Supplemental Information Report
Bighorn NF Revised LRMP
Range Suitability, 36 CFR 219.20
January 20, 2006

Summary: Shortly after the Record of Decision (ROD) for the Final Environmental Impact Statement (EIS) and Revised Forest Plan, the range suitability determinations shown on page 16 of the ROD were challenged by some Cooperating Agency personnel and representatives as being too low. Interdisciplinary team members and the Forest Supervisor participated in a series of discussions to fully understand the concerns and potential analysis issues. After a thorough review of the range suitability analysis and determination, the following actions are being taken:

1. An errata for the acres determined to be suitable for cattle grazing has been prepared. The errata amends Page 16 of the Record of Decision and FEIS appendix B. This errata is considered to be a simple correction based on a procedural error, FSH 1909.15, Chapter 10, 18.2(1).
2. This supplemental information report:
    a. describes how the Forest Plan range suitability determination is, and is not used, at both the Forest Plan decision level and the site-specific, allotment management planning, level, and
    b. documents the review process that was undertaken.

Because the Regional Forester has determined that the information in this report did not affect his decision, and will not affect subsequent Forest Plan implementation and decisions, a formal supplement and National Environmental Policy Act disclosure per 40 CFR 1502.9(c) is not required.

I. How the Forest Plan range suitability determination is, and is not used, at both the Forest Plan decision level and the site-specific, allotment management planning, level

The Record of Decision, page 16, states:

> "**Range Suitability:** At the forestwide scale of analysis, 134,615 acres were determined to be suitable for cattle grazing[1], and 185,235 acres were determined to be suitable for sheep grazing. These determinations do not directly affect the amount of livestock grazing that occurs on the Bighorn NF. Permitted and authorized grazing levels will be determined by implementing Revised Plan direction through Allotment Management Plans and Annual Operating Plans. The Revised Plan direction accomodates and provides for continued livestock grazing, while maintaining healthy plant communities and wildlife populations."

[1] References in this document to areas suitable for cattle grazing are also suitable for sheep grazing. The references to 'suitable for sheep grazing' include all the acres suited for cattle grazing, but , in addition, include areas of 41-60% slope that are otherwise suited and capable for sheep grazing.

FEIS Appendix B, pages B-30 to B-46 documents the suitability and capability for livestock grazing analysis that was conducted. The following passage, FEIS appendix B page B-33, describes interpretation of the suitability and capability determinations:

> "There are several points to consider when interpreting and 'using' the information derived from this calculation:
>
> - Range suitability is a required calculation under the 1982 planning regulations, 36 CFR 219.
> - Much of the analysis is done at the 1.1 million acre scale, using previously acquired, remotely sensed data. While a certain percentage of data is ground-truthed, it still is coarse, approximate information. Therefore, the information derived from it should be considered coarse, approximate information.
> - The number of suited acres is not used for grazing decisions at the LRMP level. Actual stocking rates, seasons of use, rotations, etc. are derived from on the ground, individual allotment planning decisions. They are based on actual conditions (applied management), and on past knowledge, trends, and conditions.
>
> For these reasons, it would be inappropriate to develop stocking rates solely from this information."

Finally, the Region 2 desk guide, which describes the capability/suitability determination procedure, includes the following at page G.14 and G.15 of the June 10, 2004 version[2]:

> ***"Forest Plan Suitability Determination***
>
> The overlay of the capable acres with the suitable acres yields the Capable and Suitable Acres. For Forest Planning purposes, the combined "capability" and "suitability" analysis constitutes a Suitability Determination. Remember that this analysis is done separately for cattle and for sheep (and possibly for other kinds of animals as needed) and for each alternative (or grouping of similar alternatives) being considered.
>
> The capability and suitability analysis and resultant Suitability Determination is not a decision to graze livestock on any specific area of land, nor is it a decision about or estimate of livestock grazing capacity. The capability/suitability analysis and suitability determination may or may not provide supporting information for a decision to graze livestock on a specific area.
>
> Any landscape area will contain areas that are capable and/or suitable as well as areas that are modeled as being other than capable and/or suitable. Since the Forest Plan level suitability determination is based on a modeling process, and is dealing with a variety of complex landscapes, it is inevitable that this intermingling will occur on a land base of any significant size. Therefore, these suitability determinations are not intended to imply that livestock will be precluded from being found on lands that may be modeled as other than capable or suitable.
>
> At the Forest Plan level the Suitability Determination provides basic information regarding the potential of the land to produce resources and supply goods and services in

[2] The same wording is in the most recent version of the desk guide, dated October 26, 2005.

a sustainable manner, as well as the appropriateness of using that land in a given manner. This information assists the interdisciplinary team and the line officer in evaluating alternatives and arriving at Forest Plan level decisions. It also helps in an analysis of alternative uses foregone.

Both capability and suitability may also have value when applied at the site specific level. At this level, both capability and suitability analyses may be reviewed, updated, or made more site specific, if doing so will provide information useful to the decisions being made. However, this use of the analyses is outside the scope of Forest Planning regulations and purposes and is strictly an application of a useful tool as an aid in management decision making. For instance, rangelands identified as capable and suitable for domestic livestock grazing in the land and resource management plan may include smaller inclusions that are not appropriate for domestic livestock grazing when analyzed at the site-specific level (i.e., some wetlands or some campgrounds). A more site specific analysis at the allotment (or multi-allotment) scale may provide information useful in planning management of the given allotment(s)."

The following summarizations can be made concerning the Forest Plan livestock grazing suitability determination:

- This is a procedural, required analysis that is used to compare Forest Plan alternatives.
- It is not appropriate to use the Forest Plan level suitability determination to:
    - Inform site specific decisions
    - Make stocking decisions or interpretations
- A refined suitability analysis may or may not be appropriate at the site specific analysis scale. On the Bighorn NF, it historically has *not* been used in the allotment management planning process.

The calculation of suitable grazing acreage shown in the FEIS appendix and the ROD, which was calculated remotely using coarse, 1.1 million acres scale information, does not *accurately* portray the suitable acreage that is, or can be, grazed by domestic livestock. The USFS recognizes more land is grazed than is depicted in the Forest Plan-level suitable grazing acreage figures. Example areas, as detailed later in this report, include but are not limited to:

- Areas of less than 30% grass/forb crown cover percent that have available forage.
- Areas that were deleted for rock percent that have suited soil types within the soil map unit.

We recognize the fact that the determination of Forest Plan-level suitable range does not mean that areas not identified as suitable are unsuitable. In other words the inverse calculation is untrue. The Forest Plan-level suitability determination is not a decision to graze livestock on any specific area of land, nor is it a decision about or estimate of livestock grazing capacity.

Should, during the life of this plan, any disagreement arise over Allotment Management Plan-level suitable grazing land calculations or estimate of livestock grazing capacity, the USFS will, in conjunction with the Forest Plan revision cooperating agencies and other interested groups and individuals, review, and, if appropriate recalculate, the suitable grazing land or estimate of livestock grazing capacity.

Why the range suitability and capability determination analysis was re-done between Draft EIS (July 2004) and Final EIS (September 2005)

Several comments on the DEIS range capability/suitability analysis process were received. Some of the comments cited reasons why the suited and capable acres were too high, while some provided reasoning why the acres were too low. Because of these comments, the Forest decided to *review* the capability and suitability analysis for the FEIS.

Examination of the process used in the DEIS range suitability and capability determination found that a mixture of scripted and ad-hoc analysis procedures were used. Due to the use of ad-hoc analysis the exact procedure used for the DEIS could not be duplicated. Because the analysis could not be duplicated, the 'review' became a full-fledged *reanalysis* between DEIS and FEIS. FEIS appendix B pages B-30 to B-46 describe the process used in the FEIS suitability and capability determination, and includes a discussion of how it differed from the DEIS suitability and capability determination.

II. The November 2005 range capability/suitability review process

Four analysis items were reviewed in detail by Bighorn National Forest ID team personnel, in consultation with Regional Office range specialists and Cooperating Agency personnel and representatives:

1. Double counting of areas deducted in step 8b of the cattle determination
2. Slope methodology
3. Canopy coverage
4. Rock Percent

For each of these four items, the report below reviews the analysis methodology, and provides a conclusion statement for each item reviewed.

1. Double counting of areas deducted in step 8b of the cattle determination

During the FEIS capability and suitability analysis, some acres were deducted twice in the cattle determination. The capability analysis was the first step in the process (summarized in Table B-18 of FEIS appendix B, page B-31), and was followed by the suitability analysis (summarized in Table B-19 of FEIS appendix B page B-32). During the November 2005 review, it was found that some acres that had been deducted during the capability determination were deducted *again* in the suitability determination. This error occurred in the cattle suitability determination only, and the correct cattle suited determination is 180,942 acres.

A more technical explanation follows: The difference between sheep and cattle capable and suitable range is the basis for the errata. During the development of table B-19, FEIS Appendix B, the acres deducted from the capable base to produce the suitable base did not discriminate between the sheep only versus cattle and sheep.

The numbers reported for each deduction are those for sheep only plus cattle. Applying those deductions to the cattle category removes acres from that category that have already been removed in step 8 of the capable range analysis. Rerunning the analysis to properly account for the split between the two types of suitable acres produces the correct suitable range for cattle of 180,942 acres.

CONCLUSION: Errata warranted to correct the error in the cattle suited acre calculation. FEIS appendix B will be corrected to show that there are 180,942 acres suited for cattle grazing as determined at the Forest Plan analysis scale.

2. Slope methodology

Step 8 of the rangeland capability determination process incorporates the landform attribute of slope to help determine capable range. This step identifies areas greater than 60% slope as not capable for cattle or sheep range. Areas between 40% and 60% slope are identified as capable for sheep grazing only and areas between 0% and 40% slope are capable for sheep and cattle grazing.

The data used for this step is a 30 meter Digital Elevation Model (DEM) produced by USGS. The first step in the process is to apply the Arc/Info Grid `slope` command. The ESRI Arc/Info documentation defines the `slope` command as:

> `Slope` *identifies the maximum rate of change in value from each cell to its neighbors. An output slope grid can be calculated as percent slope or degree of slope.*
>
> *...*
>
> *Conceptually, the* `slope` *function fits a plane to the z values of a 3x3 cell neighborhood around the processing or center cell. The direction the plane faces is the aspect for the processing cell. The slope for the cell is calculated from the 3x3 neighborhood using the average maximum technique (see references).*

The next step in the process is to assign each cell a slope class of greater than 60%, between 40% and 60% or less than 40%.

At this point the analysis used to determine the DEIS capable rangeland and the FEIS capable rangeland diverge. In the DEIS process no further work with the DEM was done. For the FEIS analysis one additional step was taken. Using the Arc/Info Grid `slope` command, as was done for the DEIS, gives an approximately two acre view of landform. This size is below the five acre minimum polygon size used during the delineation of other GIS data used in other steps of the analysis. To get a somewhat broader view of landform slope the Arc/Info Grid command `focalmajority` was used for the FEIS analysis. As implemented in this analysis the slope of each cell was determined as the modal value of slope class for the cells in a three cell or ninety meter radius around the target cell. This yields a landform view of just over six acres.

At this point the DEIS and FEIS analysis converge. Both processes convert the DEM based values into polygons using slope class as the value to determine inclusion into a polygon. The final step is to add all polygons less than five acres to the largest adjacent polygon.

The advantages of using just the results from the `slope` command are simplicity and ease of replication. The disadvantage is in using a two acre window to look at landform in a one million acre analysis.

The advantage to the method used during the FEIS process is in taking a broader view of landform during the analysis. A disadvantage is in the subjectivity applied during the aggregation process. Both the statistic and number of cells to aggregate are chosen by the analyst.

As the previous discussion shows that there are at least two methods that can be used to derive slope. The method used is usually driven by what additional analytical uses of the derived slope values.

Using the DEIS method there are 933,757 acres from 0 to 40% slope and 119,047 acres from 40% to 60% slope. Using the FEIS method there are 946,438 acres from 0 to 40% slope and 96,812 acres from 40% to 60% slope. After step 8 of the analysis the DEIS deducted 55,127 acres between 40% and 60% slope while the deduction for the FEIS is 50,621 acres. This difference is based on "isolating" the slope methodology procedure. However, because of the many other deductions applied, it is not accurate to assume that the DEIS/FEIS slope methodology difference will carry through to the final determination. That is because many of the acres are deducted for other reasons.[3]

In fact, the final suited acres using the DEIS method is 179,967 acres for cattle and sheep and 185,263 acres for sheep, which compares to the FEIS method of 180,942 and 185,235, respectively.

CONCLUSION: There are no 'errors' in the FEIS slope calculation methodology and no changes are being made to this step.

3. Canopy Coverage

FEIS Appendix B describes the process used in implementing the capable and suitable range analysis. Step 2 of the rangeland suitability process (FEIS appendix B, page B-43) identifies areas where vegetative cover precludes the area from inclusion as suitable range. During the November 2005 review of the capable and suitable rangeland process the vegetative cover deduction was reexamined.

[3] While the 50,621 acres is the difference between the cattle and sheep suitability at step 8 of the process, many acres in the 40-60% sheep base are later deducted, primarily for cover percent, which results in a final, net difference, of 4293 acres.

For both the DEIS and FEIS, areas with tree canopy cover percent greater than 70% were deducted from suitable range.

The next criteria used by the Bighorn in both the DEIS and FEIS suitability analysis was that grass cover percent plus forb cover percent had to be greater than 30% for an area to be included in suitable range. This step was substituted for the desk guide direction, which is to deduct areas with tree canopy cover percent and unpalatable shrub cover percent greater than 70%.[4] Bighorn personnel compared the results from the two methodologies (>30% Grass + Forb vs. > 70% unpalatable shrubs) and determined that the >30% Grass + Forb was a more accurate representation, at the 1.1 million acre Forest Plan scale, than the unpalatable shrub method. Reviewing digital color infrared photography and activities records showed that many areas are included in the suitable range base that should be excluded using the >70% shrub method. Examples included stands that have had a thinning operation applied, areas of recent clearcut harvest, and areas with sparse grass and forb cover. Additional selection criteria were applied to this data set in an attempt to eliminate those areas. After several iterations it was determined that these selection criteria were no better, at the coarse filter, 1.1 million acre scale, than those used in the FEIS analysis (>30% Grass + Forb).

During the November 2005 review, we examined what the effects upon the suitability determination would be if the desk guide recommendation of deducting >70% unpalatable shrub was utilized. The ID team range conservationist determined that all shrub species other than sagebrush are unpalatable. Applying this criteria at step 2 (>70% unpalatable shrub) would result in 385,116 acres suitable for sheep and cattle and 409,968 acres suitable for sheep only.

To assist in understanding the vegetative composition of the data set remaining immediately following the >70% tree cover deduction step, Table 1 was developed. This shows the distribution of grass + forb crown cover percent for the suitable rangelands data set after the greater than 70% tree cover criteria has been applied but before the greater than 30% grass and forb criteria. The gray line shows the cut made by applying the greater than 30% grass and forb criteria. For example, the table shows that 48,917 acres that are labeled as a tree life form have between 20 to 29% grass + forb crown cover. One could argue that the acres shown in the table above the gray line should be added to the acres determined to be suited for livestock grazing; however, for the reasons shown above (inclusion of recent harvests, sparse grass cover), they were not. If appropriate and necessary, some of these acres excluded in this step could be added to the areas determined to be suitable for livestock grazing during the Allotment Management Plan, site-specific, analysis.

[4] The desk guide allows for discretion on this step: "Subtract areas that currently have an overstory of tree canopy cover and/or unpalatable shrub canopy cover greater than 70% (note: local exceptions to the 70% figure may be determined to be appropriate for specific situations, such as Aspen communities, provided that the rationale is documented)." Page G.12, October 26, 2005 version.

Table 1 Acres by Dominant Life Form for at Step 2a of Suitability Process

Grass + Forb Crown Cover Percent, by 10% increments	Life Form		
	Grass/Forb	Shrub	Tree
0-9	-	645	10,939
10-19	12	2,935	33,234
20-29	780	10,893	48,917
30-39	4,669	21,103	42,158
40-49	18,164	6,118	23,005
50-59	32,543	8,793	12,983
60-69	40,795	1,063	11,119
70-79	22,849	44	4,474
80-89	17,183	-	2,010
90-99	15,760	-	1,181
100+	1,199	-	27

CONCLUSION: No change to FEIS Forest Plan scale analysis suited acres based upon vegetative cover criteria, although this step indicates an underestimation in this coarse filter estimate of suited acres.

4. Rock Percent

The Common Land Unit (CLU) coverage was used to determine the areas where soil types with substantial portions of rock outcrop are located. The CLU coverage integrates geology, landform, soil and potential natural vegetation. The mapping was done at 1:24,000 scale with minimal field verification. This produced a coarse scale soil map where several soil series might be included in one CLU polygon. Due to the nature of the data some areas could be eliminated from the capable/suitable range base even if they are an acceptable soil series if that soil series included in the CLU polygon with rock outcrops. Since some of the rock soil series were not delineated (mapped) in the CLU layer it was not possible to just remove those areas during the analysis as the analysis procedure is designed to be spatially explicit.

Unlike the vegetative cover review, we estimated approximately how many suited acres were deducted because of the coarseness of the soil data at the entire Forest scale. That is, we did not review the rock percent step using an intermediate data set generated at some point during the suitability/capability process. For the total 1.1 million acre Bighorn National Forest, 364,005 acres are in the soil types that were eliminated due to rock outcrops. Of this acreage, 129,089 acres are in soil series dominated by rock, such as rock outcrop. Thus, there are 234,916 acres that could potentially be included in the suitable rangeland base assuming those acres pass all of the additional capable and suitable screens. If appropriate and necessary, some of these acres excluded in this step could be added to the areas determined to be suitable for livestock grazing during the Allotment Management Plan, site-specific, analysis.

CONCLUSION: No change to FEIS Forest Plan scale analysis suited acres based upon the rock percent criteria, although this step indicates an underestimation in this coarse filter estimate of suited acres.

Correct comparison between DEIS and FEIS of acres between 40% and 60% slope deducted[5]

The use of different analysis procedures created a reported difference of 41,848 acres deducted for slope factors between the DEIS and FEIS. Step 8b of the Regional Rangeland Suitability Desk guide is to deduct areas with slopes between 40% and 60% from capable cattle grazing areas but not from capable sheep grazing areas. At this point in the capable range analysis the identification of areas is split between areas capable for sheep and cattle and areas capable for sheep only. In the DEIS the areas reported as being between 40% to 60% slope were those areas of sheep only grazing identified at the end of the process. Whereas in the FEIS the areas reported in step 8b are as they occur in the process and do not have all of the deductions from the suitable range process applied. Additional analysis on the DEIS data revealed that the comparable number for slopes between 40% and 60% slope in the DEIS table is 55,127 acres while the number reported in the FEIS is 50,621 acres.

[5] The document that includes the 41,848 acre figure is from "J:\fsfiles\office\forest_plan\bernie\range_suitability\2005_0808_range_suitability_tracks.doc", which is available in the project record on file at the Bighorn NF Supervisor's Office.