EXECUTIVE SUMMARY – CHAPTER 8: FUTURE SCENARIOS AND ANALYSIS

In Phase I of the original proposal (16 February 2006), it is stated that a major emphasis of the research is to, "construct a decision-oriented process that provides a planning structure for this and future BLM analysis regarding land disposal." This process should be developed as a platform for the analysis and synthesis of decisions regarding future land disposal areas for the BLM. The research team considers it important to keep the process as flexible as possible by insuring that it is independent of location, content and scale. In addition, the process should have the flexibility and capacity to discover, through various analysis, new alternative futures and assessment areas not initially defined in this or future work.

The fundamental conceptual approach in alternative future planning includes two important activities they are; 1) the establishment of assessment metrics or models and; 2) the development of alternative scenarios. The assessment issues are determined through stakeholder meetings, public surveys and scoping sessions. These biophysical and cultural issues are further researched in order to understand their various characteristics and to identify what data are needed in order to represent them. There are two fundamental types of assessment models- environmental and land-use. In this work the primary assessment metrics which the team has developed are 1) populations of rare plant species (buckwheat and poppy habitat); 2) paleontological resources (fossil substrate and paleo-points); 3) a landscape representative of the Mojave Desert (the assessment metrics on vegetation). It should be clear that the assessment metrics can be used for the evaluation of any future scenario and in addition, they may represent a constituent part of a proposed alternative future.

The alternative futures have a similar point of origin as the assessment models (metrics) in their identification and description. They may represent areas of interest in either the environmental or land-use realm. In all cases the researchers provide an array of 3-6 scenarios in order to examine a spread of development opportunities ranging from those which may be reasonably permissive to those that are more restrictive in their scope and content.

The various futures are compared with the assessment models in order to gage their performance in meeting the issues identified earlier. It is the most fundamental means to determine which of the futures are more appropriate than others. Additional and more detailed metrics and modeling techniques can be enjoined at the assessment and/or the future levels so that the potential for addressing special needs or sensitivities can be addressed. The versatility and adaptive capacity of alternative futures modeling represents an effective decision making planning strategy for those individuals developing land-use policy.

A major objective of this deliverable was to design a user friendly framework for the development of alternative scenarios which would also meet the concerns of the diversity of stake-holders in the area. To achieve this, the team developed a modular approach which utilizes a series of individual components that can be combined to create the scenarios. The modules encompass four categories of change in which the alternatives can be efficiently constructed based on the selection of components

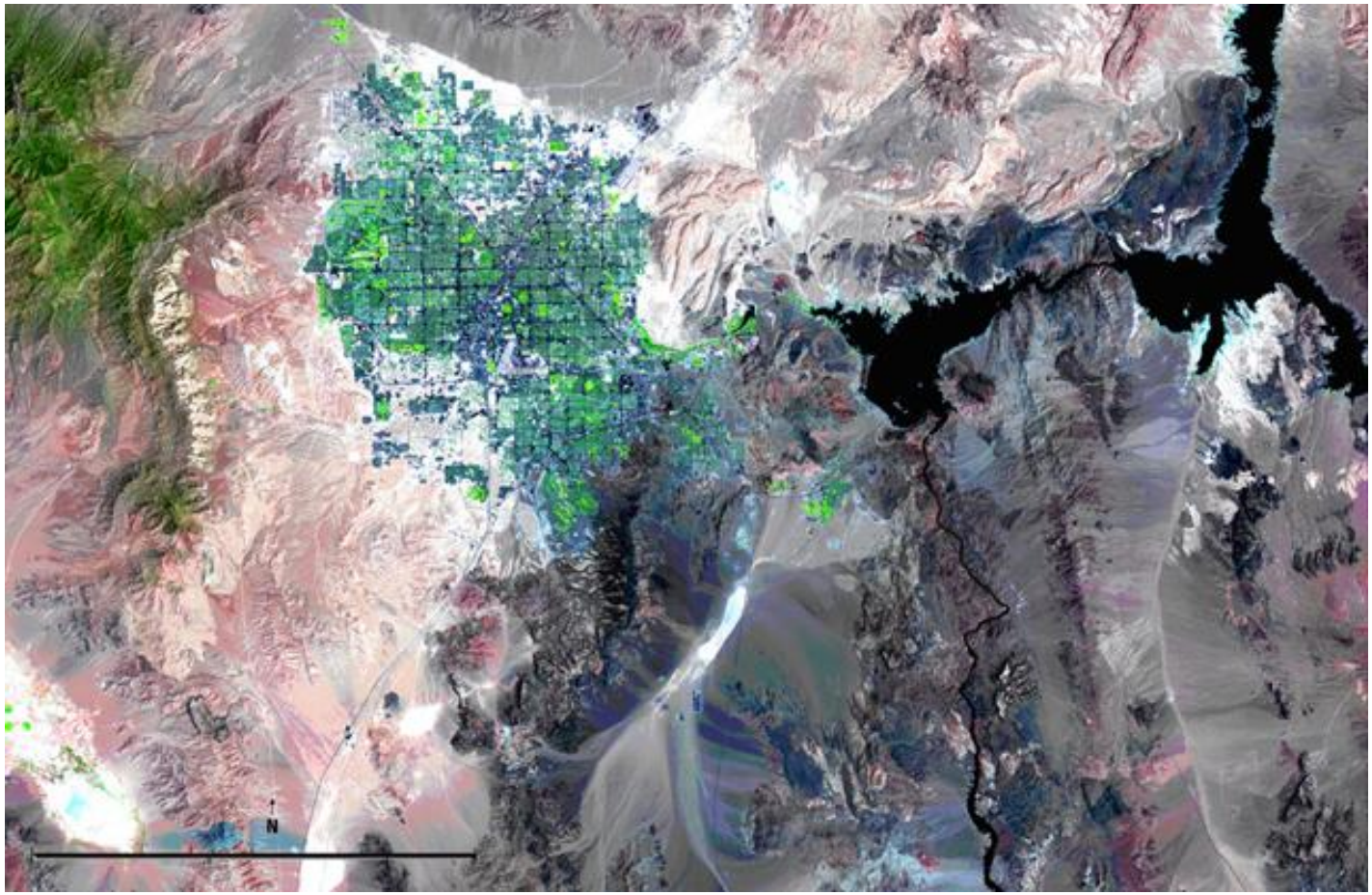
within the four categories. The four categories are: 1) The Las Vegas Paiute Indian Reservation buffer; 2) the Northwest portion of the Upper Las Vegas Wash; 3) the Recreation and public purpose lands adjacent to Floyd Lamb Park; 4) and the southeast portion of the Upper Las Vegas Wash. Each category presents a series of components that represent the concerns of stakeholders ranging from minimum conservation to maximum conservation. For the purpose of an example, the research team developed four scenarios to display the extremes of maximum conservation or minimum conservation. The other two scenarios represent the Conservation of Paleontological Resources, and the Mojave Desert Vegetation Conservation. Each of these scenarios are displayed individually with their associated assessment metrics. In order that the alternative futures can be examined more closely, each of the futures and their assessments are displayed as a group so that decision makers can review their performance in a comparative manner. It is the feeling of the research team that the process represents an affective planning tool for future evaluation of conservation transfer areas by the Bureau of Land Management.

22 Sept. '08- RET

Analysis of Alternative Future Scenarios

Upper Las Vegas Wash
Conservation Transfer Area

Las Vegas Valley



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Alternative Future Scenarios

- Modular Approach
  - Four Spatial Components
    - Paiute Indian Reservation
    - Northwest Upper Las Vegas (ULV) Wash
    - Recreation and Public Purpose (RPP) Lands
    - Southeast Upper Las Vegas (ULV) Wash
  - Multiple options under each component

Alternative Future Scenarios

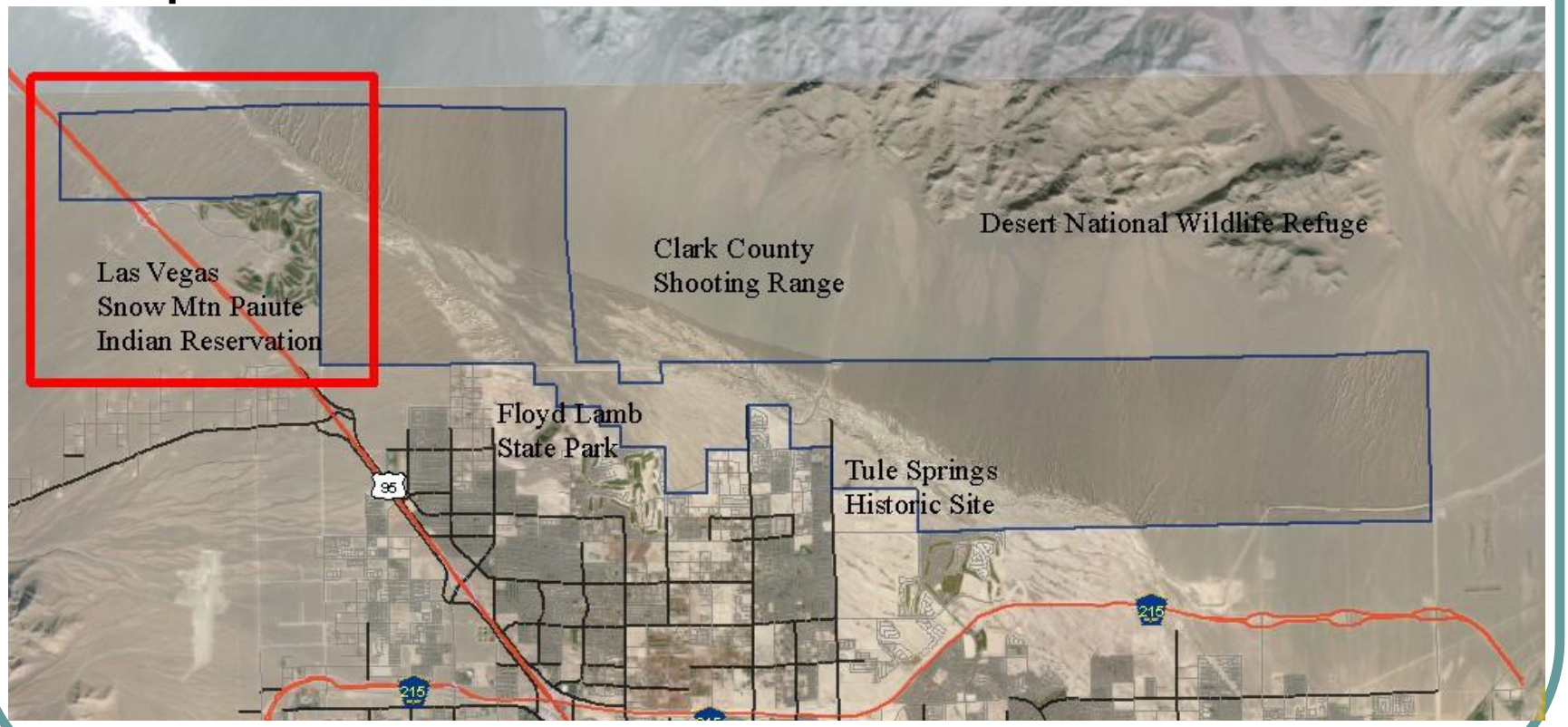
- Provides a systematic framework that permits the efficient construction of alternative future scenarios
- Allows components to be evaluated independently or collectively using assessment metrics

Decision-Oriented Process

- Establish assessment metrics based on objectives
- Construct alternative futures scenarios using modular approach
- Evaluate alternative futures scenarios with assessment metrics
- Stakeholders can select appropriate scenarios for management objectives

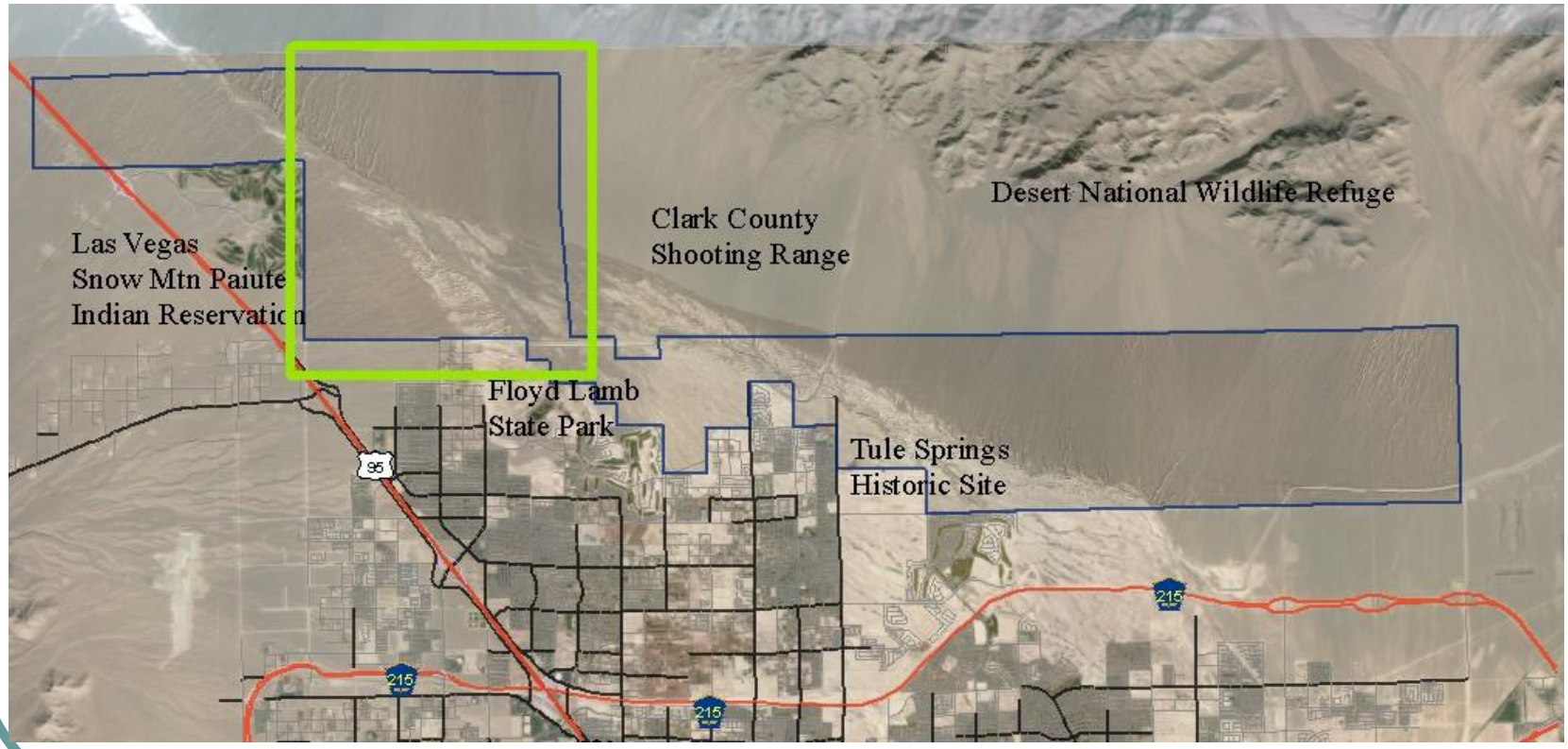
Alternative Futures Components

Component A – Paiute Indian Reservation



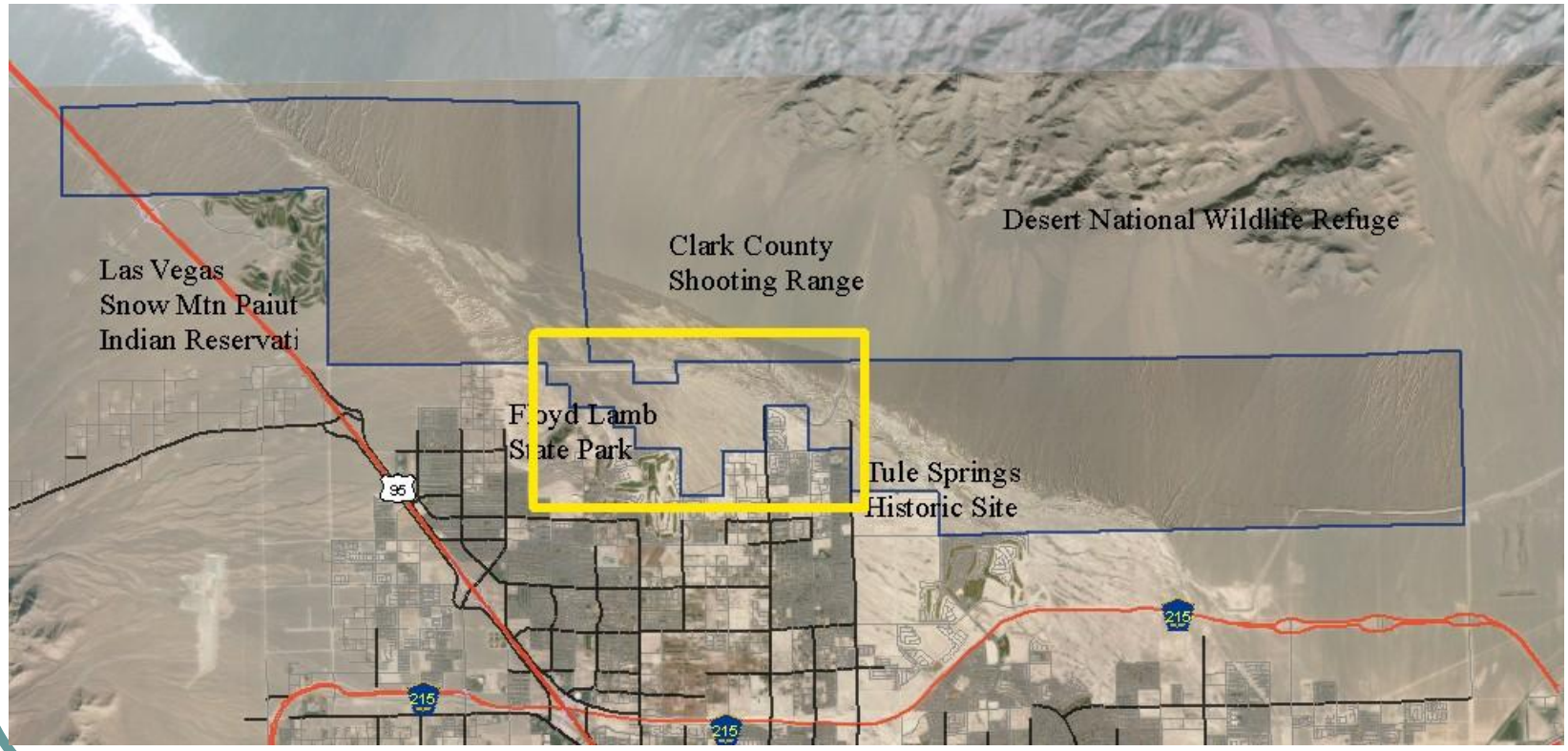
Alternative Futures Components

Component B – Northwest ULV Wash



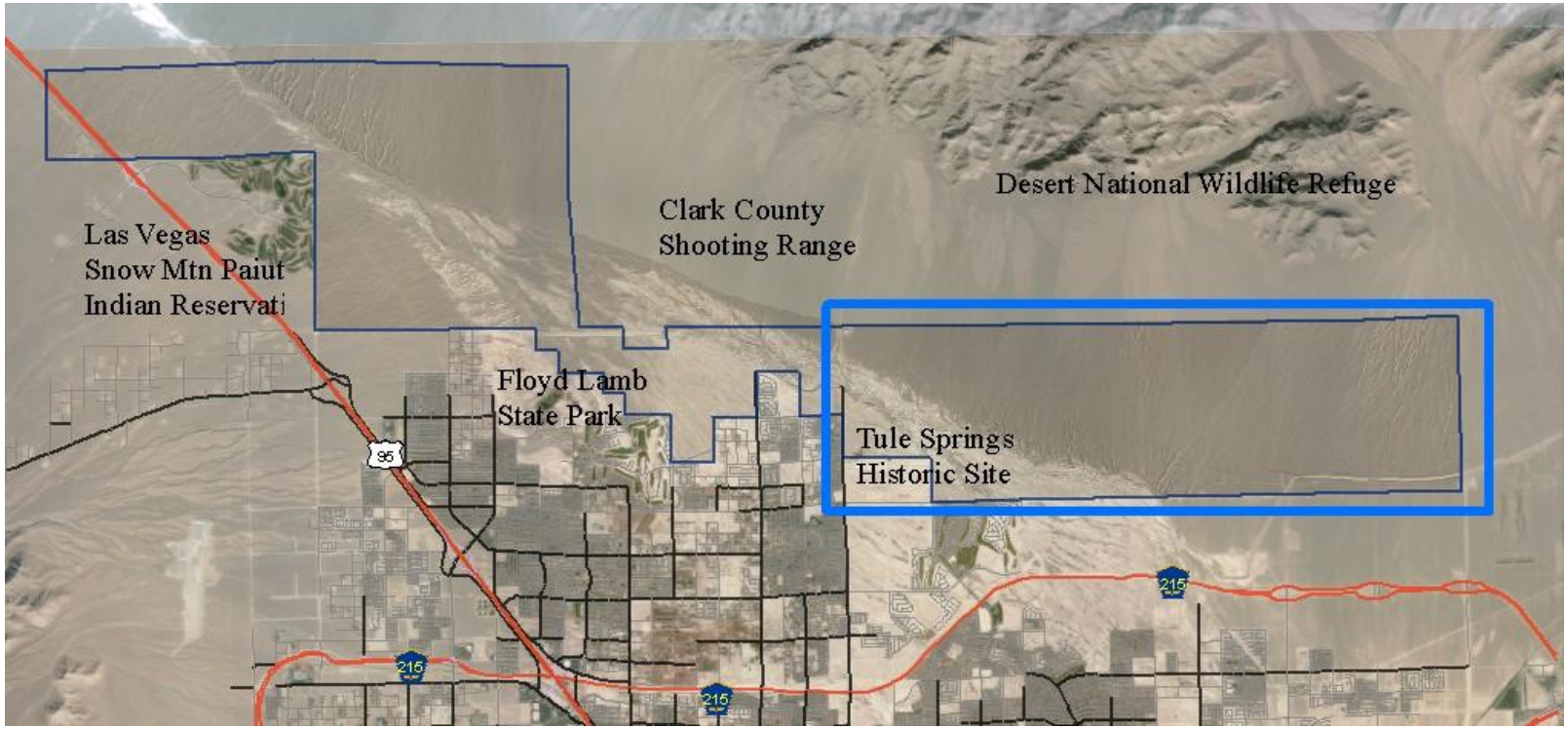
Alternative Futures Components

Component C – RPP Lands



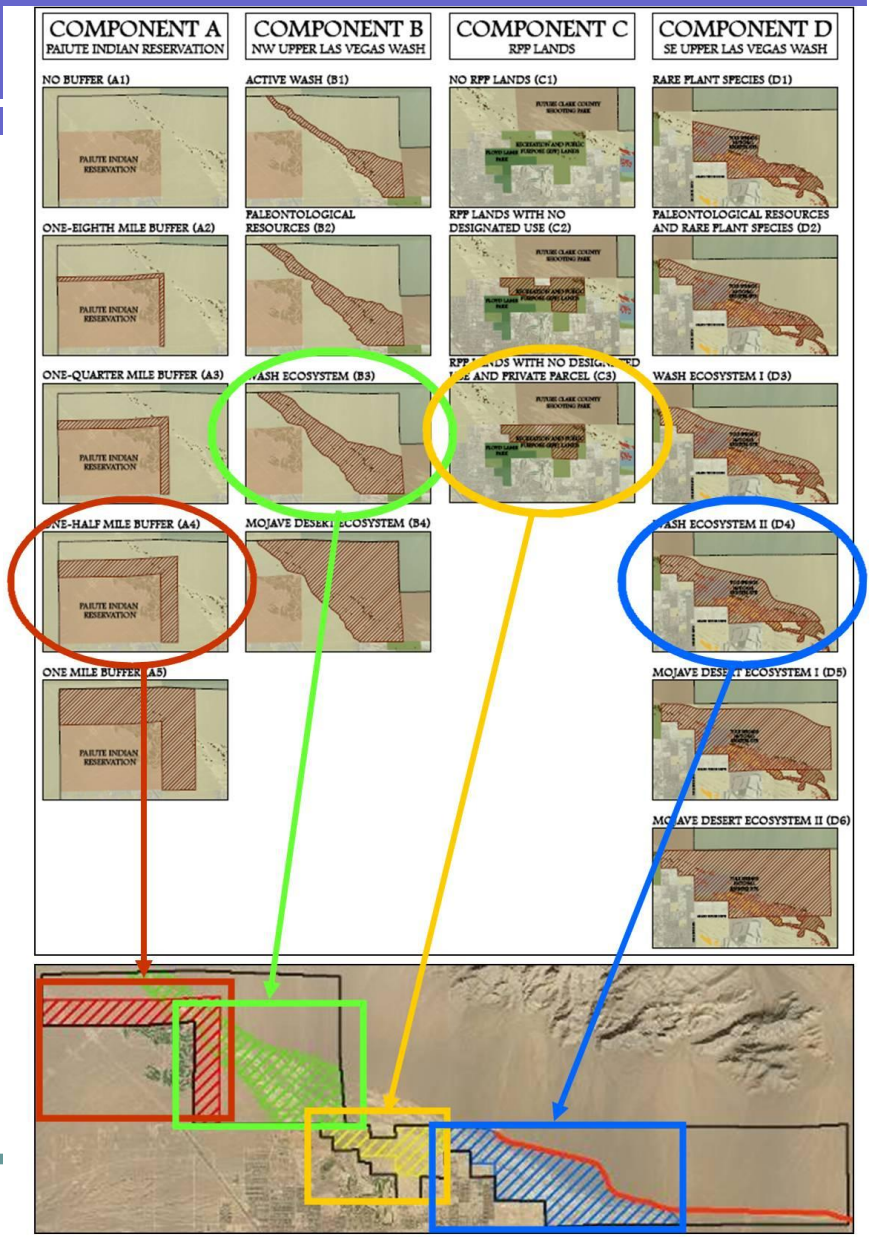
Alternative Futures Components

Component D – Southeast ULV Wash



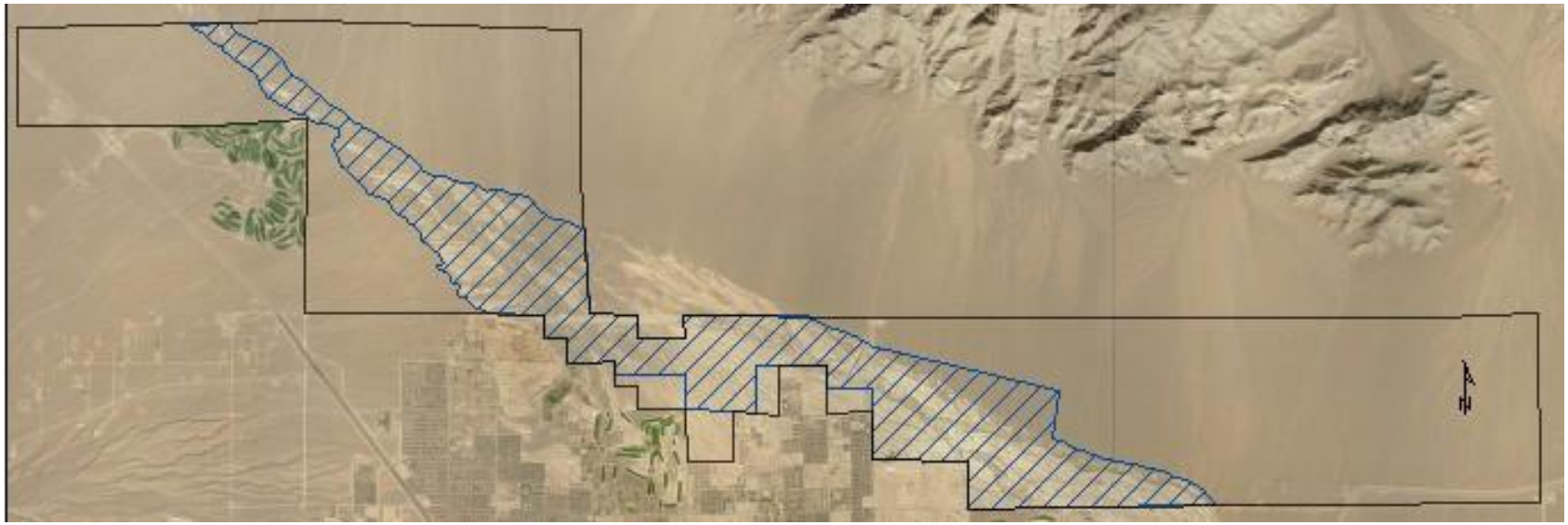
Sample Alternative Future Scenario

- One option chosen from each component
- Sub-components assembled into alternative future scenario
- A4, B3, C3, and D4



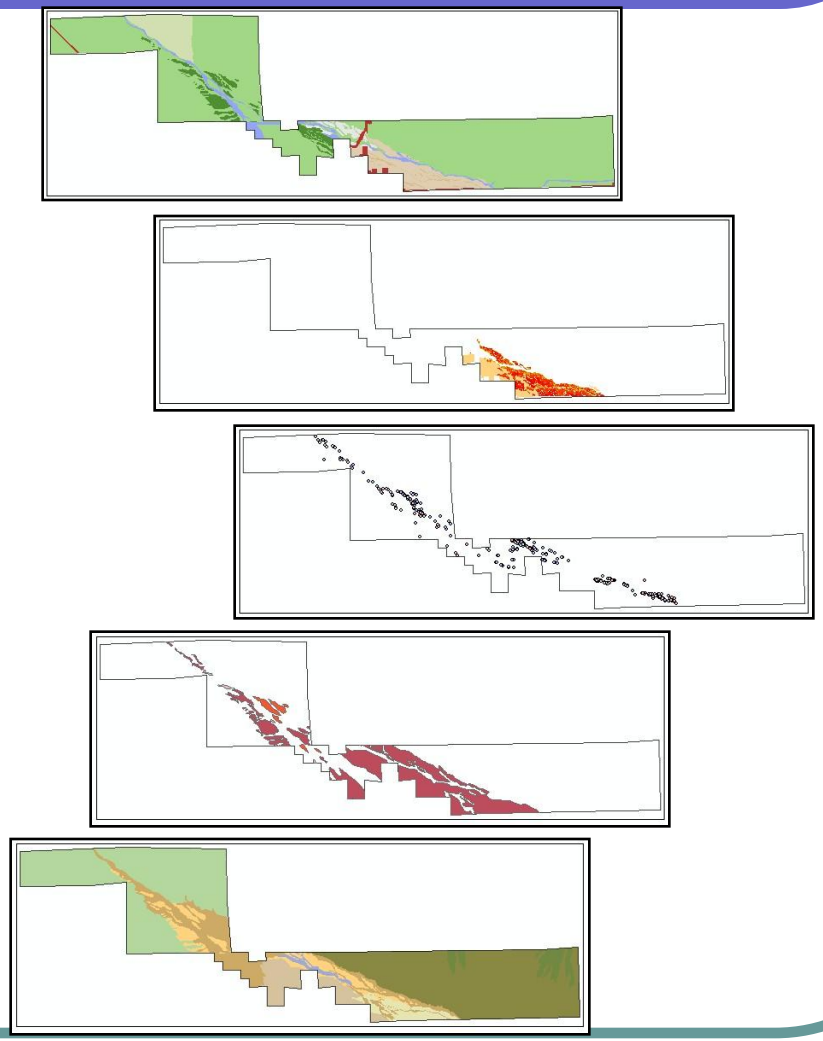
Sample Alternative Future Scenario

Composite Scenario (A4, B3, C3, and D4)



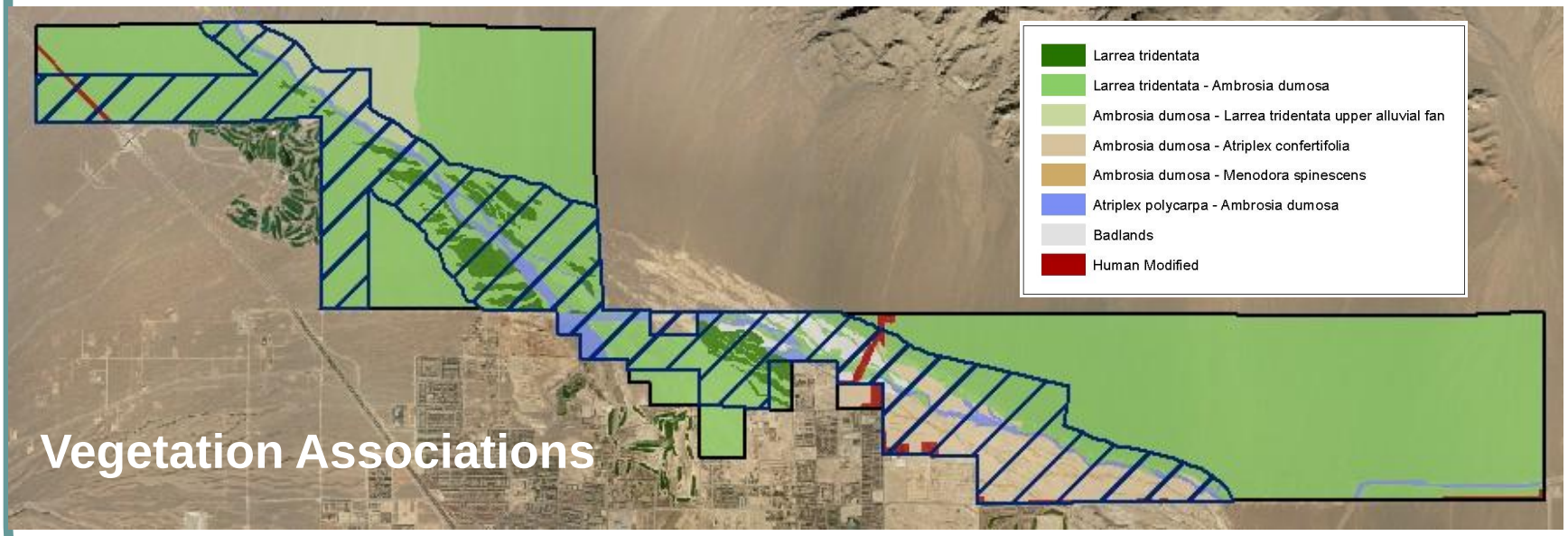
Assessment Metrics

- Vegetation
- Rare Plant Habitat
- Fossil Locations
- Fossil-bearing geologic types
- Soil Types



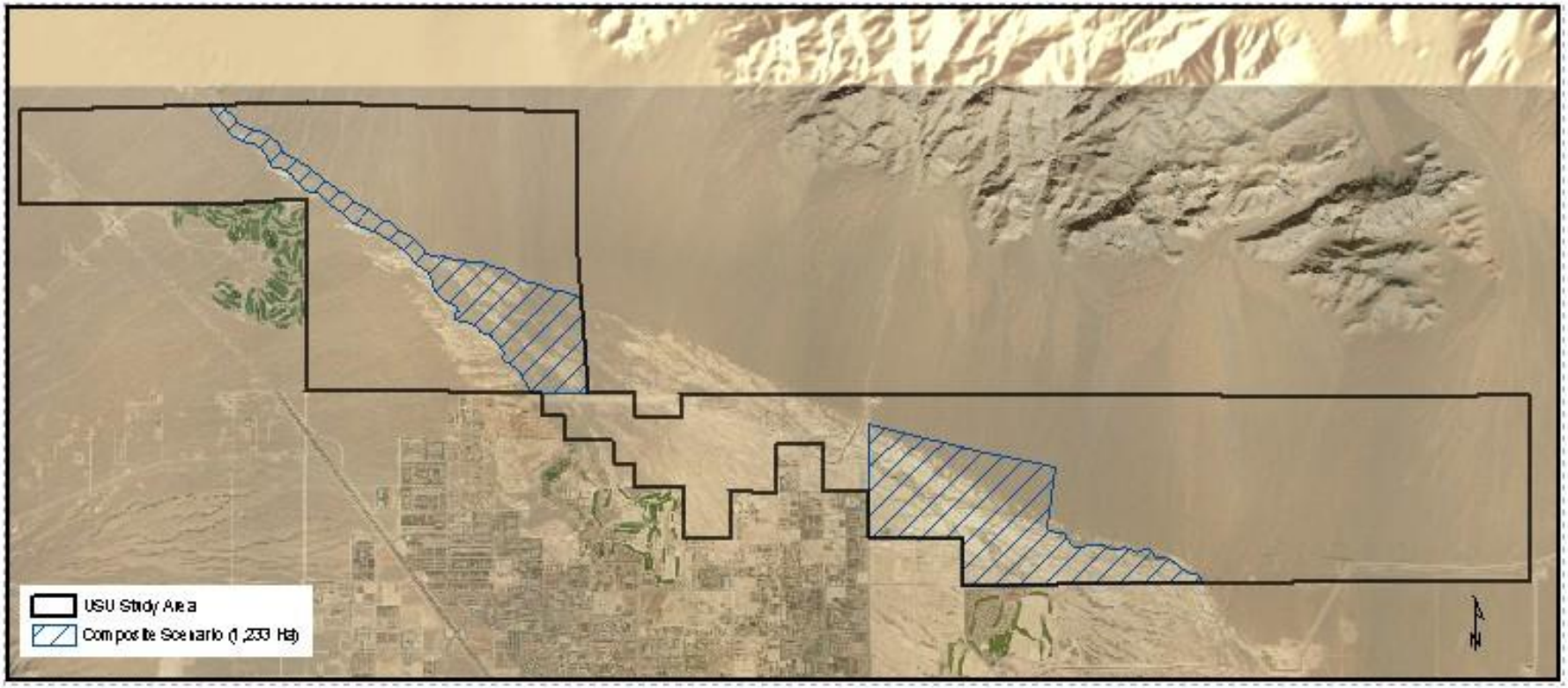
Sample Alternative Future Scenario

Scenarios are assessed against metrics using spatial analysis techniques

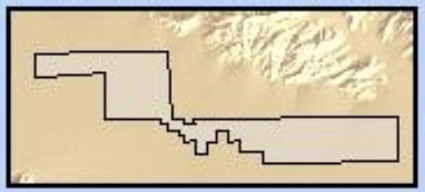


Alternative Futures Assessment Metrics

Minimum Conservation - 1,233 Hectares (3,046 Acres)

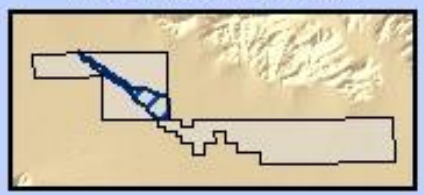


Paiute Indian Reservation



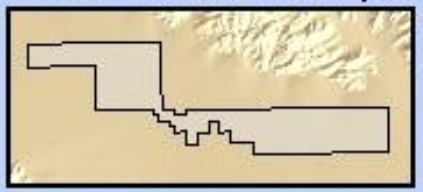
(A1) No Buffer

Northwest ULV Wash



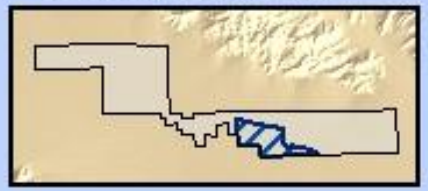
(B1) Active Wash

Recreation & Public Purpose



(C1) No Rpp Lands

Southeast ULV Wash



(D1) Rare Plant Species

Sample Alternative Future Scenario

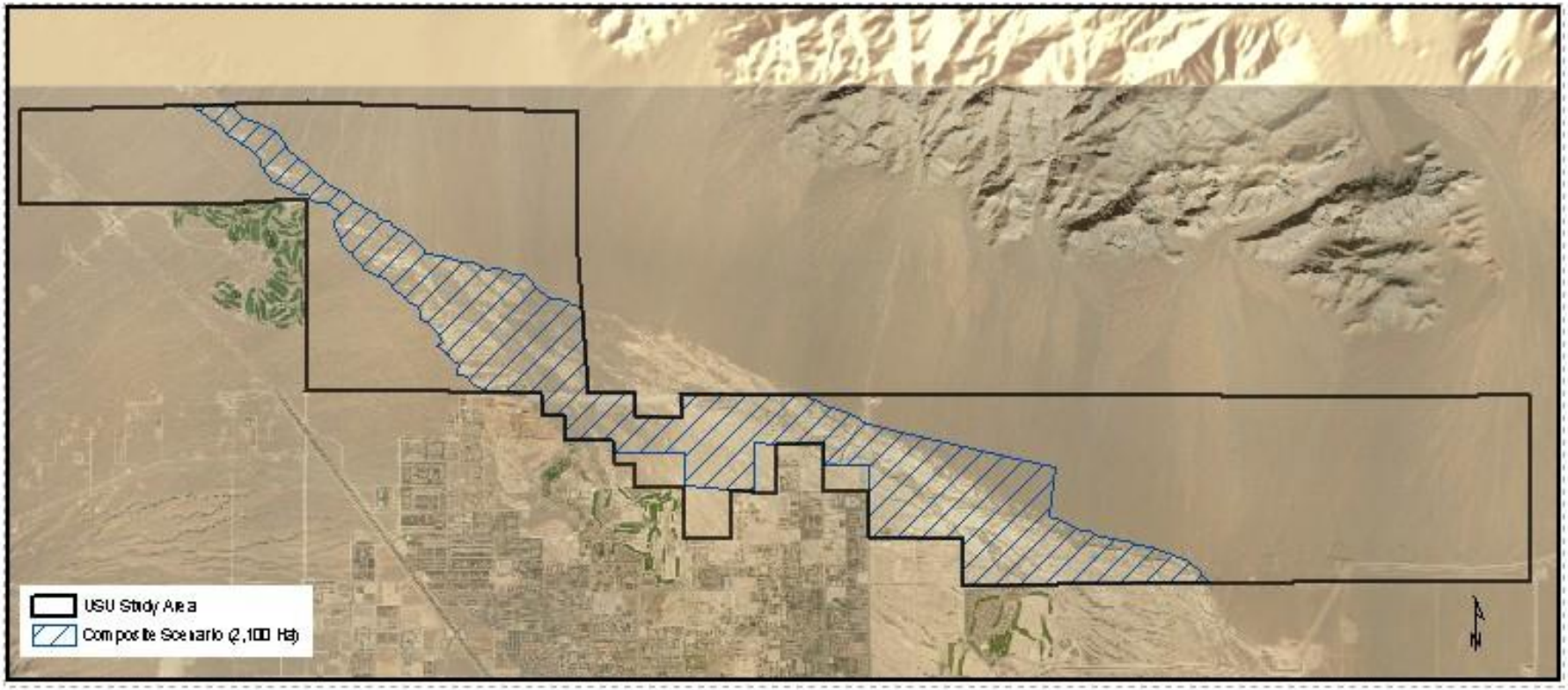
Scenario Results

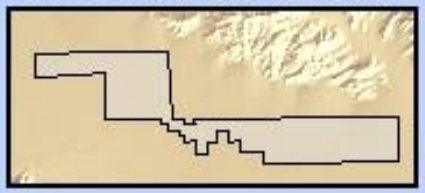
Resource Type	Category	Protected Area (ha)	Developed Area (ha)	% Protected
Rare Plant Habitat	75-100%	153	0	100
	50-75%	129	0	100
Fossil Substrate	Fossil Bearing Soil	142	969	87
Paleo Points	Artiodact	2	0	100
	Asssorted	1	0	100
	Bison	3	0	100
	Camel	8	0	100
	Equid	10	0	100
	Lagomorph	1	0	100
	Large Mammal	282	0	100
	Mammoth	74	0	100
	Medium Mammal	6	0	100
	Rodent	3	0	100
	Small Mammal	1	0	100
	Unknown	33	0	100

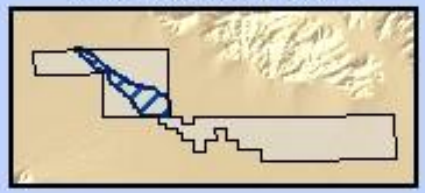
Resource Type	Category	Protected Area (ha)	Developed Area (ha)	% Protected
Soil	Arizo	68	0	100
	Badland	433	0	100
	Dalian-McCullough	817	49	94
	DeStazo	290	143	67
	Las Vegas	229	0	100
	Weiser	1325	1365	49
	Weiser-Goodspring	58	173	25
	Weiser-Wechech	2365	80	97
Vegetation Symbol	LARTRI-AMBDUM	4092	1724	70
	LARTRI	266	20	93
	ATRPOL-AMBDUM	223	22	91
	AMBDUM-ATRCON	423	22	95
	AMBDUM-LARTRI	386	0	100
	AMBDUM_MENSPI	42	0	100
	Badlands	94	0	100
	Human Modified	61	20	75

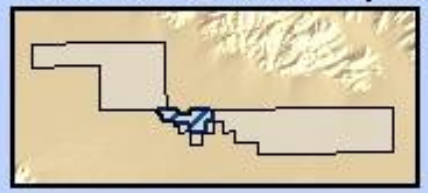
Alternative Futures Assessment Metrics

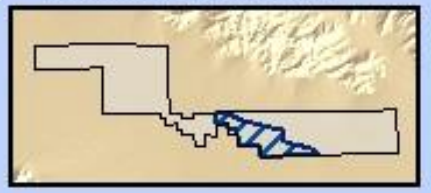
Paleontological Resources - 2100 Hectares (5,189 Acres)





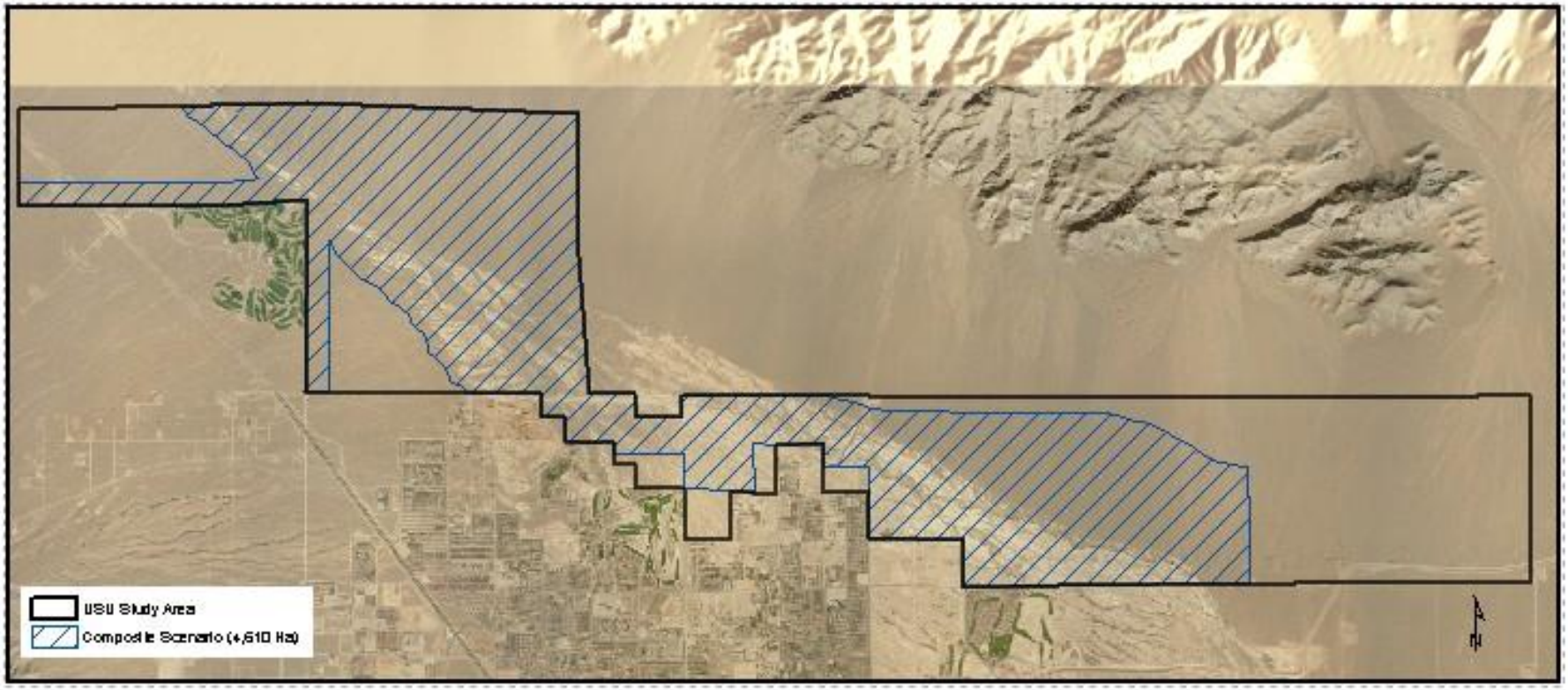






Alternative Futures Assessment Metrics

Mojave Desert Vegetation Conservation - 4,610 Hectartes (11,391 Acres)



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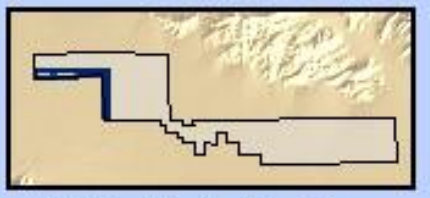
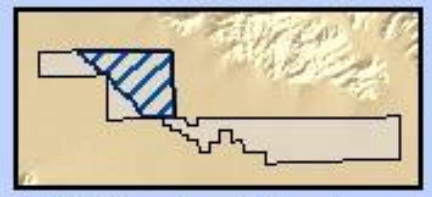


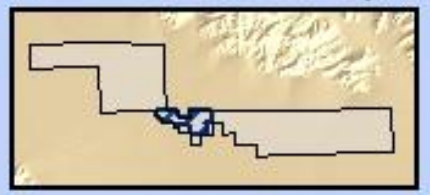
(A3) One-Quarter Mile Buffer

Northwest ULV Wash



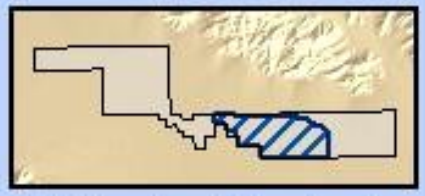
(B4) Mojave Desert Ecosystem

Recreation & Public Purpose



(C2) Rpp Lands

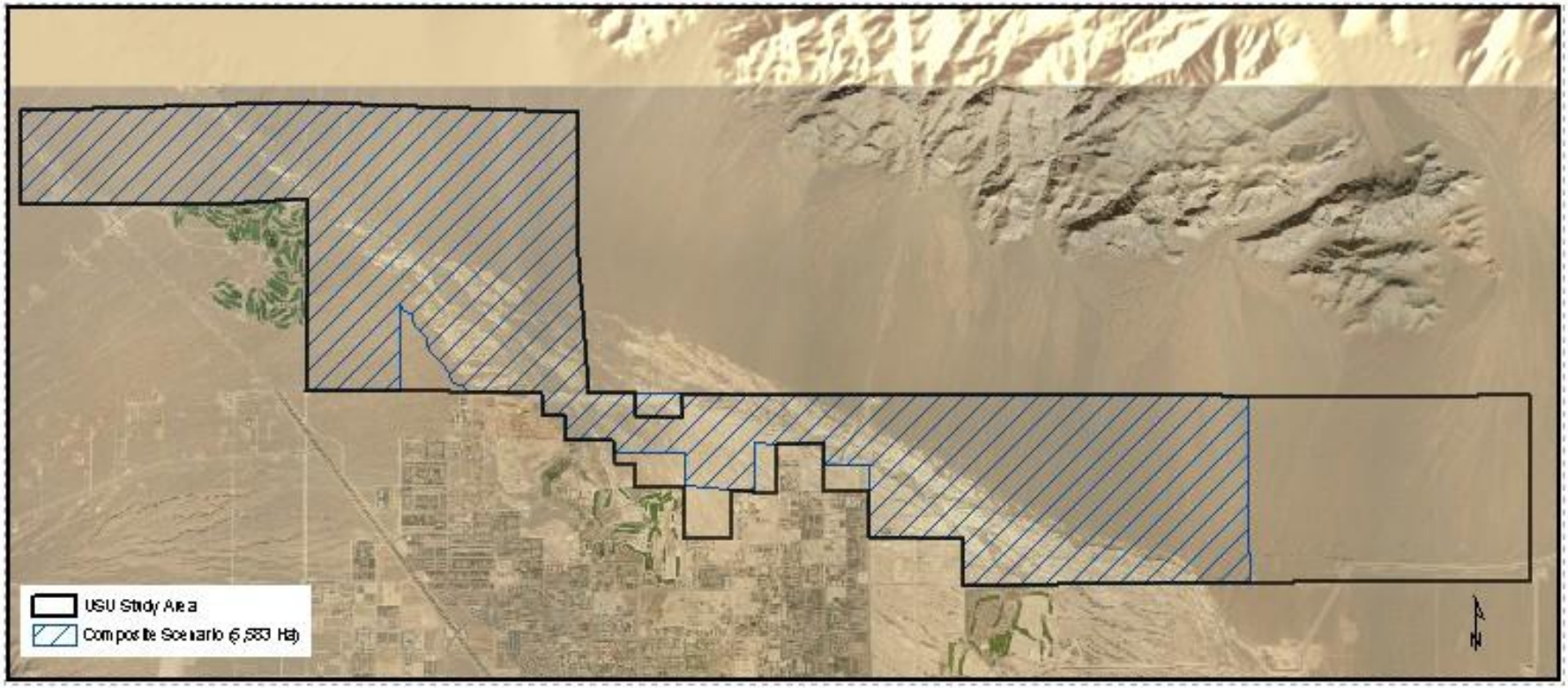
Southeast ULV Wash



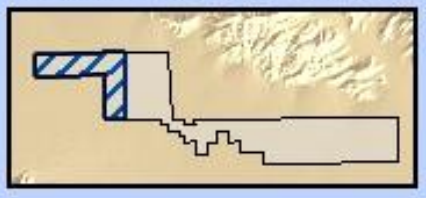
(D5) Mojave Desert Ecosystem I

Alternative Futures Assessment Metrics

Maximum Conservation - 5,583 Hectares (13,796 Acres)

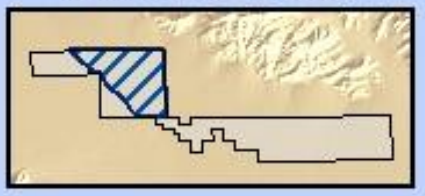


Paiute Indian Reservation



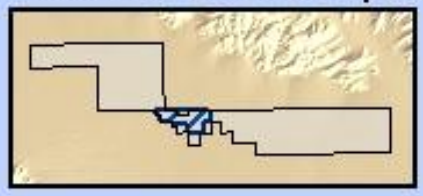
(A5) One Mile Buffer

Northwest ULV Wash



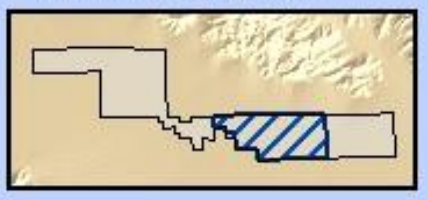
(B4) Mojave Desert Ecosystem

Recreation & Public Purpose



(C3) RPP Lands and Private Parcel

Southeast ULV Wash



(D6) Mojave Desert Ecosystem II

Alternative Future Scenarios Analysis

Summary of Alternative Future Scenarios

		Minimum Conservation		Paleontological Conservation		Mojave Desert Vegetation Conservation		Maximum Conservation	
		A1, B1, C1, D1		A1, B2, C2, D2		A3, B4, C2, D5		A5, B4, C4, D6	
	Hectares Protected	1,233.5	16.7	2,100.3	28.4	4,610.6	62.4	5,583.0	75.5
	Hectares Developed	6,160.5	83.3	5,293.7	71.6	2,783.4	37.6	1,811.0	24.5
	Total	7,394.0	100.0	7,394.0	100.0	7,394.0	100.0	7,394.0	100.0
Assessment Metric		**Protected (Ha or #)**	**% Protected**	**Protected (Ha or #)**	**% Protected**	**Protected (Ha or #)**	**% Protected**	**Protected (Ha or #)**	**% Protected**
Rare Plant Habitat	Category1	152.6	99.7	153.1	100.0	153.1	100.0	153.1	100.0
	Category2	128.2	99.7	128.6	100.0	128.6	100.0	128.6	100.0
	Category3	177.6	87.0	182.4	89.3	182.3	89.3	182.4	89.3
	Category4	778.5	11.3	1,536.3	22.3	4,140.6	60.1	5,107.7	74.1
		1,236.8		2,100.2		4,604.5		5,571.7	
Fossil Occurrence	Artiodact	2.0	100.0	2.0	100.0	2.0	100.0	2.0	100.0
	Asssorted	0.0	0.0	1.0	100.0	1.0	100.0	1.0	100.0
	Bison	3.0	100.0	3.0	100.0	3.0	100.0	3.0	100.0
	Camel	7.0	87.5	8.0	100.0	8.0	100.0	8.0	100.0
	Equid	8.0	80.0	10.0	100.0	10.0	100.0	10.0	100.0
	Lagomorph	0.0	0.0	1.0	100.0	1.0	100.0	1.0	100.0
	Large Mammal	151.0	53.5	281.0	99.6	281.0	99.6	282.0	100.0
	Mammoth	50.0	67.6	73.0	98.6	74.0	100.0	74.0	100.0
	Medium Mammal	2.0	33.3	6.0	100.0	6.0	100.0	6.0	100.0
	Rodent	0.0	0.0	3.0	100.0	3.0	100.0	3.0	100.0
	Small Mammal	1.0	100.0	1.0	100.0	1.0	100.0	1.0	100.0
	Unknown	24.0	72.7	33.0	100.0	33.0	100.0	33.0	100.0
		248.0		422.0		423.0		424.0	
Fossil Substrate	Non-Fossiferous	657.0	47.4	1,087.7	78.5	3,646.7	58.0	4,618.7	73.5
	Fossiliferous	581.7	52.3	967.7	87.1	968.8	87.2	969.1	87.2
		1,238.7		2,105.4		4,615.6		5,587.9	
Soil Type	Arizo	12.2	17.9	68.2	100.0	68.2	100.0	68.2	100.0
	Badland	181.3	41.8	432.8	99.9	433.2	100.0	433.2	100.0
	Dalian-McCullough	467.3	54.0	768.7	88.8	816.8	94.3	816.7	94.3
	DeStazo	116.7	27.4	290.2	67.0	289.9	66.9	290.2	67.0
	Las Vegas	228.5	99.9	228.7	100.0	228.7	100.0	228.7	100.0
	Weiser	191.4	7.1	194.2	7.2	1,085.4	40.2	1,325.4	49.3
	Weiser-Goodspring	0.0	0.0	0.0	0.0	3.8	1.6	58.2	25.1
	Weiser-Wechech	39.3	1.6	122.6	5.0	1,687.1	69.0	2,364.7	96.7
		1,238.7		2,105.4		4,613.0		5,585.3	
Vegetation Association	Larrea tridentata - Ambrosia dumosa	519.2	8.9	963.8	16.2	3,134.3	53.9	4,091.8	70.4
	Larrea tridentata	63.0	22.0	266.3	93.1	266.3	93.1	266.3	93.1
	Atriplex polycarpa - Ambrosia dumosa	132.2	54.0	221.9	90.6	222.8	91.0	222.8	91.0
	Ambrosia dumosa - Atriplex confertifolia	417.4	93.7	423.1	95.0	423.0	95.0	423.1	95.0
	Ambrosia dumosa - Larrea tridentata upper all	31.9	8.3	49.1	12.7	386.2	100.0	386.2	100.0
	Ambrosia dumosa - Menodora spinescens	41.7	100.0	41.7	100.0	41.7	100.0	41.7	100.0
	Badlands	6.8	7.4	94.3	99.9	94.3	99.9	94.3	99.9
	Human Modified	25.3	31.3	38.2	47.4	46.0	56.9	60.6	75.0
		1,237.6		2,104.4		4,614.5		5,586.8	

Green 80-100%
Yellow 50-79%
Red <50%

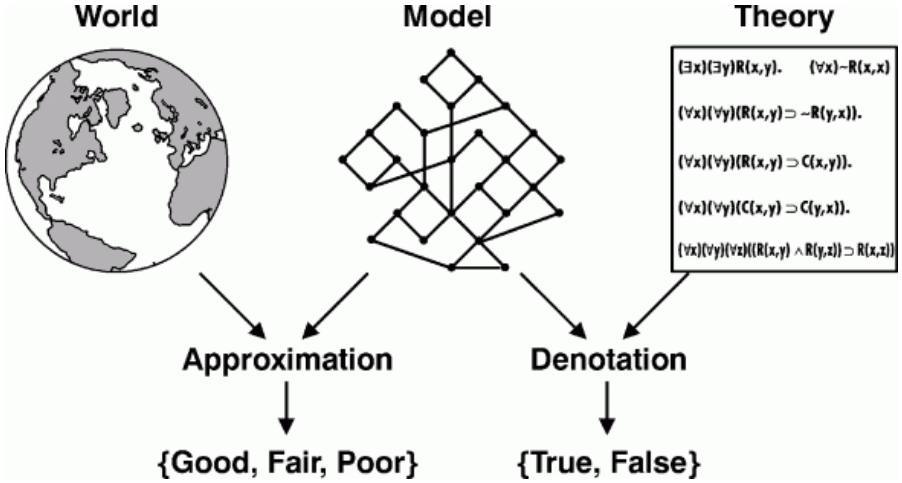
Questions and Comments

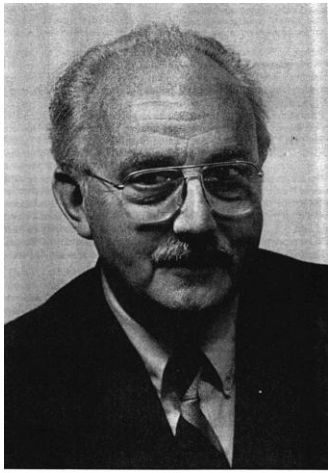
Modelling Rare Plant Species in the Upper Las Vegas Wash: Prediction Models

Thomas C Edwards
US Geological Survey & Utah State University
(Presenting on behalf of all)
James MacMahon, Richard Toth, Janis Boetinger, Rick Krannich, Glen Busch, Amy Croft
Ecology Center, Utah State University

Species Habitat Modelling in Conservation: Those Forgotten Caveats

- "All models are wrong. Some are useful."
  - G. P. E. Box, a truly distinguished Statistician





George E. P. Box

Species Habitat Modelling in Conservation: Those Forgotten Caveats

- "All models are wrong. Some are useful."
  - G. P. E. Box, a truly distinguished Statistician
- "There are three kinds of lies: lies, damn lies, and *statistics*."
  - Variously attributed to B. Disraeli, British politician, and Mark Twain, American humorist

M. Twain

B. Disraeli

Rare Plant Models: Objectives

- Use selected abiotic, topographic and bioclimatic variables to model likely locations of two plant species of concern:
  - Golden bearclaw-poppy (*Arctomecon californica*)
  - Nile's wild buckwheat (*Eriogonum corymbosum* Bentham var. *nilesii*)
- Develop spatial map products for scenario modelling

Rare Plant Models: Modelling Process

- Develop and implement a sampling strategy for the plant species
  - Both purposive (ie targeted) and random designs
- Apply one (or more) classification models
  - Spatial, non-spatial, and mixed models evaluated
- Validate models using cross-validation techniques and independent field test
- Create map product(s) in a GIS

Rare Plant Models: Modelling Process – The Data

- Data sources from (i) 27 random transects covering wash, (ii) purposive sampling, and (iii) known locations (maps) provided by BLM
  - Random => Prevalence in wash, defined as ratio of "hits" of plant presence to number of sample points
  - Purposive => Boost sample size (after all, they're rare!!)
  - BLM data => Initial model data

Rare Plant Models: Modelling Process – The Data

- Poppy modelling sample sizes by design type

	Random	Purposive	Total
Absent	203 (66.1%)	51 (16.6%)	254 (82.7%)
Present	15 (4.9%)	38 (12.4%)	53 (17.3%)
Total	218 (71.0%)	89 (28.9%)	307 (--)

Rare Plant Models: Modelling Process – The Models

- Evaluated 4 types of classification models
  - Discriminant function analysis,
  - logistic regression
  - logistic additive models
  - classification trees
- Each has different strengths and weaknesses given specific objectives of:
  - Ecological interpretability, translation into map products, high prediction capability

Rare Plant Models: Modelling Process – The Models

- Evaluated 4 types of classification models
  - Discriminant function analysis,
  - logistic regression
  - logistic additive models
  - classification trees
- Each has different strengths and weaknesses given specific objectives of:
  - Ecological interpretability, translation into map products

Rare Plant Models: Modelling Process – Models Considered

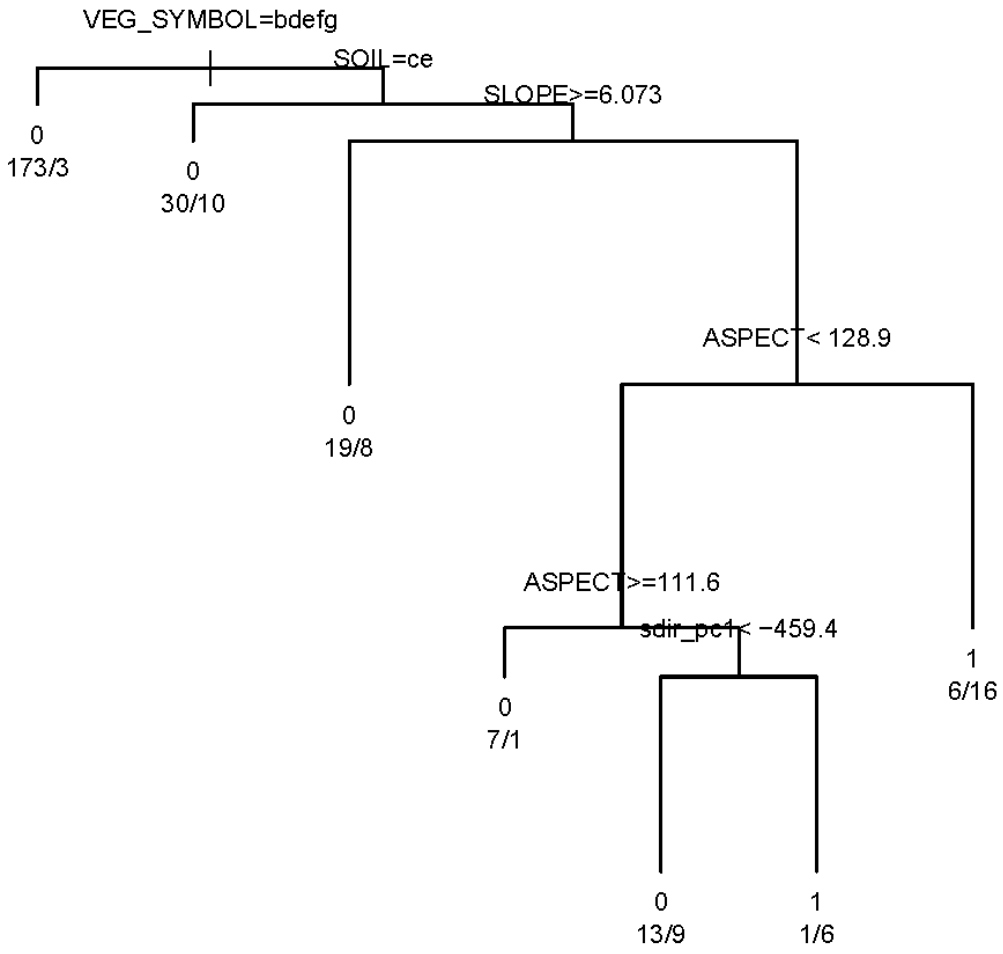
- Spatial
  - Coarse-grained variables (eg, topographic) for map products and spatial extrapolation
- Non-spatial
  - Fine-grained variables (eg, soil structure, chemistry) for understanding plant ecology
- Mixed spatial and non-spatial
  - Relative contribution of model types for prediction

Rare Plant Models: Modelling Process – The Variables

- Topographic
  - Slope, Elevation, Aspect
- Bioclimatic
  - Precipitation, temperatures, solar radiation
- Soil – Geology / Structure / Chemistry
  - Soil type, geology class, parent material, physical/biological crust, % rock, shear, pH, % clay, gysum
- Vegetation class

Rare Plant Models: Model #1 - Spatial

- Variables selected included:
  - Vegetation
  - Soil type
  - Slope
  - Aspect
  - Solar radiation

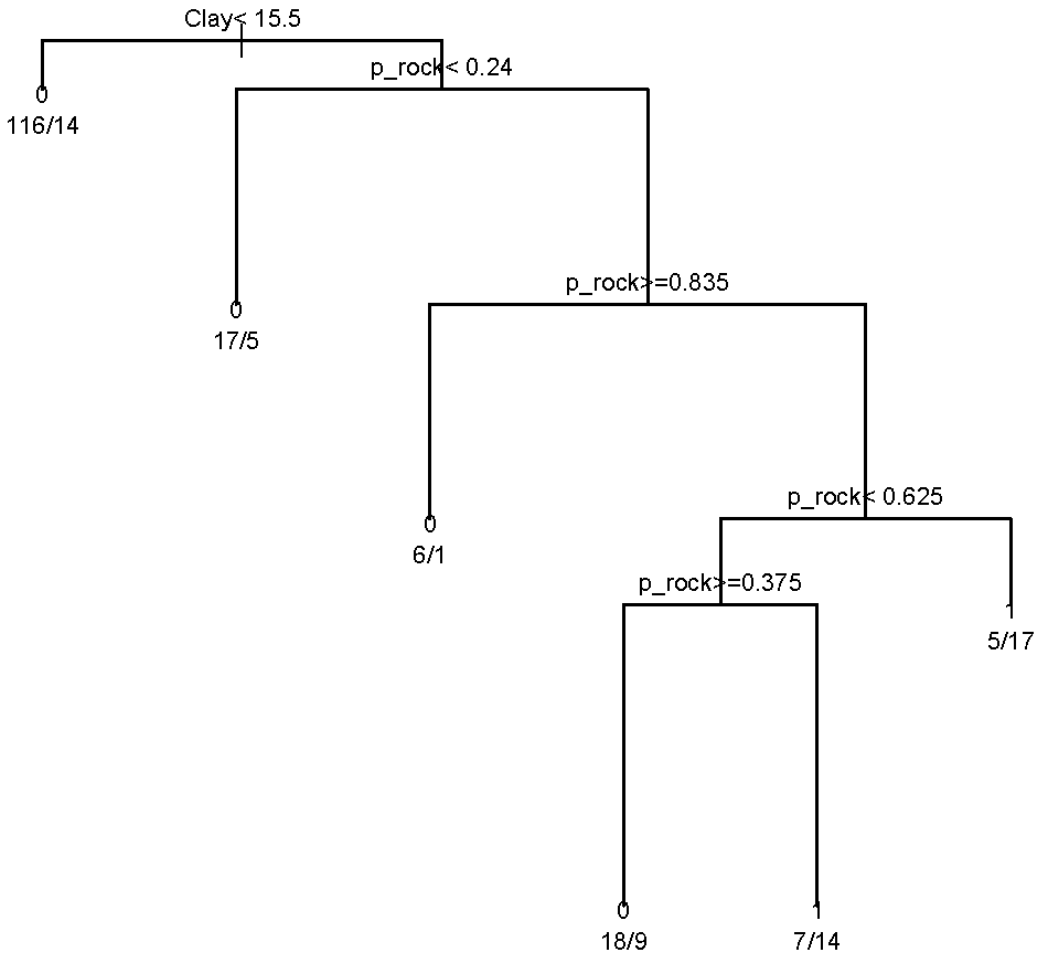


Rare Plant Models: Model #1 – Spatial Accuracies

	Resubstitution	Cross-classification
PCC	87.4	79.1
Specificity	41.5	30.2
Sensitivity	97.2	89.6
kappa	0.47	0.22
AUC	0.88	0.79

Rare Plant Models: Model #2 – Non-spatial

- Variables selected included:
  - Clay
  - % rock

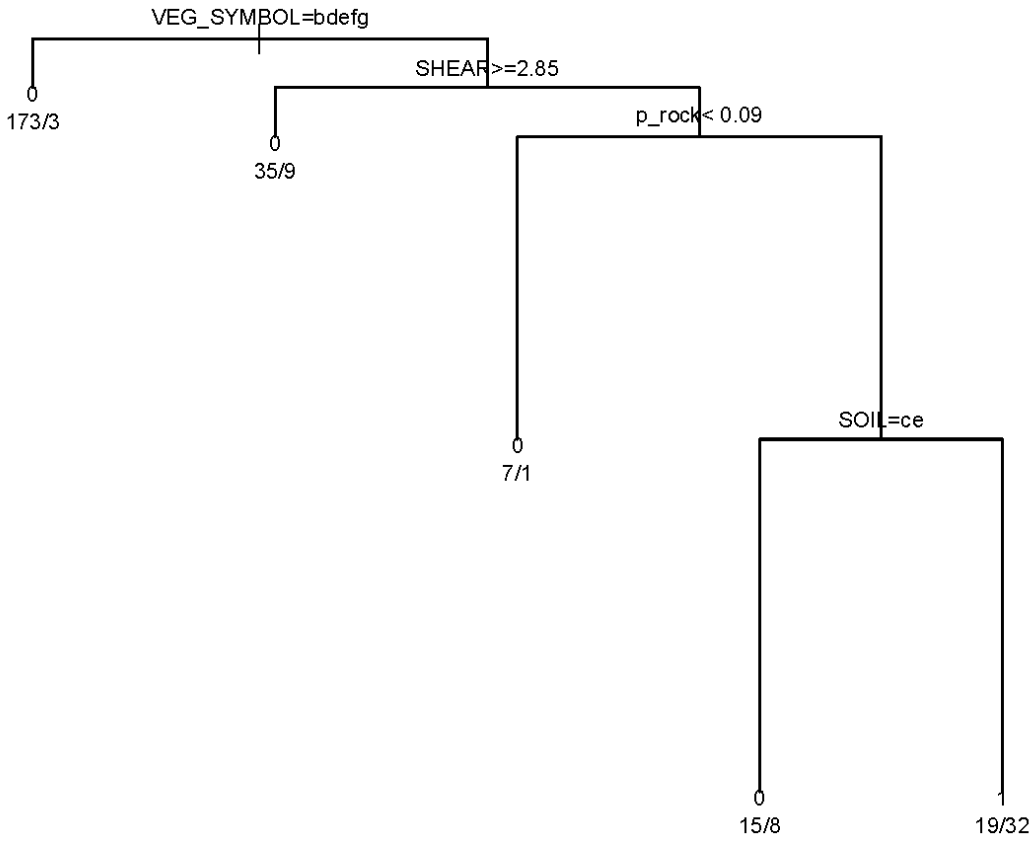


Rare Plant Models: Model #2 – Non-spatial Accuracies

	Resubstitution	Cross-classification
PCC	82.1	74.2
Specificity	51.7	30.0
Sensitivity	92.9	89.9
kappa	0.49	0.23
AUC	0.79	0.71

Rare Plant Models: Model #3 - Mixed

- Variables selected included
  - Vegetation
  - Shear strength
  - % rock
  - Soil type



Rare Plant Models: Model #2 – Non-spatial Accuracies

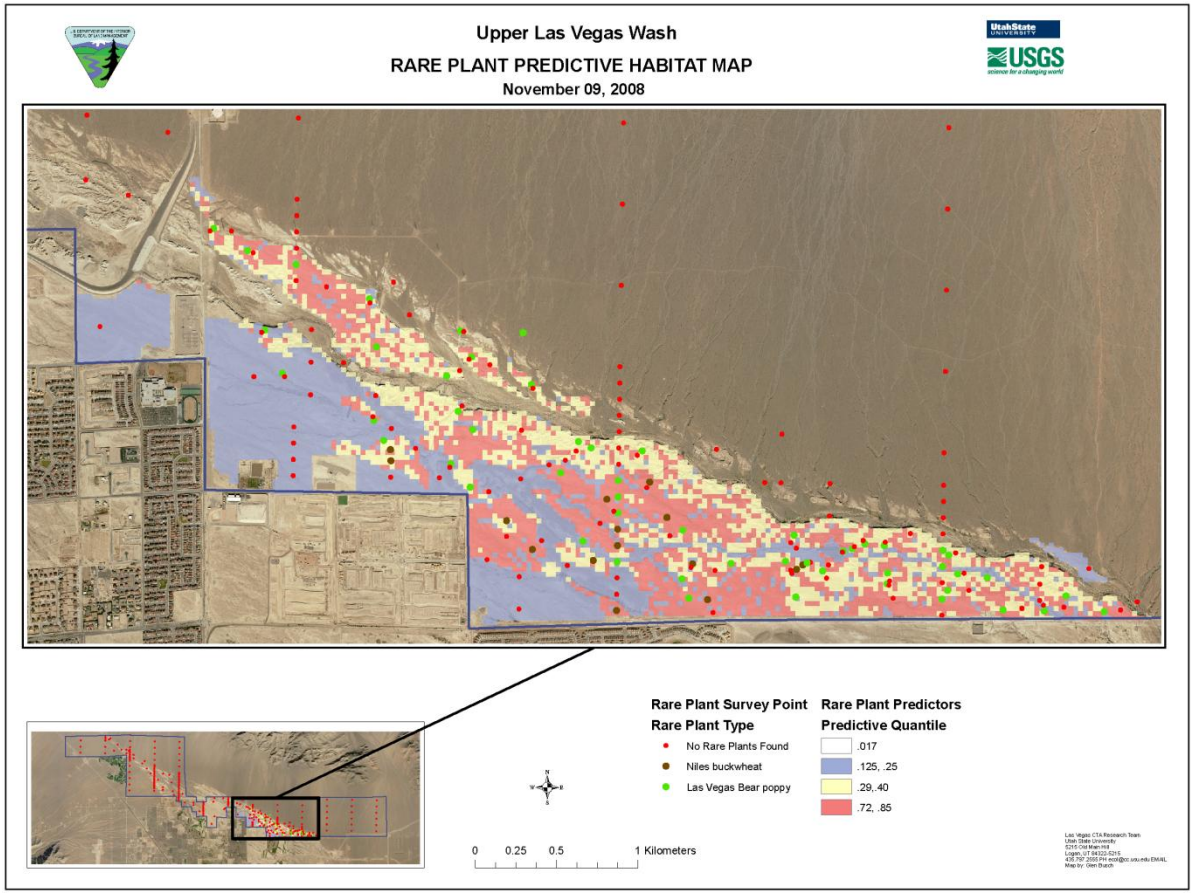
	Resubstitution	Cross-classification
PCC	86.7	79.8
Specificity	60.4	44.5
Sensitivity	92.4	91.6
kappa	0.53	0.38
AUC	0.88	0.69

Rare Plant Models: Some General Poppy Conclusions

- Model fits using are within published values and are defensible
  - Model building emphasized ability to predict poppy locations (ie sensitivity) and thereby reduce omission error
  - Consequence is model over-prediction and an increase in commission error
- Given irruptive life history characteristics of the poppy, over-prediction is a conservative management strategy

Rare Plant Models: But Does The Model Work??

- Independent field assessment implemented
- Random points selected from prediction map and field tested



Rare Plant Models: But Does The Model Work??

	Spatial	Non-spatial	Mixed
PCC	77.0	66.0	73.0
Specificity	77.6	57.1	40.8
Sensitivity	77.0	90.2	88.2
kappa	0.54	0.31	0.46
AUC	0.79	0.66	0.76

Rare Plant Models: And What About The Buckwheat?

- Buckwheat samples too small for model-building
  - Since observed co-located with poppy, applied poppy model to buckwheat

	Random	Purposive	Total
Absent	202 (93.1%)	0 (0%)	202 (93.1%)
Present	4 (1.8%)	11 (5.1%)	15 (6.9%)
Total	206 (94.9%)	11 (5.1%)	217 (--)

Rare Plant Models: Buckwheat Applied to Poppy Model

	Spatial	Non-spatial	Mixed
PCC	95.4	93.2	90.2
Specificity	78.6	57.1	50.0
Sensitivity	97.5	97.5	94.9
kappa	0.76	0.60	0.46
AUC	0.98	0.98	0.90

Rare Plant Models: Some General Buckwheat Conclusions

- Caveats regarding over-prediction (omision vs. commission errors trade-offs) apply to buckwheat as well
  - Note: no independent evaluation of buckwheat model (not enough samples found)
- Accuracies of poppy model predicting buckwheat are high and defensible
  - Suggests both species could be managed as a single group

Questions??

Such interesting contrasts …..

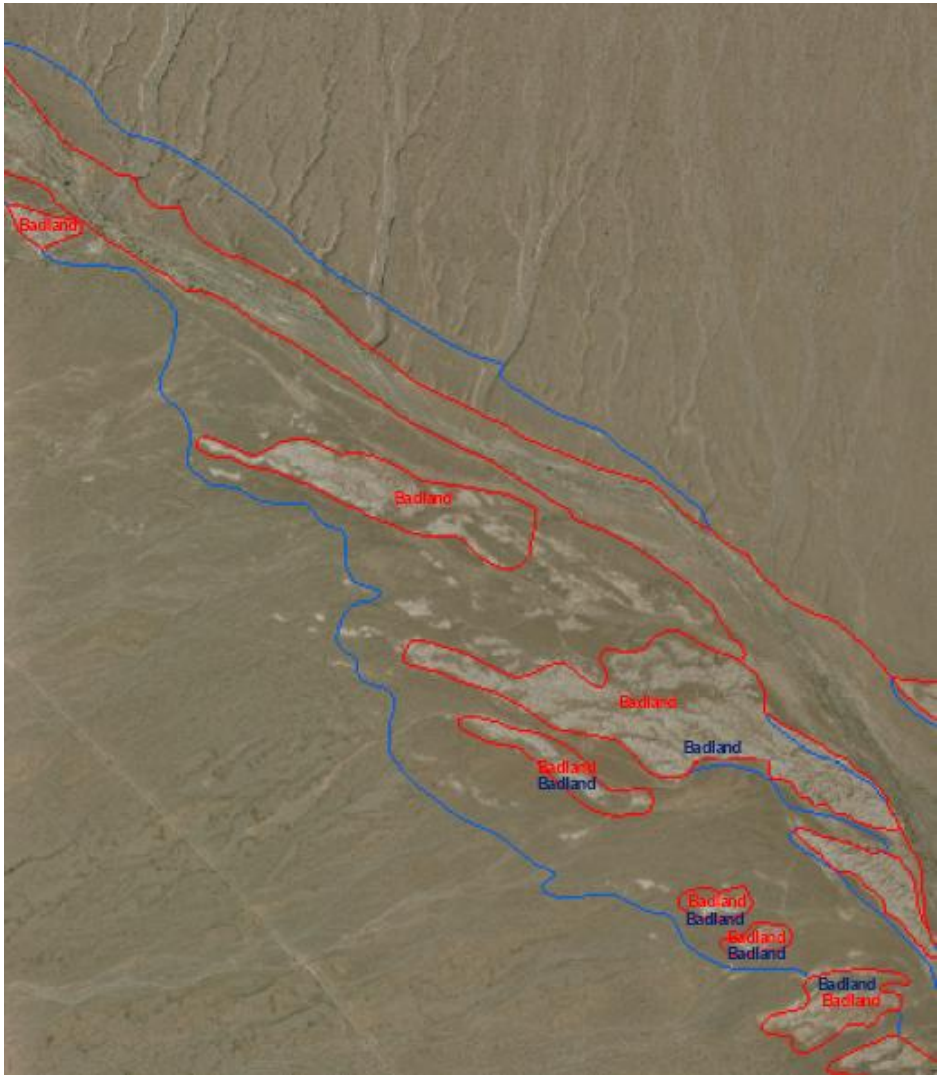
Upper Las Vegas Wash CTA: SOILS

SOILS

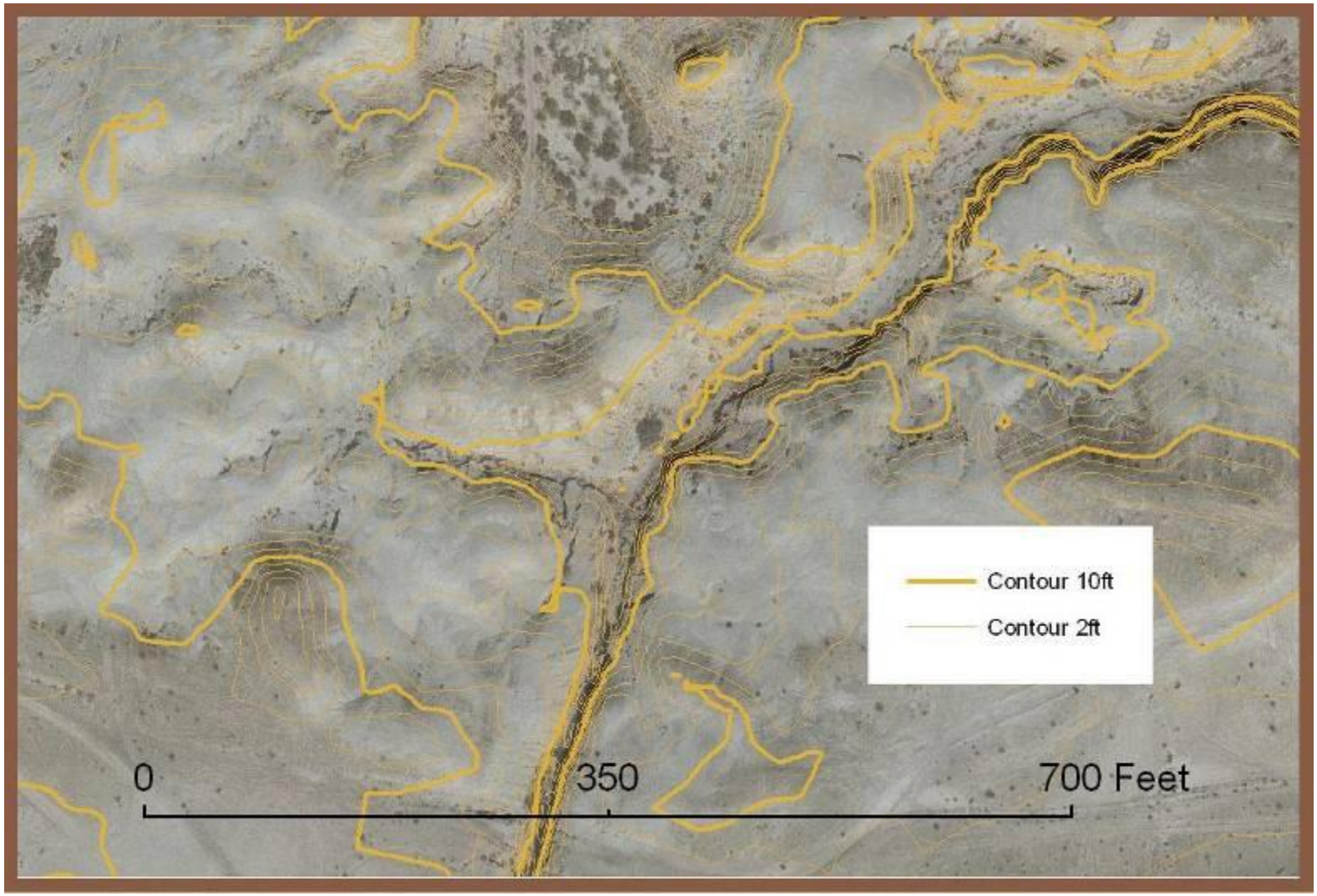
- Refine Soil Map
- Characterize Soils
  - Pedons
  - Surface Soils

Refined Soil Map

- Soil Survey Data-Spring 2007(Blue)
  - Las Vegas Valley Area
  - Clark County Area
- Geographic Information System (GIS)
  - Digital Data
- Refine polygons (Red)

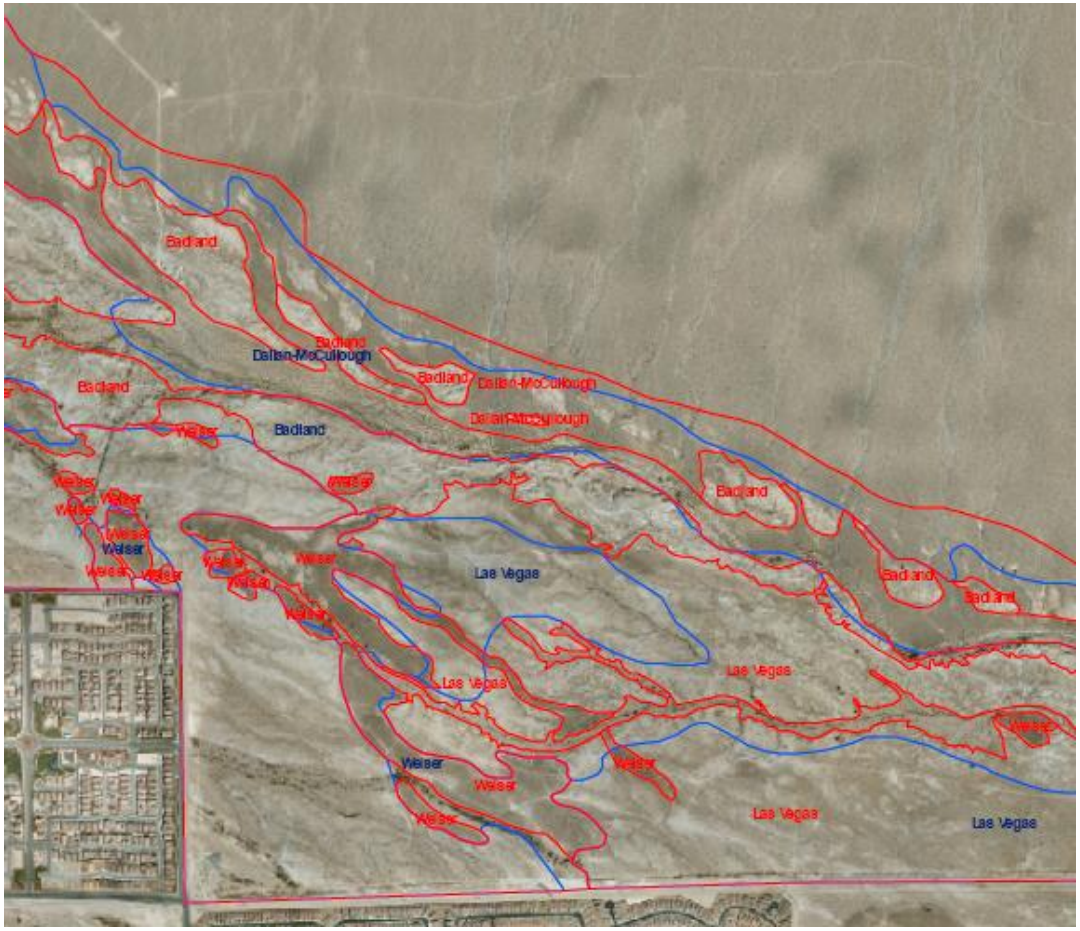


High Resolution
Aerial Photography and Topography



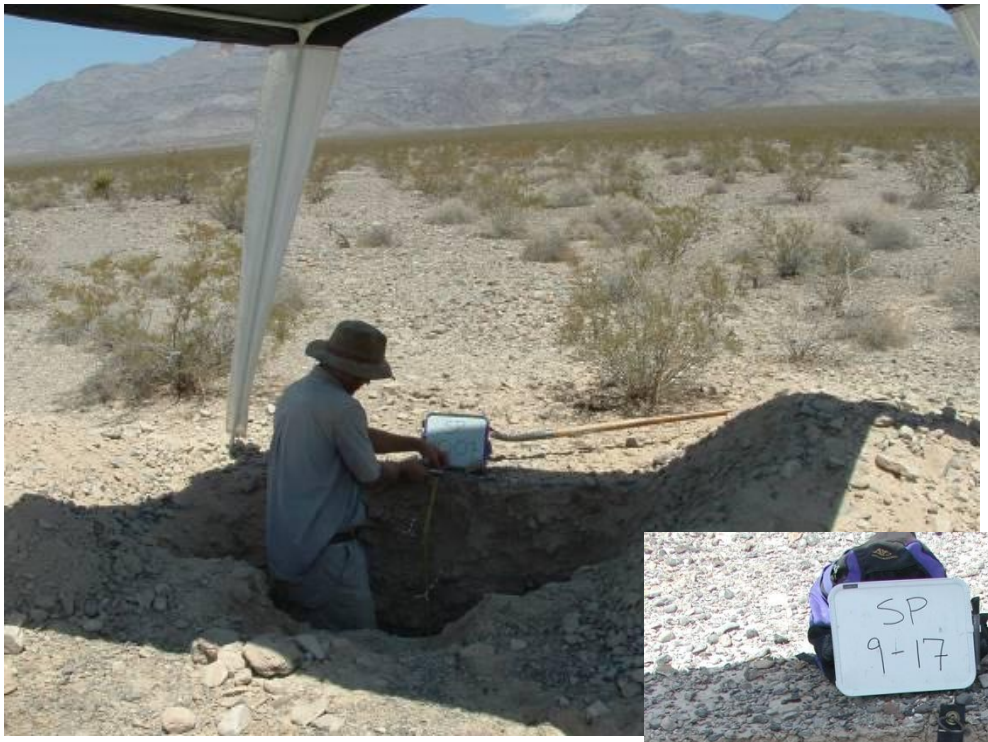
Refined Soil Map

- Better fit tones, landform, relief
- Adjust lines
  - Northwest
- Delineate new polygons
  - Southeast
  - Plants of interest
  - Complex patterns


Badland
Dalton-McCullough
Badland
Dalton-McCullough
Badland
Dalton-McCullough
Badland
Weiser
Badland
Weiser
Weiser
Weiser

Develop & Document Soil Map

- 45 pedons (soil profiles)
  - Major vegetation associations
  - Major landscape units
  - Excavated, described, and sampled
    - 26 in June 2007
    - 19 in Feb 2008



Soil Pedons

- Analyzed by genetic horizon
  - Texture
  - Clay%
  - pH
  - Calcium carbonate reaction w/ HCl
  - Electrical conductivity
  - Gypsum
  - Bulk density
  - % Calcified fragments

Refined Soil Map

- Soil Pedons
  - Classified
    - Family level USDA Soil Taxonomy

    e.g., Loamy-skeletal, carbonatic, thermic Typic Haplocalcids
  - Correlated
    - Established series

    e.g., Weiser series
- Used Established Map Units
  - USDA Natural Resources Conservation Service
    - Soil interpretations, chemical &physical data

Upper Las Vegas Wash Soils Map

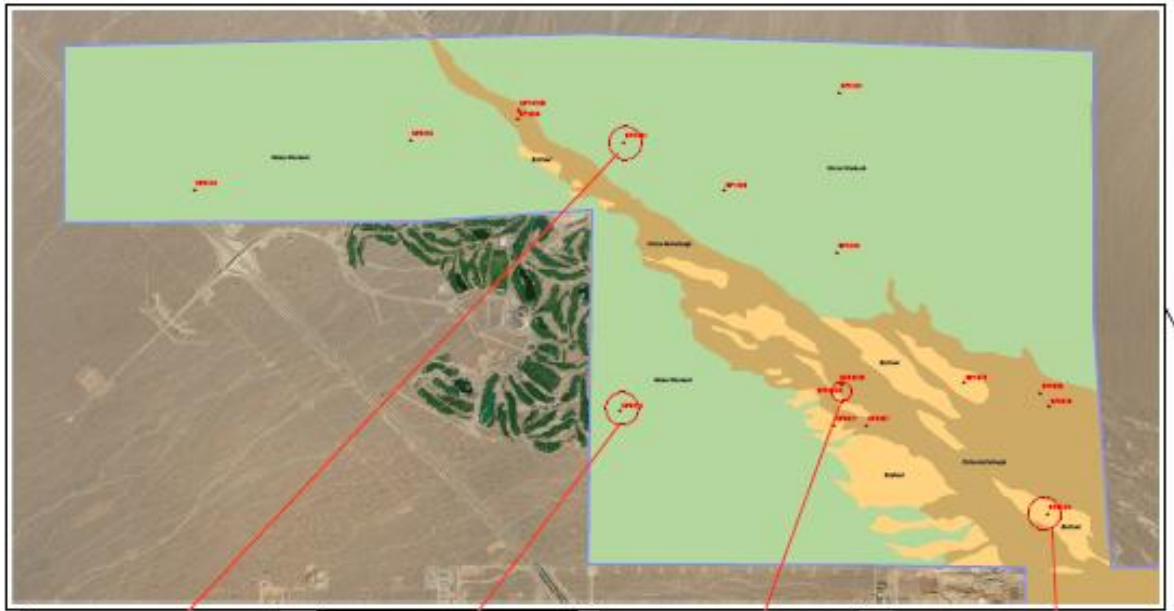
DRAFT July 7, 2008

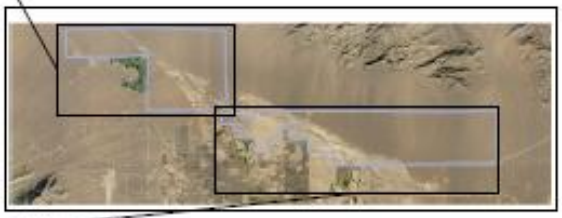
Soil Types

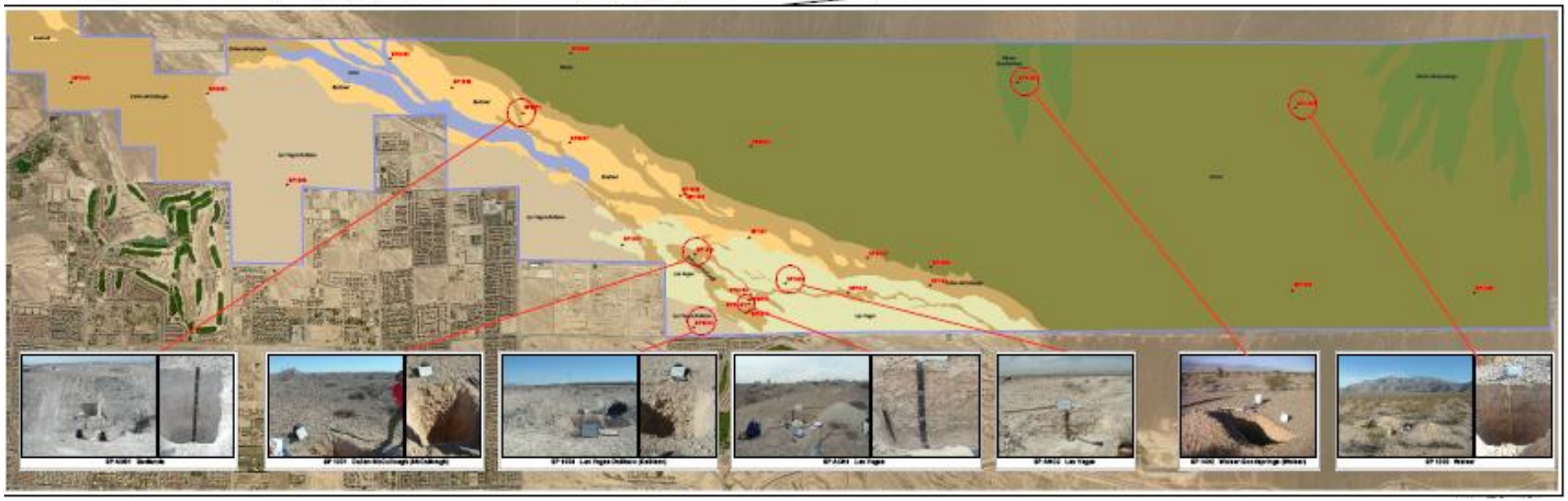
- Arizo
- Badland
- Dellan-McCullough
- Las Vegas
- Las Vegas-DeSitazo
- Weiser
- Weiser-Goodsprings
- Weiser-Wechech

Soil Pit Locations

0 0.5 1 2 Kilometers





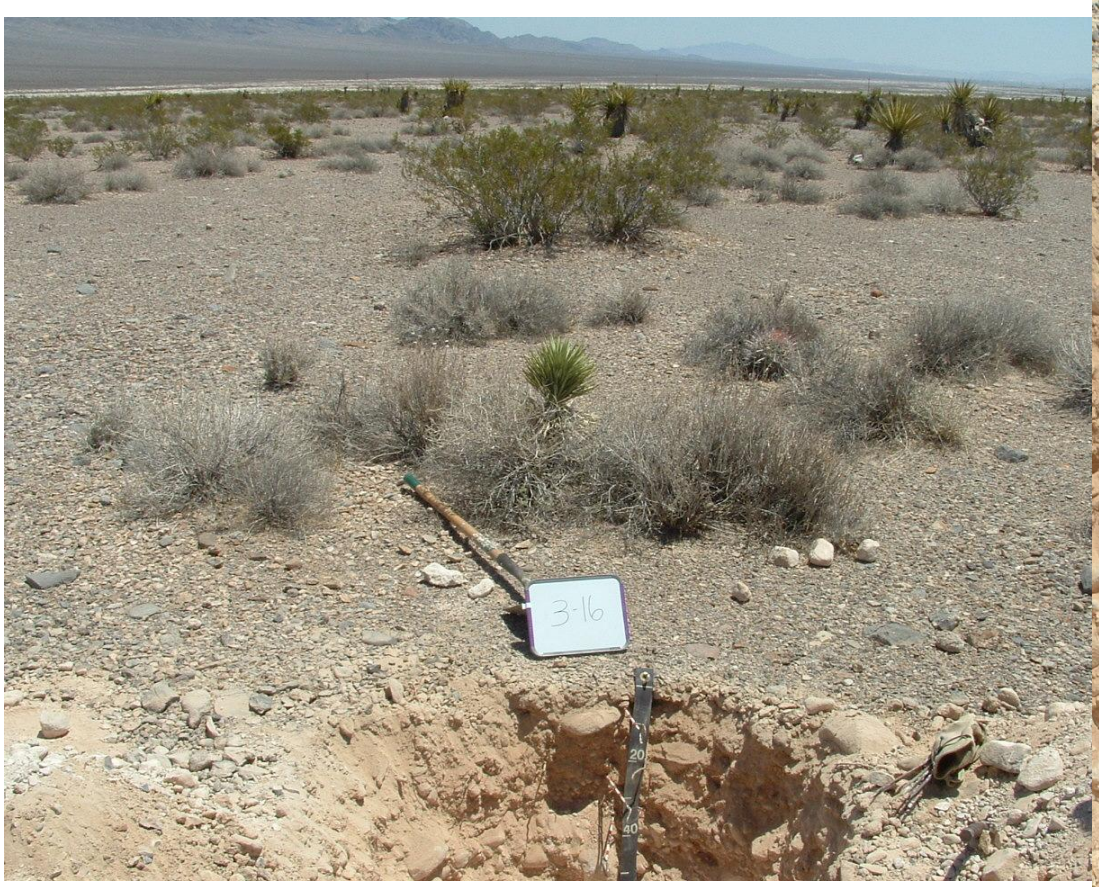


Soil Map Units

- 540—Weiser extremely gravelly fine sandy loam, 2 to 8 percent slopes

Soil Map Units

- 314—Weiser-Wechech association



Upper Las Vegas Wash Soils Map

DRAFT July 7, 2008

Soil Types

- Arizo
- Badland
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- Weiser
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- Weiser-Wechech

Soil Pit Locations

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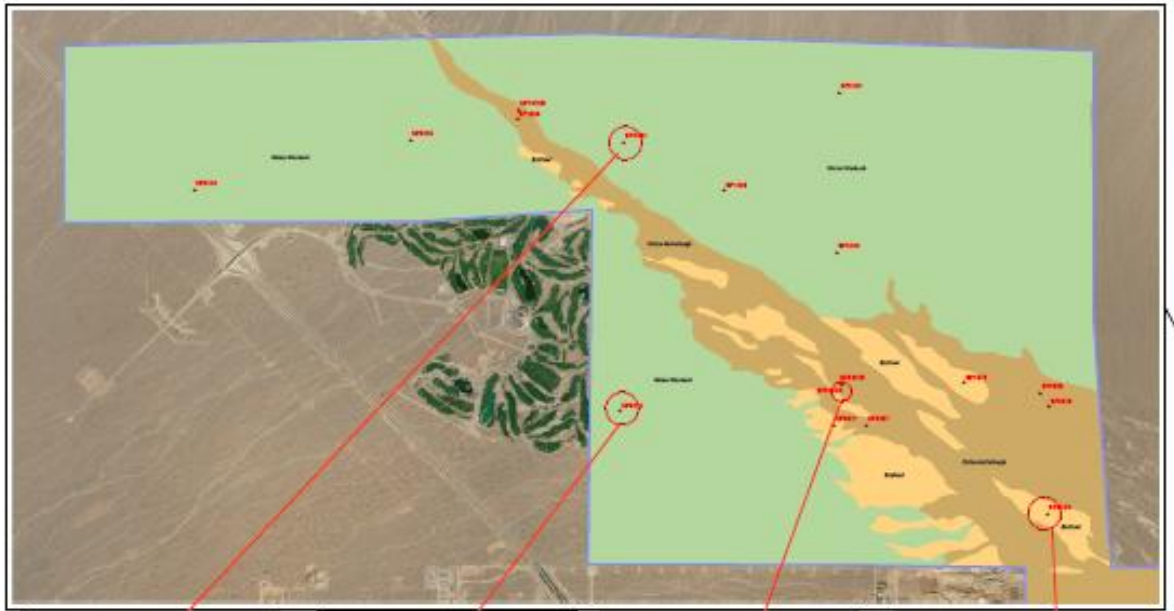
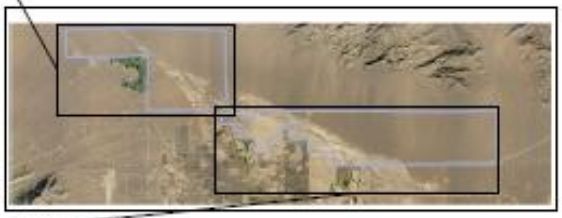
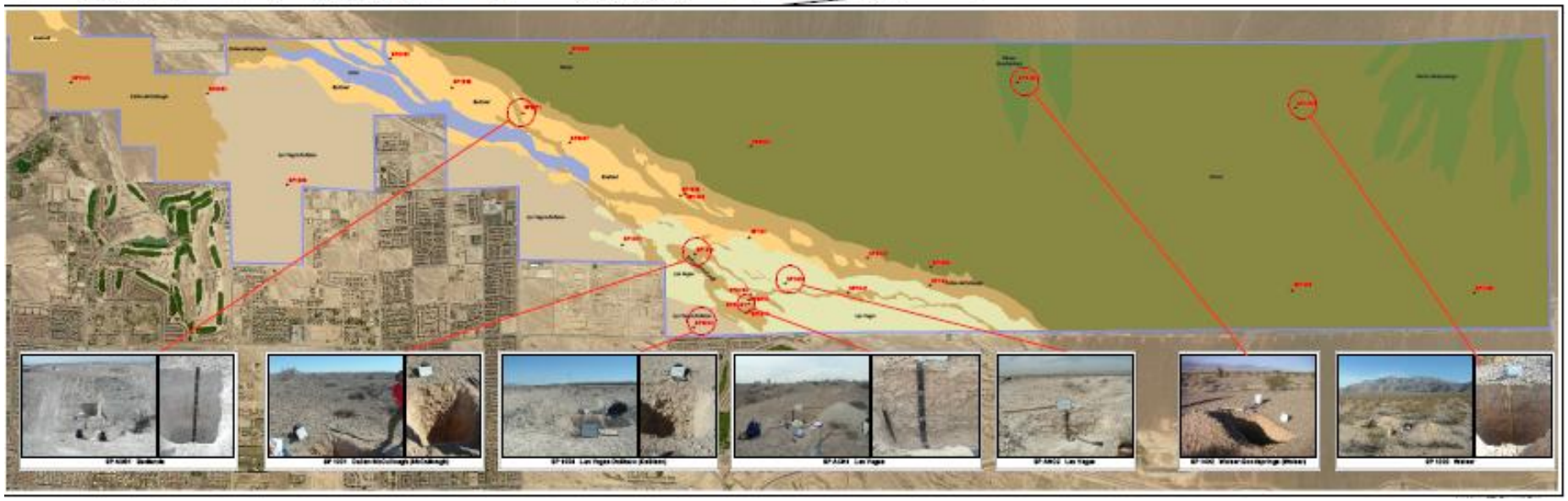




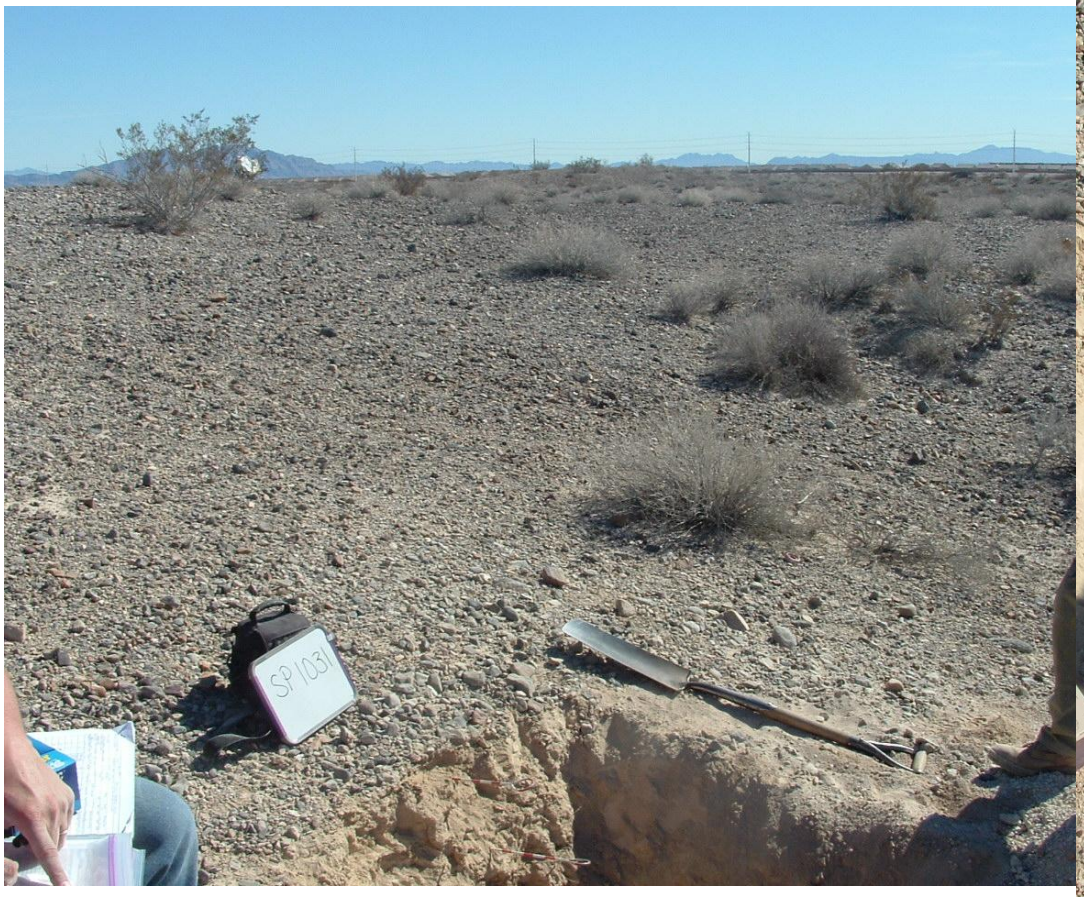


Soil Map Units

- 192—Dalian-McCullough complex, 0 to 4 percent slopes

Soil Map Units

- 192—Dalian-McCullough complex, 0 to 4 percent slopes



Upper Las Vegas Wash Soils Map

DRAFT July 7, 2008

Soil Types

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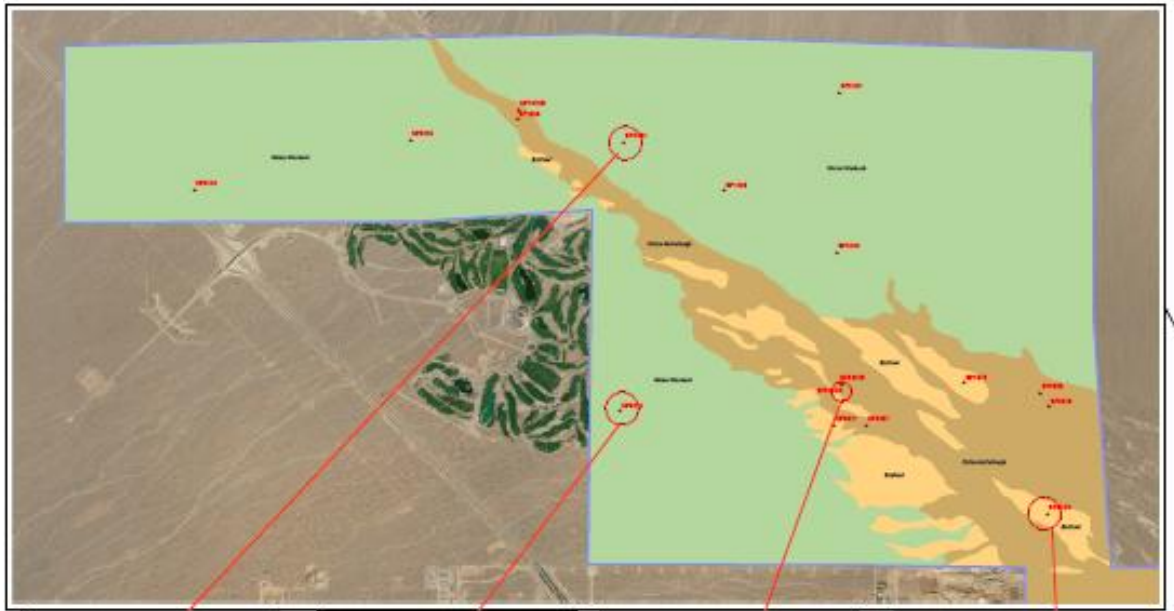
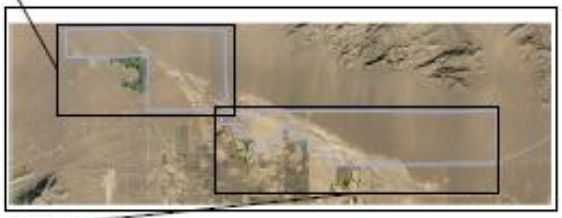
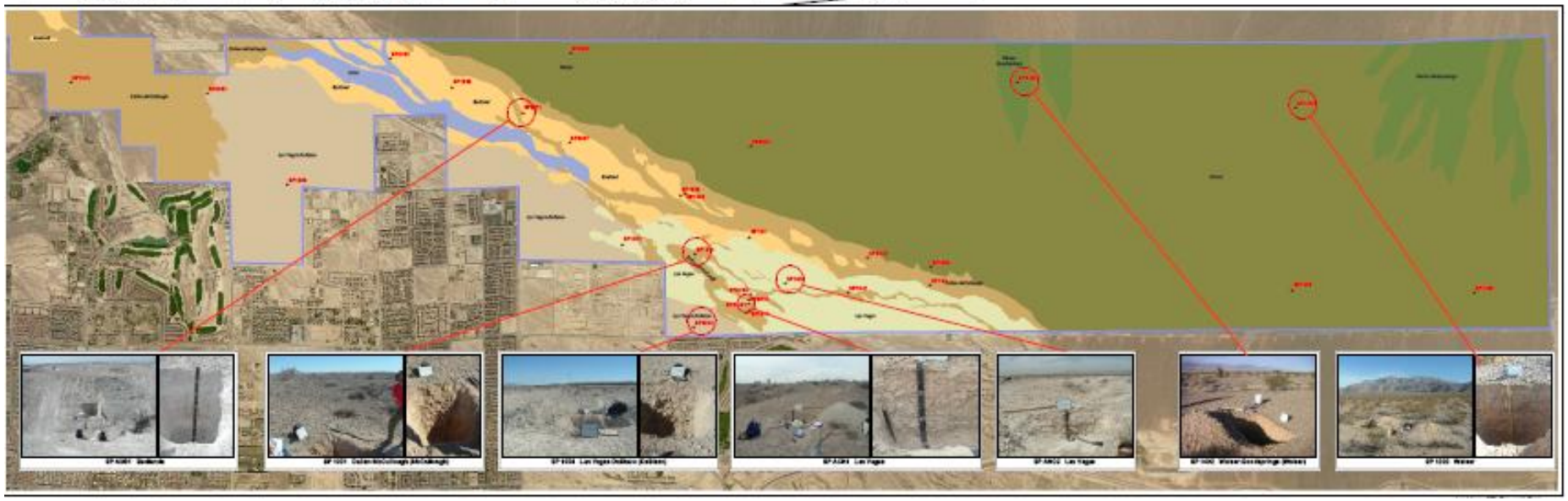
- Weiser-Wechech

Soil Pit Locations

0 0.5 1 2 Kilometers





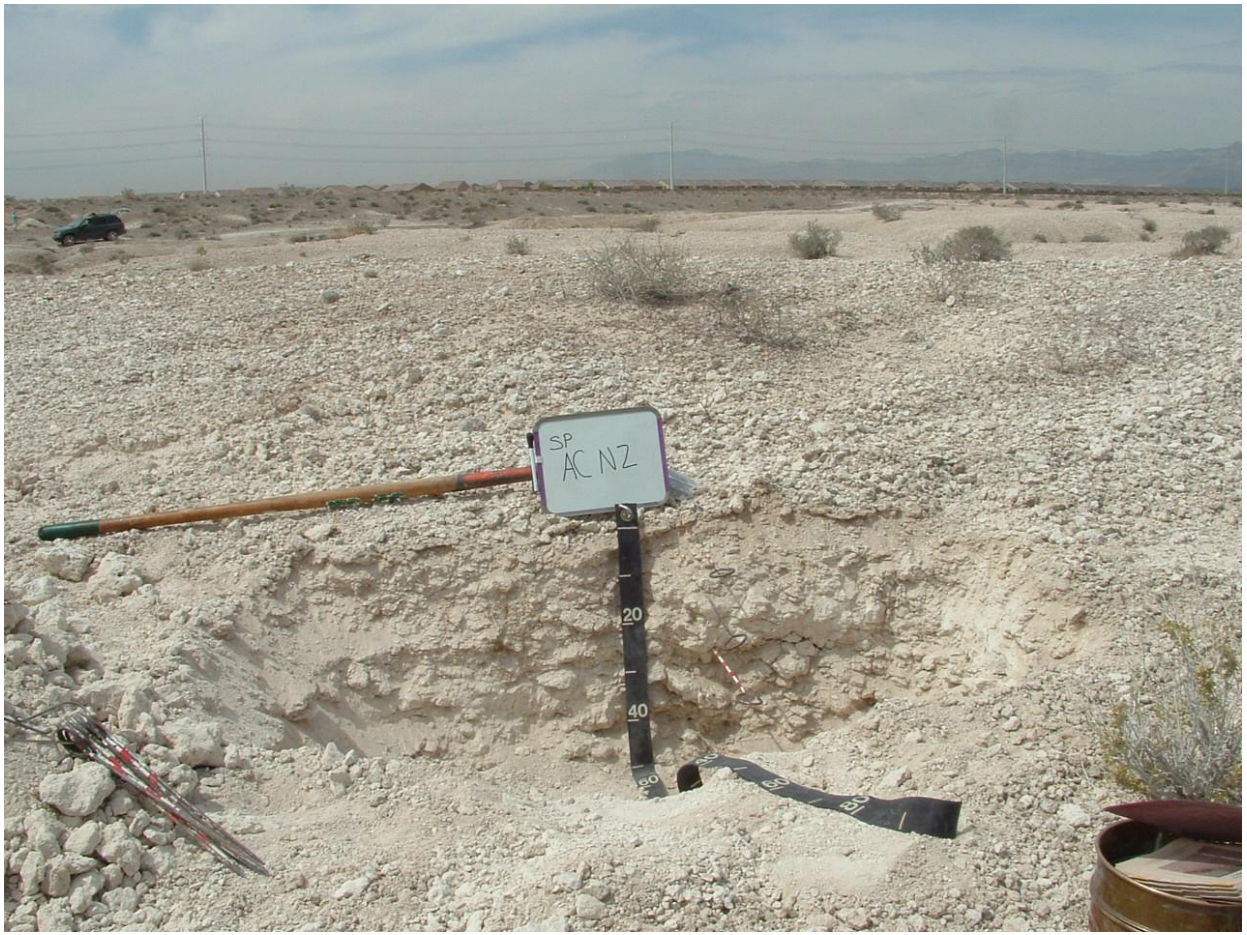


Soil Map Units

- 305—Las Vegas-DeStazo complex, 0 to 2 percent slopes

Soil Map Units

- 300—Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes

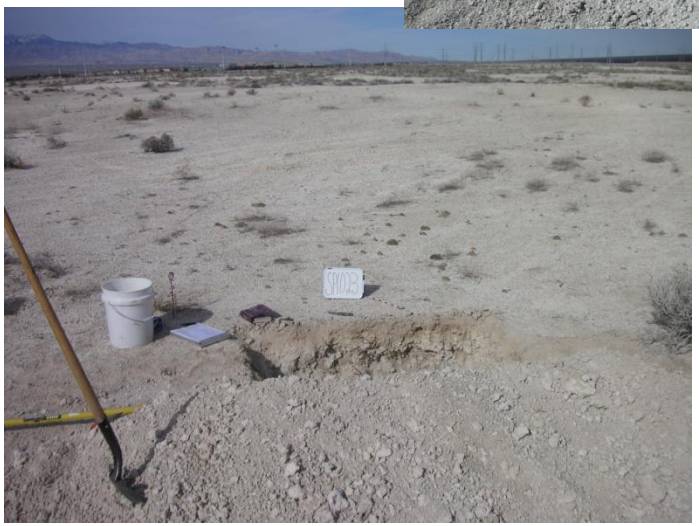


Soil Map Units

- 630—Badland (Not sampled by USDA-NRCS)

Soil Map Units

- 300-Las Vegas and 630-Badland
  - Plants of interest (POI)
  - Basin floor, spring deposits
  - Very highly calcareous
    - Cemented layers, nodules
  - Relict redoximorphic feature
    - Late Pleistocene marsh
    - Exhumed paleosols
  - Gypsum in subsoil
    - Trace (<0.1%) to 5%



Surface Soils

- Vegetation Sampling
  - 0-8 cm (0-3 in.) soil
    - 286 points X 2
      - Presence under plant canopy
      - Absence 50-cm away in open
    - Same analyses as pedons
  - Little difference between presence and absence w/in ARCCAL, ERYCOR, Shrub
  - Plants of interest presence/absence
    - Lower bulk density
    - Higher % calcified fragments
  - Gypsum rare
    - <1% all samples had ≥0.1% gypsum

Surface Soils

- Rare Plant Survey
  - 0-8 cm (0-3 in.) soil
    - 100 points
      - 38 ARCCAL presence
      - 11 ERYCOR presence
      - 51 Absence
    - Same analyses as pedons
  - ARCCAL, ERYCOR
    - Lower bulk density
  - Gypsum rare
    - <3% samples had ≥0.1% gypsum

Surface Soils

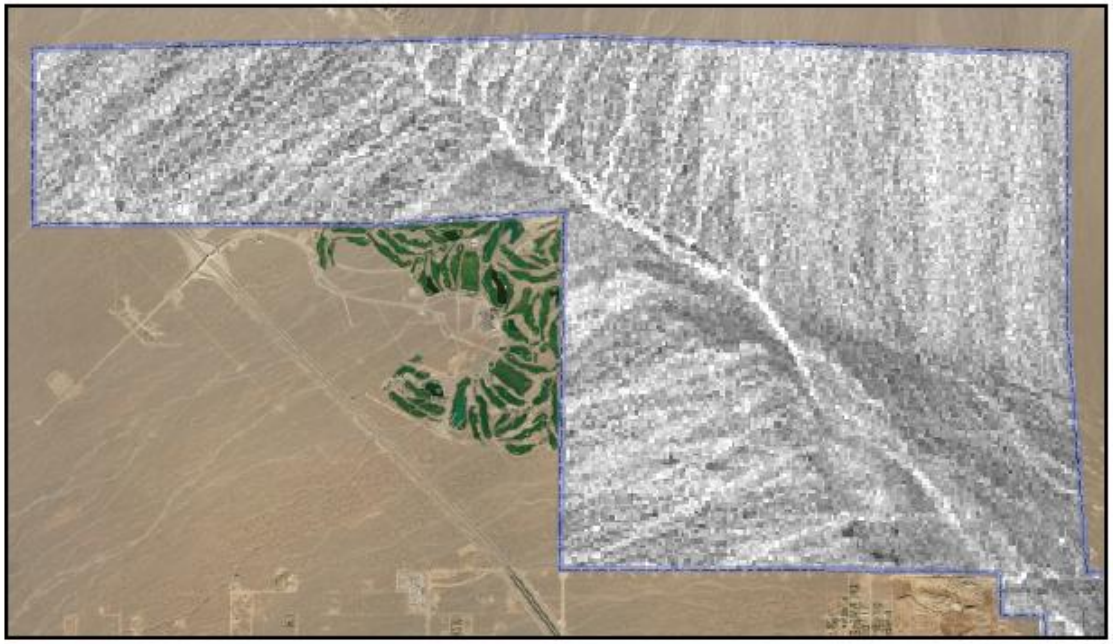
- Rare Plant Survey
  - 0-8 cm (0-3 in.) soil
    - 100 points
      - 38 ARCCAL presence
      - 11 ERYCOR presence
      - 51 Absence
    - Same analyses as pedons
  - ARCCAL, ERYCOR
    - Lower bulk density
  - Gypsum rare
    - <3% samples had ≥0.1% gypsum
- Gypsophiles???

FIGURE 2-5

Landsat 5/7 Normalized Ratio

Upper Las Vegas Wash CTA

July 21, 2008



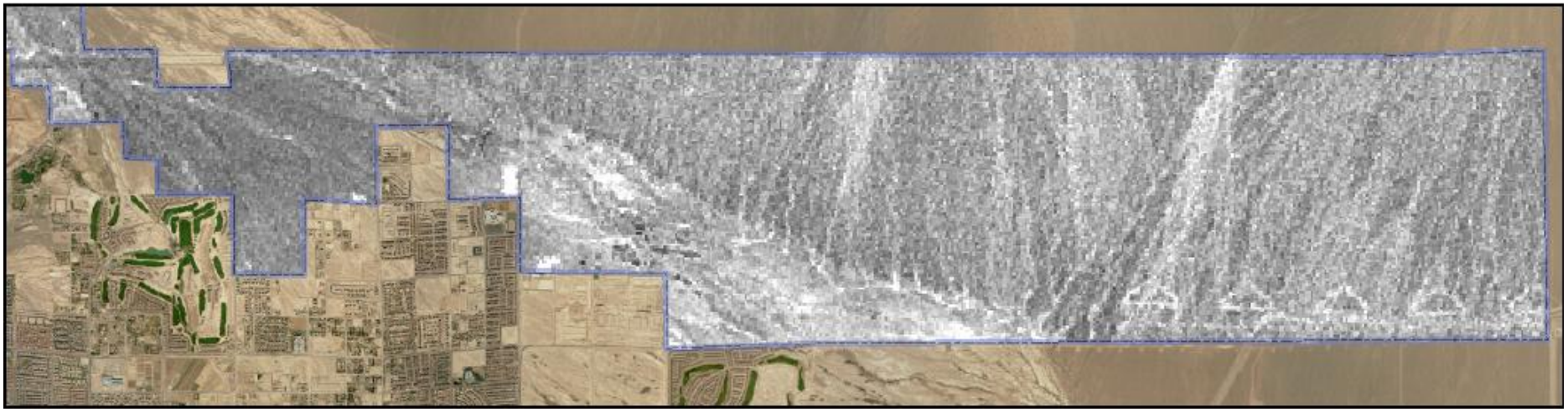


FIGURE 2-6

Landsat 5/4 Normalized Ratio

Upper Las Vegas Wash CTA

July 21, 2008

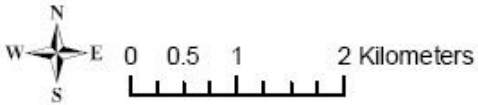
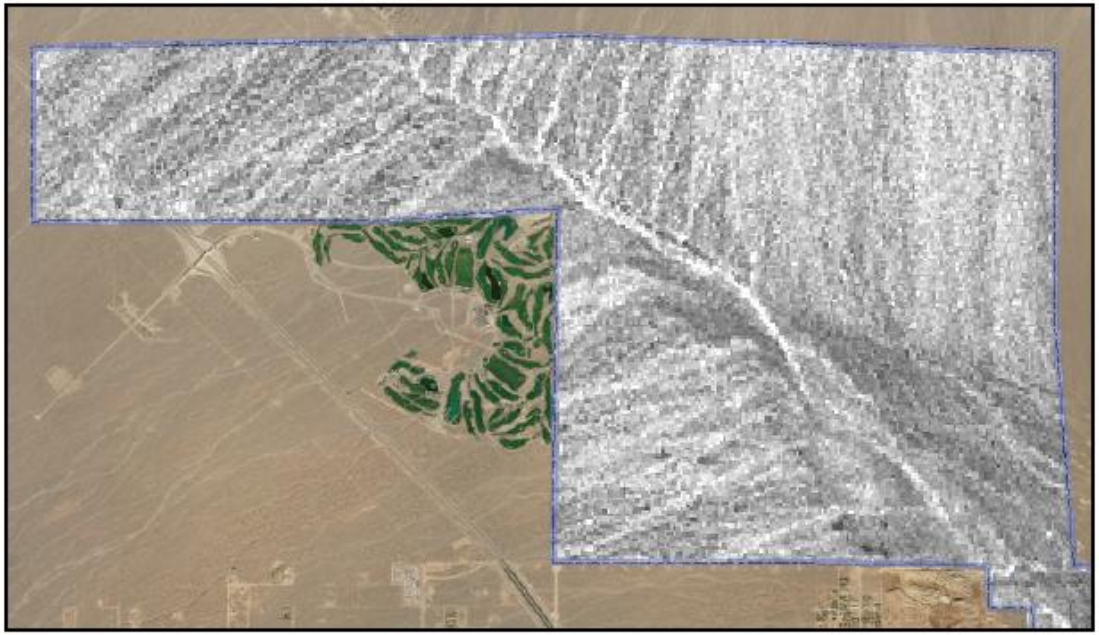
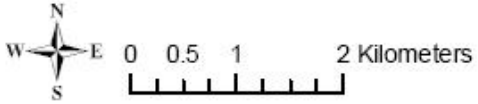
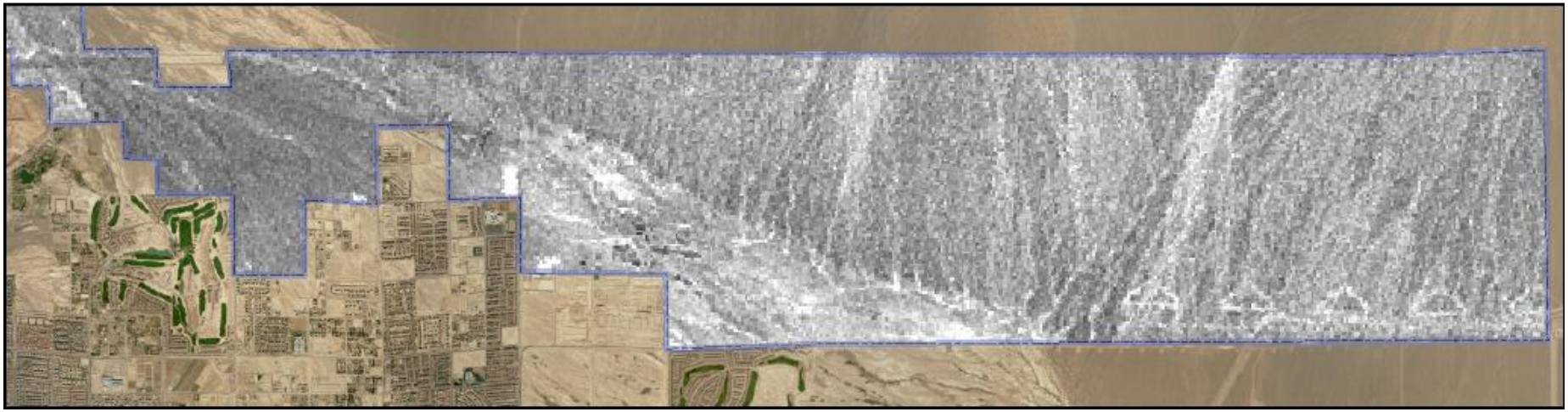


FIGURE 2-5

Landsat 5/7 Normalized Ratio

Upper Las Vegas Wash CTA

July 21, 2008