Valuation of Agricultural Land
For Eminent Domain

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Valuation of Agricultural Land

Abstract: The value of land for agricultural purposes is based on the concept of productivity. Productivity analysis is used to determine the highest and best use of a property as well as the "as-is" value for a crop. This paper walks through the analysis required to extract the productivity from soil qualities on agricultural lands and translate the productivity to bushels per acre and ultimately the land value. This process is critical to evaluate eminent domain takings in rural farming areas. We then compare dry agricultural lands to property where the pricing of land may change because of additional amenities, such as water rights.

I.   Introduction

The valuations of land for eminent domain purposes can be initiated for the needs of various governments or related agencies. These needs include: street and public services, revitalization, rapid transit, and highway widening or extensions.   Highways, of course, are not always in urban areas as they connect across the US. Overall, US land is still dominated by open space and agricultural use.[1] Appraisers whose practice includes valuation in litigation for eminent domain for right away and transit corridors will need to know the mechanics of the valuation of agricultural lands and productivity analysis to properly value in an eminent domain taking.

This paper provides a framework to evaluate agricultural land value using market indicators of agricultural land prices. We call these market indicators because the analysis is not a selection of direct comparables, but a buildup of land estimates based on agricultural productivity of soil. These market indicators are selected using the "across the fence" methodology reviewed by

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[1] *US. USDA. National Agricultural Statistics Service. Farms, Land in Farms, and Livestock Operations 2012 Summary. N.p., 19 Feb. 2013. Web. <http://usda01.library.cornell.edu/usda/current/FarmLandIn/FarmLandIn-02-19-2013.pdf.*

Hunsperger, McGuire and Throupe.[2] The "across the fence" methodology is used for transit

corridors, such as highways to select property across from, in this scenario, across or on the other

side of the highway from an actual eminent domain taking. In this manner the appraiser can

eliminate "project influence", and non-agricultural influences on land value.

The remainder of this paper develops a process and illustrates the use of productivity to value

agricultural lands. We first review past literature related to the topic. This is followed by a

discussion of the valuation process. We then use a valuation example to illustrate the process.

Next is a discussion of a need to carefully discern if property sales are not influenced by other

amenities such as mineral or water rights. We conclude with suggestions for further analysis.

II.   Literature Review

There is a set of literature that focuses on the factors impacting agricultural land value. These

factors include proximity to urbanization, natural amenities, water, and mineral rights. Prior

studies of Agricultural land show recreation and natural amenities positively influence farmland

values: Bastian, et al. 2002; Nickerson, et al. 2012; Pope 1985.[3] [4] [5] A few of these studies, do

note, that agricultural productivity is instrumental in determining the income and value of

agricultural land, but do not focus on the topic.

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[2] Wayne Hunsperger , Amy McGuire, Ron Throupe, "Transit Corridor Valuation: Issues and Methods," *The Appraisal Journal*, (Summer 2012): 235-247.
[3] C. Bastian, D. McLeod, M. Germino, W. Reiners, and B. Blasko, "Environmental Amenities and Agricultural Land Values: A Hedonic Model Using Geographic Information Systems Data" *Ecological Economics* 40, (2002): 337-349.
[4] C.J. Nickerson,., M. Morehart, T. Kuethe, J. Beckman, J. Ifft, and R. Williams. *Trends in U.S. Farmland Values and ownership*. U.S. Department of Agriculture, Economics Research Service, Rep. EIB-92, 2012.
[5] Pope, C.A. "Agricultural Productive and Consumptive Use Components of Rural Land Values in Texas," *American Journal of Agricultural Economics* 67, No.1 (1985):81-86.

In "Agricultural Productivity and Land Value," Mitchell discusses productivity as the "quality and viability of an agricultural income stream" that has a great effect on land values.[6] For example, with a lack of agricultural productivity, farmers cannot afford the loan payments, invoking a number of foreclosures. Mitchell also put forward that "Lenders will demand appraisals that include a thoroughly prepared income capitalization approach."

An extension of Mitchell is that agricultural productivity is not the sole indicator for agriculture land value. The article "The Effects of Environmental Amenities on Agricultural Land Values" by Wasson, McLeod, Bastian, and Rashford use a hedonic pricing model to capture the impact of environmental amenities on western land prices.[7] These amenities include: wildlife and fish habitat, scenic view attributes, and distance to protected federal lands. Recent work in "Linking the Price of Agricultural Land to Use Values and Amenities" by Borchers, Ifft and Buethe extends the amenity component of agricultural land pricing.[8] The authors control for natural amenities and proximity to urbanization, yet they find development potential as the key driver of the nonagricultural component of farmland values (also see Plantinga, A. and D. Miller).[9] This study included oil and natural gas as an amenity, showing a significant price effect on land. Weber addresses this economic effect in the states of Colorado, Texas and Wyoming.[10]

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[6] Robert J. Mitchell, MAI, "Agricultural Productivity and Land Value," 1986.

[7] James R. Wasson, Donald M. McLeod, Christopher T. Bastian, and Benjamin S. Rashford. "The Effects of Environmental Amenities on Agricultural Land Values," *Land Economics* 89, No. 3 (2013): 466-478.

[8] Allison Borchers, Jennifer Ifft and Todd Kuethe, "Linking the Price of Agricultural Land to Use Values and Amenities", *Agricultural & Applied Economics Association Session at the Allied Social Science Association Meetings, Philadelphia, PA, January, 3-5, 2014.*

[9] A. Plantinga and D. Miller.. "Agricultural Land Value and the Value of Rights to Future Land Development" *Land Economics* 77, No. 1 (2001): 56-67.

[10] J. Weber, "The Effects of a Natural Gas Boom on Employment and Income in Colorado, Texas, and Wyoming," *Energy Economics* 34, No. 5 (2012): 1580-1588.

This non-agricultural or amenity research area supports the need for the appraiser to control or extract, non-agricultural effects on land pricing when selecting market indicator properties.

Another amenity that needs to be controlled for is water.[11] [12] The appraiser needs to determine whether the land is irrigated or non-irrigated. Irrigated lands can create a need to perform a highest and best use analysis to determine if the irrigated agricultural will continue. We control the aforementioned effects in our example of selecting market indicators and separate non irrigated and irrigated lands in the analysis.

III.   Agricultural Land Valuation Process

Production Level Price Extraction
Utilizing the Across the Fence (ATF) methodology to select market indicator we established sales prices per acre based on production capabilities. The properties are delineated by dry or irrigated farming and then segmented into production rates based on soil type.[13] We apply the percentage of each production rate to derive the acreage within the subject corridor. A corridor is a strip of land used for transportation or transmission purposes (e.g., rail, highway, power, information, slurries, liquids).[14] Individual land sales are selected to analyze the soil composition, then to estimate the productivity of the land.

Most of the land located within Cheyenne County, and other eastern Colorado counties is used for agricultural purpose. The soil type is the decisive element of agricultural production and

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[11] Elizabeth Basta, Bonnie G. Colby, "Water Market Trends: Transactions, Quantities and Prices," "*The Appraisal Journal* 78, no. 1 (Winter 2010): 50-69.

[12] Steven J. Herzog, "The Appraisal of Water Rights: Their Nature and transferability [Part I]," *The Appraisal Journal,*78, no. 1 (Winter 2008): 39-46.

[13] Non-irrigated is valued on wheat production / irrigated is based corn/ some sales are mix of irrigated and non-irrigated lands.

[14] Appraisal Institute, *The Dictionary of Real Estate Appraisal*, 5th ed. (Chicago, IL: Appraisal Institute, 2010), 47.

potential soil yield has a great impact on the land sale price. Figure 1 (Soil Map) shows a typical land sale in Cheyenne County with soil types.

Insert Figure 1: Soil Map

The Soil maps are produced by Surety from data provided by the US Department of Agriculture (USDA) & Natural Resources Conservation Service (NRCS). From these soil maps we know the soil distribution for each market indicator sale. As shown in Figure 1, Soil Code 19, which is Keith-Richifield silt loams, 0 to 2 percent slopes, is located at the east and the middle portion of the site (location: 021-014S- 042W). It occupies 187.3 acres, or 55% of the site. Based on the wheat production, the bushel per acre yield of Soil Code 19 is 18. Wheat is chosen as the production measurement because it is the typical crop of dry land farming. Soil Code 55 and Soil Code 20 are spread at the Northwest corner of site, while Soil Code 16 is at the south west corner.

Along with Figure 1, a table of soil codes and use, is given per sale, shown as Table 1 (Soil Segmentation by Code). The information of pertinence is the type of soil, the acreage and the production capacity for crops.

Insert Table 1: Soil Segmentation by Soil Code

The segmentation of a market indicator sale by production is shown in Table 2. The yield, bushels production per acre are shown in the blue boxes. We judged the production level with the greatest amount of acreage as the most reliable. We then utilize this production level as the

benchmark to solve the system of equations for production. The production of each type of soil is calculated based on the benchmark so that different soil capabilities can be converted.   The land/soil ratio is the production ratio in comparison to the base of 18 bushels/acre. For example, if the production of the soil is 15 bushels/acre, and the benchmark is 18 bushels, its land soil ratio would be 83% (15/18).

We then ask, compared to the benchmark, how many acres does it really account to production capacity? Then, the number in orange box shows the capacity of a particular soil in acres.

Calculated% of Acres = land soil ration * Acres

The total yield capability of the site is 350.24 acres. In other words, this 338.8 acres of land production equals to 350.24 acres of land production with the benchmark soil (18 bushels /acre). The sale price is $400,000. The unit price of the benchmark soil is $1,142 ($400,000/350.24). We can then calculate the unit price of different types of soil based on the land soil ratio and the benchmark unit price.

Value/ Acre = Land Soil Ratio * (Total Sale Price/ Calculated% of Acres)

Finally, the value based on soil type production will be:

(Value/ Acre) * Acres

A summary is shown in Table 2 (**Production Level Value per Acre Extracted From Sales Prices).**

Insert Table 2: **Production Level Value per Acre Extracted From Sales Prices**

As indicated in Figure 2, (Production Yield Composite Model) the "best fit" for the average sale price per acre has a relationship with the soil production/ Bushels per acre (shown in blue). The column shown in green is the number of occurrences of a specific production level for all market indicator transactions. For example, there are 26 market indicator land transactions data collected with 18 bushels per acre production. The more occurrences, the more reliable is the average price from the analysis for each production level. A lack of observations for irrigated lands, as illustrated by the number of occurrences for production levels of the 105 to 140 bushels per acres, results in less reliable estimates. These estimates may also be influenced by non-agricultural use motivations. Requiring not only confirmation of sales information with party's to the transaction, but also a further check for positive amenities, such as fishing, minerals or water purchases.

Insert Figure 2: Production Yield Composite Model

A review of the composite production yield model illustrates that the "best fit" of the non-irrigated land is influenced by the irrigated land results. Because irrigated land prices can be influenced by water as an amenity, a separate model of irrigated and non-irrigated land is warranted. Figure 3 shows the model results for non-irrigated land. Of note is that the y axis intercept is selected as $200 per acre, with zero production. This estimate is based on non-productive open space land sales. From the model results, a subject property value can be estimated based on productivity of the soil.

Insert Figure 3: Non- Irrigated Production Yield Composite

 Figure 4 illustrates the model for irrigated land only. It is evident that the model is less reliable than the non- irrigated model. There are less observations of each production level and water sales are not all equal. Water sales can have varying seniority rights of use. This result leads to a need for further investigation of the market indicator transactions: which market indicator determines the motivation of the party's to the transaction. In particular, if the transaction was based on the going concern of an irrigated farm, or water rights with a residual dry land farm. Water as a commodity and the value of water in many parts of the US is now surpassing agricultural use. For Colorado, water purchasers are willing to pay for water based on the seniority of the water rights, the location of the water relative to ability to transport, and the willingness of local government to cooperate on water transfer requests.

Insert Figure 4: Irrigated Production Yield Composite

V.   Conclusion

Knowledge of the methodology to estimate the productivity of agricultural land is a necessity for an estimate of value for agricultural lands. This value opinion may be for eminent domain or estate purposes, rather than lending. The appraiser has to defend his (her) opinion based on the market indicators available. The Appraiser needs to be aware that the value of agricultural land can be influenced by other factors. These factors include natural amenities, proximity to urbanization, hunting or fishing leases, mineral rights and water rights.   These amenities can require the appraiser to geographically segment where market indicators are selected in order to exclude proximity to urban areas. Or vis-versa, only select market indicators that are proximate

to an urban area. Water rights in some areas are now more valuable than the going concern as

agricultural land. These rights can distort the sales price for the irrigated crop land.[15] Mineral

rights can also play a role in agricultural land sales.[16] In many locations the mineral rights have

been severed from the land, but there may be royalties associated with agricultural land. The

appraiser needs to investigate the history of the subject property to determine if any mineral

rights or royalties exist and "run with the land."

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[15] Steven J. Herzog, "The Appraisal of Water Rights: Valuation Methodology," *The Appraisal Journal*, (Spring 2008): 122-31.

[16] Joseph B. Lipscomb, PhD, MAI, and J. R. Kimball, MAI , "The Effects of Mineral Interests on Land Appraisals in Shale Gas Regions," *The Appraisal Journal* (Fall 2012): 318-329.

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Biography

Kaifeng (Kay) Zhang is a "candidate for designation" and holds a Master's degree (MSRECM) in real estate & construction management from the Burns School of Real Estate and Construction Management in the Daniels College of Business at the University of Denver. Kay was a graduate student scholarship award winner by Appraisal Education Trust in 2013. She has interned at Colliers international (Hong Kong) and is currently working with American Valuation Partners (AVP). Contact: Kay@avpartners.biz

Wayne L. Hunsperger, MAI, SRA, is president of Hunsperger & Weston, Ltd., a Greenwood Village, Colorado, real estate appraisal firm specializing in valuation of conservation easements, valuation for eminent domain, and valuation of environmentally impaired properties. He holds both the MAI and SRA professional designations awarded by the Appraisal Institute. He is on the CLE International and ALI-ABA faculties and is a frequent lecturer on the topics of valuation for eminent domain and valuation of environmentally impacted real estate. In addition to being a member of the Appraisal Institute, Hunsperger is an advisor to the Colorado Brownfields Foundation and currently serves on the Colorado Board of Real Estate Appraisers. Contact: wayne@hwltd.net

Ron Throupe, PhD, MRICS, is a managing partner with American Valuation Partners (AVP) Issaquah, Washington, and was previously the Director of Operations with Mundy Associates and later Greenfield Advisors, in Seattle. He is an Associate professor at the Franklin L. Burns School of Real Estate and Construction Management in the Daniels College of Business at the University of Denver. He is a certified general appraiser who specializes in real estate valuation in litigation, including eminent domain and detrimental conditions. Throupe is the Director of Critical Issues for the American Real Estate Society (ARES) and on the faculty of CLE International and ALI-ABA. He holds a PhD and MBA from the University of Georgia in real estate and finance, along with a BS in civil engineering from the University of Connecticut.
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Figure 1: Soil Map
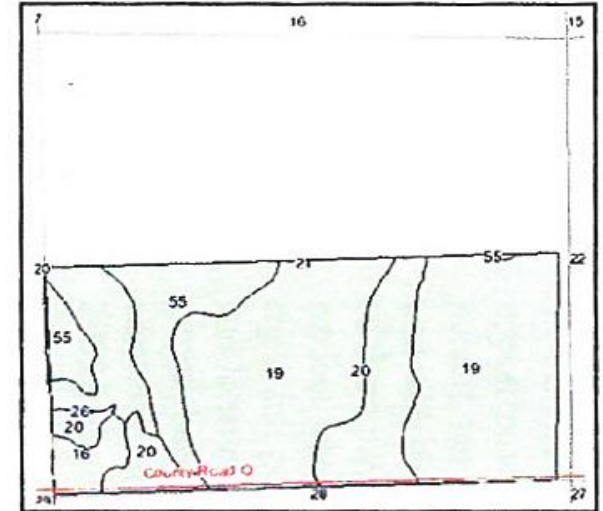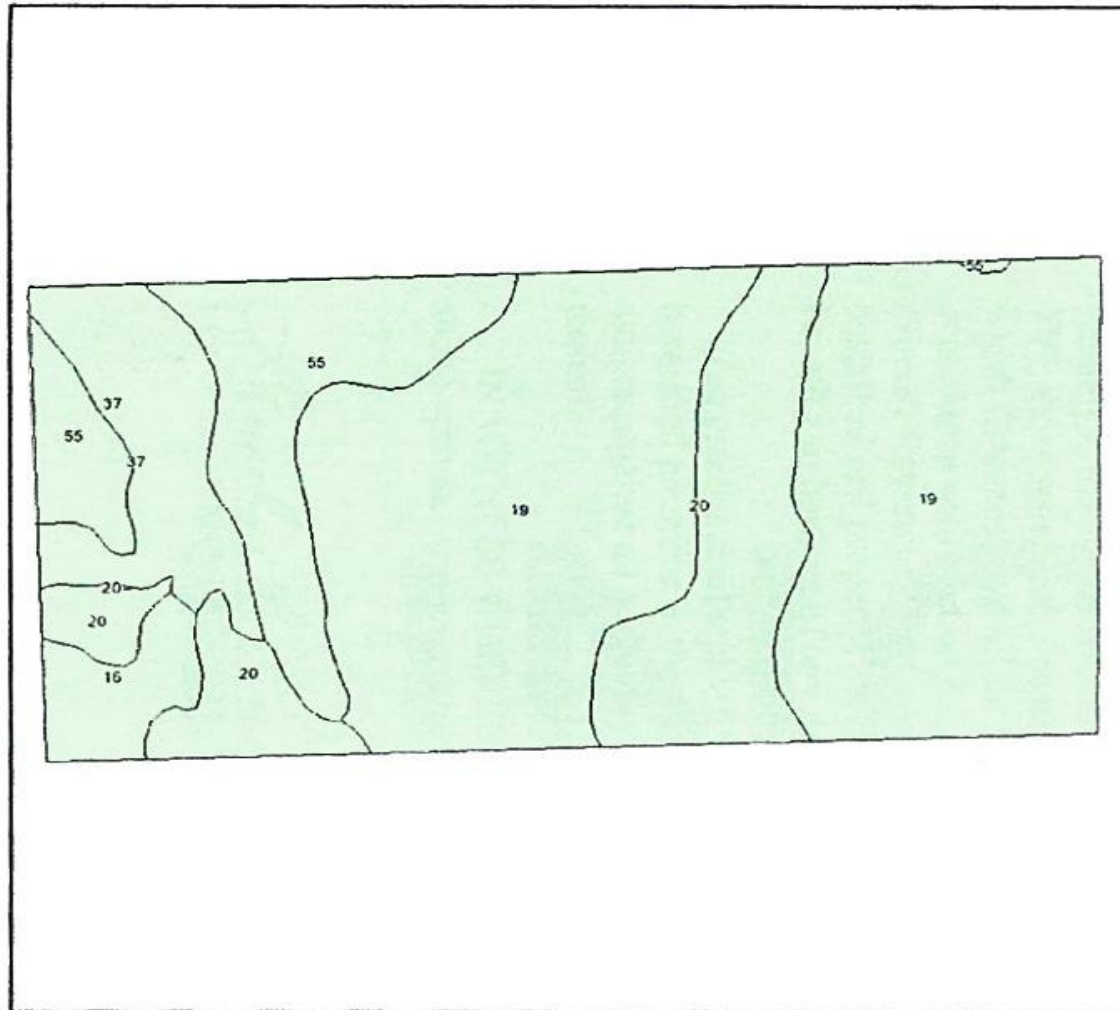
State: **Colorado**
County: **Cheyenne**
Location: **021-014S-042W**
Township: **Cheyenne Wells**
Acres: **338.8**
Date: **2/3/2011**

Fsa borders provided by the Farm Service Agency as of May 23, 2008.
Soils data provided by USDA and NRCS.

Maps provided by:
surety
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Table 1: Soil Segmentation by Code

| Code	Soil Description	Acres	Percent of Field	Non-Irr Class	Irr Class	Alfalfa hay Irrigated	Corn Irrigated	Dry pinto beans	Dry pinto beans Irrigated	Grain Sorghum	Grain sorghum Irrigated	Sugar beets Irrigated	Sun-flowers	Sunflowers Irrigated	Wheat
19	Keith-Richfield silt loams,0 to 2 percent slopes	187.3	55.3%	IIIe	IIe										18
55	Wiley complex, 3 to 5 percent slopes, eroded	54	15.9%	IVe	IIIe	4.5	115			17	60	17			15
20	Keith-Ulysses silt loams,1 to 4 percent slopes	52.7	15.6%	IIIe	IIe										
37	Sampson loam, 0 to 2 percent slopes	34.1	10.1%	IIIc	IIe	4	140	900	1800	30	90	24	1000	2500	25
16	Goshen silt loam, 0 to 1 percent slopes	10.7	3.1%	IIIc	I		120			35	105	24			
					Weighted Average	**1.1**	**36.1**	**90.9**	**181.8**	**6.8**	**21.9**	**5.9**	**101**	**252.5**	**4.9**

Source; USDA, NRCS

Table 2: Production Level Value per Acre Extracted From Sales Prices

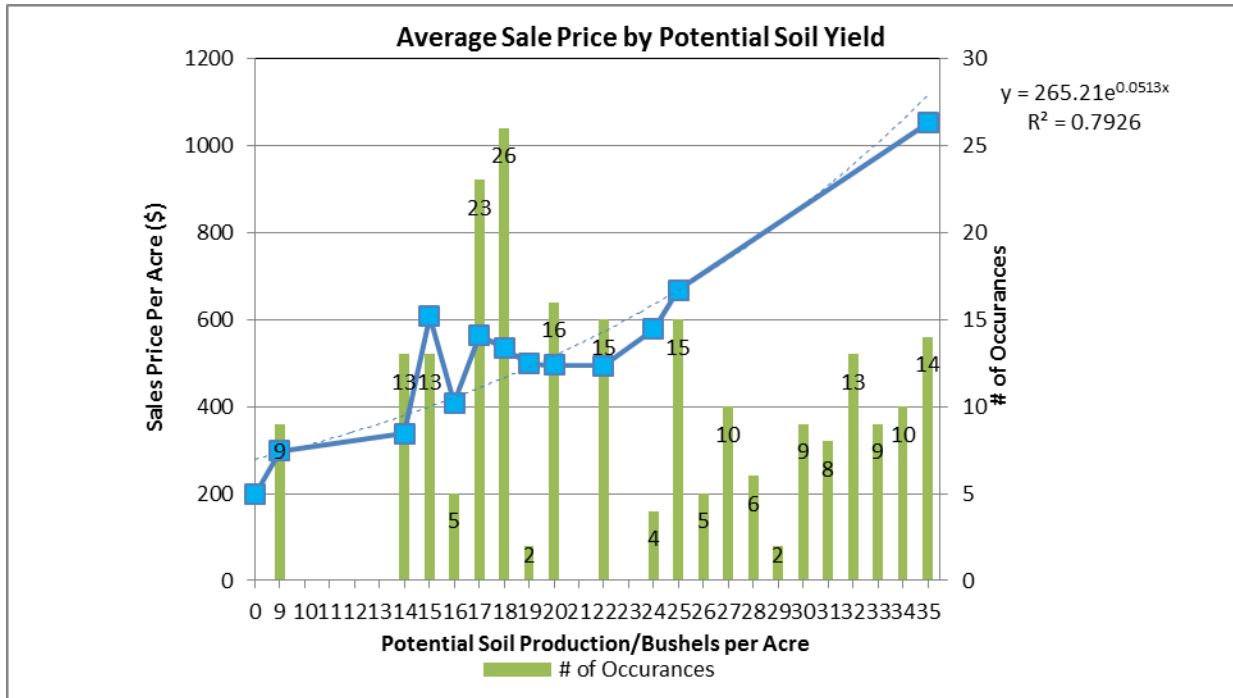| Type Land	Land Soil Ratio	Acres	Acre Yield/Bu	% of Farm Acres	Value /Acre	Calculated % of Acres	Total Value
Dry Cropland	100%	187.3	18	55%	$1,142	187.30	$213,911
	83%	54	15	16%	$952	45.00	$51,393
	94%	52.7	17	16%	$1,079	49.77	$56,844
	139%	34.1	25	10%	$1,586	47.36	$54,090
	194%	10.7	35	3%	$2,221	20.81	$23,762
	0%			0%	$0	0.00	$0
TOTAL		338.8		100%	$1,181	350.24	$400,000

Source: Natural Resources Conservation Service

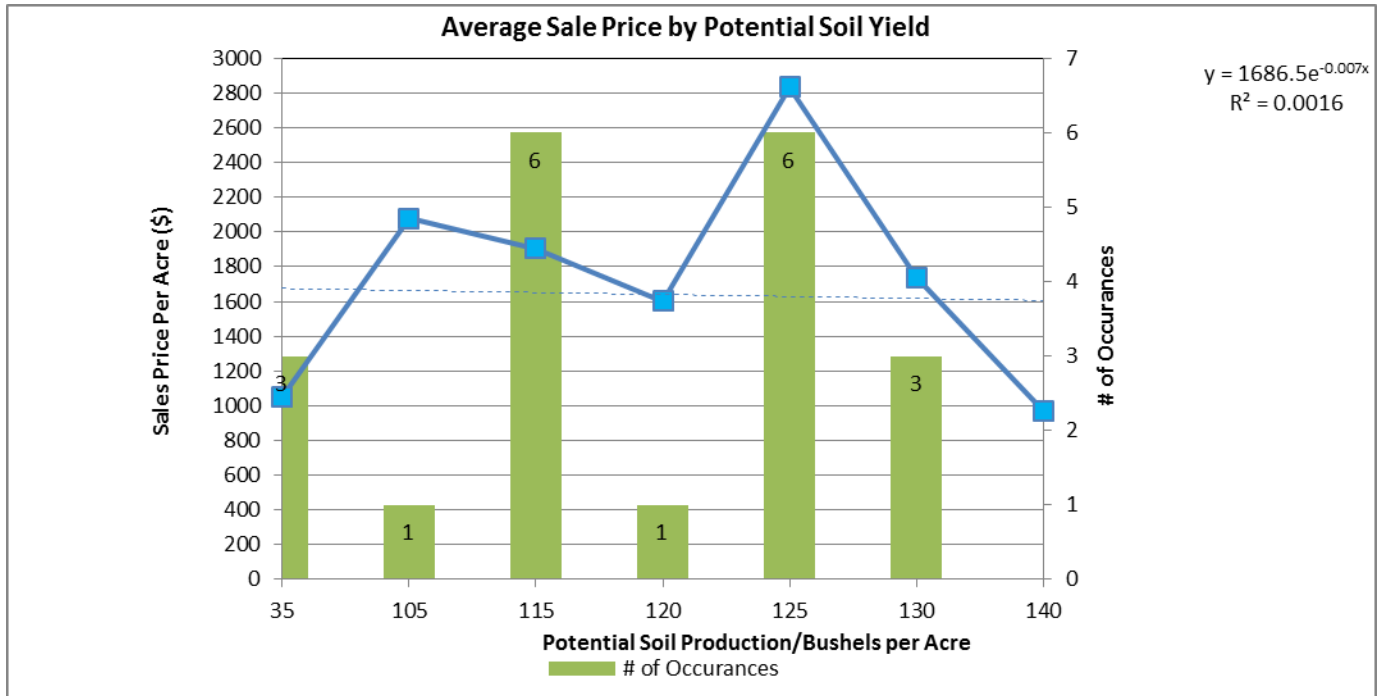**Figure 2: Production Yield Composite Model**
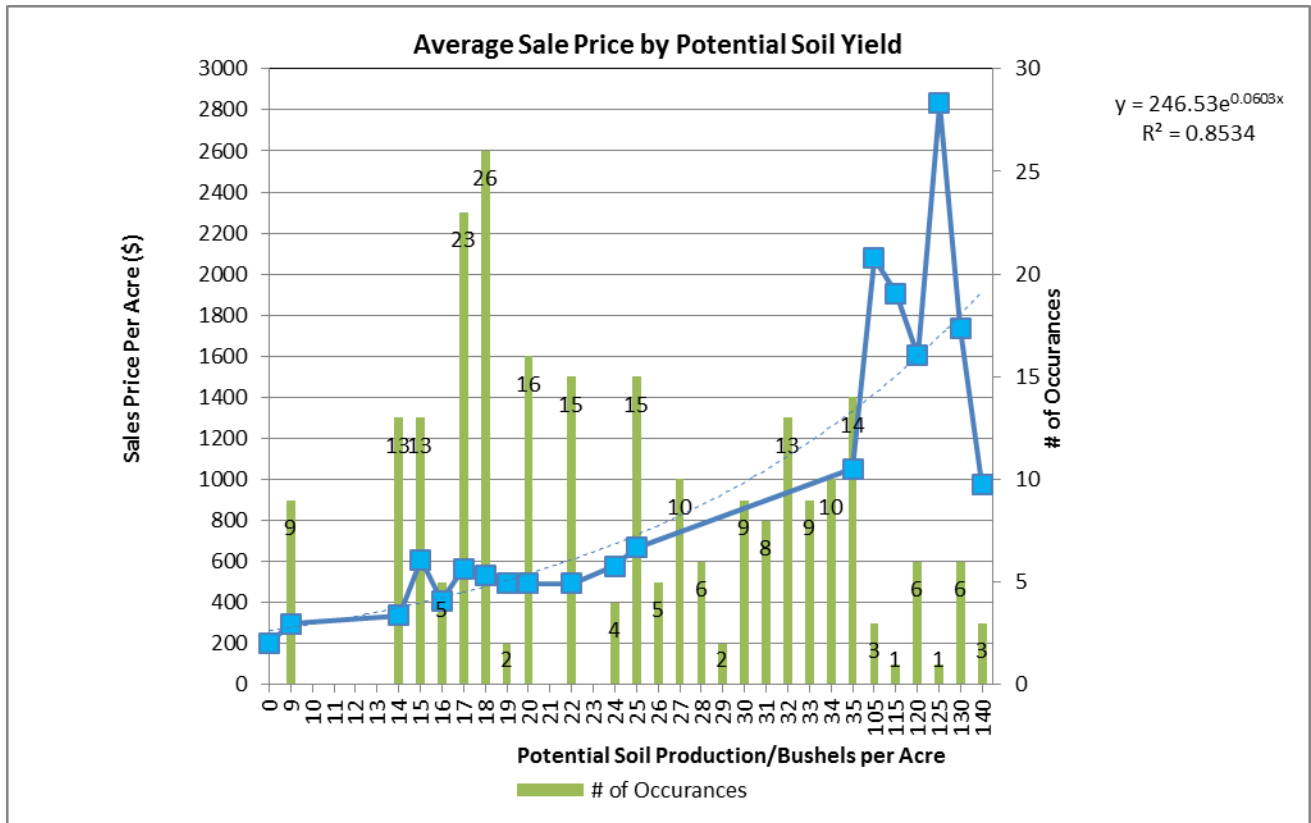
Source: authors

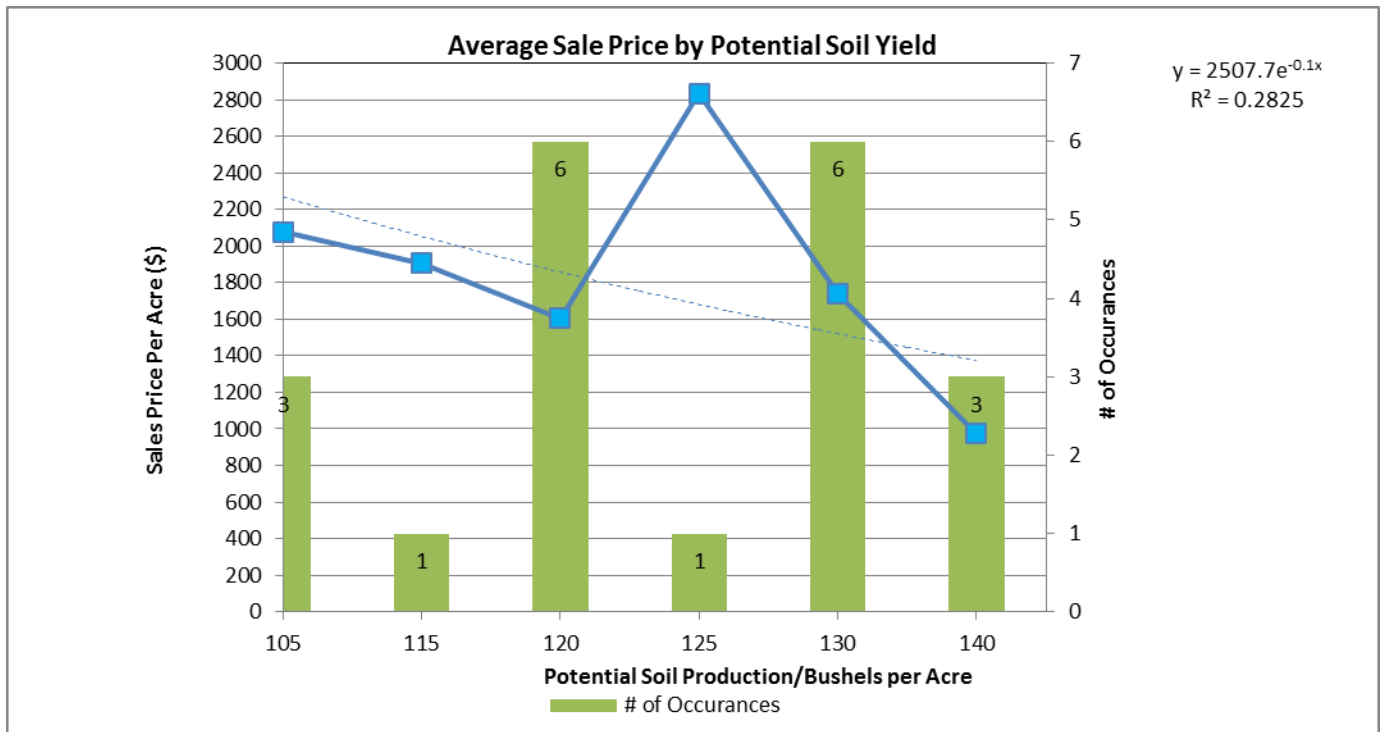**Figure 3: Non- Irrigated Production Yield Composite**

Average Sale Price by Potential Soil Yield

$y = 265.21e^{0.0513x}$
$R^2 = 0.7926$

Source: authors

Figure 4: Irrigated Production Yield Composite

Source: Authors

Source: Authors

Type Land	Land Soil Ratio	Acres	Acre Yield/Bu	% of Farm Acres	Value /Acre	Calculated % of Acres	Total Value
Dry Cropland	100%	187.3	18	55%	$1,142	187.30	$213,911
	83%	54	15	16%	$952	45.00	$51,393
	94%	52.7	17	16%	$1,079	49.77	$56,844
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	194%	10.7	35	3%	$2,221	20.81	$23,762
	0%			0%	$0	0.00	$0
TOTAL		338.8		100%	$1,181	350.24	$400,000

Sale Price of Farm $400,000

Type Land	Land Soil Ratio	Acres	Acre Yield/Bu	% of Farm Acres	Va.../A
Dry Croplan	100%	10.7	35	3%	$
	43%	54	15	16%	
	49%	52.7	17	16%	$
	71%	34.1	25	10%	$
	51%	187.3	18	55%	
	0%			0%	
TOTAL		338.8		100%	$

In filling out this table to calculate the farground values, the actual sale price of the farm is placed in the yellow square.
The actual acres of each soil yield capability is placed in the Green boxes, while the yield capabilities are placed in the Blue Boxes.
This table will then calculate the Value per acre of the farground (purple box), while checking the total value or sales price (red box). Only the yellow green and blue boxes should be filled in. All other calculations are automatic.