Appendix 14-B

Calculating Use-Value Guidelines for Agricultural Land Assessment

Wisconsin farmland assessment for property tax purposes is based on the land's productive capacity. Use-values are determined using an income approach to value. Net income from farming the land is capitalized to estimate a value-in-use. The valuation model is:

Value = Income / Rate

Subtracting expenses from gross income determines the net income that the land is capable of generating. Income is related to the productive capability of the soil. The capitalization rate reflects the risks with agricultural investment and includes the cost of money, the expected rate-of-return and the municipal effective tax rate.

Chapter Tax 18 specifies the use-value calculation. Rental income is based on the income an agricultural landowner receives from a crop-share lease. Under a crop-share lease, landowners and farm operators share the cost and income from growing a crop. In agreement with the agricultural industry standards for crop-share leases, gross income and direct operational costs are equally distributed between the landowner and farm operator. Property taxes are paid by the landowner, labor and machinery costs are paid by the farm operator. These specifications determine landowner net income. This appendix describes how use-values were estimated for 2019 under a crop-share lease. It explains the methodology and identifies data sources. The Town of Christiana, Dane County, is the example municipality.

Steps in the Process

Determine the estimated average gross income/acre for each county
Calculate the five year average base corn yield/acre
Calculate the five year average corn price ($/bu)
Calculate the average county gross income per acre under a crop-share lease ($/ac)
Yield/Acre x Price/Bushel = Gross income/Acre

Determine the estimated average net income/acre for each county
Calculate the landowner's net income per acre under a crop-share lease ($/ac)
Subtract return to management and cost of production from gross income

Determine the capitalization rate
Determine the capitalization rate = *municipal tax rate + 5 year average ag loan rate or 11%, whichever is greater*

Estimate use-value
Calculate the return for grade 2 and grade 3 land in the municipality
Calculate the return for pasture land in the municipality
Determine preliminary use-values ($/ac): *net income/cap rate = use value/acre*
Determine the statewide use-value percentage change.
Calculate the annual statewide percentage change in the agricultural use values.
Calculate the annual statewide percentage change in Equalized Values.
Determine final use values.

Determine the Estimated Average Gross Income/Acre by County

State law requires agricultural land values based upon the income that is or could be generated from its rental for agricultural use. The economic rent of agricultural land is related to soil productivity. With equivalent effort, productive soils will generally produce greater yields per acre than poor soils. Productive lands are generally more profitable and more valuable with higher rents in the agricultural marketplace.

County corn yields reported by the Wisconsin Agricultural Statistics Service (WASS) are the measure of productivity for estimating average gross income/acre. Annual county corn yields reflect variability in weather, changes in technology and soil conditions. County corn yield data provides the calculation of a *county* average gross income/acre for the model.

Calculate the Five-Year Average Base Corn Yield/Acre

WASS annually reports the acres of corn planted, harvested and the bushels produced in each Wisconsin county[1]. WASS aggregates Wisconsin's counties into nine agricultural statistical districts (see Attachment A). In any given year, some counties may not have yield data due to a low number of planted acres. In such cases, data from a county near the subject county will serve as a proxy. The average is adjusted by the relationship between the subject county and the substitute county or the difference between the subject and substitute when data was available for the subject. As an example, the yield function for Douglas County is:

Y(D) = 5.2629 + 0.8038*(Sawyer County Yield)

5.2629 is the intercept, the slope coefficient is 0.8038. The slope coefficient implies the yield for Douglas County changes 0.8038 bushels for each change of 1 bushel in the yield for Sawyer County. Table 1 provides the linear yield equations for counties without yield data.

Table 1 Counties Without Corn Yield Data

Counties Without Data	Replacement County	Linear Yield Equations
Clark County	Marathon County	Y=-1.197423921+1.046069822(Marathon County)
Taylor County	Marathon County	Y= 4.434996752+1.011681398 (Marathon County)
Milwaukee County	Racine County	Y= 47.547429+0.552679(Racine County Yield)
Ozaukee County	Racine County	Y= 32.356227+0.665578(Racine County Yield)
Langlade County	Oconto County	Y= 49.57750677+.49113414 (Oconto County Yield)
Sawyer County	Rusk County	Y= 13.1225867+0.784931(Rusk County Yield)
Ashland County	Rusk County	Y = 40.61410216 + 0.49530266 (Rusk County Yield)
Bayfield County	Rusk County	Y = 24.919654 + 0.699497 (Rusk County Yield)
Douglas County	Rusk County	Y = 19.66912 + 0.7324738 (Rusk County Yield)
Florence County	Oconto County	Y = 10.14054274 + .730403 (Oconto County Yield)
Forest County	Oconto County	Y = 1.65814605 + .909398981 (Oconto County Yield)
Iron County	Marathon County	Y = 15.3356485 +.7187749 (Marathon County Yield)
Oneida County	Marathon County	Y = 34.138122 +.52595750 (Marathon County Yield)
Vilas County	Marathon County	Y = 51.636098 +.28257468 (Marathon County Yield)
Menominee County	Oconto County	Y= 10.45982451+.90730401 (Oconto County Yield)
Marinette County	Oconto County	Y = 5.373012697 + .99109997 (Oconto County Yield)
Lincoln County	Marathon County	Y = 11.408238 +.83734659 (Marathon County Yield)
Price County	Marathon County	Y = 24.263335+.70107025 (Marathon County Yield)
Calumet County	Kewaunee County	Y = 18.0045525+.9064025 (Kewaunee County Yield)
Door County	Kewaunee County	Y = 8.06525668+.8424797 (Kewaunee County Yield)

[1] CORN FOR GRAIN: Acreage, Yield, and Production, By Counties, Wisconsin (WASS)

Figure 1 shows Dane County's reported corn yield for the last five years and the five-year moving average. The calculated average yield for Dane County is 169 bushels per acre (rounded to the nearest whole bushel).

Figure 1

Calculation of 5-Year Average Corn Yield (Dane County)

Year	Yield (bu/ac)
2012	112
2013	176
2014	181
2015	184
2016	192
5-Year Average	**169**

Calculate the Five-Year Average Corn Price

The five-year moving average corn price per bushel is calculated on a 60-month basis. Use of a 60-month average price incorporates monthly market price fluctuations resulting in a smoother year-to-year average price than five annual averages or five single-month prices. The price of corn, like other commodities, may exhibit volatility within any particular year. A 60-month average (five years) will dampen the effect of unusual monthly price changes within a year, yet preserve the general price trend within the five-year moving average period. The United States Department of Agriculture's National Agricultural Statistics Service (NASS) reports monthly corn prices for Wisconsin (see Figure 2).

Figure 2

Prices received by farmers, by year, by month (Wisconsin corn for grain, 2012-2016)

	Year		Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Corn	2012	55	5.78	6.07	6.25	6.15	6.17	6.44	6.64	7.39	7.05	6.33	6.90	6.80
Corn	2013	55	6.93	7.03	7.06	6.95	6.77	6.80	6.80	6.18	5.68	4.68	4.38	4.31
Corn	2014	55	4.40	4.30	4.47	4.55	4.72	4.56	4.28	3.80	3.53	3.67	3.61	3.67
Corn	2015	55	3.74	3.75	3.72	3.73	3.48	3.48	3.78	3.67	3.58	3.57	3.42	3.38
Corn	2016	55	3.51	3.44	3.43	3.49	3.57	3.75	3.52	3.12	3.13	3.23	3.16	3.15

60 Month Average = $4.75

Calculate the Average County Gross Income per Acre for a Landowner's Crop-Share Lease

The average gross income per acre (*GI*) is calculated for agricultural land within each county. Corn yield data from NASS does not include production information by tillable soil grade. The model assumes that corn is only grown on the best soils, namely Grade 1. Once a value for Grade 1 soil is estimated, the estimated values for other soil grades will be determined from the relationship between the productivity ratings[2] of each grade across the state. Figure 3 is an example of the gross income calculation for Grade 1 land in Dane County. Based on

[2] Land Capability and Yields Per Acre of Crops and Pasture from USDA/NRCS county soil surveys.

reported statistical data over the five-year period from 2012 through 2016 the average corn yield per acre of land in Dane County was 169 bushels (Y). The five-year average income received by a landowner under a crop-share lease, where income and direct operating costs are equally shared between the landowner and farm operator, is $4.75÷ 2, or $2.38 per bushel (P). As illustrated in Figure 3, a yield of 169 bushels generates a landowner an average gross income of $402.22 per acre.

Figure 3

Gross income formula

GI = Y 5-year	X	P 5-year
GI = 169 bu/acre	X	$2.38/bu = $402

Determine the Estimated Average Net Income Per Acre by County

Calculate the Landowner's Net Income per Acre Under a Crop-Share Lease

Once gross income per acre is calculated, subtract production and management expenses. The US Department of Agriculture publishes cost data for corn production. The five-year average cost of production is estimated $504.93 per acre. Costs will vary depending on the yield for local soil and weather conditions, factors in productivity. A unit cost (cost per bushel) is calculated by dividing the average cost per acre by the average yield per acre. The unit cost per bushel is derived from five-year averages for the Northern Crescent Region.

- Northern Crescent Region five-year average corn yield (2012-2016) = 153 bushels per acre
- Five-year average direct production costs for corn = $302.54/acre
  - Includes cost of seed, fertilizer, soil conditioners, manure, chemicals, custom operations, other variable cash expenses and interest on operating capital
- Unit cost of production per bushel = $302.54 ÷ 153, or $1.98 per bushel
- Amount paid by landowner = $1.98 ÷ 2, or $.99 per bushel
  - Under crop-share lease agreement where income and direct operating costs are equally shared between the landowner and farm operator

The per acre cost of production for Dane County is $.99 x 169 bu/acre, (5yr ave of corn 2012-2016) or $167 / acre (rounded). A management expense of 7.5 percent is deducted from gross income, representing administrative and land maintenance expenses paid by the landowner. Land maintenance expenses typically include weed eradication, laser leveling, irrigation ditch construction and any other costs of maintaining or improving the land's agricultural productivity. The management expense (M) is $30/acre. Figure 4 shows that the average net operating income (NOI) of $205 by subtracting the cost of production and management expense from gross income. Property taxes are realized in the capitalization rate and not as an expense since the calculation is property assessment.

Figure 4

Net Income per Acre

NOI	= GI	- OE	-	ME	
NOI	= $402	- $167	-	$30	= $205

Determine the Capitalization Rate

The capitalization rate is the sum of an agricultural loan interest rate and the effective full value tax rate, or 11 percent, whichever is greater. The administrative rule[3] for the assessment of agricultural property specifies the interest rate component as the five-year average of the effective 1-year adjustable rate mortgage interest rate for medium-sized agricultural loans. The rate is set as of January 1 of the five years prior to the assessment year. The rates are derived from a survey of each federal land credit associations (FLCA) and each agricultural credit association (ACA) in Wisconsin. For example, the current five-year interest rate history in Wisconsin is shown in Figure 5.

Figure 5

Agricultural Interest Rates on January 1

2014	4.05%
2015	4.18%
2016	4.40%
2017	4.53%
2018	5.65%
5-Year Average =	4.56%

The second component of the capitalization rate is specified as the effective full value tax rate. This is the net full value tax rate of each municipality for the property tax levied two years prior to the assessment year (the most recent data). The 2018 effective tax rate for the Town of Christiana in Dane County was 0.01408 or 1.41 percent. The overall capitalization rate (OCR) is the sum of the agricultural loan interest rate and the effective full value tax rate, or 11 percent, whichever is greater. As shown in Figure 6, the calculated rate for 2019 is 5.97 percent and lower than 11 percent. The actual 2019 capitalization rate is 11 percent.

Figure 6

Capitalization Rate Construction

2019 capitalization rate Town of Christiana	
Agricultural loan interest rate:	4.56%
Effective full value tax rate:	1.41%
Calculated rate =	5.97%
Actual rate =	11.00%

Estimate Use-Value

The traditional capitalization formula used to convert income into value is:

Value = Income / Rate

The first step in the process was to determine the estimated income that farmland is capable of generating from agricultural use. As it is used here, income from farming is synonymous

[3] Chapter Tax 18.07 - Use-Value

with "rent." The model estimates the net return to the land from farming, or economic rent. The economic rent, sometimes referred to as market rent, is the rental income that a property would most probably command in the open market. Net return to the land is the amount a lessee could pay in rent and still be compensated for their work effort after expenses. Economic rent, in economic terms, refers to the "rent" payments landowners received for the services of their land. Gross income is the amount of money that the land can generate before expenses. Net income, or net return to the land, is derived from gross income. The estimated average county gross income for this process is the product of the five-year average corn price (per bushel) times the county five-year average corn yield.

Calculate the Return for Grades 2 and Grade 3 Land in the Municipality

WASS' nine agricultural districts are grouped into 3 "tiers," North, Central and South. The use-value of grades 2 and 3 are determined by the relationships between the average soil productivity for each grade of soil within each agricultural tier. Soil productivity ratios (PR) are established by dividing the average grade 1 productivity by the average grade 2 productivity and the average grade 2 productivity by the average grade 3 productivity in each tier. The productivity ratios for Dane County by grade are shown in Figure 7.

Figure 7

Soil Productivity Ratios (PR)

Dane County - Southern Tier			
	Grade 1	**Grade 2**	**Grade 3**
Average productivity =	169	143	104
Productivity ratio 1:2 =		1.1854	
Productivity ratio 2:3 =			1.3734

Once the productivity relationships have been determined, the 5-year average corn yield (grade 1) in any county can be extended to impute corn yields for grades 2 and 3. Imputed corn yields on grade 2 and 3 lands are substituted into the equation from Figure 3 to derive the estimated gross income from each soil grade. Net income for each grade is calculated following the formula in Figure 4. Figure 8 summarizes these calculations for the Town of Christiana in Dane County.

Figure 8

Return Calculation for Grades 1, 2, & 3

Town of Christiana - Dane County - Southern Tier			
	Grade 1	Grade 2	Grade 3
5-year average corn yield ($Y_{5\text{-Year}}$)	169	--	--
Productivity ratio (PR)	--	1.1854	1.3734
Imputed yield (Y)		143	104
5-year average corn price ($P_{5\text{-Year}}$)	$2.38	$2.38	$2.38
Gross income/Acre (GI)	$402	$340	$248
Management expense (ME)	($30)	($26)	($19)
Production cost (OE)	($167)	($142)	($103)
Net return/Acre	$205	$172	$126

Calculate the Return for Pasture Land in the Municipality

Wisconsin data shows typical pasture rents at approximately 30% of an area's prevailing average cropland rent. This statistical relationship is applied to the average cropland rent for each county and estimated as the average of the net returns to grades 1, 2 and 3 lands. Following the cropland/pasture relationship, the average pasture rent is 30% of average net return across all three grades. Figure 9 shows the calculation for the Town of Christiana.

Figure 9

Pasture Return for Town of Christiana

Grade 1 net return	$ 205
Grade 2 net return	$ 172
Grade 3 net return	$ 126
Average cropland net return	$ 168
Pasture net return (30%)	$ 50

Determine Preliminary Use-Values ($/ac)

The model assumes corn is grown on the best soils, Grade 1. The net income per acre of $205 capitalized by 0.110 equals a Town of Christiana Grade 1 use-value of $1,863 / acre.

Figure 10

Grade 1 Use-Value Calculation

NOI	÷	OCR	=	UV grade 1
$205	÷	0.11	=	$1,863 or $1,860 /acre

The returns calculated for grade 2, grade 3, and pasture are capitalized in Figure 11.

Figure 11

	Grade 1	Grade 2	Grade 3	Pasture
Return	$205	$172	$126	$50
Capitalization Rate	0.11	0.11	0.11	0.11
Use Value	$1,863	$1,564	$1,145	$455
Rounded	$1,860/acre	$1,560/acre	$1,150/acre	$460/acre

Determine the Statewide Use-Value Percentage Change

Annual changes in the use-values for agricultural land assessment is limited to the annual statewide change in equalized values less the value of agricultural land and new construction (Tax 18.07). Figure 12 provides the statewide change in Equalized Values from 2017 to 2018 less the value of agricultural land and new construction. The percentage change in the use-values for the 2018 assessment year to 2019 is 2.86 percent for all grades.

Figure 12
Annual statewide percentage change in equalized values

	2017	2018
Equalized Value	$525,984,545,850	$549,532,691,500
Less Net New Construction*		-$8,534,265,000
Less Agricultural Land	-$2,104,285,300	-$2,156,126,600
Total	$523,880,260,550	$538,842,299,900
Amount of Change		$14,962,039,350
Percentage Change		2.86%

*Net new construction equals new construction less demolition.

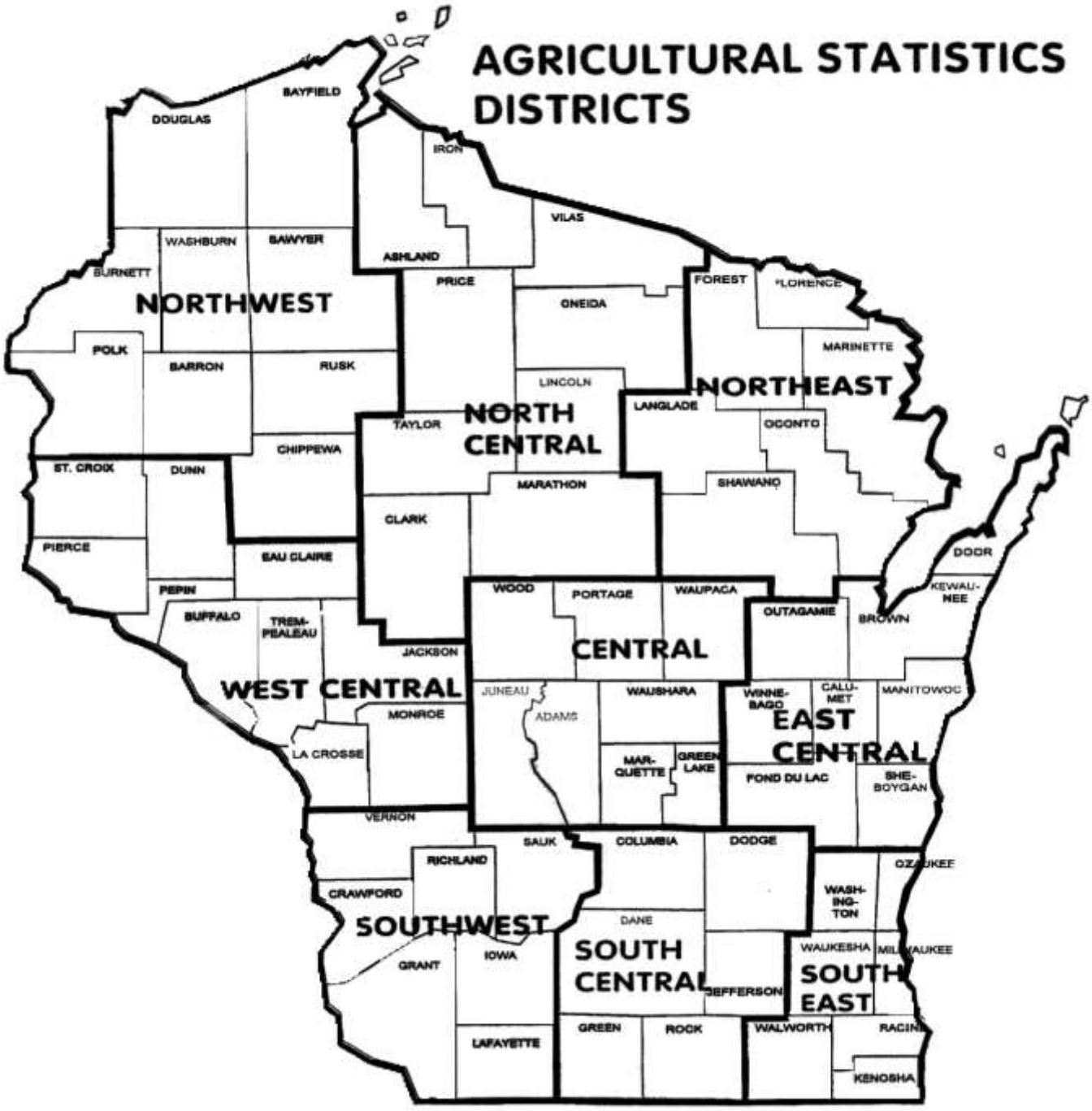
Determine Final 2019 Use-Values

Figure 13 shows the 2019 use-value guidelines for the Town of Christiana.

Figure 13
Town of Christiana, Dane County, final 2019 Use-Values

	Grade 1	Grade 2	Grade 3	Pasture
2018 Use-Value	$296	$250	$182	$73
Amount of Change at 2.86%	$8	$7	$5	$2
2019 Use-Value	$304/acre	$257/acre	$187/acre	$75/acre

Attachment A



Attachment B

Sources of Data

United States Department of Agriculture - *Corn Price, Corn Yield*

National Agricultural Statistics Service
Room 5829
1400 Independence Avenue, SW
Washington D.C. 20250
(202) 727-2707
NASS Hotline: 1-(800)-727-9540
Internet: https://www.nass.usda.gov/About_NASS/index.php

Economic Research Service - *Corn Cost of Production*
1800 M St., NW
Washington, DC 20036-5831
(202) 219-0515
Internet: https://www.ers.usda.gov/

USDA Economics and Statistics System at Mann Library, Cornell University.
USDA Data Available On-line
Internet: http://usda.mannlib.cornell.edu/MannUsda/homepage.do

Wisconsin Department of Agriculture, Trade, and Consumer Protection

Wisconsin Agricultural Statistics Service - *Corn Price, Corn Yield*
P.O. Box 8934
Madison, WI 53708-8934
(608) 224-4848
Contact: Greg Bussler, State Statistician
Internet: http://www.nass.usda.gov/wi/

Wisconsin Department of Revenue - *Capitalization Rate Components*

Division of State and Local Finance
Office of Assessment Practices - *Agricultural Loan Rate*
P.O. Box 8971
Madison, WI 53708-8971
Contact: Mark Paulat
(608) 266-2317

Local Government Services Bureau- Municipal Property Tax Rate
P.O. Box 8971
Madison, WI 53708-8971
Contact: Valeah Foy
(608) 261-5360
Internet: http://www.revenue.wi.gov/

Attachment C

Farmland Advisory Council Members

Richard G. Chandler	Chair, Secretary of Revenue
Herb Tauchen	Farmer
Amber Keller	Agricultural Lender
Kevin Bernhardt	Agricultural Economist - UW System
Tim Hanna	Mayor of a city with population more than 40,000 - City of Appleton
Jordan Lamb	Environmental Expert
Vacant	Non-Agricultural Business Person
Steven Hintz	Professor of Urban Studies
Jeff Lyon	Agribusiness Person
Michael Denor	Assessor