

NATURESERVE VISTA: A DECISION SUPPORT TOOL FOR USE IN CLIMATE ADAPTATION PLANNING

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National Adaptation Forum

**Tools for Coastal Climate Change
Vulnerability Assessment and
Adaptation Planning**

April 3, 2013



NatureServe

A Network Connecting Science With Conservation

Some Guiding Thoughts

- Climate change effects should be integrated with other stressors in a cumulative effects assessment
- Climate change adaptation should be incorporated in collaborative, landscape-scale, and multi-objective planning to avoid maladaptive responses
- A toolkit approach is necessary to accommodate the complexity of this work

A Toolkit Approach

is needed to conduct this complex work

- Current Tool Suite
- Demonstrated Tool Interoperability
- Potential tool interoperability

Vulnerability Assessment Tools

Expert Assessment Tools
 Climate Change Vulnerability Index
 Structured Decision Making
 Climate Expert Workshops

Data & Modeling Tools

Geophysical Process Tools
 N-SPECT, **Climate Predictions Models**

Ecological Process Tools
 Habitat Priority Planner,
 CircuitScape, **VDDT**

Biodiversity Tools
 Mapping and Distribution Modeling
 Tools – e.g., See5, **MaxEnt**

Ecosystem Services
 InVEST

Conservation & Mitigation Tools

**Land Allocation/
 Optimization Tools**
Marxan, Zonation, C-Plan

Mitigation Planning
Vista Site Explorer, Mitigation
 Query Tool

Info Exchange Tools

Data Portals & Exploration
 Landscape, DataBasin, Atlas, etc.

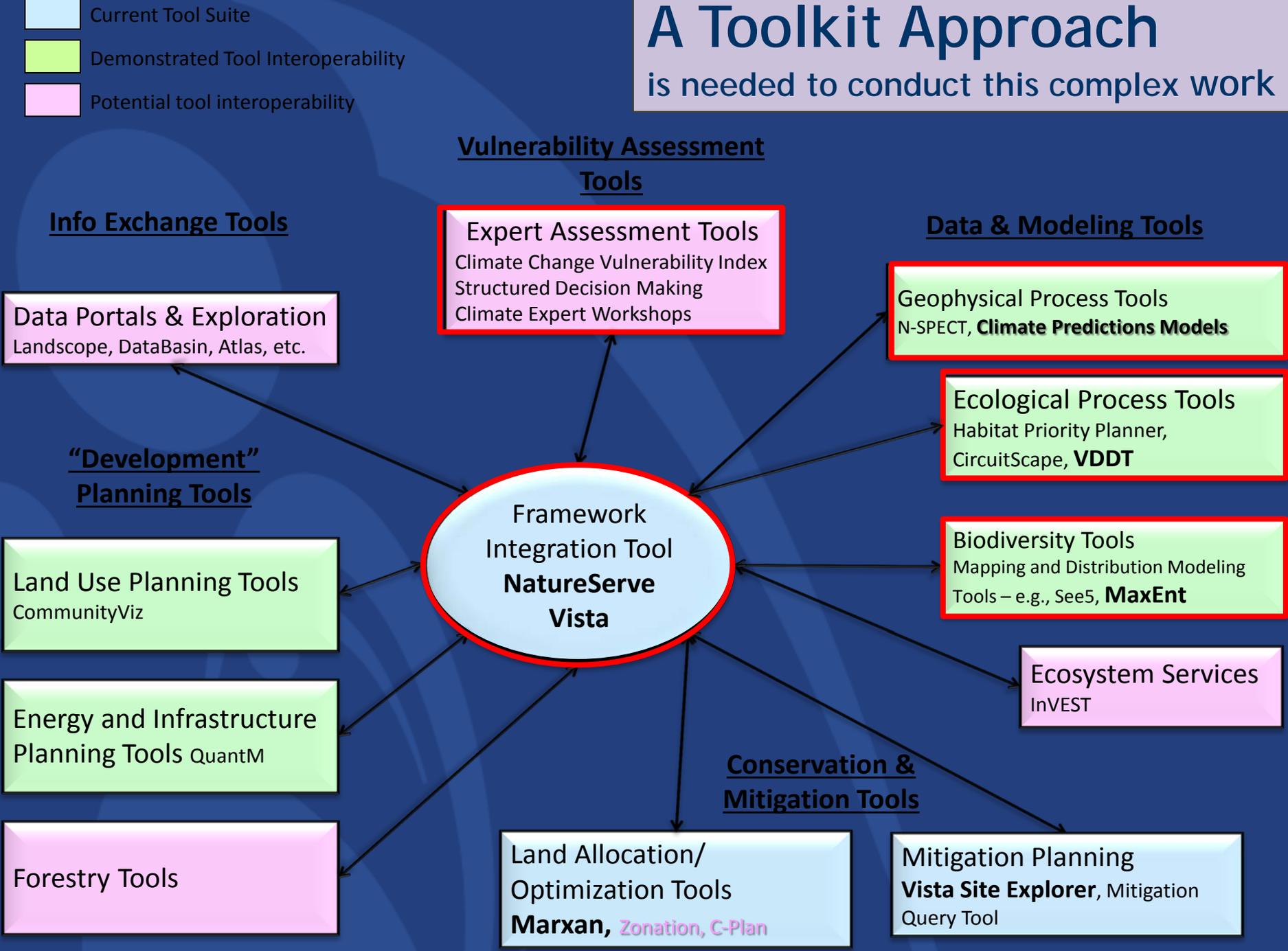
“Development” Planning Tools

Land Use Planning Tools
 CommunityViz

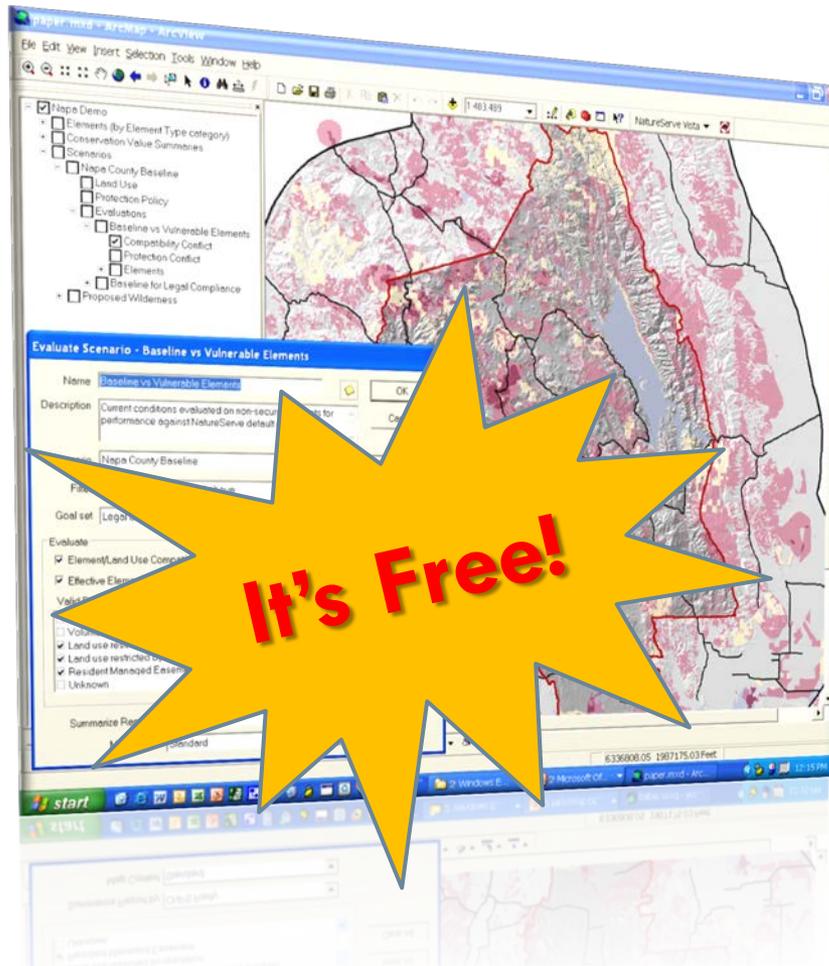
**Energy and Infrastructure
 Planning Tools** QuantM

Forestry Tools

**Framework
 Integration Tool**
**NatureServe
 Vista**



On the land, in the water, anywhere on the globe

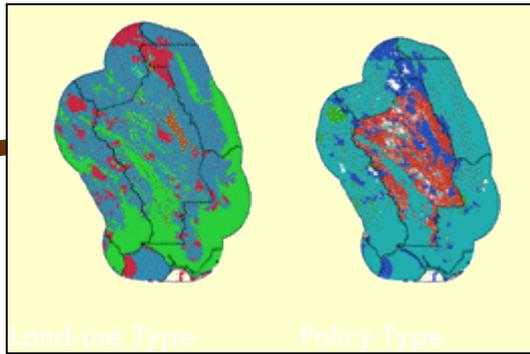


- ArcGIS 10.x extension
- \$4M+ investment
- Endowment for ongoing development and support
- Broad multi-objective applications with conservation focus
- Available tech support and training

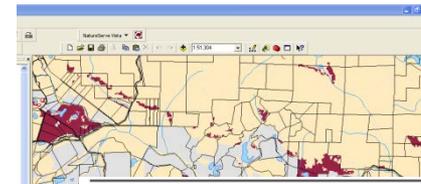
What Does Vista Help You Do?

- Organize and visualize **spatial data**
- Incorporate **expert knowledge**: species and ecosystems are more than just colors on a map. Vista incorporates important scientific data into the GIS process
- Create a more **rigorous analysis** by incorporating concepts such as goals, species viability, landscape condition and land-use policy
- **Explore** sub-regions within your area of analysis
- Define a variety of land-use **scenarios and evaluate** their ability to support species and ecosystems
- **Create alternatives** at a site specific level
- Explore the effects of **changes in policy or conditions** (zoning, climate change, etc)
- Work with **other tools** to support more in-depth analyses (e.g., aquatics, offsite mitigation, optimization, etc.)

Vista Supported Analytical Process



Scenario Outputs
baseline, buildout,
trends, alternatives



Evaluation
Maps &
Reports

Distribution		Protected and Compatible	
Name	Area (hectares)	Goal Met	Percent of goal
Caribbean wet montane forest- Sierra Palm alliance	11,965.95	1 2,481 hectares	1 167.33%
Caribbean wet montane forest- Palo Colorado alliance	3,713.49	1 762 hectares	1 469.46%
Caribbean seasonal evergreen submontane-lowland forest (young secondary)	97,270.47	1 10,862 hectares	1 10.06%
Caribbean wet submontane lowland forest (young secondary)	1,877.22	1 9,482 hectares	1 0.77%
Caribbean montane submontane karst forest (young secondary)	15,690.96	1 0 hectares	1 100%
Caribbean montane wet serpentine woodland (young secondary)	1,001.25	1 0 hectares	1 100%
Caribbean lowland moist serpentine woodland (young secondary)	1,951.38	1 0 hectares	1 100%
Caribbean lowland dry semideciduous forest (young secondary)	19,810.44	1 7,283 hectares	1 27.81%
Caribbean lowland dry riparian woodland and forest	1,231.2	1 1,229 hectares	1 7.62%
Caribbean lowland dry limestone semideciduous forest (young secondary)	3,919.32	1 0 hectares	1 100%
Caribbean lowland dry limestone semideciduous forest	10,679.4	1 8,500 hectares	1 35.99%
Caribbean floodplain forest (young secondary)	11,768.58	1 0 hectares	1 100%
Caribbean coastal dry evergreen forest	1,007.78	1 196 hectares	1 32.1%

Element Goals

Element Properties - Mediterranean California Dry Mes

Goal: 0 sq. meters

80% of sq. meters

100% of Occurrence

90% of sq. meters

80% of Occurrences

80% of sq. meters

Apply

Reset to

Maintain Primarily for Natural Values

Biodiversity

Natural area

Unknown sp

Maintained Primarily

Low intensity

Intensely managed

Low-density

Unknown sp

Utilized Primarily

Elements, values, & expert knowledge

Site Explorer

Element Name	Total	Protected Area	% Prot	Response	Compatible Area
Insular areas, California Earth and	1.27 ac's	0.72 ac's	1.1%	Incompatible	
Large Montane Pine, Upland	1,381 ac's	1.55 ac's	0.1%	Incompatible	
Central California Riparian Woodland and	229 ac's	1.6%	0.7%	Incompatible	
California Annual Grasslands Alliance	4,752 ac's	1.55 ac's	0.3%	Incompatible	
Central Valley Grasslands Alliance	425 ac's	6.4%	1.5%	Compatible	
Northwest California Woodland and	744 ac's	7.7%	1.0%	Incompatible	
Central Valley Mixed Oak Savanna	2,739 ac's	3.3%	0.1%	Incompatible	
Southern Riparian Woodland	75 ac's	2.7%	3.6%	Incompatible	
Open Grasslands Chaparral	581 ac's	8.9%	1.5%	Incompatible	
Northwestern California Riparian	940 ac's	1.6%	0.2%	Incompatible	

Screen Composition

Layers: Land Use, Policy Type, sq. meters

Apply

Review

Override: Natural area recreation, Non-use

Ecological conservation

Unknown specific natural use

Low intensity working land

Intervally managed working landscapes

Low-density development

Unknown specific working/occupational use

Mitigation & alternative scenario development

Generate Conservation Solution

NatureServe VISTA

Welcome to the Protection Solution Wizard

Generate Conservation Solution

Solution Generation Tool

<Select solution generator>

MAR-PAN

<Describe MAR-PAN>

[Link to MAR-PAN website](#)

<Describe SPOT>

[Link to SPOT website](#)

Optimized spatial solution generation via interoperating tools

Example Projects



Patrick Crist

Pat Comer

Joe Tague

Ian Varley

Jacque Bow

Sandra Brewer

Mark Coca

NV NHP

Plus

Agency reviewers



YALE FRAMEWORK PROJECT - NATURESERVE

Biodiversity Without Boundaries,
Portland 04/26,2012

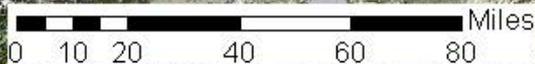
Pilot BLM Field Offices



Project Boundary

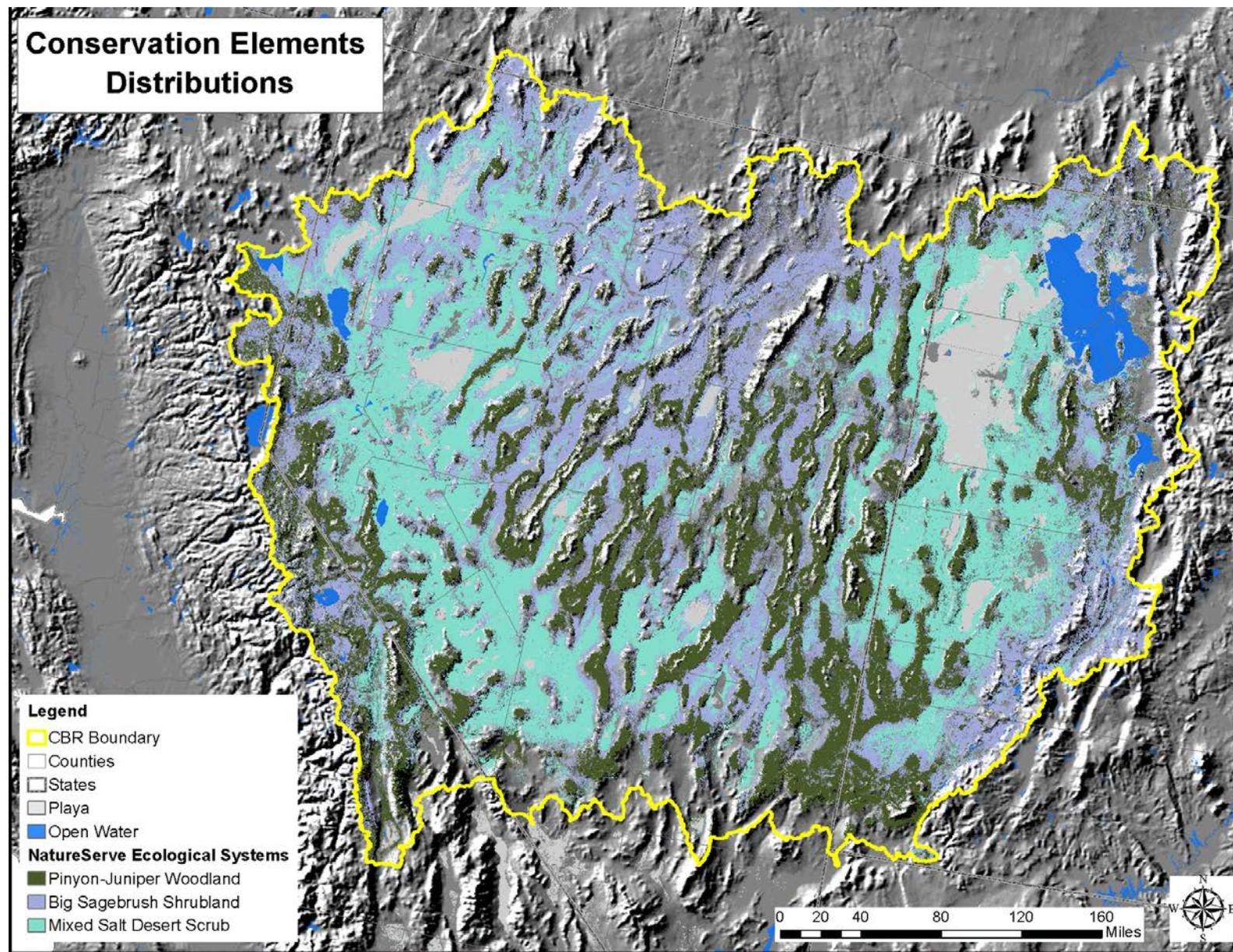
Issues

- Invasive grasses
- Altered fire regime
- Observable climate changes on vegetation condition and distribution
- Proposed renewable energy projects
- Proposed extensive new transmission corridors

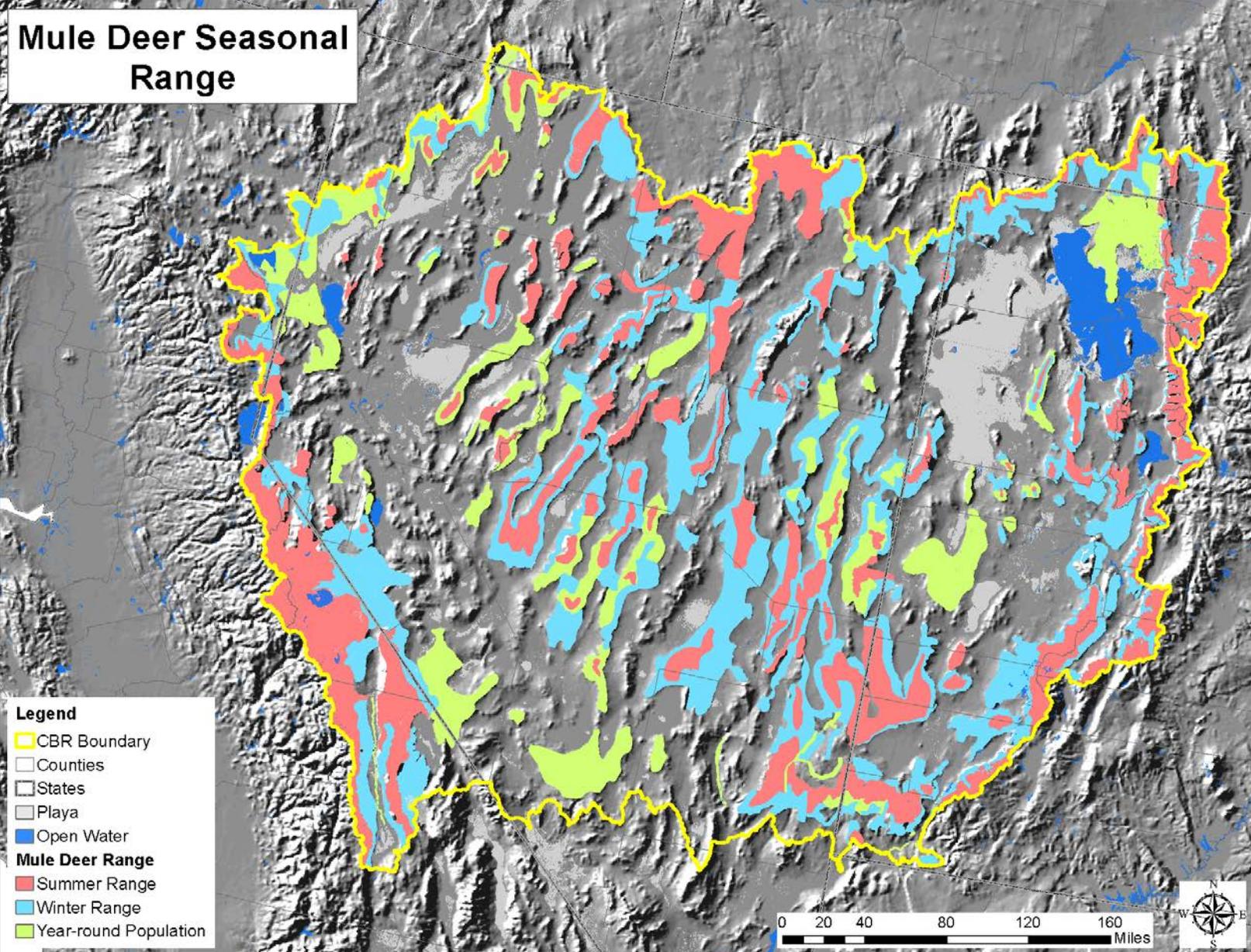


Las Vegas

Element Inputs: Ecosystems (n=26)



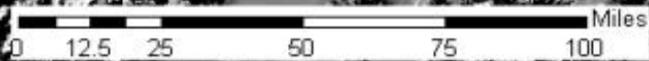
Landscape Species (n=28)

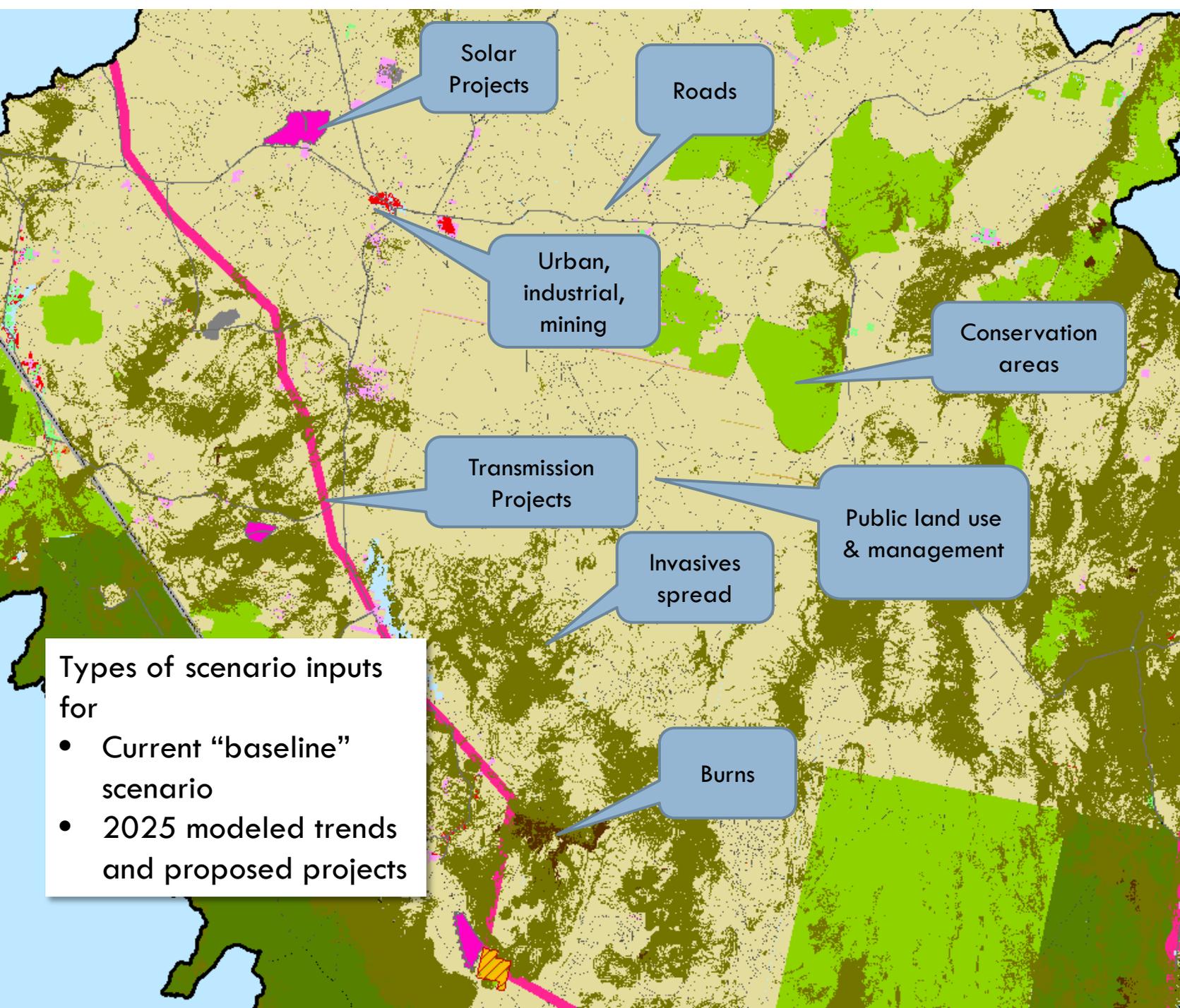


Pinyon-Juniper Woodland



Climate envelope
example:
Where will species
adapted climate
exist in the future?





Solar Projects

Roads

Urban, industrial, mining

Conservation areas

Transmission Projects

Public land use & management

Invasives spread

Burns

Types of scenario inputs for

- Current “baseline” scenario
- 2025 modeled trends and proposed projects

Forecasting Cumulative Effects

Overall Scenario Performance

All Elements (44 Total)

	Goals Met For	% of Goals Met	Goals Unmet For	% of Goals Unmet
Compatible	0 elements	0%	44	100%



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Goal Performance by Element

Elements (44 elements)

Name	Distribution Area (acres)	Occs	Avg Condition	Compatible Goal Met	Compatible Area (acres)	Occs	Avg Condition	Percent of goal
North American Warm Desert Wash	369,930	15296	0.79	100 percent of area	N 237,543	10839	0.81	64.21%
Sand Dunes Sand Soils Species Assemblage	611,966	176	0.66	100 percent of area	N 258,346	51	0.67	42.22%
Gypsum Soils Species Assemblage	128,281	88	0.64	100 percent of area	N 52,612	34	0.62	41.01%
Yellow billed Cuckoo	62,165	20	0.72	100 percent of area	N 35,472	14	0.77	57.06%
Maricopa Tiger Beetle	208,433	6	0.62	100 percent of area	N 105,779	5	0.68	50.75%
Merriam's Kangaroo Rat	562,079	8	0.6	100 percent of area	N 282,188	8	0.65	50.2%
Mule Deer - Winter Range	3,120,876	26	0.78	100 percent of area	N 2,020,562	23	0.8	64.74%
Inter Mountain Basins Wash	488,324	4836	0.81	100 percent of area	N 340,520	3821	0.82	69.73%
Burrowing Owl	30,178	10	0.75	100 percent of area	N 26,136	10	0.76	86.61%
Inter Mountain Basins Active and Stabilized Dune	1,428	1	0.75	100 percent of area	N 0	0	0	0%
Blaine's Pincushion	41	2	...	100 percent	N 0	0	0	0%

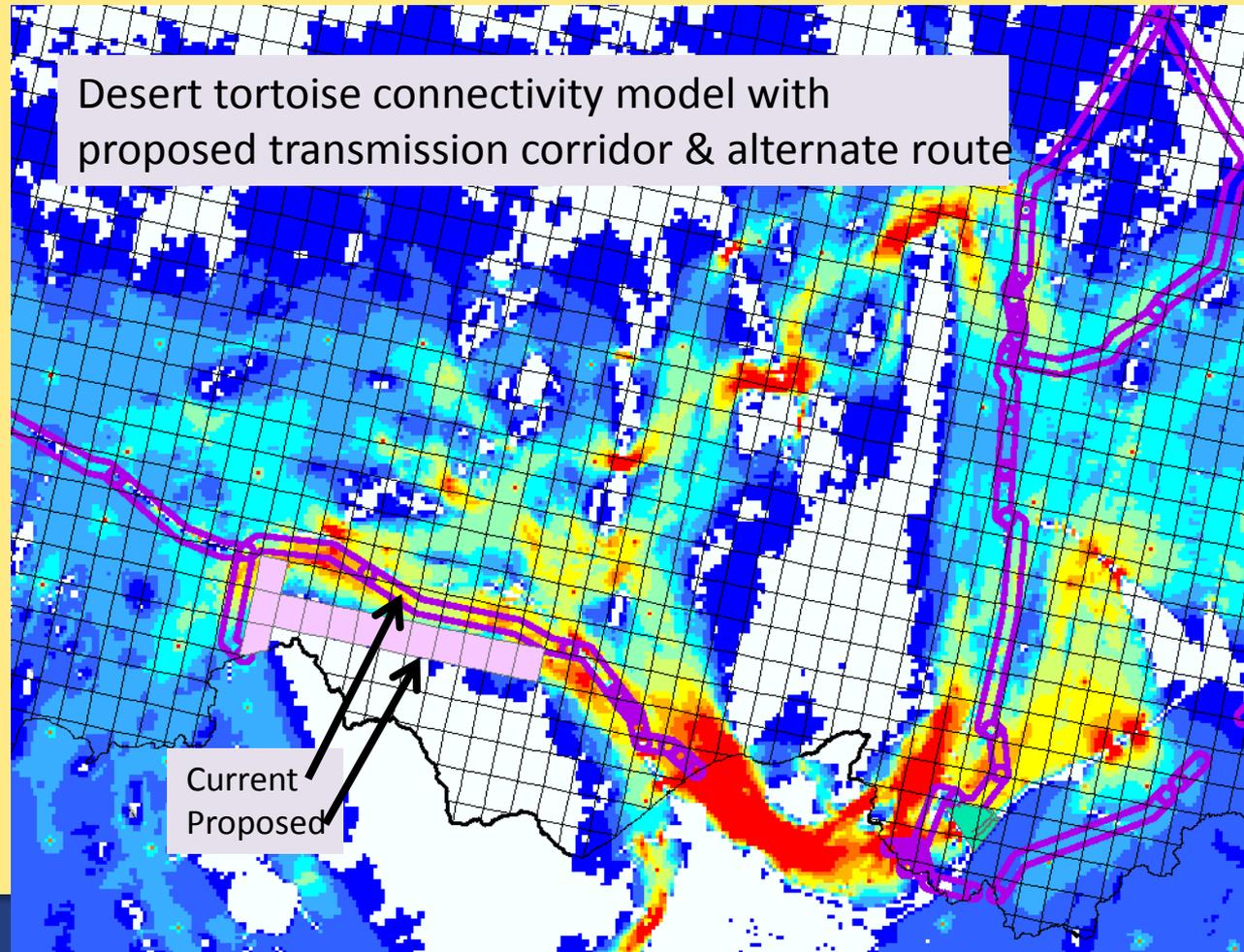
Vista Scenario Evaluation
2025 scenario
all consequences
element

Avoid current high value areas

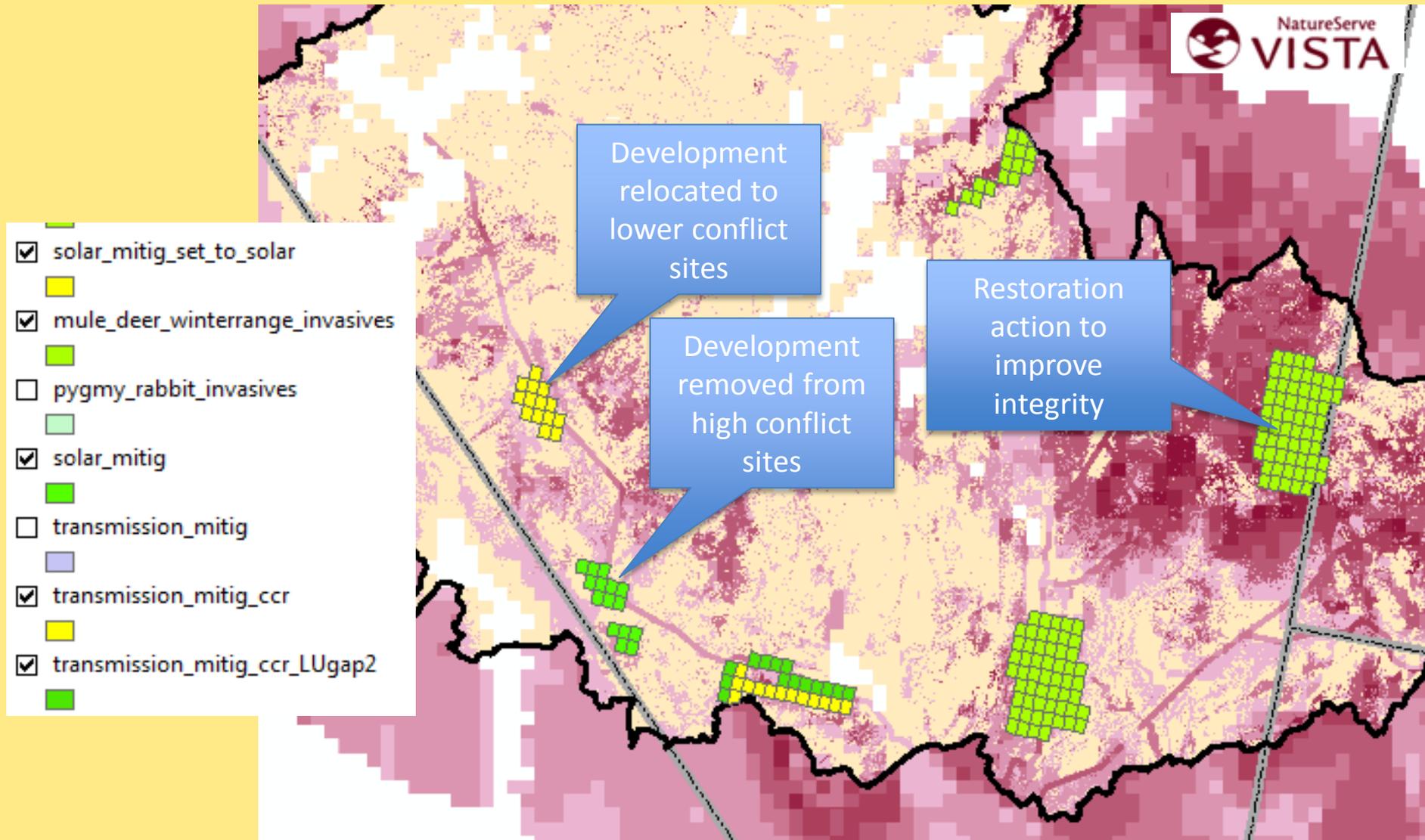


Planned transmission corridor to serve renewable energy

- Planned transmission corridor to serve renewable energy
- Intersects current high value areas & refugia concentration areas
- Mitigation/adaptation proposal reduces current conflicts and future refugia concentration area conflicts



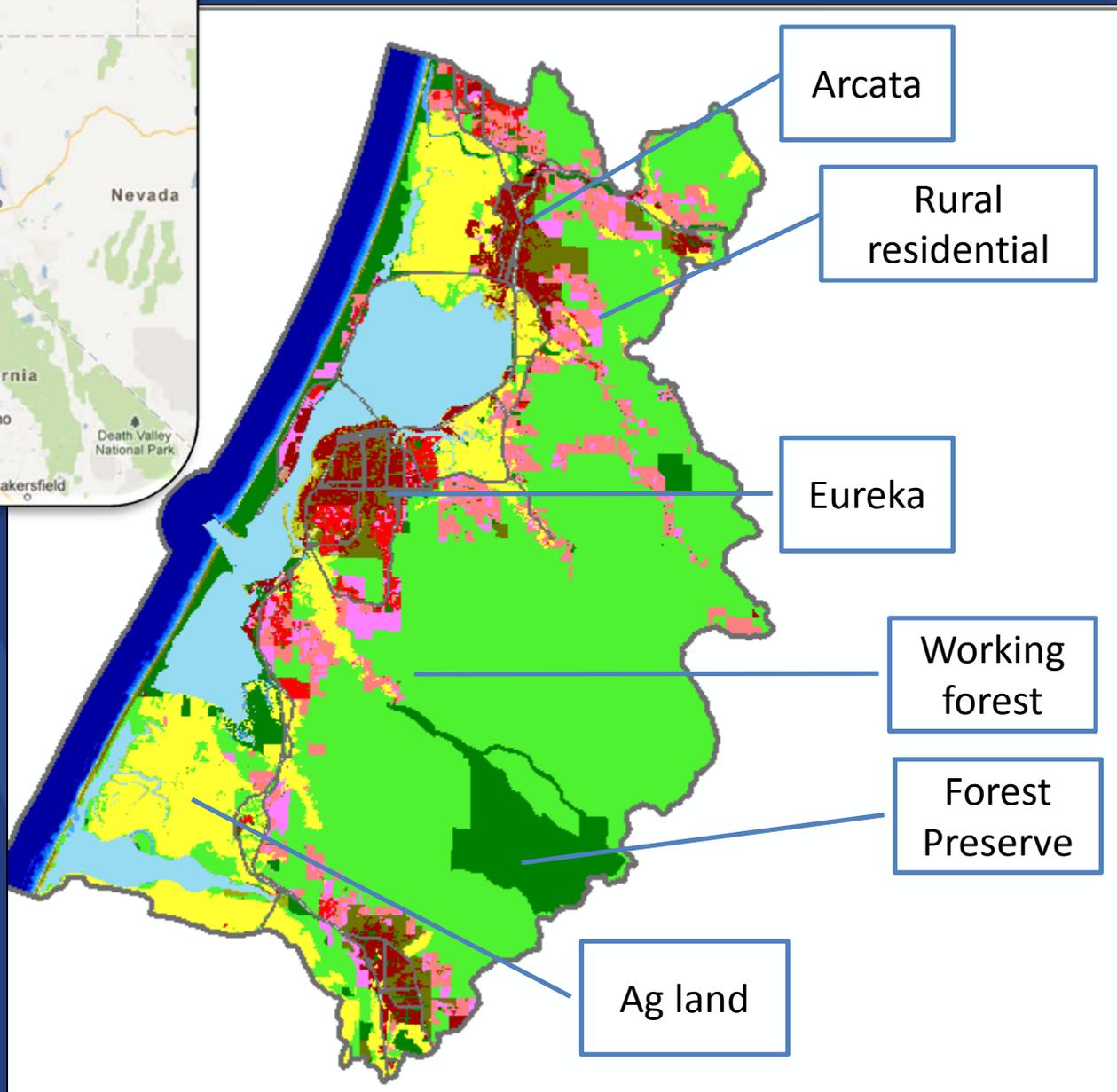
Avoid current high value areas



Humboldt Bay Initiative

Live Demonstration

w/ other examples from the Sheldon/Hart
Mountain NWR



Key questions to demonstrate

- What might happen to habitats and development under climate change?
- What might be maladaptive adaptations
- What would be better adaptations?

Overall Scenario Performance

All Elements (32 Total)

	Goals Met For	% of Goals Met	Goals Unmet For	% of Goals Unmet
Compatible	0 elements	0%	32	100%

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Goal Performance by Element

Elements (32 elements)

Name	Distribution Area (acres)		Avg Condition	Goal Met	Compatible Area (acres)		Avg Condition	Percent of goal
	Occs				Occs			
Western snowy plover	1,383.02		3 ₁	100 percent of area	N	538.8	3 ₁	38.96%
Tidewater goby	350.83		3 ₁	100 percent of area	N	270.19	2 ₁	77.01%
Sandy beach tiger beetle	390.14		1 ₁	100 percent of area	N	265.9	1 ₁	68.15%
Point Reyes birds beak	654.05		9 ₁	100 percent of area	N	229.34	9 ₁	35.07%
Pink sand verbena	406.3		12 ₁	100 percent of area	N	115.15	11 ₁	28.34%
Humboldt bay wall flower	806.98		6 ₁	100 percent of area	●	736.73	6 ₁	91.29%
Humboldt bay owl clover	3,408.29		16 ₁	100 percent of area	N	1,842.29	15 ₁	54.05%
Green sturgeon	11,605.1		1 ₁	100 percent of area	●	10,821.79	1 ₁	93.25%
Coastal cutthroat trout	9,378.58		12 ₁	100 percent of area	N	6,632.42	12 ₁	70.72%
NPMMW Douglas fir Western Hemlock Forest	2,814.35		1 ₁	100 percent of area	●	2,590.33	1 ₁	92.04%
North Pacific Hypermaritime Sitka Spruce Forest	2,983.58		1 ₁	100 percent of area	N	1,655.8	1 ₁	55.5%
Critical habitat chinook salmon	847.8		1 ₁	100 percent of area	N	429	1 ₁	50.6%
California Coastal Redwood Forest	101,377.7		1 ₁	100 percent of area	●	92,417.4	1 ₁	91.16%
Beach Sand	1,988.7		1 ₁	100 percent of area	N	417.35	1 ₁	20.99%
North Pacific Maritime Coastal Sand Dune and Sand	90.85		2 ₁	100 percent of area	N	22.13	2 ₁	24.35%

Current
Evaluation

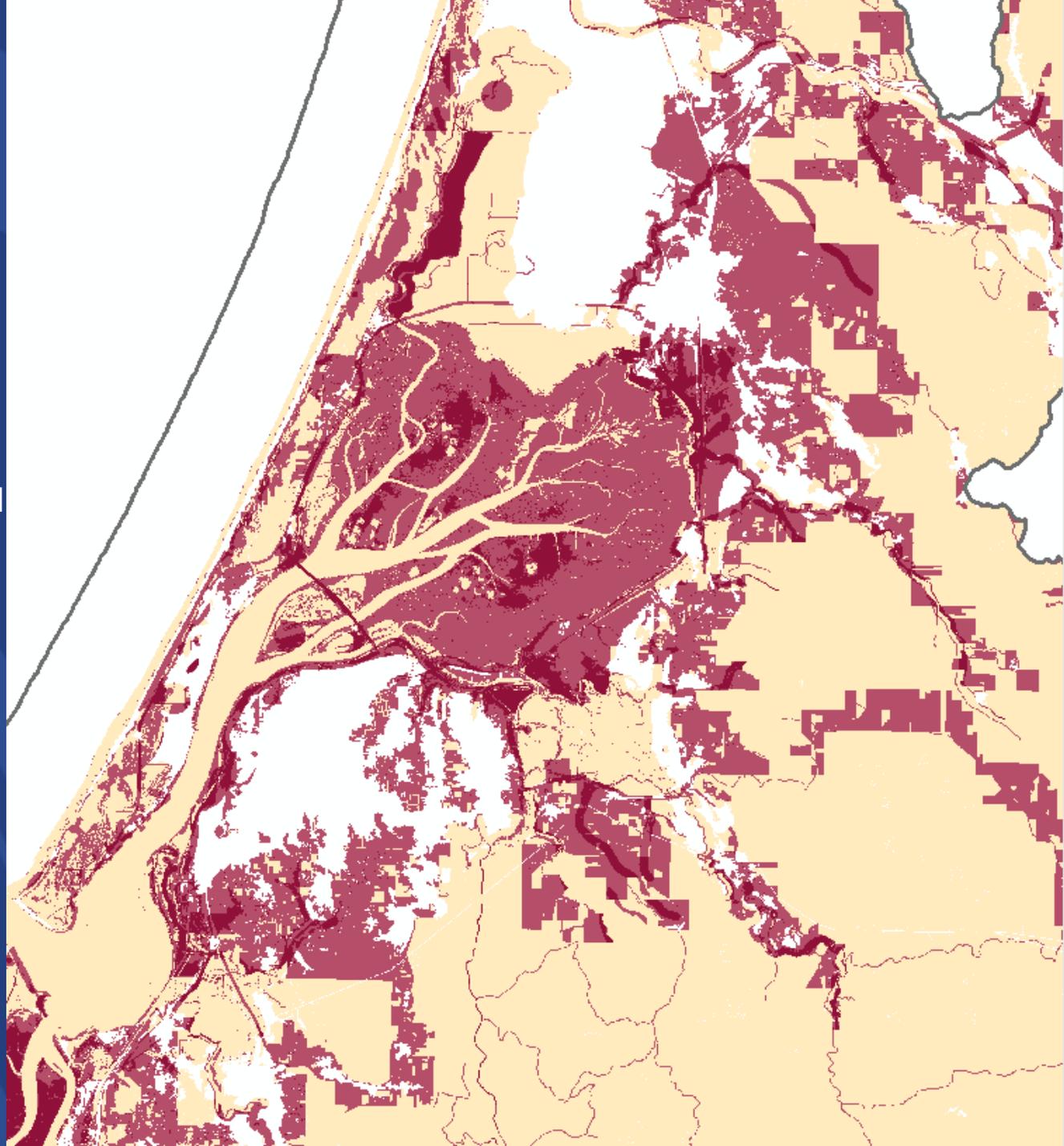
Many or
legacy of

- Low foot
- Agric
- Fore
- Bay

2M SLR Scenario Evaluation

Numerous systematic impacts
cumulative with increased
development

- Inundated areas impact development, agriculture, and terrestrial habitats and wetlands
- Increased bay depth impacts aquaculture and estuarine habitats
- Existing development impacts ability of inundated areas to provide new habitat



Vista Site Explorer tool used to investigate sites and propose alternatives

- This site preferred: no conservation elements present, no existing development, flexible land uses

Map - ArcInfo

Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:35,053

Drawing

Arial 10 B I U A

NatureServe Vista Layer: Elevation Grid (raster) Editor

Site Explorer

Future 2m SLR
Scenario Evaluation
Site Layer site_grid3_100m_subset

Selection Attributes

FID: Options ... Help
FID: Report
FID: Less <<

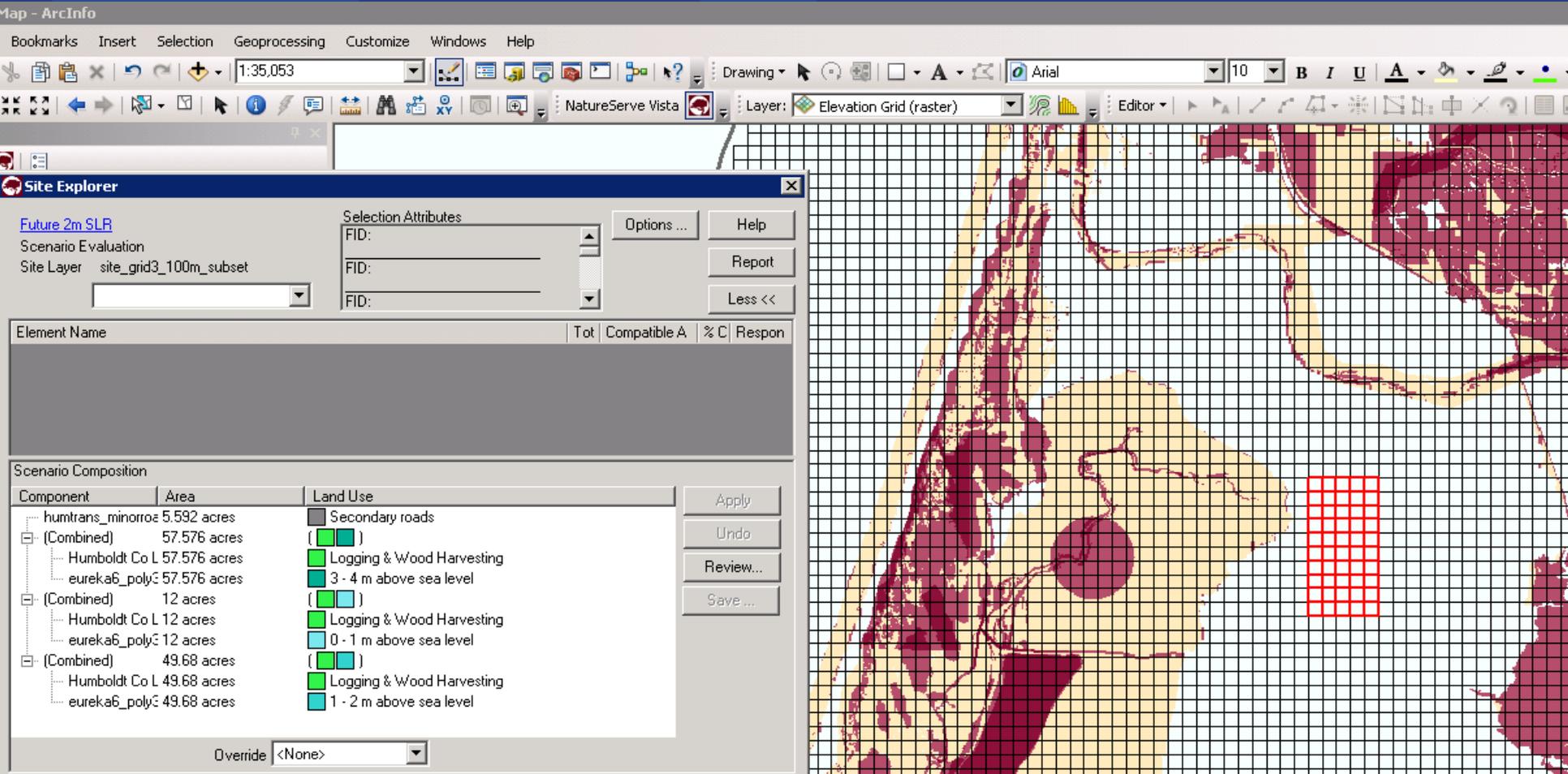
Element Name	Tot	Compatible A	% C	Respon
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Scenario Composition

Component	Area	Land Use
humtrans_minorroz	5.592 acres	Secondary roads
(Combined)	57.576 acres	([Green] [Green])
Humboldt Co L	57.576 acres	[Green] Logging & Wood Harvesting
eureka6_poly2	57.576 acres	[Green] 3 - 4 m above sea level
(Combined)	12 acres	([Green] [Blue])
Humboldt Co L	12 acres	[Green] Logging & Wood Harvesting
eureka6_poly2	12 acres	[Blue] 0 - 1 m above sea level
(Combined)	49.68 acres	([Green] [Blue])
Humboldt Co L	49.68 acres	[Green] Logging & Wood Harvesting
eureka6_poly2	49.68 acres	[Blue] 1 - 2 m above sea level

Apply
Undo
Review...
Save...

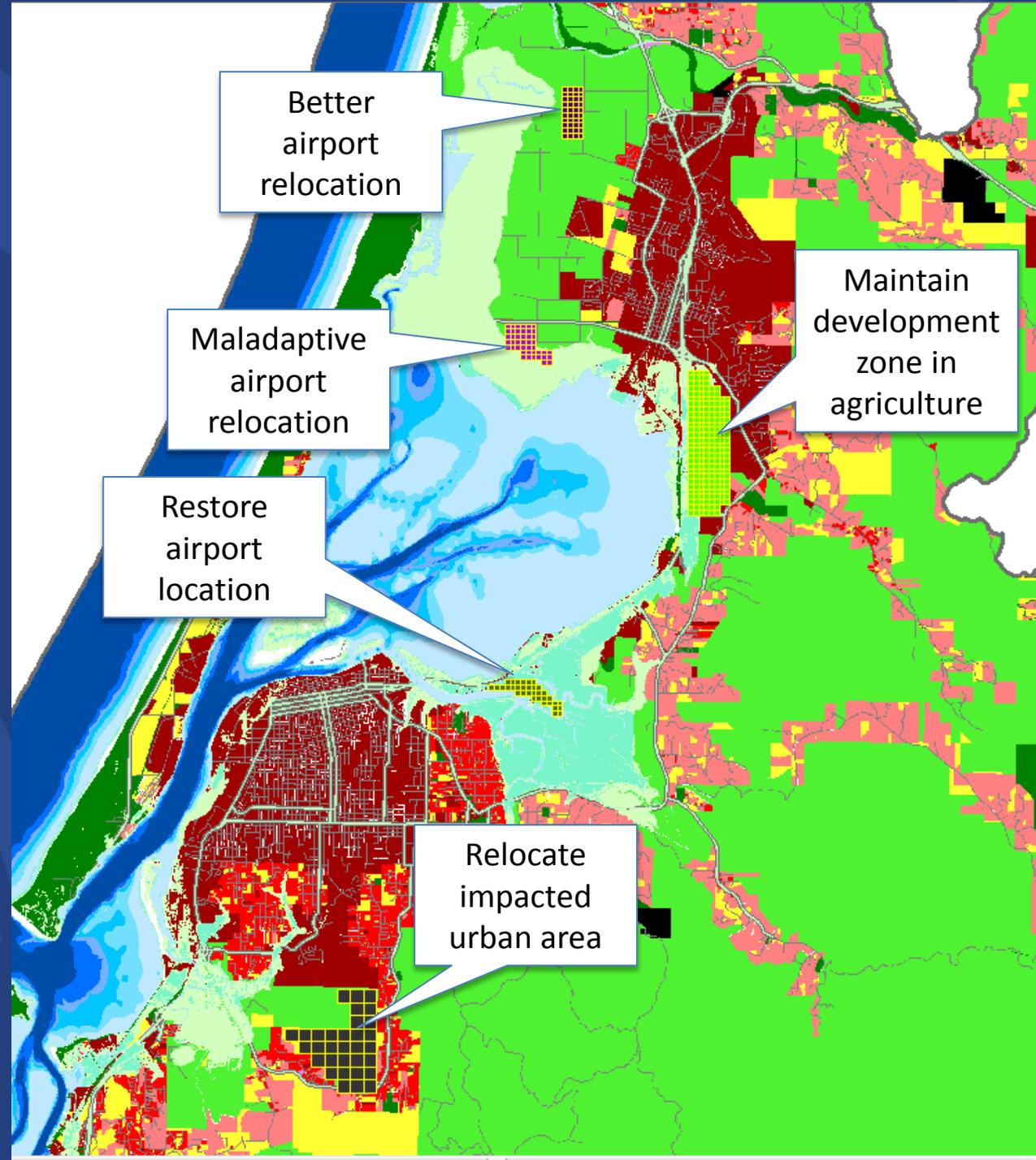
Override <None>



Mitigation Scenario

Examples of key adaptation strategies for SLR

- Impacted airport, urban, industrial relocated for long term viability
- Plan for restoration of impacted development sites after relocation
- Maladaptive options avoided
- Threatened areas zoned for development maintained in agriculture to allow future estuarine habitat



Some Conclusions

- A toolkit approach is necessary and has been demonstrated feasible in multiple contexts
- Testing for maladaptive responses can be relatively straightforward
- Dealing with fine scale effects and extreme events are still significant challenges