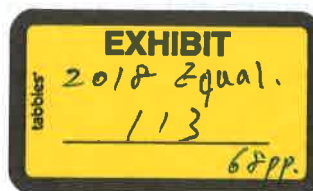


Update – Grassland LCG Classification Issue

LCG – Land Capability Groupings

Jerry Green PhD
17 April 2018



Background

- 2015 Presentation to Ruth Sorensen and PAD Staff
- 2016 Presentation at TERC Equalization Meeting
 - Land Capability Groups (LCG) Assignments
 - Grassland – arbitrary and meaningless
- 2016 & 2017 TERC Decisions
 - Grassland LCG assignments are flawed
- Morrill County Assessor
 - Acknowledgement of flawed LCG assignments
 - Understanding of why the LCG assignments are flawed

2

Ruth Sorensen and her staff were given a presentation on 30 June 2015 showing the grassland classification flaw and the impact it was causing on lower quality grassland.

A presentation was given at the TERC Equalization Proceedings on 15 April 2016 again showing the grassland classification flaw and the impact it was causing on lower quality grassland.

Legislative District 43 Senator Al Davis first saw a presentation on this topic on 22 Sept 2015. He requested three additional presentations over a span of two months that were given to a ever widening group of Nebraska Senators, government officials and farm organization representatives.

Legislative District 47 Senator Steve Erdman requested two additional presentations as he worked on legislation that would provided fairer / more equitable property tax assessments.

The flawed LCG assignments have been introduced in three TERC property tax hearings. In two of the hearings the flaw was acknowledged.

The county assessor is fully aware that the flaw exists and the source of the flaw. She first saw a presentation on this topic on 7 May 2015 along with field representatives Pat Albro, Sarah Scott and Chelsey Fessler.

Background (continued)

- Wide Spread Recognition that Grassland LCG Assignments are Flawed
- Little Recognition of the Serious Nature of the Flawed LCG Assignments

- Significant Clarity and Understanding in Last Two Years Relating to the Grassland LCG Flaw
 - Source of flaw – Rule in the Nebr. Admin. Code
 - Misunderstanding of grassland production (income) variability

3

There is wide spread recognition that the grassland LCG assignments are flawed, however, there is little recognition on the seriousness of this error.

This presentation expands on previous presentations by pointing out how this flaw came about – it's a rule written into the Nebr. Admin. Code.

The second point that additional clarity has been gained is the extreme variation in grass production occurs within many counties. There is a significant misconception that all grass parcels are the same, grass is grass. That is a misconception that will hopefully be dispelled by the end of this presentation.

Overview

■ Update on Flawed Grassland LCG Assignments

- Source of flaw & significance
 - New insight – County wide forage production variability
 - Prevailing misconception – grass is grass - there is no difference from one pasture to any other pasture
- Impact of flaw
 - New insight – Impact on mass appraisal process
 - Model building
 - Model calibration

■ Flaw Resolution

- Short term – improvement but still inadequate
- Long term – will create valuations that are uniform and *proportionate*

Comment

■ Mass Appraisal – Required Element

- 2014 International Association of Assessing Officers paper

Guidance on International Mass Appraisal and Related Tax Policy

- Relatively short 26 page paper on fundamentals
- Provides a good overview of what is contained in large text books
- Request submitting as an Exhibit
 - Download @ the following URL

https://www.iaao.org/media/Standards/International_Guidance.pdf

5

An effective market value-based property tax system requires a number of well defined components. This paper outlines these components in a brief format that is relatively easy to read.

Overall it is effective at pulling the different elements together in a relatively concise form, therefore it is appropriate to offer it as an exhibit.

Jerry Green Biography

■ Academic Career

- BS Agricultural Engineering, 1979, Univ. of Neb Lincoln
- MS Mechanical Engineering, 1986, Iowa State Univ.
- PhD Mechanical Engineering, 1992, Univ. of Wis Madison


■ Professional Career – John Deere Power Systems

- Engineer – 1979
 - Specialized in predictive model development and application
- Engine Design Analysis Technical Specialist – 1992
 - Specialized in high level analysis support
- Manager Design and Performance Technology – 2002
 - Managed a team with up to 39 worldwide staff to support JD Power Systems analytical needs

Jerry Green Bio (continued)

- Academic and Career Focus
 - Predictive model development
 - Data analysis
 - Statistics
 - Data interpretation
 - System integration
 - Accuracy a career necessity

Overview of Current Valuation Process and how the LCGs fit into this process



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MORRILL COUNTY
Real Estate Breakdown Report

Page 1
RPBRKDWNL
2/1/18 06:06 PM

Parcel ID Owner	Legal ALL S-T-R Acres: 566.140	Card File Status
County Area: 2 MARKET AREA 2	Class Code: 02-05-00-03-00-10	Value: Buildings
Neighborhood: 0 N/A	State GEO: 1653-35-0-00000-000-0000	Improvement
Location / Group: 4 RURAL	Cadastral: 1-41	Land / Lot
District: 156 41-B-3521	Book / Page: 78 / 698	Sub
School: 62-0021	Sale Date: 11/18/2016	Market
12345 20180001 227 322		Previous
		Current
		217,545
		217,545
		217,545

Soil	Use	LCG/LVG	Soil Description	LVG Description	Spot Code	Acres	Value/Acre	Assessed	Sub	Market/Acre	Market	Sub
5144	GRAS	4G	BUSHER-TASSEL LOAMY VERY	4G	N	16.730	385	6,440	0			
5851	GRAS	4G	MITCHELL-EPPING VERY FINE	4G	N	10.200	385	3,925	0			
5910	GRAS	3G	ANGORA VERY FINE SANDY LO	3G	N	23.100	385	8,895	0			
6025	GRAS	4G	TASSEL LOAMY VERY FINE SA	4G	N	324.390	385	124,890	0			
6033	GRAS	4G	TASSEL-BUSHER LOAMY VERY	4G	N	190.630	385	73,395	0			
						565.050		217,545				
ROAD	ROAD	ROAD	ROAD	ROAD	N	1.090		0	0			
Land Total						566.140		217,545				

9

This slide is one example of a parcel Real Property Breakdown (RPB) form. This form is the heart of how valuations are determined for a given property. This form is available to the land owner and to any interested party.

For Ag Land the focus is the table highlighted with the bold boarder in the center. This is the soils table.

Real Property Breakdown Soil/Valuation Table

Soil	Use	LCG	VG	Soil Description	Spot Code	Acres	Value/Acre	Assessed
5144	GRAS	4G		BUSHER-TASSEL LOAMY VERY	N	16.730	385	6,440
5851	GRAS	4G		MITCHELL-EPPING VERY FINE	N	10.200	385	3,925
5910	GRAS	3G		ANGORA VERY FINE SANDY LO	N	23.100	385	8,895
6025	GRAS	4G		TASSEL LOAMY VERY FINE SA	N	324.390	385	124,890
6033	GRAS	4G		TASSEL-BUSHER LOAMY VERY	N	190.630	385	73,395
						565.050		217,545
ROAD	ROAD	ROAD	ROAD		N	1.090	0	0
Land Total						566.140		217,545

10

This is the soil table from the previous slide but blown up to better see the different elements.

There are five soils (rows) in this example. The first column, labeled Soil is a numeric designation and that designation was set by the Natural Resources Conservation Services (NRCS). The second column is labeled Use and in this example all of the soils/entries are grass.

The third column is labeled LCG which stands for Land Capability Grouping. This is the grassland classification that has been applied to this particular soil. This classification is determined by the Property Assessment Division and is suppose to be based on NRCS data. It is these classifications that are flawed.

The column labeled Value/Acre is determined by the County Assessor and is set by the LCG classification. The step where the County Assessor sets the LCG values is called the calibration step of the Mass Appraisal Model.

Multiply the value/acre times the number of acres of this particular soil then results in the total value for this particular soil.

Summing all of the soil values then results in a total valuation for the parcel. This total value times the mill levy determines the tax that will be assessed to this parcel.

Land Capability Groups (LCG) LCG Definition

- Neb Admin Code Title 350, Chapter 14, REG-14-002 Definitions 002.41

"Land Capability Groups (LCG) are groups of soils that are similar in their suitability for most kinds of farming. It is a classification based on the capability classification, *production* and limitations of the soils; risk of damage when they are used for ordinary field crops, *grassland* and woodlands..."

11

This is the definition for LCG and is in the Nebr. Admin. Code.

It is noteworthy that production and grassland are mentioned in this definition so are pertinent to this discussion on grassland.

LCG Grassland Classifications

Neb Admin Code Title 350 Chapter 14, 4.08H(9) -4.08H(16)

- 1G1 – Grassland and meadows generally capable of producing very high yields of forage.
- 1G – Grassland and meadows generally capable of producing high yields of forage.
- 2G1 – Grassland and meadows generally capable of producing moderately high yields of forage.
- 2G – Grassland and meadows generally capable of producing above average yields of forage.
- 3G1 – Grassland and meadows generally capable of producing average yields of forage.
- 3G – Grassland and meadows generally capable of producing moderately low yields of forage.
- 4G1 – Grassland and meadows generally capable of producing low yields of forage.
- 4G – Grassland and meadows generally capable of producing very low yields of forage.

12

This slide shows the eight LCG class definitions. These definitions are all the same except for the underlined adjective. These are suppose to indicate varying levels of forage production ranging from very high to very low with 1G1 at the top being the best and 4G at the bottom being the worst.

The 1G1 through 4G designations are suppose to indicate varying levels of forage production but as we will soon learn they do not. They actually refer to something unrelated.

Dept. of Revenue Data

- LCG – Land Capability Groupings
 - Groups of soils similar in productivity
 - Set by Dept. of Revenue, Prop Assessment Division(PAD)
 - Based on NRCS data

CONVERSION FROM OLD SOIL SYMBOLS TO NEW NUMERIC SYMBOLS								
COUNTY	OLD SYMBOL	OLD NAME	NEW SYMBOL	NEW NAME	NEW ACR COUNTS	CAPABILITY GROUPINGS		
						DRY	IRR	GRS
MORRILL	Bc	Bankard fine sand, channeled	1001	Bankard fine sand, channeled, frequently flooded	13,871.	4D	4A	4G
MORRILL	Ba	Bankard loamy coarse sand, 0 to 2 percent slopes	1002	Bankard loamy coarse sand, frequently flooded	1,377.	4D1	4A1	4G1
MORRILL		This map unit was added from an adjacent county for purposes.			1,549.	4D	4A	4G
MORRILL		This map unit was added from an adjacent county for purposes.			43.	2D	2A	2G
MORRILL	Gs	Glenberg very fine sandy loam, 0 to 2 percent slopes			1,463.	2D	2A	2G
MORRILL	Gr	Glenberg loamy fine sand, 0 to 2 percent slopes			1,544.	3D	3A	3G
MORRILL	Bb	Bankard loamy fine sand, 0 to 2 percent slopes			3,967.	3D	3A	3G
...

Prescribed LCGs

DRY (D) – Dryland farming

IRR (A) – Irrigation

GRS (G) – Grassland

Grassland

1G1 through 4G

This slide is the first seven soils of the Property Assessment Division soil table for Morrill County in which they have assigned LCG designations for individual soils. Columns two and three can be ignored as that is outdated information.

Column three is labeled as New Symbol and is the soil number on the Real Property Breakdown (RPB) form (labeled as Soil) shown earlier. It is from this database that determines the LCG for each soil.

In Morrill County there are approximately 140 productive soils and each one of these have been assigned a LCG designation.

As the last three columns indicate these are the LCG designations for the three land classes of dryland farming, irrigation farming and grassland. It is worth noting that as you look across the row for each soil and compare the LCG between dry, irrigation and grassland that the only thing that changes is the letter designations, the numbers don't change. For example 4D becomes 4A for irrigation or 4G for grass. This is at the root of the LCG flaw.

Source of Grassland LCG Flaw

Land Capability Groups (LCG) Neb Admin Code 14-002.41

"Land Capability Groups are determined by the Department of Revenue Property Assessment Division based upon the dryland capability classification."

- Grassland classifications are based on merits of dryland farming and not merits of forage production

15

This rule, Neb Admin Code 14-002.41 stating that the LCGs are based on the dryland capability classification is the source of the flaw.

This is a rule that should have never been adopted as grassland classifications based on a dryland criteria are not valid.

Major Mistake of Property Assessment Division

- Using the dryland capability to set grassland classifications was a ***very bad assumption***
- Nebraska's largest geographical feature demonstrates why

"The Sandhills"

- Soils mostly classified as 4G and 4G1
 - These classifications come from 4D and 4D1 because the Sandhills are a terrible place to farm
- But – the Sandhills are a great place to grow grass
 - The Sandhills should be classified mostly as 2G – 1G

16

This turns the grassland classification system upside down from what it should be.

Assumption Result

- Very large number of acres with high to very high forage production capability incorrectly classified as low to very low forage production capability
 - Effect is to mask the true low end as to having the same capacity
 - Insufficient sales data to suggest otherwise

NRCS Data (Natural Resources Conservation Service)

- NRCS Soil Survey
 - Soil Maps
 - Countywide surveys
 - Individual parcels through AOI (Area of Interest)
 - Vegetative Productivity
 - Range Production Rating (normal year)
 - Output pounds per acre per year
 - Linear conversion to AUM (Animal Unit Month)
 - » 750 lbs/month per 1000 lb cow
 - » 25% grazing efficiency

18

In the course of my investigation I have turned to the NRCS soil surveys to study the validity of the Dept. of Revenue's LCG assignments.

One part of the soil survey is very pertinent to this discussion, the section on Vegetative Productivity and specifically Range Production Ratings.

These ratings provide a good estimate of how much forage can be produced for each and every soil.

The output is in lbs/acre. That is the amount of forage that can be produced in a year. Quite often cattlemen talk in terms of Animal Unit Month (AUM), which is how many cattle can be carried a particular piece of land. The factors listed at the bottom are the conversion factors required to go from lbs/acre to AUMs.

NRCS Rangeland Productivity Rating Morrill County Soils

Map unit symbol	Map unit name	Rating (pounds per acre per year)	Acres in AOI	Percent of AOI
1001	Bankard fine sand, channeled, frequently flooded	693	13,871.30	1.50%
1002	Bankard loamy coarse sand, occasionally flooded	2100	1,417.60	0.20%
1006	Bankard loamy fine sand, channeled, frequently flooded	700	1,549.30	0.20%
1030	Glenberg fine sandy loam, 0 to 2 percent slopes	2079	43.8	0.00%
1034	Glenberg very fine sandy loam, 0 to 2 percent slopes	2079	5,463.40	0.60%
1035	Glenberg loamy fine sand, 0 to 2 percent slopes	2100	1,544.40	0.20%
1114	Bankard loamy fine sand, occasionally flooded	2079	3,967.30	0.40%
1300	Bayard fine sandy loam, 1 to 3 percent slopes	1584	201.1	0.00%
1309	Bayard very fine sandy loam, 6 to 9 percent slopes	1600	19.3	0.00%
1316	Bayard-Dix complex, 9 to 20 percent slopes	1200	86.7	0.00%
1361	Bridget very fine sandy loam, 0 to 1 percent slopes	1700	2,290.10	0.30%
1362	Bridget very fine sandy loam, 1 to 3 percent slopes	1700	3,282.40	0.40%
1363	Bridget very fine sandy loam, 3 to 6 percent slopes	1700	3,378.90	0.40%
1364	Bridget very fine sandy loam, 6 to 9 percent slopes	1700	3,635.10	0.40%
1365	Bridget very fine sandy loam, 9 to 20 percent slopes	1700	3,469.30	0.40%
1406	Craft very fine sandy loam, rarely flooded	2400	1,287.10	0.10%
1506	Altvan-Dix complex, 3 to 9 percent slopes	1835	1,807.60	0.20%
1545	Dailey loamy fine sand, 0 to 3 percent slopes	1584	4,115.90	0.40%
1546	Dailey loamy fine sand, 3 to 9 percent slopes	1600	2,396.70	0.30%
1571	Dix gra	600	265.9	0.00%

Rangeland Ratings –
Normal Year

19

Morrill County has approximately 140 productive soils. This slide shows the first 20 entries to the full table. The first column is the soil designation and is unique to each soil. This designation is set by the NRCS and then used on the Real Property Breakdown forms for each parcel.

Column 2 is a brief description of the soil and column 3 is the data of particular interest for this discussion, the forage production.

Note that columns 4 & 5 are also useful information and will be used later to show the productivity distribution in the county. The AOI listed in the titles of columns 4 & 5 stands for Area of Interest. In this case the AOI is the entire county so these show the total number of acres and percent of this particular soil in the county.

LCG Review

LCG vs NRCS Rangeland Productivity Rating

CONVERSION FROM OLD SOIL SYMBOLS TO NEW NUMERIC SYMBOLS									
COUNTY	OLD SYMBOL	OLD NAME	NEW SYMBOL	NEW NAME	NEW ACRE COUNTS	CAPABILITY DRY	IRR	GROUPINGS GRS	NRCS Rangeland Prod. (lbs/acre) (normal year)
MORRILL	Bc	Bankard fine sand, channeled	1001	Bankard fine sand, channeled, frequently flooded	13,871.2	4D	4A	4G	693
MORRILL	Ba	Bankard loamy coarse sand, 0 to 2 percent slopes	1002	Bankard loamy coarse sand, occasionally flooded	1,417.6	4D1	4A1	4G1	2100
MORRILL		This map unit was added to the soil survey from an adjacent county for joining purposes.	1005	Bankard loamy fine sand, channeled, frequently flooded	1,549.2	4D	4A	4G	700
MORRILL		This map unit was added to the soil survey from an adjacent county for joining purposes.	1030	Glenberg fine sandy loam, 0 to 2 percent slopes	43.8	2D	2A	2G	2079
MORRILL	Gs	Glenberg very fine sandy loam, 0 to 2 percent slopes	1034	Glenberg very fine sandy loam, 0 to 2 percent slopes	5,463.4	2D	2A	2G	2079
MORRILL	Gr	Glenberg loamy fine sand, 0 to 2 percent slopes	1035	Glenberg loamy fine sand, 0 to 2 percent slopes	1,544.4	3D	3A	3G	2100
MORRILL	Bb	Bankard loamy fine sand, 0 to 2 percent slopes	1114	Bankard loamy fine sand, occasionally flooded	3,867.3	3D	3A	3G	2079
...

- Contrast NRCS Productivity Rating vs PAD LCG
 - Looking for correlation

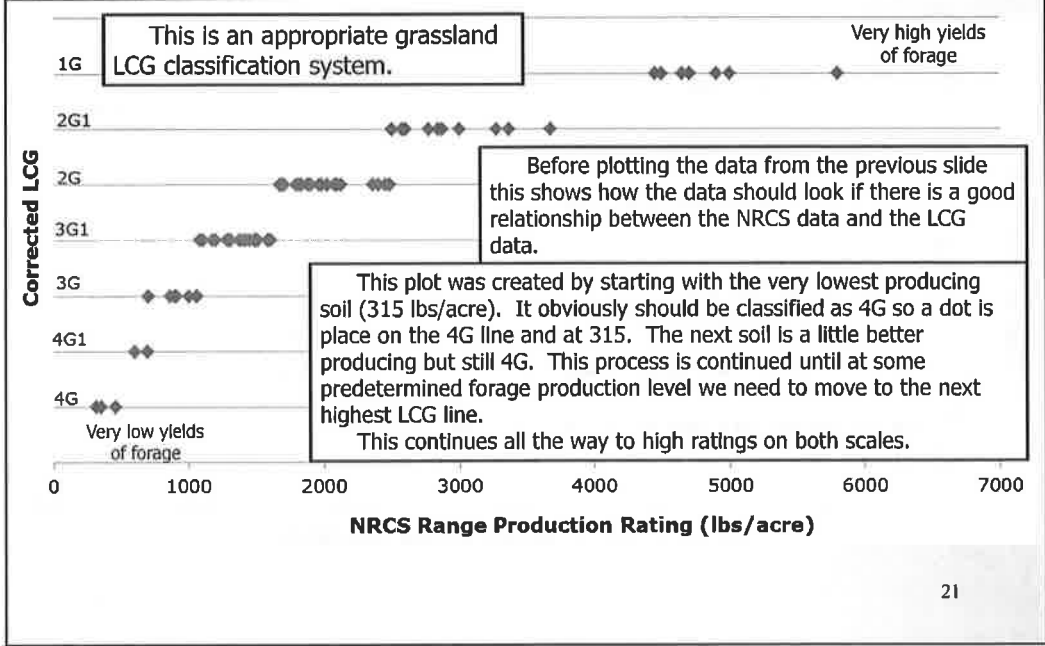
Since the LCG table and the NRCS soil table both have the same soils and both have their own productivity designation they can be combined into one table.

In the example shown here we started with the LCG table and added an additional column to include the NRCS productivity rating. The result is two columns of data that are suppose to represent the same thing, i.e. forage production.

These two designations relate to forage production but in different ways. How well they relate to each other can be checked by plotting one vs the other. Each soil will be represented as a single dot on a graph. The NRCS data will be the x-coordinate and the LCG data will be the y-coordinate.

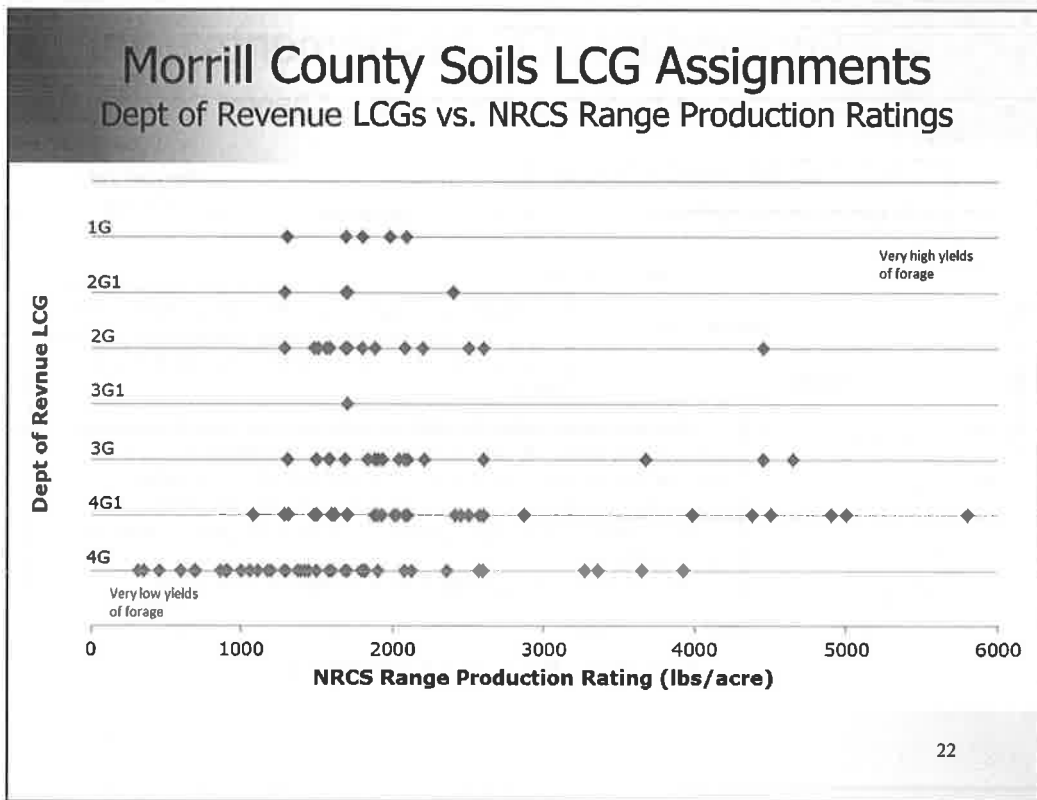
Appropriate LCG Assignments

(As Prescribed by Neb. Admin Code – Chapter 14)



This plot is an idealized version of the data on the previous page, not the actual data. This is what this data is suppose to look like and is presented here to help the reader get calibrated as to how this data should look.

This shows a nice orderly progression from the lower left corner of very low yields to the upper right corner of high yields. At every step there is a good relationship to the NRCS Range ratings on the bottom scale to the LCG ratings on the left hand scale.



This is now the actual data. Starting with the poorest soil at 315 lbs/acre it is correctly designated as 4G. The next few soils are also correct. However, continuing to the right we start seeing a popcorn popper effect, random placement of soils on different LCG levels no matter the NRCS rating.

The popcorn popper starts running out of steam above 3000 lbs/acre and the dot placements fall well below where they should be. The very best producing soil at 5800 lbs/acre has been given only a 4G1 LCG classification when it should be 1G

The random / scattered dot placement is directly related to the fact that the 1G through 4G scale has nothing to do with forage production but instead it is related to dryland crop yield. There is no correlation between forage production and crop yield!

Impact of Grassland LCG Flaw

2017 LCG Assigned \$/acre Values Morrill County Market Area #2 - Grassland

LCG	Value (\$/acre)	Crop
		Forage Yield
1G	\$385	High
2G1	\$385	Moderately High
2G	\$385	Above Average
3G1	\$385	Average
3G	\$385	Moderately Low
4G1	\$385	Low
4G	\$385	Very Low

How can it be that the same value is being applied across the entire range of forage production, very low to high?

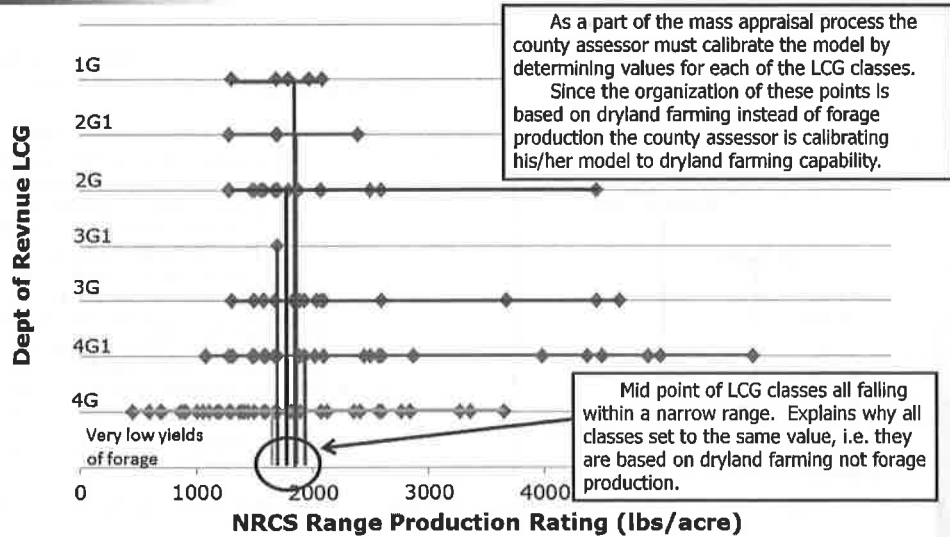
Answer – these values were calibrated based on a dryland farming criteria and not grassland. The following two slides demonstrate.

24

As was noted previously 1G through 4G was suppose to represent increasing yields of forage, but they do not. They represent increasing crop yields hence we have crossed out Forage in the column 3 header and replaced it with "Crop".

Morrill County Soils LCG Assignments

Mass Appraisal Calibration Process



Erin H. Hovland

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Returning to the previous popcorn popper generated plot provides an opportunity to understand the county assessor's valuation process.

A horizontal line is placed through each of the G level dots. From those dots a visual inspection was done to determine an approximate average. Then a vertical line was drawn from that average point down to the x axis to get an estimate of the average forage production for the particular G level.

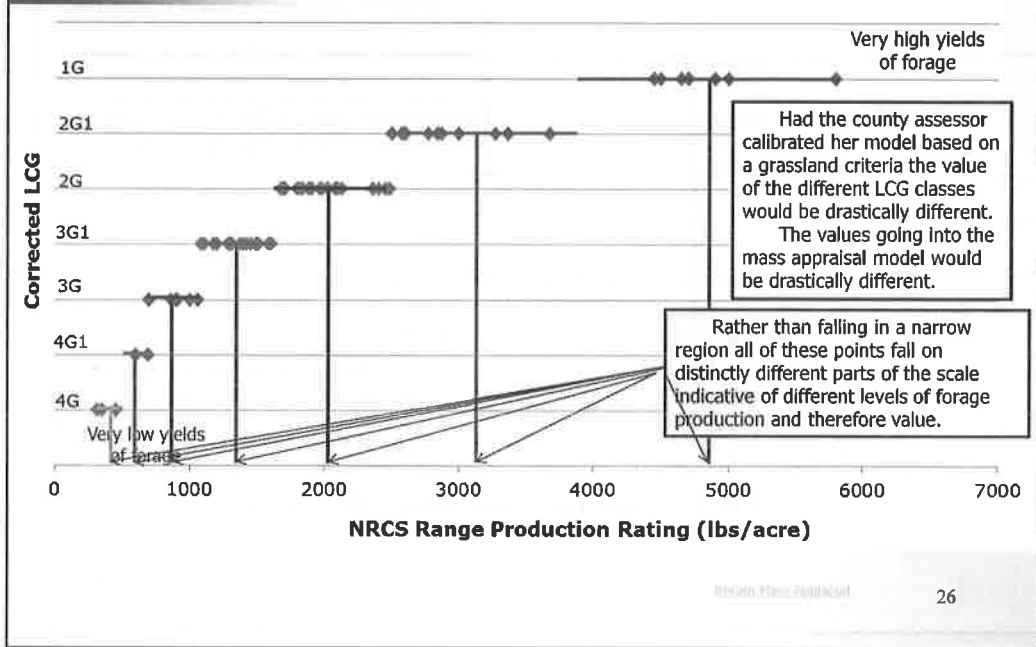
These vertical lines, i.e. production levels all fall on a narrow range on the x axis. It is no wonder that the county assessor came up with the same value for all of the same LCG classes.

This severe overlapping of the LCG bands is a direct result of using a dryland criteria to classify grassland, it doesn't apply.

These dryland derived LCG values feed into the mass appraisal model used by the county assessor to set land values.

Appropriate LCG Assignments

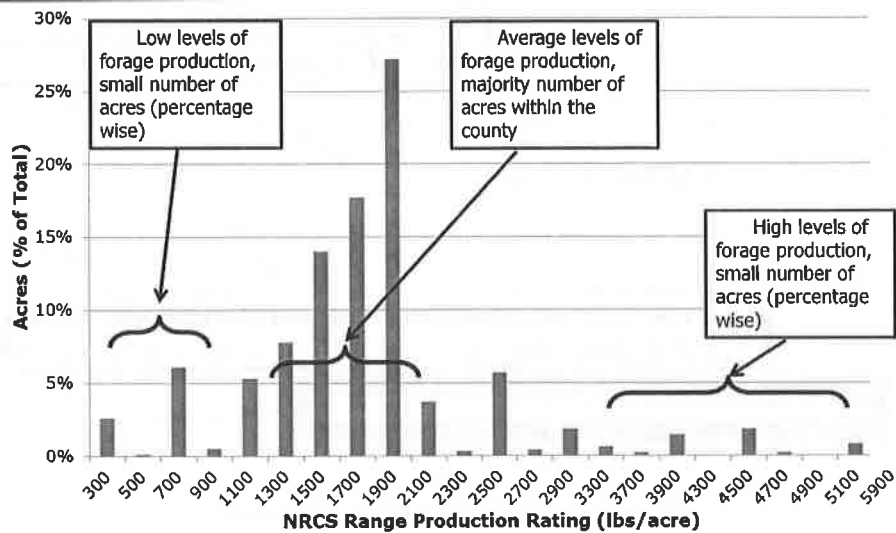
(As Prescribed by Neb. Admin Code – Chapter 14)



The same process is applied to what would be the correct LCG assignments, a horizontal line represents the production range for each G level and then a vertical line down to the x axis to get an average production level for that range.

As noted above it is very obvious that if the county assessor had used the correct grassland classes that the value for each class would be significantly different and different values would feed into the mass appraisal model.

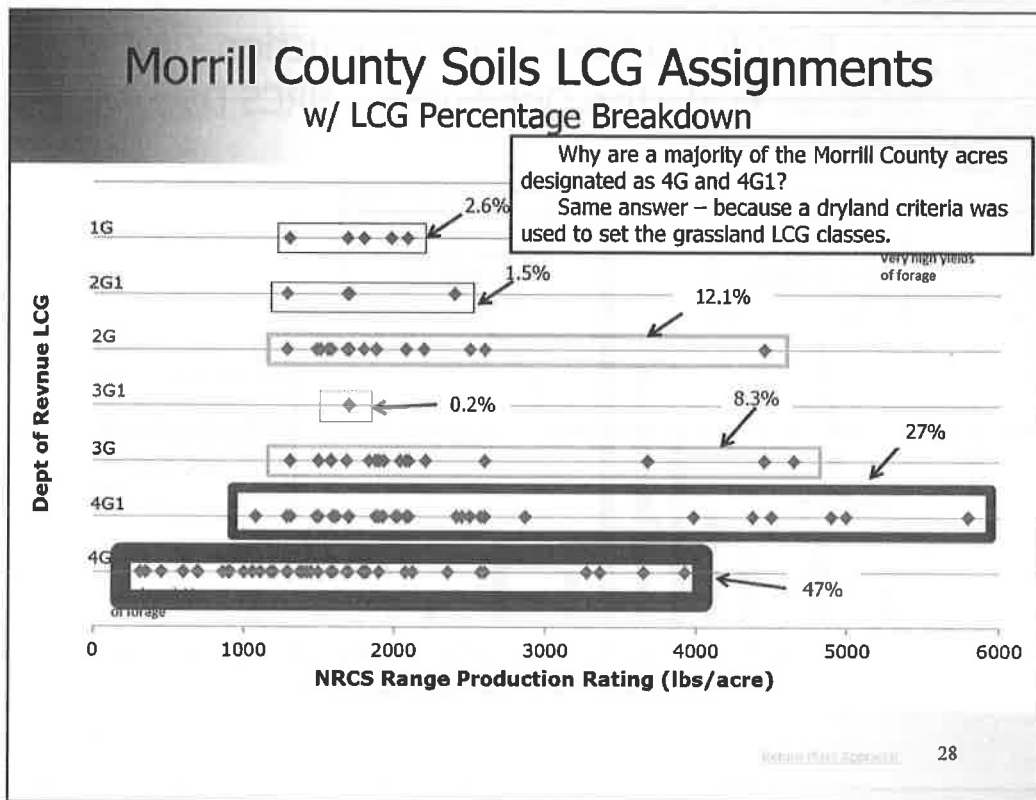
Morrill County Range Production Forage Production Distribution – NRCS Data



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This bar chart was generated from the NRCS soil table shown earlier and shows the productivity distribution within Morrill County. It is very useful in gaining an appreciation on how the LCG classes should look. The green bars are a representation of the number of acres in a given productivity range and when summed should total 100%.

Sales, statistically will follow this distribution. The center section shows where most of the county acres lie with respect to production so most of the sales will come from this region.



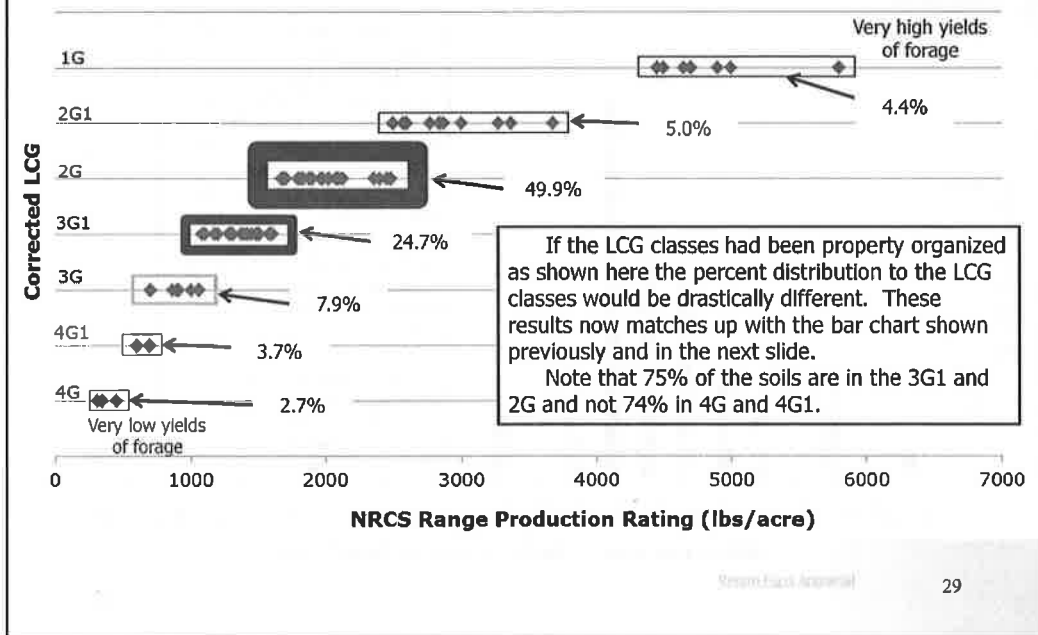
Returning to the popcorn popper generated LCG plot we now pull in another piece of information, how many acres are in each of these LCG classes. The plot originally had no acre information as each dot represents a single soil designation.

Rectangles are added around each LCG class with varying line widths. The line widths are proportionate to the number of acres in each class to provide a visual representation. A note is added to the right side with the actual % of acres in each class.

These results show this data is nonsensical. It shows 74% of the soils are 4G and 4G1 and cover the full production range. If you look back one slide and compare to the bar chart showing production distribution that comparison again shows no correlation.

Appropriate LCG Assignments

With Resulting LCG Percentage Breakdown



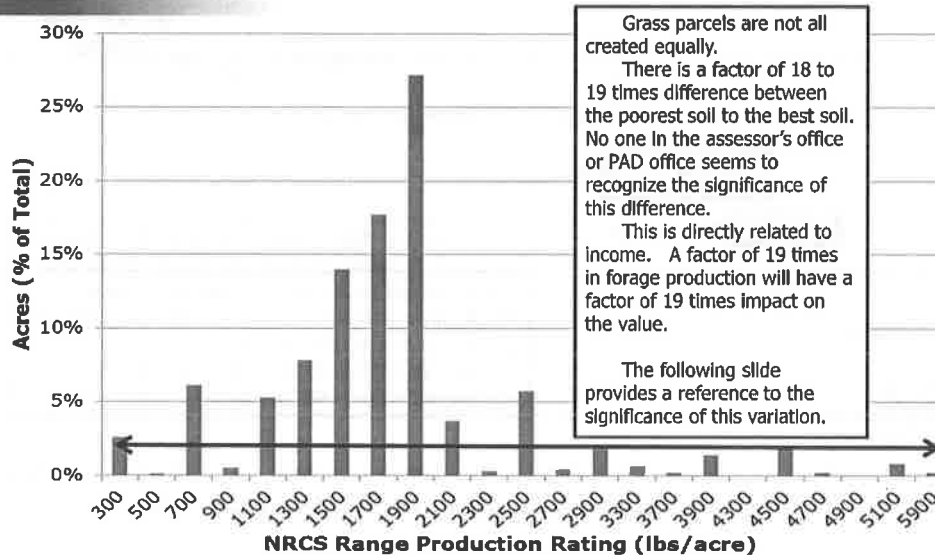
This plot returns to the corrected LCG assignments with the uniform stair-step effect going from the lower left to the upper right.

If the LCG classes had been property organized as shown here the percent distribution to the LCG classes would be drastically different. These results now match up with the bar chart shown previously and in the next slide.

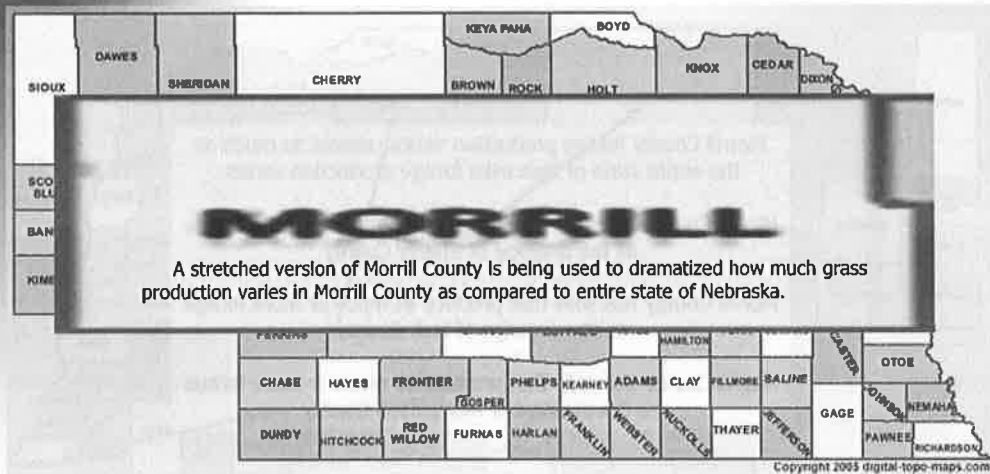
Note that 75% of the soils are in the 3G1 and 2G and not 74% in 4G and 4G1.

These results would have a dramatic difference on the mass appraisal model as applied by the county assessor as compare to the popcorn popper generated LCG plot shown on the previous slide.

Morrill County Range Production Variation in Forage Production



Forage Production Variation Morrill County as Compared to All of Nebraska



Nebraska map reproduced with permission – Digital-Top-Maps.com

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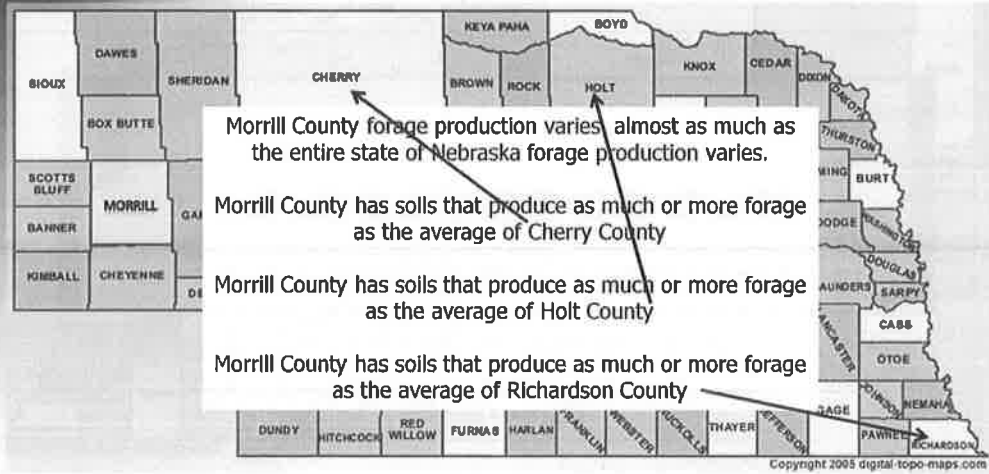
Morrill County has a huge variation in forage production, a variation that is nearly as great as the state of Nebraska forage production variation.

Morrill County on the west side of the state has soils that produce little grass and are borderline waste. On the other extreme Morrill County has sub-irrigated meadows that produce abundant amounts of grass that rivals many of the soils in the eastern part of the state.

Everyone assumes that there is little variation in grass production in a county like Morrill but that is not the case. With a factor of 19 times between the worst soil to best soil there is huge variation.

Forage Production Variation

Morrill County as Compared to All of Nebraska



Nebraska map reproduced with permission - Digial-Top-Maps.com

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The sub-irrigated meadows of Morrill County produce as much grass as the average grass production of any county in the state.

Morrill County Forage Variability

If Morrill County has soils that are more productive than the average of highly productive counties why are all soils in Morrill County Market Area #2 set to the same \$385/acre value?

Because most of these highly productive soils in Morrill County have been misclassified in the 4G and 4G1 LCG classes.

This is a direct result of applying an inappropriate dryland criteria to grassland.

Low End Productivity Scale

The previous slide demonstrates how Morrill County soils with high productivity compare with the rest of the state.

However; we run out of room to stretch on the west side of the state when comparing low productivity soils to county averages.

The poorest producing Morrill County soil is approx. ***5 times lower*** than the county average! This soil is still set to the same \$385/acre value!

34

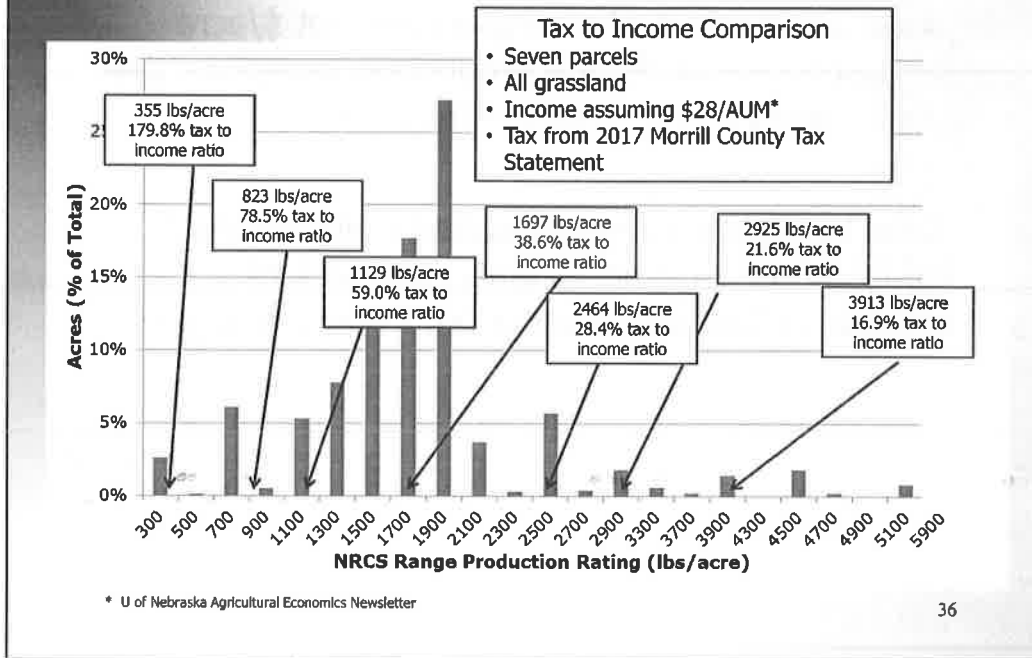
If we were to repeat the stretched version of Morrill County, shown a couple of slides earlier where we were comparing the best soil to the average of other counties, we would need to stretch well beyond the west border of Nebraska. To compare the worst Morrill County soil to a comparable county average we would have to extend well into Wyoming or possibly the desert of Arizona.

Impact of Flawed LCGs Valuations & Taxes

What is the effect of having a constant \$/acre valuation rate on forage production variations that are as great as the width of Nebraska?

A tax to income ratio calculation helps to shed light on this extreme variation and lack of understanding of this variation, i.e. grass is grass.

Morrill County Tax to Income Comparison Grassland



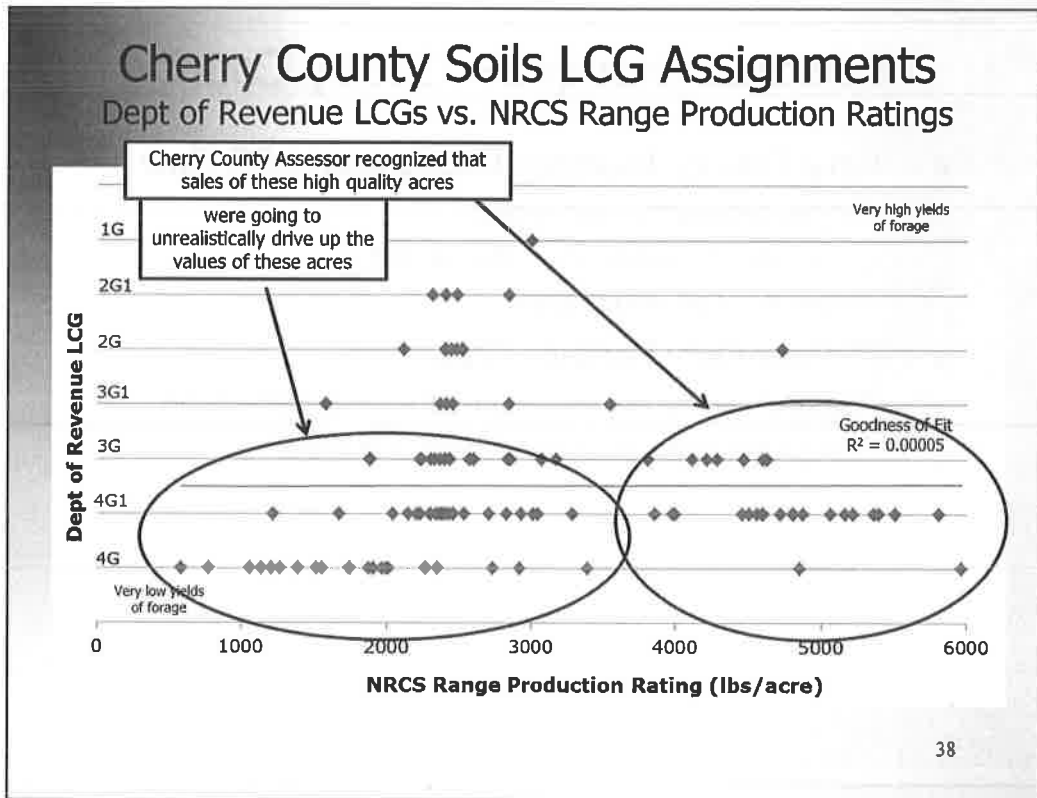
This is the outcome of having a constant valuation for all grassland soils no matter the production level. These are actual legally defined parcels in Morrill County. At the low end the owner of that parcel requires almost two years of gross income to pay one year of property tax. At the high end of the production level that owner is paying only 17% of the income potential to pay the property tax.

When you consider the production variation to be nearly as great as the production variation of Nebraska but yet no adjustment for that production the outcome is absurd.

It is well known that land prices increase significantly going from west to east in Nebraska so production does matter. To suggest otherwise is absurd. But yet Morrill County makes no adjustment for similar productivity changes. This is a direct result of being tied to LCGs that were defined for dryland farming.

Additional Example – Cherry County

- Cherry County Assessor Recognized LCG Flaw
 - Highly productive meadows
 - Incorrectly classified as 4G and 4G1
 - Implemented corrections
- LCG Flaw Only Partially Corrected
 - Created severe overvaluation of average grassland
 - Continued overvaluation of poor grassland

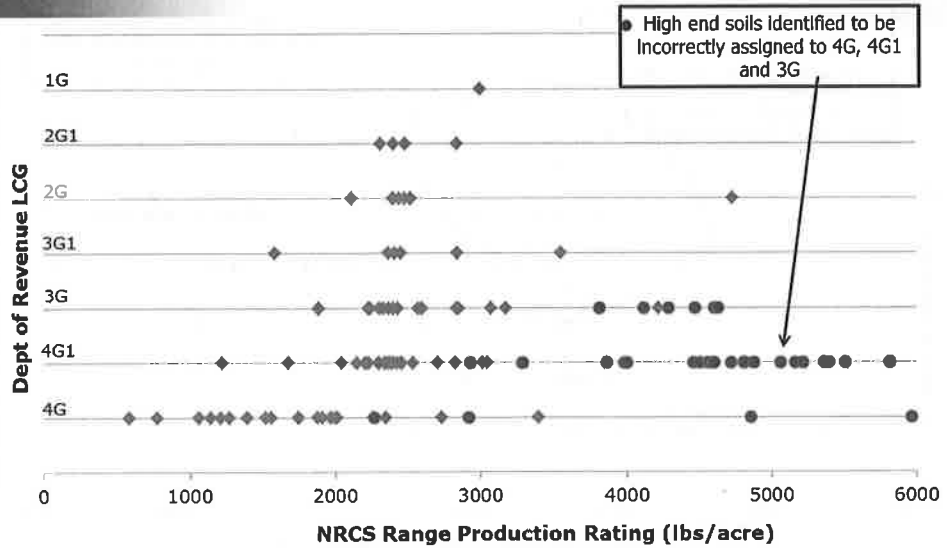


This slide demonstrates that the flawed LCG assignments are not unique to Morrill County. The popcorn popper is very much in effect in Cherry County.

However, in Cherry County the county assessor immediately recognized that the highly productive meadowlands were inappropriately designated as 4G and 4G1 and took steps to correct.

Cherry County Soils LCG Assignments

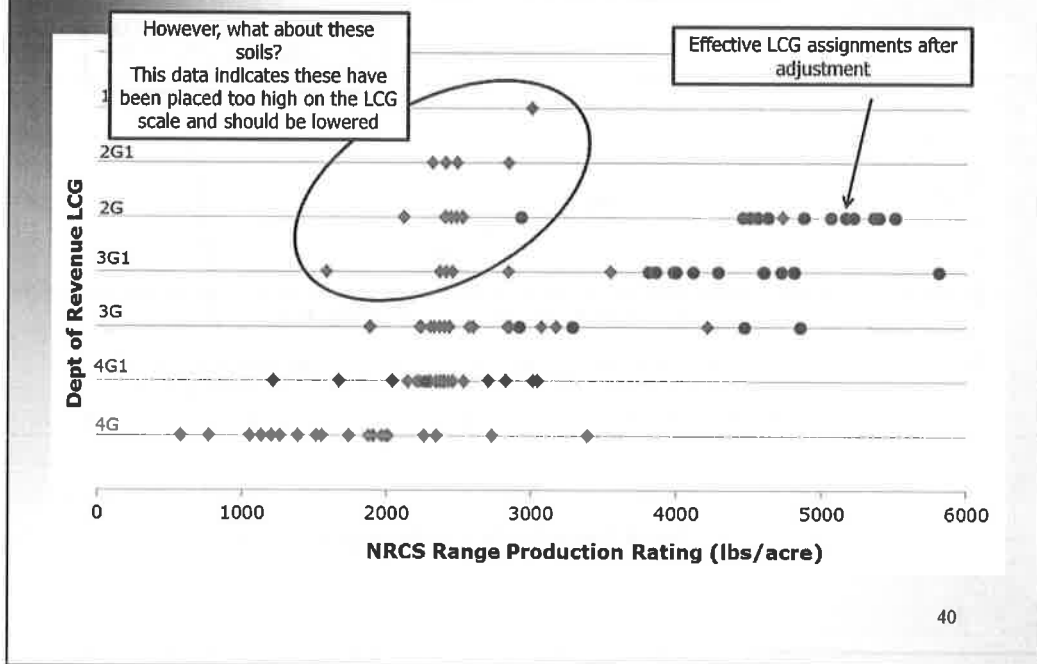
High End Soils – Before Correction



39

The dots now designated as circles (red) were all of the soils identified by the county assessor to be inappropriately classified.

Cherry County Soils LCG Assignments High End Soils – After Adjustment



Corrections to the soils were made as shown here.

With the corrections to the highly productive soils the patterns of the dots start making sense. It is possible to see the stair-step effect that was demonstrated previously with the correct LCG assignments.

These results still show a problem with the soils that are in the oval. These soils are classified too high rather than too low.

Also, these results still show a problem with too much range occurring on the 4G line. The low end soils are being grouped with soils that are six times more productive. Surely a six times increase in income capability would signify more valuable land.

2017 LCG Assigned \$/Acre Values Cherry County - Grassland

LCG	Value (\$/acre)	Crop Forage Yield
1G	\$700	High
2G1	\$670	Moderately High
2G	\$645	Above Average
3G1	\$599	Average
3G	\$550	Moderately Low
4G1	\$425	Low
4G	\$425	Very Low

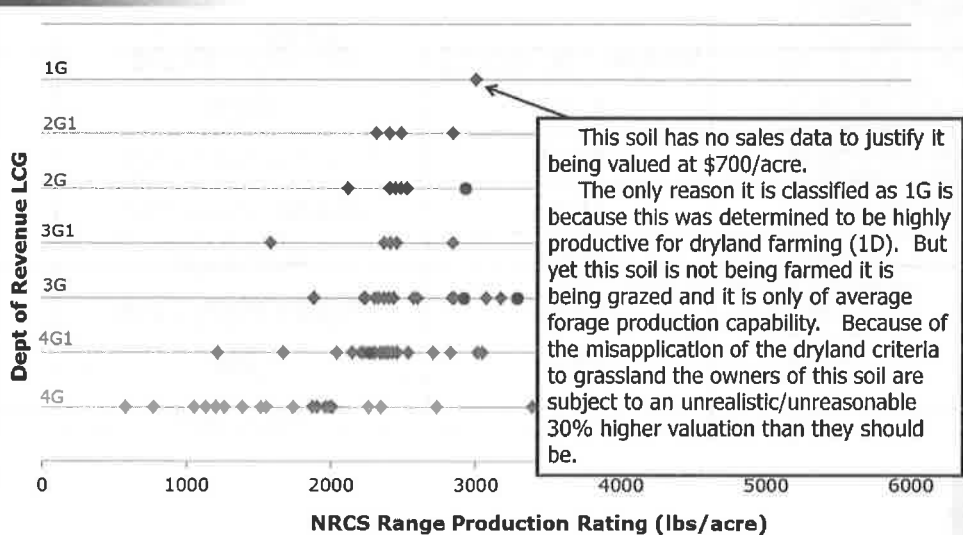
41

This is the LCG price structure for Cherry County. Since the county assessor went to considerable effort to correct for the flawed LCGs for the meadow land it wouldn't make sense to have a constant value.

However, this in itself has created a problem since it will unrealistically drive up the values of the values of the soils captured in the oval on the previous slide.

These values, mostly are based on a dryland criteria and not grassland hence the reason for changing the title Forage Yield to Crop Yield in the third column header above.

Cherry County Soils LCG Assignments High End Soils – After Adjustment



42

The note above explains what is happening to the soil on the 1G line. However, all of the soils in this vicinity are subject to the same overvaluation. It is doubtful that there is statistically significant sales data to support this.

Mass Appraisal

Systematic Appraisal of Groups of Properties

(as of a given date using standardized procedures and statistical testing)

Generalized Model Structure*

A model comprises one *dependent variable* and *one or more independent variables*.

$$MV = BV + LV \quad (\text{most basic valuation model})$$

where

MV = estimated market value

BV = estimated building value

LV = estimated land value

* Fundamental of Mass Appraisal, Robert Gloudemans and Richard Almy, International Association of Assessing Officers, 2011, pg 252.

43

As outlined in the International Association of Assessing Officers (IAAO) paper mentioned at the beginning of this presentation there are a number of required components to an effective appraisal system. Obviously the mass appraisal model is an important element in that system.

This section is included to demonstrate how the flawed LCG assignments affect this important element. Nebraska statutes mandate that a professional accepted mass appraisal system be used so not only is this an important element according to the IAAO standards, Nebraska law deems this to be an important element.

This slide provides a quick overview of a basic mass appraisal model and comes from the book, "Fundamental of Mass Appraisal". This model lends itself quite well for understanding the mass appraisal process being used for Ag land.

A model comprises one dependent value, in this case the estimated Market Values (MV). The model also has to have one or more independent variables that are predictors of value of the property being appraised.

Morrill County Mass Appraisal Focus on Grassland

$$MV_{grass} = \cancel{BV} + LV_{grass}$$

The Building Value (BV) is dropped in this example since it doesn't pertain to the discussion.

so

$$MV_{grass} = LV_{grass}$$

and

$$LV_{grass}^* = (acres_{4G} \times value_{4G}) + (acres_{4G1} \times value_{4G1}) \\ + (acres_{3G} \times value_{3G}) + (acres_{3G1} \times value_{3G1}) \\ + \dots etc. through 1G1$$

simplifying

$$LV_{grass} = f(\text{Grassland LCG Classes in acres and value})$$

* Note: value indicated here is the assessor's calibrated value for each LCG class

Current LCG Values

Current LCG Area

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Several steps into the equation development get us to the detailed Land Value (LV) portion. The third equation down shows the details that go into the value determination as shown in the Real Property Breakdown form (shown earlier). The values listed in this equation are the values determined by the county assessor also discussed previously.

The last equation simplifies the previous equation by stating that the Land Value for grass is a function of the Grassland LCG classes both in acres and in value.

Morrill County Mass Appraisal Focus on Grassland

$$LV_{grass} = f(\text{Grassland LCG Classes in acres and value})$$

But yet we have learned that Grassland LCG Classes are really Dryland LCG Classes so;

$$LV_{grass} = f(\text{Dryland LCG Classes in acres and value})$$

So we end up with a mass appraisal model as such

$$MV_{grass} = f(\text{Dryland LCG Classes in acres and value})$$

The result is a mass appraisal model that has no independent variables that are related to the major land use (MLU) being appraised!

Current LCG Values

Current LCG Acres

45

We continue through this derivation as shown. Because of the flaw Grassland LCGs are really Dryland LCGs and the resulting Market Value estimate has no independent variables relating to grassland. This is true both for the value component and the acres component.

Both of these variables can be checked by going back and contrasting slides 25 (flawed LCGs) and 26 (correct LCGs) for the value component and slides 28 (flawed LCGs) and 29 (correct LCGs) for the acre component. It's easy to see that both the value and acres would come out drastically different if the LCGs were correctly defined for grass instead of for dryland farming.

Morrill County Mass Appraisal Focus on Grassland

$$MV_{grass} = f(\text{Dryland LCG Classes in acres and value})$$

Analogy: This is like using the square feet of the barn to set the value of the house!

This CANNOT be a professionally accepted mass appraisal model!

Statutes mandate professionally accepted mass appraisal

Previous Examples Confirm an Unsuitable Model

- Morrill County – constant values for grassland variations nearly as great as the width of Nebraska
- Morrill County – property tax greater than the annual income
- Cherry County – assigning a 30% overvaluation to a soil that would be highly productive for dryland farming but is only average forage production

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Using the wrong independent variable in a mass appraisal model disqualifies that model from being a “professionally accepted mass appraisal method”. This is simple logic that common sense dictates.

The three examples listed further confirm that this is an unsuitable model as resulting values are absurd.

LCG Grassland Flaw Conclusion

- Dryland Criteria Should Have Never Been Applied to Grassland (or Irrigation)
- Well Recognized Flaw
- Impact of Flaw is Significant

- Get a Second Opinion
 - Property Taxation and Assessment Consultants
 - Almy, Gloudemans, Jacobs and Denne
 - Update consultants on LCG flaw
 - Revisit 2011 study

Report – Review of the Expanded Agricultural Land Analysis Methodology

■ 2011 Report

- Prepared for PAD & TERC
- Authors – Almy, GlouDEMANS, Jacobs & Denne
 - Property Taxation and Assessment Consultants
- 3.2.4 Enhancing Samples with So-Called Borrowed Sales (pg. 4)
 - 3.1 Background
 - LCG is referenced seven times in this section
 - LCG is referenced two additional times in other parts of the report

All of these references imply that the LCGs are accurate

This study needs to be redone with the authors informed of the LCG flaw

48

In 2011 the TERC and PAD commissioned a review on the methodology adopted for reviewing the quality of land assessments. One section, 3.2.4 of the report focused on Borrowed Sales and how appropriate it was to use this method for augmenting the sales roster.

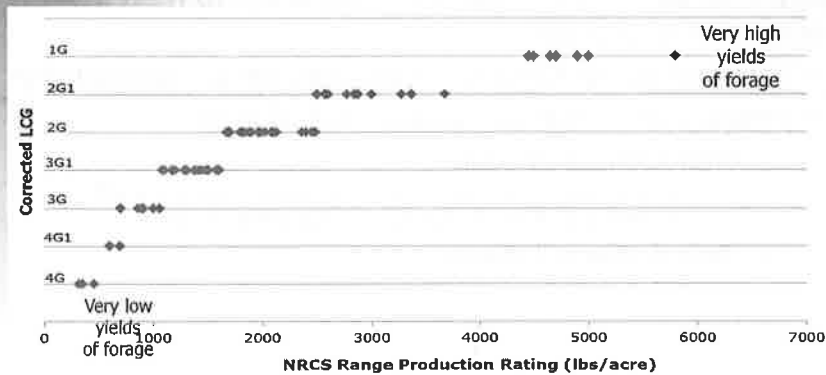
Unfortunately the consultants were not informed of the flawed nature of the grassland LCGs. They reference LCG seven times in this section with the assumption that these are accurate. If they had known they are inaccurate it is highly likely a very different conclusion would have been drawn.

That study needs to be redone with the consultants informed on the flawed LCG assignments.

Correcting the Flaw Grassland

■ Short Term Solution

- Establish grassland LCG classes
 - Based on NRCS Range Production Ratings



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When I made my presentation in 2015 to Ruth Sorensen and her staff, I had two recommendations on correcting the flaw, one I considered a short term solution and the second a long term solution.

The first, short term solution is shown here. This would be relatively easy to do, just redefine the grassland LCG classes as shown here. This would work for the entire state of Nebraska.

Since that time I have change my mind and recommend this option not to be considered. The reasons are as follows.

Short Term Solution Limitations

■ Eight Sub-Classes Limitations

- Error prone
- Current flawed LCGs have distorted the market, therefore reliable data is not available to feed a corrected process
- Steps between classes – questionable proportionality
- Process does not extrapolate well due to
 - Insufficient sales data
 - Example Cherry County 1G soil that should have been 3G but received a \$700/acre price tag as that seemed right
 - Huge productivity range

50

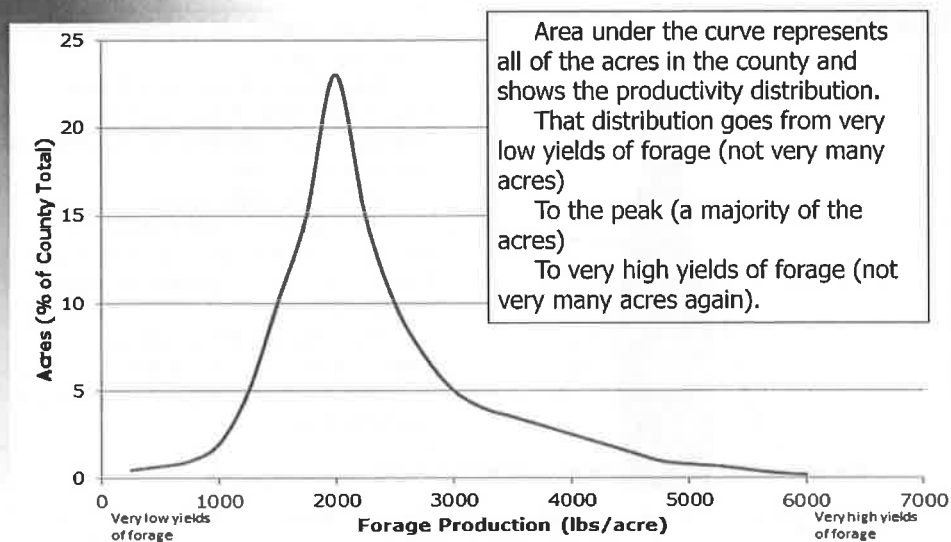
First, this process is error prone as has been demonstrated by the current process.

Secondly, the current flawed LCG assignments have distorted the market. The LCG designations and resulting valuations have made it appear that grassland variation is zero. This, without a doubt has influenced non-savvy buyers. It will take five years to get this misinformation out of the market system.

Third point is that we have large steps between classes. That may have not been an issue back in the days when property taxes were less than 10% of the gross income but now that property taxes are around 40% of the income those steps are a big deal.

Finally this process does not extrapolate well due to 1) insufficient sales data and 2) the huge productivity range that many counties have.

County Grassland Production Generic Curve – Demonstration Purposes

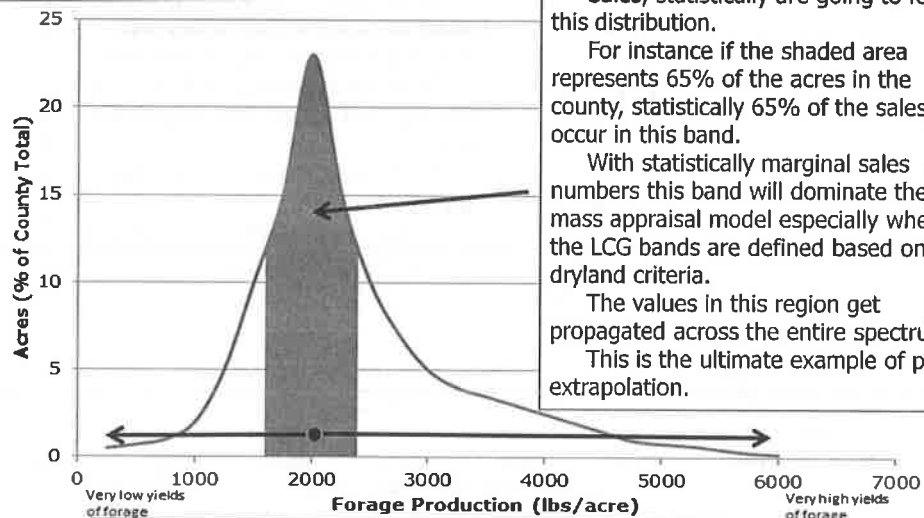


51

To demonstrate why an eight class system doesn't work well it is helpful to look at a typical production curve.

This is a generic county production curve. It is very similar to what was shown for Morrill County in a bar chart format.

County Grassland Production Constitutionally Questionable



Sales, statistically are going to follow this distribution.

For instance if the shaded area represents 65% of the acres in the county, statistically 65% of the sales will occur in this band.

With statistically marginal sales numbers this band will dominate the mass appraisal model especially when the LCG bands are defined based on a dryland criteria.

The values in this region get propagated across the entire spectrum.

This is the ultimate example of poor extrapolation.

It is impossible to characterize this extreme market variation with the current appraisal process.

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This is what happens when you have LCG classes that are ill-conceived.

It is important to remember that the production variation shown here covers most of the state of Nebraska, not just isolated within an individual county.

Report – Review of the Expanded Agricultural Land Analysis Methodology

■ 2011 Report

- Prepared for PAD & TERC
- Authors – Almy, Gloudemans, Jacobs & Denne
 - Property Taxation and Assessment Consultants
- 3.2.4 What is the importance of sample size? (pg. 9)

“Sample size has a direct effect on the reliability of the statistical conclusions drawn from analyzing the sample. The effect varies not linearly, but rather, in general, with the square root of the sample size.”

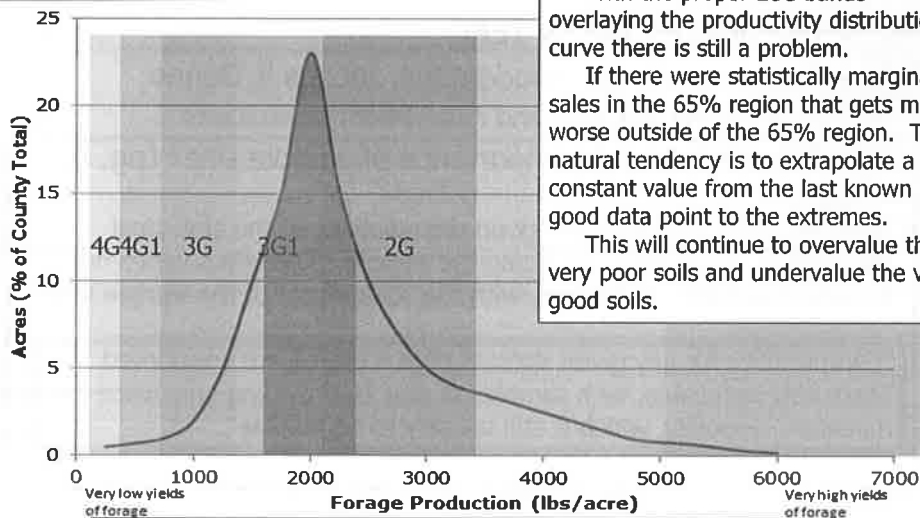
“Sample sizes for any given stratum of less than 5 are considered absolutely unreliable, with samples of size 20 providing only twice the minimum reliability, which is still unlikely to be reliable”

Another common misconception that is applied over and over is that two or three sales can be used to set values. In the 2011 paper mentioned earlier by Almy, Gloudemans, Jacobs & Denne provides an easy to understand way to look at the statistical significance of sales.

Key points – sample sizes for any given stratum of less than 5 are considered absolutely unreliable

- sample size of 20 provide only twice the minimum reliability, which is still unlikely to be reliable.

County Grassland Production w/ Corrected LCG Bands



With the proper LCG bands overlaying the productivity distribution curve there is still a problem.

If there were statistically marginal sales in the 65% region that gets much worse outside of the 65% region. The natural tendency is to extrapolate a constant value from the last known good data point to the extremes.

This will continue to overvalue the very poor soils and undervalue the very good soils.

Characterizing this extreme market variation correctly, even with corrected LCG bands is unlikely.

54

If we have 12 sales total for this county representation that means that 8 (65%) of those sales will fall within the blue band in the center. That indicates very marginal data to qualify the 3G1 and 2G bands.

The other 4 sales are going to be scattered between the other LCG bands and have to be considered absolutely unreliable.

The result will be to extrapolate off the center data to the outer extremes of the different G levels. On the poor quality end it will likely result in a constant value getting extrapolated to the far left just as it is today.

Again it is important to remember that the production variation is nearly as great as the variation of all of Nebraska so these values will get extrapolated well beyond acceptable limits.

Long Term Solution Fits within the Current Statutes

■ Different Unit of Comparison

- \$/lbs (or \$/AUM) instead of \$/acre
 - Automatically accounts for variation in production
 - Avoids current market distortion created by incorrect LCG designations
 - Extrapolates much better than a blind \$/acre value
 - Accommodates wide variation in production
 - More tolerate of statistically limited sales numbers
 - Although not common it is an accepted unit of comparison (Ref. The Appraisal of Real Estate, 13th Ed. pg. 306)

■ Sub-Class Designation

- NRCS Range Production Rating for each soil
 - Readily available
 - Keeps the classification process in the hands of the experts

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Using a unit of comparison that automatically takes into account the most important indicator of value is critical. With the extreme variation in production, \$/acre is not the most important indicator.

The NRCS Range Production ratings provide an excellent way to define the grassland sub-classes.

NRCS Rangeland Productivity Rating Grassland Sub-Classes

Map unit symbol	Map unit name	Rating (pounds per acre per year)	Acres In AOI	Percent of AOI
1001	Bankard fine sand, channeled, frequently flooded	698	13,871.30	1.50%
1002	Bankard loamy coarse sand, occasionally flooded	2100	1,417.60	0.20%
1006	Bankard loamy fine sand, channeled, frequently flooded	700	1,549.30	0.20%
1030	Glenberg fine sandy loam, 0 to 2 percent slopes	2079	43.8	0.00%
1034	Glenberg very fine sandy loam, 0 to 2 percent slopes	2079	5,463.40	0.60%
1035	Glenberg loamy fine sand, 0 to 2 percent slopes	2100	1,544.40	0.20%
		2079	3,967.30	0.40%
		1584	201.1	0.00%
		1600	19.3	0.00%
		1200	86.7	0.00%
		1700	2,290.10	0.30%
		1700	3,282.40	0.40%
1363	Bridget very fine sandy loam, 3 to 6 percent slopes	1700	3,378.90	0.40%
1364	Bridget very fine sandy loam, 6 to 9 percent slopes	1700	3,635.10	0.40%
1365	Bridget very fine sandy loam, 9 to 20 percent slopes	1700	3,469.30	0.40%
1406	Craft very fine sandy loam, rarely flooded	2400	1,287.10	0.10%
1506	Altvan-Dix complex, 3 to 9 percent slopes	1835	1,807.60	0.20%
1545	Dailey loamy fine sand, 0 to 3 percent slopes	1584	4,115.90	0.40%
1546	Dailey loamy fine sand, 3 to 9 percent slopes	1600	2,396.70	0.30%
1571	Dix gra	600	265.9	0.00%
•••		•••	•••	•••

These are ready made grassland sub-classifications. No interpretation is needed by the Dept. of Revenue and no interpretation is needed by the county assessor.

Rangeland Ratings –
Normal Year

Revised Valuation Methodology Grassland

Original Real Property Breakdown
Soil Table

Added NRCS
Productivity Rating

Sym	LCG	Acres	Value/ Acre (\$/acre)	Total Value (\$)	Prod. Index (lbs/acre)	Index x acres (lbs)
5144	4G	16.73	\$385	\$6,441	1285	21,498
5851	4G	10.28	\$314	\$3,927	1060	10,812
5910	3G	7.00	\$126	\$8,894	1683	38,877
6025	4G	1.00	\$489	\$4,890	700	227,073
6033	4G	1.00	\$233	\$2,393	1060	202,068
100	ROAD	1.09	\$0	\$0		0
		566.14		\$217,544		500,328

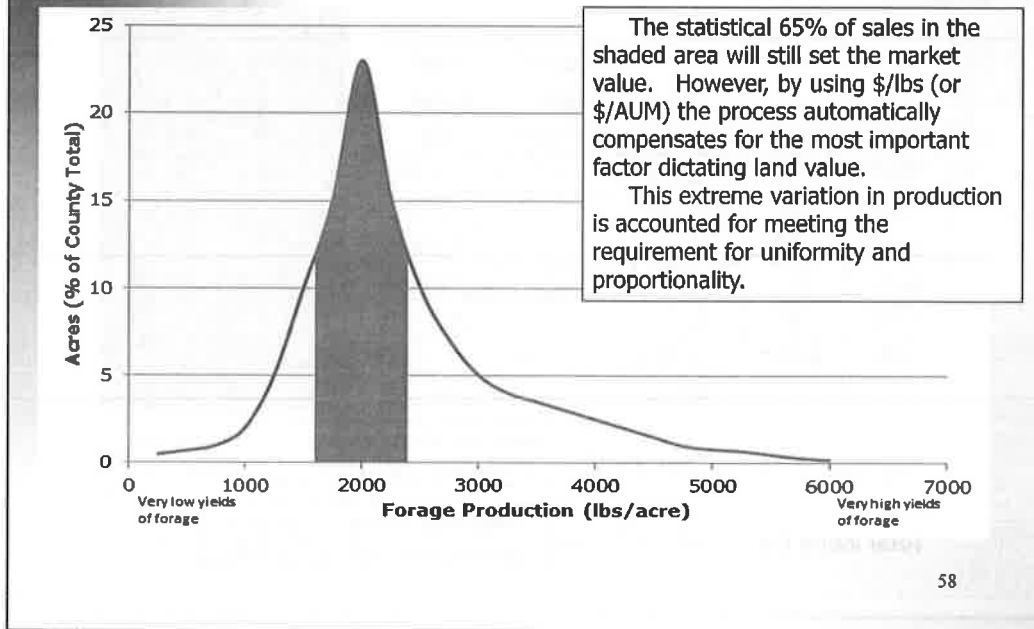
Avg. (lbs/acre) = 884 ← Value based on this avg.
production index rating $\frac{500,328 \text{ lbs}}{566 \text{ acres}}$

Total Value (\$) = \$91,210 ← Final value = Avg. x # acres x
predetermined sale price, \$/lbs

The process outlined here demonstrates how easily this approach can be applied. Simply calculate the total grass production based on the NRCS Range Ratings and sum the total.

The calculation of the Average in \$/lbs provides a single number that can be used as a metric to compare one parcel to another. Land owners, land buyers and relators will find this figure 57 invaluable as it will provide a true metric indicating land quality without having to look at individual soils.

Proposed Valuation Methodology Constitutionally Correct

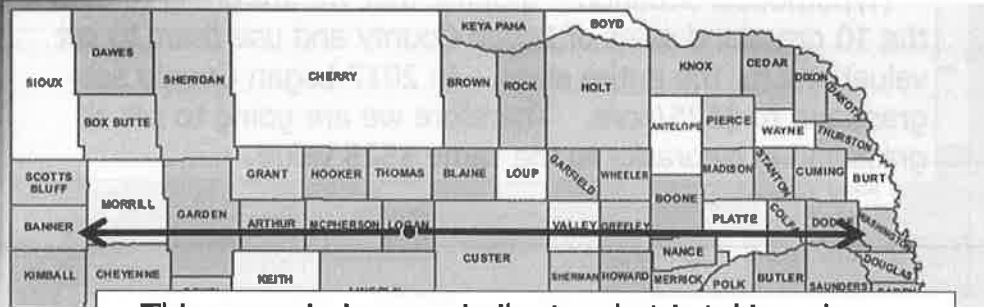


We still now have the same curve and the same set of sales. On the sales side we determine what buyers are paying for forage production capability not the cost per acre. This process gets back to the absolute most important element for income producing land.

On the valuation side setting individual parcel values becomes easy as it is determined by the position on the x-axis of this graph for each parcel. There is no wild extrapolating to the far ends of the production curve. Values automatically adjust according to the production capability.

Hypothetical Situation

Logan County Sales used to Set All of Nebraska Grassland Values



This scenario is very similar to what is taking place today in Morrill County (and many other counties). A small number of sales are concentrated on a center band and then extrapolated to the extremes of the production variation. After all many counties have nearly as much variation as the entire state.

Nebraska map reproduced with permission – Digital-Top-Maps.com

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Hypothetical Situation (continued) Example of Poor Extrapolation

- This process does not extrapolate well
 - Severe overvaluation of poor land
 - Severe undervaluation of very good land
- Fortunately, we have many counties with many sales to tell us that a constant \$525/acre is not correct.

But,

- Would this process be correct if the sales of the many counties did not exist?

Hypothetical Situation (continued) Proposed Valuation Method

- Adjust Valuations Based on Productivity

County	Avg grass prod (lbs/acre)	2017 Actual Value (\$/acre)	Proposed Methodology Value (\$/acre)	Hypotetical Value (\$/acre)
Morrill	1787	\$385	\$379	\$525
Garden	2157	\$405	\$457	\$525
Arthur	2345	\$407	\$497	\$525
McPherson	2338	\$450	\$496	\$525
Logan	2476	\$525	\$525	\$525
Valley	3173	\$1,267	\$673	\$525
Stanton	3482	\$1,494	\$738	\$525
Richardson	4107	\$1,790	\$871	\$525

Setting values based on production capability and using Logan County sales to set what the market is paying for forage production capability, results in these values.

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This slide lists seven counties besides Logan County. They are arranged geographically from west to east starting with Morrill County. The average forage production for each county is listed in column 2. Column 3 is the actual average assessed grassland value for 2017 for each of these counties.

Column 4 is the proposed values that would result if using the valuation methodology outlined a few slides back. These values are calculated by taking the \$525/acre of Logan County and making them proportionate to Logan County based on the forage production capability, shown in column 2.

Column 5 is mostly hidden but it lists \$525 for every county just as our hypothetical situation initially outlined.

Hypothetical Situation (continued) Proposed Valuation Method

■ Adjust Valuations Based on Productivity

County	Avg grass prod (lbs/acre)	2017 Actual Value (\$/acre)	Proposed Methodology Value (\$/acre)	Hypotetical Situation Value (\$/acre)
When compared to the actual value a constant \$525/acre is obviously wrong.		(\$385)	\$379	(\$525)
		(\$405)	\$457	(\$525)
		(\$407)	\$497	(\$525)
McPherson	2338	\$450	↓ \$496	\$525
Logan	2476	\$525	\$525	\$525
Valley	3173	\$1,267	\$673	\$525
Stanton	3482	\$1,494	\$738	\$525
Richardson	4107	\$1,790	\$871	\$525

The first step is to compare the constant \$525 to the actual 2017 values. It's easy to see that setting everything to a constant \$525 is not right.

Hypothetical Situation (continued) Proposed Valuation Method

■ Adjust Valuations Based on Productivity

County	Avg grass prod (lbs/acre)	2017 Actual Value (\$/acre)	Proposed Methodology Value (\$/acre)	Hypotetical Situation Value (\$/acre)
Morrill	1787	\$385	\$379	\$525
Garden	2157	\$405	\$457	\$525
		\$407	\$497	\$525
		\$450	\$496	\$525
		\$525	\$525	\$525
		\$1,267	\$673	\$525
		\$1,494	\$738	\$525
		\$1,790	\$871	\$525

The proposed methodology, although not perfect, gets values much closer to the true value.

A production adjustment is absolutely necessary when sales data is limited.

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The next step is to compare the proposed methodology values to the current 2017 values. These results show the proposed methodology estimates are more realistic value predictions. These value predictions are not perfect but are much better than a constant value extrapolated to the extremes.

This chart also helps to demonstrate quite clearly that production is very important. There are many people that claim that production doesn't matter to land value but these results clearly indicate otherwise.

Summary

- **Current Mass Appraisal Process is Invalid**
 - Uses wrong inputs to the mass appraisal model
 - Results in constant valuations for Nebraska wide like variations in production
 - Results in a tax higher than the income potential
 - Results in sever over valuations due to misclassification
- **Short Term Solution – Unsuitable**
 - Does not characterize markets with extreme variations well (which are typical in many counties)
- **Long Term Solution – Well Suited for Nebraska**
 - Use \$/lbs (\$/AUM) instead of \$/acre
 - Use NRCS indices for sub-classes
 - Works well with limited sales data
 - Works well for extreme market variations typical in many counties

Summary (continued)

■ Recognize & Acknowledge

- Available sales data is marginal for most western Nebraska counties
- Many counties have grassland production variations that are nearly as great as the entire state
 - Grass is not grass – let's not pretend that all grass parcels are equal because nothing could be further from the truth

2017 Opinions of the Property Tax Administrator for Morrill County


Class	Level of Value	Quality of Assessment	Non-binding recommendation
Residential Real Property	96	Meets generally accepted mass appraisal practices.	No recommendation.
Commercial Real Property	100	Meets generally accepted mass appraisal practices.	No recommendation.
Agricultural Land	75	Meets generally accepted mass appraisal practices.	No recommendation.
		Does not meet generally accepted mass appraisal practices.	No recommendation.

"Meets generally accepted mass appraisal practices" is simply not true

A level of value assigned to a class of property with insufficient information to determine a level of value.

Dated this 7th day of April, 2017.





 Ruth A. Sorensen
 Property Tax Administrator

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2016 Equalization of Value of Real Property Hitchcock County

■ Conclusion

- Land Use Grass Increased by 16.98%

■ Conflicting Information

- Section II – Review of Assessment Practices
 - “The uniformity and proportionality of assessments, under professionally accepted mass appraisal methods,”
- Section III – Applicable Law
 - “2. An assessment/sales ratio tool used under professionally accepted mass appraisal methods...”
 - “15. ... The comprehensive assessment ratio studies shall be developed in compliance with professionally accepted mass appraisal techniques ...”

“Meets professionally accepted mass appraisal methods” is simply not true