APPENDIX E: Element Lists and Ranking[53]

E1 Element Definition

An Element is a unit of natural biological diversity. Elements represent species (or infraspecific taxa), natural communities, or other nontaxonomic biological entities (*e.g.*, migratory species aggregation areas).[54]

To ensure that a broad, practical, and well-balanced representation of the biological diversity in a jurisdiction or ecoregion is protected, a "coarse filter/fine filter" approach to conservation site selection is utilized. Communities may be viewed as a coarse filter for natural diversity; identification and protection of the best examples of all types of communities (*i.e.*, terrestrial, subterranean, freshwater, marine) will ensure that most species and ecological processes are conserved. However, some species that are imperiled or vulnerable "fall through" the coarse filter; because of their rarity, they are not reliably found in habitats or communities where they might be expected, and their conservation cannot be assured without specific attention. Thus, a "fine filter" comprised of these species is needed. Targeting fine filter Elements for conservation along with communities ensures that a broad spectrum of biodiversity will be preserved.

Decisions on which Element groups to target for conservation vary on the basis of several factors, including differences in the amount and availability of Element information, and whether the Elements represent coarse or fine filters for biodiversity conservation (see E2.2.1 through E2.2.9, below).

E2 Element Lists

E2.1 Global, National, and Subnational Element Lists

The first step in any heritage inventory is the compilation of Elements into **ELEMENT LISTS**. Although developing a comprehensive list of all the Elements that currently exist (or have existed historically) on earth is not feasible, the Element List should include as broad and well-balanced a representation of all biodiversity as possible. Whenever possible, to ensure consistency and comparability of data across jurisdictions, the taxonomy and nomenclature in the Element List should be based on standard name references or checklists (or, if no name sources are available, on names published in the scientific literature). The Central Zoological, Botanical, and Ecological

[53]This Appendix summarizes Element listing and ranking as currently practiced. Some additional information on Element listing and ranking is contained in on-line documentation for the Element Tracking and Element Ranking files in the Biological and Conservation Data System (The Nature Conservancy 1996), and in the Natural Heritage Program Model Operations Manual (The Nature Conservancy 1988).

[54] Note that in regions where there is only limited information on Elements, surrogate targets may be used to model patterns of biodiversity for conservation planning and action. Surrogates that have been considered include higher taxonomic levels, image-derived cover types, land-use classifications, abiotic factors, and coarsely-mapped distributions of vulnerable species.

Databases of the Natural Heritage Network list standard names for many thousands of taxa (*e.g.*, vascular plants, vertebrates, community types, and many invertebrate and nonvascular taxa) occurring in North America for the benefit of network participants. The information in the Central Databases may thus be considered as a Global Element List. However, the Global Element List is currently not worldwide in scope; while the list includes global information about species and communities, it does not include all the species or communities in the world.

National and Subnational Element Lists may be developed that contain Elements found within particular nations or subnations, respectively. Such lists are a subset of the Global Element List.

E2.2 Developing an Element List

For some groups of Elements, decisions on what to include on an Element List are determined using a comprehensive approach in which all Elements within a group (typically phylum, class, order, or family for species) are listed[55]; this is termed **COMPREHENSIVE ELEMENT LISTING**. The comprehensive approach is often applied in situations where the taxonomy, status, and distribution (*e.g.*, by subnation) are reasonably well known for most species in each family or group (*e.g.*, amphibians, vascular plants, tiger beetles).

Comprehensive listing within a group of all the Elements known to occur or known to have occurred in a jurisdiction provides many benefits to a data center. Comprehensive Element listing facilitates the identification of taxa that are at risk (or, conversely, taxa that might pose risks [*e.g.*, invasive exotics]) in a particular jurisdiction and helps to ensure that vulnerable but unfamiliar species are not overlooked. Individual data centers benefit by receiving (*e.g.*, through data exchange) centrally recorded global information for all of the Elements in comprehensively listed groups in their jurisdiction. In addition, comprehensive Element listing helps to service a growing user community by providing basic, frequently requested information regarding which species in a particular group occur in a particular jurisdiction. Comprehensive Element listing also provides network-wide benefits by permitting all network data centers and a multi-jurisdictional user community to benefit from the collective work of many data centers and their collaborators. If all jurisdictions in a large region (*e.g.*, North America north of Mexico) comprehensively list and rank every Element in a particular group, rangewide information is then available for global and national conservation status assessments for most Elements in that group in the region.

For many Element groups, particularly within invertebrates and nonvascular plants, the taxonomy, distribution, and/or status of the component species are not sufficiently well known to develop a comprehensive Element List. In such cases, decisions on which Elements to list are made on the basis of a selective approach. In this situation, only some of the Elements within a group are included on an Element List without consideration of other Elements within the group, some of which could be of equal or greater conservation concern. This is termed ***AD HOC* ELEMENT LISTING**, and is usually applied to those species in poorly known groups of Elements that are believed to be imperiled and vulnerable, including species of official national or subnational concern.

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[55] The use of the verb "to list" in this Standard should not be confused with the placement of species on official lists (*e.g.*, national or subnational endangered species lists, CITES appendices).

E2.2.1 Vascular Plants

Vascular plants are relatively well known as a group in the United States and Canada. For this reason, all standard species in the network's central databases should be listed in each subnation (*i.e.*, state or province) where they occur. In Latin America, the status and distributions of most plant species are not as well known and *ad hoc* listing is necessary.

E2.2.2 Vertebrates

Vertebrate animals, except marine fishes, are relatively well known as a group in the United States and Canada. For this reason, all standard species in the network's central databases should be listed in each nation and subnation where they occur. In Latin America, the status and distribution of birds, mammals, reptiles and amphibians is relatively well known and these species should be comprehensively listed in each nation. Freshwater fishes, on the other hand, are not as well known in Latin America and *ad hoc* listing must be used. Marine fishes are generally not comprehensively listed nationally or subnationally in the United States, Canada, or Latin America, although in some cases *ad hoc* listing is used.

E2.2.3 Communities

In theory, communities should also be comprehensively listed, both for their intrinsic conservation value and as a coarse filter, assuring that many species that are not directly targeted for conservation (*e.g.*, most nonvascular plants and invertebrates, especially insects and bacteria) will still be protected. The listing of communities also helps to ensure the conservation of ecosystems and ecological processes.

In practice, however, comprehensive listing is only feasible for terrestrial vegetated communities (*i.e.*, at least at the global level) since only these community types have a standard classification system (Grossman *et al.* 1998). In contrast, global listing for subterranean (*e.g.*, caves, aquifers, lava tubes), freshwater, and marine communities is not possible until standard classification systems are developed for these community types.[56]

Lacking a global standard classification, nations and subnations may still list subterranean, freshwater, and marine communities based on locally developed classifications. In other words, each nation and subnation has the option to list (on an *ad hoc* basis) nonstandard community types, which can be beneficial for conservation in that jurisdiction. However, regional and global analyses, comparability of EOs, and identification of conservation priorities across jurisdictional lines are very difficult when each jurisdiction is listing different nonstandard Elements.

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[56] Standard classifications are currently under development for freshwater communities (Lammert *et al.* 1997) and marine communities (Sullivan Sealey and Bustamante 1999). A classification for subterranean communities is not yet under development.

E2.2.4 Nonvascular Plants[57]

In comparison with vascular plants, nonvascular plants (*e.g.*, mosses, liverworts, hornworts, lichens, other fungi, algae) are more poorly known in terms of taxonomy, distribution, rarity, and threats. Consequently, it is difficult to list nonvascular plants comprehensively. Where possible, selected groups (*e.g.*, mosses, liverworts, hornworts, and lichens) should be comprehensively listed at a national or subnational level, especially if the group is small and well known in a particular jurisdiction or region. *Ad hoc* listing of other imperiled or vulnerable species should also be considered.

Because of their more direct relationship with the substrate and their different biogeographic history, the distribution and habitats of nonvascular plants known to be at risk are often poorly correlated with those of vascular plants. Therefore, including at least selected nonvascular plants on an Element List usually provides an additional perspective on biodiversity, leading to conservation of sites that might not otherwise be chosen. Because other groups of “lower plants” (*e.g.*, various algal groups, fungi) and cyanobacteria cannot be feasibly listed in a comprehensive manner, conservation of these Elements is addressed through listing communities as a coarse filter for biodiversity.

E2.2.5 Invertebrates

Listing most invertebrates raises many of the same issues considered when listing nonvascular plants. However, in United States and Canada the status and distribution of species in some groups of invertebrates are sufficiently well known that these groups should be comprehensively listed at national and subnational levels. These groups currently include freshwater mussels, crayfishes, snails, and some insect groups, including butterflies and skippers, dragonflies and damselflies, tiger beetles, and several moth families. Additional groups may be added to this list as knowledge permits. As with nonvascular plants, although it may not be possible to assess the status and distribution of a particular invertebrate group globally, there may be sufficient information available in a given jurisdiction to do so. However, most species in most groups of invertebrates in the United States and Canada are less well known than species in the groups mentioned above, but should be individually listed on an *ad hoc* basis, especially when there is evidence that they are in need of conservation attention.

Similar to nonvascular plants, listing additional species or groups of invertebrates has led to the identification of sites that would not otherwise have been identified as priorities for conservation. Also, in some cases, such sites may be critically important on a global level to the survival of species in a particular group. For example, a high proportion of the world’s known freshwater invertebrates, especially mussels, crayfishes, and aquatic insects, are endemic to the southeastern United States.

Because most invertebrate species cannot be comprehensively listed, it is anticipated that the conservation of communities, as well as the conservation of vascular plants, vertebrates, and relatively well known invertebrate species, will capture most invertebrate biodiversity. However,

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[57] As used in this document, “nonvascular plants” includes not only bryophytes, but also lichens (more accurately termed lichen-forming fungi), fungi, algae, and blue-green “algae” (cyanobacteria); these organisms have been traditionally treated as plants, although many are now classified in other kingdoms. When listed, these organisms are usually grouped with nonvascular plants on Element Lists.

inclusion of selected additional invertebrates on an Element List will help ensure that additional sites critical to the conservation of biodiversity are identified.

E2.2.6 Undescribed Species Elements

Estimates of the total number of living species span more than an order of magnitude, from around 3 million to more than 100 million, but fewer than 2 million of these species have been scientifically described and formally named. Even in relatively well known areas such as the United States, it is estimated that less than half of the species have been described and named. In most Element groups there are many "new" undescribed species that have been discovered, but these taxa may wait many years before being formally described. Rather than wait until they are formally described, it is desirable to include undescribed Elements of possible conservation concern on an Element List if there is a reasonable expectation that they are taxonomically distinct. Unpublished scientific names should not be used in Element Lists; instead, an informal designation (*e.g., Carex* sp 7) should be used provisionally.

E2.2.7 Infraspecific Elements

Taxonomic practices and the degree to which infraspecific taxa are currently recognized vary tremendously among different Element groups. For vascular plants, subspecies and varieties are often recognized; for butterflies, subspecies are often recognized; for salmonid fish, informally named stocks are often recognized; however, for lichens, mussels, and many vertebrate groups, few subspecies are recognized in current taxonomic treatments. In most cases, the inclusion of infraspecific taxa on Element Lists should correspond to the degree to which such taxa are generally recognized by systematists working on that Element group.

E2.2.8 Questionably Distinct Elements

The taxonomic standing of many species and communities is questionable or unresolved. Uncertainty concerning the classification of a particular Element is discussed in the taxonomic comment or classification confidence fields (for species and communities, respectively) in the Element files (not necessarily by the assignment of a "Q" qualifier to the global rank[58]). In general, it is preferable to include an Element of possible conservation concern on an Element List if there is a reasonable expectation that it is taxonomically distinct.

E2.2.9 Nontaxonomic Elements

By definition, nontaxonomic Elements lack a standard global classification and, therefore, describe nonstandard types that may be listed at the discretion of each jurisdiction. Typically such Elements represent transient animal communities (*i.e.*, aggregations of migratory species). These transient animal communities include migratory shorebird concentrations; waterfowl concentrations; rookeries; bat hibernacula; alcid, tern, and gull colonies; and warm water, cold

[58] Some species may have a "Q" qualifier assigned to their global rank indicating that the rank is uncertain due to questionable taxonomy. However, not all species with questionable taxonomy have a "Q" qualifier on their global rank since the assigned rank will not always be affected by a change in taxonomy. More comprehensive information on Element ranking is contained in on-line documentation for the Element Ranking files in the Biological and Conservation Data System (The Nature Conservancy 1996), and in the Natural Heritage Program Model Operations Manual (The Nature Conservancy 1988).

water, and anadromous fish concentrations. Treating these aggregations as Elements serves to group animals that are functionally related through shared seasonal behaviors. More importantly, because of the numbers of individuals of different species, such mixed species aggregations are often significant from a conservation perspective. For example, particular migratory shorebird aggregations may contain a large proportion of the hemispheric populations of several species.

Although geologic features are sometimes listed by Heritage Programs because of requirements of a parent agency, only the listing of biologically significant geologic features that are not yet classified as community Elements (*e.g.*, caves) can be readily justified. The use of caves (which may be subdivided into various categories [*e.g.*, solution and fissure, wet and dry]) as distinct Elements serves as a surrogate classification for subterranean communities, which currently lack a standard global classification system. Since the inclusion of caves on an Element List is analogous to listing subterranean communities, such listing should be considered in the same context as community Elements.

Various non-standard community types (*e.g.*, Coastal Plain pond shores zones, dune/swale complexes) may be useful where inventory is most feasibly accomplished by such units. Use of such types should not be seen as a means of creating an alternative classification to the natural community classification used by this document, but as a necessary means of characterizing parts of the landscape that are otherwise difficult to assess using the natural community classification. It is critical that the standard community types that comprise these units be identified, so that an understanding of what is being identified and potentially protected is made clear, and what the EO rank of the standard types might be. Since each occurrence of a nonstandard EO might contain a different mix of standard Elements, each nonstandard EO should list the standard Elements found within them.

E3 Element Ranking

Global, national, and subnational Element conservation ranks (GRANKs, NRANKs, and SRANKs) provide basic information on the relative imperilment or vulnerability of an Element within the specified geographic ranges based on a five-point hierarchical scale, ranging from critically imperiled to demonstrably widespread, abundant and secure. In addition, Element ranks provide, where appropriate, specific information reflecting an Element's historical or extinct status, taxonomic level, rank certainty (as a function of available information or taxonomic questions), and hybrid, captive/cultivated, exotic, accidental, potential, reported, and breeding/nonbreeding statuses. For species, Element ranks provide an approximation of the risk of extinction, and they serve as the single most important factor used to evaluate whether occurrences of an Element should be listed. Element ranks also serve as a critical factor (for both species and communities) in setting priorities for conservation action.

E3.1 Element Ranking Factors

Rare species and communities are particularly vulnerable to both human-induced and natural hazards. As a result, rarity is a key predictor of extinction potential. Although rarity may seem a straightforward concept, it is complex to characterize. For each Element, several distinct characteristics of rarity are evaluated in assessing its conservation status: the number of different populations or occurrences of the Element; the extent of its area of occupancy; the breadth of its geographic range; and, for species, the total population size or number of individuals of the species. Considerations other than rarity are also factored into conservation status determinations. Trends, both population trend for species (whether a species' numbers are increasing, stable, or declining) and trends in area of occupancy and total range for both species and communities, are key ranking factors. The viability of existing occurrences is also an important factor, especially for Elements whose occurrences are reduced in number or extent. Viability (see Section 5.3, EO Rank Factors) is a function of population or community size, condition (*e.g.*, reproductive output, intactness of ecological processes), and landscape context (*e.g.*, genetic connectivity). Threats to the Element, both human and natural, must also be considered since these are important predictors of future decline.

E3.2 Element Ranking Definitions

Global conservation status ranks are based on a one to five scale (see Table E1), ranging from critically imperiled (G1) to demonstrably widespread, abundant, and secure (G5). Species and communities known to be extinct (GX), or missing and possibly extinct (GH), also are recorded. A numeric range rank is used to denote the range of uncertainty about the exact status of a species or community (*e.g.*, G2G3); range ranks may be assigned in situations where an Element has a relatively equal probability of being either, or any, of the ranks included in the range specified. In addition, Element rank qualifiers may be used to provide information on uncertainty of a numeric rank ("?"), questionable taxonomy ("Q"), or the captive/cultivated status of an Element ("C").

The global conservation status of infraspecific taxa (subspecies or varieties) is indicated by using a "T" subrank as part of the global rank. Rules for assigning "T" subranks follow the same principles outlined above. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A "T" subrank cannot imply that the subspecies or variety is more abundant than the species' basic rank (*e.g.*, a G1T2 subrank should not occur).

Table E1 – Definitions of Global Conservation Status Ranks

Global Rank	Description
GX	Presumed Extinct not located despite intensive searches
GH	Possibly Extinct historical; still some hope of rediscovery
G1	Critically Imperiled Globally typically 5 or fewer occurrences, or 1000 or fewer individuals
G2	Imperiled Globally typically 6-20 occurrences, or 1000 to 3000 individuals
G3	Vulnerable rare; typically 21 to 100 occurrences, or 3000 to 10,000 individuals
G4	Apparently Secure uncommon but not rare; some cause for long-term concern; usually more than 100 occurrences and 10,000 individuals
G5	Secure common; widespread and abundant; usually with considerably more than 100 occurrences and 10,000 individuals

A similar numeric scale is also used for national (N1 through N5) and subnational (S1 through S5) Element ranks. For these ranks, the status of a species or community is evaluated within specific national or subnational jurisdictions rather than on a rangewide basis.

The global Element rank represents the rangewide conservation status of a species or community. If the Element is vulnerable or imperiled everywhere it occurs, it has a global rank of G1, G2, G3, or GH. Species and communities that are imperiled or vulnerable in a local area, but common elsewhere, have global ranks of G4 or G5 and local ranks of N1, N2, N3, or NH (or S1, S2, S3, or SH). These latter species and communities are components of biological diversity locally at risk, but common and unthreatened in at least some other portion(s) of their ranges. The three levels in the conservation status ranking system allow independent distinction of global, national, and more local (subnational) conservation status.

E3.3 Element Rank Rounding[59]

Rounded ranks simplify complex GRANK, NRANK, and SRANK values. They may be useful when performing tallies or analyses, or when summarizing complex Element status information for general purposes (*e.g.*, in products for external audiences). Rounded ranks serve as an approximate substitute only; they are not intended as a replacement for the detailed Element status information contained in the GRANK, NRANK, or SRANK fields when this detail is important. In general, the rounding algorithm eliminates range ranks, strips the qualifiers off the GRANK, and focuses on the "T" subrank for infraspecific taxa. Rounded ranks include GX, GH, G1, G2, G3, G4, G5, and the equivalent “T” subranks.

[59] More comprehensive information on Element rank rounding is contained in the document titled Element Rank Rounding and Sequencing (The Nature Conservancy 1996).