Chapter 9 : ASSUMPTIONS AND LIMITATIONS FOR APPROPRIATE USE

The following assumptions and limitations were developed as caveats and guidance for appropriate development and implementation of management strategies from the results of our regional assessment. In developing these caveats, we borrowed heavily from a similar list developed by Wisdom et al. (2003). These assumptions and limitations apply generally to any regional assessment that uses remote-sensed imagery to evaluate habitats for species of concern across vast areas such as an ecoregion.

Unfortunately, some resource professionals suffer from the misperception that regional assessments are too coarse to reflect ecological patterns and processes that affect species of conservation concern. While particular criticisms are warranted for any assessment, regional or local, criticisms of regional assessments as being "too coarse" often fail to consider the objectives of the assessment (Thompson et al. 1999). For example, regional assessments may not be too coarse to meet evaluation objectives for large spatial extents such as an ecoregion or ecological province. Alternatively, the same assessment data may indeed be too coarse for planning local projects, such as for an area of 1,000 ha.

In particular, the assessment of habitats across millions of ha requires prudent use of coarse-grained data, such as the 90- x 90-m pixel size used for our assessment. Use of continuous coverage maps of fine-grained data (e.g., 1- x 1-m pixel size) across an area the size of an ecoregion is currently impractical, owing to prohibitive costs, file sizes, and computer processing demands. These problems are likely to be alleviated in the future with technological advances in remote sensing and improved capacity for computer file storage and analyses. Nonetheless, fine-grained map layers typically are not needed to meet objectives of regional assessments. For example, if objectives call for understanding the broad patterns of habitat characteristics across 5 million ha, accurate portrayal of those conditions on every 1- x 1-m pixel of the assessment area is unnecessary. On the other hand, assessment of local conditions for a small project area of 1,000 ha may require fine-grained data that can be obtained only from high-resolution maps or field data.

These points suggest that all assessments, regardless of scale, require an explicit listing of assumptions and limitations for appropriate management use. The following assumptions and limitations apply to appropriate management use of results from our regional assessment of habitats in the Great Basin and Nevada.

- The land cover types (cover types) identified in our assessment as habitats for each species may not include all environmental conditions that determine whether a population is growing, declining, or stationary. For example, areas containing abundant habitats may not support persistent populations of some species because of the negative effects of non-vegetative conditions, such as factors associated with roads. That is, habitats may contribute to stationary or increasing population growth, but the road effect may override the habitat effect, thereby resulting in a sink environment. Knowledge about the negative effects of non-vegetative factors is therefore an important, complementary component to proper management of vegetation identified as habitats for species in our assessment.

- Our estimates of habitat amount are based on estimates of the dominant plant species (land cover types) present in the overstory of each 90-m pixel used for mapping in the sagestitch map (Comer et al. 2002). As such, these estimates do not reflect the quality of understory vegetation that may render some cover types unsuitable as habitat. For example, areas dominated by sagebrush may contain highly variable vegetation in the understory, ranging from a high abundance of native grasses and forbs to complete dominance by exotic plants. Because the coarse resolution of our data does not allow understory conditions to be mapped, the amount of habitat for some sagebrush-associated species may be overestimated. For example, greater sage-grouse depend on an understory of native grasses and forbs for nesting and brood-rearing (Schroeder et al. 1999), and some areas identified as habitats for this species may be unsuitable due to displacement of native understory plants by exotic grasses.

- The cover types identified as habitats do not always translate directly to habitats for each species, and use of these cover types as habitat "proxies" may overestimate habitat amount for some species. An example is pygmy rabbit, a species strongly associated with basin big sagebrush and the deeper soils in which this taxon grows (Orr 1940, Green and Flinders 1980, Gabler et al. 2001). The cover types used in our assessment did not distinguish between homogeneous areas of basin big sagebrush versus areas co-dominated by basin big sagebrush and Wyoming big sagebrush (see Chapters 3 and 6). Consequently, areas dominated by basin big sagebrush were included in a more generic Wyoming-basin big sagebrush cover type. We included the Wyoming-basin big sagebrush cover type as habitat for pygmy rabbit, owing to the high probability that substantial areas of this cover type encompass habitats of basin big sagebrush important to the species. This approach, however, may have overestimated the amount of habitat for the species. Another example is black-throated sparrow. This species is generally not observed in desert valley floors or where shrub cover exceeds 25% (The Nature Conservancy 1999, Johnson et al. 2002). These conditions could not be excluded as non-habitat for the species under the current classification of land cover types used to identify habitats for the species.

- Amount of habitat and associated threats do not directly correlate with population effects for a given species. Loss of habitat projected from risks posed by various threats, however, is likely to be positively correlated with trends in populations of the associated species, but the degree of positive correlation is uncertain and likely varies by species and the effects of factors not accounted for in the regional assessment (Knick and Rotenberry 2002). In addition, species may not respond to habitat loss for a number of years, suggesting that observations of species under varying environmental conditions at any one point in time may not always correlate well with habitat loss over time (Knick and Rotenberry 2000).

- Estimates of habitat amount that are based on the 90- x 90-m pixel resolution of the sagestitch map, and subsequent estimates of habitat amount by levels of risk posed by threats, are of sufficient accuracy to meet regional assessment goals when results are summarized to spatial extents of the ecoregion, ecological province, subbasin, or other large areas generally ≥100,000 hectares (Hann et al. 1997; Wisdom et al. 2000). This is the manner in which we used these data for our assessment. Conversely, the 90-m sagestitch map should not be used to derive estimates for local areas, such as small areas (e.g., 1,000 ha) inside an individual watershed. Exceptions to this rule may apply to particular analyses. In general, local analyses require data mapped at finer resolution than a 90- x 90-m pixel. Such fine-grained data are not available in continuous coverage format over large spatial extents, owing to exorbitant costs and processing demands associated with deriving such maps over millions of ha.

- Linear features such as roads, narrow riparian strips, and smaller streams cannot always be mapped accurately at the 90- x 90-m pixel size (0.81 ha) used for our assessment. Consequently, habitat estimates are of lower accuracy for cover types that occur in small or linear patches, and often are substantially underestimated in relation to their true amount. Cover types that occur in small patches of <0.4 ha, for example, may not dominate a pixel, and may not be mapped. Similarly, cover types that have an average patch size <1/4 the area of a 90- x 90-m pixel (that is, <0.2 ha) would not be mapped unless such cover types occur as multiple patches within the pixel. Cover types that occur as multiple patches within a pixel and that have an average patch size >1/4 the area of a 90-m pixel (i.e. >0.2 ha), however, are typically mapped because some of these patches will be large enough to dominate the pixel. Importantly, sagebrush and salt desert cover types occur in large or multiple patches that typically are recognized and mapped with use of 90-m pixel resolution like that used for our assessment. Consequently, accuracy of the 90-m sagestitch map used for our assessment appears sufficient to meet our objective to estimate and map habitat patterns and threats over large spatial extents for species of conservation concern associated with the major shrubland cover types in the Great Basin. Not only do the shrubland habitats of interest occur in large patches that can be mapped, we also excluded the species of concern with restricted ranges and fine-scale micro-habitats, as these species' habitats cannot be detected consistently with our 90-m pixel size. Finally, estimates of habitat patterns over large spatial extents typically portray accurate broad-scale habitat patterns (Hann et al. 1997, Wisdom et al. 2000), as done for our assessment.

- Habitat risk from cheatgrass may be under- or over-estimated because of uncertainties about the changing adaptability of cheatgrass. For example, our rule set relied on elevation, slope, aspect, and landform as proxies for temperature and moisture regimes that affect a given site's potential for cheatgrass displacement of native cover types (see Chapter 4). Cheatgrass is evolving quickly, however, and past conclusions about cover types or sites being unsuitable for cheatgrass establishment have been consistently erroneous (Young and Sparks 2002). A prime example is the salt desert plant communities, considered unsuitable for widespread cheatgrass invasion <20 yrs ago, and now experiencing widespread displacement by this exotic species (Meyer et al. 2001, Young and Sparks 2002). Another example is the recent, expansive establishment of cheatgrass in the Mojave Desert of southern Nevada, in soils and cover types previously considered unsuitable (S. Meyer, personal communication, Rocky Mountain Research Station, Provo, Utah). On the other hand, large areas of salt desert scrub that occur on saline soils, such as on many valley floors in the Great Basin, may still be less suitable for cheatgrass, and these areas compose a major portion of the largest land cover type in both the Great Basin and Nevada. We considered the entire salt desert scrub cover type to be susceptible to cheatgrass invasion, within the rule sets used in the cheatgrass model, which may overestimate this risk. Portions of other cover types associated with highly saline, or other soil types that inhibit cheatgrass establishment, may also have lower risk that we estimated. It is critical that our performance of our risk model for cheatgrass be evaluated with collection of new field data as part of validation research. Without validation research, improvement of our cheatgrass risk model is not possible.

- Different species of concern respond in different ways to the same amount of habitat in a specified area, owing to variation in each species' use of the configuration of habitats (i.e., the fragmentation, patch size, and connectivity of habitats). We did not evaluate effects of habitat configuration, as these relationships are highly uncertain for many species (Haila 2002, Villard 2002), even for well-studied species like greater sage-grouse (Rowland and Wisdom 2002). New research on species responses to varying types of habitat configuration is needed to include such responses in regional assessments, as discussed by Wisdom et al. (2003).

- Knowledge of habitat requirements is better for commodity species (game or furbearer species) or threatened or endangered species (TE species, as listed under United States Endangered Species Act) than for species that have neither commodity nor TE status (Wisdom et al. 2002). Knowledge also is better for birds than mammals and for mammals than reptiles and amphibians (Wisdom et al. 2002). Consequently, higher uncertainty is associated with habitat estimates for reptiles and amphibians than for birds or mammals, particularly birds and mammals that are TE or commodity species (Wisdom et al. 2002). Similarly, the reviews of habitat associations by species experts suggests that many birds are more strongly associated with the cover types we used as proxies for species' habitats, and that amphibians, reptiles, an small mammals are less strongly associated with these cover types. That is, other environmental factors beyond the cover types may have a stronger influence on herptiles and small mammals. Thus, results of our regional assessment may be less certain for herptiles and small mammals than for birds and large mammals. Because of variable knowledge in species' requirements across taxonomic groups (Wisdom et al. 2002), different taxonomic experts may have interpreted our definition of habitat (vegetation that contributes to population persistence) in different ways when reviewing and refining the species' habitat associations used in our assessment. Such differences would result in more variability in habitat estimates across taxonomic groups.

- The large number of plant species of conservation concern and their lack of suitability for regional assessment indicates a compelling need for local assessments to estimate and monitor the status of these species' habitats and populations. How well the habitat patterns and requirements of the 40 vertebrates evaluated in our assessment represent the needs of plant species of concern is unknown, and justifies considerable effort to conduct local assessments for the plants of conservation concern, as a complement to our regional assessment.

- Invertebrates have some of the highest vulnerability rankings under the NatureServe evaluation of species at risk (NatureServe 2002). And yet, we have the least knowledge about needs of these taxa, as invertebrates are substantially understudied (Bonnet et al. 2002, Clark and May 2002). Consequently, the lack of knowledge about invertebrates may pose a bias in ranking systems used to identify species of conservation concern, including our process. Additional research focus on invertebrates is needed to assess this issue.

- Results for groups of species are intended for use in regional planning and management, allowing large numbers of species with similar habitat requirements to be managed efficiently. Each species occupies its own niche, however, and habitat estimates based on species groups may not fully reflect specific conditions for individual species within a group. Consequently, any regional management strategy based on an assessment of species groups needs to be evaluated for its effect on individual species. The regional strategy can then be improved through a number of iterations of its development, in concert with checking its effect on individual species. We outlined a specific process by which management verification of the efficacy of species groups can be implemented as part of management use of the groups (Chapter 7). This process should be followed when using the species groups to develop management strategies.

- Management use of our results for species groups is a coarse-filter approach that can be effective as regional context for local planning, analysis, and implementation. Coarse-filter management assumes that managing an appropriate amount and arrangement of all representative land areas and habitats will provide for the needs of all associated species). Without such coarse-filter approaches for large spatial extents, the basis for management decisions at local scales may be unclear or could fail to consider the cumulative effects of past management on species of conservation concern. For example, an evaluation of sagebrush habitats for pygmy rabbit in a particular BLM Field Office may indicate that such habitats are abundant and at low risk from various threats. On the scale of the Field Office, this result might imply little need for special management. Results from the ecoregion analysis may imply otherwise, however, suggesting a high risk of regional extirpation because of more widespread problems. In this case, special management of habitats within the Field Office may be important as part of a larger strategy to conserve and restore habitats for pygmy rabbit over a larger area beyond the boundaries of the Field Office.

- A major assumption of our regional assessment is that research will be conducted to corroborate key patterns or processes that are mapped or modeled, and that may lack empirical certainty. That is, results from the regional assessment serve as regional hypotheses for testing and validation through large-area management experiments (Walters 1986). If validation research is not conducted to address the major sources of uncertainty associated with results of a regional assessment, the credibility of the assessment, and its management uses, could be seriously questioned. Follow-on research to evaluate key knowledge gaps is a required part of regional assessments.

- Another major assumption is that results of our regional assessment will be considered in tandem with finer-scale evaluations of habitats as part of local management. Results from regional assessments provide regional context for designing local conservation and restoration practices. Likewise, the effectiveness of addressing regional threats and regional habitat problems depends on effectively addressing these problems through local management plans. Ultimately, the utility of regional assessments depends largely on the success of both regional and local management strategies and their implementation.

- Our assessment of broad-scale threats to habitats for species of concern in the Great Basin complements the assessment completed recently by The Nature Conservancy for the same area (Nachlinger et al. 2001). The Conservancy's Great Basin Assessment consisted of an extensive and detailed compilation of the diversity, richness, and status of native species, natural communities, and ecological systems present within the Great Basin Ecoregion (Nachlinger et al. 2001). The massive ecological compilation contained in the assessment is augmented with a detailed set of conservation targets and goals, identification of >350 conservation areas, or "portfolio sites," to meet targets and goals, and supporting maps of environmental quality in relation to human activities and threats. Conservation goals were established for each portfolio site. The Conservancy's Assessment includes conservation targets for many of our species of conservation; however, they targeted plant-based systems, such as portfolio sites, while our work was focused on widespread threats to habitats and a suite of vertebrates associated with those habitats. Land managers would benefit substantially through complementary use of results from both assessments.
- Our regional assessment was designed as a prototype, or working example, to illustrate the types of analyses that are appropriate and useful for effective management of habitats for species of conservation concern in the sagebrush ecosystem. As part of our prototype, we focused on threats to native habitats posed by invasion of cheatgrass and pinyon-juniper woodlands. Many other threats exist at regional scales in the Great Basin and in the sagebrush ecosystem (e.g., energy development, power corridors, road construction and use), and these additional threats deserve attention in subsequent analyses. (See Wisdom et al. (2003) for a complete list of such threats.) It was not possible to evaluate the potential effects of all regional threats as part of our prototype analysis, nor was it part of our objectives. Consequently, additional evaluation of all regional threats to habitats for species of conservation concern in the Great Basin is needed as part of future work.

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