

# Land Use Classification

Age: 11-14 years old (grades 6-8), but may be adapted for youth 15-19 (grades 9-12)

## **Objectives:**

1. Members/students will know and understand that soils are named and classified scientifically, called taxonomy, in a way that is similar to animals. Soils are also given common names to ease regular use.
2. Members/students will be able to locate a specific location in their county using the web-based soil survey and successfully navigate the website to find specific soil information for that location.
3. Members/students will apply suitabilities and limitations for use information related to the location's current use to evaluate, from a soils only perspective, whether the location is desirable or suitable for that use. Members/students will take into account building site development, aircraft landing site development, recreational development, and sanitary facilities data and determine the applicability and importance of each resource in explaining their recommendation regarding land use.
4. Members/students will learn to use land capability classifications to make generalizations regarding the suitability of crop categories and the quantity of adaptations or modifications necessary for this land use.
5. Members/students will obtain soil-related yield data and use it and basic algebra principles to predict an average crop yield for the entire location.

## **Resources Needed:**

- Computers for members/students (recommend at least 1 computer for 3 members/students) with Internet access
- Web-based Soil Survey available at: <http://websoilsurvey.nrcs.usda.gov/app/>

## **Preparation:**

1. Select sites within your county that is easy to identify from aerial maps. A site with or without contiguous properties should be roughly 40-180 acres. Suggestions include school grounds, large parks (but not those covered mostly with water), airports, industrial sites or fields at junctions of major roads. Locate enough sites so that each group of 2-3 students has a different site or so that no more than 2 groups have the same site.
2. Go to <http://websoilsurvey.nrcs.usda.gov/app/> and select the green "Start WSS" button.
3. Navigate the web soil survey to find and select each of the predetermined locations.

Top Tab: Area of Interest (AOI)

Navigate By...

State and County

Select "Kansas" then your county and click "View" button

4. Copy and paste the map with the entire county into a word processing or presentation document and put a mark (star, X, etc.) where they will generally need to zoom

toward. To copy and paste you will need to select the “hand” tool at the top of the map. Then right click and choose copy.

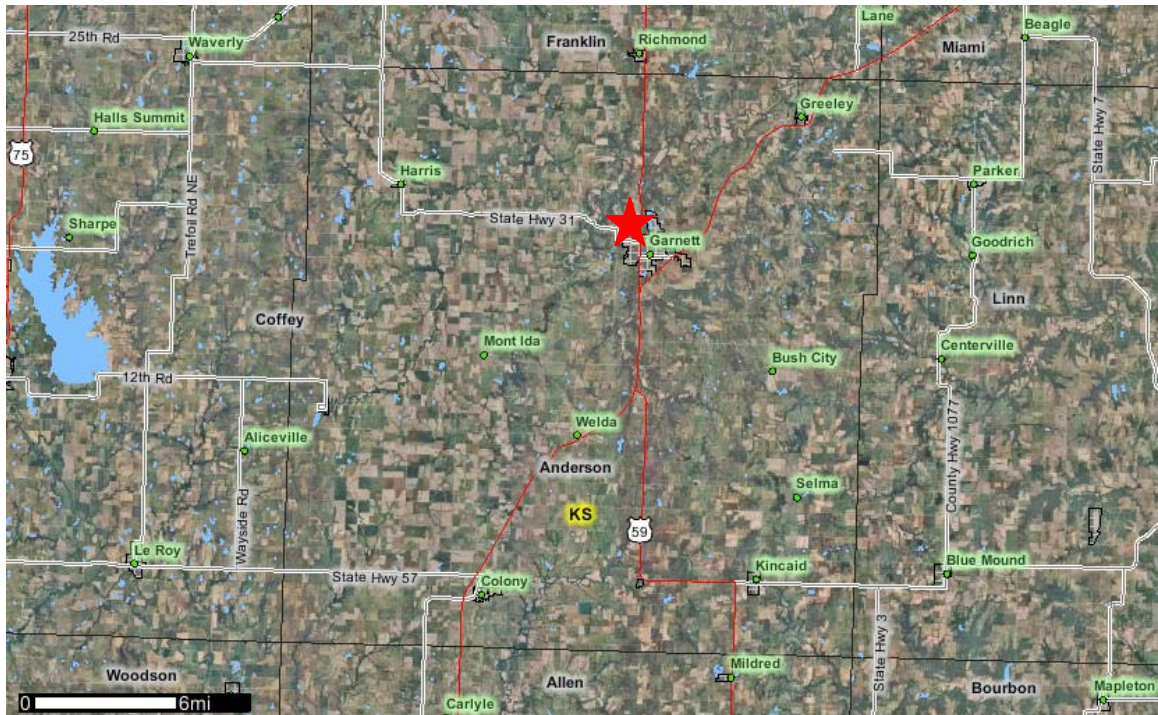
### Area of Interest Interactive Map

Zoom in – button: Magnifying glass +

Select Area of Interest (AOI) – button: AOI rectangle or AOI polygon (double click or Ctrl click to close polygon)

5. Next copy and paste a map with the area of interest (AOI) marked. For example, you may want to provide each group with a worksheet. See figure below.

Anderson County Junior Senior High School





6. Try navigating through the “Soil Map” and “Soil Data Explorer” – secondary tab “Suitabilities and Limitations for Use” tabs for at least one selected site (AOI) to familiarize yourself with the website navigation. See the navigation reference notes in the “Content” portion of this lesson plan. Notes pages are provided at the end of this lesson that you can hand out to students.

### **Interest Approach:**

- Question members/students and brainstorm ideas
  - If you were in charge of choosing sites for a new home, a school, a park, an airport, or an agricultural field, what about soils might influence your decision?  
**Brainstorm:** erosion risk, slope, clay content (shrink-swell potential), depth to water table, flooding potential, depth to bedrock, rocky/stony, water infiltration, dusty surface, organic matter content, etc.  
**Note:** Do not expect members/students to be able to come up with all of these, but by reading the “View Description” statements as part of the lesson, they should recognize them as part of the lesson.
  - You are a farmer and want to buy an agricultural field to add to your operation. Where can you find some general information about soil similarities and differences to farm fields you already manage? What if you want to build a rural home?  
**Brainstorm:** talk to current owner, ask neighbors, soil test, obtain soil survey information, etc.  
**Note:** The soil survey is the answer we are trying to achieve, but most members/students will not know that it is done.

### **Content:**

- Explain the project to members/students. The soil survey has been an important tool for many years for farmers, engineers, land use planners, etc. Until recently, soil surveys were a published book for each county in the state (of Kansas) and nearly every county throughout the United States. Now soil survey information is available online.

The NRCS (Natural Resource Conservation Service) is the government agency in charge of the soil survey. Information provided in the soil survey includes maps, soil series names and locations, soil types, slope range (i.e. 1-3%), building site development, construction materials, disaster recovery planning, land classifications, land management, military operations, recreational development, sanitary facilities, vegetative productivity, waste management, and water management resources.

Soils are classified scientifically in a way similar to animals called taxonomy. These are the way to officially name soils, but just like animals, soils also have a common name. In soils there are series names with soil type and examples include Kenoma silt loam, Eram silty clay loam, and Summit silty clay loam. (In Kansas, Harney silt loam is the state soil.) We are going to use the soil survey to learn how soils can or should impact land use.

- Experience: Go to the web-based soil survey at: <http://websoilsurvey.nrcs.usda.gov/app/> Click the green “Start WSS” button.
- Share: By working in teams, students will be able to talk about and discuss how soil properties impact land use decisions. Provide each member/student group with information on how to find a predetermined site within your county. See information in the “Preparation” portion of this lesson plan. Also provide the following website navigation tips/notes.

Top Tab: Area of Interest (AOI)

Navigate By...

State and County

Select “Kansas” then your county and click “View” button

Area of Interest Interactive Map

Zoom in – button: Magnifying glass +

Select Area of Interest (AOI) – button: AOI rectangle or AOI polygon (double click or Ctrl click to close polygon)

Do not be alarmed when you see the statement in the box below. Although it is correct, the 1:24,000 mapping scale covers too large an area to see any detail. The exact placement of the soil series boundaries are not a major concern to us. We just need some “real” soils to work with.



 **Warning: Soil Map may not be valid at this scale.**

You have zoomed in beyond the scale at which the soil map for this area is intended to be used. Mapping of soils is done at a particular scale. The soil surveys that comprise your AOI were mapped at 1:24,000. The design of map units and the level of detail shown in the resulting soil map are dependent on that map scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

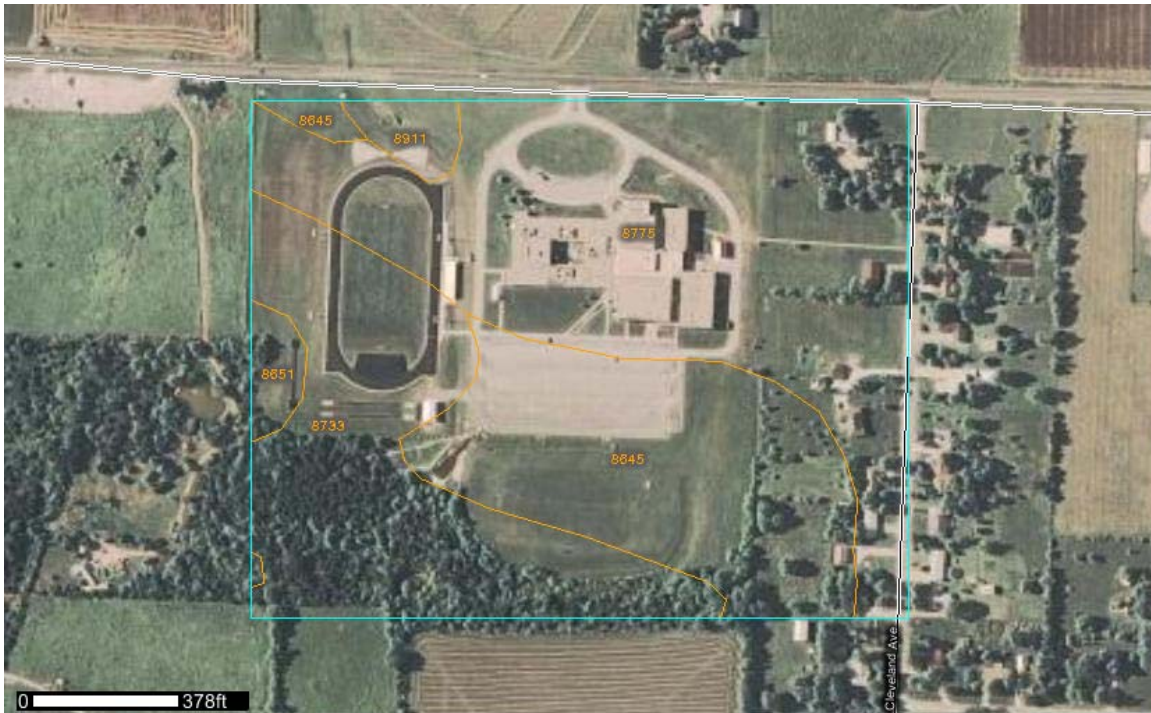
- Once you have selected an area of interest (AOI), you can find out the soil series information for your site. See the following navigation notes.

#### Top Tab: Soil Map

If you click and highlight the data table with the soils, you can go to Edit, Copy within your web browser and then paste the table into a word processing or presentation document.

| Map Unit Symbol             | Map Unit Name                                 | Acres in AOI | Percent of AOI |
|-----------------------------|---|--------------|----------------|
| 8645                        | Catoosa silt loam, 1 to 3 percent slopes      | 12.8         | 25.0%          |
| 8651                        | Clareson complex, 1 to 3 percent slopes       | 0.9          | 1.8%           |
| 8733                        | Eram silty clay loam, 1 to 3 percent slopes   | 13.5         | 26.4%          |
| 8775                        | Kenoma silt loam, 1 to 3 percent slopes       | 23.0         | 44.9%          |
| 8911                        | Summit silty clay loam, 1 to 3 percent slopes | 1.0          | 1.9%           |
| Totals for Area of Interest |   | 51.3         | 100.0%         |

If you click on the button above the map with the “hand” tool and then put the cursor over the map, you can right click and use “Save Picture As...” to obtain a digital copy of the map. You may also right click and choose copy and then paste it into a word processing or presentation document.



- Look at the soil taxonomic names. These navigation tips will help you locate them.

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Land Classifications

Soil Taxonomy Classification

Click button “View Rating”

| Map unit symbol             | Map unit name                                 | Rating  | Acres in<br>AOI | Percent of<br>AOI |
|-----------------------------|---|---|-----------------|-------------------|
| 8645                        | Catoosa silt loam, 1 to 3 percent slopes      | Fine-silty, mixed, active, thermic Typic Argiudolls | 12.8            | 25.0%             |
| 8651                        | Clareson complex, 1 to 3 percent slopes       | Clayey-skeletal, mixed, thermic Typic Argiudolls    | 0.9             | 1.8%              |
| 8733                        | Eram silty clay loam, 1 to 3 percent slopes   | Fine, mixed, thermic Aquic Argiudolls               | 13.5            | 26.4%             |
| 8775                        | Kenoma silt loam, 1 to 3 percent slopes       | Fine, smectitic, thermic Vertic Argiudolls          | 23.0            | 44.9%             |
| 8911                        | Summit silty clay loam, 1 to 3 percent slopes | Fine, smectitic, thermic Oxyaquic Vertic Argiudolls | 1.0             | 1.9%              |
| Totals for Area of Interest |   |   | 51.3            | 100.0%            |

- Process: Once you have found the taxonomic names of the soils on your site, follow these navigation tips to find out information regarding the suitabilities and limitations for the soils included on your site. First you will consider land uses other than agriculture. You will need this information to answer question 1 of your assignment.

If you click “View Description” you will see paragraphs explaining what factors relate to the soil series use classification. These descriptions may be especially valuable when explaining why you feel a site is or is not good for its current use.

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Building Site Development

Dwellings with basements

Dwellings without basements

Lawns, Landscaping, and Golf Fairways

Small Commercial Buildings

Click button “View Description”

Click button “View Rating”

\* Note – little double up arrow in circle in the tab’s right hand side will close the expanded table

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Military Operations

Helicopter Landing Zones

Click button “View Rating”

\* Note – little double up arrow in circle in the tab’s right hand side will close the expanded table

\* Note – soil suitabilities and limitations similar to those for a small airport landing strip

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Recreational Development

Camp Areas

Paths and Trails

Playgrounds

Click button “View Rating”

\* Note – little double up arrow in circle in the tab’s right hand side will close the expanded table

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Sanitary Facilities

Septic Tank Absorption Fields

Sewage Lagoons

Click button “View Rating”

\* Note – little double up arrow in circle in the tab’s right hand side will close the expanded table

- Generalize: Next we will consider this site for a farm field. See assignment question number 2. Pay particular attention to the “Non-irrigated Capability Class” “View Description” information. It will tell you what the ratings of 1-8 mean or suggest in regards to farm use. The following tips and examples will help you navigate and find this information on the web soil survey.

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Land Classifications

Non-irrigated Capability Class

Click button “View Description”

Click button “View Rating”

Land Capability Class Description:

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations that show suitability and limitations of groups of soils for rangeland, for woodland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels-capability class, subclass, and unit. Only class and subclass are included in this data set.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have few limitations that restrict their use.

Class 2 soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.



Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

| Map unit symbol             | Map unit name                                 | Rating | Acres in AOI | Percent of AOI |
|-----------------------------|---|--------|--------------|----------------|
| 8645                        | Catoosa silt loam, 1 to 3 percent slopes      | 2      | 12.8         | 25.0%          |
| 8651                        | Clareson complex, 1 to 3 percent slopes       | 6      | 0.9          | 1.8%           |
| 8733                        | Eram silty clay loam, 1 to 3 percent slopes   | 3      | 13.5         | 26.4%          |
| 8775                        | Kenoma silt loam, 1 to 3 percent slopes       | 3      | 23.0         | 44.9%          |
| 8911                        | Summit silty clay loam, 1 to 3 percent slopes | 2      | 1.0          | 1.9%           |
| Totals for Area of Interest |   |        | 51.3         | 100.0%         |



Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Land Classifications

Non-irrigated Capability Subclass

Click button "View Description"

Click button "View Rating"

Capability Subclass Description:

Capability subclasses are soil groups within one capability class. They are designated by adding a small letter, "e," "w," "s," or "c," to the class numeral, for example, 2e. The letter "e" shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; "w" shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); "s" shows that the soil is limited mainly because it is shallow, droughty, or stony; and "c," used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by "w," "s," or "c" because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, forestland, or wildlife habitat.

| Map unit symbol             | Map unit name                                 | Rating | Acres in AOI | Percent of AOI |
|-----------------------------|---|--------|--------------|----------------|
| 8645                        | Catoosa silt loam, 1 to 3 percent slopes      | e      | 12.8         | 25.0%          |
| 8651                        | Clareson complex, 1 to 3 percent slopes       | s      | 0.9          | 1.8%           |
| 8733                        | Eram silty clay loam, 1 to 3 percent slopes   | e      | 13.5         | 26.4%          |
| 8775                        | Kenoma silt loam, 1 to 3 percent slopes       | e      | 23.0         | 44.9%          |
| 8911                        | Summit silty clay loam, 1 to 3 percent slopes | e      | 1.0          | 1.9%           |
| Totals for Area of Interest |   |        | 51.3         | 100.0%         |



- Apply: One especially useful feature of the web-based soil survey for farmers is the “Vegetative Productivity” “Yields of non-irrigated crops (component).” This feature returns data for 8 different crops in terms of bushels (bu), tons, or animal unit months (AUM), whichever is appropriate. Yield data should be considered relative or used to compare two different soils. The description even states: “The estimated yields reflect the productive capacity of each soil for the selected crop. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.” The following are navigation notes for this data.

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Vegetative Productivity

Yields of non-irrigated crops (component)

Basic Options – Crop (pull down selection menu)

Choices:

Alfalfa hay

Corn

Grain Sorghum

Improved bermudagrass

Soybeans

Tall fescue

Warm season grasses

Winter wheat

### Corn (bu/a)

| Map unit symbol             | Map unit name                                 | Rating | Acres in AOI | Percent of AOI |
|-----------------------------|---|--------|--------------|----------------|
| 8645                        | Catoosa silt loam, 1 to 3 percent slopes      |        | 12.8         | 25.0%          |
| 8651                        | Clareson complex, 1 to 3 percent slopes       |        | 0.9          | 1.8%           |
| 8733                        | Eram silty clay loam, 1 to 3 percent slopes   |        | 13.5         | 26.4%          |
| 8775                        | Kenoma silt loam, 1 to 3 percent slopes       | 75.00  | 23.0         | 44.9%          |
| 8911                        | Summit silty clay loam, 1 to 3 percent slopes | 60.00  | 1.0          | 1.9%           |
| Totals for Area of Interest |   |        | 51.3         | 100.0%         |

### Soybeans (bu/a)

| Map unit symbol             | Map unit name                                 | Rating | Acres in AOI | Percent of AOI |
|-----------------------------|---|--------|--------------|----------------|
| 8645                        | Catoosa silt loam, 1 to 3 percent slopes      | 25.00  | 12.8         | 25.0%          |
| 8651                        | Clareson complex, 1 to 3 percent slopes       |        | 0.9          | 1.8%           |
| 8733                        | Eram silty clay loam, 1 to 3 percent slopes   | 25.00  | 13.5         | 26.4%          |
| 8775                        | Kenoma silt loam, 1 to 3 percent slopes       | 28.00  | 23.0         | 44.9%          |
| 8911                        | Summit silty clay loam, 1 to 3 percent slopes | 35.00  | 1.0          | 1.9%           |
| Totals for Area of Interest |   |        | 51.3         | 100.0%         |

### Winter Wheat (bu/a)

| Map unit symbol             | Map unit name                                 | Rating | Acres in AOI | Percent of AOI |
|-----------------------------|---|--------|--------------|----------------|
| 8645                        | Catoosa silt loam, 1 to 3 percent slopes      | 30.00  | 12.8         | 25.0%          |
| 8651                        | Clareson complex, 1 to 3 percent slopes       |        | 0.9          | 1.8%           |
| 8733                        | Eram silty clay loam, 1 to 3 percent slopes   | 25.00  | 13.5         | 26.4%          |
| 8775                        | Kenoma silt loam, 1 to 3 percent slopes       | 35.00  | 23.0         | 44.9%          |
| 8911                        | Summit silty clay loam, 1 to 3 percent slopes | 40.00  | 1.0          | 1.9%           |
| Totals for Area of Interest |   |        | 51.3         | 100.0%         |

### Tall Fescue (AUM)

| Map unit symbol             | Map unit name                                 | Rating | Acres in AOI | Percent of AOI |
|-----------------------------|---|--------|--------------|----------------|
| 8645                        | Catoosa silt loam, 1 to 3 percent slopes      |        | 12.8         | 25.0%          |
| 8651                        | Clareson complex, 1 to 3 percent slopes       |        | 0.9          | 1.8%           |
| 8733                        | Eram silty clay loam, 1 to 3 percent slopes   | 5.50   | 13.5         | 26.4%          |
| 8775                        | Kenoma silt loam, 1 to 3 percent slopes       | 5.00   | 23.0         | 44.9%          |
| 8911                        | Summit silty clay loam, 1 to 3 percent slopes | 6.00   | 1.0          | 1.9%           |
| Totals for Area of Interest |   |        | 51.3         | 100.0%         |

### Summary:

- Soils are given “common” names and taxonomic names.
- The soil survey can be used for land use decisions involving homes, buildings, industrial sites, parks, farm fields, etc.
- Capability classes are a general way of classifying soils in regards to agricultural field use. Classes 1-4 are suited for annual crops, while 5-8 are best for pasture, hay fields, woodlands, etc. The higher the class number, the greater the number of limitations and challenges present for use. Also higher class numbers require a greater number of modifications or management practices for appropriate use.

### Assessment/Assignment:

1. Consider what the site is being used for currently. Is it a school ground, large park, airport, industrial site, etc.? If it is an agricultural field, for purposes of this question consider it a home site. Considering soils and soil properties alone, would you have selected this site for its current use? Why or why not? Keep in mind that in some areas, all soils will have at least some limitations. Make your decision based on your evaluation of the limitations. In other words, are some considerations not as important as others and/or are the most important factors at least not categorized as “very limited?” Consider the categories mentioned under “Building Site Development,” “Military Operations,” “Recreational Development” and “Sanitary Facilities.” Copy and paste at least three tables and maps sharing data that influenced your decision.
2. If your site was to be used as an agricultural field, based on soils and soil properties alone, would it be suitable for annual crops such as corn, soybeans, winter wheat, grain sorghum, etc. What are the land capability class(es) and subclass(es) and how did they influence your decision? Copy and paste the appropriate tables and maps to support your choice. Would these soils be as good or better suited to perennial forage crops like improved bermudagrass, tall fescue, or warm season grasses? Why? Alfalfa hay is also a perennial forage crop, but it is not as long-lived and is usually rotated with annual crops. Based on your analysis, choose either an annual crop or



perennial forage crop to “plant.” Copy and paste the table for the expected or relative yields. If you planted the portion of your site with soil-based yield data to that crop, what would you expect as an average yield? Hint: use algebra

Soybeans

$$12.8+13.5+23.0+1.0=50.4$$

$$(25*12.8)+(25*13.5)+(28*23.0)+(35*1.0)=$$

$$320+337.5+644+35=1336.5$$

$$1336.5/50.4=26.5 \text{ bu/a}$$

# Land Use Classification Activity

## Web Soil Survey Navigation Notes

<http://websoilsurvey.nrcs.usda.gov/app/> Click the green “Start WSS” button.

Top Tab: Area of Interest (AOI)

Navigate By...

State and County

Select “Kansas” then your county and click “View” button

Area of Interest Interactive Map

Zoom in – button: Magnifying glass +

Select Area of Interest (AOI) – button: AOI rectangle or AOI polygon (double click or Ctrl click to close polygon)

Top Tab: Soil Map

If you click and highlight the data table with the soils, you can go to Edit, Copy within your web browser and then paste the table into a word processing or presentation document.

If you click on the button above the map with the “hand” tool and then put the cursor over the map, you can right click and use “Save Picture As...” to obtain a digital copy of the map. You may also right click and choose copy and then paste it into a word processing or presentation document.

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Land Classifications

Soil Taxonomy Classification

Click button “View Rating”

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Building Site Development

Dwellings with basements

Dwellings without basements

Lawns, Landscaping, and Golf Fairways

Small Commercial Buildings

Click button “View Description”

Click button “View Rating”

\* Note – little double up arrow in circle in the tab’s right hand side will close the expanded table

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Military Operations

Helicopter Landing Zones

Click button “View Rating”

\* Note – little double up arrow in circle in the tab’s right hand side will close the expanded table

\* Note – soil suitabilities and limitations similar to those for a small airport landing strip

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Recreational Development

Camp Areas

Paths and Trails

Playgrounds

Click button “View Rating”

\* Note – little double up arrow in circle in the tab’s right hand side will close the expanded table

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Sanitary Facilities

Septic Tank Absorption Fields

Sewage Lagoons

Click button “View Rating”

\* Note – little double up arrow in circle in the tab’s right hand side will close the expanded table

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Land Classifications

Non-irrigated Capability Class

Click button “View Description”

Click button “View Rating”

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Land Classifications

Non-irrigated Capability Subclass

Click button “View Description”

Click button “View Rating”

Top Tab: Soil Data Explorer

Secondary Top Tab: Suitabilities and Limitations for Use

Vegetative Productivity

Yields of non-irrigated crops (component)

Basic Options – Crop (pull down selection menu)

Choices:

Alfalfa hay

Corn

Grain Sorghum

Improved bermudagrass

Soybeans

Tall fescue

Warm season grasses

Winter wheat

### **References:**

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at <http://websoilsurvey.nrcs.usda.gov/> accessed [02/09/2011].

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