Utility Rating Exercise Description
February 3, 2011

Utility Rating Exercise: Description

We have provided you with an Excel workbook that contains two worksheets: 1_RatingExercise and 2_RatingExample. Worksheet 1 contains an exercise we would like you to complete, while worksheet 2 contains an example to demonstrate the exercise.   Your responses to this exercise will provide us with the information we need to complete the utility function. Based on your responses to the Curve exercise we asked you complete back in December, we determined the state structure and the slope of the values along the diagonal of the Rest matrix (figure 1). This Rating exercise will help us ascertain the values of the four corners of the Rest matrix and the four corners of the Burn/Graze matrix (figure 2). These eight corner values, along with the diagonal, will allow us to populate all of the utility matrix values by interpolation methods.
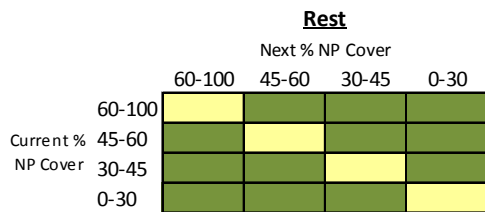

Figure 1: Utility matrix for Rest, highlighting the diagonal. The Curve exercise completed in December provided the necessary information to determine the appropriate divisions of the native cover for the state structure, and to determine the values along the diagonal of the utility matrix.
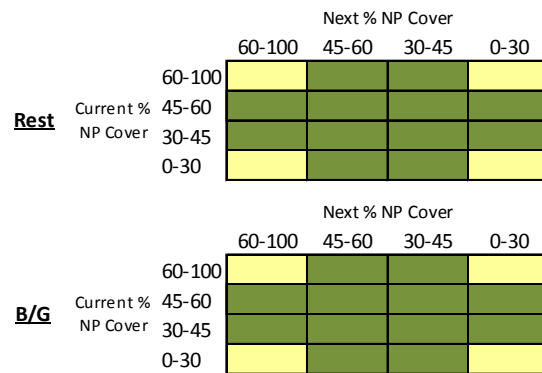

Figure 2: Utility matrices for Rest and Burn/ Graze combo, highlighting the four corners of each matrix. Eliciting values for these eight corners is the target of the Rating exercise.

As discussed during our conference call, the mechanics of the Rating exercise are simple, but wrapping your head around what it actually means, and thus how to respond, can be difficult. Thus, while an explanation of the exercise is included below, we have included an unrelated, non-prairie example of the exercise; this is the example we covered during the February 3 conference call. We hope that applying the Rating method to an unrelated problem will help clarify how to approach the prairie exercise with this method. If further explanation is needed, please don't hesitate to contact me.

Rating Exercise (modified)

Step 1: Rank your preferences
At the top of the worksheet you will see a table with four outcomes: Maintain NP at 60-100%, Maintain NP at 0-30%, Increase NP from 0-30% to 60-100%, and Decrease NP from 60-100% to 0-30%. These four outcomes represent the four corners of a single utility matrix (see figure 2; upper left, lower right, lower left, and upper right corners, respectively). You will also see two columns, one for the Rest treatment and one for the Burn/Graze combination treatment; these two treatments represent the two extremes in cost from least cost to greatest cost. Combining the four outcomes with the two treatments, we have eight possible outcomes; these eight outcomes represent the four corners of the Rest utility matrix and the four corners of the Burn/Graze utility matrix (figure 2).

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Notice that we already ranked the most desired outcome (1) as Increasing NP from 0-30% to 60-100% without having to do any management (i.e., Rest), and the least desired outcome (8) as Decreasing NP from 60-100% to 0-30% after applying the most expensive Burn/Graze treatment; these two rankings were agreed upon during our Science Team conference call on December 16 and reconfirmed with you during our conference call on February 3.

➔ Your job is to rank (2-7) your preferences among the remaining six outcomes according to how they lie between the most desired (rank 1) and the least desired (rank 8) outcome. Only the green cells need to be filled out.

Step 2: Fill in the Differences
Description
You will see the following headings in columns A - E: *Comparison, Outcome Rank, Outcome Description*, and *Difference*. There are seven two-way comparisons between sequentially ranked outcomes: Comparison 1 compares ranked-outcome 1 to ranked-outcome 2; Comparison 2 compares ranked-outcome 2 to 3; Comparison 3 compares 3 to 4; Comparison 4 compares 4 to 5; Comparison 5 compares 5 to 6; Comparison 6 compares 6 to 7; and Comparison 7 compares 7 to 8. The *Comparison* column simply enumerates the comparisons, while the *Outcome Rank* column identifies the ranked outcomes that are being compared. Based on your ranking in Step 1, the *Outcome Description* column was automatically filled in with the outcome pertaining to each assigned outcome rank. The *Difference* column, which contains seven green cells, is where you will provide your input in Step 2.

Step 2a
Examine each of the seven two-way comparisons and identify the comparison between two sequentially ranked outcomes that is the most difficult for to discriminate between in terms of how you feel about (i.e. value) them. Once identified, go to the green cell for that comparison (*Difference* column) and assign that comparison a value of "1".

> *Note*: A value of "1" is not strictly required; it could technically be any value. We recommend a value of "1" to make comparisons in Step 2b easier for you. If you choose to use a value other than "1", make sure the comparisons you make in Step 2b are all relative to this choice.

Step 2b
Now look at the six remaining two-way comparisons and provide a value to each by comparing how different the two being compared are relative to the first two-way comparison to which you gave a difference value of "1". Ask yourself **how many times more different** each two-way comparison is compared with the first two-way comparison that you set? You don't have to do these in any particular order; whatever makes the most sense to you.

> **Note:** The difference values you choose can be anything; they do not have to sum to 100 over the seven values.
> **Note:** If you chose a value other than "1" in Step2a, you can still think in terms of "how many times more different" each two-way comparison is to the Step 2a comparison by making your difference values for the other two-way comparisons multiples of your chosen Step 2a value*.*

When you have filled in a value for each of the seven green cells in the *Difference* column, columns G – I will be automatically populated. These three columns (*Outcome Rank, Outcome Description, and Scaled*

Value) show the resultant valuation of the eight ranked outcomes, scaled between 0 and 100; these scaled values are a direct result of the differences you entered in the seven green cells. Look at the scaled values. Do they fit with how you feel about the eight outcomes? If not, re-examine your responses to the two-way comparisons; you can modify your responses until you feel that the scaled values match your true values.

> ***Note****: We are using this difference approach, as opposed to a direct value approach, because 0 and 100 are arbitrary values to set as the minimum and maximum and thus these values, as well as the values in between them, are meaningless in-and-of-themselves; it is the relationship between the values (i.e., the differences) that hold meaning. Thus, we want you to focus on the difference between the sequentially ranked outcomes; we will then use those differences to scale the values between 0 and 100. If thinking in terms of differences just isn't working for you, you can directly provide us with the scaled values (in another worksheet or through an email). But, please, first at least try to think in terms of differences.*

Important Things to Keep in Mind as You Complete this Exercise

1) The utility has nothing to do with the likelihood of particular outcomes occurring; that is the sole role of the model set. Rather, the utility focuses only on how you would feel given particular outcomes did in fact occur. This is very important to keep in mind as you complete the exercise. For example, if you only have management units with very little native prairie cover and you think it is unlikely that you can achieve greater than 30% native prairie on your units, that is a likelihood issue that belongs in the model set, not the utility; therefore, don't respond that you'd be happy if you maintained 30% native prairie cover. Ask yourself what you really want and don't sell yourself short by letting your ideas about probability drive how you rank your preferences or set your values for native prairie cover (i.e., don't "settle").

2) When completing this exercise, remember that you are acting as an agent of the FWS. Think larger than your particular refuge or wetland management district. Complete the exercise by keeping in mind the values of the FWS refuge system with regards to the objective: increase native prairie cover at the least cost.

3) While it is fair to consult colleagues to help you gain perspective in regard to Important Thing #2, please be sure to work independently of other members of the Science Team. Part of the strength of the exercise will be in obtaining *independent* assessments of utility, which are key to exploring sensitivity of management decisions to variations in the utility function.

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An Unrelated, Non-Prairie Example: How do you value different vehicles?

This is the example we went through in detail on WebEx during our February 3 conference call. It can be found on the second worksheet, entitled "2_RatingExample". It is currently filled in with responses, as described below, but can be modified by you if you wish to play around with it. The description below details the process and the internal dialogue described during the conference call demonstration of this example.

Scenario
Imagine you are married, with one child (and the potential of another in the future) and one dog. You're looking to purchase a second car for the family. It needs to be able to fit everyone, plus all your stuff, and be safe. Your dog likes to get dirty and you don't want her on the car seats, so you require an area where she can be kept separate from the seats/people. Additionally, you must have 4WD capability because the family goes into the snow/mountains occasionally for recreational purposes and you don't want to deal with chains. These are your primary requirements that the vehicle you will buy must meet. But, you are also concerned with reducing your carbon footprint; though this desire is of secondary concern to your aforementioned primary requirements.

Step 1: Rank your preferences
At the top of the worksheet you will see a table with three vehicle classes: Compact, SUV, and Pick-up. You will also see two columns for "engine power", one for Gas and one for Hybrid. Combining the three vehicle classes with the two power options, results in six possible vehicles from which you have to choose: a compact car, a SUV, and a pick-up truck– each in either a Gas or Hybrid version.

Given the scenario provided, you rank your preferences as follows:
1 = Hybrid SUV
2 = Gas SUV
3 = Hybrid Pick-up
4 = Gas Pick-up
5 = Hybrid Compact
6 = Gas Compact

Reasoning for your ranking:
A SUV meets all of your primary requirements in the most comfortable way (room for current family size and room to grow; room for all your stuff; room for dog with hatchback area to keep her separate and off the seats, yet comfortably inside the same space; 4WD for snow). A pick-up (assume it has a cab), minimally meets your primary requirements, but not comfortably (room for current family size, but not comfortably and not with room to grow; room for your stuff, but it has to be in an open truck bed, exposed to the elements; room for the dog, but she has to be outside - neither comfortable nor safe; 4WD for snow). A compact car does not meet your primary requirements at all. Given how these three classes of vehicles meet/fail to meet your requirements, combined with your secondary desire to limit your carbon footprint, you rank SUV over Pick-up over Compact, with Hybrid over Gas within each vehicle class.

Step 2: Fill in the Differences
Description
You will see the following headings in columns A - E: *Comparison, Outcome Rank, Outcome Description*, and *Difference*. There are five two-way comparisons between sequentially ranked outcomes:

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Comparison 1 compares ranked-outcome 1 to ranked-outcome 2; Comparison 2 compares ranked-outcome 2 to 3; Comparison 3 compares 3 to 4; Comparison 4 compares 4 to 5; and Comparison 5 compares 5 to 6. The *Comparison* column simply enumerates the comparisons, while the *Outcome Rank* column identifies the ranked outcomes that are being compared. Based on your ranking in Step 1, the *Outcome Description* column was automatically filled in with the outcome pertaining to each assigned outcome rank. The *Difference* column, which contains five green cells, is where you will provide your input in Step 2.

Step 2a
Examine each of the five two-way comparisons and identify the comparison between two sequentially ranked outcomes that is the most difficult for you to discriminate between in terms of how you feel about (i.e. value) them. Once identified, go to the green cell for that comparison (*Difference* column) and assign that comparison a difference value of "1".

Your Answer and Reasoning: Given the scenario provided, you find it most difficult to discriminate between the Hybrid vs Gas Compact for the following reasons: 1) a Compact is useless to you because it doesn't meet your primary requirements; thus, whether it is Gas or Hybrid doesn't much matter to you; and 2) a Compact gets good gas mileage anyway, so your carbon footprint is already relatively small; therefore, you don't feel as big a need to get a Hybrid over a Gas vehicle (that is, getting a Hybrid over Gas in a Compact vehicle doesn't give you as warm a feeling as it would if it was big gas guzzling vehicle). Given this assessment, you assign a value of "1" two this two-way comparison.

Step 2b
Now look at the four remaining two-way comparisons and provide a value to each by comparing how different the two being compared are relative to the first two-way comparison to which you gave a difference value of "1". Ask yourself **how many times more different** each two-way comparison is compared with the first two-way comparison that you set? You don't have to do these in any particular order; whatever makes the most sense to you.

Given the provided scenario of your requirements/preferences/values, you fill in the two-way comparisons as follows (*note, the comparisons are not made in sequential order, but in the order that was easiest to consider the task at hand*):

Comparison 1
Hybrid SUV vs Gas SUV: How many times more different is the comparison between a Hybrid SUV and a Gas SUV than between the Hybrid and Gas Compact?
- Your Answer: 10 times
- Your Reasoning: This gets at your value of decreasing your carbon footprint. It is 10 times more important to you to get a Hybrid SUV over a Gas SUV than to get a Hybrid Compact over a Gas Compact.

Comparison 3
Hybrid Pick-up vs Gas Pick-up: How many times more different is the comparison between a Hybrid Pick-up and a Gas Pick-up than between the Hybrid and Gas Compact?
- Your Answer: 25 times
- Your Reasoning: A Pick-up gets worse gas mileage than a SUV and so it is even more important to get a hybrid when selecting a Pick-up than when a selecting a SUV; therefore, you say 15 times, which is 1.5 times greater than the difference value you provided in *Comparison 1 (10*

times). But, a Pick-up only minimally meets your primary requirements and is not comfortable, so it is even more important to you that it meet your secondary desire of decreasing your carbon footprint; therefore, you increase the 15 times to 25 times.

Comparison 2
Gas SUV vs Hybrid Pick-up: How many times more different is the comparison between a Gas SUV and a Hybrid Pick-up than between the Hybrid and Gas Compact?
- Your Answer: 20 times
- Your Reasoning: You don't want a Pick-up because it only minimally meets your primary requirements; therefore, you're thinking it is 25 times more different. However, your disappointment with a Pick-up is partially offset by the fact that it is a hybrid and meets your secondary value; thus you decrease the difference from 25 times to 20 times.

Comparison 4
Gas Pick-up vs Hybrid Compact: How many times more different is the comparison between a Gas Pick-up and a Hybrid Compact than between the Hybrid and Gas Compact?
- Your Answer: 40 times
- Your Reasoning: You really don't want a Gas Pick-up (it only minimally meets your primary requirements and doesn't meet your secondary desire to decrease your carbon footprint), but a Compact vehicle doesn't meet your primary requirements at all. Therefore, you decide this comparison is 40 times more different than the original comparison you made in Step 2a.

After filling in the difference values for all five comparisons, you notice that columns G – I were automatically populated. These three columns (*Outcome Rank, Outcome Description, and Scaled Value*) show the resultant valuation of the six ranked vehicles, scaled between 0 and 100; these scaled values are a direct result of the differences you entered in the five green cells. After looking at the scaled values, you determine that they make sense and fit with how you feel about the six different vehicles in terms of how they meet your primary requirements and your secondary desire. You're done. If you did not feel that the scaled values matched with your true values of the six vehicles, you could re-examine your responses to each of the two-way comparisons and modify your responses until you felt that the scaled values matched your true value system.