NatureServe VISTA

Decision-Support Software for Land Use and Conservation Planning

User's Manual

from

Vista On-line Help

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About This Help

This help was created by NatureServe (www.natureserve.org) to accompany its Vista decision-support software for land use and conservation planning.

Additional information related to basic mapping functions utilized in conjunction with Vista can be found in help documentation for the specific Environmental Systems Research Institute (ESRI) (www.esri.com) application being used to develop and manage geographic information system (GIS) layers (e.g., ArcGIS 10). Answers to commonly asked questions and other tips on using Vista may be found in the Knowledge Base on NatureServe's online support site at http://support.natureserve.org/Vista/.

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PREFACE

NatureServe has thirty years of experience collecting and managing biodiversity data through its network of more than 75 state, provincial, and national member Natural Heritage Programs and Conservation Data Centers. We share a common interest with many other organizations in protecting our precious natural heritage and improving our quality of life. As a primary source of biodiversity data across North America, as well as much of Latin America and the Caribbean, the NatureServe network is often the conduit to successful conservation planning efforts. As practitioners, we are challenged by a conservation planning science that is complex and not always integrated with other decision processes. With this in mind, NatureServe Vista was created to provide conservation planning tools to those who are making decisions about our natural resources.

NatureServe Vista was developed by a team of expert conservation planners and software engineers. Our work was primarily funded by a cornerstone grant from the Doris Duke Charitable Foundation and was guided by a panel of expert advisors from all relevant disciplines. The result is a product that we believe has the capability to inform policy decisions and help create outcomes of real conservation significance. As you use this tool, please provide us with regular feedback. Our pledge to you is to support your conservation planning efforts and to continue improving NatureServe Vista in order to provide you with the highest quality conservation planning software available.

ACKNOWLEDGEMENTS

NatureServe gratefully acknowledges the funders, partners, and project team members who helped create the conservation planning methodology and Vista decision support software.

Funders

Providing commercial-quality tools to all those making decisions that affect biodiversity was a tall order and risky venture. We thank our funders for their vision, faith, and willingness to take the risk for biodiversity.

The Doris Duke Charitable Foundation

The NASA ReASON Program

The Surdna Foundation

The Nature Conservancy

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MARXAN Conservation Solution Software

Ball, I. R. and H. P. Possingham, (2000) MARXAN (V1.8.2): Marine Reserve Design Using Spatially Explicit Annealing, a Manual.

Possingham, H. P., I. R. Ball and S. Andelman (2000) Mathematical methods for identifying representative reserve networks. In: S. Ferson and M. Burgman (eds) Quantitative methods for conservation biology. Springer-Verlag, New York, pp. 291-305.

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Data Credit

The biodiversity data shown in illustrations of Vista windows and reports derive from a pilot project carried out with the Land Trust of Napa County, California, which used the following sources for data developed and used in project analyses.

Element data:

California Native Plant Society

California Natural Diversity Database (CNDDB), of the California Department of Fish and Game, Wildlife and Habitat Data Analysis Branch

University of California at Davis, Information Center for the Environment (ICE)

Land status data:

Bureau of Land Management (BLM)

California Spatial Information Library:

http://gio.resources.ca.gov/ "GAP - Managed Areas"

Napa County Agricultural Preserve

Napa County GIS website: http://gis.napa.ca.gov

Napa County website providing information on Title 18 Zoning:
http://www.co.napa.ca.us/code2000/_DATA/TITLE18/index.html

U.S. Geological Survey California GAP program:
http://www.biogeog.ucsb.edu/projects/gap/gap_home.html

Public lands data:

Primary Source - GreenInfo Network

Conservation Biology Institute (CBI) Protected Areas Database:
http://www.consbio.org

Vegetation cover data:

California Department of Conservation, Division of Land Resource Protection, Farmland Mapping and Monitoring Program

California Department of Conservation, Office of Mine Reclamation, Abandoned Mined Lands Unit: http://www.consrv.ca.gov

California Department of Forestry and Fire Protection

Counties of Colusa, Glenn, Lake, Marin, Soloano, Sonoma, and Yolo, California

National Water Resources Council

U.S. Fish and Wildlife Service

U.S. Forest Service

U.S. Geological Survey

We gratefully acknowledge these sources for providing data, and for allowing their continued use in the graphics included in this documentation. Further, we gratefully acknowledge CNDDB, a NatureServe Natural Heritage member program, for allowing use of their data on significant natural communities and species as a sample data set provided with the software; the use of these data is subject to the provisions and limitations of the Data Sharing Agreement between NatureServe and CNDDB. For further information about CNDDB, visit http://www.dfg.ca.gov/whdab/html/cnddb.html.

Table of Contents

INTRODUCTION

Welcome to the NatureServe Vista (Vista) planning and assessment software. While Vista is well-suited to support conservation planning experts; Vista was specifically designed to support non-GIS and non-conservation experts to assist integration of conservation with other assessment and planning activities. Vista, however, covers a very broad suite of functions and therefore requires the support of experts to build the database and train end users in the analytical and planning functions. Vista is designed to deliver defensible science-based planning and therefore requires the involvement of subject matter expertise and initially may appear complex to apply. No one likes to read software documentation (user manuals) but spending a little time with the documentation will likely save you hours to days of frustration. From our experience offering technical support, the vast majority of questions are answered by the documentation and many problems can be avoided by following the guidance. Advanced GIS users perhaps have the most difficult time because they tend to access documentation only when they run into a problem and they tend to not use the Vista interfaces since they are used to the ESRI interfaces. Some people have tried to shortcut the system by working in the Microsoft Access back end and have destroyed their project pathways. Vista, like all software is far from perfect and you will likely run into some problems but we believe if you follow the documentation and use the software as advised you'll have a satisfying experience. If you need additional assistance we are proud to offer custom contracts for a variety of support services to ensure your success. This includes assistance in designing workflows for applying Vista and other support tools to *your* planning applications (see the Vista website support section for more information).

A System of Software and Methods

The Vista software is comprised of spatial analytical functions automated through a geographic information system and both spatial and non-spatial databases for managing inputs and Vista outputs. The methods behind Vista are drawn from the systematic conservation planning discipline though Vista can and has been used for a very broad variety of applications. At the heart of the process is the concept of setting quantitative retention goals for elements of interest, assessing how well different scenarios meet those goals, and then using the tool to mitigate problems or create alternative scenarios for implementation. Vista then supports project level implementation, ongoing monitoring, and adaptive planning and management.

Vista is designed to support a two part process that can bring solid science, data, and methods to planners and managers that are not expert either in GIS or in conservation planning. In the first part, the expertise of element experts (biologists, ecologists, and experts in other non-biological conservation features)

is utilized to populate the database with the data as well as expert knowledge. In the second part, planners and managers can be readily trained to operate those functions that allow them to assess how well current and future scenarios will meet their goals, where conflicts are, and how to mitigate conflicts or build new alternative scenarios. The best projects will keep the "experts" involved to continue advising and then to build more detailed implementation, management, and monitoring plans.

Virtually all of the functions performed by Vista can be done manually with GIS, so why use Vista? Vista automates functions that would take days to weeks to figure out and then implement in a step-by-step basis manually. Vista also provides significant automated tracking, updating, data integrity testing, and reporting functions. Thus, Vista as a decision support system makes it far easier to build and conduct spatial analyses, track data inputs and outputs, manage databases, and create reports that possible with GIS alone. No software will be able to automate all parts of the broad and complex conservation planning process, therefore, Vista is most often combined with other tools to form "toolkits" suited to different applications. NatureServe and partner organizations also offer a combination of software and services that can be tailored to individual client needs and capabilities. We expect that over time, parts of the process now met through custom services or expert tools will be incorporated into the Vista software to make those functions more accessible to planners.

Vista provides several distinct conservation planning analyses that can provide value on their own or can be integrated in a complete assessment and planning process:

Element Conservation Value layers that indicate the relative value of areas for a single element (species, ecosystem type, cultural feature, desired land use, etc.);

Landscape Condition Modeling integrates land and aquatic condition into the element conservation value layers and scenario evaluations. This functionality includes an interface with NOAA's Nonpoint-Source Pollution and Erosion Comparison Tool (N-SPECT) to investigate potential water quality changes and ecological impacts from development, other land uses, and climate change.

Conservation Value Summaries that identify areas of high conservation value in the planning region based on combinations of elements and their attributes;

Scenario Maps that provide maps and statistics on the distribution of combinations of land uses, management practices, and disturbances and the policy mechanisms behind them;

Scenario Evaluations that calculate goal achievement or gaps, identify places where goals are being met and those places causing conflict and goal shortfalls through incompatible land use or unreliable policy mechanisms;

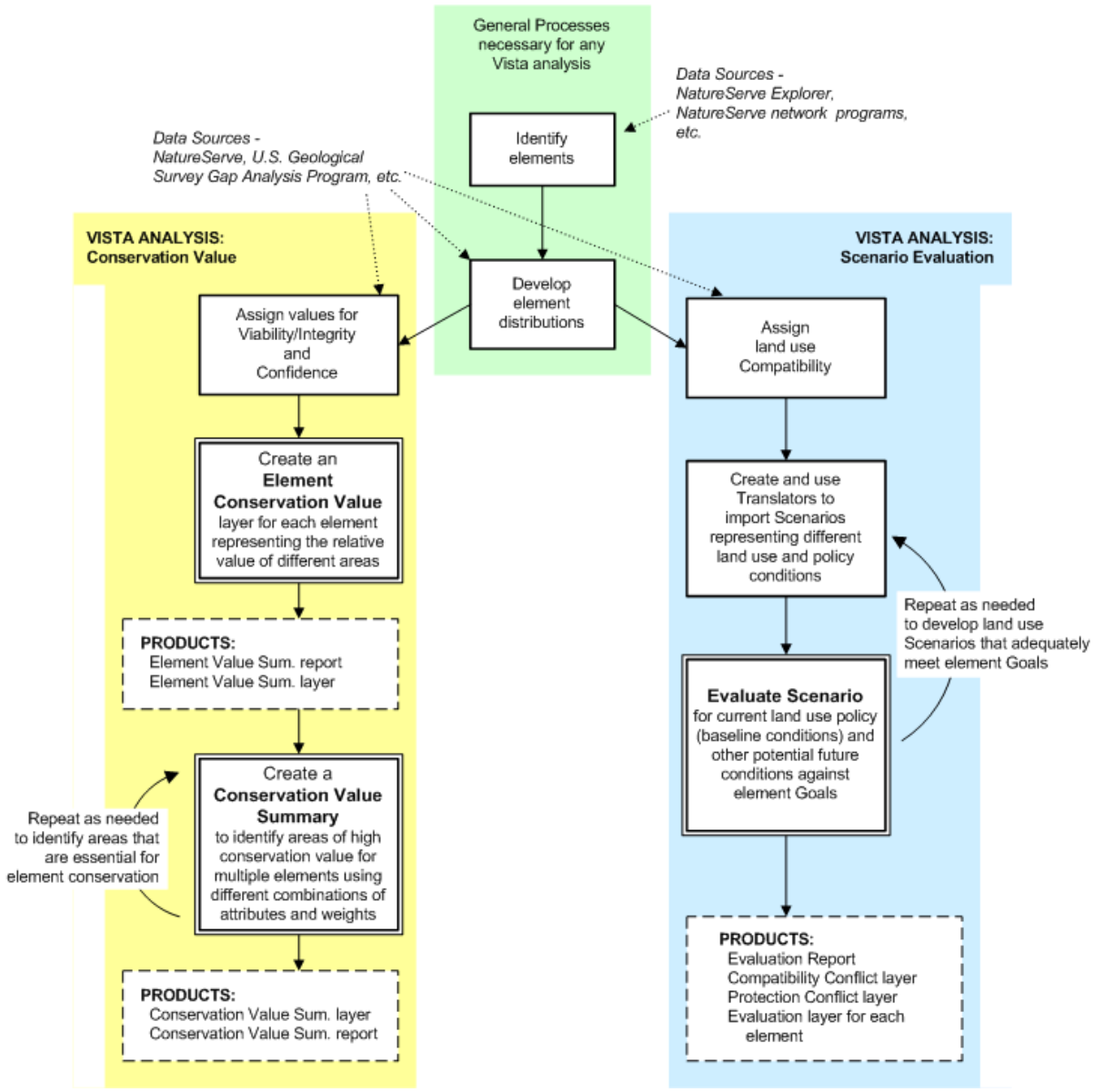
Site Explorations that examine the conservation properties of locations based on Vista Conservation Value Summaries and Scenario Evaluations. Using a Conservation Value Summary, Site Explorer displays the inventory of elements mapped for the location and the element attributes of interest.

For a Scenario Evaluation, Site Explorer provides data on the land use and/or policy types for the site selection, along with detailed information on element conservation goals achieved; in addition, Site Explorer enables the user to examine the effects on goals if alternative land uses and or policies are applied.

In addition to these analyses, Vista also includes:

Conservation Solution functionality that facilitates data exchange between Vista and external conservation solution applications, specifically MARXAN and SPOT (the Spatial Portfolio Optimization Tool). Both of these applications generate solutions of sites that can most efficiently meet conservation goals subject to criteria such as amount of area, unit cost or "conservability" dispersion or aggregration of sites, etc. Vista can be used on the front end to generate the input data needed by Marxan and SPOT, via a wizard that makes this process far easier. Vista can also capture solution results generated by these applications and more precisely evaluate their ability to meet goals and then to use the results with Vista Site Explorer to create more resolved spatial plans that specify appropriate land use and implementation mechanisms (e.g., regulations, funding source, education, etc.

Ideally, all of these analyses/functions are utilized for conservation planning, but limited resources and/or data may dictate that fewer or simpler analyses are conducted initially. Vista is thus designed to support the growth of projects as better data are developed and more robust analyses and detailed planning can be conducted. Regardless, the first steps to conservation planning using Vista are designed to prepare the element database. Below is a diagram showing the general processes used for conservation planning in Vista, as well as the processes unique to each analysis. Note that the conservation planning process is not necessarily linear (in fact, it may best be thought of as cyclical), and once the essential database is created (i.e., elements are identified and distribution and attribute data developed), one may enter the process at different points.



General conservation planning processes in Vista.

Below are very general descriptions of steps in the Vista conservation planning process, including whether they are accomplished by the software or through services, and which role(s) are responsible for completing the step (see the topic Roles in the Planning Project for further definitions.) Considerably greater information and guidance are provided in the user manual chapters related to these tasks. One item to keep in mind: roles are best thought of in terms of subject matter expertise rather than institutional or departmental associations.

1. Develop teams or working groups associated with the different data needs and decisions associated with the project (see Roles below). These commonly include a project oversight group, an ecology working group, a

data/GIS working group, and a policy/strategies working group (Service – project leadership)

2. Select conservation elements for inclusion in the Vista conservation database (Service – data development team and end user)
3. Establish the project land use intent classification by modifying the default list provided Vista. This is needed before soliciting expert knowledge about the elements. (Software – data development team and end user)
4. Determine the level of completeness and resolution of data needed to support the project purpose and develop GIS distribution layers and gather expert knowledge on the elements (Service – data development team but see Excel Experts Input spreadsheet tool on NatureServe Vista website)
5. Enter elements and associated information into the Vista conservation database, and point to distribution layers (Software – data development team)
6. Create category systems and filters for selecting elements for analysis and organizing reports (Software – end user)
7. Describe element conservation requirements in terms of the conservation unit utilized in the project (i.e., area or occurrences), minimum required area (if applicable), and response to land use types (the latter, for use in Scenario Evaluation analyses) (Software – data development team)
8. Create weighting systems for use in Conservation Value analyses and/or goal sets to be used in Scenario Evaluation analyses (Software – data development team and end user)
9. Aggregate groups of elements into Conservation Value Summaries, selecting from several variables to be included in the analysis, specifically weights, viability/ecological integrity, and confidence (Software – end user)
10. Import land use and/or policy input layers, using translators to cross-walk them to project land use intent (LUI) categories and/or policy types (PT).Then integrate the layers according to whether they override overlapping features below them or should be combined to represent multiple co-occurring land uses. Process these into scenarios which output separate maps and reports depicting and quantifying the distribution of land uses and policy types (Software – end user)
11. Evaluate the resulting scenarios for their ability to meet conservation goals using Scenario Evaluations by selecting which scenario to evaluation, what group (Filter) of elements to evaluate, what Goal Set to apply, and which policy types you believe are reliable (Software – end user)
12. Explore sites in scenarios to understand the performance of individual or groups of sites relative to conservation goals and their relative ability to contribute to specific element goals with land use and or policy changes. (Software – end user)

13. Modify/mitigate individual sites to increase element goal achievement by changing the conflicting land use to a compatible land use and/or unreliable policies to reliable ones for each selected site (Software – end user)
14. Create entire new alternative scenarios by identifying the set of sites that can most efficiently meet element conservation goals by exporting Vista information to external linked software, importing spatial solutions, and specifying appropriate land use and implementation policies for each site (Linked expert software – conservation experts)
15. Verify that planning units selected for conservation provide viable habitat for conservation elements (Outside software and/or Service – element experts)
16. Integrate all conservation and land-use objectives if you are conducting general land-use planning or management (Partially supported by software. Outside the software – end user, additional experts)
17. Create implementation plans for achieving the conservation goals on selected planning units (Service – conservation experts or end user)
18. Create management plans for conservation areas (Service – conservation experts)
19. Create inventory and monitoring plans to increase confidence in element occurrences, verify viability of elements on conservation lands, or identify need for plan revisions (Service – conservation experts)
20. Maintain currency in knowledge about status of conservation goal achievement and gaps by maintaining an updated database from monitoring activities and other information updates such that element distribution maps and expert knowledge, current actual land use, and current policies. Reanalyze current scenarios to identify gaps and revisit steps above on a routine basis to ensure achievement of goals. (Software and service—all project members).

Other sections will describe in detail steps required to develop and input data for Vista and how to utilize the application to conduct analyses.

Roles in the Planning Process

Because conservation planning (whether using Vista or not) is a data intensive and complex endeavor (as is all planning) we define two types of roles in the process:

Data Development Team – This group of experts (often organized into various specific working groups) provides the following services as needed:

- Identify the conservation elements to be included in the database and obtain or create data on their distribution from a variety of sources
- Obtain data on the current land use, regulations, and management plans that affect future land use and landscape condition (depending on end user skills this may also be an end user role)

- Format all data according to the Vista data model and add additional knowledge on element conservation requirements, for example, goals, weights, and sensitivities
- Create categorizations of elements
- Provide review of analyses as requested by the end user
- Provide additional follow up activities such as developing management and monitoring plans

End User – This individual or team utilizes the software and database to:

- Determine elements that will be used in analyses
- Create alternative weightings for elements reflecting stakeholders' values
- Conduct analyses and evaluations
- Obtain expert reviews as needed
- Create reports and GIS layers
- Create new land use and policy scenarios or site mitigations

In many organizations, all of these roles may be fulfilled internally. In other cases the end user will need to contract or partner with a qualified organization(s) to provide the database development services. In some cases, individuals will play dual roles. Detailed scientific and geographic information system (GIS) methods for developing the database are described in the Element Database section. Many NatureServe Heritage programs and environmental consultants will be qualified to provide these services. NatureServe's Vista support staff can also provide these services (see Vista support website for further information).

Because data development and integration is a costly undertaking and because conservation planning is typically a long-term and dynamic process, we envision Vista being fully integrated into a community's or organization's routine planning and review practices. The benefits to this integration are twofold:

- The Vista database can readily be maintained as decisions are made or new information is gathered
- Dynamic rather than static plans allow the user to always know where they stand in meeting their goals, and threats and opportunities can be readily identified and addressed

Applying Vista to Your Planning Problem

This section provides suggestions for applying Vista to some common planning problems; it is not exhaustive. We believe Vista is appropriate for use by any organization or individual that plans for or manages land or water use, regulates development, or seeks to influence policy NatureServe's Vista support staff can develop custom workflows and integrated toolkits to fully support your planning needs. Details on how to apply Vista to a sample of problems are provided in the Project Types section.

Applications by Conservation Organizations

- Evaluate existing government policies to identify conservation gaps.
- Evaluate your existing plans or land holdings to identify strategic goals.
- Evaluate new scenarios for conservation to see how they meet your goals.
- Provide your plans and database developed with Vista to other implementers to facilitate their adoption of your plan in a flexible decision environment.

Applications by Local or Regional Government Land Use & Infrastructure Planning

- Evaluate current plans, existing land use, and conservation areas to identify gaps in meeting your conservation goals.
- Evaluate the conservation impacts of a large development project and identify mitigation needs onsite or offsite.
- Modify the general plan and zoning to be more compatible with conservation goals and identify areas of low conflict for more intensive land use.
- Evaluate a plan provided by a conservation organization to see how it fits the community's conservation goals.

Applications by Resource Management Agencies or Industry

- Evaluate current management plans to identify gaps in meeting your conservation goals.
- Identify locations for resource use that may be free of biodiversity conflicts.
- Identify areas of likely conservation value but low data confidence that require field inventory.

Vista Conservation Biology and Systematic Planning Approach

Applying the Science of Conservation Biology to Land Use Planning

Conservation biology is an applied discipline, one that uses scientific principles and knowledge of ecology to preserve plant and animal species and communities in the real world. Land use planning that integrates conservation biology will develop and apply more precise information about the location and ecological requirements of biodiversity in the planning area – and can result in better land use decisions.

Central to this approach is the identification of 'conservation elements' of concern in the planning area. These could include threatened and endangered species or local environments, such as wetlands, that fall under environmental regulation. They could also include certain species, habitats, and 'open space' values of high local priority. In some cases, land use planning might be directed at conserving *all of the native biodiversity* in a given area. This more comprehensive approach could allow for better long-term conservation – helping avoid the situation in which new species and habitats would need to be regulated in the future causing endangered species "surprises" and development "train wrecks."

This imprecise concept – *all native biodiversity* – can be effectively addressed through careful selection of the elements of biological diversity to be conserved. Selection criteria would mandate that all characteristic ecological systems be included, complemented by rare and vulnerable communities, species assemblages, and species. These criteria reflect what is known as the "coarse filter/fine filter" hypothesis, which suggests that by conserving multiple, high-quality examples of all ecological systems, we also support the majority of native biodiversity. But since this "coarse filter" on its own might not represent all biodiversity, special attention is also needed for communities and species that are rare or vulnerable – the "fine filter." Experience suggests that this is the most efficient approach to representing all native biodiversity in a network of conservation lands.

With conservation elements clearly defined, we then ask, where are they? Creating maps that accurately describe the location of these elements takes us to a next critical step, enabling us to see where many elements are found together, and where individuals occur in isolation. We can begin to address questions like: Where do our conservation elements co-occur with various land and water uses? Detailed and realistic geographic information system (GIS) layers permit more precise evaluation and planning solutions.

We then ask: What do our conservation elements need to survive and/or function properly? A particular bird species might require several hundred acres of unfragmented and mature forest to successfully raise fledglings. A certain type of wetland might require natural vegetation in most of the surrounding uplands to support natural fluctuations in water levels. A particular grassland type might require controlled fire on a frequent basis to maintain natural diversity in plant and insect species. Each of these examples describes key ecological attributes that define the quality of individual populations or habitat patches. The relative quality of these mapped locations tells us much about our options for their conservation. For example, high quality examples of rare and vulnerable species or communities are of high conservation value because few alternative opportunities exist for their conservation. We might now ask: Are surrounding land uses in conflict with critical ecological processes? Will some locations require costly management and ecological restoration? Which ones?

We are then prepared to ask a central question of land use planning and conservation: How much is enough? Within a planning context, this question might address a *desired level of representation* for each conservation element, based on local interests and values; for example, "our county desires 10% of its lands to be in natural vegetation as open space." It could also embrace a more ecological perspective. One might apply best available knowledge to define the overall amount of each conservation element that is needed to ensure long-term survival and ecological health. This requires additional evaluation of the relative contribution of this planning area to conserving biodiversity (or other conservation values) throughout a larger region.

The science of conservation biology directs us to ask – *and answer* – a number of important questions in the context of any land use planning process. Vista embodies an approach and toolbox that enables the science of conservation biology to inform practical decision making.

REQUIREMENTS

System Requirements

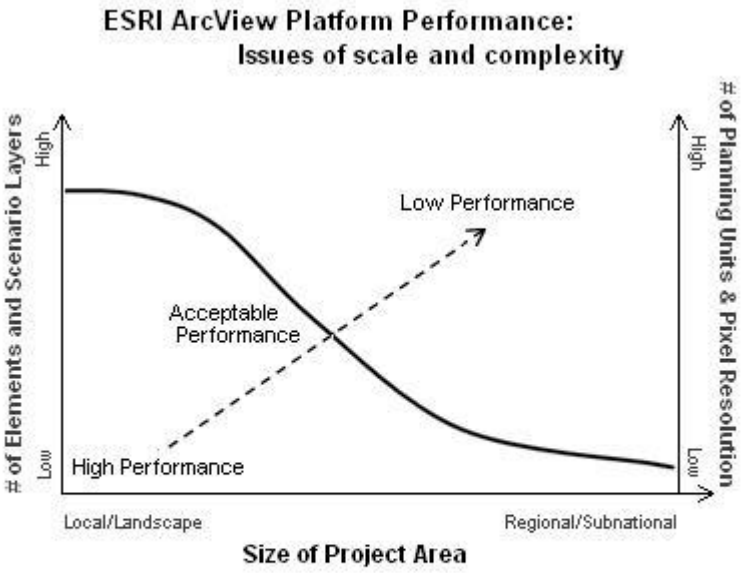
Please see the current requirements in the readme file included with the program or found on our website at:
http://www.natureserve.org/prodServices/vista/vista_sys_reqs.jsp

Common Project Requirements

Introduction

Now that you plan to use NatureServe Vista as one of your project tools, you will need to learn how to integrate it into your project or routine planning and assessment activities. However, since Vista has a broad range of applications and can be used by many types of users, we cannot provide prescriptive directions for carrying out every possible project. Instead, we describe a sample of typical planning situations, how Vista and planning methodology can be applied to those problems, types of inputs required, and nature of expertise required. The objective is to help users rapidly initiate projects that will lead directly to the answers required for decision-making. Before you do anything, carefully assess whether Vista, as an ArcView (versus ArcInfo) based tool is able to meet the computational demands of your project. We provide more detailed guidance below but generally the most advanced analyses in Vista cannot process a combination of layers that exceed 1 billion pixels. That means that for projects exceeding approximately 1 million hectares (2.2 million acres) you may need to trade off among the following variables:

- Project extent: if you desire to retain a large project extent (>1 million ha/2.2 million ac) you may need to reduce the number of conservation elements (e.g., by clustering into guilds of elements represented by a single map per guild) and increase the pixel size substantially in your analyses. Keep in mind that if you need to reduce your project extent, you will need to do this before you begin your project because Vista/ArcView will allow you to make project extents larger but not smaller. If in doubt, we recommend starting with a subregion, confirm that Vista can operate satisfactorily, and then enlarge your project accordingly.
- Number of conservation elements: if you desire to have many dozens to hundreds of elements you may need to reduce your project extent (perhaps by breaking your planning region into multiple subregions with separate Vista projects) and or increasing your analytical pixel size.
- Spatial resolution: if you desire to work at fine spatial precision (relative to the size of the planning region e.g., 30 meter to 1 ha) then you may need to reduce project extent and or reduce number of conservation elements.
- Planning sites: if you desire to work with tens of thousands of planning sites you may need to reduce the combination of variables above.



If (# of cells in project area * # of elements * # of planning units) is > 1 billion, then performance limitations will exist. [*]

[*] Highly complex datasets may create greater limitations.

Data Collection

Most projects begin with collecting information. Specific information required for initiating a Vista project is described in the Information Needed for Database Construction section. In addition to geographic information system (GIS) data layers such information must also include the values of project stakeholders. Dealing with appropriate data collection and appropriate inclusion of stakeholder values is the most critical piece of all planning projects with or without Vista. For data, you must ensure that data precision and quality match the planning purposes. For stakeholder values, Vista allows different group values to be expressed in several ways such as varying which conservation elements are selected, how their importance is weighted relative to other elements, what conservation goals are assigned to the elements, and which land-use policies are deemed valid. While Vista allows recording and analyses of different sets of values, it is up to the participants to resolve differences in the outcomes these would generate e.g., whether a scenario evaluation that meets a set of low conservation goals is appropriate to implement.

Data input

All projects will require that data be assembled, formatted, and entered into Vista following the simple Vista data model as described throughout this documentation. The basic types of inputs for Vista include:

- Planning region reference information (boundaries, streams, roads, place names, topography, digital orthophotos, etc.)

- Element distribution maps (NatureServe Heritage network element occurrences, Fish and Game species habitat maps, vegetation cover maps, modeled distribution maps, scenic views, historic sites, etc.)
- Element occurrence attributes (viability, integrity, confidence)
- Element information (name, weight, goal, conservation unit, minimum required area, etc.)
- Existing land use map
- Current land use and management policy maps (zoning, public land management plans, etc).

A more complete summary of the information inputs are described in the Data Inputs and Outputs section, but it should be noted that inputs will vary considerably depending on the project objectives, local environment, etc.

Properly assembling the data usually requires ecological and GIS expertise. While obtaining suitable data and getting it into the system is typically the most time-consuming and resource-intensive part of any project, the same is true for all projects utilizing GIS tools. Vista does provide utilities not typically included in most tools to facilitate collecting information, inputting and documenting data, and conducting thorough data validation functions that run in the background.

Common processes

In the examples that follow, the assumption is that the following steps have already been completed:

- Select a database development team
- Identify the conservation elements of interest in the planning region (e.g., species, ecosystems, scenic viewsheds, etc.)
- Develop the database and import all information into Vista
- Establish expert and stakeholder values for element weights and goals

Required Expertise and Information

Data Development Team Composition

A variety of skills will be needed if the goal is biodiversity conservation. Individuals may possess more than one skill, so the following list should not be interpreted as representing the number of team members required. Needed skills also depend on the analyses to be performed.

- Project coordination and management
- Geographic information services
- Data management
- Metadata documentation
- Terrestrial ecology
- Terrestrial zoology
- Aquatic ecology

- Aquatic zoology
- Non-biological domain expertise (depends on elements of interest to the analytical user, e.g., farmland conservation, archaeological sites, etc.)

Information Required Prior to Database Construction

This section describes the information that the analytical user should provide before the data development team begins work on the conservation database. How Vista will be used can have a great influence on the type of data required, and tailoring the database to user needs will save time and money. However, the user should also try to consider longer-term needs to reduce callbacks for additional information. For example, the analytical user may initially request a database of only legally protected elements, then later discover that the community desires much broader wildlife conservation. Even if the data development team and analytical user work on the same project or in the same organization, they should verify that they all agree on the database requirements. The following are some general questions; a check-off list of more specific information requirements is found in the Information Needed for Database Construction section.

- What will be the primary use of Vista – scenario evaluation, investigation, and education; conservation plan development; integration with general land use planning; resource management, etc.?
- Who will be using Vista and what is their level of knowledge and comfort working with the particular problem, data, and complex software?

Information Needed for Database Construction

The process of beginning a Vista project can be facilitated by identifying the various types of information needed to construct the project database first.

Planning region boundary

Identify the data layer that spatially defines the planning region based on whether:

- It is bounded by a single polygon such as a county, state, ecoregion, or watershed.
- It is bounded by specific tracts of land over which the analytical user has planning authority. These tracts may be disjunct and fall within a larger planning region with the intervening tracts left blank as "no data" regions.
- It is bounded by multiple jurisdictions that will cooperate in the implementation of Vista.

Conservation elements.

Identify the specific elements or categories of elements the client wishes to incorporate after reviewing the Vista default list of biodiversity elements and the types of compatible cultural elements that can incorporated. Decide how weights and goals will be assigned.

Baseline scenario composition.

Identify the planning, management, and regulatory jurisdictions operating within the planning region. List them in order them based on the policy dominance in cases when jurisdictional authority overlaps for the same areas.

Analytical services.

Identify any analytical services (e.g., conservation value summaries, baseline scenario evaluation, scenario generation) that the database development team should conduct prior to database delivery.

Post-delivery services.

Identify any planned post-delivery services for the database development team (e.g., review of analytical results).

Delivery date and budget for database and services.

Identify the desired delivery date and budget for delivery of the database including any analytical services.

Data layers and sources.

Identify any the key data layers and sources known to the analytical user that may be unknown to the data development team.

Data Inputs and Outputs

Introduction

Geographic information system (GIS) layers form the backbone of the Vista database, but additional non-spatial information is also required, including weights indicating social values and goals for element conservation. For use of all Vista functions, an extensive amount of data may be needed. The scale of the data and attribute detail will determine the types of analyses that can be done and the precision of the results. Obtaining and formatting the data for Vista can be a significant task and the most expensive part of the project for several reasons:

- Little-to-no data are developed specifically for conservation planning and must be converted for this use.
- Data come from many different sources and disciplines with different standards for projection, attribution, and documentation.
- Data for any planning region are largely incomplete, at different scales, and of different ages.

The following section is intended to provide a synopsis of the required inputs and outputs of Vista. It is not exhaustive but can serve as a guide for planning and getting started on data and expert knowledge acquisition.

Topics in this document are generally arranged in chronological order, although there is a lot of flexibility available after the Base Data and Conservation Element Data are entered.

Pre-processing for all data

All projections and coordinate systems must be identical, clipped to a manageable size that is larger (preferred but not critical) than the project boundary, ESRI-compatible formats.

INPUTS

Base Data

Project Area

Project boundary file must be a single polygon shapefile

- Typically a political or geophysical boundary like a county or watershed is used
- Add this layer to you ArcMap view before doing anything Vista related. This will set you Data Frame properties to match those of the boundary file.

Data Frame

Set to Layers (this will pull projection information from layers already in the .mxd)

- If you have added your pre-processed boundary file to the view, your Data Frame properties will be correct

Cell Size

A default cell size to be used in the project (can be changed at any time)

Snap Raster

ESRI GRID with cell size evenly divisible by the project cell size

Site layer

Any polygon map e.g., parcels, watersheds, etc., typically used for planning or management decisions at the scale of the project.

- This layer should be selected at the onset of the project, but will not be used until more advanced analyses are built

Land use intent list

A hierarchical list modified from the Vista default which describes physical activity/phenomena.

This list will not actually be used until the (Scenario Data section below, however, if you know that you will be creating Scenarios (most likely) then developing and inputting this list now will save a great deal of time because if it is changed, the element response (see below) must be updated by experts.

Conservation Element Data

Spatial distribution

All conservation elements (EOs, modeled habitat, ecosys, historical sites, etc) – polygon preferably defined as occurrences (can be multiple patches associated with a single ID).

- Common sources include NatureServe member network programs for EO data, land cover rasters (must be dissolved and polygonized), BLM, Fish and Wildlife, and in-house habitat and suitability modeling. The Sources of Element Distribution Data section provides information on where these data may be obtained.

Quality scores

Must have Quality scores stored in polygon attribute table or in float raster. Scores must range from 0.0 – 1.0 values (1.0 is high quality). Vista will import and transform Element Occurrence Ranks directly from NatureServe Member Network Program databases using the Biotics data management system.

- Attributes are typically used for occurrence data, while ecosystems, land cover types and some modeled data typically use a 'Landscape Integrity Raster.' The analysis takes into account negative impacts (point-source pollution, roads, mines, runoff, etc) and runs a weighted straight-line distance, then sums the layers.

Confidence scores

Must also have Confidence scores in same format, or in single value entered into text field.

- Heritage data comes with data confidence data and other datasets can be evaluated by expert opinion. These scores slide on a 0.00 – 1.0 relative scale (1.0 is high confidence).

Quantitative goal

Integer of quantity (e.g., 30 acres, 20 occurrences) or percent 0-100 of area or occurrences.

- Goal sets are a scientific value that should describe the minimum amount of an element needed to allow that element to survive/continue to be viable
- Many goal sets are possible. Sometimes when scientific minimums are uncertain a 'High Risk of Losing Element' and a 'Low Risk of Losing Element' goal sets can be made.

Optional minimum viable occurrence size

Integer value of spatial unit (e.g., 100 acres). Note that this applies to an occurrence not a patch so Vista is not very sensitive currently to fragmentation as long as parts of original occurrences sum to MVO. Recommend secondary analyses with fragmentation tools (e.g., HPP, Fragstats) when details about fragmentation relative to minimum viable patch size are important.

Optional categories of membership

Some default categories provided (e.g., ESA rank) but user can create any desired

- Categories help by organizing goals, weights, results reports, etc.

Optional importance weight

Must be a 0.0-1.0 score but many weight lists possible

- Weights should reflect stakeholder values, wishes

Scenario Data

Land use intent list

This is the *same list* that was referenced in the Land use intent list (above). It is included here because this is the last opportunity you will have to modify this list before using it in a scenario. Hopefully modifications are not necessary, because they will require manual updating of each conservation element.

Policy type list (optional but preferred)

A list of policy types (e.g., "zoning regulation") Modification of Vista default list. Can be readily changed any time (in scenario evaluation user must specify reliable policies).

Land use spatial distribution data

Polygon or integer raster map(s) of current, proposed, or modeled land use intents.

- Usually two or three scenarios will be created. This first shows land use as it currently exists. The second or third show possible future uses based and various growth or development predictions (ie CommunityViz models).
- Current land use data can often be obtained from county or city governments

Policy types spatial distribution data

Polygon or integer raster map(s) of current, proposed, modeled policy types usually inferred from the land use input file.

- This is sometimes the land use file, just translated (displayed) using different attributes.

Element responses to land use intents

Options (all sources are from element experts directly or from literature):

Categorical response

Default is selection of "negative, neutral, or beneficial" response. User can add or delete these responses.

- When you set up your responses you are simply designating how the element will be impacted by a particular land use (kind of like saying

'a lot, a little, not at all'). You will determine if the element can persist through that type of impact later.

Landscape condition response

A condition model for one or a group of elements: the degree of impact on persistence from any land use type on the immediate site and a distance effect in 0.0-1.0 scores. Actual spatial condition map is then automatically built when a scenario is entered and a condition evaluation is requested.

OUTPUTS

Elements

(used for basic understanding of element distribution, requirements, areas of high to low value)

Element conservation value

A floating point raster map with cell values reflecting the combined quality and confidence scores. Defines occurrences falling below minimum viable size.

HTML report summarizing element properties and value map

Conservation Value Summary

(used for generally planning to avoid conflicts with high value areas)

Raster floating point map based on several user-defined parameters indicating relatively low to high value of landscape based on element richness and characteristics.

Scenario

Raster integer map of land use intent distribution

Raster integer map of policy type distribution

HTML scenario report

Acreage of combinations of land use intent and policy types and maps of land use intent and policy type.

Scenario Evaluation

(primary output to identify elements not meeting goals, gap in goal achievement, and where conflicts are occurring and of what type)

Compatibility Conflict map

Raster map shows areas where elements do not meet conservation goals and are in conflict with scenario's land use intent. Visualizes "intensity" of conflict via count of number of elements in conflict per pixel.

Policy Conflict map

Raster map shows areas where elements not meeting goals because of unreliable policy and intensity of conflict per above.

Scenario Evaluation Report

HTML format report with tabular results of element goal achievement based on the evaluated scenario.

Site Explorer

(explore conflict issues at particular sites and use to generate alternative scenarios)

Site Selection Report – Conservation Value Summary exploration

HTML format report that indicates the conservation value of the selected site(s) and element information, including the number and percentage of viable occurrences on the site(s).

Site Selection Report – Scenario Evaluation exploration

HTML format report of land use on the selected site(s), along with element inventory and element response to land uses.

- **Optional:** Can be used to specify alternate land use intent and policy type per site (homogenous over entire site). Generates a shapefile that can be integrated in a new Vista alternative scenario.

GETTING STARTED

Project Types

The following examples describe how Vista may be applied to common land use planning activities. There is considerable variation in the decision processes among the tens of thousands of planning jurisdictions and purposes in the world; therefore, these descriptions are for illustrative purposes only and tend to be written from a North American perspective. Assistance in applying Vista to your specific project may be obtained through your Vista service provider.

Common processes

In the examples below, it is assumed that the following steps have already been completed:

- A database development team has been selected
- The conservation elements of interest in the planning region (e.g., species, ecosystems, scenic viewsheds, etc.) have been identified
- The database has been developed and all information imported into Vista
- Expert and stakeholder values for element weights and goals have been established

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Comprehensive land-use planning

Description: Comprehensive land use planning (also referred to as "general planning" or "long-range planning") tends to be visionary, focusing on creation of comprehensive master plans designed to guide future growth over a long period of time. Long-term planning is often broad in both scope and spatial extent, focusing on development at local to regional spatial scales. Comprehensive plans are often composed of system plans (see table below). These plans are often developed independently and emphasize infrastructure and development, while conservation is often relegated to locations undesirable for any other use rather than being strategically planned through an analytical process. Vista has most typically been used to integrate conservation with general land use planning and transportation planning. Vista is not designed as a general land use planning tool but it can help integrate and bring balance between the development and conservation systems. This integration and balance is brought about through a few optional approaches: first, by identifying areas of high conservation value (using Conservation Value Summaries) so that conservation is put on equal footing with other uses and, second, by facilitating evaluation of the degree of compatibility of other system plans with conservation goals (using Scenario Evaluations). Second, users may also input land uses as conservation elements and goal seek to meet their objectives. As long as land uses are also input as scenario components and element responses are rated for them, Vista can assist in meeting all land use objectives while helping avoid conflicts between incompatible

objectives. Suitability analyses on the other hand require other tools. Habitat suitability analyses can be conducted with a variety of other modeling tools. Land use suitability analyses likewise can be conducted with other tools such as CommunityViz. Results from these other tools can then be input to Vista to represent either element distributions or scenario inputs.

Types of Community System Plans
Land Use
Transportation
Utilities and Related Infrastructure
Environmental (air quality, water quality, solid waste)
Recreation, Open Space, Green Infrastructure
Schools
Housing
Historic and Cultural Features
Conservation / Biodiversity

Typical required inputs: Comprehensive planning is the broadest and most complex activity supported by Vista and therefore will require the full breadth of inputs. As important to the data inputs are the value inputs, which should reflect the community's values. Information needed will include the breadth of conservation elements desired (e.g., biodiversity versus only legally protected elements) and the economic trade-offs that the community is willing to make to conserve these elements.

Typical required expertise: The expertise required for developing the conservation database is described in the Vista Requirements section. For true integration of conservation system plans within comprehensive planning, a complete planning team is required. This team would consist of:

- Experts from each plan system (e.g., transportation planner, zoning planners, etc.)
- General planning coordination
- Technical experts in geographic information systems (GIS), databases, and mapping

Vista analytical path: The analyses described here represent the full conservation planning process, some of which is not incorporated into the current version of Vista. If using only Vista, follow steps 1-7; to create a conservation system plan scenario, begin at step 8.

1. Create a Conservation Value Summary (CVS) in Vista that identifies the relative conservation value (low to high) of

different areas in the planning region. Use this initial analysis to guide other system uses away from high value areas and to low value areas.

2. Import resulting system plans into Vista as scenarios to be evaluated.
3. Run a Scenario Evaluation on each scenario (i.e., system plan) as well as alternative scenarios/plans to determine how well they do or do not support conservation goal achievement.
4. Use the output of the Scenario Evaluation and Site Explorer to identify locations most in conflict with the scenarios/system plans and determine the nature of that conflict as well as the potential for the site to contribute to goals if land use or policy changes were made.
5. Modify the scenario/system land use and policy types to be compatible with elements requiring further goal achievement taking into account minimum element occurrence size requirements and opportunities to maximize goal achievement for multiple elements, retain landscape connectivity, and buffer existing conservation areas.
6. To create a conservation system plan that meets all element conservation goals in the most efficient manner, you will need some additional tools and expert help. Begin by enlisting your data development team, NatureServe network program, or Vista support staff. This will include interoperating with linked optimization tools and using results to direct alternatives and mitigations to the most efficient sites.
7. Test resulting alternative plan to ensure conservation goals are met and then evaluate with other software if other system plans are still meeting their objectives or if they need to be revised.
8. Finalize the conservation plan and develop more specific implementation, management, and monitoring plans.
9. Set up a process to ensure frequent updating and reanalysis as actual land use and policies change over time.

Development project review

Description: This activity covers the implementation of various system plans e.g., land development or infrastructure projects and often projects not included in such long range plans. Most plans allow considerable flexibility in project design, which is then assessed against plan goals and criteria and more detailed impact assessments are often required. The application in this case is to evaluate a proposed development project (though it can be any change to land use, management, or policy) against

the specific element goals to determine the project's impact on those element goals.

Typical required inputs: In addition to the conservation database including element goals, you will need a vector or raster GIS layer of the project area that indicates different land uses as separate features which are identified in an associated database (or separate layers for each land use). You may also need to refresh your element spatial data with more precise distribution data for the specific project region to downscale your analyses from the larger planning region to the local scale.

Typical required expertise: No specific expertise is required. You will need to crosswalk the different land uses in your planning region to your Vista land use intent (LUI) categories and/or policy types (PT).

Vista analytical path:

1. Create translators to convert land use and policy types in the planning region to Vista project types.
2. Copy an existing scenario and import project GIS layers. Modify existing layers (remove, override, combine with new project layers to create a new proposed scenario using translators to crosswalk LUI and PT.
3. Run Scenario Evaluations. For a shortcut, if a project occupies the majority of an existing site unit(s) in an existing Vista scenario, and has a single land use type, you can use Site Explorer to propose the alternative land use and get instant feedback on potential impacts.
4. Review the evaluation reports and layers generated by Vista.
5. As may be required use Site Explorer to conduct onsite and or offsite mitigation planning to offset impacts.

Conservation planning

Description: This activity is core to Vista functionality. Conservation planning can take many forms, but within the Vista methodology it is the act of allocating areas of land and water to compatible land uses and reliable policies for the maintenance of conservation elements. These elements can be components of biodiversity (e.g., species, ecosystems) or items of cultural value such as scenic viewsheds, historic sites, or farms. Decisions on the areas to allocate for conservation may take into account quantitative goals for preserving elements, the degree of threat posed by expected disturbances, the cost of conservation, the spatial arrangement of the conservation areas (e.g., size of areas and connectivity among them), and methods of implementation (e.g., land-use regulation, acquisition, easements, etc.). Vista does not cover all processes of conservation planning; therefore some evaluations must be conducted using other tools, custom GIS analyses, and professional opinion.

Typical required inputs: In addition to the conservation database including element goals, some of the typically-required inputs listed below are noted as optional, as their absence will not preclude development of a conservation plan.

- A baseline scenario of current land use and a "policy baseline" scenario depicting land use if all polices were carried out to be assessed for needed changes
- An acquisition budget, expressed in terms of land area to be acquired and/or monetary expenditures
- An implementation time frame
- Some reserve design rules such as whether new conservation areas should clump around existing protected areas and whether new areas should be in the most desirable locations, regardless of how dispersed they are, or if they should be aggregated together

Typical required expertise: The required expertise is the same as for Comprehensive Land Use Planning (see previous example), but the other system experts are not absolutely required.

Vista analytical path: The analytical path is the same as for Comprehensive Land-Use Planning, except that compromise with other system plans is not strictly required. In reality, compromise will always be necessary to carry out plans over large areas for many elements, thus a comprehensive approach is preferred over developing a conservation plan in isolation.

Infrastructure planning

Description: This application refers to the selection of sites for infrastructure systems or facilities such as roads, transmission corridors, flood control projects, etc. These systems and facilities often have significant direct impacts on biodiversity and also frequently spur additional development that can extend these impacts over large areas. However, infrastructure projects may generate mitigation funds that can be used to implement conservation priorities outside of their impact envelope. Vista may be used both to direct the location of facilities to less sensitive sites and, when used in conjunction with urban growth models, to mitigate the threats posed by secondary growth if planning can be done collaboratively with land use planning jurisdictions.

Typical required inputs: In addition to the co nservation database, proposed system plan(s) and/or facility location(s) for evaluation of impacts.

Typical required expertise: The required expertise is the same as for Comprehensive Land Use Planning but is limited to the infrastructure system of interest rather than all system plans (except if secondary urban growth modeling for example is desired). Scientific expertise must be

capable of determining offsite effects of the infrastructure and element sensitivities to these effects.

Vista analytical path: If an infrastructure plan has not yet been developed, the starting point could be development of a Conservation Value Summary in Vista to guide initial system plans, as in Comprehensive Land Use Planning. However, in this case we assume a proposed plan already exists.

1. Import the infrastructure plan as a scenario, and run Scenario Evaluation to determine conflicts and compatibility of land use intent and/or protection policy types with conservation goals.
2. If using just Vista, use the results of the evaluation to identify affected elements and locations where they occur that should be avoided.
3. As may be required use Site Explorer to conduct onsite and or offsite mitigation planning to offset impacts.

Inventory and monitoring

Description: Creating a reliable conservation plan requires an inventory of the resources to be conserved. Implementing the plan requires monitoring of the condition of those resources to determine if the plan needs adjusting. Vista can assist in these activities, although it currently does not provide any specific functions for inventory and monitoring. NatureServe's Biotics software was designed specifically for managing biological element inventory data and its information can be imported directly into Vista.

Typical required inputs:

For the initial inventory, the processes for selecting elements, obtaining existing spatial distribution information, and creating predicted distributions are covered under the Element Selection and Distribution sections.

For inventory and monitoring purposes, your inputs include:

- The list of elements to be monitored
- The spatial distribution maps with attributes of viability/ecological integrity of occurrences and confidence in their location
- Inventory priorities that may reference locations of low confidence coupled with areas that are known/expected to be threatened in the near future and funding and expertise available for inventory
- For monitoring, the monitoring interval (how often you will monitor each element)
- The monitoring budget and consequent design of the monitoring program

- Optionally, a regularly updated map of threats that can suggest the need for increased frequency and intensity of monitoring where conditions may be changing more rapidly
- Observations of the occurrences over time, gathered through field surveys, aerial photographs, or for large features -- satellite imagery

Typical required expertise: Both inventory and monitoring require similar types of expertise:

- Knowledge of element types to determine which elements occur in the areas of interest and the quality of their occurrences; for biodiversity elements, ecological, botanical, and zoological expertise will be needed
- Expertise in the use of geospatial analysis software and techniques, such as GIS modeling of predicted occurrences
- Sampling design for the elements of interest to determine where monitoring should occur
- Techniques such as aerial photo interpretation and field biology for collecting and interpreting observations

Vista analytical path:

Inventory: The first step is to determine what elements are to be considered in the planning process. The most inclusive approach is to identify all elements known or believed to occur in the planning area and then select the elements to be included in the analysis. The process described here also emphasizes spatially inclusive inventory in order to maximize confidence that element occurrences have been found, especially in threatened areas. As new element observations are made or improved predicted distribution maps are created, they can be imported as updates to the database. In this way, the inventory process is continuous and dynamic. Considerable detail about these processes is provided in the Element Database sections. Also please plan on sharing new or re-confirmed element observations with your state/provincial natural heritage program, conservation data center, natural history museum or other biological data repository. Following their data collection methods and database structure will facilitate incorporation of the data in their systems.

1. Create a Conservation Value Summary (CVS) that can be used to identify areas of low confidence but potential high viability/integrity (that is, areas of high conservation importance but low certainty that the element is actually there).
2. Generate a baseline scenario (or a future growth scenario) and evaluate the scenario against conservation goals for the elements of interest. Identify occurrences of elements as

conservation targets if conservation need is high (conservation falls far short of goals for an element) and land uses are incompatible with occurrences.

3. Prioritize occurrences that are highly threatened by incompatible land use, have high viability/integrity, and/or are low confidence for further inventory work.
4. Determine the appropriate method of inventory (field observation, aerial photo interpretation, etc.).
5. Use the Description field in Vista element properties to identify the element as a target for inventory and monitoring activities and to describe the plan for inventory and monitoring. These notes will be presented in the element report.
6. With new inventory/monitoring data manually or in other tools develop new distribution maps and or update values for viability/integrity and confidence of presence. Refresh the Vista element properties with the new information. Completion of these tasks results in updated Element Conservation Value (ECV) rasters, which have a relative value assigned to each grid cell based on viability/integrity and confidence.

An alternative, simpler process would be to generate an unweighted confidence index type of CVS and target areas of low average confidence for inventory. By concentrating effort at locations where these areas overlap with areas of high element richness, efficiency can be increased by inventorying for several elements at each location.

Monitoring: Once a plan is created that identifies which occurrences of which elements should be conserved, Vista can be used to identify locations where monitoring should be carried out. Monitoring assesses whether occurrences are persisting and if their viability/integrity is changing. A body of literature exists on monitoring procedures, and therefore they are not described here; however, the process is very similar to that of Inventory described above. The focus is on occurrences to be conserved and efficiency.

1. Generate a conservation plan of areas to be conserved.
2. Generate a Conservation Value Summary (CVS) representing element richness (unweighted elements without confidence or viability/integrity attributes) for the elements included in the conservation plan.
3. Overlay the map of areas to be conserved with the CVS to identify areas of richness for monitoring; the areas of overlap will be the cost-efficient locations for monitoring several elements at a time.
4. Work with monitoring specialists to devise a statistical sample of remaining element locations to be monitored.

5. As monitoring work is conducted, update Conservation Value Layers with new information on confidence and viability/integrity, and create an updated CVS as needed.

Limitations

The previous examples present only a sample of the numerous project types to which the NatureServe methodology and Vista are applicable. We also necessarily had to generalize the description of project types and the approach to undertaking them. A project will be affected by many characteristics of the planning region, such as size, biophysical environment, socioeconomics, politics, regulations, etc. Your local data development team should be able to guide you more specifically on the appropriate project path and NatureServe support staff can also assist in developing customized workflows and toolkits for your specific applications.

How to Install NatureServe Vista

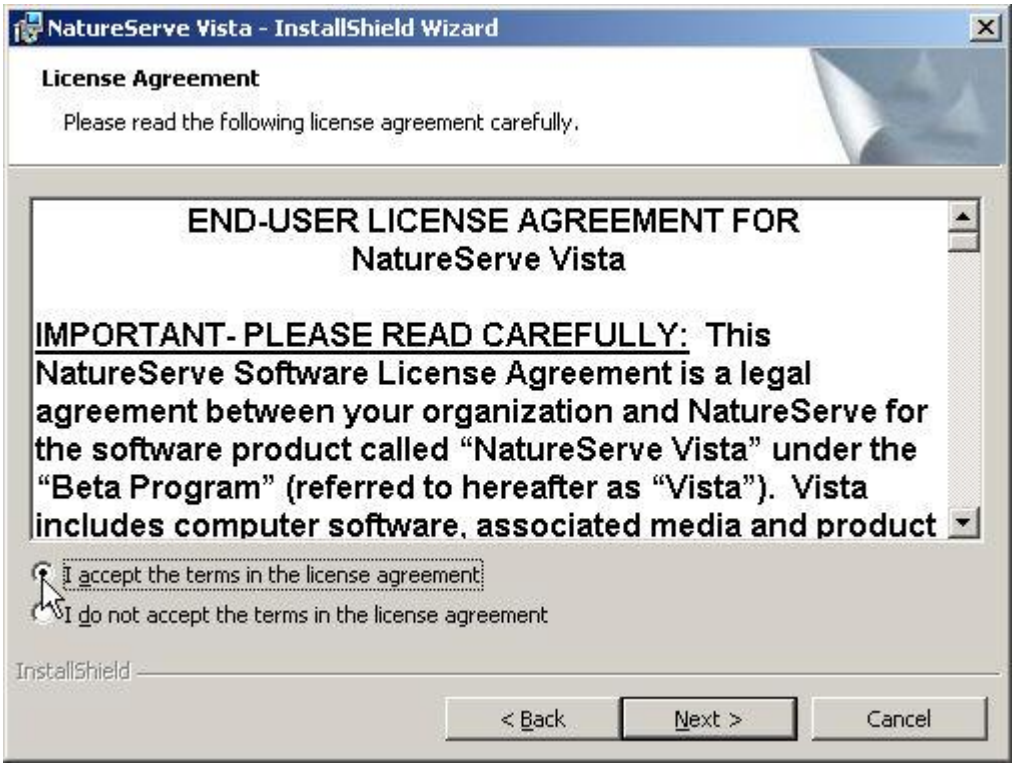
Prior to installation:

1. Make sure there is not a previous version of Natureserve Vista on the computer; if another version of the software is present, the installation will fail. If a previous version exists, uninstall using **Start**, **Settings**, **Control Panel**, **Add/Remove Programs**.
2. Make sure that Environmental Systems Research Institute (ESRI) ArcMap 9.0 with the Spatial Analyst extension is already installed on the computer. Note that Vista will not work with earlier releases of ArcView.

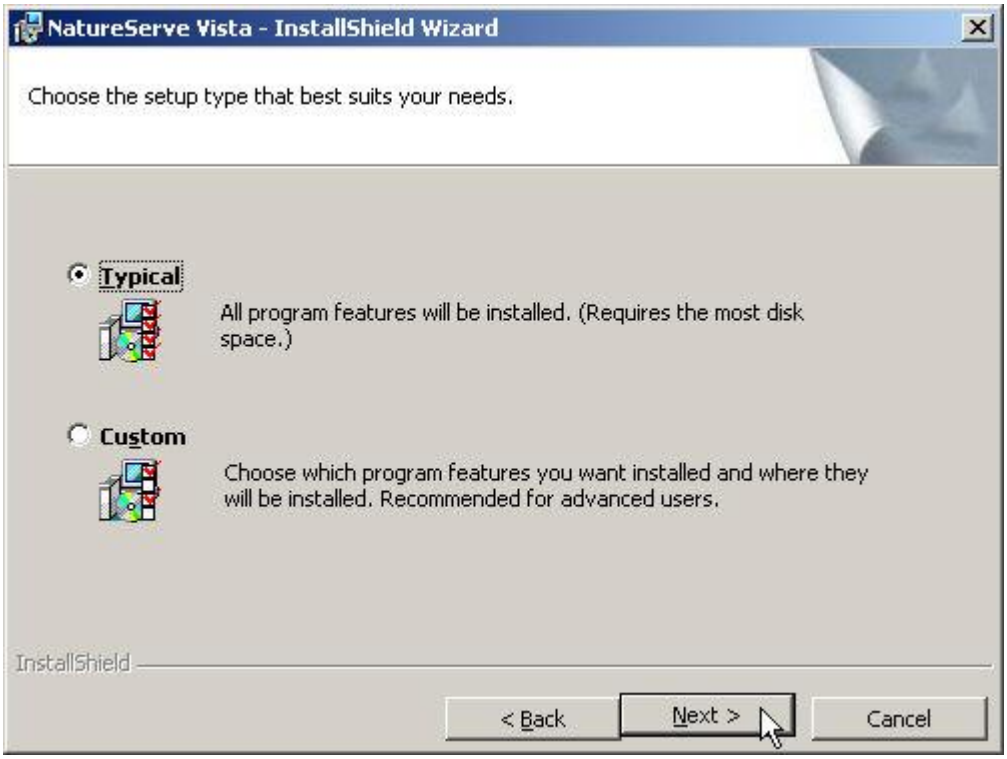
To install the software:

1. Double click on the Vista **setup.exe** and follow the directions in the install wizard.

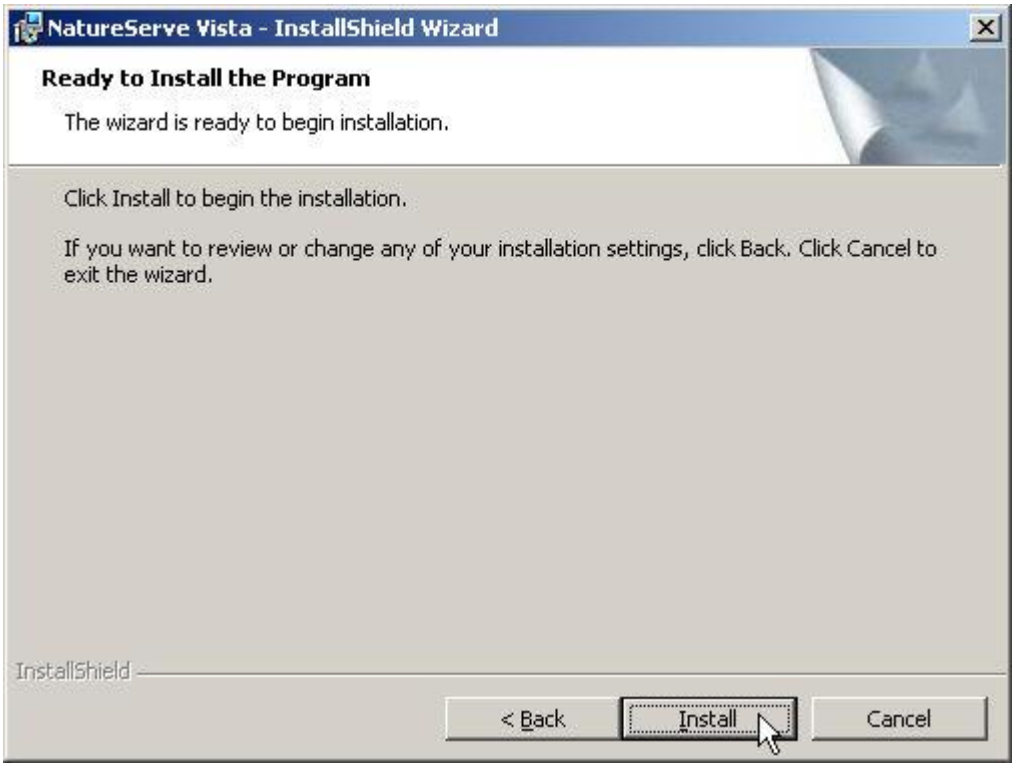
2. Click **Next** at the Welcome screen.



3. Read and accept the terms of the license agreement. Click **Next** to continue.



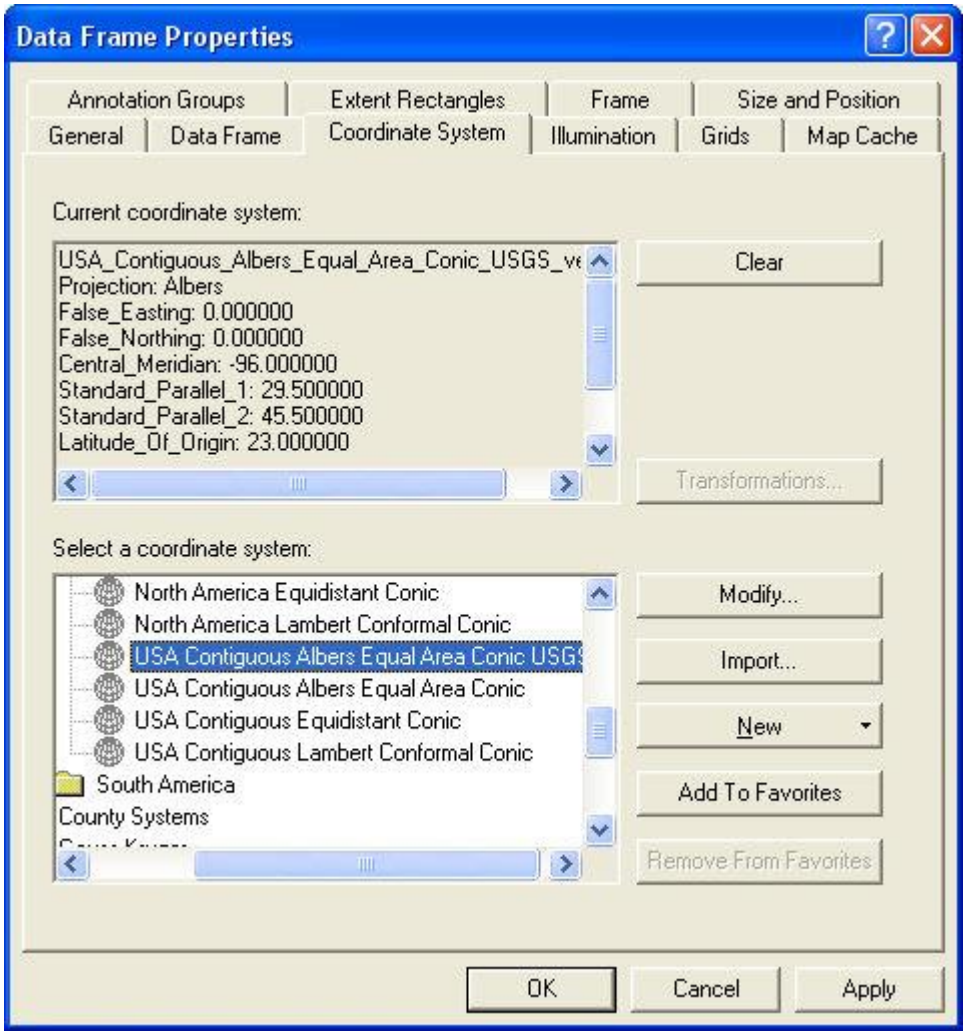
4. Select the Typical setup option. Click **Next** to continue.



5. Click the **Install** button to begin the installation.

How to Begin a New NatureServe Vista Project

1. Open ArcMap, a component of the ArcGIS application developed by the Environmental Systems Research Institute (ESRI).
2. Create a new project document by clicking the New Map File button on the ArcMap button bar. Note that a new project document can also be created by clicking File - New on the ArcMap toolbar, but a New window will result. If the latter method is used, you will need to name and save the new document before proceeding to the next step.
3. Define a projection for the data frame.
   - Select the data frame in the Table of Contents (TOC), which will have a default name of **Layers**.
   - Right-click, and select **Properties...** from the resulting menu.
   - Select the **Coordinate System** tab on the Data Frame Properties window that is displayed.



   - Navigate through the hierarchy to select the appropriate coordinate system for the project.

- Click **OK** to close the Data Frame Properties window.

4. Open the NatureServe Vista menu.
5. Select **Project▸ New...**
6. Complete data entry on the resulting Project Properties window and save the project to the hard drive.

How to Duplicate a NatureServe Vista Project

In most cases, invoking the 'Save As' menu item in an application will cause a new file to be created using the name specified, and the original file is left unchanged. However, when a map document associated with a NatureServe Vista project is open and ’r;Save As’ is invoked from the ArcMap (a component of the ArcGIS application developed by the Environmental Systems Research Institute) menu, the database and GIS data sources of that existing Vista project will not be duplicated to create a new map document with the specified name. Instead, the new map document only references the original Vista project. Thus, data edits in one of these Vista map documents will be reflected on the other map document as well.

In order to create a separate NatureServe Vista project by duplicating an existing one, the 'File copy' function can be used in either of two ways, depending on whether the map document is collocated with the Vista project, as follows:

If the map document is collocated with the NatureServe Vista project (Vista database, VistaGIS and Templates directory), copy the map document, Vista database, VistaGIS, and Templates directory to a new location.

If the map document is not collocated with the NatureServe Vista project, copy the map document, Vista database, VistaGIS, and Templates directory to a new location. Then select **Project▸Attach...** from the NatureServe Vista menu, and attach the copied database to the copied map document.

Note that if the map document to be copied is associated with a Vista database, it must be detached first by selecting **Project▸Detach...** from the NatureServe Vista menu.

VISTA HANDS-ON EXERCISE

Hands on with the Orange County, Florida training dataset

Introduction

This section of the "Getting Started Guide" is designed to 1) familiarize you with the basic functionality of NatureServe Vista, and 2) walk you through the process of entering data and running analyses so you can produce some basic results.

While these results will be relatively easy to generate, they are likely to require refinement prior to their use in informing any actual decisions. The guide, therefore, also includes details on refinements that can be made throughout the process to improve the accuracy of results derived from analyses. In addition, expedient methods for creating customized tools for use in analyses are provided as well.

To get started, we will first walk through the process of creating a new project, and then developing the element database to be used in NatureServe Vista analyses. Following this preparatory section, the guide will walk through each of the three Vista analyses in an expedited fashion in order to provide you with an overall understanding of the inputs and steps involved, and to generate some basic results. Once an analysis has been completed, there will be some recommendations describing ways to refine and customize inputs and analytical tools to improve the accuracy and reliability of the results. Finally, some useful variations on each analysis will be described.

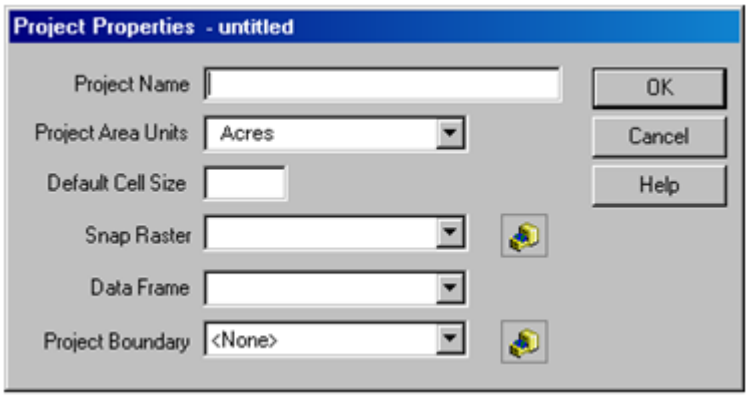
A **sample dataset** is available which can be installed and used for experimenting with NatureServe Vista (see the included readme file for instructions). It is suggested that you view the existing data input windows and analyses for the sample project as you go through this Getting Started Guide the first time. Then, once you are somewhat familiar with NatureServe Vista inputs and functionality, you can use this guide to create your own project using your own data.

Create the project

The first step in beginning a NatureServe Vista project is to create the project and set the project parameters. These data are used to help insure that the project database and associated files are set up properly. Note that all fields in this window must be completed before a Vista project can be created.

Set project properties:

1. Open the **Project Properties-Untitled** window by selecting **Project New...** from the NatureServe Vista menu.



2. Specify a name for the project in the **Project Name** field.
3. Select the units to be used for all areas that are calculated in the database (e.g., cell size units, compatible and protected areas) from the **Project**

Area Units drop-down list. **Note that once a unit has been selected for a project and saved, it cannot be changed.**

4. Enter a value in the **Default Cell Size** field to be displayed as the default cell size in all NatureServe Vista windows used to produce layers. If needed, however, the default value can then be changed in any of those windows to a size more appropriate for a particular analysis. (See Determining Grid Cell Size for more details.)
5. Select a layer from the **Snap Raster** drop-down list, or use the  ArcCatalog button to browse to the layer to be used as the project snap raster. Snap raster is used to maintain relative spatial relationships between layers throughout analyses by having each "snap" to an intersection of grid cells in the designated snap raster. Note that the designated snap raster layer can later be changed, albeit with ramifications which can be addressed by refreshing the existing analysis. (See Snap Rasters for more information)
6. Select the appropriate data frame to be used to load all the layers in NatureServe Vista from the **Data Frame** drop-down list. The default value for an ArcMap data frame in a new project is **Layers**.
7. Select a value from the **Project Boundary** drop-down list, or use the  ArcCatalog button browse to a layer to be used to define the boundary of the project area. Note that the layer designated as the boundary can be changed after the project has been created, but the new layer cannot be smaller or offset from the layer originally chosen. So, it is recommended that this selection be conservative initially since a larger encompassing layer can be utilized later if needed.
8. Click **OK** to save your new NatureServe Vista project.

Develop the element database

Once the project has been created, an element database must be developed for use in NatureServe Vista analyses. This database includes the spatial distributions of elements, as well as attributes associated with occurrences of elements. In order to expedite the process of getting data into NatureServe Vista so that analyses can be run, only essential element data will be developed along with the necessary attributes. Once you become more familiar with the analyses and can determine which will be most effective for addressing planning issues for your project area, the element database can be developed to include only those data that are specifically needed.

Select elements for analyses

The initial step in creating an element database is to select the elements that are to be considered in planning analyses. Typically a suite of different elements are selected, including individual species and ecological communities and systems that represent biodiversity in the planning region, those that are legally-protected, and other culturally-valued elements (e.g., viewsheds, historic sites).

However, for purposes of demonstration, we recommend using a very limited number of elements.

Selecting sample elements:

9. To get you comfortable with entering data as elements, we recommend entering five elements as practice. In the sampledata/ElementBase directory choose:
   a. Red Cockaded Woodpecker, picobore_project.shp
   b. Florida Sandhill Crane, grusprat_project.shp
   c. Celestial Lily, nemaflor_project.shp
   d. Wetlands, Wetlands_clip.shp
   e. Flatwoods, flatwoods_clip.shp

These elements reflect the course filter/fine filter approach to conservation planning: the distributions of certain imperiled species as well as ecosystem types that often harbor other rare or prioritized species. Note that all of these elements have been projected and clipped to the project boundary. While ArcGIS can often display layers of different projections together, for analysis NatureServe Vista requires all data to be in the same projection.

Develop element distributions

We have identified a set of elements and their corresponding distribution data. A NatureServe member heritage program, the Florida Natural Areas Inventory (FNAI) has provided these biological and ecological systems layers. We encourage you to visit FNAI's website http://www.fnai.org/index.cfm for more information on these elements.

10. Open the Element List window by selecting either **Lists▸ Element List** or **Manage Elements** from the NatureServe Vista menu, and then click the **New** button.

The Element Properties window will be displayed.

The General Tab

In the General tab, enter in the name, scientific name (if applicable), a link to the online source and a brief description. Under **Measured by** click on the radio button for **area** for all five elements. **Minimum size for viability** is an important component for many biological features. This information typically comes from scientific literature or can be assigned by consulting with biologists or ecologists. It may reflect the average minimum about of habitat that a species requires to forage or reproduce successfully. For example, the red-cockaded woodpecker needs between 400 and 240 acres as a minimum carrying capacity. Recent studies of the Whooping Cranes suggest that they need between 1623 to 3375 acres for their home ranges. We'll select the small of these values and input them in the **Minimum size for viability**. For the other elements we will disregard this value.

The other inputs we will disregard in this project but for more rigorous analyses these aspects of elements often need to be considered.

The Spatial Tab

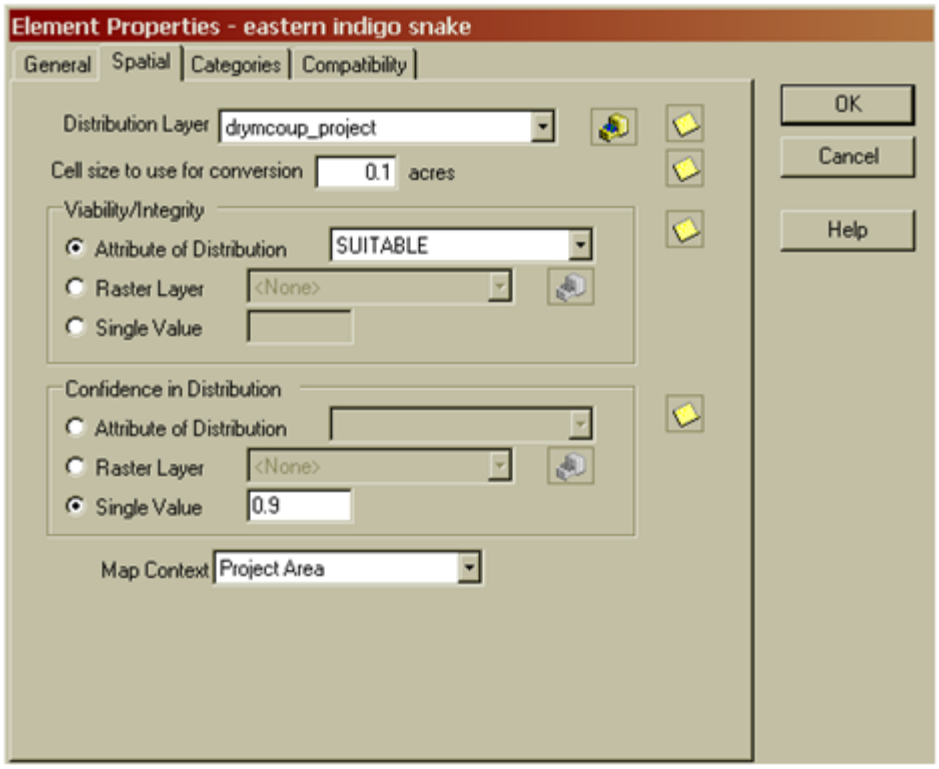
In the Spatial tab, use either the pull down window or the catalog icon to navigate to where the shapefile is stored.

Enter the cell size to be used for area conversions. To get started, choose a cell size that allows for fast processing (e.g., 1/500 of the project boundary) &endash; probably the same value determined for the landscape integrity layer created. Note, however, in an actual analysis to be used for conservation planning, this is a critical value. (See Determining Grid Cell Size for more details.)

Assign viability/integrity values

Viability and ecological integrity values (ranging from 0.0 to 1.0) are assigned and associated with individual occurrences to indicate the likelihood that the occurrence will persist. Higher viability/integrity values represent a greater likelihood of persistence. There are a number of methods that can be used to assign occurrence viability (for species) and ecological integrity (for communities and ecological systems), depending on the available data. The most expedient way to assign viability/integrity values is to convert EO ranks assigned to NatureServe Element Occurrences (EOs). [NatureServe member heritage programs track information on Element Occurrences (EOs) and assign EO ranks to indicate the estimated viability/ecological integrity of the occurrences, both according to a standard methodology.] In cases when EO rank conversions are not an option, landscape integrity or condition layers can be developed and used to assign surrogate viability/integrity values. A single value can also be used to reflect condition. For certain projects when viability/integrity is not important or unknown, a single constant value can be used for all elements.

For simplicity sake, the elements in the sample data have been assigned a viability/integrity value in the element’s attribute table called SUITABLE.



For more information about assigning viability/integrity information see the section Process for Deriving Viability/Integrity Values under the section DATA FOR CONSERVATION VALUE ANALYSES.

Assign confidence values

Confidence values (ranging from 0.0 to 1.0) are assigned and associated with individual element occurrences to indicate the net spatial and/or temporal confidence associated with each occurrence. Higher confidence values represent greater certainty that the element is actually present in and throughout the occurrence.

There are a number of methods that can be used to assign confidence values to occurrences, depending on the available data. The most expedient way to assign confidence is to select a single value to represent all occurrences of a particular element, which is the option we will use for this exercise. Because this value is set in the Element Properties window, we will not add columns to the distribution layers to store confidence values, which would be the method utilized when a single value is not appropriate for all occurrences of an element. For certain projects when confidence is not important or unknown, a single constant value can be used for all elements.

For more detailed information on assigning values to represent confidence, see the section on Confidence for attribute data.

Confidence values for the sample elements:

a. Red Cockaded Woodpecker: 0.9

b. Florida Sandhill Crane: 0.9

c. Celestial Lily: 0.9

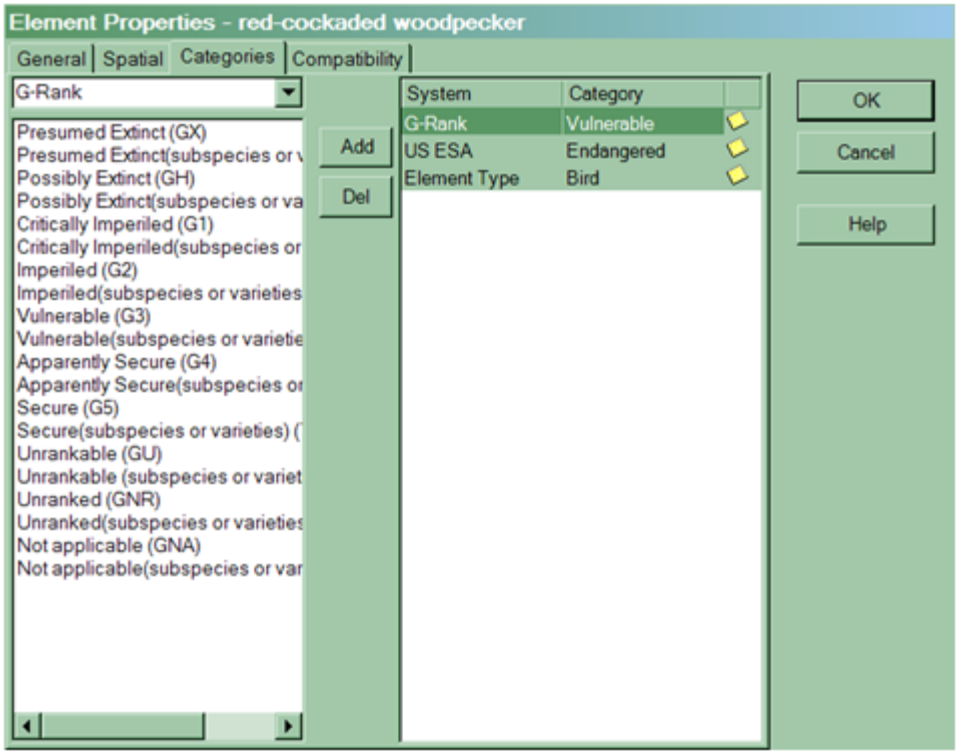
d. Wetlands: 0.7

e. Flatwoods: 0.7

Categories tab inputs

Category systems provide a means to group elements based on similar characteristics, including those that are of local concern. NatureServe Vista comes with several existing category systems; however as understanding of the potential uses of the database increases, category systems can be developed to group elements for custom uses (e.g., tourism value). (For more complete details, see Category Systems).

Select one of the default category systems from the drop-down menu, then indicate the category to which the element belongs for that system (displayed in the list below the selected system name), and click the Add button. Repeat with other category systems as appropriate. Elements that are not included in a particular category system will not be included in an analysis that is filtered on the basis of this system. Current information about imperilment rankings for species can be found be entering that species name or scientific name into the NatureServe Explorer: http://www.natureserve.org/explorer/



The Compatibility Tab

Compatibility is assigned by evaluating whether a particular land use will permit the element to remain viable (species) or to maintain ecological integrity

(ecological elements). Land use categories deemed compatible would permit an acceptable level of viability/integrity for the element, while land uses with lower compatibility would have a negative effect on the element's continued existence at that location. Thus, compatibility is a key part of Scenario Evaluations through its use in identifying areas where land uses are likely to permit the achievement of element conservation goals, as well as areas of incompatible land uses that could be changed to improve goal attainment. Until we create a Scenario and establish our land uses, we will disregard this section and return to it later.

Click on **OK** and click ’r;**Yes**’ when prompted to generate the element conservation value.

To view element results:

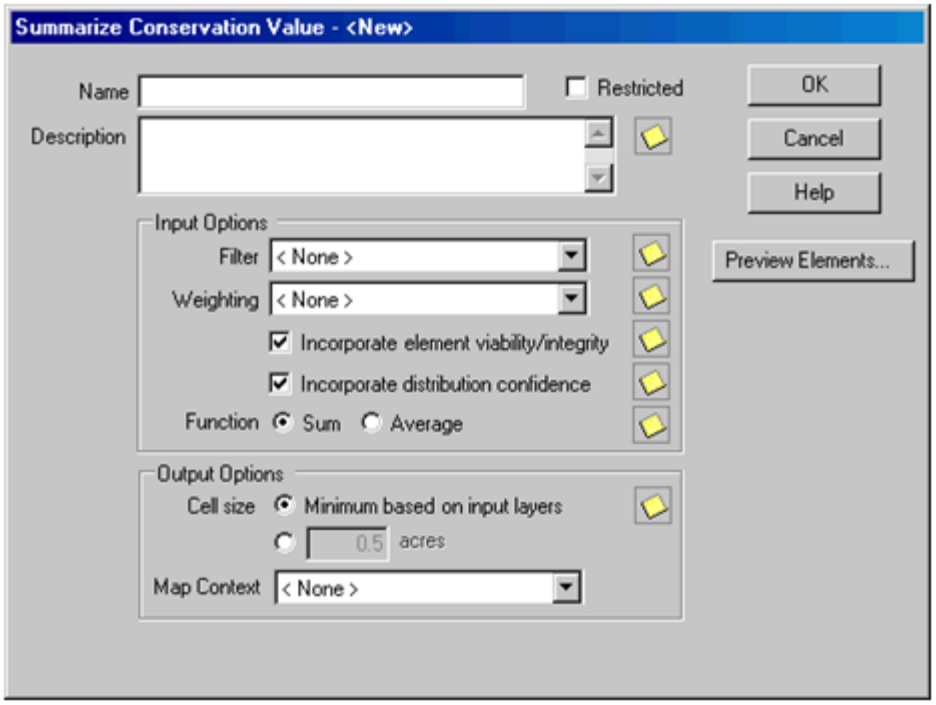
- The report for the Element Conservation Value can be viewed by right-clicking on the element in the NatureServe Vista display tab (far left hand corner), and selecting **Element Report** from the menu.
- The layer for Element Conservation Value can be viewed by checking the box next to the element in the Vista Table of Contents. If the layer is not in the project, Vista will ask if you want to add it. Select **Yes**. To view the legend for the layer as well, find the element on the ArcMap Display tab in the Table of Contents. The elements may be found under the Elements grouping on the Display tab. You may also display the layer from the Display tab by checking the box next to the layer here.

Conservation Value Summaries

A Conservation Value Summary (CVS) identifies areas across the planning region that are most important for conservation through the aggregation of individual element layers with associated viability/integrity and confidence values, weighted according to their relative conservation importance. Creating multiple CVS using different weights and categories provides the user with different 'lenses' in which to examine your data. For example, a weighting system could be created to reflect degree of species imperilment or a filter applied that selects just reptiles and amphibians. Use different CVS to visualize the conservation value of your study area in unique ways.

Expedited walk-through of the analysis:

1. Open the Summarize Conservation Value - <New> window by selecting Summarize Conservation Value... from the NatureServe Vista menu.



2. Enter a name for the Conservation Value Summary.
3. Select a filter to be applied to the data set that defines the set of elements and/or the area to be included in the analysis. (See the Filters topic for more details)
4. Select a weighting system to be applied to the data set that indicates the relative importance of different elements. (See the Weighting Systems topic for more details)
5. Click the **Preview Elements...** button to see a report showing the set of elements to be included in the summary and the weights that have been set for these elements.
6. Place a check in the element viability/integrity checkbox to incorporate these values in the summary.
7. Place a check in the distribution confidence checkbox to incorporate these values in the summary.
8. Select the Sum radio button to indicate that values for the grid cells in the summary are to be derived using a sum.
9. Indicate that the size of grid cells in the summary is to be the minimum possible based on the input layers using the radio button. (See the Determining Grid Cell Size topic for more details)
10. Generate the Conservation Value Summary by clicking **OK**.

To view analysis results:

The **report** for the Conservation Value Summary can be viewed right-clicking on the Conservation Value Summary in the NatureServe Vista Table of Contents, and selecting **Conservation Value Summary Report** from the menu.

The **layer** for the Conservation Value Summary can be viewed by checking the box next to the Conservation Value Summary in the Vista Table of Contents (under the Conservation Value Summaries heading) or, to see the legend as well, view the Conservation Value Summary in the ArcMap Display tab in the Table of Contents where it can be found under the Analyses grouping.

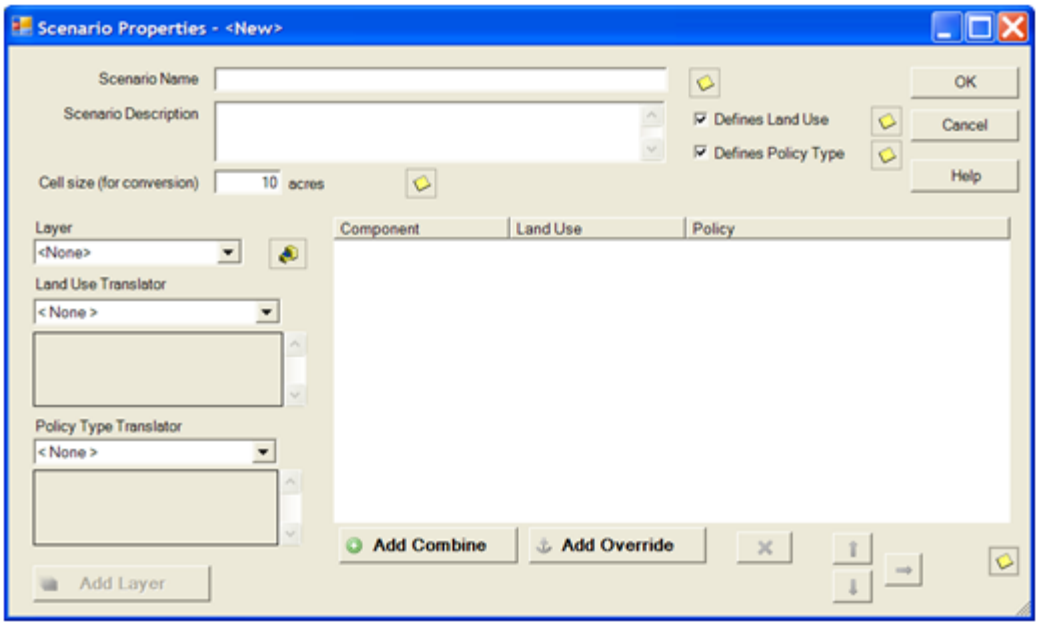
Scenarios and Scenario Evaluations

Scenarios representing both current and potential land uses and protection policies in the planning region are imported into NatureServe Vista using translators that cross-walk the land status categories to common types used in Vista. Scenarios are then evaluated according to element distributions and compatibility with different land uses in order to identify areas in the planning region that support element conservation goals, as well as areas where development or other land uses would have minimal impact on element conservation.

The process of creating translators and defining scenarios is integral before an evaluation can take place. For demonstration purposes, we will create simple translations while importing on land use layer to create a scenario. Input layers for scenarios may come from many sources, including zoning maps, holdings of land trusts, state and federal land managers, and local laws governing land use (e.g., stream setbacks, steep slopes).

Creating a Scenario

1. Go to the vista dropdown menu and select **Define Scenario...**



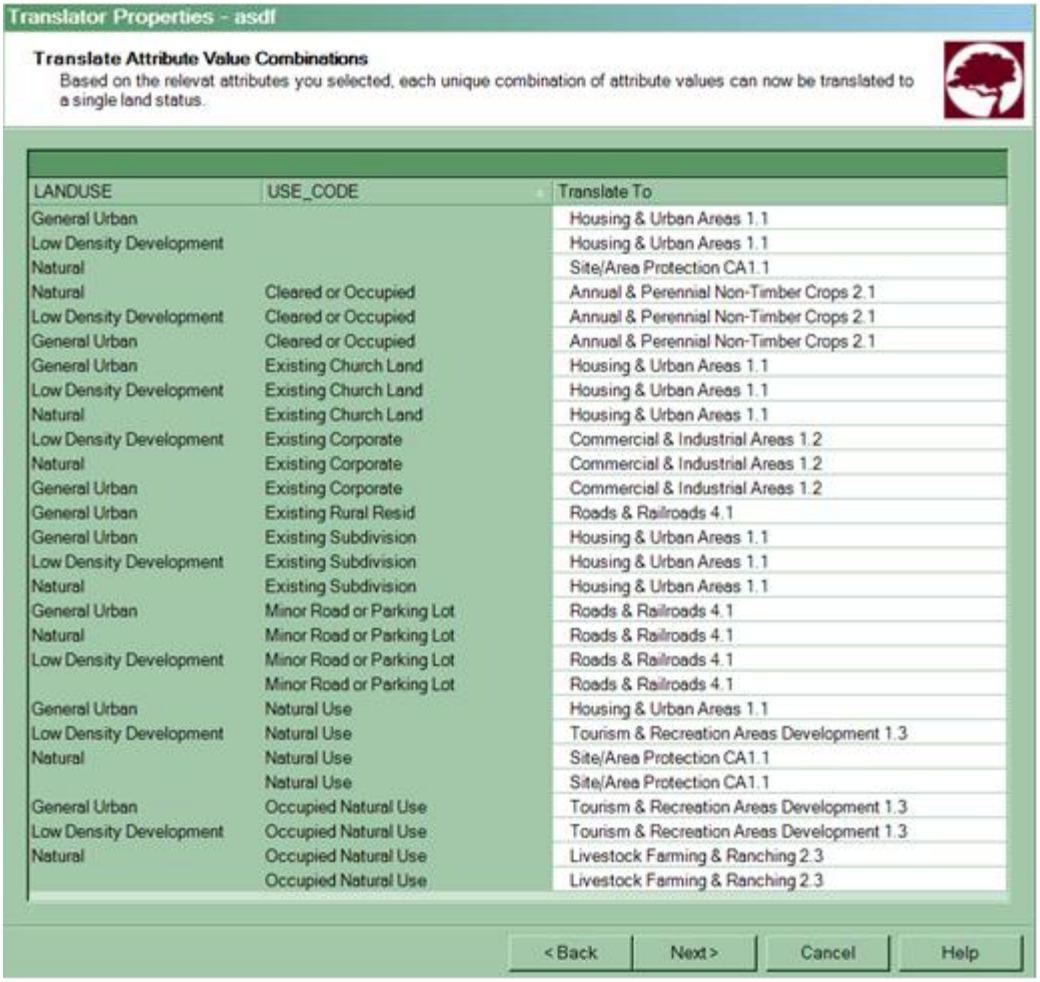
2. Type orange county baseline in the Name field
3. Type 1.0 into the Cell size (for conversion) field
4. Unclick Defines Policy Type
5. Click the  button.

6. In the Layer dropdown browse to SampleData\Scenario_files and add **alignment_one_impact.shp**
7. In the Land Use Translator dropdown, choose <**Add New...**>
8. Name this translator **alignment one impact**
9. Click <**Next**>
10. Select 'r;**Translate all features to a single land use status**' and click <**Next**>
11. Click **Finish**
12. Click the 

button

In the Layer dropdown browse to SampleData\Scenario_files and add **ns_statusquo.shp**

13. In the Land Use Translator dropdown, choose <**Add New...**>
14. Name this translator **statusquo**
15. Click <**Next**>
16. Select Translate features based on attribute values and click <**Next**>
17. Select **LANDUSE and USE_CODE** from the drop-down menu and click <**Next**>
18. Use the following table as a guideline for cross-walking the land uses, when you area finished click <Next>



19. Click **Finish**
20. Click the  button

21. 22. Select a component layer in the window and use the arrows in the right hand corner to make adjustments to the hierarchical order of the layers. For example, **alignment one impact** should be above **statusquo**. This is because in Override mode Vista ”r;sees” the top layers first and establishes that land use over the component layers below it.
22. 23. Click **OK**
23. 24. Be patient... depending on your system, sometimes creating a Scenario can take awhile.

Preparing the Elements for a Scenario Evaluation

This process prepares the elements for evaluation with the land use scenario you just created. Return to the element **compatibility tab** (got to Vista dropdown menu > Manage Elements > Properties> click Compatibility). Typically, when creating a project, you would want to populate this tab hen you initially entered the element, however, we have split out this step here to help emphasize which inputs are used for which analyses.

1. Use the following chart to assign compatibilities for each of the five elements. These compatibility assignations are for demonstration only. Perhaps more than any other process step in NatureServe Vista, compatibility should be vetted with an expert (in this case a biologist or ecologist) familiar with the elements and the local land uses.

	Red-Cockaded Woodpecker	Florida Sandhill Crane	Celestial Lily	Wetlands	Flatwoods
Housing & Urban Areas 1.1	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible
Site/Area Protection CA1.1	Compatible	Compatible	Compatible	Compatible	Compatible
Annual & Perennial Non-Timber Crops 2.1	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible
Commercial & Industrial Areas 1.2	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible
Roads & Railroads 4.1	Incompatible	Incompatible	Incompatible	Incompatible	Incompatible
Tourism & Recreation Areas Development 1.3	Incompatible	Compatible	Compatible	Compatible	Compatible
Livestock Farming & Ranching 2.3	Incompatible	Compatible	Incompatible	Compatible	Compatible

2. Click **OK** when finished with each element.

Scenario Evaluation

Scenario Evaluation is the process of taking your elements and comparing them to the scenario you just created, then viewing the results against a set of pre-determined goals. We will establish a very simple retention goal: 100% of elements are to be retained. While unlikely in many scenarios, setting your goal at 100% can help you identify areas where elements are already in conflict with the existing land use. It can also help you critically evaluate your spatial data up to this point: are there errors in my element distributions or in my land use scenario? Have I correctly assigned the compatibility? There are many questions you can ask of a scenario evaluation that can improve the robustness of your analysis.

Defining your Goal Set

1. Open the Vista dropdown menu

2. Go to Lists &endash; Goal Set List...
3. Click on **New**
4. Give your Goal Set a name
5. Set your Default Goal to 100 percent (notice that all your elements are set to the default goal)
6. Click on **OK**.

Defining the Scenario Evaluation

1. Open Vista dropdown menu
2. Select Evaluate Scenario...
3. Click **New**
4. Enter **Baseline Scenario** as the name
5. Select the **Orange County Baseline** from the Scenario drop-down list.
6. Select the goal list you just defined from the Goal Set dropdown.
7. Check Positive and Neutral under Compatible Element Responses
8. By clicking **Positive** and **Neutral** we are telling Vista that both positive and neutral element responses will count towards our goals.
9. Generate the Scenario Evaluation by clicking **OK**.
10. Processing a Scenario Evaluation will take between 10 and 15 minutes depending on your computer. As with many computer programs saving your project after each step can save you a lot of frustration if something should go wrong.

Interpreting Results

1. **Compatibility Conflict Map:** Areas displayed in darker shades are those areas where a high number of elements included in your evaluation coincide with areas of incompatible land use. Lighter areas are locations where fewer elements are incompatible with the land use. This layer is showing us what impact land use is having on our conservation goals. Right click on the evaluation name and select **Scenario Evaluation Repor**t to create a report associated with this evaluation gives us the quantitative details about how many of our element conservation goals have been met based on this scenario evaluation.
2. **Elements:** Expand the list of elements and right click on the element name. Select **Scenario-Element Evaluation Report** to create a report that shows how the element fared under the evaluation in greater detail.

Going further: Using different scenarios and evaluating them (as described above) adds a lot to your vista project. The sample data includes **Alignment_one_mixed_use** and **Alignment_one_residential_use** to reflect two different future land use scenarios reflecting different urban densities. Mixed use assumes a denser, more urban type land use pattern while residential shows a low-density suburban pattern. Try building new scenarios substituting these layers in for the **statusquo** layer following the same steps outlined in that

section. When you evaluate these layers the results will be quite different. Compare the **Scenario-Element Evaluation Report** and **Compatibility Conflict Map** to see these results in tabular and spatial format.