.edu/~konkoly/'
&r %.com%legend.aml
map end
&mess &pop
&if [query 'Okay to make a graphic file'] &then &do
  &if [exists %mapname%.ps -file] &then &do
    &s status [delete %mapname%.ps]
  &echo &off
  &end
  mkgraphic %mapname% # 2
  &sys mv %mapname%.ps /afs/iastate.edu/public/scratch/konkoly/%mapname%.ps
  &sys rotate /afs/iastate.edu/public/scratch/konkoly/%mapname%.ps
/home/konkoly/%mapname%3d.ps
  &sys rm -r %mapname%.map
/*  &sys gs261 -q -sDEVICE=gif8 -sOutputFile=%mapname%3d.gif -dNOPAUSE
%mapname%3d.ps
 &end
&mess &on
&return
&echo &off
&return
```

Table III-1. Remap tables corncolor.lut and beancolor.lut in cents for floating point grids defining the five cent color intervals

Soybean price intervals		Color codes	Corn price intervals		Color codes
230	240	125	520	530	125
240	250	61	530	540	61
250	260	12	540	550	42
260	270	56	550	560	96
270	280	43	560	570	46
280	290	104	570	580	123
290	300	110	580	590	57
300	310	70	590	600	86
310	320	55	600	610	68
320	330	83	610	620	41
330	340	84	620	630	110
340	350	30	630	640	113
350	360	66	640	650	55
360	370	111	650	660	76
370	380	97	660	670	99
380	390	119	670	680	14
390	400	73	680	690	108
400	410	35	690	700	71
410	420	88	700	710	103
420	430	108	710	720	70
430	440	127	720	730	105
440	450	46	730	740	36
450	460	67	740	750	83
460	470	103	750	760	84
470	480	58	760	770	112
480	490	78	770	780	50
490	500	98	780	790	119
500	510	112	790	800	56
510	520	32	800	810	95
520	530	52	810	820	53
530	540	71	820	830	73
			830	840	93
			840	850	103

Table III-2. Arc Macro Languages cornlegend.aml and beanlegend.aml for legend display

Corn price map legend `aml`	Soybean price map `aml`
move 3.4 1.6 shadeset colornames.shd textsize 0.2 0.2 textcolor black text "Legend" textsize 0.15 0.15 move 3.4 1.4 textcolor darkviolet text "230-240:Dark Violet" move 3.4 1.25 textcolor darkgreen text "240-250:Dark Green" move 3.4 1.1 textcolor peachpuff text "250-260:Peach" move 3.4 0.95 textcolor cyan text "260-270:Cyan" move 3.4 0.8 textcolor blue text "270-280:Blue" move 3.4 0.65 textcolor orange text "280-290:Orange" move 3.4 0.5 textcolor red text "290-300:Red" move 3.4 0.35 textcolor green text "300-310:Green" move 5.2 1.4 textcolor turquoise text "310-320:Turquoise"	move 3.4 1.6 shadeset colornames.shd textsize 0.18 0.18 textcolor black text "Legend" textsize 0.15 0.15 move 3.4 1.4 textcolor darkviolet text "520 530:Dark Violet" move 3.4 1.25 textcolor darkgreen text "530 540:Dark Green" move 3.4 1.1 textcolor greenyellow text "540 550:Green Yellow" move 3.4 0.95 textcolor sandybrown text "550 560:Sandy Brown" move 3.4 0.8 textcolor skyblue text "560 570:Sky Blue" move 3.4 0.65 textcolor mediumorchid text "570 580:Medium Orchid" move 3.4 0.5 textcolor lightcyan text "580 590:Light Cyan" move 3.4 0.35 textcolor goldenrod text "590 600:Goldenrod" move 5.2 1.4 textcolor springgreen text "600 610:Spring Green"

Table III-2. (continued)

```
move 5.2 1.25
textcolor yellow
text "320-330:Yellow"

move 5.2 1.1
textcolor gold
text "330-340:Gold"

move 5.2 0.95
textcolor slategray
text "340-350:Slate Gray"

move 5.2 0.8
textcolor lightseagreen
text "350-360:Light Seagreen"

move 5.2 0.65
textcolor hotpink
text "360-370:Hot Pink"

move 5.2 0.5
textcolor tan
text "370-380:Tan"

move 5.2 0.35
textcolor magenta
text "380-390:Magenta"

move 7 1.4
textcolor greenyellow
text "390-400:Green Yellow"

move 7 1.25
textcolor navy
text "400-410:Navy"

move 7 1.1
textcolor rosybrown
text "410-420:Rosy Brown"

move 7 0.95
```

```
move 5.2 1.25
textcolor mediumblue
text "610 620:Medium Blue"

move 5.2 1.1
textcolor red
text "620 630:Red"

move 5.2 0.95
textcolor pink
text "630 640:Pink"

move 5.2 0.8
textcolor turquoise
text "640 650:Turquoise"

move 5.2 0.65
textcolor forestgreen
text "650 660:Forest Green"

move 5.2 0.5
textcolor firebrick
text "660 670:Firebrick"

move 5.2 0.35
textcolor moccasin
text "670 680:Moccasin"

move 7 1.4
textcolor tomato
text "680 690:Tomato"

move 7 1.25
textcolor chartreuse
text "690 700:Chartreuse"

move 7 1.1
textcolor lightsalmon
text "700 710:Light Salmon"

move 7 0.95
textcolor green
text "710 720:Green"
```

Table III-2. (continued)

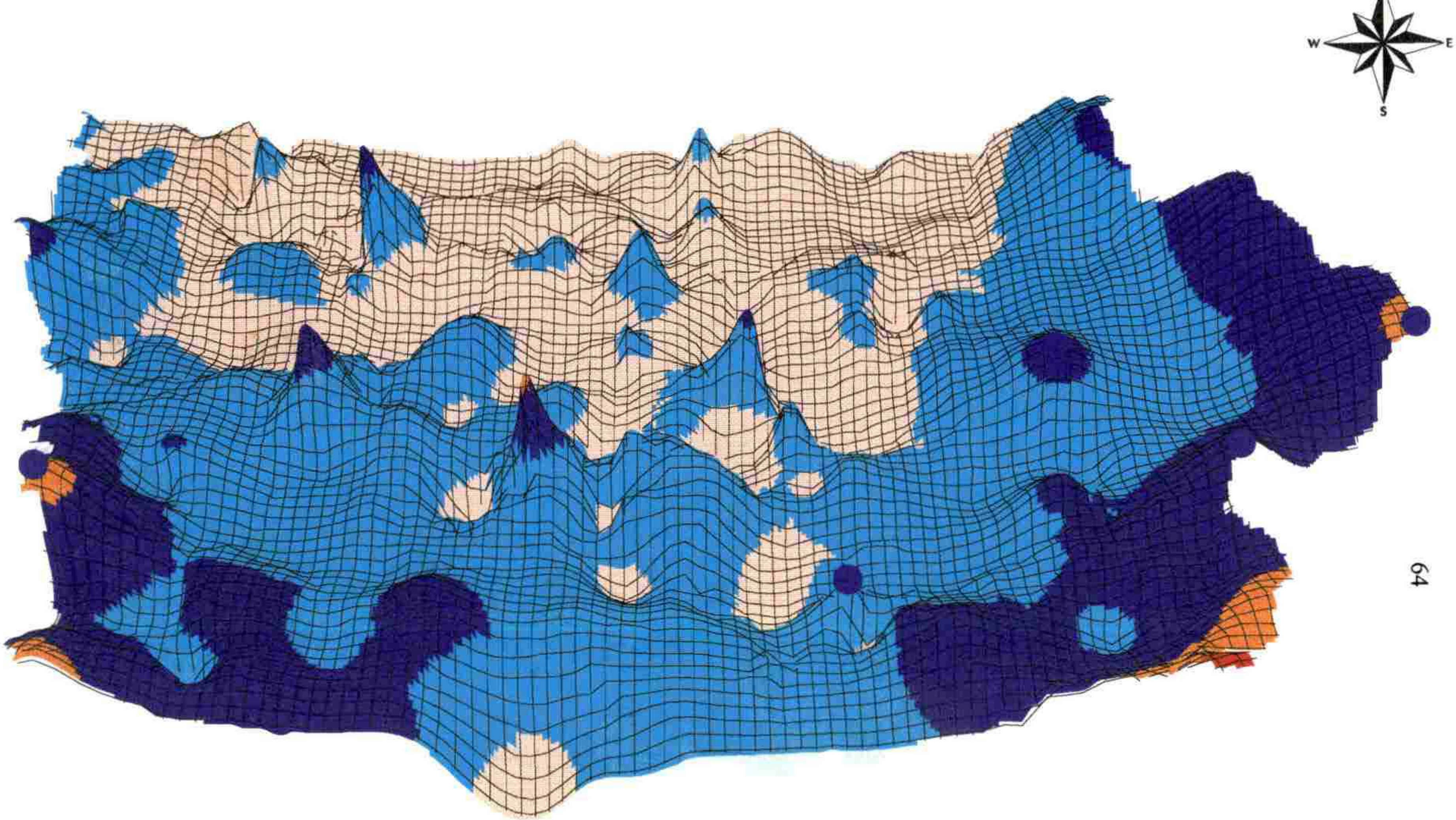
```
textcolor tomato
text "420-430:Tomato"

move 7 0.8
textcolor purple
text "430-440:Purple"

move 7 0.65
textcolor skyblue
text "440-450:Sky Blue"

move 7 0.5
textcolor palegreen
text "450-460:Pale Green"

move 7 0.35
textcolor lightsalmon
text "460-470:Light Salmon"

move 8.8 1.4
textcolor cadetblue
text "470-480:Cadet Blue"

move 8.8 1.25
textcolor darkkhaki
text "480-490:Dark Khaki"

move 8.8 1.1
textcolor chocolate
text "490-500:Chocolate"

move 8.8 0.95
textcolor deeppink
text "500-510:Deep Pink"

move 8.8 0.8
textcolor gray
text "510-520:Gray"

move 8.8 0.65
textcolor paleturquoise
text "520-530:Pale Turquoise"
```

```
move 7 0.8
textcolor darkorange
text "720 730:Dark Orange"

move 7 0.65
textcolor cornflowerblue
text "730 740:Cornflower Blue"

move 7 0.5
textcolor yellow
text "740 750:Yellow"

move 7 0.35
textcolor gold
text "750 760:Gold"

move 8.8 1.4
textcolor deeppink
text "760 770:Deep Pink"

move 8.8 1.25
textcolor lightblue
text "770 780:Light Blue"

move 8.8 1.1
textcolor magenta
text "780 790:Magenta"

move 8.8 0.95
textcolor cyan
text "790 800:Cyan"

move 8.8 0.8
textcolor wheat
text "800 810:Wheat"

move 8.8 0.65
textcolor darkturquoise
text "810 820:Dark Turquoise"

move 8.8 0.5
textcolor greenyellow
```

Table III-2. (continued)

move 8.8 0.5	text "820 830:Green Yellow"
textcolor chartreuse	move 8.8 0.35
text "530-540:Chartreuse"	textcolor burlywood
	text "830 840:Burly Wood"
&return	&return

APPENDIX IV
PRICE SURFACE MAPS



July 19, 1995 Iowa Corn Prices

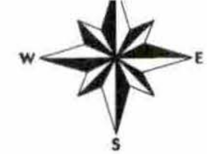
Min = 247, Max = 294, Mean = 263, Std = 6
Zscale 600-6, Azimuth 180 0.13 450km

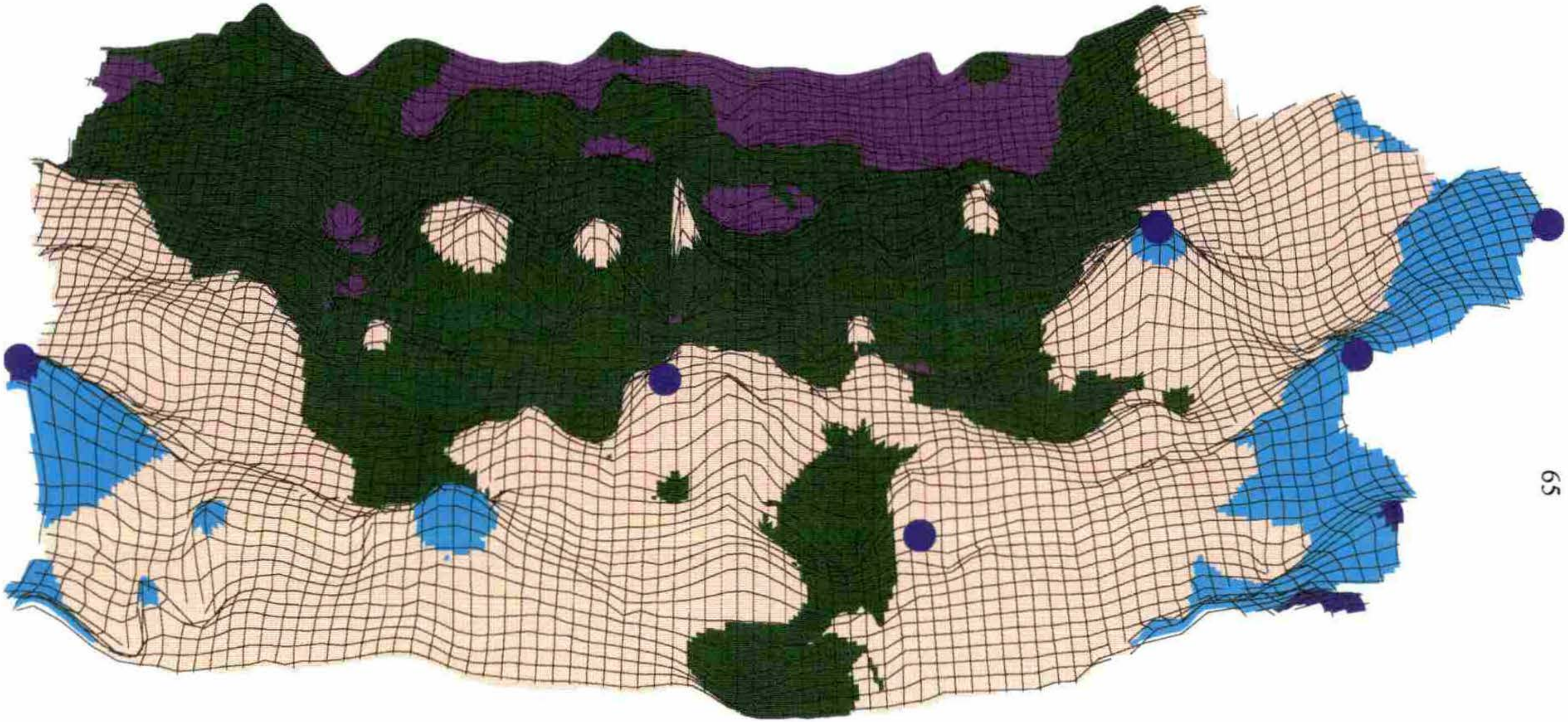
Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

August 14, 1995 Iowa Corn Prices
Min = 234, Max = 277, Mean = 249, Std = 7
Zscale 600-6, Azimuth 180 0.13 450km





Legend

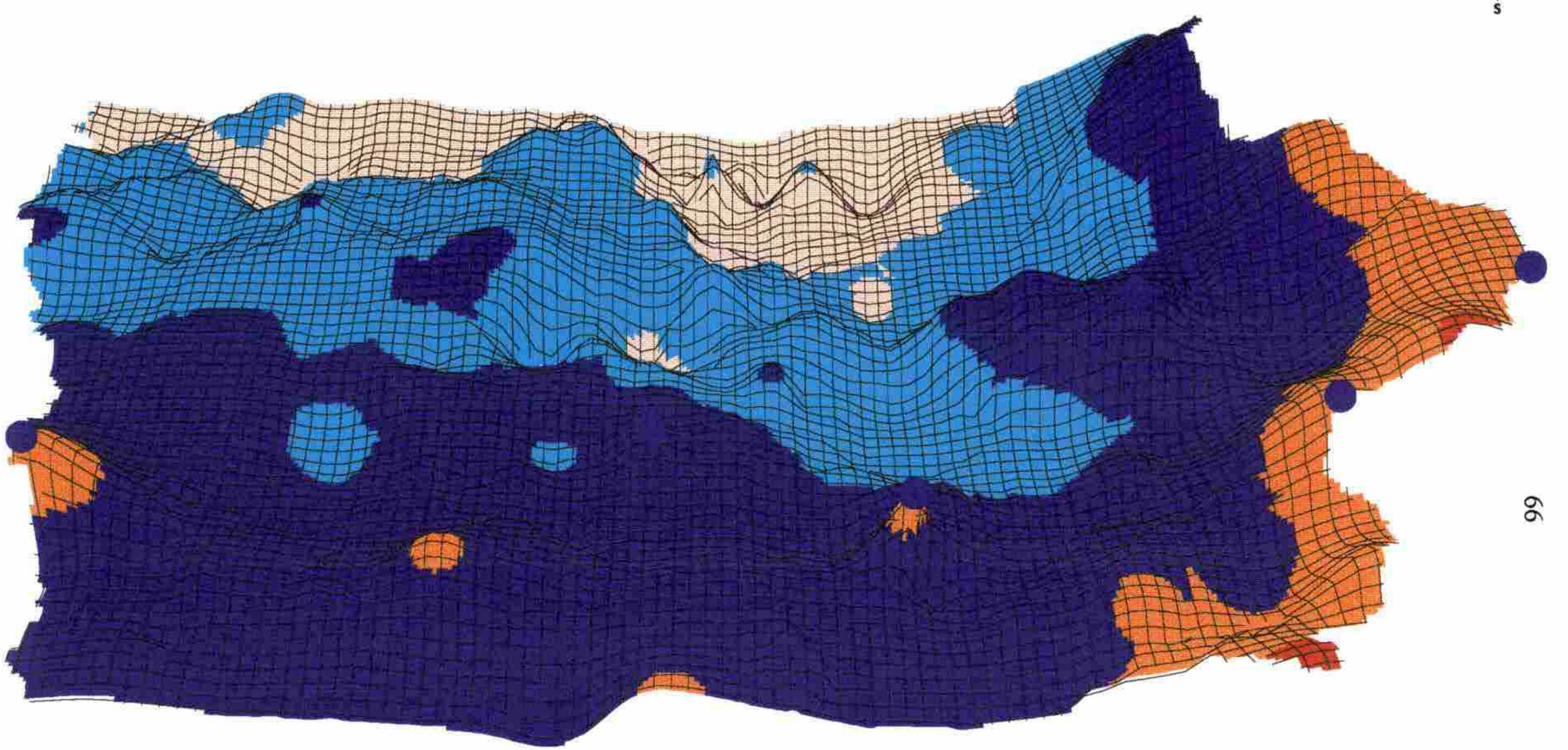
230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

September 21, 1995 Iowa Corn Prices

Min = 249, Max = 294, Mean = 270, Std = 7

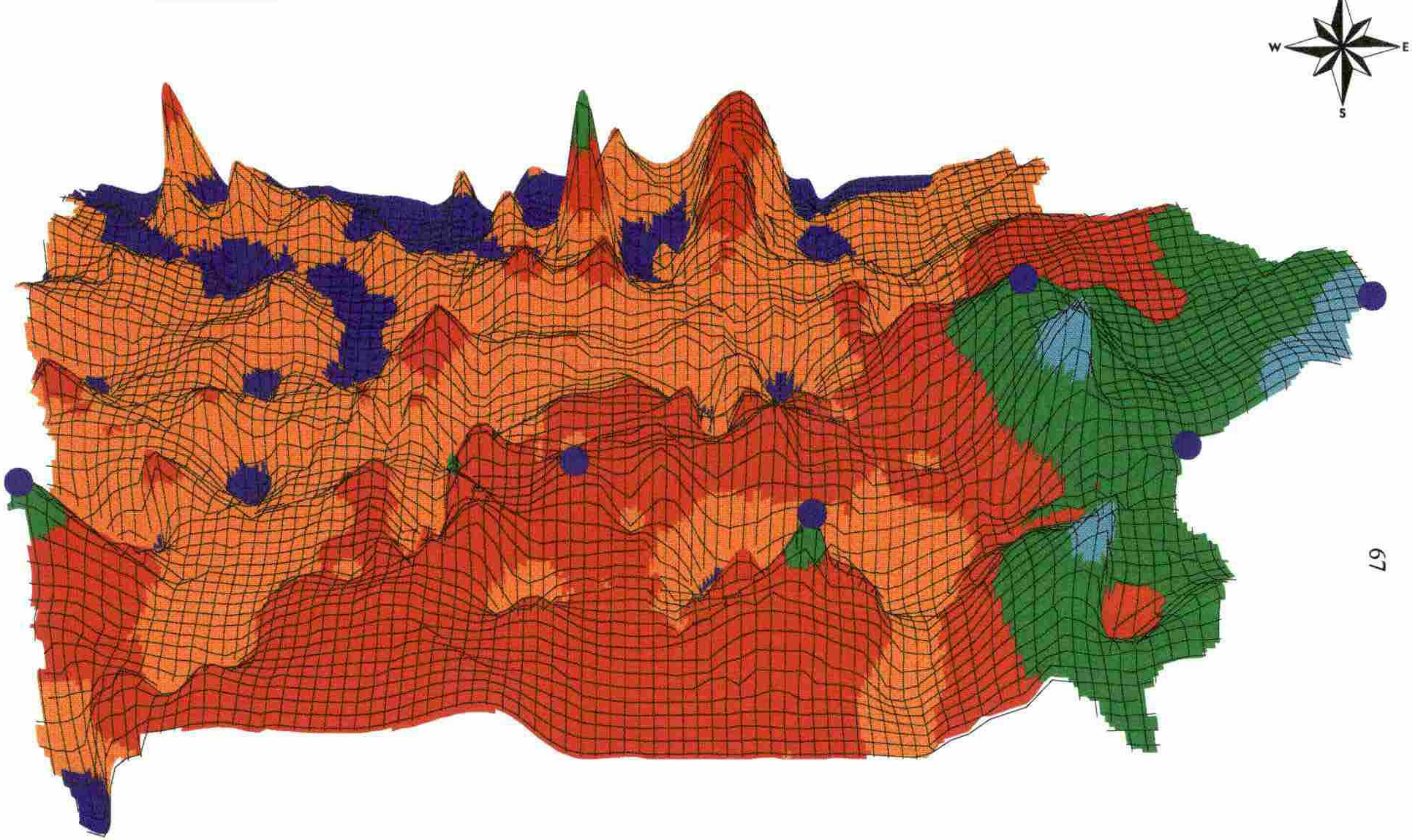
Zscale 600-6, Azimuth 180 0.13 450km



Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/



October 17, 1995 Iowa Corn Prices

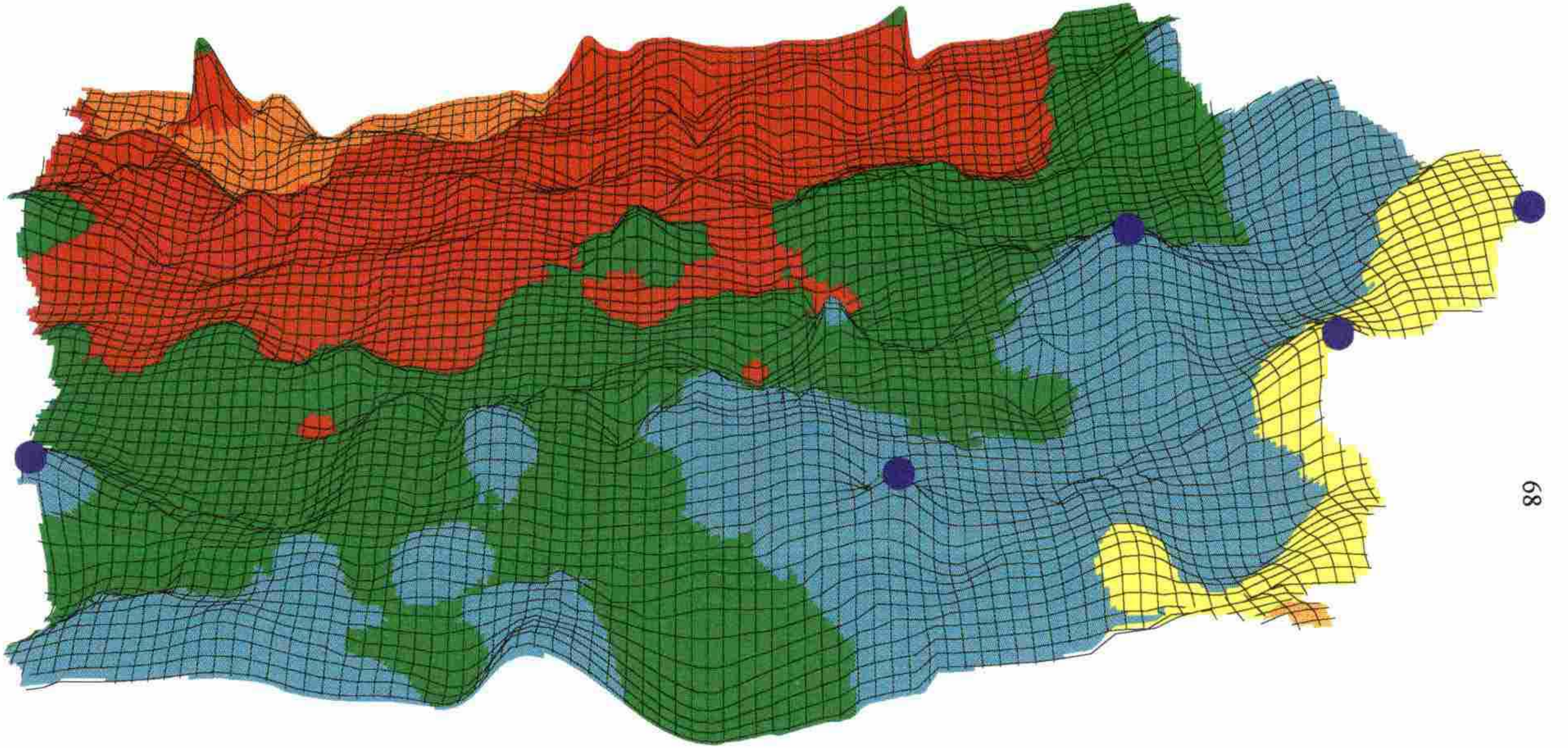
Min = 269, Max = 318, Mean = 289, Std = 8
Zscale 600-6, Azimuth 180 0.13 450km

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

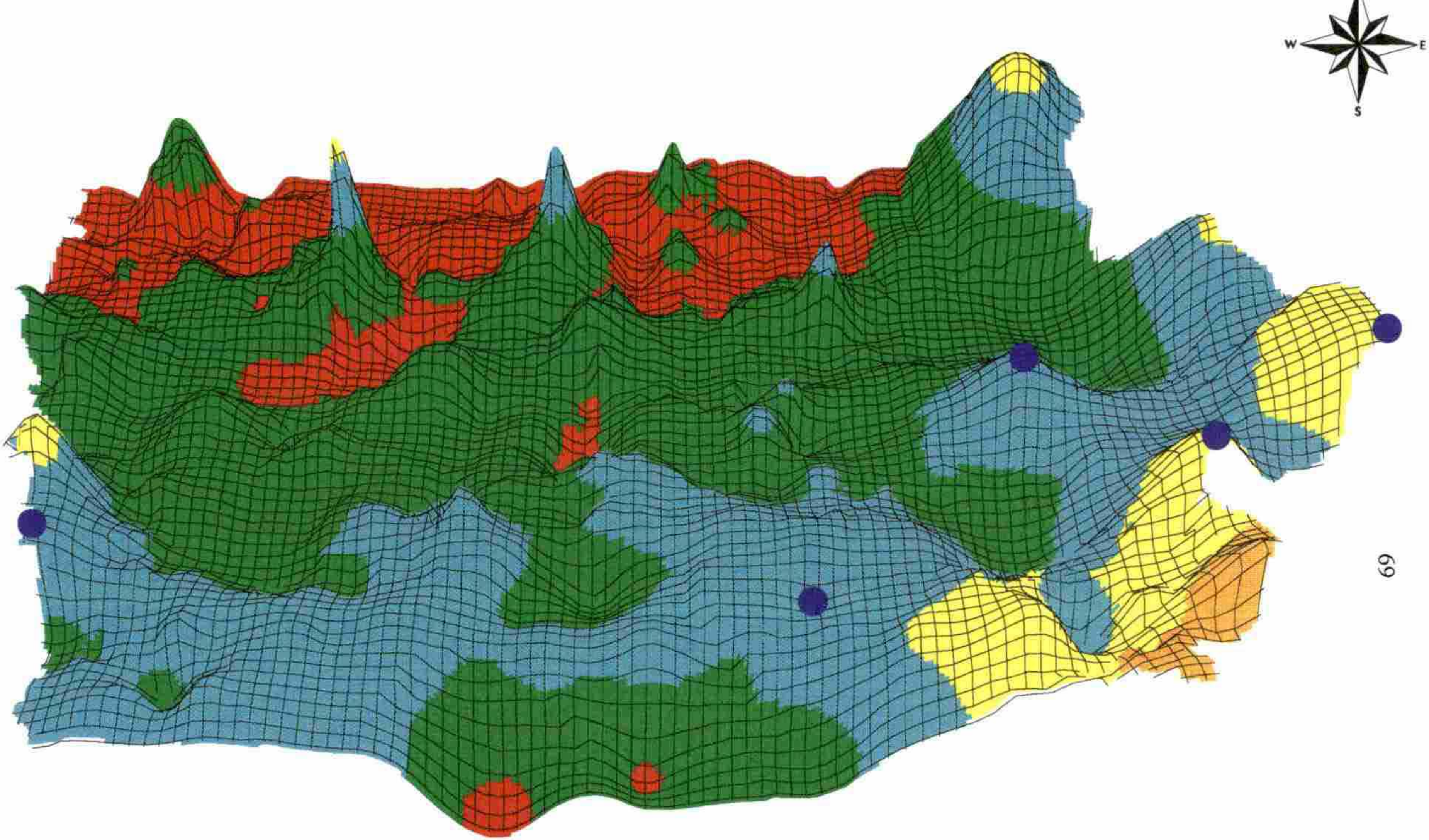
November 6, 1995 Iowa Corn Prices
Min = 281, Max = 334, Mean = 304, Std = 9
Zscale 600-6, Azimuth 180 0.13 450km



Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/



December 7, 1995 Iowa Corn Prices

Min = 289, Max = 340, Mean = 307, Std = 8

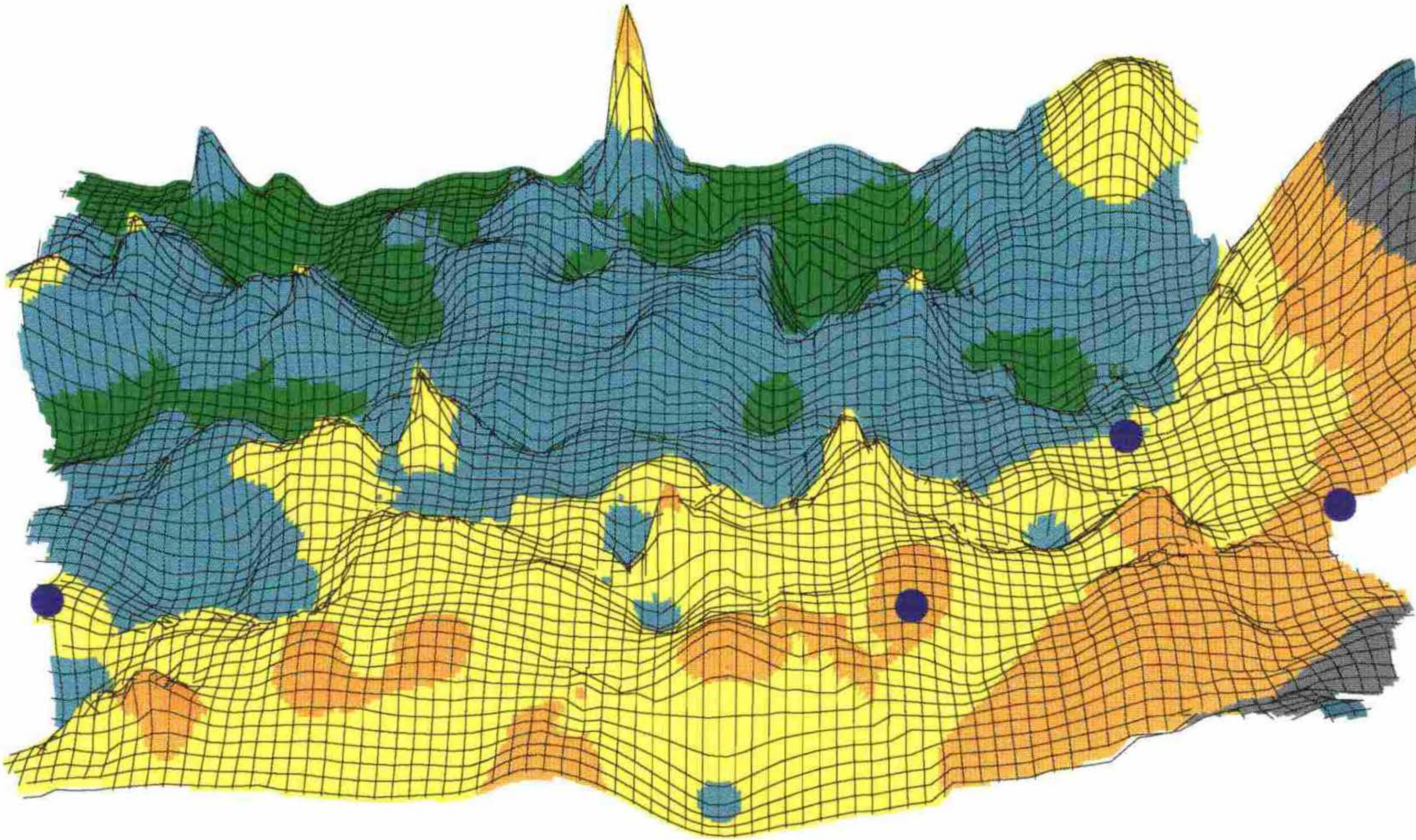
Zscale 600-6, Azimuth 180 0.13 450km

Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

January 18, 1996 Iowa Corn Prices
Min = 300, Max = 353, Mean = 320, Std = 10
Zscale 600-6, Azimuth 180 0.13 450km

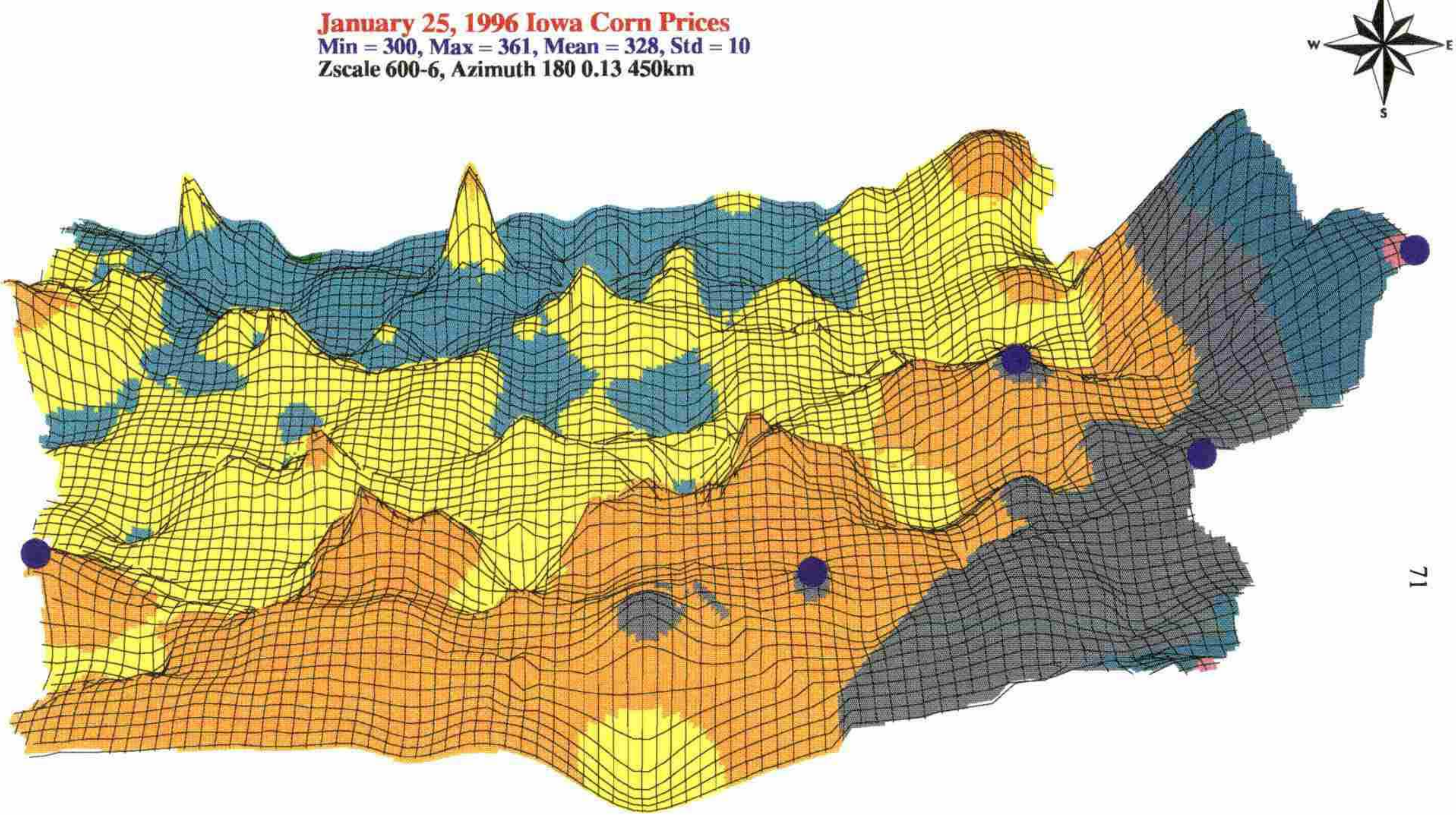


Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

January 25, 1996 Iowa Corn Prices
Min = 300, Max = 361, Mean = 328, Std = 10
Zscale 600-6, Azimuth 180 0.13 450km

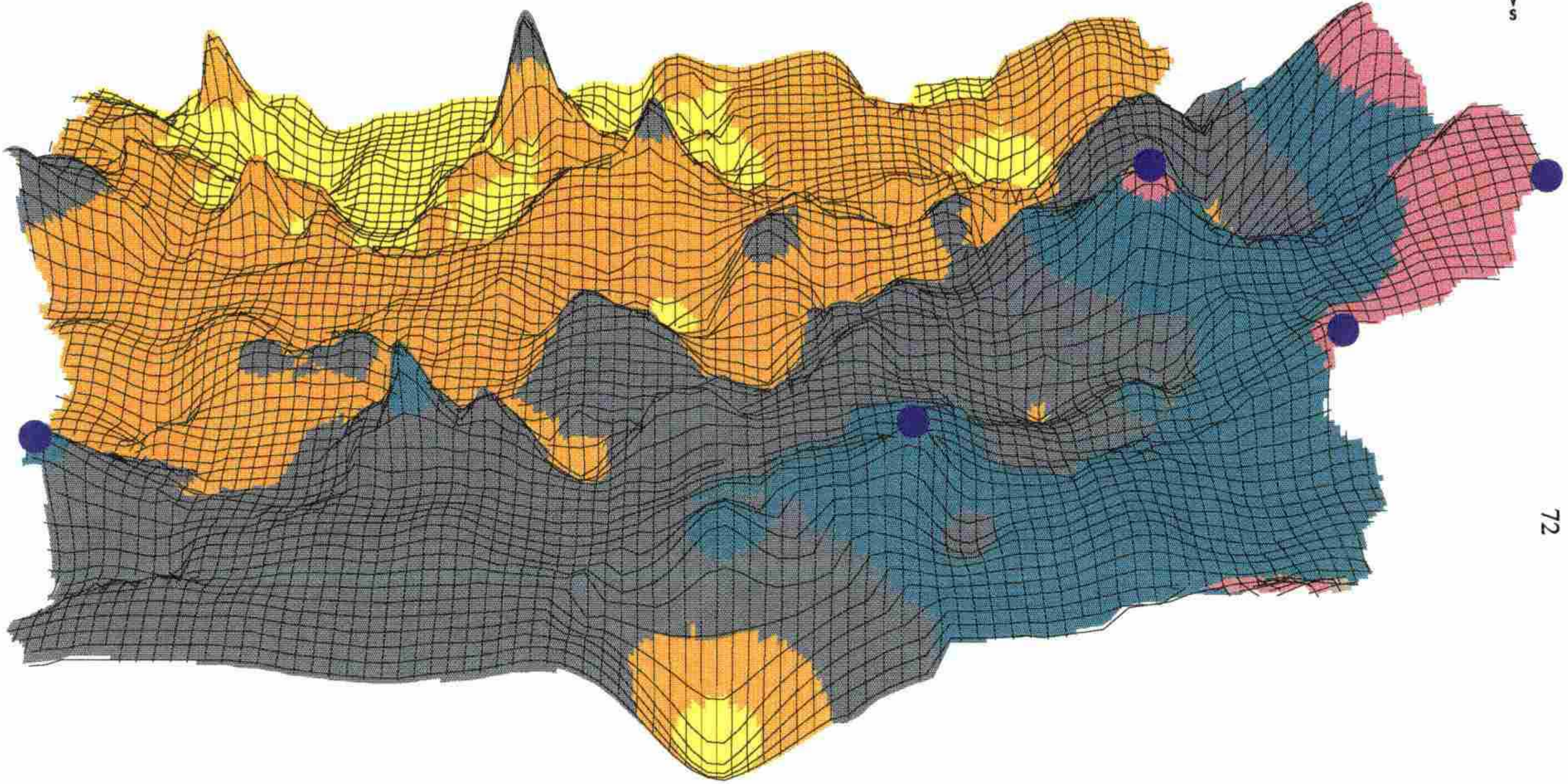


Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

January 30, 1996 Iowa Corn Prices
Min = 319, Max = 371, Mean = 341, Std = 10
Zscale 600-6, Azimuth 180 0.13 450km

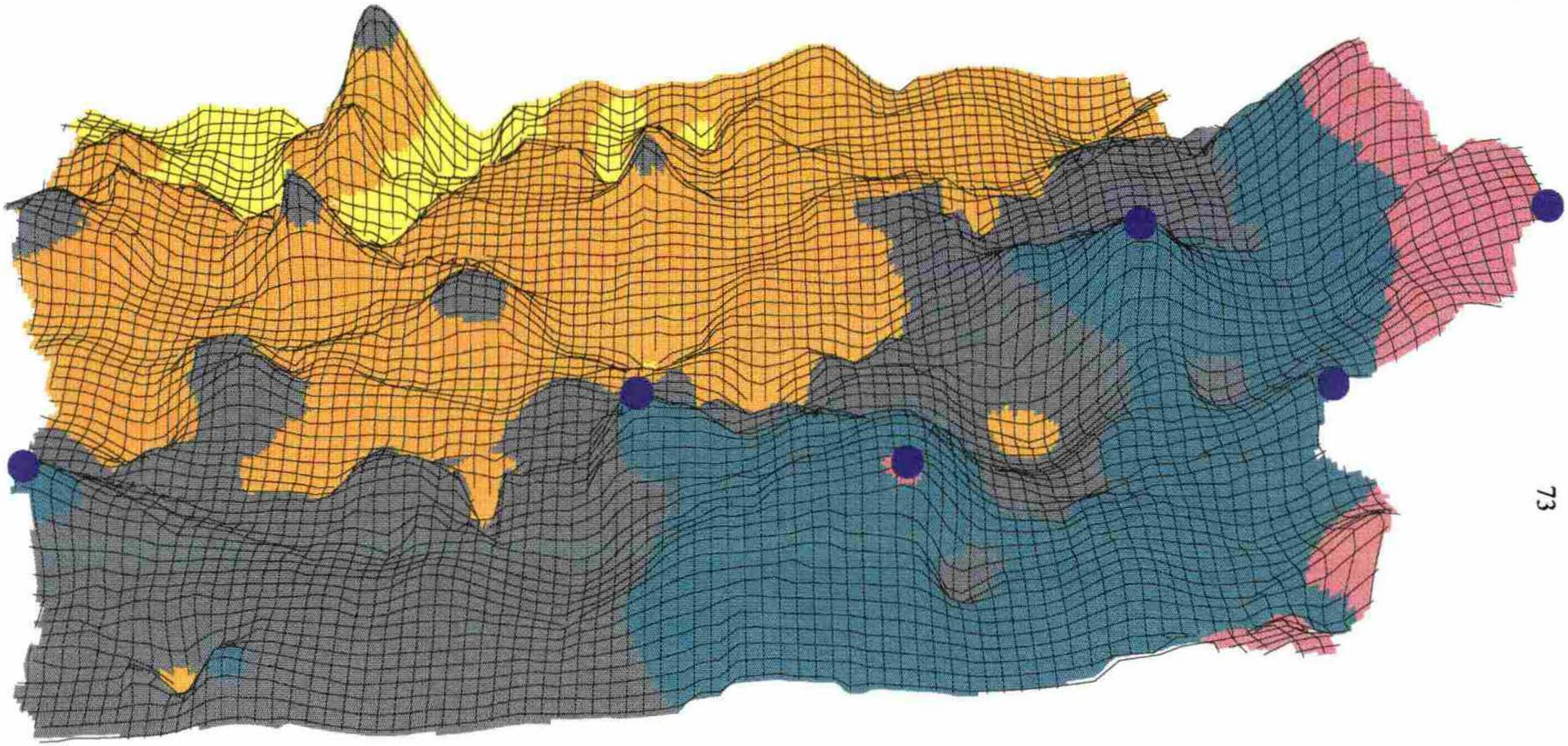


Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

February 12, 1996 Iowa Corn Prices
Min = 322, Max = 370, Mean = 342, Std = 9
Zscale 600-6, Azimuth 180 0.13 450km



Legend

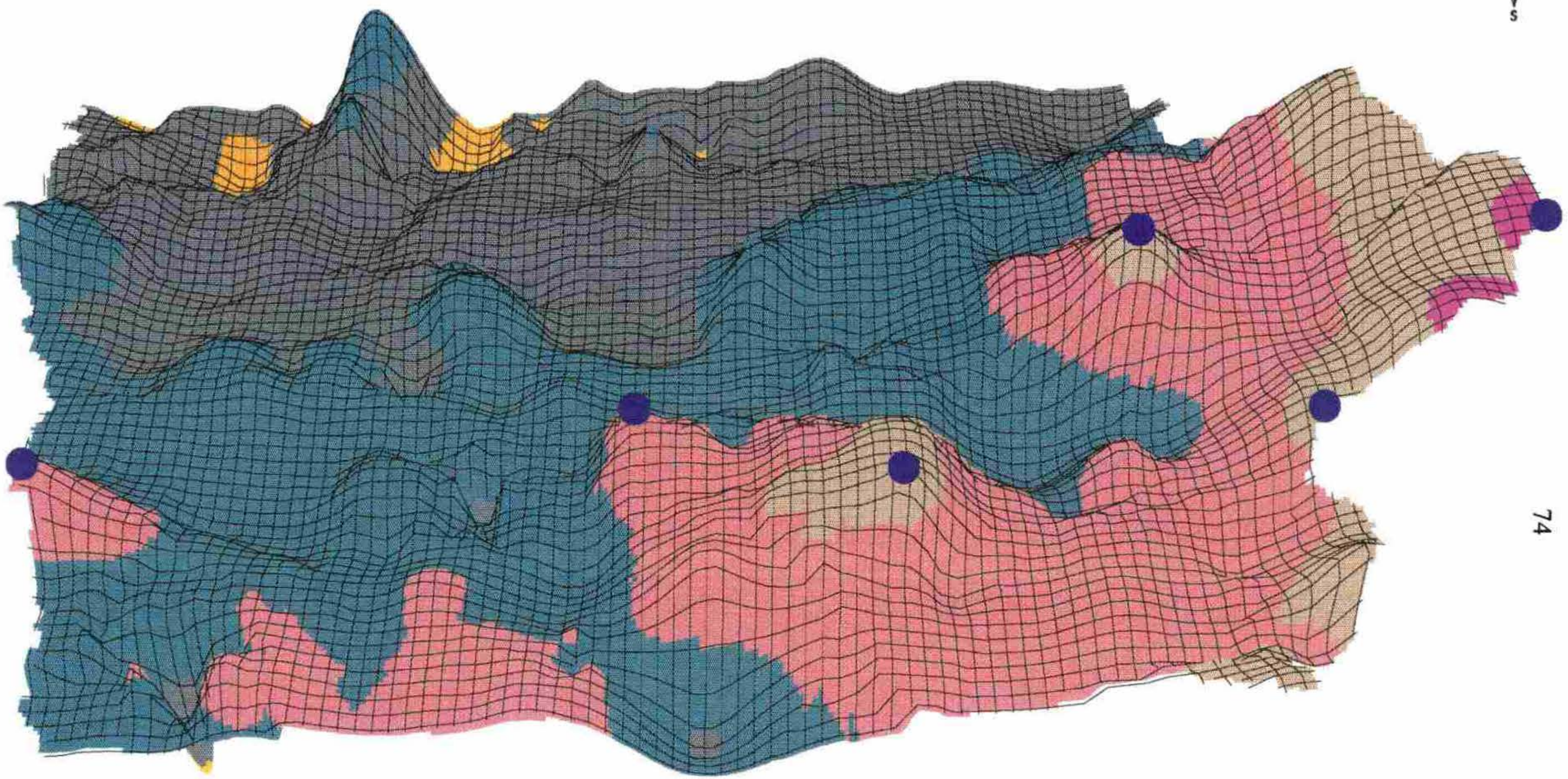
230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

February 14, 1996 Iowa Corn Prices

Min = 334, Max = 382, Mean = 353, Std = 9

Zscale 600-6, Azimuth 180 0.13 450km



Legend

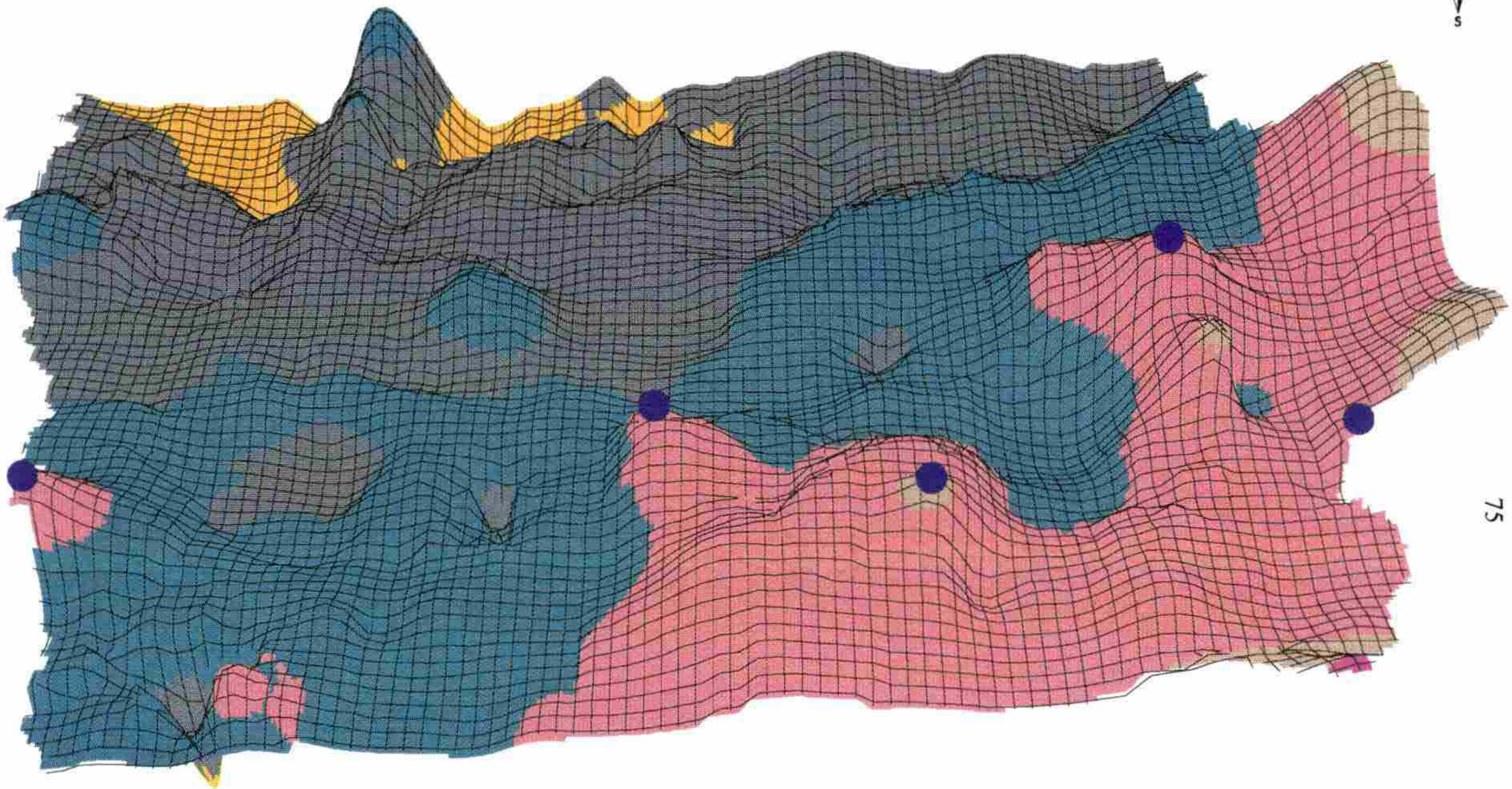
230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

February 22, 1996 Iowa Corn Prices

Min = 334, Max = 382, Mean = 353, Std = 9

Zscale 600-6, Azimuth 180 0.13 450km



Legend

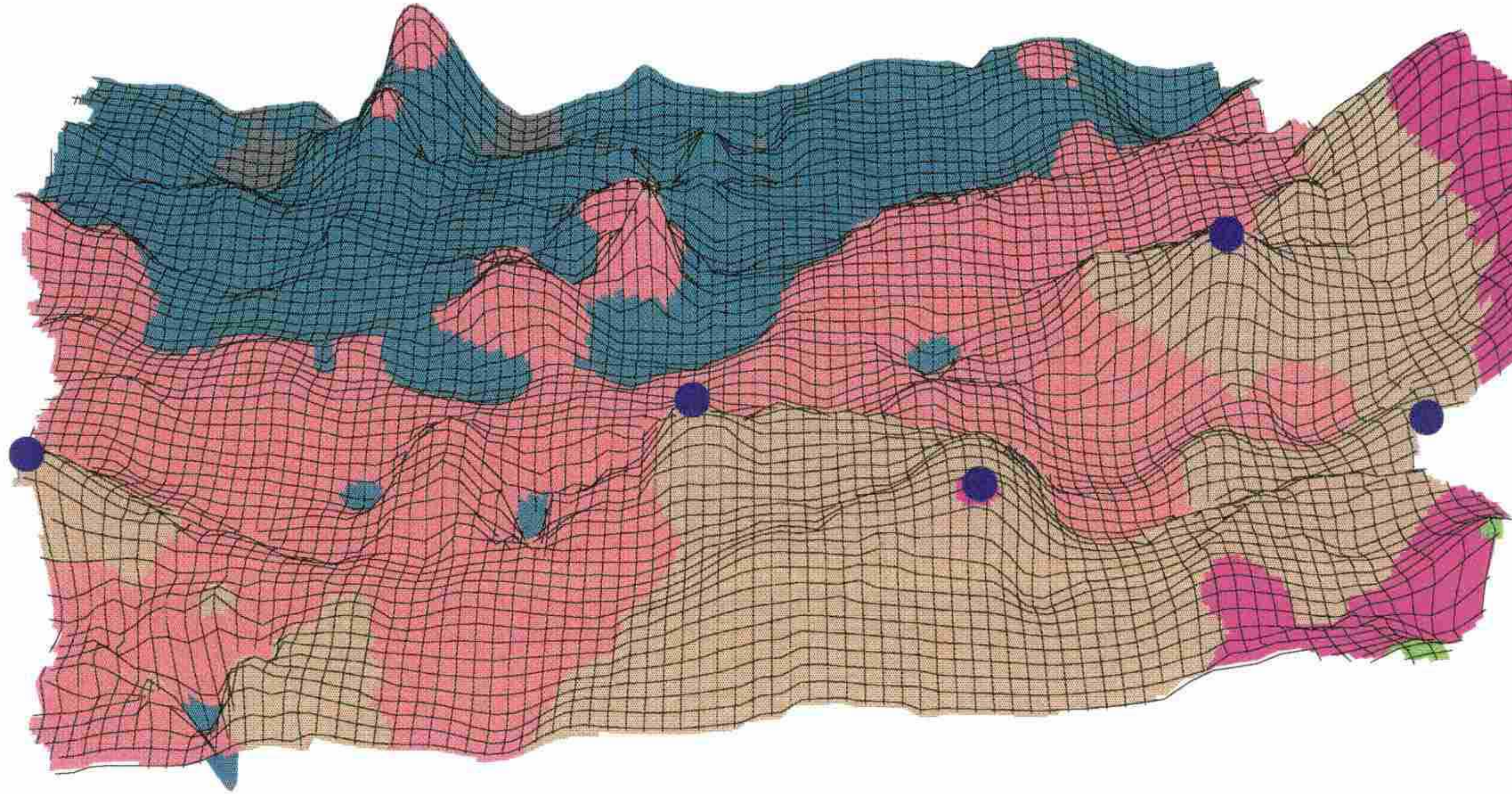
- 230-240:Dark Violet
- 240-250:Dark Green
- 250-260:Peach
- 260-270:Cyan
- 270-280:Blue
- 280-290:Orange
- 290-300:Red
- 300-310:Green
- 310-320:Turquoise
- 320-330:Yellow
- 330-340:Gold
- 340-350:Slate Gray
- 350-360:Light Seagreen
- 360-370:Hot Pink
- 370-380:Tan
- 380-390:Magenta
- 390-400:Green Yellow
- 400-410:Navy
- 410-420:Rosy Brown
- 420-430:Tomato
- 430-440:Purple
- 440-450:Sky Blue
- 450-460:Pale Green
- 460-470:Light Salmon
- 470-480:Cadet Blue
- 480-490:Dark Khaki
- 490-500:Chocolate
- 500-510:Deep Pink
- 510-520:Gray
- 520-530:Pale Turquoise
- 530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

February 27, 1996 Iowa Corn Prices

Min = 345, Max = 393, Mean = 365, Std = 9

Zscale 600-6, Azimuth 180 0.13 450km



Legend

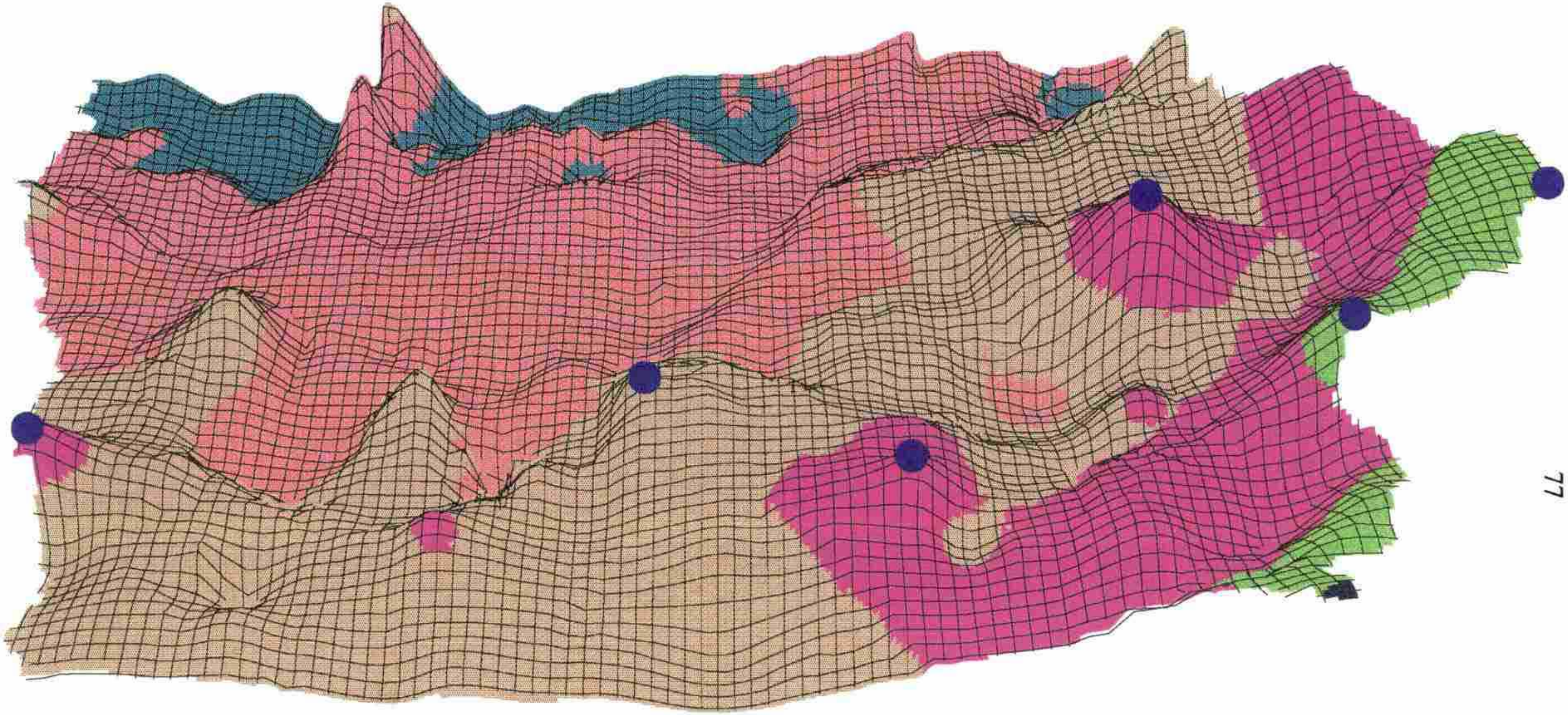
230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

March 14, 1996 Iowa Corn Prices

Min = 352, Max = 401, Mean = 371, Std = 9

Zscale 600-6, Azimuth 180 0.12 450km

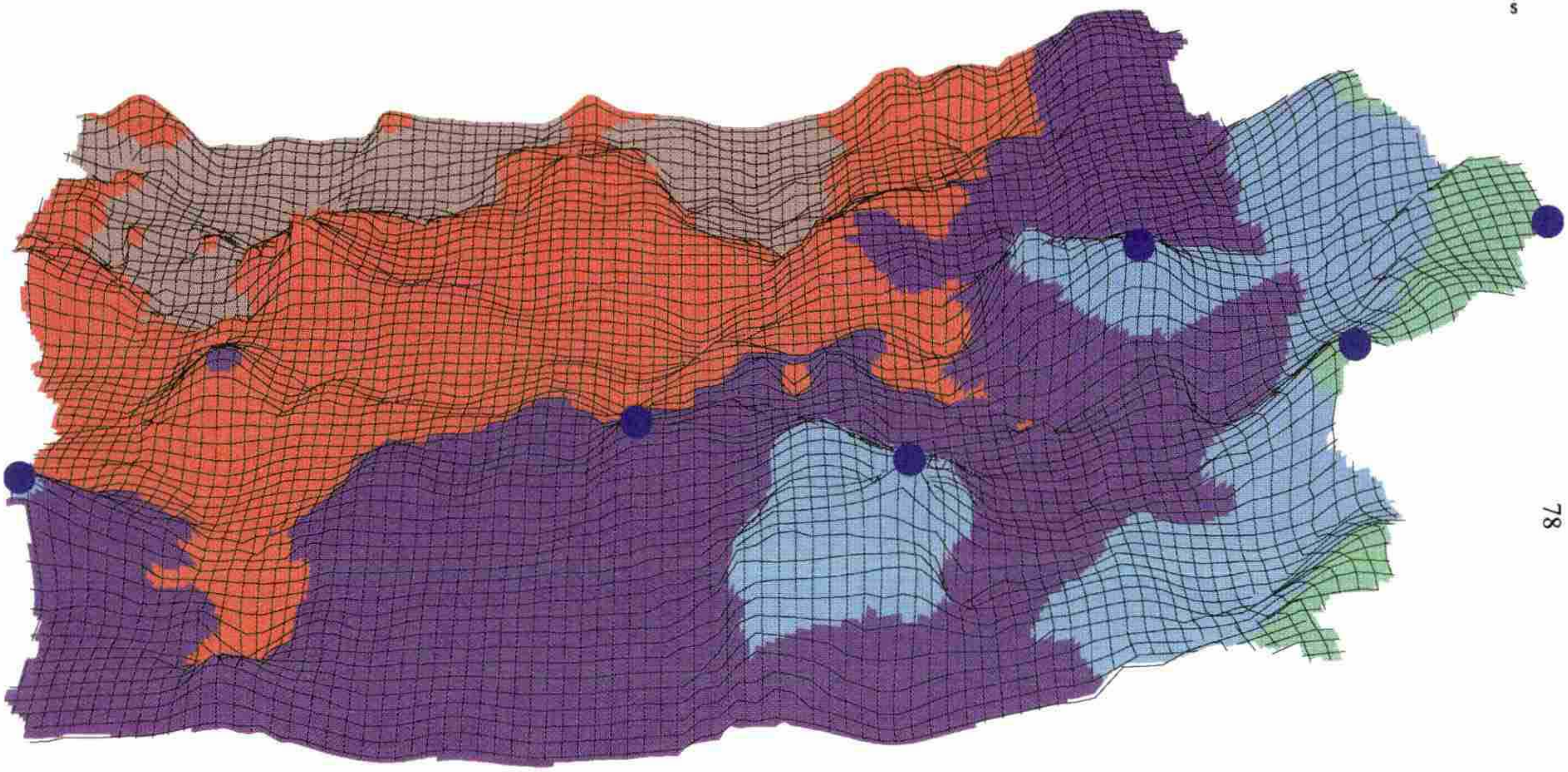


Legend

- 230-240:Dark Violet
- 240-250:Dark Green
- 250-260:Peach
- 260-270:Cyan
- 270-280:Blue
- 280-290:Orange
- 290-300:Red
- 300-310:Green
- 310-320:Turquoise
- 320-330:Yellow
- 330-340:Gold
- 340-350:Slate Gray
- 350-360:Light Seagreen
- 360-370:Hot Pink
- 370-380:Tan
- 380-390:Magenta
- 390-400:Green Yellow
- 400-410:Navy
- 410-420:Rosy Brown
- 420-430:Tomato
- 430-440:Purple
- 440-450:Sky Blue
- 450-460:Pale Green
- 460-470:Light Salmon
- 470-480:Cadet Blue
- 480-490:Dark Khaki
- 490-500:Chocolate
- 500-510:Deep Pink
- 510-520:Gray
- 520-530:Pale Turquoise
- 530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

April 12, 1996 Iowa Corn Prices
Min = 413, Max = 455, Mean = 430, Std = 9
Zscale 600-6, Azimuth 180 0.13 450km



Legend

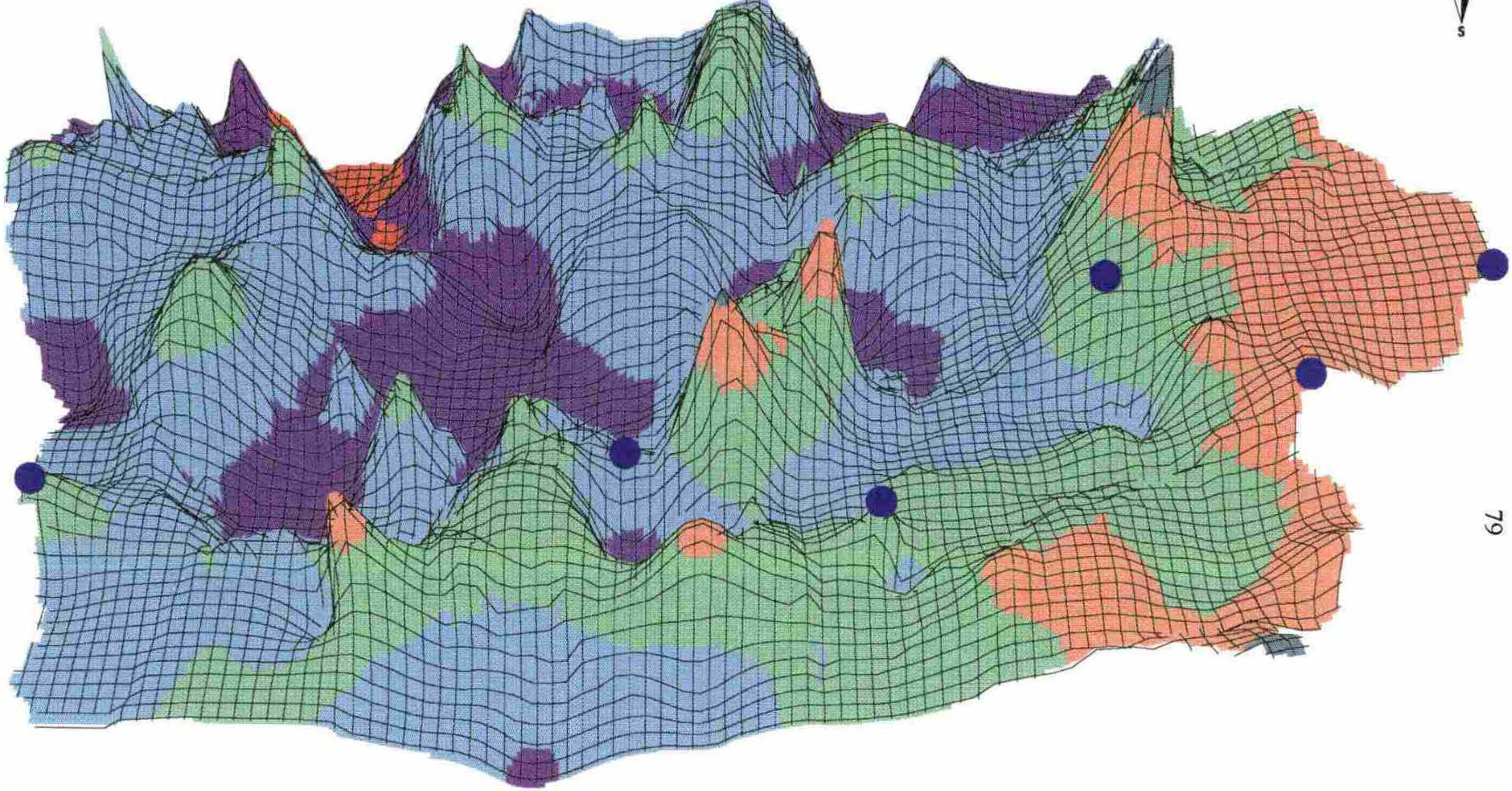
230-240:Dark Violet	310-320:Turquoise	390-400:Green Yellow	470-480:Cadet Blue
240-250:Dark Green	320-330:Yellow	400-410:Navy	480-490:Dark Khaki
250-260:Peach	330-340:Gold	410-420:Rosy Brown	490-500:Chocolate
260-270:Cyan	340-350:Slate Gray	420-430:Tomato	500-510:Deep Pink
270-280:Blue	350-360:Light Seagreen	430-440:Purple	510-520:Gray
280-290:Orange	360-370:Hot Pink	440-450:Sky Blue	520-530:Pale Turquoise
290-300:Red	370-380:Tan	450-460:Pale Green	530-540:Chartreuse
300-310:Green	380-390:Magenta	460-470:Light Salmon	

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

April 29, 1996 Iowa Corn Prices

Min = 418, Max = 477, Mean = 447, Std = 9

Zscale 600-6, Azimuth 180 0.13 450km

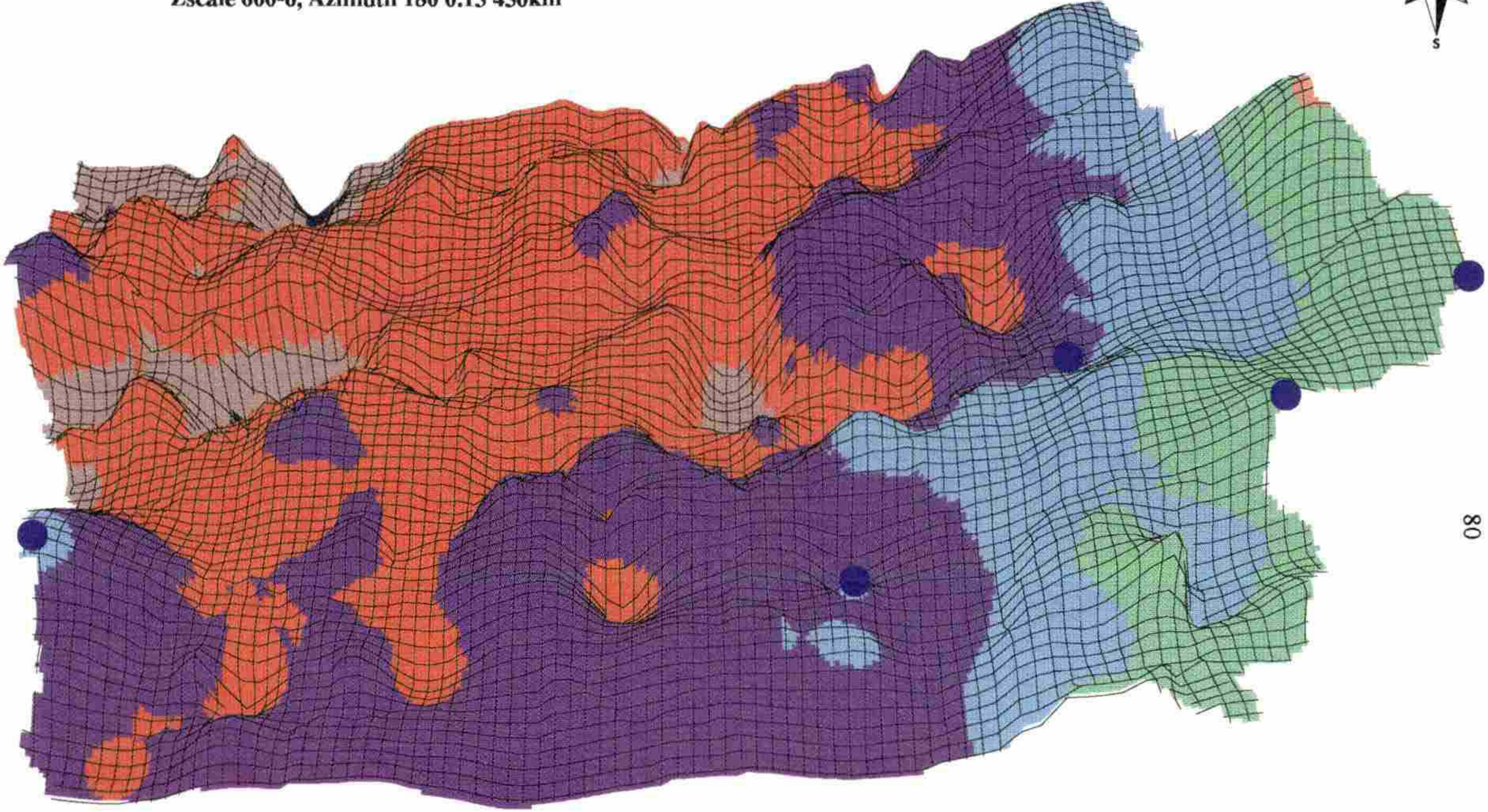


Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

April 30, 1996 Iowa Corn Prices
Min = 405, Max = 461, Mean = 433, Std = 10
Zscale 600-6, Azimuth 180 0.13 450km

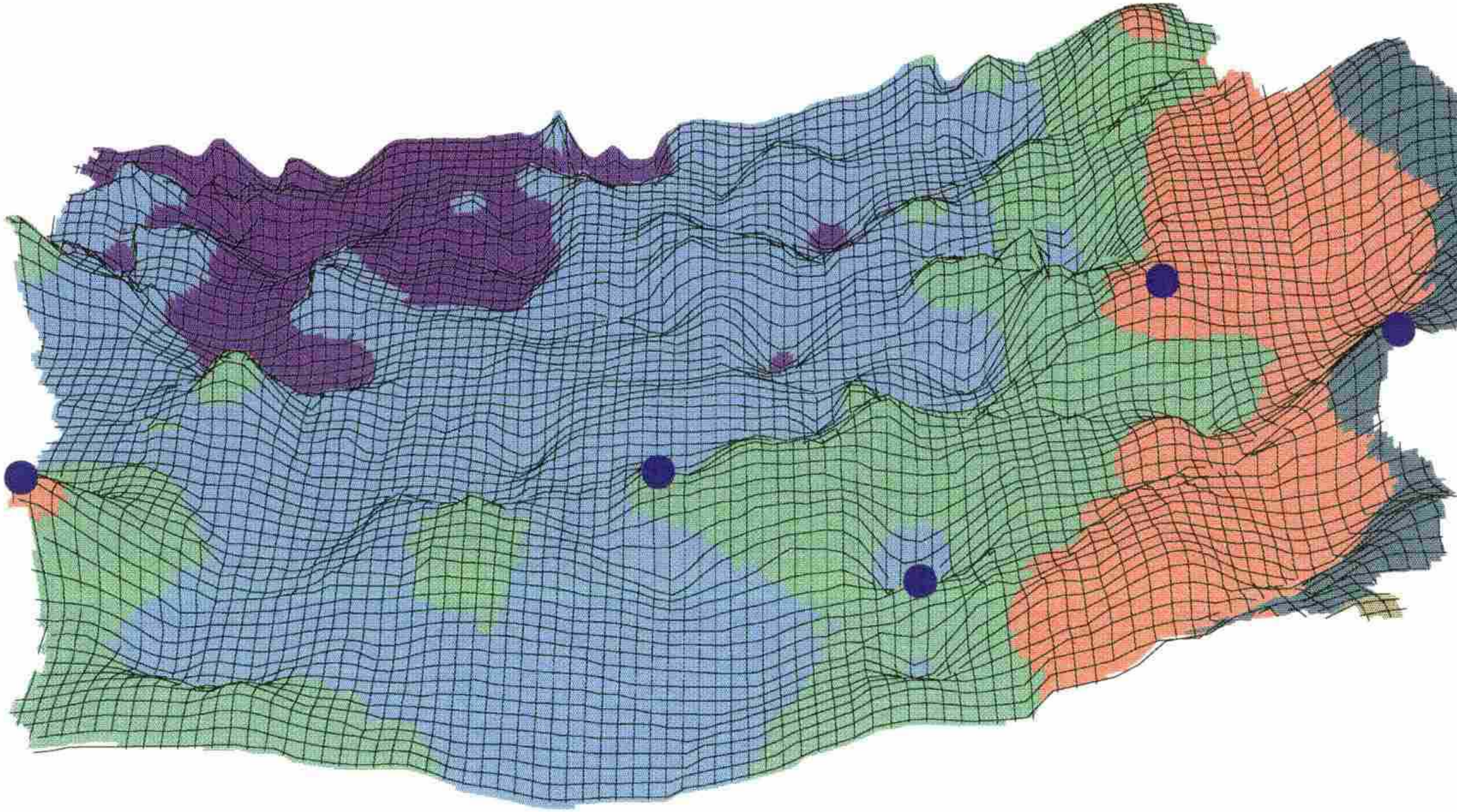


Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

May 7, 1996 Iowa Corn Prices
Min = 430, Max = 482, Mean = 450, Std = 10
Zscale 600-6, Azimuth 180 0.13 450km



Legend

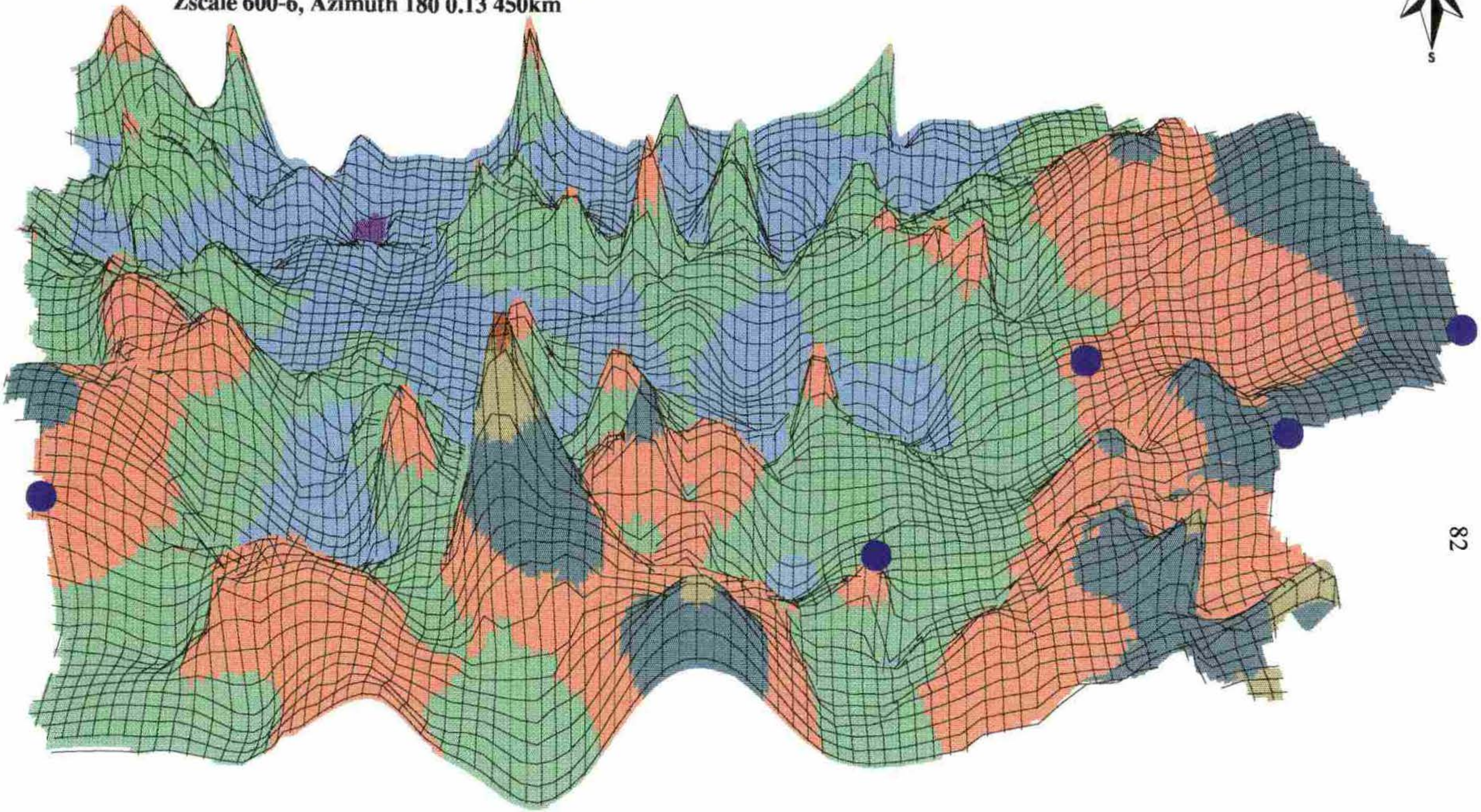
230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

May 29, 1996 Iowa Corn Prices

Min = 436, Max = 493, Mean = 457, Std = 9

Zscale 600-6, Azimuth 180 0.13 450km



Legend

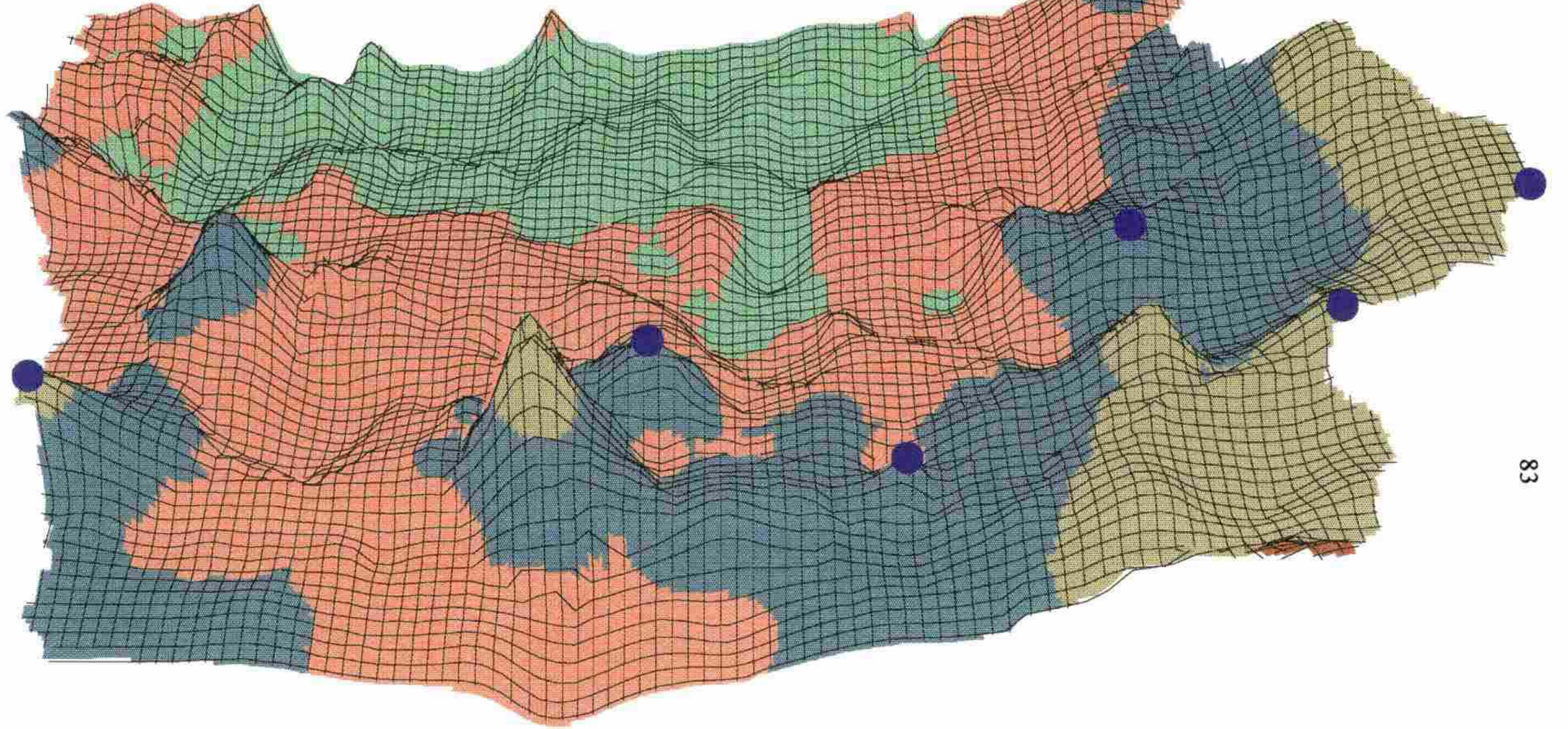
230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

May 31, 1996 Iowa Corn Prices

Min = 449, Max = 498, Mean = 467, Std = 9

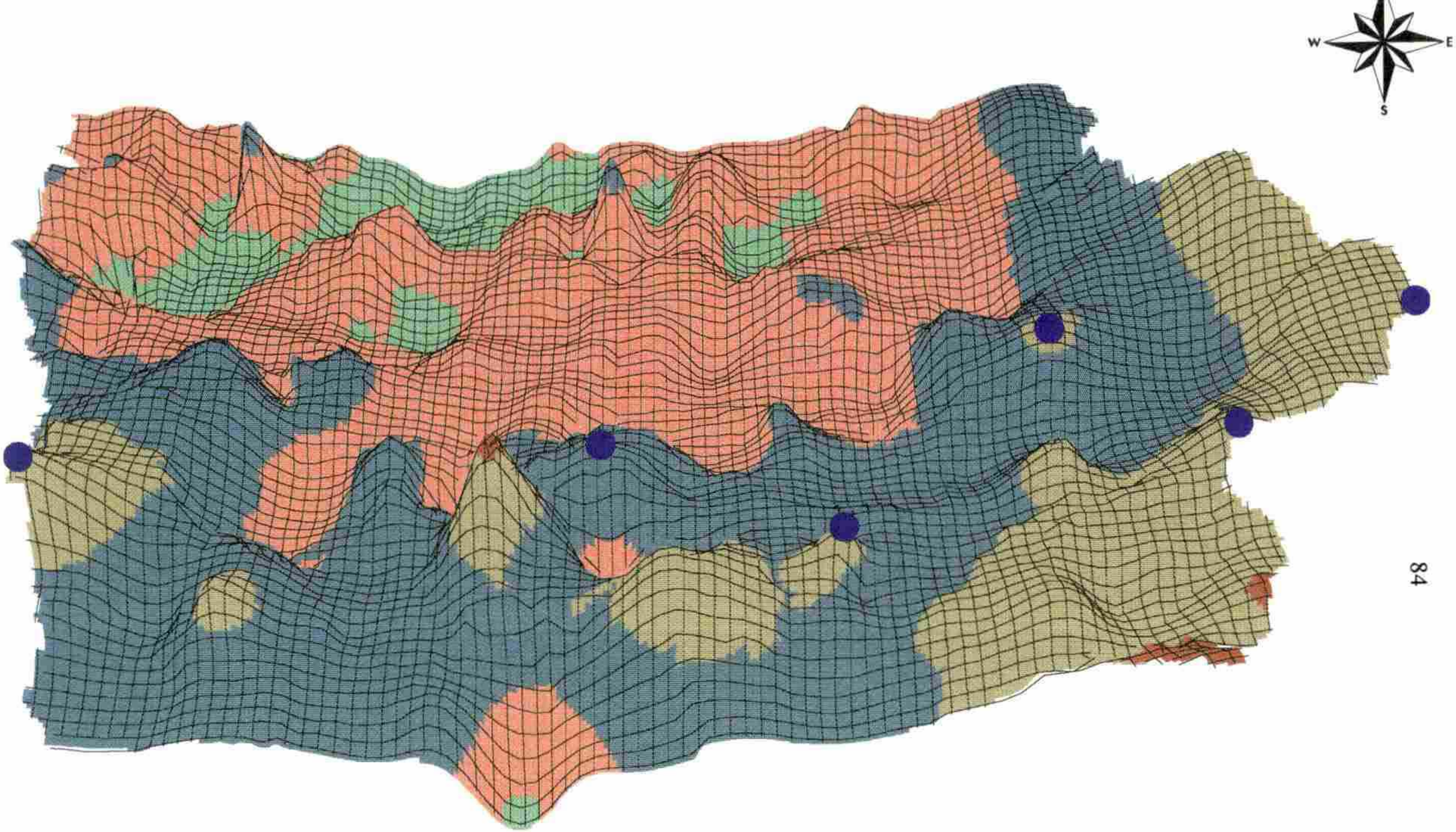
Zscale 600-6, Azimuth 180 0.13 450km



Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/



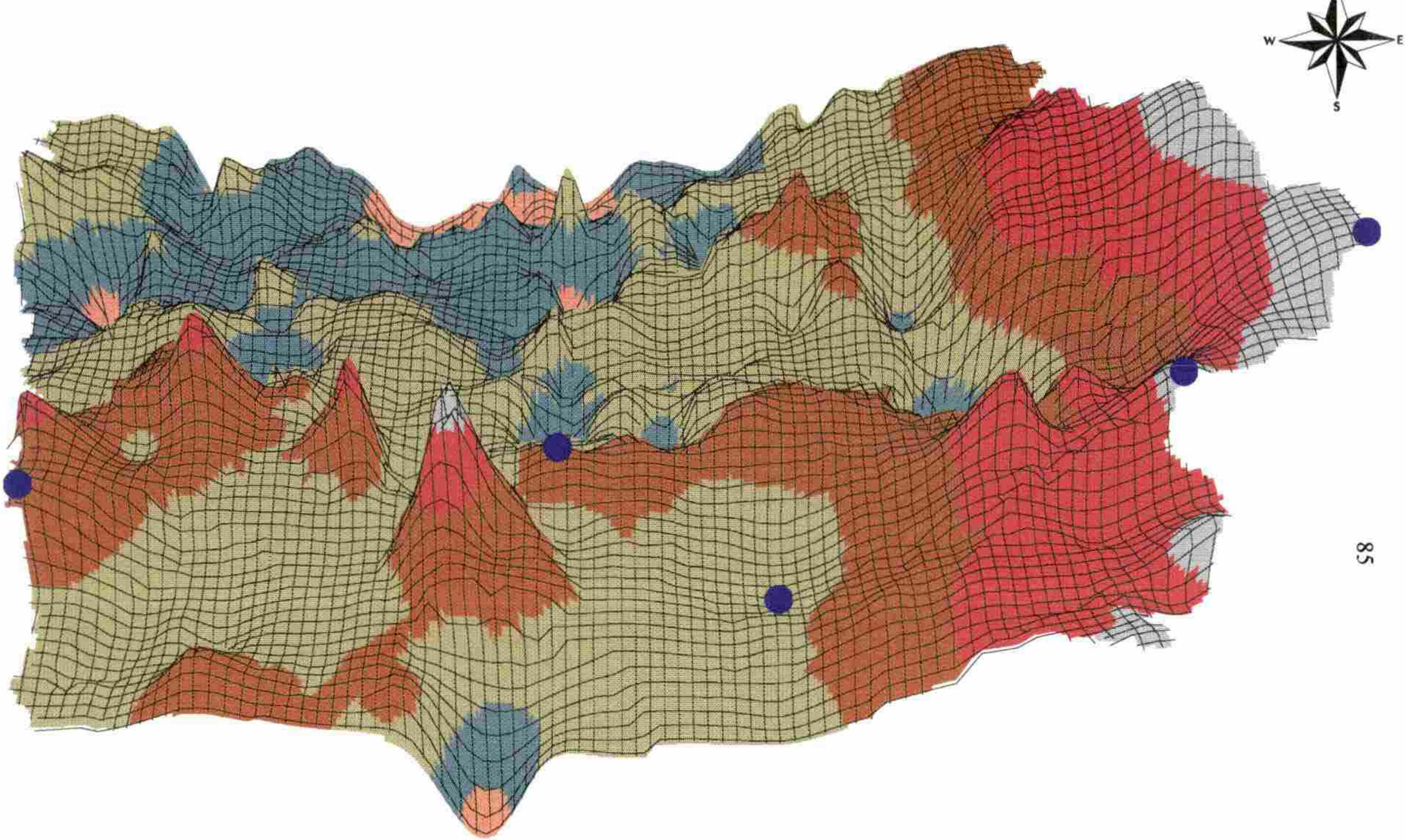
June 12, 1996 Iowa Corn Prices

Min = 450, Max = 500, Mean = 471, Std = 8
Zscale 600-6, Azimuth 180 0.13 450km

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse



July 2, 1996 Iowa Corn Prices

Min = 460, Max = 516, Mean = 487, Std = 10

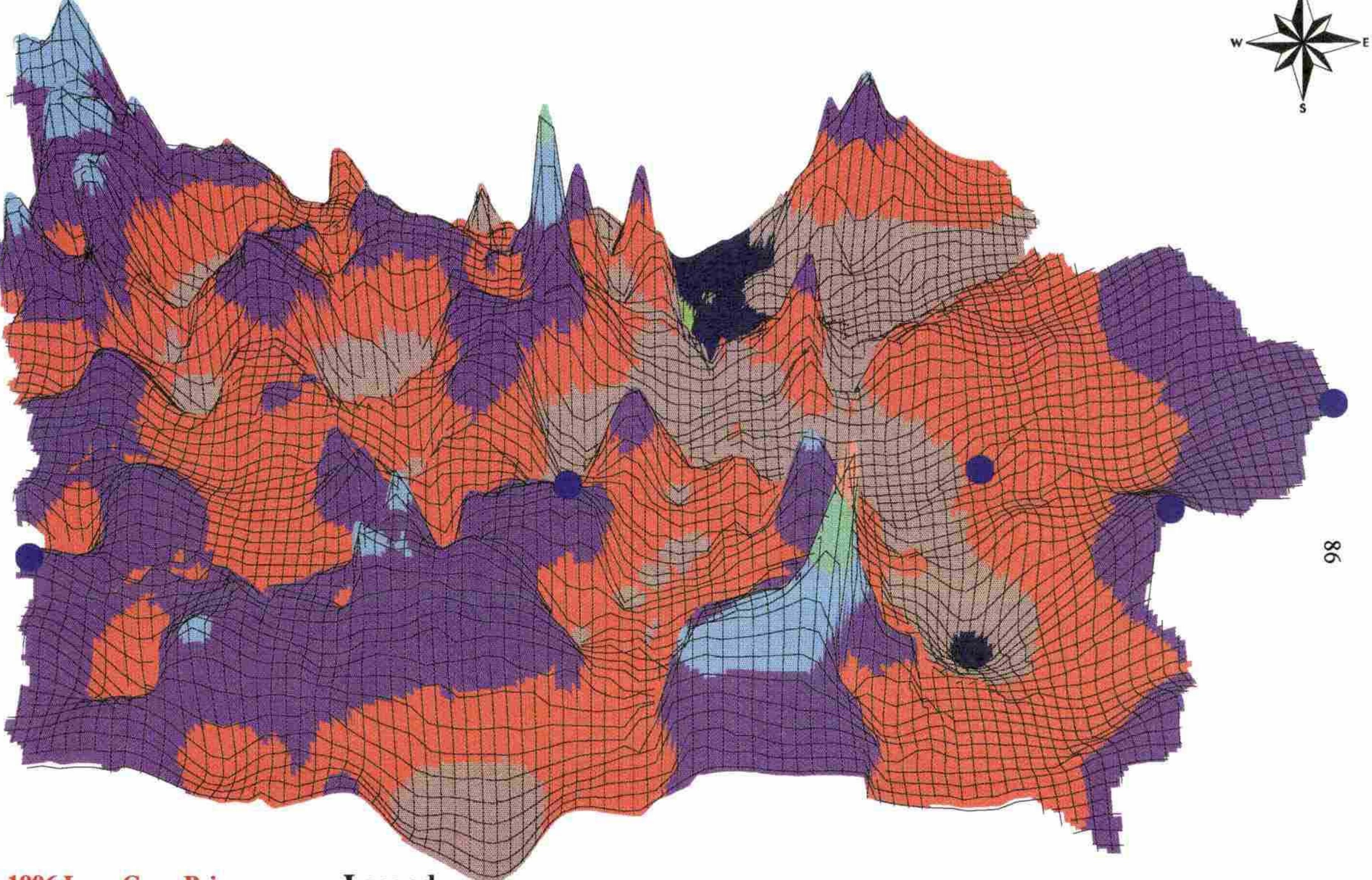
Zscale 600-6, Azimuth 180 0.13 450km

Source: Attila Konkoly; (515)296-7552

http://www.public.iastate.edu/~konkoly/

Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse



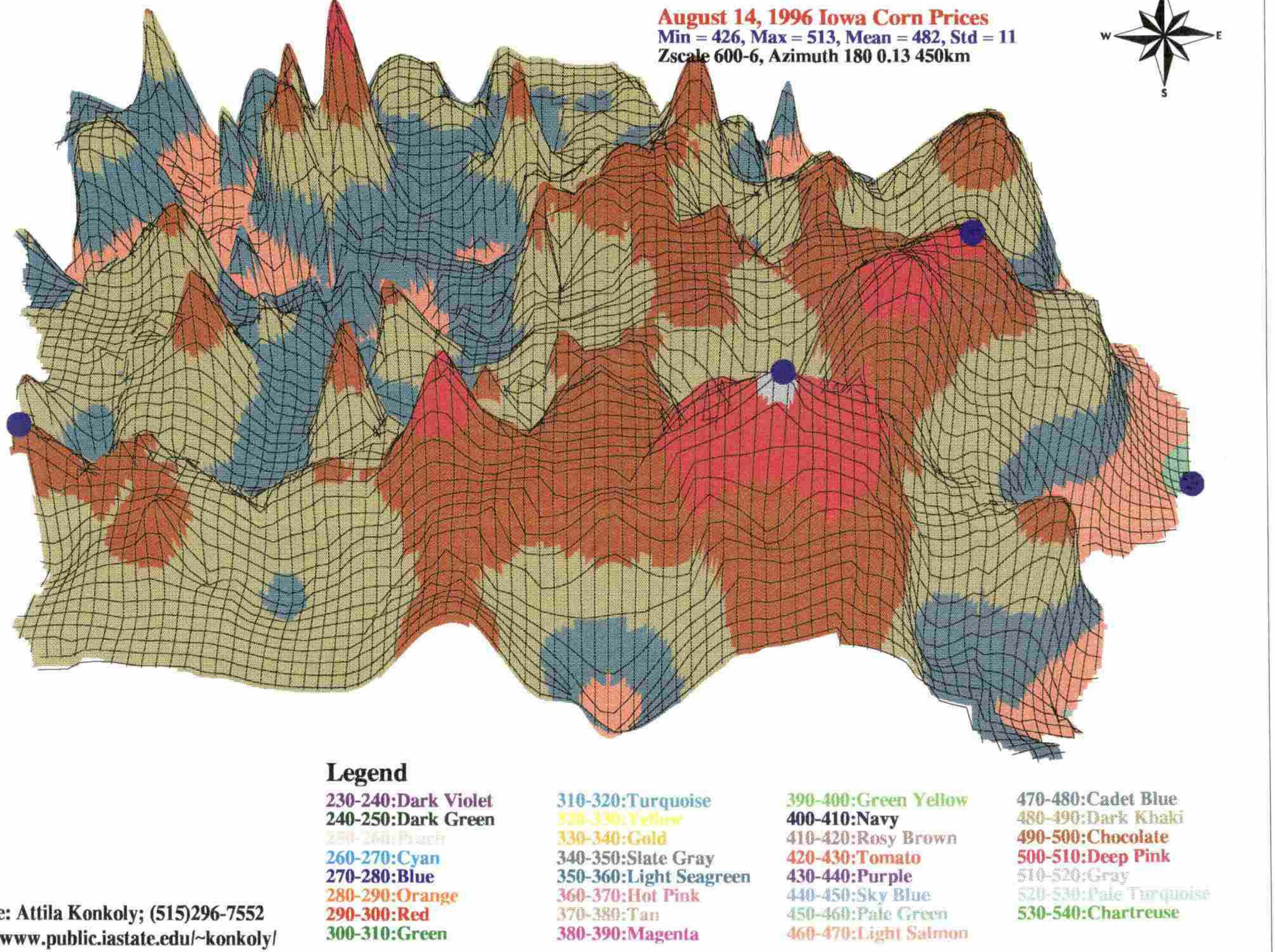
July 19, 1996 Iowa Corn Prices

Min = 386, Max = 468, Mean = 425, Std = 9
Zscale 600-6, Azimuth 180 0.13 450km

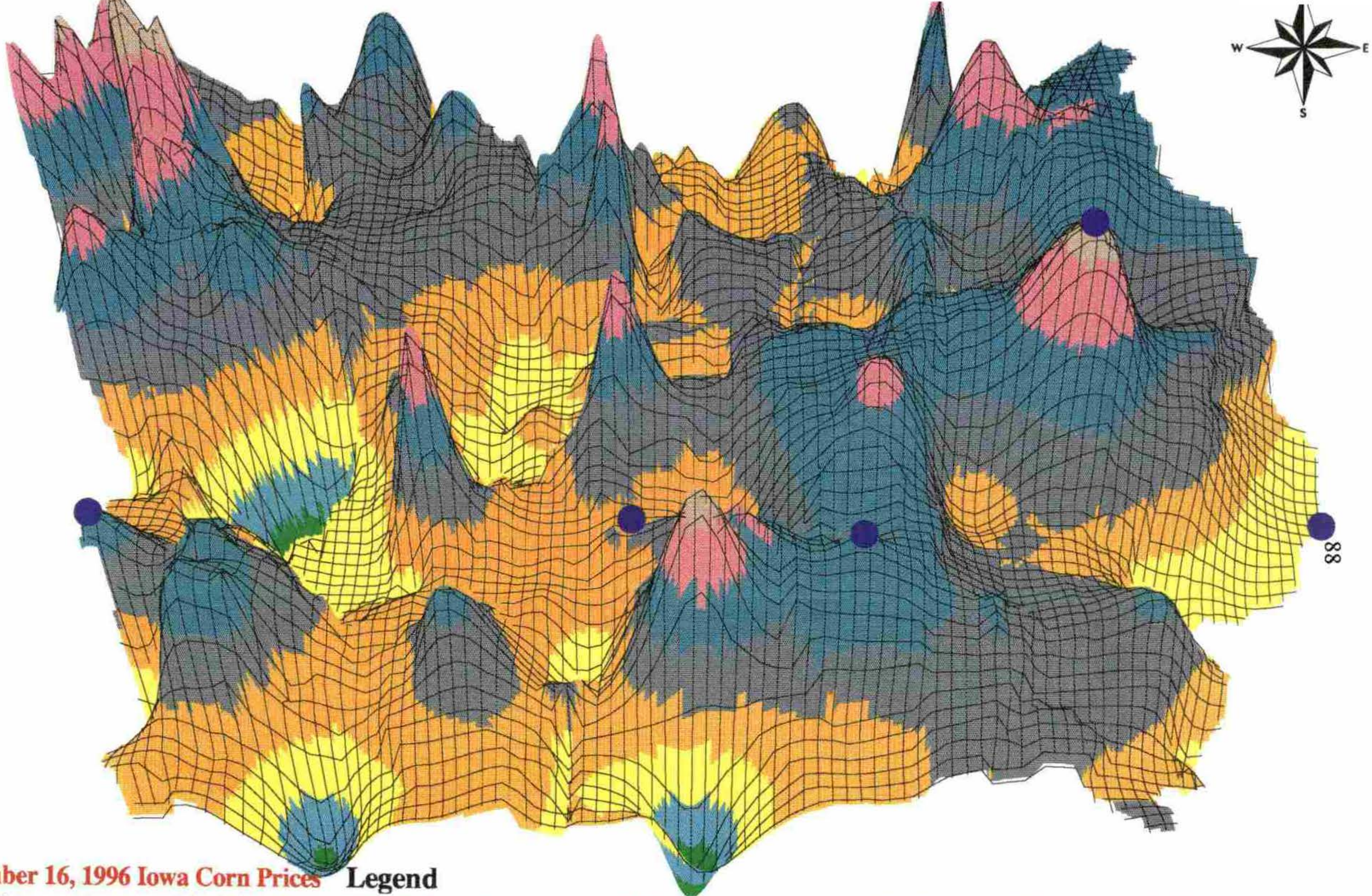
Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse



Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/



September 16, 1996 Iowa Corn Prices

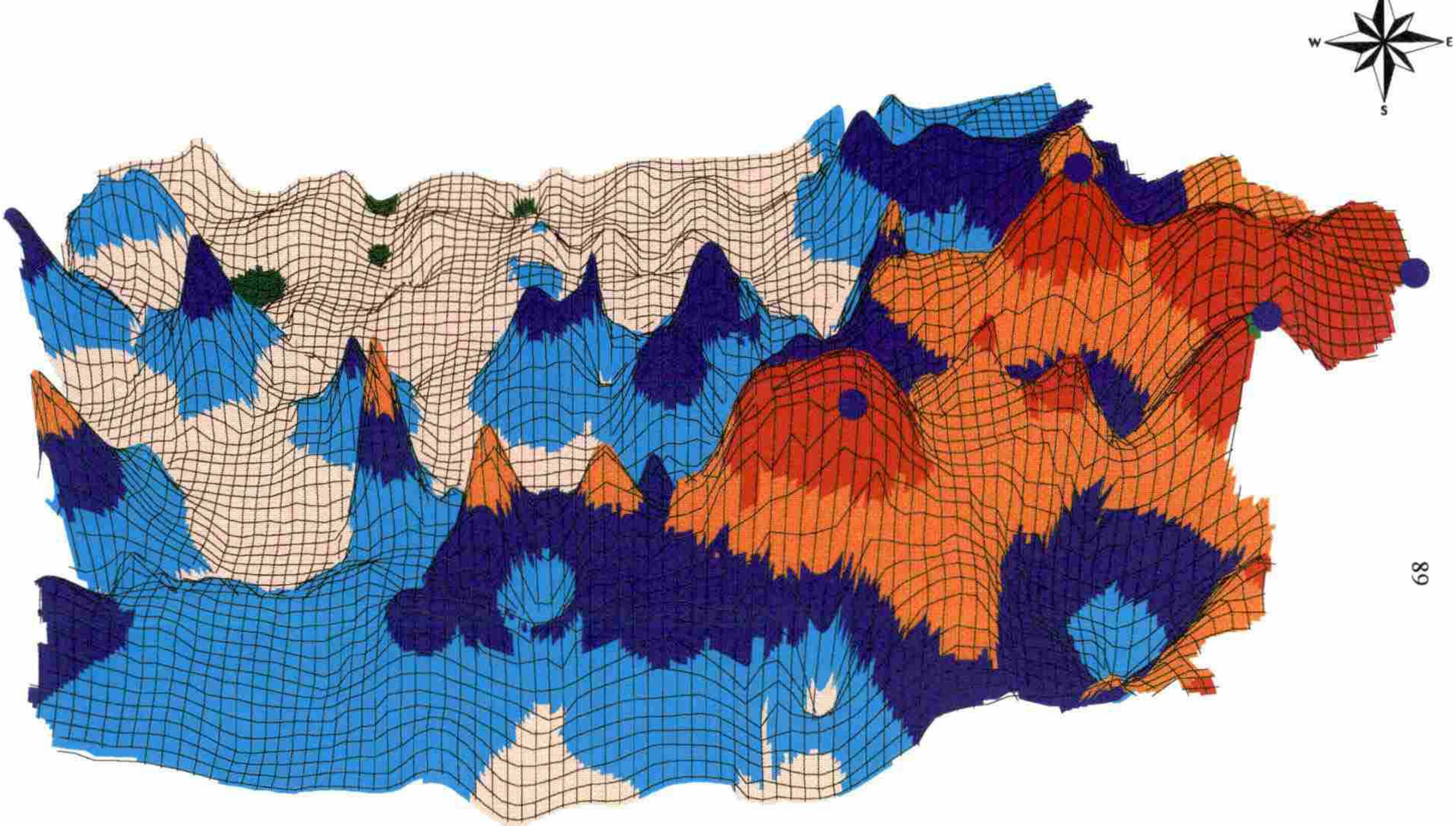
Min = 284, Max = 380, Mean = 341, Std = 12

Zscale 600-6, Azimuth 180 0.13 450km

Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/



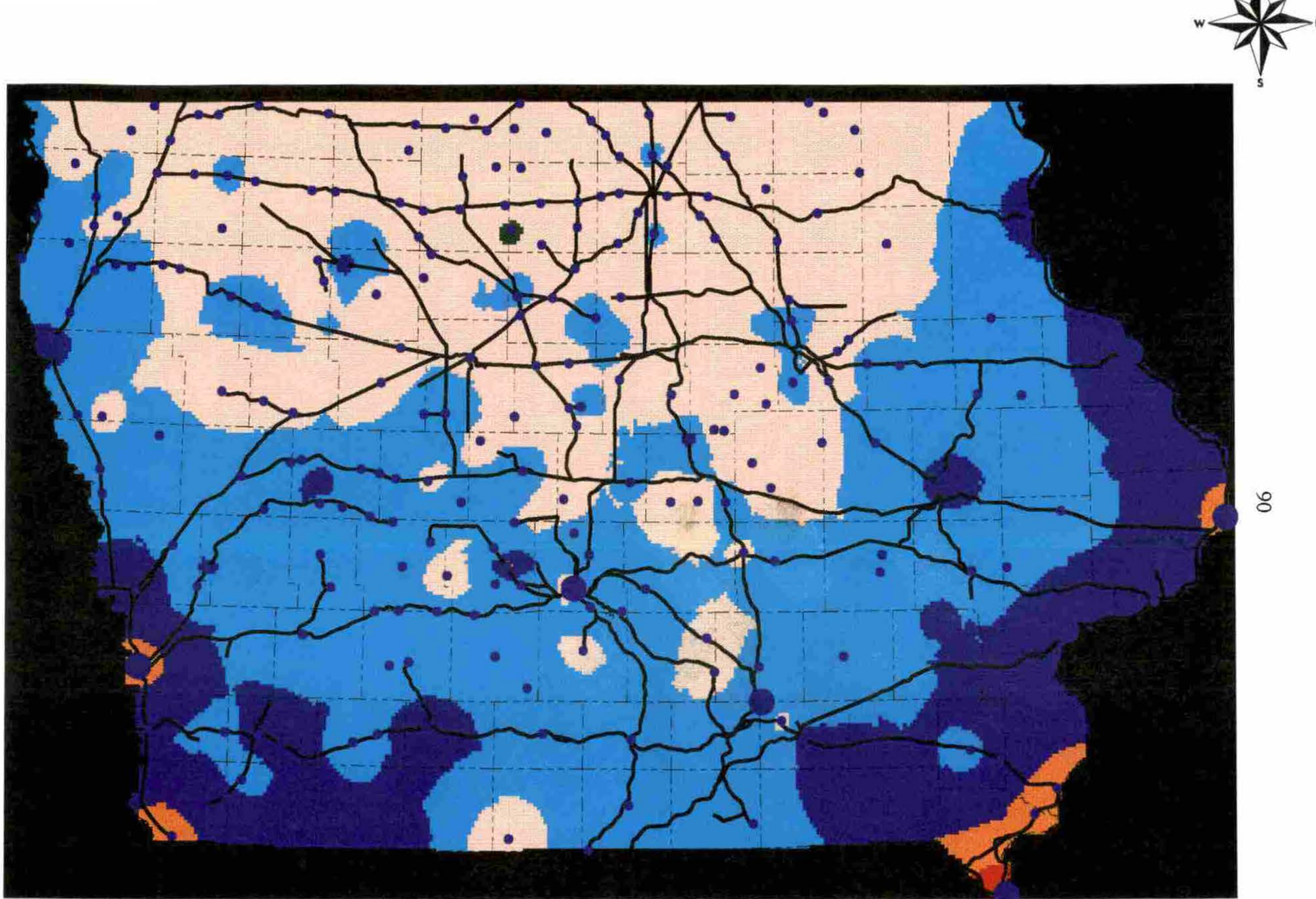
October 17, 1996 Iowa Corn Prices

Min = 245, Max = 301, Mean = 267, Std = 12
Zscale 600-6, Azimuth 180 0.13 450km

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse



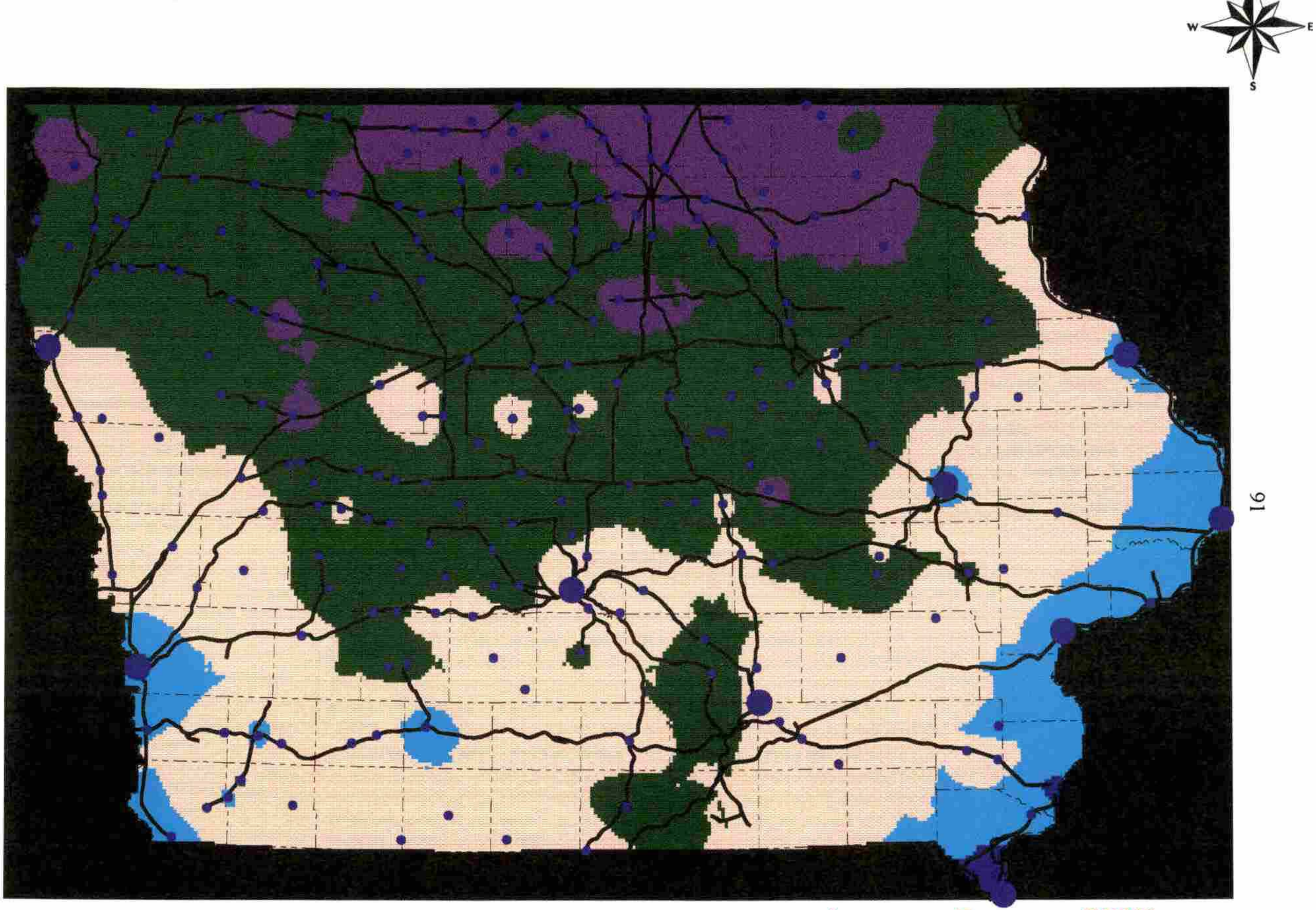
July 19, 1995 Iowa Corn Prices; (min = 247, max = 294)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES

0 35 70 KILOMETERS



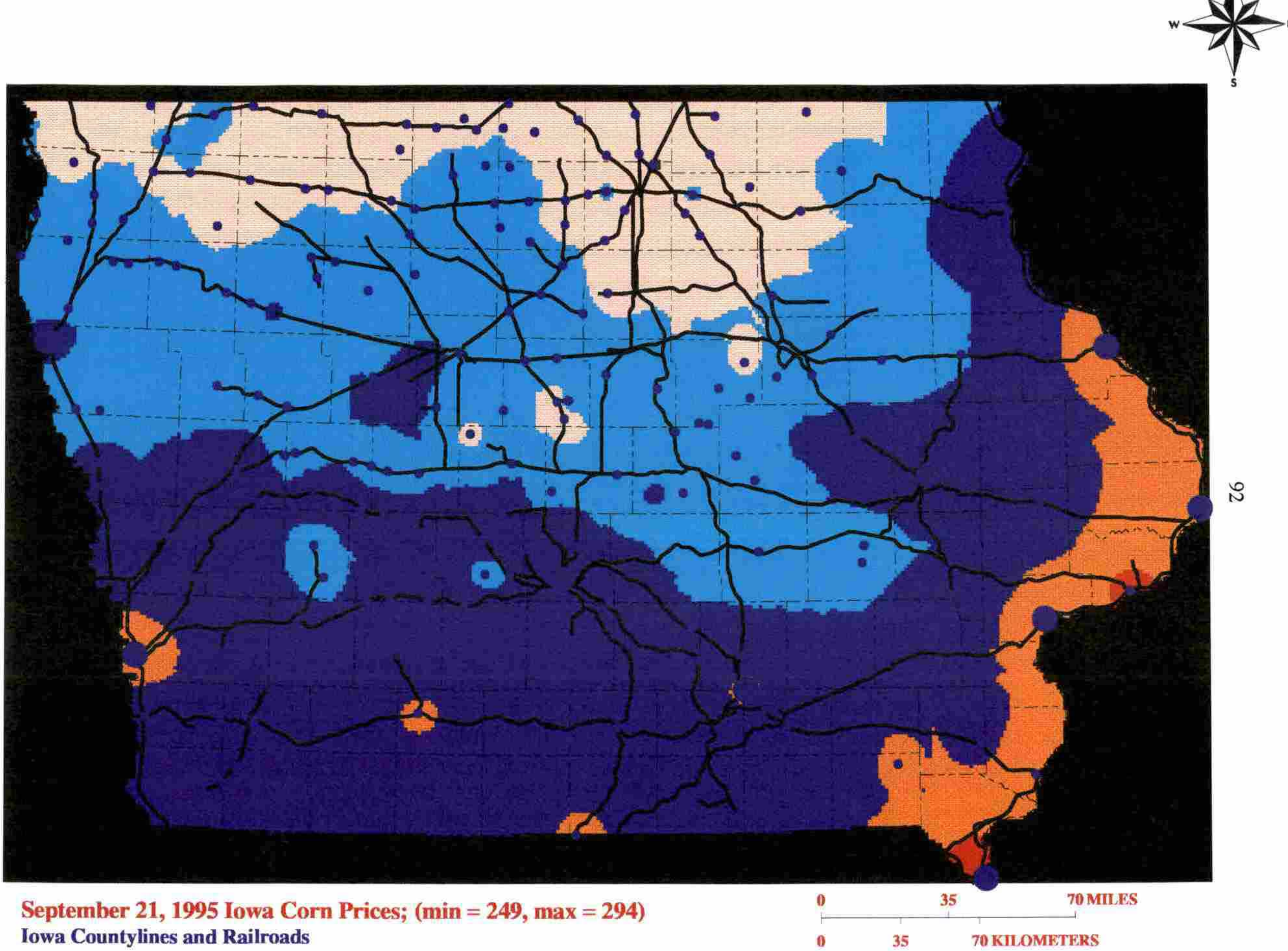
August 14, 1995 Iowa Corn Prices; (min = 234, max = 277)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

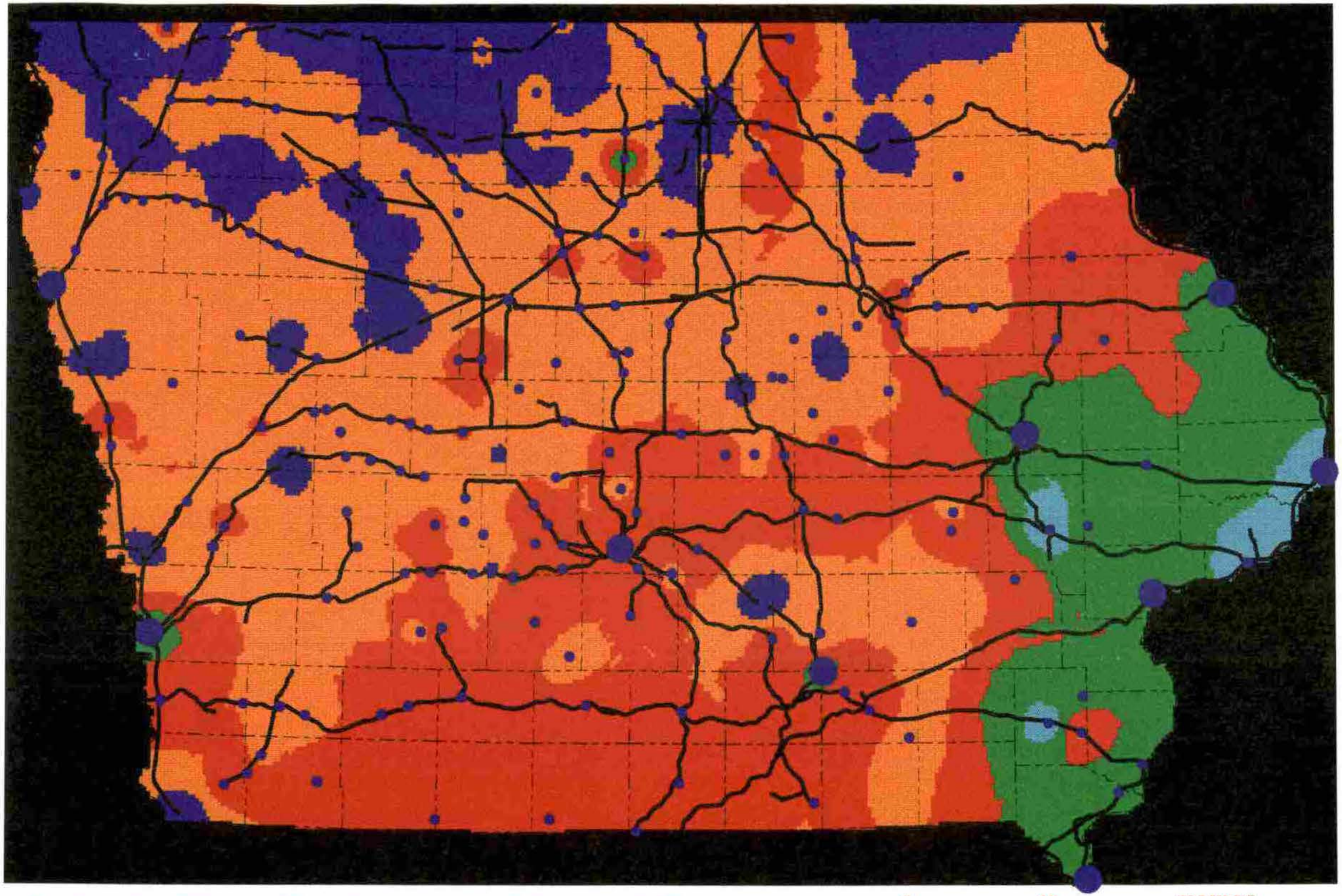
0 35 70 MILES

0 35 70 KILOMETERS



September 21, 1995 Iowa Corn Prices; (min = 249, max = 294)

Iowa Countylines and Railroads



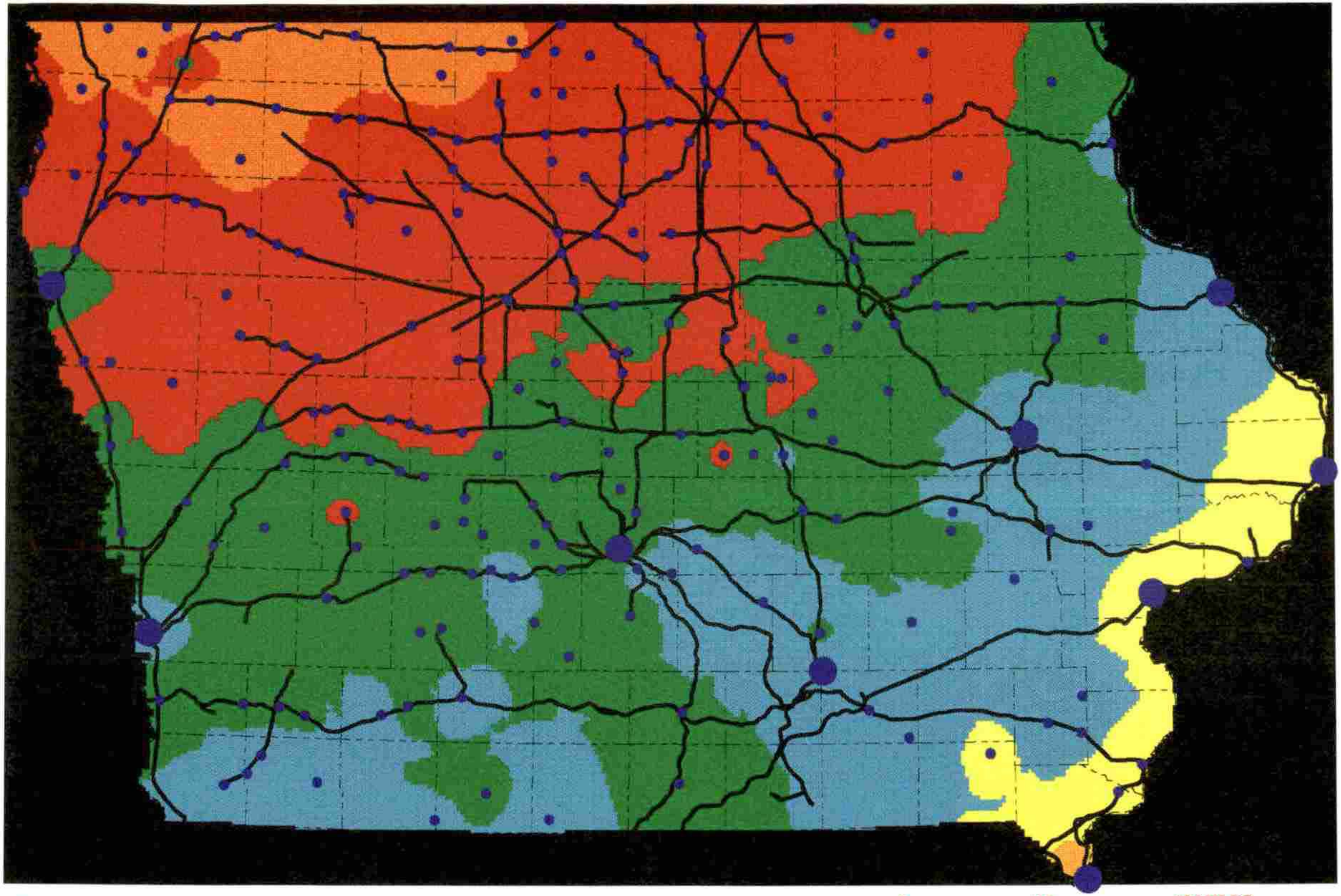
October 17, 1995 Iowa Corn Prices; (min = 269, max = 318)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES

0 35 70 KILOMETERS



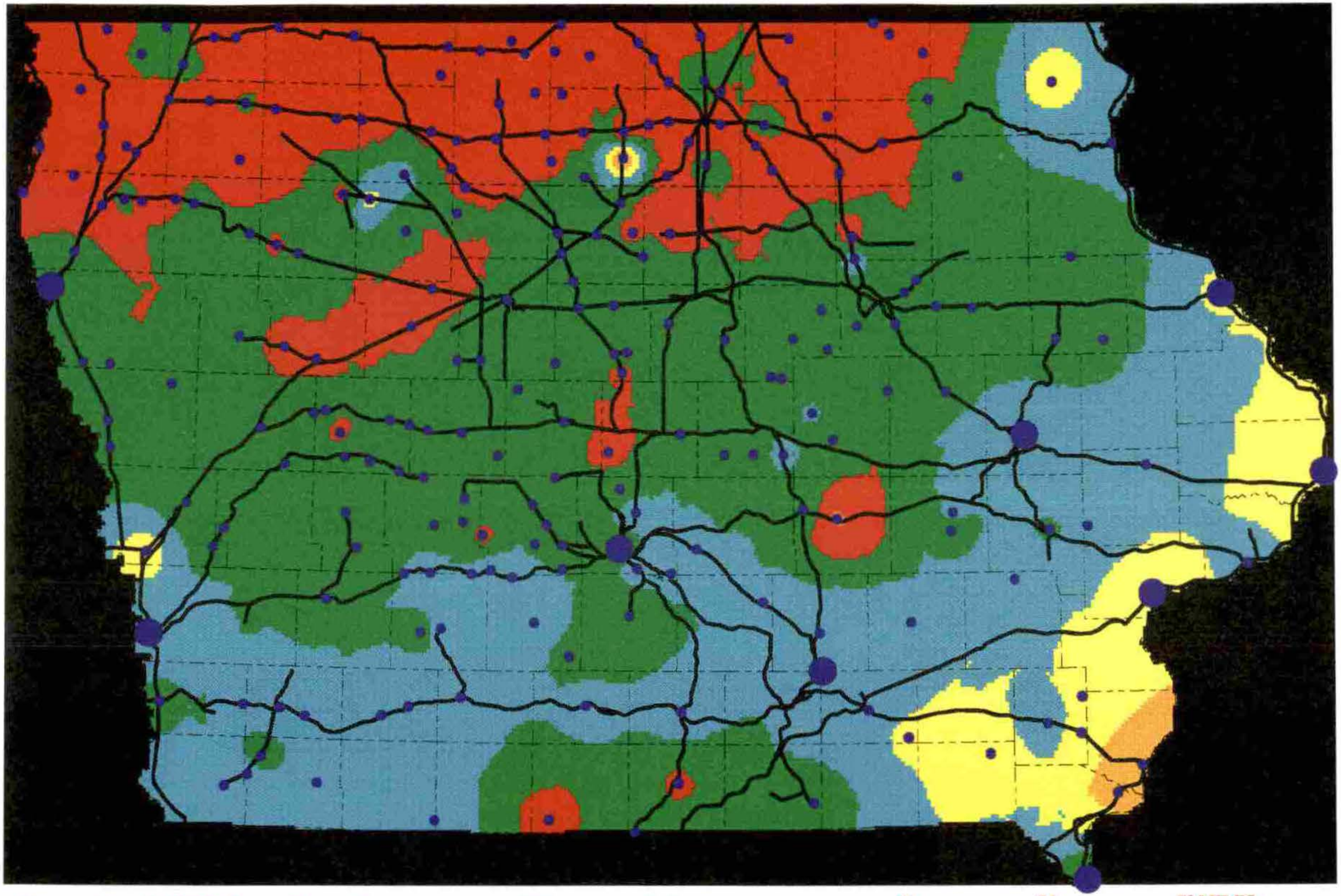
0 35 70 MILES

0 35 70 KILOMETERS

November 6, 1995 Iowa Corn Prices; (min = 281, max = 334)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/



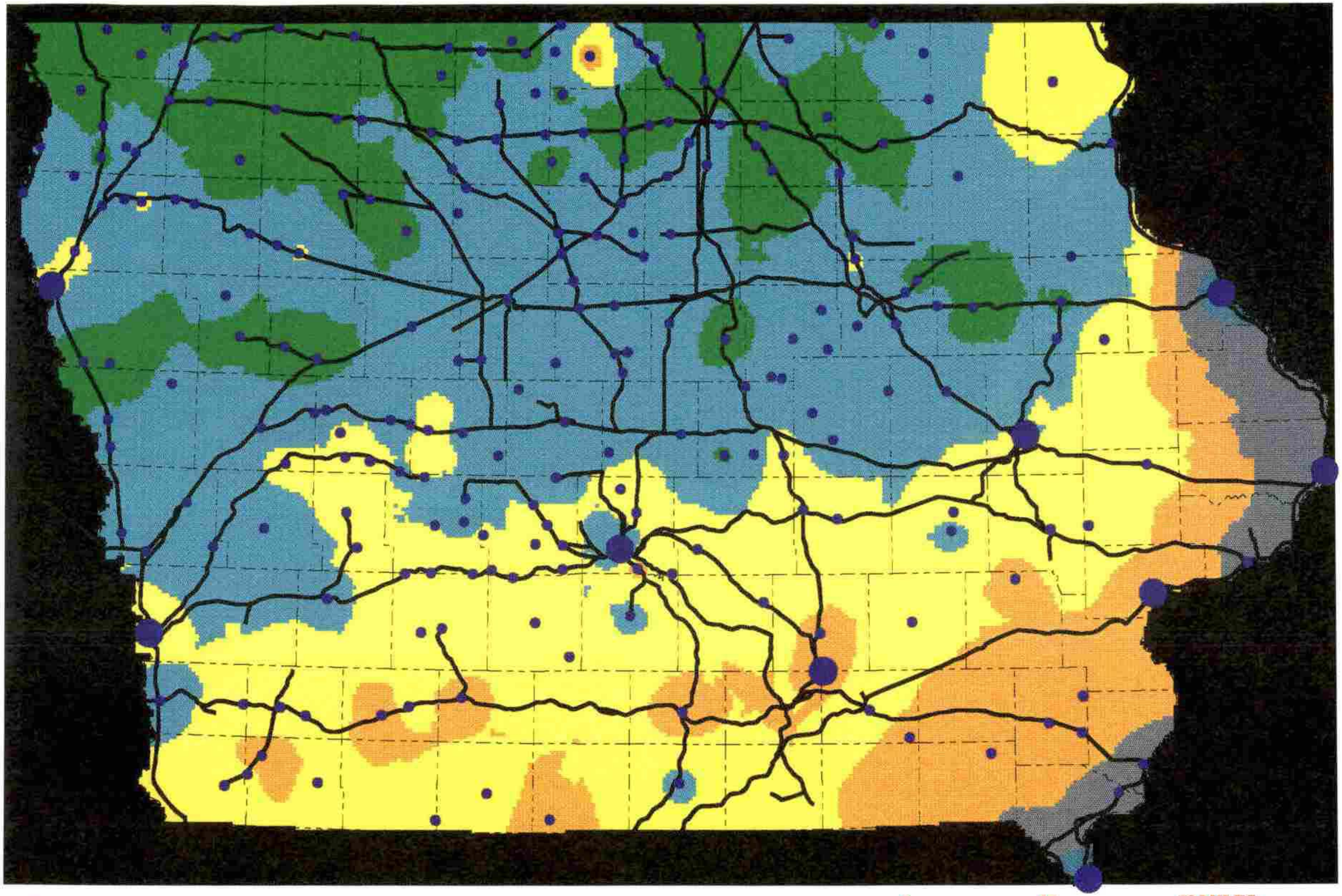
December 7, 1995 Iowa Corn Prices; (min = 289, max = 340)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES

0 35 70 KILOMETERS



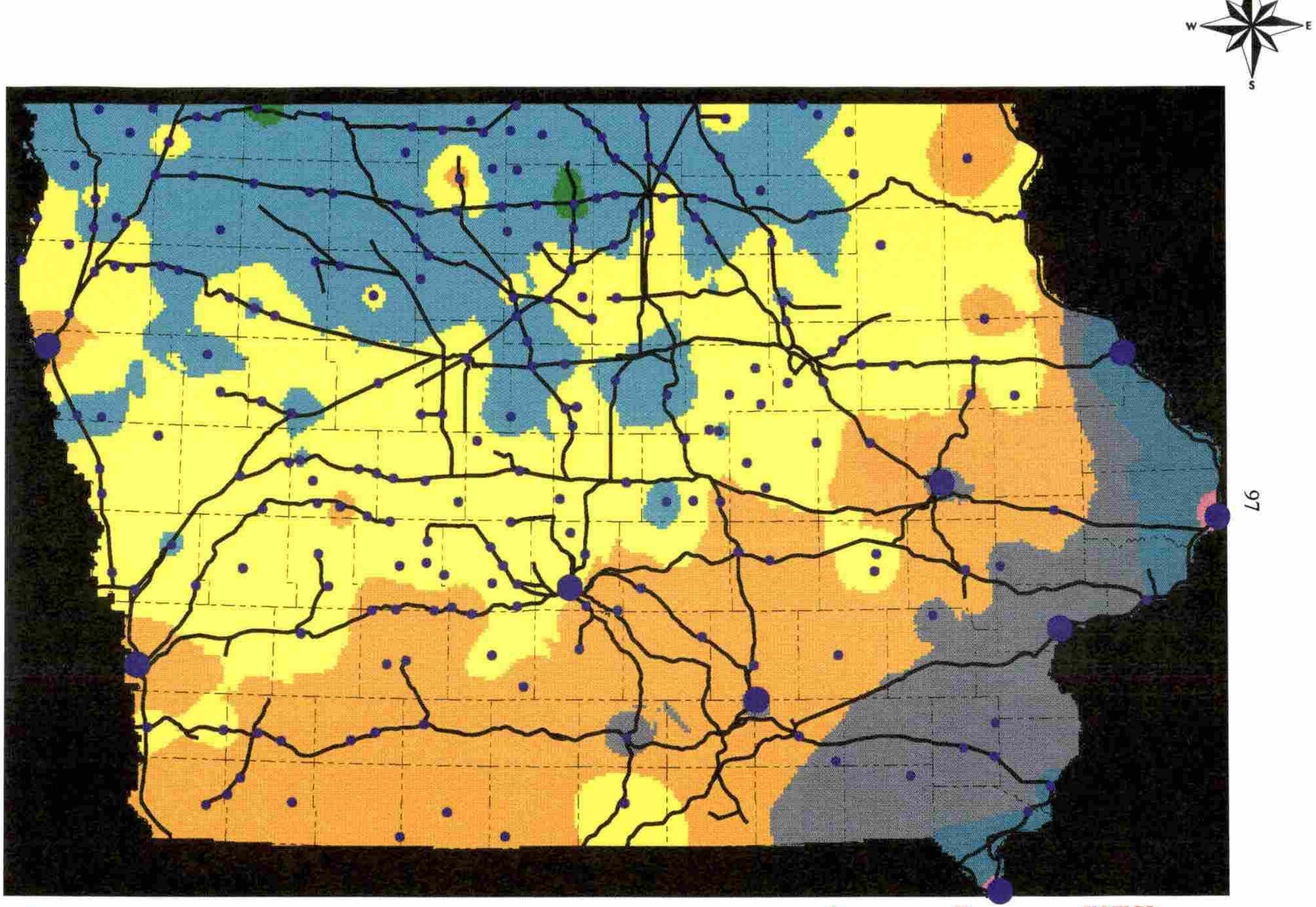
January 18, 1996 Iowa Corn Prices; (min = 300, max = 353)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES

0 35 70 KILOMETERS



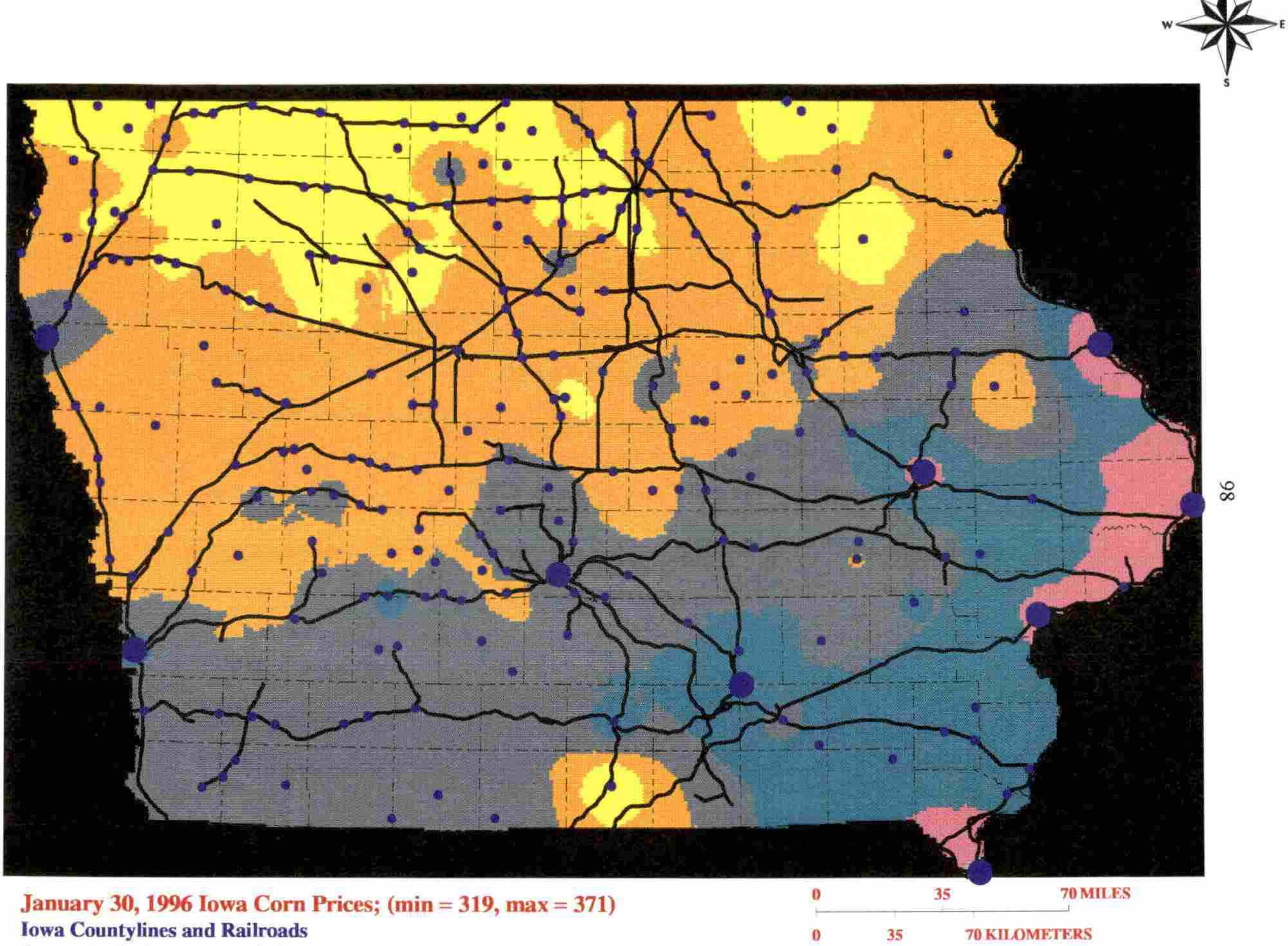
January 25, 1996 Iowa Corn Prices; (min = 300, max = 361)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES

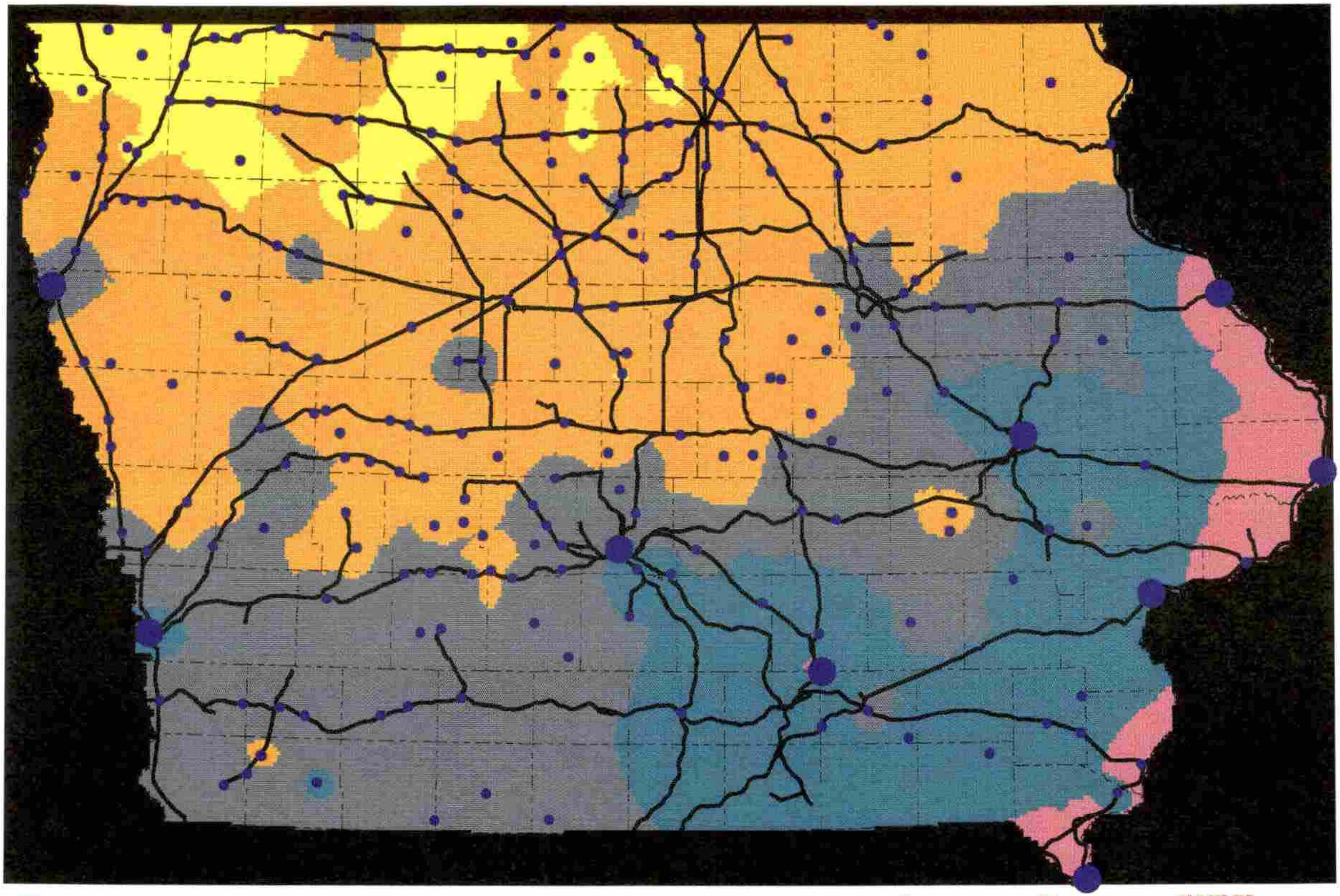
0 35 70 KILOMETERS



January 30, 1996 Iowa Corn Prices; (min = 319, max = 371)

Iowa Countylines and Railroads

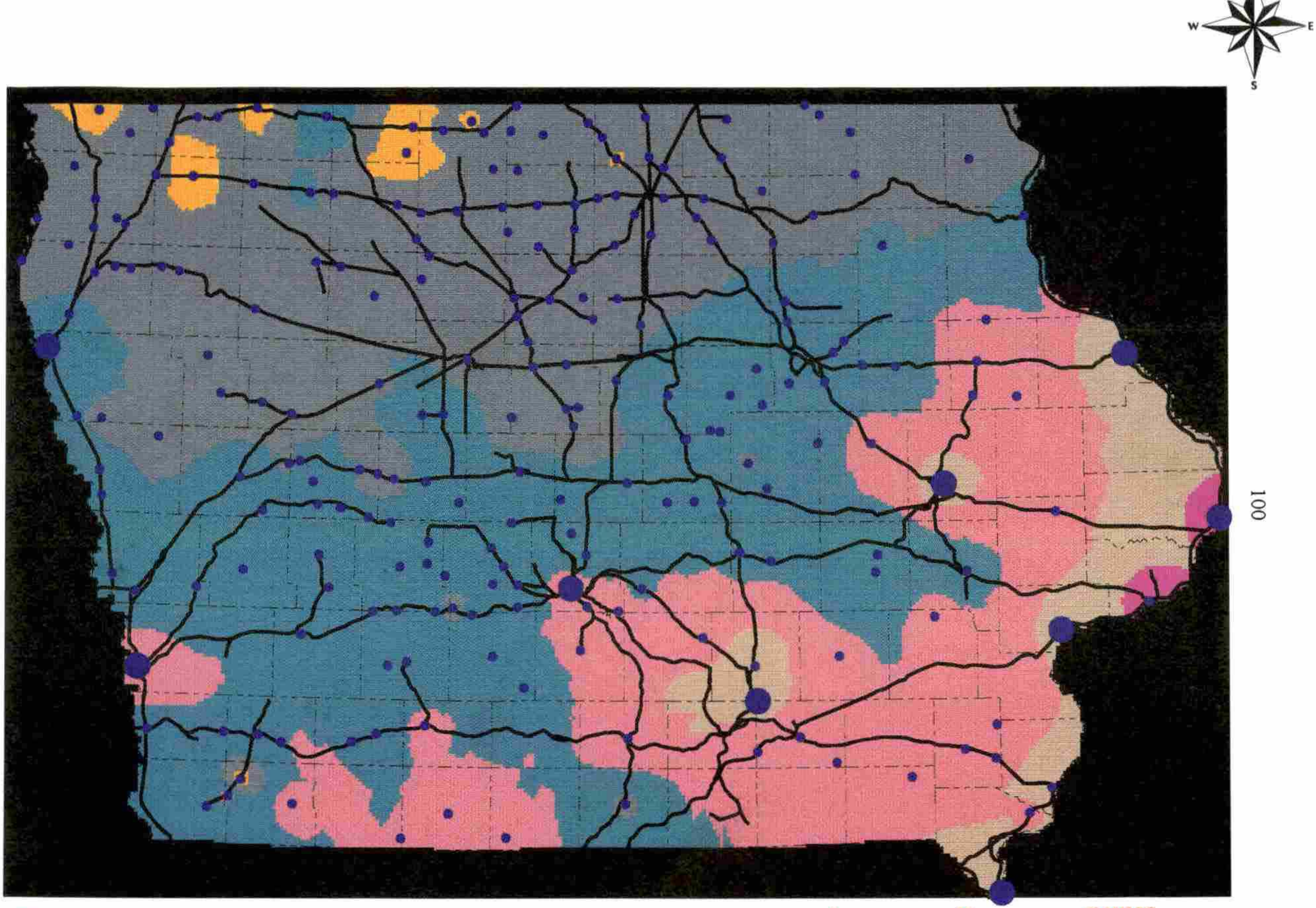
Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/



February 12, 1996 Iowa Corn Prices; (min = 322, max = 370)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/



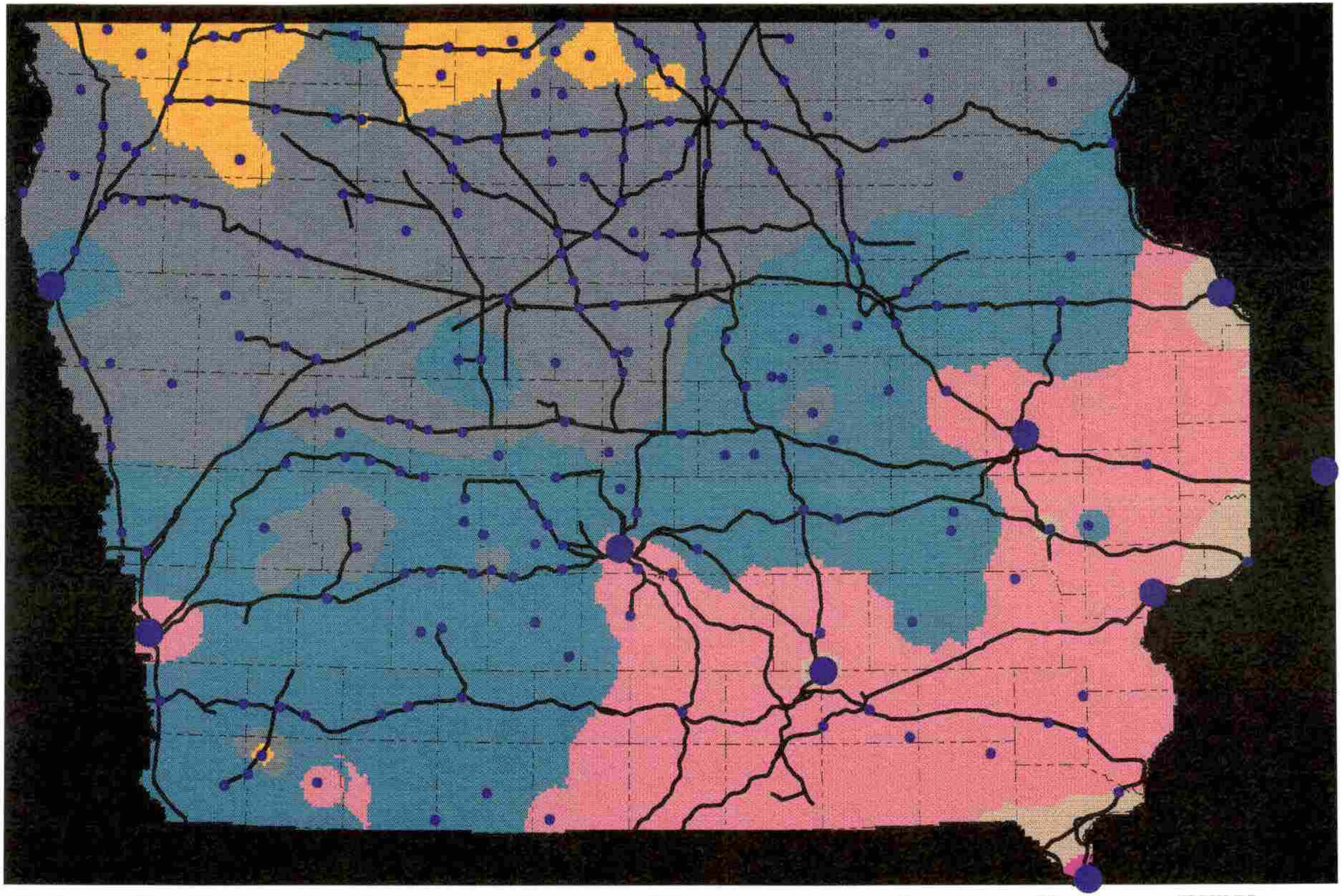
February 14, 1996 Iowa Corn Prices; (min = 334, max = 382)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES

0 35 70 KILOMETERS



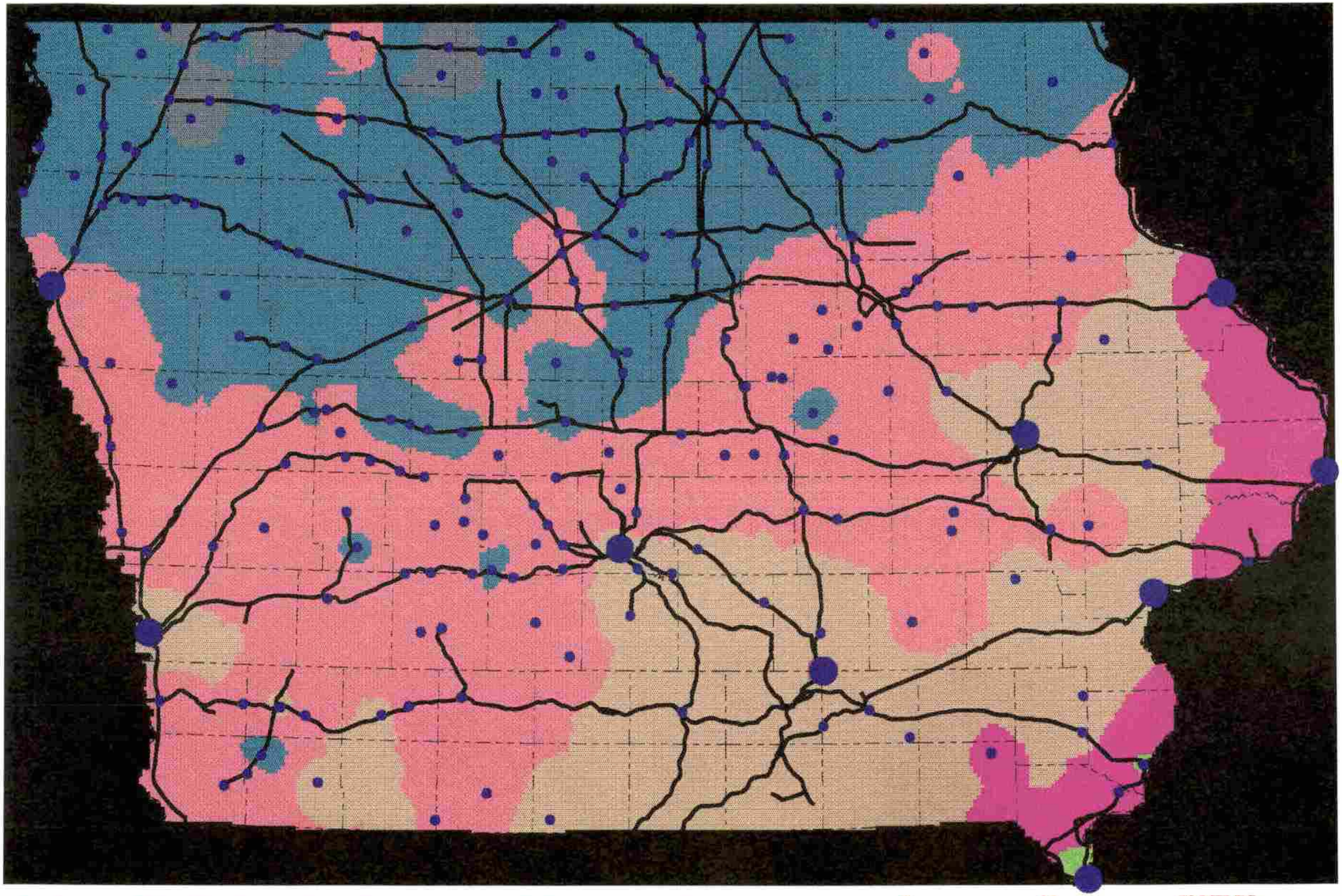
February 22, 1996 Iowa Corn Prices; (min = 334, max = 382)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

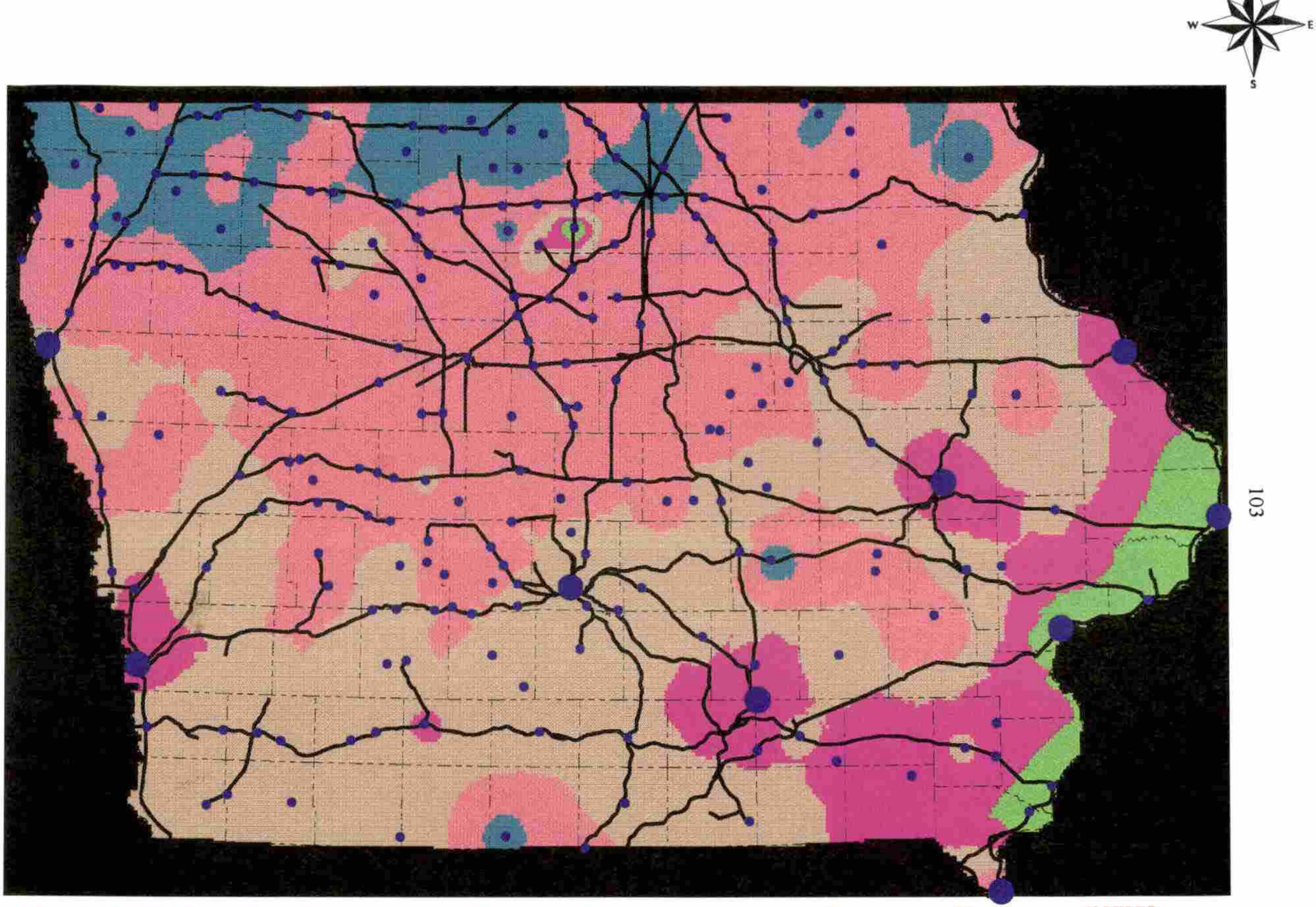
0 35 70 MILES

0 35 70 KILOMETERS



February 27, 1996 Iowa Corn Prices; (min = 345, max = 393)
Iowa Countylines and Railroads
Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES
0 35 70 KILOMETERS



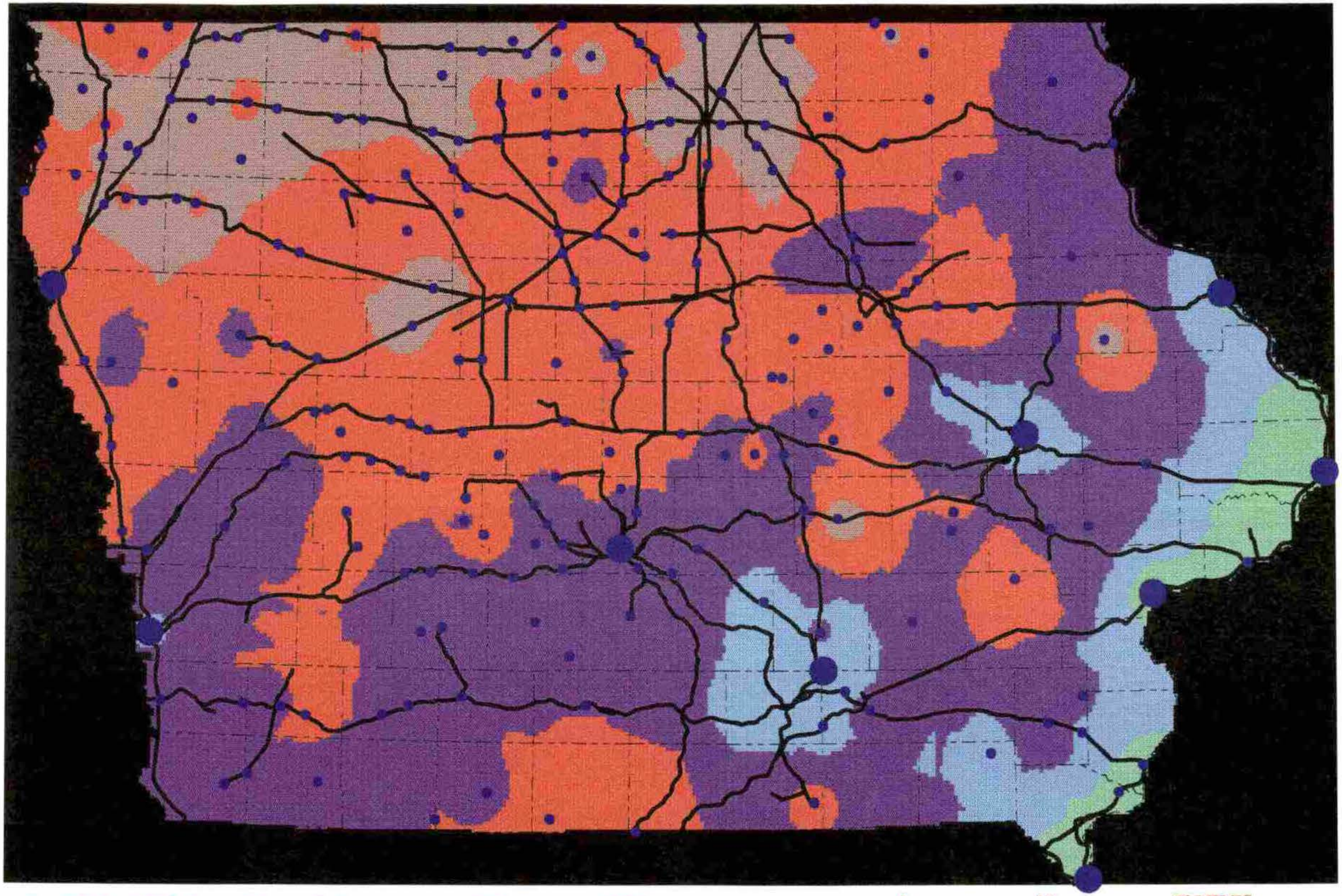
0 35 70 MILES

0 35 70 KILOMETERS

March 14, 1996 Iowa Corn Prices; (min = 352, max = 401)

Iowa Countylines and Railroads

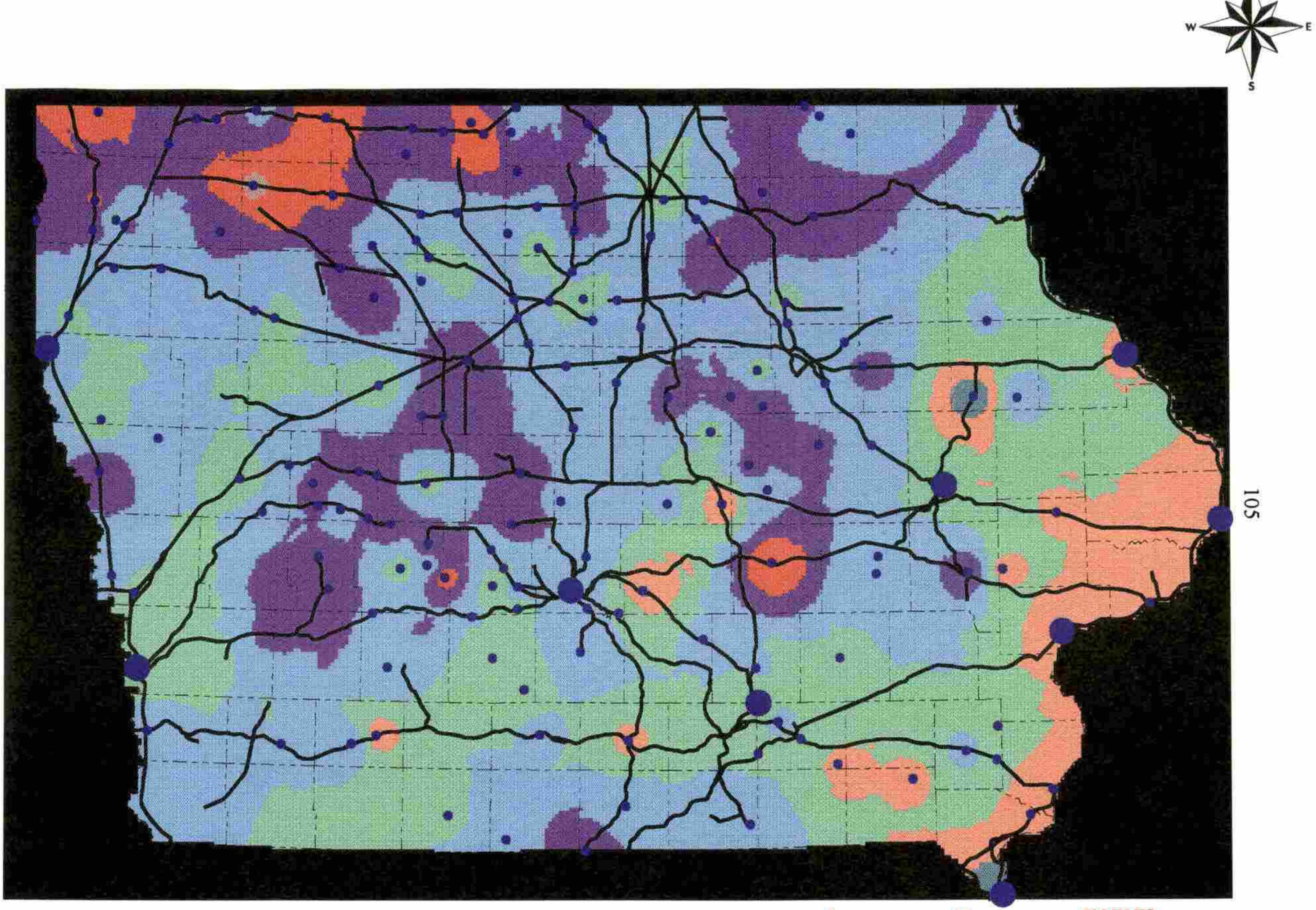
Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/



April 12, 1996 Iowa Corn Prices; (min = 413, max = 455)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/



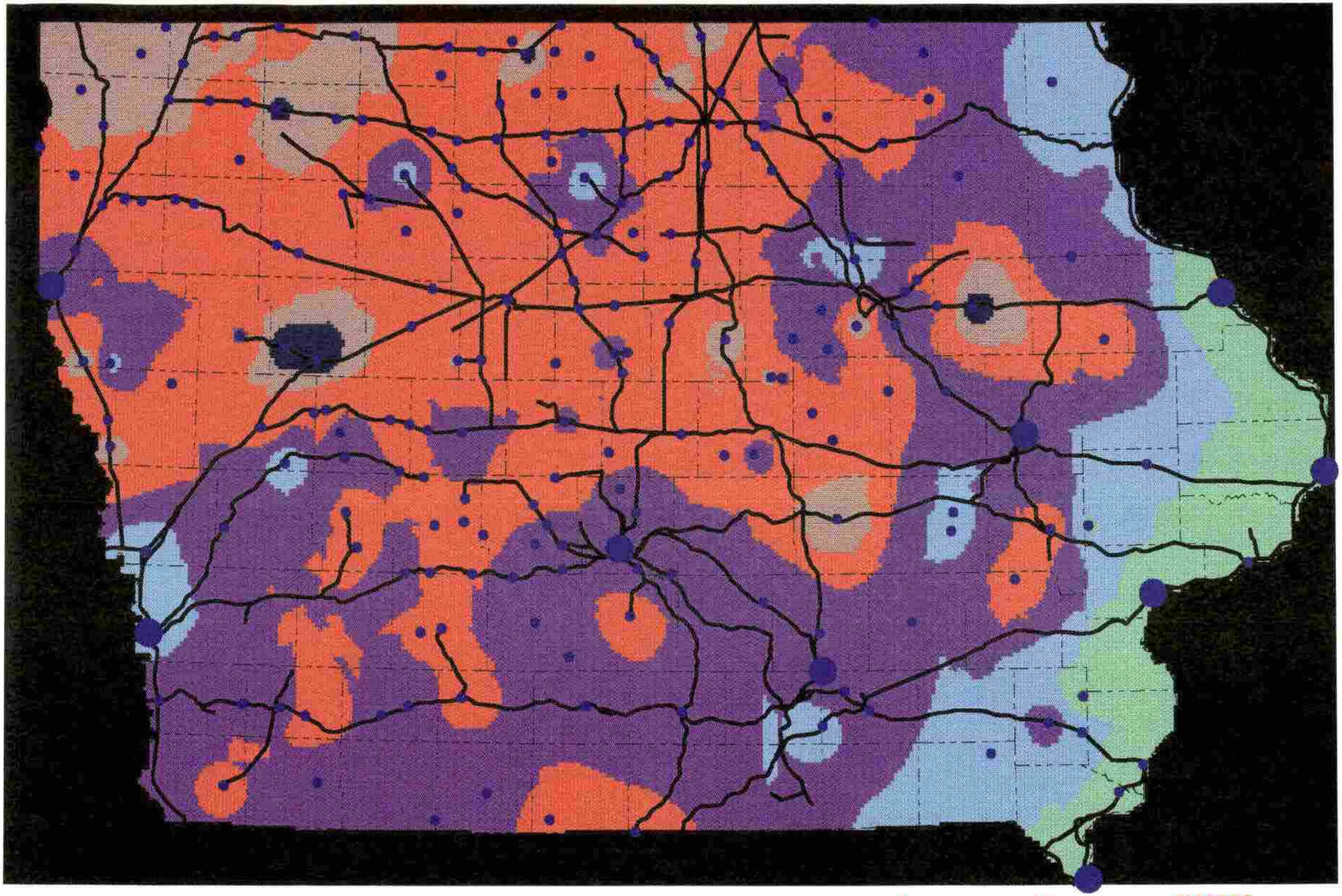
0 35 70 MILES

0 35 70 KILOMETERS

April 29, 1996 Iowa Corn Prices; (min = 418, max = 477)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/



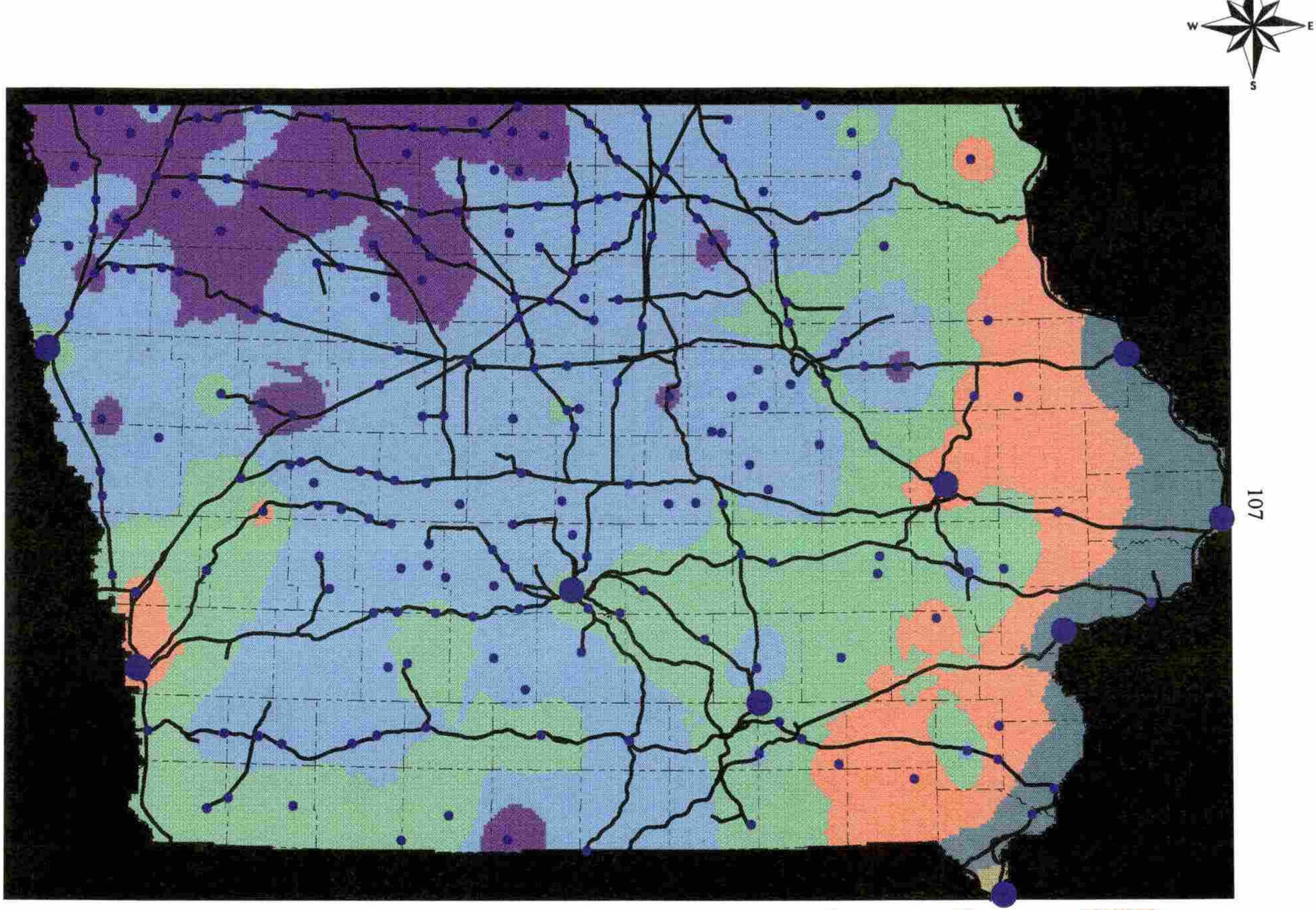
April 30, 1996 Iowa Corn Prices; (min = 405, max = 461)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES

0 35 70 KILOMETERS



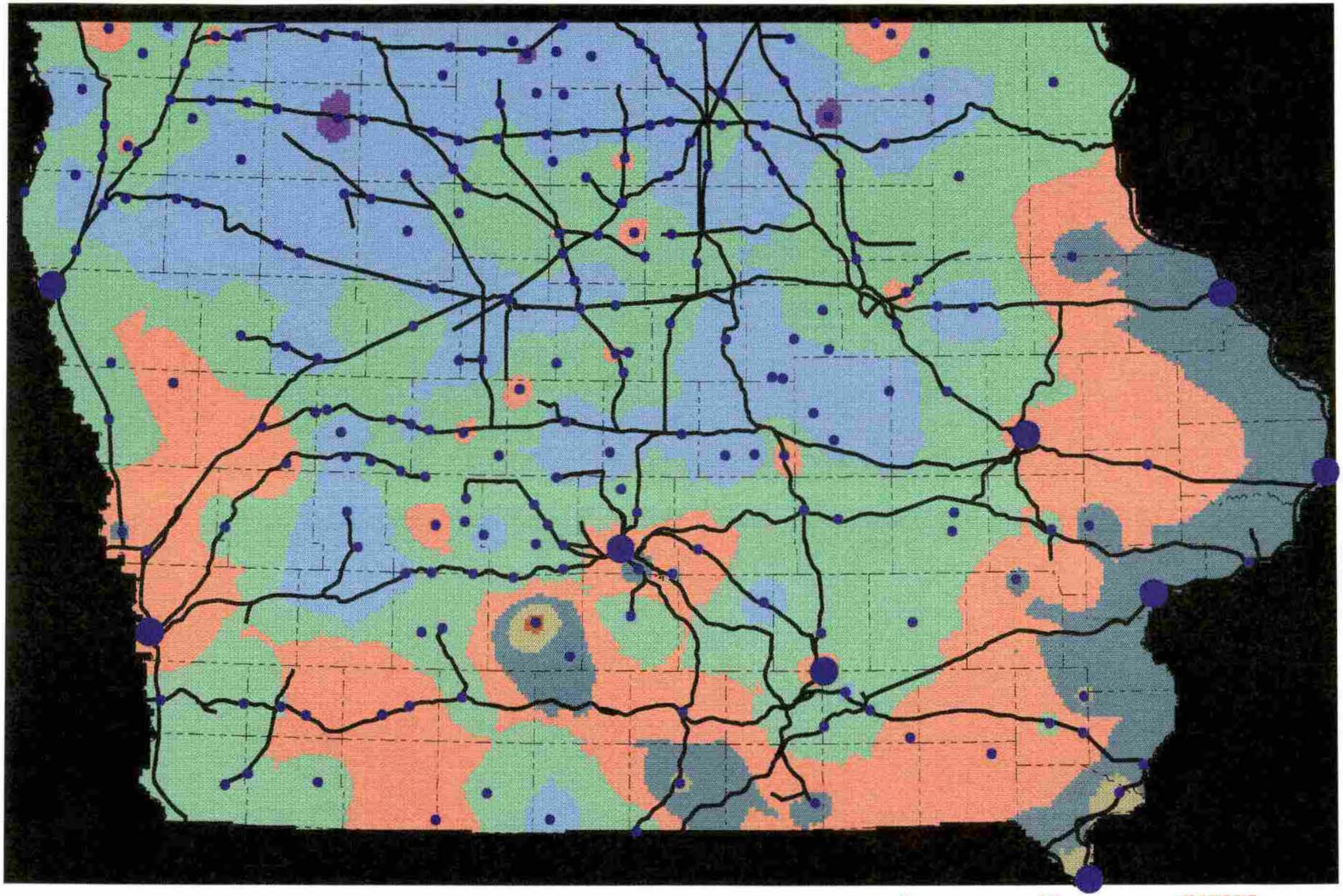
May 7, 1996 Iowa Corn Prices; (min = 430, max = 482)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES

0 35 70 KILOMETERS



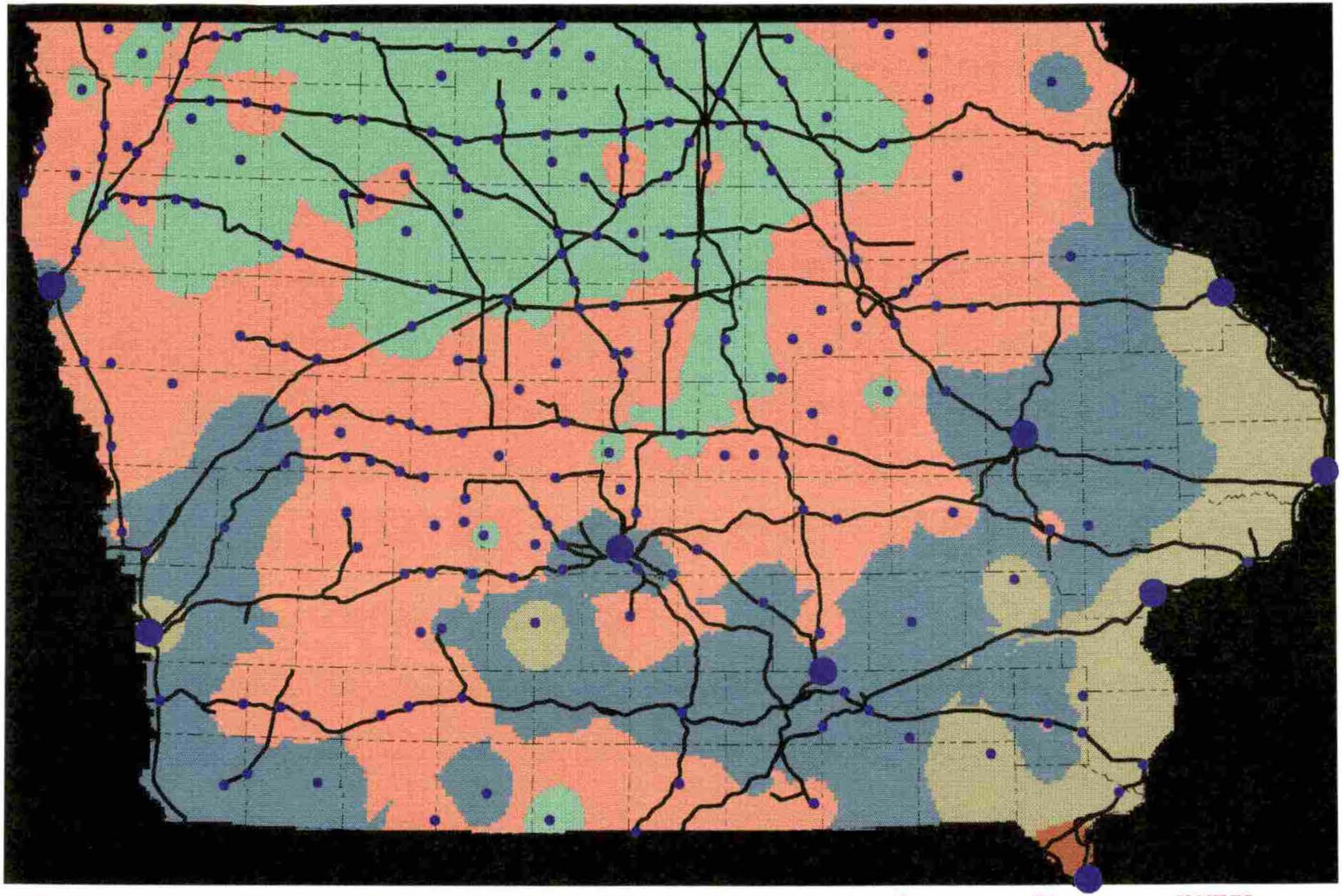
May 29, 1995 Iowa Corn Prices; (min = 436, max = 493)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES

0 35 70 KILOMETERS



May 31, 1996 Iowa Corn Prices; (min = 449, max = 498)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

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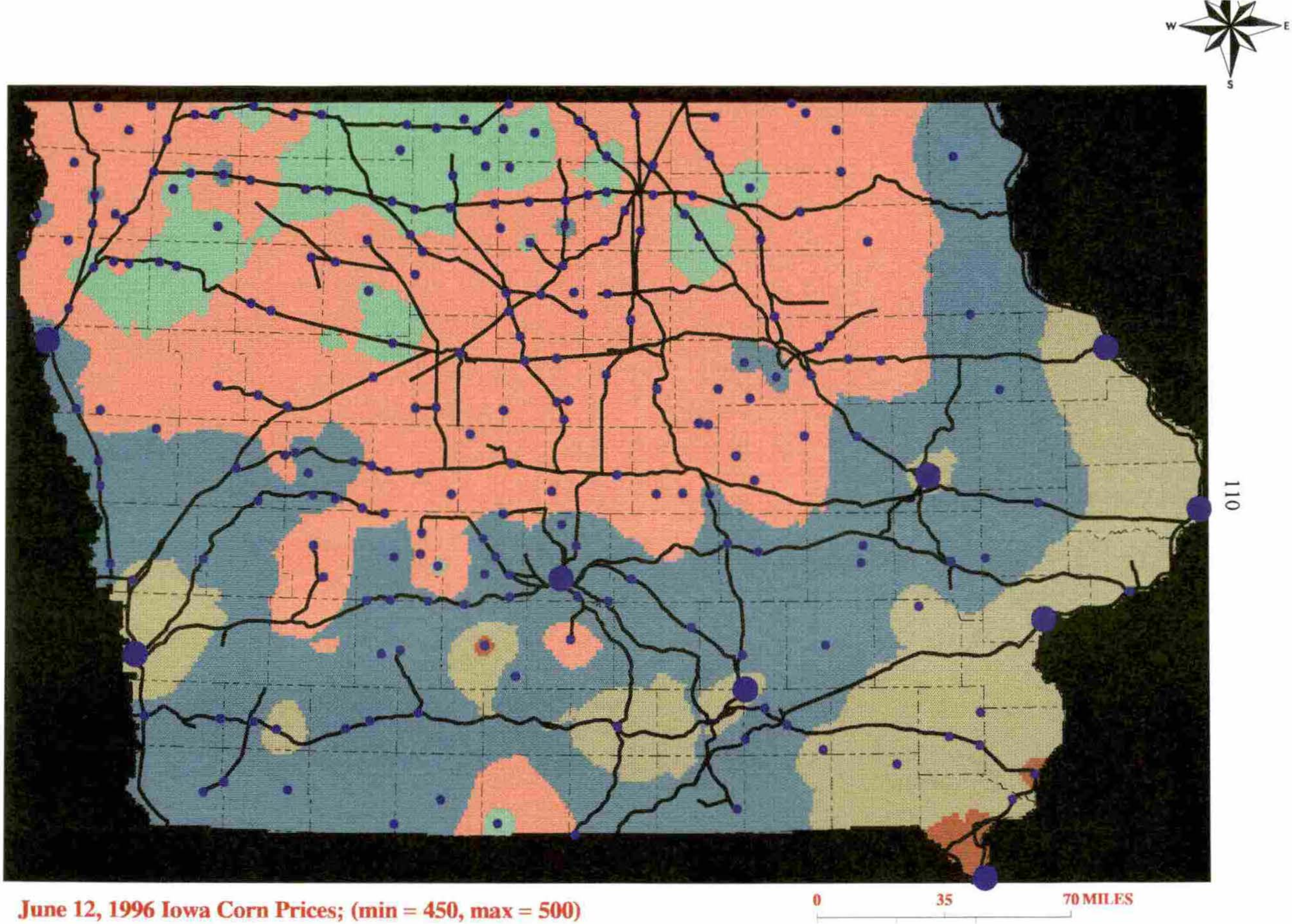
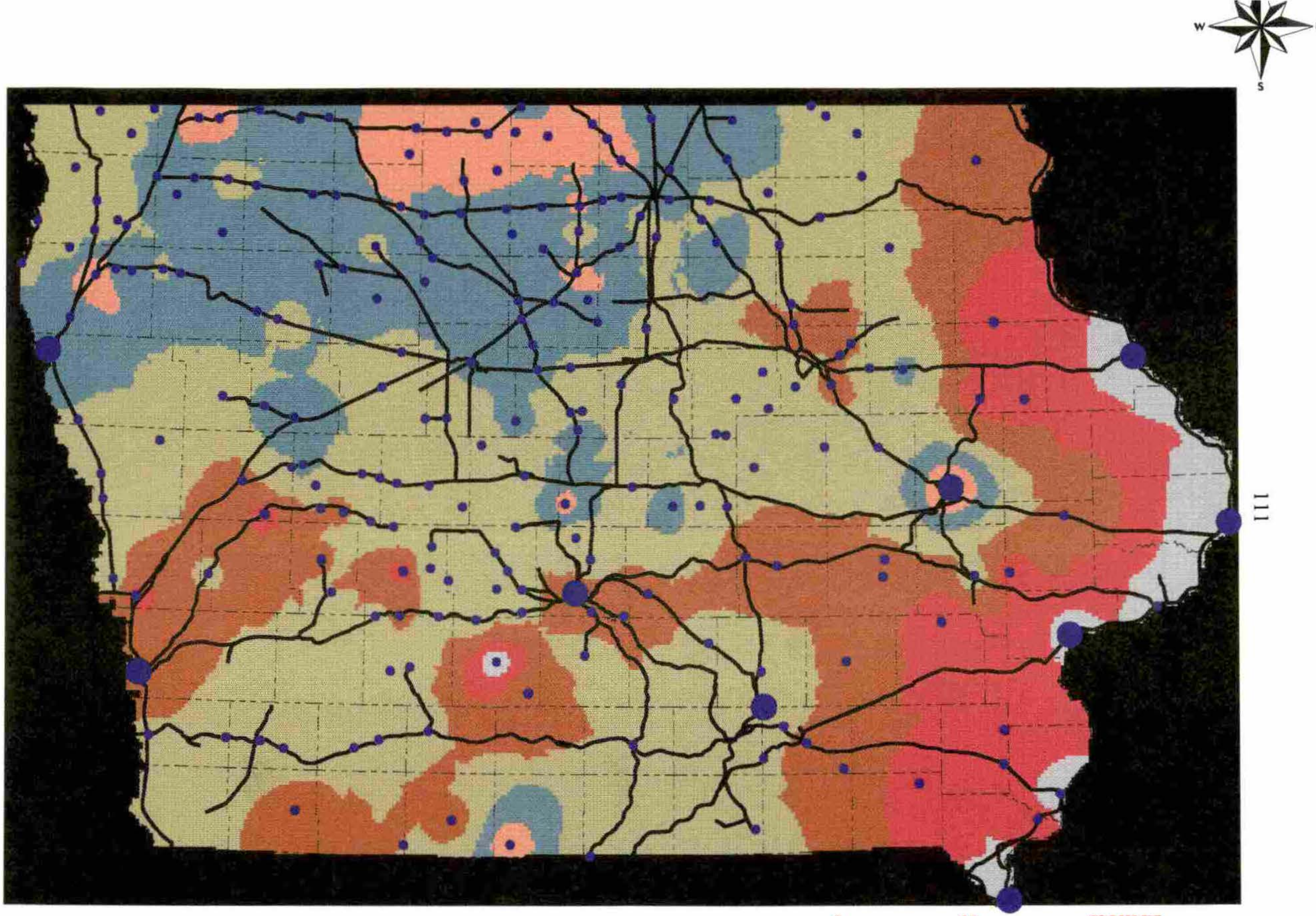
0 35 70 KILOMETERS

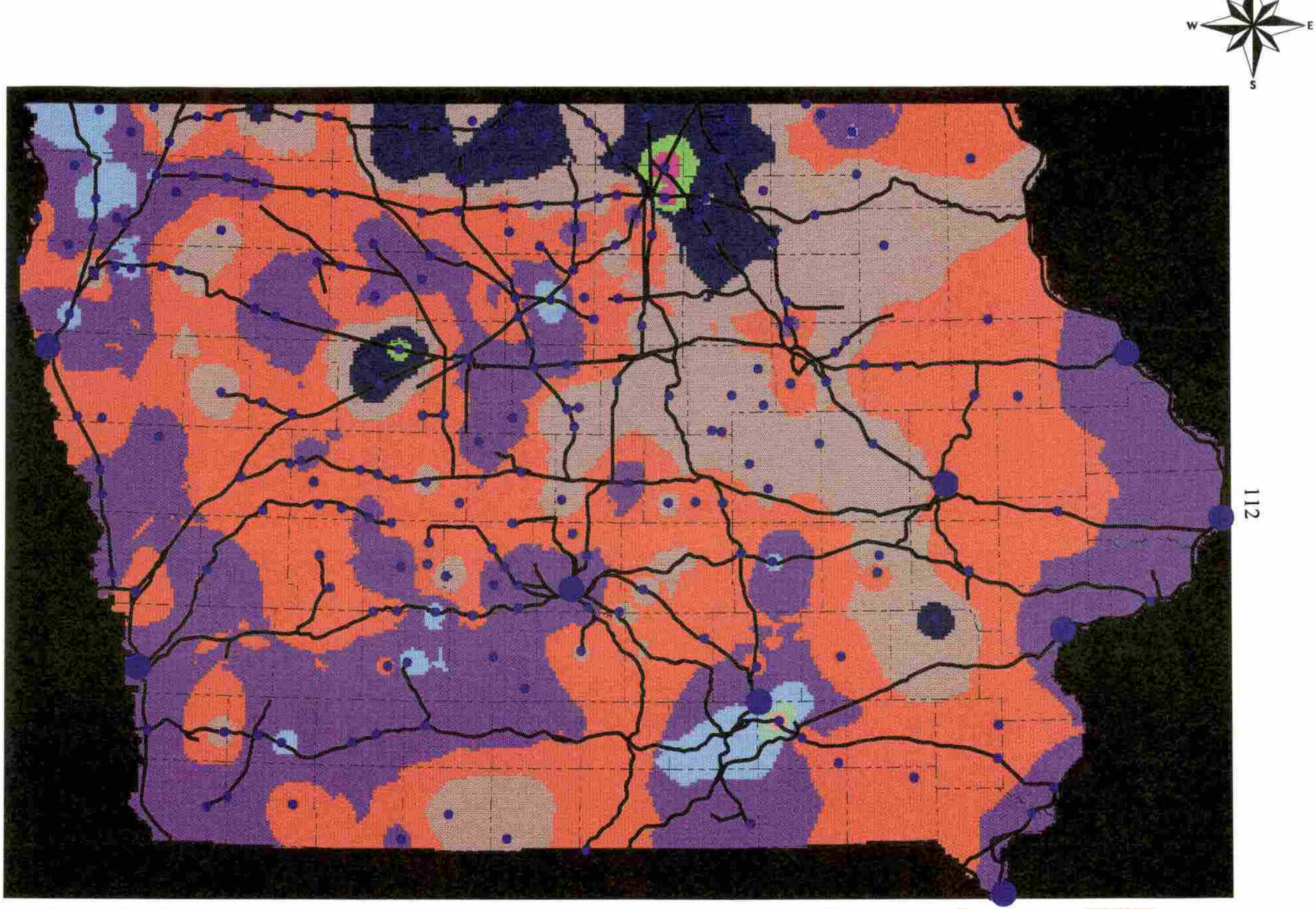


June 12, 1996 Iowa Corn Prices; (min = 450, max = 500)
Iowa Countylines and Railroads
Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/



July 2, 1996 Iowa Corn Prices; (min = 460, max = 516)
Iowa Countylines and Railroads
Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES
0 35 70 KILOMETERS



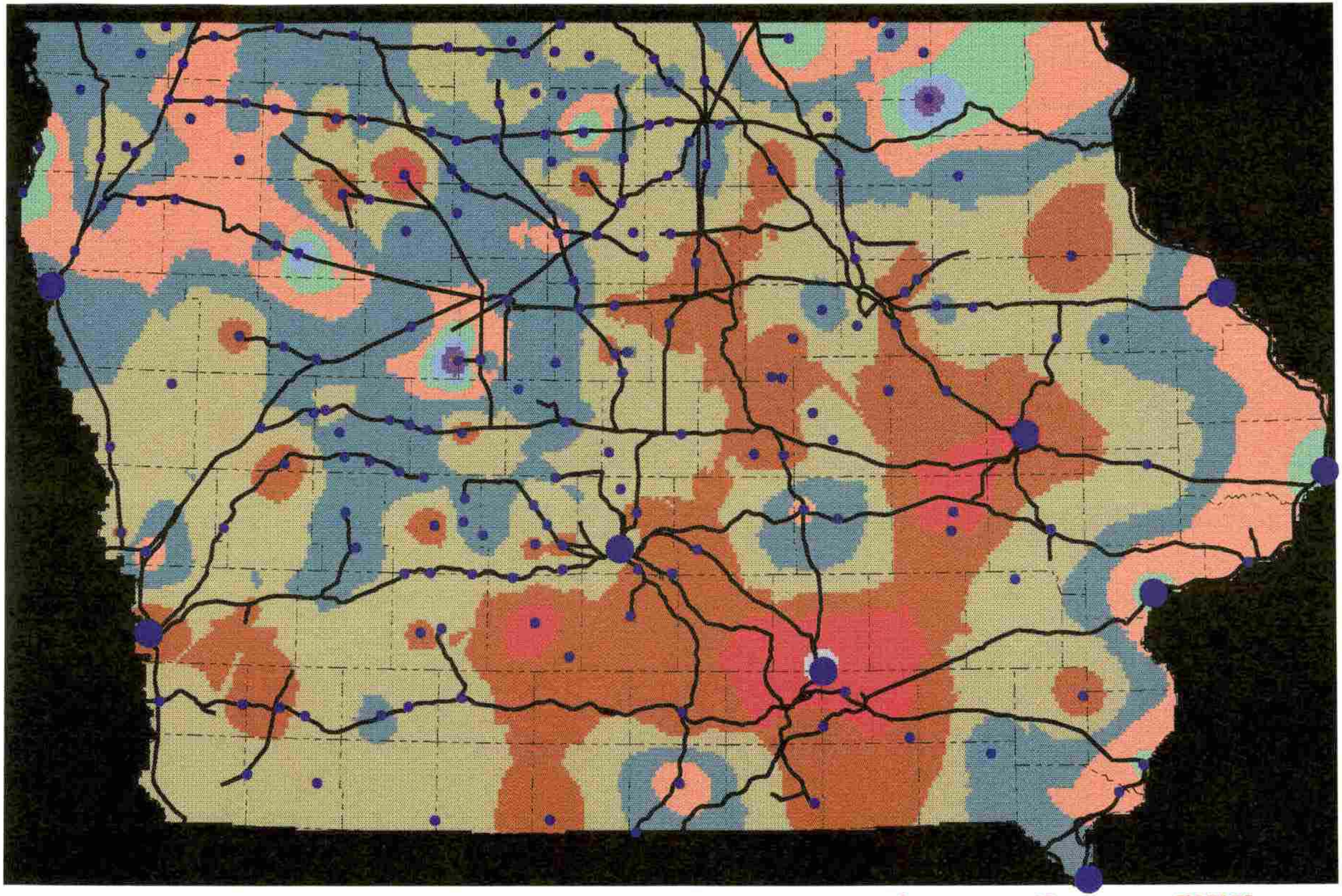
0 35 70 MILES

0 35 70 KILOMETERS

July 19, 1996 Iowa Corn Prices; (min = 386, max = 468)

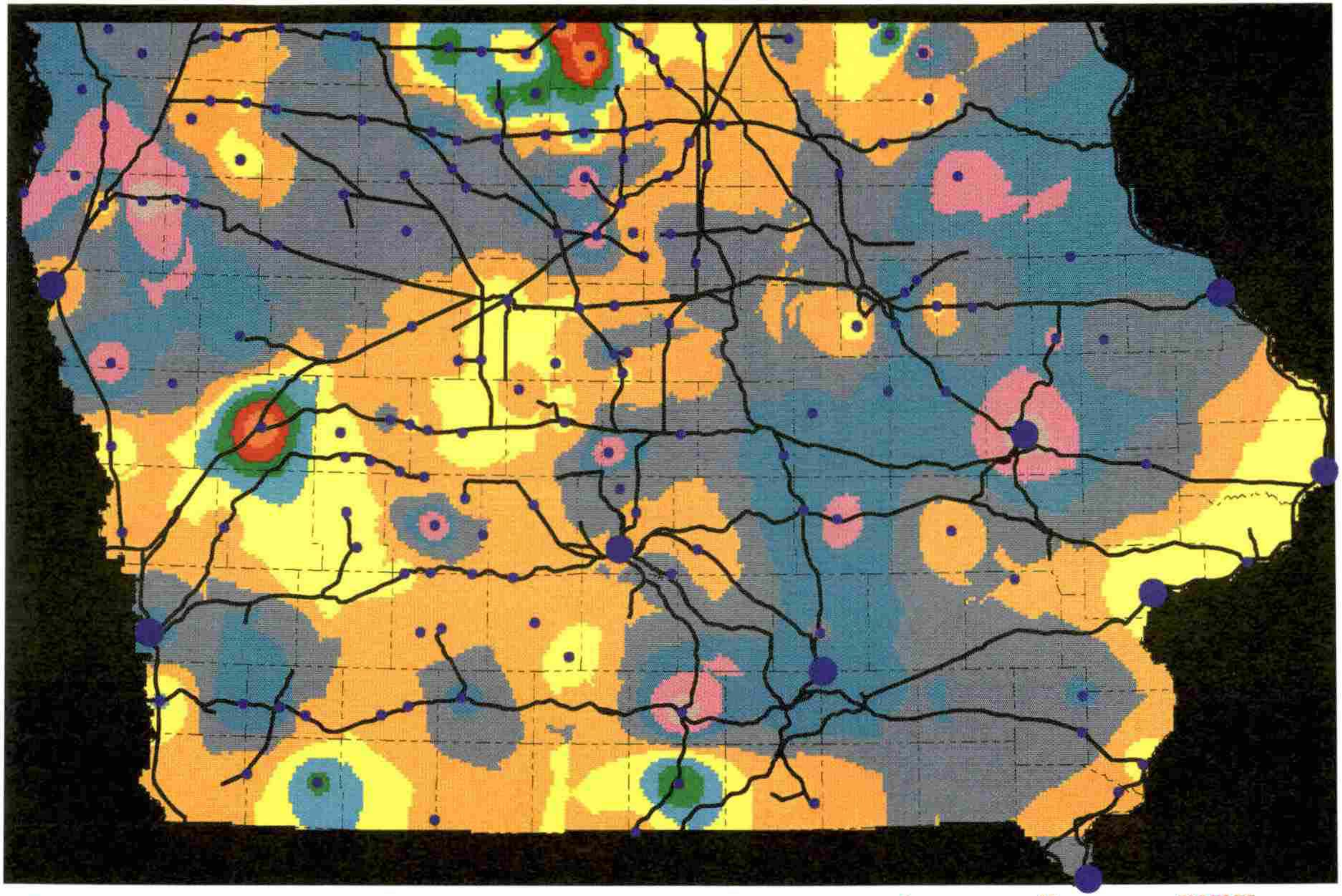
Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/



August 14, 1996 Iowa Corn Prices; (min = 426, max = 513)
Iowa Countylines and Railroads
Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES
0 35 70 KILOMETERS



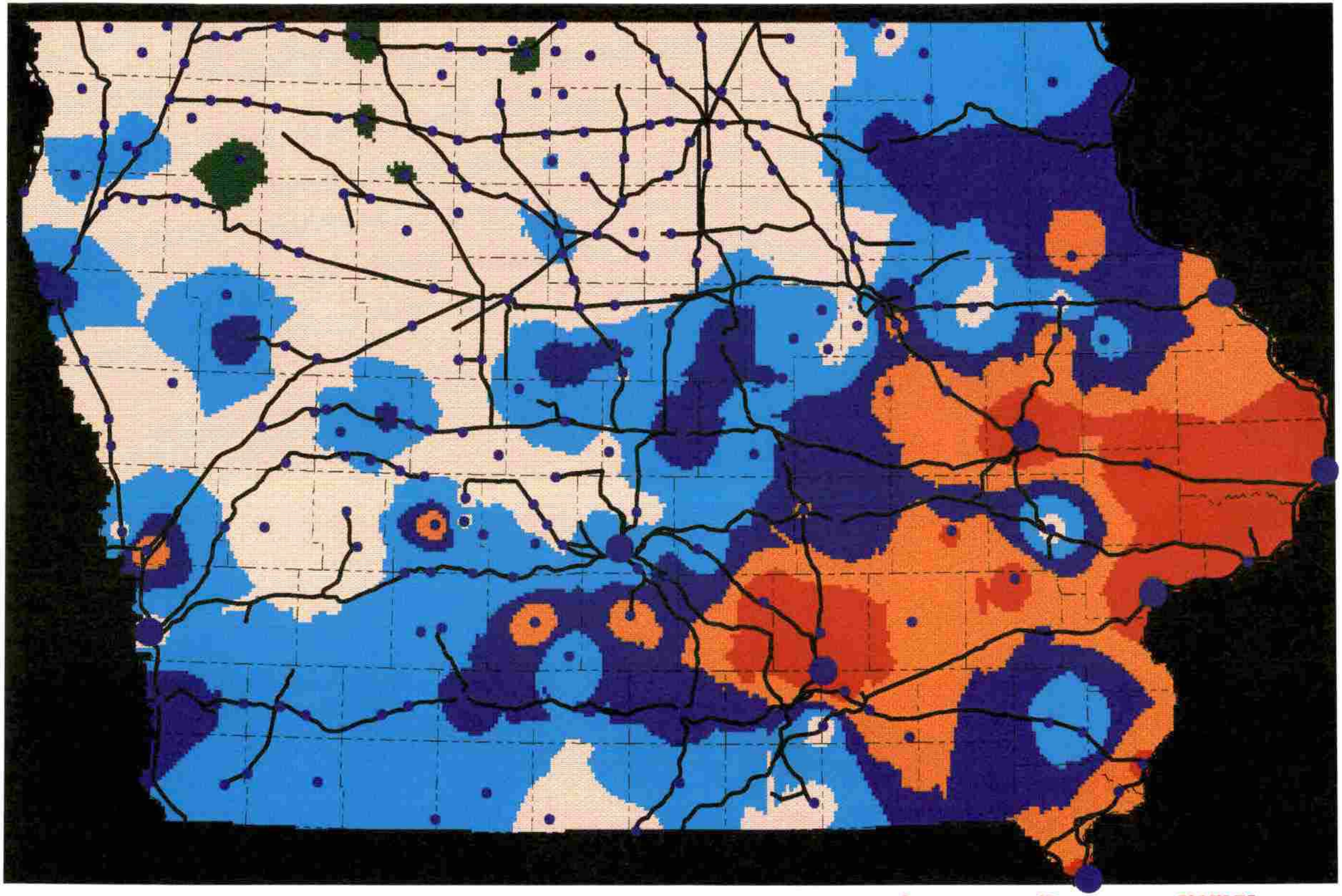
September 16, 1996 Iowa Corn Prices; (min = 284, max = 380)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES

0 35 70 KILOMETERS



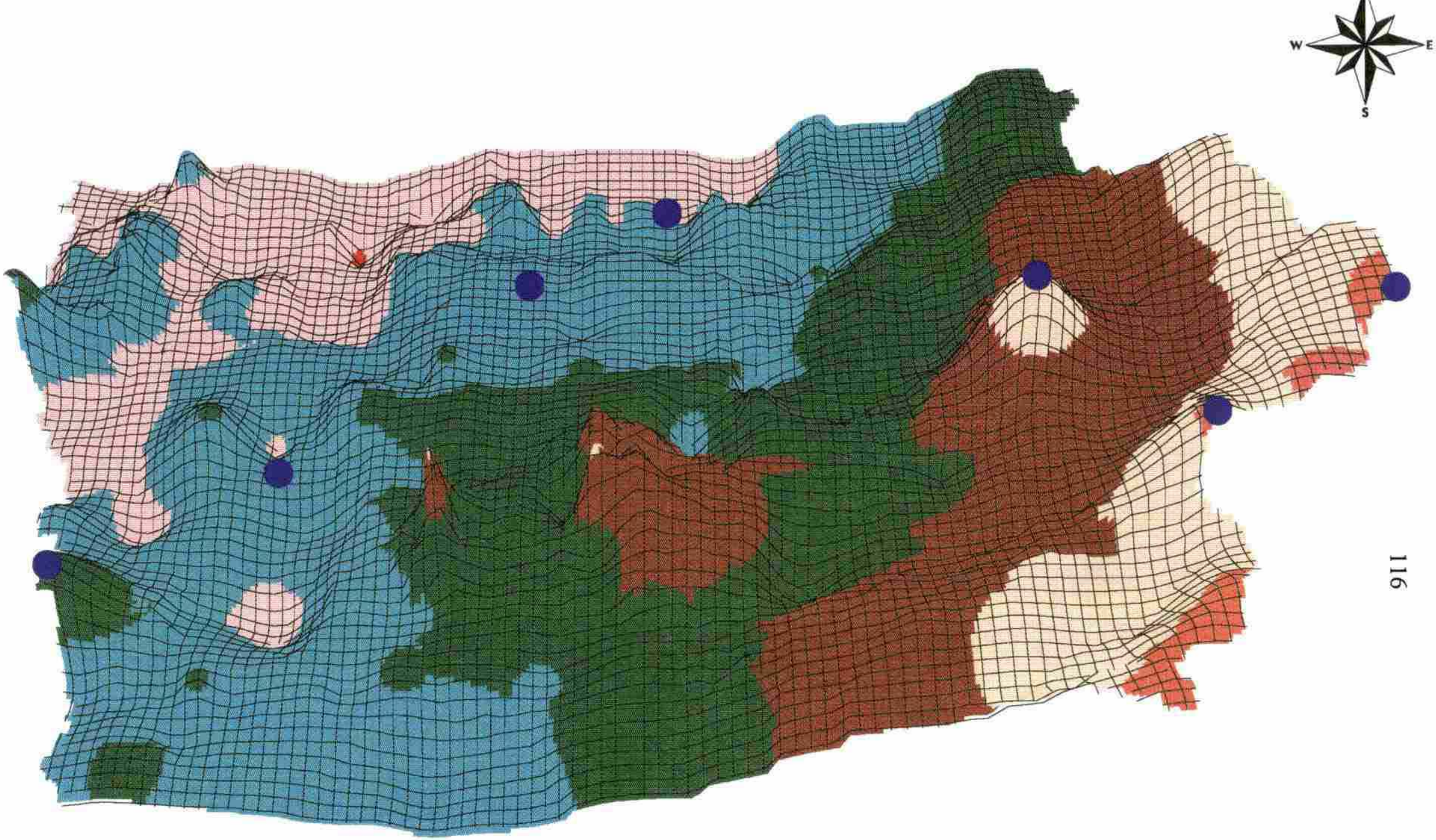
October 17, 1996 Iowa Corn Prices; (min = 245, max = 301)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES

0 35 70 KILOMETERS



November 6, 1995 Iowa Soybean Prices **Legend**

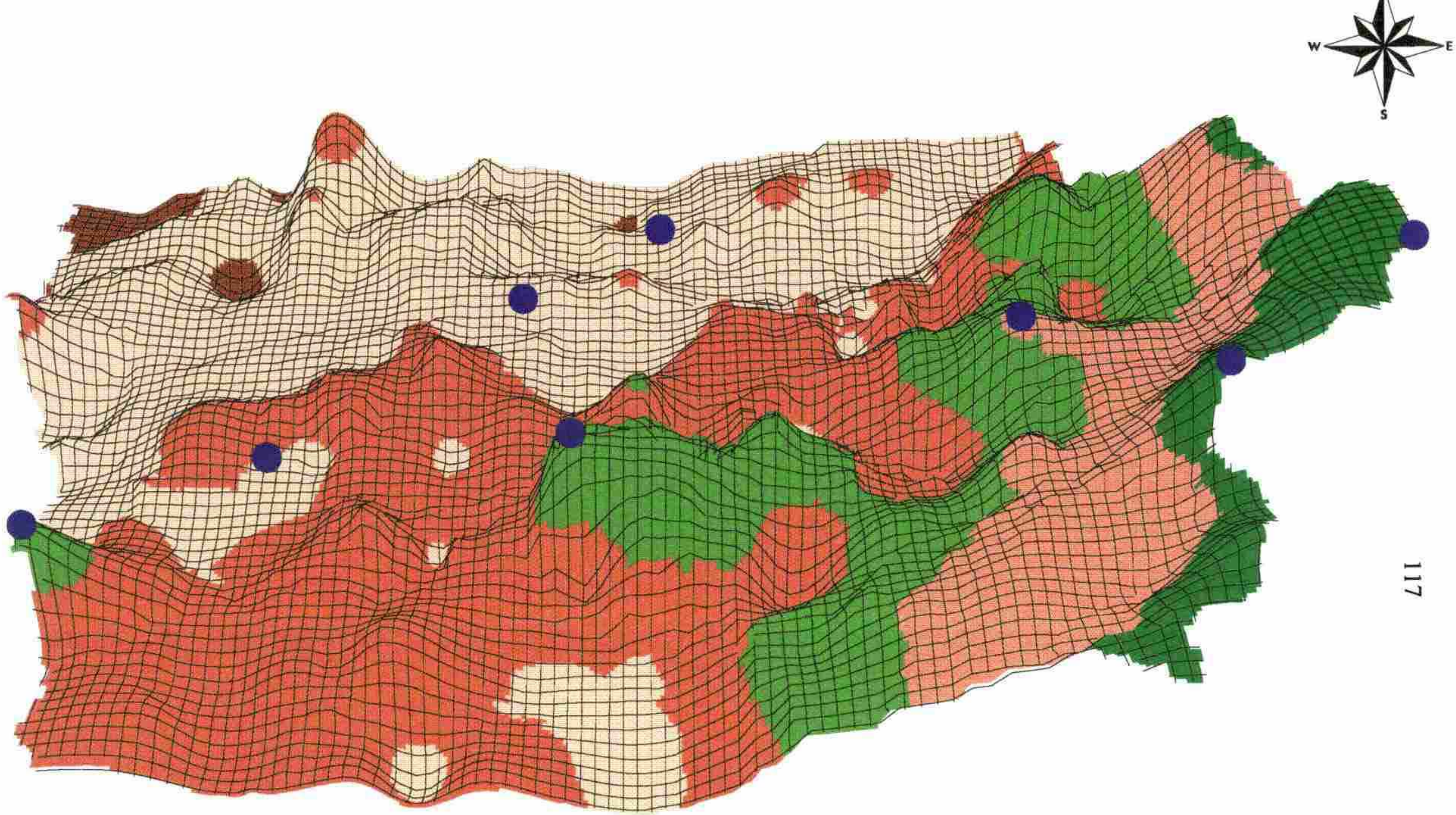
Min = 629, Max = 686, Mean = 652, Std = 11

Zscale 600-6, Azimuth 180 0.13 450km

520 530:Dark Violet	600 610:Spring Green	680 690:Tomato	760 770:Deep Pink
530 540:Dark Green	610 620:Medium Blue	690 700:Chartreuse	770 780:Light Blue
540 550:Green Yellow	620 630:Red	700 710:Light Salmon	780 790:Magenta
550 560:Sandy Brown	630 640:Pink	710 720:Green	790 800:Cyan
560 570:Sky Blue	640 650:Turquoise	720 730:Dark Orange	800 810:Wheat
570 580:Medium Orchid	650 660:Forest Green	730 740:Cornflower Blue	810 820:Dark Turquoise
	660 670:Firebrick	740 750:Yellow	820 830:Green Yellow
590 600:Goldenrod	670 680:Moccasin	750 760:Gold	830 840:Burly Wood

Source: Attila Konkoly; (515)296-7552

http://www.public.iastate.edu/~konkoly/



March 6, 1996 Iowa Soybean Prices

Min = 665, Max = 720, Mean = 685, Std = 11

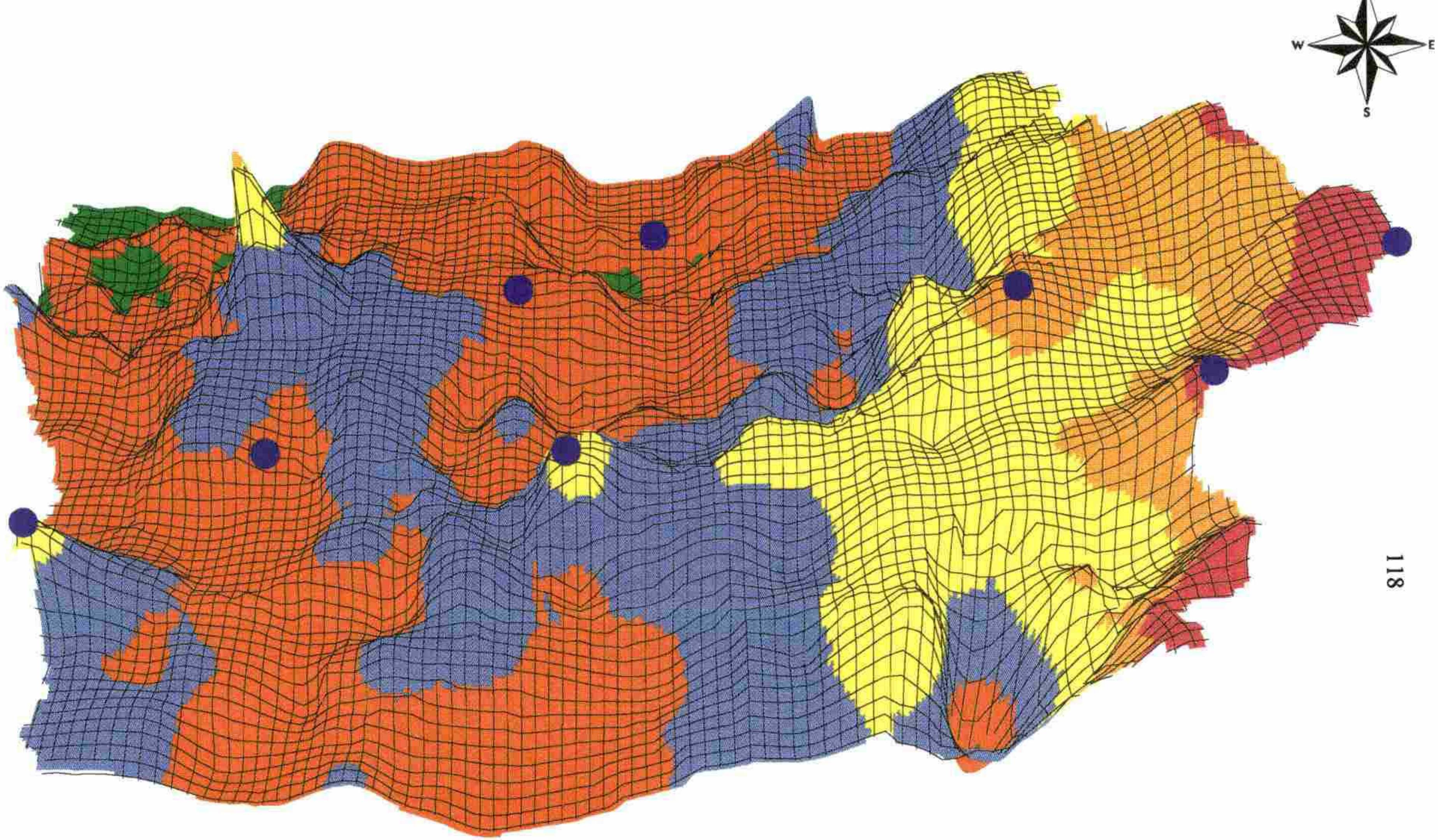
Zscale 600-6, Azimuth 180 0.13 450km

Source: Attila Konkoly; (515)296-7552

http://www.public.iastate.edu/~konkoly/

Legend

520 530:Dark Violet
530 540:Dark Green
540 550:Green Yellow
550 560:Sandy Brown
560 570:Sky Blue
570 580:Medium Orchid
590 600:Goldenrod
600 610:Spring Green
610 620:Medium Blue
620 630:Red
630 640:Pink
640 650:Turquoise
650 660:Forest Green
660 670:Firebrick
670 680:Moccasin
680 690:Tomato
690 700:Chartreuse
700 710:Light Salmon
710 720:Green
720 730:Dark Orange
730 740:Cornflower Blue
740 750:Yellow
750 760:Gold
760 770:Deep Pink
770 780:Light Blue
780 790:Magenta
790 800:Cyan
800 810:Wheat
810 820:Dark Turquoise
820 830:Green Yellow
830 840:Burly Wood



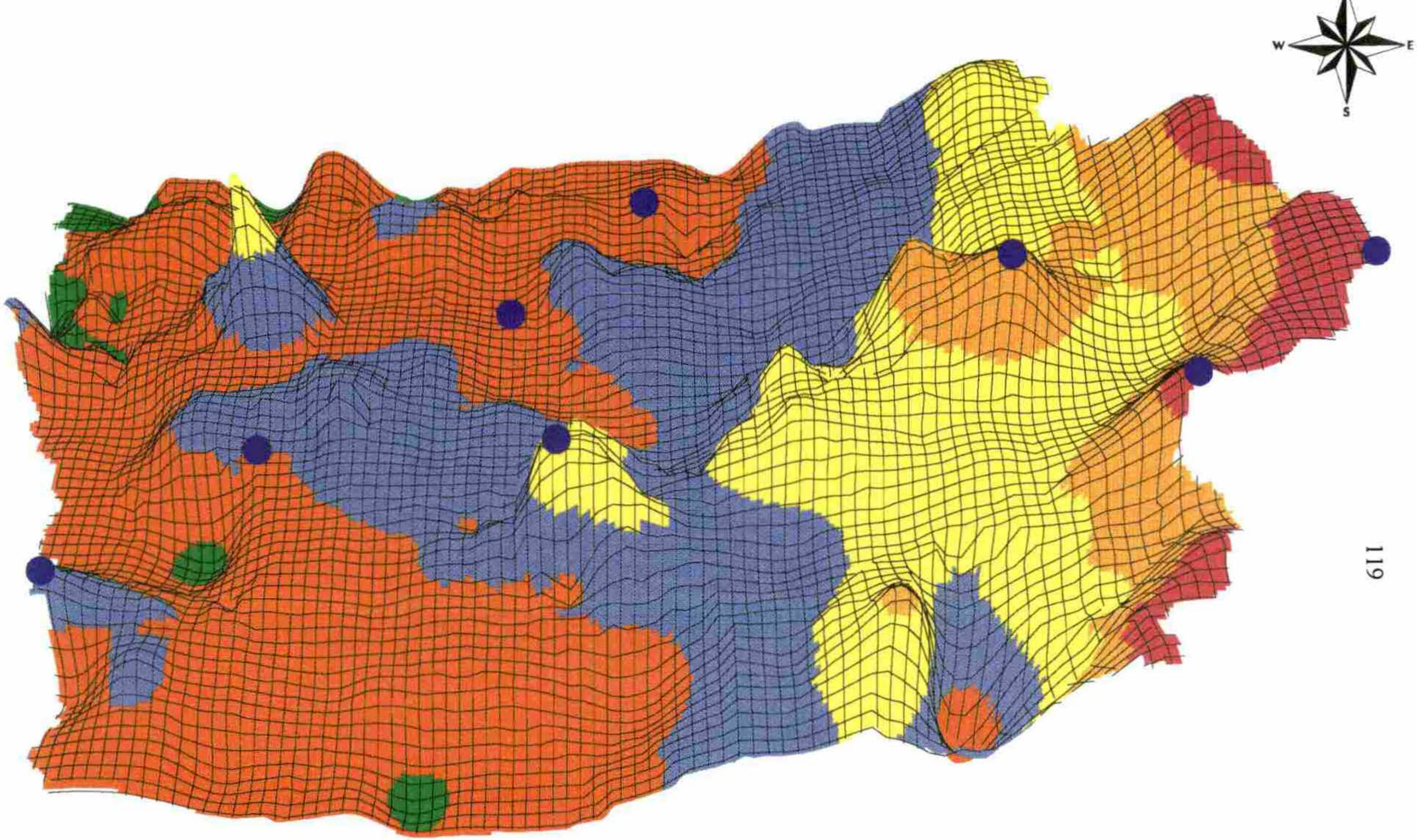
June 12, 1996 Iowa Soybean Prices

Min = 713, Max = 767, Mean = 733, Std = 11
Zscale 600-6, Azimuth 180 0.13 450km

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

Legend

520 530:Dark Violet
530 540:Dark Green
540 550:Green Yellow
550 560:Sandy Brown
560 570:Sky Blue
570 580:Medium Orchid
[illegible]
590 600:Goldenrod
600 610:Spring Green
610 620:Medium Blue
620 630:Red
630 640:Pink
640 650:Turquoise
650 660:Forest Green
660 670:Firebrick
[illegible]
680 690:Tomato
690 700:Chartreuse
700 710:Light Salmon
710 720:Green
720 730:Dark Orange
730 740:Cornflower Blue
740 750:Yellow
750 760:Gold
760 770:Deep Pink
770 780:Light Blue
780 790:Magenta
790 800:Cyan
800 810:Wheat
810 820:Dark Turquoise
820 830:Green Yellow
830 840:Burly Wood



July 30, 1995 Iowa Soybean Prices

Min = 711, Max = 765, Mean = 734, Std = 11

Zscale 600-6, Azimuth 180 0.13 450km

Source: Attila Konkoly; (515)296-7552

http://www.public.iastate.edu/~konkoly/

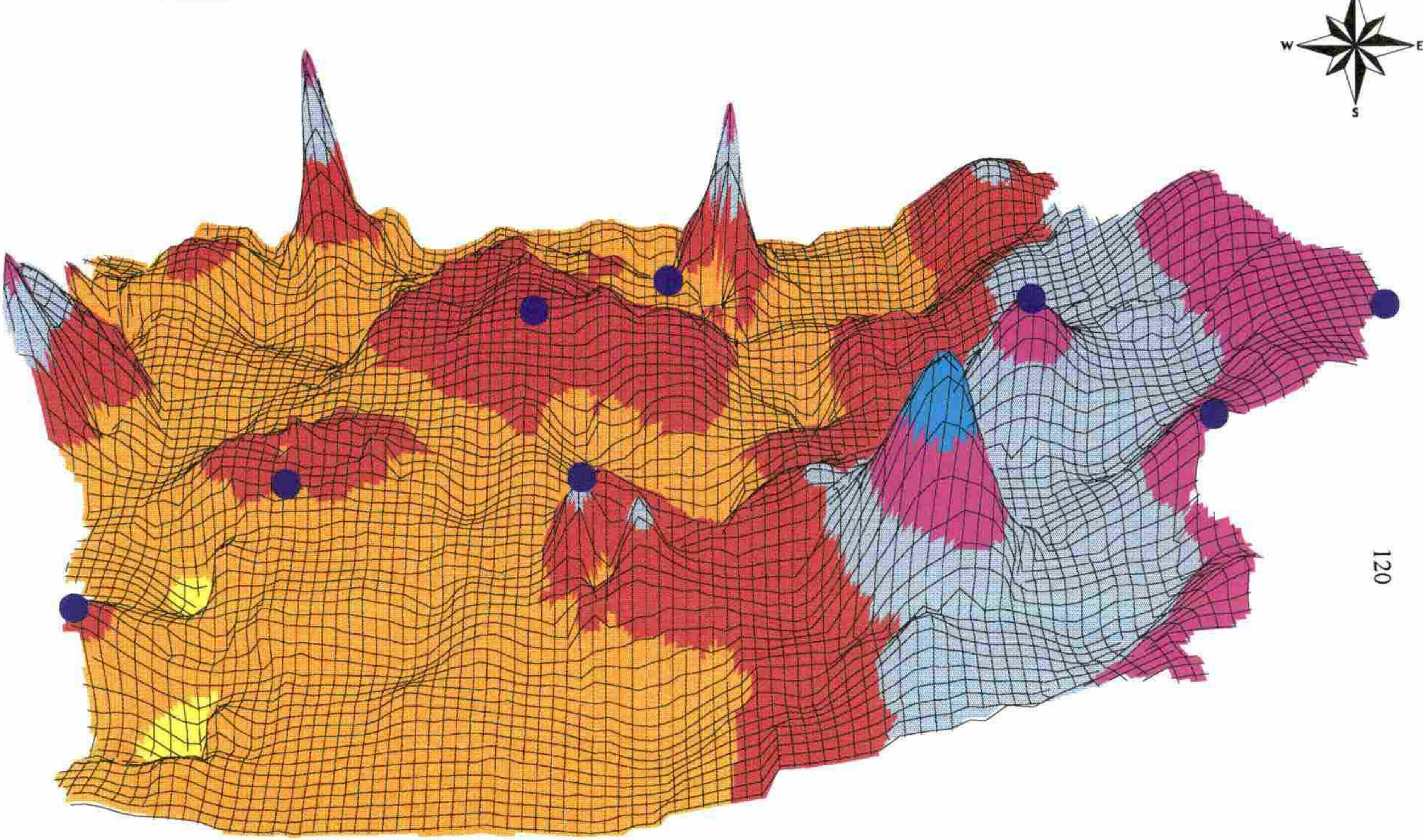
Legend

520 530:Dark Violet
530 540:Dark Green
540 550:Green Yellow
550 560:Sandy Brown
560 570:Sky Blue
570 580:Medium Orchid
590 600:Goldenrod

600 610:Spring Green
610 620:Medium Blue
620 630:Red
630 640:Pink
640 650:Turquoise
650 660:Forest Green
660 670:Firebrick
[illegible]

680 690:Tomato
690 700:Chartreuse
700 710:Light Salmon
710 720:Green
720 730:Dark Orange
730 740:Cornflower Blue
740 750:Yellow
750 760:Gold

760 770:Deep Pink
770 780:Light Blue
780 790:Magenta
790 800:Cyan
800 810:Wheat
810 820:Dark Turquoise
820 830:Green Yellow
830 840:Burly Wood



August 8, 1995 Iowa Soybean Prices

Min = 739, Max = 798, Mean = 763, Std = 9

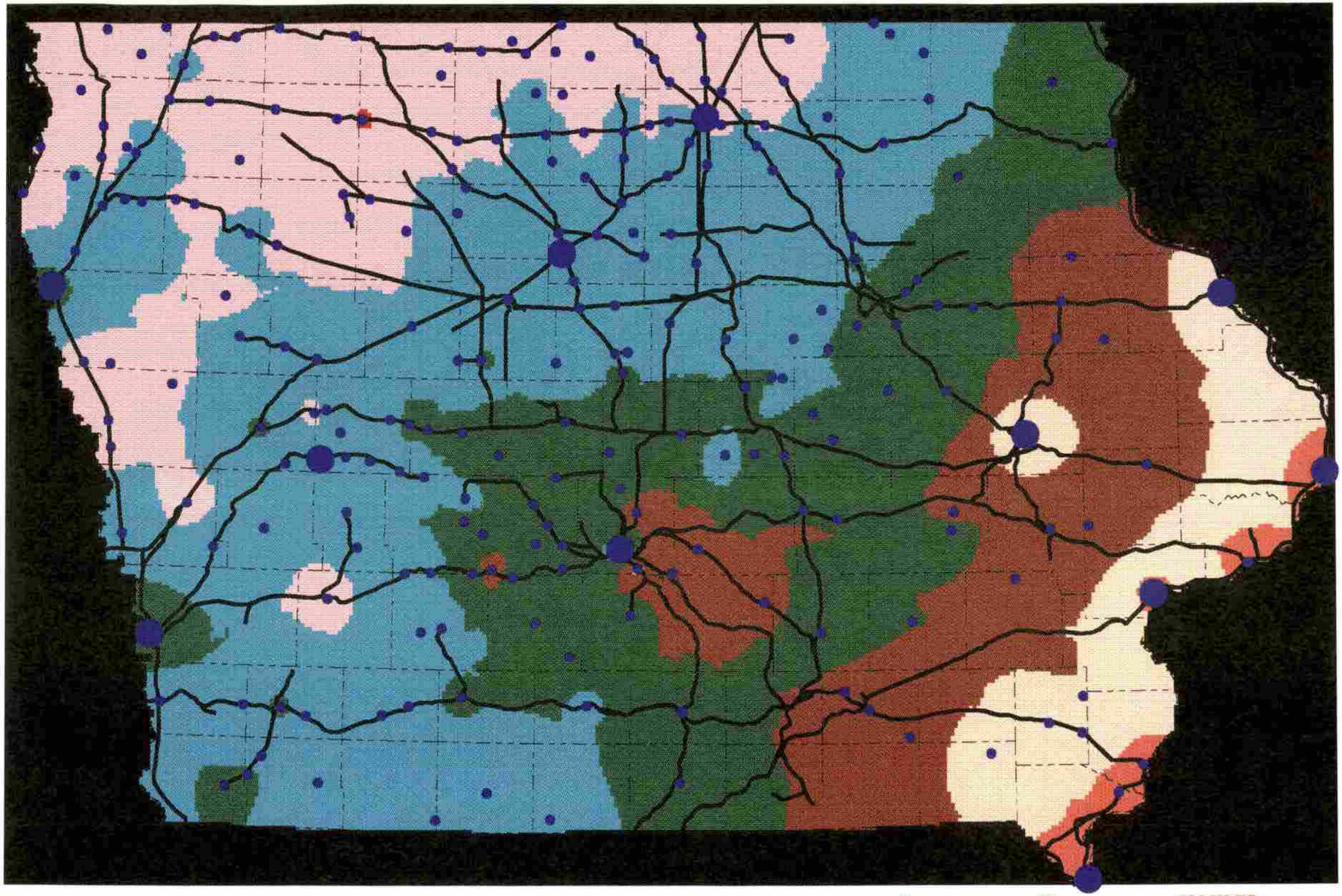
Zscale 600-6, Azimuth 180 0.13 450km

Legend

520 530:Dark Violet
530 540:Dark Green
540 550:Green Yellow
550 560:Sandy Brown
560 570:Sky Blue
570 580:Medium Orchid

590 600:Goldenrod
600 610:Spring Green
610 620:Medium Blue
620 630:Red
630 640:Pink
640 650:Turquoise
650 660:Forest Green
660 670:Firebrick
670 680:Moccasin
680 690:Tomato
690 700:Chartreuse
700 710:Light Salmon
710 720:Green
720 730:Dark Orange
730 740:Cornflower Blue
740 750:Yellow
750 760:Gold
760 770:Deep Pink
770 780:Light Blue
780 790:Magenta
790 800:Cyan
800 810:Wheat
810 820:Dark Turquoise
820 830:Green Yellow
830 840:Burly Wood

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/



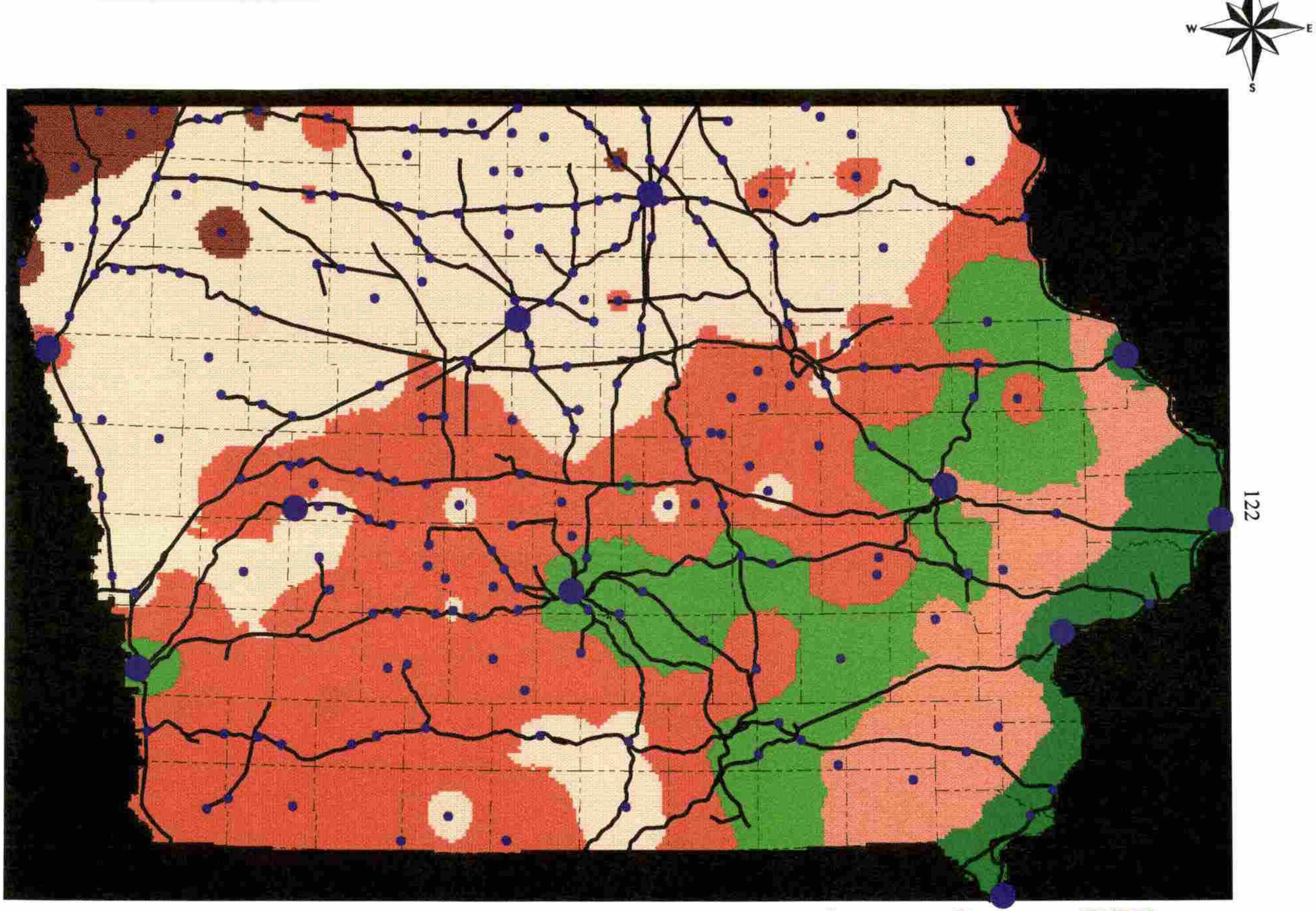
November 6, 1995 Iowa Soybean Prices; (min = 629, max = 686)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES

0 35 70 KILOMETERS



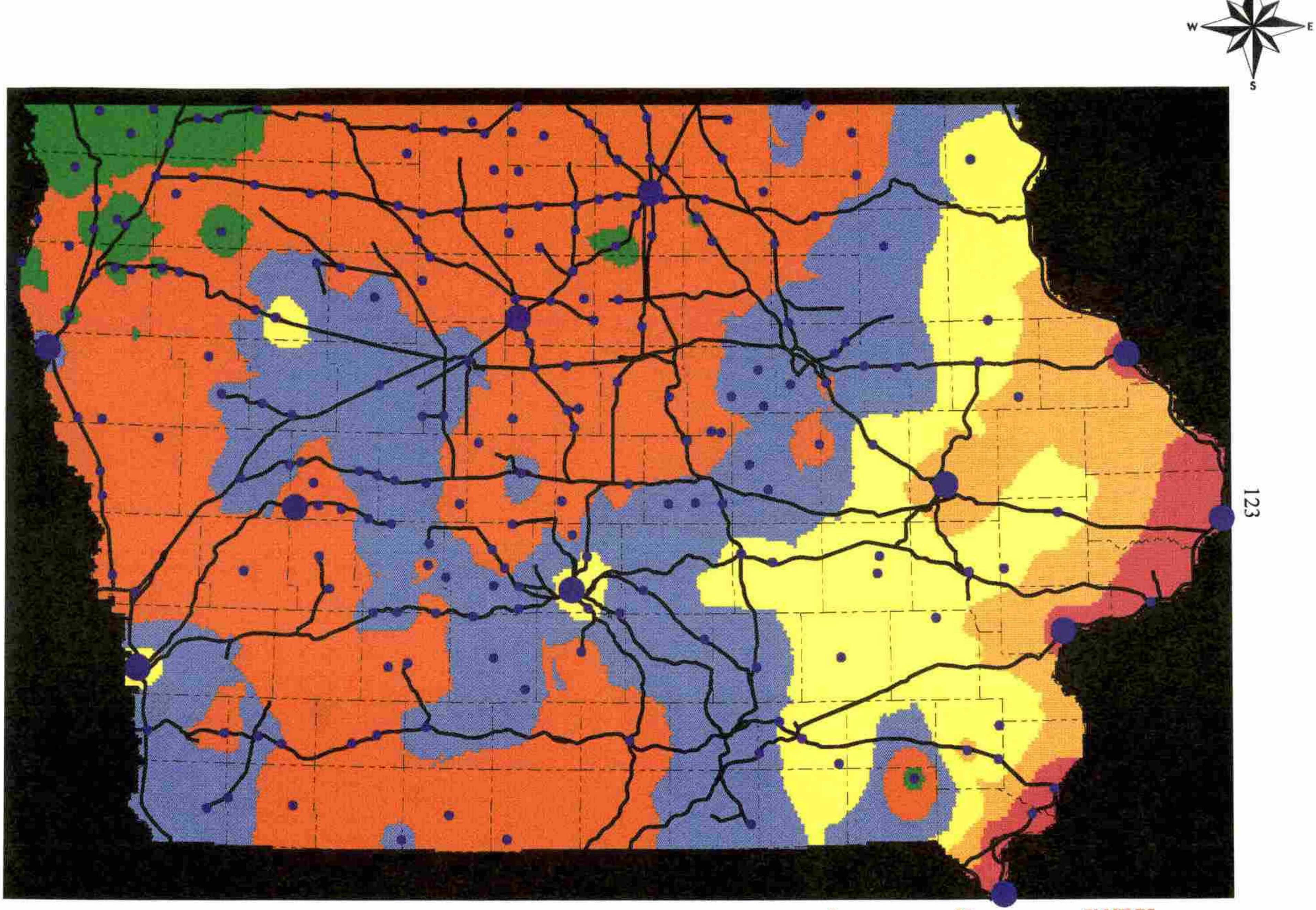
0 35 70 MILES

0 35 70 KILOMETERS

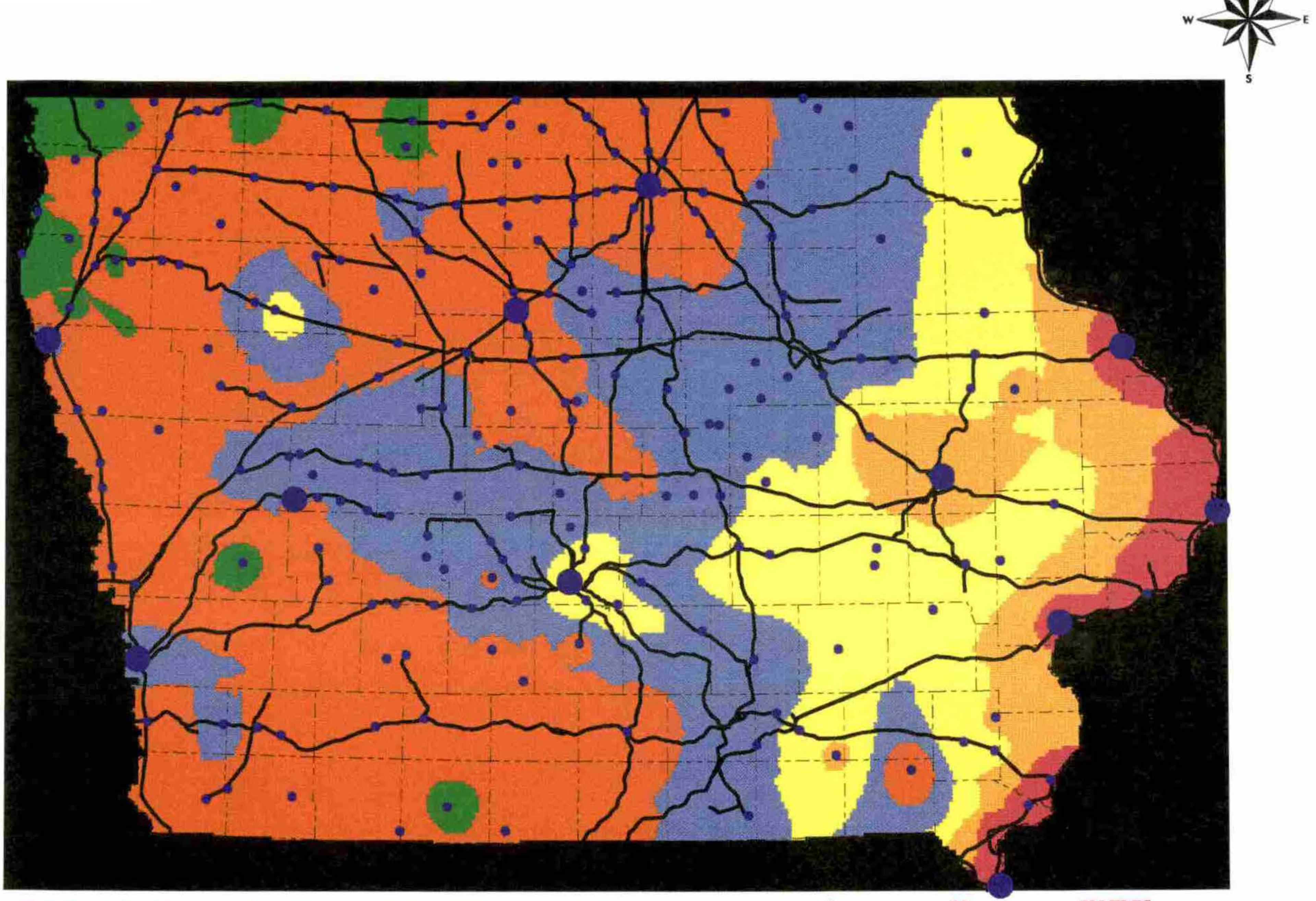
March 6, 1996 Iowa Soybean Prices; (min = 665, max = 720)

Iowa Countylines and Railroads

Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/



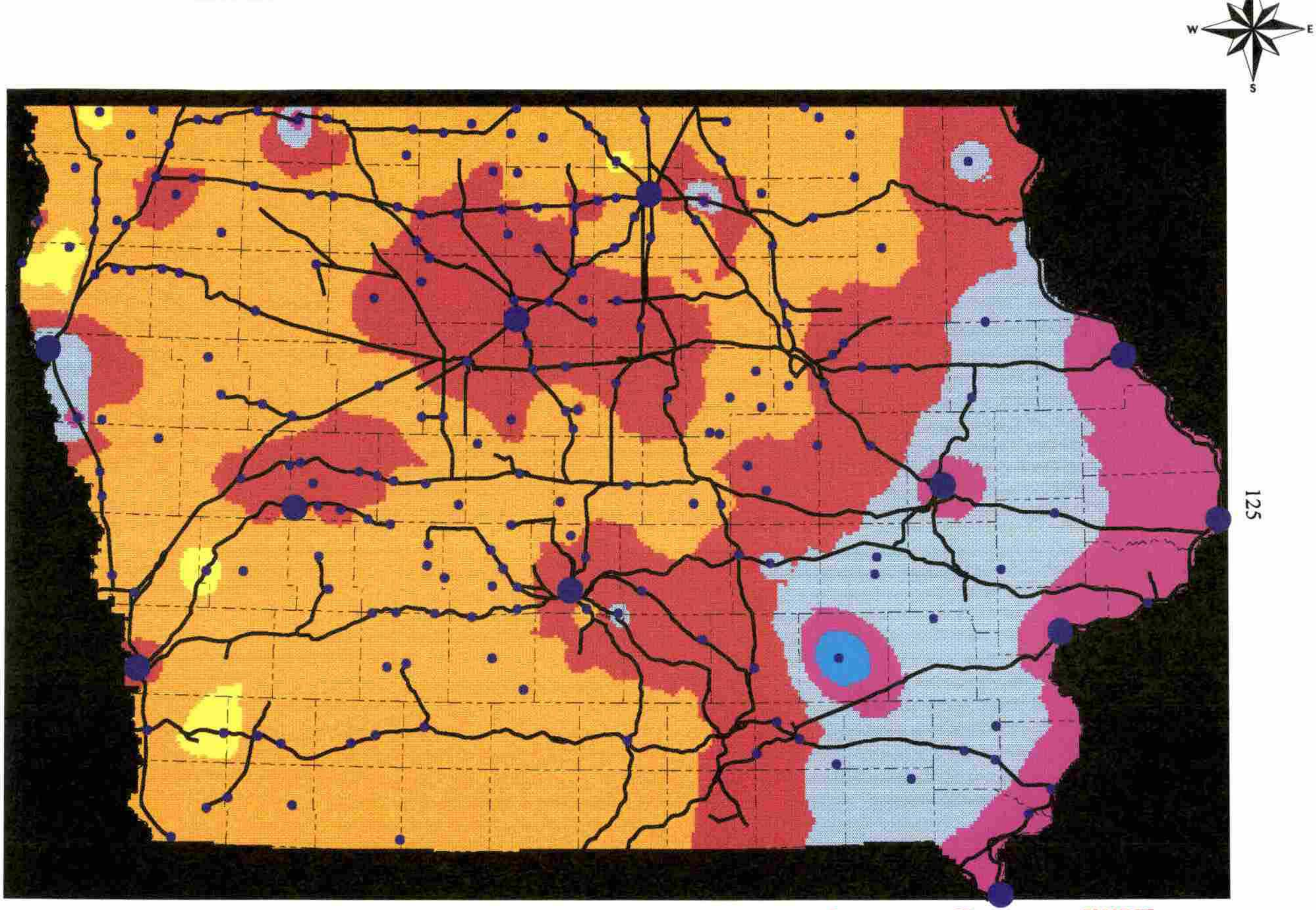
June 12, 1996 Iowa Soybean Prices; (min = 718, max = 785)
Iowa Countylines and Railroads
Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/



July 30, 1996 Iowa Soybean Prices; (min = 711, max = 765)

Iowa Countylines and Railroads

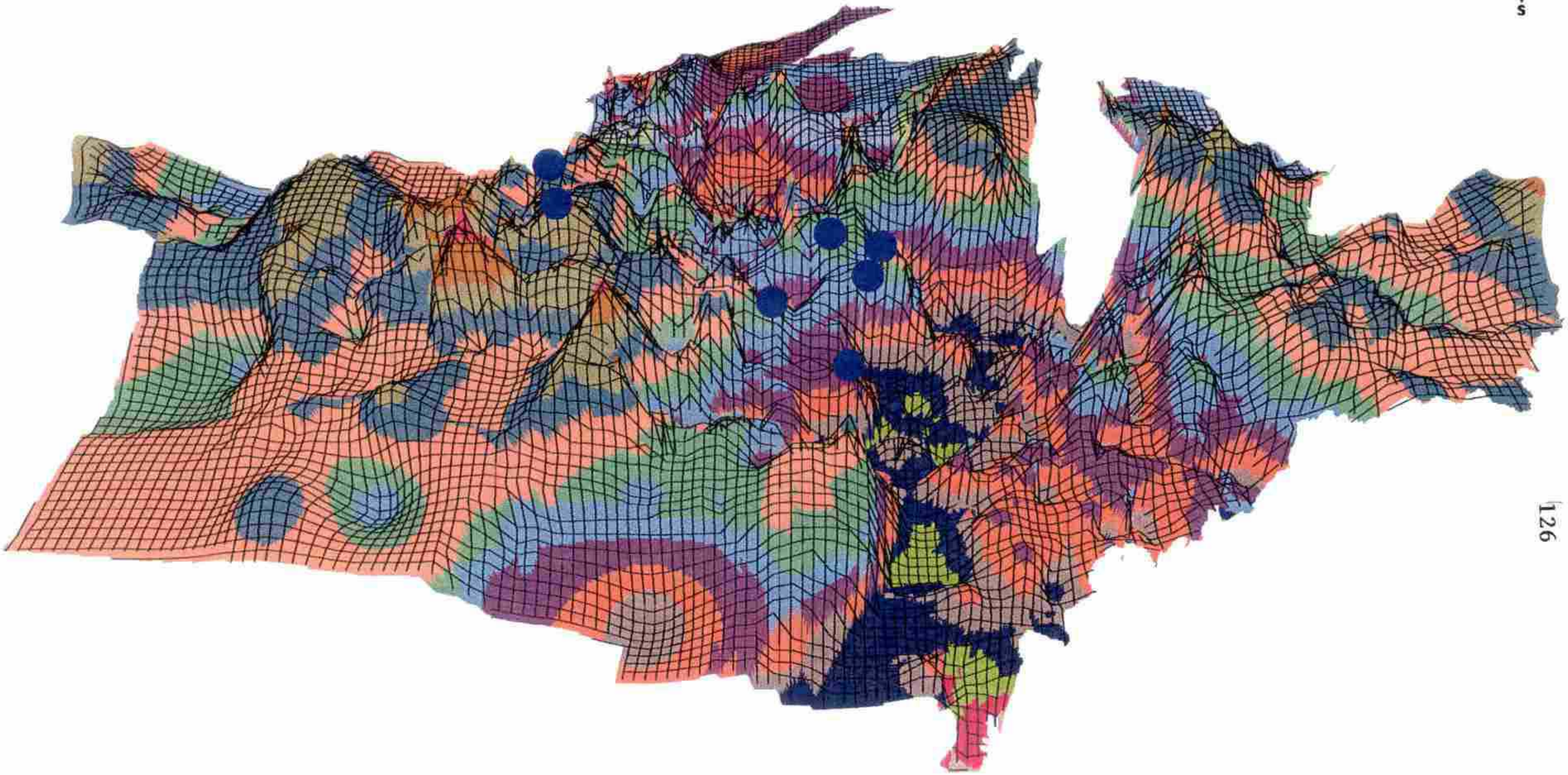
Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/



August 8, 1996 Iowa Soybean Prices; (min = 739, max = 798)
Iowa Countylines and Railroads
Source: Attila Konkoly; (515)296-7552; http://www.iastate.edu/~konkoly/

0 35 70 MILES
0 35 70 KILOMETERS

Average August 1996 Cornbelt Corn Prices
Min = 362, Max = 507, Mean = 447, Std = 23.5
Zscale 600-6, Azimuth 180 0.13 800km



Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

Average September 1996 Cornbelt Corn Prices

Min = 264, Max = 425, Mean = 337, Std = 22.5

Zscale 600-6, Azimuth 180 0.13 800km

Legend

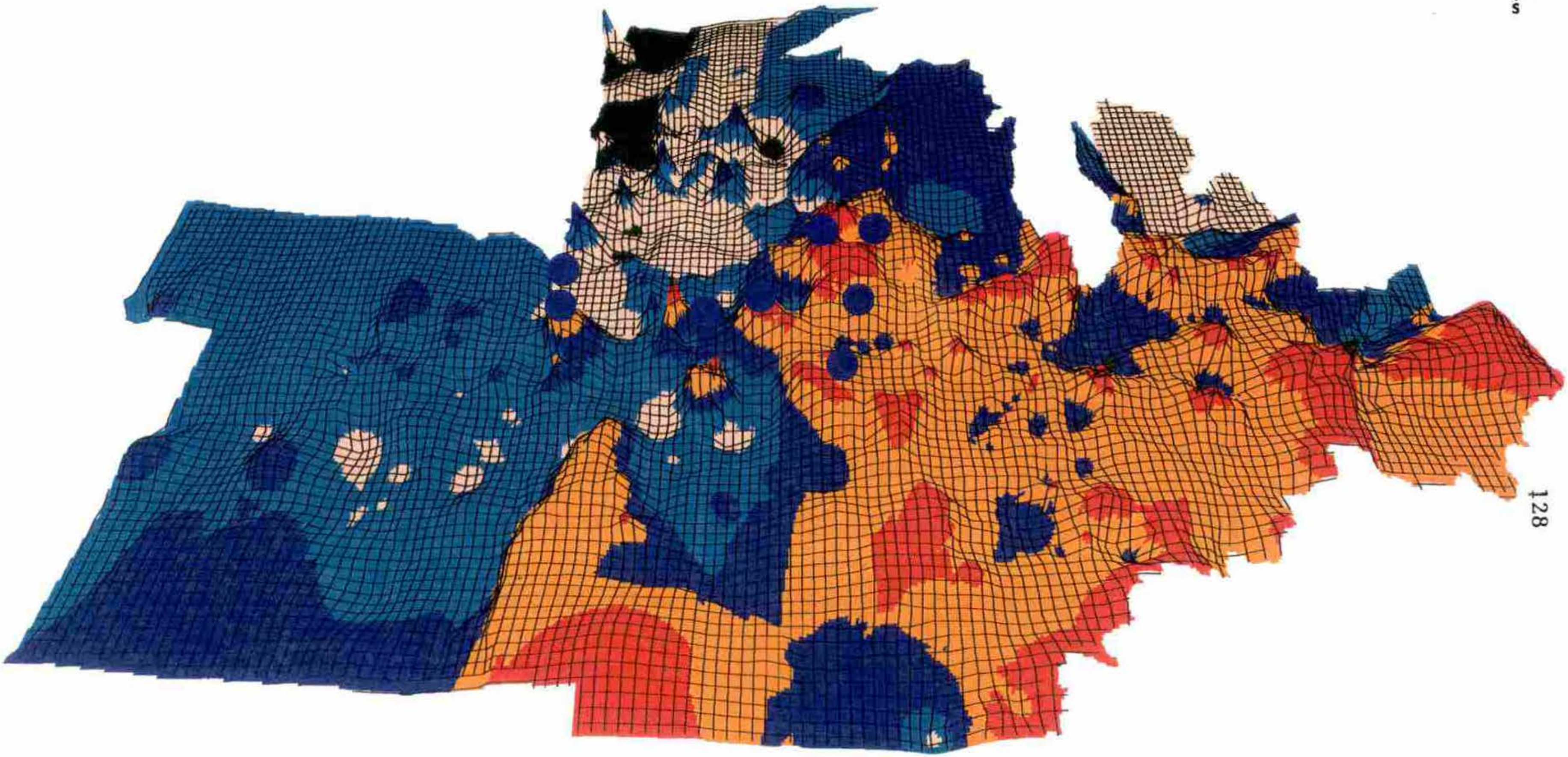
230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

Average October 1996 Cornbelt Corn Prices

Min = 237, Max = 306, Mean = 271, Std = 12

Zscale 600-6, Azimuth 180 0.13 800km



Legend

230-240:Dark Violet
240-250:Dark Green
250-260:Peach
260-270:Cyan
270-280:Blue
280-290:Orange
290-300:Red
300-310:Green
310-320:Turquoise
320-330:Yellow
330-340:Gold
340-350:Slate Gray
350-360:Light Seagreen
360-370:Hot Pink
370-380:Tan
380-390:Magenta
390-400:Green Yellow
400-410:Navy
410-420:Rosy Brown
420-430:Tomato
430-440:Purple
440-450:Sky Blue
450-460:Pale Green
460-470:Light Salmon
470-480:Cadet Blue
480-490:Dark Khaki
490-500:Chocolate
500-510:Deep Pink
510-520:Gray
520-530:Pale Turquoise
530-540:Chartreuse

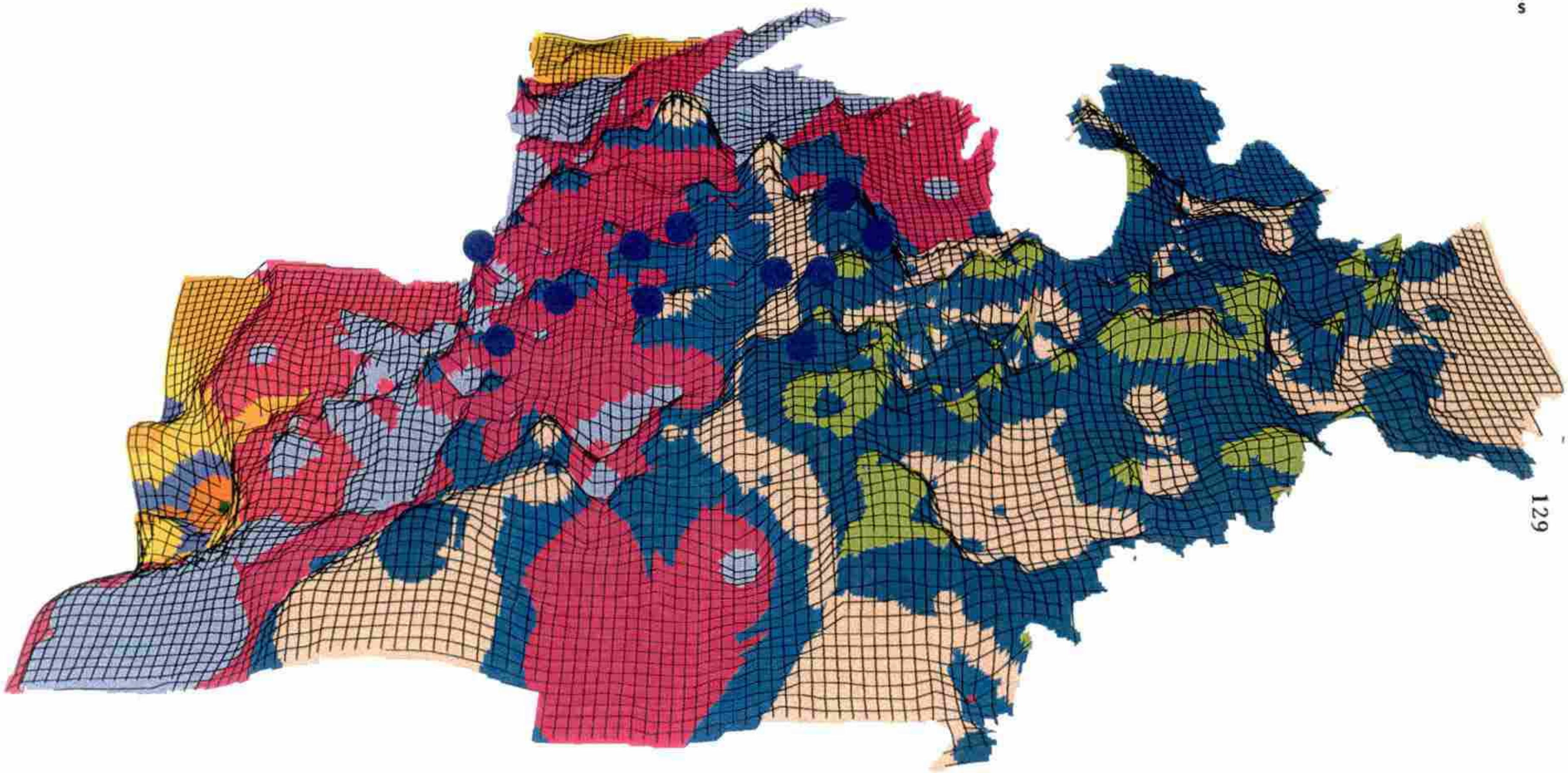
Corn Price in New Orleans: 333

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

Average August 1996 Cornbelt Soybean Prices

Min = 700, Max = 844, Mean = 790, Std = 20.6

Zscale 600-6, Azimuth 180 0.13 800km



Legend

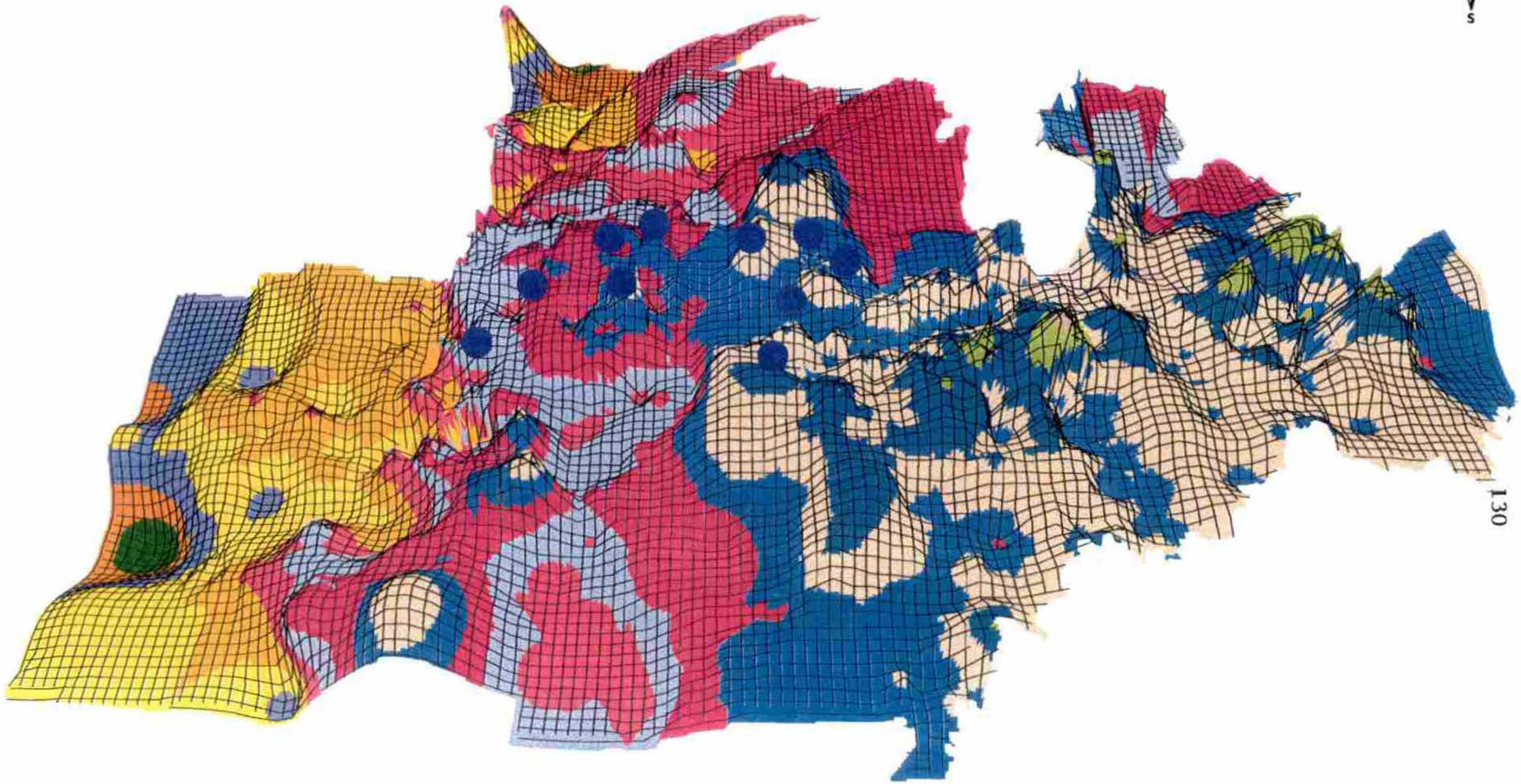
520 530:Dark Violet	600 610:Spring Green	680 690:Tomato	760 770:Deep Pink
530 540:Dark Green	610 620:Medium Blue	690 700:Chartreuse	770 780:Light Blue
540 550:Green Yellow	620 630:Red	700 710:Light Salmon	780 790:Magenta
550 560:Sandy Brown	630 640:Pink	710 720:Green	790 800:Cyan
560 570:Sky Blue	640 650:Turquoise	720 730:Dark Orange	800 810:Wheat
570 580:Medium Orchid	650 660:Forest Green	730 740:Cornflower Blue	810 820:Dark Turquoise
[illegible]	660 670:Firebrick	740 750:Yellow	820 830:Green Yellow
590 600:Goldenrod	670 680:Moccasin	750 760:Gold	830 840:Burly Wood

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

Average September 1996 Cornbelt Soybean Prices

Min = 654, Max = 842, Mean = 777, Std = 24.8

Zscale 600-6, Azimuth 180 0.13 800km



Legend

520 530:Dark Violet
530 540:Dark Green
540 550:Green Yellow
550 560:Sandy Brown
560 570:Sky Blue
570 580:Medium Orchid
590 600:Goldenrod

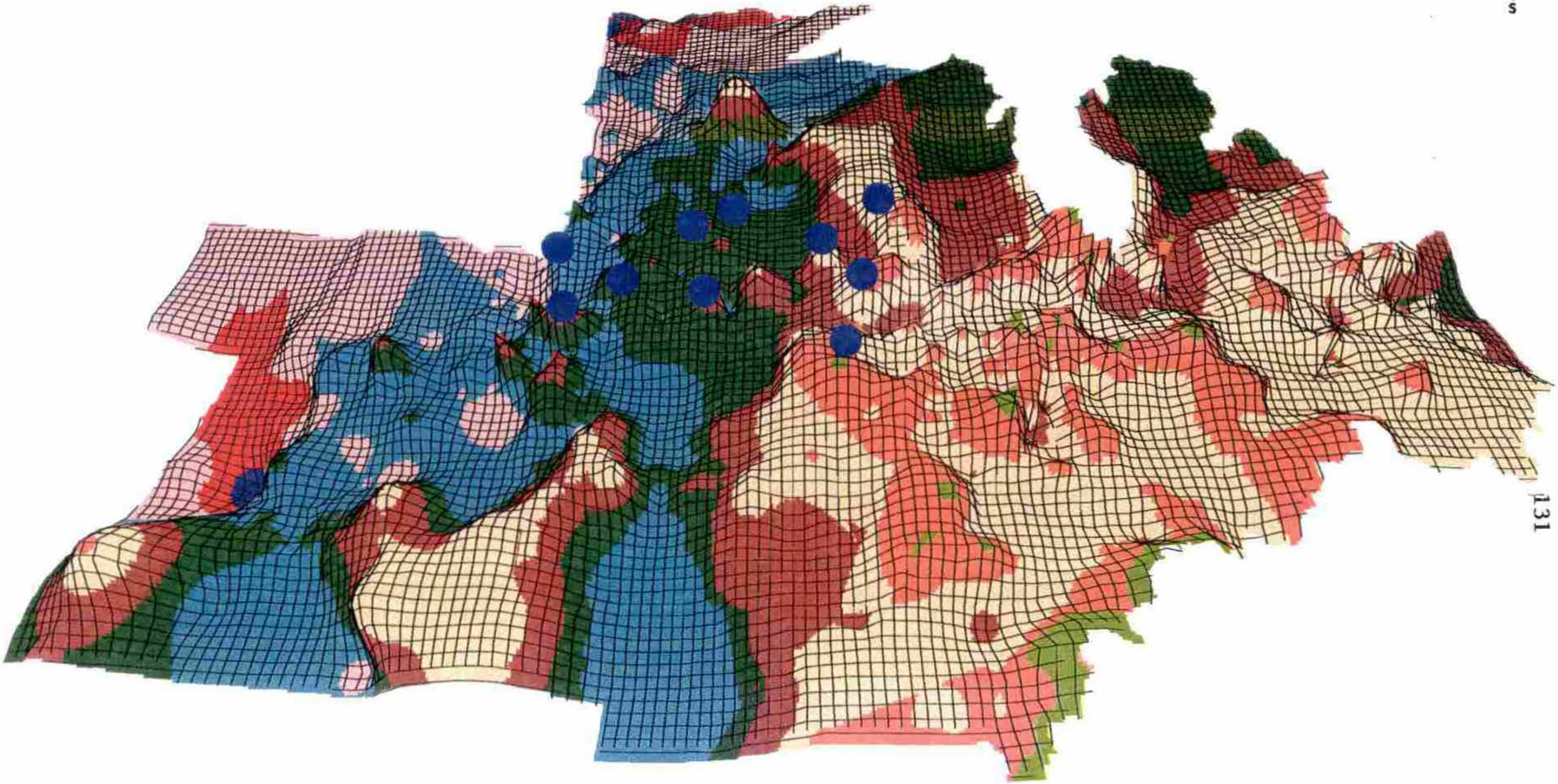
600 610:Spring Green
610 620:Medium Blue
620 630:Red
630 640:Pink
640 650:Turquoise
650 660:Forest Green
660 670:Firebrick

680 690:Tomato
690 700:Chartreuse
700 710:Light Salmon
710 720:Green
720 730:Dark Orange
730 740:Cornflower Blue
740 750:Yellow
750 760:Gold

760 770:Deep Pink
770 780:Light Blue
780 790:Magenta
790 800:Cyan
800 810:Wheat
810 820:Dark Turquoise
820 830:Green Yellow
830 840:Burly Wood

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

Average October 1996 Cornbelt Soybean Prices
Min = 610, Max = 703, Mean = 657, Std = 17
Zscale 600-6, Azimuth 180 0.13 800km



Legend

520 530:Dark Violet	600 610:Spring Green	680 690:Tomato	760 770:Deep Pink
530 540:Dark Green	610 620:Medium Blue	690 700:Chartreuse	770 780:Light Blue
540 550:Green Yellow	620 630:Red	700 710:Light Salmon	780 790:Magenta
550 560:Sandy Brown	630 640:Pink	710 720:Green	790 800:Cyan
560 570:Sky Blue	640 650:Turquoise	720 730:Dark Orange	800 810:Wheat
570 580:Medium Orchid	650 660:Forest Green	730 740:Cornflower Blue	810 820:Dark Turquoise
	660 670:Firebrick	740 750:Yellow	820 830:Green Yellow
590 600:Goldenrod		750 760:Gold	830 840:Burly Wood

Soybean Price in New Orleans: 724

Source: Attila Konkoly; (515)296-7552
http://www.public.iastate.edu/~konkoly/

APPENDIX V

COMPUTER DISK CONTAINING PRICE DATA

The enclosed computer disk contains all corn and soybean price data gathered during this study. It is saved in comma delimited format, that is recognized by most database and spreadsheet programs.

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I also would like to express my appreciation to Dr. Reginald R. Souleyrette, Dr. Sunday Tim, Jim Majure and Fulbert L. Namwamba whose guidance helped this project reach this final stage.