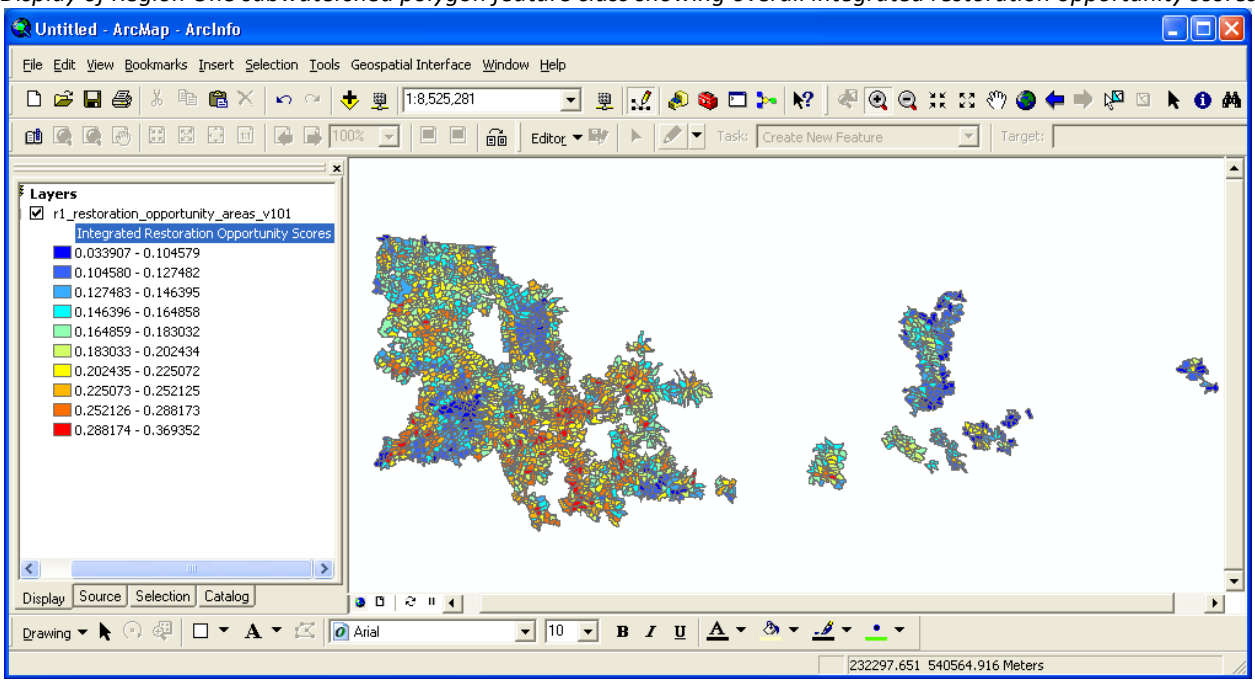
How to use the Integrated Restoration and Protection Strategy (IRPSv102) GIS datasets

This document describes what the IRPSv102 GIS dataset is and how to use it to identify integrated restoration opportunity watersheds. Please read the ***"IRPS_Brief_Overview_with_maps.pdf"*** document first for an overview of the IRPSv102 analysis. The IRPSv102 GIS dataset consists of a Region One wide subwatershed (6th code huc) polygon feature class, four sub-region subwatershed polygon features classes (subsets of the region wide feature class), and a table with scenario Value and Risk inputs for each subwatershed. Most Forest users will work with one of the four sub-region 6th code watershed polygon features (Idaho, MtWest, MtEast, or Plains). This document will describe the region wide watershed layer and associated scenario Value and Risk inputs table first, and then describes the sub-region watershed layers.

Display of Region One subwatershed polygon feature class showing overall integrated restoration opportunity scores

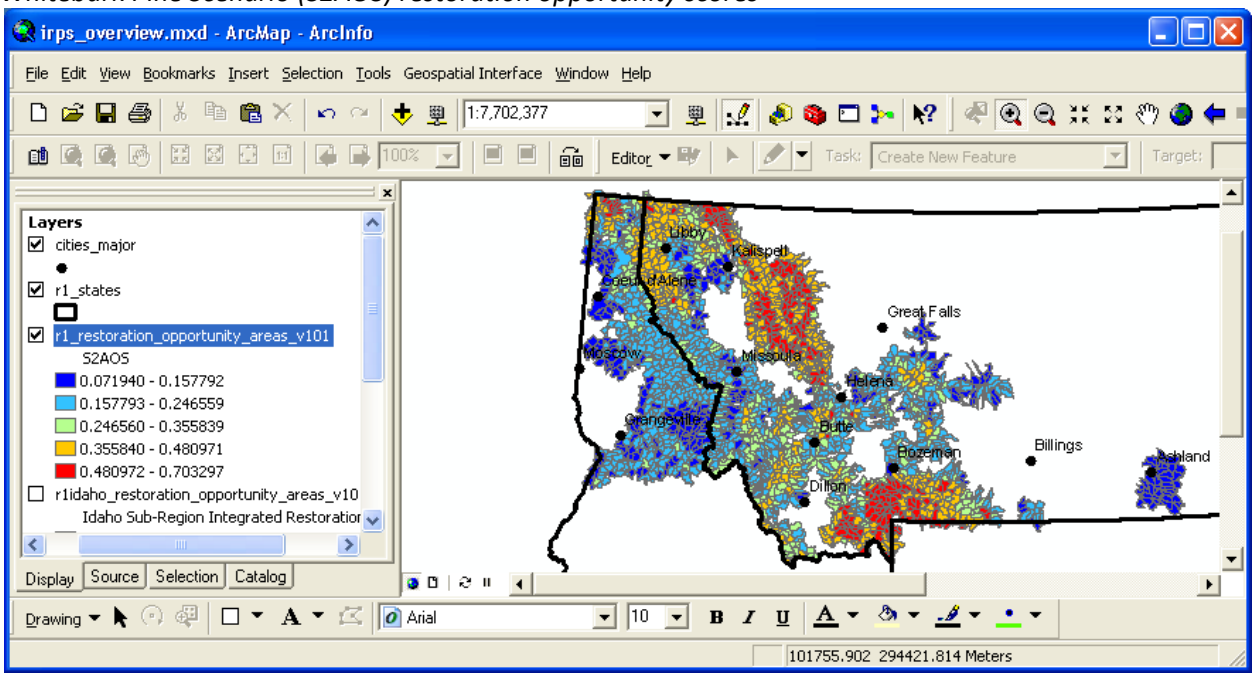


Region Wide Subwatershed Layer - with Scenario, Theme, and Overall Restoration Opportunity Scores

The IRPSv102 analysis is based on resource specific scenarios that measure resource Values, and Risks to those Values. Subwatersheds with high Value and Risk inputs have higher restoration opportunities for that scenario resource. The IRPSv102 analysis has 19 resource scenarios evaluated for all subwatersheds. For example in the Whitebark pine scenario (S2A) there are two Value inputs: percentage of Whitebark pine habitat and percentage of Grizzly bear species range within the subwatershed. This scenario has three Risk inputs: crown fire burn probability, blister rust damage, and insect occurrence based on ADS surveys from 2002-2009. The Value and Risk inputs are summed in an equation and a Whitebark pine restoration opportunity score (oppscore) is calculated for every subwatershed. All scenario restoration opportunity scores fall between zero and one and subwatersheds with scores nearer one have higher restoration opportunities for that scenario.

In the map display below Whitebark pine scenario restoration opportunity scores are shown. Notice how the Bob Marshall and Greater Yellowstone Area both have higher scores because those areas have both Whitebark pine and Grizzly bear species range.

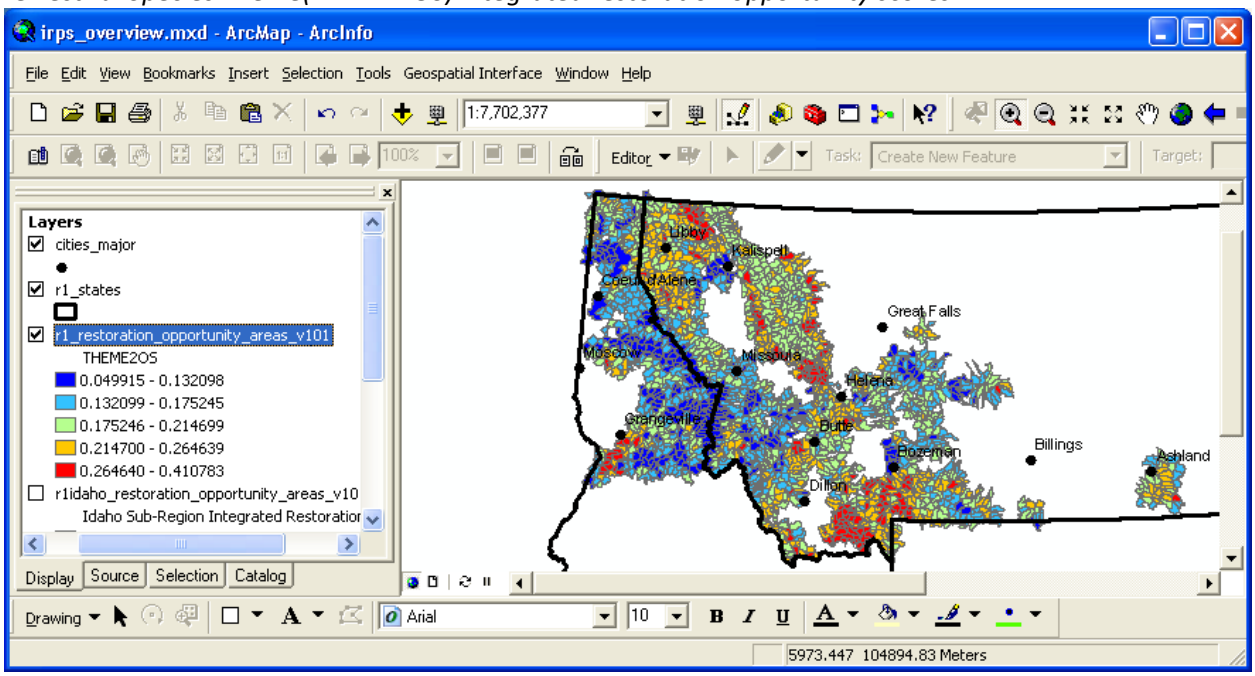
Whitebark Pine Scenario (S2AOS) restoration opportunity scores



The next step in the IRPSv101 analysis was to integrate resource specific scenarios into six major themes. For example the Whitebark pine scenario is part of the terrestrial species theme (Theme 2) that integrates nine unique wildlife habitat, connectivity, or threatened and endangered species issues. Subwatersheds with higher theme 2 scores have greater restoration opportunities for multiple wildlife issues. The nine terrestrial species scenario restoration opportunity scores are averaged into a Theme 2 restoration opportunity score using equal weights:

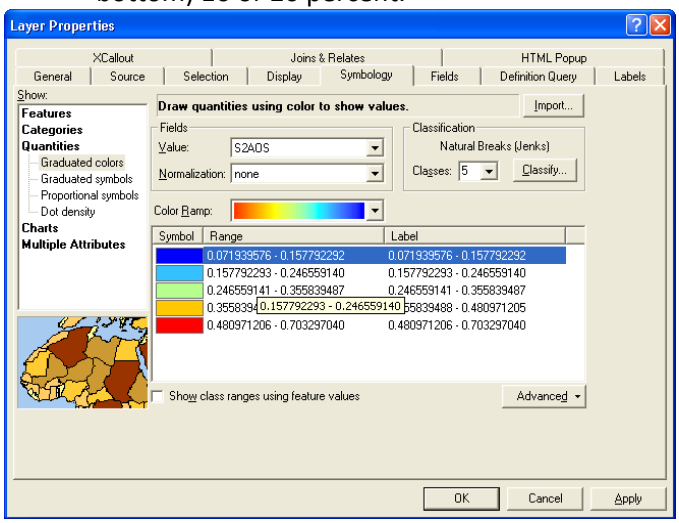
(S2AOS + S2BOS + S2COS + S2DOS + S2EOS + S2FOS + S2GOS + S2HOS + S2IOS) / 9 = THEME2OS

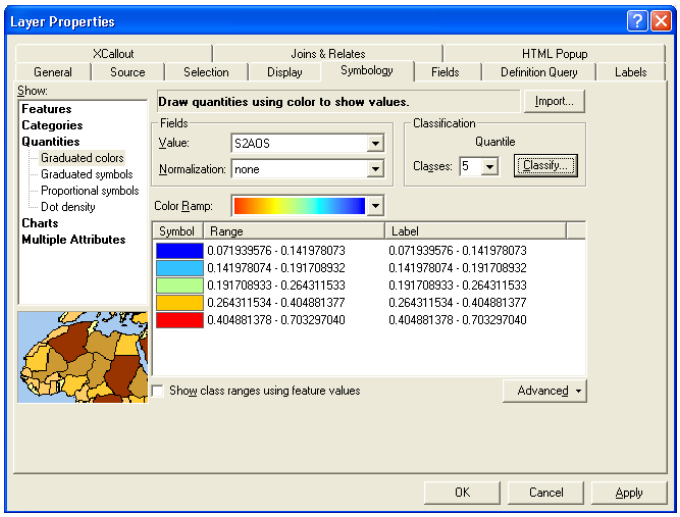
Terrestrial Species Theme(THEME2OS) integrated restoration opportunity scores



How to Display Scenario or Theme Restoration Opportunity Scores

- Bring up the IRPSv102 subwatershed properties window in ArcMap and select the Symbology tab.
- In the Symbology tab, select Quantities and then select the scenario/theme restoration opportunity score to display. By default, ArcMap displays quantities using 5 classes with Natural Breaks; another way of displaying oppscores that allows direct side-by-side comparison of different scores is to select Quantile breaks with 5 or 10 classes. Quantiles not only facilitate comparison, they allow users to identify subwatersheds in the top (or bottom) 10 or 20 percent.





Here is a list of scenarios by theme groups:

(Note: three scenarios are used a second time in theme 6 based on current regional priorities for bark beetle projects)

Theme 1 – Vegetation Resilience

Scenario 1a*:* *Community Fire Resilience*
Scenario 1b*:* *Vegetation Resilience and Current Departure from Desired Conditions in Forested areas addressing resiliency and vulnerability*
Scenario 1c: *Ecosystem Resilience and Vulnerability in non-forested areas*

Theme 2 – Terrestial Species

Scenario 2a: *Whitebark Pine*
Scenario 2b: *Low Elevation Dry Forest Communities*
Scenario 2c: *Dry Shrublands (Low Elevation Sagebrush)*
Scenario 2d: *Aspen*
Scenario 2e: *Woody Draws*
Scenario 2f: *Mixed Grass Prairie*
Scenario 2g: *Riparian, wetland and seeps*
Scenario 2h: *Big game Winter Range*
Scenario 2i: *T&E Core grizzly bear habitat*

Theme 3 – Watershed Management

Scenario 3*:* *Watershed Quality (Sediment)*

Theme 4 – Aquatic Species

Scenario4*:* *Threatened, Endangered, and Sensitive Fish Species*

Theme 5 – Recreation Settings and Opportunities

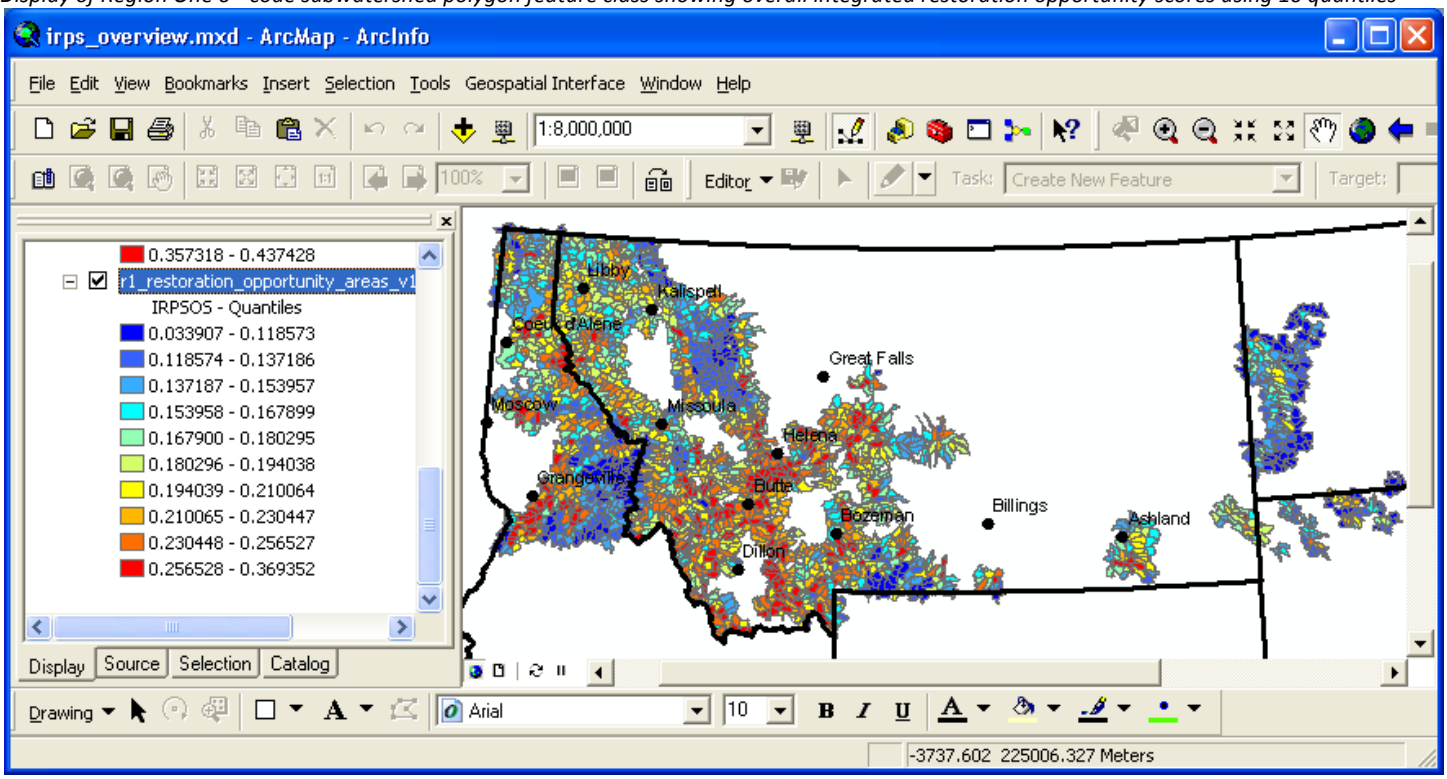
Scenario 5a: *Safety*
Scenario 5b: *Investment Protection*
Scenario 5c: *Recreation Setting Restoration*
Scenario 5d: *Scenic Integrity Restoration*
Scenario 5e: *Scenic Integrity Protection*

Theme 6 – Public Safety and Infrastructure Protection

Scenario 1a*:* *Community Fire Resilience*
Scenario 5a: *Safety*
Scenario 5b: *Investment Protection*

The final step in the IRPSv101 analysis was to integrate all six theme restoration opportunity scores into an overall integrated restoration opportunity score (IRPSOS). Note: all theme and overall integrated restoration opportunity scores fall between zero and one, and subwatersheds with scores nearer one have greater restoration opportunities. The six theme restoration opportunity scores were averaged into an overall score: (THEME1OS + THEME2OS + THEME3OS + THEME4OS + THEME5OS + THEME6OS) / 6 = IRPSOS

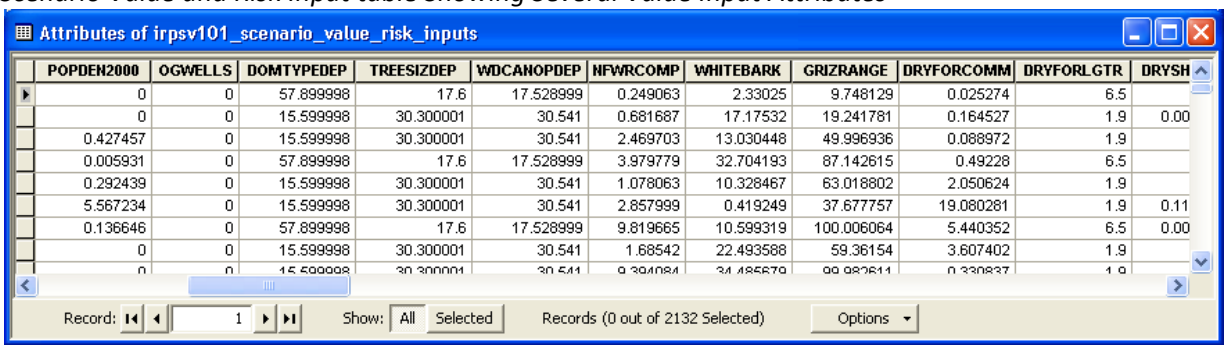
Display of Region One 6th code subwatershed polygon feature class showing overall integrated restoration opportunity scores using 10 quantiles



Scenario Value and Risk Inputs Table

As described above, Value and Risk inputs were used to calculate scenario restoration opportunity scores. A table with all scenario Value and Risk inputs (over 50 of them) was created that could be joined to the IRPSv102 Subwatershed layers (region-wide and sub-region layers). The scenario Value and Risk input table can be used to spatially view Value and Risk input distributions across subwatersheds. The table can also be used to recalculate scenario restoration opportunity scores by changing the Value and Risk input weights for that scenario. The Value and Risk input values in the table could be updated with local Forest data and scenario restoration opportunity scores recalculated. Another option would be adding a new Value or Risk input for a scenario and then recalculating scenario restoration opportunity scores. Again, there are over 50 Value and Risk inputs calculated for every watershed in the region; a metadata file for the table explains the Value and Risk input source and units (also brief descriptions in Appendix A).

Scenario Value and Risk Input table Showing Several Value Input Attributes



Attributes of irpsv101_scenario_value_risk_inputs

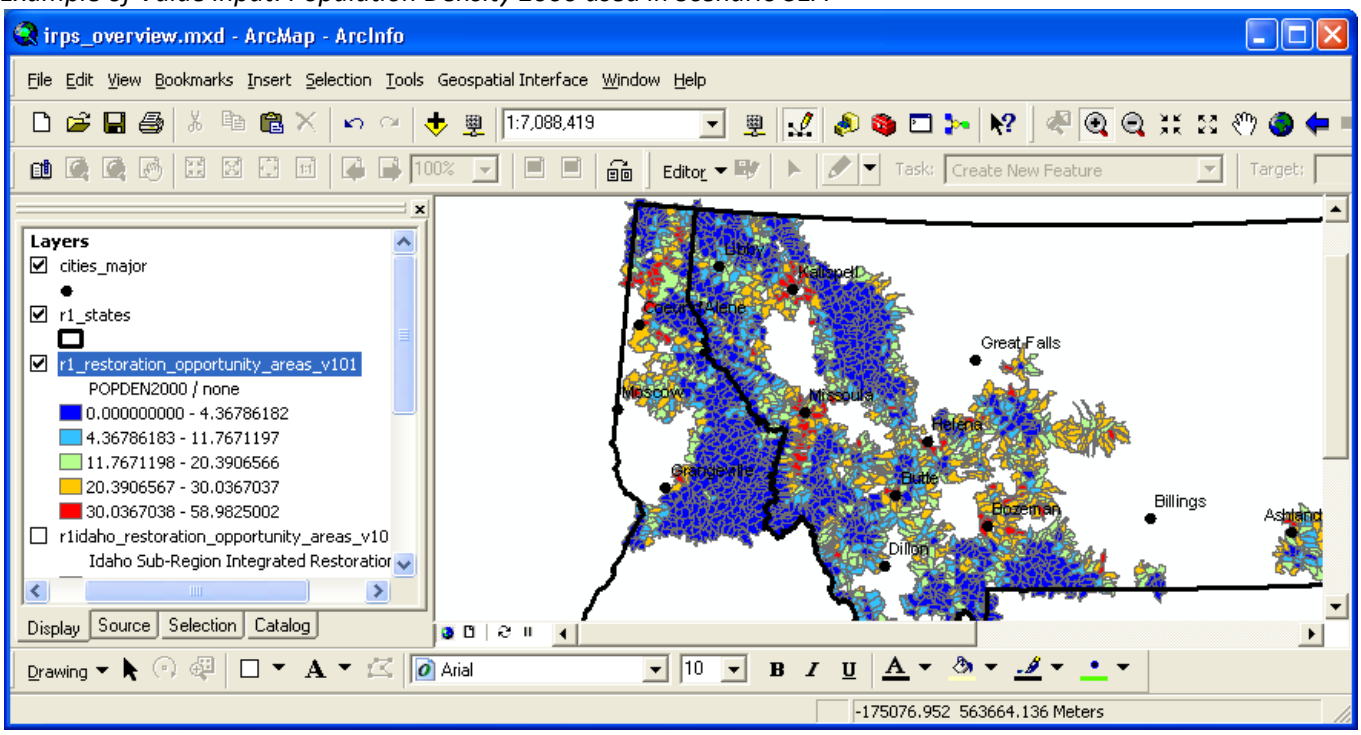
POPDEN2000	OGWELLS	DOMTYPEDEP	TREESIZDEP	WDCANOPDEP	NFWRCOMP	WHITEBARK	GRIZRANGE	DRYFORCOMM	DRYFORLGTR	DRYSH
0	0	57.899998	17.6	17.528999	0.249063	2.33025	9.748129	0.025274	6.5	
0	0	15.599998	30.300001	30.541	0.681687	17.17532	19.241781	0.164527	1.9	0.00
0.427457	0	15.599998	30.300001	30.541	2.469703	13.030448	49.996936	0.088972	1.9	
0.005931	0	57.899998	17.6	17.528999	3.979779	32.704193	87.142615	0.49228	6.5	
0.292439	0	15.599998	30.300001	30.541	1.078063	10.328467	63.018802	2.050624	1.9	
5.567234	0	15.599998	30.300001	30.541	2.857999	0.419249	37.677757	19.080281	1.9	0.11
0.136646	0	57.899998	17.6	17.528999	9.819665	10.599319	100.006064	5.440352	6.5	0.00
0	0	15.599998	30.300001	30.541	1.68542	22.493588	59.36154	3.607402	1.9	
0	0	15.599998	30.300001	30.541	9.394084	34.485679	99.982611	0.330837	1.9	

Record: 1 Show: All Selected Records (0 out of 2132 Selected) Options

To join the Scenario Value and Risk table to a IRPSv102 subwatershed layer and display Value or Risk input data:

- Join using the HUC_12 attribute in both tables.
- Set symbology to quantities and select Value or Risk field to display.

Example of Value input: Population Density 2000 used in Scenario S1A



How to recalculate a Scenario Restoration Opportunity Score

Value and Risk input values are normalized from 0-1 using min-max values. This allows Value and Risk inputs with different units to be summed (e.g., combining percent big game hiding cover with miles of open roads). The general outline of a scenario oppscore formula is:

*(((<input attribute1> - min1) / (max1 - min1)) * weight1) + (((<input attribute2> - min2) / (max2 - min2)) * weight2) + …*

- Remove any table joins to the Scenario Value and Risk table.
- Open the Scenario Value and Risk table.
- Open the Scenario Value and Risk table metadata file (right click on table, select data->view metadata)
- Scroll to the last column. called OPPSCORE.
- Right-click on the OPPSCORE column header and select field calculator.
- In the metadata, copy and paste (use mouse) the scenario opportunity score formula into the field calculator window (scenario opportunity score formulas are also in Appendix B).
  *** Adjust Value and Risk input weights and/or attribute min and max values in the formula as needed.
- Click ok in the field calculator.
- Join the scenario Value and Risk table to the watershed layer (use HUC_12 attribute in both tables).
- Use the field calculator to update the watershed layer scenario oppscore attribute from the OPPSCORE attribute.
- Use the field calculator to update the theme oppscore attribute using updated scenario oppscores.

Example of Community Fire Resilience oppscore formula:

S1AOS = ((([POPDEN2000]-0)/(58.99-0))*0.5) + ((([OGWELLS]-0)/(46-0))*0.2) + ((([BURNPROB]-0)/(0.587-0))*0.2) + ((([ADSBBOCC]-0)/(100-0)*0.05) + ((([BBHAZ]-0)/(1-0))*0.05)

Metadata - irpsv101_scenario_value_risk_inputs

Stylesheet: XTools Pro Metadata

Geospatial Data Presentation Form: digital data
Publication Information:
Publication Place: Missoula, MT
Publisher: USDA Forest Service, Northern Region, Engineering, Geospatial Group
Online Linkage:

Description:
Abstract:

This table contains the 2010 Region One Integrated Restoration and Protection Strategy (IRPS) Value and Risk inputs used to calculate Scenario opportunity scores in the r1_restoration_opportunity_areas_v101 feature class. The Scenario opportunity score formulas are shown below. In the formulas Value and Risk inputs were normalized from 0-1 using their data range and then multiplied by their input weight for the Scenario. The attribute descriptions contain information about the attribute data source and what the attribute is. Most of the Value and Risk attributes are based on a watershed measure of the attribute - percentage of area, number of occurrence, or miles per square mile. A few attributes are based on FIA data queries across Forest Planning/Landscape areas or fifth code watersheds and contain a percentage of FIA plots meeting query criteria. The last attribute in the table (OPPSCORE) can be used to calculate Scenario opportunity scores using the ArcMap field calculator and formulas below. Users could also export this table to a dbase or excel file to run additional analysis.

This table was also used to calculate Scenario opportunity scores for the four Subregions - Idaho, MtWest, MtEast, and Plains. The subregion Scenario opportunity score formulas are the same as shown below except the Value and Risk normalization ranges are based on the subregion watersheds only. Please see the Subregion feature class layers metadata files for the Subregion Scenario formulas.

S1A Community Fire Resilience
S1AOS = (([POPDEN2000] / 58.99) * 0.5) + (([OGWELLS] / 46) * 0.2) + (([BURNPROB] / 0.587) * 0.2) + (([ADSBBOCC] / 100) * 0.05) + (([BBHAZ] / 1) * 0.05)

S1B Vegetation Resilience and Current Departure from Desired Conditions in Forested Areas
S1BOS = (([DOMTYPEDEP] / 75.1) * 0.25) + (([TREESIZDEP] / 56.11) * 0.05) + (([WDCANOPDEP] / 39.39) * 0.4) + (([ADSBBOCC] / 100) * 0.15) + (([CRNFIRECOM] / 0.696285) * 0.1) + (([BBHAZ] /1) * 0.05)

Field Calculator

Fields:
OBJECTID
HUC_12
HUC12_NAME
HUC_ACRES
HUC_SQMI
REGIONALAA
S1B_FOREST
S1B_AA
FSACRES
FSOWND
POPDEN2000
OGWELLS

Type: Number / String / Date

Functions: Abs ( ) Atn ( ) Cos ( ) Exp ( ) Fix ( ) Int ( ) Log ( ) Sin ( ) Sqr ( )

OPPSCORE = (Advanced)

(([POPDEN2000] / 58.99) * 0.5) + (([OGWELLS] / 46) * 0.2) + (([BURNPROB] / 0.587) * 0.2) + (([ADSBBOCC] / 100) * 0.05) + (([BBHAZ] / 1) * 0.05)

Load... Save... Help OK Cancel

Calculate selected records only

Field Calculator

Fields:
irpsv101_scenario_value_risk_inputs.ROADSTRMXC
irpsv101_scenario_value_risk_inputs.ROADCOMB
irpsv101_scenario_value_risk_inputs.DAMS
irpsv101_scenario_value_risk_inputs.STRMBARR
irpsv101_scenario_value_risk_inputs.DISPRECALL
irpsv101_scenario_value_risk_inputs.S3AOS
irpsv101_scenario_value_risk_inputs.POPDEN2030
irpsv101_scenario_value_risk_inputs.NONWILDER
irpsv101_scenario_value_risk_inputs.HUMANDEV
irpsv101_scenario_value_risk_inputs.OPPSCORE

Type: Number / String / Date

Functions: Abs ( ) Atn ( ) Cos ( ) Exp ( ) Fix ( ) Int ( ) Log ( ) Sin ( ) Sqr ( )

r1_restoration_opportunity_areas_v101.S1AOS = (Advanced)

[irpsv101_scenario_value_risk_inputs.OPPSCORE]

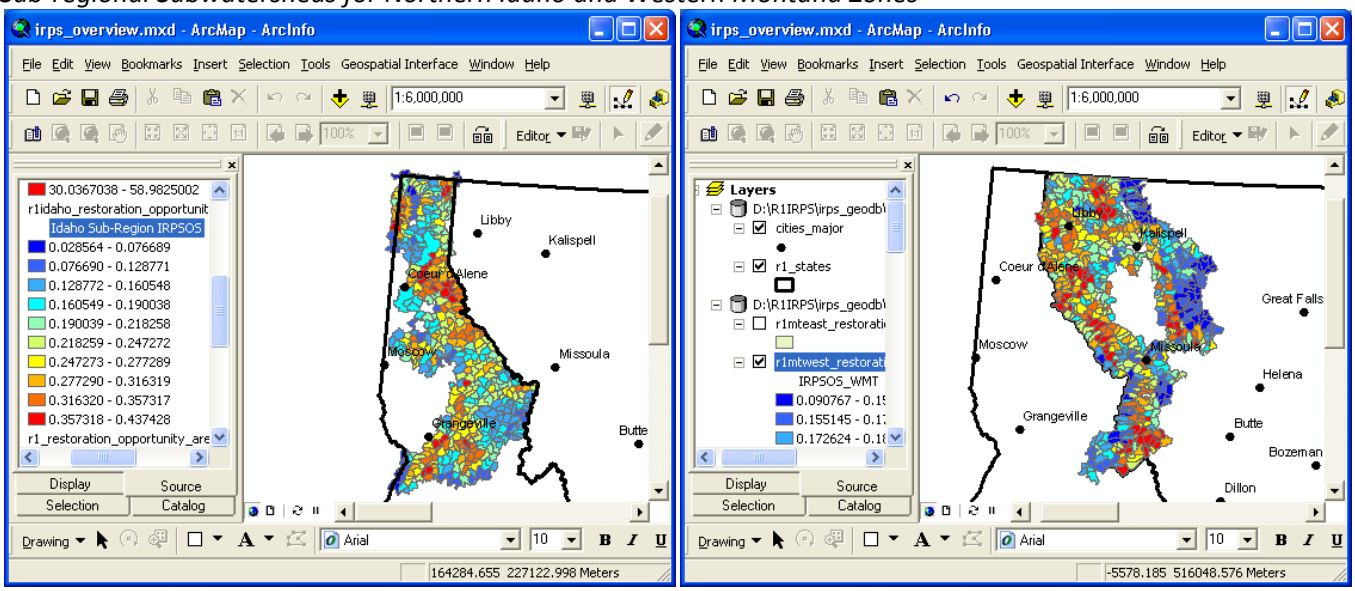
Load... Save... Help OK Cancel

Calculate selected records only

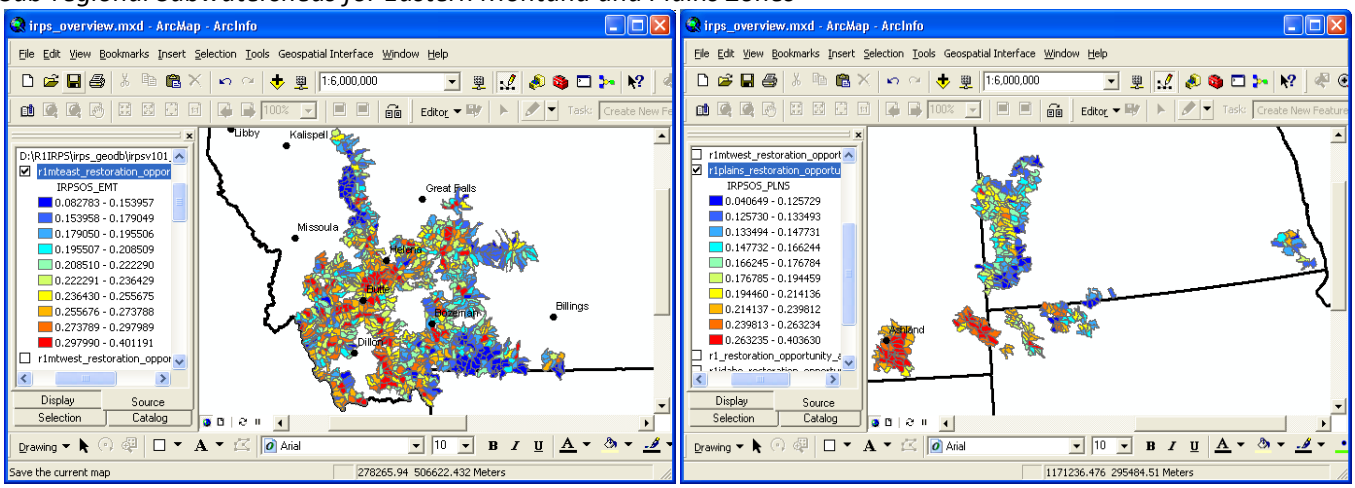
Sub-region Subwatershed Layers - with Scenario, Theme, and Overall Restoration Opportunity Scores

As mentioned in the introduction, there are four sub-region subwatershed layers that are subsets of the IRPSv101 region-wide subwatershed layer. The four sub-regions are based on Ecological and General Forest Planning Zones and include: Northern Idaho *(Idaho Panhandle, Clearwater, Nez Perce)*, Western Montana (*Kootenai, Flathead, Lolo, Bitterroot)*, Eastern Montana *(Beaverhead-Deerlodge, Helena, Lewis-Clark, Gallatin, Beartooth RD Custer)*, and Plains *(Ashland and Sioux RD Custer, Dakota Prairie Grasslands)*. Subwatershed restoration opportunity assessments are more meaningful at the sub-regional scale than across the entire region. Some of the scenario resource concerns only occur across sub-regional areas and thus subwatershed comparisons between Northern Idaho and North Dakota are not practical. The sub-regional layers have the same scenario, theme, and overall integrated restoration opportunity scores described in the region wide watershed layer. ***All of the scenario restoration opportunity scores were calculated using Value and Risk input ranges across sub-regional subwatersheds only.*** Revised theme and overall integrated restoration opportunity scores were also calculated. The sub-regional analysis is considered a starting point for Forest Planning Zones. The regional office anticipates working with Forest Planning Zones to adjust scenario Value and Risk input weights and possibly adding new inputs specific to sub-regional analysis.

Sub-regional Subwatersheds for Northern Idaho and Western Montana Zones



Sub-regional Subwatersheds for Eastern Montana and Plains Zones



Appendix A - Brief Description of Subwatershed and Scenario Value and Risk Input Table Attributes

Region-wide Subwatershed and Sub-region Subwatershed Feature Classes:

HUC_10	Unique identifier for each watershed (5th code huc)
HUC_10_NAME	Unique name for each watershed (5th code huc)
HUC_12	Unique identifier for each subwatershed (6th code huc)
HUC_12_NAME	Unique name for each subwatershed (6th code huc)
HUC_ACRES	Acres of watershed
HUC_SQMI	Square miles of watershed
REGIONAL_AA	Sub-region analysis area: Idaho, MtWest, MtEast, Plains
S1B_FOREST	National Forest with majority of lands within watershed (used in Scenario S1B analysis)
S1B_AA	Unique numeric code for Scenario S1B FIA data analysis (codes grouped by Forest)
FS_ACRES	Acres of land managed by the USDA Forest Service within watershed based on 2009 Alp data
FSOWND	Percentage of land managed by the USDA Forest Service within watershed
S1AOS	Opportunity score for Scenario S1A Community Fire Resilience
S1BOS	Opportunity score for Scenario S1B Vegetation Resilience and CDDC in Forest Areas
S1COS	Opportunity score for Scenario S1C Ecosystem Resilience and Vulnerability in Non-forested Areas
S2AOS	Opportunity score for Scenario S2A Whitebark Pine
S2BOS	Opportunity score for Scenario S2B Low Elevation Dry Forest Communities
S2COS	Opportunity score for Scenario S2C Dry Shrublands
S2DOS	Opportunity score for Scenario S2D Aspen
S2EOS	Opportunity score for Scenario S2E Woody Draws
S2FOS	Opportunity score for Scenario S2F Mixed Grass Prairie
S2GOS	Opportunity score for Scenario S2G Riparian
S2HOS	Opportunity score for Scenario S2H Big Game Winter Range
S2IOS	Opportunity score for Scenario S2I Core Grizzly Bear Habitat
S3AOS	Opportunity score for Scenario S3 Watershed Quality
S4AOS	Opportunity score for Scenario S4 Threatened, Endangered, and Sensitive Fish Species
S5AOS	Opportunity score for Scenario S5A Safety (recreation site safety based on use levels)
S5BOS	Opportunity score for Scenario S5B Investment Protection (recreation site protection based on investments)
S5COS	Opportunity score for Scenario S5C Recreation Setting Restoration
S5DOS	Opportunity score for Scenario S5D Scenic Integrity Restoration
S5EOS	Opportunity score for Scenario S5E Scenic Integrity Protection
THEME1OS	Opportunity score for Theme 1 Vegetation Resilience based on Scenarios S1A+S1B+S1C
THEME2OS	Opportunity score for Theme 2 Terrestrial Species based on Scenarios S2A+S2B+S2C+S2D+S2E+S2F+S2G+S2H+S2I
THEME3OS	Opportunity score for Theme 3 Watershed Management based on Scenario S3A
THEME4OS	Opportunity score for Theme 4 Aquatic Species based on Scenarios S4A
THEME5OS	Opportunity score for Theme 5 Recreation Settings and Opportunities based on Scenarios S5A+S5B+S5C+S5D+S5E
THEME6OS	Opportunity score for Theme 6 Safety based on Scenarios S1A+S5A+S5B
IRPSOS	Opportunity score for Final Integration of all six Themes

Note: in Sub-region subwatershed layers all scores have the initials of the regional analysis area after the attribute name: S1AOS_ID, S1AOS_WMT, S1AOS_EMT, S1AOS_PLNS, etc …

Scenario Value and Risk Inputs Table (note: table has Value inputs first and then Risk inputs):

HUC_12	Unique identifier for each subwatershed (6th code huc)
HUC_12_NAME	Unique name for each subwatershed (6th code huc)
HUC_ACRES	Acres of subwatershed
HUC_SQMI	Square miles of subwatershed
REGIONAL_AA	Sub-region analysis area: Idaho, MtWest, MtEast, Plains
S1B_FOREST	National Forest with majority of lands within subwatershed (used in Scenario S1B analysis)
S1B_AA	Unique numeric code for Scenario S1B FIA data analysis (codes grouped by Forest)
FS_ACRES	Acres of land managed by the USDA Forest Service within subwatershed based on 2010 Alp data
FSOWND	Percentage of land managed by the USDA Forest Service within watershed
POPDEN2000	Percentage of watershed with high housing density based on the "Forests on the Edge" 2000 housing density model
OGWELLS	Number of active oil or gas wells on Forest Service lands based on minerals database
DOMTYPEDEP	Percentage of cddc or hrv for forest dominance types based on FIA data query by S1B analysis area
TREESIZDEP	Percentage of cddc or hrv for forest tree size class groups based on FIA data query by S1B analysis area
WDCANOPDEP	Percentage of cddc or hrv for warm dry forest canopy closure based on FIA data query by S1B analysis area
NFWRCOMP	Percentage of watershed with nonforest types that have weed risk based on Landfire Rapid Refresh and R1 weedrisk
WHITEBARK	Percentage of watershed with whitebark pine based on Bob Keane blister rust map
GRIZRANGE	Percentage of watershed with grizzly bear range based on USFWS 2007 occupied area map
DRYFORCOMM	Percentage of watershed with dry forest communities based on Landfire Rapid Refresh (LF_1.0.1)
DRYFORLGTR	Percentage of dry forest type with large trees based on FIA data query by S1B analysis area
DRYSHRUB	Percentage of watershed with dry shrublands based on Landfire Rapid Refresh (LF_1.0.1)
ASPEN	Percentage of watershed with aspen based on Landfire Rapid Refresh (LF_1.0.1)
WOODYDRAW	Percentage of watershed with woody draws based on Landfire Rapid Refresh (LF_1.0.1)
MGPRAIRIE	Percentage of watershed with mixed grass prairie based on Landfire Rapid Refresh (LF_1.0.1)
RIPWETLAND	Percentage of watershed with riparian/wetland based on Landfire Rapid Refresh (LF_1.0.1)
BIGGAMEWR	Percentage of watershed with big game winter range based on IRPSv602
MUNICWSHD	Municipal Watershed based on IRPS V062 (1=yes/0=no)
D303	Indicates whether the watershed has 303D listed impaired stream reaches as of 2008 (1=yes/0=no)
AQUATPRIOR	Aquatic Priority Watershed based on sub-regional criteria (1=yes/0=no)
DEVRECUSE	Weighted sum of number of developed recreation sites based on use
DISPRECHVH	Percentage of watershed with modeled dispersed recreation use in high or very high class
RECRESID	Number of special use permit recreation residence cabins
SKIAREAS	Number of ski areas
ADSROADS	Miles of Forest Service system roads in opm class 3/4/5 that are within 150 feet of 2002-2009 ADS bark beetle polygon
ADSTRAIL	Miles of Forest Service System trails are within 150 feet of 2002-2009 ADS bark beetle polygon
DEVRECINV	Weighted sum of number of developed recreation sites based on investment value
ADSUTILITY	Miles of High Voltage Utility lines that are within 150 feet of 2002-2009 ADS bark beetle polygon
SCENICINTL	Percentage of watershed with modeled scenic integrity in moderate or low class
RECOPSPEC	Percentage of watershed with modeled recreation opportunity spectrum in urban, roaded natural, semi-primitive motorized
SCENICINTH	Percentage of watershed with modeled scenic integrity in high or very high class
BURNPROB	Combined crown and ground fire burn probability based on Large Fire Simulator (FireSim) runs
CRNFIRECOM	Crown fire burn probability based on Large Fire Simulator (FireSim) runs
FOGNFIRCOM	Forest area ground fire burn probability based on Large Fire Simulator (FireSim) runs
NFGNFIRCOM	Non-forest area ground fire burn probability based on Large Fire Simulator (FireSim) runs
ADSBBOCC	Percentage of watershed with weighted sum of bark beetle occurrence class based on 2002-2009 ADS data
BBHAZ	Probability of pine stands being attacked by bark beetles based on FIA data query by 5th code huc
NFFRCC	Percentage of watershed non-forest areas with FRCC class 3 based on Landfire (LF_1.0.0)
GRAZCOMB	Combined grazing risk probability based on percentage of active allotments and amu levels
ACTALLOT	Percentage of watershed with active allotments on Forest Service lands
AMU	Number of AMU in active allotments
WBPBLISTRU	Percentage of watershed with blister rust based on Bob Keane blister rust map
MTBSMODHI	Percentage of watershed with 2000-2008 MTBS moderate or high burn severity class
WEEDRISK	Percentage of watershed with weighted sum of modeled weed risk class based on three sources across the region
GRSHRENCRO	Percentage of watershed with modeled conifer succession (encroachment) in grasslands/shrublands based on Landfire data
DECIDENCRO	Percentage of watershed with modeled conifer succession (encroachment) in deciduous forest based on Landfire data
ASPENFRCC	Percentage of watershed with weighted sum of FRCC class in aspen based on Landfire data
WOODRWFRCC	Percentage of watershed with weighted sum of FRCC class in woody draws based on Landfire data
S1BOS	Opportunity score for Scenario S2B Low Elevation Dry Forest Communities (used as a risk)
S1COS	Opportunity score for Scenario S1C Ecosystem Resilience and Vulnerability in Non-forested Areas (used as a risk)
MOTORROUTE	Miles per sqmi of open roads and motorized trails based on 2008 Forest travel routes layer
DEVRECSITE	Number of developed recreation sites per sqmi
MINES	Number of problem mines per sqmi based on abandoned mines layers for Idaho and Montana

ROADTOTDEN	Total road density per square mile based on 2008 Forest travel routes layer
ROADRIPDEN	Riparian road density per square mile based on 2008 Forest travel routes within 60m of 2008 NHD stream data
ROADSTRMXC	Number of stream crossings per stream mile based on 2008 Forest travel routes and 2008 NHD stream data
ROADCOMB	Combination of ROADTOTDEN + ROADRIPDEN + ROADSTRMXC
DAMS	Number of dams per stream mile based on water rights website of each state and 2008 NHD stream data
STRMBARR	Number of fish barriers per stream mile based on region one culverts_apr06.shp and 2008 NHD stream data
DISPRECALL	Percentage of watershed with weighted sum of modeled dispersed recreation class
S3AOS	Opportunity score for Scenario S3 Watershed Quality (used as a risk)
POPDEN2030	Percentage of watershed with high housing density based on the "Forests on the Edge" 2030 housing density model
NONWILDER	Percentage of watershed that is non-wilderness (used as a feasibility criteria)
HUMANDEV	Number of recreation residence cabins, developed recreation sites, and ski areas per sqmi and multiplied by 10,000
OPPSCORE	Attribute used to calculate Scenario Opportunity Scores

Appendix B - Scenario Restoration Opportunity Score Formulas for Region Wide and Sub-Region Subwatersheds
Note: Sub-region formulas have different Value and Risk input data ranges based sub-set areas

THEME 1

S1AOS = (([POPDEN2000] / 58.99) * 0.5) + (([OGWELLS] / 46) * 0.2) + (([BURNPROB] / 0.587) * 0.2) + (([ADSBBOCC] / 100) * 0.05) + (([BBHAZ] / 1) * 0.05)
S1AOS_ID = (([POPDEN2000] / 50.25) * 0.5) + ([OGWELLS] * 0.2) + ((([BURNPROB] - 0.038) / (0.587 - 0.038)) * 0.2) + (([ADSBBOCC] / 100) * 0.05) + (([BBHAZ] / 1) * 0.05)
S1AOS_WMT = (([POPDEN2000] / 58.99) * 0.5) + ([OGWELLS] * 0.2) + ((([BURNPROB] - 0.107) / (0.565 - 0.107)) * 0.2) + (([ADSBBOCC] / 73.7) * 0.05) + (([BBHAZ] / 1) * 0.05)
S1AOS_EMT = (([POPDEN2000] / 49.375) * 0.5) + ([OGWELLS] * 0.2) + ((([BURNPROB] - 0.043) / (0.587 - 0.043)) * 0.2) + (([ADSBBOCC] / 100) * 0.05) + (([BBHAZ] / 1) * 0.05)
S1AOS_PLNS = (([POPDEN2000] / 35.39) * 0.5) + (([OGWELLS] / 46) * 0.2) + (([BURNPROB] / 0.372) * 0.2) + (([ADSBBOCC] / 0.209) * 0.05) + (([BBHAZ] / 0.8) * 0.05)

S1BOS = (([DOMTYPEDEP] / 75.1) * 0.25) + (([TREESIZDEP] / 56.11) * 0.05) + (([WDCANOPDEP] / 39.39) * 0.4) + (([ADSBBOCC] / 100) * 0.15) + (([CRNFIRECOM] / 0.696285) * 0.1) + (([BBHAZ] /1) * 0.05)
S1BOS_ID = ((([DOMTYPEDEP] - 1.6) / (75.1 - 1.6)) * 0.25) + (([TREESIZDEP] / 35.4) * 0.05) + (([WDCANOPDEP] / 36.3) * 0.4) + (([ADSBBOCC] / 99.627893) * 0.15) + (([CRNFIRECOM] / 0.696285) * 0.1) + (([BBHAZ] / 1) * 0.05)
S1BOS_WMT = ((([DOMTYPEDEP] - 4) / (64.1 - 4)) * 0.25) + (([TREESIZDEP] / 35.9) * 0.05) + (([WDCANOPDEP] / 39.4) * 0.4) + (([ADSBBOCC] / 73.700989) * 0.15) + (([CRNFIRECOM] / 0.641392) * 0.1) + (([BBHAZ] / 1) * 0.05)
S1BOS_EMT = ((([DOMTYPEDEP] - 7.1) / (66.8 - 7.1)) * 0.25) + (([TREESIZDEP] / 56.1) * 0.05) + (([WDCANOPDEP] / 30.1) * 0.4) + (([ADSBBOCC] / 100) * 0.15) + (([CRNFIRECOM] / 0.625202) * 0.1) + (([BBHAZ] / 1) * 0.05)
S1BOS_PLNS = (([DOMTYPEDEP] / 49.1) * 0.25) + (([TREESIZDEP] / 1.5) * 0.05) + (([WDCANOPDEP] / 26) * 0.4) + ([ADSBBOCC] * 0.15) + (([CRNFIRECOM] / 0.235013) * 0.1) + (([BBHAZ] / 0.8) * 0.05)

S1COS = (([NFWRCOMP] / 87.93) * 0.7) + (([NFFRCC] / 71.34) * 0.15) + (([GRAZCOMB] / 0.832034) * 0.15)
S1COS_ID = ((([NFWRCOMP] - 0.249) / (50.34 - 0.249)) * 0.7) + ((([NFFRCC] - 0.23) / (47.032 - 0.23)) * 0.15) + (([GRAZCOMB] / 0.523742) * 0.15)
S1COS_WMT = ((([NFWRCOMP] - 1.9) / (49.7 - 1.9)) * 0.7) + ((([NFFRCC] - 0.93) / (48.43 - 0.93)) * 0.15) + (([GRAZCOMB] / 0.513033) * 0.15)
S1COS_EMT = ((([NFWRCOMP] - 3.7) / (84.9 - 3.7)) * 0.7) + ((([NFFRCC] - 2.6) / (61.33 - 2.6)) * 0.15) + (([GRAZCOMB] / 0.642118) * 0.15)
S1COS_PLNS = ((([NFWRCOMP] - 8.365) / (87.93 - 8.365)) * 0.7) + ((([NFFRCC] - 4.39) / (71.33 - 4.39)) * 0.15) + ((([GRAZCOMB] - 0.005729) / (0.832034 - 0.005729)) * 0.15)

THEME1OS = ([S1AOS] + [S1BOS] + [S1COS]) / 3
THEME1OS_ID = ([S1AOS_ID] + [S1BOS_ID] + [S1COS_ID]) / 3
THEME1OS_WMT = ([S1AOS_WMT] + [S1BOS_WMT] + [S1COS_WMT]) / 3
THEME1OS_EMT = ([S1AOS_EMT] + [S1BOS_EMT] + [S1COS_EMT]) / 3
THEME1OS_PLNS = ([S1AOS_PLNS] + [S1BOS_PLNS] + [S1COS_PLNS]) / 3

THEME 2

S2AOS = ((([WHITEBARK] - 0) / 100) * 0.30) + ((([GRIZRANGE] - 0) / 100) * 0.20) + ((([CRNFIRECOM] - 0) / 0.696285) * 0.15) + ((([WBPBLISTRU] - 0) / 77.507754) * 0.10) + ((([ADSBBOCC] - 0) / 100) * 0.10) + ((([NONWILDER] - 0) / 100) * 0.10) + ((([MTBSMODHI] - 0) / 72.882448) * 0.05)
S2AOS_ID = ((([WHITEBARK] - 0) / 56.571944) * 0.30) + ((([GRIZRANGE] - 0) / 100) * 0.20) + ((([CRNFIRECOM] - 0) / 0.696285) * 0.15) + ((([WBPBLISTRU] - 0) / 48.775023) * 0.10) + ((([ADSBBOCC] - 0) / 99.627893) * 0.10) + ((([NONWILDER] - 0) / 100) * 0.10) + ((([MTBSMODHI] - 0) / 49.054094) * 0.05)
S2AOS_WMT = ((([WHITEBARK] - 0) / 72.467653) * 0.30) + ((([GRIZRANGE] - 0) / 100) * 0.20) + ((([CRNFIRECOM] - 0) / 0.641392) * 0.15) + ((([WBPBLISTRU] - 0) / 71.788833) * 0.10) + ((([ADSBBOCC] - 0) / 73.700989) * 0.10) + ((([NONWILDER] - 0) / 100) * 0.10) + ((([MTBSMODHI] - 0) / 72.882448) * 0.05)
S2AOS_EMT = ((([WHITEBARK] - 0) / 100) * 0.30) + ((([GRIZRANGE] - 0) / 100) * 0.20) + ((([CRNFIRECOM] - 0) / 0.625202) * 0.15) + ((([WBPBLISTRU] - 0) / 77.507754) * 0.10) + ((([ADSBBOCC] - 0) / 100) * 0.10) + ((([NONWILDER] - 0) / 100) * 0.10) + ((([MTBSMODHI] - 0) / 51.928066) * 0.05)

S2BOS = ((([DRYFORCOMM] - 0) / 83.419964) * 0.4) + ((([DRYFORLGTR] - 0) / 47.9) * 0.2) + ((([CRNFIRECOM] - 0) / 0.696285) * 0.22) + ((([BBHAZ] - 0) / 1) * 0.06) + ((([WEEDRISK] - 1.095319) / (98.975642 - 1.095319)) * 0.06) + ((([GRAZCOMB] - 0) / 0.832034) * 0.06)
S2BOS_ID = ((([DRYFORCOMM] - 0) / 78.942845) * 0.4) + ((([DRYFORLGTR] - 0.5) / (47.9 - 0.5)) * 0.2) + ((([CRNFIRECOM] - 0) / 0.696285) * 0.22) + ((([BBHAZ] - 0) / 1) * 0.06) + ((([WEEDRISK] - 1.095319) / (57.363703 - 1.095319)) * 0.06) + ((([GRAZCOMB] - 0) / 0.523742) * 0.06)
S2BOS_WMT = ((([DRYFORCOMM] - 0) / 80.150964) * 0.4) + ((([DRYFORLGTR] - 0.6) / (23.6 - 0.6)) * 0.2) + ((([CRNFIRECOM] - 0) / 0.641392) * 0.22) + ((([BBHAZ] - 0) / 1) * 0.06) + ((([WEEDRISK] - 2.773894) / (63.39186 - 2.773894)) * 0.06) + ((([GRAZCOMB] - 0) / 0.513033) * 0.06)
S2BOS_EMT = ((([DRYFORCOMM] - 0.098264) / (83.419964 - 0.098264)) * 0.4) + ((([DRYFORLGTR] - 0) / 13) * 0.2) + ((([CRNFIRECOM] - 0) / 0.625202) * 0.22) + ((([BBHAZ] - 0) / 1) * 0.06) + ((([WEEDRISK] - 2.329092) / (81.212349 - 2.329092)) * 0.06) + ((([GRAZCOMB] - 0) / 0.642118) * 0.06)
S2BOS_PLNS = ((([DRYFORCOMM] - 0) / 46.36846) * 0.4) + ((([DRYFORLGTR] - 0) / 12) * 0.2) + ((([CRNFIRECOM] - 0) / 0.235013) * 0.22) + ((([BBHAZ] - 0) / 0.8) * 0.06) + ((([WEEDRISK] - 3.759667) / (98.975642 - 3.759667)) * 0.06) + ((([GRAZCOMB] - 0.005729) / (0.832034 - 0.005729)) * 0.06)

S2COS = ((([DRYSHRUB] - 0) / 92.740152) * 0.6) + ((([GRSHRENCRO] - 0) / 7.665211) * 0.18) + ((([WEEDRISK] - 1.095319) / (98.975642 - 1.095319)) * 0.09) + ((([GRAZCOMB] - 0) / 0.832034) * 0.09) + ((([NFGNFIRCOM] - 0) / 0.896802) * 0.04)
S2COS_ID = ((([DRYSHRUB] - 0) / 23.440346) * 0.6) + ((([GRSHRENCRO] - 0) / 3.945029) * 0.18) + ((([WEEDRISK] - 1.095319) / (57.363703 - 1.095319)) * 0.09) + ((([GRAZCOMB] - 0) / 0.523742) * 0.09) + ((([NFGNFIRCOM] - 0.033254) / (0.632276 - 0.033254)) * 0.04)
S2COS_WMT = ((([DRYSHRUB] - 0) / 27.631625) * 0.6) + ((([GRSHRENCRO] - 0) / 2.739066) * 0.18) + ((([WEEDRISK] - 2.773894) / (63.39186 - 2.773894)) * 0.09) + ((([GRAZCOMB] - 0) / 0.513033) * 0.09) + ((([NFGNFIRCOM] - 0.047446) / (0.651329 - 0.047446)) * 0.04)
S2COS_EMT = ((([DRYSHRUB] - 0.003758) / (92.740152 - 0.003758)) * 0.6) + ((([GRSHRENCRO] - 0) / 7.092342) * 0.18) + ((([WEEDRISK] - 2.329092) / (81.212349 - 2.329092)) * 0.09) + ((([GRAZCOMB] - 0) / 0.642118) * 0.09) + ((([NFGNFIRCOM] - 0.067013) / (0.896802 - 0.067013)) * 0.04)

S2COS_PLNS = ((([DRYSHRUB] - 0) / 39.813746) * 0.6) + ((([GRSHRENCRO] - 0) / 7.665211) * 0.18) + ((([WEEDRISK] - 3.759667) / (98.975642 - 3.759667)) * 0.09) + ((([GRAZCOMB] - 0.005729) / (0.832034 - 0.005729)) * 0.09) + ((([NFGNFIRCOM] - 0) / 0.884038) * 0.04)

S2DOS = ((([ASPEN] - 0) / 21.428781) * 0.6) + ((([GRAZCOMB] - 0) / 0.832034) * 0.12) + ((([BIGGAMEWR] - 0) / 100) * 0.10) + ((([DECIDENCRO] - 0) / 2.068026) * 0.09) + ((([ASPENFRCC] - 0) / 11.034032) * 0.09)
S2DOS_ID = ((([ASPEN] - 0) / 2.982946) * 0.6) + ((([GRAZCOMB] - 0) / 0.523742) * 0.12) + ((([BIGGAMEWR] - 0) / 100) * 0.10) + ((([DECIDENCRO] - 0) / 0.314455) * 0.09) + ((([ASPENFRCC] - 0) / 1.455367) * 0.09)
S2DOS_WMT = ((([ASPEN] - 0) / 1.967653) * 0.6) + ((([GRAZCOMB] - 0) / 0.513033) * 0.12) + ((([BIGGAMEWR] - 0) / 99.705688) * 0.10) + ((([DECIDENCRO] - 0) / 0.414538) * 0.09) + ((([ASPENFRCC] - 0) / 1.298651) * 0.09)
S2DOS_EMT = ((([ASPEN] - 0) / 21.428781) * 0.6) + ((([GRAZCOMB] - 0) / 0.642118) * 0.12) + ((([BIGGAMEWR] - 0) / 100) * 0.10) + ((([DECIDENCRO] - 0) / 2.068026) * 0.09) + ((([ASPENFRCC] - 0) / 11.034032) * 0.09)
S2DOS_PLNS = ((([ASPEN] - 0) / 0.287612) * 0.6) + ((([GRAZCOMB] - 0) / 0.832034) * 0.12) + ((([BIGGAMEWR] - 0) / 57.386193) * 0.10) + (0 * 0.09) + ((([ASPENFRCC] - 0) / 0.129363) * 0.09)

S2EOS = ((([WOODYDRAW] - 0) / 27.445381) * 0.6) + ((([WOODRWFRCC] - 0) / 14.22642) * 0.14) + ((([GRAZCOMB] - 0) / 0.832034) * 0.14) + ((([BURNPROB] - 0) / 0.586931) * 0.12)
S2EOS_EMT = ((([WOODYDRAW] - 0) / 5.053928) * 0.6) + ((([WOODRWFRCC] - 0) / 3.054094) * 0.14) + ((([GRAZCOMB] - 0) / 0.642118) * 0.14) + ((([BURNPROB] - 0.042793) / (0.586931 - 0.042793)) * 0.12)
S2EOS_PLNS = ((([WOODYDRAW] - 0) / 27.445381) * 0.6) + ((([WOODRWFRCC] - 0) / 14.22642) * 0.14) + ((([GRAZCOMB] - 0.005729) / (0.832034 - 0.005729)) * 0.14) + ((([BURNPROB] - 0) / 0.37204) * 0.12)

S2FOS = ((([MGPRAIRIE] - 0) / 96.177379) * 0.6) + ((([GRAZCOMB] - 0) / 0.832034) * 0.18) + ((([WEEDRISK] - 1.095319) / (98.975642 - 1.095319)) * 0.11) + ((([NFGNFIRCOM] - 0.896802) / (0 - 0.896802)) * 0.11)
S2FOS_EMT = ((([MGPRAIRIE] - 0) / 66.61403) * 0.6) + ((([GRAZCOMB] - 0) / 0.642118) * 0.18) + ((([WEEDRISK] - 2.329092) / (81.212349 - 2.329092)) * 0.11) + ((([NFGNFIRCOM] - 0.896802) / (0.067013 - 0.896802)) * 0.11)
S2FOS_PLNS = ((([MGPRAIRIE] - 0) / 96.177379) * 0.6) + ((([GRAZCOMB] - 0.005729) / (0.832034 - 0.005729)) * 0.18) + ((([WEEDRISK] - 3.759667) / (98.975642 - 3.759667)) * 0.11) + ((([NFGNFIRCOM] - 0.884038) / (0 - 0.884038)) * 0.11)

S2GOS = ((([RIPWETLAND] - 0.016649) / (21.987018 - 0.016649)) * 0.6) + ((([GRAZCOMB] - 0) / 0.832034) * 0.2) + ((([WEEDRISK] - 1.095319) / (98.975642 - 1.095319)) * 0.09) + ((([ROADRIPDEN] - 0) / 9.063564) * .09) + ((([CRNFIRECOM] - 0) / 0.696285) * 0.02)
S2GOS_ID = ((([RIPWETLAND] - 0.030273) / (20.400666 - 0.030273)) * 0.6) + ((([GRAZCOMB] - 0) / 0.523742) * 0.2) + ((([WEEDRISK] - 1.095319) / (57.363703 - 1.095319)) * 0.09) + ((([ROADRIPDEN] - 0) / 6.388504) * .09) + ((([CRNFIRECOM] - 0) / 0.696285) * 0.02)
S2GOS_WMT = ((([RIPWETLAND] - 0.016649) / (21.987018 - 0.016649)) * 0.6) + ((([GRAZCOMB] - 0) / 0.513033) * 0.2) + ((([WEEDRISK] - 2.773894) / (63.39186 - 2.773894)) * 0.09) + ((([ROADRIPDEN] - 0) / 5.919286) * .09) + ((([CRNFIRECOM] - 0) / 0.641392) * 0.02)
S2GOS_EMT = ((([RIPWETLAND] - 0.077199) / (21.475871 - 0.077199)) * 0.6) + ((([GRAZCOMB] - 0) / 0.642118) * 0.2) + ((([WEEDRISK] - 2.329092) / (81.212349 - 2.329092)) * 0.09) + ((([ROADRIPDEN] - 0) / 7.775854) * .09) + ((([CRNFIRECOM] - 0) / 0.625202) * 0.02)
S2GOS_PLNS = ((([RIPWETLAND] - 0.258703) / (12.74041 - 0.258703)) * 0.6) + ((([GRAZCOMB] - 0.005729) / (0.832034 - 0.005729)) * 0.2) + ((([WEEDRISK] - 3.759667) / (98.975642 - 3.759667)) * 0.09) + ((([ROADRIPDEN] - 0) / 9.063564) * .09) + ((([CRNFIRECOM] - 0) / 0.235013) * 0.02)

S2HOS = ((([BIGGAMEWR] - 0) / 100) * 0.6) + ((([S1BOS] - 0) / 0.840257) * 0.09) + ((([S1COS] - 0.00247) / (0.96216- 0.00247)) * 0.09) + ((([WEEDRISK] - 1.095319) / (98.975642 - 1.095319)) * 0.11) + ((([GRAZCOMB] - 0) / 0.832034) * 0.11)
S2HOS_ID = ((([BIGGAMEWR] - 0) / 100) * 0.6) + ((([S1BOS] - 0.131035) / (0.873099- 0.131035)) * 0.09) + ((([S1COS] - 0.000006) / (0.850146 - 0.000006)) * 0.09) + ((([WEEDRISK] - 1.095319) / (57.363703 - 1.095319)) * 0.11) + ((([GRAZCOMB] - 0) / 0.523742) * 0.11)
S2HOS_WMT = ((([BIGGAMEWR] - 0) / 99.705688) * 0.6) + ((([S1BOS] - 0.0263) / (0.846533- 0.0263)) * 0.09) + ((([S1COS] - 0.000294) / (0.851628- 0.000294)) * 0.09) + ((([WEEDRISK] - 2.773894) / (63.39186 - 2.773894)) * 0.11) + ((([GRAZCOMB] - 0) / 0.513033) * 0.11)
S2HOS_EMT = ((([BIGGAMEWR] - 0) / 100) * 0.6) + ((([S1BOS] - 0.040286) / (0.871005- 0.040286)) * 0.09) + ((([S1COS] - 0.001791) / (0.886344- 0.001791)) * 0.09) + ((([WEEDRISK] - 2.329092) / (81.212349 - 2.329092)) * 0.11) + ((([GRAZCOMB] - 0) / 0.642118) * 0.11)
S2HOS_PLNS = ((([BIGGAMEWR] - 0) / 57.386193) * 0.6) + ((([S1BOS] - 0) / 0.780197) * 0.09) + ((([S1COS] - 0.01866) / (0.960201 - 0.01866)) * 0.09) + ((([WEEDRISK] - 3.759667) / (98.975642 - 3.759667)) * 0.11) + ((([GRAZCOMB] - 0.005729) / (0.832034 - 0.005729)) * 0.11)

S2IOS = ((([GRIZRANGE] - 0) / 100) * 0.6) + ((([MOTORROUTE] - 0) / 5.177427) * 0.3) + ((([HUMANDEV] - 0) / 0.010438) * 0.1)
S2IOS_ID = ((([GRIZRANGE] - 0) / 100) * 0.6) + ((([MOTORROUTE] - 0) / 3.995461) * 0.3) + ((([HUMANDEV] - 0) / 0.005018) * 0.1)
S2IOS_WMT = ((([GRIZRANGE] - 0) / 100) * 0.6) + ((([MOTORROUTE] - 0) / 5.177427) * 0.3) + ((([HUMANDEV] - 0) / 0.004919) * 0.1)
S2IOS_EMT = ((([GRIZRANGE] - 0) / 100) * 0.6) + ((([MOTORROUTE] - 0) / 3.432214) * 0.3) + ((([HUMANDEV] - 0) / 0.010438) * 0.1)

THEME2OS = ([S2AOS] + [S2BOS] + [S2COS] + [S2DOS] + [S2EOS] + [S2FOS] + [S2GOS] + [S2HOS] + [S2IOS]) / 9
THEME2OS_ID = ([S2AOS_ID] + [S2BOS_ID] + [S2COS_ID] + [S2DOS_ID] + [S2GOS_ID] + [S2HOS_ID] + [S2IOS_ID]) / 7
THEME2OS_WMT = ([S2AOS_WMT] + [S2BOS_WMT] + [S2COS_WMT] + [S2DOS_WMT] + [S2GOS_WMT] + [S2HOS_WMT] + [S2IOS_WMT]) / 7
THEME20S_EMT = ([S2AOS_EMT] + [S2BOS_EMT] + [S2COS_EMT] + [S2DOS_EMT] + [S2EOS_EMT] + [S2FOS_EMT] + [S2GOS_EMT] + [S2HOS_EMT] + [S2IOS_EMT]) / 9
THEME2OS_PLNS = ([S2BOS_PLNS] + [S2COS_PLNS] + [S2DOS_PLNS] + [S2EOS_PLNS] + [S2FOS_PLNS] + [S2GOS_PLNS] + [S2HOS_PLNS]) / 7

THEME 3

S3AOS = ([MUNICWSHD] * 0.15) + ([D303] * 0.15) + (([MINES] / 0.774278) * 0.1) + (([ROADCOMB] / 0.83621) * 0.1) + (([MTBSMODHI] / 72.882448) * 0.1) + (([GRAZCOMB] / 0.832034) * 0.1) + (([CRNFIRECOM]/0.696285) * 0.06) + (([ADSBBOCC] / 100) * 0.06) + (([DAMS] / 0.312665) * 0.06) + (([POPDEN2000] / 58.9825) * 0.04) +(([DEVRECSITE] / 2.703567) * 0.04) + (([OGWELLS] / 46) * 0.04)
S3AOS_ID = ([MUNICWSHD] * 0.15) + ([D303] * 0.15) + (([MINES] / 0.319371) * 0.1) + (([ROADCOMB] / 0.582136) * 0.1) + (([MTBSMODHI] / 49.054094) * 0.1) + (([GRAZCOMB] / 0.523742) * 0.1) + (([CRNFIRECOM] / 0.696285) * 0.06) + (([ADSBBOCC] / 100) * 0.06) + (([DAMS] / 0.146796) * 0.06) + (([POPDEN2000] / 50.24745) * 0.04) + (([DEVRECSITE] / 1.29955) * 0.04) + ([OGWELLS] * 0.04)

S3AOS_WMT = ([MUNICWSHD] * 0.15) + ([D303] * 0.15) + (([MINES] / 0.147355) * 0.1) + (([ROADCOMB] / 0.598575) * 0.1) + (([MTBSMODHI] / 72.882448) * 0.1) + (([GRAZCOMB] / 0.513033) * 0.1) + (([CRNFIRECOM] / 0.641392) * 0.06) + (([ADSBBOCC] / 73.700989) * 0.06) + (([DAMS] / 0.163958) * 0.06) + (([POPDEN2000] / 58.9825) * 0.04) +(([DEVRECSITE] / 1.273964) * 0.04) + ([OGWELLS] * 0.04)
S3AOS_EMT = ([MUNICWSHD] * 0.15) + ([D303] * 0.15) + (([MINES] / 0.774278) * 0.1) + (([ROADCOMB] / 0.791438) * 0.1) + (([MTBSMODHI] / 51.928066) * 0.1) + (([GRAZCOMB] / 0.642118) * 0.1) + (([CRNFIRECOM] / 0.625202) * 0.06) + (([ADSBBOCC] / 100) * 0.06) + (([DAMS] / 0.197954) * 0.06) + (([POPDEN2000] / 49.375428) * 0.04) +(([DEVRECSITE] / 2.703567) * 0.04) + ([OGWELLS] * 0.04)
S3AOS_PLNS = ([MUNICWSHD] * 0.15) + ([D303] * 0.15) + (([MINES] / 0.144339) * 0.1) + (([ROADCOMB] / 0.83621) * 0.1) + (([MTBSMODHI] / 24.12789) * 0.1) + (([GRAZCOMB] - 0.005729) / (0.832034 - 0.005729) * 0.1) + (([CRNFIRECOM] / 0.235013) * 0.06) + (([ADSBBOCC] / 0.208613) * 0.06) + (([DAMS] / 0.312665) * 0.06) + (([POPDEN2000] / 35.385658) * 0.04) + (([DEVRECSITE] / 0.068782) * 0.04) + (([OGWELLS] / 46) * 0.04)

THEME 4

S4AOS = ([AQUATPRIOR] * 0.4) + (([STRMBARR] / 13.068695) * 0.12) + (([ROADCOMB] / 0.83621) * 0.14) + (([GRAZCOMB] / 0.832034) * 0.12) + (([MINES] / 0.774278) * 0.1) + (([DISPRECALL] / 57.485944) * 0.04) + (([DAMS] / 0.312665) * 0.08)
S4AOS_ID = ([AQUATPRIOR] * 0.4) + (([STRMBARR] / 12.668319) * 0.12) + (([ROADCOMB] / 0.582136) * 0.14) + (([GRAZCOMB] / 0.523742) * 0.12) + (([MINES] / 0.319371) * 0.1) + (([DISPRECALL] / 36.753851) * 0.04) + (([DAMS] / 0.146796) * 0.08)
S4AOS_WMT = ([AQUATPRIOR] * 0.4) + (([STRMBARR] / 13.068695) * 0.12) + (([ROADCOMB] / 0.598575) * 0.14) + (([GRAZCOMB] / 0.513033) * 0.12) + (([MINES] / 0.147355) * 0.1) + (([DISPRECALL] / 51.039823) * 0.04) + (([DAMS] / 0.163958) * 0.08)
S4AOS_EMT = ([AQUATPRIOR] * 0.4) + (([STRMBARR] / 10.076321) * 0.12) + (([ROADCOMB] / 0.791438) * 0.14) + (([GRAZCOMB] / 0.642118) * 0.12) + (([MINES] / 0.774278) * 0.1) + (([DISPRECALL] / 30.14474) * 0.04) + (([DAMS] / 0.197954) * 0.08)
S4AOS_PLNS = ([AQUATPRIOR] * 0.4) + (([STRMBARR] / 10.076321) * 0.12) + (([ROADCOMB] / 0.83621) * 0.14) + (([GRAZCOMB] - 0.005729) / (0.642118 - 0.005729) * 0.12) + (([MINES] / 0.144339) * 0.1) + (([DISPRECALL] / 57.485944) * 0.04) + (([DAMS] / 0.312665) * 0.08)

THEME 5

S5AOS = (([DEVRECUSE] / 46.24) * 0.2) + (([DISPRECHVH] / 51.04) * 0.15) + (([RECRESID] / 127) * 0.1) + (([SKIAREAS] / 1) * 0.1) + (([ADSROADS] / 24.62) * 0.1) + (([ADSTRAIL] / 56.17) * 0.05) + (([BURNPROB] / 0.587) * 0.1) + (([BBHAZ] / 1) * 0.1) + (([ADSBBOCC] / 100) * 0.1)
S5AOS_ID = (([DEVRECUSE] / 46.24) * 0.2) + (([DISPRECHVH] / 36.75) * 0.15) + (([RECRESID] / 127) * 0.1) + (([SKIAREAS] / 1) * 0.1) + (([ADSROADS] / 22.34) * 0.1) + (([ADSTRAIL] / 45.62) * 0.05) + ((([BURNPROB] - 0.038) / (0.587 - 0.038)) * 0.1) + (([BBHAZ] / 1) * 0.1) + (([ADSBBOCC] / 100) * 0.1)
S5AOS_WMT = (([DEVRECUSE] / 24.25) * 0.2) + (([DISPRECHVH] / 51.04) * 0.15) + (([RECRESID] / 44) * 0.1) + (([SKIAREAS] / 1) * 0.1) + (([ADSROADS] / 19.245) * 0.1) + (([ADSTRAIL] / 26.358) * 0.05) + ((([BURNPROB] - 0.107) / (0.565 - 0.107)) * 0.1) + (([BBHAZ] / 1) * 0.1) + (([ADSBBOCC] / 73.7) * 0.1)
S5AOS_EMT = (([DEVRECUSE] / 32.52) * 0.2) + (([DISPRECHVH] / 30.145) * 0.15) + (([RECRESID] / 62) * 0.1) + (([SKIAREAS] / 1) * 0.1) + (([ADSROADS] / 24.62) * 0.1) + (([ADSTRAIL] / 56.17) * 0.05) + ((([BURNPROB] - 0.043) / (0.587 - 0.043)) * 0.1) + (([BBHAZ] / 1) * 0.1) + (([ADSBBOCC] / 100) * 0.1)
S5AOS_PLNS = (([DEVRECUSE] / 5.58) * 0.2) + (([DISPRECHVH] / 43.86) * 0.15) + ([RECRESID] * 0.1) + ([SKIAREAS] * 0.1) + (([ADSROADS] / 0.885) * 0.1) + ([ADSTRAIL] * 0.05) + (([BURNPROB] / 0.372) * 0.1) + (([BBHAZ] / 0.8) * 0.1) + (([ADSBBOCC] / 0.209) * 0.1)

S5BOS = (([DEVRECINV] / 44.54) * 0.3) + (([RECRESID] / 127) * 0.1) + (([SKIAREAS] / 1) * 0.1) + (([ADSUTILITY] / 14.07) * 0.1) + (([ELECTSITES] / 105) * 0.05) + (([ADMINSITES] / 2) * 0.05) + (([BURNPROB] / 0.587) * 0.1) + (([BBHAZ] / 1) * 0.1) + (([ADSBBOCC] / 100) * 0.1)
S5BOS_ID = (([DEVRECINV] / 44.54) * 0.3) + (([RECRESID] / 127) * 0.1) + (([SKIAREAS] / 1) * 0.1) + (([ADSUTILITY] / 6.59) * 0.1) + (([ELECTSITES] / 37) * 0.05) + (([ADMINSITES] / 2) * 0.05) + ((([BURNPROB] - 0.038) / (0.587 - 0.038)) * 0.1) + (([BBHAZ] / 1) * 0.1) + (([ADSBBOCC] / 100) * 0.1)
S5BOS_WMT = (([DEVRECINV] / 23.59) * 0.3) + (([RECRESID] / 44) * 0.1) + (([SKIAREAS] / 1) * 0.1) + (([ADSUTILITY] / 10.209) * 0.1) + (([ELECTSITES] / 105) * 0.05) + (([ADMINSITES] / 2) * 0.05) + ((([BURNPROB] - 0.107) / (0.565 - 0.107)) * 0.1) + (([BBHAZ] / 1) * 0.1) + (([ADSBBOCC] / 73.7) * 0.1)
S5BOS_EMT = (([DEVRECINV] / 39.45) * 0.3) + (([RECRESID] / 62) * 0.1) + (([SKIAREAS] / 1) * 0.1) + (([ADSUTILITY] / 14.07) * 0.1) + (([ELECTSITES] / 82) * 0.05) + (([ADMINSITES] / 2) * 0.05) + ((([BURNPROB] - 0.043) / (0.587 - 0.043)) * 0.1) + (([BBHAZ] / 1) * 0.1) + (([ADSBBOCC] / 100) * 0.1)
S5BOS_PLNS = (([DEVRECINV] / 7.97) * 0.3) + ([RECRESID] * 0) + ([SKIAREAS] * 0) + (([ADSUTILITY] / 0.214) * 0.1) + (([ELECTSITES] / 9) * 0.05) + (([ADMINSITES] / 1) * 0.05) + (([BURNPROB] / 0.372) * 0.1) + (([BBHAZ] / 0.8) * 0.1) + (([ADSBBOCC] / 0.209) * 0.1)

S5COS = (([DISPRECHVH] / 51.04) * 0.5) + ([S3AOS] * 0. 5)
S5COS_ID = (([DISPRECHVH] / 36.75) * 0.5) + ([S3AOS] * 0.5)
S5COS_WMT = (([DISPRECHVH] / 51.4) * 0.5) + ([S3AOS] * 0.5)
S5COS_EMT = (([DISPRECHVH] / 30.145) * 0.5) + ([S3AOS] * 0.5)
S5COS_PLNS = (([DISPRECHVH] / 43.86) * 0.5) + ([S3AOS] * 0.5)

S5DOS = (([SCENICINTL] / 82.96) * 0.5) + (([POPDEN2000] / 58.99) * 0.25) + (([RECOPSPEC] / 100) * 0.25)
S5DOS_ID = (([SCENICINTL] / 82.96) * 0.5) + (([POPDEN2000] / 50.25) * 0.25) + (([RECOPSPEC] / 100) * 0.25)
S5DOS_WMT = (([SCENICINTL] / 68.8) * 0.5) + (([POPDEN2000] / 58.99) * 0.25) + (([RECOPSPEC] / 100) * 0.25)
S5DOS_EMT = (([SCENICINTL] / 49.74) * 0.5) + (([POPDEN2000] / 49.28) * 0.25) + (([RECOPSPEC] / 100) * 0.25)
S5DOS_PLNS = (([SCENICINTL] / 34.3) * 0.5) + (([POPDEN2000] / 35.4) * 0.25) + (([RECOPSPEC] / 100) * 0.25)

S5EOS = (([SCENICINTH] / 100) * 0.3) + (([POPDEN2000] / 58.99) * 0.15) + (([RECOPSPEC] / 100) * 0.15) + (([BURNPROB] / 0.587) * 0.15) + (([BBHAZ] / 1) * 0.1) + (([POPDEN2030] / 81.44) * 0.15)
S5EOS_ID = (([SCENICINTH] / 100) * 0.3) + (([POPDEN2000] / 50.25) * 0.15) + (([RECOPSPEC] / 100) * 0.15) + ((([BURNPROB] - 0.038) / (0.587 - 0.038)) * 0.2) + (([BBHAZ] / 1) * 0.1) + (([POPDEN2030] / 67.04) * 0.15)
S5EOS_WMT = (([SCENICINTH] / 100) * 0.3) +(([POPDEN2000] / 58.99) * 0.15) + (([RECOPSPEC] / 100) * 0.15) + ((([BURNPROB] - 0.107) / (0.565 - 0.107)) * 0.15) + (([BBHAZ] / 1) * 0.1) + (([POPDEN2030] / 81.44) * 0.15)

S5EOS_EMT = (([SCENICINTH] / 100) * 0.3) + (([POPDEN2000] / 49.28) * 0.15) + (([RECOPSPEC] / 100) * 0.15) + ((([BURNPROB] - 0.043) / (0.587 - 0.043)) * 0.15) + (([BBHAZ] / 1) * 0.1) + (([POPDEN2030] / 66.54) * 0.15)
S5EOS_PLNS = (([SCENICINTH] / 94.2) * 0.3) + (([POPDEN2000] / 35.4) * 0.15) + (([RECOPSPEC] / 100) * 0.15) + (([BURNPROB] / 0.372) * 0.15) + (([BBHAZ] / 0.8) * 0.1) + (([POPDEN2030] / 35.13) * 0.15)

THEME5OS = ([S5AOS] + [S5BOS] + [S5COS] + [S5DOS] + [S5EOS]) / 5
THEME5OS_ID = ([S5AOS_ID] + [S5BOS_ID] + [S5COS_ID] + [S5DOS_ID] + [S5EOS_ID]) / 5
THEME5OS_WMT = ([S5AOS_WMT] + [S5BOS_WMT] + [S5COS_WMT] + [S5DOS_WMT] + [S5EOS_WMT]) / 5
THEME5OS_EMT = ([S5AOS_EMT] + [S5BOS_EMT] + [S5COS_EMT] + [S5DOS_EMT] + [S5EOS_EMT]) / 5
THEME5OS_PLNS = ([S5AOS_PLNS] + [S5BOS_PLNS] + [S5COS_PLNS] + [S5DOS_PLNS] + [S5EOS_PLNS]) / 5

THEME 6

THEME6OS = ([S1AOS] + [S5AOS] + [S5BOS]) / 3
THEME6OS_ID = ([S1AOS_ID] + [S5AOS_ID] + [S5BOS_ID]) / 3
THEME6OS_WMT = ([S1AOS_WMT] + [S5AOS_WMT] + [S5BOS_WMT]) / 3
THEME6OS_EMT = ([S1AOS_EMT] + [S5AOS_EMT] + [S5BOS_EMT]) / 3
THEME6OS_PLNS = ([S1AOS_PLNS] + [S5AOS_PLNS] + [S5BOS_PLNS]) / 3

FINAL INTEGRATION

IRPSOS = ([THEME1OS] + [THEME2OS] + [THEME3OS] + [THEME4OS] + [THEME5OS] + [THEME6OS]) / 6
IRPSOS_ID = ([THEME1OS_ID] + [THEME2OS_ID] + [THEME3OS_ID] + [THEME4OS_ID] + [THEME5OS_ID] + [THEME6OS_ID]) / 6
IRPSOS_WMT = ([THEME1OS_WMT] + [THEME2OS_WMT] + [THEME3OS_WMT] + [THEME4OS_WMT] + [THEME5OS_WMT] + [THEME6OS_WMT]) / 6
IRPSOS_EMT = ([THEME1OS_EMT] + [THEME2OS_EMT] + [THEME3OS_EMT] + [THEME4OS_EMT] + [THEME5OS_EMT] + [THEME6OS_EMT]) / 6
IRPSOS_ PLNS = ([THEME1OS_PLNS] + [THEME2OS_PLNS] + [THEME3OS_PLNS] + [THEME4OS_PLNS] + [THEME5OS_PLNS] + [THEME6OS_PLNS]) / 6