Table 1. Ecosystem assessment condition categories and variables.

Condition Category	Status-All	Status-BFS	Risk-All	Risk-BFS	Opportunity-BFS
Water Quality	H4WQS	H4WQ_BFS	H4WQR	H4WQR_BFS	H4WQO_BFS
Aquatic System	H4ACS	H4ACS_BFS	H4ACR	H4ACR_BFS	H4ACO_BFS
Terrestrial Family 1 (TF1)	H4TF1S	H4TF1S_BFS	H4TF1R	H4TF1R_BFS	H4TF1O_BFS
Terrestrial Family 2 (TF2)	H4TF2S	H4TF2S_BFS	H4TF2R	H4TF2R_BFS	H4TF2O_BFS
Terrestrial Family 7 (TF7)	H4TF7S	H4TF7S_BFS	H4TF7R	H4TF7R_BFS	H4TF7O_BFS
Terrestrial Family 10 (TF10)	H4TF10S	H4TF10S_BF	H4TF10R	H4TF10R_BF	H4TF10O_BF
Terrestrial Family 11 (TF11)	H4TF11S	H4TF11S_BF	H4TF11R	H4TF11R_BF	H4TF11O_BF
Terrestrial Family 12 (TF12)	H4TF12S	H4TF12S_BF	H4TF12R	H4TF12R_BF	H4TF12O_BF
Fire and Fuel	H4FFS	H4FFS_BFS	H4FFR	H4FFR_BFS	H4FFO_BFS
Air Quality	H4AIRS	H4AIRS_BFS	H4AIRR	H4AIRR_BFS	H4AIRO_BFS
Forest Health	H4FHS	H4FHS_BFS	H4FHR	H4FHR_BFS	H4FHO_BFS
Range Health	H4RHS	H4RHS_BFS	H4RHR	H4RHR_BFS	H4RH0_BFS
Watershed	H4WSS	H4WSS_BFS	H4WSR	H4WSR_BFS	H4WSO_BFS
Urban-Rural/Wildland	H4URWIS	H4URWIS_BF	H4URWIR	H4URWIR_BF	H4URWIO_BF
Timber Harvest	H4THS	H4THS_BFS	H4THR	H4THR_BFS	H4THO_BFS
Livestock Grazing	H4LGS	H4LGS_BFS	H4LGR	H4LGR_BFS	H4LG0_BFS
Recreation Value	H4RVS	H4RVS_BFS	H4RVR	H4RVR_BFS	H4RVO_BFS
Community Resiliency	H4CRS	H4CRS_BFS	H4CRR	H4CRR_BFS	H4CRR_BFS
Noxious Weeds	H4NOXS	H4NOXS_BFS	H4NOXR	H4NOXR_BFS	H4NOXO_BFS
Tribal Treaty & Trust Resource	H4TTRS	H4TTRS_BFS	H4TTRR	H4TTRR_BFS	H4TTRO_BFS
Landscape Health	H4LHS	H4LHS_BFS	H4LHR	H4LHR_BFS	H4LHO_BFS

[1] WQ - water quality; AC - aquatic condition; TF1 - Low elevation old forest species; TF2 - old forest species; TF7 - young and old forest and nonforest mosaic species; TF10 - sagebrush shrub species; TF11 - grass and open shrub species; TF12 - early seral forest species; FF - fire and fuel condition; AIR - air quality; FH - forest health; RH - range health; WS - watershed condition; URWI - urban-rural/wildland interface; TH - timber harvest; LG - livestock grazing; RV - recreation value; CR - community resiliency; NOX - noxious weeds; TTR - tribal treaty & trust resourse; LH - landscape health; S - status; R - risk; O - opportunity; All - assessed for all land ownerships; BFS - assessed for only BLM- and FS-administered lands.

Water Quality
The first set of variables derived to describe aquatic conditions was intended to characterize status, risk, and restoration opportunities associated with water quality, where water quality is narrowly defined in terms of the fish communities it supports. As described below, this view is consistent with the "beneficial use" concept used by the Environmental Protection Agency (EPA) in the designation of water quality standards. The water quality indicators were calculated at the watershed and subwatershed scale, and then averaged to describe subbasin conditions. Average values were calculated across watersheds or subwatersheds for all land ownerships, and additionally across only those watersheds or subwatersheds containing BLM- and FS-administered lands.

Water quality is often defined in terms of the physical features of the water body of interest. For example, temperature, suspended solids, pH, and dissolved oxygen are measurable physical attributes. An alternative approach is to describe water quality in terms of the beneficial uses that it supports. For example, at one end of the scale would be waterways that support navigation but little else, versus waters suitable for use by stream-dwelling salmonids that require clean, cold water. In the past, the EPA has designated beneficial uses and set corresponding water quality standards in terms of more easily measured physical parameters. In their recently proposed water quality standards for Idaho (EPA 1997, Federal Register 62(81):23003-23029), the EPA proposed using the presence of sensitive species, particularly bull trout (*Salvelinus confluentus*), as indicators of beneficial uses that could prompt more stringent water quality standards. We lack the data necessary to physically characterize water quality conditions across the basin, but we do have some ability to characterize watersheds in terms of the fish communities that they currently support. Thus, consistent with the rationale behind the EPA's approach, we used native fish communities as indicators of existing high-quality waters.

Status—Our measure of water quality status was derived from six indicator variables (table 2) that were calculated for each watershed (5th-field HUC) using the fish distribution data bases developed by Lee and others (1997). A composite index (WQ_SUM) was generated by summing the six indicator variables at the watershed scale. This index was then averaged across all watersheds, and across all watersheds fully or partially administered by the BLM or Forest Service within each subbasin to derive the subbasin indexes of water quality status (H4WQS and H4WQS_F, respectively). Subbasins were assigned an ordinal ranking based on the mean value of WQ_SUM: "High" = mean $\geq$ 3.0, "Moderate" = 2.0$\leq$ mean < 3.0, "Low" = mean < 2.0.

Table 2—Indicator variables used to calculate an index of water quality status.

Variable	Description
btr_strong	bull trout stronghold
strong	key salmonid stronghold
nat_sal	native salmonid presence
anad	anadromous fish presence
concern	listed or sensitive species presence
no_wwext	no warm-water introduced species

Risk and Opportunity—The concepts of risk and restoration opportunity, as applied to water quality, extend beyond waterway boundaries to include conditions and activities occurring on the terrestrial landscape. In order to calculate indicator variables to reflect risks and opportunities we used subwatershed (6th-field HUC) information on aquatic, terrestrial, and socioeconomic conditions. At the subwatershed level, basin-wide information on fishes is restricted to the seven key salmonids analyzed by Lee and others (1997). Two aquatic variables, the number of key salmonids present within a subwatershed (AQKEY) and the number of key salmonid species in "strong" condition within the subwatershed (AQSTR), and ten landscape variables (table 3) were used jointly to identify risks and opportunities. The ten landscape variables were chosen based on a preliminary analysis that suggested that each of the ten had a statistically significant association with at least one of the aquatic variables.

Table 3—Landscape variables used to assess risk and opportunities associated with water quality. Further discussion of these variables are provided elsewhere in this document.

Variable	Description
SFBR_C	Severe fire behavior risk
URWI_ALL	Urban-rural/wildland fire interface
FHV_C	Forest health vegetation vulnerability
SIM	Similarity to native vegetation patterns
HSV_C	Hydrologic system vulnerability
FSR	Forest structure restoration
THS_BFS	Timber harvest status on BLM- and FS-administered lands
SNPATCLASS	Livestock season of use pattern
LGS	Livestock grazing status
HER	Human ecological resiliency

Subwatershed indicators of risks and opportunity were generated in a 5 step process:

1. The two aquatic variables were combined into a single ordinal measure, AQLEVEL, according to the rules displayed in table 4.
2. A classification tree (Breiman and others 1984) was constructed using the ten landscape variables as predictors and AQLEVEL as the response variable.
3. Using the classification tree, predictions of AQLEVEL were made for each subwatershed.
4. Predicted AQLEVEL values were compared to observed values. If the predicted level was less than the observed level, this was interpreted as a risk and quantified in terms of the difference between observed and predicted (e.g., if observed = "C" and predicted = "A", then risk = 2). If the predicted level was greater than the observed value, this was interpreted as an opportunity and quantified similar to risk (e.g., if observed = "A" and predicted = "C", then opportunity = 2). A positive risk implied zero opportunity, and vice versa. When observed equaled predicted, neither risk nor opportunity was assigned (both equal zero).
5. Risk and opportunity measures were averaged across all subwatersheds within each subbasin and across subwatersheds containing BLM- and FS-administered lands, and ordinal rankings assigned for risk (H4WQR and H4WQR_F) and restoration opportunity

(H4WQO and H4WQO_F) according to the mean value of the respective measures, where “High” = mean ≥ 0.4, “Moderate” = 0.15 ≤ mean < 0.4, and “Low” = mean < 0.15.

Table 4—Rule set for combining the number of key salmonids (AQKEY) and the number of strong populations (AQSTR) into a single indicator (AQLEVEL).

AQKEY	AQSTR	AQLEVEL
0	0	A
1	0	B
	1	C
2 or more	0	C
	1	D
	2 or more	E

Overall Aquatic Conditions at the Subbasin Scale

The second set of variables related to aquatic conditions characterized overall integrity of aquatic ecosystems at the subbasin scale, and the risks and opportunities created by the mix of conditions within each subbasin. Like water quality, these measures reflected the ability of the subbasin to support native fish communities, but examined subbasin conditions more holistically and subjectively. Since these variables come from an assessment of overall subbasin conditions, no distinction existed between BLM- and FS-administered lands and other lands.

Lee and others (1997) developed a classification system that grouped subbasins into one of three categories based on their resemblance to natural, fully functional aquatic ecosystems. This classification relied heavily on the empirical information gathered in the scientific assessment regarding the distribution and status of native fishes, but also considered human influences as indicated through land ownership patterns, administrative boundaries, and the presence of roads, dams, and mines. Rather than a strict data-based analysis as was conducted for water quality, the subbasin classification of Lee and others (1997) allowed a more subjective interpretation of conditions and opportunities by resource specialists.

We adopted the subbasin classification of Lee and others (1997) for this analysis as an indicator of overall aquatic conditions. In order to recast the earlier classification in terms of status, risk, and opportunities, the following rules were used for status and opportunity:

Category	Current Status (H4ACS)	Restoration Opportunity (H4ACO)
one	high	moderate
two	moderate	high
three	low	low

The risks to overall aquatic conditions followed those identified for water quality. An additional consideration was that changes in water quality that directly affected individual subwatersheds could be disproportionately disruptive to the overall integrity of the larger subbasin. For this reason, we used the risk estimates derived for water quality (H4WQR) to describe risks to overall conditions, but modified them by increasing the risk category one class for those subbasins in watershed categories one and two.

Terrestrial Family Conditions

Wendel : AH59a processes and relationship to initial AH59 Terrestrial piece. Need to include text here indicating what was done in regards to Terrestrial Family conditions. The original TF data is not being released. The new AH59a data is being included, but does not directly relate to the overall analysis found here.

Fire And Fuel Condition

Fire and fuel condition was an assessment of the status, risk, and opportunity related to the potential severity of fire behavior and effects. Fire behavior was considered to be primarily influenced by weather, fuels, terrain, and the probability of ignition (Hann and others 1997). The departure from the inherent succession/disturbance regime and pattern of vegetation composition and structure provides a useful indicator of the potential for both erratic fire behavior and effects that are not typical for a given kind of environment. The subwatershed was considered to be the appropriate scale for prediction of landscape level fire behavior and effects that could then be summarized to a subbasin level.

Status was considered to be the relative difference between subbasins across the ICB of the current potential for severe fire behavior or effects. This relative relationship was determined for all lands as well as for BLM- and FS-administered lands. A decade time period was used to assess the average risk of severe fire behavior and effects given the current conditions (Hann and others 1997). Status was calculated at a subwatershed level using the variables: 1) current severe fire behavior risk (SFBR_C); 2) current severe fire effects risk (SFER_C); and 3) current landscape vegetation pattern (LVP_C). SFBR_C and SFER_C were given equal weight in the calculation of status, while LVP_C was used to exclude subwatersheds dominated by agricultural land use. Status was calculated as the lack of probability of SFBR_C and SFER_C by subtracting their combined values from 100. Methods and results for development of the variables SFBR_C, SFER_C, and LVP_C are reported in Hann and others (in prep). The formula for fire and fuel condition status follows.

H6FFS = [100-(SFBR_C + SFER_+C)]/2 Where LVP_C ≠ AGL
H6FFS - subwatershed fire and fuel status.
SFBR_C - current severe fire behavior risk.
SFER_C - current severe fire effects risk.
LVP_C - current landscape vegetation pattern.
AGL - agricultural landscape pattern.

The subwatershed status variable H6FFS was summarized to a subbasin fire and fuel condition status variable (H4FFS) by calculating a weighted average of all subwatersheds within the subbasin. The four classes of NA, L, M, and H were assigned by using a frequency distribution of subbasin values. Values of 0 were assigned NA, nonzero values in the lower 30 percent of the range were assigned to L, 40 percent of the nonzero values in the middle of the range were assigned to M, and 30 percent of the values in the upper portion of the range were assigned to H. The status on BLM- and FS-administered lands was determined through the use of FMC codes "Y" and "P" and then summarized by calculating a weighted average at the subbasin scale.

Risk to current status from fire and fuel conditions was based on the direct risk of severe fire behavior and effects (Hann and others 1997). Risk was calculated for all lands and for only BLM- and FS-administered lands at the subwatershed scale. However, the variable SFBR_C was weighted with twice the value as SFER_C because of the potential hazard for loss of lives and property from wildfire and the high cost of suppression. Methods and results for development of the variables SFBR_C, SFER_C and LVP_C are reported in Hann and others (in prep). The formula for fire and fuel risk follows.

$$H6FFR = [(2*SFBR\_C) + SFER\_C]/3 \quad \text{Where } LVP\_C \neq AGL$$

H6FFR - subwatershed fire and fuel risk.
SFBR_C - current severe fire behavior risk.
SFER_C - current severe fire effects risk.
LVP_C - current landscape vegetation pattern.
AGL - agricultural landscape pattern.

Fire and fuel condition risk was summarized to the subbasin scale (H4FFR) in a manner similar to that in status. Risk on BLM- and FS-administered lands (H4FFR_BFS) was also summarized in a manner similar to that in status.

The opportunity to improve status and reduce risk for fire and fuel conditions was calculated only for BLM- and FS-administered lands. The variables used to assess opportunities on BLM- and FS-administered lands at the subwatershed scale included: 1) prescribed fire opportunities index for planned ignition (PFO_P); 2) prescribed fire opportunities index for unplanned ignition (PFO_U); 3) woody fuel management opportunities index (WFMO); 4) current landscape vegetation pattern (LVP_C); and 5) FMC. The variables PFO_P and WFMO were each weighted with twice the value as the PFO_U since opportunities for prescribed fire unplanned ignition are limited to the larger wilderness and roadless areas (Hann and others 1997). Most areas are too fragmented in ownership, lack suitable barriers to contain large fires during a typical summer season, have high hazard fuel conditions, would incur severe fire effects, and can produce extended periods of smoke with poor dispersion, such that unplanned ignition is a much less suitable option compared to planned ignition. Under planned ignition, size and shape, fire behavior, fire effects, and smoke production can be controlled much more effectively to achieve management objectives. The variable WFMO included conditions where woody forest or shrub fuel conditions occurred that were not consistent with the inherent succession/disturbance regime and vegetation composition/structure pattern in range, forest-range mosaics, or forest landscapes. Methods and results for development of the variables PFO_P, PFO_U, WFO, LVP_C and FMC are reported in Hann and others (in prep). The formula for fire and fuel opportunity to improve status and reduce risk follows.

$$H6FFO = [(2*PFO\_P) + PFO\_U + (2*WFMO)]/5 \quad \text{Where } LVP\_C \neq AGL \text{ and } FMC \neq N$$

H6FFO_BFS - subwatershed fire and fuel opportunity on BLM- and FS-administered lands.
PFO_P - prescribed fire opportunities planned ignition.
PFO_U - prescribed fire opportunities unplanned ignition.
WFMO - woody fuel management opportunities.
LVP_C - current landscape vegetation pattern.
AGL - agricultural landscape pattern.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Fire and fuel condition opportunity was summarized to the subbasin scale (H4FFO_BFS) in a manner similar to that in status.

Air Quality
Air quality condition was an assessment of the status, risk, and opportunity related to air. Clean air conditions and quality of air was considered to be primarily affected by weather, potential for inversions, cumulative effects of particulates, and potential for production of particulates (Hann and others 1997). The subwatershed was considered to be the appropriate scale for prediction of conditions for air quality as influenced by conditions at the subbasin scale and cumulative effects from other subwatersheds. This information was then summarized to a subbasin level.

Status was considered to be the relative difference between subbasins across the ICB of the current potential for inversions and cumulative particulate accumulations (Hann and others 1997). This relative relationship was determined for all lands and for areas that were at least partially made up of BLM- and FS-administered lands. Status was calculated at a subwatershed level using the variables: 1) inversion potential (INVP); and 2) cumulative particulate potential (CPP). Status was calculated as the lack of potential for INVP and CPP by subtracting their combined values from 100. Methods and results for development of the variables INVP and CPP are reported in Hann and others (in prep). The formula for clean air condition status follows.

$$H6AIS = 100-[(INVP + CPP)/2]$$

H6AIRS - subwatershed clean air status.
INVP - inversion potential.
CPP - cumulative particulate potential.

The subwatershed status variable H6AIRS was summarized to a subbasin clean air condition status variable (H4AIRS) by calculating a weighted average of all subwatersheds within the subbasin. By using a frequency distribution of subbasin values, the classes NA, L, M, and H were assigned. Values of 0 were assigned NA, nonzero values in the lower 30 percent of the range were assigned to L, 40 percent of the nonzero values in mid-range were assigned to M, and 30 percent of the values at the upper end of the range were assigned to H. The status on BLM- and FS-administered lands was determined through the use of FMC codes “Y” and “P” and then summarized by calculating a weighted average at the subbasin scale.

Risk to current status of clean air was based on direct effects of inversion (INVP) and cumulative particulates (CPP) with the added effects of risks of severe wildfire behavior and associated smoke production (SFBR_C), urban-rural/wildland interface additions to particulates (i.e. wood smoke, road dust, agricultural burning, and agricultural dust) (U-R/WI), and prescribed fire unplanned ignition smoke production (PFO_U) (Hann and others 1997). Risk was calculated for all lands and for only BLM- and FS-administered lands at the subwatershed scale. All variables were given equal value since there appeared to be no specific trend to predominance of one type of effect. Methods and results for development of the variables INVP, CPP, SFBR_C, U-R/WI, and PFO_U are reported in Hann and others (in prep). The formula for clean air risk follows.

$$H6AIRR = (INVP + CPP + SFBR\_C + U\text{-}R/WI + PFO\_U)/5$$

H6AIRR - subwatershed clean air risk.
INVP - inversion potential.
CPP - cumulative particulate potential.
SFBR_C - current severe fire behavior risk.
U-R/WI - urban-rural/wildland interface.
PFO_U - prescribed fire unplanned ignition.

Clean air condition risk was summarized to the subbasin scale (H4FFR) in a manner similar to that in status. Risk on BLM- and FS-administered lands (H4FFR_BFS) was also summarized in a manner similar to that in status.

The opportunity to improve status and reduce risk for clean air condition was calculated only for BLM- and FS-administered lands. The variables used to assess opportunities on BLM- and FS-administered lands at the subwatershed scale included: 1) forest structure restoration (FSR); 2) woody fuel management opportunities (WFMO); 3) prescribed fire opportunities planned ignition (PFO_P); and 4) FMC where inversion potential (INVP) and cumulative particulate potential (CPP) had moderate or higher values. All variables were given equal weight since each would contribute to the reduction of risk to wildfire and production of large volumes of smoke for extended periods with high potential for inversions (Hann and others 1997). The variable FSR included areas where forest structures and patch patterns were not consistent with the inherent succession/disturbance regime and vegetation composition/structure pattern. The variable WFMO included conditions where woody forest or shrub fuel conditions occurred that were not consistent with the inherent succession/disturbance regime and vegetation composition/structure pattern in range, forest-range mosaics, or forest landscapes. The variable PFO_P included conditions where planned prescribed fire would reduce departure from the inherent succession/disturbance regime and vegetation composition/structure pattern. Methods and results for development of the variables FSR, WFMO, PFO_P, FMC, INVP, and CPP are reported in Hann and others (in prep). The formula for clean air opportunity to improve status and reduce risk follows.

$$H6AIRO\_BFS = (FSR + WFMO + PFO\_P +)/3 \quad \text{Where } INVP > 35 \text{ and } CPP > 35 \text{ and } FMC \neq N$$

H6AIRO_BFS - subwatershed clean air opportunity on BLM- and FS-administered lands.
FSR - forest structure restoration.
WFMO - woody fuel management opportunities.

PFO_P - prescribed fire opportunities planned ignition.
INVP - inversion potential.
CPP - cumulative particulate potential.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Clean air condition opportunity was summarized to the subbasin scale (H4AIRO_BFS) in a manner similar to that of status.

Forest Health

Forest Health condition was an assessment of the status, risk, and opportunity related to forests and woodlands. Forest health was considered to be defined as "conditions under which the integrity of the soil and ecological processes are sustained resulting in systems that maintain their diversity, resiliency, and productivity with associated sustainable resource values (Hann and others 1997). The subwatershed was considered to be the appropriate scale for prediction of conditions for forest health since this is the scale where the patterns of effects of fire, insect/disease, invasion by exotic species, and stress are most influenced by contagion processes of connectivity and fragmentation. This information was then summarized to a subbasin level.

Status was considered to be the relative difference between subbasins across the ICB of current forest health conditions (Hann and others 1997). This relative relationship was determined for all lands as well as for BLM- and FS-administered lands. Status was calculated at a subwatershed level using different calculations depending on the type of subwatershed landscape pattern. These patterns included forest (FTL), forest-range (FRL), and agriculture-range-forest (ARF). Forest health for range (RGL) and agricultural (AGL) landscape patterns was considered non-applicable. The input variables for status included: 1) current forest health vulnerability (FHV_C); and 2) similarity to the inherent succession/disturbance regime and vegetation composition/structure pattern (SIM). Within the FTL and FRL landscapes, emphasis was placed on the combination of FHV_C and SIM because of the predominant influences on forest health of insect and disease effects, succession/disturbance regime, and connectivity/fragmentation. Status was calculated as the lack of FHV_C and departure from SIM (100-SIM) by subtracting their combined values from 100. Methods and results for development of the variables FHV_C and SIM are reported in Hann and others (in prep). The formula for forest health condition status in FTL and FRL landscape patterns follows.

H6FHS_FTL and H6FHS_FRL = 100-{[FHV_C + (100-SIM)]/2} Where LVP_C = FTL or FRL

H6FHS_FTL - subwatershed forest health status in forest landscape patterns.
H6FHS_FRL - subwatershed forest health status in forest-range landscape patterns.
FHV_C - current forest health vegetation vulnerability to insects/disease and stress.
SIM - similarity to the inherent succession/disturbance regime and vegetation composition/structure pattern.
LVP_C - current landscape vegetation pattern.
FTL - forest pattern landscapes.

FRL - forest-range mosaic landscape patterns.

The variable FHV_C was used to determine status within the agriculture-range-forest landscapes (LVP_ARF). Within the ARF landscapes, SIM was not used because these landscapes are usually highly fragmented due to the historic effects of different land uses across fragmented ownership patterns. The predominant influences are insect and disease effects, stress, and fire, rather than departure from SIM because the changes in connectivity/fragmentation are of a permanent nature associated with ownership and land use patterns. Status was calculated as the lack of FHV_C by subtracting the value from 100. The formula for forest health condition status in ARF landscape patterns follows.

H6FHS_ARF = 100-FHV_C   Where LVP_C = ARF

H6FHS_ARF - subwatershed forest health status in agriculture-range-forest landscape patterns.
FHV_C - current forest health vegetation vulnerability to insects/disease and stress.
LVP_C - current landscape vegetation pattern.
ARF - agriculture-range-forest pattern landscapes.

The subwatershed forest health status variable H6FHS was summarized by adding FTL, FRL, and ARF subwatershed landscape pattern types together and assigning non-applicable (N or NA) codes to AGL and RGL subwatersheds to account for all subwatersheds in the Basin. The subwatershed status variable H6FHS was summarized to a subbasin forest health condition status variable (H4FHS) by calculating a weighted average of all applicable subwatersheds within the subbasin. Classes of NA, L, M, and H were assigned by using a frequency distribution of subbasin values. Values of N, NA, or 0 were assigned NA, nonzero values in the lower 30 percent of the range were assigned to L, 40 percent of the nonzero values in the middle of the range were assigned to M, and 30 percent of the values in the upper portion of the range were assigned to H. The status on BLM- and FS-administered lands (BFS) was determined through the use of FMC codes “Y” and “P.” Subbasin BFS was summarized by calculating a weighted average of BFS subwatershed values.

Risk to current status of forest health also differed by type of current landscape vegetation pattern (LVP_C) (Hann and others 1997). Risk was calculated for all lands and for only BLM- and FS-administered lands at the subwatershed scale. Input variables for determination of risk included: 1) current forest health vulnerability (FHV_C); 2) current severe fire effects risk (SFER_C); 3) exotic plant invasion vulnerability for moist sites (EPIV_CM); and 4) exotic plant invasion vulnerability for dry and moist sites (EPIV_BC). For FTL subwatersheds, FHV_C was multiplied by three because of the predominance of insect and disease mortality in these kinds of landscapes. The variable SFER_C was multiplied by two to give less emphasis than FHV_C, but more emphasis than EPIV_CM. The variable EPIV_CM was considered important in these landscapes because of the high correlation of moist site exotic plants, such as Canada thistle *(Cirsium arvense)* and spotted knapweed *(Centaurea maculosa)* invasion, with soil disturbance. Methods and results for development of the variables LVP_C, FHV_C, SFER_C, and EPIV_CM are reported in Hann and others (in prep). The formula for forest health risk in forest landscapes follows.

H6FSR_FTL = [(3*FHV_C) + (2*(SFER_C) + EPIV_CM]/6 Where LVP_C = FTL

H6FSR_FTL - subwatershed forest health risk in forest landscapes.
FHV_C - current forest health vulnerability.
SFER_C - current severe fire effects risk.
EPIV_CM - exotic plant invasion vulnerability on dry and moist site subwatersheds.

In the FRL patterns, the variables FHV_C, SFER_C, and exotic plant invasion vulnerability on dry and moist site subwatersheds (EPIV_BC) were used in the forest health risk calculation. The variable FHV_C was doubled to emphasize effects of insect, disease, and stress, while SFER_C was tripled in order to emphasize the predominance of fire in affecting these landscapes. The variable EPIV_BC was used because of the high correlation of both dry and moist site exotic plants, such as cheatgrass *(Bromus tectorum)*, goatweed *(Hypericum perforatum)*, and spotted knapweed, with soil disturbance. Methods and results for development of the variable EPIV_BC are reported in Hann and others (in prep). The formula for forest health risk in FRL landscapes follows.

H6FSR_FRL = [(2*FHV_C) + (3*(SFER_C) + EPIV_BC]/6 Where LVP_C = FRL

H6FSR_FRL - subwatershed forest health risk in forest-range landscapes.
FHV_C - current forest health vulnerability.
SFER_C - current severe fire effects risk.
EPIV_BC - exotic plant invasion vulnerability on dry and moist site subwatersheds.

In the ARF patterns, the variables FHV_C, SFER_C, and exotic plant invasion vulnerability on both moist and dry site subwatersheds (EPIV_BC) were used in the forest health risk calculation. All variables were treated with equal risk because of the fragmented conditions of these kinds of landscapes and the high probability of soil disturbances. The formula for forest health risk in ARF landscapes follows.

H6FSR_OTH = (FHV_C + SFER_C + EPIV_BC)/3 Where LVP_C = ARF

H6FSR_OTH - subwatershed forest health risk in agricultural-range-forest landscapes.
FHV_C - current forest health vulnerability.
SFER_C - current severe fire effects risk.
EPIV_BC - exotic plant invasion vulnerability on both moist and dry subwatersheds.

Forest health condition risk was summarized to the subbasin scale (H4FHR) in a manner similar to that in status. Risk on BLM- and FS-administered lands (H4FHR_BFS) was also summarized in a manner similar to that in status.

Opportunity to improve status and reduce risk to forest health also differed based on the type of

LVP_C (Hann and others 1997). Opportunity was calculated for only BLM- and FS-administered lands at the subwatershed scale. For FTL patterns, opportunity was based on the variables: 1) forest structure restoration (FSR); 2) woody fuel management opportunities (WFM); 3) prescribed fire opportunities planned ignition (PFO_P); 4) prescribed fire opportunities unplanned ignition (PFO_U); 5) exotic plant invasion vulnerability for moist site subwatersheds (EPIV_CM); and 6) FMC. The variable FSR was given four times the weight of other variables because of the importance of forest structure and composition in FTL landscapes for functioning ecological processes and insect/disease components of the succession/disturbance regimes (Hann and others 1997). The variable WFM was given twice the weight of other variables because of the high potential for fuel accumulations in these landscapes. The variable PFO_P was given twice the weight of other variables because of the importance of fire to adaptations of native species and as a tool for forest community and pattern restoration. The variable FSR included areas where forest structures and patch patterns are not consistent with the inherent succession/disturbance regime and vegetation composition/structure pattern. The variable WFM included conditions where woody forest or shrub fuel conditions occurred that were not consistent with the inherent succession/disturbance regime and vegetation composition/structure pattern. The variable PFO_P included conditions where planned prescribed fire would reduce departure from the inherent succession/disturbance regime and vegetation composition/structure pattern. It also included conditions where unplanned ignitions could be contained and could achieve desired prescribed fire objectives for reduction of departure from the inherent succession/disturbance regime and vegetation composition/structure pattern. The variable EPIV_CM included areas with high potential for exotic plant invasion, such as Canada thistle and spotted knapweed, associated with soil disturbance. Methods and results for development of the variables FSR, WFM, WBO, PFO_P, PFO_U, and EPIV_CM are reported in Hann and others (in prep). The formula for forest health restoration opportunity on FTL landscapes follows.

$$H6FHO\_FTL = [(4*FSR) + (2*WFM) + (2*PFO\_P) + PFO\_U + EPIV\_CM]/10$$

H6FHO_FTL - subwatershed forest health restoration opportunity on forest landscapes.
FSR - forest structure restoration.
WFM - woody fuel management opportunities.
PFO_P - prescribed fire opportunities planned ignition.
PFO_U - prescribed fire opportunities unplanned ignition.

For FRL patterns, opportunity was based on the variables: 1) FSR; 2) WFM; 3) PFO_P; 4) PFO_U; 5) EPIV_BC); and 6) grazing allotment plan revision opportunity (GRO). The variable FSR was given two times the weight of other variables because of the importance of forest structure and composition in FTL landscapes for functioning ecological processes, insect/disease components of the succession/disturbance regimes, and effects on spread of crown wildfires (Hann and others 1997). The variable WFM was weighted with twice the importance of other variables because of the high risk of wildfire in these landscapes. The variable PFO_P was given twice the importance of other variables because of the importance of fire to adaptations of native species and as a tool for forest community and pattern restoration. The variable PFO_U was included because of the importance of unplanned ignition prescribed fire for restoration in the large wilderness and roadless areas. The variable EPIV_BC was added because of the risk of dry and moist site exotic species associated with soil disturbance. The variable GRO was added because many of the FRL landscapes are grazed by livestock and there was a high correlation between probability of wildfire ignition, fine fuel conditions, and type of livestock grazing. The variable GRO was a ranking of revision opportunities for livestock allotment management plans based on departure from inherent succession/disturbance regime and vegetation composition/structure; range health; and potential fire severity. Methods and results for development of the variable GRO are reported in Hann and others (in prep). The formula for forest health restoration opportunity on FRL landscapes follows.

H6FHO_FRL = (2*FSR) + (2*WFM) + (2*PFO_P) + PFO_U + EPIV_BC + GRO)/9

H6FHO_FRL - subwatershed forest health restoration opportunity on forest-range landscapes.
FSR - forest structure restoration.
WFM - woody fuel management opportunities.
PFO_P - prescribed fire opportunities planned ignition.
PFO_U - prescribed fire opportunities unplanned ignition.
EPIV_BC - exotic plant invasion vulnerability in dry and moist site subwatersheds.
GRO - livestock grazing allotment revision opportunity.

For ARF patterns, opportunity was based on the variables: 1) FSR; 2) WFM); 3) PFO_P; 4) EPIV_BC; and 5) GRO. The variables FSR and WFM were given twice the weight of other variables because of the high risks of insect, disease, stress, and fire in these landscapes. The variable PFO_P was given less weight because of the difficulty in using prescribed fire in fragmented ownership patterns that are often adjacent to urban-rural areas. PFO_U was not included because of the high escape risk of prescribed fires onto other land ownerships from unplanned ignitions during the summer season. EPIV_BC was added because of the risk of dry and moist site exotic species associated with soil disturbance and the proximity to agricultural areas, which can be sources for new species invasion. GRO was added as a factor because most of the ARF landscapes are grazed by livestock and there was a high correlation between problems with tree regeneration, probability of wildfire ignition, fine fuel conditions, and type of livestock grazing. The formula for forest health restoration opportunity on ARF landscapes follows.

H6FHO_OTH = [(2*FSR) + (2*WFM) + PFO_P + EPIV_BC + GRO]/7

H6FHO_OTH - subwatershed forest health restoration opportunity on agriculture-range-forest (ARF) landscapes.
FSR - forest structure restoration.
WFM - woody fuel management opportunities.
PFO_P - prescribed fire opportunities planned ignition.
GRO - livestock grazing allotment revision opportunity.

Forest health restoration opportunity was summarized to the subbasin scale (H4FRO_BFS) in a manner similar to that for status, but for only BLM- and FS-administered lands.

Range Health Condition

Range Health condition was an assessment of the status, risk, and opportunity related to forage and habitats in pasture, grasslands, shrublands, woodlands, and forests. Range health was considered to be defined as "conditions under which the integrity of the soil and ecological processes are sustained resulting in systems that maintain their diversity, resiliency, and productivity with associated sustainable resource values" (Hann and others 1997). The subwatershed was considered to be the appropriate scale for prediction of range health conditions since this is the scale where patterns of effects of livestock distribution, forage utilization, habitat connectivity, fire, drought, insects/disease, invasion by exotic species, and stress are most influenced by contagion processes of connectivity and fragmentation. This information was then summarized to a subbasin level.

Status—Status was considered to be the relative difference of current range health conditions between subbasins across the ICB. This relative relationship was determined for all lands as well as for BLM- and FS-administered lands. Status was calculated at a subwatershed level using different calculations depending on the type of subwatershed landscape pattern. These patterns include range (RGL), forest-range (FRL), agriculture-range-forest (ARF), forest (FTL); and agricultural (AGL). The input variables for status included: 1) current range health vulnerability (RHV_C); 2) range health soil sensitivity (RHS); 3) similarity to the inherent succession/disturbance regime and vegetation composition/structure pattern (SIM); 4) exotic plant vulnerability on dry sites (EPIV_BT); 5) exotic plant vulnerability on moist sites (EPIV_CM); and 6) exotic plant vulnerability on both dry and moist sites (EPIV_BC. For information on methods and results for development of these variables see Hann and others (in prep).

<u>Range Landscape Patterns (RGL)</u>—Within the RGL landscapes, emphasis was placed on the combination of RHS, RHV_C, SIM, and EPIV_BT because of the predominant influences on range health of soil conditions and dynamics of drought, succession/disturbance regime, and invasion by annual grasses and noxious weeds. The variables RHS and EPIV_BT were given twice the weight of other variables because of the importance of soils in the dryer rangeland landscapes and the altered succession/disturbance regimes caused by invasion by annual grasses. Status was calculated as the lack of RHS, RHV_C, departure from SIM (100-SIM), and EPIV_BT by subtracting their combined values from 100. The formula for range health condition status in RGL landscape patterns follows.

H6RHS_RGL = 100-[(2*RHS) + RHV_C + (100-SIM) + (2*EPIV_BT)/5] Where LVP_C = RGL

H6RHS_RGL - subwatershed range health status in range landscape patterns.
RHS - range health soil susceptibility.
RHV_C - current range health vegetation vulnerability to insects/disease and stress.
SIM - similarity to the inherent succession/disturbance regime and vegetation composition/structure pattern.

EPIV_BT - exotic plant invasion vulnerability on dry sites.
LVP_C - current landscape vegetation pattern.
RGL - range pattern landscapes.

Forest-Range Landscape Patterns (FRL)—In the FRL landscapes, the variables RHS, RHV_C, SIM, and EPIV_CM were used to calculate status. Equal weight was given to all variables because of the complex relationships between soils, vegetation, succession/disturbance regimes, and exotic weed invasion in landscapes that have a mosaic of forest and non-forest communities. Status was calculated as the lack of RHS, RHV_C, departure from SIM (100-SIM), and EPIV_CM by subtracting their combined values from 100. The formula for range health condition status in FRL landscape patterns follows.

H6RHS_FRL = 100-(RHS + RHV_C + (100-SIM) + EPIV_CM)/4) Where LVP_C = FRL

H6RHS_FRL - subwatershed range health status in forest-range landscape patterns.
RHS - range health soil susceptibility.
RHV_C - current range health vegetation vulnerability to insects/disease and stress.
SIM - similarity to the inherent succession/disturbance regime and vegetation composition/structure pattern.
EPIV_CM - exotic plant invasion vulnerability on moist sites.
LVP_C - current landscape vegetation pattern.
FRL - forest-range pattern landscapes.

Agriculture-Range-Forest, Forest, and Agricultural Landscape Patterns (ARF, FTL, and AGL)—The variables SIM and EPIV_BC were used to determine status within the ARF and FTL landscapes, while only the variable EPIV_BC was used in AGL landscapes. Within the ARF, FTL, and AGL landscapes neither RHS nor RHV_C were used because the methods used for development of these variables (Hann and others in prep) were designed primarily for range or forest-range landscape patterns. The variable SIM was not used for AGL landscapes because the succession/disturbance regime has been deliberately altered and a different regime has been maintained. The primary effect of agricultural landscape status on range health was considered to be the potential for spread of noxious weeds and exotic annual grasses. For ARF or FTL landscapes, status was calculated as the lack of departure from SIM (100-SIM) and EPIV_BC by subtracting the sum of values divided by 2 from 100. Status for AGL landscapes was calculated as the lack of EPIV_BC. The formula for range health condition status in ARF landscape patterns follows.

H6RHS_OTH = 100-{[(100-SIM) + EPIV_BC]/2} Where LVP_C = ARF or FTL,
Else = (100-EPIV_BC) Where LVP_C = AGL

H6FHS_OTH - subwatershed range health status in agriculture-range-forest (ARF) , forest (FTL), or agricultural (AGL) landscape patterns.
SIM - similarity to the inherent succession/disturbance regime and vegetation

composition/structure pattern.
EPIV_BC - exotic plant invasion vulnerability on dry and moist sites.
LVP_C - current landscape vegetation pattern.
ARF - agriculture-range-forest landscape pattern.
FTL - forest landscape pattern.
AGL - agricultural landscape pattern.

Range Health Status Summary—The subwatershed range health status variable H6RHS was summarized by adding H6RHS_RGL, H6RHS_FRL, and H6RHS_OTH subwatershed landscape pattern types to account for all subwatersheds in the Basin. The subwatershed status variable H6RHS was summarized to a subbasin range health condition status variable (H4RHS) by calculating a weighted average of all applicable subwatersheds within the subbasin. The four classes of NA, L, M, and H were assigned by using a frequency distribution of subbasin values. Values of N, NA, or 0 were assigned NA, nonzero values in the lower 30 percent of the range were assigned to L, 40 percent of the nonzero values in the middle of the range were assigned to M, and 30 percent of the values in the upper portion of the range were assigned to H. The status on BLM- and FS-administered lands (H6RHS_BFS) was determined through the use of FMC codes "Y" and "P." Subbasin status on BLM- and FS-administered lands (H4RHS_BFS) was summarized by calculating a weighted average of H6RHS_BFS values.

Risk—Risk to range health condition was considered to be the current probability of present status decline or biophysical capability loss. Methods for risk determination differed depending on the type of current landscape vegetation pattern (LVP_C). Risk was calculated for all lands and for only BLM- and FS-administered lands at the subwatershed scale. Input variables for determination of risk included: 1) current range health vegetation vulnerability (RHV_C); 2) range health soil sensitivity (RHS); 3) vulnerability to exotic plant invasion on dry sites (EPIV_BT); 4) vulnerability to exotic plant invasion on moist sites (EPIV_CM); 5) vulnerability to exotic plant invasion on both dry and moist sites (EPIV_BC); 6) current severe fire effects risk (SFER_C); 7) vegetation/soil risk from season of livestock pattern use class (SnPatclass); and 8) current forest health vegetation vulnerability (FHV_C). For information on methods and results for development of these variables see Hann and others (in prep).

Range Landscape Patterns (RGL)—For risk calculation in RGL subwatersheds, RHS was multiplied by two because of the predominant influence of soils in affecting outcomes in these kinds of landscapes. EPIV_BT was also multiplied by two because of the high risk to alteration of the inherent succession/disturbance regime and loss of native range communities as a result of invasion by exotic annual grasses and dry site noxious weeds. RHV_C, SFER_C, and SnPatClass were all given equal weight because of potential risks to vegetation composition and structure or soil potentials. The formula for range health risk in RGL landscapes follows.

$$H6RHR\_RGL = [(2*RHS) + RHV\_C + SFER\_C + (2* EPIV\_BT) + SnPatClass]/7$$

Where LVP_C = RGL

H6RHR_RGL - subwatershed range health risk in range landscapes.
RHS - range health soil susceptibility.

RHV_C - current range health vulnerability.
SFER_C - current severe fire effects risk.
EPIV_BT - exotic plant invasion vulnerability on dry site subwatersheds.
SnPatClass - risk to vegetation/soil from livestock seasonal pattern of use class.
LVP_C - current landscape vegetation pattern.
RGL - range pattern landscapes.

Forest-Range Landscape Patterns (FRL)—In the FRL patterns, the variables RHS, RHV_C, SFER_C, and EPIV_CM were used in the range health risk calculation. RHV_C was doubled to emphasize the vulnerability of the vegetation relative to RHS in the forest-range mosaic patterns. SFER_C was doubled in order to emphasize the predominance of effects of severe fire on these landscapes, particularly where forest and woodland encroachment have resulted in high fuel loadings on shrub-grassland developed soils. EPIV_CM was included because of the high vulnerability to invasion by moist site exotic plants, such as spotted knapweed and Canada thistle, associated with soil disturbing activities. The variable SNPatClass was used to add the risks of early season and season-long patterns of livestock grazing to vegetation composition and soil structure. The formula for range health risk in FRL landscapes follows.

H6RHR_FRL = [RHS + (2*RHV_C) + (2*SFER_C) + EPIV_CM + SnPatclass]/7 Where LVP_C = FRL

H6RHR_FRL - subwatershed range health risk in forest-range landscapes.
RHS - range health soil susceptibility.
RHV_C - current range health vulnerability.
SFER_C - current severe fire effects risk.
EPIV_CM - exotic plant invasion vulnerability on dry and moist site subwatersheds.
SnPatClass - vegetation/soil risk from livestock seasonal pattern of use class.
LVP_C - current landscape vegetation pattern.
FRL - forest-range pattern landscapes.

Agriculture-Range-Forest, Forest, and Agricultural Landscape Patterns (ARF, FTL, and AGL)—The variables RHS, RHV_C, FHV_C, SFER_C, EPIV_BC, and SnPatClass were used to determine risk within the ARF landscapes, while only the variable EPIV_BC was used in AGL and FTL landscapes. Within the ARF types of landscape patterns, FHV_C, SFER_C, and SnPatClass were used with equal weight, while EPIV_BC was weighted with twice the relative risk. The variable FHV_C was used because of the correlated relationships between forest stand structure and range vegetation health in these kind of mosaic landscapes. The variable RHS was added to emphasize the risk to sensitive soils. Within the AGL landscapes, only the variable EPIV_BC was used because of the potentially high risk of spread of exotic plants and noxious weeds to rangelands from agricultural lands. For the FTL landscapes only EPIV_BC was used because of the high correlation of invasion by noxious and exotic weeds with soil disturbing activities in forest types and the general lack of risk to range health from the other variables. The formula for range health condition risk was as follows.

H6RHR_OTH = [RHS + RHV_C + FHV_C + SFER_C + (2*EPIV_BC) + SnPatClass)]/7

Where LVP_C = ARF, Else = EPIV_BC Where LVP_C = AGL or FTL
H6FHR_OTH - subwatershed range health risk in agriculture-range-forest (ARF) , forest (FTL), or agricultural (AGL) landscape patterns.
RHS - subwatershed range soil health sensitivity.
RHV_C - current range health vulnerability.
FHV_C - current forest health vulnerability.
SFER_C - current severe fire effects risk.
EPIV_BC - exotic plant invasion vulnerability on dry and moist sites.
LVP_C - current landscape vegetation pattern.
ARF - agriculture-range-forest landscape pattern.
FTL - forest landscape pattern.
AGL - agricultural landscape pattern.

Range Health Risk Summary—Range health condition risk was summarized to the subbasin scale (H4FHR) in a manner similar to that in status. Risk on BLM- and FS-administered lands (H4FHR_BFS) was also summarized in a manner similar to that in status.

Opportunity—Range health condition opportunity was considered to be the identification of areas with various option levels for range status improvement and risk reduction to status. Opportunity to improve status and reduce risk to range health also differed based on the type of LVP_C. Opportunity was calculated for only BLM- and FS-administered lands at the subwatershed scale. Opportunity was based on the variables: 1) grazing allotment plan revision opportunity (GRO); 2) exotic plant invasion vulnerability for dry site subwatersheds (EPIV_BT); 3) exotic plant invasion vulnerability for moist site subwatersheds (EPIV_CM); 4) exotic plant invasion vulnerability for both dry and moist site subwatersheds (EPIV_BC); 5) prescribed fire opportunities planned ignition (PFO_P); 6) prescribed fire opportunities unplanned ignition (PFO_U); 7) range health vegetation vulnerability (RHV_C); 8) range health soil sensitivity (RHS); 9) woody fuel management opportunities (WFM); and 10) FMC. Methods and results for development of the variables are reported in Hann and others (in prep).

Range Landscape Patterns—The value of GRO was doubled in order to emphasize the importance of allotment plan revision priorities to achieving range health improvement. EPIV_BT was also weighted double to emphasize the importance of containing spread and restoring areas invaded by dry site noxious weeds and annual grasses. Other variables used included PFO_P_BFS, PFO_U_BFS, RHV_C, and RHS. These variables were assigned equal weight. One assumption made in modeling the variables PFO_P_BFS and PFO_U_BFS (Hann and others in prep) was that both planned and unplanned prescribed fire would not be used unless appropriate technology and fuel treatments were available to preclude further ecological function loss.. This assumption focused on RGL subwatershed environments altered by: 1) the invasion by exotics, particularly annual grasses, 2) encroachment of forest and woodlands, 3) loss of riparian function, or 4) loss of soil or nutrient capital. PFO_P included conditions where planned prescribed fire would reduce departure from the inherent succession/disturbance regime and vegetation composition/structure pattern. PFO_U_BFS included conditions where unplanned ignitions could be contained and could achieve desired prescribed fire objectives for reducing departure from the inherent succession/disturbance regime and vegetation composition/structure pattern. We also assumed that fire management suppression strategies would be implemented that would protect these altered environments, as well as people and property. RHV_C and RHS were included to emphasize status improvement and risk reduction where range vegetation vulnerability and range soil health were high. The formula for range health restoration opportunity on RGL landscapes follows.

If LVP_C = RGL and GRO > 15 and FMC = Y or P

Then

H6RHO_RGL = [(2*GRO) + (2*EPIV_BT) + PFO_P_BFS + PFO_U_BFS + RHV_C + RHS]/8

LVP_C - current subwatershed landscape vegetation pattern.
RGL - subwatershed range landscape pattern
GRO - grazing allotment plan revision opportunity.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.
H6RHO_RGL - subwatershed range health restoration opportunity on range landscape patterns.
EPIV_BT - exotic plant invasion vulnerability on dry site subwatersheds.
PFO_P - prescribed fire opportunities planned ignition.
PFO_U - prescribed fire opportunities unplanned ignition.
RHV_C - current range health vulnerability.
RHS - subwatershed range soil health sensitivity.

<u>Forest-Range Landscape Patterns</u>—For FRL patterns, opportunity was based on the variables GRO, WFM, EPIV_CM, PFO_P_BFS, PFO_U_BFS, RHV_C, and RHS. The value of GRO was doubled in order to emphasize the importance of allotment plan revision priorities to achieving range health improvement. The variable RHV_C was also weighted double to emphasize the importance of managing for appropriate succession/disturbance regime patterns and vegetation composition and structure in forest-range landscapes. The other variables were assigned equal weight. The variable EPIV_CM was used to emphasize the opportunities available to reduce noxious or exotic forb and grass invasion by species such as knapweeds, Canada thistle, bluegrass *(Poa* spp.), and other more moist site species through integrated weed management strategies designed to contain spread and restore high priority forest-range landscapes. PFO_U_BFS included conditions where unplanned ignitions could be contained and could achieve desired prescribed fire objectives for reduction of departure from the inherent succession/disturbance regime and vegetation composition/structure pattern. We also assumed implementation of fire management strategies designed to suppress fires outside of prescription for those fire effects that could result in altered surface soils, extensive erosion, damaged riparian environments, or damage to people and property. The variables RHV_C and RHS were included to emphasize status improvement and risk reduction to those range areas with high vulnerability to vegetation health and high susceptibility to soil health. The formula for range health restoration opportunity on FRL landscapes follows.

If LVP_C = FRL and GRO > 15 and FMC = Y or P

Then H6RHO_FRL = [(2*GRO) + WFM + EPIV_CM + PFO_P_BFS + PFO_U_BFS + (2*RHV_C) + RHS]/9

LVP_C - current subwatershed landscape vegetation pattern.
RGL - subwatershed range landscape pattern
GRO - grazing allotment plan revision opportunity.
WFM - woody fuel management opportunities.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.
H6RHO_FRL - subwatershed range health restoration opportunity on forest-range landscape patterns.
EPIV_CM - exotic plant invasion vulnerability on moist site subwatersheds.
PFO_P - prescribed fire opportunities planned ignition.
PFO_U - prescribed fire opportunities unplanned ignition.
RHV_C - current range health vulnerability.
RHS - subwatershed range soil health sensitivity.

Agriculture-Range-Forest, Forest, and Agricultural Landscape Patterns (ARF, FTL, and AGL)—For other landscape patterns, opportunity was based on the variables GRO, WFM, EPIV_BC, FSR, PFO_P_BFS, PFO_U_BFS, and RHV_C. For subwatersheds with ARF landscape patterns the value of GRO was doubled in order to emphasize the importance of allotment plan revision priorities to achieving range health improvement. Other variables used with equal weight included WFM, EPIV_BC, FSR, PFO_P_BFS, PFO_U_BFS, and RHV_C. The variable FSR was included because of the importance of forest structures to range health in the ARF subwatershed landscape patterns. The variable PFO_U_BFS included the conditions primarily in FTL subwatershed landscape patterns where unplanned ignitions could be contained and could achieve desired prescribed fire objectives for reducing departure from the inherent succession/disturbance regime and the vegetation composition/structure pattern. We also assumed implementation of fire management suppression strategies that would suppress fires outside of prescription for those fire effects that could result in altered surface soils, extensive erosion, damaged riparian environments, or damage to people and property. The variable RHV_C was included to emphasize status improvement and risk reduction where range vegetation vulnerability was high. The variable RHS was not included because there appeared to be very limited opportunity for restoration (other than grazing allotment plan revision) to reduce soil sensitivity in these environments (Hann and others in prep). For AGL and FTL subwatershed landscape patterns, the variables GRO and EPIV_BC were used. These allotments are typically scattered and fragmented within agricultural and forest lands where the priority opportunities are revision of grazing allotment plans for season and pattern of livestock use, and containment and control of noxious and exotic weeds in order to restore composition and structure. The formula for range health restoration opportunity on FRL landscapes follows.

If LVP_C = ARF and GRO > 15 and FMC = Y or P
Then H6RHO_OTH = [(2*GRO) + WFM + EPIV_BC + FSR + PFO_P_BFS + PFO_U_BFS + RHV_C]/8,
Else If LVP_C = AGL or FTL and GRO > 15 and FMC = Y or P
Then H6RHO_OTH = (GRO + EPIV_BC)/2

LVP_C - current subwatershed landscape vegetation pattern.
RGL - subwatershed range landscape pattern

GRO - grazing allotment plan revision opportunity.
WFM - woody fuel management opportunities.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.
H6RHO_FRL - subwatershed range health restoration opportunity on forest-range landscape patterns.
EPIV_BC - exotic plant invasion vulnerability on dry and moist site subwatersheds.
FSR - forest structure restoration.
PFO_P - prescribed fire opportunities planned ignition.
PFO_U - prescribed fire opportunities unplanned ignition.
RHV_C - current range health vulnerability.

Range Health Opportunity Summary—Range health restoration opportunity was summarized to the subbasin scale (H4RHO_BFS) in a manner similar to that of status, but for only BLM- and FS-administered lands.

Watershed Condition

Watershed condition was considered to be a measure of the health or integrity of the interacting hydrologic, nutrient cycling, and soil processes.

The variables used in this analysis were direct estimates of factors or were proxies for primary factors. Proxies are variables that can be measured at a broad- or mid-scale and used directly, in combination with other variables, or weighted to infer primary factors or conditions at a finer scale. A variety of proxy variables were used to predict the status, risk, and opportunity for watershed condition. The analysis included the variables: 1) current hydrologic system vulnerability (HSV_C); 2) similarity to the native succession/disturbance regime and vegetation composition/structure pattern; 3) current severe fire effects risk (SFER_C); 4) road density class (ROAD_CLADSS); and 5) FMC. Methods for development of these variables are reported in Hann and others (in prep). The variable HSV_C was based on synthesis of erosion susceptibility, sediment transport potential, riparian and stream channel function sensitivity, vegetation cover, and impacts of recent historic land use, high road densities, dams, and mines on impairment of factors. The variable SIM was based on comparison of the current succession/disturbance regime patterns and the composition/structure patterns with the historic patterns, resulting in a high value where patterns were similar and low value where they were dissimilar. SFER_C was developed through modeling fire severity based on type of terrain, typical fire weather and fuel moisture conditions, fuels, vegetation, and site sensitivity.

Status—The calculation of status was determined as a departure from the sum of HSV_C and dissimilarity to SIM (100-SIM) by subtraction from 100. Twice the emphasis was given to the variable HSV_C to emphasize the hydrologic system as the connecting linkages between streams, riparian areas, uplands, nutrient cycling, and soil processes. The formula follows.

$$H6WSS = 100 - [(2*HSV\_C) + (100- SIM)]/3$$

H6WJSS - subwatershed watershed status.

HSV_C - hydrologic system vulnerability to erosion, sediment transport, riparian and channel decline, nutrient cycle disruption, water routing and flow disruption, and loss of long-term productivity.
SIM - similarity to native (see footnote 1) succession/disturbance regime, vegetation composition/structure, and landscape mosaics.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

The subwatershed status variable H6WSS was summarized to a subbasin watershed condition status variable (H4WSS) by calculating a weighted average of all subwatersheds within the subbasin. By using a frequency distribution of subbasin values, classes of NA, L, M, and H were assigned. Values of zero were assigned NA, nonzero values in the lower 30 percent of the range were assigned to L, 40 percent of the nonzero values in the middle of the range were assigned to M, and 30 percent of the values in the upper portion of the range were assigned to H. The status on BLM- and FS-administered lands was determined through the use of FMC codes “Y” and “P” and then summarized by calculating a weighted average at the subbasin scale.

Risk—The risk to current watershed condition was considered to be affected primarily by HSV_C, SFER_C, and departure from SIM. The calculation was also weighted to emphasize risk to subwatersheds with high values of HSV_C. The formula follows.

$$H6WSR = [(2*HSV\_C) + SFER\_C + (100 - SIM)]/4$$

H6SWR - subwatershed watershed condition risk.
HSV_C - hydrologic system vulnerability to erosion, sediment transport, riparian and channel decline, nutrient cycle disruption, water routing and flow disruption, and loss of long-term productivity.
SFER_C - current severe fire effects risk.
SIM - similarity to native (see footnote 1) succession/disturbance regime, vegetation composition/structure, and landscape mosaics.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Watershed condition risk was summarized to the subbasin scale (H4WSR) in a manner similar to that in status. Risk on BLM- and FS-administered lands (H4WSR_BFS) was also summarized in a manner similar to that in status.

Opportunities—The opportunities to reduce risk or improve status for watershed condition on BLM- and FS-administered lands were considered to be affected primarily by HSV_C, SIM, and ROAD_CLASS. Opportunities for status improvement and risk reduction were calculated by adding these variables together and giving twice the weight to HSV_C and ROAD_CLASS as for SIM. This weighting was conducted because in many cases the desired management course may not be for SIM, but for some altered or managed regime. The formula follows.

$$H6WSO\_BFS = [(2*HSV\_C) + (100 - SIM) + (2*ROAD\_CLASS)]/5 \text{ where FMC = “Y” or “P”}$$

H6WSO_BFS - subwatershed watershed condition opportunities on BLM- and

FS-administered lands.
HSV_C - hydrologic system vulnerability to erosion, sediment transport, riparian and channel decline, nutrient cycle disruption, water routing and flow disruption, and loss of long-term productivity.
SIM - similarity to native (see footnote 1) succession/disturbance regime, vegetation composition/structure, and landscape mosaics.
ROAD_CLASS - subwatershed road density class.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Urban-Rural/Wildland Interface Condition
The urban-rural/wildland interface condition was considered to be the status, risk, and opportunity on the interface landscapes containing mosaics of urban/ rural housing and wildland forest and range environments. Status and risk were assessed for both BLM- and FS-administered lands and all lands, while opportunities were assessed only for BLM- and FS-administered lands.

The variables used in this analysis were direct estimates of factors or were proxies for primary factors. Proxies are variables that can be measured at a broad- or mid-scale and used directly, in combination with other variables, or weighted to infer primary factors or conditions at a finer scale. A variety of proxy variables were used to predict the status, risk, and opportunity for timber harvest condition. The analysis included the variables: 1) subwatershed urban-rural/wildland interface areas; 2) subwatershed human ecological resiliency; 3) subwatershed urban-rural/wildland interface fire risk; and 4) FMC. Methods for development of these variables are reported in Hann and others (in prep).

Status—Status for the urban-rural/wildland interface condition was considered to reflect relative differences between the levels of complexity of the urban-rural housing and wildland mosaic adjusted by the human population density. Calculations were conducted in the same fashion for all lands as for BLM- and FS-administered lands. The formula for subwatershed urban-rural/wildland condition status on all lands follows.

H6URWIS = [(2*URWI_ALL) + HER]/3

H6URWIS - subwatershed urban-rural/wildland interface class.
HER - subwatershed human ecological resiliency class based on subbasin socioeconomic class, environment, and resource availability.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

The subwatershed status variable H6URWIS was summarized to a subbasin recreation value condition status variable (H4URWIS) by calculating a weighted average of all subwatersheds within the subbasin. Classes of NA, L, M, and H were assigned by using a frequency distribution of subbasin values. Values of zero were assigned NA, non-zero values in the lower 30 percent of the range were assigned to L, 40 percent of the non-zero values in the middle of the range were assigned to M, and 30 percent of the values in the upper portion of the range were assigned to H.

The status on BLM- and FS-administered lands was determined through the use of FMC codes "Y" and "P" and then summarized by calculating a weighted average at the subbasin scale.

Risk—The risk (H6URWIR) to current urban-rural/wildland condition was considered to be primarily affected by fire risk in the interface areas, forest health vulnerability to mortality, and lack of human ecological resiliency. Risk on BLM- and FS-administered lands was calculated by the same methodology as for all lands. The weight of the fire risk value was doubled because of the strong concern for human lives and property. The ratio URWI_ALL/100 was used to adjust the amount of risk. The formula follows.

H6URWIR = [(2*URWI_FR_ALL) + (FHV_C) + (100-HER)]/4 * (URWI_ALL)/100

H6URWIR - subwatershed urban-rural/wildland interface risk.
URWI_FR_ALL - current severe fire behavior risk in the urban-rural/wildland interface.
FHV_C - current forest health vegetation vulnerability to tree mortality.
HER - subwatershed human ecological resiliency.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Urban-rural/wildland condition risk was summarized to the subbasin scale (H4URWIR) in a manner similar to that in status. Risk on BLM- and FS-administered lands (H4URWIR_BFS) was also summarized in a manner similar to that in status.

Opportunities—The opportunities on BLM- and FS-administered lands were developed with a focus on reduction of risk. The variables used included the urban-rural/wildland interface risk and BLM- and FS-administered lands. The formula follows.

Where FMC = "Y" or "P," H6URWIO_BFS = H6URWIR

H6URWIO_BFS - subwatershed urban-rural/wildland risk reduction opportunities on BLM- and FS-administered lands.
H6URWIR - subwatershed urban-rural/wildland interface risk.
FMC - federal management class; codes Y and P are BLM- and FS-administered lands all or partial, respectively.

Timber Harvest Condition

Timber harvest condition was considered to be the status, risk, and opportunity for harvest of timber for commercial products from BLM- and FS-administered lands with cumulative effects to all lands.

The variables used in this analysis were direct estimates of factors or were proxies for primary factors. Proxies are variables that can be measured at a broad- or mid-scale and used directly, in combination with other variables, or weighted to infer primary factors or conditions at a finer scale. A variety of proxy variables were used to predict the status, risk, and opportunity for timber harvest condition. The analysis included the variables: 1) subwatershed timber value potential (TmbrValPot); 2) subwatershed timber value (TmbrVal); 3) relative importance of timber harvest at the subbasin scale (HARVEST_N); 4) subwatershed timber harvest status on BLM- and FS-administered lands (THS_BFS); 5) subwatershed current severe fire behavior risk (SFBR_C); 6) subwatershed current forest health vegetation vulnerability (FHV_C); 7) subwatershed wood biomass opportunities (WBO); subwatershed forest structure restoration opportunities (FSR); 8) subwatershed current landscape vegetation pattern (LVP_C); 9) subwatershed roaded/roadless (R/L); 10) subwatershed National Park Service administered lands (NPS); 11) subwatershed Wilderness designated lands (WILD); and 12) FMC. Methods for development of these variables are reported in Hann and others (in prep).

Status—Status for timber harvest condition was considered to reflect relative differences between current harvest of timber products including commercial sawlogs, posts and poles, firewood, and other wood materials. Calculations were conducted differently for all lands as compared to BLM- and FS-administered lands because of differences in data reliability. *The relative values for all lands should be treated with less confidence than the relative values for BLM- and FS-administered lands*. The formula for subwatershed timber harvest status on all lands follows.

H6THS = (TmbrValPot + (3*TmbrVal) + HARVEST_N)/5

Where LVP_C ≠ AGL or RGL and TmbrValPot > L and TmbrVal > L and R/L = Y and NPS = N and WILD = N

TmbrValPot - timber value based on site potential.
TmbrVal - timber value based on standing volume and composition.
HARVEST_N - subbasin timber harvest importance.
BLM/FS; N = no BLM- and FS-administered lands.
LVP_C - current landscape vegetation pattern.
AGL- agricultural landscape pattern.
RGL - range landscape pattern.
R/L - roaded or roadless; Y = access to subwatershed.
NPS - National Park Service; N = none.
WILD - wilderness; N = none.

The formula for subwatershed timber harvest status on BLM- and FS-administered lands follows.

H6THS_BFS = [(4*THS_BFS) + HARVEST_N]/5

Where FMC = No and THS_BFS ≠ N or VL and LVP_C ≠ AGL or RGL and TmbrValPot > L and TmbrVal > L and R/L = Y and NPS = N and WILD = N

THS_BFS - subwatershed timber harvest status for BLM- and FS-administered lands.
TmbrValPot - timber value based on site potential.
TmbrVal - timber value based on standing volume and composition.
HARVEST_N - subbasin timber harvest importance.
BLM/FS; N = no BLM- and FS-administered lands.
LVP_C - current landscape vegetation pattern.
AGL- agricultural landscape pattern.
RGL - range landscape pattern.
R/L - roaded or roadless; Y = access to subwatershed.

NPS - National Park Service; N = none.
WILD - wilderness; N = none.

The subwatershed status variable H6THS was summarized to a subbasin watershed condition status variable (H4THS) by calculating a weighted average of all subwatersheds within the subbasin. Four classes, NA, L, M, and H, were assigned by using a frequency distribution of subbasin values. Values of zero were assigned NA, nonzero values in the lower 30 percent of the range were assigned to L, 40 percent of the nonzero values in the middle of the range were assigned to M, and 30 percent of the values in the upper portion of the range were assigned to H. The status on BLM- and FS-administered lands was determined through the use of FMC codes "Y" and "P" and then summarized by calculating a weighted average at the subbasin scale.

Risk—The risk to current timber harvest status (H6THS) was considered to be affected primarily by current severe fire behavior risk (SFBR_C) and current forest health vulnerability to mortality from insects, disease, and stress (FHV_C). Risk on BLM- and FS-administered lands was calculated by the same methodology as for all lands and each variable was weighted equally. The formula follows.

$$H6THR = (H6THS + SFBR\_C + FHV\_C)/3$$

H6THR - subwatershed timber harvest risk to status and loss of standing volume.
SFBR_C - current severe fire behavior risk.
FHV_C - current forest health vulnerability to tree mortality.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Timber harvest risk was summarized to the subbasin scale (H4NOXR) in a manner similar to that in status. Risk on BLM- and FS-administered lands (H4THR_BFS) was also summarized in a manner similar to that in status.

Opportunities—The opportunities on BLM- and FS-administered lands were developed primarily in consideration of status rather than reduction of risk. Emphasis on reduction of risk would be a duplication of the forest health opportunities. The variables used included current status, available wood biomass, forest structure restoration opportunities, and importance to local areas. Opportunities for status improvement and risk reduction were calculated by adding these variables together. The formula follows.

$$H6THO\_BFS = (WBO + FSR + H6THS + HARVEST\_N)/4$$

Where FMC = "Y" or "P"
H6THO_BFS - subwatershed timber harvest opportunities on BLM- and FS-administered lands.
WBO - subwatershed wood biomass opportunities.
FSR - forest structure restoration opportunities.
HARVEST_N - subbasin timber harvest importance.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Livestock Grazing Condition
Livestock grazing condition was considered to be the status, risk, and opportunity for livestock grazing on BLM- and FS-administered lands and all lands.

The variables used in this analysis were direct estimates of factors or were proxies for primary factors. Proxies are variables that can be measured at a broad- or mid-scale and used directly, in combination with other variables, or weighted to infer primary factors or conditions at a finer scale. A variety of proxy variables were used to predict the status, risk, and opportunity for timber harvest condition. The analysis included the variables: 1) subwatershed livestock grazing potential; 2) importance of livestock grazing to local areas (RANGE_CODE_N); 3) subwatershed livestock grazing allotment revision opportunities (GRO); 4) livestock grazing status on federal lands (federal includes more than BLM- and FS-administered lands) (LGS); 5) exotic plant invasion vulnerability on both dry and moist sites (EPIV_BC); 6) range health soil susceptibility (RHS); 7) current range health vegetation vulnerability; 8) current hydrologic system vulnerability; 9) subwatershed National Park Service administered lands (NPS); 10) subwatershed Wilderness designated lands (WILD); and 11) FMC. Methods for development of these variables are reported in Hann and others (in prep).

Status—Status for livestock grazing condition was considered to reflect relative differences between current levels of livestock grazing. Calculations were conducted differently for all lands as compared to BLM- and FS-administered lands because of differences in input data reliability. *The relative values for all lands should be treated with less confidence than the relative values for BLM- and FS-administered lands*. The formula for subwatershed livestock grazing condition status on all lands follows.

H6LGS = [(2*LGP) +RANGE_CODE_N]/3

H6LGS - subwatershed livestock grazing status.
LGP - livestock grazing potential used as a relative indicator on all lands.
RANGE_CODE_N - subbasin relative socioeconomic importance of livestock grazing.

The formula for subwatershed livestock grazing condition status on BLM- and FS-administered lands follows.

H6LGS_BFS = [(2*LGS) +RANGE_CODE_N]/3 Where FMC = N

H6LGS - subwatershed livestock grazing status.
LGS - subwatershed livestock grazing status on federal lands.
RANGE_CODE_N - subbasin relative socioeconomic importance of livestock grazing.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

The subwatershed status variable H6LGS was summarized to a subbasin livestock grazing condition status variable (H4LGS) by calculating a weighted average of all subwatersheds within the subbasin. Classes of NA, L, M, and H were assigned by using a frequency distribution of subbasin values. Values of zero were assigned NA, nonzero values in the lower 30 percent of the range were assigned to L, 40 percent of the nonzero values in the middle of the range were assigned to M, and 30 percent of the values in the upper portion of the range assigned to H. The status on BLM- and FS-administered lands was determined through the use of FMC codes "Y" and "P" and then summarized by calculating a weighted average at the subbasin scale.

Risk—The risks (H6LGR) to current livestock grazing status was considered to be affected primarily by exotic plant invasion vulnerability, range health risks, and hydrologic system risks. Risk on BLM- and FS-administered lands was calculated with the same methodology as for all lands. The risk from exotic plant invasion was weighted double compared to other variables. The formula follows.

H6LGR = (H6LGS + (2*EPIV_BC) + RHS + RHV_C + HSV_C)/7
H6LGR - subwatershed livestock grazing risk.
H6LGS - subwatershed livestock grazing status.
EPIV_BC - exotic plant invasion vulnerability on both dry and moist sites.
RHS - range health soil susceptibility.
RHV_C - current range health vegetation vulnerability.
HSV_C - current hydrologic system vulnerability.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Livestock grazing risk was summarized to the subbasin scale (H4LGR) in a manner similar to that in status. Risk on BLM- and FS-administered lands (H4LGR_BFS) was also summarized in a manner similar to that in status.

Opportunities—The opportunities on BLM- and FS-administered lands were developed in consideration of importance to local areas, current status, potential for production of livestock, and reduction of risk. The formula follows.

H6LGO_BFS = (RANGE_CODE_N + H6LGS + H6RHO + LGP)/4 Where FMC = "Y" or "P"
H6LGO_BFS - subwatershed livestock grazing opportunities on BLM- and FS-administered lands.
RANGE_CODE_N - subbasin relative socioeconomic importance of livestock grazing.
H6LGS - subwatershed livestock grazing status.
H6RHO - subwatershed range health opportunities.
LGP - livestock grazing potential used as a relative indicator on all lands.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Recreation Value Condition
Recreation value condition was considered to be the status, risk, and opportunity for the broad mix of recreational activities on BLM- and FS-administered lands and all lands. This variable was the most difficult to predict and the results did not fully meet our expectations. The primary

problems encountered were our inability to account for: 1) variations in actual use as compared to potential use at the subwatershed scale; and 2) lack of data on recreational use of rivers, lakes, and reservoirs for floating and boating activities at the subwatershed scale.

The variables used in this analysis were direct estimates of factors or were proxies for primary factors. Proxies are variables that can be measured at a broad- or mid-scale and used directly, in combination with other variables, or weighted to infer primary factors or conditions at a finer scale. A variety of proxy variables were used to predict the status, risk, and opportunity for timber harvest condition. The analysis included the variables: 1) subwatershed recreation value status, 2) subbasin recreation use index; 3) subwatershed current severe fire behavior risk (SBFR_C); 4) subwatershed watershed condition risk (H6WSR); 5) subbasin socioeconomic growth potential (H4GrowthPotential); 6); subwatershed fire and fuel condition opportunities (H6FFO); 7) subwatershed watershed condition opportunities; 8) subwatershed recreation value risk; and 9) FMC. Methods for development of these variables are reported in Hann and others (in prep).

Status—Status for recreation value condition was considered to reflect relative differences between current dispersed, developed, and wilderness/roadless recreation. Calculations were conducted the same for all lands as compared to BLM- and FS-administered lands. The formula for subwatershed recreation value status on all lands follows.

$$H6RVS = [(2*RVS) + REC\_USE]/3$$

RVS - subwatershed recreation value based on availability of dispersed, developed, and wilderness/roadless attributes adjusted by access and population density.
REC_USE - proxy for relative subbasin recreation use.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

The subwatershed status variable H6RVS was summarized to a subbasin recreation value condition status variable (H4RVS) by calculating a weighted average of all subwatersheds within the subbasin. Classes of NA, L, M, and H were assigned by using a frequency distribution of subbasin values. Values of zero were assigned NA, nonzero values in the lower 30 percent of the range were assigned to L, 40 percent of the nonzero values in the middle of the range were assigned to M, and 30 percent of the values in the upper portion of the range assigned to H. The status on BLM- and FS-administered lands was determined through the use of FMC codes "Y" and "P" and then summarized by calculating a weighted average at the subbasin scale.

Risk—The risk (H6THR) to current recreation value status was considered to be affected primarily by: 1) current severe fire behavior risk (SFBR_C); 2) risk to watershed condition (H6WSR); and socioeconomic growth potential (H4GrowthPotential). Risk on BLM- and FS-administered lands was calculated with the same methodology as for all lands. The current recreation value and growth potentials were weighted with double value, as was the variable for effects of severe fire behavior. The H6WSR was a single weight. The formula follows.

H6RVR = [(2*H6RVS) + (2*SFBR_C) + H6WSR + (2*H4Growth Potential)]/7

H6RVR - subwatershed recreation value risk.
SFBR_C - current severe fire behavior risk.
H6WSR - subwatershed watershed condition risk.
H4GrowthPotential - socioeconomic growth potential.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Recreation value risk was summarized to the subbasin scale (H4RVR) in a manner similar to that in status. Risk on BLM- and FS-administered lands (H4RVR_BFS) was also summarized in a manner similar to that in status.

Opportunities—The opportunities on BLM- and FS-administered lands were developed in consideration of both status and risk. The variables used included growth potential, fuel and fire condition opportunities, watershed condition opportunities, and recreation value risk. Opportunities for status improvement and risk reduction were calculated by adding these variables together. The formula follows.

H6RVO_BFS = [(2*H4GrowthPotential) + (2*H6FFO) + H6WSO + (2*H6RVR)]/7 Where FMC = “Y” or “P”

H6RVO_BFS - subwatershed recreation value opportunities on BLM- and FS-administered lands.
H4GrowthPotential - socioeconomic growth potential.
H6FFO - subwatershed fire and fuel condition opportunities.
H6WSO - subwatershed watershed condition opportunities.
H6RVR - subwatershed recreation value condition risk.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Community Resiliency Condition

Community resiliency condition was considered to be the status, risk, and opportunity of the variety of large to small human communities in the Basin. Status and risk were assessed for both BLM- and FS-administered lands and all lands, while opportunities were assessed only for BLM- and FS-administered lands.

The variables used in this analysis were direct estimates of factors or were proxies for primary factors. Proxies are variables that can be measured at a broad- or mid-scale and used directly, in combination with other variables, or weighted to infer primary factors or conditions at a finer scale. A variety of proxy variables were used to predict the status, risk, and opportunity for timber harvest condition. The analysis included the variables: 1) subwatershed human ecological resiliency (HER); 2) subbasin socioeconomic relative condition (SOCECOVAL_N); 3) subbasin economic resiliency (ECON_RESIL_N); 4) subwatershed recreation value opportunities (H6RVO_BFS); 5) subwatershed timber harvest opportunities (H6THO_BFS); 6) subwatershed livestock grazing opportunities (H6LGO_BFS); 7) subwatershed urban-rural/wildland interface opportunities; and 8) FMC. Methods for development of these variables are reported in Hann and others (in prep).

Status—Status for community resiliency condition was considered to reflect relative differences between the resiliency of human communities based on broad-scale subbasin social and economic conditions, subwatershed environments, and subwatershed availability of recreation, timber, and livestock resources. Calculations were conducted the same for all lands as compared to BLM- and FS-administered lands. The formula for subwatershed community resiliency condition status on all lands follows.

H6CRS = [(2*HER) + SOCECOVAL_N]/3

H6CRS - subwatershed community resiliency status.
HER - subwatershed human ecological resiliency class based on subbasin socioeconomic class, environment, and resource availability.
SOCECOVAL_N - subbasin socioeconomic rating class.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

The subwatershed status variable H6CRS was summarized to a subbasin recreation value condition status variable H4CRS by calculating a weighted average of all subwatersheds within the subbasin. Classes of NA, L, M, and H were assigned by using a frequency distribution of subbasin values. Values of zero were assigned NA, nonzero values in the lower 30 percent of the range were assigned to L, 40 percent of the nonzero values in the middle of the range were assigned to M, and 30 percent of the values in the upper portion of the range were assigned to H. The status on BLM- and FS-administered lands was determined through the use of FMC codes "Y" and "P" and then summarized by calculating a weighted average at the subbasin scale.

Risk—The risk (H6CRR) to community resiliency was considered to be affected primarily by lack of human ecological resiliency. Risk on BLM- and FS-administered lands was calculated with the same methodology as for all lands. The formula follows.

H6CRR = (100 - CRS)

H6CRR - subwatershed community resiliency risk.
HER - subwatershed human ecological resiliency.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Community resiliency condition risk was summarized to the subbasin scale (H4CRR) in a manner similar to that in status. Risk on BLM- and FS-administered lands (H4CRR_BFS) was also summarized in a manner similar to that in status.

Opportunities—The opportunities on BLM- and FS-administered lands were developed with a focus the subbasin importance of BLM- and FS-administered lands to local economies and the subwatershed reduction of community resiliency and urban-rural/wildland interface risk, and production opportunities for recreation, timber harvest, and livestock grazing. The formula follows.

Where FMC = “Y” or “P” and Where ECON_RESIL_N = 100
Then H6CRO_BFS = [(100-H6CRS) + H6RVO_BFS + H6LGO_BFS + H6THO_BFS + 6URWIO_BFS]/5, Else
H6CRO_BFS = {(.65)*[(100-H6CRS) + H6RVO_BFS + H6LGO_BFS + H6THO_BFS + H6URWIO_BFS]/5}

H6CRO_BFS - subwatershed community resiliency opportunities on BLM- and FS-administered lands.
ECON_RESIL_N - subbasin economic importance of BLM- and FS-administered lands activities.
H6RVO_BFS - subwatershed recreation value opportunities on BLM- and FS-administered lands.
H6LGO_BFS - subwatershed livestock grazing opportunities on BLM- and FS-administered lands.
H6THO_BFS - subwatershed timber harvest opportunities on BLM- and FS-administered lands.
H6URWIO_BFS - subwatershed urban-rural/wildland risk reduction opportunities on BLM- and FS-administered lands.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Tribal, Treaty, and Trust Resource Condition
Bureau of Land Management- and Forest Service-administered lands provide a resource for Native Americans. This was determined to be a key indicator variable for assessment of integrated risk and opportunity across the Interior Columbia Basin (ICB) BLM- and FS-administered lands. The variables used in this analysis were direct estimates of factors or were proxies for primary factors. Proxies are variables that can be measured at a broad- or mid-scale and used directly, in combination with other variables, or weighted to infer primary factors or conditions at a finer scale. The following factors are included in tribal, treaty, and trust resource condition: 1) the geographic extent, distribution, and juxtaposition relationships of Tribal, BLM- and FS-administered lands, and other lands; 2) availability of culturally important fishing, animal, and plant resources; 3) the native or “natural” character of landscapes; 4) road and trail access to these resources; and 5) protection of cultural resources and sacred sites. A variety of proxy variables were used to predict these factors.

A proxy for of tribal, treaty, and trust resource status was based on the relative difference in the current condition and availability of these resources between subbasins across the ICB. This condition was determined at a subwatershed level using the variables: 1) FMC as a proxy for BLM- and FS-administered lands with treaty and trust resources; 2) tribal, treaty, and trust land use index (TTLUI-index rating availability of tribal and public lands based on ownership patterns); 3) similarity to native patterns of succession/disturbance regimes, vegetation composition/structure, and landscape mosaics (SIM); 4) current hydrologic system vulnerability of soils, riparian, and channel conditions, nutrient cycling, water routing and flow, and long-term productivity (HSV_C); 5) a subwatershed water quality status index (WQSUM-an indicator of both water quality, potential fish productivity, and native aquatic community diversity); 6) human environmental class (HEC-an indicator of desirable environments for humans); 7) and a resource availability index (RAI_All-an indicator of availability of food and medicinal plants when combined with HEC, big game forage, wood, recreation, and access). The calculation was a sum of these variables with twice the emphasis on TTLUI, conversion of HSV_C to a hydrologic system condition by subtracting the value from 100, and division by the number of variables to recalibrate the value to between zero and 100. The value (100-HSV_C) was used as a proxy with WQSUM to strengthen the emphasis on potential fish production and to include the hydrologic systems condition. The formula follows.

H6TTRS = [(2*TTLUI) + SIM + (100-HSV_C) + WQSUM + HEC + RAI_ALL]/7

H6TTRS - subwatershed tribal, treaty, and trust resource status.
TTLUI - tribal, treaty, and trust resources land use index.
SIM - similarity to native (see footnote 1) succession/disturbance regime, vegetation composition/structure, and landscape mosaics.
HSV_C - hydrologic system vulnerability to erosion, compaction, riparian and channel decline, nutrient cycle disruption, water routing and flow disruption, and loss of long-term productivity.
WQSUM - water quality, potential fish productivity, and native aquatic community index.
HEC - human environment class index to desirable human environments.
RAI_All - resource availability of plant materials, big game and livestock forage, wood, and recreation.

The subwatershed status variable H6TTRS was summarized to a subbasin tribal, treaty, and trust resource condition status variable (H4TTRS) by calculating a weighted average of all subwatersheds within the subbasin. Classes of NA, L, M, and H were assigned by using a frequency distribution of subbasin values. Values of zero were assigned NA, nonzero values in the lower 30 percent of the range were assigned to L, 40 percent of the nonzero values in the middle of the range were assigned to M, and 30 percent of the values in the upper portion of the range were assigned to H. The status on BLM- and FS-administered lands was determined through the use of FMC codes "Y" and "P" and then summarized by calculating a weighted average at the subbasin scale.

The risk to current status of tribal, treaty, and trust resources was considered to be affected primarily by: 1) urban-rural development adjacent or embedded within the wildland interface associated with risk to status from human impacts and loss of access to associated public lands (U-R/WI_All); 2) potential for land exchanges of BLM- and FS-administered lands of small amounts or in fragmented ownership mosaics (PLEP_W - weighted rating based on ownership patterns of uniform, mosaic, or mixed); 3) risk of severe fire behavior and effects (H6FFR); and 4) risk to watershed conditions that would result in failure of roads, road closures, and loss of hydrologic system function (H6WSR). The value of PLEP_W was weighted twice that of the other risks because many areas with potential for high cultural value and for gathering of food and medicinal plants with "natural character" appeared to occur in small, scattered parcels of low elevation BLM- and FS-administered lands. These lands are typically unique because much of their native biophysical character has been substantially changed through cropland and urban development, logging, roads, livestock grazing, irrigation, or submersion in reservoirs behind dams. The calculation was also weighted to emphasize risk in association with high subwatershed status by adding twice the weight of H6TTRS. The formula follows.

H6TTRR = [(2*H6TTRS) + U-R/WI_All + (2*PLEP_W) + H6FFR + H6WSR]/7
H6TTRR - subwatershed tribal, treaty, and trust resource risk.
H6TTRS - subwatershed tribal, treaty, and trust resource status.
U-R/WI_All - urban-rural/wildland interface on all lands.
PLEP_W - weighted public land exchange potential index.
H6FFR - fire and fuel condition risk.
H6WSR - watershed condition risk.

Tribal, treaty, and trust resource risk was summarized to the subbasin scale (H4TTRR) in a manner similar to that in status. Risk on BLM- and FS-administered lands (H4TTRR_BFS) was also summarized in a manner similar to that in status.

Opportunities—The opportunities to reduce risk or improve status of tribal, treaty, and trust resources on BLM- and FS-administered lands was considered to be affected primarily by: 1) FMC; 2) status of tribal, treaty, and trust resources (H6TTRS); and 3) risk to tribal, treaty, and trust resources (H6TTRR). Opportunities for status improvement and risk reduction were calculated by adding H6TTRS to H6TTRR. Risk was weighted with twice the value of status in order to emphasize the opportunities to reduce high risk on moderate to high status lands. The formula follows.

H6TTRO_BFS = [H6TTRS + (2*H6TTRR)]/3 Where FMC = “Y” or “P”
H6TTRO_BFS - subwatershed tribal, treaty, and trust resource opportunities on BLM- and FS-administered lands.
H6TTRR - subwatershed tribal, treaty, and trust resource risk.
H6TTRS - subwatershed tribal, treaty, and trust resource status.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

BLM- and FS-administered lands tribal, treaty, and trust resource opportunity was summarized to the subbasin scale (H4TTRO_BFS) in a manner similar to that in status.

Noxious And Undesirable Weed Condition
Noxious and undesirable weeds were considered to be those plants listed as noxious or weeds of concern within the DEIS. Weeds of concern include annual exotic grasses, such as cheatgrass and medusahead *(Taeniatherum caput-medusae)*, that are not classified as noxious, but are considered weeds with negative value in forests and rangelands. Value of noxious and undesirable weeds was based on the lack of their presence, since they are considered to have negative effects.

The variables used in this analysis were direct estimates of factors or were proxies for primary factors. Proxies are variables that can be measured at a broad- or mid-scale and used directly, in combination with other variables, or weighted to infer primary factors or conditions at a finer scale. A variety of proxy variables were used to predict the status, risk, and opportunity for noxious and undesirable weed condition. The analysis included the variables: 1) exotic plant invasion vulnerability for both dry and moist site species (EPIV_BC); 2) exotic plant invasion vulnerability for dry site species (EPIV_BT); 3) exotic plant invasion vulnerability for moist site species (EPIV_CM); 4) index of environmental susceptibility for exotic plant invasion (IEPIV); 5) current range health vegetation vulnerability (RHV_C), 6) current severe fire effects risk (SFER_C); and 7) FMC. Methods for development of these variables are reported in Hann and others (in prep).

Status—*Status for noxious and undesirable weeds was considered to be the absence of weeds.* Consequently, the calculation of status was determined as a departure from the sum of EPIV_BC, EPIV_BT, and EPIV_CM, by subtraction from 100. Equal weight was given to all three variables. The formula follows.

H6NOXS = 100 - (EPIV_BC + EPIV_BT + EPIV_CM)/3

H6NOXS - subwatershed noxious and undesirable weed status.
EPIV_BC - subwatershed exotic plant invasion vulnerability on dry and moist sites.
EPIV_BT - subwatershed exotic plant invasion vulnerability on dry sites.
EPIV_CM - subwatershed exotic plant invasion vulnerability on moist sites.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

The subwatershed status variable H6NOXS was summarized to a subbasin watershed condition status variable H4NOXS by calculating a weighted average of all subwatersheds within the subbasin. Classes of NA, L, M, and H were assigned by using a frequency distribution of subbasin values. Values of zero were assigned NA, nonzero values in the lower 30 percent of the range were assigned to L, 40 percent of the nonzero values in the middle of the range were assigned to M, and 30 percent of the values in the upper portion of the range were assigned to H. The status on BLM- and FS-administered lands was determined through the use of FMC codes "Y" and "P" and then summarized by calculating a weighted average at the subbasin scale.

Risk—The risk to current noxious and undesirable weed status was considered to be affected primarily by: 1) the potential presence of noxious and undesirable weeds calculated by subtracting H6NOXS from 100; 2) IEPIV; 3) RHV_C, and 4) SFER_C. Potential presence of noxious and other undesirable weeds was given three times the weight of other variables because of the importance of an exotic source for further spread. Other variables were given equal weight. The formula follows.

H6NOXR = {[3*(100-H6NOXS)] + IEPIV + RHV_C + SFER_C}/4

H6NOXR - subwatershed noxious and undesirable weed risk.
H6NOXS - subwatershed noxious and undesirable weed status.
IEPIV - index of environmental susceptibility for exotic plant invasion.
RHV_C - current range health vegetation vulnerability.
SFER_C - current severe fire effects risk.

FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Noxious and undesirable weed risk was summarized to the subbasin scale (H4NOXR) in a manner similar to that in status. Risk on BLM- and FS-administered lands (H4NOXR_BFS) was also summarized in a manner similar to that in status.

Opportunities—The opportunities to reduce risk or improve status for noxious and undesirable weeds on BLM- and FS-administered lands was considered to be affected primarily by H6NOXS and H6NOXR. Opportunities for improvement of status and reduction of risk were calculated by adding these variables together and giving twice the weight to H6NOXS as for H6NOXR. This broad-scale calculation gives higher value to places with low current noxious weed and undesirable plant status; i.e. the potential presence of weed invasion sources; and high current weed invasion risk. *Calculation of opportunities at mid- or fine-scales would logically be the opposite, and emphasize prioritization of areas with high status; i.e. lack of presence of weeds; and high risk of invasion in order to contain spread.* At the broad-scale this strategy would not be appropriate since it would de-emphasize the risk of broad-scale presence of weed invasion sources. The formula follows.

H6NOXO_BFS = [(2*(100-H6NOXS) + H6NOXR]/3 Where FMC = “Y” or “P”
H6NOXO_BFS - subwatershed noxious and undesirable weed opportunities on BLM- and FS-administered lands.
H6NOXS - subwatershed noxious and undesirable weed status.
H6NOXR - subwatershed noxious and undesirable weed risk.
FMC - federal management class for BLM- and FS-administered lands; Y = all BLM/FS; P = partial BLM/FS; N = no BLM/FS.

Landscape Health Condition
Landscape health condition was considered to be the status, risk, and opportunity of the relationships at the subwatershed scale of the 20 condition variables. Status and risk were assessed for both BLM- and FS-administered lands and all lands, while opportunities were assessed only for BLM- and FS-administered lands.

The variables used in this analysis were the 20 condition variables assessed for status, risk, and opportunity. These variables can be classified into the three general groups (land use, ecosystem health, native species diversity) shown below.

Land Use	Ecosystem Health	Native Species Diversity
Timber Harvest	Water Quality	Aquatic System
Livestock Grazing	Air Quality	Terrestrial Family 1
Recreation Value	Fire and Fuel	Terrestrial Family 2
Urban-Rural/Wildland Interface	Forest Health	Terrestrial Family 7

Land Use	Ecosystem Health	Native Species Diversity
Tribe, Treaty, and Trust Resources	Range Health	Terrestrial Family 10
Community Resiliency	Watershed Condition	Terrestrial Family 11
	Noxious Weeds	Terrestrial Family 12

The analysis process involved clustering similar values at the subwatershed scale of status on all lands, status on BLM- and FS-administered lands, risk on all lands, risk on BLM- and FS-administered lands, and opportunities on BLM- and FS-administered lands. The cluster analysis produced 31 clusters of similar subwatersheds for each set of condition status, risk, or opportunity inputs. Statistics from the input variables were calculated and a rank was assigned to clusters along with the range and similarity estimates of variation. The weighted average value for the subbasin was calculated based on the cluster composition.

Status—Status of landscape health (H6LHS) was the relative ranking of the combined tendency of all 20 input status variables at the subwatershed scale. The 31 different clusters resulted in the variety of status conditions reflected below.

Cluster Number	Group Number*	Description
1	32	BLM- and FS-administered lands with traditional reserve range landscape patterns and TF10 habitats.
2	33	BLM- and FS-administered lands with traditional reserve range landscape patterns and air quality.
3	34	Partial BLM- and FS-administered lands with traditional reserve range landscape patterns and recreation.
4	35	Partial BLM- and FS-administered lands with traditional reserve range landscape patterns and air quality.
5	36	Other lands with traditional commodity range landscape patterns.
6	37	Partial BLM- and FS-administered lands with traditional commodity range landscape patterns.
7	38	Partial BLM- and FS-administered lands with traditional commodity range landscape patterns.
8	39	Mixed BLM- and FS-administered lands and Other lands with traditional commodity range landscape patterns.
9	40	Other lands with traditional commodity agriculture-range-forest landscape patterns.
10	41	Mixed BLM- and FS-administered lands and Other lands with traditional commodity agriculture and forest-range landscape patterns.

Cluster Number	Group Number*	Description
11	42	Other lands with traditional commodity agriculture and agriculture-range-forest landscape patterns.
12	43	Mixed BLM- and FS-administered lands and Other lands with traditional commodity agriculture-range-forest landscape patterns.
13	44	Partial BLM- and FS-administered lands with traditional commodity forest-range landscape patterns.
14	45	Mixed BLM- and FS-administered lands and Other lands with traditional commodity forest landscape patterns.
15	46	Partial BLM- and FS-administered lands with traditional commodity forest landscape patterns and water quality.
16	47	Partial BLM- and FS-administered lands with traditional commodity forest-range landscape patterns and aquatic species/water quality/anadromous fish.
17	48	BLM- and FS-administered lands with traditional commodity forest-range landscape patterns, anadromous fish, and timber harvest.
18	49	BLM- and FS-administered lands with traditional commodity forest-range landscape patterns, anadromous fish, timber harvest, aquatic species, and tribal/treaty/trust.
19	50	BLM- and FS-administered lands with traditional commodity forest landscape patterns, anadromous fish, timber harvest, aquatic species, and urban-rural/wildland interface.
20	51	BLM- and FS-administered lands with traditional commodity forest landscape patterns, anadromous fish, timber harvest, and aquatic species.
21	52	Partial BLM- and FS-administered lands with traditional commodity forest landscape patterns, anadromous fish, and aquatic species.
22	53	Partial BLM- and FS-administered lands with traditional commodity forest and forest-range landscape patterns, water quality, anadromous fish, and tribal/treaty/trust.
23	54	Partial BLM- and FS-administered lands with traditional reserve forest landscape patterns, watershed, livestock grazing, and anadromous fish.
24	55	Partial BLM- and FS-administered lands with traditional reserve forest landscape patterns.
25	56	BLM- and FS-administered lands with traditional reserve range landscape patterns and watershed.
26	57	Partial BLM- and FS-administered lands with traditional reserve range landscape patterns and recreation.

Cluster Number	Group Number*	Description
27	58	Partial BLM- and FS-administered lands with traditional reserve forest-range landscape patterns.
28	59	Partial BLM- and FS-administered lands with traditional reserve forest landscape patterns.
29	60	BLM- and FS-administered lands with native forest-range landscape patterns, water quality, aquatic species, and anadromous fish.
30	61	BLM- and FS-administered lands with native forest landscape patterns, water quality, aquatic species, and anadromous fish.
31	62	BLM- and FS-administered lands with native forest landscape patterns, water quality, aquatic species, and forest health.

*For data tracking purposes only.

The subwatershed status variable H6LHS was summarized to a subbasin recreation value condition status variable (H4LHS) by calculating a weighted average of the subwatershed cluster values within the subbasin. Employing a frequency distribution of subbasin values, classes NA, L, M, and H were assigned. Values of zero were assigned NA, nonzero values in the lower 30 percent of the range were assigned to L, 40 percent of the nonzero values in the middle of the range were assigned to M, and 30 percent of the values in the upper portion of the range were assigned to H.

The status on BLM- and FS-administered lands was determined through a separate cluster of similar variables for BLM- and FS-administered lands. Null values were assigned to the non-BLM- and FS-administered lands through the use of FMC codes “Y” or “P.”

Risk—The risk (H6CRR) to landscape health was based on a cluster of the 20 subwatershed risk variables.

Landscape health condition risk was summarized to the subbasin scale (H4LHR) in a manner similar to that in status. Risk on BLM- and FS-administered lands (H4LHR_BFS) was also summarized in a manner similar to that in status.

Opportunities—The opportunities on BLM- and FS-administered lands were developed from a cluster of the 20 BLM- and FS-administered lands opportunity variables.

RESULTS

Wendel, add your own wording here. Documentation of results of this analysis are not complete at this time.

REFERENCES

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