Attachment D

Questions and Answers Pertaining to this Instruction Memorandum

Existing Land Cover Classification System

1. This IM is for RMPs and other planning documents, but what about vegetation data for a project that covers a small area? These data would probably have been collected with actual on the ground surveys, so it is important to emphasize that these data use the same classification system, but just down to a finer level such as alliances or associations, right?

Response: *You are correct, the classification system is hierarchical and is intended to be used at all scales of planning and analysis. This is only briefly mentioned in this IM but will be discussed in greater detail in a Handbook we will start working on soon.*

2. Instead of having riparian vegetation under two groups "Forest and Woodland" and "Mesic Shrubland & Grassland", why can't it be a separate group since it's so important for land use planning.

Response: *The classification system easily allows one to focus on riparian habitat at the sub-division level by aggregating the riparian ecological systems. The term "riparian" is a location descriptor of certain woodlands, shrublands and grasslands (linear band of these plant communities along a water feature) and as such is not consistent with the National Vegetation Classification Standard (NVCS) or the definition associated with the "Group" level. The sub-division level is the appropriate classification level for aggregating riparian ecological systems.*

3. The definition for "Forest" under Group, Class, and Division, etc., appears to only apply to percentage of cover and this has minimal value when such may range from sapling to old growth.

Response: *The classification system is hierarchical with more detail concerning the existing plant communities as one goes to finer scales. The land cover definitions for the above mentioned broad classification levels are based on percent canopy cover (forest versus woodland) and leaf retention (evergreen versus deciduous versus mixed). At the sub-division level additional refinement is possible, depending on planning or analysis needs, by focusing on particular individual or groupings of ecological systems (refer to Table 4 in Attachment A). For example, ponderosa pine woodlands may be a management focus. In this case these woodlands could be spatially separated from the other evergreen woodland ecological systems at the sub-division level. If ponderosa pine woodland age and/or condition data are important and available, then the corresponding spatial data sets could be overlayed onto the existing vegetation base layer. All these data sets (land cover, age, condition) may be desired but it is very important to keep them as separate spatial layers of information.*

4. What is the relationship between this classification system and ecological site descriptions? How does this system relate to the ecological site inventory and monitoring guidance, and is it consistent with the National Range Handbook?

Response: *The Idaho LCCS provides a classification structure for describing existing vegetation and other land cover categories (e.g., barren lands, urban areas). Associations are the finest scale descriptions of existing plant communities (see glossary for definition). Ecological sites are associated with describing potential vegetation at a fine-scale and are defined as " ….a kind of land with a specific*

potential natural community and specific physical site characteristics, differing from other kinds of land in their ability to produce distinctive kinds and amounts of vegetation and to respond to management. Ecological sites are defined and described with information about soil, species composition, and annual production" (Habich 2001). Ecological sites and the Associations in the LCCS provide fine-scale descriptions of vegetation. The former describes potential and the latter describes existing. They are related and must complement each other but will often be different. For example, an ecological site description may describe a Mountain Big Sagebrush/Bluebunch Wheatgrass plant community but the existing vegetation is actually Western Juniper/Mountain Big Sagebrush Woodland Association due to juniper expansion. In addition, annual grass-dominant communities describe the existing vegetation for a variety of ecological sites in the Snake River Plain. Both sets of information are important and one cannot replace the other.

Existing vegetation classification and descriptions as used for the National Vegetation Classification System (NVCS - upon which the Idaho LCCS is based) are not discussed in the National Range Handbook or any other guidance associated with ecological site inventories. However, Dr. Sherm Karl at the BLM National Operations Center is the BLM representative for the NVCS and involved with other agencies concerning ecological site reference material. There is a national committee currently working on a cross-walk between the NVCS and ecological site descriptions.

5. In northern Idaho we have been using the Gap Analysis vegetation cover categories to describe existing land cover. Can we cross-walk existing Gap data so there's a link to the Plant Association categories, rather than entirely remapping the existing vegetation cover layer?

Response: *Yes, we have developed cross-walks for Gap, NWRegap, Landfire, Shrubmap and PNNL (Boise District only) at the Division level. At this point we do not have these data linked to the lower levels (associations and alliances) but, it is doable and may be part of the Handbook we are working on. Other regional or local land cover data can also be cross-walked at the Division level as long as descriptions are available for the existing vegetation types.*

6. The Plant Association category does not seem to provide the opportunity to assign forest vegetation to a "mixed xeric", "mixed mesic", or "mixed subalpine" category compared with the Gap Analysis categories.

Response: *The classification system is hierarchical and plant associations are very fine-scaled and may not be appropriate for your needs as described here. There are a couple of mixed forest ecological systems that may be appropriate and several alliances. In addition, the classification system allows field offices to group appropriate ecological systems in mixed communities as sub-divisions, as needed.*

7. We have attempted to map vegetation cover by percentage using a range of percentages (like 25-50%) to define the four general categories. This feature isn't incorporated into the proposed classification. Perhaps it was determined to be unnecessary or too time-consuming?

Response: *Percent canopy cover is implicitly included in that some of the categories (i.e., forest versus woodland) are defined based on canopy closure. If additional vegetation canopy cover, age or condition categories are important for resource management decisions, then additional spatial data layers are needed to display this information. It is very important that these are developed as separate data layers used in conjunction with the existing vegetation base layer, which is represented by this classification standard.*

8. Field crews usually take a habitat typing manual (incorporating a key) with them when doing inventory. There is a need for an abbreviated field manual for the overall classification system.

Some sort of field-going manual would encourage people to apply this classification regularly and consistently.

Response: *This is a good idea and we will consider developing such a manual as part of the upcoming handbook being developed.*

9. I don't see any class that reflects recently burned areas. Will that be one of the Sub-Divisions, Ecological Systems, Alliances, or Associations?

Response: *Recently burned areas are a temporary phenomena that need to be placed in the classification category based on their resulting dominant land cover, in many cases a native grassland ecological system, annual or non-native perennial grassland. Fire perimeter data in conjunction with subsequent land treatment data are valuable aides in helping to decide the proper classification. Non-burned islands larger than the minimum mapping units that are within fire perimeters need to be accounted for when updating the land cover map.*

10. Where can I find help on using the classification system?

Response: *We have put information concerning the classification system in the following Q Drive:*

Q:\loc\other\Idaho Land Cover Classification System

We will be working on an internal website for the information over the course of the next year too. The NatureServe website also contains all the descriptions for ecological systems, alliances and associations, which you can download.

RMP Land Cover Maps

1. Displaying only to the Division level is too course and finer resolution is needed for meaningful analysis.

Response: *Mapping is at the Ecological Systems level while displaying the existing vegetation on the 'General RMP vegetation Map' cannot be finer than the Division level. Meaningful analyses can be conducted at various spatial and thematic scales depending on resource objectives.*

2. In the IM it states "If an existing land cover type represents more than 35 percent of the RMP land cover area then a finer thematic classification to the next level (e.g., class to division) is warranted. What is the source for this percentage and is it a commonly accepted norm (e.g., why not 30% or 40%?)

Response: *We removed this direction from the IM since we believe that the direction to display vegetation on the 'General RMP vegetation Map' to the Division level will suffice. The intent of this direction was to insure that the 'General RMP vegetation Map' had sufficient land cover information to be meaningful.*

3. Why can't we display some finer scale vegetation cover types on our 'General RMP Vegetation Map' if they are important?

Response: *Development of a map of existing land cover typically depends on data from a variety of sources (field data, aerial photography, satellite imagery). However these multiple-scaled data sources are analyzed such that the resulting land cover map represents a single, consistent scale across the entire*

area. Combining data from different scales into a single map without consideration of the effects of the varying scales is inappropriate. If there are certain vegetation communities of special interest then additional finer-scaled maps can and should be developed, displayed and analyzed for the RMP.

4. Can potential natural vegetation data be used for the land cover map?

Response: *No, land cover maps spatially describe existing vegetation. Potential vegetation maps cannot be used in a general manner to "fill-in" areas and then display them as "existing vegetation." Potential vegetation and vegetation condition data sets are separate from this existing land cover data set.*

Mapping Standards

1. We need to remember that the data sources (e.g., NW ReGap, Shrubmap, Landfire, etc.) used for the RMPs with this standard are based on 30-meter resolution satellite imagery. As long as we understand the intended use of these data sources are for RMP vegetation description consistency and not as the principle land cover vegetation mapping source at the project scale, we should be okay.

Response: *We agree, consistent existing land cover classification at the RMP level is the major purpose of this IM. However, the land cover classification is set up in a hierarchical framework so that it can be used at the project level for vegetation mapping at that scale as well. For instance, while the focus is on mapping ecological systems (and above) at the RMP level, the appropriate associations and alliances nested within ecological systems are included for mapping at the project level. One should not use satellite data for fine-scale mapping efforts.*

2. Minimum map unit (MMU) values seem too small/large to be analyzed in an RMP. Why do we care about a minimum acreage size? If we have one acre of a rare species wouldn't we want that in land cover map?

Response: *From a mapping perspective, defining a MMU is important and routine. The minimum size of the MMU is predetermined by the spatial resolution of imagery used (e.g., maps from Landsat cannot have a MMU smaller than 0.09ha or 1 30X30m cell). However, the selected size of the MMU is often based more on the thematic classification and the need to smooth out the noise (or 'salt-and-pepper'). Applying a MMU effectively removes the majority of thematic noise in land cover maps and results in a more interpretable product. The higher the spatial resolution of the imagery, the more difficult it is to reliably map, assess, and interpret single pixels or even small groups of pixels and the more a MMU is necessary.*

While the values we have chosen for the standard (2-ha and 0.5-ha) are somewhat arbitrary, they are commonly used for mid-scale (i.e., 30X30m resolution) mapping. The 2-ha value for uplands closely approximates a 5X5 window of cells (150X150m) and helps account for possible errors in the geo-rectification (alignment) of the imagery as well as possible errors in point data used for training the classification. The 0.5-ha value is used for riparian areas that otherwise may be obscured.

The MMU values in the IM are intended for the development of the land cover map and based on the characteristics of the imagery likely to be used. Assuming these data will be used at a later date to provide context for finer level projects (i.e., site-specific) then it is important to maintain a smaller MMU (such as that suggested in the IM). If the data are to only be used for RMP and broader efforts, then a larger MMU may be sufficient. Keep in mind that the size of the MMU is also important for assessing accuracy and if a larger MMU is chosen, then the accuracy assessment will also be based on that larger 'patch' size.

If you have one acre of a rare species it should be addressed separately. The best approach would be to map the patch by hand (i.e., use a GPS to define the boundary) and not by using satellite or aerial photography.

3. Why is BLM mapping private, state and other Federal lands?

Response: *Land cover information for the "RMP landscape" is important regardless of ownership for many resource analyses pertinent to BLM land use planning. Some of these include cumulative impact, fire fuels continuity and various habitat fragmentation assessments. In any case, mapping land cover across jurisdictional boundaries is commonplace (e.g., NLCD, GAP, Landfire, Shrubmap, etc.).*

4. The IM indicates that each field office must extend their mapping 2 miles beyond their boundaries. Where adjoining field offices have conflicting map classes, who resolves these and what is the process?

Response: *This will be a situation that relies on expert opinion – both the remote sensing/mapping expert and the vegetation ecologist expert. Several factors that need to be considered include 1) date of the imagery used, 2) type and quality of imagery (e.g., spatial and spectral resolution, clouds, etc), 3) vegetation types mapped, 4) possible disturbances (i.e., fire), etc. At the Division level in the classification, the chances of conflicts are pretty small – and if there are conflicts they should be easily resolved (e.g., one mapped as forest, one as shrubland).*

5. Will the data be maintained as raster? If so, will users have an ability to make local edits to the data?

Response*: There are pros and cons to both raster and vector approaches. Mid- to broad-scale land cover mapping efforts are typically in raster format for many reasons including ease of storage (size, speed), display (speed) and most important, ease of analysis. Editing raster data can be tricky; however with regular schedule for updating (i.e., not just changing pieces here and there) it can be efficiently accomplished. Local edits should be reviewed and approved by the data stewards and GIS specialists working together.*

6. Why are botanists or ecologists recommended as data stewards?

Response: *The data steward needs to be familiar with plant systematics and the plant communities associated with a variety of ecosystems including montane forests, cold deserts, alpine communities, wetlands and semi-desert woodlands. Most botanists and ecologists will have the botanical education and experience needed for this broad array of ecosystems. However, there are range management specialists or foresters that may have the experience and interest to be the data steward.*

Data stewards should be working closely with GIS specialists and the State Office program managers to insure classification and mapping consistency across BLM landscape. Existing land cover data needs to be consistently applied for mapping purposes so we can aggregate information beyond field office boundaries.

Accuracy Assessments

1. Why are accuracy assessments required?

Response: *Accuracy assessments are a standard component of map-making using remotely sensed data. As a Federal agency we are obliged to use the best available information. An accuracy assessment*

allows the BLM to quantitatively assess the quality of mapped information. This is important since many resource management objectives, analyses and decisions are based on these data. Not having an assessment as to the accuracy, or inaccuracy, of the land cover data may create questions concerning the quality of analyses.

2. Aren't accuracy assessments expensive and time consuming?

Response: *Accuracy assessments do not have to be a huge workload if well-thought out and prepared for. They are standard procedure and should be a component of any contracts for new land cover maps.*

3. Do we include non-BLM lands in our accuracy assessments?

Response: *Mapping accuracy for non-BLM lands can be assessed with aerial photography. If aerial photography is not available then metadata and description of methods for the accuracy assessment should specify that accuracy was only assessed on BLM lands.*

4. How do we know what methodology for accuracy assessments we should use?

Response: *There is no single accepted methodology or standard for assessing accuracy of land cover maps. There are instead several methodologies documented and accepted in the peer-reviewed scientific literature that can be used. It is important to document the procedures used for mapping and the accuracy assessment. The land cover classification report completed by the Pacific Northwest National Laboratory completed for Boise District has a good example of the mapping procedures documentation and accuracy assessment needed (PNNL 2005).*

5. If one uses only land cover data from LANDFIRE. GAP or Northwest ReGAP a 90% accuracy or better is highly unlikely. LANDSAT-based image classification will only get you so far. These data sources serve as starting points, but that local level knowledge and input is critical to building better layers.

Response: *There are instances when >90% accuracy can be achieved – however, these instances almost universally include small acreages, high resolution imagery, a few specific vegetation classes, and considerable field data. Obviously, these efforts also carry significant costs. In the majority of cases, mapping a suite of land cover classes over broad areas using 30- meter data with traditional maximum-likelihood methods results in an accuracy of somewhere around 70% (with some classes higher and some lower). That said, there are newer methods (i.e., object-oriented) that when combined with mid-high resolution imagery (e.g., 10-15 meter SPOT or ASTER) are showing promising results with overall accuracies in the low to mid 80's. This is still at the fore-front of applied classification and does require local level knowledge and input.*

6. If we require accuracy assessments for land cover mapping, won't that set up the public expectation that we perform these assessments for all our data sets?

Response: *We should have descriptions of methods for compiling and analyzing all our resource data used for decision-making. Many of these standard methods are already described (e.g., proper functioning condition assessments, land health assessments, fuel condition assessments, etc.). How we organize these data for spatial display or analysis also should be described, when done for an RMP or otherwise. In addition, as a Federal agency, the BLM uses the U.S. National Map Accuracy Standards, Draft National Standard for Spatial Data Accuracy and the Federal Data Quality Act as guidelines for mapping.*

7. What is the relationship between metadata and accuracy assessments?

Response: *The FGDC metadata are required and the metadata contains information about the spatial data including accuracy, methodologies, use limitations and other pertinent directions. Accuracy assessments are the quantitative identification and measurement of map errors. As such, metadata are not a replacement for an accuracy assessment. The results of the accuracy assessment should be reported in the metadata.*

8. **The IM indicates that accuracy assessments must be done but not who is responsible to complete them. Is it the job of the botanist/ecologist data steward or the job of the GIS staff?**

Response: *The accuracy assessment for the RMP land cover maps should be completed by the person(s) developing the map (typically a GIS/remote sensing expert) with input and collaboration from the field office botanists, ecologists and other staff.*

9. I understand that we can use aerial photography to check satellite imagery. I assume we must use field data to check aerial photography. If BLM displays existing land cover to the Division level for the RMPs and accuracy should be tested on 50 locations per division, this may be a significant workload.

Response: *The data used to assess accuracy of a land cover map, be it collected from the field or from aerial photography, is assumed to be correct and typically of higher resolution than the satellite data being assessed. So, for example, aerial photography is often used in combination with field data to assess satellite-derived maps. Aerial photography can be used almost exclusively for assessing satellite imagery accuracy for some Divisions (e.g., evergreen forest, evergreen woodland, agriculture). Aerial photography in combination with existing field data recently collected for other purposes may suffice for other Divisions.*

As a general 'rule-of-thumb', roughly 50 locations per classification level (in this case Division level) are suggested for assessing accuracy. As stated in the IM (and will be expanded on in the handbook), this value can and often should be adjusted for a number of reasons including the size of the map area, the extent of the class, the inherent variability of the class, and the relative importance of the class. For any one field office, there will likely be only six to eight divisions, so an estimate of 300-400 sample points will likely be sufficient for assessing accuracy at this level. These sample points will likely not be distributed equally among classes. For example, identifying areas of agriculture is much more easily done with remote sensing than identifying areas of annual grassland. So, instead of assessing 50 points in agriculture and 50 in annual semi-desert grassland, it would make more sense to use a minimum of points in agriculture (say 15) and more points in annual grasslands (85). Again, these numbers are just 'rule-of-thumb' and need to be evaluated in each area.

The accuracy assessment portion of every land cover mapping project does take work – but it is a valuable and necessary aspect of every mapping project without which the intended users would have no means of knowing potential inherent errors. One approach that would minimize the workload for field office personnel in those instances when land cover maps have been created but not assessed (i.e., it wasn't included in the original contract), would be the creation of a sample reference database. Populated with existing field data (e.g., fire plots, ESI, etc.) and cross-walked to classification scheme (at least at the Division level), the database could serve as a source of sample data for anyone wanting or needing to assess accuracy in their area.

10. How can existing field data be used for developing these RMP land cover maps?

Response: *Existing field data that describes the existing vegetation, not potential vegetation, can be used very effectively either for development of land cover maps or accuracy assessment. These data should be considered in the process of designing a land cover mapping project.*

11. The statement that "there are many methods for collecting reference data…" seems to open the door to an opportunity to a challenge on sampling methodology.

Response: *There are several acceptable methodologies in the peer-review literature for collecting reference data. The choice depends on numerous factors including the land cover classes to be assessed, accessibility of the area, time available, and cost. The rationale behind the methodology used should be documented.*

12. What about the timing of data collection? We may need to work with "best available" data with a range of mixed source, scale and vintage of data.

Response: *Ideally, field data would be collected in the same general time frame as the imagery. However, the typical case is more like the situation mentioned here – a range of data from different time periods. These data can still be used, they just require more effort in error checking to make sure they are still appropriate for classifying existing vegetation or other land cover. For instance, one would want to compare older field data with fire perimeter boundaries to identify data no longer accurate.*

13. How will an accuracy assessment add to a RMP, and why is it needed for analysis at this planning scale?

Response: *Accuracy assessments are standard procedure for map making when using remote sensing data. Many analyses for an RMP and its implementation rely on the land cover data. Without an accuracy assessment, the implicit assumption is that the land cover data are correct, which may or may not be true. Potential map errors may then affect the reliability of certain analyses (e.g., trend analyses) and basis for resource management decisions. With a well planned accuracy assessment in place, any errors by class or across space can be taken into consideration during analyses and decision-making.*