PLANNING METHODS FOR ECOREGIONAL TARGETS: SPECIES*

Coarse-filter and fine-filter targets

The mission of the Nature Conservancy is the long-term conservation of all species present in all ecoregions. This broad objective encompasses every living thing from large mobile carnivores to ancient rooted forests to transient breeding birds to microscopic soil invertebrates. Such comprehensive protection can only be approached using a "coarse-filter / fine-filter" strategy. "Coarse-filter" species are protected implicitly through the conservation of ecosystems, communities and landscapes – a strategy that accounts for roughly 99% of the species present in the ecoregion. "Fine-filter" species are those that we believe can not be adequately conserved by the protection of ecosystems alone but require explicit and direct conservation attention. The latter group of species, requiring direct attention, we termed *primary species targets* and are the focus of this section.

Primary species targets

Primary species targets consist of a heterogeneous set of species warranting extreme conservation concern in the ecoregion. Typically they cross many taxonomic lines (mammals, birds, fish, mussels, insects and plants) but each species exhibits one or more of the following distribution and abundance patterns:

- globally rare, with less than 20 known populations (G1-G3)[1],
- endemic to the ecoregion
- currently in demonstrable decline
- extremely wide ranging individuals
- designated as threatened or endangered by federal or state authorities

The implication of a species being identified as a *primary target* is that its conservation needs were addressed explicitly in the ecoregional plan. This means that the science team: 1) set a quantitative goal for the number and distribution of local populations required to conserve the species, 2) compiled information on the location and characteristics of known populations in the ecoregion, and 3) assessed the viability of

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The standard methodologies sections created for this and all Northeast ecoregional assessment reports were adapted from material originally written by team leaders and other scientists and analysts who served on ecoregional planning teams in the Northeast and Mid-Atlantic regions. The sections have been reviewed by several planners and scientists within the Conservancy. Team leaders included Mark Anderson, Henry Barbour, Andrew Beers, Steve Buttrick, Sara Davison, Jarel Hilton, Doug Samson, Elizabeth Thompson, Jim Thorne, and Robert Zaremba. Arlene Olivero was the primary author of freshwater aquatic methods. Mark Anderson substantially wrote or reworked all other methodologies sections. Susan Bernstein edited and compiled all sections.

[1] G1 refers to a global rarity rank where there are only between 1-5 viable occurrences of an element rangewide. G2 references a global rarity rank based on 6-20 viable occurrences rangewide, and G3 on 21-100 occurrences rangewide. Transitional ranks like G3G4 reflect uncertainty about whether the occurrence is G3 or G4 and T-ranks reflect a rarity rank based on rarity of a subspecies or other taxonomically unique unit (Maybury 1999).

each local population with respect to its size, condition, landscape context and ultimately its probability of persistence over the next century.

Viable examples of local populations ("occurrences") were spatially mapped and their locations were given informal "survey site" names. The number and distribution of viable occurrences were then evaluated relative to the conservation goals to identify portfolio candidates, inventory needs and information gaps for remediation. Ultimately each viable population occurrence and its survey site will require a local and more extensive conservation plan to develop a strategy for long term protection of that population at that location.

Secondary species targets

A second set of species, termed *secondary targets*, was also identified based on the life history, distribution and demographics of the species. Secondary targets were species of concern in the ecoregion due to many of the same reasons as the primary targets except that we had reasonable confidence that they would be conserved through the "coarse-filter" conservation of ecosystems (see the section on Matrix-Forming Ecosystems). To insure this, the compiled list of secondary targets was used in developing viability criteria for the ecosystem targets. For instance, the breeding needs of the conifer forest dwelling blackburnian warbler were used (along with other information from other species) to develop the size and condition factors for conifer forest matrix ecosystems. This guaranteed that the conservation of these forest ecosystems would be performed in such a way as to ensure the protection of the characteristic species that breed in this habitat. Additionally, known breeding concentration areas influenced the selection of which examples of this ecosystem were prioritized for conservation action.

Developing the target list

Development of the primary and secondary species target lists began with a compilation of all species occurring in the ecoregion that exhibited the characteristics mentioned above (see also Table SPP1 for definitions of selection criteria). The initial list was compiled from state or provincial conservation databases, Partners-in-flight and/or American Bird Conservation lists for corresponding ecoregions, literature sources and solicited expert opinion. The database searches begin with all species occurring in the ecoregion for which there were fewer than 100 known local populations (G1-G3G4 and T1-T3). Commoner species (G4, G5) were nominated for discussion by each of the state programs and by other experts.

Table SPP1. Criteria for selecting species targets

Imperiled species	Have a global rank of G1-G2 (T1-T2), that is, recognized as imperiled or critically imperiled throughout their ranges by Natural Heritage Programs/Conservation Data Centers. Regularly reviewed and updated by experts, these ranks take into account number of occurrences, quality and condition of occurrences, population size, range of distribution, threats and protection status.
Endangered and threatened species	Federally listed or proposed for listing under the Endangered Species Act.

Species of special concern:	Ranked G3-G5 by Natural Heritage Programs/Conservation Data Centers, but match one or more of the following criteria:
Declining species	Exhibit significant, long-term declines in habitat and/or numbers, are subject to a high degree of threat, or may have unique habitat or behavioral requirements that expose them to great risk.
Endemic species	Restricted to the ecoregion (or a small geographic area within an ecoregion), depending entirely on the ecoregion for survival, and may be more vulnerable than species with a broader distribution.
Disjunct species	Have populations that are geographically isolated from other populations.
Peripheral species	Are more widely distributed in other ecoregions but have populations in this ecoregion at the edge of their geographical range.
Vulnerable species	Are usually abundant and may or may not be declining, but some aspect of their life history makes them especially vulnerable (e.g., migratory concentration or rare/endemic habitat).
Focal species	Have spatial, compositional, and functional requirements that may encompass those of other species in the region and may help address the functionality of ecological systems. Focal species can include: *Keystone species*: those whose impact on a community or ecological system is disproportionately large for their abundance. They contribute to ecosystem function in a unique and significant manner through their activities. Their removal initiates changes in ecosystem structure and often a loss of diversity. *Wide-ranging species*: regional-scale species that depend on vast areas. These species often include top-level predators (e.g., wolves, grizzly bear, pike minnow, killer whale), wide-ranging herbivores (e.g., elk), and wide-ranging omnivores (e.g., black bear) but also migratory mammals, anadromous fish, birds, bats and some insects.

The exhaustive initial list was whittled down to a smaller final set through discussion and agreement by technical teams of scientists familiar with the species in the ecoregion. Virtually all ecoregional assessments had separate technical teams for plant species and animal species. Many regions also divided the zoology team further, having, for example, separate teams for birds, aquatic species, herptiles, mammals or invertebrates. The compiled results were rolled up to create the final species target list. To some extent the justifications for including each target species have been archived in ecoregional databases.

No single defining factor guaranteed that a species would be confirmed as a primary target. Thoughtful consideration was given to each species' range-wide distribution, the reasons for its rarity, the severity of its decline both locally and globally, its relationships to identifiable habitats and the importance of the ecoregion to its conservation. As the list was refined, species were eliminated for different reasons. Some were removed because of questions about the taxonomic status of the species, others because they were considered to be more common throughout their range than reflected in the current global rank; the global rank for the latter species needs to be updated. Among species for which distribution information was considered to be inadequate, several were retained on a

potential target list for future consideration. Table SPP2 illustrates the range of numbers of species targets selected by teams across several ecoregional plans.

Table SPP2. Comparison of the numbers of primary species targets across several ecoregions

SPECIES TYPE	LNE	NAP	NAC	HAL	STL	CAP	CBY	WAP
Mammals	3	2	1	3	2	7	2	3
Birds	0	n/a	2	0	0	1	4	0
Herptiles	2	n/a	1	2	3	7	2	6
Fish	3	1	2	6	6	7	2	15
Invertebrates	57	12	50	22	11	95	16	29
Vascular Plants	42	25	42	22	12	73	32	24

LNE: Lower New England/Northern Piedmont; NAP: Northern Appalachian/Boreal Forest; NAC: North Atlantic Coast; HAL: High Allegheny Plateau; STL: St. Lawrence/Champlain Valley; CAP: Central Appalachian Forest; CBY: Chesapeake Bay Lowlands; WAP: Western Allegheny Plateau

Setting Minimum Conservation Goals for Species Targets

The minimum conservation goal for a primary target species in an ecoregional plan was defined (conceptually) as the minimum number and spatial distribution of viable local populations required for the persistence of the species in the ecoregion over one century. Ideally, conservation goals should be determined based on the ecology and life history characteristics of each species using a population viability analysis.

Because it was not possible to conduct such assessments for each species during the time allotted for the planning process, generic minimum goals were established for groups of species based on their distribution and life history characteristics. These minimum goals were intended to provide guidance for conservation activity over the next few decades. They should serve as benchmarks of conservation progress until more accurate goals can be developed for each target. The generic goals were not intended to replace more comprehensive species recovery plans. On the contrary, species that do not meet the ecoregional minimum goals should be prioritized for receiving a full recovery plan including an exhaustive inventory if such does not already exist.

Quantitative global minimums

Our conservation goals had two components: numeric and distributional. The *numeric* goal assumed that a global minimum number of at least 20 local populations over all ecoregions was necessary to insure the persistence of at least one of those populations over a century (see Cox et al 1994, Anderson 1999, Quinn and Hastings 1987 and reliability theory for details). This number is intended to serve as a initial minimum not a true estimate of the number of local populations need for multi-century survival of the species. Subsequently, the number 20 was adjusted for the ecoregion of focus based on the relative percentage of the total population occurring in the ecoregion, the pattern of the species distribution within the ecoregion and the global rarity of each species (see Table SPP3). When the range of a rare species extended across more than one ecoregion,

the assumption was made that the species would be included in the protection plans of multiple ecoregions. Such species may require fewer protected examples within the ecoregion of focus relative to a species whose ranges is contained entirely within the ecoregion.

To highlight the importance of the ecoregion to the species, each primary target species was assigned to one of four rangewide distribution categories – Restricted, Limited, Widespread, Peripheral – all measured relative to the ecoregion (Table SPP3). Assignments were made by the species technical teams using distribution information available from NatureServe, the Heritage Programs, and from other sources available at the Eastern Conservation Science (ECS) center. In general, for species with a "restricted" distribution, the ecoregional goals was equal to the global minimum and set at 20; for species with a "limited" distribution, the ecoregional goal was set at 10. For species with "widespread" or "peripheral/disjunct" distributions, the goal was set at 5 for the entire ecoregion.

Table SPP3. Conservation goals based on distribution categories and global rarity rank (Grank). Numbers refer to the minimum number of viable populations targeted for protection.

CATEGORY	DEFINITION	G1	G2	G3-G5
Restricted	Occurs in only one ecoregion	20	20	20
Limited	Occurs in the ecoregion and in one other or only a few adjacent ecoregions	10	10	10
Widespread	Widely distributed in more than three ecoregions	5	5	5
Peripheral or Disjunct	More commonly found in other ecoregions	5	5	5

Distribution and Stratification goals

The distribution component of the conservation goal, referred to as the *stratification* goal, was intended to insure that independent populations will be conserved across ecoregional gradients reflecting variation in climate, soils, bedrock geology, vegetation zones and landform settings under which the species occurs. In most cases the distribution criteria required that there be at least one viable population conserved in each subsection[2] of the ecoregion where the species occurred historically, i.e. where there is or has been habitat for the species. The conservation goal is met for a species when both the numerical and stratification standards are met.

In addition to the scientific assumptions used in setting conservation goals, the goals contain institutional assumptions that will require future assessment as well. For example, the goals assume that targeted species in one ecoregion are targeted species in all ecoregions in which they occur. That is likely the case for rare (G1-G3) species, but not a certainty for commoner (G4, G5) species. After the completion of the full set of first

[2] Subsections are geographic sub-units defined for ecoregions (Bailey et al 1994; Keys et al 1995).

iteration ecoregional plans, species target goals should be assessed, reevaluated and adjusted. Rangewide planning should eventually be undertaken for all targets.

Assessing the Viability of Local Populations

The conservation goals discussed above incorporate assumptions about the viability of the species across the ecoregion. The goals assume that local populations unlikely to persist over time have been screened out by an analysis of local viability factors. This section describes how the planning teams evaluated the viability of each local population or "occurrence" at a given location.

Merely defining an occurrence of a local population can be challenging. The factors that constitute an occurrence of a species population may be quite different between species of differing biology and life histories. Some are stationary and long lived (e.g. woody plants), others are mobile and short lived (e.g. migrating insects), and innumerable permutations appear in between. Irrevocable life history differences between species partially account for the critical importance of the coarse-filter strategy of ecosystem and habitat conservation. Nevertheless, for most rare species the factors that define a population or an occurrence of a population have been thought through and are well documented in the state Natural Heritage databases. The criteria take into account metapopulation structure for some species, while for others they are based more on the number of reproducing individuals. Whenever it was available we adopted the Heritage specifications, termed "element occurrence specifications" or EOspecs for short (where *element* refers to any element of biodiversity) [3].

Whenever possible, the local populations of each species selected for a conservation portfolio should exhibit the ability to persist over time under present conditions. In general, this means that the observed population is in good condition and has sufficient size and resilience to survive occasional natural and human stresses. Prior to examining each occurrence, we developed an estimate of potential viability through a succinct assessment of a population's **size**, **condition**, and **landscape context**. These three characteristics have been recorded for most occurrences by Natural Heritage programs that have also developed separate criteria for evaluating each attribute relative to the species of concern. This information is termed "element occurrence ranking specifications" and these "EO rank specs" served as our primary source of information on these issues.

As the name implies, element occurrence ranking specifications were not originally conceived to be an estimate of the absolute viability of a local population but rather a prioritization tool that ranked one occurrence relative to another. Recently, however, the specifications have been revised in concept to be a reasonable estimate of occurrence viability. Unfortunately, revising the information for each species is a slow process and must be followed by a reevaluation of each occurrence relative to the new scale. Fortunately, the catalog records for each population occurrence tracked in the Heritage/CDC database contain sufficient information on its size, condition and

[3] An Element Occurrence, or EO, is a georeferenced occurrence of a plant or animal population or a natural community recorded in a Natural Heritage database.

landscape context that a generic estimate of occurrence viability may be ascertained from the heritage records.

The synthesized priority ranks (EO rank) currently assigned by the state Heritage Program staff reflected evaluations conducted using standard field forms and ranking criteria that were in use at the time that the occurrence was first documented by a field biologist. These ranks, while informative, were somewhat variable for similar occurrences across state lines. Thus for viability estimation the EO rank was supplemented by the raw tabular information on size, condition and landscape context. Additionally, several ecoregion teams further augmented this with a spatial GIS assessment of the land cover classes and road densities located in a 1000 acre proximity of the occurrence's central point. The latter served as an objective measure of landscape context.

All known occurrences for each primary target species were assembled at ECS from the state Heritage Programs through data sharing agreements. The occurrences were sorted by species, and spreadsheets for the species targets were prepared for group discussion, using the information described above. Further data included: a unique occurrence identification number, the species name, global rank, site name, and date of last observation. Tables of all occurrences were provided to each technical team member along with ecoregional distribution maps of the occurrences. Final decisions on the estimated viability of each local population was provided by the technical team and reviewed by the appropriate state and divisional scientists.