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Quantification of Landscape Structure Within the Land Condition-Trend Analysis Monitoring Program at Camp Williams, Utah

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QUANTIFICATION OF LANDSCAPE STRUCTURE WITHIN THE LAND CONDITION-TREND ANALYSIS MONITORING PROGRAM AT CAMP WILLIAMS, UTAH

by

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ABSTRACT

Quantification of Landscape Structure Within the Land Condition-Trend Analysis Monitoring Program at Camp Williams, Utah

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The Land Condition-Trend Analysis (LCTA) program was developed by the U.S. Army to assist in the sustainable management of natural resources on U.S. Army lands. The LCTA program applies a standardized procedure in order to select long-term monitoring sites. The LCTA monitoring program was applied to Camp Williams, a National Army Guard training site located in central Utah. Due to the criteria set by the LCTA monitoring program, 61 percent of Camp Williams was explicitly excluded from the LCTA monitoring protocol because it appeared to be more heterogeneous, which would make it difficult to locate monitoring sites in the field.

This study compared the monitored landscape with the unmonitored landscape to determine how the two landscapes differed. The expectation was that the monitored landscape would contain larger, less numerous patches compared with the unmonitored landscape, which was expected to contain smaller, more numerous patches. Accordingly,

the landscape structures of the included and excluded lands were compared. The landscape metrics utilized to quantify landscape structure were largest patch index (percent), number of patches, patch density (#/100 ha), mean patch size (ha), double log fractal dimension, Simpson's diversity index, Simpson's evenness index, interspersion (percent), and contagion. Small differences did occur between the two landscapes, though the population variance showed that the two landscapes were more alike than different for all metrics, except interspersion and contagion which did show small differences. Due to the criteria set by the LCTA monitoring program, these results were not expected. Since it was shown for the majority of landscape metrics that the two landscapes were more alike than different, the 61 percent of Camp Williams excluded from monitoring consideration was not greatly different. However, important features such as riparian areas and recent small burns were largely contained within the areas excluded by the LCTA program. Further investigation of landscape metrics is encouraged because previously unmonitored features of wildlands can only be assessed by examination of these coarse-scale characteristics.

(162 pages)

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CHAPTER 1

INTRODUCTION

Considering the landscape approach

There is a constant flux of knowledge and paradigms on how to manage our rangelands. Ecosystem management (EM) is dominating current thought as a new framework for managing rangelands (Kessler *et al.* 1992). In the past, attaining knowledge about natural processes was accomplished via a reductionistic approach. That approach studies natural processes within a small-scale, controlled environment, and then attempts to extrapolate the results of such studies to the landscape. However, relationships observed on small portions may not always apply to the complex landscape or vice versa.

The EM approach is concerned with understanding the whole, and not just the parts that make up the whole. Also, unlike a reductionistic view, an EM approach addresses the need to confront natural resource issues from larger temporal and spatial scales. Fortunately, current technological advances such as remote sensing (RS) and geographic information systems (GIS) can contribute to understanding multiple temporal and spatial scales of natural processes. LANDSAT imagery in particular provides the capability for frequent landscape assessment over large areas (Foran 1986), and with GIS, spatial relationships at a landscape level can be easily portrayed. An importance component of EM is the necessity for monitoring. The Committee on Rangeland Classification (1994, p.12) stated the following:

> Monitoring assists in the ability to assess the health of federal and nonfederal rangelands and can judge whether current management practices are adequately sustaining the rangeland's capacity to satisfy values and produce commodities.

In order to understand how a landscape is responding to certain management decisions, appropriate, well designed monitoring approaches are paramount. Kessler *et al.* (1992) wrote, "The concept of learning from management experience provides a process for adjusting management in response to results provided by the research and monitoring framework."

In applying EM, not only is it essential to monitor population and community level information, it is important to consider landscapes in monitoring. Although, in the past, available tools only allowed for the monitoring of population and community phenomenon, today, RS and GIS have given the natural resource manager the ability to monitor the landscape, as well.

The knowledge that RS could be utilized to study the landscape is not a recent view point. Johnson (1969, p.2) noted, "Remote sensing promises to bridge the gap between ecological research and the better planning and management of landscapes." Over 20 years later, Allen and Hoekstra (1992) remarked that remote sensing has allowed the landscape ecologist to move upscale, by giving the landscape ecologist the tools for analyzing landscape ecological relationships. Turner and Gardner (1991, p.5), in the first major handbook of methods, stated:

> Broad scale indices of landscape structure may provide an important metric for monitoring regional ecological changes. Such applications are of particular importance because changes in broad-scale patterns (e.g., in response to global change) can be measured with remote-sensing

technology, and an understanding of the pattern-process relationship will allow functional changes to be inferred.

The attempt to incorporate landscape-level monitoring approaches into the management of natural resources is fairly recent, and as a result, only the research community has begun to explore the possibilities. Consequently, the management of natural resources, especially as it pertains to monitoring, is currently utilizing our understanding of community or population ecology as opposed to incorporating a landscape ecological approach.

An example of this is with the Land Condition-Trend Analysis (LCTA) monitoring program, developed by the U.S. Army. The LCTA program, a contemporary approach to monitoring natural resources on military reserves, applies RS and GIS. The monitoring program's major objective is to assist in the sustainable management of natural resources in order to support the training and testing missions of the U.S. Army (Diersing *et al.* 1988). The monitoring is accomplished solely at the community level; however, important changes may be occurring at a larger scale that may not be detected at the community scale.

The Land Condition-Trend Analysis monitoring program

The U.S. Army is responsible for managing over 4.8 million ha of land for military use. The U.S. Army is concerned with maintaining the long-term integrity of land and resource conditions in order to support the training and testing missions of army lands (Blackburn *et al.* 1990). The U.S. Army has also been called upon to comply with

environmental regulations, because the natural resource amenities occurring on U.S. Army land has attracted greater public scrutiny compared with the past. Thus, conservation of natural resources has become a high priority to the U.S. (Anonymous 1994). In response to the demands placed on the U.S. Army to better manage their lands, they have utilized RS and GIS to develop the LCTA monitoring program. The major objectives of this program are described below.

The program was developed at the U.S. Army Construction Engineering Research Laboratory (USA CERL) under the principles of sustained yield and multiple use of training lands. The overall goals of the LCTA Program are (Tazik *et al.* 1992, p.1):

(1) evaluate the capability of land to meet the multiple-use demands of the U.S. Army on a sustained basis.
(2) monitor and evaluate changes in natural resources relative to current land uses.
(3) delineate the biophysical and regulatory constraints to use of the land.
(4) serve as a basis for amending land management plans to ensure long-term resource availability.
(5) implement standardized data collection, analysis, and reporting procedures that enable compilation and evaluation of data and other information on an army-wide basis, and
(6) characterize the flora and fauna on army installations.

The hope is that the program can address most resource information needs and unique natural resource problems occurring on U.S. Army lands (Tazik *et al.* 1992). The program attempts to identify problems before damage becomes irreversible, and thus allow for the activation of alternative management plans.

Techniques used for the LCTA monitoring program

The LCTA program uses remotely sensed imagery recorded by the French SPOT (Systeme Probatoire pour l'Observation de la Terre) satellite to stratify its sampling. The satellite images are obtained during peak plant growth (Diersing *et al.* 1992). Statistical spectral clusters derived from the satellite imagery using an unsupervised classification are overlaid on soil mapping units of the installation. Combinations of the spectral clusters overlaid on the soil mapping units resulting in polygons less than 2 ha in size are ignored because of the difficulty in identifying areas this small in the field (Diersing *et al.* 1992). Finally, inventory sites are assigned in a stratified random fashion to the areas represented by the unique spectral clusters/soil mapping unit combinations of greater than 2 ha in size. During the field season these inventory sites are located, and data are collected to create baseline information. This is repeated over successive years to monitor changes.

Warren *et al.* (1990, p.333) stated, "The LCTA program employs an objective procedure to select sites for field sampling and verification of multispectral classification categories." As well, the procedure utilizes GIS technology and *a priori* incorporation of ancillary data to maximize the representativeness of field sample sites (Warren *et al.* 1990). The LCTA approach focuses entirely on community criteria at sampling points and does not attempt to monitor synoptic changes occurring within landscapes. Because polygons less than 2 ha in size are not considered for monitoring, possibly important features of the landscape are going unmonitored. These possibly important features of the

landscape are the areas consisting of a mosaic of patches ("salt and pepper" areas) and long, thin, linear patterns. Such areas of high landscape diversity can be considered as ecotonal and are usually important for maintaining total species richness. While the LCTA approach attempts to sample representative communities, potentially important components of the landscape are completely excluded from monitoring. Thus, elements of biodiversity being impacted by U.S. Army activity could be missed.

Landscape-level information could assist the land manager in making critical decisions. Landscape features, such as patch area, have been shown to correlate strongly with species diversity (Turner and Gardner 1991). Hence, an important land management issue like maintaining species diversity of an area may be better resolved with landscape-level knowledge. Thus, it is the goal of this study to test the incorporation of landscape metrics into the LCTA monitoring program.

Study area

Camp Williams (CW) is a National Guard Training Site, operated by the Utah Army National Guard. It covers 11,340 ha and is located 42 kilometers south of Salt Lake City, 35 kilometers miles northwest of Provo, and 8 kilometers northwest of Lehi, UT. The reserve straddles the Salt Lake and Utah County boundaries along the crest of the western part of the Traverse Mountains, adjoining the Oquirrh Mountains. A small portion of the Jordan River runs along the eastern perimeter of the reserve.

The average annual temperature at CW can range from 4.5 °C to 12.2 °C, depending on ecological site. Similarly, the average annual precipitation is 381 to 635

millimeters depending upon ecological site (Soil Conservation Service 1974). The average frost-free season ranges from 60 to 180 days. The native vegetation is dominated by bunch grasses, bitterbrush, oakbrush, big sagebrush, and some juniper. Elevation ranges from 1,373 to 2,135 m. The topography is predominantly mountainous.

The rocks on CW are predominantly brecciated and faulted quartzite and limestone of the Pennsylvanian Oquirrh Formation, and Tertiary latite and andesite flows and tuffaceous strata of the Salt Lake Group (Stokes 1986). Recent alluvial deposits occur on low slopes on the southern boundary, and Pleistocene Lake Bonneville deposits cover the east and northeast installation boundaries (Stokes 1986).

Landuse

Camp Williams was declared a federal military reservation in 1914, but was used for encampments as early as 1854. Training facilities at CW include weapons firing ranges, heliports, a combat assault landing strip, an airborne facility, wash racks, and rappelling towers. The primary mission of CW is to provide annual and weekend training facilities for Utah Army National Guard units.

Non-military uses occur at CW. Presently, unmonitored use by cattle and sheep grazing occurs on the reserve. There exists a large mule deer population on the reserve; as a result, illegal hunting does occur at CW.

Objectives

At CW the LCTA monitoring program identified polygons satisfying a given standard and then sampled community-level information from a quadrat existing within

the chosen polygon (Anonymous 1994). The plant community existing within the quadrat was assumed to be representative of that polygon. The major objective of this study was to incorporate landscape metrics into the LCTA monitoring program applied to CW. This was accomplished by comparing the landscape excluded by the LCTA monitoring program (non-LCTA landscape)---about half of CW---with the landscape monitored by the LCTA program (LCTA landscape).

CHAPTER 2

LITERATURE REVIEW

Introduction

Since the 19th century, an awareness of civilization's power to change and destroy the biological world has grown (Botkin 1990). In the past, anthropogenic impacts upon nature were mostly viewed from a local level and within small temporal scales. Today, there exists an understanding that man is changing nature at larger scales (Riitters *et al.* 1995). As a result, an interest in the spatial-temporal scales at which the dynamics of natural systems operate has grown. A product of this growing interest is the emergence of landscape ecology. Landscape ecology focuses upon spatial and temporal patterns across landscapes and examines the development and dynamics of spatial heterogeneity and its influence on biotic and abiotic processes (Turner 1987).

Landscape ecology's role

The importance of landscape ecology in managing our natural resources has grown over the past decade. Noss (1983) observed that in particularly heterogeneous regions, the landscape level may be a more appropriate unit to study and manage compared to focusing on single sites or ecosystems. He views the interconnections among the patches in a landscape at least as significant to the maintenance of diversity as the size of the patches. Also, the landscape approach identifies patterns that might otherwise go unnoticed (Noss 1983). A landscape approach combines the spatial attributes of ecosystem behavior with human activities affecting the spatial pattern of the

movement of energy and material at the landscape level (Risser 1985). In order to preserve the greatest possible amount of our natural heritage of biological diversity, it is necessary to understand how human disturbance affects natural communities at the landscape level (Loehle and Wein 1994). Naveh (1987, p.77) asserted:

> The readiness of human society to apply ecological knowledge and wisdom in land use is lagging far behind its technological skills in exploiting these functions for short-term economic benefits. For this reason, the study of the interrelationships between landscape functions and land use patterns is not only of basic scientific interest, but also of great practical importance.

The importance of scale

The effects of spatial and temporal scale must be considered in landscape ecology (Meentemeyer and Box 1987; Milne *et al.* 1989; Turner *et al.* 1989a; Urban *et al.* 1987), as spatial scaling is vitally important to the ecologist (O'Neill *et al.* 1986). All ecological processes and types of ecological structure are multiscaled in both time and space (Allen and Hoekstra 1991; Allen and Hoekstra 1992; Baker 1989; Meentemeyer and Box 1987; Milne 1992; O'Neill *et al.* 1986; O'Neill *et al.* 1991b; Turner 1989; Turner *et al.* 1989a; Turner *et al.* 1989b; Wiens 1989; Wiens and Milne 1989). For example, ecological processes occur from square millimeters to hundreds of square kilometers and from time scales of minutes to millennia (Risser 1987). It is the mixture of ecological processes consisting of different spatial and temporal scales, all operating as a system, that leads to the ideas of landscape ecology (Risser 1987).

The scale at which a study is conducted is important to understand since ecological processes occur across different scales (Turner 1989). Naveh (1994) wrote

that a more human scale should be emphasized. He argued that not only should the bioecological aspects of landscape heterogeneity be considered for study, but the human ecological, cultural, and perceptional aspects of landscape heterogeneity should also be considered. Naveh (1994) does not consider humans to be external disturbance factors, but as interacting coevolutionary ecosystem components. It is the interrelationships between ecological, socioeconomic, and cultural factors that influence landscape heterogeneity (Naveh 1987; Naveh 1994; Naveh and Lieberman 1990).

Wiens (1985, 1992) has argued, however, that the scale at which we study landscape ecology is too human-centered. Humans usually view structure on different scales than an aphid or ant. He has suggested that adopting an organism-centered view of the environment is necessary in understanding important patch structure or dynamics (Wiens 1985). Karr (1994) supports this view point, but adds that the scale for a study should not only be determined by the organisms, but by the questions under investigation.

Hierarchy theory in landscape ecology

Due to scaling issues, the hierarchy theory has been introduced as a useful framework for ordering scale complexities (Allen and Hoekstra 1992; Allen and Starr 1982; O'Neill 1989). O'Neill *et al.* 1986 contend that when approaching scientific questions, the focus should be on a specific spatio-temporal scale of observation (O'Neill *et al.* 1986). When extrapolating from a specific observation set to other scales of observation, problems arise, since one specific observation set is not optimal or absolute (O'Neill *et al.* 1986). Rather, the specific phenomena under investigation are set by the

purpose of the study. If the purpose changes, so does the appropriate spatial and temporal extent of the system. This theory supports the focus of a particular level of interest, in which the investigator must pay attention to the spatial and temporal scales on which the phenomena of interest are occurring. The temporal and spatial scale must be taken into account when designing experiments or land management actions. Allen and Hoekstra (1992, p.8) termed this "criteria for observation" and noted the following:

> Criteria are the basis upon which one makes a decision as to what relationships are important in an ecological observation....Scaling is done by the observer; it is not a matter of nature independent of observation.... Levels emerge from the interaction between decisions of the observer and the part of the universe observed.

Spatial and temporal heterogeneity in landscapes

Understanding heterogeneity in landscape ecology is as important as understanding scale. Landscape heterogeneity is defined by Risser (1987) as the dissimilar or diverse components or elements making up the landscape. Spatial heterogeneity results from the interactions between the spatial distribution of environmental constraints and the differential responses of organisms to the constraints (Milne 1991). Spatial heterogeneity may vary continuously with spatial scale (Kotliar and Wiens 1990; Mandelbrot 1983; O'Neill *et al.* 1991a; Pickett and Cadenasso 1995, Senft *et al.* 1987; Wiens 1989; Wiens and Milne 1989). An example of this is the spatial patterns resulting from fire disturbance compared with the spatial patterns resulting from activities such as digging and burrowing by animals (Pickett and Cadenasso 1995).

The landscape is also temporally heterogeneous, that is, ecological processes

operate at different time scales (Romme 1982; Romme and Knight 1982). An example of this is with the long life span of forest trees compared with the ephemeral life span of annual crops.

Historically, ecology considered spatial heterogeneity as an unwelcome complication or a necessary evil, although Pickett and Cadenasso (1995) have written that landscape ecology considers spatial heterogeneity as a main causal factor in ecological systems. This spatial and temporal heterogeneity makes it difficult to extrapolate from data collected at small scales to larger scales (Johnson 1990).

Spatial and temporal heterogeneity are affected by ecological processes (Castello *et al.* 1995; Peterjohn and Correll 1984; Risser 1990; Romme 1982; Romme and Knight 1982; Turner and Romme 1994). A major goal in landscape ecological study is to understand how heterogeneity influences the biotic and abiotic processes (Risser 1987).

As described above, landscapes are spatially heterogeneous areas (i.e., environmental mosaics). As a result, the structure, function, and change of landscapes are scale-dependent (Turner 1989). With this understanding, these basic components making up the landscape mosaic are discussed below.

Landscape structure, function, and change

Forman and Godron (1986) defined the fundamental characteristics of landscapes as possessing qualities of structure, function, and change. Structure is the spatial relationships among distinctive ecosystems. Patches are the building blocks of a landscape or make up the structure of a landscape (Risser 1987). The impact on the

landscape by humans has resulted in a landscape structure consisting of a mixture of natural and human-managed patches that vary in size, shape, and arrangement (Forman and Godron 1986; Forman and Godron 1981; Krummel *et al.* 1987; Turner and Ruscher 1988). Function involves the interactions among the spatial elements or the flow of energy, materials, and species among the component ecosystems. Change is the alteration of structure and function of the ecological mosaic over time (Forman and Godron 1986).

Landscape structure

Landscape pattern is understood by quantifying the landscape structure, that is, size, shape, biotic type, number, and configuration of patches (Forman and Godron 1986). Many studies have attempted to quantify landscape structure. Quantifying landscape structure is necessary in order to compare different landscapes, identify significant changes through time, and relate landscape patterns to ecological function (Turner 1989).

In a study located in the subalpine portion of Yellowstone National Park, indices of richness, evenness, and patchiness were calculated. These metrics were then related to the fire history of the site since 1600 A.D. (Romme 1982; Romme and Knight 1982). The results from this study suggest that Yellowstone Park is a non-steady-state system, where long-term cyclic changes in landscape composition and diversity result.

Turner and Ruscher (1988) utilized landscape measurements to study the human land-use patterns in Georgia. Their study showed a general trend of decreasing landscape diversity from the mountains to the coastal plain of Georgia.

O'Neill *et al.* 1988 used three landscape indices, dominance, contagion, and

fractal. dimension, in the eastern United States. These indices discriminated between major landscape types, such as urban coastal, mountain forest, and agricultural areas.

Riitters *et al.* 1995 studied a set of landscape metrics for monitoring landscape condition in terms of land use pattern and structure. This study concluded that six univariate metrics, average perimeter-area ratio, contagion, standardized patch shape, patch perimeter-area scaling, number of attribute classes, and large-patch density-area scaling, may be useful in monitoring landscape condition relative to land use pattern and structure.

Turner (1990) applied a spatial analysis program (SPAN) to quantify landscape patterns and their changes. SPAN calculates landscapes metrics such as fractal dimension, contagion, dominance, a diversity index, proportion of the landscape occupied by each category, size and perimeter of each patch, edges between each pair of categories, and probabilities of adjacency (Turner 1990). Turner (1990) showed that simple indices and measures can capture features of landscape pattern at different scales and significant changes in landscape patterns can be detected through time.

Hoover and Parker (1991) used traditional measures of species diversity and spatially explicit measures of landscape diversity to compare the biotic diversity in six landscapes across Georgia. Also, this study showed that species diversity measurements did not closely correspond with landscape diversity measurements, showing that the measures of biotic diversity used are scale-dependent (Hoover and Parker 1991).

McGarigal and McComb (1995) investigated the relationship between landscape structure and breeding bird abundance in the central Oregon Coast Range. Vegetation

and birds in 30 landscapes (250-300 ha) were sampled. They computed a variety of landscape metrics from digital vegetation cover maps. In their study they concluded that species abundances were greater in the more heterogeneous landscapes.

Shapes have been quantified by using fractal geometry, which provides a measure of complexity of the spatial patterns (Turner *et al.* 1989b). Mandelbrot (1977, 1983) introduced fractal geometry as a method to study shapes that are partially correlated over many scales.

Krummel *et al.* 1987, O'Neill *et al.* 1988, and Turner and Ruscher (1988) used fractals to compare the geometry of different landscapes. These studies suggested that human-influenced landscapes display simpler patterns compared with natural landscapes.

Wiens and Milne (1989) measured the patterns of beetle landscapes and beetle movements in a semiarid grassland in the Sevilleta National Wildlife Refuge in New Mexico. They showed a significant tendency of beetles to avoid areas with distinct fractal dimensions. They showed how landscape structure modified beetle movements in heterogeneous landscapes (Wiens and Milne 1989).

With (1994) utilized a fractal analysis of movement patterns to identify the scales at which organisms are interacting with the patch structure of the landscape. This analysis showed significant differences in the fractal dimension of movement patterns of two species and suggested that the two species may be interacting with the patch structure at different scales. Here fractal analysis compared the landscape perceptions of different species within the same environment.

Palmer (1988) used fractal geometry for describing spatial patterns of plant communities. The fractal dimensions resulting from this study suggested a weak spatial dependence and patterns of spatial variation at one scale cannot be reliably extrapolated to other scales (Palmer 1988).

The grazing patterns of white-tailed deer and Spanish goats were studied in southern Texas using a fractal dimension (Owens *et al.* 1996). The grazing paths were represented as fractals showing the tortuosity of the animal movements. The study showed that in the same pastures, white-tailed deer grazing paths were significantly different from the path of Spanish goats.

Loehle (1990) used a fractal approach to quantify animal movement patterns. This approach captured detail that would have otherwise been lost had the traditional method for describing home range been applied (Loehle 1990).

Landscape function

Landscape patterns influence ecological processes and vice versa (Forman and Godron 1981; Karr 1994; Risser 1987; Risser 1990; Turner 1989; Turner and Gardner 1991; Turner *et al.* 1991; Urban *et al.* 1987; Wiens *et al.* 1985). The following describes some studies involving functional characteristics of landscapes.

An example of how landscape patterns have influenced processes can be found in Peterjohn and Correll (1984). They studied the concentrations of nutrients (carbon, nitrogen, and phosphorus) in surface runoff and shallow groundwater in an agricultural watershed that contained both cropland and riparian forest (Peterjohn and Correll 1984).

Their study showed that without the riparian forest, twice as much nitrate nitrogen would have been lost to the stream.

Ludwig and Tongway (1995) found that in Australian semiarid woodlands, landscape patches at all scales functioned to capture and retain scarce resources, rather than these resources being lost from the system. All scales of patches, ranging from grass clumps to larger woodlands, served an important function/resource regulators. They concluded that in order to prevent the degradation of semiarid woodland landscape, a full range of large- to small-scale patches should be maintained (Ludwig and Tongway 1995)

Romme (1982) described how changes in landscape patterns influence a variety of natural features such as wildlife, water and nutrient flow and the probability of different kinds of natural disturbance. For example, he found that mature coniferous forest stands in Yellowstone National Park are generally most susceptible to fire, whereas younger forests are least susceptible.

Landscape patterns not only affect ecological processes, landscape processes can influence landscape patterns (Risser 1990). An example of this discussed by Castillo *et al.* (1995). They described how pathogens regulate, and in turn are regulated by, patterns and processes in forest ecosystems. They also concluded that pathogens affect forested landscapes primarily through tree mortality or reduced competitive ability and it is landscape pattern that promotes disease development.

Landscape heterogeneity may enhance or inhibit the spread of disturbance (Pickett and White 1985). Turner and Romme (1994) observed that there is a two-way interaction between crown fires and the spatial patterning of a landscape. Broad-scale patterns in

vegetation are created by crown fires by producing a patch mosaic of stand age classes; however, spatial patterns in terrain and fuel across the landscape may constrain the spread and behavior of crown fires (Turner and Romme 1994).

Spatial patterning and changes in landscape structure (e.g., habitat fragmentation) influence the distribution, movement, and persistence of species (Turner 1989). Milne *et al.* (1989) studied the effects of landscape fragmentation on the wintering areas of white-tailed deer. This study demonstrated that sites containing suitable habitat, but isolated from other suitable patches, were not used by the deer (Milne *et al.* 1989).

Weins *et al.* (1993) described how a the pattern of Scandinavian boreal forest influences the movement of a vole. The movement of a vole through the landscape is influenced by local habitat patches, and by the locational relationship of the patches within a mosaic--the sizes, shapes, arrangement, and connectedness (Wiens *et al.* 1993).

Landscape change

Landscapes change over time, but landscape processes do not occur simultaneously or at the same rate (Risser 1987). Change in landscape heterogeneity is affected by a number of processes (Forman and Godron 1986). Geomorphic processes occurring over long time periods influence landscape heterogeneity. Colonization patterns of organisms occurring over short and long time-scales shape landscape heterogeneity. Local disturbances of individual ecosystems over short time periods influence landscape heterogeneity. Most importantly, the natural land cover has been changed by human activities such as urbanization, agriculture, and forestry, where the

natural vegetation has been replaced by managed systems of altered structure (Krummel *et al.* 1987). It is not yet generally understood if the heterogeneity observed in the landscape has resulted from environmental factors, past disturbances, or both. It is the understanding of the interplay of environment and history that will be a major challenge for landscape ecology (Pickett and White 1985).

CHAPTER 3

METHODS

Introduction

The discipline of landscape ecology acknowledges that patterning of landscape elements or patches greatly influences ecological processes (McGarigal and Marks 1995). Patches are the building blocks of a landscape or make up the structure of a landscape (Risser 1987). In quantifying landscape structure, landscape function and change can be studied (McGarigal and Marks 1995).

In this study, the landscape elements (patches) measured consisted of 30 x 30 m pixels or cells; thus, the size of the individual units (grain) of investigation was no smaller than 30 x 30 m. This is a coarser spatial resolution compared with that seen directly at ground level. Aerial photography, also, contains a much finer spatial resolution compared with that of satellite imagery. For example, the spatial resolution of the U.S. Department of Agriculture 1:20,000 black-and-white aerial photography is about 1 m (Campbell 1987). It is important to recognize that the patch must be defined relative to the phenomenon under investigation (McGarigal and Marks 1995). Here, the patches measured were associated with particular vegetation classes characterized by Van Niel (1995), who used the same 30 x 30 m scale.

In this study, the landscape structure of the LCTA landscape was compared with the non-LCTA landscape. The differences in landscape structure between these two portions of CW were quantified utilizing FRAGSTATS, which is a spatial pattern

analysis software program developed by McGarigal and Marks (1995) at Oregon State University. There are many indices that FRAGSTATS (McGarigal and Mark 1995) calculates. This study only focused on 10 indices. The landscape metrics utilized for comparison were largest patch index (percent), number of patches, patch density (#/100 ha), mean patch size (ha), patch size deviation (ha), double log fractal dimension, Simpson's diversity index, Simpson's evenness index, interspersion index (percent), and contagion.

GRASS

The data used in this project were initially retrieved utilizing the Geographical Resources Analysis Support System (GRASS), which is a public domain geographic information system developed by the U.S. Army Construction Engineering Research Laboratory (U.S. Army CERL) (Warren *et al.* 1990). The data were received from the U.S. Army CERL in GRASS format copied onto an 8-mm cassette tape. After the files were manipulated in GRASS, the files were ready to be imported into IMAGINE 8.0. Table 1 shows the parameters used to import the GRASS files into IMAGINE 8.0.

Table 1. Information needed to import the GRASS files into IMAGINE 8.0.

Importation information	CW landscape (Fig. 1)	LCTA landscape (Fig. 2)
Import type	Generic binary data	Generic binary data
Data format	BSQ	BSQ
Data type	Unsigned 16-bit file	Unsigned 8-bit file
Number of rows	1400	370
Number of columns	2750	667
Number of layers	1	1

There were two files of interest in this project. The first file was an unsupervised classification of the entire CW landscape. An unsupervised classification is the identification of spectrally homogeneous clusters within multispectral data, which does not require extensive prior knowledge of the region of interest (Campbell 1987). This image contained statistical spectral clusters as opposed to cover classes. A cover class has been associated with some vegetation class on the ground. Spectral classes are groups of pixels that are uniform with respect to the brightnesses in their several spectral channels (Campbell 1987). The entire CW landscape can be seen in Figure 1. The CW landscape was clustered by CERL into 256 statistical spectral clusters.

The second file of interest was the landscape (LCTA landscape) considered by the LCTA monitoring program for long-term sampling (Fig. 2). The LCTA landscape consisted of nine categories. Statistical spectral clusters derived from the satellite imagery (CW landscape) were overlain on soil mapping units of the installation. Combinations of statistical spectral clusters and soil mapping units resulting in polygons less than 2 ha in size were excluded. The nine categories within the LCTA landscape were a product of this procedure, representing polygons greater than 2 ha.

FRAGSTATS

After the GRASS files were successfully imported into IMAGINE, analysis was conducted using FRAGSTATS 2.0, to quantify landscape structure. A raster version of the software was used for this study (McGarigal and Marks 1995). This version is a C

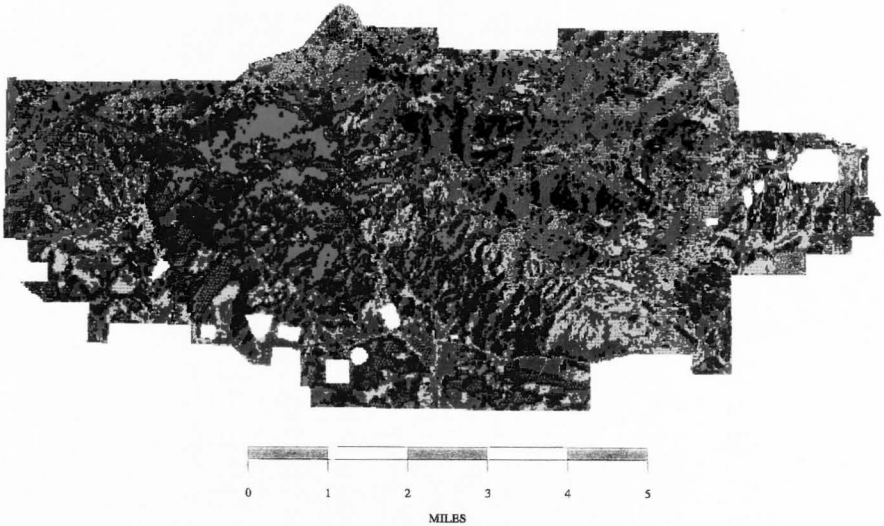

Fig. 1. Map of Camp Williams showing the statistical spectral clusters resulting from the unsupervised classification. The spectral clusters are made up of 256 categories, which are represented by numerous color categories derived from SPOT imagery of February 1992. White colorless areas represent intensive training areas. These areas do not show up in subsequent analysis.

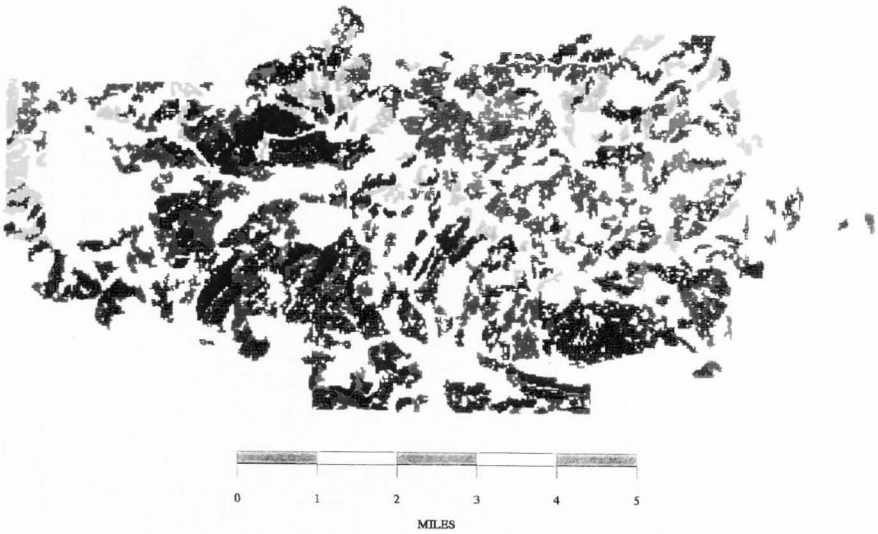

Fig. 2. Landscape polygons utilized by the LCTA monitoring program to locate long-term monitoring sites.

program that accepts ASCII image files, 8- or 16-bit binary image files, Arc/Info SVF files, ERDAS image files, and IDRISI image files.

The FRAGSTATS software was obtained from Oregon State University via the internet by using a file transfer program or ftp. In order to assure that FRAGSTATS was properly functioning, the following steps were taken. First, the LCTA landscape IMAGINE format file was exported as an ERDAS version 7.5 file. This step was completed because FRAGSTATS does not accept IMAGINE image files. To run FRAGSTATS there is a single command line, consisting of several arguments, issued from the prompts as follows:

> fragstats in_image out_file cellsize edge_dist data_type [rows] [cols]
> [background] [max_classes] [weight_file] [id_image] [desc_file]
> [bound_wght] [diags] [prox_dist] [nndist] [patch_stats] [class_stats].

These arguments are described in Table 2. The mathematical formulae used to calculate each landscape metric (i.e., double log fractal dimension) are discussed in the FRAGSTATS manual (McGarigal and Marks 1995). These mathematical formulae are described in narrative terms in Table 3.

A file containing the output indices was produced. Contained in the FRAGSTATS output file were patch indices, class indices, and landscape indices. This study was concerned mostly with landscape indices that FRAGSTATS generated as opposed to patch and class indices

In order to verify that the FRAGSTATS calculations were consistent, a sub-sample of the LCTA landscape was created in ERDAS. Landscape metrics were generated on this sublandscape. The landscape metrics of the sublandscape were then

Table 2. Description of the arguments used to execute FRAGSTATS.

Arguments	Description of arguments
In_image	Name of input landscape file
Out_file	Basename for output ACSII files
Cellsize	Cell size (m) in the input image (i.e., 30 m)
Edge_dist	Distance from patch edge (m) used to determine core area (i.e., interior habitat)
Data_type	The type of input image file (i.e., SVF, ASCII, eight or 16 bit binary file)
Rows	Number of rows in input image
Cols	Number of columns in input image
Background	The value of background cells
Maximum_classes	Maximum number of patch types
Weight_file	The name of an ASCII file containing weights for each combination of patch type
Id_image	The method for assigning patch ID's to each patch in the landscape
Descriptor_file	The name of an ASCII file containing character descriptors for each patch type
Bound_weight	The method for assigning what proportion of the landscape boundary and background class will be included as edge in the metrics based on edge length
Diagonals	Option to choose if diagonal neighbors should be evaluated when finding the cells that make up a patch
Proximity_distance	The search radius inmto use calculating the proximity indices
Nearest neighbor distance	Option to choose if indices based on nearest neighbor will be calculated
Patch_statistics	Option to choose if patch indices should be written to the output files
Class_statistics	Option to choose if class indices should be written to the output files

compared with landscape metrics associated with the entire LCTA landscape. The comparison between the metrics of the LCTA landscape and the sublandscape showed

Table 3. Narrative description of the landscape metric mathematical formulae.

Landscape metrics	Description
Total area (ha)	Equals the total area (m^2) of the landscape, divided by 10,000 (to convert to ha)
Largest patch index (percent)	Equals the area (m^2) of the largest patch in the landscape divided by the total landscape area (m^2), multiplied by 100 (to convert to percentage)
Number of patches	Equals the number of patches in the landscape
Patch density (#/100 ha)	Equals the number of patches in the landscape divided by total landscape area, multiplied by 10,000 and 100 (to convert to 100 ha)
Mean patch size (ha)	Equals the total landscape area (m^2), divided by the total number of patches, divided by 10,000 (to convert to ha)
Double log fractal dimension	Equals two divided by the slope of the regression line obtained by regressing the logarithm of patch area (m^2) against the logarithm of patch perimeter (m)
Simpson's diversity index	Equals one minus the sum, across all patch types, of the proportional abundance of each patch type squared
Simpson's evenness index	Equals one minus the sum, across all patch types, of the proportional abundance of each patch type squared, divided by one minus one divided by the number of patch types.
Interspersion	Equals the minus the sum of the length (m) of each unique edge type divided by the total landscape edge (m), multiplied by the logarithm of the same quantity, summed over each unique edge type; divided by the logarithm of the number of patch types time the number of patch types minus one divided by two; multiplied by 100 (to convert to a percent).
Contagion	Equals minus the sum of the proportional abundance of each patch type multiplied by number of adjacencies between cells of that patch type and all other patch types, multiplied by the logarithm of the same quantity, summed over each patch type; divided by two times the logarithm of the number of patch types; multiplied by 100 (to convert to percent)

no differences. It was then concluded that FRAGSTATS was properly calculating consistent values for both the landscapes.

Non-LCTA landscape

All files delivered by CERL were geometrically registered one to another. With this registration, a third image file representing the excluded, or the inverse of the LCTA landscape was created. This was done by overlaying the LCTA landscape over the CW landscape. In doing so, areas where the CW landscape did not intersect with the LCTA landscape (blank areas in Fig. 2) were considered non-LCTA. These areas represented the interspaces between the elements of the LCTA landscape. The LCTA landscape file was recoded, changing all zeros to one and all non-zero numbers to zero. A third file was created by overlaying the recoded LCTA landscape file with the CW landscape. Areas that intersected with the value one were transferred to the third file. Areas that intersected with zero were not transferred. This third file (Fig. 3) representing the non-LCTA landscape consisted of many colored polygons, which represented the many excluded statistical spectral clusters.

Vegetation map

A vegetation classification map of CW, created by Van Niel (1995), was a significant source of information (Fig. 4). The imagery utilized by Van Niel to create the vegetation classification was a Thematic Mapper or TM image from July 20th of 1993. Van Niel's vegetation classification map of CW was ground truthed and determined to have an overall accuracy of 89 percent (Van Niel 1995). As mentioned earlier, both the

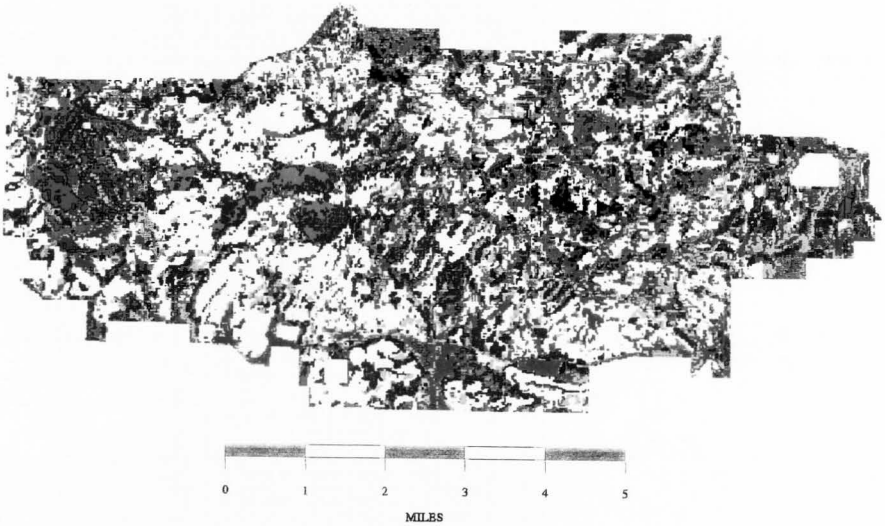

Fig. 3. Map showing the landscape polygons not considered for monitoring by the LCTA monitoring program. The colors represent statistical spectral clusters, resulting from the unsupervised classification.

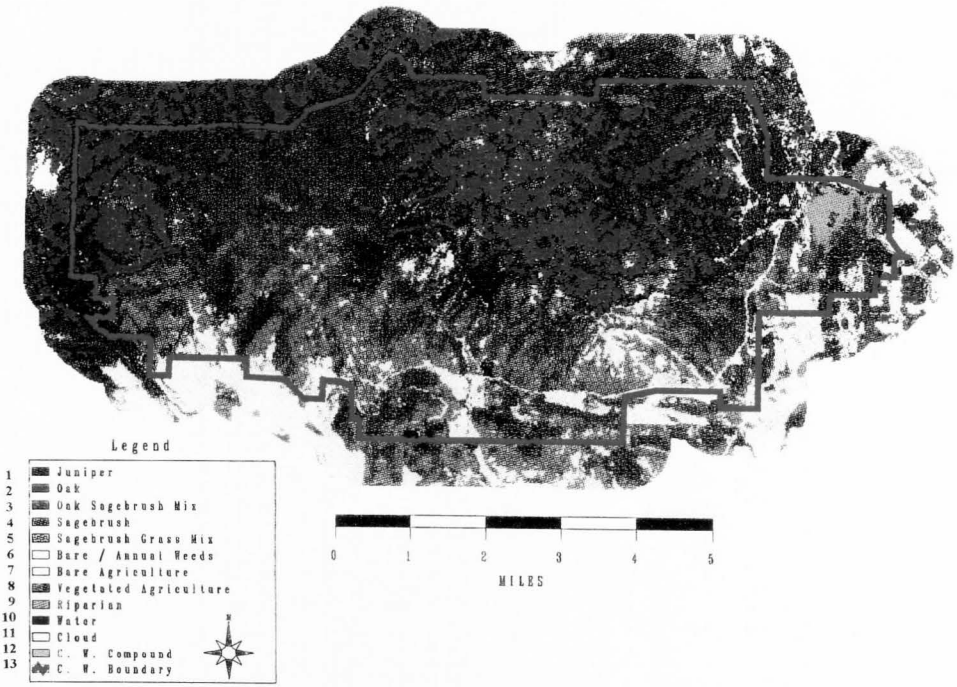

Fig. 4. Vegetation cover type map of Camp Williams created by Van Niel (1995).

CW landscape and the LCTA landscapes were unsupervised classifications; thus, the statistical spectral clusters for both landscapes were not linked to actual vegetation classes on the ground. Because the LCTA landscape was compared with the non-LCTA landscape, knowing the vegetation classes, and not just spectral clusters, was essential for the landscape metrics generated by FRAGSTATS to be meaningful.

By utilizing Van Niel's vegetation classification, a final LCTA landscape image (Fig. 5) file and a non-LCTA landscape image (Fig. 6) file were created. The final LCTA landscape image file was created by overlaying the LCTA landscape file with Van Niel's vegetation classification. The LCTA landscape image file served as a template to cut out all the areas in Van Niel's classification that were not considered for monitoring by the LCTA program. The non-LCTA landscape was created in the same way. The colored areas contained within both files represented the vegetation classes characterized by Van Niel. Figure 4 shows the color legend associated with a particular vegetation class.

Van Niel's vegetation map contained not only all of the CW area within its boundary but also contained a 200-m buffer falling outside the CW boundary. The LCTA landscape and the non-LCTA landscape do not contain this area outside the CW boundary. In order to calculate the amount of vegetation occurring in various ground cover classes at CW, it was necessary to create a file that would contain the vegetation only occurring within CW boundary. A file in GRASS that consisted of only the outline of CW was imported into IMAGINE 8.0. Van Niel's (1995) vegetation map was overlaid with this outline file and this resulted in a vegetation map that did not contain the 200-m

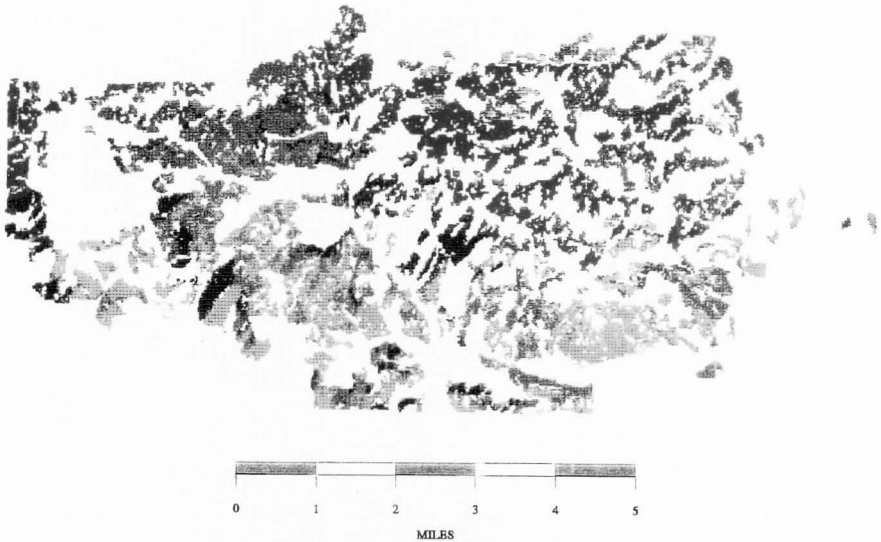

Fig. 5. Map of Camp Williams landscape showing the polygons that were utilized for the selection of long-term monitoring sites.

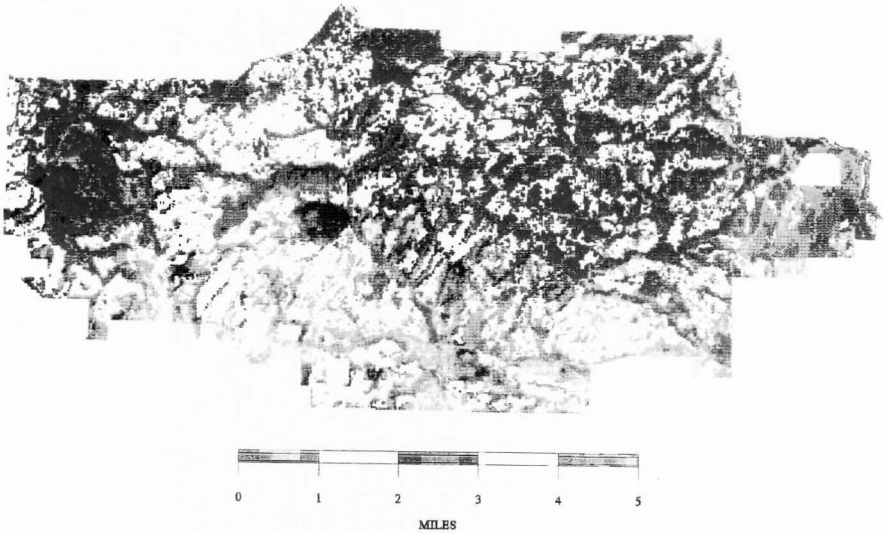

Fig. 6. Map of Camp Williams showing the landscape excluded by the LCTA monitoring program.

buffer falling outside the CW boundary. Table 4 shows the percent of vegetation cover classes present at CW, based on Van Niel's vegetation classification.

Quantifying landscape structure

After the final LCTA and the non-LCTA landscapes were produced, the landscape structure for the two landscapes was quantified utilizing FRAGSTATS. The comparison between the landscape metrics for the two landscapes showed differences between metrics. The most obvious difference was that of area; the total LCTA-landscape area was 3,808 ha and the total non-LCTA landscape area was 5,891 ha (Table 5). Because of these varying areas, a question that arose was whether the differences observed in landscape metrics resulted from the varying areas or resulted due to actual differences in landscape structure. In order to test this, the landscapes for both files were divided into 10 equal portions. Each of the 10 portions contained the same number of pixel rows and

Table 4. Percentage of vegetation cover classes present at CW.

Vegetation classes	Percent total	Percent of vegetation class of LCTA landscape	Percent of vegetation class of the non-LCTA landscape
Oak	22	20	23
Juniper	6	8	5
Vegetated agriculture	0.15	0.01	0.26
Oak/sagebrush mix	14	11	16
Sagebrush	29	31	29
Sagebrush/grass mix	21	26	18
Bare/annual weeds	0.06	3	5
Bare/agriculture	4.2	0.9	4

Table 5. Total amount of hectares represented by the LCTA and the non-LCTA landscape.

Total area (ha)	9699 ha	Percentage of total area
Total area sampled by the LCTA program (ha)	3808 ha	39% of CW is monitored by the LCTA program
Total area not sampled by the LCTA program	5891 ha	61% of CW is not monitored by the LCTA program

pixel columns (210 rows, 154 columns). It is important to note that the landscape area contained within one portion was not necessarily equal to the landscape area comprising another portion, as only the file coordinates were equal (Table 6).

FRAGSTATS generated landscape metrics for all portions. The comparison between the 10 landscape metrics for the LCTA landscape and the 10 landscape metrics for the non-LCTA landscape showed that the metrics were not equal. The landscape metrics differed as the landscape area changed for each portion; thus, it was concluded that the landscape metrics were definitely area dependent. As a result, it was necessary to compare equal areas in order that comparison of the landscape metrics be meaningful.

Since the LCTA landscape comprised 3,808 ha, while the non-LCTA landscape comprised an area of 5,891 ha, the largest landscape sampled in each was 3,808 ha. The boundary of CW was approximately rectangular in shape. Because it was important to optimize the amount of area to be measured, nested rectangular portions were first created. Geographic coordinates located in the center of each landscape were utilized as a starting point. A rectangular portion was drawn so that the midpoint of the rectangular

Table 6. Landscape metrics derived from the 10 portions, consisting of 210 rows and 154 columns each.

Landscape metrics	Portion 1	Portion 2	Portion 3	Portion 4	Portion 5	Portion 6	Portion 7	Portion 8	Portion 9	Portion 10	Average	Population St. dev.
LCTA landscape												
Total area (ha)	192	455	441	403	298	193	462	524	505	341	381	121
Largest patch index (%)	15	42	14	12	7	15	8	18	13	14	16	10
Number of patches	370	497	820	704	707	295	394	647	775	502	571	184
Patch density (#/100 ha)	192	109	186	175	237	153	85	123	153	147	156	44
Mean patch size (ha)	0.52	0.92	0.54	0.57	0.42	0.65	1.20	0.81	0.65	0.68	0.70	0.23
Double log fractal dimension	1.43	1.42	1.43	1.45	1.46	1.36	1.41	1.41	1.44	1.43	1.42	0.03
Simpson's diversity index	0.68	0.55	0.71	0.57	0.71	0.68	0.64	0.66	0.74	0.70	0.66	0.06
Simpson's evenness index	0.80	0.66	0.85	0.69	0.88	0.79	0.73	0.76	0.86	0.84	0.79	0.07
Interspersion index (%)	60	65	73	57	71	64	37	52	63	63	61	10
Contagion	48	54	40	51	34	50	59	53	44	43	48	7
Non-LCTA landscape												
Total area (ha)	537	379	671	611	658	386	365	680	722	500	551	137
Largest patch index (%)	24	18	4	4	6	15	8	6	3	4	9	7
Number of patches	793	718	1398	1128	1166	607	661	1128	1382	919	990	291
Patch density (#/100 ha)	148	189	208	185	177	157	181	165	191	184	179	18
Mean patch size (ha)	0.68	0.53	0.48	0.54	0.56	0.64	0.55	0.60	0.52	0.54	0.56	0.06
Double log fractal dimension	1.45	1.42	1.45	1.44	1.47	1.45	1.39	1.45	1.44	1.45	1.44	0.02
Simpson's diversity index	0.69	0.65	0.75	0.67	0.73	0.79	0.72	0.78	0.78	0.79	0.74	0.05
Simpson's evenness index	0.83	0.78	0.90	0.81	0.91	0.92	0.84	0.92	0.91	0.92	0.87	0.05
Interspersion index (%)	74	71	73	59	74	74	62	76	73	68	70	6
Contagion	38	42	32	42	29	34	44	34	33	34	36	5

portion corresponded to centrally located geographic coordinates. Seven portions were nested on top of one another (Fig. 7). The area size contained within the first rectangular nested portion was roughly 59.5 ha, the second portion doubled to 119 ha, the third portion doubled to 238 ha, and so on, until the largest portion contained approximately 3808 ha for the LCTA and non-LCTA landscape.

The above was completed in IMAGINE under AOI (area of interest), where a rectangular box of any size can be created. For each portion, an estimation was made to determine the size the rectangular box needed to be in order to contain a given area. After a rectangular box was created, image statistics were created for that portion of the layer. With these data, the area values associated with each cover class were determined. Area values were summed, and depending upon the calculated area, the rectangular portion was made either larger or smaller. When the area contained within the rectangular portion was equal or close to the area needed, this AOI was subsetted in ERDAS.

Both the LCTA and the non-LCTA landscapes consisted of seven rectangular nested portions that were all converted to ERDAS version 7.5. FRAGSTATS generated the landscape metrics for each portion and the landscape metrics between equal area portions were compared (Table 7). In keeping the area constant, differences between both landscapes still existed. However, it could now be concluded that these differences resulted from differences in landscape structure between the LCTA and the non-LCTA landscapes, and not area, since area was held constant.

Fig. 7. Figure showing how the nested rectangular portions were applied.

Table 7. Landscape metrics and averages associated with the nested rectangular portions.

Landscape metrics	59.5 ha	119 ha	238 ha	476 ha	952 ha	1,904 ha	3,808 ha
LCTA landscape							
Total area (ha)	64	121	241	479	947	1,942	3,808
Largest patch index (%)	12	7.5	9.4	11	12	11	5.9
Number of patches	182	3391	511	796	1,403	2,695	5,544
Patch density (#/100 ha)	284	281	212	166	148	139	146
Mean patch size (ha)	0.35	0.36	0.47	0.60	0.68	0.72	0.69
Patch size deviation (ha)	.83	.88	1.56	3.22	4.90	5.88	4.69
Double log fractal dimension	1.42	1.41	1.41	1.42	1.43	1.44	1.43
Simpson's diversity index	0.76	0.76	0.75	0.76	0.75	0.75	0.78
Simpson's evenness index	0.91	0.92	0.90	0.91	0.91	0.88	0.86
Interspersion index (%)	73	76	76	75	73	64	52
Contagion	31	32	36	38	40	45	52
Non-LCTA landscape							
Total area (ha)	59.5	116	246	472	954	1,951	3,830
Largest patch index (%)	21	11	8.2	8.2	5.2	6.1	3.1
Number of patches	149	266	553	926	1,806	3,848	6,945
Patch density (#/100 ha)	250	229	225	196	189	197	181
Mean patch size (ha)	0.40	0.44	0.44	0.51	0.53	0.51	0.55
Patch size deviation (ha)	1.11	1.29	1.39	1.83	2.03	2.52	2.51
Double log fractal dimension	1.46	1.46	1.45	1.45	1.45	1.44	1.45
Simpson's diversity index	0.81	0.82	0.80	0.79	0.79	0.78	0.80
Simpson's evenness index	0.97	0.98	0.96	0.95	0.94	0.91	0.93
Interspersion index (%)	88	91	88	87	84	73	73
Contagion	21	22	23	25	27	34	33

The next step was the placement of equal area portions throughout the landscape. It is important to note that as the area of the landscape increases, the numbers of patches increase. This increase in patches make the landscape metrics more meaningful because the basic unit used by FRAGSTATS to calculate landscape metrics is a patch, thus, the more patches the more robust the landscape metrics. Because the largest landscape that could be sampled was 3808 ha, six portions each containing close to 600 ha of land were chosen to be placed throughout the LCTA and non-LCTA landscapes. The landscapes containing 600 ha were subsetted and FRAGSTATS was used to quantify landscape structure (Table 8). The 600-ha portions showed a better picture of what was occurring across the two landscapes, compared with the 3808 ha portion alone.

The two landscapes at this point were sampled using the nested rectangular portions along with the 600-ha equal area portions. Also, nine portions, each containing 200 ha, were placed throughout the landscapes. FRAGSTATS was then executed on the 200-ha portions (Table 9).

Fire boundaries

Areas of known dramatic and recent changes were needed to see if the landscape metrics can detect known change in land cover. The quickest, most dramatic changes at CW are due to wildfire. There were six fairly recent and obvious fire boundaries occurring at CW up to 1994. The large fire of 1995 could not be accounted for in the imagery available at the time this study was done. Figure 8 shows the location of fire

Table 8. Landscape metrics for each the 600 ha portions, plus the average and standard deviations.

Landscape metrics	Portion 1	Portion 2	Portion 3	Portion 4	Portion 5	Portion 6	Average	Population St. dev.
LCTA landscape								
Total area (ha)	592	605	612	592	594	593	598	7
Largest patch index (%)	33	5	6	18	4	11	13	10
Number of patches	675	1233	888	1115	1087	554	925	244
Patch density (#/100 ha)	114	204	145	188	183	94	155	40
Mean patch size (ha)	0.88	0.49	0.69	0.53	0.55	1.07	0.70	.21
Patch size deviation (ha)	8.00	1.90	2.60	3.73	1.85	4.72		
Double log fractal dimension	1.42	1.46	1.43	1.42	1.45	1.40	1.43	.02
Simpson's diversity index	0.57	0.64	0.67	0.73	0.78	0.64	0.67	.07
Simpson's evenness index	0.68	0.80	0.78	0.87	0.94	0.73	0.80	.09
Interspersion index (%)	64	65	55	81	67	43	63	12
Contagion	51	41	50	39	36	59	46	8
Non-LCTA landscape								
Total area (ha)	591	604	591	604	600	614	600	8
Largest patch index (%)	24	19	4	7	4	17	13	8
Number of patches	823	1113	1155	1048	1352	982	1079	162
Patch density (#/100 ha)	139	184	195	174	225	160	180	27
Mean patch size (ha)	0.72	0.54	0.51	0.58	0.44	0.63	0.57	.09
Patch size deviation (ha)	5.27	3.86	1.45	2.43	1.26	3.86		
Double log fractal dimension	1.45	1.43	1.45	1.46	1.45	1.41	1.44	.02
Simpson's diversity index	0.70	0.70	0.70	0.67	0.78	0.70	0.71	.03
Simpson's evenness index	0.84	0.84	0.84	0.84	0.94	0.81	0.85	.04
Interspersion index (%)	74	78	67	64	78	68	72	5
Contagion	38	36	37	35	29	43	36	4

Table 9. Landscape metrics derived for each of for the 200 ha portions, plus the averages and their standard deviation.

Landscape metrics	Portion 1	Portion 2	Portion 3	Portion 4	Portion 5	Portion 6	Portion 7	Portion 8	Portion 9	Average	Population St. dev.
LCTA landscape											
Total Area (ha)	198	206	196	201	206	200	201	198	200	201	3
Largest Patch Index (%)	12	10	12	31	22	10	22	18	20	17	7
Number of Patches	442	383	292	199	184	237	380	431	383	326	94
Patch Density (#/100 ha)	223	186	149	99	90	119	189	218	191	163	47
Mean patch size (ha)	0.45	0.54	0.67	1.01	1.12	0.84	0.53	0.46	0.52	0.68	0.24
Patch Size Deviation (ha)	1.63	1.63	2.17	5.23	4.26	2.49	2.59	2.01	2.33		
Double Log Fractal Dimension	1.43	1.48	1.45	1.42	1.41	1.38	1.44	1.40	1.43	1.43	0.03
Simpson's Diversity Index	0.62	0.68	0.69	0.50	0.56	0.63	0.65	0.76	0.66	0.64	0.07
Simpson's Evenness Index	0.74	0.85	0.83	0.59	0.67	0.72	0.78	0.91	0.83	0.77	0.10
Interspersion Index (%)	60	58	56	35	37	44	57	80	74	56	15
Contagion	46	39	44	65	59	59	46	36	39	48	10
Non-LCTA											
Total Area (ha)	199	204	201	194	200	200	203	204	199	201	3
Largest Patch Index (%)	12	40	15	20	7	9	12	5	6	14	10
Number of Patches	400	317	274	340	473	529	341	486	413	397	81
Patch Density (#/100 ha)	201	156	136	175	237	264	168	239	207	198	40
Mean patch size (ha)	0.50	0.64	0.74	0.57	0.42	0.38	0.60	0.42	0.48	0.53	0.11
Patch Size Deviation (ha)	2.045	4.863		2.429	1.09	1.158	1.771	.979	1.186		
Double Log Fractal Dimension	1.46	1.39	1.44	1.47	1.42	1.42	1.45	1.45	1.44	1.44	0.02
Simpson's Diversity Index	0.66	0.52	0.74	0.73	0.67	0.71	0.75	0.79	0.74	0.70	0.07
Simpson's Evenness Index	0.79	0.62	0.86	0.92	0.80	0.85	0.94	0.95	0.92	0.85	0.1
Interspersion Index (%)	55	67	64	77	68	64	79	86	76	71	9
Contagion	42	53	41	28	40	38	26	23	29	36	9

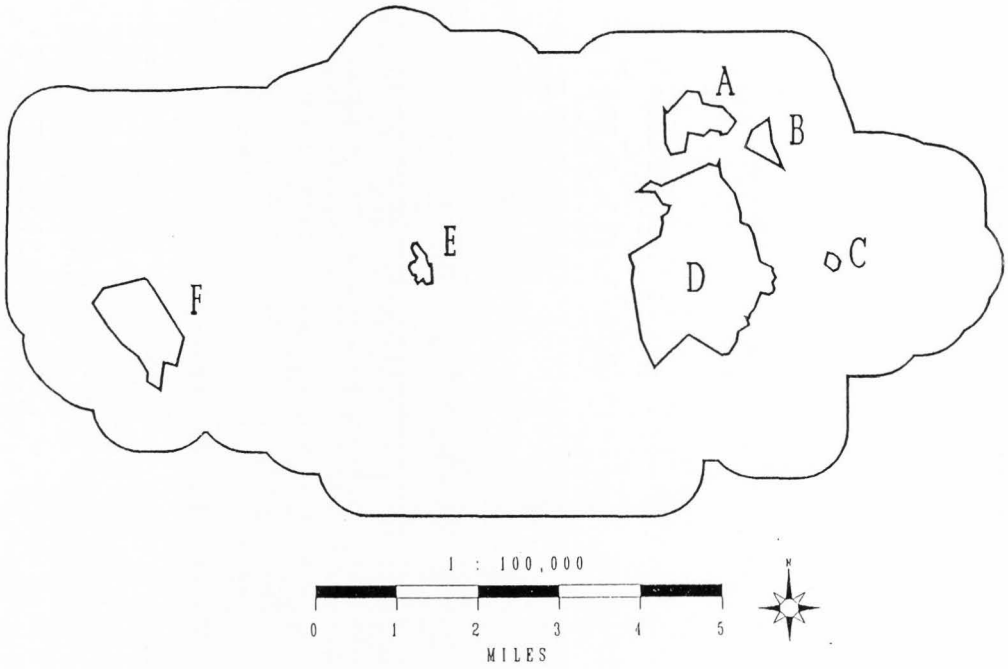

Fig. 8. Location of the fire boundaries occurring at Camp Williams prior to 1995.

boundaries up to 1994. These fire boundaries were determined utilizing a Trimble GPS (Godfrey 1995) and dated by growth ring analysis of several oakbrush stems within the fire boundaries (Van Niel 1995). The fire boundaries were laid over the LCTA landscape and the non-LCTA landscape. By utilizing the AOI dialog box, polygons were drawn around each fire boundary in the LCTA and non-LCTA landscape. The areas contained within the fire boundaries were calculated for both landscapes (Table 10). These areas were then compared to determine how much burned areas were contained within the LCTA and non-LCTA landscape.

A synoptic approach

Most studies or experiments yield a set of data from a sample of some population. This is because rarely is it possible, especially affordable, to enumerate the entire population. Representative data are then compiled and statistically analyzed to infer something about that population.

This was a synoptic study, which differs from traditional investigations, in that the total population was quantified. Such a synoptic approach was made possible by the application of RS and GIS technology. Because the total population was sampled in the LCTA landscape and in most of the non-LCTA landscape, any differences that occurred between the two landscapes were differences between entire populations. Metrics shown to be numerically different represent differences in their entirety; however, it became a scientific call as to whether these differences were ecologically significant. In determining the ecological significance of differences between metrics, understanding the

Table 10. Included and excluded areas (ha) within fire boundaries A-F.

	A	A	B	B	C	C	D	D	E	E	F	F
	LCTA	Non-LCTA	LCTA	Non-LCTA	LCTA	Non-LCTA	LCTA	Non-LCTA	LCTA	Non-LCTA	LCTA	Non-LCTA
Oakbrush	2	12	2.5	33	0	0	83	192	1.6	0.96	14	19
Juniper	0	0	3.5	3.84	0	0	0	0.6	3.5	2.0	0	0
Vegetated Agriculture	2.5	0	0	0	0	0	0	0	0	0	0	0
Oak/sage-brush mix	0.16	10	0.84	12	0	0	63	130	0	0.6	8.8	27
Sagebrush	0	4.3	18	41	0.44	0.36	32	82	4.2	5.4	4.2	23
Sagebrush/ grass mix	0	0.68	63	29	0.24	6.52	47	54	1.7	2.4	0.04	1.6
Bare/annual weeds	0	1.2	1.5	0.8	0	0.56	23	24	0.76	1.4	0.04	0.44
Bare agriculture	0	0	0.36	0.32	0	0	0	0	0	0	0	0
Total area	4.6	29	89	119	0.68	7.4	247	483	12	13	28	72
Total fire area in LCTA (ha):	**381**											
Total fire area in Non-LCTA (ha):	**722**											

variability of these metrics was essential. In this approach, metrics were compared, yet the variability between these metrics was also compared in order to determine whether numerical differences observed represented possible ecological differences. In observing population variability, ecological significance is questionable in a situation where the variability between metrics overlaps, as such an overlap may suggest little difference to managers. On the other hand, if overlap does not occur between the metrics, this suggests that such a difference may reflect some ecological significance on the ground. More experience with these newly available means of comparison will be required before we can make confident decisions from them.

CHAPTER 4

RESULTS AND DISCUSSION

Landscape-level metrics

FRAGSTATS can calculate patch-, class-, and landscape-level metrics. This study focuses specifically on the landscape-level metrics. Patch- and class-level metrics would be especially important if the land manager were interested in managing for a particular type of habitat. With the LCTA monitoring project at CW, there were no major objectives pertaining to particular vegetation classes; therefore, class- and patch-level metrics have been ignored in this study.

Vegetation of Camp Williams

Percent vegetation was calculated for each class Van Niel (1995) classified within the CW boundary (Table 4). Oakbrush, one of the major vegetation types, occupied 22 percent of the land cover at CW. For the LCTA landscape, oakbrush comprised 20 percent and in the non-LCTA landscape, oakbrush comprised 23 percent. Juniper covered a total of six percent of CW. In the LCTA landscape, eight percent was made up of juniper, while juniper comprised five percent of the non-LCTA landscape. Fourteen percent of the total landscape in CW was made up of oak/sagebrush mix (Table 4). The LCTA landscape consisted of 11 percent of this class and 16 percent in the non-LCTA landscape. For the sagebrush type, the total CW landscape consisted of 29 percent sagebrush. The LCTA landscape had 31 percent sagebrush and the non-LCTA landscape consisted of 29 percent sagebrush. The sagebrush/grass mix comprised 21 percent of

CW. Twenty-six percent of the area in the LCTA landscape was sagebrush/grass mix and 18 percent of the non-LCTA landscape was sagebrush/grass mix (Table 4). The bareground/annual weed type comprised only 0.06 percent of the total CW landscape. The LCTA landscape had three percent, while the non-LCTA landscape had four percent of bareground/annual weed type. The percentage of the bare/agricultural class at CW was 4.2. The LCTA landscape had 0.9 percent bare/agriculture and the non-LCTA landscape comprised four percent. The CW landscape consisted of 0.15 percent vegetated agriculture. The vegetated agriculture present in the LCTA landscape was 0.01 percent and 0.26 percent for the non-LCTA landscape. These separate percentages did not totally add up to 100 percent for both columns, as cloud, riparian, and other water-related classes were not included in Table 4, and were not quantified in FRAGSTATS.

Total area

The total area occurring within CW boundaries was 9,699 ha. The total LCTA landscape area was 3808 ha and there were 5,891 ha of land present in the non-LCTA landscape (Table 5). Due to the criteria established by the U.S. Army CERL, the LCTA monitoring program has excluded over half (61 percent) of the area of CW from monitoring. Because 61 percent of the landscape was ignored, any significant changes occurring within the larger excluded area will go undetected.

Despite the exclusion of 61 percent of the landscape from monitoring, the LCTA landscape contained all the major vegetation types (e.g., sagebrush, oakbrush) occurring on the reserve. For example, the sagebrush vegetation type represented 29 percent of

Camp William's total landscape. In the LCTA landscape, 31 percent of the cover classes were represented by sagebrush vegetation. The non-LCTA landscape was comprised of 29 percent sagebrush. All vegetation types were represented approximately equally in both the LCTA and non-LCTA areas (Table 4).

The nested portions (Table 7) show that the values of the landscape metrics were area dependent. In taking note of the nested portions (Table 7), which range from 59.5 ha to 476 ha, the landscape metrics were not as consistent as compared with the portions that contain greater areas. As the area of the landscape increases, at least for some landscape metrics (i.e., contagion and interspersion), the values appear to level. This leveling can be seen in Figures 9 and 10. Metrics, like the number of patches, increased as the landscape area increased. The landscape metrics attained from the landscapes with larger areas may be closer to the true values for the LCTA landscape and the non-LCTA landscape. Table 8 shows the landscape metrics resulting from the six 600-ha portions. Metrics from the nine portions comprising 200-ha can be viewed in Table 9.

Largest patch index

The largest patch index quantifies the percentage of total landscape area comprised by the largest patch (McGarigal and Marks 1995). In the 600-ha portions, the largest patch average was 10 percent in the LCTA landscape [standard deviation of the population (stdevp) is 10] and 12 percent (stdevp=8.0) in the non-LCTA landscape. In the 200-ha portions, the largest patch average comprised 17 percent (stdevp=7.0) in the

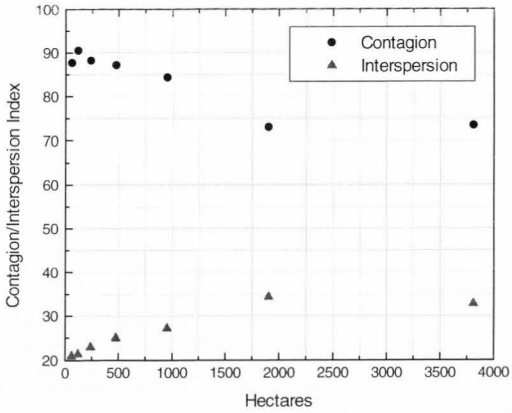

Figure 9. The relationship of the area of the landscape to landscape indices for contagion and interspersion in the non-LCTA landscape.

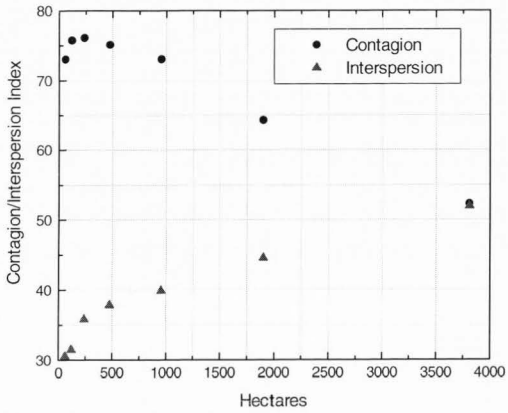

Figure 10. The relationship of the area of the landscape to landscape indices for contagion and interspersion in the LCTA landscape.

LCTA landscape and 14 percent (stdevp=10) in the non-LCTA landscape.

The non-LCTA landscape showed a larger average percentage for largest patch index compared with the LCTA landscape. Because the standard deviation of the populations overlapped for both the 200- and 600-ha portions, it was concluded that the largest patch index was more similar than different in both landscapes. This result was not consistent with the criteria set by the LCTA monitoring program, which established a minimum patch size, *a priori*. The expected result was that patches contained in the LCTA landscape should have been greater than the patches in the non-LCTA landscape. Hence, the LCTA landscape was not just dominated by large patches, but rather this landscape contained smaller more numerous patches than expected.

Patch number and density

Table 11 shows the number of patches associated with the various cover classes for the total LCTA and total non-LCTA landscapes. In the LCTA landscape, there were 894 oakbrush patches found. There were almost twice as many patches of oakbrush found on the non-LCTA landscape (1,760). The juniper cover class contained 38 percent more juniper (784) in the non- LCTA landscape than in the LCTA landscape (483). The oak/sagebrush mix had 1,289 patches in the LCTA landscape, while there were 39 percent more patches (2,109) in the non-LCTA. The sagebrush cover type consisted of 1,496 patches in the LCTA landscape and 2,103 patches in the non-LCTA landscape, or 29 percent more sagebrush patches in the non-LCTA landscape versus the LCTA landscape. In the sagebrush/grass mix, there were 809 patches in the LCTA landscape

and 1,795 patches in the non-LCTA landscape, or 55 percent more sagebrush/grass mix patches in the non-LCTA landscape versus the LCTA landscape. The patches comprising bareground and annual weeds were 453 for the LCTA landscape and 805 in the non-LCTA landscape. There were 44 percent more in the non-LCTA landscape patches than LCTA landscape patches. Bare agriculture had 115 patches in the LCTA landscape and 181 patches in the non-LCTA landscape. The LCTA landscape had two patches of vegetated agriculture whereas patches occurred in the non-LCTA landscape.

The 3,808-ha landscape portions had 5,544 patches occurring in the LCTA landscape and 6,945 patches in the non-LCTA. The patch density was 146 patches/100 ha in the LCTA landscape and 181 patches/100 ha in the non-LCTA landscape. In the 600-ha portions, the average number of patches located in the LCTA landscape was 925 (stdevp=245), while the non-LCTA landscape contained 1,078 (stdevp=162) patches. The average patch density was 155 patches/100 ha (stdevp=40) for the LCTA landscape

Table 11. Number of cells and patches present in the total LCTA landscape and non-LCTA landscape.

Vegetation class	LCTA landscape cells	Non-LCTA landscape cells	LCTA landscape patches	Non-LCTA landscape patches
Oak	19,166	33,164	894	1,760
Juniper	7,581	7,016	483	784
Vegetated agriculture	5	375	2	7
Oak sagebrush-mix	10,082	24,027	1,289	2,109
Sagebrush	29,349	41,673	1,496	2,503
Sagebrush grass-mix	24,928	26,535	809	1,795
Bare/annual weeds	3,228	7,053	453	805
Bare agriculture	852	6,528	115	181

and 180 patches/100 ha (stdevp=27) for the non-LCTA landscape. The 200 ha portions contained a patch number 326 (stdevp=94) in the LCTA landscape, while the non-LCTA landscape had 397 (stdevp=81) patches. The patch density was 163 patches/100 ha (stdevp=47) in the LCTA landscape and 198 patches/100 ha (stdevp=40) in the non-LCTA landscape.

There were consistently more patches present in the excluded landscape than the included landscape. This is directly reflected in the density of patches per 100 ha, which showed greater densities for the excluded areas compared with the included areas. Again, the standard deviation of the population for both landscapes overlapped in the 600-ha and 200-ha portions; as a result, it can be concluded that the landscapes were more alike than different. The fact that these landscapes were more alike than different was not consistent with the criteria set by the LCTA program. These criteria were expected to result in a LCTA landscape where patches were less numerous for a given area, while the excluded landscape was expected to consist of more numerous patches for the same area.

Mean patch size

The mean patch size for the 3,808-ha portions (Table 7) was 0.69 ha (stdev=4.69) in the LCTA landscape and 0.55 ha (stdev=2.51) in the non-LCTA landscape. The mean patch size for the 600-ha portions were 0.70 ha (stdevp=0.21) in the LCTA landscape and 0.57 ha (stdevp= 0.09) in the non-LCTA landscape. The 200 ha portions had a mean patch size of 0.68 ha (stdevp=0.24) in LCTA landscape and 0.53 ha (stdevp=0.11) in the non-LCTA landscape.

The comparison between the nested portion of the total LCTA landscape (3,808 ha) and 3,808 ha of the non-LCTA landscape showed an unexpected result. This result was that the mean patch size was less than 1 ha in size for the LCTA landscape, which was not expected since patch sizes of greater than 2 ha in size should have occurred in the LCTA landscape. This unexpected result is shown with individual portions in the nested rectangular, 600- and 200-ha portions. For instance, in the 59.5-ha portion the mean patch size was 0.35 ha with only a patch size deviation of 0.833 ha. An explanation as to why the mean patch size in the LCTA landscape was smaller than expected is found in Chapter 5. Another unexpected result was that there existed patches greater than 2 ha in the non-LCTA landscape, which should not have been the case. The nested rectangular, 600-, and 200-ha portions in the non-LCTA landscape showed large patch size deviations greater than 2 ha. For example, for the first 600-ha portion in the non-LCTA landscape, the mean patch size was 0.72 and with a patch size deviation of 5.27 ha. This was not expected because supposedly areas greater than 2 ha in size occurred only in the LCTA landscape.

The mean patch size alone did not offer much information about the landscape, but when viewed together with patch size variability, a key aspect of landscape heterogeneity was captured. First, in viewing the variability of patch size relative to the 3,808 ha-portions, the distribution of patch sizes was skewed to the left as opposed to normally distributed for both the LCTA and non-LCTA landscapes. The patch size variability was higher in the LCTA landscape (stdev=4.69) compared with the non-LCTA landscape (stdev=2.51). In the LCTA landscape, there were smaller patches than

expected, though the LCTA landscape contained more larger patches and less smaller patches compared with the non-LCTA landscape. In the non-LCTA landscape, patch size variability was smaller. There were many smaller patches and few larger patches in the non-LCTA landscape compared with the LCTA landscape. The greater patch size variability in the LCTA landscape indicated less uniformity in pattern compared with non-LCTA landscape. Even though the LCTA landscape contained larger patches and the non-LCTA contained smaller patches, overlap did occur based on the patch size deviation; therefore, the two landscapes were more alike than different.

Possibly the mean patch size for the non-LCTA landscape would have been smaller; however, an anomaly exists in the western portion of the non-LCTA landscape, where patches greater than 2 ha in size were found to occur, based on both Van Niel's map and CERL's data base. This can be seen in the left-hand side of Figure 6. Patches of this size should have only been found in the LCTA landscape. This area, consisting of larger homogenous patches, biased the results of the mean patch size analysis, resulting in larger mean patch sizes for the excluded area, and a smaller patch density. However, in the 600-ha portions for the non-LCTA landscape, the mean patch size for several of the 600-ha portions showed a greater than expected mean patch size. This suggests that despite the anomalous area, there were still patch sizes greater than 2 ha occurring in the non-LCTA landscape.

Double log fractal dimension

The fractal dimension is an index that quantifies the complexity of shapes

occurring on the landscape (O'Neill *et al.* 1988). A landscape composed of simple geometric shapes, like squares and rectangles, will have a small fractal dimension. The fractal dimension will be large in a landscape that contains many patches with complex and convoluted shapes (Krummel *et al.* 1987). The greater the double log fractal dimension, the greater the patch shape complexity.

In the nested portions, the double log fractal dimension was 1.43 in the included landscape and 1.45 in the excluded landscape. In the 600-ha portions, the LCTA landscape showed an average double log fractal dimension of 1.43 (stdevp=0.02) and the non-LCTA was 1.44 (stdevp=0.02). In the 200-ha portions, the LCTA landscape had a double log fractal dimension of 1.43 (stdevp=0.03) and the non-LCTA landscape had an average value of 1.44 (stdevp=0.02).

The double log fractal dimensions were marginally greater for excluded than included areas, though, because the standard deviations of the population overlapped, the two landscapes were more alike than different.

Simpson's diversity index and Simpson's evenness index

In the 3,808 ha nested portions, the LCTA landscape had a Simpson's diversity index value of 0.78, whereas the non-LCTA had a value of 0.80. The LCTA landscape in 600-ha portions had an average value of 0.67 (stdevp=0.07), while the non-LCTA landscape had a value of 0.71 (stdevp=0.03). In the 200-ha portions, the LCTA landscape had a value of 0.64 (stdevp=0.07) and the non-LCTA landscape had a value of 0.70 (stdevp=0.07).

The value of Simpson's index represents the probability that any two cover types selected at random would be different. A value of 0.79 means that there is a 79 percent probability that two randomly chosen patches would represent different patch types. Thus, the higher the diversity value, the greater the likelihood that any two randomly drawn patches would be different patch types (i.e., greater diversity) (McGarigal and Marks 1995). The excluded landscape showed a greater value for the Simpson's diversity index in the nested rectangular, 200-, and 600-ha portions, compared with the included landscape, though, again because the variability resulted in an overlap between the two landscapes, it was concluded that the LCTA and non-LCTA landscapes were more alike than different.

The evenness measure shows how equally distributed the patches are in the landscape. The Simpson's evenness index in the 3,808-ha nested portions was 0.86 in the LCTA landscape and 0.93 in the non-LCTA landscape. The 600-ha portions showed a value of 0.80 (stdevp=0.09) in the included landscape and 0.85 (stdevp=0.04) in the excluded landscape. The 200-ha portions in the LCTA landscape was 0.77 (stdevp=0.09) and 0.85 (stdevp=0.10) in the non-LCTA landscape.

Evenness measures the distribution of area among patch types (McGarigal and Marks 1995). Larger evenness values indicate greater landscape evenness. A Simpson's evenness index of 80 percent can be interpreted as the distribution of area among patch type is 80 percent of the maximum evenness for a given landscape. The non-LCTA landscape had greater evenness values compared with the LCTA landscape, though, the

standard deviation of the population overlapped, showing that the two landscapes were more alike than different.

The diversity metrics computed by FRAGSTATS were influenced by two components, richness and evenness (Maggurran 1988). Richness refers to the number of patches present and evenness refers to the distribution of area among different types. Because these indices take both evenness and species richness into account, they are termed heterogeneity indices (Maggurran 1988). Richness values for both landscapes were the same since they contained the same cover types; therefore, the evenness and diversity indices were not biased by richness. It is important to note that evenness and richness do not convey any information about which patch types are most or least abundant or which may be of greater ecological significance (McGarigal and Marks 1995).

Interspersion and contagion

The interspersion index measures the extent to which patch types are interspersed. The interspersion value for the included landscape in the nested portions was 52 percent and 73 percent in the non-LCTA landscape. The 600-ha portions showed an average value of 63 percent (stdevp=12) in the LCTA landscape and 72 percent (stdevp=5.0) in the non-LCTA landscape. The value for interspersion in the 200-ha portions was 56 percent (stdevp=14) in the LCTA landscape and 71 percent (stdevp=9.0) in the non-LCTA landscape.

Consistently, the values for interspersion were greater for the excluded landscape than the included landscape. The 200-ha portion showed no overlap between the two landscapes, while the 600 ha portions showed overlap. Interspersion for the 600-ha portions were more alike than different, whereas interspersion for the 200-ha portions show a small difference as demonstrated by the standard deviation of the population. Higher interspersion values result from a landscape in which the patch types are well interspersed, representing greater diversity, whereas lower values characterize landscapes in which the patch types are poorly interspersed (McGarigal and Marks 1995).

Contagion measures the intermixing of units of different patch types. A landscape in which the patch types are well interspersed will have a lower contagion value compared with a landscape in which patch types are poorly interspersed. Therefore, contagion measures the extent to which patch types are aggregated or clumped (i.e., dispersion) (O'Neill *et al.* 1988). In the 3,808 nested portions, mean contagion was 52 for the LCTA landscape and 33 for the non-LCTA landscape. The 600-ha portions had a mean value of 46 (stdevp=8) in the LCTA landscape and 36 (stdevp=4) in the non-LCTA landscape. The 200-ha portions had an average contagion value of 48 (stdevp=10) in the LCTA landscape and 36 (stdevp=9) in the non-LCTA landscape. Higher mean values of contagion may result from landscapes with a few large, contiguous patches, whereas lower mean values generally characterize landscape with many small and dispersed patches (O'Neill *et al.* 1988).

The mean contagion values were different in the included landscape compared with the exluded landscape. The standard deviation of the population between the two

landscapes did not overlap; thus, a small difference suggests that the LCTA landscape contained fewer, larger, and more contiguous patches, relative to the excluded landscape. This reinforces the discussion above in that the LCTA landscape contained fewer smaller patches compared with the non-LCTA landscape.

Area within the fire boundaries

The fire boundaries for both the LCTA and non-LCTA landscape were determined (Table 10). The A fire boundary included within the LCTA landscape comprised 4.6 ha, while the non-LCTA landscape contained 29 ha. The B fire boundary in the included landscape had 90 ha, while the excluded landscape comprised 119 ha. The included landscape in the C fire boundary had 0.68 ha and the excluded landscape contained 7.4 ha. The D fire boundary had 247 ha of land in the included LCTA landscape and 483 ha in the excluded landscape. The E fire boundary in the LCTA landscape comprised 12 ha and 13 ha in the non-LCTA landscape. The F fire boundary contained 28 ha in the LCTA landscape, while the non-LCTA fire boundary was 72. The total amount of area occurring within the LCTA fire boundaries was 381 ha, and 722 ha within the non-LCTA fire boundaries.

There were clearly more burned areas located in the non-LCTA landscape compared with the LCTA landscape. This information is important, as these areas may be important to the land manager.

Advantages and disadvantages of a synoptic study

This is a synoptic study of an entire landscape as opposed to the study of random

subsamples from that landscape; as a result, conventional statistical testing was not appropriate. In time, however, the metrics generated here may be statistically tested via time series to detect changes in metric values over time for this landscape.

The most important outcome of this study was that the two landscapes were more alike than different, which was not expected due to the criteria set by the LCTA monitoring program. In this study, the population variance was utilized in order to compare those metrics that had calculated means. Because the total population in the LCTA landscape was sampled and a majority of the non-LCTA landscape was also sampled, the mean values for the entire populations were known. Thus, an advantage of a synoptic study is that whole populations are sampled and there is no need for subsampling. With conventional statistics, subsamples are needed to infer something about the population.

CHAPTER 5

IMPLICATIONS AND CONCLUSION

Introduction

Due to the criteria set by the LCTA program, it was expected that the patches comprising the LCTA landscape would be larger, less numerous, and less diverse than those of the excluded landscape. The expectations were not reached, as the two landscapes were more alike than different for the majority of the metrics used. The interspersion metric for the 200-ha portion and the contagion metric for both the 200/600-ha portions did show a small difference between the two landscapes; however, this result is the only one that reached expectations. Along with the conclusion that the two landscapes were more alike than different, other outcomes resulting from the LCTA monitoring program were observed. The following discusses the implications arising from the LCTA monitoring approach.

The significance of this landscape approach to the land manager

Most of the landscape-level indices explored in this analysis show that the two landscapes were more alike than different. This result was not expected due to the criteria set by the LCTA monitoring program to locate monitoring sites. The non-LCTA landscape was explicitly excluded from the LCTA monitoring protocol because it appeared to be more complex, thus making these areas more challenging to monitor. The population variance showed that although numerical differences did occur between the two landscapes, the two landscapes were more alike than different. Since it has been

shown for the majority of landscape metrics that the two landscapes were more alike than different, the 5,891 ha of excluded land should have also been considered in the random stratification process that was utilized to locate inventory sites.

The population variance for the interspersion at 200 ha and contagion at 600/200 ha did not overlap. It is important to emphasize that the functional significance of these differences in contagion and interspersion is unknown so far. Little is understood about these landscape metrics and what they mean on the ground. Turner (1989) stated that landscapes have critical thresholds at which ecological processes will change qualitatively. These thresholds are largely unknown and how such thresholds correspond to particular landscape indices needs further study. In the context of this study, it is a scientific call as to whether these small differences observed are biologically significant on the ground. Most metrics demonstrated that the two landscapes were more alike than different, and thus it can be argued that the differences were not biologically significant.

In this study, the diversity metrics appeared less useful to the land manager than the others available. The more useful metrics were patch size, density, and numbers because they showed a better picture of what was occurring across the two landscapes. Even though there was overlap with patch size variability, it was shown that the non-LCTA landscape contained many more, smaller patches compared with the LCTA landscape. These smaller patches cannot be overlooked, because this characteristic suggests that pockets of heterogeneity exist within the non-LCTA landscape that have gone unmonitored and such knowledge may be important to the land manager.

Problems arising from the unsupervised classification

The LCTA monitoring program utilizes remote sensing technology in order to allocate monitoring points. The program attempts to substitute computer-based analysis for vital ground work in locating monitoring sites. It is important to understand the ramifications of such an approach.

An unsupervised classification was used to identify spectral clusters. Monitoring sites were selected by the stratification of these spectral categories with soil mapping units (Warren and Bagley 1992). The stratification was applied to ensure that all spectral categories were represented (Warren and Bagley 1992). The number of sites assigned to an individual spectral category and soil mapping unit combinations was proportional to the percent of the total land area that it covered (Warren and Bagley 1992). In other words, if 20 percent of the landscape was represented by a particular spectral category and soil mapping unit combination, then 20 percent of the monitoring sites were placed in these areas.

As described above, these spectral clusters were never ground truthed, and a particular spectral cluster does not always correspond to a single cover type. Rather, one spectral class may represent more than one cover type. For example, the sagebrush cover type corresponds to the same spectral category as the juniper cover type. Table 12 shows the predominant vegetation types comprising particular spectral categories. Image category number one shows several associated cover classes within each category.

Table 12. Vegetation classes associated with each monitoring number and LCTA image category associated with the monitoring site. These data were acquired from the LCTA monitoring program at CW.

Plot number	LCTA image category number	Vegetation type
1	1	Sagebrush/shrub
2	1	Sagebrush/shrub
3	1	Juniper/shrub
4	1	Sagebrush
5	1	Juniper
6	1	Juniper/shrub
85	1	Sagebrush/annual
86	1	Juniper/shrub
88	1	Sagebrush/shrub
90	1	Annual
7	2	Sagebrush
8	2	Annual
9	2	Juniper/shrub
10	2	Juniper/shrub
11	2	Rabbitbrush
12	2	Annual grass
13	2	Annual grass
14	2	Juniper
80	2	Sagebrush
81	2	Sagebrush
83	2	Sagebrush/grass
84	2	Sagebrush/shrub
30	2	Juniper/shrub
31	2	Sagebrush/shrub
32	2	Oakbrush/shrub
15	3	Juniper/shrub
16	3	Sagebrush/shrub
17	3	Oakbrush/shrub
77	3	Sagebrush
79	3	Oakbrush/shrub

Table 12. Continued.

Plot number	LCTA image category number	Vegetation type
19	4	Oak
20	4	Oak
21	4	Oak
22	4	Oak
23	4	Oak/shrub
24	4	Oak
70	4	Oak
71	4	Oak
72	4	Oak/shrub
73	4	Oak
25	5	Sage annuals
26	5	Sage annuals
27	5	Annual grass
28	5	Annual grass
29	5	Sage grass
31	5	Sage annuals
32	5	Sage annuals
33	5	Annual grass
68	5	Annual grass
69	5	Annual
4	5	Sage
34	6	Sage grass
36	6	Annual grass
37	6	Annual
39	6	Annual
64	6	Annual grass
65	6	Perennial grass
66	6	Sagebrush/grass
67	6	Sagebrush/grass

Table 12. Continued.

Plot number	LCTA image category number	Vegetation type
40	7	Oakbrush (open)
41	7	Oakbrush (open)
42	7	Oakbrush/shrub
43	7	Oakbrush/shrub
60	7	Oakbrush (open)
62	7	Oakbrush (open)
63	7	Oakbrush (open)
44	8	Oakbrush
45	8	Oakbrush (open)
58	8	Oakbrush
47	9	Oakbrush/shrub
48	9	Oakbrush (open)
49	9	Sagebrush/shrub
50	9	Oakbrush (open)
51	9	Oakbrush (open)
52	9	Oakbrush/shrub
54	9	Sagebrush/shrub

Some cover classes (e.g., oakbrush and annuals) were represented by a single image category. Oakbrush areas were in most cases dominated by a robust cover with little interspace for other plant species to persist. This can be seen with image category number four in Table 12. Furthermore, annuals thrive in degraded areas were there is much soil exposure. Like oakbrush, these areas have a distinct spectral signature. This can be seen with image category number five in Table 12. On the other hand, sagebrush, sagebrush/shrub, oakbrush/shrub, and sagebrush/grass areas were not easily differentiated by spectral signature. This results in more than one cover class represented by a single

image category, and this is reflected in Table 12. These problems could be amended with ground truthing.

The land manager must understand the ramifications from the selection of non-ground truthed monitoring sites derived from an unsupervised classification. Such a system of classification could pose problems in the stratification of statistical spectral cluster and soil mapping unit combinations, as a particular cover type may not be adequately sampled. Warren and Bagley (1992, p.36) stated, "It is important that sampled portions are representative of the kinds and conditions of land resources actually existing on the monitored landscape." It is also important to understand that in this case, representative sample sites were not chosen on the basis of community type or condition of land resources; rather, representativeness was based on statistical spectral clusters, where one spectral cluster type represented several community types. As it pertains to the application of this approach to CW, Table 4 shows that each cover type was sampled in proportion to its distribution in the landscape and this is a strength of this approach as applied to CW.

Scale and homogeneity

A question that arose in the field and during computer analysis pertained to the issue of homogeneity. It is agreed that homogeneity is scale dependent or a hierarchical mosaic of patches within patches occurs over a broad range of scales (Kotliar and Wiens 1990; Senft *et al.* 1987). The LCTA program is concerned with monitoring community-level change. LCTA monitoring sites were located by utilizing remotely sensed imagery

to identify homogenous patches at the landscape level and patches thus identified were considered for monitoring. The LCTA monitoring program is attempting to monitor community-level change in patches that were identified as homogeneous at the landscape level, though in many of the areas, homogeneity identified at the landscape-level was not present at the community-level.

This change in homogeneity with change of scale was experienced first hand in the field. When viewed on the ground, LCTA monitoring sites were not commonly found to be homogenous areas, but areas that contained several vegetation classes. In many cases, it appeared that the monitoring transect merged into ecotones. This was a function of how the sites were selected from the imagery. The LCTA monitoring program defined homogeneity at the landscape scale, yet monitored at the community scale, and at this scale, some areas were no longer homogenous. Due to the homogeneity problem and the lack of ground truthing, many LCTA spectral clusters were dissected by more patches than represented by the final map used to identify monitoring sites. As a result, the LCTA program is serendipitously monitoring a more heterogeneous landscape than planned.

This change from a more heterogeneous environment at the community scale was apparent by looking at patch sizes in the included landscape. These patch sizes were not much larger than those of the excluded landscape, despite the *a priori* 2-ha minimum size criteria set by the LCTA program. In fact, the average patch size in the LCTA landscape was no greater than 1 ha. The reason is that spectral categories greater than 2-ha in size were included for monitoring, though, as previously discussed, several more patches exist

within a spectral category. These patches were on the average no greater than a hectare. Had the spectral cover classes actually represented homogenous areas at the community level, greater differences between the LCTA landscape metrics and the non-LCTA landscape metrics would have occurred. This is the main explanation as to why the LCTA patches were smaller than expected and why the two landscapes were more alike than different.

Critical areas ignored

The LCTA program attempted to exclude soil mapping units and spectral cluster combinations of less than 2 ha in size in order to exclude patches that were small and thereby difficult to sample in the field. Unfortunately, this approach resulted in the exclusion of some important areas.

An example of this is the exclusion from monitoring of the major riparian areas at CW, which were Tickville Spring and the Jordan River banks. Since these areas did not meet the minimum size criterion, they were totally excluded from monitoring. Some fire-disturbed areas were also left out of the monitoring scheme because the recovery status of fire areas created spectral noise that was difficult to classify. It is important that the land manager pay attention to critical areas, like riparian vegetation and small burned areas, that may be overlooked with this approach.

Monitoring objectives

As described above, some problems have resulted due to the LCTA approach. First, this technique is automated and consistently applied to each military reserve. The

monitoring objectives are also uniform throughout, which may pose some problems in the long term. Monitoring methodology should be linked to management objectives (West *et al.* 1994). The LCTA program monitoring objectives are generally vague and the same for each reserve. This may lead to problems, as local objectives for management may vary. The national monitoring objectives are defined, yet local land management decisions may undermine this national monitoring approach. For monitoring to be effective, the local land manager must adjust the monitoring approach to address local management objectives. Such a flexible approach will help minimize futility in monitoring efforts over the long term.

Incorporating a landscape measurement

As elaborated above, the incorporation of landscape metrics into the LCTA monitoring program has shown some ramifications of the LCTA monitoring approach. By understanding such outcomes of the LCTA approach and incorporating landscape metrics into its monitoring protocol, the LCTA program could be enhanced. As shown in the CW case study, these metrics identified important patterns at the landscape scale that were not apparent at the community scale, the only scale at which the LCTA program is currently monitoring. Also, by monitoring with landscape metrics, the land manager may detect important landscape-level changes over time and thereby recognize the need to adjust management in response to these changes.

These landscape metrics can be incorporated into the LCTA monitoring program in the following ways. For example, any changes in landscape-level heterogeneity could

be detected by monitoring the change in patch numbers over time. The LCTA monitoring program may be concerned with managing a particular habitat type. For example, sagebrush/oakbrush mix may be a suitable habitat for a particular animal. These areas can be spatially displayed at a landscape scale, and numerous landscape metrics like the number of patches or area represented by this habitat type can be quantified. Over time, the patch characteristics of this habitat type can be monitored to detect any important changes. The U.S. Army may also be concerned with a particular patch type because of its fire potential. Over time, these areas can be monitored at the landscape level in order to assess whether these areas are increasing or decreasing. Lastly, the community-level information collected over time can be compared to landscape-level pattern changes in order to understand the association between community level changes and changes in landscape pattern.

Conclusion

In recent years, a larger scale view of ecological phenomena is possible because of GIS and RS technology. The natural resource field is rapidly applying this recent technology to many studies. Much has been written on how this technology has been applied, yet little is written on the outcomes that may arise from the use of such tools. This analysis described some ramifications that resulted from the use of these tools by the LCTA monitoring program.

In this case study, landscape metrics were incorporated into the LCTA monitoring program, and by quantifying landscape structure, some outcomes associated with the

LCTA monitoring approach were identified. The understanding of such ramifications can strengthen the LCTA monitoring program. First, based on the criteria set by the LCTA monitoring program, it was expected that LCTA landscape would consist of larger, less numerous patches and the non-LCTA landscape would consist of smaller, more numerous patches. Contrary to what was expected, this was not the case, as the LCTA landscape contained smaller patches than expected, while the non-LCTA landscape contained larger patches than expected and the metrics showed that the two landscapes were more alike than different. This being the case, the 5,891 ha of excluded land should have been considered in the random stratification process that was utilized to locate inventory sites. It was shown in this study that the LCTA and non-LCTA landscapes appeared different to the U.S. Army CERL because the spectral clusters were never ground truthed. Also, this study showed that the excluded landscape contained critical habitat like riparian areas and many burned areas. Lastly, this study pointed out that the LCTA monitoring objectives are too generalized. This may pose some future problems because the vague LCTA monitoring objectives may make it more difficult to solve land issues compared with a monitoring program that is designed to answer more specific needs and questions.

In this study, the diversity metrics appeared less useful compared with the mean patch size, patch number, and density. Average patch size alone did not offer adequate information. In addition, patch size variability showed much about what was occurring across the two landscapes; thus, in the context of this study it was a very useful metric for the land manager. Both landscapes showed much patch size variability and because of

this variability, ground knowledge of the area is paramount in the interpretation and application of these metrics. In other words, because quantifying landscape structure results in a single number for a particular landscape index, these numbers may simplify the complexity occurring across the landscape; thus, these landscape metrics cannot totally replace ground-level knowledge. Den Boer (1981, p.52) wrote the following about heterogeneity and variability:

> Heterogeneity and variability should not be considered just drawbacks of field situations, that can best be circumvented by retreating into the laboratory....On the contrary, heterogeneity and changeablity must be recognized as fundamental features, not only of the natural environment of a population but also of life itself.

This study incorporated landscape metrics into the LCTA monitoring program, showing that such metrics can be applied to this type of situation and that these metrics identified important patterns at the landscape scale that were not apparent at the community scale. These metrics offered a view of the CW landscape that was not apparent at the community level. This landscape-level view can enhance the LCTA monitoring program. As well, the application of landscape metrics into future natural resource management projects looks promising.

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APPENDIX

Subset1

Processing image: subset1.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 27530 cells of background exterior to the landscape found

Class	1:	2297 cells,	31 patches
Class	2:	642 cells,	80 patches
Class	4:	722 cells,	110 patches
Class	5:	1062 cells,	85 patches
Class	6:	71 cells,	7 patches
Class	9:	10 cells,	6 patches
Class	11:	6 cells,	1 patches

number of classes: 7
max patches/class: 110
max_patch_size: 27256 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	192.400
Largest Patch Index(%):	15.447
Number of patches:	370
Patch Density (#/100 ha):	192.308
Mean Patch Size (ha):	0.520
Patch Size Standard Dev (ha):	2.112
Patch Size Coeff of Variation (%):	406.064
Total Edge (m):	92980.000
Edge Density (m/ha):	483.264
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	16.758
Mean Shape Index:	1.285
Area-Weighted Mean Shape Index:	2.755
Double Log Fractal Dimension:	1.429
Mean Patch Fractal Dimension:	1.047
Area-Weighted Mean Fractal Dimension:	1.163
Total Core Area (ha):	55.500
Number of Core Areas:	100
Core Area Density (#/100 ha):	51.975
Mean Core Area 1 (ha):	0.150
Core Area Standard Dev 1 (ha):	1.007
Core Area Coeff of Variation 1 (%):	671.089
Mean Core Area 2 (ha):	0.555
Core Area Standard Dev 2 (ha):	1.878
Core Area Coeff of Variation 2 (%):	1251.572
Total Core Area Index (%):	28.857
Mean Core Area Index (%):	3.058
Mean Nearest Neighbor (m):	69.226
Nearest Neighbor Standard Dev (m):	130.831
Nearest Neigh Coeff of Variation (%):	188.990
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.323
Simpson's Diversity Index:	0.683
Modified Simpson's Diversity Index:	1.148
Patch Richness:	7
Patch Richness Density (#/100 ha):	3.638
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.680
Simpson's Evenness Index:	0.796
Modified Simpson's Evenness Index:	0.592
Interspersion/Juxtaposition Index (%):	59.375
Contagion (%):	47.751

Subset2

Processing image: subset2.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 20965 cells of background exterior to the landscape found

Class	1:	696 cells,	97 patches
Class	2:	647 cells,	111 patches
Class	4:	1847 cells,	133 patches
Class	5:	7329 cells,	94 patches
Class	6:	839 cells,	55 patches
Class	9:	17 cells,	7 patches

number of classes: 6
max patches/class: 133
max_patch_size: 14510 (background/border patch)

LANDSCAPE INDICES

Total Area (ha):	455.000
Largest Patch Index(%):	42.488
Number of patches:	497
Patch Density (#/100 ha):	109.231
Mean Patch Size (ha):	0.915
Patch Size Standard Dev (ha):	8.981
Patch Size Coeff of Variation (%):	980.992
Total Edge (m):	155160.000
Edge Density (m/ha):	341.011
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	18.185
Mean Shape Index:	1.273
Area-Weighted Mean Shape Index:	5.558
Double Log Fractal Dimension:	1.420
Mean Patch Fractal Dimension:	1.044
Area-Weighted Mean Fractal Dimension:	1.225
Total Core Area (ha):	192.960
Number of Core Areas:	151
Core Area Density (#/100 ha):	35.385
Mean Core Area 1 (ha):	0.388
Core Area Standard Dev 1 (ha):	5.360
Core Area Coeff of Variation 1 (%):	1380.319
Mean Core Area 2 (ha):	1.199
Core Area Standard Dev 2 (ha):	9.365
Core Area Coeff of Variation 2 (%):	2412.219
Total Core Area Index (%):	42.409
Mean Core Area Index (%):	3.157
Mean Nearest Neighbor (m):	67.084
Nearest Neighbor Standard Dev (m):	106.234
Nearest Neigh Coeff of Variation (%):	158.360
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.114
Simpson's Diversity Index:	0.546
Modified Simpson's Diversity Index:	0.790
Patch Richness:	6
Patch Richness Density (#/100 ha):	1.319
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.622
Simpson's Evenness Index:	0.655
Modified Simpson's Evenness Index:	0.441
Interspersion/Juxtaposition Index (%):	54.535
Contagion (%):	59.575

Subset3

Processing image: subset3.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 21318 cells of background exterior to the landscape found

Class	1:	4922 cells,	171 patches
Class	2:	1111 cells,	119 patches
Class	4:	1864 cells,	246 patches
Class	5:	2489 cells,	194 patches
Class	6:	513 cells,	51 patches
Class	9:	123 cells,	39 patches

number of classes: 6
max patches/class: 246
max_patch_size: 19535 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	440.880
Largest Patch Index(%):	14.235
Number of patches:	820
Patch Density (#/100 ha):	185.992
Mean Patch Size (ha):	0.538
Patch Size Standard Dev (ha):	2.814
Patch Size Coeff of Variation (%):	523.297
Total Edge (m):	201320.000
Edge Density (m/ha):	456.632
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	23.970
Mean Shape Index:	1.274
Area-Weighted Mean Shape Index:	3.037
Double Log Fractal Dimension:	1.430
Mean Patch Fractal Dimension:	1.045
Area-Weighted Mean Fractal Dimension:	1.173
Total Core Area (ha):	135.320
Number of Core Areas:	225
Core Area Density (#/100 ha):	51.034
Mean Core Area 1 (ha):	0.165
Core Area Standard Dev 1 (ha):	1.543
Core Area Coeff of Variation 1 (%):	935.150
Mean Core Area 2 (ha):	0.601
Core Area Standard Dev 2 (ha):	2.991
Core Area Coeff of Variation 2 (%):	1758.042
Total Core Area Index (%):	30.693
Mean Core Area Index (%):	2.637
Mean Nearest Neighbor (m):	57.240
Nearest Neighbor Standard Dev (m):	76.370
Nearest Neigh Coeff of Variation (%):	133.422
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.421
Simpson's Diversity Index:	0.709
Modified Simpson's Diversity Index:	1.233
Patch Richness:	6
Patch Richness Density (#/100 ha):	1.361
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.793
Simpson's Evenness Index:	0.850
Modified Simpson's Evenness Index:	0.688
Interspersion/Juxtaposition Index (%):	73.331
Contagion (%):	40.253

```
subset4
Processing image: subset4.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....


... 22256 cells of background exterior to the landscape found

Class   1:    6168 cells,    156 patches
Class   2:      20 cells,      2 patches
Class   4:    1889 cells,    305 patches
Class   5:    1074 cells,    152 patches
Class   6:     828 cells,     54 patches
Class   9:     105 cells,     35 patches

number of classes: 6
max patches/class: 305
max_patch_size: 21416 (background/border patch)
LANDSCAPE INDICES
Total Area (ha):                                  403.360
Largest Patch Index(%):                            11.831
Number of patches:                                    704
Patch Density (#/100 ha):                         174.534
Mean Patch Size (ha):                               0.573
Patch Size Standard Dev (ha):                       2.868
Patch Size Coeff of Variation (%):                500.521
Total Edge (m):                                195760.000
Edge Density (m/ha):                              485.323
Contrast-Weight Edge Density (m/ha):                   NA
Total Edge Contrast Index (%):                         NA
Mean Edge Contrast Index (%):                          NA
Area-Weighted Mean Edge Contrast (%):                  NA
Landscape Shape Index:                             24.368
Mean Shape Index:                                   1.303
Area-Weighted Mean Shape Index:                     3.313
Double Log Fractal Dimension:                       1.448
Mean Patch Fractal Dimension:                       1.048
Area-Weighted Mean Fractal Dimension:               1.184
Total Core Area (ha):                             116.440
Number of Core Areas:                                 200
Core Area Density (#/100 ha):                      49.583
Mean Core Area 1 (ha):                              0.165
Core Area Standard Dev 1 (ha):                      1.458
Core Area Coeff of Variation 1 (%):               881.490
Mean Core Area 2 (ha):                              0.582
Core Area Standard Dev 2 (ha):                      2.691
Core Area Coeff of Variation 2 (%):              1626.783
Total Core Area Index (%):                         28.868
Mean Core Area Index (%):                           2.757
Mean Nearest Neighbor (m):                         60.605
Nearest Neighbor Standard Dev (m):                 84.808
Nearest Neigh Coeff of Variation (%):             139.934
Mean Proximity Index:                                  NA
Shannon's Diversity Index:                          1.118
Simpson's Diversity Index:                          0.573
Modified Simpson's Diversity Index:                 0.650
Patch Richness:                                         6
Patch Richness Density (#/100 ha):                  1.488
Relative Patch Richness (%):                           NA
Shannon's Evenness Index:                           0.624
Simpson's Evenness Index:                           0.687
Modified Simpson's Evenness Index:                  0.474
Interspersion/Juxtaposition Index (%):             56.702
Contagion (%):                                     51.433
```

subset5

Processing image: subset5.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 24869 cells of background exterior to the landscape found

Class	1:	2614 cells,	159 patches
Class	4:	2512 cells,	233 patches
Class	5:	1729 cells,	194 patches
Class	6:	441 cells,	65 patches
Class	9:	175 cells,	56 patches

LANDSCAPE INDICES	
Total Area (ha):	298.840
Largest Patch Index(%):	7.174
Number of patches:	707
Patch Density (#/100 ha):	236.581
Mean Patch Size (ha):	0.423
Patch Size Standard Dev (ha):	1.276
Patch Size Coeff of Variation (%):	301.992
Total Edge (m):	171040.000
Edge Density (m/ha):	572.346
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	24.735
Mean Shape Index:	1.314
Area-Weighted Mean Shape Index:	2.519
Double Log Fractal Dimension:	1.459
Mean Patch Fractal Dimension:	1.053
Area-Weighted Mean Fractal Dimension:	1.156
Total Core Area (ha):	55.200
Number of Core Areas:	212
Core Area Density (#/100 ha):	70.941
Mean Core Area 1 (ha):	0.078
Core Area Standard Dev 1 (ha):	0.473
Core Area Coeff of Variation 1 (%):	605.732
Mean Core Area 2 (ha):	0.260
Core Area Standard Dev 2 (ha):	0.836
Core Area Coeff of Variation 2 (%):	1070.395
Total Core Area Index (%):	18.471
Mean Core Area Index (%):	2.634
Mean Nearest Neighbor (m):	50.978
Nearest Neighbor Standard Dev (m):	60.707
Nearest Neigh Coeff of Variation (%):	119.084
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.328
Simpson's Diversity Index:	0.707
Modified Simpson's Diversity Index:	1.227
Patch Richness:	5
Patch Richness Density (#/100 ha):	1.673
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.825
Simpson's Evenness Index:	0.884
Modified Shannon's Evenness Index:	0.760

```
subset6
Processing image: subset6.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 27524 cells of background exterior to the landscape found

Class   1:      369 cells,      44 patches
Class   2:      921 cells,      43 patches
Class   4:      109 cells,      41 patches
Class   5:      957 cells,     113 patches
Class   6:     2367 cells,      33 patches
Class   9:       44 cells,      12 patches
Class  10:       49 cells,       9 patches

number of classes: 7
max patches/class: 113
max_patch_size: 27311 (background/border patch)

LANDSCAPE INDICES
Total Area (ha):                              192.640
Largest Patch Index(%):                        14.826
Number of patches:                                295
Patch Density (#/100 ha):                     153.135
Mean Patch Size (ha):                           0.653
Patch Size Standard Dev (ha):                   2.333
Patch Size Coeff of Variation (%):            357.278
Total Edge (m):                             74560.000
Edge Density (m/ha):                          387.043
Contrast-Weight Edge Density (m/ha):               NA
Total Edge Contrast Index (%):                     NA
Mean Edge Contrast Index (%):                      NA
Area-Weighted Mean Edge Contrast (%):              NA
Landscape Shape Index:                         13.430
Mean Shape Index:                               1.253
Area-Weighted Mean Shape Index:                 2.398
Double Log Fractal Dimension:                   1.362
Mean Patch Fractal Dimension:                   1.043
Area-Weighted Mean Fractal Dimension:           1.144
Total Core Area (ha):                          76.560
Number of Core Areas:                             72
Core Area Density (#/100 ha):                  37.375
Mean Core Area 1 (ha):                          0.260
Core Area Standard Dev 1 (ha):                  1.330
Core Area Coeff of Variation 1 (%):           512.658
Mean Core Area 2 (ha):                          1.063
Core Area Standard Dev 2 (ha):                  2.529
Core Area Coeff of Variation 2 (%):           974.641
Total Core Area Index (%):                     39.743
Mean Core Area Index (%):                       4.219
Mean Nearest Neighbor (m):                     66.299
Nearest Neighbor Standard Dev (m):             72.918
Nearest Neigh Coeff of Variation (%):         109.983
Mean Proximity Index:                              NA
Shannon's Diversity Index:                      1.359
Simpson's Diversity Index:                      0.676
Modified Simpson's Diversity Index:             1.126
Patch Richness:                                    7
Patch Richness Density (#/100 ha):              3.634
Relative Patch Richness (%):                       NA
Shannon's Evenness Index:                       0.698
Simpson's Evenness Index:                       0.799
```

ubset7

Processing image: subset7.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 20795 cells of background exterior to the landscape found

Class	1:	26 cells,	12 patches
Class	2:	1518 cells,	47 patches
Class	4:	37 cells,	16 patches
Class	5:	4205 cells,	143 patches
Class	6:	5242 cells,	104 patches
Class	8:	2 cells,	1 patches
Class	9:	122 cells,	42 patches
Class	10:	393 cells,	29 patches

number of classes: 8
max patches/class: 143
max_patch_size: 16992 (background/border patch

LANDSCAPE INDICES	
Total Area (ha):	461.800
Largest Patch Index(%):	7.518
Number of patches:	394
Patch Density (#/100 ha):	85.318
Mean Patch Size (ha):	1.172
Patch Size Standard Dev (ha):	4.012
Patch Size Coeff of Variation (%):	342.297
Total Edge (m):	154580.000
Edge Density (m/ha):	334.734
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	17.983
Mean Shape Index:	1.369
Area-Weighted Mean Shape Index:	3.138
Double Log Fractal Dimension:	1.406
Mean Patch Fractal Dimension:	1.055
Area-Weighted Mean Fractal Dimension:	1.179
Total Core Area (ha):	193.920
Number of Core Areas:	182
Core Area Density (#/100 ha):	39.411
Mean Core Area 1 (ha):	0.492
Core Area Standard Dev 1 (ha):	2.196
Core Area Coeff of Variation 1 (%):	446.084
Mean Core Area 2 (ha):	1.065
Core Area Standard Dev 2 (ha):	3.134
Core Area Coeff of Variation 2 (%):	636.840
Total Core Area Index (%):	41.992
Mean Core Area Index (%):	5.454
Mean Nearest Neighbor (m):	64.050
Nearest Neighbor Standard Dev (m):	94.932
Nearest Neigh Coeff of Variation (%):	148.216
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.190
Simpson's Diversity Index:	0.643
Modified Simpson's Diversity Index:	1.029
Patch Richness:	8
Patch Richness Density (#/100 ha):	1.732
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.572
Simpson's Evenness Index:	0.734
Modified Simpson's Evenness Index:	0.495

```
ubset8

Processing image: subset8.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 19234 cells of background exterior to the landscape found

Class    1:       113 cells,       42 patches
Class    2:      2037 cells,       68 patches
Class    4:        65 cells,       29 patches
Class    5:      3985 cells,      230 patches
Class    6:      6244 cells,      134 patches
Class    9:       442 cells,      114 patches
Class   10:       220 cells,       30 patches

number of classes: 7
max patches/class: 230
max_patch_size: 18027 (background/border patch
```

LANDSCAPE INDICES	
Total Area (ha):	524.240
Largest Patch Index(%):	18.129
Number of patches:	647
Patch Density (#/100 ha):	123.417
Mean Patch Size (ha):	0.810
Patch Size Standard Dev (ha):	4.553
Patch Size Coeff of Variation (%):	561.904
Total Edge (m):	202620.000
Edge Density (m/ha):	386.502
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	22.124
Mean Shape Index:	1.299
Area-Weighted Mean Shape Index:	4.023
Double Log Fractal Dimension:	1.414
Mean Patch Fractal Dimension:	1.047
Area-Weighted Mean Fractal Dimension:	1.195
Total Core Area (ha):	192.600
Number of Core Areas:	229
Core Area Density (#/100 ha):	43.682
Mean Core Area 1 (ha):	0.298
Core Area Standard Dev 1 (ha):	2.219
Core Area Coeff of Variation 1 (%):	745.498
Mean Core Area 2 (ha):	0.841
Core Area Standard Dev 2 (ha):	3.668
Core Area Coeff of Variation 2 (%):	1232.337
Total Core Area Index (%):	36.739
Mean Core Area Index (%):	3.831
Mean Nearest Neighbor (m):	57.834
Nearest Neighbor Standard Dev (m):	66.629
Nearest Neigh Coeff of Variation (%):	115.207
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.255
Simpson's Diversity Index:	0.655
Modified Simpson's Diversity Index:	1.064
Patch Richness:	7
Patch Richness Density (#/100 ha):	1.335
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.645
Simpson's Evenness Index:	0.764
Modified Simpson's Evenness Index:	0.547

Subset9

```
Processing image: subset9.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 19710 cells of background exterior to the landscape found

Class   1:     1411 cells,     97 patches
Class   2:      790 cells,     36 patches
Class   4:      584 cells,    150 patches
Class   5:     4035 cells,    194 patches
Class   6:     4655 cells,    192 patches
Class   9:     1005 cells,     71 patches
Class  10:      150 cells,     35 patches

number of classes: 7
max patches/class: 194
max_patch_size: 18226 (background/border patch)
```

LANDSCAPE INDICES	
Total Area (ha):	505.200
Largest Patch Index(%):	13.151
Number of patches:	775
Patch Density (#/100 ha):	153.405
Mean Patch Size (ha):	0.652
Patch Size Standard Dev (ha):	3.084
Patch Size Coeff of Variation (%):	473.162
Total Edge (m):	232240.000
Edge Density (m/ha):	459.699
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	25.831
Mean Shape Index:	1.321
Area-Weighted Mean Shape Index:	3.341
Double Log Fractal Dimension:	1.435
Mean Patch Fractal Dimension:	1.051
Area-Weighted Mean Fractal Dimension:	1.183
Total Core Area (ha):	153.600
Number of Core Areas:	262
Core Area Density (#/100 ha):	51.861
Mean Core Area 1 (ha):	0.198
Core Area Standard Dev 1 (ha):	1.496
Core Area Coeff of Variation 1 (%):	755.027
Mean Core Area 2 (ha):	0.586
Core Area Standard Dev 2 (ha):	2.529
Core Area Coeff of Variation 2 (%):	1276.066
Total Core Area Index (%):	30.404
Mean Core Area Index (%):	3.624
Mean Nearest Neighbor (m):	61.713
Nearest Neighbor Standard Dev (m):	87.408
Nearest Neigh Coeff of Variation (%):	141.636
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.547
Simpson's Diversity Index:	0.737
Modified Simpson's Diversity Index:	1.335
Patch Richness:	7
Patch Richness Density (#/100 ha):	1.386
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.795
Simpson's Evenness Index:	0.860
Modified Simpson's Evenness Index:	0.687
Interspersion/Juxtaposition Index (%):	63.214
Contagion (%):	43.523

Subset10

Processing image: subset10.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 23823 cells of background exterior to the landscape found

Class	1:	694 cells,	78 patches
Class	4:	521 cells,	63 patches
Class	5:	2395 cells,	140 patches
Class	6:	3728 cells,	128 patches
Class	9:	1133 cells,	78 patches
Class	10:	46 cells,	15 patches

number of classes: 6
max patches/class: 140
max_patch_size: 23104 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	340.680
Largest Patch Index(%):	14.066
Number of patches:	502
Patch Density (#/100 ha):	147.352
Mean Patch Size (ha):	0.679
Patch Size Standard Dev (ha):	2.992
Patch Size Coeff of Variation (%):	440.944
Total Edge (m):	151840.000
Edge Density (m/ha):	445.697
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	20.566
Mean Shape Index:	1.332
Area-Weighted Mean Shape Index:	3.203
Double Log Fractal Dimension:	1.434
Mean Patch Fractal Dimension:	1.053
Area-Weighted Mean Fractal Dimension:	1.180
Total Core Area (ha):	106.680
Number of Core Areas:	183
Core Area Density (#/100 ha):	53.716
Mean Core Area 1 (ha):	0.213
Core Area Standard Dev 1 (ha):	1.513
Core Area Coeff of Variation 1 (%):	711.779
Mean Core Area 2 (ha):	0.583
Core Area Standard Dev 2 (ha):	2.462
Core Area Coeff of Variation 2 (%):	1158.426
Total Core Area Index (%):	31.314
Mean Core Area Index (%):	3.719
Mean Nearest Neighbor (m):	55.713
Nearest Neighbor Standard Dev (m):	68.055
Nearest Neigh Coeff of Variation (%):	122.154
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.390
Simpson's Diversity Index:	0.701
Modified Simpson's Diversity Index:	1.208
Patch Richness:	6
Patch Richness Density (#/100 ha):	1.761
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.776
Simpson's Evenness Index:	0.841
Modified Simpson's Evenness Index:	0.674
Interspersion/Juxtaposition Index (%):	62.283
Contagion (%):	43.008

```
Processing image: subsetx1.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 18904 cells of background exterior to the landscape found

Class    1:     6378 cells,     167 patches
Class    2:      861 cells,     129 patches
Class    4:     2735 cells,     220 patches
Class    5:     2616 cells,     178 patches
Class    6:      715 cells,      49 patches
Class    9:      131 cells,      50 patches


LANDSCAPE INDICES
Total Area (ha):                                  537.440
Largest Patch Index(%):                            23.511
Number of patches:                                    793
Patch Density (#/100 ha):                         147.551
Mean Patch Size (ha):                               0.678
Patch Size Standard Dev (ha):                       4.877
Patch Size Coeff of Variation (%):                719.588
Total Edge (m):                                190420.000
Edge Density (m/ha):                              354.309
Contrast-Weight Edge Density (m/ha):                   NA
Total Edge Contrast Index (%):                         NA
Mean Edge Contrast Index (%):                          NA
Area-Weighted Mean Edge Contrast (%):                  NA
Landscape Shape Index:                             20.535
Mean Shape Index:                                   1.308
Area-Weighted Mean Shape Index:                     3.775
Double Log Fractal Dimension:                       1.448
Mean Patch Fractal Dimension:                       1.050
Area-Weighted Mean Fractal Dimension:               1.188
Total Core Area (ha):                             168.800
Number of Core Areas:                                 300
Core Area Density (#/100 ha):                      55.820
Mean Core Area 1 (ha):                              0.213
Core Area Standard Dev 1 (ha):                      2.924
Core Area Coeff of Variation 1 (%):              1373.651
Mean Core Area 2 (ha):                              0.563
Core Area Standard Dev 2 (ha):                      4.733
Core Area Coeff of Variation 2 (%):              2223.580
Total Core Area Index (%):                         31.408
Mean Core Area Index (%):                           3.255
Mean Nearest Neighbor (m):                         51.197
Nearest Neighbor Standard Dev (m):                 56.025
Nearest Neigh Coeff of Variation (%):             109.430
Mean Proximity Index:                                  NA
Shannon's Diversity Index:                          1.374
Simpson's Diversity Index:                          0.688
Modified Simpson's Diversity Index:                 1.166
Patch Richness:                                         6
Patch Richness Density (#/100 ha):                  1.116
Relative Patch Richness (%):                           NA
Shannon's Evenness Index:                           0.767
Simpson's Evenness Index:                           0.826
Modified Simpson's Evenness Index:                  0.651
Interspersion/Juxtaposition Index (%):             73.515
```

Subsetx2

Processing image: subsetx2.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 22860 cells of background exterior to the landscape found

Class	1:	1175 cells,	135 patches
Class	2:	480 cells,	115 patches
Class	4:	1834 cells,	182 patches
Class	5:	5106 cells,	197 patches
Class	6:	752 cells,	73 patches
Class	9:	133 cells,	16 patches

LANDSCAPE INDICES

Total Area (ha):	379.200
Largest Patch Index(%):	17.816
Number of patches:	718
Patch Density (#/100 ha):	189.346
Mean Patch Size (ha):	0.528
Patch Size Standard Dev (ha):	2.962
Patch Size Coeff of Variation (%):	560.810
Total Edge (m):	171320.000
Edge Density (m/ha):	451.793
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	21.994
Mean Shape Index:	1.274
Area-Weighted Mean Shape Index:	3.190
Double Log Fractal Dimension:	1.418
Mean Patch Fractal Dimension:	1.046
Area-Weighted Mean Fractal Dimension:	1.168
Total Core Area (ha):	105.160
Number of Core Areas:	227
Core Area Density (#/100 ha):	59.863
Mean Core Area 1 (ha):	0.146
Core Area Standard Dev 1 (ha):	1.521
Core Area Coeff of Variation 1 (%):	1038.434
Mean Core Area 2 (ha):	0.463
Core Area Standard Dev 2 (ha):	2.678
Core Area Coeff of Variation 2 (%):	1828.219
Total Core Area Index (%):	27.732
Mean Core Area Index (%):	3.053
Mean Nearest Neighbor (m):	54.881
Nearest Neighbor Standard Dev (m):	69.168
Nearest Neigh Coeff of Variation (%):	126.032
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.322
Simpson's Diversity Index:	0.648
Modified Simpson's Diversity Index:	1.044
Patch Richness:	6
Patch Richness Density (#/100 ha):	1.582
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.738
Simpson's Evenness Index:	0.778
Modified Simpson's Evenness Index:	0.583
[illegible]	[illegible]

Subset3

Processing image: subsetx3.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 15553 cells of background exterior to the landscape found

Class	1:	5410 cells,	377 patches
Class	2:	1335 cells,	190 patches
Class	4:	4457 cells,	358 patches
Class	5:	4433 cells,	301 patches
Class	6:	871 cells,	101 patches
Class	9:	281 cells,	71 patches

number of classes: 6
max patches/class: 377
max_patch_size: 7950 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	671.480
Largest Patch Index(%):	4.372
Number of patches:	1398
Patch Density (#/100 ha):	208.197
Mean Patch Size (ha):	0.480
Patch Size Standard Dev (ha):	1.735
Patch Size Coeff of Variation (%):	361.262
Total Edge (m):	312240.000
Edge Density (m/ha):	465.003
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	30.124
Mean Shape Index:	1.309
Area-Weighted Mean Shape Index:	2.802
Double Log Fractal Dimension:	1.450
Mean Patch Fractal Dimension:	1.051
Area-Weighted Mean Fractal Dimension:	1.162
Total Core Area (ha):	134.680
Number of Core Areas:	454
Core Area Density (#/100 ha):	67.612
Mean Core Area 1 (ha):	0.096
Core Area Standard Dev 1 (ha):	0.700
Core Area Coeff of Variation 1 (%):	726.671
Mean Core Area 2 (ha):	0.297
Core Area Standard Dev 2 (ha):	1.204
Core Area Coeff of Variation 2 (%):	1249.798
Total Core Area Index (%):	20.057
Mean Core Area Index (%):	2.867
Mean Nearest Neighbor (m):	47.681
Nearest Neighbor Standard Dev (m):	55.023
Nearest Neigh Coeff of Variation (%):	115.399
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.492
Simpson's Diversity Index:	0.747
Modified Simpson's Diversity Index:	1.373
Patch Richness:	6
Patch Richness Density (#/100 ha):	0.894
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.833
Simpson's Evenness Index:	0.896
Modified Simpson's Evenness Index:	0.766
Interspersion/Juxtaposition Index (%):	73.486
Contagion (%):	31.829

Subsetx4

Processing image: subsetx4.gis
Number of rows, cols: 210, 154
Interior Background value: 0
Exterior Background value: 0
Reading 8 bit ERDAS image ....

... 17062 cells of background exterior to the landscape found

Class	1:	7016 cells,	337 patches
Class	2:	16 cells,	3 patches
Class	4:	4318 cells,	366 patches
Class	5:	2690 cells,	250 patches
Class	6:	1051 cells,	103 patches
Class	9:	187 cells,	69 patches

number of classes: 6
max patches/class: 366
max_patch_size: 7643 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	611.120
Largest Patch Index(%):	4.274
Number of patches:	1128
Patch Density (#/100 ha):	184.579
Mean Patch Size (ha):	0.542
Patch Size Standard Dev (ha):	1.754
Patch Size Coeff of Variation (%):	322.753
Total Edge (m):	279740.000
Edge Density (m/ha):	457.750
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	28.290
Mean Shape Index:	1.320
Area-Weighted Mean Shape Index:	2.698
Double Log Fractal Dimension:	1.436
Mean Patch Fractal Dimension:	1.052
Area-Weighted Mean Fractal Dimension:	1.159
Total Core Area (ha):	142.900
Number of Core Areas:	392
Core Area Density (#/100 ha):	64.145
Mean Core Area 1 (ha):	0.127
Core Area Standard Dev 1 (ha):	0.743
Core Area Coeff of Variation 1 (%):	586.822
Mean Core Area 2 (ha):	0.364
Core Area Standard Dev 2 (ha):	1.225
Core Area Coeff of Variation 2 (%):	967.929
Total Core Area Index (%):	23.367
Mean Core Area Index (%):	3.731
Mean Nearest Neighbor (m):	49.558
Nearest Neighbor Standard Dev (m):	62.632
Nearest Neigh Coeff of Variation (%):	126.382
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.266
Simpson's Diversity Index:	0.673
Modified Simpson's Diversity Index:	1.119
Patch Richness:	6
Patch Richness Density (#/100 ha):	0.982
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.706
Simpson's Evenness Index:	0.808
Modified Simpson's Evenness Index:	0.624
Interspersion/Juxtaposition Index (%):	58.522
Contagion (%):	42.090

Subset5

Processing image: subsetx5.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 15896 cells of background exterior to the landscape found

Class	1:	4759 cells,	301 patches
Class	4:	5404 cells,	375 patches
Class	5:	4505 cells,	251 patches
Class	6:	940 cells,	133 patches
Class	9:	836 cells,	106 patches

number of classes: 5
max patches/class: 375
max_patch_size: 9702 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	657.760
Largest Patch Index(%):	6.312
Number of patches:	1166
Patch Density (#/100 ha):	177.268
Mean Patch Size (ha):	0.564
Patch Size Standard Dev (ha):	2.041
Patch Size Coeff of Variation (%):	361.882
Total Edge (m):	291020.000
Edge Density (m/ha):	442.441
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	28.368
Mean Shape Index:	1.341
Area-Weighted Mean Shape Index:	3.053
Double Log Fractal Dimension:	1.466
Mean Patch Fractal Dimension:	1.054
Area-Weighted Mean Fractal Dimension:	1.174
Total Core Area (ha):	141.600
Number of Core Areas:	438
Core Area Density (#/100 ha):	66.590
Mean Core Area 1 (ha):	0.121
Core Area Standard Dev 1 (ha):	0.793
Core Area Coeff of Variation 1 (%):	652.793
Mean Core Area 2 (ha):	0.323
Core Area Standard Dev 2 (ha):	1.268
Core Area Coeff of Variation 2 (%):	1044.115
Total Core Area Index (%):	21.528
Mean Core Area Index (%):	3.278
Mean Nearest Neighbor (m):	41.050
Nearest Neighbor Standard Dev (m):	38.278
Nearest Neigh Coeff of Variation (%):	93.248
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.394
Simpson's Diversity Index:	0.727
Modified Simpson's Diversity Index:	1.300
Patch Richness:	5
Patch Richness Density (#/100 ha):	0.760
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.866
Simpson's Evenness Index:	0.909
Modified Simpson's Evenness Index:	0.807
Interspersion/Juxtaposition Index (%):	74.083
Contagion (%):	29.029

Subset 6

Processing image: subset6.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 22687 cells of background exterior to the landscape found

Class	1:	2417 cells,	91 patches
Class	2:	730 cells,	74 patches
Class	4:	1082 cells,	97 patches
Class	5:	2550 cells,	173 patches
Class	6:	2294 cells,	128 patches
Class	9:	70 cells,	25 patches
Class	10:	510 cells,	19 patches

number of classes: 7
max patches/class: 173
max_patch_size: 21264 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	386.120
Largest Patch Index(%):	15.436
Number of patches:	607
Patch Density (#/100 ha):	157.205
Mean Patch Size (ha):	0.636
Patch Size Standard Dev (ha):	2.780
Patch Size Coeff of Variation (%):	437.062
Total Edge (m):	151720.000
Edge Density (m/ha):	392.935
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	19.303
Mean Shape Index:	1.334
Area-Weighted Mean Shape Index:	3.051
Double Log Fractal Dimension:	1.451
Mean Patch Fractal Dimension:	1.052
Area-Weighted Mean Fractal Dimension:	1.171
Total Core Area (ha):	102.360
Number of Core Areas:	237
Core Area Density (#/100 ha):	61.380
Mean Core Area 1 (ha):	0.169
Core Area Standard Dev 1 (ha):	1.392
Core Area Coeff of Variation 1 (%):	825.718
Mean Core Area 2 (ha):	0.432
Core Area Standard Dev 2 (ha):	2.203
Core Area Coeff of Variation 2 (%):	1306.236
Total Core Area Index (%):	26.510
Mean Core Area Index (%):	3.821
Mean Nearest Neighbor (m):	50.996
Nearest Neighbor Standard Dev (m):	59.647
Nearest Neigh Coeff of Variation (%):	116.971
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.672
Simpson's Diversity Index:	0.790
Modified Simpson's Diversity Index:	1.560
Patch Richness:	7
Patch Richness Density (#/100 ha):	1.813
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.859
Simpson's Evenness Index:	0.922
Modified Simpson's Evenness Index:	0.802
Interspersion/Juxtaposition Index (%):	73.716
Contagion (%):	33.581

Subset7

Processing image: subset7.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 23215 cells of background exterior to the landscape found

Class	1:	82 cells,	15 patches
Class	2:	695 cells,	66 patches
Class	4:	100 cells,	28 patches
Class	5:	3222 cells,	200 patches
Class	6:	3197 cells,	257 patches
Class	9:	574 cells,	56 patches
Class	10:	1255 cells,	39 patches

number of classes: 7
max patches/class: 257
max_patch_size: 22680 (background/border patch)

LANDSCAPE INDICES

Total Area (ha):	365.000
Largest Patch Index(%):	8.351
Number of patches:	661
Patch Density (#/100 ha):	181.096
Mean Patch Size (ha):	0.552
Patch Size Standard Dev (ha):	1.913
Patch Size Coeff of Variation (%):	346.348
Total Edge (m):	165460.000
Edge Density (m/ha):	453.315
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	21.651
Mean Shape Index:	1.281
Area-Weighted Mean Shape Index:	2.367
Double Log Fractal Dimension:	1.389
Mean Patch Fractal Dimension:	1.048
Area-Weighted Mean Fractal Dimension:	1.141
Total Core Area (ha):	103.150
Number of Core Areas:	203
Core Area Density (#/100 ha):	55.616
Mean Core Area 1 (ha):	0.156
Core Area Standard Dev 1 (ha):	1.051
Core Area Coeff of Variation 1 (%):	673.516
Mean Core Area 2 (ha):	0.508
Core Area Standard Dev 2 (ha):	1.849
Core Area Coeff of Variation 2 (%):	1184.740
Total Core Area Index (%):	28.260
Mean Core Area Index (%):	4.118
Mean Nearest Neighbor (m):	58.504
Nearest Neighbor Standard Dev (m):	102.378
Nearest Neigh Coeff of Variation (%):	174.480
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.470
Simpson's Diversity Index:	0.724
Modified Simpson's Diversity Index:	1.286
Patch Richness:	7
Patch Richness Density (#/100 ha):	1.918
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.755
Simpson's Evenness Index:	0.844
Modified Simpson's Evenness Index:	0.661
Interspersion/Juxtaposition Index (%):	52.081
Contagion (%):	43.729

Subset#8

```
Processing image: subset#8.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 15336 cells of background exterior to the landscape found

Class    1:      609 cells,      65 patches
Class    2:     2352 cells,     140 patches
Class    4:      584 cells,      92 patches
Class    5:     4832 cells,     319 patches
Class    6:     5166 cells,     335 patches
Class    9:     1571 cells,     138 patches
Class   10:     1890 cells,      39 patches

number of classes: 7
max patches/class: 335
max_patch_size: 6793 (background/border patch)
```

LANDSCAPE INDICES

Total Area (ha):	680.160
Largest Patch Index(%):	6.151
Number of patches:	1128
Patch Density (#/100 ha):	165.843
Mean Patch Size (ha):	0.603
Patch Size Standard Dev (ha):	2.284
Patch Size Coeff of Variation (%):	378.756
Total Edge (m):	287700.000
Edge Density (m/ha):	422.989
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	27.579
Mean Shape Index:	1.332
Area-Weighted Mean Shape Index:	2.693
Double Log Fractal Dimension:	1.445
Mean Patch Fractal Dimension:	1.054
Area-Weighted Mean Fractal Dimension:	1.160
Total Core Area (ha):	178.200
Number of Core Areas:	445
Core Area Density (#/100 ha):	65.573
Mean Core Area 1 (ha):	0.156
Core Area Standard Dev 1 (ha):	1.293
Core Area Coeff of Variation 1 (%):	818.737
Mean Core Area 2 (ha):	0.400
Core Area Standard Dev 2 (ha):	2.033
Core Area Coeff of Variation 2 (%):	1287.125
Total Core Area Index (%):	26.200
Mean Core Area Index (%):	3.741
Mean Nearest Neighbor (m):	50.959
Nearest Neighbor Standard Dev (m):	75.329
Nearest Neigh Coeff of Variation (%):	147.823
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.692
Simpson's Diversity Index:	0.784
Modified Simpson's Diversity Index:	1.535
Patch Richness:	7
Patch Richness Density (#/100 ha):	1.029
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.870
Simpson's Evenness Index:	0.915
Modified Simpson's Evenness Index:	0.789
Interspersion/Juxtaposition Index (%):	76.008
Contagion (%):	33.722

Subsetx9

Processing image: subsetx9.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 14297 cells of background exterior to the landscape found

Class	1:	3155 cells,	166 patches
Class	2:	657 cells,	99 patches
Class	4:	1537 cells,	232 patches
Class	5:	4804 cells,	385 patches
Class	6:	5722 cells,	309 patches
Class	9:	1138 cells,	153 patches
Class	10:	1030 cells,	38 patches

number of classes: 7
max patches/class: 385
max_patch_size: 5598 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	721.720
Largest Patch Index(%):	3.475
Number of patches:	1382
Patch Density (#/100 ha):	191.487
Mean Patch Size (ha):	0.522
Patch Size Standard Dev (ha):	1.589
Patch Size Coeff of Variation (%):	304.208
Total Edge (m):	331640.000
Edge Density (m/ha):	459.513
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	30.662
Mean Shape Index:	1.327
Area-Weighted Mean Shape Index:	2.482
Double Log Fractal Dimension:	1.441
Mean Patch Fractal Dimension:	1.053
Area-Weighted Mean Fractal Dimension:	1.152
Total Core Area (ha):	159.120
Number of Core Areas:	445
Core Area Density (#/100 ha):	61.658
Mean Core Area 1 (ha):	0.122
Core Area Standard Dev 1 (ha):	0.760
Core Area Coeff of Variation 1 (%):	621.174
Mean Core Area 2 (ha):	0.380
Core Area Standard Dev 2 (ha):	1.303
Core Area Coeff of Variation 2 (%):	1064.393
Total Core Area Index (%):	23.433
Mean Core Area Index (%):	3.368
Mean Nearest Neighbor (m):	46.528
Nearest Neighbor Standard Dev (m):	58.099
Nearest Neigh Coeff of Variation (%):	124.870
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.690
Simpson's Diversity Index:	0.782
Modified Simpson's Diversity Index:	1.524
Patch Richness:	7
Patch Richness Density (#/100 ha):	0.970
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.868
Simpson's Evenness Index:	0.912
Modified Simpson's Evenness Index:	0.783
Interspersion/Juxtaposition Index (%):	73.227
Contagion (%):	33.257

```
Subsetx10

Processing image: subsetx10.gis
Number of rows, cols: 210, 154
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 19846 cells of background exterior to the landscape found

Class    1:     1817 cells,     132 patches
Class    2:        8 cells,       4 patches
Class    4:     1604 cells,     145 patches
Class    5:     3619 cells,     253 patches
Class    6:     3542 cells,     261 patches
Class    9:     1213 cells,     103 patches
Class   10:      691 cells,      21 patches

number of classes: 7
max patches/class: 261
max_patch_size: 15230 (background/border patch)
```

LANDSCAPE INDICES	
Total Area (ha):	499.760
Largest Patch Index(%):	3.714
Number of patches:	919
Patch Density (#/100 ha):	183.888
Mean Patch Size (ha):	0.544
Patch Size Standard Dev (ha):	1.557
Patch Size Coeff of Variation (%):	286.246
Total Edge (m):	229660.000
Edge Density (m/ha):	459.541
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	25.683
Mean Shape Index:	1.335
Area-Weighted Mean Shape Index:	2.633
Double Log Fractal Dimension:	1.452
Mean Patch Fractal Dimension:	1.053
Area-Weighted Mean Fractal Dimension:	1.161
Total Core Area (ha):	104.040
Number of Core Areas:	343
Core Area Density (#/100 ha):	68.633
Mean Core Area 1 (ha):	0.113
Core Area Standard Dev 1 (ha):	0.594
Core Area Coeff of Variation 1 (%):	524.874
Mean Core Area 2 (ha):	0.303
Core Area Standard Dev 2 (ha):	0.943
Core Area Coeff of Variation 2 (%):	832.547
Total Core Area Index (%):	20.818
Mean Core Area Index (%):	3.546
Mean Nearest Neighbor (m):	44.875
Nearest Neighbor Standard Dev (m):	51.100
Nearest Neigh Coeff of Variation (%):	113.871
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.651
Simpson's Diversity Index:	0.786
Modified Simpson's Diversity Index:	1.540
Patch Richness:	7
Patch Richness Density (#/100 ha):	1.401
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.849
Simpson's Evenness Index:	0.917
Modified Simpson's Evenness Index:	0.791
Interspersion/Juxtaposition Index (%):	68.366
Contagion (%):	71.[illegible]

60ha

Processing image: 60ha.gis
Number of rows, cols: 59, 82
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 3233 cells of background exterior to the landscape found

Class	1:	327 cells,	31 patches
Class	2:	585 cells,	33 patches
Class	4:	69 cells,	22 patches
Class	5:	371 cells,	54 patches
Class	6:	119 cells,	23 patches
Class	9:	134 cells,	19 patches

number of classes: 6
max patches/class: 54
max_patch_size: 3156 (background/border patch)

LANDSCAPE INDICES

Total Area (ha):	64.200
Largest Patch Index(%):	11.526
Number of patches:	182
Patch Density (#/100 ha):	283.489
Mean Patch Size (ha):	0.353
Patch Size Standard Dev (ha):	0.833
Patch Size Coeff of Variation (%):	236.109
Total Edge (m):	36900.000
Edge Density (m/ha):	574.766
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	11.513
Mean Shape Index:	1.271
Area-Weighted Mean Shape Index:	2.126
Double Log Fractal Dimension:	1.418
Mean Patch Fractal Dimension:	1.047
Area-Weighted Mean Fractal Dimension:	1.133
Total Core Area (ha):	10.760
Number of Core Areas:	46
Core Area Density (#/100 ha):	71.651
Mean Core Area 1 (ha):	0.059
Core Area Standard Dev 1 (ha):	0.264
Core Area Coeff of Variation 1 (%):	446.810
Mean Core Area 2 (ha):	0.234
Core Area Standard Dev 2 (ha):	0.485
Core Area Coeff of Variation 2 (%):	820.306
Total Core Area Index (%):	16.760
Mean Core Area Index (%):	2.859
Mean Nearest Neighbor (m):	72.034
Nearest Neighbor Standard Dev (m):	105.446
Nearest Neigh Coeff of Variation (%):	146.384
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.566
Simpson's Diversity Index:	0.758
Modified Simpson's Diversity Index:	1.418
Patch Richness:	6
Patch Richness Density (#/100 ha):	9.346
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.874
Simpson's Evenness Index:	0.909
Modified Simpson's Evenness Index:	0.792
Interspersion/Juxtaposition Index (%):	73.033
Contagion (%):	30.548

```
120ha
catProcessing image: 120ha.gis
Number of rows, cols: 88, 120
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 7543 cells of background exterior to the landscape found

Class   1:     490 cells,     60 patches
Class   2:    1037 cells,     56 patches
Class   4:     116 cells,     47 patches
Class   5:     811 cells,    104 patches
Class   6:     342 cells,     43 patches
Class   9:     221 cells,     29 patches

number of classes: 6
max patches/class: 104
max_patch_size: 7342 (background/border patch)
```

LANDSCAPE INDICES

Total Area (ha):	120.680
Largest Patch Index(%):	7.458
Number of patches:	339
Patch Density (#/100 ha):	280.908
Mean Patch Size (ha):	0.356
Patch Size Standard Dev (ha):	0.879
Patch Size Coeff of Variation (%):	246.978
Total Edge (m):	68660.000
Edge Density (m/ha):	568.943
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	15.625
Mean Shape Index:	1.248
Area-Weighted Mean Shape Index:	2.143
Double Log Fractal Dimension:	1.407
Mean Patch Fractal Dimension:	1.042
Area-Weighted Mean Fractal Dimension:	1.134
Total Core Area (ha):	22.800
Number of Core Areas:	82
Core Area Density (#/100 ha):	67.948
Mean Core Area 1 (ha):	0.067
Core Area Standard Dev 1 (ha):	0.286
Core Area Coeff of Variation 1 (%):	425.054
Mean Core Area 2 (ha):	0.278
Core Area Standard Dev 2 (ha):	2.528
Core Area Coeff of Variation 2 (%):	785.715
Total Core Area Index (%):	18.893
Mean Core Area Index (%):	2.828
Mean Nearest Neighbor (m):	67.374
Nearest Neighbor Standard Dev (m):	85.151
Nearest Neigh Coeff of Variation (%):	126.386
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.579
Simpson's Diversity Index:	0.764
Modified Simpson's Diversity Index:	1.442
Patch Richness:	6
Patch Richness Density (#/100 ha):	4.972
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.881
Simpson's Evenness Index:	0.916
Modified Simpson's Evenness Index:	0.805
Interspersion/Juxtaposition Index (%):	75.741
Contagion (%):	31.485

238ha

Processing image: 238ha.gis
Number of rows, cols: 112, 159
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 11778 cells of background exterior to the landscape found

Class	1:	992 cells,	85 patches
Class	2:	2018 cells,	76 patches
Class	4:	233 cells,	76 patches
Class	5:	1885 cells,	151 patches
Class	6:	639 cells,	74 patches
Class	9:	263 cells,	49 patches

number of classes: 6
max patches/class: 151
max_patch_size: 11217 (background/border patch)

LANDSCAPE INDICES

Total Area (ha):	241.200
Largest Patch Index(%):	9.436
Number of patches:	511
Patch Density (#/100 ha):	211.857
Mean Patch Size (ha):	0.472
Patch Size Standard Dev (ha):	1.559
Patch Size Coeff of Variation (%):	330.190
Total Edge (m):	114840.000
Edge Density (m/ha):	476.119
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	18.486
Mean Shape Index:	1.258
Area-Weighted Mean Shape Index:	2.313
Double Log Fractal Dimension:	1.405
Mean Patch Fractal Dimension:	1.043
Area-Weighted Mean Fractal Dimension:	1.144
Total Core Area (ha):	69.680
Number of Core Areas:	135
Core Area Density (#/100 ha):	55.970
Mean Core Area 1 (ha):	0.136
Core Area Standard Dev 1 (ha):	0.860
Core Area Coeff of Variation 1 (%):	630.370
Mean Core Area 2 (ha):	0.516
Core Area Standard Dev 2 (ha):	1.613
Core Area Coeff of Variation 2 (%):	1182.659
Total Core Area Index (%):	28.889
Mean Core Area Index (%):	3.193
Mean Nearest Neighbor (m):	64.904
Nearest Neighbor Standard Dev (m):	77.654
Nearest Neigh Coeff of Variation (%):	119.643
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.527
Simpson's Diversity Index:	0.749
Modified Simpson's Diversity Index:	1.381
Patch Richness:	6
Patch Richness Density (#/100 ha):	2.488
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.852
Simpson's Evenness Index:	0.898
Modified Simpson's Evenness Index:	0.771
Interspersion/Juxtaposition Index (%):	76.110
Contagion (%):	

475ha

Processing image: 475ha.gis
Number of rows, cols: 151, 202
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 18525 cells of background exterior to the landscape found

Class	1:	2159 cells,	120 patches
Class	2:	2715 cells,	111 patches
Class	4:	428 cells,	138 patches
Class	5:	4217 cells,	225 patches
Class	6:	2137 cells,	127 patches
Class	9:	321 cells,	75 patches

number of classes: 6
max patches/class: 225
max_patch_size: 15925 (background/border patch)

LANDSCAPE INDICES

Total Area (ha):	479.080
Largest Patch Index(%):	10.453
Number of patches:	796
Patch Density (#/100 ha):	166.152
Mean Patch Size (ha):	0.602
Patch Size Standard Dev (ha):	3.220
Patch Size Coeff of Variation (%):	535.014
Total Edge (m):	199960.000
Edge Density (m/ha):	417.383
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	22.839
Mean Shape Index:	1.261
Area-Weighted Mean Shape Index:	3.240
Double Log Fractal Dimension:	1.420
Mean Patch Fractal Dimension:	1.043
Area-Weighted Mean Fractal Dimension:	1.178
Total Core Area (ha):	167.840
Number of Core Areas:	213
Core Area Density (#/100 ha):	44.460
Mean Core Area 1 (ha):	0.211
Core Area Standard Dev 1 (ha):	1.788
Core Area Coeff of Variation 1 (%):	847.978
Mean Core Area 2 (ha):	0.788
Core Area Standard Dev 2 (ha):	3.390
Core Area Coeff of Variation 2 (%):	1607.772
Total Core Area Index (%):	35.034
Mean Core Area Index (%):	2.837
Mean Nearest Neighbor (m):	61.870
Nearest Neighbor Standard Dev (m):	73.544
Nearest Neigh Coeff of Variation (%):	118.869
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.536
Simpson's Diversity Index:	0.758
Modified Simpson's Diversity Index:	1.420
Patch Richness:	6
Patch Richness Density (#/100 ha):	1.252
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.857
Simpson's Evenness Index:	0.910
Modified Simpson's Evenness Index:	0.793
Interspersion/Juxtaposition Index (%):	75.103
Contagion (%):	37.863

```
944ha
Processing image: 944ha.gis
Number of rows, cols: 195, 278
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....


... 30540 cells of background exterior to the landscape found

Class    1:      5176 cells,     180 patches
Class    2:      3051 cells,     169 patches
Class    4:       915 cells,     280 patches
Class    5:      8188 cells,     379 patches
Class    6:      5773 cells,     250 patches
Class    9:       567 cells,     145 patches

number of classes: 6
max patches/class: 379
max_patch_size: 26621 (background/border patch)
```

```
LANDSCAPE INDICES
Total Area (ha):                                946.800
Largest Patch Index(%):                          11.914
Number of patches:                                1403
Patch Density (#/100 ha):                       148.183
Mean Patch Size (ha):                             0.675
Patch Size Standard Dev (ha):                     4.899
Patch Size Coeff of Variation (%):              726.006
Total Edge (m):                              389980.000
Edge Density (m/ha):                            411.893
Contrast-Weight. Edge Density (m/ha):                NA
Total Edge Contrast Index (%):                       NA
Mean Edge Contrast Index (%):                        NA
Area-Weighted Mean Edge Contrast (%):                NA
Landscape Shape Index:                           31.685
Mean Shape Index:                                 1.259
Area-Weighted Mean Shape Index:                   4.253
Double Log Fractal Dimension:                     1.430
Mean Patch Fractal Dimension:                     1.043
Area-Weighted Mean Fractal Dimension:             1.203
Total Core Area (ha):                           340.280
Number of Core Areas:                               420
Core Area Density (#/100 ha):                    44.360
Mean Core Area 1 (ha):                            0.243
Core Area Standard Dev 1 (ha):                    2.706
Core Area Coeff of Variation 1 (%):            1115.507
Mean Core Area 2 (ha):                            0.810
Core Area Standard Dev 2 (ha):                    4.898
Core Area Coeff of Variation 2 (%):            2019.545
Total Core Area Index (%):                       35.940
Mean Core Area Index (%):                         2.638
Mean Nearest Neighbor (m):                       59.025
Nearest Neighbor Standard Dev (m):               72.444
Nearest Neigh Coeff of Variation (%):           122.734
Mean Proximity Index:                                NA
Shannon's Diversity Index:                        1.523
Simpson's Diversity Index:                        0.754
Modified Simpson's Diversity Index:               1.404
Patch Richness:                                       6
Patch Richness Density (#/100 ha):                0.634
Relative Patch Richness (%):                         NA
Shannon's Evenness Index:                         0.850
Simpson's Evenness Index:                         0.905
Modified Simpson's Evenness Index:                0.784
Interspersion/Juxtaposition Index (%):           73.013
Contagion (%):                                   39.904
```

1900ha

Processing image: 1900ha.gis
Number of rows, cols: 251, 426

Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 58383 cells of background exterior to the landscape found

Class	1:	9160 cells,	352 patches
Class	2:	4377 cells,	261 patches
Class	4:	2819 cells,	617 patches
Class	5:	17034 cells,	726 patches
Class	6:	13606 cells,	465 patches
Class	9:	1500 cells,	260 patches
Class	10:	47 cells,	14 patches

number of classes: 7
max patches/class: 726
max_patch_size: 45831 (background/border patch)

LANDSCAPE INDICES

Total Area (ha):	1941.720
Largest Patch Index(%):	11.083
Number of patches:	2695
Patch Density (#/100 ha):	138.794
Mean Patch Size (ha):	0.720
Patch Size Standard Dev (ha):	5.883
Patch Size Coeff of Variation (%):	816.540
Total Edge (m):	791340.000
Edge Density (m/ha):	407.546
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	44.896
Mean Shape Index:	1.291
Area-Weighted Mean Shape Index:	4.552
Double Log Fractal Dimension:	1.437
Mean Patch Fractal Dimension:	1.046
Area-Weighted Mean Fractal Dimension:	1.206
Total Core Area (ha):	700.320
Number of Core Areas:	853
Core Area Density (#/100 ha):	43.930
Mean Core Area 1 (ha):	0.260
Core Area Standard Dev 1 (ha):	3.309
Core Area Coeff of Variation 1 (%):	1273.500
Mean Core Area 2 (ha):	0.821
Core Area Standard Dev 2 (ha):	5.843
Core Area Coeff of Variation 2 (%):	2248.501
Total Core Area Index (%):	36.067
Mean Core Area Index (%):	2.823
Mean Nearest Neighbor (m):	58.048
Nearest Neighbor Standard Dev (m):	81.133
Nearest Neigh Coeff of Variation (%):	139.770
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.535
Simpson's Diversity Index:	0.750
Modified Simpson's Diversity Index:	1.387
Patch Richness:	7
Patch Richness Density (#/100 ha):	0.361
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.789
Simpson's Evenness Index:	0.875
Modified Simpson's Evenness Index:	0.713
Interspersion/Juxtaposition Index (%):	64.264
Contagion (%):	44.547

3800ha
Processing image: lcta_infinal.gis
Number of rows, cols: 551, 1001

Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 456351 cells of background exterior to the landscape found

Class	1:	19166 cells,	894 patches
Class	2:	7581 cells,	483 patches
Class	3:	5 cells,	2 patches
Class	4:	10082 cells,	1289 patches
Class	5:	29349 cells,	1496 patches
Class	6:	24928 cells,	809 patches
Class	8:	2 cells,	1 patches
Class	9:	3228 cells,	453 patches
Class	10:	852 cells,	115 patches
Class	11:	6 cells,	1 patches
Class	12:	1 cells,	1 patches

LANDSCAPE INDICES	
Total Area (ha):	3808.000
Largest Patch Index(%):	5.894
Number of patches:	5544
Patch Density (#/100 ha):	145.588
Mean Patch Size (ha):	0.687
Patch Size Standard Dev (ha):	4.689
Patch Size Coeff of Variation (%):	682.651
Total Edge (m):	1608080.000
Edge Density (m/ha):	422.290
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	65.148
Mean Shape Index:	1.305
Area-Weighted Mean Shape Index:	3.900
Double Log Fractal Dimension:	1.433
Mean Patch Fractal Dimension:	1.049
Area-Weighted Mean Fractal Dimension:	1.191
Total Core Area (ha):	1294.960
Number of Core Areas:	1789
Core Area Density (#/100 ha):	46.980
Mean Core Area 1 (ha):	0.234
Core Area Standard Dev 1 (ha):	2.586
Core Area Coeff of Variation 1 (%):	1107.155
Mean Core Area 2 (ha):	0.724
Core Area Standard Dev 2 (ha):	4.513
Core Area Coeff of Variation 2 (%):	1932.255
Total Core Area Index (%):	34.006
Mean Core Area Index (%):	3.239
Mean Nearest Neighbor (m):	58.132
Nearest Neighbor Standard Dev (m):	85.090
Nearest Neigh Coeff of Variation (%):	146.373
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.634
Simpson's Diversity Index:	0.777
Modified Simpson's Diversity Index:	1.501
Patch Richness:	11
Patch Richness Density (#/100 ha):	0.289
Relative Patch Richness (%):	91.667
Shannon's Evenness Index:	0.681
Simpson's Evenness Index:	0.855
Modified Simpson's Evenness Index:	0.626
Interspersion/Juxtaposition Index (%):	52.258
Contagion (%):	51.927

```
60eha
Processing image: 59eha.gis
Number of rows, cols: 37, 57
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 621 cells of background exterior to the landscape found

Class    1:      430 cells,     19 patches
Class    2:      264 cells,     36 patches
Class    4:      114 cells,     25 patches
Class    5:      305 cells,     28 patches
Class    6:      174 cells,     17 patches
Class    9:      201 cells,     24 patches

number of classes: 6
max patches/class: 36
max patch size: 306

Verifying that background patches are classified co
```

LANDSCAPE INDICES

Total Area (ha):	59.520
Largest Patch Index(%):	20.565
Number of patches:	149
Patch Density (#/100 ha):	250.336
Mean Patch Size (ha):	0.399
Patch Size Standard Dev (ha):	1.106
Patch Size Coeff of Variation (%):	276.991
Total Edge (m):	30000.000
Edge Density (m/ha):	504.032
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	9.721
Mean Shape Index:	1.312
Area-Weighted Mean Shape Index:	2.540
Double Log Fractal Dimension:	1.455
Mean Patch Fractal Dimension:	1.054
Area-Weighted Mean Fractal Dimension:	1.149
Total Core Area (ha):	7.840
Number of Core Areas:	45
Core Area Density (#/100 ha):	75.605
Mean Core Area 1 (ha):	0.053
Core Area Standard Dev 1 (ha):	0.299
Core Area Coeff of Variation 1 (%):	567.525
Mean Core Area 2 (ha):	0.174
Core Area Standard Dev 2 (ha):	0.524
Core Area Coeff of Variation 2 (%):	994.955
Total Core Area Index (%):	13.172
Mean Core Area Index (%):	2.703
Mean Nearest Neighbor (m):	42.136
Nearest Neighbor Standard Dev (m):	36.033
Nearest Neigh Coeff of Variation (%):	85.516
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.709
Simpson's Diversity Index:	0.805
Modified Simpson's Diversity Index:	1.636
Patch Richness:	6
Patch Richness Density (#/100 ha):	10.081
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.954
Simpson's Evenness Index:	0.966
Modified Simpson's Evenness Index:	0.913
Interspersion/Juxtaposition Index (%):	87.726
Contagion (%):	20.99

```
120eha
Processing image: 119eha.gis
Number of rows, cols: 53, 79
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 1280 cells of background exterior to the landscape found

Class   1:      592 cells,      41 patches
Class   2:      597 cells,      55 patches
Class   4:      242 cells,      44 patches
Class   5:      683 cells,      59 patches
Class   6:      298 cells,      33 patches
Class   9:      495 cells,      34 patches

number of classes: 6
max patches/class: 59
max_patch_size: 466 (background/border patch)
```

LANDSCAPE INDICES

Total Area (ha):	116.280
Largest Patch Index(%):	11.008
Number of patches:	266
Patch Density (#/100 ha):	228.758
Mean Patch Size (ha):	0.437
Patch Size Standard Dev (ha):	1.288
Patch Size Coeff of Variation (%):	294.739
Total Edge (m):	54860.000
Edge Density (m/ha):	471.792
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	12.719
Mean Shape Index:	1.302
Area-Weighted Mean Shape Index:	2.509
Double Log Fractal Dimension:	1.456
Mean Patch Fractal Dimension:	1.051
Area-Weighted Mean Fractal Dimension:	1.148
Total Core Area (ha):	21.320
Number of Core Areas:	80
Core Area Density (#/100 ha):	68.799
Mean Core Area 1 (ha):	0.080
Core Area Standard Dev 1 (ha):	0.457
Core Area Coeff of Variation 1 (%):	570.013
Mean Core Area 2 (ha):	0.266
Core Area Standard Dev 2 (ha):	0.803
Core Area Coeff of Variation 2 (%):	1001.516
Total Core Area Index (%):	18.335
Mean Core Area Index (%):	2.739
Mean Nearest Neighbor (m):	49.890
Nearest Neighbor Standard Dev (m):	47.443
Nearest Neigh Coeff of Variation (%):	95.095
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.731
Simpson's Diversity Index:	0.815
Modified Simpson's Diversity Index:	1.686
Patch Richness:	6
Patch Richness Density (#/100 ha):	5.160
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.966
Simpson's Evenness Index:	0.978
Modified Simpson's Evenness Index:	0.941
Interspersion/Juxtaposition Index (%):	90.507
Contagion (%):	21.458

238ha

Processing image: 238eha.gis

Number of rows, cols: 79, 113
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 2789 cells of background exterior to the landscape found

Class	1:	993 cells,	82 patches
Class	2:	1566 cells,	109 patches
Class	4:	502 cells,	91 patches
Class	5:	1708 cells,	133 patches
Class	6:	738 cells,	71 patches
Class	9:	631 cells,	67 patches

number of classes: 6
max patches/class: 133

LANDSCAPE INDICES

Total Area (ha):	245.520
Largest Patch Index(%):	8.179
Number of patches:	553
Patch Density (#/100 ha):	225.236
Mean Patch Size (ha):	0.444
Patch Size Standard Dev (ha):	1.385
Patch Size Coeff of Variation (%):	311.999
Total Edge (m):	114220.000
Edge Density (m/ha):	465.217
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	18.224
Mean Shape Index:	1.313
Area-Weighted Mean Shape Index:	2.430
Double Log Fractal Dimension:	1.452
Mean Patch Fractal Dimension:	1.054
Area-Weighted Mean Fractal Dimension:	1.146
Total Core Area (ha):	46.760
Number of Core Areas:	166
Core Area Density (#/100 ha):	67.612
Mean Core Area 1 (ha):	0.085
Core Area Standard Dev 1 (ha):	0.629
Core Area Coeff of Variation 1 (%):	744.319
Mean Core Area 2 (ha):	0.282
Core Area Standard Dev 2 (ha):	1.124
Core Area Coeff of Variation 2 (%):	1329.634
Total Core Area Index (%):	19.045
Mean Core Area Index (%):	2.807
Mean Nearest Neighbor (m):	47.828
Nearest Neighbor Standard Dev (m):	42.136
Nearest Neigh Coeff of Variation (%):	88.099
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.692
Simpson's Diversity Index:	0.800
Modified Simpson's Diversity Index:	1.607
Patch Richness:	6
Patch Richness Density (#/100 ha):	2.444
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.945
Simpson's Evenness Index:	0.960
Modified Simpson's Evenness Index:	0.897
Interspersion/Juxtaposition Index (%):	88.220

475eha

```
Processing image: 475eha.gis
Number of rows, cols: 111, 161
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 6073 cells of background exterior to the landscape found

Class    1:      1864 cells,     133 patches
Class    2:      2733 cells,     166 patches
Class    4:      1099 cells,     161 patches
Class    5:      3726 cells,     217 patches
Class    6:      1558 cells,     136 patches
Class    9:       818 cells,     113 patches

number of classes: 6
max patches/class: 217
max_patch_size: 1441 (background/border patch)
```

LANDSCAPE INDICES	
Total Area (ha):	471.920
Largest Patch Index(%):	8.154
Number of patches:	926
Patch Density (#/100 ha):	196.220
Mean Patch Size (ha):	0.510
Patch Size Standard Dev (ha):	1.830
Patch Size Coeff of Variation (%):	359.149
Total Edge (m):	204880.000
Edge Density (m/ha):	434.141
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	23.578
Mean Shape Index:	1.326
Area-Weighted Mean Shape Index:	2.622
Double Log Fractal Dimension:	1.453
Mean Patch Fractal Dimension:	1.054
Area-Weighted Mean Fractal Dimension:	1.157
Total Core Area (ha):	104.880
Number of Core Areas:	319
Core Area Density (#/100 ha):	67.596
Mean Core Area 1 (ha):	0.113
Core Area Standard Dev 1 (ha):	0.949
Core Area Coeff of Variation 1 (%):	837.534
Mean Core Area 2 (ha):	0.329
Core Area Standard Dev 2 (ha):	1.594
Core Area Coeff of Variation 2 (%):	1407.475
Total Core Area Index (%):	22.224
Mean Core Area Index (%):	3.101
Mean Nearest Neighbor (m):	48.973
Nearest Neighbor Standard Dev (m):	49.984
Nearest Neigh Coeff of Variation (%):	102.066
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.668
Simpson's Diversity Index:	0.791
Modified Simpson's Diversity Index:	1.564
Patch Richness:	6
Patch Richness Density (#/100 ha):	1.271
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.931
Simpson's Evenness Index:	0.949
Modified Simpson's Evenness Index:	0.873
Interspersion/Juxtaposition Index (%):	87.123

```
944eha
Processing image: 950eha.gis
Number of rows, cols: 167, 243
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....


... 16734 cells of background exterior to the landscape found

Class    1:      4054 cells,     275 patches
Class    2:      3507 cells,     285 patches
Class    4:      2388 cells,     320 patches
Class    5:      8124 cells,     445 patches
Class    6:      4536 cells,     292 patches
Class    9:      1238 cells,     189 patches

number of classes: 6
max patches/class: 445
max_patch_size: 5123 (background/border patch)
Verifying that background patches are classified
```

LANDSCAPE INDICES	
Total Area (ha):	953.880
Largest Patch Index(%):	5.221
Number of patches:	1806
Patch Density (#/100 ha):	189.332
Mean Patch Size (ha):	0.528
Patch Size Standard Dev (ha):	2.032
Patch Size Coeff of Variation (%):	384.691
Total Edge (m):	420660.000
Edge Density (m/ha):	440.999
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	34.051
Mean Shape Index:	1.313
Area-Weighted Mean Shape Index:	2.803
Double Log Fractal Dimension:	1.449
Mean Patch Fractal Dimension:	1.051
Area-Weighted Mean Fractal Dimension:	1.164
Total Core Area (ha):	211.880
Number of Core Areas:	644
Core Area Density (#/100 ha):	67.514
Mean Core Area 1 (ha):	0.117
Core Area Standard Dev 1 (ha):	0.995
Core Area Coeff of Variation 1 (%):	847.887
Mean Core Area 2 (ha):	0.329
Core Area Standard Dev 2 (ha):	1.645
Core Area Coeff of Variation 2 (%):	1401.956
Total Core Area Index (%):	22.212
Mean Core Area Index (%):	3.121
Mean Nearest Neighbor (m):	48.690
Nearest Neighbor Standard Dev (m):	51.961
Nearest Neigh Coeff of Variation (%):	106.716
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.650
Simpson's Diversity Index:	0.785
Modified Simpson's Diversity Index:	1.535
Patch Richness:	6
Patch Richness Density (#/100 ha):	0.629
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.921
Simpson's Evenness Index:	0.941
Modified Simpson's Evenness Index:	0.857
Interspersion/Juxtaposition Index (%):	34.313
Contagion (%):	27.146

1900eha

Processing image: 1900eha.gis
Number of rows, cols: 243, 379
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 43322 cells of background exterior to the landscape found

Class	1:	10364 cells,	634 patches
Class	2:	4213 cells,	425 patches
Class	4:	6198 cells,	775 patches
Class	5:	16291 cells,	955 patches
Class	6:	9456 cells,	701 patches
Class	9:	2082 cells,	350 patches
Class	10:	171 cells,	8 patches

number of classes: 7
max patches/class: 955
max_patch_size: 15974 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	1951.000
Largest Patch Index(%):	6.050
Number of patches:	3848
Patch Density (#/100 ha):	197.232
Mean Patch Size (ha):	0.507
Patch Size Standard Dev (ha):	2.518
Patch Size Coeff of Variation (%):	496.681
Total Edge (m):	897420.000
Edge Density (m/ha):	459.979
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	50.793
Mean Shape Index:	1.302
Area-Weighted Mean Shape Index:	2.951
Double Log Fractal Dimension:	1.438
Mean Patch Fractal Dimension:	1.050
Area-Weighted Mean Fractal Dimension:	1.163
Total Core Area (ha):	451.240
Number of Core Areas:	1258
Core Area Density (#/100 ha):	64.480
Mean Core Area 1 (ha):	0.117
Core Area Standard Dev 1 (ha):	1.321
Core Area Coeff of Variation 1 (%):	1126.245
Mean Core Area 2 (ha):	0.359
Core Area Standard Dev 2 (ha):	2.291
Core Area Coeff of Variation 2 (%):	1953.694
Total Core Area Index (%):	23.129
Mean Core Area Index (%):	3.191
Mean Nearest Neighbor (m):	48.779
Nearest Neighbor Standard Dev (m):	65.578
Nearest Neigh Coeff of Variation (%):	134.439
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.642
Simpson's Diversity Index:	0.780
Modified Simpson's Diversity Index:	1.515
Patch Richness:	7
Patch Richness Density (#/100 ha):	0.359
Relative Patch Richness (%):	[illegible]
Shannon's Evenness Index:	0.844
Simpson's Evenness Index:	0.910
Modified Simpson's Evenness Index:	0.779
Interspersion/Juxtaposition Index (%):	72.950
Contagion (%):	34.365

3800eha

Processing Image: 3800eha.gis
Number of rows, cols: 297, 599
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 82142 cells of background exterior to the landscape found

Class	1:	23068 cells,	1241 patches
Class	2:	5569 cells,	607 patches
Class	4:	15720 cells,	1494 patches
Class	5:	26904 cells,	1724 patches
Class	6:	17447 cells,	1223 patches
Class	9:	4440 cells,	594 patches
Class	10:	2613 cells,	62 patches

number of classes: 7
max patches/class: 1724
max_patch_size: 26537 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	3830.440
Largest Patch Index(%):	3.130
Number of patches:	6945
Patch Density (#/100 ha):	181.311
Mean Patch Size (ha):	0.552
Patch Size Standard Dev (ha):	2.508
Patch Size Coeff of Variation (%):	454.659
Total Edge (m):	1692940.000
Edge Density (m/ha):	441.970
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	68.384
Mean Shape Index:	1.315
Area-Weighted Mean Shape Index:	3.029
Double Log Fractal Dimension:	1.445
Mean Patch Fractal Dimension:	1.051
Area-Weighted Mean Fractal Dimension:	1.169
Total Core Area (ha):	925.560
Number of Core Areas:	2437
Core Area Density (#/100 ha):	63.622
Mean Core Area 1 (ha):	0.133
Core Area Standard Dev 1 (ha):	1.249
Core Area Coeff of Variation 1 (%):	937.084
Mean Core Area 2 (ha):	0.380
Core Area Standard Dev 2 (ha):	2.086
Core Area Coeff of Variation 2 (%):	1565.177
Total Core Area Index (%):	24.163
Mean Core Area Index (%):	3.305
Mean Nearest Neighbor (m):	47.955
Nearest Neighbor Standard Dev (m):	72.749
Nearest Neigh Coeff of Variation (%):	151.702
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.713
Simpson's Diversity Index:	0.797
Modified Simpson's Diversity Index:	1.593
Patch Richness:	7
Patch Richness Density (#/100 ha):	0.183
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.880
Simpson's Evenness Index:	0.929
Modified Simpson's Evenness Index:	0.818
Interspersion/Juxtaposition Index (%):	73.353
Contagion (%):	32.716

```
lin

Processing image: lin.lan
Number of rows, cols: 153, 208
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 17020 cells of background exterior to the landscape found

Class   1:     857 cells,    117 patches
Class   2:    1132 cells,    159 patches
Class   4:    1332 cells,    172 patches
Class   5:    9310 cells,    129 patches
Class   6:    2119 cells,     82 patches
Class   9:      54 cells,     16 patches

number of classes: 6
max patches/class: 172
max_patch_size: 15033 (background/border patch)
```

LANDSCAPE INDICES

Total Area (ha):	592.160
Largest Patch Index(%):	32.903
Number of patches:	675
Patch Density (#/100 ha):	113.989
Mean Patch Size (ha):	0.877
Patch Size Standard Dev (ha):	8.004
Patch Size Coeff of Variation (%):	912.427
Total Edge (m):	210740.000
Edge Density (m/ha):	355.884
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	21.650
Mean Shape Index:	1.294
Area-Weighted Mean Shape Index:	5.145
Double Log Fractal Dimension:	1.419
Mean Patch Fractal Dimension:	1.047
Area-Weighted Mean Fractal Dimension:	1.217
Total Core Area (ha):	235.160
Number of Core Areas:	238
Core Area Density (#/100 ha):	40.192
Mean Core Area 1 (ha):	0.348
Core Area Standard Dev 1 (ha):	4.727
Core Area Coeff of Variation 1 (%):	1356.355
Mean Core Area 2 (ha):	0.988
Core Area Standard Dev 2 (ha):	7.921
Core Area Coeff of Variation 2 (%):	2273.632
Total Core Area Index (%):	39.712
Mean Core Area Index (%):	3.554
Mean Nearest Neighbor (m):	63.167
Nearest Neigh Standard Dev (m):	89.230
Nearest Neigh Coeff of Variation (%):	141.259
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.153
Simpson's Diversity Index:	0.567
Modified Simpson's Diversity Index:	0.936
Patch Richness:	6
Patch Richness Density (#/100 ha):	1.013
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.652
Simpson's Evenness Index:	0.680
Modified Simpson's Evenness Index:	0.467
Interspersion/Juxtaposition Index (%):	54.364
Contagion (%):	51.105

2in

Processing image: 2in.lan
Number of rows, cols: 167, 260
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 28296 cells of background exterior to the landscape found

Class	1:	7745 cells,	292 patches
Class	4:	4252 cells,	488 patches
Class	5:	2087 cells,	289 patches
Class	6:	805 cells,	88 patches
Class	9:	235 cells,	76 patches

number of classes: 5
max patches/class: 488
max_patch_size: 27354 (background/border patch)

LANDSCAPE INDICES

Total Area (ha):	604.960
Largest Patch Index(%):	5.177
Number of patches:	1233
Patch Density (#/100 ha):	203.815
Mean Patch Size (ha):	0.491
Patch Size Standard Dev (ha):	1.895
Patch Size Coeff of Variation (%):	386.298
Total Edge (m):	323700.000
Edge Density (m/ha):	535.077
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	32.902
Mean Shape Index:	1.315
Area-Weighted Mean Shape Index:	2.888
Double Log Fractal Dimension:	1.460
Mean Patch Fractal Dimension:	1.051
Area-Weighted Mean Fractal Dimension:	1.172
Total Core Area (ha):	140.440
Number of Core Areas:	374
Core Area Density (#/100 ha):	61.822
Mean Core Area 1 (ha):	0.114
Core Area Standard Dev 1 (ha):	0.827
Core Area Coeff of Variation 1 (%):	726.149
Mean Core Area 2 (ha):	0.376
Core Area Standard Dev 2 (ha):	1.469
Core Area Coeff of Variation 2 (%):	1289.459
Total Core Area Index (%):	23.215
Mean Core Area Index (%):	2.601
Mean Nearest Neighbor (m):	54.962
Nearest Neighbor Standard Dev (m):	72.282
Nearest Neigh Coeff of Variation (%):	131.512
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.194
Simpson's Diversity Index:	0.637
Modified Simpson's Diversity Index:	1.012
Patch Richness:	5
Patch Richness Density (#/100 ha):	0.827
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.742
Simpson's Evenness Index:	0.796
Modified Simpson's Evenness Index:	0.629
Interspersion/Juxtaposition Index (%):	65.163
Contagion (%):	40.807

Processing image: 3in.lan
Number of rows, cols: 167, 228
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 22765 cells of background exterior to the landscape found

Class	1:	413 cells,	66 patches
Class	2:	1897 cells,	60 patches
Class	4:	262 cells,	82 patches
Class	5:	5981 cells,	273 patches
Class	6:	6094 cells,	251 patches
Class	9:	450 cells,	105 patches
Class	10:	214 cells,	31 patches

number of classes: 7
max patches/class: 273
max_patch_size: 21443 (background/border patch)

LANDSCAPE INDICES

Total Area (ha):	612.440
Largest Patch Index(%):	5.473
Number of patches:	888
Patch Density (#/100 ha):	144.994
Mean Patch Size (ha):	0.690
Patch Size Standard Dev (ha):	2.599
Patch Size Coeff of Variation (%):	376.828
Total Edge (m):	268020.000
Edge Density (m/ha):	437.627
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	27.075
Mean Shape Index:	1.319
Area-Weighted Mean Shape Index:	2.924
Double Log Fractal Dimension:	1.427
Mean Patch Fractal Dimension:	1.051
Area-Weighted Mean Fractal Dimension:	1.173
Total Core Area (ha):	200.120
Number of Core Areas:	307
Core Area Density (#/100 ha):	50.127
Mean Core Area 1 (ha):	0.225
Core Area Standard Dev 1 (ha):	1.335
Core Area Coeff of Variation 1 (%):	592.417
Mean Core Area 2 (ha):	0.652
Core Area Standard Dev 2 (ha):	2.209
Core Area Coeff of Variation 2 (%):	338.003
Total Core Area Index (%):	32.676
Mean Core Area Index (%):	3.884
Mean Nearest Neighbor (m):	59.383
Nearest Neighbor Standard Dev (m):	77.948
Nearest Neigh Coeff of Variation (%):	131.262
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.323
Simpson's Diversity Index:	0.672
Modified Simpson's Diversity Index:	1.113
Patch Richness:	7
Patch Richness Density (#/100 ha):	1.143
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.680
Simpson's Evenness Index:	0.783
Modified Simpson's Evenness Index:	0.572
Interspersion/Juxtaposition Index (%):	55.280
Contagion (%):	50.062

```
4in
Processing image: 4in.lan
Number of rows, cols: 171, 214
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....


... 21794 cells of background exterior to the landscape found

Class   1:     6424 cells,     202 patches
Class   2:     2578 cells,     122 patches
Class   4:     1227 cells,     290 patches
Class   5:     3034 cells,     281 patches
Class   6:     1143 cells,     133 patches
Class   9:      394 cells,      87 patches

number of classes: 6
max patches/class: 290
max_patch_size: 20114 (background/border patch)
```

LANDSCAPE INDICES

Total Area (ha):	592.000
Largest Patch Index(%):	18.399
Number of patches:	1115
Patch Density (#/100 ha):	188.345
Mean Patch Size (ha):	0.531
Patch Size Standard Dev (ha):	3.731
Patch Size Coeff of Variation (%):	702.718
Total Edge (m):	262500.000
Edge Density (m/ha):	443.412
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	26.972
Mean Shape Index:	1.247
Area-Weighted Mean Shape Index:	3.356
Double Log Fractal Dimension:	1.419
Mean Patch Fractal Dimension:	1.041
Area-Weighted Mean Fractal Dimension:	1.177
Total Core Area (ha):	198.280
Number of Core Areas:	262
Core Area Density (#/100 ha):	44.257
Mean Core Area 1 (ha):	0.178
Core Area Standard Dev 1 (ha):	2.231
Core Area Coeff of Variation 1 (%	1254.305
Mean Core Area 2 (ha):	0.757
Core Area Standard Dev 2 (ha):	4.554
Core Area Coeff of Variation 2 (%):	2560.708
Total Core Area Index (%):	33.493
Mean Core Area Index (%):	2.453
Mean Nearest Neighbor (m):	63.293
Nearest Neighbor Standard Dev (m):	85.044
Nearest Neigh Coeff of Variation (%):	134.366
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.492
Simpson's Diversity Index:	0.726
Modified Simpson's Diversity Index:	1.253
Patch Richness:	6
Patch Richness Density (#/100 ha):	1.014
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.833
Simpson's Evenness Index:	0.871
Modified Simpson's Evenness Index:	0.722
Interspersion/Juxtaposition Index (%):	80.779
Contagion (%):	38.659

Sin

```
Processing image: Sin.lan
Number of rows, cols: 184, 214
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 24515 cells of background exterior to the landscape found

Class   1:     3844 cells,     263 patches
Class   2:       39 cells,      14 patches
Class   4:     2428 cells,     286 patches
Class   5:     3018 cells,     242 patches
Class   6:     3953 cells,     178 patches
Class   9:     1579 cells,     102 patches

number of classes: 6
max patches/class: 288
max_patch_size: 22237 (background/border patch)
```

LANDSCAPE INDICES	
Total Area (ha):	594.440
Largest Patch Index(%):	4.401
Number of patches:	1087
Patch Density (#/100 ha):	182.861
Mean Patch Size (ha):	0.547
Patch Size Standard Dev (ha):	1.850
Patch Size Coeff of Variation (%):	338.260
Total Edge (m):	307520.000
Edge Density (m/ha):	517.327
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	31.533
Mean Shape Index:	1.336
Area-Weighted Mean Shape Index:	2.844
Double Log Fractal Dimension:	1.452
Mean Patch Fractal Dimension:	1.054
Area-Weighted Mean Fractal Dimension:	1.172
Total Core Area (ha):	142.260
Number of Core Areas:	371
Core Area Density (#/100 ha):	62.412
Mean Core Area 1 (ha):	0.131
Core Area Standard Dev 1 (ha):	0.761
Core Area Coeff of Variation 1 (%):	581.142
Mean Core Area 2 (ha):	0.384
Core Area Standard Dev 2 (ha):	1.264
Core Area Coeff of Variation 2 (%):	965.901
Total Core Area Index (%):	23.935
Mean Core Area Index (%):	3.213
Mean Nearest Neighbor (m):	58.377
Nearest Neighbor Standard Dev (m):	81.612
Nearest Neigh Coeff of Variation (%):	139.800
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.576
Simpson's Diversity Index:	0.783
Modified Simpson's Diversity Index:	1.526
Patch Richness:	6
Patch Richness Density (#/100 ha):	1.009
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.879
Simpson's Evenness Index:	0.940
Modified Simpson's Evenness Index:	0.853
Interspersion/Juxtaposition Index (%):	66.664
Contagion (%):	35.992

6in

Processing image: 6in.lan
Number of rows, cols: 179, 192
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 19554 cells of background exterior to the landscape found

Class	1:	126 cells,	50 patches
Class	2:	1921 cells,	104 patches
Class	4:	209 cells,	68 patches
Class	5:	6848 cells,	179 patches
Class	6:	5338 cells,	112 patches
Class	8:	2 cells,	1 patches
Class	9:	52 cells,	15 patches
Class	10:	318 cells,	25 patches

number of classes: 8
max patches/class: 179
max_patch_size: 17415 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	592.560
Largest Patch Index(%):	10.706
Number of patches:	554
Patch Density (#/100 ha):	93.493
Mean Patch Size (ha):	1.070
Patch Size Standard Dev (ha):	4.724
Patch Size Coeff of Variation (%):	441.636
Total Edge (m):	198380.000
Edge Density (m/ha):	334.785
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	20.374
Mean Shape Index:	1.326
Area-Weighted Mean Shape Index:	3.576
Double Log Fractal Dimension:	1.401
Mean Patch Fractal Dimension:	1.050
Area-Weighted Mean Fractal Dimension:	1.187
Total Core Area (ha):	254.240
Number of Core Areas:	215
Core Area Density (#/100 ha):	36.283
Mean Core Area 1 (ha):	0.455
Core Area Standard Dev 1 (ha):	2.499
Core Area Coeff of Variation 1 (%):	544.617
Mean Core Area 2 (ha):	1.183
Core Area Standard Dev 2 (ha):	3.904
Core Area Coeff of Variation 2 (%):	850.678
Total Core Area Index (%):	42.905
Mean Core Area Index (%):	4.481
Mean Nearest Neighbor (m):	58.271
Nearest Neighbor Standard Dev (m):	92.140
Nearest Neigh Coeff of Variation (%):	134.962
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.194
Simpson's Diversity Index:	0.639
Modified Simpson's Diversity Index:	1.019
Patch Richness:	8
Patch Richness Density (#/100 ha):	1.350
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.574
Simpson's Evenness Index:	0.730
Modified Simpson's Evenness Index:	0.490
Interspersion/Juxtaposition Index (%):	43.358
Contagion (%):	58.653

```
Processing image: lex.lan
Number of rows, cols: 119, 167
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 5110 cells of background exterior to the landscape found

Class   1:     6519 cells,     139 patches
Class   2:      886 cells,     145 patches
Class   4:     2959 cells,     223 patches
Class   5:     3488 cells,     207 patches
Class   6:      766 cells,      56 patches
Class   9:      145 cells,      53 patches

number of classes: 6
max patches/class: 223
max patch size: 3503
```

LANDSCAPE INDICES

Total Area (ha):	590.520
Largest Patch Index(%):	23.728
Number of patches:	823
Patch Density (#/100 ha):	139.369
Mean Patch Size (ha):	0.718
Patch Size Standard Dev (ha):	5.274
Patch Size Coeff of Variation (%):	734.999
Total Edge (m):	203960.000
Edge Density (m/ha):	345.391
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	20.983
Mean Shape Index:	1.317
Area-Weighted Mean Shape Index:	3.846
Double Log Fractal Dimension:	1.448
Mean Patch Fractal Dimension:	1.050
Area-Weighted Mean Fractal Dimension:	1.190
Total Core Area (ha):	193.000
Number of Core Areas:	322
Core Area Density (#/100 ha):	54.529
Mean Core Area 1 (ha):	0.235
Core Area Standard Dev 1 (ha):	3.208
Core Area Coeff of Variation 1 (%):	1367.856
Mean Core Area 2 (ha):	0.599
Core Area Standard Dev 2 (ha):	5.107
Core Area Coeff of Variation 2 (%):	2177.705
Total Core Area Index (%):	32.683
Mean Core Area Index (%):	3.461
Mean Nearest Neighbor (m):	51.352
Nearest Neighbor Standard Dev (m):	56.224
Nearest Neigh Coeff of Variation (%):	109.485
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.392
Simpson's Diversity Index:	0.703
Modified Simpson's Diversity Index:	1.213
Patch Richness:	6
Patch Richness Density (#/100 ha):	1.016
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.777
Simpson's Evenness Index:	0.843
Modified Simpson's Evenness Index:	0.677
Interspersion/Juxtaposition Index (%):	74.002
Contagion (%):	37.435

2ex

Processing image: 2ex.lan
Number of rows, cols: 139, 207
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 13677 cells of background exterior to the landscape found

Class	1:	1852 cells,	196 patches
Class	2:	1869 cells,	193 patches
Class	4:	2070 cells,	230 patches
Class	5:	7363 cells,	274 patches
Class	6:	1553 cells,	154 patches
Class	9:	389 cells,	66 patches

number of classes: 6
max patches/class: 274
max_patch_size: 9823 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	603.840
Largest Patch Index(%):	19.032
Number of patches:	1113
Patch Density (#/100 ha):	184.320
Mean Patch Size (ha):	5.543
Patch Size Standard Dev (ha):	3.858
Patch Size Coeff of Variation (%):	711.032
Total Edge (m):	253240.000
Edge Density (m/ha):	419.383
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	25.764
Mean Shape Index:	1.280
Area-Weighted Mean Shape Index:	3.613
Double Log Fractal Dimension:	1.428
Mean Patch Fractal Dimension:	1.047
Area-Weighted Mean Fractal Dimension:	1.176
Total Core Area (ha):	169.320
Number of Core Areas:	332
Core Area Density (#/100 ha):	54.981
Mean Core Area 1 (ha):	0.152
Core Area Standard Dev 1 (ha):	2.132
Core Area Coeff of Variation 1 (%):	1401.427
Mean Core Area 2 (ha):	0.510
Core Area Standard Dev 2 (ha):	3.880
Core Area Coeff of Variation 2 (%):	2550.541
Total Core Area Index (%):	28.041
Mean Core Area Index (%):	2.779
Mean Nearest Neighbor (m):	49.742
Nearest Neighbor Standard Dev (m):	57.944
Nearest Neigh Coeff of Variation (%):	116.486
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.467
Simpson's Diversity Index:	0.702
Modified Simpson's Diversity Index:	1.212
Patch Richness:	6
Patch Richness Density (#/100 ha):	0.994
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.819
Simpson's Evenness Index:	0.842
Modified Simpson's Evenness Index:	0.675
Interspersion/Juxtaposition Index (%):	78.431
Contagion (%):	35.543

3ex

Processing image: 3ex.lan
Number of rows, cols: 129, 199
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 10896 cells of background exterior to the landscape found

Class	1:	6444 cells,	332 patches
Class	2:	268 cells,	37 patches
Class	4:	3843 cells,	355 patches
Class	5:	2862 cells,	241 patches
Class	6:	1119 cells,	117 patches
Class	9:	239 cells,	73 patches

number of classes: 6
max patches/class: 355
max_patch_size: 3506 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	591.000
Largest Patch Index(%):	3.675
Number of patches:	1155
Patch Density (#/100 ha):	195.431
Mean Patch Size (ha):	0.512
Patch Size Standard Dev (ha):	1.446
Patch Size Coeff of Variation (%):	282.635
Total Edge (m):	277820.000
Edge Density (m/ha):	470.085
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	28.570
Mean Shape Index:	1.330
Area-Weighted Mean Shape Index:	2.550
Double Log Fractal Dimension:	1.449
Mean Patch Fractal Dimension:	1.054
Area-Weighted Mean Fractal Dimension:	1.156
Total Core Area (ha):	120.000
Number of Core Areas:	415
Core Area Density (#/100 ha):	70.220
Mean Core Area 1 (ha):	0.104
Core Area Standard Dev 1 (ha):	0.542
Core Area Coeff of Variation 1 (%):	522.006
Mean Core Area 2 (ha):	0.299
Core Area Standard Dev 2 (ha):	0.875
Core Area Coeff of Variation 2 (%):	841.872
Total Core Area Index (%):	20.305
Mean Core Area Index (%):	3.558
Mean Nearest Neighbor (m):	50.314
Nearest Neighbor Standard Dev (m):	60.237
Nearest Neigh Coeff of Variation (%):	119.724
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.265
Simpson's Diversity Index:	0.695
Modified Simpson's Diversity Index:	1.156
Patch Richness:	6
Patch Richness Density (#/100 ha):	1.015
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.762
Simpson's Evenness Index:	0.838
Modified Simpson's Evenness Index:	0.669
Interspersion/Juxtaposition Index (%):	66.676
Contagion (%):	37.062

4ex

Processing image: 4ex.lan
Number of rows, cols: 121, 185
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 7296 cells of background exterior to the landscape found

Class	1:	6106 cells,	290 patches
Class	4:	5550 cells,	356 patches
Class	5:	2385 cells,	250 patches
Class	6:	517 cells,	76 patches
Class	9:	531 cells,	76 patches

Number of classes: 5
max patches/class: 356
max_patch_size: 2140 (background/border patch)

LANDSCAPE INDICES	
Total Area (ha):	603.560
Largest Patch Index(%):	6.879
Number of patches:	1048
Patch Density (#/100 ha):	173.636
Mean Patch Size (ha):	0.576
Patch Size Standard Dev (ha):	2.425
Patch Size Coeff of Variation (%):	421.106
Total Edge (m):	265720.000
Edge Density (m/ha):	440.254
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	27.040
Mean Shape Index:	1.325
Area-Weighted Mean Shape Index:	3.462
Double Log Fractal Dimension:	1.464
Mean Patch Fractal Dimension:	1.051
Area-Weighted Mean Fractal Dimension:	1.187
Total Core Area (ha):	143.520
Number of Core Areas:	392
Core Area Density (#/100 ha):	64.948
Mean Core Area 1 (ha):	0.137
Core Area Standard Dev 1 (ha):	0.951
Core Area Coeff of Variation 1 (%):	694.375
Mean Core Area 2 (ha):	0.366
Core Area Standard Dev 2 (ha):	1.528
Core Area Coeff of Variation 2 (%):	1215.478
Total Core Area Index (%):	23.779
Mean Core Area Index (%):	3.058
Mean Nearest Neighbor (m):	61.461
Nearest Neighbor Standard Dev (m):	49.202
Nearest Neigh Coeff of Variation (%):	115.378
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.259
Simpson's Diversity Index:	0.674
Modified Simpson's Diversity Index:	1.120
Patch Richness:	5
Patch Richness Density (#/100 ha):	0.828
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.782
Simpson's Evenness Index:	0.842
Modified Simpson's Evenness Index:	0.696
Interspersion/Juxtaposition Index (%):	64.294
Contagion (%):	35.251

Sex

```
Processing image: Sex.lan
Number of rows, cols: 127, 199
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 10280 cells of background exterior to the landscape found

Class   1:     3999 cells,     222 patches
Class   2:      262 cells,      52 patches
Class   4:     1973 cells,     264 patches
Class   5:     3614 cells,     344 patches
Class   6:     3887 cells,     293 patches
Class   9:     1258 cells,     177 patches

number of classes: 6
max patches/class: 344
max_patch_size: 5430 (background/border patch)
```

LANDSCAPE INDICES

Total Area (ha):	599.720
Largest Patch Index(%):	4.182
Number of patches:	1352
Patch Density (#/100 ha):	225.439
Mean Patch Size (ha):	0.444
Patch Size Standard Dev (ha):	1.258
Patch Size Coeff of Variation (%):	283.500
Total Edge (m):	298460.000
Edge Density (m/ha):	497.666
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	30.469
Mean Shape Index:	1.319
Area-Weighted Mean Shape Index:	2.390
Double Log Fractal Dimension:	1.451
Mean Patch Fractal Dimension:	1.053
Area-Weighted Mean Fractal Dimension:	1.149
Total Core Area (ha):	111.640
Number of Core Areas:	396
Core Area Density (#/100 ha):	66.031
Mean Core Area 1 (ha):	0.283
Core Area Standard Dev 1 (ha):	0.509
Core Area Coeff of Variation 1 (%):	518.321
Mean Core Area 2 (ha):	0.282
Core Area Standard Dev 2 (ha):	0.910
Core Area Coeff of Variation 2 (%):	1102.019
Total Core Area Index (%):	18.615
Mean Core Area Index (%):	2.946
Mean Nearest Neighbor (m):	43.716
Nearest Neighbor Standard Dev (m):	50.273
Nearest Neigh Coeff of Variation (%):	115.000
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.591
Simpson's Diversity Index:	0.779
Modified Simpson's Diversity Index:	1.509
Patch Richness:	6
Patch Richness Density (#/100 ha):	1.000
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.888
Simpson's Evenness Index:	0.935
Modified Simpson's Evenness Index:	0.842
Interspersion/Juxtaposition Index (%):	77.824
Contagion (%):	28.517

```
6ex

Processing image: 6ex.lan
Number of rows, cols: 135, 223
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 14762 cells of background exterior to the landscape found

Class    1:      782 cells,      80 patches
Class    2:     1838 cells,     110 patches
Class    4:      654 cells,      98 patches
Class    5:     7007 cells,     292 patches
Class    6:     4248 cells,     306 patches
Class    9:      450 cells,      75 patches
Class   10:      364 cells,      21 patches

number of classes: 7
max patches/class: 306
max_patch_size: 13417 (background/border patch)

LANDSCAPE INDICES
Total Area (ha):                          613.720
Largest Patch Index(%):                    17.285
Number of patches:                            982
Patch Density (#/100 ha):                 160.008
Mean Patch Size (ha):                       0.625
Patch Size Standard Dev (ha):               3.856
Patch Size Coeff of Variation (%):        617.030
Total Edge (m):                        248160.000
Edge Density (m/ha):                      404.354
Contrast-Weight Edge Density (m/ha):           NA
Total Edge Contrast Index (%):                 NA
Mean Edge Contrast Index (%):                  NA
Area-Weighted Mean Edge Contrast (%):          NA
Landscape Shape Index:                     25.043
Mean Shape Index:                           1.290
Area-Weighted Mean Shape Index:             3.225
Double Log Fractal Dimension:               1.414
Mean Patch Fractal Dimension:               1.042
Area-Weighted Mean Fractal Dimension:       1.159
Total Core Area (ha):                     383.766
```

Date: Fri Jun 9 00:00:06 1995
Image Name: 2010in.gis
Basename For Output Files: 2010in
Rows: 80 Cols: 165 Cellsize: 20.0 Data Type: 5
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used: Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	200.080
Largest Patch Index(%):	19.452
Number of patches:	383
Patch Density (#/100 ha):	191.423
Mean Patch Size (ha):	0.522
Patch Size Standard Dev (ha):	2.325
Patch Size Coeff of Variation (%):	445.007
Total Edge (m):	96860.000
Edge Density (m/ha):	484.106
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	17.119
Mean Shape Index:	1.294
Area-Weighted Mean Shape Index:	2.849
Double Log Fractal Dimension:	1.428
Mean Patch Fractal Dimension:	1.049
Area-Weighted Mean Fractal Dimension:	1.165
Total Core Area (ha):	55.800
Number of Core Areas:	96
Core Area Density (#/100 ha):	47.951
Mean Core Area 1 (ha):	0.146
Core Area Standard Dev 1 (ha):	1.144
Core Area Coeff of Variation 1 (%):	784.914
Mean Core Area 2 (ha):	0.581
Core Area Standard Dev 2 (ha):	2.228
Core Area Coeff of Variation 2 (%):	1529.272
Total Core Area Index (%):	27.889
Mean Core Area Index (%):	2.943
Mean Nearest Neighbor (m):	53.139
Nearest Neighbor Standard Dev (m):	67.629
Nearest Neigh Coeff of Variation (%):	127.267
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.285
Simpson's Diversity Index:	0.664
Modified Simpson's Diversity Index:	1.092
Patch Richness:	5
Patch Richness Density (#/100 ha):	2.499
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.798
Simpson's Evenness Index:	0.831
Modified Simpson's Evenness Index:	0.678
Interspersion/Juxtaposition Index (%):	73.990
Contagion (%):	38.639

Date: Thu Jun 8 23:52:02 1995
Image Name: 2001in.gis
Basename For Output Files: 2001in
Rows: 80 Cols: 101 Cellsize: 20.0 Data Type: 5
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used: Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	206.000
Largest Patch Index(%):	67.417
Number of patches:	190
Patch Density (#/100 ha):	92.233
Mean Patch Size (ha):	1.084
Patch Size Standard Dev (ha):	10.121
Patch Size Coeff of Variation (%):	931.680
Total Edge (m):	62640.000
Edge Density (m/ha):	304.078
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	12.911
Mean Shape Index:	1.236
Area-Weighted Mean Shape Index:	5.227
Double Log Fractal Dimension:	1.415
Mean Patch Fractal Dimension:	1.039
Area-Weighted Mean Fractal Dimension:	1.241
Total Core Area (ha):	97.349
Number of Core Areas:	61
Core Area Density (#/100 ha):	29.612
Mean Core Area 1 (ha):	1.511
Core Area Standard Dev 1 (ha):	5.828
Core Area Coeff of Variation 1 (%):	1141.033
Mean Core Area 2 (ha):	1.591
Core Area Standard Dev 2 (ha):	10.201
Core Area Coeff of Variation 2 (%):	1997.345
Total Core Area Index (%):	47.107
Mean Core Area Index (%):	2.561
Mean Nearest Neighbor (m):	98.750
Nearest Neighbor Standard Dev (m):	144.795
Nearest Neigh Coeff of Variation (%):	162.149
Mean Proximity Index:	NA
Shannon's Diversity Index:	0.792
Simpson's Diversity Index:	0.357
Modified Simpson's Diversity Index:	0.442
Patch Richness:	5
Patch Richness Density (#/100 ha):	2.913
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.442
Simpson's Evenness Index:	0.428
Modified Simpson's Evenness Index:	0.246
Interspersion/Juxtaposition Index (%):	53.395
Contagion (%):	45.102

Date: Thu Jun 8 23:52:49 1995
Image Name: 2002in.gis
Basename For Output Files: 2002in
Rows: 102 Cols: 151 Cellsize: 20.0 Data Type: S
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	197.840
Largest Patch Index(%):	11.646
Number of patches:	442
Patch Density (#/100 ha):	223.413
Mean Patch Size (ha):	0.448
Patch Size Standard Dev (ha):	1.633
Patch Size Coeff of Variation (%):	364.880
Total Edge (m):	109640.000
Edge Density (m/ha):	554.185
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	19.487
Mean Shape Index:	1.283
Area-Weighted Mean Shape Index:	2.616
Double Log Fractal Dimension:	1.429
Mean Patch Fractal Dimension:	1.048
Area-Weighted Mean Fractal Dimension:	1.158
Total Core Area (ha):	46.490
Number of Core Areas:	108
Core Area Density (#/100 ha):	54.590
Mean Core Area 1 (ha):	0.105
Core Area Standard Dev 1 (ha):	0.709
Core Area Coeff of Variation 1 (%):	674.531
Mean Core Area 2 (ha):	0.430
Core Area Standard Dev 2 (ha):	1.385
Core Area Coeff of Variation 2 (%):	1217.395
Total Core Area Index (%):	23.494
Mean Core Area Index (%):	2.754
Mean Nearest Neighbor (m):	62.906
Nearest Neighbor Standard Dev (m):	86.961
Nearest Neigh Coeff of Variation (%):	138.229
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.287
Simpson's Diversity Index:	0.620
Modified Simpson's Diversity Index:	0.968
Patch Richness:	6
Patch Richness Density (#/100 ha):	3.032
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.718
Simpson's Evenness Index:	0.744
Modified Simpson's Evenness Index:	0.540
Interspersion/Juxtaposition Index (%):	56.744

Date: Thu Jun 8 23:53:44 1995
Image Name: 2003in.gis
Basename For Output Files: 2003in
Rows: 95 Cols: 145 Cellsize: 20.0 Data Type: I
Edge Dist: 20.0 Max Patch Type Possible: N0 Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	206.320
Largest Patch Index(%):	10.392
Number of patches:	383
Patch Density (#/100 ha):	185.634
Mean Patch Size (ha):	0.539
Patch Size Standard Dev (ha):	1.629
Patch Size Coeff of Variation (%):	302.432
Total Edge (m):	110700.000
Edge Density (m/ha):	536.545
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	19.257
Mean Shape Index:	1.361
Area-Weighted Mean Shape Index:	2.808
Double Log Fractal Dimension:	1.476
Mean Patch Fractal Dimension:	1.056
Area-Weighted Mean Fractal Dimension:	1.175
Total Core Area (ha):	44.000
Number of Core Areas:	127
Core Area Density (#/100 ha):	55.402
Mean Core Area 1 (ha):	0.115
Core Area Standard Dev 1 (ha):	0.615
Core Area Coeff of Variation 1 (%):	535.386
Mean Core Area 2 (ha):	0.321
Core Area Standard Dev 2 (ha):	0.996
Core Area Coeff of Variation 2 (%):	866.679
Total Core Area Index (%):	21.326
Mean Core Area Index (%):	3.162
Mean Nearest Neighbor (m):	56.406
Nearest Neighbor Standard Dev (m):	102.784
Nearest Neigh Coeff of Variation (%):	182.222
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.249
Simpson's Diversity Index:	0.680
Modified Simpson's Diversity Index:	1.139
Patch Richness:	5
Patch Richness Density (#/100 ha):	2.423
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.776
Simpson's Evenness Index:	0.850
Modified Simpson's Evenness Index:	0.708
Interspersion/Juxtaposition Index (%):	57.378
Contagion (%):	70.156

Date: Thu Jun 8 23:55:05 1995
Image Name: 2004in.gis
Basename For Output Files: 2004in
Rows: 83 Cols: 133 Cellsize: 20.0 Data Type: 5
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	195.960
Largest Patch Index(%):	12.268
Number of patches:	292
Patch Density (#/100 ha):	149.010
Mean Patch Size (ha):	0.671
Patch Size Standard Dev (ha):	2.170
Patch Size Coeff of Variation (%):	323.340
Total Edge (m):	93320.000
Edge Density (m/ha):	476.220
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	16.666
Mean Shape Index:	1.363
Area-Weighted Mean Shape Index:	3.082
Double Log Fractal Dimension:	1.450
Mean Patch Fractal Dimension:	1.055
Area-Weighted Mean Fractal Dimension:	1.180
Total Core Area (ha):	50.725
Number of Core Areas:	124
Core Area Density (#/100 ha):	63.278
Mean Core Area 1 (ha):	0.174
Core Area Standard Dev 1 (ha):	0.611
Core Area Coeff of Variation 1 (%):	350.984
Mean Core Area 2 (ha):	0.409
Core Area Standard Dev 2 (ha):	1.205
Core Area Coeff of Variation 2 (%):	293.995
Total Core Area Index (%):	25.883
Mean Core Area Index (%):	4.061
Mean Nearest Neighbor (m):	64.672
Nearest Neighbor Standard Dev (m):	95.124
Nearest Neigh Coeff of Variation (%):	147.103
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.336
Simpson's Diversity Index:	0.688
Modified Simpson's Diversity Index:	1.164
Patch Richness:	6
Patch Richness Density (#/100 ha):	3.062
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.746
Simpson's Evenness Index:	0.625
Modified Simpson's Evenness Index:	1.044
Interspersion-Juxtaposition Index (%):	33.360

Date: Thu Jun 8 23:55:51 1995
Image Name: 2005in.gis
Basename For Output Files: 2005i
Rows: 75 Cols: 125 Cellsize: 20.0 Data Type: 6
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices, Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	201.080
Largest Patch Index(%):	30.953
Number of patches:	159
Patch Density (#/100 ha):	79.066
Mean Patch Size (ha):	1.010
Patch Size Standard Dev (ha):	5.225
Patch Size Coeff of Variation (%):	517.150
Total Edge (m):	73620.000
Edge Density (m/ha):	366.123
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	12.979
Mean Shape Index:	1.316
Area-Weighted Mean Shape Index:	4.256
Double Log Fractal Dimension:	1.423
Mean Patch Fractal Dimension:	1.046
Area-Weighted Mean Fractal Dimension:	1.210
Total Core Area (ha):	78.600
Number of Core Areas:	82
Core Area Density (#/100 ha):	40.782
Mean Core Area 1 (ha):	0.395
Core Area Standard Dev 1 (ha):	2.564
Core Area Coeff of Variation 1 (%):	649.163
Mean Core Area 2 (ha):	0.477
Core Area Standard Dev 2 (ha):	3.929
Core Area Coeff of Variation 2 (%):	824.757
Total Core Area Index (%):	39.084
Mean Core Area Index (%):	3.991
Mean Nearest Neighbor (m):	57.322
Nearest Neighbor Standard Dev (m):	60.781
Nearest Neigh Coeff of Variation (%):	146.160
Mean Proximity Index:	NA
Shannon's Diversity Index:	0.901
Simpson's Diversity Index:	0.502
Modified Simpson's Diversity Index:	0.697
Patch Richness:	7
Patch Richness Density (#/100 ha):	3.481
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.463
Simpson's Evenness Index:	0.586
Modified Simpson's Evenness Index:	0.358
Interspersion/Juxtaposition Index (%):	34.843
Contagion (%):	44.329

Date: Thu Jun 8 23:57:29 1995
Image Name: 2006in.gis
Basename For Output Files: 2006in
Rows: 70 Cols: 122 Cellsize: 20.0 Data Type: 5
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	205.600
Largest Patch Index(%):	22.335
Number of patches:	184
Patch Density (#/100 ha):	89.494
Mean Patch Size (ha):	1.117
Patch Size Standard Dev (ha):	4.255
Patch Size Coeff of Variation (%):	380.827
Total Edge (m):	71360.000
Edge Density (m/ha):	347.179
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	12.445
Mean Shape Index:	1.351
Area-Weighted Mean Shape Index:	3.480
Double Log Fractal Dimension:	1.410
Mean Patch Fractal Dimension:	1.051
Area-Weighted Mean Fractal Dimension:	1.190
Total Core Area (ha):	59.722
Number of Core Areas:	97
Core Area Density (#/100 ha):	42.315
Mean Core Area 1 (ha):	0.439
Core Area Standard Dev 1 (ha):	2.120
Core Area Coeff of Variation 1 (%):	483.364
Mean Core Area 2 (ha):	0.329
Core Area Standard Dev 2 (ha):	3.009
Core Area Coeff of Variation 2 (%):	685.471
Total Core Area Index (%):	29.051
Mean Core Area Index (%):	5.466
Mean Nearest Neighbor (m):	48.047
Nearest Neighbor Standard Dev (m):	42.405
Nearest Neigh Coeff of Variation (%):	134.046
Mean Proximity Index:	NA
Shannon's Diversity Index:	0.965
Simpson's Diversity Index:	0.561
Modified Simpson's Diversity Index:	0.824
Patch Richness:	5
Patch Richness Density (#/100 ha):	2.918
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.538
Simpson's Evenness Index:	0.574
Modified Simpson's Evenness Index:	0.460
Interspersion/Juxtaposition Index (%):	37.372
Contagion (%):	59.378

Date: Thu Jun 8 23:58:11 1995
Image Name: 2007in.gis
Basename For Output Files: 2007in
Rows: 83 Cols: 137 Cellsize: 20.0 Data Type: S
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used: Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	199.840
Largest Patch Index(%):	9.648
Number of patches:	237
Patch Density (#/100 ha):	118.595
Mean Patch Size (ha):	0.843
Patch Size Standard Dev (ha):	2.485
Patch Size Coeff of Variation (%):	294.751
Total Edge (m):	74760.000
Edge Density (m/ha):	374.099
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	10.221
Mean Shape Index:	1.321
Area-Weighted Mean Shape Index:	2.466
Double Log Fractal Dimension:	1.277
Mean Patch Fractal Dimension:	1.052
Area-Weighted Mean Fractal Dimension:	1.152
Total Core Area (ha):	81.900
Number of Core Areas:	72
Core Area Density (#/100 ha):	36.029
Mean Core Area 1 (ha):	0.345
Core Area Standard Dev 1 (ha):	1.357
Core Area Coeff of Variation 1 (%):	392.132
Mean Core Area 2 (ha):	1.136
Core Area Standard Dev 2 (ha):	2.265
Core Area Coeff of Variation 2 (%):	656.291
Total Core Area Index (%):	40.932
Mean Core Area Index (%):	4.964
Mean Nearest Neighbor (m):	79.138
Nearest Neighbor Standard Dev (m):	110.476
Nearest Neigh Coeff of Variation (%):	139.600
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.199
Simpson's Diversity Index:	0.622
Modified Simpson's Diversity Index:	0.999
Patch Richness:	9
Patch Richness Density (#/100 ha):	4.003
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.576
Simpson's Evenness Index:	0.722
Modified Simpson's Evenness Index:	0.481
Interspersion/Juxtaposition Index (%):	44.435
Contagion (%):	52.496

Date: Thu Jun 8 23:58:50 1995
Image Name: 2008in.gis
Basename For Output Files: 2008in
Rows: 99 Cols: 169 Cellsize: 20.0 Data Type: 5
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used: Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	201.080
Largest Patch Index(%):	21.504
Number of patches:	380
Patch Density (#/100 ha):	188.980
Mean Patch Size (ha):	0.529
Patch Size Standard Dev (ha):	2.594
Patch Size Coeff of Variation (%):	490.129
Total Edge (m):	99220.000
Edge Density (m/ha):	493.435
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	17.493
Mean Shape Index:	1.304
Area-Weighted Mean Shape Index:	3.480
Double Log Fractal Dimension:	1.442
Mean Patch Fractal Dimension:	1.049
Area-Weighted Mean Fractal Dimension:	1.183
Total Core Area (ha):	49.520
Number of Core Areas:	117
Core Area Density (#/100 ha):	58.184
Mean Core Area 1 (ha):	0.100
Core Area Standard Dev 1 (ha):	1.064
Core Area Coeff of Variation 1 (%):	836.716
Mean Core Area 2 (ha):	0.422
Core Area Standard Dev 2 (ha):	1.885
Core Area Coeff of Variation 2 (%):	1446.962
Total Core Area Index (%):	24.627
Mean Core Area Index (%):	2.329
Mean Nearest Neighbor (m):	53.216
Nearest Neighbor Standard Dev (m):	93.940
Nearest Neigh Coeff of Variation (%):	176.497
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.192
Simpson's Diversity Index:	0.648
Modified Simpson's Diversity Index:	1.065
Patch Richness:	5
Patch Richness Density (#/100 ha):	2.484
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.665
Simpson's Evenness Index:	0.778
Modified Simpson's Evenness Index:	0.582
Interspersion/Juxtaposition Index (%):	56.735
Contagion (%):	45.970

Date: Thu Jun 8 23:59:24 1995
Image Name: 2009in.gis
Basename For Output Files: 2009in
Rows: 80 Cols: 165 Cellsize: 20.0 Data Type: S
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used: Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	197.920
Largest Patch Index(%):	18.048
Number of patches:	431
Patch Density (#/100 ha):	217.765
Mean Patch Size (ha):	0.459
Patch Size Standard Dev (ha):	2.013
Patch Size Coeff of Variation (%):	438.371
Total Edge (m):	96000.000
Edge Density (m/ha):	485.044
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	17.060
Mean Shape Index:	1.251
Area-Weighted Mean Shape Index:	2.409
Double Log Fractal Dimension:	1.402
Mean Patch Fractal Dimension:	1.044
Area-Weighted Mean Fractal Dimension:	1.146
Total Core Area (ha):	53.560
Number of Core Areas:	46
Core Area Density (#/100 ha):	23.234
Mean Core Area 1 (ha):	0.139
Core Area Standard Dev 1 (ha):	1.214
Core Area Coeff of Variation 1 (%):	879.822
Mean Core Area 2 (ha):	0.620
Core Area Standard Dev 2 (ha):	2.617
Core Area Coeff of Variation 2 (%):	1821.744
Total Core Area Index (%):	30.093
Mean Core Area Index (%):	2.970
Mean Nearest Neighbor (m):	63.481
Nearest Neighbor Standard Dev (m):	74.745
Nearest Neigh Coeff of Variation (%):	117.743
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.567
Simpson's Diversity Index:	0.759
Modified Simpson's Diversity Index:	1.424
Patch Richness:	5
Patch Richness Density (#/100 ha):	3.032
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.875
Simpson's Evenness Index:	0.511
Modified Simpson's Evenness Index:	0.795
Interspersion/Juxtaposition Index (%):	79.574
Contagion (%):	35.722

Date: Fri Jun 9 00:04:32 1995
Image Name: 2001ex.gis
Basename For Output Files: 2001ex
Rows: 86 Cols: 107 Cellsize: 20.0 Data Type: S
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	199.440
Largest Patch Index(%):	12.254
Number of patches:	400
Patch Density (#/100 ha):	200.562
Mean Patch Size (ha):	0.499
Patch Size Standard Dev (ha):	1.045
Patch Size Coeff of Variation (%):	410.162
Total Edge (m):	89260.000
Edge Density (m/ha):	447.553
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	15.801
Mean Shape Index:	1.704
Area-Weighted Mean Shape Index:	3.101
Double Log Fractal Dimension:	1.456
Mean Patch Fractal Dimension:	1.059
Area-Weighted Mean Fractal Dimension:	1.178
Total Core Area (ha):	44.120
Number of Core Areas:	127
Core Area Density (#/100 ha):	63.678
Mean Core Area 1 (ha):	0.111
Core Area Standard Dev 1 (ha):	0.879
Core Area Coeff of Variation 1 (%):	793.375
Mean Core Area 2 (ha):	0.347
Core Area Standard Dev 2 (ha):	1.521
Core Area Coeff of Variation 2 (%):	1388.456
Total Core Area Index (%):	22.122
Mean Core Area Index (%):	3.464
Mean Nearest Neighbor (m):	48.010
Nearest Neighbor Standard Dev (m):	58.916
Nearest Neigh Coeff of Variation (%):	122.717
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.229
Simpson's Diversity Index:	0.661
Modified Simpson's Diversity Index:	1.091
Patch Richness:	6
Patch Richness Density (#/100 ha):	3.008
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.685
Simpson's Evenness Index:	0.732
Modified Simpson's Evenness Index:	0.607
Interspersion Juxtaposition Index (%):	55.[illegible]
Contagion (%):	67.[illegible]

Date: Fri Jun 9 00:05:09 1995
Image Name: 2002ex.gis
Basename For Output Files: 2002ex
Rows: 86 Cols: 129 Cellsize: 20.0 Data Type: S
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	203.680
Largest Patch Index(%):	40.082
Number of patches:	317
Patch Density (#/100 ha):	155.636
Mean Patch Size (ha):	0.642
Patch Size Standard Dev (ha):	4.863
Patch Size Coeff of Variation (%):	756.786
Total Edge (m):	78860.000
Edge Density (m/ha):	387.176
Contrast-Weight Edge Density (%/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	13.814
Mean Shape Index:	1.243
Area-Weighted Mean Shape Index:	2.995
Double Log Fractal Dimension:	1.385
Mean Patch Fractal Dimension:	1.042
Area-Weighted Mean Fractal Dimension:	1.185
Total Core Area (ha):	75.460
Number of Core Areas:	97
Core Area Density (#/100 ha):	47.624
Mean Core Area 1 (ha):	0.235
Core Area Standard Dev 1 (ha):	2.762
Core Area Coeff of Variation 1 (%):	1159.902
Mean Core Area 2 (ha):	0.778
Core Area Standard Dev 2 (ha):	4.950
Core Area Coeff of Variation 2 (%):	2078.090
Total Core Area Index (%):	37.058
Mean Core Area Index (%):	3.114
Mean Nearest Neighbor (m):	64.141
Nearest Neighbor Standard Dev (m):	105.230
Nearest Neigh Coeff of Variation (%):	164.060
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.098
Simpson's Diversity Index:	0.520
Modified Simpson's Diversity Index:	0.734
Patch Richness:	5
Patch Richness Density (#/100 ha):	2.946
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.613
Simpson's Evenness Index:	0.524
Modified Simpson's Evenness Index:	0.410
Interspersion/Juxtaposition Index (%):	46.700
Contagion (%):	52.567

Rows: 66 Cols: 133 Cellsize: 20.0 Data Type: 5
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	201.440
Largest Patch Index(%):	15.012
Number of patches:	274
Patch Density (#/100 ha):	136.021
Mean Patch Size (ha):	0.735
Patch Size Standard Dev (ha):	2.382
Patch Size Coeff of Variation (%):	324.061
Total Edge (m):	79980.000
Edge Density (m/ha):	397.041
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	14.088
Mean Shape Index:	1.365
Area-Weighted Mean Shape Index:	2.624
Double Log Fractal Dimension:	1.437
Mean Patch Fractal Dimension:	1.056
Area-Weighted Mean Fractal Dimension:	1.157
Total Core Area (ha):	58.640
Number of Core Areas:	128
Core Area Density (#/100 ha):	63.542
Mean Core Area 1 (ha):	0.214
Core Area Standard Dev 1 (ha):	1.389
Core Area Coeff of Variation 1 (%):	649.021
Mean Core Area 2 (ha):	0.458
Core Area Standard Dev 2 (ha):	2.005
Core Area Coeff of Variation 2 (%):	936.630
Total Core Area Index (%):	29.110
Mean Core Area Index (%):	5.071
Mean Nearest Neighbor (m):	59.041
Nearest Neighbor Standard Dev (m):	114.076
Nearest Neigh Coeff of Variation (%):	193.215
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.505
Simpson's Diversity Index:	0.741
Modified Simpson's Diversity Index:	1.351
Patch Richness:	7
Patch Richness Density (#/100 ha):	3.475
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.773
Simpson's Evenness Index:	0.864
Modified Simpson's Evenness Index:	0.694
Interspersion/Juxtaposition Index (%):	62.567
Contagion (%):	41.253

Date: Fri Jun 9 00:06:19 1995
Image Name: 2004ex.gis
Basename For Output Files: 2004ex
Rows: 59 Cols: 127 Cellsize: 20.0 Data Type: 5
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	194.280
Largest Patch Index(%):	20.362
Number of patches:	340
Patch Density (#/100 ha):	175.005
Mean Patch Size (ha):	0.571
Patch Size Standard Dev (ha):	2.425
Patch Size Coeff of Variation (%):	425.164
Total Edge (m):	86100.000
Edge Density (m/ha):	443.175
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	15.442
Mean Shape Index:	1.332
Area-Weighted Mean Shape Index:	2.420
Double Log Fractal Dimension:	1.474
Mean Patch Fractal Dimension:	1.052
Area-Weighted Mean Fractal Dimension:	1.185
Total Core Area (ha):	42.520
Number of Core Areas:	122
Core Area Density (#/100 ha):	62.777
Mean Core Area 1 (ha):	0.103
Core Area Standard Dev 1 (ha):	0.335
Core Area Coeff of Variation 1 (%):	323.772
Mean Core Area 2 (ha):	0.764
Core Area Standard Dev 2 (ha):	1.530
Core Area Coeff of Variation 2 (%):	1223.472
Total Core Area Index (%):	21.886
Mean Core Area Index (%):	2.006
Mean Nearest Neighbor (m):	42.670
Nearest Neighbor Standard Dev (m):	53.886
Nearest Neigh Coeff of Variation (%):	126.299
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.423
Simpson's Diversity Index:	0.722
Modified Simpson's Diversity Index:	1.319
Patch Richness:	5
Patch Richness Density (#/100 ha):	2.574
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.885
Simpson's Evenness Index:	0.915
Modified Simpson's Evenness Index:	0.819
Interspersion/Juxtaposition Index (%):	74.460
Contagion (%):	59.351

Date: Fri Jun 9 00:06:57 1995
Image Name: 200Sex.gis
Basename For Output Files: 200Sex
Rows: 68 Cols: 153 Cellsize: 20.0 Data Type: 5
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	199.520
Largest Patch Index(%):	7.398
Number of patches:	470
Patch Density (#/100 ha):	237.069
Mean Patch Size (ha):	0.42
Patch Size Standard Dev (ha):	1.090
Patch Size Coeff of Variation (%):	259.448
Total Edge (m):	106400.000
Edge Density (m/ha):	533.280
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	18.832
Mean Shape Index:	1.294
Area-Weighted Mean Shape Index:	2.201
Double Log Fractal Dimension:	1.422
Mean Patch Fractal Dimension:	1.051
Area-Weighted Mean Fractal Dimension:	1.124
Total Core Area (ha):	35.820
Number of Core Areas:	149
Core Area Density (#/100 ha):	74.672
Mean Core Area 1 (ha):	0.075
Core Area Standard Dev 1 (ha):	0.372
Core Area Coeff of Variation 1 (%):	491.664
Mean Core Area 2 (ha):	0.249
Core Area Standard Dev 2 (ha):	0.640
Core Area Coeff of Variation 2 (%):	850.440
Total Core Area Index (%):	17.843
Mean Core Area Index (%):	3.468
Mean Nearest Neighbor (m):	53.785
Nearest Neighbor Standard Dev (m):	53.017
Nearest Neigh Coeff of Variation (%):	117.160
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.322
Simpson's Diversity Index:	0.665
Modified Simpson's Diversity Index:	1.094
Patch Richness:	5
Patch Richness Density (#/100 ha):	3.007
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.722
Simpson's Evenness Index:	0.799
Modified Simpson's Evenness Index:	0.611
Interspersion/Juxtaposition Index (%):	0.000
Contagion (%):	46.629

Date: Fri Jun 9 00:07:30 1995
Image Name: 2006ex.gis
Basename For Output Files: 2006ex
Rows: 78 Cols: 173 Cellsize: 20.0 Data Type: 5
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	200.320
Largest Patch Index(%):	9.026
Number of patches:	529
Patch Density (#/100 ha):	264.077
Mean Patch Size (ha):	0.379
Patch Size Standard Dev (ha):	1.158
Patch Size Coeff of Variation (%):	305.696
Total Edge (m):	110020.000
Edge Density (m/ha):	549.221
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	19.433
Mean Shape Index:	1.269
Area-Weighted Mean Shape Index:	2.302
Double Log Fractal Dimension:	1.422
Mean Patch Fractal Dimension:	1.047
Area-Weighted Mean Fractal Dimension:	1.161
Total Core Area (ha):	35.820
Number of Core Areas:	137
Core Area Density (#/100 ha):	68.391
Mean Core Area 1 (ha):	0.067
Core Area Standard Dev 1 (ha):	0.451
Core Area Coeff of Variation 1 (%):	671.854
Mean Core Area 2 (ha):	0.259
Core Area Standard Dev 2 (ha):	3.356
Core Area Coeff of Variation 2 (%):	1277.681
Total Core Area Index (%):	17.732
Mean Core Area Index (%):	2.433
Mean Nearest Neighbor (m):	48.742
Nearest Neighbor Standard Dev (m):	51.209
Nearest Neigh Coeff of Variation (%):	105.062
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.345
Simpson's Diversity Index:	0.705
Modified Simpson's Diversity Index:	1.222
Patch Richness:	6
Patch Richness Density (#/100 ha):	2.995
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.751
Simpson's Evenness Index:	0.846
Modified Simpson's Evenness Index:	0.682
Interspersion/Juxtaposition Index (%):	64.102
Contagion (%):	38.351

Date: Fri Jun 9 00:08:17 1995
Image Name: 2007ex.gis
Basename For Output Files: 2007ex
Rows: 70 Cols: 169 Cellsize: 20.0 Data Type: 5
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	155.640
Largest Patch Index(%):	18.350
Number of patches:	196
Patch Density (#/100 ha):	125.932
Mean Patch Size (ha):	0.794
Patch Size Standard Dev (ha):	2.905
Patch Size Coeff of Variation (%):	365.852
Total Edge (m):	55500.000
Edge Density (m/ha):	356.592
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	11.122
Mean Shape Index:	1.281
Area-Weighted Mean Shape Index:	2.508
Double Log Fractal Dimension:	1.370
Mean Patch Fractal Dimension:	1.047
Area-Weighted Mean Fractal Dimension:	1.149
Total Core Area (ha):	58.640
Number of Core Areas:	43
Core Area Density (#/100 ha):	27.628
Mean Core Area 1 (ha):	0.350
Core Area Standard Dev 1 (ha):	1.736
Core Area Coeff of Variation 1 (%):	495.600
Mean Core Area 2 (ha):	1.596
Core Area Standard Dev 2 (ha):	3.427
Core Area Coeff of Variation 2 (%):	978.459
Total Core Area Index (%):	44.102
Mean Core Area Index (%):	4.449
Mean Nearest Neighbor (m):	80.311
Nearest Neighbor Standard Dev (m):	141.136
Nearest Neigh Coeff of Variation (%):	175.736
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.275
Simpson's Diversity Index:	0.653
Modified Simpson's Diversity Index:	1.058
Patch Richness:	3
Patch Richness Density (#/100 ha):	5.140
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.613
Simpson's Evenness Index:	0.746
Modified Simpson's Evenness Index:	0.509
Interspersion/Juxtaposition Index (%):	50.719
Contagion (%):	56.721

Date: Fri Jun 9 00:13:30 1995
Image Name: 2008ex.gis
Basename For Output Files: 2008ex
Rows: 58 Cols: 119 Cellsize: 20.0 Data Type: 5
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	203.120
Largest Patch Index(%):	12.267
Number of patches:	341
Patch Density (#/100 ha):	167.881
Mean Patch Size (ha):	0.596
Patch Size Standard Dev (ha):	1.771
Patch Size Coeff of Variation (%):	297.293
Total Edge (m):	86840.000
Edge Density (m/ha):	427.531
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	15.233
Mean Shape Index:	1.349
Area-Weighted Mean Shape Index:	2.764
Double Log Fractal Dimension:	1.452
Mean Patch Fractal Dimension:	1.054
Area-Weighted Mean Fractal Dimension:	1.163
Total Core Area (ha):	44.980
Number of Core Areas:	147
Core Area Density (#/100 ha):	72.371
Mean Core Area 1 (ha):	0.132
Core Area Standard Dev 1 (ha):	0.550
Core Area Coeff of Variation 1 (%):	492.798
Mean Core Area 2 (ha):	0.305
Core Area Standard Dev 2 (ha):	0.963
Core Area Coeff of Variation 2 (%):	731.451
Total Core Area Index (%):	22.095
Mean Core Area Index (%):	4.094
Mean Nearest Neighbor (m):	43.464
Nearest Neighbor Standard Dev (m):	42.617
Nearest Neigh Coeff of Variation (%):	98.056
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.480
Simpson's Diversity Index:	0.751
Modified Simpson's Diversity Index:	1.391
Patch Richness:	5
Patch Richness Density (#/100 ha):	2.462
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.919
Simpson's Evenness Index:	0.939
Modified Simpson's Evenness Index:	0.864
Interspersion/Juxtaposition Index (%):	78.837
Contagion (%):	26.215

Date: Fri Jun 9 00:09:02 1995
Image Name: 2009ex.gis
Basename For Output Files: 2009ex
Rows: 62 Cols: 119 Cellsize: 20.0 Data Type: S
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	203.520
Largest Patch Index(%):	5.326
Number of patches:	486
Patch Density (#/100 ha):	238.797
Mean Patch Size (ha):	0.419
Patch Size Standard Dev (ha):	0.979
Patch Size Coeff of Variation (%):	233.796
Total Edge (m):	100860.000
Edge Density (m/ha):	495.575
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	27.640
Mean Shape Index:	1.216
Area-Weighted Mean Shape Index:	2.362
Double Log Fractal Dimension:	1.445
Mean Patch Fractal Dimension:	1.053
Area-Weighted Mean Fractal Dimension:	1.144
Total Core Area (ha):	22.090
Number of Core Areas:	159
Core Area Density (#/100 ha):	78.131
Mean Core Area 1 (ha):	0.152
Core Area Standard Dev 1 (ha):	0.260
Core Area Coeff of Variation 1 (%):	419.536
Mean Core Area 2 (ha):	0.190
Core Area Standard Dev 2 (ha):	0.428
Core Area Coeff of Variation 2 (%):	691.161
Total Core Area Index (%):	14.780
Mean Core Area Index (%):	3.527
Mean Nearest Neighbor (m):	46.233
Nearest Neighbor Standard Dev (m):	42.558
Nearest Neigh Coeff of Variation (%):	92.068
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.658
Simpson's Diversity Index:	0.751
Modified Simpson's Diversity Index:	1.563
Patch Richness:	6
Patch Richness Density (#/100 ha):	2.948
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.926
Simpson's Evenness Index:	0.949
Modified Simpson's Evenness Index:	0.873
Interspersion/Juxtaposition Index (%):	55.373
Contagion (%):	33.055

Date: Fri Jun 9 00:09:37 1995
Image Name: 2010ex.gis
Basename For Output Files: 2010ex
Rows: 78 Cols: 157 Cellsize: 20.0 Data Type: S
Edge Dist: 20.0 Max Patch Type Possible: NA Background: 0
No ID Image Will Be Output
Image Does Not Include a Landscape Border
Proportion of Boundary/Background to Count as Edge: 1.00
Diagonals Used; Proximity Indices Not Calculated
Nearest Neighbor Calcs
Do not Write Patch Indices; Do Not Write Class Indices

LANDSCAPE INDICES

Total Area (ha):	199.240
Largest Patch Index(%):	5.682
Number of patches:	413
Patch Density (#/100 ha):	207.258
Mean Patch Size (ha):	0.482
Patch Size Standard Dev (ha):	1.186
Patch Size Coeff of Variation (%):	245.859
Total Edge (m):	99000.000
Edge Density (m/ha):	496.968
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	17.824
Mean Shape Index:	1.322
Area-Weighted Mean Shape Index:	2.349
Double Log Fractal Dimension:	1.444
Mean Patch Fractal Dimension:	1.055
Area-Weighted Mean Fractal Dimension:	1.145
Total Core Area (ha):	97.263
Number of Core Areas:	164
Core Area Density (#/100 ha):	82.375
Mean Core Area 1 (ha):	0.593
Core Area Standard Dev 1 (ha):	0.457
Core Area Coeff of Variation 1 (%):	449.577
Mean Core Area 2 (ha):	0.259
Core Area Standard Dev 2 (ha):	0.656
Core Area Coeff of Variation 2 (%):	725.329
Total Core Area Index (%):	48.811
Mean Core Area Index (%):	2.525
Mean Nearest Neighbor (m):	44.534
Nearest Neighbor Standard Dev (m):	48.561
Nearest Neigh Coeff of Variation (%):	97.814
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.401
Simpson's Diversity Index:	0.775
Modified Simpson's Diversity Index:	1.023
Patch Richness:	5
Patch Richness Density (#/100 ha):	2.510
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.870
Simpson's Evenness Index:	0.919
Modified Simpson's Evenness Index:	1.026
Interspersion/Juxtaposition Index (%):	73.877
Proximity = 0(%):	0.000

```
Processing image: lcta_infinal.gis
Number of rows, cols: 551, 1001
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....

... 456351 cells of background exterior to the landscape found

Class    1:    19166 cells,     894 patches
Class    2:     7581 cells,     483 patches
Class    3:        5 cells,       2 patches
Class    4:    10082 cells,    1289 patches
Class    5:    29349 cells,    1496 patches
Class    6:    24928 cells,     809 patches
Class    8:        2 cells,       1 patches
Class    9:     3228 cells,     453 patches
Class   10:      852 cells,     115 patches
Class   11:        6 cells,       1 patches
Class   12:        1 cells,       1 patches

number of classes: 11
max patches/class: 1496
max_patch_size: 447848 (background/border patch)


CLASS 1
CLASS INDICES

Patch Type:                          1   Class Area (ha):           766.640
Total Area (ha):              3808.000   Percent of Landscape (%):   20.132
Largest Patch Index (%):         2.860   Number Patches:                894
Patch Density (#/100 ha):       23.477   Mean Patch Size (ha):        0.858
Patch Size SD (ha):              4.610   Patch Size CV (%):         537.571
Total Edge (m):             428040.000   Edge Den (m/ha):           112.405
Con-Wght Edge Den (m/ha):           NA   Total Edge Contrast (%):       NA
Mean Edge Contrast (%):             NA   Area-Wt Mean Edge Con(%):      NA
Landscape Shape Index:           48.583   Mean Shape Index:            1.354
Area-Weighted Mean Shape:         3.800   Double Log Fractal:          1.456
Mean Patch Fractal:               1.053   Area-Weighted Mean Fractal:  1.202
Core % of Landscape (%):          7.062   Total Core Area (ha):      268.920
Number Core Areas:                  362   Core Area Den (#/100 ha):    9.506
Mean Core Area 1 (ha):            0.301   Core Area SD 1 (ha):         2.582
Core Area CV 1 (%):             858.312   Mean Core Area 2 (ha):       0.743
Core Area SD 2 (ha):              4.017   Core Area CV 2 (%):        540.698
Total Core Area Index (%):       35.078   Mean Core Area Index (%):    3.610
Mean NearNeigh Dist (m):         51.420   Nearest Neighbor SD (m):    91.173
Nearest Neighbor CV (%):        177.211   Mean Prox Index:               NA
Intersper/Juxtapos (%):          49.762
```

CLASS 2
CLASS INDICES

Patch Type:	2	Class Area (ha):	303.240
Total Area (ha):	3808.000	Percent of Landscape (%):	7.963
Largest Patch Index (%):	0.938	Number Patches:	483
Patch Density (#/100 ha):	12.684	Mean Patch Size (ha):	0.628
Patch Size SD (ha):	2.496	Patch Size CV (%):	397.515
Total Edge (m):	157080.000	Edge Den (m/ha):	43.876
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	44.607	Mean Shape Index:	1.259
Area-Weighted Mean Shape:	2.363	Double Log Fractal:	1.362
Mean Patch Fractal:	1.044	Area-Weighted Mean Fractal:	1.140
Core % of Landscape (%):	3.062	Total Core Area (ha):	116.600
Number Core Areas:	130	Core Area Den (#/100 ha):	3.414
Mean Core Area 1 (ha):	0.241	Core Area SD 1 (ha):	1.548
Core Area CV 1 (%):	641.199	Mean Core Area 2 (ha):	0.897
Core Area SD 2 (ha):	2.883	Core Area CV 2 (%):	321.480
Total Core Area Index (%):	38.451	Mean Core Area Index (%):	4.492
Mean NearNeigh Dist (m):	67.271	Nearest Neighbor SD (m):	75.393
Nearest Neighbor CV (%):	112.073	Mean Prox Index:	NA
Intersper/Juxtapos (%):	40.314		

CLASS 3
CLASS INDICES

Patch Type:	3	Class Area (ha):	0.200
Total Area (ha):	3808.000	Percent of Landscape (%):	0.005
Largest Patch Index (%):	0.004	Number Patches:	2
Patch Density (#/100 ha):	0.053	Mean Patch Size (ha):	0.100
Patch Size SD (ha):	0.060	Patch Size CV (%):	60.000
Total Edge (m):	240.000	Edge Den (m/ha):	0.063
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	40.270	Mean Shape Index:	1.000
Area-Weighted Mean Shape:	1.000	Double Log Fractal:	1.000
Mean Patch Fractal:	1.000	Area-Weighted Mean Fractal:	1.000
Core % of Landscape (%):	0.000	Total Core Area (ha):	0.000
Number Core Areas:	0	Core Area Den (#/100 ha):	0.000
Mean Core Area 1 (ha):	0.000	Core Area SD 1 (ha):	0.000
Core Area CV 1 (%):	0.000	Mean Core Area 2 (ha):	0.000
Core Area SD 2 (ha):	0.000	Core Area CV 2 (%):	0.000
Total Core Area Index (%):	0.000	Mean Core Area Index (%):	0.000
Mean NearNeigh Dist (m):	120.000	Nearest Neighbor SD (m):	0.000
Nearest Neighbor CV (%):	0.000	Mean Prox Index:	NA
Intersper/Juxtapos (%):	21.732		

CLASS 4
CLASS INDICES

Patch Type:	4	Class Area (ha):	403.280
Total Area (ha):	3808.000	Percent of Landscape (%):	10.590
Largest Patch Index (%):	1.147	Number Patches:	1289
Patch Density (#/100 ha):	33.850	Mean Patch Size (ha):	0.313
Patch Size SD (ha):	1.410	Patch Size CV (%):	450.567
Total Edge (m):	350880.000	Edge Den (m/ha):	92.143
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	48.589	Mean Shape Index:	1.253
Area-Weighted Mean Shape:	2.721	Double Log Fractal:	1.453
Mean Patch Fractal:	1.045	Area-Weighted Mean Fractal:	1.152
Core % of Landscape (%):	1.557	Total Core Area (ha):	59.280
Number Core Areas:	257	Core Area Den (#/100 ha):	6.749
Mean Core Area 1 (ha):	0.046	Core Area SD 1 (ha):	0.514
Core Area CV 1 (%):	1118.209	Mean Core Area 2 (ha):	0.231
Core Area SD 2 (ha):	1.133	Core Area CV 2 (%):	491.219
Total Core Area Index (%):	14.699	Mean Core Area Index (%):	1.591
Mean NearNeigh Dist (m):	53.374	Nearest Neighbor SD (m):	59.035
Nearest Neighbor CV (%):	129.343	Mean Prox Index:	NA
Intersper/Juxtapos (%):	38.250		
ls			

CLASS 5
CLASS INDICES

Patch Type:	5	Class Area (ha):	1173.960
Total Area (ha):	3808.000	Percent of Landscape (%):	30.829
Largest Patch Index (%):	5.894	Number Patches:	1496
Patch Density (#/100 ha):	39.286	Mean Patch Size (ha):	0.785
Patch Size SD (ha):	6.517	Patch Size CV (%):	830.434
Total Edge (m):	650400.000	Edge Den (m/ha):	170.798
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	55.194	Mean Shape Index:	1.330
Area-Weighted Mean Shape:	4.538	Double Log Fractal:	1.440
Mean Patch Fractal:	1.052	Area-Weighted Mean Fractal:	1.206
Core % of Landscape (%):	11.176	Total Core Area (ha):	425.600
Number Core Areas:	519	Core Area Den (#/100 ha):	13.629
Mean Core Area 1 (ha):	0.284	Core Area SD 1 (ha):	3.777
Core Area CV 1 (%):	1327.773	Mean Core Area 2 (ha):	0.820
Core Area SD 2 (ha):	6.379	Core Area CV 2 (%):	777.876
Total Core Area Index (%):	36.253	Mean Core Area Index (%):	3.359
Mean NearNeigh Dist (m):	44.491	Nearest Neighbor SD (m):	43.705
Nearest Neighbor CV (%):	98.233	Mean Prox Index:	NA
Intersper/Juxtapos (%):	57.958		

CLASS 6

CLASS INDICES

Patch Type:	6	Class Area (ha):	997.120
Total Area (ha):	3808.000	Percent of Landscape (%):	26.185
Largest Patch Index (%):	3.254	Number Patches:	809
Patch Density (#/100 ha):	21.245	Mean Patch Size (ha):	1.233
Patch Size SD (ha):	6.346	Patch Size CV (%):	514.895
Total Edge (m):	488680.000	Edge Den (m/ha):	128.330
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	50.698	Mean Shape Index:	1.395
Area-Weighted Mean Shape:	4.416	Double Log Fractal:	1.427
Mean Patch Fractal:	1.056	Area-Weighted Mean Fractal:	1.207
Core % of Landscape (%):	10.429	Total Core Area (ha):	397.120
Number Core Areas:	419	Core Area Den (#/100 ha):	11.003
Mean Core Area 1 (ha):	0.491	Core Area SD 1 (ha):	3.160
Core Area CV 1 (%):	643.669	Mean Core Area 2 (ha):	0.948
Core Area SD 2 (ha):	4.341	Core Area CV 2 (%):	457.995
Total Core Area Index (%):	39.327	Mean Core Area Index (%):	5.384
Mean NearNeigh Dist (m):	56.002	Nearest Neighbor SD (m):	85.604
Nearest Neighbor CV (%):	152.859	Mean Prox Index:	NA
Intersper/Juxtapos (%):	40.271		

CLASS 8

CLASS INDICES

Patch Type:	8	Class Area (ha):	0.080
Total Area (ha):	3808.000	Percent of Landscape (%):	0.002
Largest Patch Index (%):	0.002	Number Patches:	1
Patch Density (#/100 ha):	0.026	Mean Patch Size (ha):	0.080
Patch Size SD (ha):	0.000	Patch Size CV (%):	0.000
Total Edge (m):	120.000	Edge Den (m/ha):	0.032
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	40.270	Mean Shape Index:	1.061
Area-Weighted Mean Shape:	1.061	Double Log Fractal Index:	NA
Mean Patch Fractal:	1.018	Area-Weighted Mean Fractal:	1.018
Core % of Landscape (%):	0.000	Total Core Area (ha):	0.000
Number Core Areas:	0	Core Area Den (#/100 ha):	0.000
Mean Core Area 1 (ha):	0.000	Core Area SD 1 (ha):	0.000
Core Area CV 1 (%):	0.000	Mean Core Area 2 (ha):	0.000
Core Area SD 2 (ha):	0.000	Core Area CV 2 (%):	0.000
Total Core Area Index (%):	0.000	Mean Core Area Index (%):	0.000
Mean NearNeigh Dist(m):	NONE	Near Neighor SD (m):	NA
Nearest Neighbor CV (%):	NA	Mean Prox Index:	NA
Intersper/Juxtapos (%):	45.154		

CLASS 9

CLASS INDICES

Patch Type:	9	Class Area (ha):	129.120
Total Area (ha):	3808.000	Percent of Landscape (%):	3.391
Largest Patch Index (%):	0.502	Number Patches:	453
Patch Density (#/100 ha):	11.896	Mean Patch Size (ha):	0.285
Patch Size SD (ha):	1.085	Patch Size CV (%):	380.516
Total Edge (m):	110520.000	Edge Den (m/ha):	29.023
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	43.100	Mean Shape Index:	1.191
Area-Weighted Mean Shape:	2.584	Double Log Fractal:	1.406
Mean Patch Fractal:	1.034	Area-Weighted Mean Fractal:	1.142
Core % of Landscape (%):	0.500	Total Core Area (ha):	19.040
Number Core Areas:	86	Core Area Den (#/100 ha):	2.258
Mean Core Area 1 (ha):	0.042	Core Area SD 1 (ha):	0.276
Core Area CV 1 (%):	656.789	Mean Core Area 2 (ha):	0.221
Core Area SD 2 (ha):	0.601	Core Area CV 2 (%):	271.648
Total Core Area Index (%):	14.746	Mean Core Area Index (%):	1.692
Mean NearNeigh Dist (m):	115.279	Nearest Neighbor SD (m):	147.425
Nearest Neighbor CV (%):	127.886	Mean Prox Index:	NA
Intersper/Juxtapos (%):	36.150		

CLASS 10
CLASS INDICES

Patch Type:	10	Class Area (ha):	34.080
Total Area (ha):	3808.000	Percent of Landscape (%):	0.895
Largest Patch Index (%):	0.276	Number Patches:	115
Patch Density (#/100 ha):	3.020	Mean Patch Size (ha):	0.296
Patch Size SD (ha):	1.022	Patch Size CV (%):	344.721
Total Edge (m):	26000.000	Edge Den (m/ha):	6.828
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	40.843	Mean Shape Index:	1.194
Area-Weighted Mean Shape:	1.771	Double Log Fractal:	1.229
Mean Patch Fractal:	1.040	Area-Weighted Mean Fractal:	1.102
Core % of Landscape (%):	0.221	Total Core Area (ha):	8.400
Number Core Areas:	16	Core Area Den (#/100 ha):	0.420
Mean Core Area 1 (ha):	0.073	Core Area SD 1 (ha):	0.558
Core Area CV 1 (%):	764.018	Mean Core Area 2 (ha):	0.525
Core Area SD 2 (ha):	1.415	Core Area CV 2 (%):	269.453
Total Core Area Index (%):	24.648	Mean Core Area Index (%):	2.021
Mean NearNeigh Dist (m):	91.515	Nearest Neighbor SD (m):	165.757
Nearest Neighbor CV (%):	181.126	Mean Prox Index:	NA
Intersper/Juxtapos (%):	31.195		

CLASS 11
CLASS INDICES

Patch Type:	11	Class Area (ha):	0.240
Total Area (ha):	3808.000	Percent of Landscape (%):	0.006
Largest Patch Index (%):	0.006	Number Patches:	1
Patch Density (#/100 ha):	0.026	Mean Patch Size (ha):	0.240
Patch Size SD (ha):	0.000	Patch Size CV (%):	0.000
Total Edge (m):	200.000	Edge Den (m/ha):	0.053
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	40.270	Mean Shape Index:	1.021
Area-Weighted Mean Shape:	1.021	Double Log Fractal Index:	NA
Mean Patch Fractal:	1.005	Area-Weighted Mean Fractal:	1.005
Core % of Landscape (%):	0.000	Total Core Area (ha):	0.000
Number Core Areas:	0	Core Area Den (#/100 ha):	0.000
Mean Core Area 1 (ha):	0.000	Core Area SD 1 (ha):	0.000
Core Area CV 1 (%):	0.000	Mean Core Area 2 (ha):	0.000
Core Area SD 2 (ha):	0.000	Core Area CV 2 (%):	0.000
Total Core Area Index (%):	0.000	Mean Core Area Index (%):	0.000
Mean NearNeigh Dist(m):	NONE	Near Neighor SD (m):	NA
Nearest Neighbor CV (%):	NA	Mean Prox Index:	NA
Intersper/Juxtapos (%):	29.229		

CLASS 12

Patch Type:	12	Class Area (ha):	0.040
Total Area (ha):	3808.000	Percent of Landscape (%):	0.001
Largest Patch Index (%):	0.001	Number Patches:	1
Patch Density (#/100 ha):	0.026	Mean Patch Size (ha):	0.040
Patch Size SD (ha):	0.000	Patch Size CV (%):	0.000
Total Edge (m):	80.000	Edge Den (m/ha):	0.021
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	40.268	Mean Shape Index:	1.000
Area-Weighted Mean Shape:	1.000	Double Log Fractal Index:	NA
Mean Patch Fractal:	1.000	Area-Weighted Mean Fractal:	1.000
Core % of Landscape (%):	0.000	Total Core Area (ha):	0.000
Number Core Areas:	0	Core Area Den (#/100 ha):	0.000
Mean Core Area 1 (ha):	0.000	Core Area SD 1 (ha):	0.000
Core Area CV 1 (%):	0.000	Mean Core Area 2 (ha):	0.000
Core Area SD 2 (ha):	0.000	Core Area CV 2 (%):	0.000
Total Core Area Index (%):	0.000	Mean Core Area Index (%):	0.000
Mean NearNeigh Dist(m):	NONE	Near Neighor SD (m):	NA
Nearest Neighbor CV (%):	NA	Mean Prox Index:	NA
Intersper/Juxtapos (%):	30.103		

LANDSCAPE INDICES

Total Area (ha):	3808.000
Largest Patch Index(%):	5.894
Number of patches:	5544
Patch Density (#/100 ha):	145.588
Mean Patch Size (ha):	0.687
Patch Size Standard Dev (ha):	4.689
Patch Size Coeff of Variation (%):	682.651
Total Edge (m):	1608080.000
Edge Density (m/ha):	422.290
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	65.148
Mean Shape Index:	1.305
Area-Weighted Mean Shape Index:	3.900
Double Log Fractal Dimension:	1.433
Mean Patch Fractal Dimension:	1.049
Area-Weighted Mean Fractal Dimension:	1.191
Total Core Area (ha):	1294.960
Number of Core Areas:	1789
Core Area Density (#/100 ha):	46.980
Mean Core Area 1 (ha):	0.234
Core Area Standard Dev 1 (ha):	2.586
Core Area Coeff of Variation 1 (%):	1107.155
Mean Core Area 2 (ha):	0.724
Core Area Standard Dev 2 (ha):	4.513
Core Area Coeff of Variation 2 (%):	1932.255
Total Core Area Index (%):	34.006
Mean Core Area Index (%):	3.239
Mean Nearest Neighbor (m):	58.132
Nearest Neighbor Standard Dev (m):	85.090
Nearest Neigh Coeff of Variation (%):	146.373
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.634
Simpson's Diversity Index:	0.777
Modified Simpson's Diversity Index:	1.501
Patch Richness:	11
Patch Richness Density (#/100 ha):	0.289
Relative Patch Richness (%):	91.667
Shannon's Evenness Index:	0.681
Simpson's Evenness Index:	0.855
Modified Simpson's Evenness Index:	0.626
Interspersion/Juxtaposition Index (%):	52.258
Contagion (%):	51.927

```
Processing image: lcta_exfinal.gis
Number of rows, cols: 551, 1001
Interior Background Value: 0
Exterior Background Value: 0
Reading 8 bit ERDAS image ....


... 404269 cells of background exterior to the landscape found

Class     1:     33164 cells,     1760 patches
Class     2:      7016 cells,      784 patches
Class     3:       375 cells,        7 patches
Class     4:     24027 cells,     2109 patches
Class     5:     41673 cells,     2503 patches
Class     6:     26535 cells,     1795 patches
Class     8:       156 cells,       17 patches
Class     9:      7053 cells,      805 patches
Class    10:      6528 cells,      181 patches
Class    12:       755 cells,       19 patches

number of classes: 10
max patches/class: 2503
max_patch_size: 360767 (background/border patch)
```

CLASS 1 (oakbrush)

CLASS INDICES

Patch Type:	1	Class Area (ha):	1326.560
Total Area (ha):	5891.280	Percent of Landscape (%):	22.517
Largest Patch Index (%):	3.119	Number Patches:	1760
Patch Density (#/100 ha):	29.875	Mean Patch Size (ha):	0.754
Patch Size SD (ha):	5.094	Patch Size CV (%):	675.871
Total Edge (m):	803440.000	Edge Den (m/ha):	136.378
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	52.806	Mean Shape Index:	1.349
Area-Weighted Mean Shape:	4.135	Double Log Fractal:	1.462
Mean Patch Fractal:	1.054	Area-Weighted Mean Fractal:	1.202
Core % of Landscape (%):	6.909	Total Core Area (ha):	407.000
Number Core Areas:	746	Core Area Den (#/100 ha):	12.663
Mean Core Area 1 (ha):	0.231	Core Area SD 1 (ha):	2.910
Core Area CV 1 (%):	1258.581	Mean Core Area 2 (ha):	0.546
Core Area SD 2 (ha):	4.451	Core Area CV 2 (%):	815.874
Total Core Area Index (%):	30.681	Mean Core Area Index (%):	3.626
Mean NearNeigh Dist (m):	40.442	Nearest Neighbor SD (m):	59.058
Nearest Neighbor CV (%):	146.032	Mean Prox Index:	NA
Intersper/Juxtapos (%):	53.657		

CLASS 2
CLASS INDICES

Patch Type:	2	Class Area (ha):	280.640
Total Area (ha):	5891.280	Percent of Landscape (%):	4.764
Largest Patch Index (%):	0.671	Number Patches:	784
Patch Density (#/100 ha):	13.308	Mean Patch Size (ha):	0.358
Patch Size SD (ha):	1.577	Patch Size CV (%):	440.610
Total Edge (m):	213440.000	Edge Den (m/ha):	36.230
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	38.974	Mean Shape Index:	1.235
Area-Weighted Mean Shape:	2.178	Double Log Fractal:	1.394
Mean Patch Fractal:	1.043	Area-Weighted Mean Fractal:	1.127
Core % of Landscape (%):	1.001	Total Core Area (ha):	59.000
Number Core Areas:	163	Core Area Den (#/100 ha):	2.767
Mean Core Area 1 (ha):	0.075	Core Area SD 1 (ha):	0.925
Core Area CV 1 (%):	1228.865	Mean Core Area 2 (ha):	0.362
Core Area SD 2 (ha):	2.002	Core Area CV 2 (%):	553.212
Total Core Area Index (%):	21.023	Mean Core Area Index (%):	2.384
Mean NearNeigh Dist (m):	63.521	Nearest Neighbor SD (m):	76.331
Nearest Neighbor CV (%):	120.167	Mean Prox Index:	NA
Intersper/Juxtapos (%):	53.780		

CLASS 3
CLASS INDICES

Patch Type:	3	Class Area (ha):	15.000
Total Area (ha):	5891.280	Percent of Landscape (%):	0.255
Largest Patch Index (%):	0.170	Number Patches:	7
Patch Density (#/100 ha):	0.119	Mean Patch Size (ha):	2.143
Patch Size SD (ha):	3.261	Patch Size CV (%):	152.186
Total Edge (m):	4880.000	Edge Den (m/ha):	0.828
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	34.072	Mean Shape Index:	1.364
Area-Weighted Mean Shape:	1.600	Double Log Fractal:	1.168
Mean Patch Fractal:	1.065	Area-Weighted Mean Fractal:	1.083
Core % of Landscape (%):	0.141	Total Core Area (ha):	8.320
Number Core Areas:	5	Core Area Den (#/100 ha):	0.085
Mean Core Area 1 (ha):	1.189	Core Area SD 1 (ha):	2.324
Core Area CV 1 (%):	195.496	Mean Core Area 2 (ha):	1.664
Core Area SD 2 (ha):	2.601	Core Area CV 2 (%):	156.339
Total Core Area Index (%):	55.467	Mean Core Area Index (%):	25.156
Mean NearNeigh Dist (m):	140.149	Nearest Neighbor SD (m):	172.589
Nearest Neighbor CV (%):	123.147	Mean Prox Index:	NA
Intersper/Juxtapos (%):	65.239		

CLASS 4 (oak-sagebrush mix)
CLASS INDICES

Patch Type:	4	Class Area (ha):	961.080
Total Area (ha):	5891.280	Percent of Landscape (%):	16.314
Largest Patch Index (%):	0.553	Number Patches:	2109
Patch Density (#/100 ha):	35.799	Mean Patch Size (ha):	0.456
Patch Size SD (ha):	1.495	Patch Size CV (%):	327.998
Total Edge (m):	765960.000	Edge Den (m/ha):	130.016
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	53.854	Mean Shape Index:	1.335
Area-Weighted Mean Shape:	2.856	Double Log Fractal:	1.484
Mean Patch Fractal:	1.054	Area-Weighted Mean Fractal:	1.167
Core % of Landscape (%):	2.527	Total Core Area (ha):	148.880
Number Core Areas:	712	Core Area Den (#/100 ha):	12.086
Mean Core Area 1 (ha):	0.071	Core Area SD 1 (ha):	0.453
Core Area CV 1 (%):	641.862	Mean Core Area 2 (ha):	0.209
Core Area SD 2 (ha):	0.761	Core Area CV 2 (%):	363.954
Total Core Area Index (%):	15.491	Mean Core Area Index (%):	2.499
Mean NearNeigh Dist (m):	42.874	Nearest Neighbor SD (m):	50.958
Nearest Neighbor CV (%):	118.857	Mean Prox Index:	NA
Intersper/Juxtapos (%):	45.487		

CLASS 5 Sagebrush
CLASS INDICES

Patch Type:	5	Class Area (ha):	1666.920
Total Area (ha):	5891.280	Percent of Landscape (%):	28.295
Largest Patch Index (%):	2.035	Number Patches:	2503
Patch Density (#/100 ha):	42.487	Mean Patch Size (ha):	0.666
Patch Size SD (ha):	3.203	Patch Size CV (%):	480.969
Total Edge (m):	1075480.000	Edge Den (m/ha):	182.555
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	59.404	Mean Shape Index:	1.351
Area-Weighted Mean Shape:	3.218	Double Log Fractal:	1.454
Mean Patch Fractal:	1.054	Area-Weighted Mean Fractal:	1.178
Core % of Landscape (%):	7.566	Total Core Area (ha):	445.760
Number Core Areas:	1049	Core Area Den (#/100 ha):	17.806
Mean Core Area 1 (ha):	0.178	Core Area SD 1 (ha):	1.706
Core Area CV 1 (%):	957.808	Mean Core Area 2 (ha):	0.425
Core Area SD 2 (ha):	2.615	Core Area CV 2 (%):	615.361
Total Core Area Index (%):	26.742	Mean Core Area Index (%):	3.879
Mean NearNeigh Dist (m):	38.134	Nearest Neighbor SD (m):	28.695
Nearest Neighbor CV (%):	75.249	Mean Prox Index:	NA
Intersper/Juxtapos (%):	68.893		

CLASS 6 (sagebrush grass mix)
CLASS INDICES

Patch Type:	6	Class Area (ha):	1061.400
Total Area (ha):	5891.280	Percent of Landscape (%):	18.016
Largest Patch Index (%):	1.080	Number Patches:	1795
Patch Density (#/100 ha):	30.469	Mean Patch Size (ha):	0.591
Patch Size SD (ha):	2.131	Patch Size CV (%):	360.422
Total Edge (m):	717280.000	Edge Den (m/ha):	121.753
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	49.519	Mean Shape Index:	1.329
Area-Weighted Mean Shape:	2.833	Double Log Fractal:	1.427
Mean Patch Fractal:	1.053	Area-Weighted Mean Fractal:	1.160
Core % of Landscape (%):	4.204	Total Core Area (ha):	247.640
Number Core Areas:	710	Core Area Den (#/100 ha):	12.052
Mean Core Area 1 (ha):	0.138	Core Area SD 1 (ha):	0.888
Core Area CV 1 (%):	643.797	Mean Core Area 2 (ha):	0.349
Core Area SD 2 (ha):	1.386	Core Area CV 2 (%):	397.364
Total Core Area Index (%):	23.331	Mean Core Area Index (%):	4.226
Mean NearNeigh Dist (m):	45.092	Nearest Neighbor SD (m):	50.280
Nearest Neighbor CV (%):	111.505	Mean Prox Index:	NA
Intersper/Juxtapos (%):	58.620		

CLASS 8

CLASS INDICES

Patch Type:	8	Class Area (ha):	6.240
Total Area (ha):	5891.280	Percent of Landscape (%):	0.106
Largest Patch Index (%):	0.035	Number Patches:	17
Patch Density (#/100 ha):	0.289	Mean Patch Size (ha):	0.367
Patch Size SD (ha):	0.479	Patch Size CV (%):	130.568
Total Edge (m):	5240.000	Edge Den (m/ha):	0.889
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	34.016	Mean Shape Index:	1.331
Area-Weighted Mean Shape:	1.610	Double Log Fractal:	1.422
Mean Patch Fractal:	1.063	Area-Weighted Mean Fractal:	1.099
Core % of Landscape (%):	0.011	Total Core Area (ha):	0.640
Number Core Areas:	2	Core Area Den (#/100 ha):	0.034
Mean Core Area 1 (ha):	0.038	Core Area SD 1 (ha):	0.107
Core Area CV 1 (%):	283.395	Mean Core Area 2 (ha):	0.320
Core Area SD 2 (ha):	0.080	Core Area CV 2 (%):	25.000
Total Core Area Index (%):	10.256	Mean Core Area Index (%):	2.624
Mean NearNeigh Dist (m):	140.899	Nearest Neighbor SD (m):	242.112
Nearest Neighbor CV (%):	171.833	Mean Prox Index:	NA
Intersper/Juxtapos (%):	81.406		

CLASS 9
CLASS INDICES

Patch Type:	9	Class Area (ha):	282.120
Total Area (ha):	5891.280	Percent of Landscape (%):	4.789
Largest Patch Index (%):	0.210	Number Patches:	805
Patch Density (#/100 ha):	13.664	Mean Patch Size (ha):	0.350
Patch Size SD (ha):	1.036	Patch Size CV (%):	295.733
Total Edge (m):	214800.000	Edge Den (m/ha):	36.461
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	39.428	Mean Shape Index:	1.211
Area-Weighted Mean Shape:	2.127	Double Log Fractal:	1.402
Mean Patch Fractal:	1.037	Area-Weighted Mean Fractal:	1.126
Core % of Landscape (%):	0.976	Total Core Area (ha):	57.520
Number Core Areas:	160	Core Area Den (#/100 ha):	2.716
Mean Core Area 1 (ha):	0.071	Core Area SD 1 (ha):	0.427
Core Area CV 1 (%):	597.439	Mean Core Area 2 (ha):	0.359
Core Area SD 2 (ha):	0.902	Core Area CV 2 (%):	250.860
Total Core Area Index (%):	20.388	Mean Core Area Index (%):	2.285
Mean NearNeigh Dist (m):	86.339	Nearest Neighbor SD (m):	92.025
Nearest Neighbor CV (%):	106.586	Mean Prox Index:	NA
Intersper/Juxtapos (%):	63.782		

CLASS 10
CLASS INDICES

Patch Type:	10	Class Area (ha):	261.120
Total Area (ha):	5891.280	Percent of Landscape (%):	4.432
Largest Patch Index (%):	0.710	Number Patches:	181
Patch Density (#/100 ha):	3.072	Mean Patch Size (ha):	1.443
Patch Size SD (ha):	5.096	Patch Size CV (%):	353.235
Total Edge (m):	97360.000	Edge Den (m/ha):	16.526
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	36.443	Mean Shape Index:	1.324
Area-Weighted Mean Shape:	2.655	Double Log Fractal:	1.359
Mean Patch Fractal:	1.051	Area-Weighted Mean Fractal:	1.153
Core % of Landscape (%):	2.285	Total Core Area (ha):	134.640
Number Core Areas:	80	Core Area Den (#/100 ha):	1.358
Mean Core Area 1 (ha):	0.744	Core Area SD 1 (ha):	3.346
Core Area CV 1 (%):	449.828	Mean Core Area 2 (ha):	1.683
Core Area SD 2 (ha):	4.874	Core Area CV 2 (%):	289.576
Total Core Area Index (%):	51.562	Mean Core Area Index (%):	6.504
Mean NearNeigh Dist (m):	54.188	Nearest Neighbor SD (m):	46.449
Nearest Neighbor CV (%):	85.718	Mean Prox Index:	NA
Intersper/Juxtapos (%):	47.840		

CLASS 12
CLASS INDICES

Patch Type:	12	Class Area (ha):	30.200
Total Area (ha):	5891.280	Percent of Landscape (%):	0.513
Largest Patch Index (%):	0.244	Number Patches:	19
Patch Density (#/100 ha):	0.323	Mean Patch Size (ha):	1.589
Patch Size SD (ha):	3.549	Patch Size CV (%):	223.256
Total Edge (m):	13600.000	Edge Den (m/ha):	2.308
Con-Wght Edge Den (m/ha):	NA	Total Edge Contrast (%):	NA
Mean Edge Contrast (%):	NA	Area-Wt Mean Edge Con(%):	NA
Landscape Shape Index:	34.305	Mean Shape Index:	1.443
Area-Weighted Mean Shape:	2.774	Double Log Fractal:	1.431
Mean Patch Fractal:	1.058	Area-Weighted Mean Fractal:	1.170
Core % of Landscape (%):	0.208	Total Core Area (ha):	12.240
Number Core Areas:	13	Core Area Den (#/100 ha):	0.221
Mean Core Area 1 (ha):	0.644	Core Area SD 1 (ha):	1.800
Core Area CV 1 (%):	279.465	Mean Core Area 2 (ha):	0.942
Core Area SD 2 (ha):	2.111	Core Area CV 2 (%):	224.231
Total Core Area Index (%):	40.530	Mean Core Area Index (%):	7.615
Mean NearNeigh Dist (m):	56.809	Nearest Neighbor SD (m):	67.700
Nearest Neighbor CV (%):	119.173	Mean Prox Index:	NA
Intersper/Juxtapos (%):	52.273		

LANDSCAPE INDICES

Total Area (ha):	5891.280
Largest Patch Index(%):	3.119
Number of patches:	9980
Patch Density (#/100 ha):	169.403
Mean Patch Size (ha):	0.590
Patch Size Standard Dev (ha):	3.043
Patch Size Coeff of Variation (%):	515.480
Total Edge (m):	2476680.000
Edge Density (m/ha):	420.398
Contrast-Weight Edge Density (m/ha):	NA
Total Edge Contrast Index (%):	NA
Mean Edge Contrast Index (%):	NA
Area-Weighted Mean Edge Contrast (%):	NA
Landscape Shape Index:	80.669
Mean Shape Index:	1.322
Area-Weighted Mean Shape Index:	3.161
Double Log Fractal Dimension:	1.447
Mean Patch Fractal Dimension:	1.052
Area-Weighted Mean Fractal Dimension:	1.172
Total Core Area (ha):	1521.640
Number of Core Areas:	3640
Core Area Density (#/100 ha):	61.786
Mean Core Area 1 (ha):	0.152
Core Area Standard Dev 1 (ha):	1.648
Core Area Coeff of Variation 1 (%):	1080.712
Mean Core Area 2 (ha):	0.418
Core Area Standard Dev 2 (ha):	2.708
Core Area Coeff of Variation 2 (%):	1776.077
Total Core Area Index (%):	25.829
Mean Core Area Index (%):	3.427
Mean Nearest Neighbor (m):	47.250
Nearest Neighbor Standard Dev (m):	57.745
Nearest Neigh Coeff of Variation (%):	122.211
Mean Proximity Index:	NA
Shannon's Diversity Index:	1.776
Simpson's Diversity Index:	0.804
Modified Simpson's Diversity Index:	1.628
Patch Richness:	10
Patch Richness Density (#/100 ha):	0.170
Relative Patch Richness (%):	NA
Shannon's Evenness Index:	0.771
Simpson's Evenness Index:	0.893
Modified Simpson's Evenness Index:	0.707
Interspersion/Juxtaposition Index (%):	61.248
Contagion (%):	41.630