❖Standard 10: Screen all target/biodiversity element occurrences for viability or ecological integrity.

Summary: **Assessing Condition/Integrity of Ecosystems: Using Spatial Data to Develop Suitability Indices**

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Purpose

Spatial data can be used to infer the relative ecological integrity of communities and ecosystems through evaluating their condition and landscape context and developing a suitability index. This is a rapid approach to quantify the relative quality and potential for persistence of specific biodiversity targets, as well as landscapes in general.

A base map of communities or ecosystems, watersheds or regular polygons such as hexagons are necessary as a platform to attribute spatial units with data. Using a geographic information system (GIS), these spatial units can be attributed with tabular data such as species composition, environmental condition and management practices, expert knowledge, or spatial data such as land use/cover and other data which provide spatial patterns on natural/unnatural lands, roads, urban areas, dams and other information. Below are examples based on expert knowledge and spatial data.

Example 1

Expert knowledge was used to evaluate grassland conditions in Arizona and other portions of the Apache Highlands ecoregion of the Southwestern United States. Regional grassland experts were given maps of native grassland ecosystems. The experts delineated polygons of current and historic grasslands and assigned each polygon to one of the following six condition classes:

A) native grassland with low shrub cover
B) shrub-encroached non-native grassland with restoration potential using prescribed fire
C) sacaton riparian grassland
D) non-native (exotic) grassland with low shrub cover (<10%)
E) non-native (exotic) grassland with 10-35% shrub cover)
F) former grassland that has undergone conversion to shrubland (>35% shrub cover)

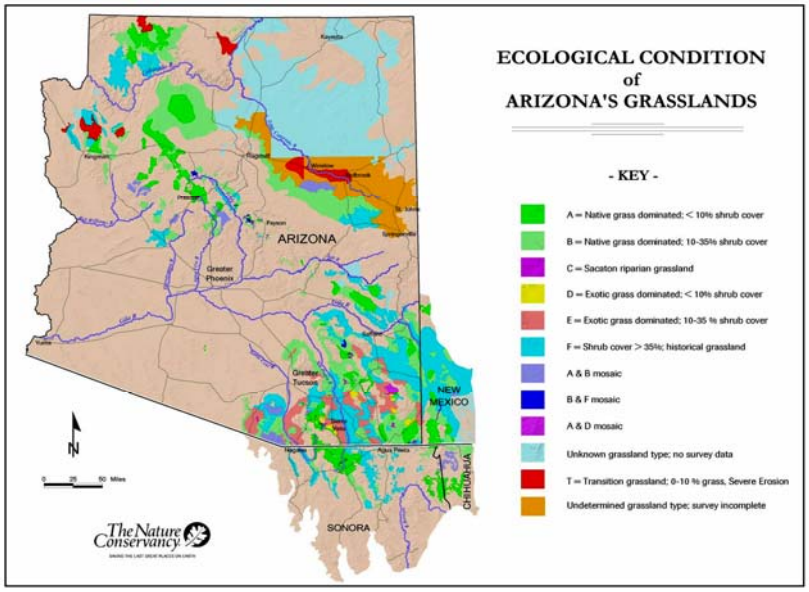


Figure 1. Ecological condition of grassland ecosystems in Arizona and a portion of New Mexico, United States, and a portion of northern Mexico.

Sources

Gori, D.F., and C.A.F. Enquist. 2003. An Assessment of the Spatial Extent and Condition of Grasslands in Central and Southern Arizona, Southwestern New Mexico and Northern Mexico. The Nature Conservancy, Arizona Chapter. 28 pp.

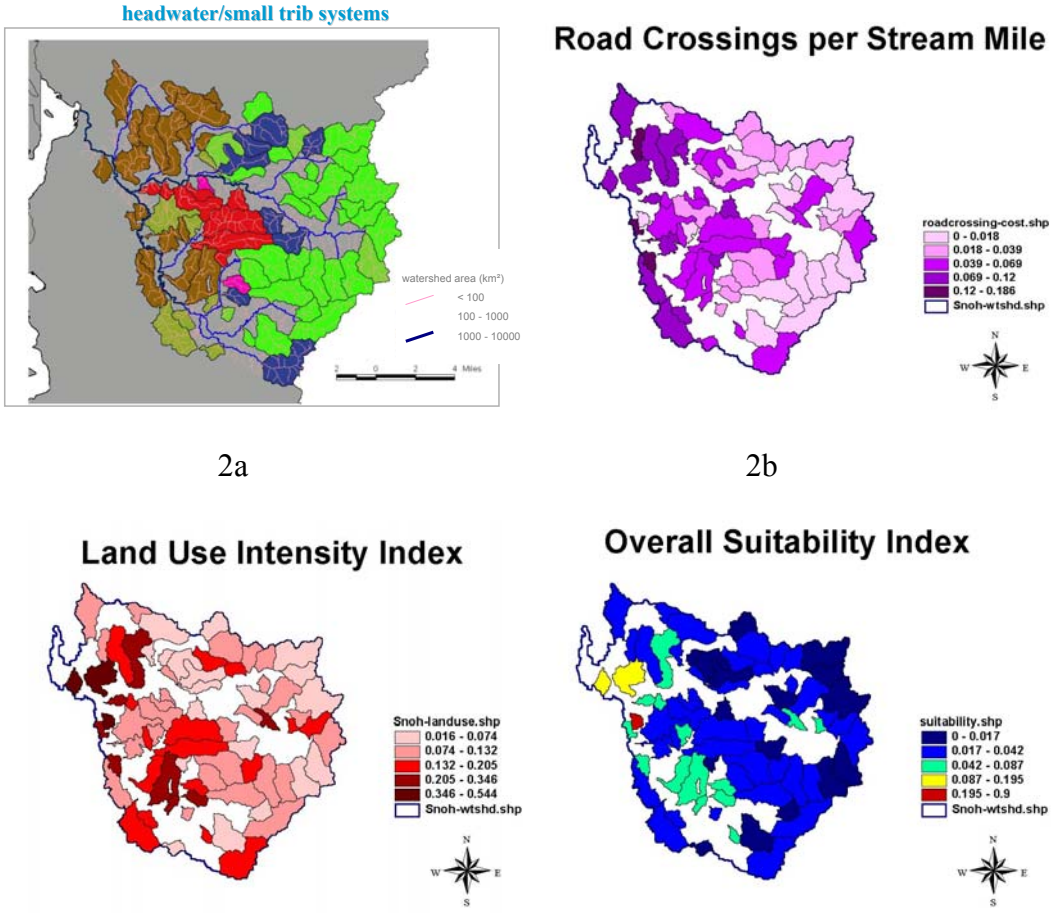
Schussman, H., and D. F. Gori. 2004. An Ecological Assessment of the Bureau of Land Management's Current Fire Management Practices: Materials and Recommendations for Future Fire Planning. The Nature Conservancy, Arizona Chapter. 86 pp.

These documents and other relevant documents are available on line at: http://www.azconservation.org/grasslands.htm

Example 2

Spatial data were used to develop a suitability index of freshwater ecosystems in the Snohomish River watershed in Washington, United States. This example shows how headwater and small tributary ecosystems (figure 2a) were used as the spatial assessment unit. While figures 2b and 2c show patterns of road/stream crossings and land use (agriculture), similar analyses were conducted for dam storage capacity and water quality ratings. All of these factors were used to develop a single suitability index for each example of every ecosystem type (figure 2d). Each factor was scored by quintile[1]. The index was an average of the sum of the quintiles of each factor. This analysis shows examples of ecosystem types that are least impacted and potentially in the best condition, and those that are clearly impacted by many factors. Those with moderate index levels should be further reviewed by regional experts.

[1]Quintile - The portion of a frequency distribution containing one fifth of the total sample.



2a 2b

2c 2d

Figure 2. A composite suitability index was developed for (a) headwater and small tributaries in the Snohomish River watershed, WA using several indicators of system integrity including (b) road crossing density and (c) land use. Results are shown (d).

Additional examples of spatial analyses of ecosystem minimum dynamic area and suitability indices:

Determining the size of Eastern Forest Reserves. Anderson et al. 2004. An example of assessing minimum dynamic area of forest matrix blocks to withstand natural

disturbances and to maintain area sensitive species. Available on line: http://conserveonline.org/2005/03/b/Eastern_Forest_Reserves;internal&action=buildframes.action.

Systematic reserve selection in the USA: an example from the Columbia Plateau ecoregion. Davis, F. W., D. M. Stoms, and S. Andelman. 1999. Parks 9:31-41. An example of using data layers such as road density, population density and percent natural land cover to assess the viability and integrity of potential conservation areas (from Groves, 2003).

The Redwood Forest: History, Ecology, and Conservation of the Coast Redwoods. Noss, R. F., ed. 2000. Washington, D. C.: Island Press. An example of using spatial and tabular source data on patch functions (patch size, road density, threatened and endangered species), neighborhood functions (concentration, age composition, fragmentation and proximity to protected areas), and watershed functions (road/stream intersections, and riparian zones). (from Groves, 2003).

Ecosystem Integrity. In U.S. Department of Agriculture, Forest Service. 1996. Status of the interior Columbiabasin: summary of scientific findings. Gen. Tech. Rep. PNW-GTR-385. Portland, OR:U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station;U.S. Department of the Interior, Bureau of Land Management. 144 p. A document that provides detailed examples and maps of assessing terrestrial and aquatic ecosystem integrity in the Pacific Northwest United States using spatial data and survey information. On line document: http://www.fs.fed.us/pnw/pubs/summary/gtr_385f.pdf.