

Ag Use Value Methodology

To: Douglas County Board of County Commissioners
From: Marion R. Johnson, Douglas County Appraiser
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Topic: Agricultural use value methodology

How does the Division of Property Valuation (PVD) of the Department of Revenue determine agricultural land use values? This is a question that is complex and full of mystery to most people even those who work in the agricultural industry. The appraisal method used to value agricultural land is a modified income approach. The basic income formula is value equals income divided by the capitalization rate. This Paper will look at how the components of this formula are developed.

K.S.A. 79-1476 requires that agricultural land be valued using an eight year average of landlord net incomes. Again, what does that really mean? (The eight years used in the 2000 valuation cycle are 1991 thru 1998).

Agricultural use values are determined for two basic classifications of agricultural land, cropland (dryland and irrigated) and grassland (native and tame grassland). Values per acre are determined for each individual soil type in each classification of agricultural land. The main components of the dryland analysis include: the soil rating for plant growth (SRPG), the crop mix, yields, prices, landlord's share of crops, landlord's share of expenses, production costs, management fees and landlord's share of net income. The main components of the grassland analysis, both native and tame, are: the grazing indices, rental rates, gross rental income, expenses, management fees, and landlord's net rental income.

Following are the formulas used to calculate cropland and pastureland values (the income portion of the income approach formula) for each soil type and a discussion of each component of the formulas:

Cropland methodology:

Dryland formula:

Step #1: Crop yield x average price x typical crop mix x landlord share = Weighted landlord gross income.

Step #2: Landlord production costs x landlord's share of expenses = weighted landlord production costs.

Step #3: Weighted landlord gross income x indexed SRPG for each soil type = indexed landlord gross income minus weighted production costs minus management charge = landlord net' income.

Soil rating for plant growth (SRPG) - This is a method developed by the Natural Resource Conservation Service to rank each soil type. Items taken into consideration in this rating are: surface structure and nutrients, water features, toxicity, soil reaction, climate, physical profile and landscape. Each soil type is then indexed using the weighted average SRPG by dividing the individual SRPG for each soil type by the weighted average SRPG.

For example, the weighted average SRPG for a group of 45 soil types in Douglas County is 64.889.' The SRPG for Eudora Silt Loam soil in 2000 is 83. The indexed SRPG for this soil

type would be 1.279 (83/64.889).

Crop mix - A crop mix is the percentage of planted acres for each crop type in a county relative to the total planted acres in the county. This method establishes the typical cropping practice in a county and weights each crop according to its importance.' Only crops comprising five percent or more of the total planted acres for a county are considered in the calculations. The crop mix percentages are used to weight gross income and production expenses. The percentages are the same for each soil mapping unit in a given county.

For example, in 1988 there are 81,869 total planted acres in Douglas County which consists of 13,000' acres of wheat, 37,000 acres of soybeans, 23,569 acres of corn, 5,200 acres of sorghum and 3,100 acres of alfalfa. The percentage of each crop would be: wheat, 16 percent (13,000/81,869); soybeans, 45 percent (37,000/81,869); corn, 29 percent (23,569/81,869); sorghum, six (6) percent (5,200/81,869) and alfalfa, 4 percent (3,100/81,869) .Alfalfa would' be dropped from the final crop mix since any crop which is less than five (5) percent of the total planted acres is ignored. The eight (8) years worth of crop mix information is summed and divided by eight (8) to get a weighted average for each crop category which is used in the' agricultural use formula.

The final typical crop mix four (4) Douglas County in 2000 would be: wheat, 22.4 percent; soybeans, 43.7 per cent; corn, 22.2 percent and sorghum, 11.7 percent.

Yields -The source of yield information is the Kansas Agricultural Statistics (KAS) of the Kansas State Board of Agriculture. Yields for all crops are based on planted acres and are calculated by dividing the crop production for each crop by the total number of acres planted for the crop. The lone exception is alfalfa which uses harvested acres as the basis for calculating average yield per acre.

For example, if 24,000 bushels of wheat were harvested from the 600 acres planted in the county, the yield for that year would be 40 bushels per acres (24,000/600).The eight (8) years worth of yield information is summed and divided by eight (8) to get a weighted average for each crop category which is used in the agricultural use formula.

The 1998 yield numbers for Douglas County that will be added to rolling yield average are: wheat, 34.8 bushels per acre; sorghum, 75.4 bushels per acre; soybeans, 32.3 bushels per acre; corn, 93.9 bushels per acre and alfalfa, 3.1 tons per acre. The 1990 yields that were removed from the average were: wheat, 34.5 bushels per acre; sorghum 77.5 bushels per acre; soybeans, 25.1 bushels per acre and corn 94.8 bushels per acre.

Prices -The source of information is also the Kansas Agricultural Statistics. Each month the KAS collects the average monthly price paid to farmers for wheat, grain sorghum, corn and soybeans for each of the nine crop reporting districts in the state. They also collect the monthly price paid for alfalfa and sunflowers at the statewide level. These are the prices received by the farmer, and therefore, reflect any dockage or adjustment for quality or moisture content. In addition the KAS collects the percentage of the total crop sold during each month. The monthly prices were weighted with the percentage of the crop sold during the corresponding month. The sum of these weighted monthly prices is the weighted annual price for each crop.

For example, in the month of January the price for a bushel of wheat was \$4.25 and the percentage of the crop sold during the month was six (6) percent. The weighted monthly price per bushel would be 0.26 (4.25 x .06).' This calculation is done for each month and the weighted monthly prices per bushel are then summed to arrive at an annual weighted

price. The eight (8) years worth of annual weighted price information is summed and divided by eight (8) to get an annual weighted price average for each crop category which is used in the' agricultural use formula.

The average prices per bushel used in Douglas County in 2000 were: wheat, \$3.52; soybeans, \$6.10; corn, \$2.46 and sorghum, \$2.20. The average price of alfalfa was \$75.95 per ton. These numbers compare to the 1999 prices at: wheat, \$3.55; soybeans, \$6.08; corn, \$2.49 and sorghum, \$2.22. The average price of alfalfa in 1999 was \$74.67 per ton.

Landlord's share of crop - K.S.A. 79-1476 requires that the share of net income normally received by the landlord shall be used as the basis for determining agricultural income. Thus, the landlord's share of the crop is defined as the most frequently occurring arrangement for each county. What is currently used to determine this information is a lease arrangement study done in 1999 by the Department of Agricultural Economics at Kansas State University. This information is broken down by crop reporting districts. From that study, typically what is used as the landlord's share of the crop for this area is a one-third crop share or 33.33 percent.

Landlord's share of expenses - The same 1999 lease agreement survey conducted by KSU is the source of information used to determine the landlord's share of expenses. Other sources of expense information were a 1997 survey of customer applicators, 1998 KAS study of Kansas Custom Rates and 1998 KSU Farm Management Guide. Expenses such as fertilizer, herbicides, etc. were developed for each crop type. The total expenses for each crop type are calculated and then multiplied by the appropriate crop mix percentage to get a weighted landlord production cost.

For example, in district EC 80, the location of Douglas County, the landlord's percent of expenses for fertilizer was determined to be 28.1 percent. The total fertilizer expense for wheat in this district was \$22.34 per acre, therefore, the landlord's share of expenses per acre for wheat was \$6.28 ($\$22.34 \times .281$). When you add up the total landlord's share of expenses for wheat in the district you get a cost of \$8.66 per acre. The weighted landlord's production cost would then be \$1.94 ($\$8.66 \times .224$).

The total weighted landlord's share of expenses per acre for each of the crops in Douglas County for 2000 were: wheat, \$1.94; soybean, \$4.36; corn, \$3.30; sorghum, \$1.41. This compares to the 1999 expenses as follows: wheat, \$2.27; soybean, \$4.55; sorghum, \$1.74; corn, \$3.40.

Management fee - A management fee is calculated to account for the costs associated with business and managerial decisions. The fee is ten percent of the weighted landlord gross income, which according to KSU surveys and various farm management companies, is consistent with the current rates charged by farm management and consulting firms in Kansas.

Government program payments - PVD has excluded any government payments from the landlord's net income calculations. For example, land that is in the CRP program is treated as dryland but the government payments are not figured into the net income calculations.

Landlord's net income - This is the final product of the dryland formula and is the income value that is plugged into the income approach valuation formula for dryland. The landlord's net income is an eight year average.' It is divided by the capitalization rate to arrive at a value per acre for each dryland soil type.

Pastureland methodology :

Native and Tame grass formula:

Step #1: Cash rent x Indexed grazing rate = Indexed landlord's gross income

Step #2: Indexed landlord's gross income minus expenses (fence costs, maintenance costs, watering costs and management costs) = landlord's net rental income.

Indexed grazing rate - The grazing index measures the carrying capacity for each soil type and was developed by Kansas State University and the Natural Resource Conservation Service. Each soil type has a carrying capacity measured in animal unit months per acre.' Animal unit months are a measure of the forage producing capacity of the soil. It measures the amount of forage required for an animal unit for 30 days. An animal unit is based on a 1,000 pound mature cow and a calf, three to four months old that weans at 400 pounds. Several factors affect plant growth and forage production such as weather, soil characteristics (depth, texture, slope, fertility and moisture holding capacity) and plant stage of development. For each district the weighted average grazing index is calculated for both native and tame pasture. Each soil type in the county is then indexed by dividing the individual grazing rate for each soil type by the weighted average grazing index for the district.

For example, the weighted average tame grazing index for the district is 3.23. The tame' grazing index for Eudora Silt Loam soil is 5.10. The indexed tame pasture grazing rate would be 1.579 (5.10/3.23).

Rental rates - Cash rental rates are used to calculate the gross receipts the grassland will generate. Cash rental rates for native and tame grass were developed for each crop reporting district from a survey conducted by Kansas Agriculture Statistics.

Indexed landlord's gross income - This represents the rental value of the differing productivity levels for each soil type within the district. It is calculated by multiplying the indexed grazing rate for each soil type by the district rental rate.

For example, the district rental rate for tame grass in 2000 is \$18.20 per acre. The indexed' tame pasture grazing index for Eudora Silt Loam soil is 1.579. The indexed landlord's gross income for this soil type would then be \$28.73 (\$18.20 x 1.579).

Expenses - Four type of expenses are typically used in the pastureland formula. They are fencing costs, maintenance costs, livestock water costs and management fees.

Fence costs - Fence costs are calculated on a per acre basis and reflect the annual ownership cost of the durable asset which includes depreciation and interest costs. Since fence costs vary with the size of the pasture a standard pasture size was established for each crop reporting district. From a survey, conducted by the Kansas Agricultural Statistics, the mode, or most frequently occurring, pasture size was selected as the standard for each crop reporting district. Using only those surveys with the standard pasture size, the average feet of fence for that pasture size was determined. Also the cost per foot of fence is calculated by talking to suppliers of fencing materials across the state. These two pieces of information are used to calculate a total fence cost per acre (feet of fence per acre x cost per foot of fence). The annual ownership cost of the fence is then determined.' A 1997 pasture survey conducted by Kansas Agricultural Statistics indicated that only 50 percent of the amortized fence ownership costs should be used in the pastureland formula.

Maintenance costs - These costs are developed on a per acre basis. Included in these costs are fence maintenance, brush control and burning costs. Based on the pasture survey conducted in 1998 maintenance costs were determined to be 6.5 percent of the initial fence cost.

Livestock watering costs - These costs include such items as ponds, stock tanks, wells, windmills, spring development and hauling water and are calculated on a per acre cost. The KAS survey indicated that watering costs were \$0.70 per acre.

Management fee - The management fee is calculated to account for the costs associated with business and managerial decisions. A fee of ten percent per acre of gross rent was used in the formula and is consistent, according to a KSU survey and other various farm management companies, with the current rates charged by farm management and consulting firms in Kansas.

Landlord's net rental income - This is the final product of the pastureland formula and is the income value that is plugged into the income approach valuation formula. The landlord's net rental income is an eight year average. The value is divided by the capitalization rate to arrive at a value per acre for each pastureland soil type.

Capitalization rate:

The second part of the income approach valuation formula is the capitalization rate. The capitalization rate used in the agricultural use value methodology consists of several parts. First, there is the Federal Land Bank and Farm Credit Bank loan rate which is averaged over the last five years. For the valuation year 2000 the five year average is 8.94 percent.

Secondly, a percentage of 0.75 is mandated in the statutes to be added to the five year average loan rate. Next is the PVD director's discretionary increase. By statute the director can add up to an additional two percent to the capitalization rate. For the year 2000 the full two percent was added. This gives you the base capitalization rate for the state which is 11.69 percent in 2000.

The final step in the cap rate calculation is the addition of the county agricultural tax rate. This rate is developed by taking the county's average rural levy for each of the last eight years and multiplying that levy by the agricultural assessment rate of 30 percent to get an agricultural tax rate. The agricultural tax rates are then averaged over the eight year period to get the tax rate used in the cap rate formula. For 2000, that figure is 3.02 percent which makes the overall capitalization rate in the county 14.71 percent. That compares to an overall rate of 15.07 percent in 1999. In the income approach method a decrease in the capitalization rate typically leads to an increase in value.