Decision Support Tools to Support Climate Change Vulnerability Assessments

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Goals

- Provide context for decision support tools.
- Describe some potential tools for this assessment.
- Brief case study using tools in conservation planning under uncertainty.
- Resources

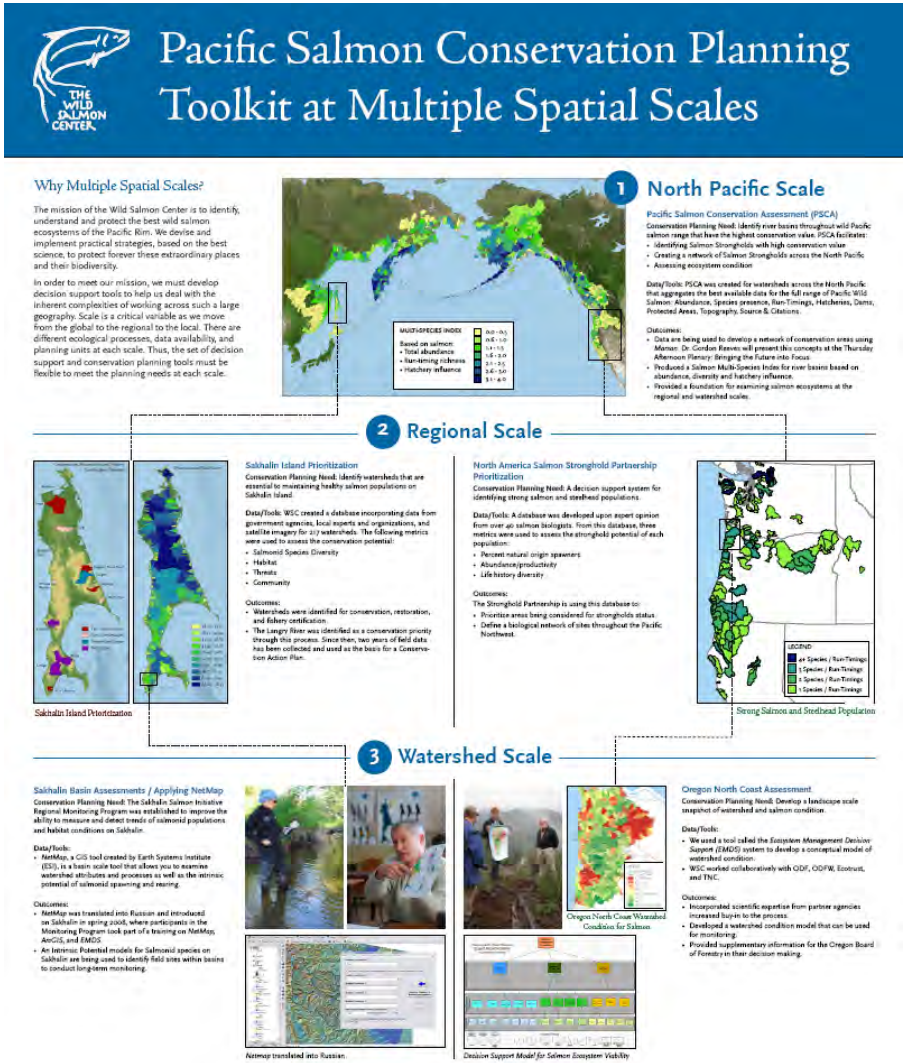
Role of “Decision Support Tools”

- Management of uncertainty
- Can work towards building consensus on decisions.
- Transparency
- Based on literature, case studies
- Build scenarios.

(Three Stooges Picture)

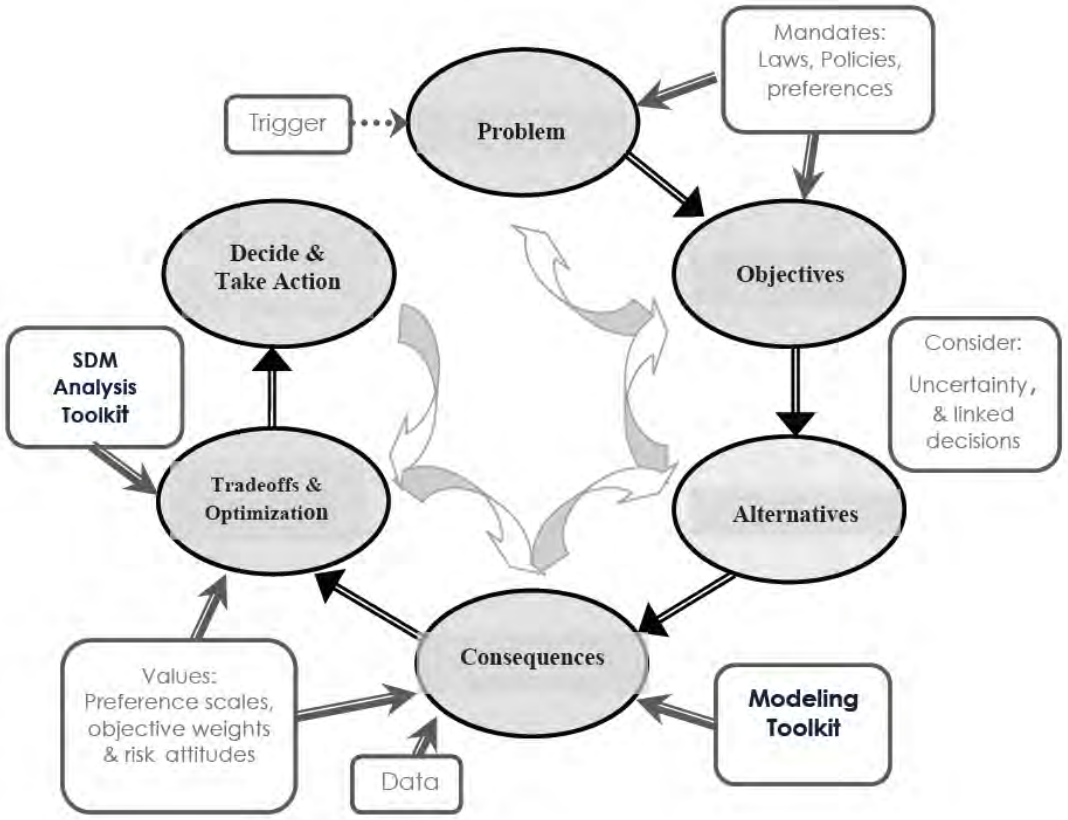
Types of Decision Support Tools

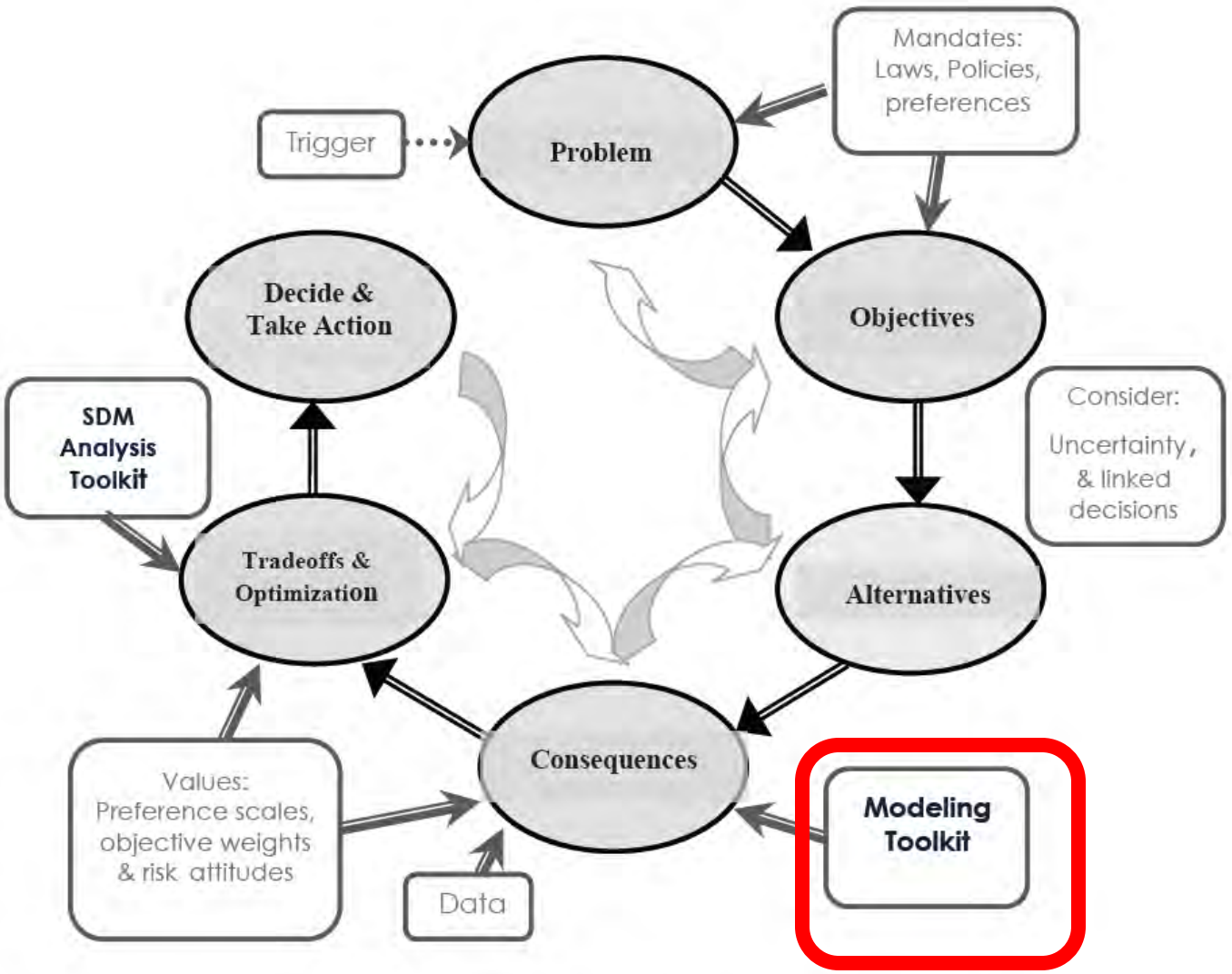
- Species
- Habitat
- Hydrological
- Process
- Expert Based
- Data Driven
- Models



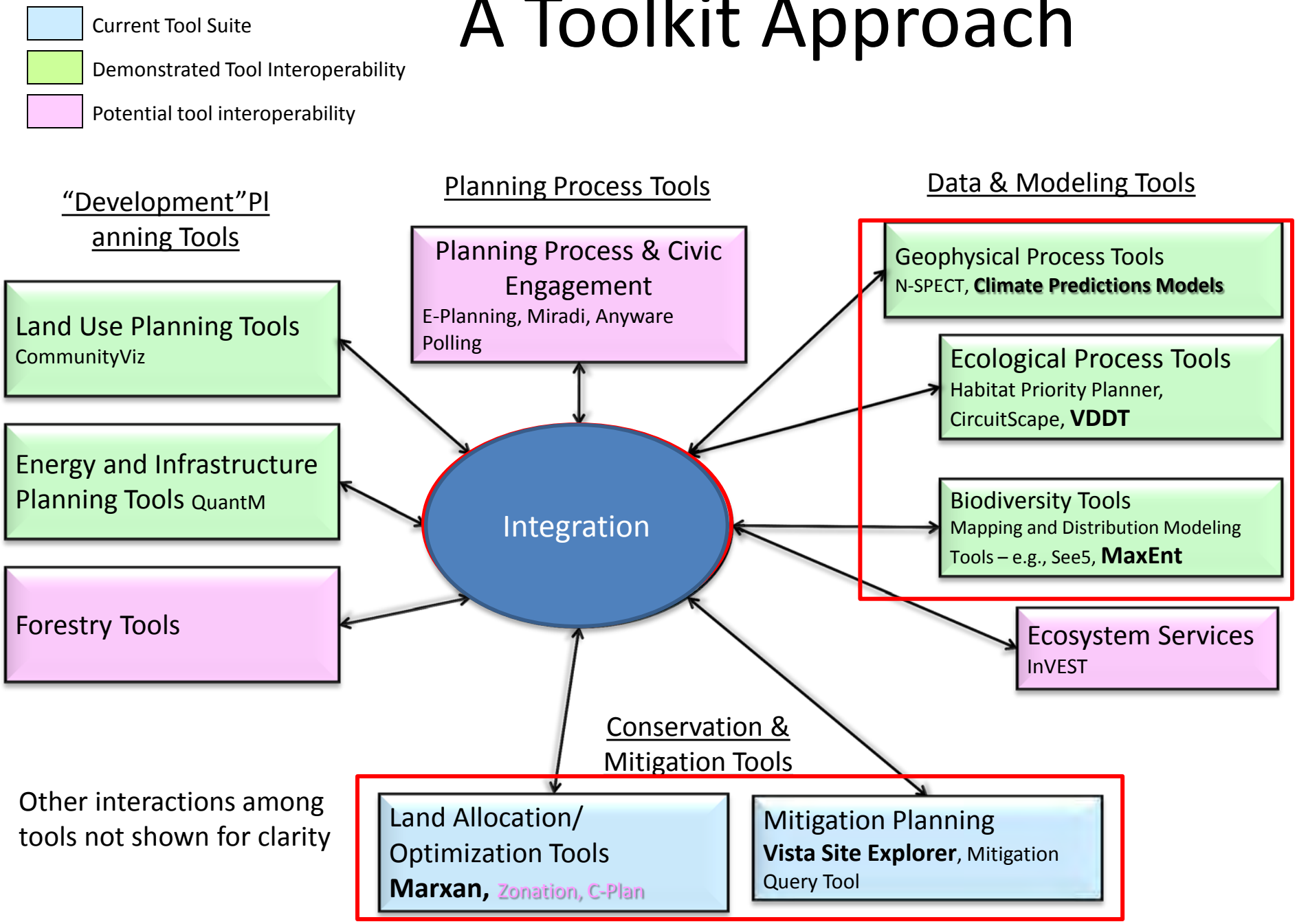
Which Tools to Use?

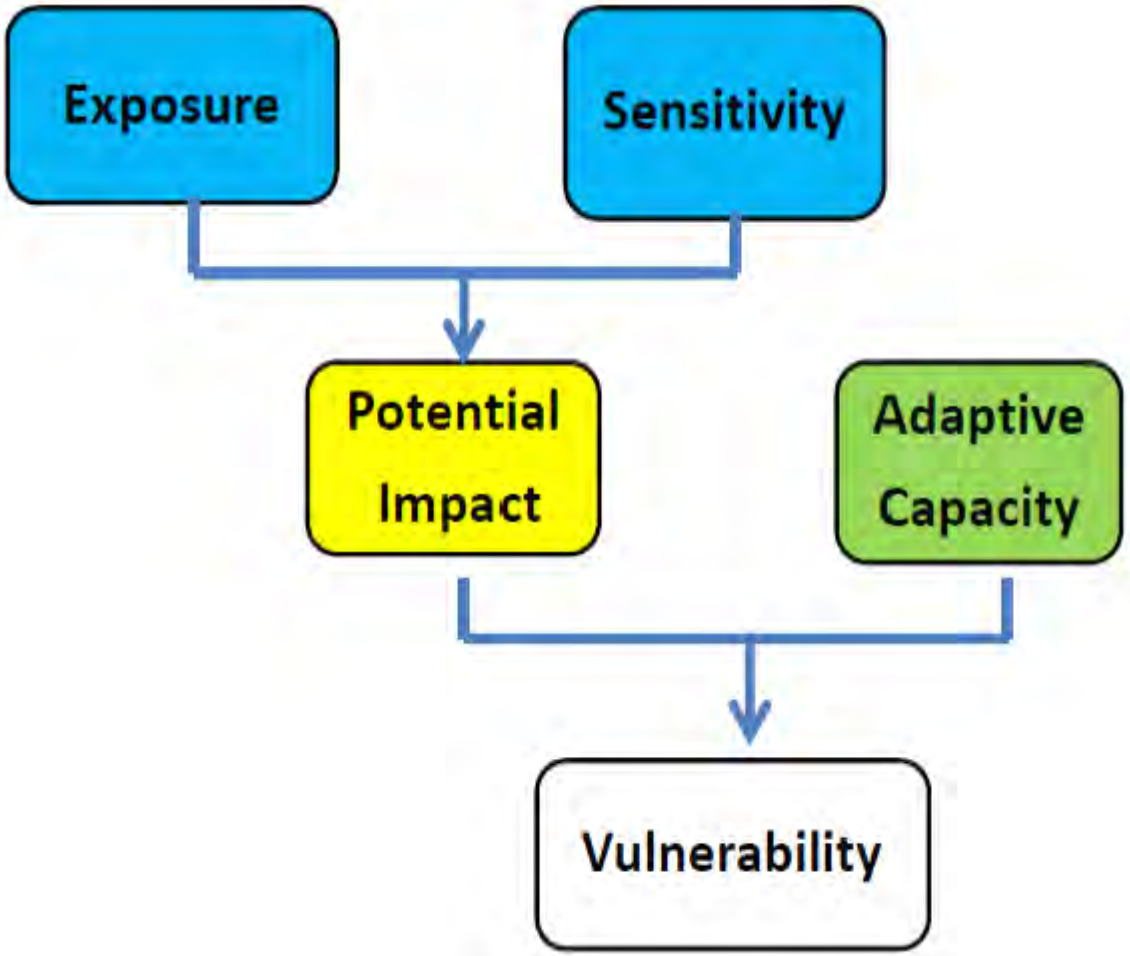
- Depends on the question.
- Quantitative, Qualitative, mix
- Depends on Resources.
- What exists already?




Mandates:
Laws, Policies,
preferences
Trigger
Problem
Decide &
Take Action
Objectives
SDM
Analysis
Toolkit
Consider:
Uncertainty,
& linked
decisions
Tradeoffs &
Optimization
Alternatives
Consequences
Values:
Preference scales,
objective weights
& risk attitudes
Data
Modeling
Toolkit

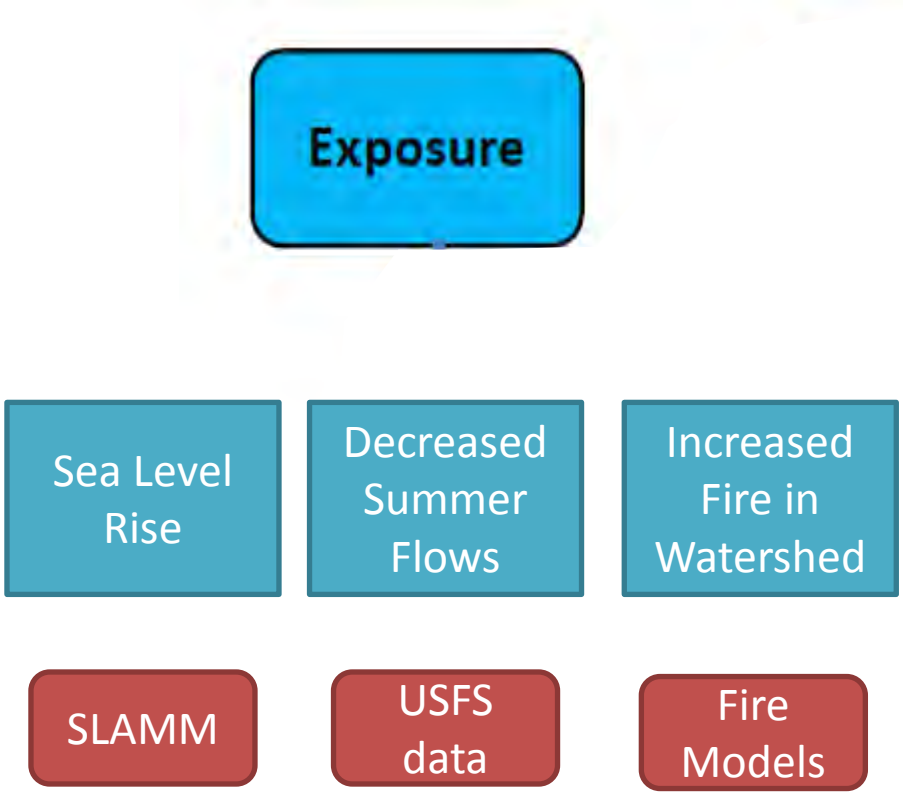
A Toolkit Approach





Scanning the Conservation Horizon, 2011

Potentials for Coquille



FIRE & LANDSCAPES TOOLS & DATA

LANDFIRE Vegetation Dynamics Development Tool (VDDT)

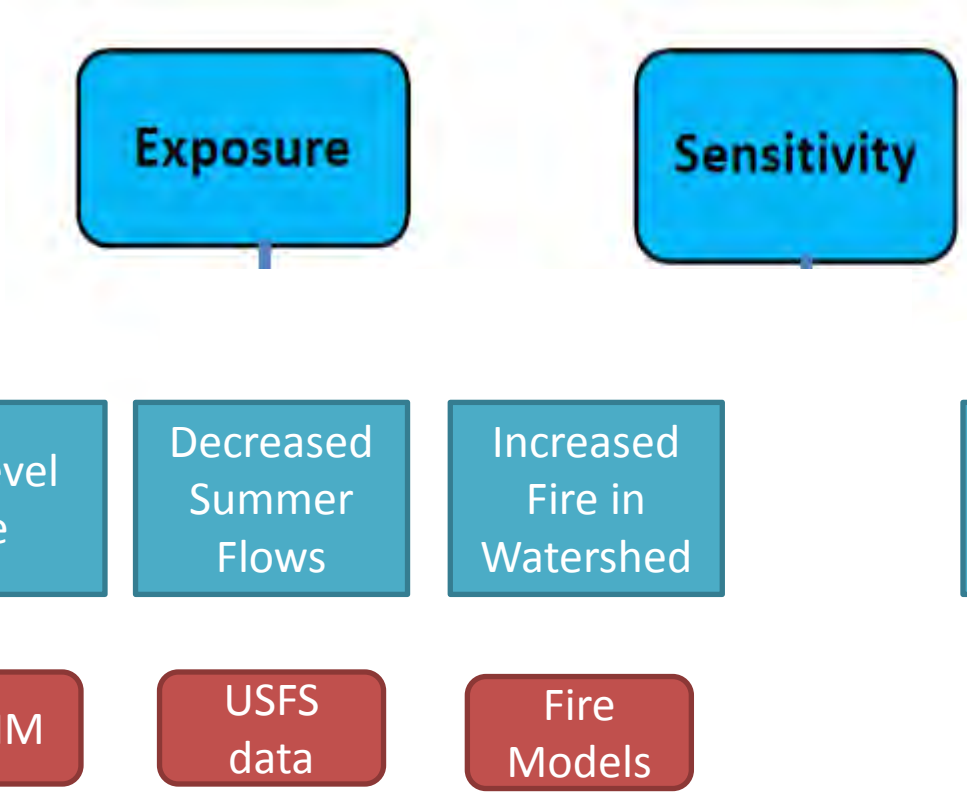
VIEW LINK: http://www.essa.com/tools/vddt/

The Vegetation Dynamics Development Tool (VDDT) is a user-friendly, Windows-based computer tool that provides a state and transition landscape modeling framework for examining the role of various disturbance agents and management actions in vegetation change. It allows users to create and test descriptions of vegetation dynamics, simulating them at the landscape level.

Projecting changes in vegetation structure and composition over time is an important part of landscape-level analyses. Vegetation may change for a variety of reasons, such as human activity, fires, insects, pathogens, mammals, weather, or growth and competition. The interaction of these factors is complex and the combined effects are difficult to predict over long periods.

VDDT provides a common platform for specialists from different disciplines — e.g., entomology, pathology, fire ecology, silviculture, wildlife biology and ecology — to collectively define the roles of various processes and agents of change on landscape-level vegetation dynamics. Moreover, VDDT allows for rapid gaming and testing of the sensitivity of the ecosystem to alternative assumptions. It thus provides a means for learning and communication.

Potentials for Coquille



Section C: Sensitivity

Mark an "X" in all boxes that apply.

Effect on Vulnerability						
Greatly increase	Increase	Somewhat increase	Neutral	Somewhat decrease	Decrease	Unknown
						X
						X
						X
						X
						X
						X
						X
						X
						X
						X
						X
						X
						X
						X
						X
						X

Factors that influence vulnerability *(* at least 10 required)*

1) **Dispersal and movements**
2) Predicted **sensitivity to temperature** and **moisture changes**
   a) Predicted **sensitivity to changes in temperature**
      i) **historical thermal niche**
      ii) **physiological thermal niche**
   b) Predicted **sensitivity to changes in precipitation, hydrology, or moisture regime**
      i) **historical hydrological niche**
      ii) **physiological hydrological niche**
   c) Dependence on a **specific disturbance regime** likely to be impacted by climate change
   d) Dependence on **ice, ice-edge, or snow-cover habitats**
3) **Restriction to uncommon geological features or derivatives**
4) **Reliance on interspecific interactions**
   a) Dependence on **other species to generate habitat**
   b) **Dietary versatility** (animals only)
   c) **Pollinator versatility** (plants only)
   d) Dependence on **other species for propagule dispersal**
   e) Forms part of an **interspecific interaction** not covered by 4a-d
5) **Genetic factors**
   a) Measured **genetic variation**
   b) Occurrence of **bottlenecks** in recent evolutionary history *(use only if 5a is "unknown")*
6) **Phenological response to** changing seasonal temperature and precipitation dynamics

Climate Change Sensitivity Database

Oncorhynchus tshawytscha - Pacific Northwest, focusing on Portland Harbor

April 3, 2012 by Jorge Tomasevic
Author(s) Expertise:

✓ This species is complete.

Login or register to post comments

Sensitivity Factor	Sensitivity	Confidence
Generalist/Specialist	4 Medium-High	5 Very Good
Physiology	6 High	5 Very Good
Life History	2 Medium-Low	5 Very Good
Habitat	7 Extremely High	4 Good
Dispersal Distance	1 Low	5 Very Good
Dispersal Barriers	4 Medium-High	4 Good
Disturbance Regimes	7 Extremely High	5 Very Good
Ecology	5 High	4 Good
Non-Climatic	6 High	5 Very Good
Other (weight)		

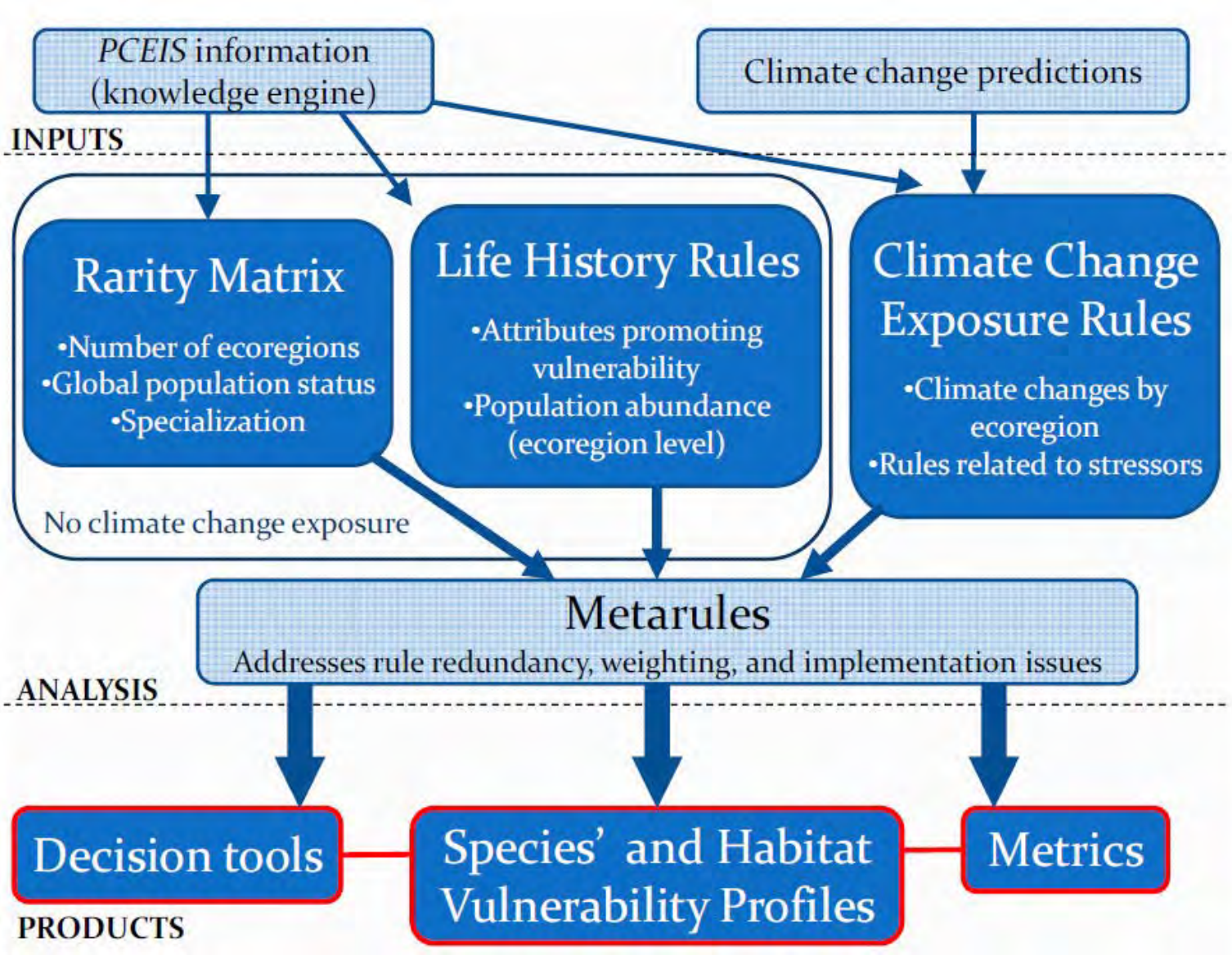
Sensitivity Score: Extremely High

Confidence Score: Good

Overall User Ranking: High

Login or register to post comments

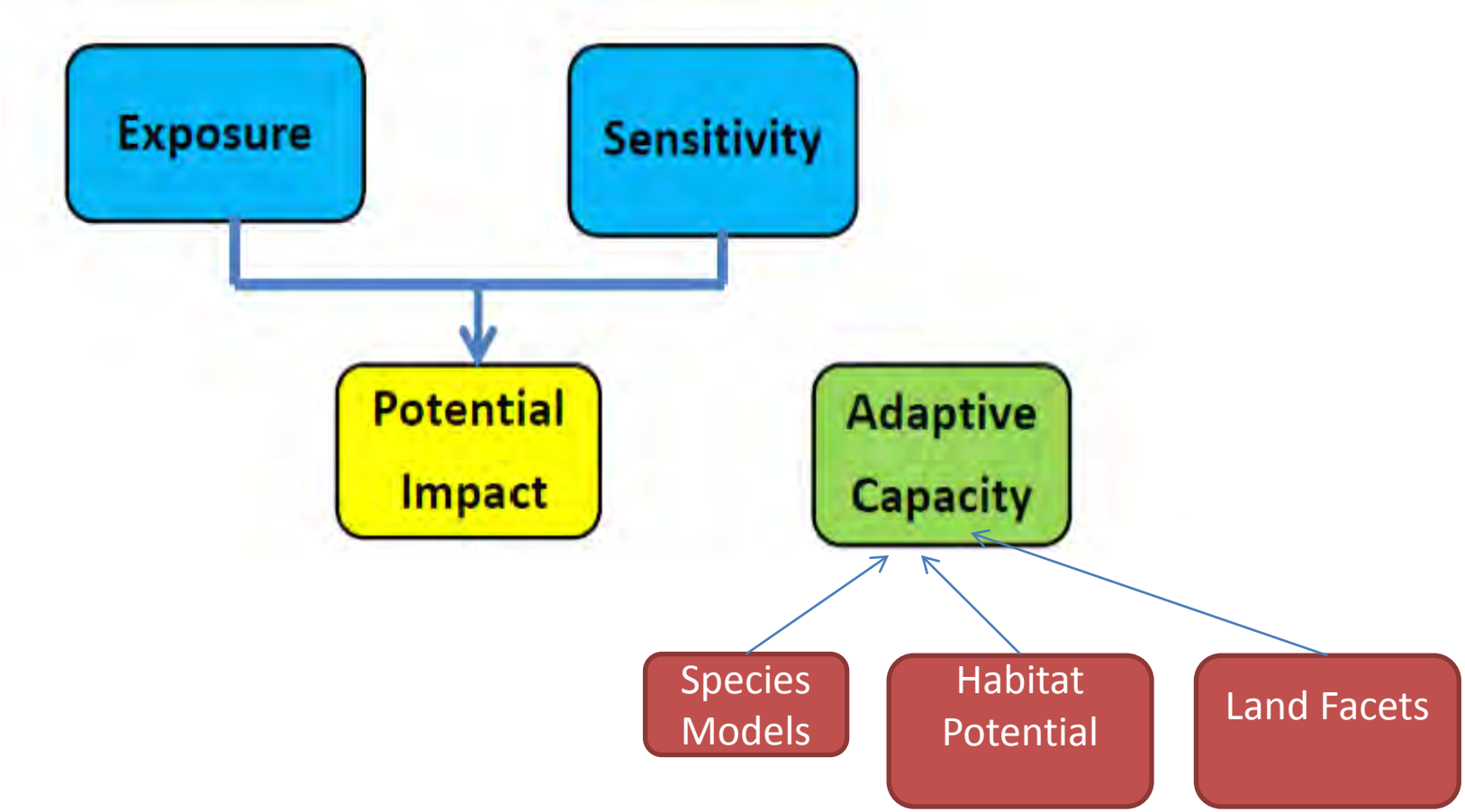
Predicting the vulnerability of nearshore species and habitats to climate change effects, Reusser et al : due 2013



Factors for a CCSI

- Dispersal ability
- Dispersal barriers
- Availability of refuge habitat
- Environmental specificity
- Ecological specificity
- Range size
- Others?

Potentials for Coquille



NetMap: Watershed Template

CLIMATE CHANGE: ASSESSING LANDSCAPE VULNERABILITY

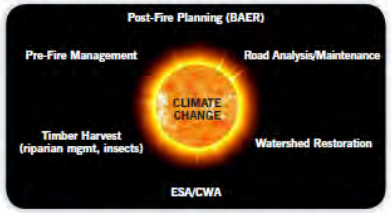
Pacific Northwest Research Station — Earth Systems Institute

NetMap

Community Digital Watersheds & Shared Analysis Tools (www.netmaptools.org)

Climate Change: Linking with Other Priorities

Climate change impacts can be considered on their own (impacts of warmer stream temperatures on sensitive fish species) or climate change can be considered in context of other, ongoing management priorities.



Analysis Approaches

There are options: (1) Cause and effects models can be used to assess singular responses (air or water temperature predictions) or (2) Analysts can use a flexible and exploratory assessment to consider how the pieces of the watershed puzzle fit together.

Climate Change and Road Concerns

In this illustrative example in the Boise watershed in Idaho, we perform a 'landscape vulnerability' assessment in the context of climate change: a higher chance of winter flooding can pose a risk to the road system & aquatic habitats.

Step 1: Define Vulnerable Habitats

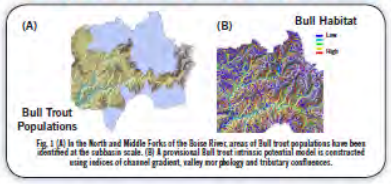


Fig. 1 (A) In the North and Middle Forks of the Boise River, areas of Bull trout populations have been identified at the subbasin scale. (B) A provisional Bull trout intrinsic potential model is constructed using indices of channel gradient, valley morphology and tributary confluences.

Step 2: Examine Downscaled GCM Predictions

One of the climate change predictions made by the Climate Impact Group (UW) is the difference between the ratio of snowmelt runoff to total runoff between historical and the future (2080 in this example).

Large increases in the ratio of snowmelt runoff to total runoff stem from a lowering of the snowpack in winter.

In certain areas, this implies lower stream flows in the summer and a higher chance of winter flooding (rain on snow) in the winter (Fig. 2). Areas containing vulnerable roads may be at higher risk to winter floods (and streams with lower summer flow may present a risk to fisheries).

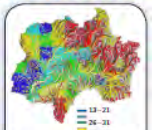


Fig. 2. Ratio of snowmelt runoff to total runoff, in percent (2080-historical)

Step 3: Calculate Road Density

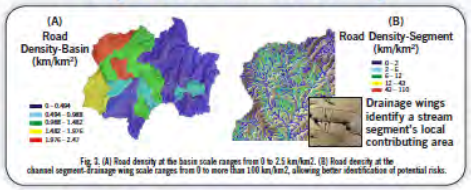


Fig. 3. (A) Road density at the basin scale ranges from 0 to 2.5 km/km2. (B) Road density at the channel segment-drainage wing scale ranges from 0 to more than 100 km/km2, allowing better identification of potential risks.

Step 4: Road Drainage Diversion/Surface Erosion

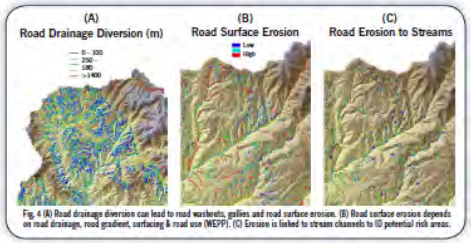


Fig. 4 (A) Road drainage diversion can lead to road washouts, gullies and road surface erosion. (B) Road surface erosion depends on road drainage, road gradient, surfacing & road use (WEPP). (C) Erosion is linked to stream channels to ID potential risk areas.

Step 5: Roads in Floodplains

NetMap's flexible floodplain tool is used to map the inundation area based on a number of bankfull depths above the channel elevation.

The predicted floodplain surface at 3X bankfull depth is shown in Fig. 5.

Roads that cross floodplains are highlighted using the tool. During large winter floods, these areas could contribute to aquatic impacts.

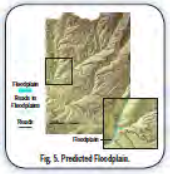


Fig. 5. Predicted Floodplain.

Step 6: Roads Stability

One of NetMap's erosion parameters 'generic erosion potential' (GEP) is based on a topographic index that combines hillslope steepness and curvature, drivers of gully erosion and shallow failures.

In NetMap, road segments (~10 m) are classified according to the GEP index of the underlying hillside (Fig. 6). This provides an approximation of road failure potential, particularly during storms or following fires.

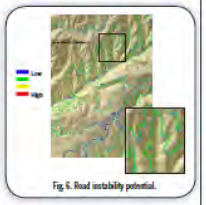


Fig. 6. Road instability potential.

Step 7: Roads & Debris Flows

Debris flows can be one of the most destructive events following fires or storms, events that could increase with climate change.

NetMap can classify all road – headwater stream crossings by debris flow potential (Fig. 7). Flagged areas could be used to prioritize field surveys and road maintenance programs.

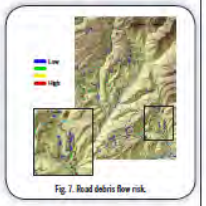


Fig. 7. Road debris flow risk.

Step 8: Putting the Pieces Together

There are numerous ways to put the pieces together to evaluate the risk posed by the road network in the context of climate change.

For example, NeMap's overlap tool can be used to search for locations where threshold values overlap between Bull trout habitat (Fig. 1, B) and debris flow potential (Fig. 8,A) or road density (Fig. 3,B) and habitat (Fig. 8,B).

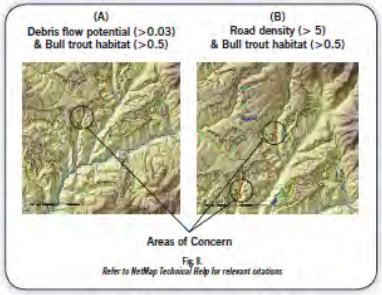
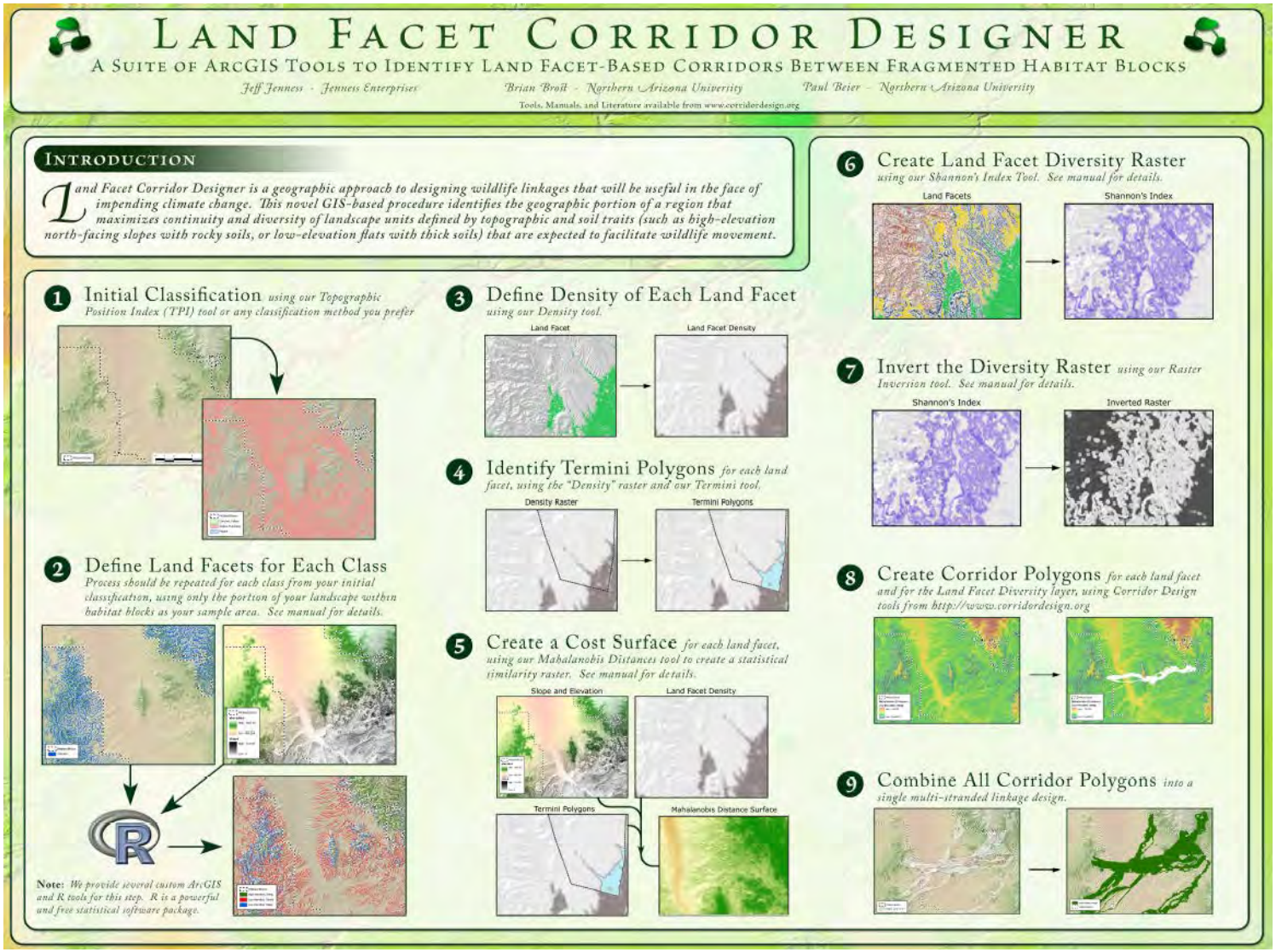
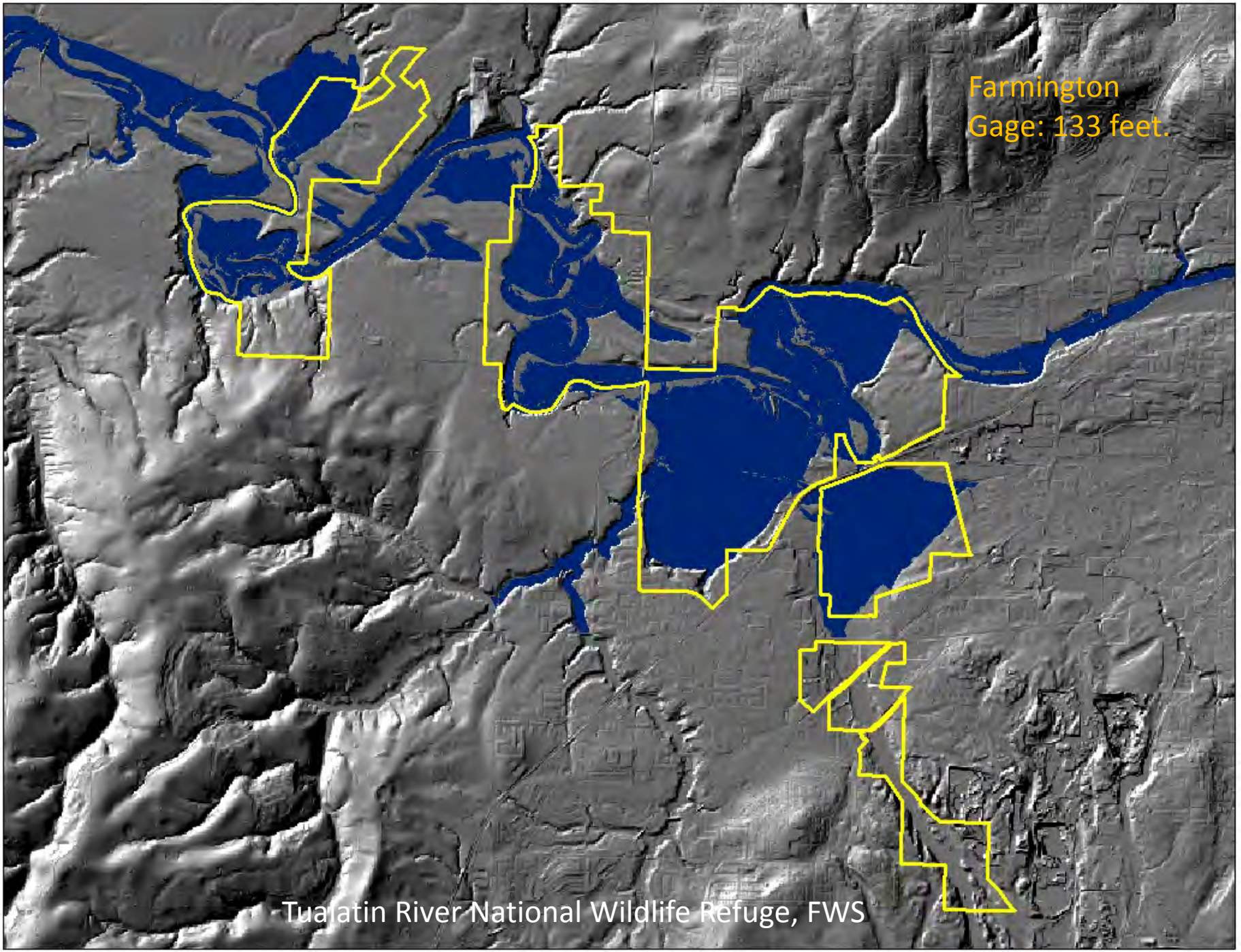


Fig. 8.
Refer to NetMap Technical Help for relevant citations

Contact Earth Systems Institute at:
www.earthsystems.net or www.netmaptools.org

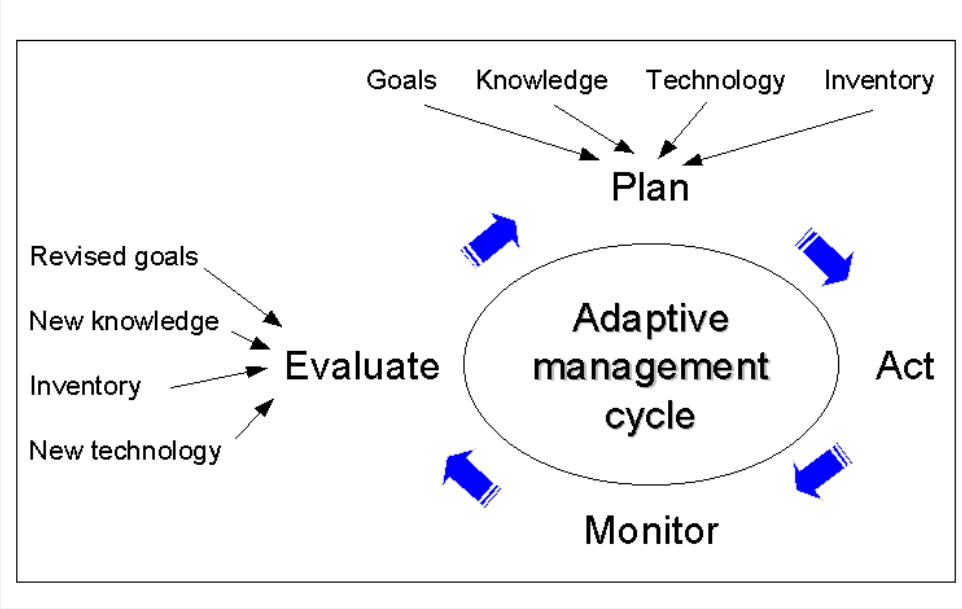
Protect the Stage




Farmington
Gage: 133 feet.
Tualatin River National Wildlife Refuge, FWS

Decision Support Modeling

- Ecosystem Management Decision Support:
  - NetWeaver Logic Model

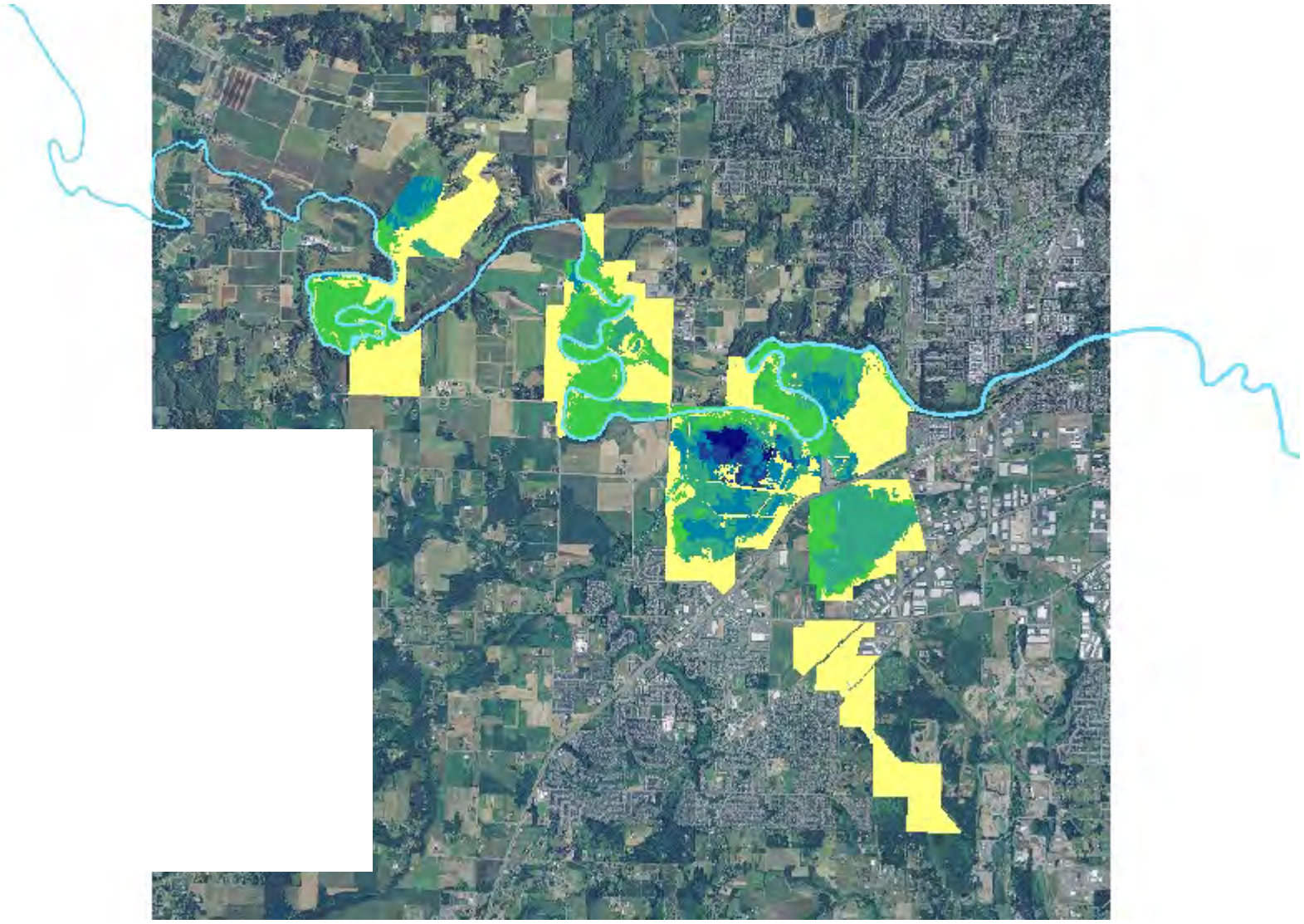


Develop the Support (Evidence)

- Current Vegetation
- Historic Vegetation
- Soils
- Inundation Frequency

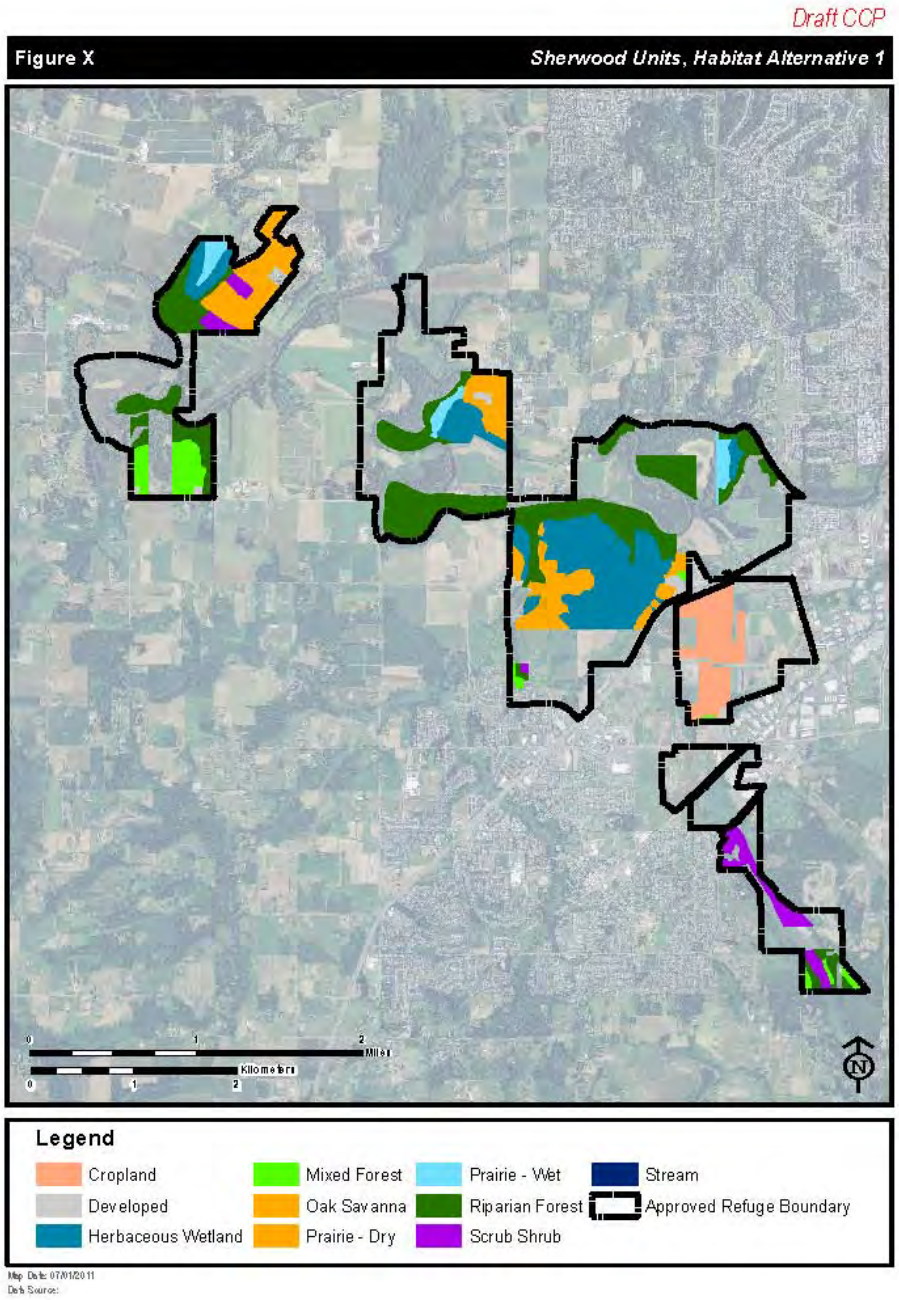
- Based upon expert opinion, literature, data.

Proposition: Parcel X will develop naturally into Wet Meadow Prairie.



Tualatin River National Wildlife Refuge, FWS

Alternatives for Comprehensive Conservation Plan



Tualatin River National Wildlife Refuge, FWS

Matrix of Tools

Tool Name	Adaptation Database for Planning Tool (ADAPT)	CRiSTAL (Community-based Risk Screening Tool – Adaptation and Livelihoods)	NOAA CSC Coastal Inudation Toolkit	NOAA CSC Roadmap	Ecosystem-Based Managment Tools Network	Digital Coast	ClimateWizard	Climate Sensitivity Database	DataBasin Climate Center	Northeast Climate Data
Tool Type	Process				Tool Portals		Data portals			
Description	An online database that guides users through ICLEI's 5 Milestones for Climate Adaptation planning framework. ADAPT walks you through the process of assessing your vulnerabilities, setting resiliency goals, and developing plans that integrate into existing hazard and comprehensive planning efforts.	CriSTAL enables local decision makers to assess the impact a project may have on the resources of a community, and modify projects to reduce vulnerability and enhance adaptive capacity by incorporating adaptation methods. This decision support tool is a user-friendly process for planners and managers to identify the links between the livelihoods of locals and climate. CRiSTAL steps the user through a series of worksheets for each of these elements from the identification of impacts, through implementation and evaluation of strategies. It also includes example reports or case studies.	This toolkit provides guidance on how to prepare and map inundation estimate for your area. The toolkit was developed by the Digital Coast Partnership Group to help communities understand and address coastal inundation issues. Website components include: Understand basic information about coastal inundation; Identify your county's exposure and examine potential impacts; Map inundation to "see" potential impacts; Assess your community's risks, vulnerability, and resilience; Communicate risk strategies to initiate change; and, Discover how other communities are addressing this issue.	A three hour training designed to help communities characterize their exposure to current and future hazard and climate threats and assess how existing planning and policy efforts may integrate this information to address community issues. After completeing this course, participants will be able to: Identify key issues and impacts associated with current and future coastal hazard risks; Identify major elements of community vulnerability; and, Identify strategic "win-win" approaches for reducing risks and vulnerabilities while also addressing other community issues	A Network of tool providers and practicioners that works to bring geospatial and other tools to planning processes. At the EBM Tools Network website, you can find: an online database of tools, training resources, webinars, and links to case studies.	Digital Coast is a data and tool portal provide by NOAA Coastal Services Center. The Digital Coast also provides the tools, training, and information needed to turn these data into the information most needed by coastal resource management professionals. Digital Coast is used to address timely coastal issues, including land use, coastal conservation, hazards, marine spatial planning, and climate change. One of the goals behind the creation of the Digital Coast was to unify groups that might not otherwise work together. This partnership network is building not only a website, but also a strong collaboration of coastal professionals intent on addressing coastal resource management needs.	With ClimateWizard you can: - view historic temperature and rainfall maps for anywhere in the world - view state-of-the-art future predictions of temperature and rainfall around the world - view and download climate change maps in a few easy steps ClimateWizard enables technical and non-technical audiences alike to access leading climate change information and visualize the impacts anywhere on Earth. The first generation of this web based program allows the user to choose a state or country and both assess how climate has changed over time and to project what future changes are predicted to occur in a given area. ClimateWizard 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.	Climate changes poses a daunting challenge to natural resource managers and in response the University of Washington has partnered with key collaborators to conduct a climate change sensitivity assessment. This assessment is designed to evaluate the sensitivity of the species and ecological systems of the Pacific Northwest to climate change. This digital database summarizes the inherent climate change sensitivities for species and habitats of concern throughout the Pacific Northwest and will provide resource managers and decision makers with some of the most basic and most important information about how species and systems will likely respond to climate change.	The Climate Center is one of the entryways to Data Basin, the on-line database with data manipulation tools created by the Conservation Biology Institute (CBI). The Climate Center: - lists the most recent datasets, maps and galleries with relevance to climate change issues. - provides special features that tell stories around specific datasets available in Data Basin. - provides news briefs about recent publications or observations of change. - highlights climate change-related data providers and climate change experts. - CBI staff are working on developing special tools that will help provide climate change guidance The Climate Center is being built to meet users needs. Let	This database provides projections of changes in temperature, precipitation, relative humidity, and snow cover for the U.S. Northeast that can be expected over the coming century under higher and lower emission scenarios as well as data on these variables for the period since 1961. The data compiled here was generated as part of the Northeast Climate Impacts Assessment, a collaborative research effort between the Union of Concerned Scientists and more than 50 independent scientists from across the Northeast region and beyond. Information can be displayed geographically or as a time series, and can be plotted for the entire region, an individual state, or major cities
Tool Type	Process	Process	Process/Visualization	Process	NA	NA	Climate data access, visualization, analysis	On-line database and index	on line data, collaboration tool	Climate data access, visualization
Complexity	Low	Low	Medium to High	Low	Low	Low	Low	Low-Medium	Low	Low
Developer	ICLEI Sustainable Communities	International Institute for Sustainable Dev (IISD), World Conservation Union (IUCN), SEI-US	NOAA CSC	NOAA CSC	EBM Tools Network	NOAA Central Services Center	C. Zganjar (TNC); E. Girvetz (then U. Washington, now TNC), and G. Raber (U. Southern Mississippi)	Univ. Washington / TNC	Conservation Biology Institute	Huyhoe, Wake, Anderson, Liang, Maurer, Zhu, Bradbury, DeGaetano, Stoner and Wuebbles.
Price	Requires member-ship with ICLEI	Free	Free	Free	Free	Free	Free	Free	Free	Free
Additional Software Needed	NA	NA	ArcGIS. VDatum, orther geospatial models	NA	NA	NA	None	None	None	None
Link	http://www.icleiusa.org/	http://www.cristaltool.org	http://www.csc.NOAA.gov/digitalcoast	http://www.csc.noaa.gov/digitalcoast/train	http://www.ebmtoolsdatabase.org/	http://www.csc.noaa.gov/digitalcoast/index	http://www.climatewizard.org/	http://sparrow.uwashington.edu/ccdb/drupal/	http://databasin.org/climate-center	http://www.northeastclimatedata.org/

Resources

- Ecosystem Based Management Tools
  - Ebmtools.org
- Climate Adaptation Knowledge Exchange
  - Cakex.org

Conclusion

- Several different approaches
- Depends upon needs, questions, and resources
- Putting together the necessary tools to answer questions, what are the gaps?
- Understand what is out there already.

“The significant problems we face today cannot be solved with the same level of thinking that we were at when we created them.”

--*Albert Einstein*