Farmland Soil Potential Index (SPI)

Definition

The Soil Potential Index (SPI) is a tool to be used by the assessing officials to determine where in the farmland range of values, a specific property should be assessed. The SPI is a numerical rating of a soil's relative suitability for growing corn silage and grass legume hay in New Hampshire. These two crops were selected by agricultural specialists as being the two most representative crops grown in the state, from North to South and would be the best crops to use as indicators of a soil's ability to be farmed. Whether or not the soils in a particular region of the state are currently being used to grow such crops, all soil is evaluated equally on their agricultural potential if the soils were planted to these crops.

WHERE TO GET YOUR SPI

Farmland owners should reach out to their County Conservation District Office. To find your County Office go to http://www.nhacd.net/member-districts.html.

How to get your Soil Potential Index

1. The SPI may be obtained from the landowner's County Conservation District Office. Conservation Districts may charge a small fee for calculating the SPI. Landowners should first determine from their assessing officials where within the range of assessments their property is placed, then get an SPI, and then determine if using an SPI is beneficial to them. To find your County Office go to http://www.nhacd.net/member-districts.html. If the County Conservation District Office is unable to immediately provide the SPI for a particular parcel of land, they will provide a letter to the landowner stating that the SPI will be forthcoming. The landowner should give this letter to the assessing officials as notification that an SPI will be provided for this land. When the landowner receives the SPI, he should forward it to the assessing official so it may be applied in the farmland assessment calculation.
2. Once the landowner has provided the SPI, the assessing officials will apply the SPI to the assessment calculation until such time as a revised SPI is provided.
3. Cub 304.04(b) provides the formula for assessing farmland. Assuming an SPI of .60, the formula would calculate as follows:

High end of farmland range	$425
Low end of farmland range	- $25
Difference	$400
Sample SPI of .60	x .60
Subtotal	$240
Low end of range added back	+$25
Per acre assessed value	**$265**

4. The landowner must provide the SPI to the assessing officials in order for the assessors to apply it. Otherwise, the assessing officials may use their own discretion when assigning a valuation within the farmland assessment range.

Agricultural Buildings

1. The assessing officials shall apply Cub 303.02, the definition of building lot, when determining how much land must be left out of current use or removed from current use due to the presence of a building for agricultural purposes. The assessing officials must determine:

a. How much land is actually taken up by the building (the footprint of the building), and
b. How much contiguous land around the building is groomed, maintained or needed to support the building? (Also referred to as the curtilage.)

Soil Potential Index Addendum

The SPI is derived from indexes of soil production, cost of corrective measures, and the cost for continuing limitations. The SPI can be expressed by the equation: SPI = P -(CM+CL), where P is the index of production or yield capability, CM is the index of costs to apply corrective measures to overcome soil limitations and CL is the index of costs resulting from continued limitations. These calculations are completed for soils using corn silage as the indicator crop, and completed a second time using grass legume hay as the indicator crop. The resulting two values are then averaged to arrive at the final SPI value. In order to array all of the soils in New Hampshire according to their agricultural potential, a yield production standard was determined and assigned an SPI value of 100. The advantage to setting a production standard at 100 is that the best agricultural soils in the state will have an SPI of 100 and all other soils arrayed in descending values. Ranking all soils from best to worst on a scale of 100 to 0, provides an easy to understand basis for comprehending relative suitability.

This process of determining SPI has resulted in a consistently applied evaluation process that is scientifically sound and legally defensible. This is not to say that current SPI values will never need further refinement. As the soil science community continues to make technological advancements and expands the knowledge base from which soil behavioral characteristics are determined, there will most likely be a need to re-visit the current SPI system.

Production Standard

The production standard was established and defined by a committee of agricultural specialists. The standard used in New Hampshire is that soil which has those soil properties that assure the highest yield. The standard soil for corn silage and grass legume hay is a well-drained, moderately permeable soil that does not have rock fragments in the surface layer. It is very deep to bedrock, has a high available water holding capacity, is on a slope of less than 3 percent, and has a mean annual temperature at 20 inches greater than or equal to 47 degrees F (mesic). This combination of soil properties will produce the highest yields per acre and the soil has the capacity for sustained high production, year to year, without applying any corrective measures under good management and without damaging the resource base. The production standard in New Hampshire assumes that the soil is intensively managed for corn silage or grass legume hay. Farming operations are timely, lime and fertilizer are applied according to soil analysis, and soil erosion is kept at or below the allowable soil loss value.

Soil Evaluation Factors

Seven soil evaluation factors are used to determine soil potential ratings. The evaluation factors include slope, available water holding capacity in the upper 40 inches, depth to bedrock, rock fragments in the surface layer, water table level, soil permeability, and mean annual soil temperature. Each of these factors may have detrimental effects that can impact the production of corn silage and grass legume hay in New Hampshire. Other soil factors were considered in the evaluation process such as flooding hazard, soil pH, and contrasting inclusions within soil map units. After lengthy review by a committee of agricultural specialists, it was determined these factors should not be used either because there is little

overall impact on agricultural land, there is very little variation in New Hampshire soils and the incorporation of these factors into the evaluation process would add considerable complexity and the end result would not significantly change the overall ranking, or SPI, of the soil.

SPI and Prime Farmland

For many years, the USDA Soil Conservation Service has defined and identified prime farmland soils. These soils are considered to be the best soils for the production of food and fiber. Prime farmland soils in New Hampshire have a range in SPI ranking from 68 to 100 which gives the appearance of inconsistency when some prime farmland soils are rated at 100 and others only at 68. Although there appears to be an apparent conflict, one needs to keep in mind the difference in the process used to arrive at the different ratings and what they mean.

The most significant difference between the two rating systems is that the economics of overcoming soil limitations and costs of continuing limitations are not factors in the determination of prime farmland, but is a major factor in determining SPI. Also, one needs to keep in mind that the SPI number assigned to any soil has no real meaning or value except to provide a relative placement among all soils in the state. The SPI rating system uses a much finer breakdown in soil physical properties than does the prime farmland rating system. For example, for a soil to qualify as prime farmland, the soil either "has no water table, or has a water table that is maintained at a sufficient depth during the growing season to allow cultivated crops common to the area to be grown".

In the SPI rating system, the water table factor is separated into eight divisions based on the severity of the limitation and any economic losses due to continuing limitations. Based on the water table factor alone, prime farmland soils can have an SPI value ranging from 100 to 78. If one adds to this, the cost factor of removing stones from year to year, and subtracting points for frigid temperature regime, the SPI's for some prime farmland soils can drop into the low 70's or upper 60's.

History of Soil Potential Index

The SPI method of placing farmland values within a range is not solely a NH activity; many states use the SPI method to place farmland with ranges of programs similar to NH’s Current Use program. Using an SPI gives municipalities, a legal, scientific, and defensible way to place farmland into the Current Use range; landowners will know that their land is being correctly placed within the categories.

In 1974 the New Hampshire legislative session passed a long awaited and hard-fought-for Current Use Assessment Law (RSA 79-A). The purpose of this legislation was in the interest of reducing the conversion of open space to more intensive use and encouraging preservation of open space through property taxation based on current use. In order to apply equitable tax assessment to all open land, the New Hampshire Department of Revenue (DRA) adopted the soil potential index rating system (SPI) developed by the USDA Soil Conservation Service in 1988. This system, which ranks the soils of New Hampshire based on their agricultural suitability, was originally established for use in a Land Evaluation and Site Assessment (LESA) system for use as a planning tool by resource conservationists, planners and city and town officials.

The Legislative Rules committee revised the definition of lands that fall under the current use law for the 1992 tax year, this created an incentive to enhance the SPI rating system for that year as well.

The enhancement of the old system was conducted over an eight month period from October 1991 to May of 1992. Many of the basic principles developed in 1988 for the LESA system are still valid today for application in the soil potential index system and no attempt was made to adjust or revise this criteria. Many committees and groups of specialists were organized in 1988 to develop the initial ranking of soils and no effort was made during this enhancement to revise the work accomplished by these committees.

Development of Soil Potential Ratings (SPI)

There are more than 1,700 different soil map units recognized in New Hampshire. All of the SPI ratings were calculated manually. Although the USDA Soil Conservation Service (SCS)has a soil properties database that stores physical property data, some of the criteria used in the SPI calculations required expert decisions not currently possible with present day technology. This manual process was completed by the SCS soils staff in Durham, New Hampshire and forwarded to eight soil scientists around the state for review and cross checking. Each soil was compared against similar soils with similar properties to assure similar SPIs. Groups of soils occurring within small geographic areas were compared against one-another to assure reasonableness in the relative ranking. And all soils within a published soil survey area were reviewed for consistency and compatibility

Flood prone soils in New Hampshire do not normally flood during the growing season. Almost all of the soils in New Hampshire have similar soil reaction properties to 20 inches. Contrasting inclusions are expected components of every map unit; when assessing these inclusions for SPI, some have higher SPI values, some lower. After evaluating several map units based on type and extent of inclusions, it was determined that overall SPI ranking does not change appreciably from the SPI of the named soil.

Upland glacial till soils recognized as non-stony because the stones have been removed, cannot be easily separated in the database from soils that are inherently stone-free. Also, Tables 1A through 2F describe critical breaks in certain soil properties that are not easily discernable in the database. For example, available water holding capacity in the upper 40 inches of soil have critical breaks at 3.2 inches of water, 2.8 inches of water and 2.4 inches of water. Some of the soils recognized in New Hampshire are described as having a range that spans both sides of a critical break. In situations like this, the soil scientists researched actual field documentation and conferred on a decision to place this particular soil feature on one side of the critical break or the other.

SPI Corrective Measures and Continuing Limitations

Since the costs of corrective measures are total initial costs and costs resulting from continuing limitations are annual, economic analysis or amortization was used to derive a common basis for the corrective measures and continuing limitations. Amortization is sometimes called the partial payment or capital recovery factor. This factor will convert capital or initial cost to annual cost. It will determine what annual payment including interest must be made to pay off the initial cost over a given number of years.

For soils with yields less than the standard, the lower yield was considered a continuing limitation equal to a factor representing the amount of yield that was below the standard. This was necessary to account for a lower yield that was not overcome by corrective measures.

A committee of landowners, contractors and specialists provided data on costs for corrective measures and for most of the continuing limitations. All of the assumptions and sources of information were documented so that individuals who use the ratings would understand that some of

the measures are not absolute measures of performance. Sloping land and high inherent erodibility (K) require measures to protect the soil against erosion. Protection can be provided through either no-till, a diversion system, strip-cropping, or crop rotation. The local committee estimated the costs for these corrective measures with the basic intent that each measure would ensure that erosion did not exceed the allowable soil loss. Continuing limitations were identified as operation and maintenance costs and the cost resulting from reduced yields.

The cost for corrective measures for seasonal high water table and soil permeability were estimated using the New Hampshire Soil Conservation Service Drainage Guide. Three permeability groupings were used to calculate costs. These costs reflect subsurface tile drainage systems that have closer spacing as the soil permeability becomes less. The continuing limitation costs were identified as maintenance costs for the tile drainage system and the cost resulting from reduced yields.

Current state and federal land use regulations pertaining to wetlands were not considered in the calculation of SPI for the following reasons. The new SPI values are based on soil physical properties only; land-use regulations do not affect a soil's potential or suitability for a given use. Land-use regulations are subject to change which could result in dramatic variations in SPI values whenever the legislature was so inclined. Most wetlands in New Hampshire are not farmed and are classified as wildlife habitat and do not fall under current-use laws. There are a few areas of farmed wetlands in New Hampshire and those that are farmed obviously have some agricultural value.

Rock fragments in the surface layer are a very common limitation in the upland glacial till soils in New Hampshire. The typical corrective measure is removal of the large fragments that hamper tillage operations. After the corrective measure is complete, there is a continuing limitation of operation of equipment because rock fragments continue to work their way to the surface by frost action. The continuing limitation of stones is more severe when the land is planted to corn rather than hay because of the wear and tear on tillage implements.

There are no feasible corrective measures for some soil limitations such as available water holding capacity and depth to bedrock. For these soils, costs are based on reduced yields and treated as a continuing limitation. Since irrigation is not a typical corrective measure in New Hampshire, no corrective measure is assessed for the available water holding capacity soil limitation. Soils with low or very low available water capacity yield less than the standard, therefore the reduced yield is a continuing limitation. No corrective action is feasible to alter the depth to bedrock therefore the cost of reduced yields is used as a continuing limitation.

There are no corrective measures for soil temperature. It has been documented, however, that soils with a mesic soil temperature regime (mean annual soil temperature greater than or equal to 47 degrees F.) have higher yields for crop production than soils with a frigid soil temperature regime occurring in slightly colder climates if all of the other soil evaluation factors and soil and site conditions remain the same. Therefore, delayed planting and reduced yield are considered a continuing limitation for soils that have a frigid soil temperature. Some soils, in the higher elevations in New Hampshire have a temperature regime cold enough to be considered unsuitable for cropland.

Some soil limitations such as steep slopes and extremely stony cover have no realistic corrective measure. A cost index is assigned as a continuing limitation for soils occupying these areas.

Deriving Corrective Measures and Continuing Limitations for SPI

Since amortization was used on the corrective measure cost, corrective measure costs are in effect annual costs. The continuing limitation costs are also annual costs. Therefore, the costs for calculating an SPI index are on an equal basis.

A committee of agricultural specialists accepted the "worst case-scenario" to derive indexes whereby all of the costs for corrective measures and continuing limitations were summed for the soil map unit with the most soil limitations.