APPENDIX C – USE OF THE SIMPPLLE MODEL

USE OF THE SIMPPLLE MODEL IN DEVELOPING RMP ALTERNATIVES

General Overview

Simulating Patterns and Processes at Landscape Scales (SIMPPLLE) is a computer modeling program that simulates vegetation patterns and processes emphasizing the dynamics of landscaped level change. It was developed for the USDA Forest Service, Region 1 as a management tool. SIMPPLLE's purpose is to help provide an understanding of the dynamics of where processes will occur across a landscape. The SIMPPLLE model has been utilized by the Beaverhead-Deerlodge National Forest during their Forest Plan Revision and during the BLM's Dillon Field Office Resource Management Plan revision.

SIMPPLLE was selected for use by the Butte Field Office (BFO) because it is both spatially and temporal explicit, meaning that landscape level vegetation change can be explored in relation to location and neighboring vegetation communities, as well as change within these communities over time. The SIMPPLLE model was used to: (a) simulate future vegetation changes caused by various disturbance processes at multiple landscape scales, (b) show trends in vegetative communities over the next 50 years as a result of fire suppression, (c) simulate historic vegetative conditions by running the model over 500 years with variables such as fire, insect and disease activity, (d) simulate management treatment alternatives for their impact on disturbance processes and the attainment of desired conditions defined at the landscapes scale, and (e) to provide a basis for identifying the probability of disturbance processes and vegetation conditions.

Vegetation Layer

At the time the Resource Management Plan revision began the Butte Field Office lacked a current comprehensive GIS vegetation layer for the planning area. This vegetation layer was needed in order to determine the existing condition, calculate potential treatment acres and to conduct effects analysis. It was determined that the existing Forest Service Potential Natural Vegetation (PNV) layer was not adequate for our purposes due to the small size and scattered ownership of BLM lands within the planning area.

A Vegetation Subgroup was established and tasked with creating this digital vegetation layer and using it to run the SIMPPLLE model. This subgroup consisted of seven members: two foresters, a wildlife biologist, a fire/fuels specialist, a soil scientist, a riparian/range/ special status plants specialist, and a GIS specialist.

Ssurgo soil survey data was obtained from the Natural Resources Conservation Service (NRCS) for BLM managed and private lands within the Butte Field Office for Jefferson, Broadwater, Lewis and Clark, Gallatin, and Deerlodge counties. As a majority of these lands were determined to be grasslands it was assumed that potential vegetation was the same as the existing situation. As a result of Silver Bow County not having a completed Ssurgo soil survey completed the soil scientist for the Butte Field Office generated a vegetation map for the county based on his extensive knowledge of the area. Park County also did not have a published county soils survey, so a Potential Natural Vegetation coverage obtained from the US Forest Service (Fire Sciences Laboratory, Rocky Mountain Research Station, 2001) was used to fill in any data gaps. This data layer was also used to fill any data omissions on the Gallatin National Forest.

Soil and vegetation data relating to national forest lands was obtained from both the Beaverhead-Deerlodge and Helena National Forests. Forest Service soil data was used in conjunction with Forest Service stand data to determine potential natural vegetation Forest Service timber stand data was merged with the county soil survey data.

The county soil surveys lumped grassland and sagebrush habitat as grasslands. To map sagebrush habitat, our special status plants specialist created a map depicting sagebrush. Ssurgo soil survey data from NRCS for BLM and private lands in the Butte Field Office for Jefferson, Broadwater, Lewis and Clark, Gallatin, and Deerlodge Counties was queried for polygons which show big sagebrush as part of the characteristic vegetation. This map was then merged with the vegetation map the BFO Soil Scientist created for Silver Bow County. Professional knowledge and data collected by the Northwinds contractor were used to check and fill in gaps. Park county and Beaverhead county were not included due to incomplete soil survey data.

The BLM has detailed forest stand data that was merged into the vegetation data. A crosswalk was developed to move the forest stand data from the existing database, Forest Vegetation Information System (FORVIS), to the vegetation coverage. The crosswalk included data for the following attributes: cover class, density, habitat type, size class, species type, dominant vegetation, and potential vegetation. This crosswalk then allowed data required to run the SIMPPLLE model to be extracted from the vegetation coverage.

Encroachment for grasslands was mapped using orthophotos to run the model. Encroachment for sagebrush polygons was not mapped by the time the model was run (7/05) but was mapped in August, 2005 in the vegetation coverage. Discuss how acres of treatment would be identified between encroachment in grassland and sagebrush.

Agriculture, Urban and Mining lands were mapped using orthophotos for Deerlodge, Silver Bow, Jefferson, Lewis and Clark and Broadwater Counties and merged into the vegetation coverage. In Park and Gallatin Counties, agriculture lands were mapped using the FS Potential Natural Vegetation Grid.

All polygons less than eight acres in size were merged with adjacent polygons.

To run the SIMPPLLE Model, large polygons were broken down to polygons less than 250 acres in size. Insect and disease from the 2003 survey flights was provided by the Forest Service was added to the SIMPPLLE model database in an attempt to accurately represent the existing ground condition. The model was able to break out and summarize data for the 7 major watersheds in the field office.

SIMPPLLE Process

1. Gathering Data

Jimmie Chew and Chris Stalling started working with the Butte Resource Management Plan group in 2003. Discussion at this first stage centered on the data requirements for running a landscape analysis using the SIMPPLLE model. Data needs for running SIMPPLLE included a GIS coverage (ArcInfo format with polygon topology), with attributes of species, size class, and density for each vegetation polygon, as well as some way to stratify the vegetation (i.e. habitat group). Other optional attributes that enhance SIMPPLLE simulations and representation of the landscape include land ownership, a code indicating the presence or absence of roads, fire management zones, prior landscape processes (i.e. insect disease and activity), and a "special area" field that can be filled with anything the user decides would help to logically represent the landscape. An ArcInfo Digital Elevation Model (DEM) for the same spatial extent as the vegetation coverage is necessary to create a neighbor file, which, when paired with a vegetation file derived from the ArcInfo coverage, loads into SIMPPLLE to create a landscape ready for simulation (a file with the .area extension).

Managers must also consider the size of the area that will best represent their goals. Since SIMPPLLE is a landscape level, process driven, spatially explicit simulation model, vegetation as it is represented on the entire landscape will influence and be influenced by the processes that cause change over time and space. In order for all vegetation polygons to be included in SIMPPLLE simulations, a contiguous landscape must be used with all polygons populated with vegetation information including water and nonforest conditions including rock and agriculture. This initial data-gathering step was accomplished by the Butte Field Office (BFO) working with a contractor, Dave Highness from Tetra Tech.

2. Cross-walk and Data Loading

Once the BFO had pulled this information together and discussed the approach to building a cross-walk from their data into SIMPPLLE attributes with Chris Stalling, they put together their first cut. The SIMPPLLE User's Guide describes the attributes and can be downloaded from http://www.fs.fed.us/rm/ecology/publications/simpplle/.

Several errors were found by BFO personnel, and they worked through editing and resolving these errors with Chris Stalling. Errors are expected to be found a majority of the time following a cross-walk to SIMPPLLE attributes; the cross-walk is iterative and subject to expert knowledge of the most likely vegetation expected at specific locations on the landscape. Once the initial vegetation attributes were examined by the BFO, discussion followed with Jimmie Chew and Chris Stalling about whether specific vegetation pathways should be developed for the Butte landscape in order to improve model behavior; several nonforest pathways were then adjusted.

Analysis of initial model behavior was accomplished by considering the landscape as current and looking at vegetation change over several decades, or time-steps, as they are represented in the SIMPPLLE environment. Further analysis was accomplished on a representation of historical landscape conditions by running simulations out for several hundred years without fire suppression and then saving the "new" landscape as one example of the historical Butte landscape. From this new starting point, SIMPPLLE simulations were run and the output was compared to that obtained from the current condition. Users have the option to make multiple landscape representations so that various approaches to stratification can be tested such as breaking the landscape by ownership, or by differences in the special area field.

3. Adjusting the Vegetation

An initial iteration of a SIMPPLLE landscape representation provides managers with the opportunity to consider how well the vegetation is being modeled. Further adjustment of vegetation states as well as other aspects of vegetation change was accomplished by the BFO with some interaction by telephone and in meetings in Butte. Resultant files that augmented model behavior were developed for vegetation pathways, vegetation regeneration, and conifer encroachment. Further comparisons of current and historical conditions were made similar to the earlier iteration.

4. Processes

Fire is the most extensive process on the Butte landscape and time was spent working on fire behavior with Charles Tuss. Files were developed to augment this behavior including better representations for fire occurrence, fire management zones (fire history based on data that can be provided from PCHA), and fire spread. Analysis of model behavior was conducted in a meeting at the BFO with Jim and Chris by running simulations of current and historical landscapes. Model behavior was analyzed using output comparisons as described above.

5. Alternative Development

Charles worked with Jim in Missoula at the RMRS to develop management plan alternatives for the BFO. They discussed model treatment logic in SIMPPLLE and how to alter that logic for simulation. Jim added a "cutting" treatment for the WUI, dropped the follow-up treatment to "group selection," changed the "density change" logic for "commercial-thinning" (added density of 2 along with 3), and made changes to the follow-up treatment for "encroachment-thin-and-burn" and "ecosystem-thin-and-burn." Jim and Charles also made changes to allow selection of JUSC for cutting. They ended up with treatment schedules for the RMP alternatives. Variables that where considered in development of the treatment schedule for alternative development were:

1. Sleeping Giant and Sheep Creek WSA/ACEC, Elkhorn WSA, Black Sage WSA, Humbug Spires WSA, – no acres were identified for treatment in these areas
2. We considered the effects of treatment in designated semi-primitive areas (including ROS and VRM categories).
3. Recreation sites and lands adjacent to recreation sites were taken into account.
4. Adjacent land ownership and management was taken into account.
5. Access to lands for treatment was considered. Including the existing road system.
6. Budget was NOT used during identification of acres for treatment.
7. Urban interface was taken into consideration and a "heavy-handed" approach was used in these areas. These areas were not identified for "ecosystem restoration." The Wildland Urban Interface Communities at Risk Hazard Assessment, 2004 – (The Helena Valley) was used as a tool for assessment.
8. Past treatments (logging and fire) as well as past wildfires were considered.
9. Topographical features (including rocky and steep sites) were taken into account.
10. Wildlife habitat including elk winter range, corridors, security habitat and habitat for sensitive species was considered.
11. We addressed errors in the vegetation coverage and made corrections based on professional knowledge of the area.
12. We used the Simpplle Model historical reference for each major watershed to guide us in determining the number of acres treated.

Riparian –

Polygons which had FORVIS data were selected from the BFO vegetation layer. It was assumed that if the polygon had FORVIS data it was/is forested. The BFO riparian layer was then queried for FAR reaches. The FAR selection was then clipped based on the FORVIS selection to get a forested FAR riparian shapefile. The clipped selection had repeated lengths which rendered acreage calculations impossible. The forested FAR riparian shapefile was then buffered by 200 feet. The buffer shapefile was converted to a coverage to produce an estimate of forested FAR riparian acres. This procedure was repeated for NFU and PFC reaches to get forested riparian acres for those as well.

Forested Riparian

FAR	3,037 acres	or	63 Miles
NFU	937 acres	or	19 Miles
PFC	3,725 acres	or	77 Miles

To get grass/shrub riparian acres, the FAR, PFC and NFU selections were summarized to get total lengths for each. These figures were used to derive acres by multiplying the total length by 400 feet (200ft buffer on each side) and dividing by 43,560. Forested riparian acres were subtracted to get "wide grass" acres. This figure was converted to square feet and divided by 400 to get back to lineal feet. The resulting figure was multiplied by 200 feet (100ft buffer on each side) and divided by 43,560 to get back to "narrow or actual" grass/shrub riparian acres as follows:

Grass/Shrub Riparian

FAR	1,228 acres	or	51 miles
NFU	499 acres	or	21 miles
PFC	1,703 acres	or	70 miles

Each FAR reach was reviewed and an estimation was made as to whether the reach could be treated or not through a fuels project, a forestry project or a prescribed burn project. This estimation was based on whether the reach was in a forested polygon, and the riparian coordinator's personal knowledge of each reach. Notations were made as to whether reaches had such

problems as roads, altered flows, small land ownership, historical mining etc. Some of these determinations were based upon the riparian coordinator's personal knowledge of each reach-the riparian coordinator has visited approximately 75% of the reaches. The riparian coordinator also made an estimation whether reaches could be treated (or are being treated) by grazing practices, exclosures, AML reclamation etc. These reaches were then intersected with the FAR buffer polygon to derive acres.

FAR Treatable Acres

Fuels/forestry/prescribed burns 1,966 acres

AML reclamation, grazing, exclosures, weed treatment 689 acres

Limited treatment forested due to roads, ownership etc. 1,072 acres

Limited treatment grass/shrub due to roads, mining, etc. 542 acres

PFC Maintenance riparian acres

The riparian coordinator then went through each PFC reach and made an estimation as to whether the reach may be treated or not through a fuels project, a forestry project or a prescribed burn project to maintain the functioning condition of the reach. This estimation was based on whether the reach was in a forested polygon, whether the reach was in a WSA, whether the reach was along a major river (all major rivers were excluded from treatment—i.e. Yellowstone, Missouri, Jefferson, etc.) and personal knowledge of the riparian coordinator. The resulting reaches were then intersected with the PFC buffer polygon to derive acres.

PFC Maintenance Acres

Fuels/forestry/prescribed burns 1,789 acres

6. Simulation Output and Reports

Once SIMPPLLE was behaving in an acceptable manner, simulations for current with no management, historical, and current with management treatments applied were run. Macros for Excel are used with model output to display data trends and some time was spent working with the RMRS to put together displays. These include current trends and historical range of variation.

I

Watershed	FAR Treatable -Forest	FAR Limited Treatment-Forest	FAR Treatable-Grass/Shrub	FAR Limited Treatment-Grass/Shrub	PFC Main-Forest
Yellowstone	0	0	0	21	48
Big Hole	774	129	111	267	633
Upper Missouri	575	472	297	154	859
Jefferson	593	471	278	71	249
Gallatin	0	0	0	29	0
Upper Clark Fork	24	0	3	0	0
Blackfoot	0	0	0	0	0
Total	**1,966**	**1,072**	**689**	**542**	**1,789**

II

Watershed	FAR Forest Total	NFU Forest Total	PFC Forest Total	FAR Grass/Shrub	NFU Grass Shrub	PFC Grass/Shrub
Yellowstone	0	0	62	21	0	267
Big Hole	903	0	1,207	378	37	614
Upper Missouri	1,047	595	1,699	451	310	549
Jefferson	1,064	342	665	349	153	273
Gallatin	0	0	0	29	0	0
Upper Clark Fork	24	0	0	3	0	0
Blackfoot	0	0	92	0	0	0
Totals	**3,038**	**937**	**3,725**	**1,231**	**500**	**1,703**