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The Application and Use of Land Quality Ratings In the Valuation of Agricultural Land: An Evaluation of the South Dakota Experience

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Abstract

The development of land classification and soil productivity rating systems (SPR) are examined for their application to valuation of agricultural land in South Dakota, USA. The application of SPR data to land valuation work conducted by real estate appraisers, tax assessors, and economists are discussed along with an assessment of its benefits and limitations.

Introduction:

The soil science profession has pioneered the development of land quality rating systems for land use management purposes in the United States. Farm and ranch managers, forestry managers, land conservation professionals, and rural land valuation appraisers have been long time users of this information. More recently (1970s and 1980s), real estate tax assessors have been major users of land quality rating systems for assessment of agricultural land in many states in the United States. Increasing attention is devoted to incorporating environmental indicators in soil quality ratings.

In this paper, we briefly discuss the development of the major soil classification and soil productivity rating systems used in South Dakota. Next we discuss their specific use by land valuation professionals (rural land appraisers and real estate tax assessors). Third, we present our evaluation of the soil productivity rating system used in South Dakota, based on economic studies and our joint teaching (12 years) of a rural real estate appraisal class at South Dakota State University. Based on the South Dakota experience, we discuss potential uses and limitations of land quality rating systems.

Development of Land Classification and Soil Productivity Rating Systems:

Land classification and soil quality rating systems have been guided by the pragmatic concept of developing reliable science-based information systems for multiple users. The most comprehensive agricultural land classification system used in all states of the U.S. is the Land Capability Class (LCC) and subclass system developed by the U.S. Dept. of Agriculture Soil Conservation Service in the 1940s. Soils in most U.S. counties have been classified and mapped using this system. There are eight land classes in this system based on suitability of soils for different types of agricultural production. Soils in land class 1, 2, 3, and 4 are normally suitable for crop production, while soils in land classes 5, 6, and 7 are suitable for range or timber production. Soils in land class 8 have little or no value for agriculture, but often have value for environmental, recreational, or wildlife uses. As the Land Capability Class numerical ranking increases there are increasing limitations to crop, grass, or timber production. Subclass is used to designate the major hazard (if any) to agricultural production (erosion, high water table, root-restriction, or climatic factors).

In South Dakota the proportion of agricultural land in cropland or rangeland by soil mapping unit is strongly correlated with its land capability class. Nearly 90% of class I land is in crop production, compared to about 50% of class 4 land. More than 98% of class 5, 6 and 7 land is in range or forest uses.

Soil productivity ratings (SPR) were developed in South Dakota to compare relative productivity of different soils for crop and grass production. The main reason for dual emphasis on crop and grass production is 45% of South Dakotas agricultural land is used for crop production, while 55% is in range or timber production. Four steps used to calculate soil productivity ratings in this procedure are (Malo, 1999):

1. Determine comparative crop ratings for every soil mapping unit based on examination of typical yields for the major crops.
2. Determine a comparative range (grass) production rating for every soil type.
3. Calculate a balance-point factor (used to equate range ratings to crop ratings) by equating crop and grass production for land class 4 soils which are usually considered to be marginal for crop production and suitable for grass production.
4. Develop a soil productivity rating that reflects the highest and best use for each soil mapping unit. The final productivity rating varies from 0 to 100.

   Data used to construct the soil productivity ratings are crop and range yields under normal climatic conditions with average management, range species composition, and modern detailed soil survey information (Westin and Malo,1978). Soil productivity ratings have been available across South Dakota since the late 1970s (Malo and Westin, 1978).

Land Valuation Uses of Soil Productivity Rating Systems

Rural real estate appraisers and real estate tax assessors are two major direct users of soil productivity rating systems in their professional work. Many farmland market participants directly or indirectly use this information as an aid in determining purchase/ sale prices or cash rental rates.

In the United States, most real estate appraisers use the sales comparison, income-capitalization, and/or inventory approaches to estimating the market value of agricultural and forestry lands. In the sales comparison approach, the major valuation characteristics of comparable sale properties are matched and adjusted to the specific characteristics of the subject farm. Percent tillable acres and soil productivity ratings are usually two major adjustments used in the sales comparison approach. Since soil productivity ratings are derived from relative yields of crop and forage production, SPR ratings are sometimes indirectly used in the income approach if cash rental rate information is not available in the local market.

The most important use of land classification or rating systems is in the inventory approach to land valuation. In the **classical method** of land inventory valuation, the appraiser classifies agricultural fields by their dominant land use and land capability class and inventories the number of acres (hectares) in each land class. Unit values (per acre or hectare) is assigned to each land class based on investigation of unit sale prices of unimproved land parcels that is predominantly one land use / land capability class. The final appraisal estimate of market value is the weighted average of unit prices of each land class inventoried on the subject farm multiplied by the farm size.

A modern variant of the inventory method using soil productivity ratings is directly used by real estate tax appraiser and by many rural land appraisers. Procedures used in the **modern method** is to inventory the number of acres (or hectares) of each soil mapping unit, determine the soil productivity rating of the soil mapping unit, and calculate the weighted average soil productivity rating for the subject farm and for comparable sale farms. The weighted average SPR is determined from the proportion of farm acreage in each soil mapping unit. Relative unit market values are usually estimated by a linear relationship of soil productivity ratings to unit (per acre or hectare) sale prices of unimproved farmland sale parcels.

Agricultural land tax assessment in South Dakota is primarily based on market value of farmland parcels. Soil productivity ratings (and other factors) are used to determine the relative unit value of one farmland parcel to all other farmland parcels in the county. Sales price data from bona fide agricultural land sales within the past year are used to determine the overall unit value of farmland in a county, while the weighted average SPR assigned to each farm parcel is used to determine relative unit values. Tax assessors are required each year to maintain a median assessed value to sale price ratio between 85% and 100% which implies that overall average assessed value of agricultural land must be relatively close to and follow changes in market values.

Evaluation of Soil Productivity Rating Systems for Rural Land Value Estimation

Soil productivity ratings developed for use in South Dakota compare soils and should not change **relative** to each other with **fluctuations in economic conditions** as the ratings are based on physical and chemical properties of soils. Advancements in technology should not greatly alter the ranking of soils, because soils tend to behave similarly. The potential yield advantage of one soil over another does not usually change because a new form of fertilizer or a new grain variety has been developed. (Malo, 1999, pp. 2). Thus, soil productivity ratings can primarily be used to explain relative variation in agricultural land values in cross-sectional analyses, but cannot be used to forecast future directions in rural land values.

Soil productivity ratings usually serve as a proxy variable for net returns to farmland in economic studies of rural land values. Capitalized net returns are normally used in economic models (time series or cross sectional models) of farmland valuation. The strength of the relationship between SPR and rural land values depends on the proportional influence that agricultural production activities have on rural land values, compared to other attributes of rural landscapes for recreation, forestry, industrial or housing developments etc. A critical assumption of SPR is that agricultural production activity, crop or grass production, is the highest and best use of rural land.

Within the context of agricultural land values, soil ratings based on relative yields should have a nonlinear relationship to net returns and to sale price. The cost function for crop production across soil types is nonlinear with respect to crop yield, because many tillage and harvesting costs are incurred regardless of yield (productivity) level. However, on marginal lands the highest and best use is: (1) range land, or (2) switching cropping patterns to lower production cost crops (from corn/soybeans to small grains). This shift in crop/forage patterns across soil types is reflected in the SPR system and may increase the linear range between SPR and net returns.

Economic studies of agricultural land value relationships across South Dakota from 1975 1987 and 1995-1999, using different data sets, indicates **relative stability** of agricultural land values between the 66 counties during this period. The major exception was the increase in relative land values in the Black Hills region where considerable recreational development has occurred. Relative stability in unit (per acre) agricultural land values is present even though per acre land values (in nominal dollars) tripled during this period (Janssen, 1999 and 1988).

Econometric studies of cross-sectional farmland value relationships in various South Dakota counties has been conducted using comparable sales tract data. Characteristics examined included soil productivity ratings, percent tillable acres, location attributes, financing terms, and other variables. Stepwise multiple regression results indicated the tract SPR was the most important explanatory variable in the land valuation model. Variables included in the full model explained nearly 80% of the variation in per acre sale price, with SPR and SPR squared terms explaining nearly 45% of sale price variation (Swinson, 1984; Janssen, 1987). Results from another econometric study by Janssen and Haque (1986) using comparable sales data from all South Dakota counties confirmed the importance of productivity related variables as the major explanation of variation in per acre sale price from 1978 1984.

Agricultural productivity rating systems have been developed for most soil types in the major farming regions of the United States. The use of soil productivity rating approaches for estimating values of farmland in many states (including South Dakota) has led to refinement of the inventory approach in estimating market value of farmland. The development of microcomputer software that incorporates soils information with other geographic information of farms will probably lead to widespread use of more advanced techniques of estimating farmland values. Furthermore, it will be possible to develop environmental indices of land use and land quality at the farm parcel level.

Appraisers and other users should be cautioned against over reliance on land productivity rating systems as a proxy for land value ratings. In the West North Central region of the United States, land capability class and more precise land productivity rating systems are often highly correlated with variation in land market value, but the correlation is NOT perfect! Many factors besides soil productivity ratings and relative yields determine net returns to farmland and, especially, sale prices or market values of farmland. In particular, land productivity ratings based on relative crop/forage yields may not be highly correlated with land sale prices in rural areas subject to major urban/ suburban development and recreational development pressures.

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