THE COLUMBIA PLATEAU ECOREGIONAL ASSESSMENT:

A PILOT EFFORT IN ECOREGIONAL CONSERVATION

Prepared by The Nature Conservancy's Columbia Plateau Ecoregional Planning Team - 1999

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Introduction and Background on the Pilot Project

This report summarizes the process and results of the portfolio selection phase of the Columbia Plateau Pilot Project in Ecoregional Conservation. In 1996, The Nature Conservancy (TNC) adopted Conservation by Design, a framework to assist the Conservancy and others to develop new approaches for more efficient and effective conservation at larger geographic scales.

Both conservationists and academic scientists now recognize that maintaining viable populations of native species and the ecological integrity of large scale natural communities requires a flexible approach for working efficiently at multiple geographic scales. The long-term viability of many imperiled species and natural systems depends on large scale ecological patterns and on processes that transcend individual sites. Maintaining or restoring these processes may require and be best accomplished by strategies that extend beyond the scale of individual sites, and even beyond the scale of individual states or countries. From this perspective, integrating local, site-specific conservation actions with regional scale planning across many sites makes good conservation sense. However, both within and outside the Conservancy there is a wide range of views about what ecoregional conservation might involve, and about how this approach might affect the efficiency and effectiveness of TNC's or others' conservation activities.

The Columbia Plateau project is one of ten pilot projects initially proposed by TNC to help define the organization's approach to working and planning on an ecoregional scale. The project was coordinated by a team of Conservancy staff, with critical input from TNC colleagues, public agency land managers and academic scientists.

The three main goals of TNC's Columbia Plateau project were to:

1) Identify a first iteration of a portfolio of conservation sites that, collectively (and with appropriate conservation actions) could maintain all viable native species and natural communities within this ecoregion;

2) produce a companion conservation plan and report to provide additional context and guidance for use and implementation of the conservation portfolio; and

3) evaluate different approaches to identifying and designing ecoregion-scale conservation portfolios, to inform future ecoregional conservation efforts by TNC or others.

From the beginning of this effort, TNC has recognized that there are numerous opportunities to learn from and potentially also to support and enhance compatible efforts by others, both in this ecoregion (e.g., the Interior Columbia Basin Ecosystem Management Project) and in other regions where the Conservancy works. Thus, the purpose of this report is to document the initial iteration of TNC's Columbia Plateau project and to propose conservation actions that will begin to achieve conservation at the ecoregional scale. The project is dynamic, and will evolve over time as conservation actions occur and as ecological, political and social conditions change.

Conservation Goal for the Columbia Plateau Ecoregion

The conservation goal for the Columbia Plateau Ecoregion is a restatement of the conservation goal found in "Conservation by Design". The goal calls for the long-term survival of all viable native species and community types in the ecoregion.

Overview of the Columbia Plateau Ecoregion

Geographic Setting

The Columbia Plateau is a broad expanse of sagebrush covered volcanic plains and valleys, punctuated by isolated mountain ranges and the dramatic river systems of the Snake, Owyhee, Boise and Columbia. Covering 301,329 km^2 (Figure 1), the Columbia Plateau stretches across the sagebrush steppe of southern Idaho, connecting the Columbia Basin of eastern Washington and Oregon to the northern Great Basin of Nevada, Utah and California. State representation in the ecoregion is varied with Oregon having the largest percentage of the area at 32%, followed closely by Idaho. Nevada and Washington have similar representations (17-18%) but California, Utah and Wyoming have only minor area within the ecoregion (Table 1).

TABLE 1. State Representation within Columbia Plateau Ecoregion

State	Size (Sq. Km)	Percent of Ecoregion
California	5565.0447	1.85
Idaho	89491.5617	29.70
Nevada	51455.9877	17.08
Oregon	96957.8168	32.18
Utah	2089.0641	0.69
Washington	55741.4180	18.50
Wyoming	28.3087	0.01

Elevations range from near sea level at the western end of the ecoregion to over 3000 meters on the highest mountain peaks. Precipitation occurs on a declining gradient from west to east with forest vegetation being supported only at higher elevations. In the rain shadows of mountain ranges there are alkali deserts that receive less than 15 cm of precipitation a year. Geologically and ecologically speaking, much of the ecoregion has quite modern origins dating back only a million years to the Pleistocene.

Biological Values

At least 239 vulnerable plants and animals (species that are considered to be globally threatened with extinction), including approximately 72 endemic plant species, are found in the Columbia Plateau ecoregion. The vulnerable species occur in all habitats and sections of the ecoregion but they are not distributed equally across it. There are concentrations of endemism in unique habitats and there are also concentrations of vulnerable species found in habitats that have been significantly altered by human activities. Some of the most threatened species are invertebrates which are only beginning to be taxonomically defined by experts. In this semi-arid land it is instructive to be reminded that the ecoregion's fisheries are an important part of its diversity. The Columbia River system, first bisecting the ecoregion between Oregon and Washington and then forming the core of its extent in Idaho and stretching all the way into northern Nevada, at one time sustained one of the largest salmon runs in the world. Today, the salmon runs have declined to less than a tenth of their former size due to the effects of dams, diversions, over-fishing and upland habitat degradation. The fisheries in those portions of the ecoregion not in the Columbia River basin are made up of numerous isolated desert fishes that are threatened throughout the ecoregion. The sagebrush steppe ecosystem supports huge herds of pronghorn that still have seasonal migrations and numerous species of birds of prey nest here at higher densities than anywhere else on earth.

Approximately 46 plant community alliances (according to the Gap Analysis Program (GAP) of U.S. Geological Survey) and approximately 450 plant community associations (according to TNC/Heritage classification) occur in the Columbia Plateau (Appendix 1). These plant communities are representative of the incredible biological diversity present in the ecoregion. Over 20% of these plant associations (105 plant community associations) are considered vulnerable by Heritage Programs in the ecoregion. Riparian and aquatic natural communities, that are only now beginning to be classified, represent along with their resident species another aspect of diversity that is yet be fully realized.

Ownership Patterns

Nearly half of the Columbia Plateau ecoregion is owned by the federal government, much of which is managed by the Bureau of Land Management (BLM) (Figure 2). The Department of Energy (DOE) manages two large tracts of land, Hanford Military Reservation and the Idaho National Engineering and Environmental Laboratory (INEEL), that are critical strongholds of biodiversity in the ecoregion. A number of relatively smaller, but ecologically important sites are managed by the U.S. Fish & Wildlife Service as National Wildlife Refuges. Private lands cover a similar percentage of the landscape as public lands but their distribution differs considerably from public lands. Valley bottomlands, stream drainages and the arable lands are all largely in private ownership. Land conversion, mostly to foster intensive agriculture, has occurred to a considerable extent on private lands in the ecoregion. Table 2 shows the percentage of land ownership by section of all major land owners in the ecoregion.

Different sections of the ecoregion display different ownership patterns as well. The Columbia Basin and the Palouse (Sections 342I and 331A) are dominated by private lands with over 75% of the land base in private ownership and much of that in intensive agriculture. The High Lava Plains (Section 342H) is evenly split between private and BLM ownership, again with the private lands used for agriculture. The Upper and Lower Snake River Plains (Sections 342D and 342C) have significant private lands holdings that are largely used for irrigated agriculture but there is a greater amount of land in BLM ownership which has grazing as a dominant use. The Upper Snake River Plains also has one of the large DOE holdings at INEEL. BLM lands cover nearly two-thirds of the western Basin & Range (Section 342BW) in contrast to the eastern Basin & Range (Section 342BE) which has over 40% its lands under US Forest Service (USFS) management, the only section in the ecoregion with significant Forest Service presence.

Table 2. Percent Representation of Agency, Private, Tribal, and State Lands within Ecoregion on a Section Basis.

SECTION	AGENCIES										
	BLM	BOR	DOD	DOE	NPS	PRIV	STATE	TNC	TRIBAL	USFS	USFWS
342I	6.60	1.73	1.26	1.03	0.00	72.67	10.69	0.70	2.28	0.07	2.47
331A	0.20	0.00	0.02	0.00	0.00	84.15	4.72	7.69	1.37	0.83	0.00
342D	49.25	0.38	0.00	3.87	0.79	35.51	3.30	0.01	2.98	0.97	0.73
342H	45.76	0.00	0.00	0.00	0.53	46.09	0.32	0.00	0.00	7.30	0.00
342C	57.00	1.31	0.21	0.00	0.00	25.71	6.40	9.10	4.52	0.00	0.00
342BW	65.90	0.00	0.65	0.00	0.00	21.91	5.55	0.00	1.54	2.64	4.27
342BE	15.62	0.00	0.28	0.00	0.00	36.43	4.39	0.24	0.00	41.67	0.00
FOR ENTIRE ECO REGION	40.45	0.95	0.73	1.21	0.07	45.46	3.57	0.01	2.84	2.76	1.40

Regional Economy

The Columbia Plateau's economic base remains firmly rooted in agriculture and commodity extractive related businesses and industry, although there are strong indications that extractive sectors of the economy are declining in importance. Irrigated agriculture is the most significant economic force in the ecoregion with crops ranging from potatoes and peas to wheat and alfalfa. Agriculture is prominent throughout the Snake River Plains of Idaho and the Columbia Basin which dominates portions of three states: Oregon, Washington, and Idaho. Throughout much of the rest of the ecoregion ranching is the dominant industry. Small family ranches mixed in with larger corporate ranches dot vast areas of the Basin & Range country and the Owyhee Uplands. Industrial development is limited mostly to Boise and the Tri Cities of Washington. One of the largest employers in the ecoregion is the federal government which is tied to its prominent land ownership. Population centers are widely dispersed in the ecoregion with only one metropolitan area, Boise, Idaho, exceeding 100,000 in population. Other cities are growing rapidly, however, with the Tri Cities of Washington (Kenniwick, Pasco, Richland); Bend, Oregon; Moscow, Twin Falls and Idaho Falls, Idaho all likely to become major centers in the near future. Growth is occurring in these population centers but it has not dramatically affected much of the ecoregion which still retains its rural character.

Principal Threats

Principal threats to the maintenance of biodiversity in the ecoregion include:

1. Poorly managed livestock grazing;
2. Changes to large-scale ecological processes such as fires and floods;
3. Invasive exotic species such as cheatgrass;
4. Water withdrawal and other hydrologic alterations;
5. Fragmentation of natural landscapes by agriculture and roads.

Extent of Conservation

Only 3% of the ecoregion has formal management designation that gives priority to maintaining biological diversity. To put this figure in perspective, approximately 3% of the terrestrial land base world-wide is managed for biodiversity (McNeely 1994). Biodiversity designations include Research Natural Area (RNA), Area of Critical Environmental Concern (ACEC), National Wildlife Refuge, TNC Preserve, National Park, Wild & Scenic River, and established Wilderness Area. Of the 3% that is designated for biodiversity protection, a much smaller percentage are adequately designed and managed to maintain that diversity. Many of the existing conservation areas are small, continue to support competing and unbalanced management goals (such as cattle grazing and recreation), and receive only minimal management and monitoring.

Conservancy Experience

Inventory: Biodiversity inventory efforts have not been evenly distributed across the ecoregion, although most state field offices and Heritage Programs have been actively engaged in inventory projects in the ecoregion.

Private Lands Protection: TNC currently owns and manages 25 preserves in the ecoregion, totaling 6,577 acres. A total of 24 target elements (7% of TNC's vulnerable species and community targets for the ecoregion) occurs on TNC lands, including 20 plant and animal species and 4 plant communities.

Public Lands Protection: In Washington state, TNC has worked for several years on public lands projects, including working to secure appropriate management designation of the Department of Energy's Fitzner-Eberhard Arid Lands Ecology Reserve as well as for the designation of the Hanford Reach - the last free-flowing stretch of the Columbia River - as a Wild and Scenic River. In Idaho, TNC recently purchased a ranch in the Owyhee Canyonlands, and has worked with federal agencies for many years to designate Areas of Critical Environmental Concern and Research Natural Areas, including the Snake River Birds of Prey Conservation Area. In Oregon TNC has worked on the Boardman RNA

(Department of Defense), Warner Wetlands ACEC (BLM) and at Hart Mountain National Antelope Refuge (USFWS) and has played a significant role in the identification and designation of RNAs and ACECs on BLM lands. The Nevada field office has several ongoing inventory efforts on Forest Service, USFWS and BLM lands in the ecoregion, and recently, acquired a key private parcel in the Jarbidge drainage.

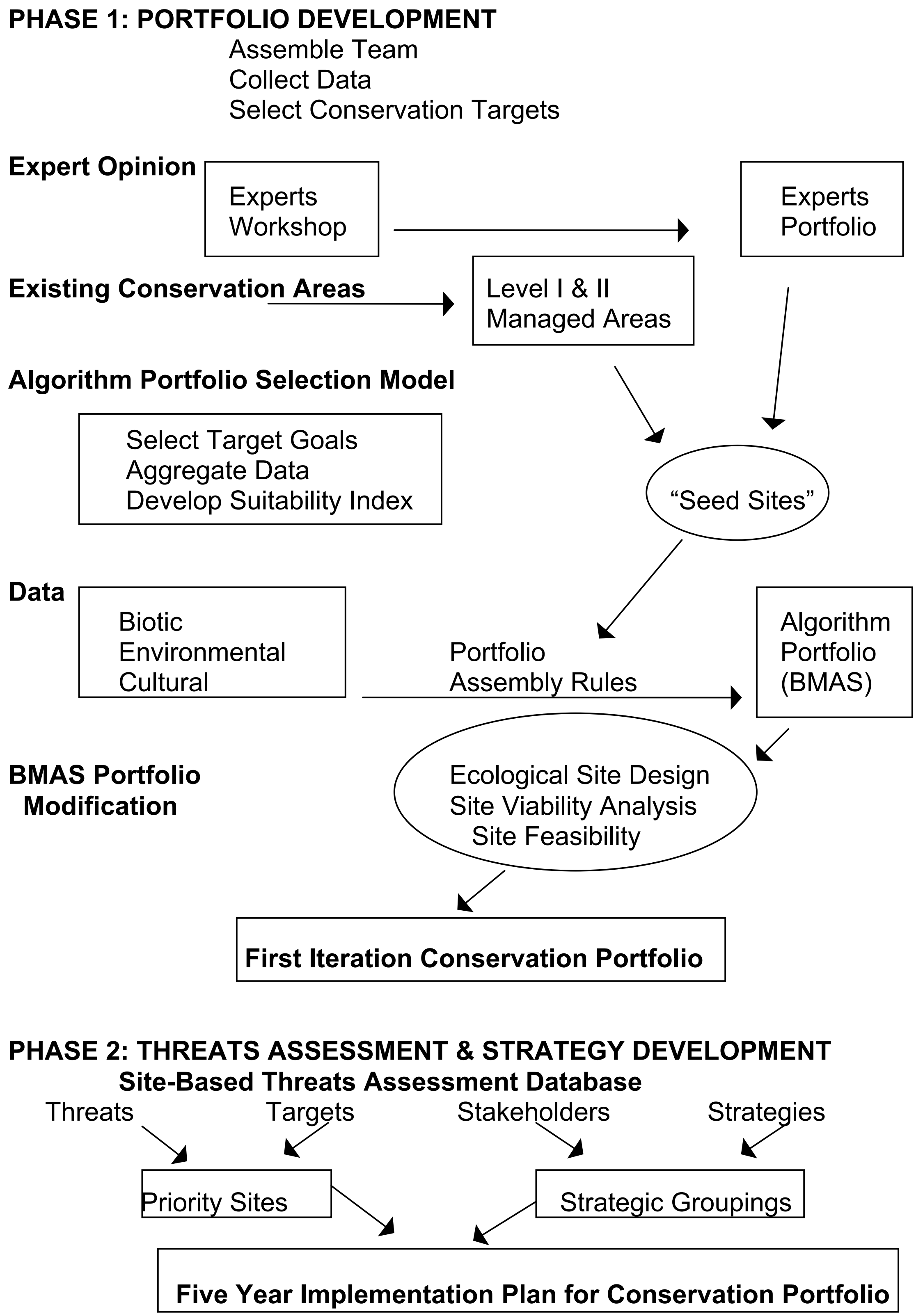
Overview of Columbia Plateau Planning Process

A diagram of the Columbia Plateau planning process is shown in Figure 3. The core planning team was selected from knowledgeable individuals within TNC field offices and Heritage Programs within the ecoregion. In addition, there was representation on the team by the Western Regional Office and the Western Regional Heritage Task Force. At the outset of the planning process, two distinct and sequential planning phases were envisioned: Phase 1, to develop the first iteration of the conservation portfolio; and Phase 2, to conduct a threats assessment of the portfolio sites and craft strategies and an implementation plan. As the process evolved and the portfolio development phase was taking place, it was decided to utilize a second planning team to work on the threats and strategies phase of the plan. This Phase 2 team included several members of the Phase 1 team as well as other persons who did not participate in the Phase 1 aspects of the planning process. All members of both planning teams are listed at the beginning of this document.

Because this was a pilot effort, there was some experimentation with different approaches to compiling data and assembling the portfolio of sites. After a first "credible iteration" of the portfolio was developed, the threats assessment process was begun, again using some experimentation of different approaches to arrive at the ultimate format for the assessment and subsequent strategies development. The threats assessment process was designed in such a way as to drive the conservation strategies and implementation phase of the ecoregional assessment.

Data compilation took the form of developing data sets that were compatible with Geographic Information System based (GIS) computer analysis. Some data layers were acquired directly as GIS files from various sources, other data layers were created through conversion of database files into GIS files, and still other sources of information had to be converted from text files to maps and then digitized into GIS data layers. Considerable effort was expended in making data sets complete and compatible. All information was stored and analyzed in ARCINFO/ARCVIEW compatible formats.

Figure 3. Columbia Plateau Planning Process



Three interrelated approaches were used to assemble draft portfolios that resulted in the final portfolio or first iteration of conservation sites. The approaches were, (1) experts workshop; (2) Biodiversity Management Area Selection (BMAS) model developed by the Frank Davis lab in the Institute of Earth System Sciences at the University of California, Santa Barbara; (3) BMAS with modifications made by the planning team and other persons knowledgeable with the ecoregion. The BMAS modeling process, using information derived from the experts workshop, was the ultimate source of the conservation portfolio after site modifications were made by members of the core planning team. The GIS was also used to compare the results of the different portfolio assembly approaches.

The BMAS modeling approach tested various methods for developing a conservation portfolio for the ecoregion. These methods included (1) TNC's fine filter concept which focuses on rare species as a means for protecting biodiversity; (2) TNC's coarse filter concept which focuses on protecting communities and ecosystems as surrogates for the species which inhabit them; and (3) a combined fine filter/coarse filter approach. More information regarding the BMAS model and the approaches used in its development can be found in the Davis et al paper included in Appendix 3.

The portfolio assembly process, the approaches taken, and the resulting conservation portfolios are explained in detail in later sections of the report.

Threats assessment, conservation strategies development and plan implementation were organized within a GIS environment utilizing a comprehensive site-based database. The database facilitated rapid analysis of multi-site threats, interested parties, and conservation targets. The database also analyzed and made comparisons of numerous sites that could employ similar conservation strategies.

Gathering the Data and Setting Conservation Targets

Ecoregion Boundaries

The boundaries of the Columbia Plateau Ecoregion are based on the US Forest Service ECOMAP framework map (Bailey et al 1994) as modified and adopted by TNC as the base map for TNC ecoregional units across the United States (Geography of Hope, TNC, 1997). The Columbia Plateau Ecoregion is derived from Bailey's Intermountain Semi-Desert Province #342. The Columbia Plateau team further modified the ecoregional boundaries by including the Palouse Prairie section (#331A) of Eastern Washington and Western Idaho in the ecoregion and omitting the disjunct portion of ecoregion that occurs in Wyoming (sections #342E, 342G, 342F, 342A). A minor modification was made to section #342B, Northwestern Basin and Range, effectively splitting it into eastern and western halves denoted by 342B-E and 342B-W section numbers. The exact boundaries of the ecoregion were refined slightly to conform to landform and vegetation patterns in the ecoregion.

The modified TNC ecoregion which was originally called the Intermountain Semi-Desert Province was re-named the Columbia Plateau Ecoregion to better represent the geographic landscape it covered. The Columbia Plateau includes the lower elevation portions of the Columbia Basin as well as the northern portion of the Great Basin, the Palouse, and the Snake River Plains. The Columbia Plateau ecoregion is distinguished by its sagebrush steppe dominated vegetation which rarely includes expansive montane coniferous forests. The US Forest Service's Interior Columbia Basin Ecosystem Management Project (ICBEMP) includes these coniferous forests and thus covers a broader geographic area than the Columbia Plateau project.

The Columbia Plateau Ecoregion included the following Bailey sections as modified by TNC:

331A	Palouse Prairie section
342I	Columbia Basin section
342H	High Lava Plains section
342B-W	Northwestern Basin and Range section-West
342B-E	Northwestern Basin and Range section-East
342C	Owyhee Uplands section
342D	Snake River Basalts section

Selecting Conservation Targets: Species and Vegetation Communities

Data Sources

Sources of data on the status and distribution of elements of biological diversity included:

- State Natural Heritage Programs (California, Idaho, Oregon, Nevada, Utah, Washington)
- Interior Columbia Basin Ecosystem Management Project (US Forest Service)
- Gap Analysis Program of the U.S. Geological Survey
- State Departments of Fish and Wildlife (Oregon, Washington, Idaho, Nevada)

Other data sets that were used in the portfolio analysis included:

- Environmental Data: elevation, rainfall, fire regimes, erosion potential, stream recovery potential
- Human Use and Impacts Data: predicted road density, mining claim density, population density, agricultural land conversion, current fire regime, land ownership.

Data sources are discussed in more detail in Appendix 1-A: Gathering the Pieces.

Data Management

Data management responsibilities reside with the Oregon Field Office in its GIS shop which is shared with the Oregon Natural Heritage Program. Three types of data are maintained in electronic formats:

1) Database files
2) GIS import files
3) GIS project files

The Database files consist of information that is organized around the first iteration conservation portfolio. These files include information about conservation targets, vegetation targets, threats and conservation strategies related to the portfolio sites. GIS import files are the files which came from the Data Sources cited above and include Heritage element occurrences (EOs), GAP vegetation coverages for the ecoregion, and other environmental data. The GIS import files are generally not specific to the conservation portfolio; they typically pertain to the ecoregion, overall. Finally, the GIS project files are files which have been created by TNC for the purposes of analysis and display. The project files utilize the database files and/or the GIS import files in a GIS format to provide site selection information, threats analysis, and map displays.

Plants
Natural Heritage Program botanists from Idaho, Washington and Oregon met in September 1996 to draft the list of vulnerable plant species for the Columbia Plateau ecoregion. At that time it was decided to include all G1-G3 species and all G4-G5, S1-S3 species as conservation targets (Appendix 1). Collectively, 349 plant species are tracked in this ecoregion by the six state natural heritage programs. Of these, 189 species are considered globally rare (i.e., they are ranked G1 - G3), and 160 are considered rare at the scale of one or more individual states (i.e., G4 - G5, S1 - S3). Many (n=72) of the G1 - G3 plants are endemic to the Columbia Plateau and most of these are endemic to a single section of the Columbia Plateau ecoregion. At the time of portfolio assembly it was decided to only include the G1-G3 plant species in the assembly process as the data set was too large and unwieldy when the S1-S3 species were included. It was assumed that a coarse filter approach would take into account the representativeness of the state sensitive (S ranked) plant species. During the analysis phase of the project, no attempt was made to determine if this assumption was well founded.

Invertebrates
All invertebrates with global ranks of G1, G2 or G3 are considered conservation targets (Appendix 1) in the Columbia Plateau. This list undoubtedly excludes many imperiled invertebrates, however relevant data are lacking for most invertebrate species. For the purposes of the site selection process 48 invertebrate species, including both terrestrial and aquatic species, were considered as conservation targets. Available data for many of these species is considered incomplete. For instance, the data set included only one known occurrence per section for most G1 - G3 terrestrial invertebrates, and only a few invertebrates had more than 3 known occurrences per section.

Terrestrial Vertebrates
Six hundred and nine terrestrial vertebrate species (9 G1s, 6 G2s, 15 G3s, 55 G4s, 524 G5s) occur in the Columbia Plateau, (Natural Heritage Program network 1996). After review by heritage program scientists, a total of fifty-seven species, excluding fish species, were selected as conservation targets. Selected targets included 12 herptile species, 30 species of birds and 15 mammals (Appendix 1). Species not known to breed in the ecoregion, those with greater than 95% of their distribution outside the ecoregion (e.g., kit fox, Yellow-billed Cuckoo), or those for which habitat was only minimally included within the ecoregion (e.g., Ruby-crowned Kinglet which depends on forest habitats) were eliminated from the list of potential conservation targets.

The final list of target vertebrates includes all rare and/or vulnerable vertebrates. Species with global ranks of G1, G2 or G3 in the Natural Heritage Database; G4 and G5-ranked species with documented population declines; endemic species;

species with documented threats; and G4 and G5-ranked neotropical migratory songbirds that had documented declines as determined in the Partners in Flight Breeding Bird Survey data were all considered vulnerable and were potential candidates for conservation target status. The status of bats, amphibians, and reptiles could not be determined from information in the Heritage database. For these species, expert opinion was relied on to determine rarity and/or vulnerability. It should be noted that Heritage Programs did not have element occurrence information for nearly 70% of the target vertebrates, making it impossible to assess how well the conservation portfolio protected these species.

Aquatic Vertebrates
Heritage Programs were initially contacted in order to compile a list conservation targets in this group. This resulted in a list of 80 species, some of which were common species (G5 rank) and included 28 exotic species as well. A more complete list of aquatic vertebrates was located with the Interior Columbia Basin Ecosystem Management Project (ICBEMP). The ICBEMP list included 91 native species and it noted those which were narrow endemics as well as those which had some associated conservation status such as federally listed, state listed or were considered candidates or sensitive species. The Heritage list and the ICBEMP list were then compared and all species occurring on either list that were narrow endemics or had some conservation status were retained.

For the site selection process 44 fish species were included as conservation targets, however, 72% species had no EOs associated with them. Because of this, the algorithm-based site selection assessment (BMAS) did not have adequate data to represent sites for aquatic vertebrate occurrences. Refinement of the aquatic vertebrate conservation target list, particularly with regards to runs of anadromous fish, will be a priority for the next iteration of the Columbia Plateau ecoregional assessment.

The lack of aquatic data was addressed in the project by using surrogates in the site selection process. Surrogates used for vulnerable aquatic species as well as riparian and aquatic communities came from ICBEMP which developed an Aquatic Integrity Index for the project. The Index classified watersheds as having high, medium or low aquatic habitat integrity which is thought to correlate well with aquatic species diversity. A watershed with high aquatic integrity has a mosaic of well-connected, high quality water and habitats that support a diverse assemblage of native and desired non-native species, the full expression of potential life histories and dispersal mechanisms, and the genetic diversity necessary for long-term persistence and adaptation in a variable environment (ICBEMP 1996).

Plant Communities
There are a total of 449 plant associations documented or suspected to occur in the ecoregion, based on the TNC regional classification for plant associations

(TNC-WRO 1996). Out of these nearly 450 associations, there are 113 G1 and G2 associations which form the basis for conservation targets for vulnerable plant associations in the ecoregion. The vulnerable associations include Granks of: G1, G1?, G1Q, G1G2, G2, G2? & G2Q; they are listed as Rare and Uncommon plant associations in Appendix 1. Of these G1-G2 associations, 32 associations are considered to be restricted to the Columbia Plateau Ecoregion (Appendix 1). Heritage ecologists recommended not including G3 ranked plant associations with the more vulnerable associations (G1 and G2) because it would have greatly increased the number of conservation targets, many for which there were no EOs.

For these ranked associations we have Element Occurrence Records (EOs) for 71 associations while 42 associations have no EOs. There are a total of 169 EOs for G1 & G2 plant associations of which 28 of the EOs date back to 1980 or older. A large number of the EOs are for plant associations that occur within existing protected areas such as RNAs and ACECs. Because of the anomaly of the data, site selection based on rare plant community occurrences will be biased towards the existing protected areas.

Conservation targets for plant associations also included representatives of more common associations (G3, G4, and G5 ranks). These more common associations were crosswalked with GAP cover types and the GAP cover types were then used as surrogates for the more specifically defined plant associations.

The GAP vegetation maps which are the basis for the vegetation layer in the GIS were developed through an involved process that required extensive edge mapping of adjoining states' GAP vegetation maps. The process also required that cover types agree across state lines and that the mapping resolution was relatively uniform. For a more complete description of this process see Stoms et al. (1997) that is included in Appendix 4.

Viability Analysis

Viability analysis for occurrences of conservation targets is important to provide a reasonable level of assurance that sites selected on the basis of the presence of particular targets will remain viable into the foreseeable future. Given adequate data on occurrences that are recorded in the Heritage databases the EO rank provides such an assessment. However, within the Columbia Plateau data sets many target species EOs have not been assigned ranks and most target community EOs do not have ranks. Therefore, the viability of target occurrences was assessed using more indirect measures. For vulnerable species (G1-G3), all element occurrences in the Natural Heritage database not reconfirmed by ground truthing since 1980 were excluded from the analysis under the assumption that the occurrence may no longer be present. Other element occurrence records lacking critical information such as date, location or observer were excluded from the data sets.

In contrast to EOs for vulnerable species, “historic” occurrences (pre -1980) for vulnerable plant associations (G1-G2) were not excluded from the data sets because most of the occurrences are still likely to occur where they were found in the past. The exclusion of pre-1980 plant community EOs would have resulted in nearly half of the community EOs not being used in the analysis, thereby making the site selection process quite insensitive to vulnerable communities.

Establishing Levels of Representation for Conservation Targets

Ecologists agree that some level of replication or redundancy in representing each conservation target within a portfolio of sites is essential. With more examples of each element in the portfolio, it is more likely that the full array of genotypic and/or phenotypic variation within that element will be maintained, the likelihood of catastrophic loss may be reduced, effective population sizes may be increased, and for some species, metapopulation structures may be enhanced (e.g., Soule & Simberloff 1986; Lande & Barrowclough 1987; Noss 1995). However, the importance of redundancy will vary both within and among ecosystems. For example, in highly fragmented or converted landscapes, where there is “less room for mistakes,” greater redundancy may be more critical than in relatively intact ecosystems. Moreover, ecological considerations need to be balanced against the increased area and costs of greater levels of redundancy.

Although ecologists agree that some redundancy is essential when deciding how many sites to protect for a species or ecosystem, there is little agreement about the optimal level of redundancy. For example, for natural land systems in New South Wales, Pressey and Nicholls (1989) applied a flexible level of replication, from one to five sites per conservation target, depending on the frequency of known occurrences; in Latin America and the Caribbean, Dinerstein et. al. (1995) proposed that three replicates of each habitat type is sufficient; whereas in Florida, based on extrapolations from Lande & Barrowclough, Cox et. al. (1996) conclude that for vertebrates ten replicates is required.

In principle, the number of replicates required to ensure persistence should depend on the level of biodiversity under consideration (e.g., a single species vs. a vegetation community), the spatial and temporal pattern and distribution of the target, as well as its vulnerability to ecological change (such as fragmentation, conversion, catastrophes, etc.). However, in practice, data for specific conservation targets are rarely sufficient to complete these kinds of evaluations on a case by case basis.

To help determine appropriate levels of representation for conservation targets in the Columbia Plateau, we plotted the probability of losing all known sites within a section for an element $(p_s)^N$ as a function of the probability of losing a single site for that element (p_s) and the number of protected sites for that element in the section (N).

Vulnerable Species

For occurrences of vulnerable plant and animal species, target levels of representation were based simply on the number of occurrences, since, for most species, data on population size or aerial extent of the occurrence were not available. It was not possible to base levels of representation on EO ranks for targets (i.e. only A or B ranked occurrences will be used for meeting conservation goals) as many EOs were not ranked.

Plants

For G1 - G3 plants endemic to a single section of the Columbia Plateau, the conservation goal was to represent all known occurrences up to a total of five occurrences per section, in the portfolio.

For more widespread G1-G3 plants (i.e., those occurring in two or more sections), the conservation goal was to represent up to a total of three occurrences per section in the portfolio.

Vertebrates

For those G1 - G3 vertebrates (terrestrial and aquatic) restricted to a single section, the goal was to represent all known occurrences up to five per section in the conservation portfolio. For more widespread vertebrates (i.e., those occurring in two or more sections), the goal was to represent all known occurrences, up to a total of three per section. These representation goals mimic those of target plant species with similar element ranks.

Invertebrates

Maintaining invertebrate populations typically requires little land, and therefore the cost of redundancy should be low for most invertebrates relative to other taxa. An arbitrary goal of representing all known occurrences of each G1 and G2 invertebrate per section within the portfolio was utilized in the site selection process. For G3 invertebrates the goal was to represent all known occurrences up to a total of five per section within the portfolio. It should be noted that only 5 G1-G2 invertebrate species (out of a total of 15 species) had more than 5 EOs, thus protecting all G1-G2 species occurrences was not unduly biasing the portfolio.

This representation goal should be reconsidered in future iterations of the portfolio in light of increased data for this group of species.

Rare Plant Communities

Rare plant community targets were split into two main groups: rare communities (G1, G2) and more common communities (G3, G4, G5). For the group of rare communities, sites were identified using EO data from the Natural Heritage

Programs. As noted previously, nearly half of these rare communities had no EOs associated with them and thus a significant “data gap” occurs for these biodiversity elements. Some of these communities will be captured along with more common communities in the process described below.

The more common communities were crosswalked with the GAP cover type map at the section level in order to use the GAP types as surrogates for the more common communities. Although the GAP map is not differentiated at the section level, this crosswalk process allows for the analysis of these communities x GAP type x sections.

Finally, the GAP cover types based on natural vegetation were categorized into 4 groups to take into consideration the following factors:

a. Overall regional distribution.
b. Value of the cover type and communities in it as “coarse filters”.
c. Relative rarity of the cover type and communities in it.
d. Pattern of distribution within the Columbia Plateau, focusing on whether the types occur in small patches or cover large areas.

Determination of the coarse filter value of cover types was made by Heritage ecologists based on their individual and collective knowledge. Species diversity of the particular cover types was an important criteria as was habitat uniqueness and the possible implications this may have for ecological values such as future speciation potential and genetic diversity.

The GAP alliances or cover types included within each of these Groups are displayed in Table 3 below.

Table 3. Representation Goals for GAP Land-Cover Types

Land-cover type	**Mapped Distribution (km^2)**
Group A - coarse-filter < 500 km^2 (50% goal)	
Seasonally/temporarily flooded cold-deciduous forest	382
Populus tremuloides woodland	184
Quercus garryana woodland	463
Non-tidal temperate or subpolar hydromorphic rooted vegetation (marsh and wetland)	482
Sparsely vegetated sand dunes	345
Sparsely vegetated boulder, gravel, cobble, talus rock	69
Group A - coarse filter > 500 km^2 (25% goal)	
Pinus ponderosa woodland	5,804
Artemisia rigida dwarf shrubland	700

Temperate deciduous shrub types -- Mountain brush	2,027
Cercocarpus ledifolius or *C. montanus* shrubland	516
Purshia tridentata shrubland	1,140
Seasonally/temporarily flooded cold-deciduous shrubland	1,279
Sarcobatus vermiculatus shrubland	3,576
Seasonally/temporarily flooded sand flats	1,670
Group B - small patch communities (20% goal)	
Abies species (*A. concolor, A. grandis* or *A. magnifica*) forest or woodland	1,397
Picea engelmannii and/or *Abies lasiocarpa* forest or woodland	83
Pseudotsuga menziesii forest	2,149
Populus tremuloides forest	740
Pinyon woodland (*Pinus edulis* or *P. monophylla*)	165
Pinyon-juniper woodland (*Pinus edulis* or *P. monophylla* with *Juniperus osteosperma* or *J. scopulorum*)	193
Pseudotsuga menziesii woodland	27
Artemisia cana shrubland	536
Artemisia tripartita shrubland	3,696
Artemisia nova dwarf-shrubland	164
Group C - large patch communities (10% goal)	
Juniper woodland (*Juniperus osteosperma* or *J. scopulorum*)	2,101
Juniperus occidentalis woodland	18,380
Artemisia tridentata ssp. vaseyana shrubland	17,181
Artemisia arbuscula-A. nova dwarf shrubland	1,816
Artemisia tridentata-A. arbuscula shrubland	45,144
Artemisia tridentata shrubland	64,574
Land-cover type	**Mapped Distribution (km^2)**
Mixed salt desert scrub (*Atriplex* spp.)	11,304
Dry grassland - *Pseudoroegneria* (*Agropyron*)-*Poa*	15,671
Moist grassland - *Festuca*	2,671
Group D - peripheral communities (0% goal)	
Pinus contorta forest	176
Pinus ponderosa forest	153
Pinus ponderosa-Pseudotsuga menziesii forest	784
Pinus monticola-Thuja plicata forest	20
Pinus flexilis or *P. albicaulis* woodland	104
Pinus contorta woodland	22
Pinus jeffreyi forest and woodland	2
Alpine tundra	3
Wet or dry meadow	30

Group E - cultivated, developed types and water (0% goal)

Agropyron cristatum seedings, *Poa pratensis*, hayfields, and Conservation Reserve Program lands	8,169
Annual grasses - *Bromus tectorum*, etc.	10,177
Urban or human settlements and mining	1,201
Agriculture	69,820
Water	3,568

Goals for Plant Communities

1. For those G1 through G2 communities for which EOs are available, it was desirable to include all those locations in the selected sites. There are some of these communities for which many EOs exist, but typically they are small, fragmented patches of once extensive vegetation types (e.g. Palouse grassland types). Rare communities or which there are no EOs will be identified for future inventory and protection efforts.

2. The more common associations were treated as components of the GAP cover type surrogates. Goals identified below that call for a percent representation are on a *per section basis.* The cover types were grouped into the following 4 groups based on factors stated previously. Representation goals for these groups reflect both the coarse filter values attributed to the cover types as well as the overall rarity of the types and their patch size. In other words, the higher the coarse filter value, the more rare the type, and the smaller the patch size of the type then the representation goal is correspondingly higher on a per section basis.

Group A: Those which have high (1) or medium (2) coarse filter value, and typically occur in small patches in the landscape. Most of these are restricted to unusual substrate or hydrologic conditions (or maybe even disturbance regimes), and/or are limited in their distribution and so need to be protected in the Columbia Plateau.

Goal A: 50% for types less than or equal to 500 sq. km,
25% for types greater than 500 sq. km

Group B: Those which have medium coarse filter value (2) and occur in relatively small patches. This is an interesting group of alliances, and contains 2 different patterns of vegetation types: those that are “disjunctly peripheral” to this ecoregion, and yet cover large areas and are important; and some of the less common *Artemisia* alliances with limited ranges of distribution. Most of these have total areas of < 500 sq. km.

Goal B: 20% per section

Group C: All those with high (1) to medium (2) coarse filter value and typically found in big patches. This includes the vegetation types that really “distinguish” the Columbia Plateau from surrounding mountainous ecoregions: *Juniper* Woodlands, *Artemisia* shrublands, big sage - low sage mixed shrublands, *Atriplex* salt desert, perennial grasslands. Most of these are very heterogeneous containing many associations. Several of them cover >10,000 sq. km and all are over 1000 sq. km in area in the Columbia Plateau. Interestingly, most of these are very poorly represented in Level 1 or 2 management areas.

Goal C: 10% per section

Group D: Those which have low (3) coarse filter value and which are mostly in small patches. These are primarily vegetation types which are only peripherally in the CP ecoregion because of the vagaries of the boundaries. Their primary range of distribution is outside of this ecoregion, and so most protection will not occur in the CP.

Goal D: Goal implemented was 0%

SUMMARY OF REPRESENTATION GOALS FOR CONSERVATION TARGETS

Rare Species (G1-G3) and Rare Communities (G1-G2)

If target occurs only in 1 section: All occurrences up to 5 per section

If target occurs in 2 or more sections: Up to three occurrences per section

Representative Vegetation (% of cover type on a per section)

Group A:	50% for types less than or equal to 500 sq. km 25% for types greater than 500 sq. km
Group B:	20%
Group C:	10%
Group D:	0%

Evaluating Existing Conservation Areas

Existing conservation areas within the Columbia Plateau Ecoregion account for approximately 3% of the landscape. These sites are a subset of a much greater number of sites that fall under a wide variety of management designations. All designated sites were individually evaluated as to their contribution towards the conservation of biodiversity and the complementarity of the goals of their management plans, when such plans exist. The ranking of conservation sites followed the guidelines outlined in Chapter 6 of "Geography of Hope" with all sites being assigned to categories I-IV; Level I sites having the greatest conservation value regarding biodiversity conservation and Level IV being of least value[1]. Sites ranked Levels I and II were compiled into a GIS data layer of conservation areas that was used in the final portfolio analysis for the Columbia Plateau project. Nearly all of these sites were incorporated into the final portfolio with only a few exceptions. Figure 4 shows the existing conservation areas in the Columbia Plateau that have identified conservation Levels of I and II.

The principal sources of information and instruction used in evaluating existing conservation areas were:

1. GAP Management Status (GIS Data Layer provided by the Biogeography Lab - University of California at Santa Barbara).

2. Natural Areas GIS data layer clipped to the TNC Columbia Plateau Ecoregion from the BVBNAT GIS Data Layer provided by Angela Evenden, US Forest Service, Missoula, MT.

3. "Evaluating the Contribution of Existing Conservation Areas," draft chapter for TNC's Geography of Hope guidelines.

4. Management level (1-4) rankings for the natural areas listed in item 2. (above) provided by: Idaho - Bob Moseley, Nevada - Steve Hobbs, Oregon - Dick Vander Schaaf, and Washington - Curt Soper.

Conservation areas included in the final portfolio are listed by site name in Appendix 2 with accompanying information regarding site designation and ownership, size, state and section in which they occur. Also included in Appendix 2 is supplementary information regarding procedures used to create the conservation areas data layer.

Of the 338 plant and animal species targeted by TNC as conservation priorities in the Columbia Plateau, less than 10% occur within existing protected areas.

[1] Reference Appendix 2 for an explanation of reasons for deviating from the standard Level 1 - Level IV Managed Area ranks.

Expert Opinion

Even in a relatively data rich ecoregion such as the Columbia Plateau, there continues to be large gaps in the data contained in established data sets that were heavily relied upon for the algorithm site selection process. A way to capture ecological information that does not currently exist in Heritage Programs is to solicit expert opinion regarding conservation targets and potential sites for conservation actions. Convening a workshop of knowledgeable experts to supplement available digital data proved particularly useful for the Columbia Plateau project, and is already being replicated by the Conservancy in other ecoregions. In addition to insuring consideration of the most up to date information in the portfolio assembly process, involving regional experts in the process enhances the credibility of the TNC's efforts, and builds an important constituency for the organization's work within the ecoregion.

Workshop Goal

Develop a list of sites in the Columbia Plateau ecoregion that, if managed for conservation, will protect the full range of biodiversity in the ecoregion.

Workshop Attendees

Over fifty experts attended from diverse organizations such as Natural Heritage programs, BLM, USF&WS, State Fish and Wildlife Programs, universities, private consulting firms, and TNC. Members of the Columbia Plateau Core Planning Team, other TNC staff and volunteers served as panel facilitators, recorders, and mapping coordinators.

Process

DAY 1: After a brief description of TNC's ecoregional planning efforts, the Columbia Plateau project goals and workshop goals, participants divided into panels organized around the following six topics: plants and plant communities; mammals; birds; herptiles; terrestrial invertebrates; and fish and aquatic communities.

Each panel had both a facilitator and recorder. A training session was conducted prior to the workshop for facilitators and recorders to make the panel sessions as smooth and productive as possible. Facilitators kept panels on task and ensured equal opportunity for participants to discuss sites. Recorders took notes on site selection rationale, discussion of specific species and communities, threats, data gaps, and other issues.

Experts had been asked to come prepared to nominate and map the most important sites in the ecoregion, both for conservation "targets" (i.e., G3 and above species and communities) and for representative sites (i.e., excellent examples of more common plant/animal communities). Lists of conservation targets were provided to panel members for each of the six categories. Experts were asked to bring maps and complete a Site Nomination Form describing the significance and threats for each nominated site .

Each panel accomplished the following:

- reviewed and modified conservation targets lists
- mapped approximate boundaries of nominated sites on mylar overlay of 1:500,000 scale map of the ecoregion
- labeled each mapped site to match its corresponding Site Nomination Form
- discussed threats and opportunities at sites
- discussed data gaps
- suggested other experts to contact

After each panel finished mapping sites, their task for the day was complete. That evening, several Core Team members and colleagues consolidated the sites onto one mylar overlay, using different colors to distinguish the six categories. Three copies of this consolidated mylar were made for use during the Day 2 sessions.

DAY 2: All participants convened to look at the composite map of nominated sites. The experts were eager to see the combined results of the panels' work. Participants were invited to offer comments on the previous day's effort. A lively discussion followed about how to tackle the next step: synthesizing the site information. There was much discussion of whether and how to consolidate overlapping site boundaries, and about whether to group concentrations of smaller sites into larger macrosites. There was also a suggestion to reach consensus on "crown jewel" sites in the ecoregion.

The participants split into three groups, each with a mixture of expertise. Each group evaluated a different portion of the ecoregion and attempted to identify the following: common threats and processes for sites; "crown jewel" sites; resources available to help with biodiversity protection; and data gaps. The groups also attempted to answer, "With the sites now mapped, can we say we have captured the full range of biodiversity within the ecoregion?" This question allowed experts to better apply the information they had provided the day before, but it still proved difficult for groups to address. All groups recognized this portion of the workshop as important but were somewhat frustrated with their end product.

Products/Follow Up

- Over 250 sites were nominated by workshop panels that, after eliminating duplications, resulted in approximately 120 discrete areas.
- Each site was digitized into GIS, and separate data layers were created for each of the panel categories.

- Panel minutes and list of workshop participants were sent to each panel member for edits/corrections
- Panel minutes were summarized and distributed to the Core Team.

An analysis of the portfolio compiled by the experts workshop which is a compilation of all sites nominated by all of the panels, after eliminating duplicate sites, is contained in Appendix 3. Lists of Conservation Targets met by groupings of 1-5 panels and 3-5 panels are included in the Appendix.
In general the 3-5 panel grouping resulted in meeting fewer of the Conservation Targets than the 1-5 panels grouping which incorporated results from the panels which chose to nominate sites. The terrestrial invertebrates panel nominated few sites, choosing to rely on a more coarse filter approach to protect biodiversity within this diverse group of species. At the other end of the spectrum, the Aquatics panel chose sites that more often than not were entire watersheds, covering a significant portion of the entire ecoregion. The Aquatics panel also noted that the ecoregion boundaries, by not being drawn on watershed lines, would not serve conservation efforts well.

Sites selected by at least four experts workshop panels were used to develop the starting condition for the portfolio assembly process. Figure 5 shows the sites selected by each expert panel. Sites which were selected by at least four panels became part of the starting condition for the algorithm driven site selection process.

Portfolio Assembly

The Columbia Plateau project utilized an algorithm approach for assembling the conservation portfolio. This approach was based largely upon the sources of data described in the Data Gathering section of this report but the approach also used information derived from the experts workshop as well as GIS files related to managed areas in the ecoregion. Several iterations of the portfolio were produced following review and analysis by the core team and Heritage scientists. The final portfolio, termed the first iteration portfolio, was the end product of these modifications and is described more fully in the following section of the report entitled "Conservation Portfolio".

A detailed description of the computer-based algorithm approach to portfolio assembly is provided in Appendix 4. The initial portfolio assembly phase of the project was conducted under contract by the Institute for Computational Earth System Science and Department of Geography, University of California, Santa Barbara. All assembly work was done in a GIS environment that allowed for rapid assessment of alternative portfolios.

Identifying Site Selection Units

Working at a regional scale, it was neither feasible nor desirable to delineate detailed ecological boundaries for all potential conservation sites in the Columbia Plateau (but see Goldsmith 1987; Kershaw et. al. 1995 for exceptions). For a region of this size, this type of delineation is most appropriately done as part of the site conservation planning process. Therefore, instead of relying on detailed, ecologically defined sites, we used a set of relatively uniform selection units as the potential "building blocks" of the conservation portfolio. The advantages of this approach for identifying potential reserve systems at both regional and global scales are widely recognized (e.g., Australia: Margules & Nicholls 1987; Purdie 1987; Purdie et. al. 1986; Pressey & Logan 19xx; Europe: Ryti 1992; Saetersdal et. al. 1993; Williams et. al. 1996; South Africa: Cowling & Bond 1991; Lombard et. al. 1991; Rebelo & Siegfried 1992; Freitag et. al. 1996; Willis et. al. 1996; Lombard et. al. in press; North America: Stoms 1994; Davis et. al. 1996; et. al. 1997).

Assuming that site identification and portfolio assembly are followed by more intensive delineation of ecological boundaries based on ground truthing and interpretation of low elevation aerial photography, a variety of potential selection units can be used to assemble conservation portfolios. Potential units include arbitrarily sized, regular grid cells (Kirkpatrick 1983; Purdie 1987; Purdie et. al. 1986; Rebelo & Siegfried 1990; 1992; Kirkpatrick & Brown 1991; Vane-Wright et. al. 1991; Belbin 1993; Church et. al. 1996; Williams et. al. 1996; Lombard et. al. in press); other regular shapes such as hexagons (Pennisi 1993; Csuti 1994; Csuti et. al. 1997); units of ownership or land use (Pressey & Nicholls 1989);

resource management units (RACAC 1996); or natural subdivisions such as watersheds (Lewis et. al. 1991; Bedward et. al. 1992; Davis et. al. 1996).

For the Columbia Plateau, we chose USGS "6th HUC subwatersheds" as the selection units for potential conservation sites. There are 4,036 of these subwatershed units in this ecoregion (Figure 6). They vary in size from 693 to 86,942 hectares, with an average individual size of 8,668 hectares (21,419 acres). Subwatersheds are reasonable selection units because they are based on natural landscape features delineated by easily recognized physiographic criteria; their size is a reasonable scale for managing ecological or hydrologic processes (or several units can be aggregated where larger sites are needed); and they approximate the scale of ecologically defined sites TNC field offices or other land managers might typically work at in this ecoregion (note that sites are ecologically defined, and often are larger than the boundaries of strict preserves). GIS data layers delineating subwatershed units were available for the entire project area from the Interior Columbia Basin Ecosystem Management Project, which used them for resource and ecological assessments, as well as for allocating potential management units.

Assembly Rules

The goal in assembling the BMAS portfolio was to maximize the representation of conservation targets up to the stated goals and to optimize the suitability of the sites selected, while simultaneously minimizing the number of sites and total area within the portfolio.

For each potential site or site selection unit, the following questions were asked: a) is the conservation target present; b) is the conservation target already adequately protected; c) is the site suitable or potentially suitable; d) is there a better or more efficient site?

Because of the large number of potential site selection units (subwatersheds) and conservation targets in the Columbia Plateau, it would not have been possible to use this approach to site selection and portfolio assembly without a Geographic Information System and the use of a computer to process all of the potential decisions and choices required for each site selection unit. It should be noted that each computer modeling run required considerable computational time.

Index of Conservation Suitability

In order to integrate programmatic, economic and socio-political concerns into the portfolio assembly process an Index of Conservation Suitability was developed. The index was used to determine the relative suitability of site selection units (subwatersheds) for potential inclusion into the conservation portfolio by means of a value compiled from factors characterizing the subwatershed. The index was calculated for each site selection unit (subwatershed), based on the following factors: distance to level 1 and 2 managed areas, already selected subwatersheds and sites selected by at least 4 experts panels; human population density; road density; % of habitat converted; aquatic integrity; and % of watershed in private ownership.

The index functioned as a screen for site viability and as a filter for the conservation feasibility of the particular subwatershed being evaluated. Factors related to site viability included road density, % habitat converted, aquatic integrity, and expert opinion. Factors related to conservation feasibility included population density, % private, and distance to seed or core areas. An example of how the suitability index was used is that when a conservation target is present in two subwatersheds (that biodiversity-wise are identical) which have different conservation suitabilities, as indicated by the index, the algorithm model selects the more suitable subwatershed for the BMAS portfolio. By utilizing the suitability index at the initial stages of site selection it was hoped that the planning team could avoid some of the difficult decision-making involving site evaluation at a later date. This is especially important when selected sites are not well known to TNC and are thus difficult to evaluate from a conservation feasibility standpoint.

Index of Conservation Suitability Factor Weights

Road Density = 0.2
Pop Density = 0.2
Pct Private = 0.2
Pct Converted = 0.2
Km to Seeds = 5.0 (Existing BMA + Expert Num >=4)
Expert Opinion = 0.2
Aquatic Integrity = 0.2

(note: BMA=Level 1 or 2 Managed Area and/or BMAS site)

Starting Condition for Algorithm Process

Starting Condition = existing Level 1 & 2 managed areas + sites selected by at least 4 experts panels from the experts workshop

The starting condition for the algorithm portfolio assembly process was based upon the level I and II existing managed areas within the ecoregion and sites selected by at least four panels of experts from the experts workshop. Figure 4 shows the existing conservation areas in the Columbia Plateau that have identified conservation levels of I and II. Figure 5 shows the sites which were selected by at least four panels that became part of the starting condition for the algorithm driven site selection process.

The starting condition sites acted as “seed” sites for the algorithm process whereby the subwatersheds in which they existed would be given a weighted preference in terms of potential site selection in determining the conservation portfolio.

Preliminary Portfolios

In addition to the conservation portfolio produced at the experts workshop, there were two preliminary conservation portfolios developed sequentially before the “first credible iteration” was finalized in January 1998. The progression or development of these portfolios is described below in chronological order with the changes between the previous version and the current version noted. Each successive portfolio utilizes the previous portfolio as a starting point from which the described portfolio was developed. The portfolio analyses and subsequent modifications focused on enhancing site viability and capturing conservation targets that were under-represented.

The purpose for describing in detail the successive portfolios which led to the “first credible iteration” portfolio is to show how the approaches differed as well as how they were used to arrive at the conservation portfolio in January 1998.

1) Experts Workshop Portfolio--January 1997

As noted previously in the section of the report titled “Expert Opinion”, the experts workshop for the Columbia Plateau project resulted in a conservation portfolio that was a composite of sites recommended by each of the six panels of experts. In the estimation of the experts at the workshop, protection of this portfolio of sites will conserve the biodiversity present in the ecoregion. The 258 sites nominated by experts panels reduced down to approximately 120 sites in the composite experts portfolio after duplicate and overlapping sites were taken into account. The experts workshop portfolio covers 191,422 sq. km and yet still leaves 18 of the 195 vulnerable land-cover types under represented (Stoms et al 1997). This portfolio meets two-thirds of the conservation targets for species and 90% of the conservation targets for vulnerable plant communities. The area covered by this version of conservation portfolio is approximately 63% of the entire Columbia Plateau, an area that would be very challenging from a conservation standpoint and would be politically untenable.

2) BMAS Portfolio--May 1997

The BMAS portfolio, developed by the Institute for Computational Earth System Sciences and Department of Geography at the University of California, Santa Barbara, was the product of the algorithm site selection process. The operative goal of the BMAS model was to meet the representativeness goals for the conservation targets in an as efficient manner as possible. Efficiency is defined as meeting the target goals with as few sites as possible requiring the least total area. The portfolio used subwatersheds for site selection units and tested several alternative portfolio assembly approaches based on (1) land-cover types alone (coarse filter), (2) rare elements alone (fine filter), and (3) cover types and rare elements together (integrated coarse and fine filters). Level I and II managed areas were assumed protected in all alternatives as were all subwatersheds identified by at least four of the six experts workshop panels.

The managed areas accounted for 9693 sq. km and the 105 subwatersheds identified by at least four experts panels accounted for another 9145 sq. km. The coarse filter alternative required an additional 185 subwatersheds be included in the portfolio while the fine filter alternative required an additional 501 subwatersheds to achieve the representation goals established for the conservation targets. Of particular importance when comparing these two alternative approaches are the changes to the total suitability index, the sum of the all suitability indexes for all subwatersheds in the alternative. (Note: the higher the suitability index, the lower the suitability of the watershed.) The total area of the subwatersheds containing the rare elements (fine filter alternative) is 160% greater than the area of the subwatersheds representing the GAP alliances (coarse filter alternative) while the suitability index was more than 400% greater. This result shows that there are fewer options (alternative sites) for meeting conservation goals for fine filter targets than for coarse filter targets and these fewer alternative sites come at a substantial cost in terms of less overall conservation suitability as portrayed by the higher index value. See Stoms et al 1997 in Appendix 4 for additional discussion of these alternative approaches of portfolio assembly.

The actual BMAS conservation portfolio is based on an integrated coarse- and fine-filter approach. The model selected 567 subwatersheds in addition to 105 subwatersheds accounted for by the experts workshop for a total of 75,191 sq. km. There was some efficiency gained in the integrated approach but again there were few optional sites with regards to fine filter conservation targets. A map of the BMAS portfolio is shown in Figure 7.

Results of the BMAS portfolio are detailed in Table 4 of Appendix 4. By design, the BMAS model met all the established representation goals for conservation targets except for those targets that did not have EOs associated with them.

The BMAS portfolio is useful as a benchmark from which to evaluate existing reserve systems or other potential conservation portfolios, it is not intended to be a final portfolio of sites without further evaluation as to economic, political and environmental factors. These factors include consideration of site design, site viability, site conservation feasibility, and changes in public lands management. For these reasons, BMAS became the starting point from which the first iteration conservation portfolio was developed.

3) BMAS Modified Portfolio--June 1997

The Columbia Plateau Ecoregional planning team used the BMAS model as a starting point from which to further refine site boundaries and to incorporate site information that could not be factored into the algorithm process. These modifications were made to the BMAS portfolio during an interactive meeting with Heritage Program scientists, the planning core team, and a GIS operator. Modifications were made on mylar overlays and flat maps of the BMAS portfolio using the computer-based GIS to identify conservation targets associated with the sites.

Modifications made to sites were based on expert Conservancy and Heritage knowledge of the site and of the conservation targets present, including viability of the site as it pertains to the element occurrences (EOs) as well as the viability of the site as it pertains to overall site persistence within the landscape. In other words, viability analysis of the portfolio sites was conducted at this time on a site by site basis using expert opinion of the sites and the conservation targets. Modifications made to sites because of consideration of viability issues were extensive and involved essentially all sites in the initial BMAS portfolio. Feasibility of potential conservation action was also factored in to portfolio modifications.

Examples of site modifications included re-designing site boundaries basing them more on landscape boundaries instead of merely subwatersheds. This often involved combining a number of subwatershed “sites” from BMAS into a single large site. Sometimes, boundaries were modified to capture only the intended target, resulting in shrinking the original subwatershed to a much small size. In other cases, entire BMAS sites were dropped because they were in landscapes that were highly degraded or fragmented and may have been originally selected for conservation targets such as long-billed curlew that could be easily met elsewhere.

Other portfolio modifications included: reducing site size for sites selected for rare plants in the Palouse and other places from subwatersheds to nominal point sites (0.202 sq. km or 50 acres); extending sites to the edges of the ecoregion when they would likely be identified as a site in an adjacent ecoregion (North and Middle Fork John Day River, South Fork Snake River); adding conservation buffers to sites designed around existing Level I and II managed areas; extending sites along major rivers in the ecoregion in order to capture additional aquatic diversity; joining subwatersheds into larger sites that were overlaid with BLM WSA designations such as in the Owyhee Plateau; adding acreage to existing sites to capture cover types that may have been lost due to other sites being dropped from the portfolio.

Site modifications continued to occur over a period of several months and involved core team members, Heritage scientists, and field office staff. Most modifications were made on draft maps of the portfolio and were then digitized into the GIS. Mapping errors occurring at this stage of the process may have resulted in some EOs being inadvertently omitted from the final portfolio. It is assumed that site conservation planning, which will occur when field offices implement the results of the ecoregional assessment, will be responsible for fine tuning site boundaries and targets.

The Conservation Portfolio

The conservation portfolio, entitled the first credible iteration in "Geography of Hope", was the last of several successive iterations of the BMAS portfolio. After the initial modifications to the BMAS portfolio (June 1997) were incorporated into the GIS and a revised portfolio was mapped, analysis of the conservation targets showed that a number of targets no longer met conservation goals established for the ecoregion. The targets that were most easily addressed were the species-based targets.

Core team members from their respective states addressed these issues on a section by section basis in the ecoregion, in many cases reflecting on the veracity of the selection of certain species as targets. In some instances it was decided that EO data was insufficient for these species when their conservation goals were based on numbers of occurrences per section. Species which were involved in these types of concerns could be grouped into two distinct categories: 1) species which are not currently tracked by all Heritage programs and/or species which may not have had much effort expended to record observations (i.e. short-horned lizard (*Phrynosoma douglasi*), and long-billed curlew (*Numenius americanus*); and 2) species which are on the periphery of their range that is more accurately centered within another ecoregion (i.e. kit fox (*Vulpes macrotis*) and green-tinged paintbrush (*Castilleja chlorotica*). In addition, there were several instances where conservation targets were not met because species EOs did not have adequate location information such as latitude/longitude coordinates. This resulted in EOs for the Borax Lake chub (*Gila boraxobius*) being inadvertently omitted from the BMAS portfolio even though the only occurrence of the species is on a TNC preserve.

Further refinements to portfolio sites, based on expert site knowledge, resulted when it was believed that the land had been converted or was of undesirable quality. In addition, there were site boundary changes made to include high quality lands adjacent to existing sites in the portfolio so as to include more intact landscapes. Site-based changes are detailed in Appendix 5 in a memo from Chris Hansen from WAFO.

Revisions to the June 1997 portfolio also were made when it became apparent that there were additional level I and II managed area sites within the portfolio that were not initially identified. Out of 43 newly identified managed areas within the portfolio, 15 were added as new sites, 16 were appended to existing sites, 11 areas were dropped from the portfolio as they added nothing in terms of biodiversity conserved, and for 1 site there was no action taken on it due to a lack of knowledge (the site is in California which was not actively involved in the ecoregional planning effort.) A FAX memo from Chris Hansen lists the 43 managed areas and their eventual disposition with regards to the final portfolio sites (Appendix 5).

First Iteration of the Conservation Portfolio (*January 1998)*

The first iteration of the conservation portfolio for the Columbia Plateau ecoregion includes 139 sites covering 63,860 sq. km, over 20% of the ecoregion (Figure 8). The sites are well distributed throughout the ecoregion with sizable representation in each of sections with the exception being in the Palouse country, section # 331A and in the eastern Basin & Range, section 342B-E. The largest site is centered on Steens Mountain in Oregon and includes the Alvord Desert as well as the Malheur National Wildlife Refuge; this site alone covers 5352 sq. km or over 1.3 million acres. The smallest sites are mostly rare species sites that were arbitrarily established at 0.202 sq. km or 50 acres. A tabular description of each of the sites selected with conservation targets present and major land ownerships is complied in Appendix 5. Also, an Access database titled "Columbia Plateau Sites" that contains information on each of the sites, including conservation targets and major land ownerships, is available upon request and is included on the CD version of the assessment. A list of the portfolio sites is included in Table 4 below.

Table 4. First Iteration Conservation Portfolio Sites for the Columbia Plateau Ecoregion.

Poly ID	Site Name	State	Section	Size (Sq. Km)	Targets
1	Dyer Haystacks	WA	342I	162.1470	communities
2	Grand Creek	WA	342I	706.3220	inverts;plants;animals
3	Waterville Plateau	WA	342I	307.6300	rare animals
4	Sinking Creek	WA	342I	616.2680	sharptail grouse
5	Wilson Creek	WA	342I	34.7690	rare plants
6	Rock Island Creek	WA	342I	630.0920	plants
7	Sagebrush Flat	WA	342I	177.5400	animals, comm
8	Douglas Creek	WA	342I	104.7410	rare plants
9	Upper Crab Creek	WA	342I	23.2560	rare plants
10	Crab Creek	WA	342I	933.4100	comm; plants
11	Turnbull NWR	WA	342I	75.1930	rare plants
12	Beezley Hills	WA	342I	305.1120	animals - verts
13	Hog Lake	WA	342I	27.2370	comm
14	Rock and Bonnie Lakes	WA	342I	72.7260	comm
15	Marcellus (Rocky Coulee)	WA	342I	100.6600	rare plants, comm
16	Rising Trout Meadows	WA	342I	85.6670	verts; inverts
17	Upper Dry Gulch	WA	342I	133.9650	rare plants
19	Potholes Reservoir	WA	342I	808.2890	water birds, comm
20	Steptoe point sites (2)	WA	331A	148.9140	rare plant
21	Hanford/Yakima TC	WA	342I	3588.0830	rare plants, comm
22	L.T. Murray	WA	342I	398.3120	fish; riparian; plants
23	Kahlotus	WA	342I	221.4940	comm
24	Esquatzel Coulee	WA	342I	837.9190	t&e animals, birds
26	Snake Breaks	WA	331A	370.3370	rare plants; comm
27	Alpowa	WA	331A	102.4030	cover
29	Horse Heaven Hills	WA	342I	779.0320	plants; b. owls; hawks
30	Upper Touchet Creek	WA	331A	29.6130	riparian communities

31	Juniper Dunes	WA	342I	168.1850	t&e animals, birds
32	Walla Walla	WA	342I	144.4950	fish; butterfly; plant
33	Alder Creek Ridge	WA	342I	156.2470	t&e plants, b. owls
34	Rock Creek	WA	342I	229.6740	comm; cover; animals
36	Columbia Hills	WA	342I	468.8900	plants, inverts, comm
107	Palouse pot. restore pt site	WA	331A	3.0410	plants, comm
108	Palouse pot. restore pt site	WA	331A	0.2020	plants, comm
109	Eureka Flats point sites	WA	342I	0.2020	
111	P. ponderosa comm pt. sites	WA	342I	0.2020	
112	Magnusson Butte	WA	342I	0.2020	
119	P. ponderosa comm pt. sites	WA	342I	0.2020	
134	Cowiche Canyon ACEC	WA	342I	2.2590	
135	TNC Rose Creek Preserve	WA	331A	0.0700	
97	Raft River Mountains	UT	342B-E	185.0180	t&e plant
73	Steens/Alvord/Malheur	OR, NV	342B-W	5352.2250	t&e species
92	Oregon Canyon Mtns	OR, NV	342B-W	301.8850	t&e plants, comm
65	Succor Creek	OR, ID	342C	2770.4880	rare plants, comm
86	Hart Mtn/Warner Basin	OR, CA	342B-W	2394.4670	t&e species, comm
35	Boardman	OR	342I	679.9860	comm, t&e animals
37	Willow Creek	OR	342I	146.6880	riparian
38	Umatilla River	OR	342I	479.4980	t&e plants; riparian; fish
39	Deschutes River	OR	342I	665.1210	rare snails; chinook
40	Birch Creek	OR	342I	212.6050	rare plants
42	Butter Creek	OR	331A	84.4140	fish
43	Lawrence Grasslands	OR	342I	248.5240	communities
44	Clarno Canyon	OR	342H	757.2010	communities
45	Mutton Mountains	OR	342I	110.6350	rare snails; chinook
46	Middle - North Fork John Day	OR	342H	505.7940	fish, comm
47	Painted Hills/Sutton Mtn	OR	342H	238.6380	rare plants;comm
48	S Fork /Main stem John Day	OR	342H	350.9350	rare plants/fish
49	Metolius Bench	OR	342H	32.9050	riparian
50	Cline Buttes	OR	342H	1018.5110	comm
52	North Fork Crooked River	OR	342H	225.5110	riparian comm
54	Powell Butte	OR	342H	3.1430	comm
55	Cottonwood Mtn	OR	342C	413.4560	comm
56	Bear Creek	OR	342H	107.1370	comm
57	E. cusickii pt. site #2	OR	342B-W	0.2020	rare plants
59	Castle Rock	OR	342C	66.6200	comm
61	Horse Ridge	OR	342H	4.7540	comm
63	Harper	OR	342C	308.1440	rare plants, comm
67	Devils Garden ACEC	OR	342B-W	131.6870	comm
68	Squaw Ridge WSA	OR	342B-W	111.6190	comm
69	Dry Creek	OR	342C	404.7610	comm/plants
71	Four Craters WSA	OR	342B-W	61.1880	comm
72	Lost Forest	OR	342B-W	173.4640	comm
74	Connley Hills	OR	342B-W	21.7140	comm
75	Saddle Butte	OR	342C	677.3720	bats, comm
80	Summer Lake	OR	342B-W	423.8220	fish, comm
83	Crooked Creek	OR	342C	194.2910	t&e plants, comm
84	Lake Albert	OR	342B-W	380.8400	shorebirds; comm
88	Guano Slough	OR	342B-W	18.0890	comm
91	Deep Creek	OR	342B-W	110.1960	fish/rare plants/
96	Hawk Mtn	OR	342B-W	97.2250	t&e comm
106	Alkali Gulch	OR	342C	279.4010	t&e plants
113	Mousetail	OR	342I	0.2020	t&e plants
114	Venator Canyon	OR	342B-W	0.2020	t&e plants

115	Juniper Mountain	OR	342B-W	0.2020	comm
116	Malheur Cave	OR	342B-W	0.2020	rare inverts
117	Barren Valley	OR	342B-W	0.4040	t&e plants
120	E. cusickii pt. site #1	OR	342B-W	0.2020	rare plants
121	Foster Flat RNA	OR	342B-W	27.7800	comm
125	E. chrysops point sites	OR	342C	0.2020	t&e plants
138	Benjamin Pasture ACEC/RNA	OR	342B-W	2.6810	comm
139	Stockade Mountain ACEC/RNA	OR	342C	2.9860	comm
94	Piute Creek/Sheldon	NV, OR	342B-W	2795.8520	t&e plants/fish
89	Jarbidge Creek	NV, ID	342B-E	1357.4620	fish; bighorn; plants
98	Santa Rosa Mtn	NV	342B-W	594.1760	comm
103	Pyramid Lake	NV	342B-W	1854.3640	rare fish
60	Teton Marsh	ID, WY	342D	739.9310	birds, cover
18	Liberty Butte	ID, WA	331A	52.2480	community
93	Goose Creek	ID, UT, NV	342B-E	741.0850	endemic plants;comm
90	Albion Mtns	ID, UT	342B-E	433.5610	t&e plants; fish;comm
87	Owyhee Canyon Lands	ID, OR, NV	342C	4121.7740	comm, animals
95	Duck Valley	ID, NV	342C	344.4430	wetlands
25	Paradise Ridge	ID	331A	109.4250	rare plant; comm
28	Camas Prairie	ID	331A	432.4280	rare plants, comm
41	Substation Tract ACEC	ID	342D	1.7620	
51	Weiser Sand Hills	ID	342C	508.1010	plants/animals/comm
53	St. Anthony Dunes	ID	342D	1463.5550	tiger beetle; cover
58	Camas Mud Lake	ID	342D	549.5710	t&e species
62	Big Desert (INEL)	ID	342D	2385.6760	t&e species, cover
64	Boise Front	ID	342C	372.1400	end plants
66	Idaho Falls Dunes	ID	342D	157.1480	tiger beetle
70	Craters of the Moon	ID	342D	1617.0440	t&e birds, plants, cover
76	Birds of Prey NCA	ID	342C	658.2040	bird/comm/sturgeon
77	Blackfoot wetlands	ID	342B-E	634.9390	wetlands, birds
78	American Falls	ID	342D	312.7520	shorebirds, t&e species
79	Bruneau-Jacks Creek	ID	342C	2140.8740	snails
81	Middle Snake River Corridor	ID	342D	1984.8760	fish, snails, waterbirds
82	Dietrich Dunes	ID	342D	57.5180	tiger beetle
85	Formation Spring	ID	342-BE	6.9310	aquatic values, comm
110	Palouse pot. restore pt site	ID	331A	0.2020	
118	Curlew Natl Grsslnd pt sites	ID	342B-E	0.2020	
122	S. Fork Snake River	ID	342D	340.2610	
123	Salmon Falls Creek	ID	342C	747.8720	
124	Black Pine Crest	ID	342B-E	24.3450	
126	Big Juniper Kipuka RNA/ACEC	ID	342D	1.3070	comm
127	Sand Kipuka RNA/ACEC	ID	342D	1.3020	comm
128	TNC Stapp-Soldier Creek Pres	ID	342C	0.3640	comm
129	Dry Creek WSR/RNA	ID	342C	4.4190	comm
130	Big Wood WSR	ID	342C	2.4600	riparian
131	TNC Silver Creek Preserve	ID	342C	7.5170	riparian
132	ID-33-015 WSA	ID	342D	2.9900	comm
133	Middle Frk Clearwater WSR	ID	331A	18.4130	riparian
136	Trapper Creek PRNA	ID	342B-E	1.8550	
137	Tex Creek Wildlife Mgmt Area	ID	342B-E	68.6820	
99	Upper Surprise Valley	CA, NV	342B-W	256.9770	
100	Lower Surprise Valley	CA, NV	342B-W	274.8890	
101	Madeline Plains	CA, NV	342B-W	220.7600	
102	Honey Lake Valley	CA, NV	342B-W	1600.4990	
105	Upper Long Valley	CA, NV	342B-W	87.3010	
104	Five Spring Mtn	CA	342B-W	20.0660	

The conservation portfolio includes a broad spectrum of land ownerships; essentially all the land owners in the ecoregion are represented in the portfolio in relatively similar proportions to their ownership in the ecoregion as a whole. The percent ownership of major land owners in the portfolio are listed below.

Land Owner	Total Area of Sites (Sq. Km)	Percent Total Area
BLM	24045.13	37.65
DOD	1380.43	2.16
DOE	2765.02	4.33
PRIVATE	23114.55	36.20
STATE	3089.06	4.84
TNC	19.96	0.03
TRIBAL	1514.81	2.86
USFS	1826.18	2.86
USFWS	3969.00	6.22
OTHER GOV	1110.20	1.74

The portfolio sites are widely distributed throughout the ecoregion but with some tendency to have more sites and more total acreage of sites in certain sections than in others. Table 5 below shows the total number of sites per section, the total acreage of sites and the size of the section for comparison purposes. The percent of the section included in the conservation portfolio is also shown in Table 5.

It can be seen that the larger sections contain more acreage of portfolio sites, however there are some notable exceptions to this generalization. Two sections, the Palouse (section 331A) and the Eastern Basin & Range (section 342B-E) have a considerably smaller percentage of their lands in the portfolio. The reasons for this is related to several factors. Section 331A consists of a higher percentage of private lands than other sections in the ecoregion and these lands have a higher percent of land conversion to crop agriculture than other sections with the possible exception of the Columbia Basin (section 342I). Consequently many of the sites within section 331A are small, being the minimal size of 0.202 sq. km, with little potential for landscape level conservation. Section 342B-E has a smaller percentage of its lands in the portfolio based largely on the fact that there was little Heritage Program data for the section and few managed areas. Without EO data and existing protected areas there were few sites selected initially by the BMAS model, and very little added in later iterations due to lack of knowledge of the section.

Table 5. Numbers of Portfolio Sites and their Combined Areas per Section.

Section	# of Sites	Site Area (Sq. Km)	Section Area (Sq. Km)	Percent of Section
331A	13	1351.71	18444.30	7%
342I	41	14843.68	64399.72	23%
342H	10	3244.53	16334.29	20%
342D	14	9615.69	32365.54	30%
342C	21	14025.89	62953.20	22%
342B-W	30	17315.18	72911.76	24%
342B-E	10	3454.08	33920.12	10%

Conservation Targets Met in First Iteration Portfolio

The conservation portfolio did a reasonably good job of meeting the conservation goals for the targets identified for the ecoregion plan. Documentation of conservation target goals met by the ecoregional assessment are included in Appendix 5. Goals related to vulnerable species and vulnerable plant communities were most easy to assess as they were based on EOs captured by the portfolio in each of the sections of the ecoregion in which they occurred. Goals related to percent cover of GAP land cover types represented in the portfolio were more difficult to assess as there were 4 different representation goals, each attributed to a specific group of GAP cover types (see p. 27 for goals).

The analysis of GAP cover type goals was assessed on a section by section basis in order to portray how the conservation portfolio fared in the different sections in the ecoregion. Table 6 below shows this analysis. It should be noted that this analysis does not show on a percentage or acreage basis how well individual cover types are protected in the portfolio.

Table 6. GAP Cover Type Conservation Goals Met in Portfolio

Section	Total # alliances	Target Met Y	N	% Met
331A	11	5	6	45
342I	19	15	4	79
342H	16	12	4	75
342BW	29	23	6	79
342BE	24	15	9	63
342C	24	17	7	71
342D	16	16	0	100
TOTAL	139	103	36	74%

In most sections one or more GAP alliances did not meet the representation goals. A small number of alliances were not well represented in several sections and should be the focus of additional inventory and conservation efforts in order to locate appropriate sites that can be incorporated into the conservation portfolio. The alliances needing conservation attention include: (41) lowland riparian forest; (72) aspen woodland; (97) big sagebrush shrubland; (102) bitterbrush; (110) alluvial riparian shrubland.

Conservation target species and rare communities met by the first iteration portfolio are summarized below in Table 7.

Table 7. Conservation Target Species and Communities Goals Met by First Iteration Portfolio

Group	#Total Targets	#Targets Met	% Met	#Targets w/ EOs	%Targets w/ EOs Met
Plants	189	93	49%	133	70%
Plant Communities	113	58	51%	72	81%
Mammals	16	7	44%	11	64%
Inverts	48	15	31%	23	65%
Herptiles	12	8	67%	10	80%
Fish	44	10	23%	12	83%
Birds	30	11	37%	23	48%
Total	452	202	45%	284	71%

This table indicates that out of a total of 452 conservation targets only 202 targets (45%) met the goals established for them by the conservation portfolio. At first glance this seems like an unacceptable number of targets not meeting conservation goals but when the summary table is further examined taking into account the targets for which there are EOs then the percentage of conservation targets meeting their goals becomes 71% out of a total of 284 targets. In this analysis 82 targets, all of which had EOs associated with them, did not meet the conservation goals set for them.

There are a number of reasons why the conservation goals were not met for the above noted targets. Vulnerable plant communities, for instance, have not been well represented by EO records in Heritage Program databases. This is related to both a lack of inventory for these elements and a lack of recording occurrences into the database as well. The lack of government contracts, in some states, for inventory of and for managing data on such communities is partly responsible for the omission of community EOs from Heritage Program databases. Invertebrates also suffer from lack of inventory as there are few experts who know the species and, until recently, there has been little interest in these species from federal land management agencies and conservationists. Finally, a number of the wildlife targets (birds, mammals, herptiles) have historically not had occurrences reported to Heritage Programs when the species are encountered. This is a result of agency biologists not being keyed into Heritage Programs' data collection and record updating needs; it is not a reflection on biologists not caring about these species.

The largest group of taxa that did not meet the conservation goals were plants, and there are some general reasons why this occurred. One reason that there were so many plants not meeting target goals is that there were more plant species targets than any other group of taxa. This fact is somewhat exacerbated by the extensive EO data for plants such that more occurrences in more sections of the ecoregion translates into more section goals to be met. Another reason for the large number of unmet goals for plant targets is that 12 of the unmet targets had only 1 EO within the ecoregion and are not considered to be truly Columbia Plateau species. In other words, these species' habitats are more characteristic of neighboring ecoregions. Their occurrences within the Columbia Plateau are related more to the vagaries of indistinct boundaries between ecoregions than to concerns that the species' habitat really extends into this ecoregion in any significant way. Nevertheless, there remains some consideration for "edge of range" effects on genetic and species conservation. Within the plant group, 23 of the unmet targets are G3 species, 12 are G2 species and 5 species are G1s.

Regarding the unmet G1 plant targets, *Thelypodium howellii ssp. spectabilis* has only 1 occurrence in the ecoregion and is more closely associated with the Idaho Batholith ecoregion; *Arabis falcatoria* is a narrow endemic which must be protected in this ecoregion; *Astragalus collinus var. laurentii* is also restricted to the ecoregion and is well represented in the portfolio in one section.

Unmet conservation target goals are a serious concern for the ecoregional assessment that will need to be addressed in several ways. Site conservation planning will need to consider modifying site boundaries when unmet target occurrences are nearby. Additional inventory work is necessary for many vulnerable communities and invertebrate targets. And finally, better reporting of targets by field biologists has the potential to greatly expand the databases which were the basis for much of the site selection in the conservation portfolio.

Conserving Ecological Processes

In addition to conservation target goals, there were also general conservation goals for the portfolio that are related to the maintenance of ecological processes across the landscape. These goals are difficult to assess from an objective point of view but subjectively, looking at the suite of sites selected in the portfolio, there appears to be adequate representation of large landscape sites that have some level of intact ecological processes. Sites that include landscapes which may support ecological processes are listed in Table 8.

Table 8. Portfolio Sites Capable of Supporting Landscape Scale Ecological Processes

Site ID	Site Name	Section	Size (Sq. Km)
2	Grand Creek	342I	706.32
19	Potholes Reservoir	342I	808.29
21	Hanford/Yakima TC	342I	3588.08
22	L.T.Murray	342I	398.31
23	Kahlotus	342I	221.49
24	Esquatzel Coulee	342I	837.92
35	Boardman	342I	468.89
44	Clarno Canyon	342H	757.20
62	Big Desert (INEL)	342D	2385.68
65	Succor Creek	342C	2770.49
70	Craters of the Moon	342D	1617.04
73	Steens/Alvord/Malheur	342BW	5352.23
79	Bruneau-Jacks Creek	342C	2140.87
81	Middle Snake River Corridor	342D	1984.88
86	Hart Mtn/Warner Basin	342BW	2394.47
87	Owyhee Canyon Lands	342C	4121.77
89	Jarbidge Creek	342BE	1357.46
90	Albion Mtns	342BE	433.56
93	Goose Creek	342BE	741.09
94	Piute Creek/Sheldon	342BW	2795.85
102	Honey Lake Valley	342BW	1600.50

In addition, there are many other portfolio sites in each section that have the potential to act as large functioning landscapes in the future given restoration of their ecosystems.

Threats Assessment

Background

Summary and analysis of ecological, social, political and economic information on sites selected for the ecoregional portfolio served as the basis for the development of ecoregional conservation strategies and actions. Site information was summarized in graphic and tabular form to highlight patterns, assess the scope of conservation efforts needed, and categorize the relative importance and urgency of sites, strategies, and actions. Specifically, the purpose of the site information and threats assessment process was to:

1) Assess the feasibility of protecting targeted elements at each site;
2) Identify the scope of our conservation challenges in the ecoregion;
3) Categorize sites by importance and urgency;
4) Identify the most urgent threats to high priority sites;
5) Identify and rank multi-site threats;
6) Identify site and multi-site stakeholders/key players, opportunities, and obstacles;
7) Identify TNC's potential role at sites and in the ecoregion;
8) Set the baseline status of conservation (site management status and threat ranks) in the ecoregion for measuring the effectiveness of conservation efforts over time; and
9) Identify conservation strategies.

Information assembled in the ecoregional site database included the site size, target occurrences, ownership, and current conservation management status of sites in the portfolio. To complete the site and threats assessment additional data was developed for each site that addressed the threats, human context, potential strategies, and TNC role at each site selected for the portfolio. This data was incorporated into the threats assessment database (Columbia Plateau Sites.mdb).

Threats Assessment Methods

The threats assessment phase of the Columbia Plateau ecoregional assessment project was conducted by a subgroup of the core team which began working together in August 1997. As much of the site selection phase of the project was conducted within a GIS environment, it was decided to continue to use GIS in the threats assessment phase as well.

A site-based threats assessment database was developed in Access that linked sites, land ownership patterns, and conservation targets with threats. The database is organized around forms that contain discrete types of information. The forms are labeled "Site," "Species" and "Threat." Basic fields on the forms were populated from the GIS site database, such as site name, ownership, vegetation cover, EOs present; other fields were then completed by the core team. All fields on the forms are searchable within the database and multiple level complex searches can also be undertaken. The database relies upon site based knowledge, which was not always present. A lack of knowledge about a site was able to be recorded in most fields.

A copy of the edited version of the database titled “Columbia Plateau Sites.mdb” is included on the CD or available by contacting the Conservancy.

The threats assessment database has its utility in being able to analyze the portfolio sites from a number of different perspectives. These perspectives include, but are not limited to: ownership, conservation targets, habitats, managed areas and threats. Within each of these perspectives there may be several different scaled parameters which can also be analyzed. For instance, in terms of threats, each type of threat that is noted to be of concern for a site is evaluated as to its scope or affect (loss likely, significant, minor, unknown); when it occurred (in past, now, within 5 years, 5-15 years); whether it is reversible; and the level of knowledge regarding the threat (good, moderate, minor, none).

A summary of the threats reported for the portfolio sites in the ecoregion is displayed in Table 9 below. The table lists by threat the number of times a particular threat is recorded for all sites, regardless of the scope of the threat or when is occurred. The threat occurrences are compiled on a section by section basis, based on where the sites are located. The total number of occurrences attributed to each type of threat in the threats database is shown in the far right-hand column of the table.

The summary shows that the most frequently cited threats for the portfolio sites (and their number of occurrences) are: grazing (105), non-native plants (85), altered fire regime (49), recreation (44), crop agriculture (42), residential development (27), diversions (26), and hydrologic alteration (19). Except for recreation and possibly residential development, these threats were assumed at the outset of the project to represent the most significant challenges to conservation of biodiversity in the ecoregion. The table also shows which sections in the Columbia Plateau recorded the greatest number of threats. The Columbia Basin (section 342I) had the greatest number of recorded threats (183 threats) for the portfolio sites contained within the section followed by the western Basin & Range (section 342B-W) with a total of 138 individual threats. The Lower Snake River Plains/Owyhee Uplands (section 342C) was third in terms of total threats with 78 threats. The other sections trailed these sections in total threats.

Table 9. Portfolio Site Threats Compiled by Section of the Ecoregion

THREATS	331A	342BE	342BW	342C	342D	342H	342I	**TOTAL THREAT OCCUR**
blank							2	
Agriculture - Crop	4	1	9	4	2	2	20	42
Air Pollution							1	1
Altered Fire Regime	2	1	14	12	1	8	11	49
Aquaculture			1		1			2
Commercial Development			2			1	1	4
Commercial Development (comm sites)		1						1
Concentrated Livestock			1				3	4
Dams			3		1		3	7
Diversions	2	1	8	3	1	4	7	26
Dredging	1		3				1	5
Dredging (Flood Control)			1					1
Fishing			1				1	2
Grazing	5	8	25	19	7	10	31	105
Ground Water Withdrawal			2	2	2		5	11
Hazmat Spill (Railroad and I80)			1					1
Hunting			3					3
Hydrologic Alteration	1	1	5	3	4		5	19
Industrial Production			1					1
Logging	2	3		1		3	1	10
Loss of Habitat Elsewhere	1	1	1				4	7
Mining		1	5	6	1	1		14
Mining (Gravel)			1					1
Native Population Outbreak		1						1
Non-native Aquatic Invertebrates					1		1	2
Non-native Fish		1	4		1	1	5	12
Non-native Mammals			1				4	5
Non-native Plants	7	2	13	13	6	11	33	85
Other Harvest (Fuelwood Gathering)			1					1
Other Land Use							1	1
Pesticide drift	1							1
Recreation	1	1	15	7	5	2	13	44
Residential Development	2	2	5	2	4	4	8	27
Restriction of Range	3	1	1		1		3	9
Roads/Rights Of Way	1	1			1		4	7
Seedings			1	1				2
Small Population	2		4	2	1		4	13
Vandalism & Harassment			1				2	3
Water Pollution	2		2	1	1	2	7	15
Water Pollution (Ag Return)			1					1
Weapons Testing/Training				2			2	4
TOTAL THREATS PER SECT	37	27	136	78	41	49	183	549

In addition to the most common threats in the ecoregion, it is instructive to note the least common threats in Table 9. Threats that were noted to occur less than 5 times in the threats database include: air pollution, aquaculture, commercial development, concentrated livestock, dredging (flood control), fishing, hazardous materials spills, hunting, industrial production, native population outbreak, non-native aquatic invertebrates, non-native fish, fuelwood gathering, other landuse, pesticide drift, seedings, vandalism, water pollution (ag runoff) and weapons testing/training. The few instances these threats occur does not imply that they are not significant threats to biodiversity conservation, but rather that they may have diminished utility regarding the development of multi-site strategies to abate them.

Table 9 also shows in which sections of the ecoregion particular threats are most prevalent. Crop agriculture is a dominant threat in section 342I, the Columbia Basin, but it is much less important in most other sections. Altered fire regime is a threat that is most often attributed to the western Basin & Range (section 342BW) but it also has numerous occurrences in portfolio sites in the Columbia Basin section. Recreation and hydrologic alteration threats show similar patterns in terms of being prominent in both the western Basin & Range and in the Columbia Basin. Grazing is cited as being the dominant threat in nearly all sections of the ecoregion with only the Columbia Basin showing another threat (Non-native plants) as having as many occurrences.

The GIS format can be linked to the threats database to show patterns of threats across the ecoregion, displaying the information listed in Table 9. For example, the scope of the threat to biodiversity across the portfolio sites is shown in Figure 9. Here it can be seen that the likely loss of a conservation target is predicted for only a few portfolio sites, but significant threats are far more common, being cited for nearly two-thirds of the portfolio.

Conservation Strategies and Assessment Implementation

For the Columbia Plateau ecoregion, the evaluation and determination of conservation strategies that will conserve biodiversity is based on information derived from the threats assessment database and analyzed within a framework of grouping similar sites together for purposes of analysis. The process developed for determining conservation strategies is portrayed in Figure 10. Assessment implementation is based on site priorities, site knowledge, conservation opportunities and leverage as well as the capabilities and resources of the individual state field offices. Site priorities have been derived from a combination of biodiversity values and threat severity and urgency. Site knowledge, conservation opportunities and leverage were determined on a best estimate basis by core team members.

Key Stakeholders in the Ecoregion

Stakeholders in the ecoregion were assessed on a site by site basis by the core team members. The stakeholders identified included:

Federal Agencies
State Agencies
County/Local Government
Native American Interests
Private Interests
Recreation Interests
Organized Groups

Due to the outdated nature of this information, it was deleted from the current version of the database, but was used to generate the analyses discussed below.

A tally of the key stakeholders, based on the results of the threats database, is shown in Table 10. The table summarizes which stakeholders were cited most often as being an “interest” group in portfolio sites. Stakeholders noted less than 10 times in the database of sites are not included in the table.

Table 10. Key Stakeholders Identified in the Columbia Plateau Ecoregional Assessment

Stakeholder	**Database Occurrences**	**Stakeholder**	**Database Occurrences**
BLM	97	USFS	20
Ranchers	89	Recreation Grps	19
State FW Dept	47	NRDC	18
State Enviro Grps	44	State Lands	17
Hikers	41	Local Enviro Grps	14
Farmers	37	Anglers	14
State Cattle Assn.	37	Anti Enviro Grps	12
Local Cattle Assn.	30	Campers	11
County Planning	30	Water Res. Dept	10
Researchers	29	Dept Enviro Qual	10
ORV Users	24	Miners	10
Hunters	22	Power Co.	10
Tribes	21	Educators	10
USFWS	21	BOR	10

The most frequently cited stakeholders are, not surprisingly, the largest landowners in the conservation portfolio, namely the BLM and ranchers. The next two most often cited stakeholders are a bit more interesting as State Fish and Wildlife Departments and State-based environmental organizations are noted to be prominent interest groups in fully a third of the 139 portfolio sites. The stakeholder list also held several other surprises, including County planning, researchers, and recreationists who could play strategic roles in conservation activities in the ecoregion.

The stakeholder list is of interest in and of itself but it will become even more useful in the development and implementation of conservation strategies for the ecoregion.

TNC Role in Ecoregional Conservation

Similar to the stakeholders assessment, TNC's role in ecoregional conservation was evaluated using the threats assessment database. The database compiled information on TNC's current role in the conservation of the portfolio sites. The database recorded 78 sites in which TNC has a current role at the site. Current role was defined as including land ownership, land management, advocacy, fund raising, acquisition assistance, and management expertise. Due to the dated and sensitive nature of this information, it was also deleted from the database.

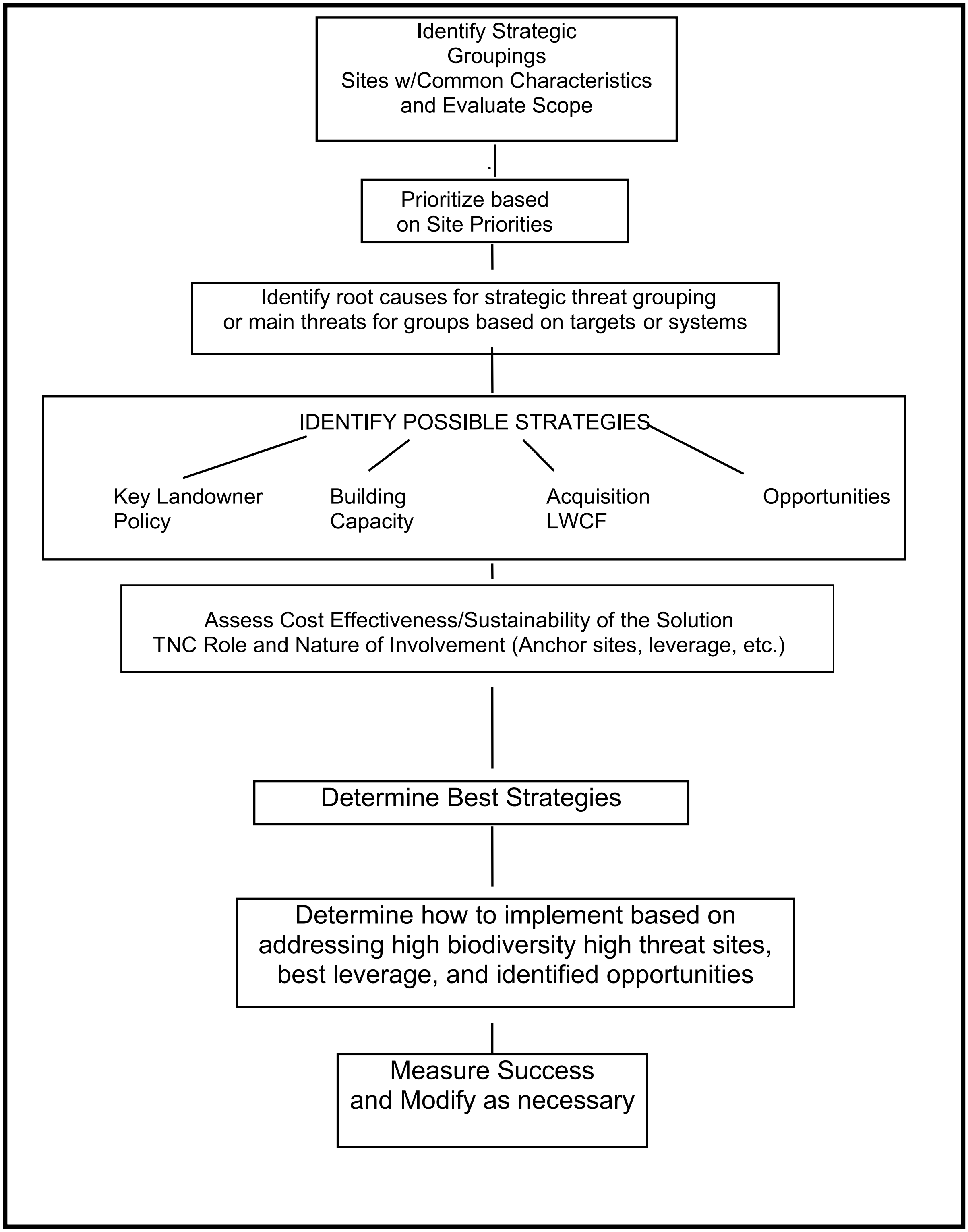
Strategic Groupings

The threats database has its utility in being able to analyze the portfolio sites from a number of different perspectives. These perspectives include, but are not limit to: ownership, conservation targets, habitats, threats, and human context. Because of the seemingly endless numbers of perspectives from which to analyze the database, the large number of portfolio sites and the many kinds of threats present in the ecoregion there was a definite need to hone down the number of analyses or perspectives from which conservation strategies would be derived. Given an almost infinite number of possible ways to look at the data the core team used a "strategic groupings" concept as a means to limit the number of combinations and to act as a starting point for analysis. From these varied perspectives, sites, and threats a number of strategic groupings became apparent when the data was reviewed. The strategic groupings were based on dominant threats, ownership patterns, and prominent conservation strategies. Some of these groupings were expected, such as grazing and weeds being significant threats for many sites, but others were not anticipated prior to looking at the data.

Queries to the database were made to develop summary data for the following strategic groupings:

Grazing
Altered fire regimes
Non-native plants
Aquatic threats (dams, diversions, hydrologic alterations, non-native species)
Palouse grasslands
BLM WSAs
Opportunity sites
Managed Areas--level I & II
Easily conserved sites
Sites with TNC presence
DOE and DOD sites
Residential and commercial development
Agriculture

Figure 10. Conservation Strategies Development Process



Core team members were each assigned one or more strategic groupings to analyze based on the process diagrammed in Figure 10. For each strategic grouping the process includes the following steps:

- Scope of issue
- Description of future vision
- Root causes and stakeholders
- All possible strategies
- Purpose of strategy
- Cost assessment, leverage potential, TNC role, probability of success, time frame, measures of success
- Implementation recommendation

The strategic groupings listed above represented most of the sites in the portfolio and accounted for approximately 90% of the conservation target goals in the ecoregion. Many sites fell into more than one strategic grouping but this was of no consequence as the goal was to evaluate the grouping as a whole, not as individual sites that may be represented by it. The intended result of evaluating the grouping is to come up with a finite set of multi-site strategies that will efficiently and effectively conserve biodiversity in the ecoregion.

Developing Multi-Site Strategies

The results from the strategic grouping evaluation process, as outlined in Figure 10, will include a set of conservation strategies for each grouping. The strategies developed are, by definition, multi-site strategies, as each strategic grouping includes more than one site. (It should be noted that there is some overlap between different strategic groupings as a number sites may be classified as one or more groupings.) The strategies developed for the different groupings will be compared and contrasted in order to arrive at a more refined list of strategies that have the potential to effect the most conservation across the ecoregion.

There will be some conservation strategies common to a number of strategic groupings, such as working with federal land management partners, that will be relevant across many sites in the ecoregion. Conversely it is expected that there will be other proposed conservation strategies that may only apply to a limited number of sites but, because of the importance of these sites, these strategies may be implemented in the same time frame and with the same commitment of resources as more broad-based strategies.

Setting Priorities Among Sites

Site priorities were assessed by evaluating the biodiversity values, threats, leverage and landscape-scale ecological processes that are present at each site. Biodiversity values were classified by placing each of the portfolio sites into one of six categories, listed below:

- sites with 5 or more G1s
- sites with at least 3 G1s
- sites with at least 1 G1
- sites with more than 50 EOs
- sites with less than 50 EOs, no G1s, at least 5 G2 or G3s
- sites with less than 50 EOs, no G1s, at least 1 G2 or G3s
- sites with less than 50 EOs, no G1-G3s
- site knowledge none

Sites were also classified as to the severity and number of threats present, utilizing the following categories:

- loss likely of conservation target(s) occurring now or within 5 years
- at least 5 significant threats occurring now or within 5 years
- at least 3 significant threats occurring now or within 5 years
- at least 1 significant threat occurring now or within 5 years
- sites with at least 1 significant threat other than now or within 5 years
- sites with only minor or unknown threats

A matrix of portfolio sites was developed to portray biodiversity values and threats. Priority sites include those sites which have a combination of high biodiversity values and high urgency based on threats. The matrix with corresponding site ID numbers are shown in Table 11 below.

Table 11. Portfolio site priority matrix displaying levels of threat and biodiversity value. Values in the matrix cells represent site ID numbers; Table 4 relates the site names to the site ID numbers.

	At least 1 sig. threat occur now or w/in 5 years and loss likely	at least 5 sig. threats occur now or w/in 5 years	At least 3 sig. threats occur now or w/in 5 years	At least 1 sig. threat occur now or w/in 5 years	No sig. threats occur now or w/in 5 years	At least 1 sig. threat other than now or w/in 5 years	Minor or unknown threats
At least 5 G1s	2,6	81	10,21,22, 26,28,53, 65	5,23, 93,102 107	0	0	49
At least 3 G1s	0	79	35,36	14,40	9,90	125	0
At least 1 G1	34	38,73,86	30,91,117	18,34,61, 70,78,85, 87,101, 112, 116, 114, 119	20,66	15	88
At least 50 EOs, no G1s	57	19	24,29,31, 64	0	0	0	0
<50 EOs at least 5 G2/G3s, no G1s	0	4,7,50,80	3,76,87,99	8,17, 51,62,110	63,89	13	0
<5 G2/G3s, no G1s	0	84	80	0	129	134	57,58,83, 113
<50 EOs, no G1s	103	16,48,50 ,80,92	37,42,43, 44,46,47, 49,52,55, 56,75,112	1,11,12,58,69,72,77,83,96,100,106,113, 120,121, 122,133, 139	41,57,67,95, 118,123,126 ,127, 128,135, 136,137, 138	0	0
Site knowledge is none	0	0	0	0	39,97	0	0

Priority sites within the Columbia Plateau Ecoregion identified because of the biodiversity values and threats are defined as those sites which have at least 1 significant threat occurring now or within the next 5 years and at least 3 G1s; or the sites have a likely loss of a conservation target within 5 years; or there are at least 5 significant threats occurring now or within 5 years and there are at least 50 EOs present at the site.

Portfolio sites which are capable of supporting landscape scale ecological processes are listed in Table 8. These sites are also considered priority sites. Finally, sites which have a high potential for leverage of conservation actions in the ecoregion have also been included as priority sites. High leverage sites include areas where TNC has established a preserve as well as where TNC has worked or intends to work with landowners and managers on broad-based conservation activities. Table 12 lists the priority portfolio sites which will be targeted for conservation action in the next five years.

Table 12. Priority Portfolio Sites.

Site ID	Site Name	State	Section	Size (sq. km)
2	Grand Creek	WA	342I	706.32
3	Waterville Plateau	WA	342I	307.63
6	Rock Island Creek	WA	342I	630.09
10	Crab Creek	WA	342I	933.41
12	Beezley Hills	WA	342I	305.11
14	Rock and Bonnie Lakes	WA	342I	72.73
18	Liberty Butte	WA,ID	331A	52.25
19	Potholes Reservoir	WA	342I	808.29
21	Hanford/Yakima TC	WA	342I	3588.08
22	L.T. Murray	WA	342I	398.31
23	Kahlotus	WA	342I	221.49
24	Esquatzel Coulee	WA	342I	837.92
26	Snake Breaks	WA	331A	370.34
28	Camas Prairie	ID	331A	432.43
29	Horse Heaven Hills	WA	342I	779.03
34	Rock Creek	WA	342I	229.67
35	Boardman	OR	342I	679.99
36	Columbia Hills	WA	342I	468.89
38	Umatilla River	OR	342I	479.50
40	Birch Creek	OR	342I	212.61
46	Middle-North John Day	OR	342H	505.79
50	Cline Buttes	OR	342H	1018.51
53	St. Anthony Dunes	ID	342D	1463.56
62	Big Desert (INEEL)	ID	342D	2385.68
65	Succor Creek	OR,ID	342C	2770.49
73	Steens, Alvord/Malheur	OR,NV	342BW	5352.23
79	Bruneau-Jacks Creek	ID	342C	2140.87
81	Middle Snake Corridor	ID	342D	1984.88
86	Hart Mtn/Warner Basin	OR,CA	342BW	2394.47
87	Owyhee Canyonlands	ID,OR,NV	342C	4121.77
89	Jarbidge Creek	ID,NV	342BE	1357.46
90	Albion Mtns	ID,UT	342BE	433.56
93	Goose Creek	ID,NV,UT	342BE	741.09
102	Honey Lake Valley	CA,NV	342BW	1600.50
103	Pyramid Lake	NV	342BW	1854.36
107	WA	WA	331A	9.51

Multi-Site Strategies

Multi-site strategies are still being developed for the ecoregion and are dependent upon the individual assessments of the strategic groupings that were referred to previously. While most of the time honored conservation strategies that TNC has used for years will come into play in the Columbia Plateau ecoregion there will be need to be a more intensive focus on several strategies that have the potential to affect many of the sites within the ecoregion.

Federal Partners
The largest landowner in the conservation portfolio is the BLM which manages over 40% of the combined land area of the portfolio sites. The BLM ownership contains a comparable amount of the biodiversity represented in the portfolio and, while not immune from threats, the agency is intent on addressing the threats which impact their lands. To date, the Conservancy has enjoyed a good relationship with the agency based on common interests in rare species management and in the emerging fields of restoration and adaptive management. Our relationship with the BLM has begun to spread to the BLM's traditional affected public as well, the ranching community. The Conservancy would be hard pressed to select a better strategy than working with the BLM in this ecoregion.

In addition to the BLM, the Conservancy will need to strengthen ties to DOD and DOE at the important sites which they manage in the ecoregion as well as the US Fish & Wildlife Service, both on their refuges as well as in conjunction with the endangered species program which they administer.

Ranchers and Grazing Management
Going hand in hand with the BLM lands are the ranchers who traditionally have had the greatest control over the public lands in the ecoregion and much of the private lands, at least in several of the sections. The Conservancy has some ongoing alliances with the ranching community in this ecoregion that have been in place for up to 10 years. Nevertheless there are other areas of the country where TNC has worked with this industry at many more sites and in a variety of arrangements that could serve as potential models for conservation strategies at some portfolio sites in the Columbia Plateau.

Water Issues
Under the broad heading of dams, diversions, groundwater withdrawal, and hydrologic alteration there are numerous occurrences of threats to biodiversity in the ecoregion (Table 9). Strategies to mitigate and abate these threats include working with the crop agriculture community, ranchers, aquaculture interests in Idaho, power companies and municipal water delivery managers. No single strategy will work within the diverse field of water issues but rather TNC will have to work at the site level when some of our most threatened species are of concern, as well as at the watershed level where there may be a host of species spanning several taxa. Some of the most complex resource problems facing the ecoregion in the next century revolve around water issues.

Recreation and Residential Development
While not always thought of in the same breadth, the threats are closely related and involve population growth in an ecoregion that is currently mostly rural and

thought of as containing some of the most remote lands in the country. Cooperating with county planning agencies will be important in conserving important tracts of land near growing population centers. Equally important will be connecting with user groups and, through education, making them part of the conservation solution at portfolio sites which have high recreation values.

Insights and Implications for Partnerships and Public Lands Management

Several important insights emerged relating to the significance of federal lands for biodiversity conservation in this ecoregion. For example, the US Department of Energy owns only 1.2% of the ecoregion, but DOE lands contain two of the highest quality and most significant examples of sagebrush steppe ecosystems remaining in the Intermountain West.

The ecoregional project also has given TNC a new perspective on the ICBEMP and the proposed management outcomes for federal lands. In May,1997, based on the ICBEMP assessment, the US Forest Service and BLM announced a “preferred management alternative” for federal lands in the ecoregion. Members of the planning team reviewed the DEIS and commented that the preferred management alternative (or any of the others) would not be effective for maintaining biodiversity and recommended that a new preferred alternative be developed.

Overall, approximately 50% of the Conservancy’s target vulnerable species and communities occur on lands whose management will be affected by the Interior Columbia Basin Management Plan (i.e., USFS and BLM lands).

Both TNC and the federal agencies agree that effective management of public lands is critical to the long-term maintenance of biodiversity in this ecoregion. However, the ICBEMP alternative does not recommend designation of any new reserves, and instead emphasizes multiple use of all federal lands, combined with intensive management and restoration activities. As part of TNC’s comments on the ICBEMP proposed alternative, the organization will provide data not considered by the federal assessment as well as a technical review of the modeling approach, and an assessment of whether the proposed management is likely to accomplish the desired outcome.

Timeline for Next Iteration of Columbia Plateau Ecoregional Assessment

The Columbia Plateau Ecoregional Assessment will be reviewed for accuracy and progress on a regular basis. A state by state evaluation of progress will be compiled by members of the core team and summarized by the team leader or other designated team member to facilitate information sharing regarding projects initiated during the past year and current progress at threat abatement in the ecoregion. The summary report will be distributed to all states within the ecoregion with state directors and other affected staff being the target audience. An annual meeting of the Columbia Plateau core team will be given high priority in order to assess implementation progress.

Most states in the ecoregion will be involved in planning for other ecoregions within their states for the next five years. Because of these commitments there will not be a planned second iteration ecoregional assessment for the Columbia Plateau for at least six years or until the affected states have finished the first round planning for all ecoregions. The five year planning horizon will likely be adequate in terms of not missing any opportunities and it is unlikely that there will be any significant changes with respect to threats, ownership or other important factors relevant to conservation in the ecoregion.

The next iteration will focus on incorporating new data into the data sets and on including a diverse array of partners in the assessment process. Data gaps will be one of the priority areas that the next iteration will focus on with a special emphasis being placed on incorporating what is expected to be a nearly complete riparian community classification and inventory for the ecoregion. The next iteration will also have more complete data sets for aquatic elements, particularly aquatic invertebrates. It is also anticipated that other public and private partners will contribute to the assessment process, both in refining the scope and methodologies used for the assessment and in determining the final products and implementation strategies.

Data Gaps

Data gaps are inevitable when gathering together information across an ecoregion. In the Columbia Plateau ecoregion, where inventories have been restricted in remote areas and where certain taxa have only recently been discovered, data gaps have affected the development of the conservation portfolio and the threats assessment phase of the planning project. In the portfolio development phase, data gaps came into play when conservation targets and GAP vegetation cover types were evaluated. Many areas of the ecoregion had no EOs associated with them and thus were largely excluded from consideration as portfolio sites. In the threats assessment phase, lack of data for some of the sites selected for the portfolio resulted in a lack of specificity regarding threats at these sites which had corresponding impacts to potential conservation strategies.

Terrestrial Vertebrates

Three types of data gaps were identified for each target species in each state that it occurred.

1) If a species occurred in a state but was not tracked by a Heritage program at the element occurrence (EO) level;
2) Incomplete species inventories; and
3) information for a species exists but has not been incorporated in the Heritage program's databases.

Data gaps regarding vertebrates were addressed at the experts workshop when ornithologists and mammalogists recommended additions and deletions to the proposed list of conservation targets. Unfortunately most of the recommended species were not currently being tracked by Heritage Programs and thus could not be included within the BMAS modeling aspect of the site selection process as there was no EO data associated with the species. The recommended species did figure into the portfolio, at least in a minor way however, as expert workshop sites were used as “seeds” for the BMAS derived portfolio.

Invertebrates

Invertebrates present a special challenge in terms of gathering comprehensive data for ecoregional planning. Few species of invertebrates are tracked by Heritage Programs, in large part, because the taxa are poorly known and have not had adequate surveys. In addition, the invertebrates represent a very large and diverse group of organisms that are still largely unknown in terms of even their basic biology and taxonomy. For these reasons invertebrates have often been relegated to being captured by coarse filter types of identification techniques. Obviously, for invertebrate species, which as a group surely are far larger in terms of numbers of species than plants or vertebrates in the Columbia Plateau and elsewhere, this is potentially a major data gap that should be focused on in the next iteration. Given the lack of knowledge of the group as a whole it is probably safe to assume that invertebrates will remain a significant data gap in most ecoregions for the foreseeable future.

Aquatics

Aquatic elements of diversity presented a special challenge to ecoregional planning as Heritage and Conservancy knowledge was relatively low in terms of aquatic species present and their rarity. This was also true for aquatic and riparian communities which have only begun to be adequately classified by Heritage programs. Because EO data were distinctly lacking for aquatic species and communities, surrogates were used in an attempt to capture these elements in the portfolio. The surrogates acted as coarse filters with a large reliance being placed on using the Aquatic Integrity Index database developed by ICBEMP as a factor within the larger suitability index in the BMAS site selection model. The species selected as conservation targets also were chosen to act as coarse filter representatives for other species and communities that may be associated with them.

Plants and Plant Communities

Data for vulnerable plant species, vulnerable plant communities and more common communities included some of the largest and most complete data sets used in the project. Nevertheless, data gaps still existed, largely due to lack of inventory in the more remote areas of the ecoregion. These gaps resulted in some areas which may have considerable biological diversity being overlooked for their potential contribution in the selected portfolio. There was also some inconsistency between Heritage programs in terms of knowledge of their respective portions of the ecoregion. This was especially true for California and Utah which had only small areas included within the ecoregion.

Conservation targets for plant communities were, for the most part, dependent upon the quality of GAP cover type data. The GAP data was often used as a surrogate for more narrowly defined plant community types which occurred in much smaller patches that what could be determined by the mapping techniques employed by GAP researchers. As was addressed above in the aquatics section, significant data gaps occurred with regards to aquatic and riparian communities. GAP cover type maps or GIS layers do not even depict riparian communities such that conservation goals for these groups of communities had no direct means of being met and thus sites were not directly selected to meet these key goals. The inclusion of riparian and aquatic communities in the portfolio was primarily addressed during the site modification work by Heritage experts that occurred after the BMAS model was developed. A second iteration of the assessment will likely have access to more complete community classifications for at least riparian communities and may include aquatic types as well.

Lessons Learned

The Columbia Plateau ecoregional assessment was conceived as an experimental pilot project that would test a number of techniques designed to develop a comprehensive conservation portfolio. The project was challenging as it involved 4 TNC offices and 6 states, requiring extensive cross-state coordination and collaborative effort. After the first iteration of the conservation portfolio was completed an intensive review was undertaken to fully assess the lessons learned regarding this first part of the process. The complete, unedited lessons learned document from this part of the project is included in Appendix 6. A summary of the findings is presented below.

Science

1. Regardless of the scale at which TNC works or plans, there is a clear benefit to be gained from articulating measurable conservation goals, so that the potential contribution of individual sites to those goals can be easily evaluated and compared. More effort could have been expended within the core team to communicate the basis behind some of the conservation goals.
2. Until the organization has experience with several ecoregional projects "under its belt," the guidelines articulated in the "Geography of Hope" should remain flexible, and creativity by individual teams should be strongly encouraged.
3. To facilitate evaluation and comparison of different approaches and methods across ecoregions, there is a need for consistent and accurate documentation of project goals, assumptions, data sources, methods and costs. Documentation was lacking in some of these aspects of the Columbia Plateau assessment project.
4. Geographic Information Systems provide a critical tool for assembling, managing and interpreting large, spatial datasets, but the technology is expensive and requires specialized training by its users. Currently only about four field offices in the West have some GIS capacity, and the regional office has only recently begun to develop the needed tools and staff to support ecoregional conservation efforts. While the GIS was invaluable in the planning project, there was a tendency to underestimate the effort required to ready data for the GIS as well as the effort required to use GIS to its full capacity.
5. Peer review of ecoregional conservation targets and site selection and portfolio methods by colleagues in TNC, the academic community, and other organizations will help to improve the quality of work products as well as to create a constituency for TNC's ecoregional approach to conservation.
6. Expert opinion and digital databases are complementary sources of information on the distribution and trends of ecoregional biodiversity. Convening workshops of ecoregional experts on the species and ecosystems of concern to TNC ensures the continued flow of new information into the Natural Heritage data network, and also develops support for the Conservancy's work in the ecoregion.

7. Viability analysis remains one of the most vexing problems in data driven site selection processes, both at the species or target level as well as at the site level.

Internal Capacity and Management Structure

1. TNC does not currently have the staff or technical capacity to implement ecoregional planning, let along ecoregional conservation, everywhere the organization works. The organization has to be realistic about the costs of working at an ecoregional scale, and must decide whether to forego existing commitments and projects or to increase capacity to meet the staffing and resource requirements for effective ecoregional planning and conservation. Most staff currently engaged in ecoregional efforts are doing so in addition to all of the responsibilities of their existing positions.
2. Enhancements to the wide area network and voicemail system are needed for maintaining efficient and regular communication among TNC field offices and Natural Heritage Programs, as well as with collaborators and contractors. At the inception of the Columbia Plateau project, there was no single mechanism that would allow rapid communication to all team members. Regular, biweekly communication among the core team is critical when there are high expectations of rapid product delivery.
3. The core team size and structure was adequate for the project except for the fact that there was minimal participation from two of the states within the ecoregion. In the future, it is recommended that all states have active members on the planning team. There could have been more sub-groups established at the beginning of the process to focus on specific aspects of the project including data gaps such as aquatics.
4. Developing and managing ecoregional datasets represents a significant investment, and there is not yet agreement as to who will be responsible for that management (e.g., regional offices, field offices, Heritage programs, or some combination), or what it will cost and who will pay for it.
5. New approaches and incentives are needed to facilitate management of diverse and geographically distributed ecoregional teams, and to improve accountability among team members who have many other competing priorities. Without volunteer assistance, which contributed nearly 700 hours of needed assistance, the project would not be completed.
6. The utilization of two teams, operating sequentially, to first develop the portfolio and then complete the threats assessment, strategies and implementation aspects of the assessment was somewhat problematic as the transition required more interaction between the teams than was at first perceived to be necessary. In the future, it is recommended that if the two-team approach is utilized then it is imperative that coordination between the teams be given a high priority in order to keep the planning process moving. It may be beneficial to have the strategies and implementation team begin meeting somewhat before the portfolio development team completes their task.

Project Budget

Columbia Plateau Project Costs

Columbia Plateau Phase 1 (July 1, 1996 - June 30, 1997): $185,000 (includes approximately $85,000 in direct costs and $100,000 of staff time; does not include $ 25,000 special allocation from TNC national office for additional research on ecoregional planning and analysis methods). Cost to the Washington Field Office (lead state): $80,000

Support to Heritage Programs

Nevada:	$3,000
Oregon:	5,000
Washington:	5,000
Idaho:	8,000
TOTAL	21,000

Experts Workshop Cost and Time Estimates

Meeting services:	$2,500
Travel, food, lodging:	3,000
Miscellaneous:	500
TOTAL	6,000

TNC Staff Time (planning/conducting the workshop): 310 hrs
Volunteer Time (assisting with preparations/follow-up): 100 hrs

Columbia Plateau Phase 2 (July 1, 1997 - March 31, 1998): $56,000. Indirect costs (staff time and travel) to field offices were $9600 each for Washington, Idaho and Nevada; indirect costs to Oregon, the lead state for phase 2, were $17,000. Direct costs, for GIS and support, assessed to each state were $2600.

REFERENCES

Bedward, M., Pressey, R.L. & D.A. Keith. 1992. A new approach to selecting fully representative reserve networks: Addressing efficiency, reserve design and land suitability with an iterative analysis. *Biol. Conserv*. **62**: 115-125.

Church, R.L., Stoms, D.M. & F.W. Davis. 1996. Reserve selection as a maximal covering location problem. *Biol. Conserv*. **76**: 105-112.

Cowling, R.M. and W.J. Bond. 1991. How small can reserves be? An empirical approach in the Cape Fynbos, South Africa. *Biol. Conserv*. **58**: 243-256.

Csuti, B. 1994. Gap analysis: Mapping biodiversity for conservation and management. *Endangered Species Update* **11(5):** 1-4.

Csuti, B., Polasky, S., Williams, P.H., Pressey, R.L., Camm, J.D., Kershaw, M., Kiester, A.R., Downs, B., Hamilton, R., Huso, M. and K. Sahr. 1997. A comparison of reserve selection algorithms using data on terrestrial vertebrates in Oregon. *Biol. Conserv*. **80**: 83-97.

Davis, F.W., Stoms, D.M., Church, R.L., Okin, W.J. and N.L. Johnson. 1996. Selecting biodiversity management areas. Pp. 1503-1528 in *Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. II, Assessments and Scientific Basis for Management Options*. Davis: University of California, Centers for Water and Wildland Resources.

Freitag, S., Nicholls, A.O. & A.S. van Jaarsveld. 1996. Nature reserve selection in the Transvaal, South Africa: What data should we be using*? Biodiv. Conserv*. **5**: 685-698.

Goldsmith, F.B. 1987. Selection procedures for forest nature reserves in Nova Scotia, Canada. *Biol. Conserv*. **41**: 185-201.

Kershaw, M., Mace, G.M. & P.H. Williams. 1995. Threatened status, rarity and diversity as alternative selection measures for protected areas: A test using Afrotropical antelopes. *Conserv. Biol*. **9**: 324-334.

Kirkpatrick, J.B. 1983. An iterative method for establishing priorities for the selection of nature reserves: An example from Tasmania. *Biol. Conserv*. **25**: 127-134.

Kirkpatrick, J.B. & M.J. Brown. 1991. *Reservation analysis of Tasmanian forests*. Resource Assessment Commission Forest and Timber Inquiry Consultancy Series, Number FTC91/16. Canberra.

Lewis, A., Stein, J.L., Stein, J.A., Nix, H.A., Mackey, B.G. & J.K. Bowyer. 1991. *An assessment of regional conservation adequacy: Tasmania*. Resource Assessment Commission Forest and Timber Inquiry Consultancy Series, Number FTC91/17. Canberra.

Lombard, A.T., Nicholls, A.O. & P.V. August. 1995. Where should nature reserves be located in South Africa? A snake's perspective. *Conserv. Biol*. **9**: 363-372.

Lombard, A.T., Cowling, R.M., Pressey, R.L. & P.J. Mustart. *In press*. Reserve design on the Agulhas Plain, South Africa: A flexible tool for conservation in a species-rich and fragmented landscape. *Conserv. Biol.*

Margules, C.R. & A.O. Nicholls. 1987. Assessing the conservation value of remnant "islands": Mallee patches on the western Eyre Peninsula, South Australia. Pp. 89-102 in *Nature Conservation: The Role of Remnants of Native Vegetation*, ed. by. D.A. Saunders, G.W. Arnold, A.A. Burbridge & A.J.M. Hopkins. Sydney: Surrey Beatty and Sons.

Pennisi, E. 1993. Filling the gaps: Computer mapping finds unprotected species. *Science News* **144**: 248-251.

Pressey, R.L. and V.S. Logan. 19xx. Size of selection units for future reserves and its influence on actual vs. targeted representation of features: A case study in western New South Wales. *ms. in review*.

RACAC (Resource and Conservation Assessment Council). 1996. *Draft Interim Forestry Assessment Report*. Sydney: RACAC.

Rebelo, A.G. & W.R. Siegfried. 1990. Protection of Fynbos vegetation: Ideal and real world options. *Biol. Conserv*. **54**: 15-31.

Rebelo, A.G. & W.R. Siegfried. 1992. Where should nature reserves be located in the Cape Floristic Region, South Africa? - Models for the spatial configuration of a reserve network aimed at maximizing the protection of floral diversity. *Conserv. Biol.* **6**: 243-252.

Ryti, R.T. 1992. Effect of the focal taxon on the selection of nature reserves. *Ecol. Applic.* **2**: 404-410.

Saetersdal, M., Line, J.M. & H.J.B. Birks. 1993. How to maximize biological diversity in nature reserve selection: Vascular plants and breeding birds in deciduous woodlands, western Norway. *Biol. Conserv*. **66**: 131-138.

Stoms, D.M. 1994. Scale dependence of species richness maps. *Prof. Geogr*. **46**: 346-358.

Vane-Wright, Humphries, C.J. & P.H. Williams. 1991. What to protect? - Systematics and the agony of choice. *Biol. Conserv*. **55**: 235-254.

Williams, P., Gibbons, D., Margules, C. Rebelo, A., Humphries, C. & R. Pressey. 1996. A comparison of richness hotspots, rarity hotspots and complementary areas for conserving diversity using British birds. *Conserv. Biol*. **10**: 155-174.

Willis, C.K., Lombard, A.T., Cowling, R.M., Heydenrych, B.J. & C.J. Burgers. 1996. Reserve systems for lime limestone endemic flora of the Cape lowland fynbos: Iterative versus linear programming techniques. *Biol. Conserv*. **77**: 53-62.