Mapping summer and winter recreation opportunity spectrum for Flathead Forest Plan Revision

Overview of process

The Forest choose to map both winter and summer recreation opportunity spectrum for the forest plan revision. This was done for each alternative in the FEIS. The following recreation opportunity spectrum modeling protocol was completed to produce the starting point for the existing recreation opportunity spectrum on the forest. From this map, the Forest produced desired condition recreation opportunity spectrum maps for the proposed action utilizing forest recreation program manager, district recreation specialist, regional office recreation planner, forest landscape architect, and revision recreation planner.

Modeling summer recreation opportunity spectrum using travel routes and terrain

This document was created in 2010 by Dave McMorran Humbolt-Toiyabe Forest (retired) and was revised by Chip Fisher R1 Geospatial Group in Feb/July 2013. A set of recreation opportunity spectrum modeling tools were developed in 2010 for use in ArcGIS 9.3 and those tools were updated for use in ArcGIS 10.0 SP4. The general recreation opportunity spectrum model process is described below and then some detailed GIS processing instructions follow that section. The recreation opportunity spectrum model process requires a travel routes (road and trails) layer that identifies improved motorized roads, unimproved motorized roads, and motorized trails. It also requires a 30 meter dem and a project area boundary (typically a forest administrative boundary).

General Process

Recreational settings are primarily determined by motorized travel routes and terrain (specifically slope). There are six primary recreation opportunity spectrum classes in order of highest to lowest solitude or undeveloped level: primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, roaded modified, rural, and urban. To model recreation settings recreation opportunity spectrum zones are used and they are based on the difficulty in reaching a particular point. In general these are applied to zones ½ mile and 3 miles around motorized road and trails. In earlier recreation opportunity spectrum modeling, ½ mile and 3 mile buffers were used to define three recreation opportunity spectrum zones: 0 to ½ mile, ½ to 3 miles, and greater than 3 miles. Urban, rural, roaded natural, or semi-primitive motorized were defined in the 0 to ½ mile zone; semi-primitive non-motorized in the ½ to 3 mile zone; and primitive areas in the greater than 3 mile zone. Additional criteria (road density level and improved vs. unimproved roads/trails), were used to separate urban, rural, roaded natural, or semi-primitive motorized areas. Size criteria were applied to reclassify small primitive and semi-primitive non-motorized areas to other recreation opportunity spectrum settings.

In 2010 a new recreation opportunity spectrum model was developed to account for the increased difficulty of traveling over rough terrain. Slope was used to measure the difficulty; the steeper the slope, the tougher it is to cross the landscape. Thus, in steep areas primitive areas could be less than 3 miles from a motorized route and in flat areas farther than 3 miles.

Slopes, in percent, can be calculated from the digital elevation model. This slope raster is then used to assign a cost or impedance to crossing each cell in the raster. Human modifications, like

roads and trails can mitigate the slope impedance. Raster math is used to modify the impedance for cells containing roads and trails using the following table.

Table 1. Type of route and impedance

Type of route	Impedance
Improved Roads	0
Unimproved Roads, Motorized Trails	slope / 3
Closed Roads, Non-Motorized Trails,	slope / 3
Unimproved terrain	slope

Cost distance mapping computes the accumulative cost of crossing the raster. For every cell, the impedance (slope) and distance (cell size) are combined to develop a map if the relative costs of getting from every cell to the nearest source cell. The cost distance function uses two raster inputs: a source cell raster based on motorized routes and a cost raster based on slope calculated above. Two cost distance paths are mapped, once for the improved roads and again using all motorized routes as a source cell. The difference between the two maps determines the SPM settings. For example if 30m cell 1 has slope of 10 and 30 meter cell 2 has slope of 20 then the cost at cell 2 is: (5*30m + 10*30m) / 2 = 225; if 30 meter cell 3 has slope 25 then the cost at cell 3 is: (225 + 20*30m) / 2 = 412.5.

Each cost distance map is reclassified into three zones where zone one is the equivalent of the ½ mile zone, 2 is the ½ to 3 mile zone and 3s represent everything over 3 miles (on flat land). R1 recreation staff working with Dave McMorran developed the following reclassification table of cost distances based on recreation opportunity spectrum modeling of forests in Region 1.

Table 2. cost distance of reclass and distance

Cost distance Reclass	Distance	Zone
0-8,000	0 to ½ mile	1
8,000-60,000	½ to 3 mile	2
60,000+	Gt 3 mile	3

When the two reclassified cost distance maps are combined a matrix table can be used to assign recreation opportunity spectrum setting. For example if a cell in the improved roads cost distance is 2 and the same cell in all roads cost distance is 1 then it is a semi-primitive motorized setting.

Table 3. Improved roads, recreation opportunity spectrum class by zones

Improved/all rds	1	2	3
1	Roaded natural (or higher)	Roaded natural	Roaded natural
2	Semiprimitive motorized	Semiprimitive nonmotorized	Semiprimitive nonmotorized
3	Semiprimitive motorized	Semiprimitive motorized	Primitive

Road density is used to determine urban or rural settings within the roaded natural areas delineated above. Road densities are computed for all roads, using spatial analysis focal functions. Roaded natural areas have road densities < 2.5 miles/sqmi; rural areas have road density from 2.5 to 8 miles/sqmi; and urban areas have road densities above 8mi/sqmi. At this point there is a draft raster recreation opportunity spectrum classification with up to six recreation opportunity spectrum settings (primitive, semiprimitive nonmotorized, semiprimitive motorized, roaded natural, rural, and urban).

In the last step the draft raster is converted to polygons and the recreation opportunity spectrum units are then checked for minimum sizes as defined in the recreation opportunity spectrum handbook. Recreation opportunity spectrum units smaller than the minimum size are reclassified into other recreation opportunity spectrum settings. Recreation staff should review urban and rural settings to see if they are actually roaded modified areas which the model does not classify.

Table 4. Recreation opportunity spectrum setting class and minimum size

Setting	Minimum size in acres
Primitive	5000 (can consider adjacent SPNM)
Semiprimitive nonmotorized	2500 (can consider adjacent PR)
Semiprimitive motorized	2500
Roaded natural	no min
Rural	no min
Urban	no min

GIS Processing Instructions

Assigning road and trail motorized use levels (ROS_type)

The model requires a travel routes layer created by combining roads and trails into a single layer and assigning values to an attribute called: ROS_type (short). It is probably easier to add the ROS_type attribute and assign values to it in the roads and trail layers separately as the attributes queried to assign ROS_type values are different in roads and trails. NonFS roads (State/County/OtherFed/Private) within the project boundary and up to 3 miles outside the project boundary need to be added to the final travel routes layer (ROS classification is based on all motorized routes in an area). This is the most difficult and time consuming part of the ROS model process.

The table below has ROS_type values with specific query instructions below it. In general all State/County/OtherFed/Private roads are assumed open for motorized use unless there is specific information that they are not open for motorized use. Private timber roads closed to public use but open for commercial use, are considered open for motorized use in the ROS model.

Table 5. Route type by value

Route Type	value
State/County/Private/OtherFed Roads open for motorized use	10
Improved roads (op_maint 3, 4, 5) open for motorized use	10
Unimproved roads (op_maint 1,2), open for motorized use and Motorized trails	3
Roads closed yearlong and Trails not open for motorized use	1

Query for NFS improved roads using infra core road attributes ROS_type = 10

"ROUTE_STATUS" <> 'DE - DECOMMISSIONED' AND
"SYSTEM" = 'NFSR - NATIONAL FOREST SYSTEM ROAD' AND
"OPER_MAINT_LEVEL" IN ('3 - SUITABLE FOR PASSENGER CARS',
'4 - MODERATE DEGREE OF USER COMFORT', '5 - HIGH DEGREE OF USER COMFORT')

- May need to use travel attribute to verify open for motorized use

Query for NFS unimproved roads using infra core road attributes ROS_type = 3

"ROUTE_STATUS" <> 'DE - DECOMMISSIONED' AND
"SYSTEM" = 'NFSR - NATIONAL FOREST SYSTEM ROAD' AND
"OPER_MAINT_LEVEL" IN ('1 - BASIC CUSTODIAL CARE (CLOSED)', '2 - HIGH CLEARANCE VEHICLES')

- Use current travel attribute to select motorized use during any part of the year may include roads converted to motorized trails
- Roads closed to public use but open for administrative use and used frequently should be included in this group; if unsure of use level include them in this group

Query for NFS trails open for motorized use ROS_type = 3
Use current travel attribute to select motorized use during any part of the year

Query for NFS closed roads using infra core road attributes ROS_type = 1
"ROUTE_STATUS" <> 'DE - DECOMMISSIONED' AND
"SYSTEM" = 'NFSR - NATIONAL FOREST SYSTEM ROAD'

- Use current travel attribute to select closed for motorized use during entire year
- Roads closed to public use but open for administrative use and used very rarely (less than once per year) maybe put into this group

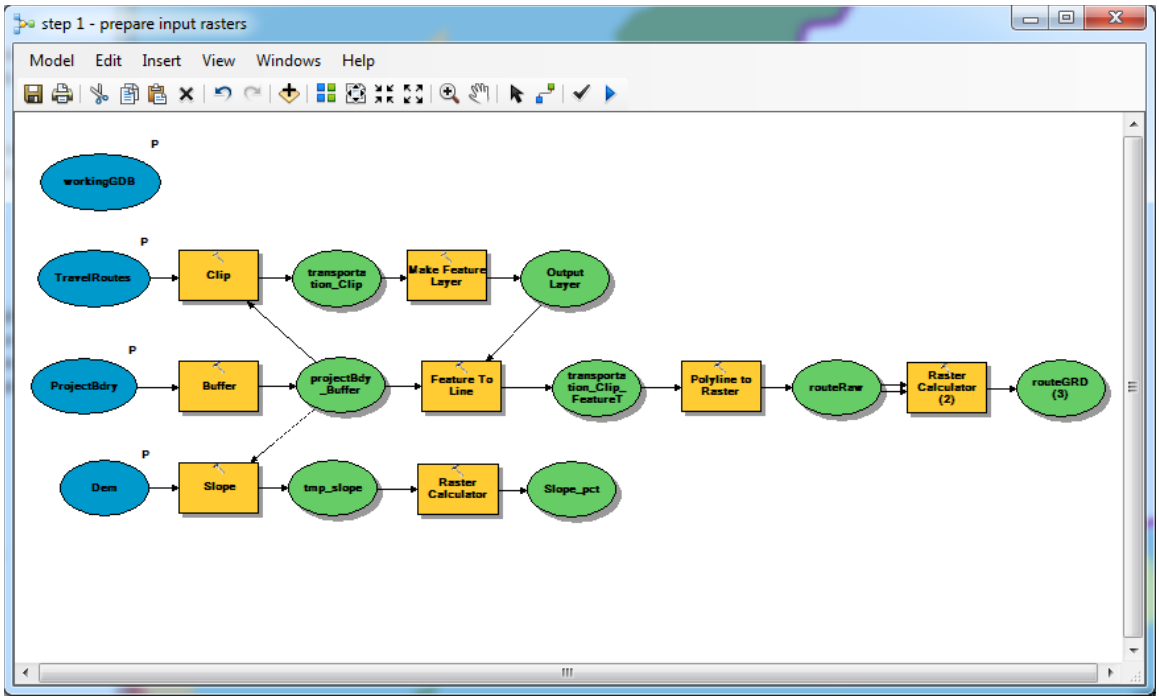
Query for NFS trails closed to motorized use ROS_type = 1
Use current travel attribute to select closed to motorized use all year

Running ArcGIS 10 Models in ROS Toolbox

In the ROS_Models_2013.tbx ArcGIS 10.0 SP4 toolbox there are four models that are run to create a draft summer recreation opportunity spectrum classification polygon layer. It is assumed the draft summer recreation opportunity spectrum classification layer may require some edits after review by a units recreation staff. In particular areas classified as rural or urban in the model could be reclassified as roaded modified based on the Forest setting *(this is because timber production areas tend to have high road density that get classified as rural or urban in the recreation opportunity spectrum model)*. Note there is a fifth model in the ROS_Models_2013.tbx toolbox used for winter recreation opportunity spectrum modeling only.

Step 1 - prepare input rasters model

In this model, a 30m percent slope raster is created and the travel routes layer is converted to a 30m raster layer based on the ROS_type attribute. This model has four required inputs: 30m dem, travel routes line layer with ROS_type attribute filled in from step 1 above, project area boundary polygon layer, and an output geodatabase to store output GIS layers in. The travel routes line layer and the percent slope raster are clipped to the project area boundary to reduce the processing time in the second model. In the slope raster cells with slope < 1 are set to 1 and cells with slope > 100 are set to 100. This is done to simplify the cost distance function. This model produces two outputs: a 30m route raster and a 30m slope raster.



Step 2 - build ROS zones model

This model has four main steps:
Step A – create a cost distance raster for all motorized routes;
Step B – create a cost distance raster for improved roads only;
Step C – create a route density raster; and
Step D – reclassify and combine the three rasters from steps A-C.

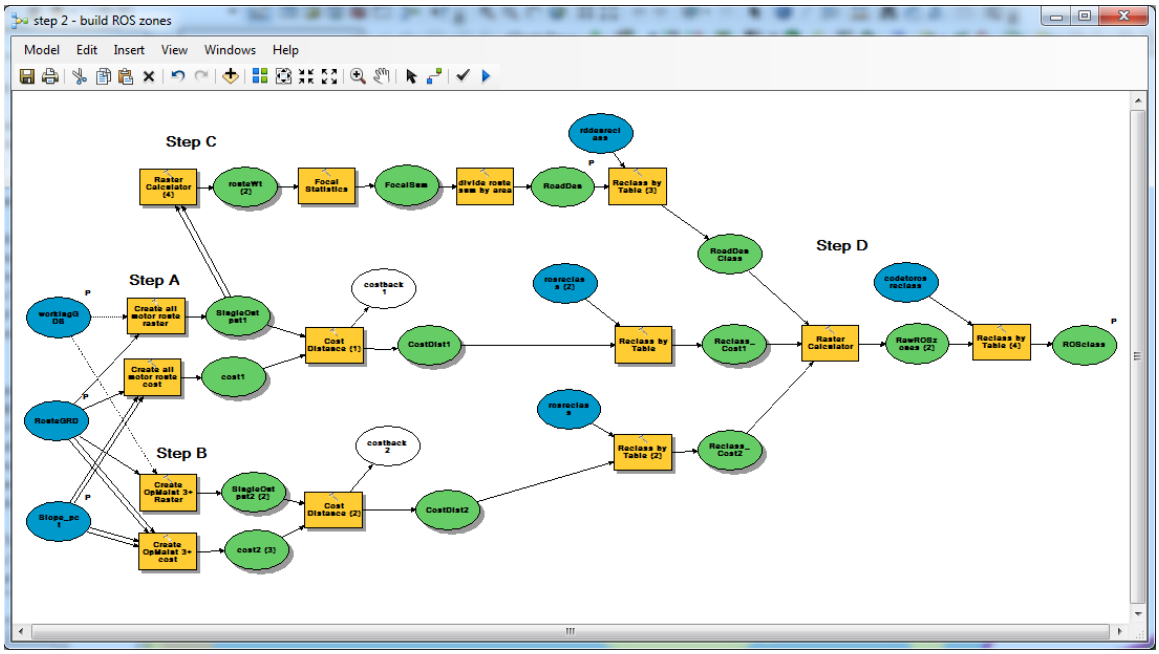
This model has seven required inputs: the 30m route raster and a 30m slope raster from model 1, and output geodatabase, and four tables for recoding raster layers (in the ROStables.gdb provided with the Toolbox).

In step A, two rasters are created for cost distance mapping of all motorized routes: a source raster with all motorized route cells recoded to 1 and all other cells set to nodata and a cost raster based on slope with adjustment for cells identified as motorized (slope / 3). The two input rasters are then used in the cost distance function to produce a cost distance raster with values from 0-500,000+ (remember it is slope * 30m summed over many cells going away from motorized routes).

Step B is the same as step A, except only improved roads are recoded to 1. Step B also produces a cost distance raster with values from 0-500,000+.

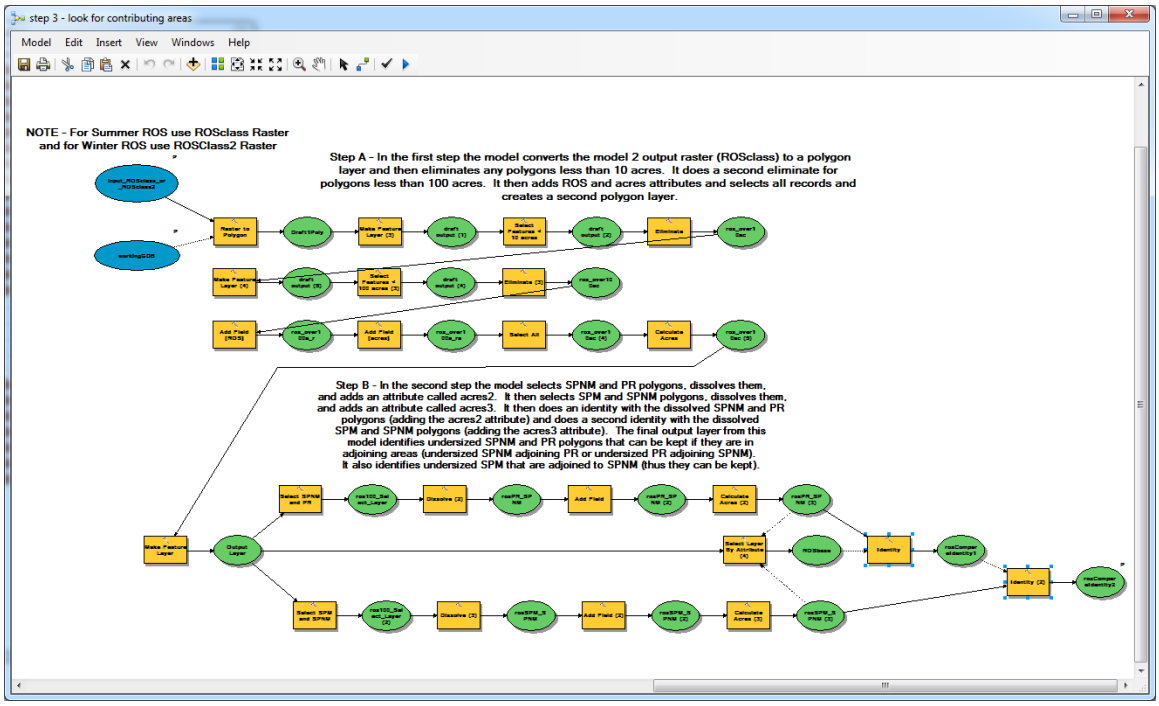
Step C uses the all motorized route source raster in a focal sum function to produce a road density raster.

Step D reclassifies the two cost distance rasters and the road density raster into three classes each and then combines all three rasters. The combined raster is then recoded into a draft ROS classification raster called ROSclass. The ROSclass raster has values: 1 (U), 2 (R), 3 (RN), 4 (SPM), 5 (SPNM), and 6 (PR).

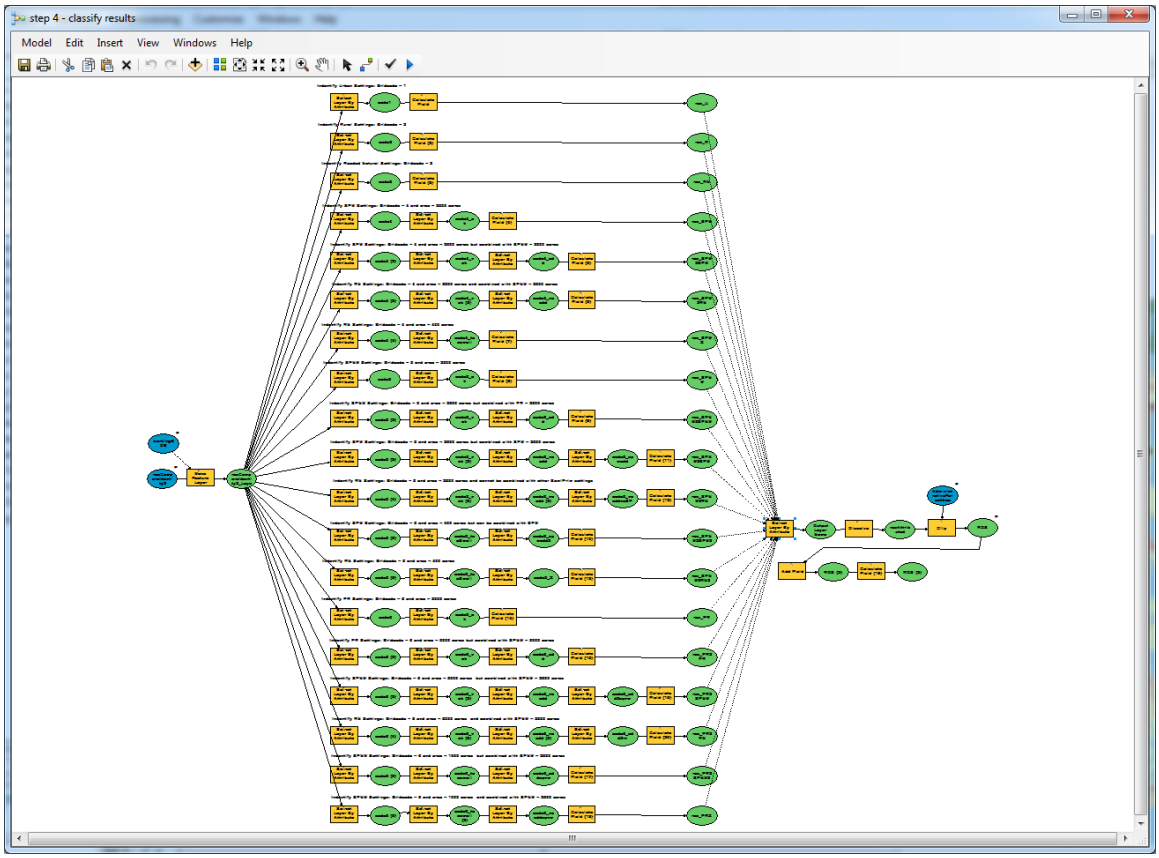


Step 3 - look for contributing areas model

This model converts the draft recreation opportunity spectrum classification into multiple polygon layers and then runs identities on them to calculate areas of overlap in the ½ mile to 3 mile zone. This model has two required inputs: the draft recreation opportunity spectrum classification raster from model 2 and an output geodatabase. This model produces a draft recreation opportunity spectrum classification polygon layer.



Step 4 - classify results
This model reclassifies undersize recreation opportunity spectrum settings (primitive, semiprimitive nonmotorized, etc. into other recreation opportunity spectrum settings based on criteria supplied by the Region 1 recreation staff and 1987 recreation opportunity spectrum documentation. The output polygon is the final recreation opportunity spectrum classification for review by recreation staff.



Final step – Review by forest recreation staff

The draft summer recreation opportunity spectrum classification was reviewed by forest recreation staff. The recreation opportunity spectrum classification was intersected with the basic ownership layers (from forest ref library layer files) and only polygons in USDA Forest Service ownership had the ros attribute filled in (ie: removed recreation opportunity spectrum classification from nonfs lands). The forest did not utilize the roaded modified class. Some semiprimitive (motorized and non-motorized) areas that were less than the minimum size were not reclassified as they were better represented in their original classified type.

For example, in alternative B modified, a decision to allocate the Teakettle Area on the Hungry Horse district as semiprimitive nonmotorized was made although the area is below the minimum size of 2,500 acres. It is currently 1,900 acres with a strip of private land that is undeveloped and then a large areas of NFS that is also mapped semiprimitive non-motorized (2500 acres +). This area is also a key grizzly bear connectivity area.

To develop the desired summer recreation opportunity spectrum for alternatives, the management

area allocation map for that alternative, the motor use vehicle map for the districts and the recreation opportunity spectrum characteristics table (Appendix A in this document) were used. Other maps such as big game winter range and grizzly bear connectivity were reviewed.

Modeling winter recreation opportunity spectrum using travel routes and terrain

This document was created in 2010 by Dave McMorran Humbolt-Toiyabe Forest (retired) and was revised by Chip Fisher R1 Geospatial Group in Feb 2013. A set of recreation opportunity spectrum modeling tools were developed in 2010 for use in ArcGIS 9.3 and those tools were updated for use in ArcGIS 10.0 SP4. The general recreation opportunity spectrum model process is described below and then some detailed GIS processing instructions follow that section. The winter recreation opportunity spectrum model used the same four model steps as the summer recreation opportunity spectrum model but had an additional step to address areas open for cross country over the snow travel. Similar to the summer recreation opportunity spectrum model, the winter version requires a travel routes (road and trails) layer that identifies plowed or groomed roads, and nongroomed motorized roads, and motorized trails. It also requires a layer of areas open for cross country over the snow travel *(note: this layer must have an attribute called ROS_Winopen (short) set to 1 for open areas).*, a 30m dem, and a project area boundary (typically a forest administrative boundary).

General Process

Recreational Settings are primarily determined by motorized travel routes and terrain (specifically slope). There are six primary ROS classes in order of highest to lowest solitude or undeveloped level: primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, rural, and urban. To model recreation settings recreation opportunity spectrum zones are used and they are based on the difficulty in reaching a particular point. In general these are applied to zones ½ mile and 3 miles around motorized road and trails. In earlier recreation opportunity spectrum modeling ½ mile and 3 mile buffers were used to define three recreation opportunity spectrum zones: 0 to ½ mile, ½ to 3 miles, and greater than 3 miles. Urban, rural, roaded natural, or semi-primitive motorized were defined in the 0 to ½ mile zone; semi-primitive non-motorized in the ½ to 3 mile zone; and primitive areas in the greater than 3 mile zone. Additional criteria (road density level and improved vs. unimproved roads/trails), were used to separate urban, rural, roaded natural, or semi-primitive motorized areas. Size criteria were applied to reclassify small primitive and semi-primitive non-motorized areas to other recreation opportunity spectrum settings.

In 2010, a new recreation opportunity spectrum model was developed to account for the increased difficulty of traveling over rough terrain. Slope was used to measure the difficulty; the steeper the slope, the tougher it is to cross the landscape. Thus, in steep areas primitive areas could be less than 3 miles from a motorized route and in flat areas farther than 3 miles.

Slopes, in percent, can be calculated from the digital elevation model. This slope raster is then used to assign a cost or impedance to crossing each cell in the raster. Human modifications, like roads and trails, can mitigate the slope impedance. Raster math is used to modify the impedance for cells containing roads and trails using the following table.

Table 6. Type of route and Impedance

Type of route	Impedance
Improved Roads	0
Unimproved Roads, Motorized Trails	slope / 3
Closed Roads, Non-Motorized Trails,	slope / 3
Unimproved terrain	slope

Cost distance mapping computes the accumulative cost of crossing the raster. For every cell, the impedance (slope) and distance (cell size) are combined to develop a map if the relative costs of getting from every cell to the nearest source cell. The cost distance function uses two raster inputs: a source cell raster based on motorized routes and a cost raster based on slope calculated above. Two cost distance paths are mapped, once for the improved roads and again using all motorized routes as a source cell. The difference between the two maps determines the semi-primitive motorized settings. For example if 30m cell 1 has slope of 10 and 30m cell 2 has slope of 20 then the cost at cell 2 is: (5*30m + 10*30m) / 2 = 225; if 30m cell 3 has slope 25 then the cost at cell 3 is: (225 + 20*30m) / 2 = 412.5.

Each cost distance map is reclassified into three zones (1,2,3) where zone one is the equivalent of the ½ mile zone, 2 is the ½ to 3 mile zone and 3s represent everything over 3 miles (on flat land). Region 1 recreation staff, working with Dave McMorran, developed the following reclassification table of cost distances based on recreation opportunity spectrum modeling of forests in Region 1.

Table 7. Cost distance and zone

Cost distance Reclass	Zone
0-8,000	0 to ½ mile
8,000-60,000	½ to 3 mile
60,000+	Gt 3 mile

When the two reclassified cost distance maps are combined a matrix table can be used to assign recreation opportunity spectrum setting. For example if a cell in the improved roads cost distance is 2 and the same cell in all roads cost distance is 1 then it is a semi-primitive motorized setting.

Table 8. Improved all roads and zones

Improved/all rds	Zone 1	Zone 2	Zone 3
1	RN (or above)	RN	RN
2	SPM	SPNM	SPNM
3	SPM	SPM	PR

Road density is used to determine urban or rural settings within the roaded natural areas delineated above. Road densities are computed for all roads, using spatial analysis focal functions. Roaded natural settings have road densities < 2.5 miles/sqmi; rural areas have road density from 2.5 to 8 miles/sqmi; and urban areas have road densities above 8mi/sqmi. At this point there is a draft raster recreation opportunity spectrum classification with up to six recreation opportunity spectrum settings (primitive, semi-primitive nonmotorized, semi-primitve motorized, roaded natural, rural, and urban).

In the last step the draft raster is converted to polygons and the recreation opportunity spectrum units are then checked for minimum sizes as defined in the recreation opportunity spectrum handbook. Recreation opportunity spectrum units smaller than the minimum size are reclassified into other recreation opportunity spectrum settings. Recreation staff should review urban and rural settings to see if they are actually roaded modified areas which the model does not classify.

Table 9 Recreation opportunity spectrum setting and minimum size

Setting	Minimum size in acres
Primitive	5000 (can consider adjacent SPNM)
SPNM	2500 (can consider adjacent PR)
SPM	2500

Roaded Natural	no min
Rural	no min
Urban	no min

GIS Processing Instructions

Assigning motorized use level to roads and trails (ROS_type)

The model requires a travel routes layer created by combining roads and trails into a single layer and assigning values to an attribute called: ROS_type (short). It is probably easier to add the ROS_type attribute and assign values to it in the roads and trail layers separately as the attributes queried to assign ROS_type values are different in roads and trails. NonFS roads (State/County/OtherFed/Private) within the project boundary and up to 3 miles outside the project boundary need to be added to the final travel routes layer (ROS classification is based on all motorized routes in an area). This is the most important and most difficult step in the model process.

The table below has ROS_type values with specific query instructions below it. In general all State/County/OtherFed/Private roads are assumed open for motorized use and are assumed to be plowed unless there is specific information that they are not open for motorized use or are not plowed. Private timber roads closed to public use but open for commercial use, are considered open for motorized use in the ROS model.

Table 10. Route type by Value

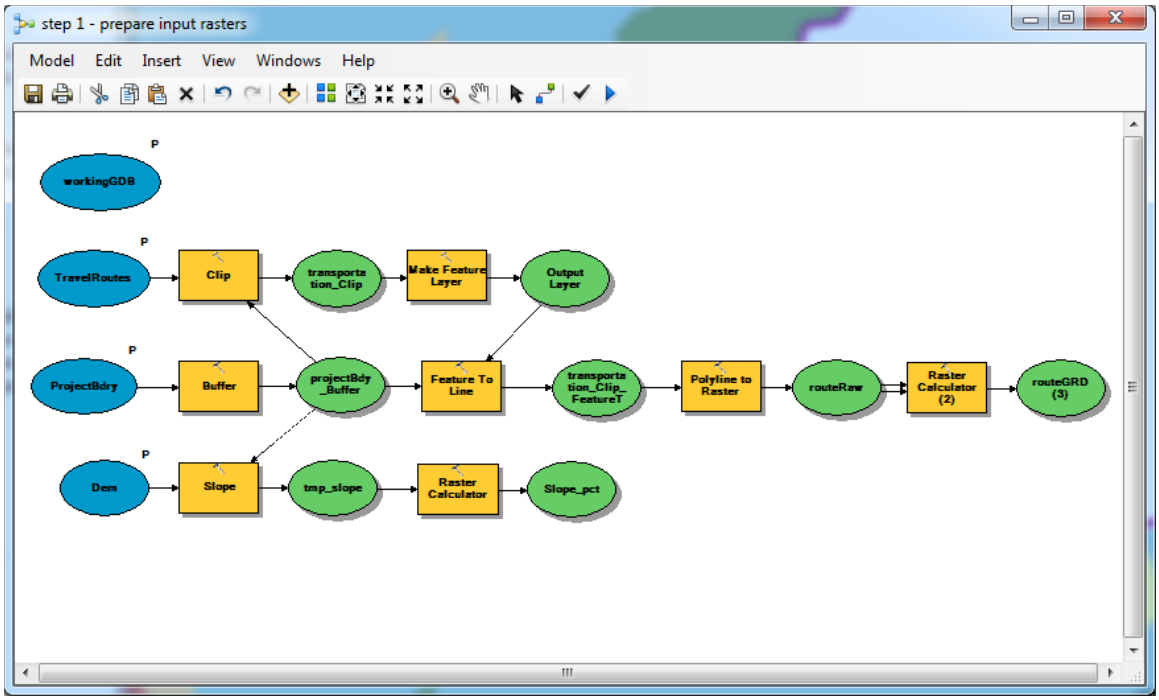
Route Type	Value
State/County/Private/OtherFed Roads open for motorized use and plowed	10
Plowed or groomed roads and trails	10
Not plowed or not groomed roads and trails open for motorized use	3
Roads closed yearlong and trails not open for motorized use	1

Running ArcGIS 10 Models in ROS Toolbox

In the ROS_Models_2013.tbx ArcGIS 10.0 SP4 toolbox there are five models that are run to create a draft winter recreation opportunity spectrum classification polygon layer. It is assumed the draft winter recreation opportunity spectrum classification layer may require some edits after review by a units recreation staff. In particular areas classified as rural or urban in the model could be reclassified as roaded modified based on the forest setting (this is because timber production areas tend to have high road density that get classified as rural or urban in the recreation opportunity spectrum model).

Step 1 - prepare input rasters model

In this model a 30m percent slope raster is created and the travel routes layer is converted to a 30m raster layer based on the ROS_type attribute. This model has four required inputs: 30m dem, travel routes line layer with ROS_type attribute filled in from step 1 above, project area boundary polygon layer, and an output geodatabase to store output GIS layers in. The travel routes line layer and the percent slope raster are clipped to the project area boundary to reduce the processing time in the second model. In the slope raster cells with slope < 1 are set to 1 and cells with slope > 100 are set to 100. This is done to simplify the cost distance function. This model produces two outputs: a 30m route raster and a 30m slope raster.



Step 2 - build ROS zones model

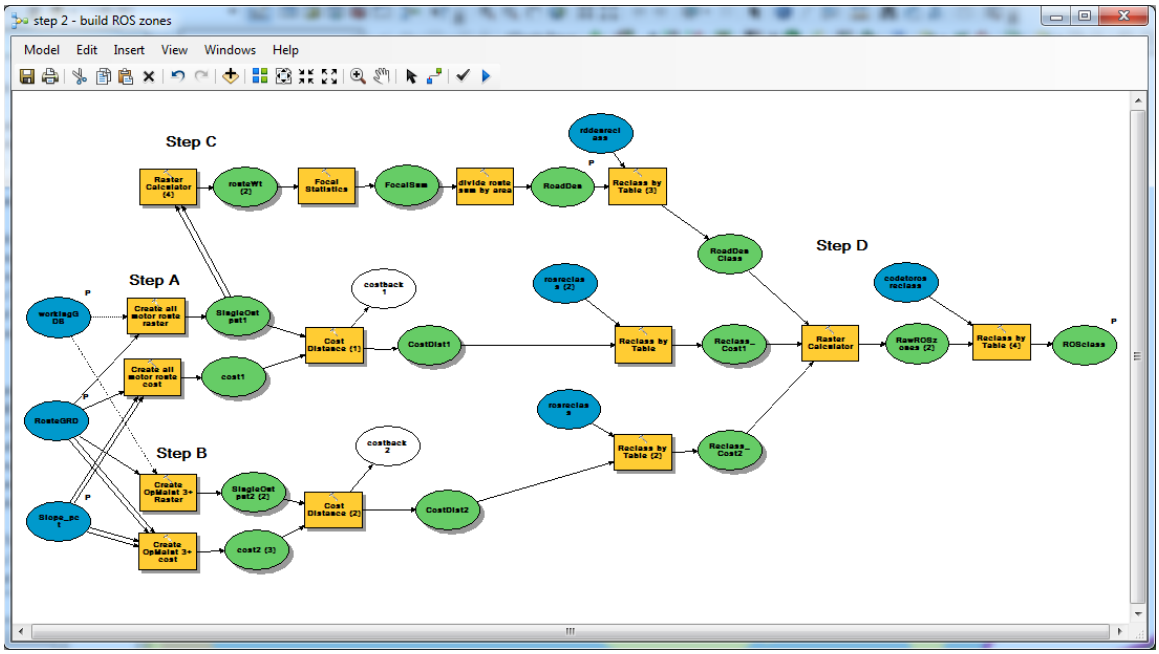
This model has four main steps:
Step A – create a cost distance raster for all motorized routes;
Step B – create a cost distance raster for plowed or groomed routes only;
Step C – create a route density raster based on all motorized routes; and
Step D – reclassify and combine the three rasters from steps A-C. This model has seven required inputs: the 30m route raster and a 30m slope raster from model 1, and output geodatabase, and four tables for recoding raster layers (in the ROStables.gdb provided with the Toolbox).

In step A two rasters are created for cost distance mapping of all motorized routes: a source raster with all motorized route cells recoded to 1 and all other cells set to nodata and a cost raster based on slope with adjustment for cells identified as motorized (slope / 3). The two input rasters are then used in the cost distance function to produce a cost distance raster with values from 0-500,000+ (remember it is slope * 30m summed over many cells going away from motorized routes).

Step B is the same as step A except only plowed or groomed routes are recoded to 1. Step B also produces a cost distance raster with values from 0-500,000+.

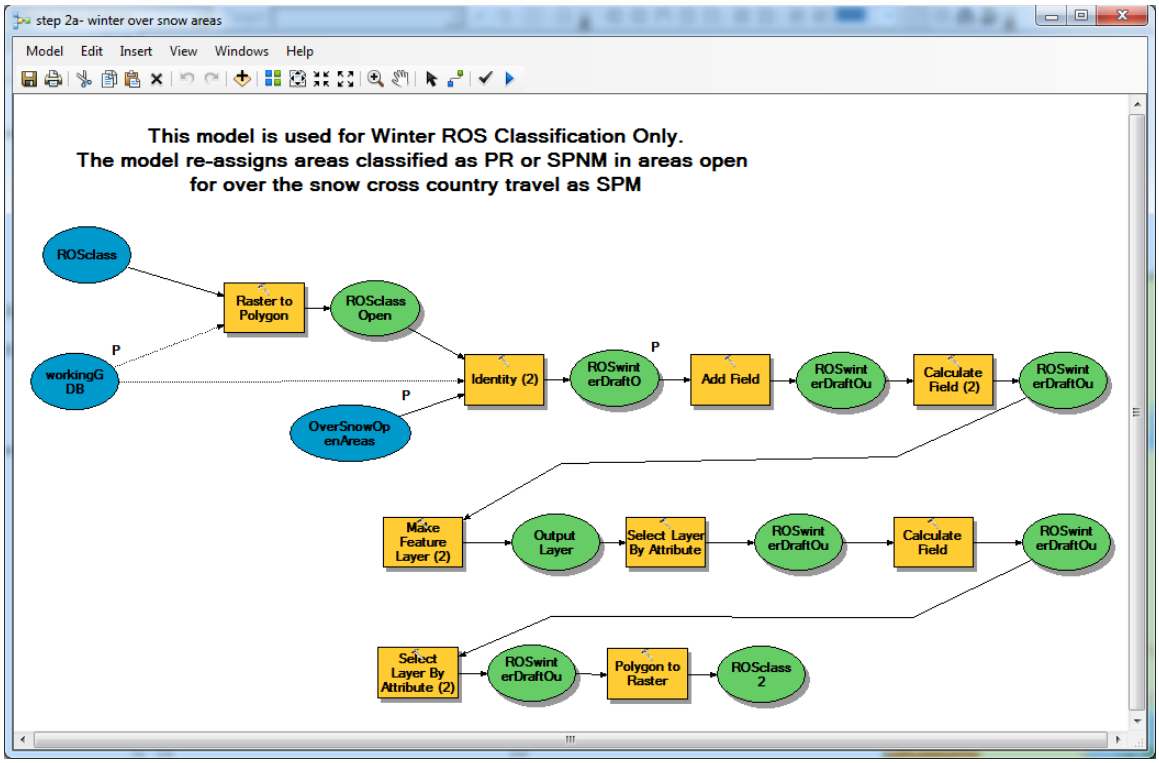
Step C uses the all motorized route source raster in a focal sum function to produce a road density raster.

Step D reclassifies the two cost distance rasters and the road density raster into three classes each and then combines all three rasters. The combined raster is then recoded into a draft ROS classification raster called ROSclass. The ROSclass raster has values: 1 (U), 2 (R), 3 (RN), 4 (SPM), 5 (SPNM), and 6 (PR).



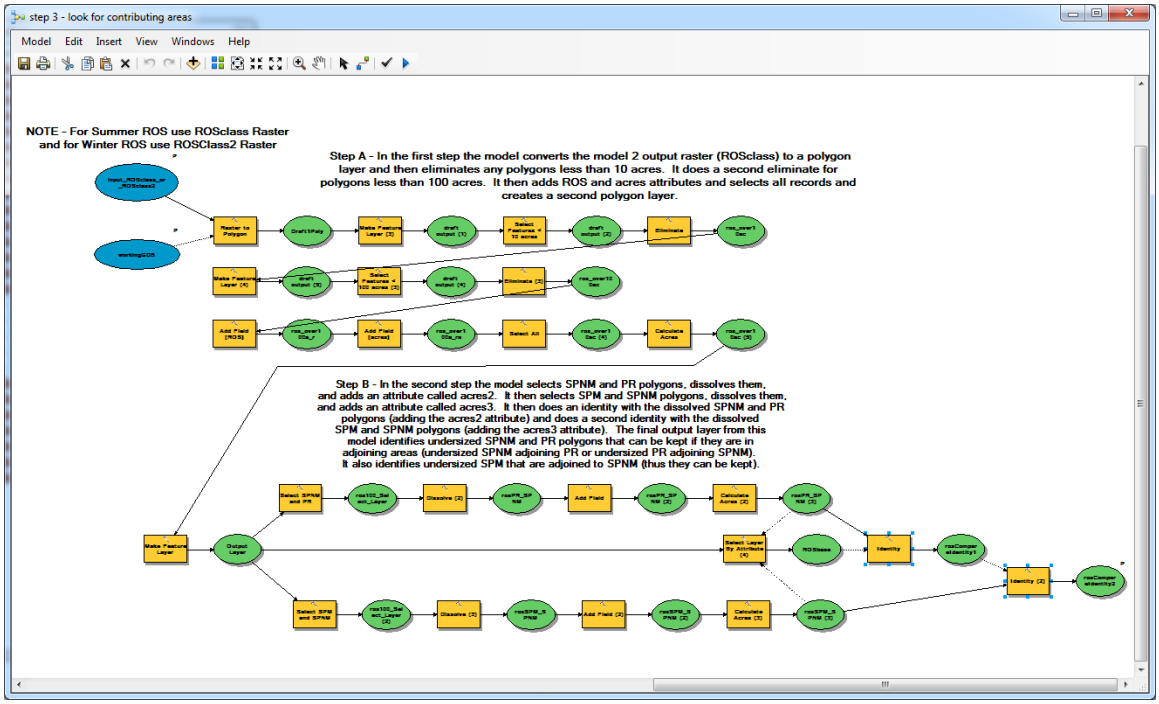
Step 2a- winter over snow areas model

This model re-assigns areas classified as SPNM (grid_code = 5) or PR (grid_code = 6) that are in areas open for over the snow cross country travel as SPM. The model takes the output of step 2 (ROSclass raster) and converts it to a polygon layer. It then runs an identity between the output polygons and an open over snow cross country travel area layer *(note: open over snow cross country travel area layer must have an attribute called ROS_Winopen (short) set to 1 for open areas).* The model produces a draft Winter ROS classification raster layer called: ROSclass2. The ROSclass2 raster has values: 1 (U), 2 (R), 3 (RN), 4 (SPM), 5 (SPNM), and 6 (PR).



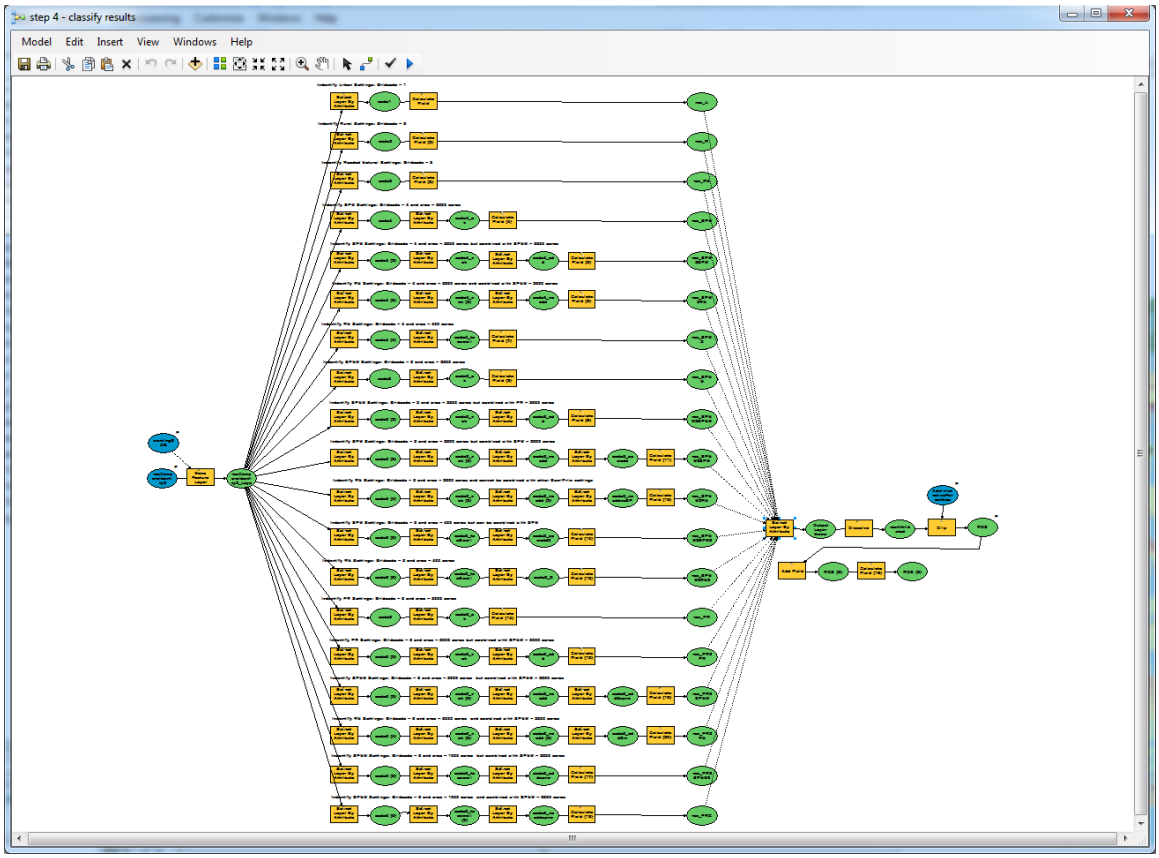
Step 3 - look for contributing areas model

This model converts the draft winter recreation opportunity spectrum classification from step 2a into multiple polygon layers and then runs identities on them to calculate areas of overlap in the ½ mile to 3 mile zone. This model has two required inputs: the draft recreation opportunity spectrum classification raster from model 2a called ROSclass2 and an output geodatabase. This model produces a draft recreation opportunity spectrum classification polygon layer.



Step 4 - classify results

This model reclassifies undersize recreation opportunity spectrum settings (primitive, semi-primitive non-motorized, etc. into other recreation opportunity spectrum settings based on criteria supplied by the Region 1 recreation staff and 1987 recreation opportunity spectrum documentation. The output polygon is the final recreation opportunity spectrum classification for review by recreation staff. Remember to evaluate areas classified as urban or rural that might be roaded modified.



Final review by recreation staff and reclassification of Rural or Urban areas to Roaded Modified

The draft winter recreation opportunity spectrum classification was reviewed by forest recreation staff. The recreation opportunity spectrum classification was intersected with the basic ownership layers (from forest ref library layer files) and only polygons in USDA Forest Service ownership had the ros attribute filled in (ie: removed recreation opportunity spectrum classification from nonfs lands). The forest did not utilize the roaded modified class. Some semiprimitive (motorized and non-motorized) areas that were less than the minimum size were not reclassified as they were better represented in their original classified type.

To develop the desired winter recreation opportunity spectrum for alternatives, the management area allocation map for that alternative, the oversnow vehicle map for the districts and the recreation opportunity spectrum characteristics table (Appendix A in this document) were used. Other maps such as big game winter range and grizzly bear connectivity were reviewed.

Appendix A

Summer and Winter Recreation Opportunity Spectrum Setting Characteristics Table

ROS SETTING		SUMMER CHARACTERISTICS	WINTER CHARACTERISTICS
Primitive	Physical	**Theme:** Predominately unmodified, naturally evolving, vast, and remote	
		Remoteness: 3 miles or more from designated motorized routes and areas	
		Size: 5,000 or more acres	
		Infrastructure (access and facilities) *Access* - Non-motorized trails, class 1; Travel on foot and horse, no motorized travel, no mechanized travel within designated Wilderness *Rec sites* – Dev. scale 0, no improvements *Sanitation* – no facilities, leave no trace; *Water supply* – undeveloped natural; *Signing* – minimal, constructed of rustic, natural materials; *Interpretation* - through self-discovery *Water crossing* – minimal, pedestrian only, made of natural materials	*Access* – No roads or motorized trails. User-created ski and snow shoe trails, No motorized travel No mechanized travel within designated Wilderness No other infrastructure or facilities typically present
		Vegetation: Natural, no treatments except for fire use.	
		Scenic Integrity: Very High	
	Managerial	Little to no on-site regimentation, few encounters with rangers	
	Social	Very high probability of solitude; closeness to nature; self-reliance, high challenge and risk; little evidence of people. Typically 6 or less encounters with other parties on trails, and less than 3 parties visible from camping sites.	
Se	Physical	**Theme:** Predominately natural/natural appearing; rustic improvements to protect resources.	
		Remoteness: ½ mile or more from designated motorized routes and areas.	
		Size: 2,500 or more acres	

ROS SETTING		SUMMER CHARACTERISTICS	WINTER CHARACTERISTICS
		Infrastructure (access and facilities) *Access* - Non-motorized routes, trail classes 1-2 typical. Foot/horse/mountain bike use - no motorized travel. Closed and temporary roads may be present. *Rec sites* – Dev Scale 0-1, minor investments to protect resources *Sanitation* – no facilities, leave no trace *Water supply* – undeveloped, natural *Signing* – rustic, natural materials. *Interpretation* - typically self-discovery *Water crossing* – rustic structures for foot/horse traffic	*Access* – Ungroomed non-motorized trails with some trail markers, user created routes and areas from ski or snow shoe use. No motorized travel No other infrastructure or facilities typically available
		Vegetation: Predominately natural treatment to enhance forest health	
		Scenic Integrity: High	
	Managerial	Minimum or subtle signing, regulations, or other regimentation. Low encounters with rangers.	
	Social	High probability of solitude, closeness to nature, self-reliance. High to moderate challenge and risk. Usually 6-15 encounters with other parties on trails. 6 or less parties visible from camping sites.	
Semi-Primitive Motorized		**Theme:** Predominately natural appearing, motorized use visible and audible.	
		Remoteness: ½ mile or more from OM 3-5 roads	
		Size: 2,500 or more acres	
	Physical	**Infrastructure (access and facilities)** *Access* - Motorized routes: OML 2 roads and trail class 2 typical; OHVs allowed on designated routes and areas *Rec sites* – Dev. Scales 0-2; investments to protect resources *Sanitation* – limited facilities, outhouses may be in areas of concentrated use. *Water supply* - undeveloped natural *Signing* – rustic, made of natural materials; *Interpretation* – self-discovery, some located on site or at trailheads; *Water crossing* - rustic structures or bridges	*Access* – ungroomed but marked over-snow vehicle routes and areas. Ungroomed ski trails. Over snow vehicles on designated routes and areas. Few, if any, facilities or services available
		Vegetation: treatment areas are very small in number, widely disbursed, and consistent with natural vegetation patterns.	
		Scenic Integrity: High or Moderate	
	Managerial	Minimum, subtle on-site controls; designated motorized routes/areas	Minimum, subtle on-site controls; Designated routes and areas for over-snow vehicles.
	Social	Moderate to high probability of solitude. High degree of risk/challenge	
Road	**Physical**	**Theme:** Natural Appearing with nodes and corridors of development such as campgrounds, trailheads, boat launches, and rustic, small-scale resorts.	
		Remoteness: encompass ½ mile buffer of OML 3-5 roads.	
		Size: **n/a**	

ROS SETTING		SUMMER CHARACTERISTICS	WINTER CHARACTERISTICS
		Infrastructure (access and facilities): *Access* – Typically :OML 2-5 roads and Trail Class 3-4, hwy. vehicles, OHVs and non-motorized travel on designated routes *Rec sites* – Dev. Scales 0-3 typical *Sanitation* –typically vault toilets *Water supply* – often developed *Signing* – variety of materials, blend with natural setting *Interpretation* – simple roadside signs, some interpretive displays *Water crossings* – bridges, natural materials.	*Access – Some plowed roads and groomed snowmobile routes. Groomed ski trails may also exist.* Warming huts, cabins, and rustic facilities may be present.
		Vegetation: Vegetation treatment are evident but in harmony/subordinate to natural setting.	
		Scenic Integrity: High to Low	
	Managerial	Signs and regulations present but typically subordinate to the setting. Moderate likelihood of encountering Forest Service rangers.	
	Social	Moderate evidence of human sights and sounds; moderate concentration of users at campsites; little challenge or risk.	
Rural	**Physical**	**Theme:** Altered landscapes with cultural emphasis such as: rural, pastoral, and/or agricultural. Administrative sites, historic complexes, and moderately developed resorts are typical	
		Remoteness: not remote, often near other (non-FS) rural settings and communities.	
		Size: n/a but typically small parcels within larger roaded natural settings.	
		Infrastructure (access and facilities): *Access* – typically OML 3-5 roads and trail classes 3-5, mass transit sometimes available *Rec sites* – Dev. scale 4-5 *Sanitation* – Flush toilets *Water supply* – developed, showers common *Signing* – natural and synthetic materials *Interpretation* –roadside exhibits, interpretive. programs, etc. *Water crossings* – bridges, accommodating hwy. vehicles, RVs, heavy equipment	*Access* – Groomed over-snow vehicle routes, groomed cross-country skiing, skate skiing, and downhill ski/snowboard trails Full service facilities: and resorts often present
		Vegetation: treatments often visible, blend with landscape	
		Scenic Integrity: High to Low	
	Managerial	Obvious signing (regulation and information), education and law enforcement staff. Motorized and mechanized travel common and often separated.	
	Social	High interaction among users is common. Other people in constant view. Little challenge or risk associated with being outdoors.	

ROS SETTING		SUMMER CHARACTERISTICS	WINTER CHARACTERISTICS
Urba	**Physical**	**Theme:** Highly developed site modifications and facilities. Ski areas, large visitor centers, and large resorts are examples of urban nodes within NF System lands.	
		Remoteness: often close to towns and cities**.**	
		Size: n/a but typically small nodes	

		Infrastructure (access and facilities): *Access* – OML 4-5 roads and trail classes 4-5, mass transit often available *Rec sites* – Dev scale 5 typical *Sanitation* – flush toilets *Water supply* – Hot water, showers *Signing* – extensive *Interpretation* –exhibits in staffed visitor centers, highly developed and formalized exhibits *Water crossings* - bridges for: hwy. vehicles, buses, RVs, heavy equip.	*Access* – Groomed over-snow vehicle routes, groomed cross-country skiing, skate skiing and downhill ski/snowboard trails Full service facilities: visitor centers, resorts and lodging often present
		Vegetation: often planted, manicured and maintained	
		Scenic Integrity: High to Low	
	Managerial	Intensive on-site management, obvious signs, and staffing, education and law enforcement available. Motorized and mechanized travel restricted to designated routes. No motorized or mechanized travel allowed off designated travel routes.	
	Social	High degree of interaction with people. People are in constant view. Challenge and risk are unimportant except for competitive sports.	