Appalachian LLC Data Needs Assessment Report

Task Five – Interpretive text and graphics for AppLCC web portal (conservation planning tools)

We have provided some interpretation material and text for conservation planning tools. These programs have been grouped into broad, sometime overlapping purposes. These brief descriptions of the various conservation planning tools can be put up on the AppLCC web portal, for users to get an idea about the tools available and what purposes they could serve. We have alo provided other links, where users can get detailed information about the tool.

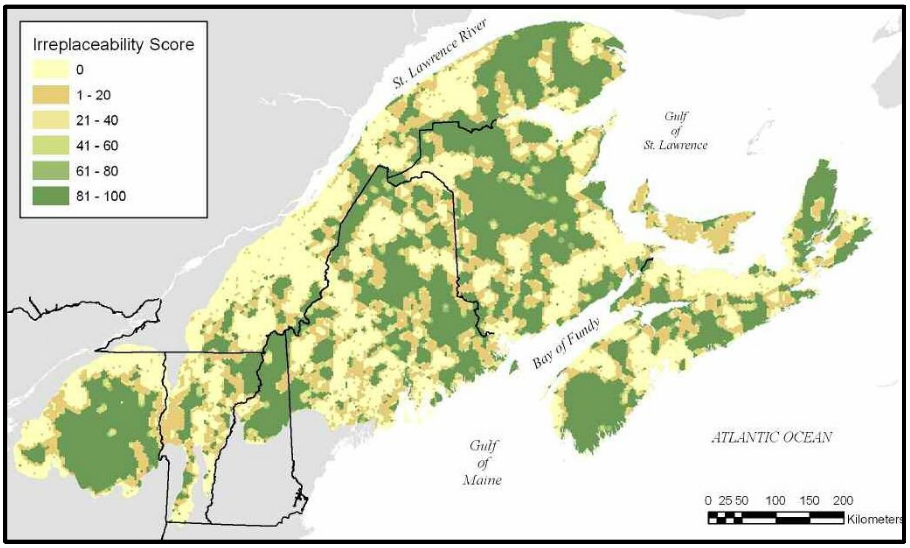
RESERVE SELECTION

Most existing reserves were put into place in something other than a systematic biological selection process (Margules and Pressey 2000). The emerging field of systematic conservation planning seeks to identify areas that are irreplaceable, categorize them as to levels of threat and vulnerability, and thus prioritize conservation action. The software involves setting numerous assumptions, usually arrived at through consultation with regional experts and other stakeholders. For example, conservation goals (how much?) are frequently set through an iterative process for conservation targets (what?). Reserve selection then implies that the goals and targets have already been decided. This process usually involves stakeholder and multi-agency input to determine goals, targets and trade-offs.

Examples of some reserve selection tools

Marxan is freely available conservation planning software that helps address several reserve selection issues such as to what is the determining the performance of existing reserve systems; how and where to design new reserve systems; and developing multiple-use zoning plans for natural resource management. They support the selection of areas large enough to perpetuate target species and maintain biodiversity while minimizing losses.

Marxan combined with a GIS environment (raster), or Zonation, with its prioritization of theme layers (large scale raster layers), attempt to minimize cost while maximizing biodiversity. Cost in these models are not necessarily defined in terms of money, but may refer to tradeoffs in ecosystem services.



An example of a possible scenario for reserve selection in the Northern Appalachian ecoregion of the United States and Canada. Irreplaceability scores come from the reserve selection software MARXAN, and represent the number of solutions in which a particular area was selected by the software given input parameters (Trombulak et al. 2008).

ZONATION
Conservation planning software

Zonation is a conservation planning framework and software. It produces a hierarchical prioritization of the landscape based on the occurrence levels of biodiversity features in sites (cells) by iteratively removing the least valuable remaining cell while accounting for connectivity and generalized complementarity. The output of Zonation can be imported into GIS software to create maps or for further analysis. Zonation v. 3.1 can process very large data sets containing up to ~50 million grid cells with effective data.

Please explore these and other available tools at

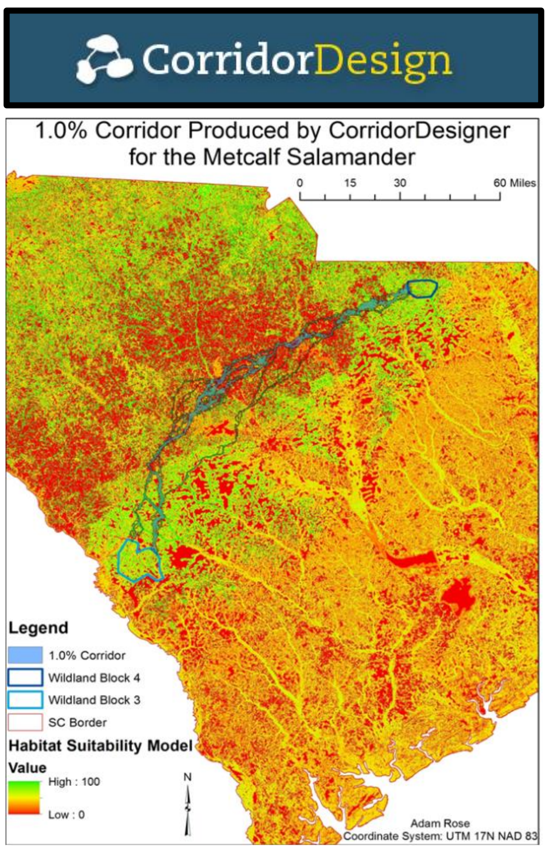
Marxan	http://www.uq.edu.au/marxan/
Marxan with zones	http://www.uq.edu.au/marxan/
Sites	http://www.biogeog.ucsb.edu/projects/tnc/toolbox.html
Zonation	http://www.helsinki.fi/bioscience/consplan/software/Zonation/index.html

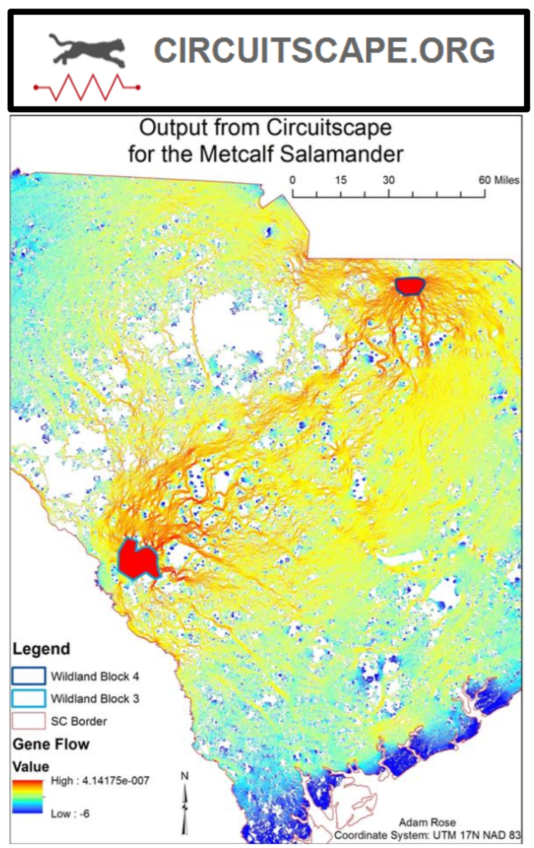
HABITAT CONNECTIVITY

Habitat connectivity is the degree to which a landscape facilitates animal movement gene flow, and other ecological flows. Maintaining connectivity between habitat patches allows species to move between different habitats in adjacent areas and is an integral component of landscape level conservation planning.

All pieces of connectivity software use an input layer that represents landscape resistance. Resistance is the degree that any kind of land cover presents resistance to movement by organisms. Resistance is sometimes scaled to individual species or taxa based on known habitat requirements; this more often is the approach in very localized habitat connectivity mapping projects (e.g., the example for corridors between two known patches), but sometimes is employed regionally for species with well-known movement parameters. More often however there is the attempt to create generalized resistance surfaces that might work for groups of organisms; such resistance layers are often derived from mapped indexes of land cover transformation by humans, and naturalness.

Examples of some connectivity tools





Example of connectivity analysis: Output of two different modeling approaches (Corridor Designer and Circuitscape) for the same organism and landscape showing different outputs. As seen in the images, the output implies different pathways in each model even though the species, and input data are identical (A. Rose, P. Leonard, R. Baldwin unpublished data). Users will have to select a particular program based on what their question, scale, and purpose is.

Please explore these and other available tools at

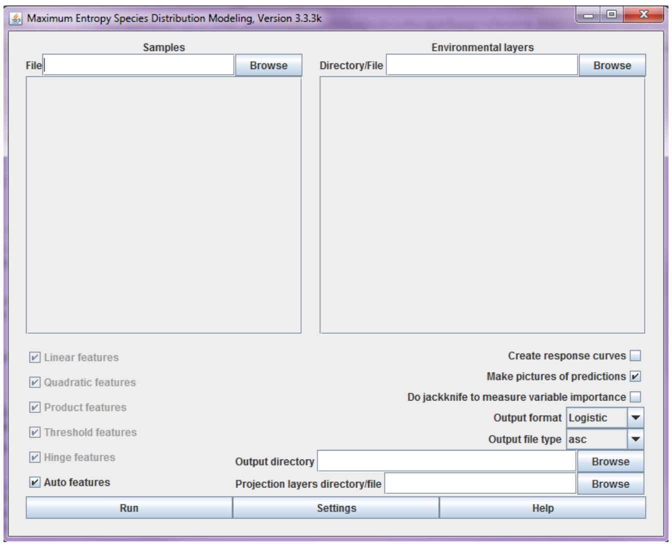
Corridor Design	http://www.corridordesign.org/
Circuitscape	http://www.circuitscape.org/Circuitscape/Welcome.html
Linkage mapper	http://code.google.com/p/linkage-mapper/
FunConn	http://www.nrel.colostate.edu/projects/starmap/funconn_index.htm
Wild Lifelines	http://www.twp.org/what-we-do/scientific-approach/wild-lifelines

SPECIES DISTRIBUTIONS AND VIABILITY

Accurate species distributions are one of the most fundamental and difficult to obtain sources of information, for conservation planning. Accurate maps of species distributions can be integral to conservation planning. For instance one goal of reserve selection is to represent regional species diversity in a set of reserves. Software like Marxan can use mapped species distributions as targets in the conservation scenarios. Endangered Species conservation is a particularly compelling case for accurate mapped species distributions. The goal is to predict where species might occur, based on known conditions at known locations where they do occur.

Examples of some Species distribution and viability tools:

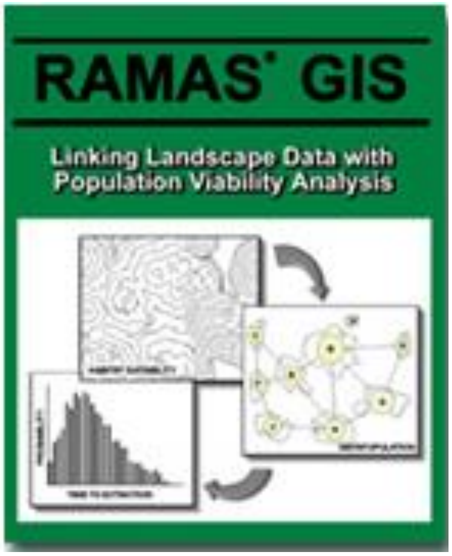
Maxent



Maxent can generate maps of species distributions by using a modeling process in which known locations are used to develop predictive models based on mapped environmental variables. Maxent uses environmental layers key to the existence of a specie along with known location of the species to predict where the target species might exists. This program breaks down the range of a focal species to identify where that species might exist based on the environmental characteristics (temperature, precipitation, aspect, and so on) where it is already known to exist.

The above picture is a screenshot of a blank project in Maxent.

RAMAS GIS



RAMAS GIS is a program that links metapopulation modeling with landscape data and GIS technology. It has several tools to assist in building metapopulations of a species, building time change maps, assessing ecological risk and/or risk of extinction for the focal species. Like maxent, RAMAS GIS, can be useful in evaluating potential target species and identifying the locations of their habitat.

Please explore these and other available tools at

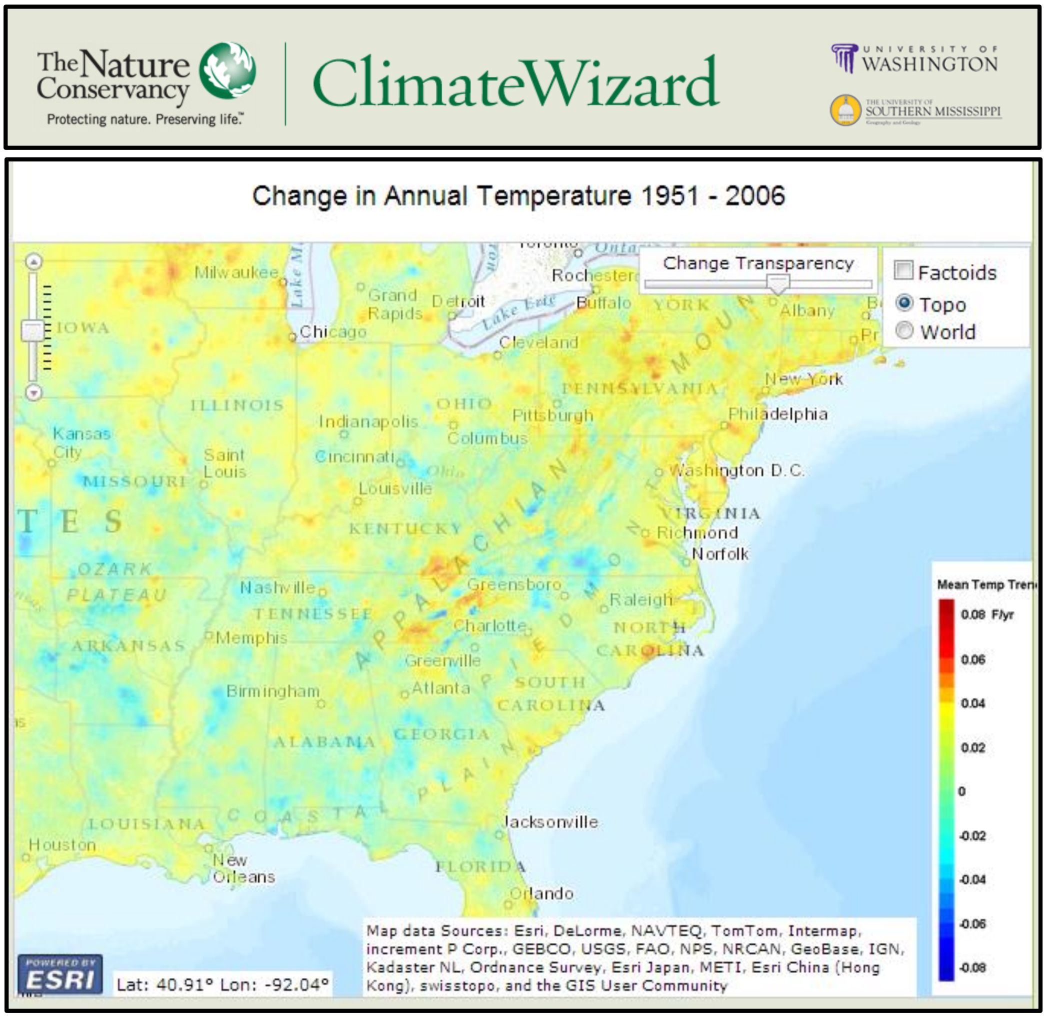
Presence	http://www.mbr-pwrc.usgs.gov/software/presence.html
Maxent	http://www.cs.princeton.edu/~schapire/maxent/
RAMAS GIS	http://www.ramas.com/ramas.htm#gis

CLIMATE

Conservation planning seeks to integrate climate change, and as such is considered a “climate adaptation” strategy. Large, interconnected areas of high naturalness are more likely to provide climate corridors to accommodate range shifts, than many, smaller, fragmented areas, and will likely also sequester carbon, mitigate effects of drought, flood, and storm events. Conservation planning that integrates climate change addresses the problem of interacting stressors and how they are likely to influence the resilience of systems, including the ability of species to shift their ranges given land use change and habitat fragmentation.

Examples of some Climate adaptability tools

Climate Wizard



Climate Wizard can be used to assess how climate has changed over time and to project what future changes are likely to occur in a given area. Climate Wizard represents the first time ever the full range of climate history and impacts for a landscape have been brought together in a user-friendly format.

Please explore these and other available tools at

Climate Wizard http://www.climatewizard.org/

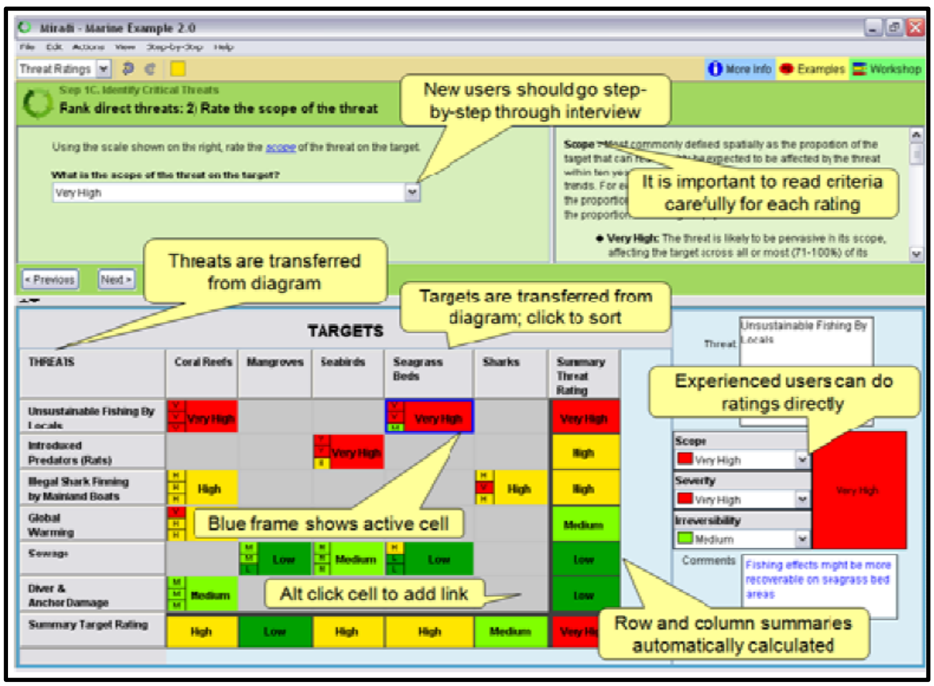
Climate and conservation
http://www.conservation.org/learn/climate/Pages/climate_overview.aspx

Climate change and landscapes http://www.wcs.org/conservation-challenges/climate-change.aspx

INTEGRATIVE PLANNING

Conservation planning in more than an academic and scientific exercise. This suit of software provide ways to engage multiple partners and stakeholders in an integrated and systematic workflow. The process of conservation planning explicitly integrates people throughout. Ideally this occurs in nested groups with a core group of conservation planning experts conducting modeling exercises, and informed by larger groups. Feedback loops at every stage of the project are essential for insuring that the planning products make sense to stakeholders. Following implementation, monitoring for success and more review occurs

Examples of some integrative planning tools



Miradi is project management software designed by conservation practitioners, for conservation practitioners. It was built as a tool to implement planning and measurement best practices adopted by the CMP (Conservation Measures Partnership) Open Standards for the Practice of Conservation. Miradi's graphic user interface (GUI) looks like a cross between "TurboTax" and a graphic modeling tool and is fairly user friendly.

NatureServe Vista free decision-support system that helps users integrate conservation with land use and resource planning of all types. Vista can be used to conduct conservation planning and assessments; integrate conservation values with other planning and assessment activities, such as land use, transportation, energy, natural resource, and ecosystem-based management; evaluate, create, implement, and monitor land use and resource management scenarios designed to achieve conservation goals within existing economic, social, and political contexts. Later versions of Vista are envisioned as a toolkit framework that can incorporate the other conservation planning programs such as Marxan, community viz , etc as part of an adaptive management process.

Please explore these tools at

Natureserve Vista http://www.natureserve.org/prodServices/vista/overview.jsp

Miradi https://miradi.org/

THREATS (BUILDOUTS AND NATURALNESS)

Conservation planning anticipates threats to biodiversity and to prioritize conservation actions based on how vulnerable sites are to threatsConservation planning seeks to identify, understand, and map the distribution of activities that are known to threaten diversity and function of ecosystems. Such threats include: human population density, housing density, roads, road traffic, gas and oil development, some forestry and agricultural methods. Fire suppression, flood control, and other activities to control ecological process have also been considered threats. Modeling land use change has been a productive area of conservation planning research. The ability to develop predictive maps of land use change and loss of naturalness in the landscape has increased rapidly over the past decade, and they have been used prioritize landscapes for conservation action.

Examples of some tools

CommunityViz planning software is an extension for ArcGIS Desktop. As a GIS-based decision-support tool, it demonstrates the implications of different plans and choices. It supports scenario planning, sketch planning, 3-D visualization, suitability analysis, impact assessment, growth modeling and other techniques. Because it runs in a GIS environment, CommunityViz, unlike the other project programs, can incorporate numerous data layers that might include the entire infrastructure of a region.

Please explore these and other tools and datasets at

Community Viz (Local Buildout)	http://placeways.com/communityviz/
Global Human Footprint	http://sedac.ciesin.columbia.edu/wildareas/
Future Human Footprint scenarios	http://www.2c1forest.org/
Future housing and impervious surface scenarios	http://www.pnas.org/content/107/49/20887.full