Forest Service Groundwater Dependent Ecosystems Protocol:

Assessing the Function and Condition of Springs and Isolated Wetlands

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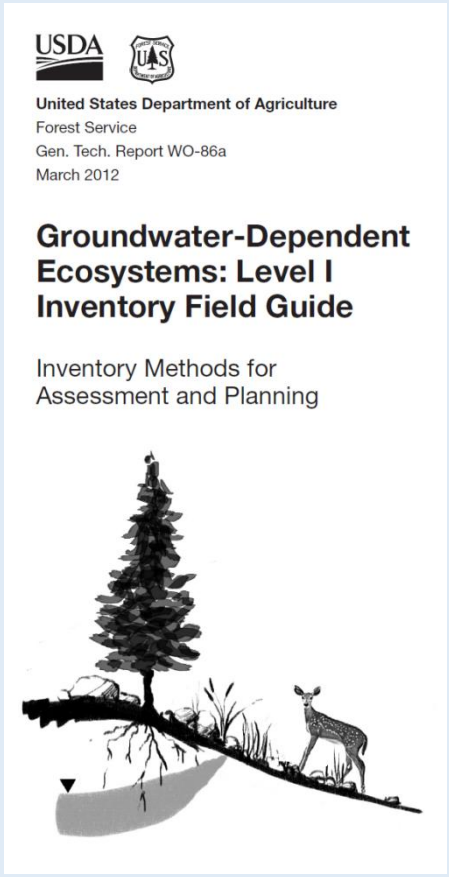
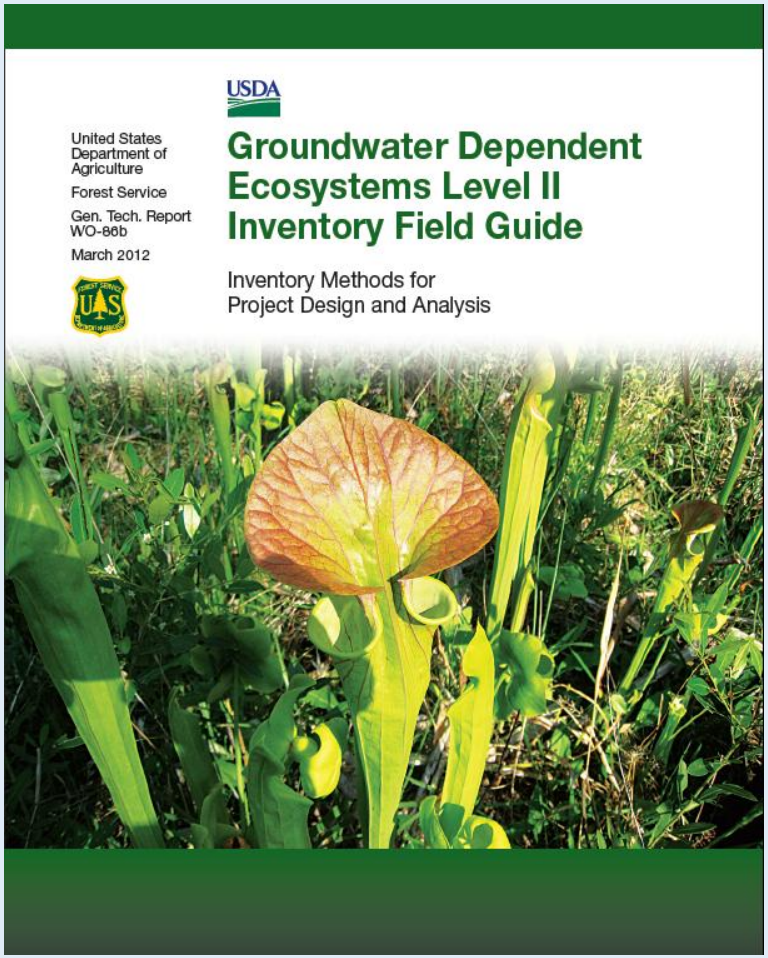


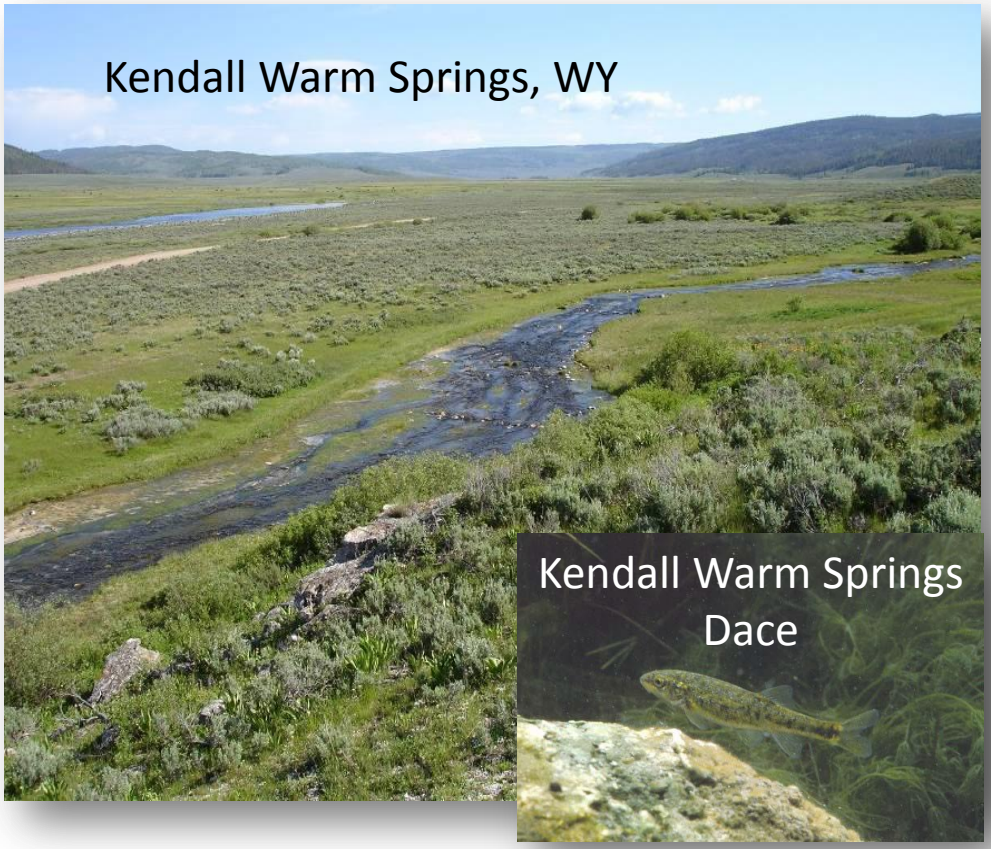


Level I - Qualitatively locate and characterize GDEs

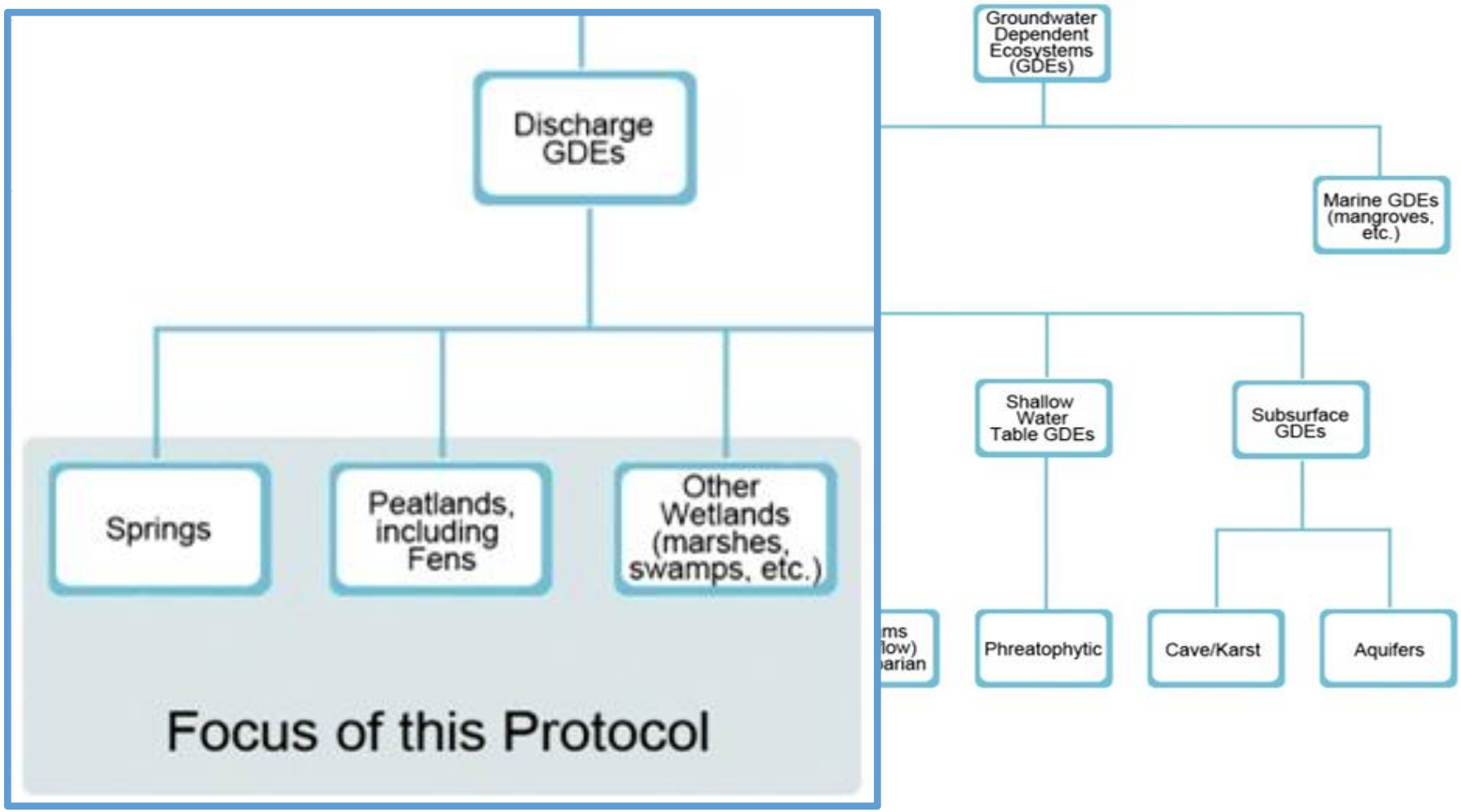
Level II - Quantitatively describe major ecosystem attributes

What are Groundwater Dependent Ecosystems?

- GDEs are communities of plants and animals whose extent and life processes are dependent on access to, or discharge of groundwater.



Groundwater Dependent Ecosystems Classification & Focus



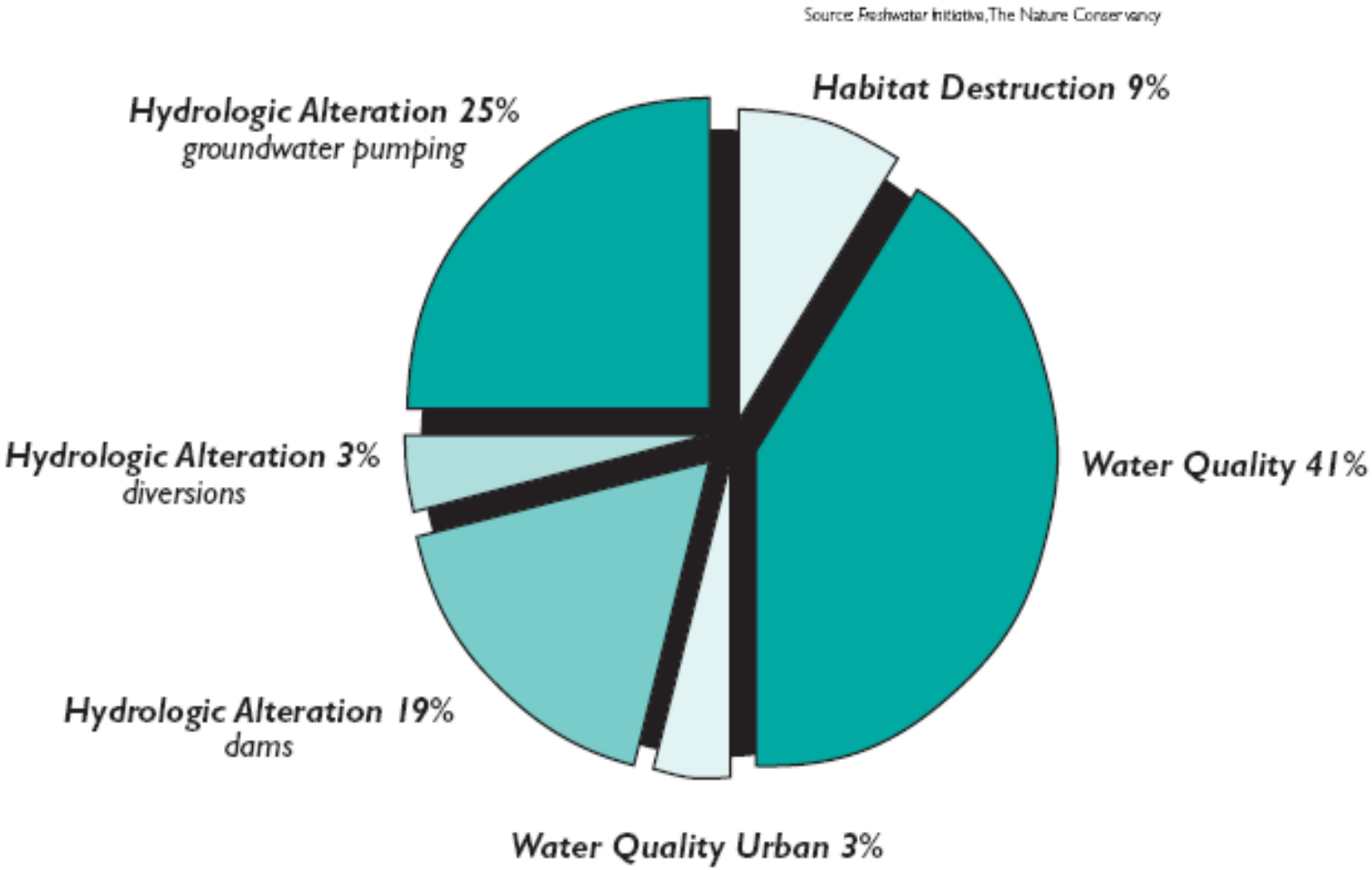
Wet Meadows, California

Fens, Colorado

Northern Hardwood Seepage Forests, New Hampshire

Springs, Oregon

Management Concerns



(From Brown et al, 2005)

Why Inventory GDEs?

- Document GDE location
- Document presence of species
- Establish baseline/desired conditions
- Determine vulnerability
- Document alteration
- Evaluate management
- Determine need for protection or restoration

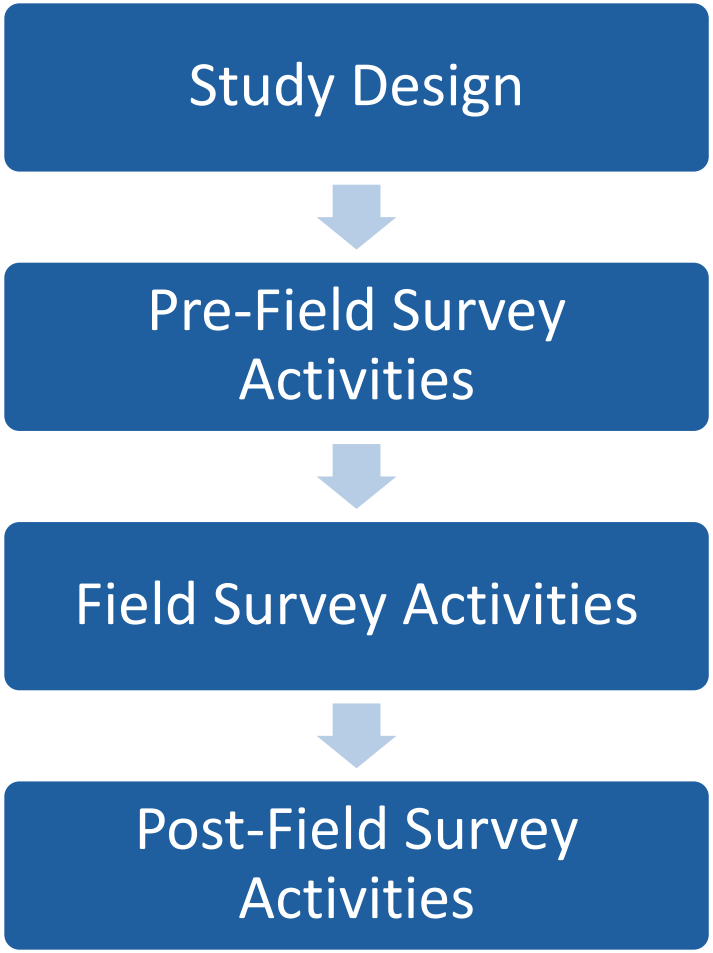
Field Survey Overview

- Personnel with skills in botany, soils, hydrology, geology
  - Level I: 2-3 people
  - Level II: 3-5 people

- Survey time:
  - Level I: less than 2 hours/site
  - Level II: 3-6 hours/site

Lesson Learned: Must have a trained interdisciplinary crew or data is collected poorly or not at all.

Inventory Steps



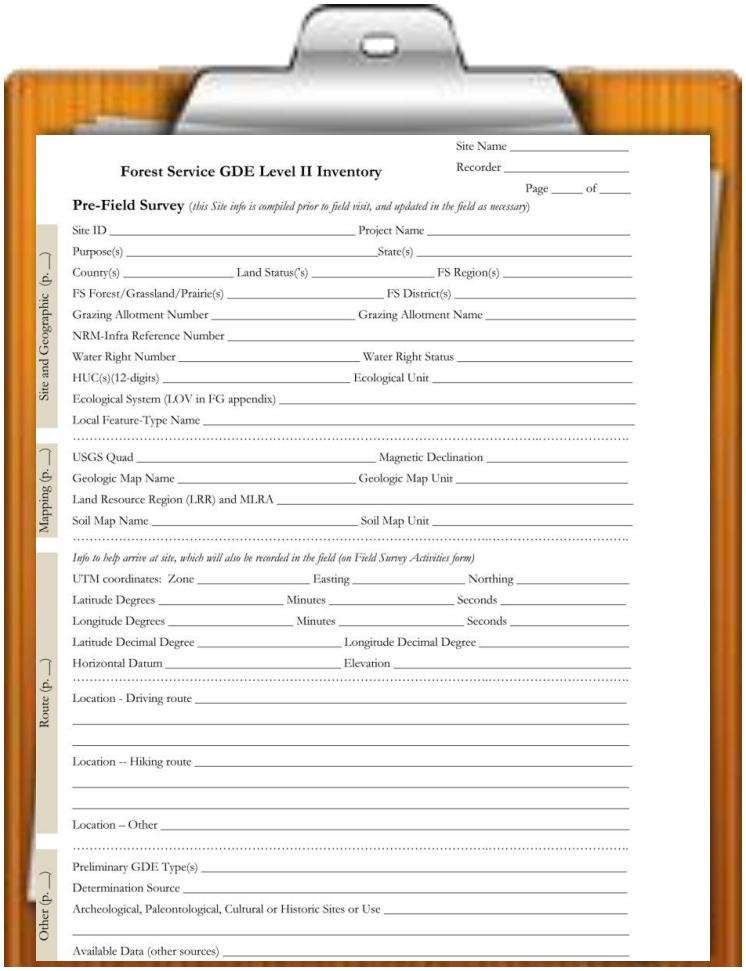
Inventory Steps: Study Design

- Identify management questions and set inventory objectives
- Determine area of interest (population of sites) and study design (random, stratified, etc.)
- Create sampling schedule
- Identify relationships to other inventory programs and data
- Coordinate with other partners
- Develop QA/QC procedures, including training and data management

This is covered in greater depth in the

Groundwater Inventory and Monitoring Technical Guide

Inventory Steps: Pre-Field Survey



Site Name _____
Recorder _____
Page ____ of ____

Forest Service GDE Level II Inventory

Pre-Field Survey *(this Site info is compiled prior to field visit, and updated in the field as necessary)*

Site and Geographic (p.__)

Site ID _____ Project Name _____
Purpose(s) _____ State(s) _____
County(s) _____ Land Status('s) _____ FS Region(s) _____
FS Forest/Grassland/Prairie(s) _____ FS District(s) _____
Grazing Allotment Number _____ Grazing Allotment Name _____
NRM-Infra Reference Number _____
Water Right Number _____ Water Right Status _____
HUC(s)(12-digits) _____ Ecological Unit _____
Ecological System (LOV in FG appendix) _____
Local Feature-Type Name _____

Mapping (p.__)

USGS Quad _____ Magnetic Declination _____
Geologic Map Name _____ Geologic Map Unit _____
Land Resource Region (LRR) and MLRA _____
Soil Map Name _____ Soil Map Unit _____

Route (p.__)

Info to help arrive at site, which will also be recorded in the field (on Field Survey Activities form)
UTM coordinates: Zone _____ Easting _____ Northing _____
Latitude Degrees _____ Minutes _____ Seconds _____
Longitude Degrees _____ Minutes _____ Seconds _____
Latitude Decimal Degree _____ Longitude Decimal Degree _____
Horizontal Datum _____ Elevation _____
Location - Driving route _____
Location -- Hiking route _____
Location – Other _____

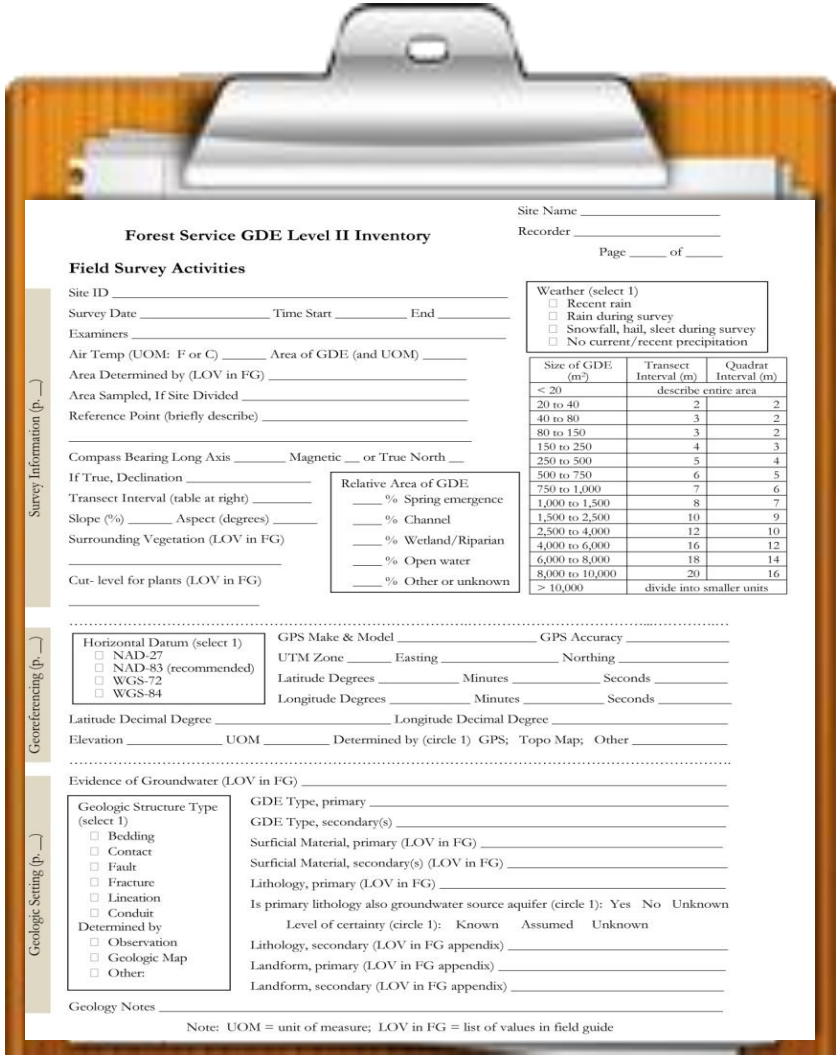
Other (p.__)

Preliminary GDE Type(s) _____
Determination Source _____
Archeological, Paleontological, Cultural or Historic Sites or Use _____
Available Data (other sources) _____

Paper Form - 1 page

- Site and Geographic
  - Purpose, County, HUC, etc.
- Mapping
  - USGS Quad, Geologic Map, LRR and MLRA, Soil Map
- Route
  - UTMs, Lat/Long, Elevation, Access Route
- Other
  - Preliminary GDE Type, Available Data (about site)

Inventory Steps: Field Survey



Site Name _____
Recorder _____
Page _____ of _____

Forest Service GDE Level II Inventory

Field Survey Activities

Survey Information (p. __)

Site ID _____
Survey Date _____ Time Start _____ End _____
Examiners _____
Air Temp (UOM: F or C) _____ Area of GDE (and UOM) _____
Area Determined by (LOV in FG) _____
Area Sampled, If Site Divided _____
Reference Point (briefly describe) _____
_____
Compass Bearing Long Axis _____ Magnetic __ or True North __
If True, Declination _____
Transect Interval (table at right) _____
Slope (%) _____ Aspect (degrees) _____
Surrounding Vegetation (LOV in FG)
_____
Cut- level for plants (LOV in FG)
_____

Weather (select 1)
- ☐ Recent rain
- ☐ Rain during survey
- ☐ Snowfall, hail, sleet during survey
- ☐ No current/recent precipitation

Relative Area of GDE
- ____ % Spring emergence
- ____ % Channel
- ____ % Wetland/Riparian
- ____ % Open water
- ____ % Other or unknown

Size of GDE (m^2)	Transect Interval (m)	Quadrat Interval (m)
< 20	describe entire area	
20 to 40	2	2
40 to 80	3	2
80 to 150	3	2
150 to 250	4	3
250 to 500	5	4
500 to 750	6	5
750 to 1,000	7	6
1,000 to 1,500	8	7
1,500 to 2,500	10	9
2,500 to 4,000	12	10
4,000 to 6,000	16	12
6,000 to 8,000	18	14
8,000 to 10,000	20	16
> 10,000	divide into smaller units	

Georeferencing (p. __)

Horizontal Datum (select 1)
- ☐ NAD-27
- ☐ NAD-83 (recommended)
- ☐ WGS-72
- ☐ WGS-84

GPS Make & Model _____ GPS Accuracy _____
UTM Zone _____ Easting _____ Northing _____
Latitude Degrees _____ Minutes _____ Seconds _____
Longitude Degrees _____ Minutes _____ Seconds _____
Latitude Decimal Degree _____ Longitude Decimal Degree _____
Elevation _____ UOM _____ Determined by (circle 1) GPS; Topo Map; Other _____

Geologic Setting (p. __)

Evidence of Groundwater (LOV in FG) _____

Geologic Structure Type (select 1)
- ☐ Bedding
- ☐ Contact
- ☐ Fault
- ☐ Fracture
- ☐ Lineation
- ☐ Conduit

Determined by
- ☐ Observation
- ☐ Geologic Map
- ☐ Other:

GDE Type, primary _____
GDE Type, secondary(s) _____
Surficial Material, primary (LOV in FG) _____
Surficial Material, secondary(s) (LOV in FG) _____
Lithology, primary (LOV in FG) _____
Is primary lithology also groundwater source aquifer (circle 1): Yes No Unknown
Level of certainty (circle 1): Known Assumed Unknown
Lithology, secondary (LOV in FG appendix) _____
Landform, primary (LOV in FG appendix) _____
Landform, secondary (LOV in FG appendix) _____
Geology Notes _____

Note: UOM = unit of measure; LOV in FG = list of values in field guide

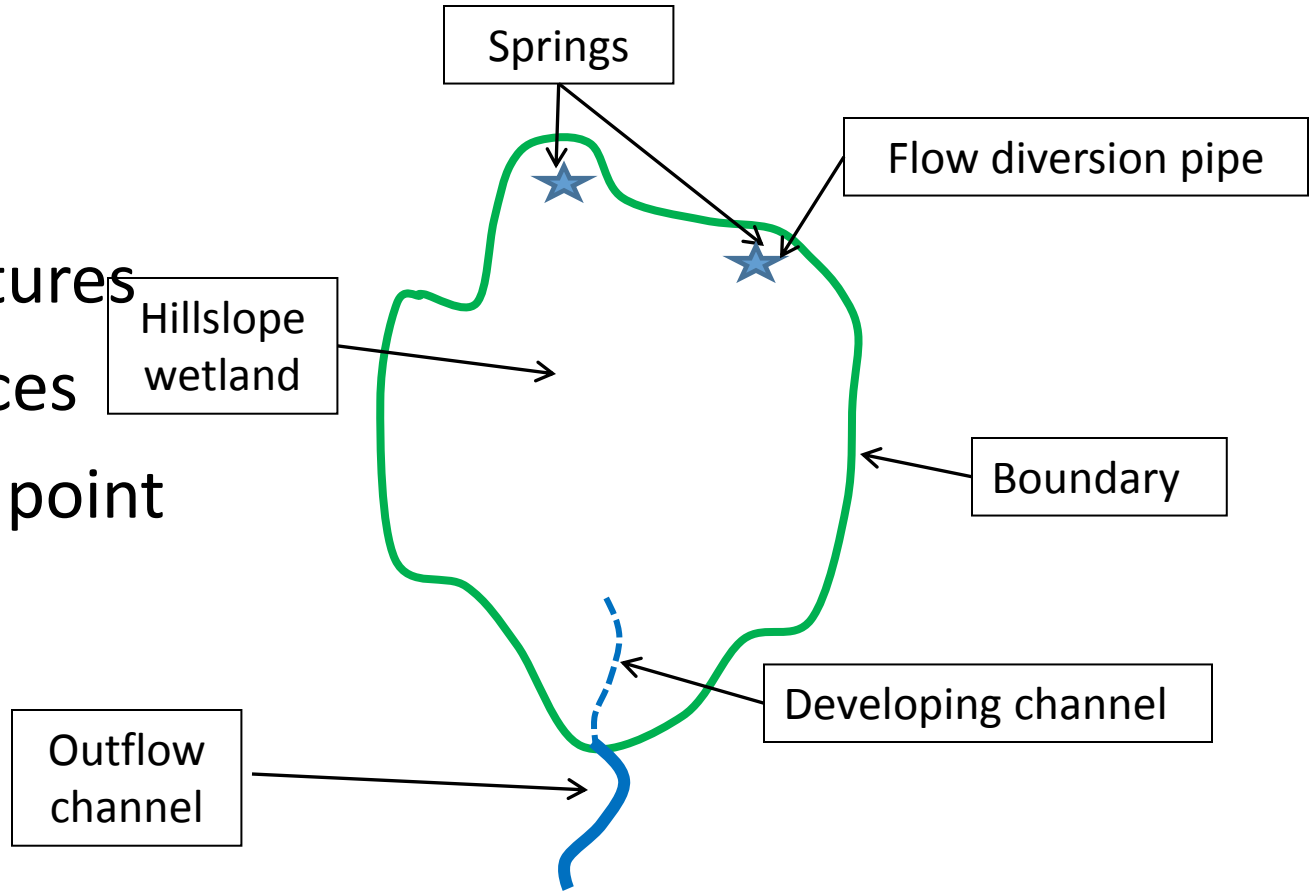
Paper forms

- 10 pages for Level I
  2 hours with 2-3 people

- 14 pages for Level II
  3-6 hours with 3-5 people

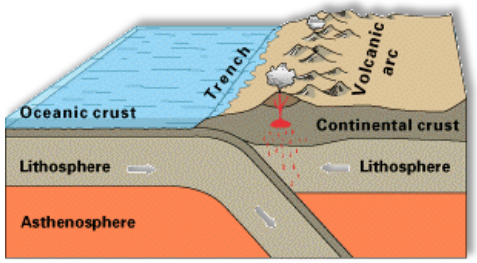
Field Survey Attributes

- **General information**
- **Georeferencing**
  - Boundary
  - Structures
  - Water features
  - Disturbances
  - Reference point

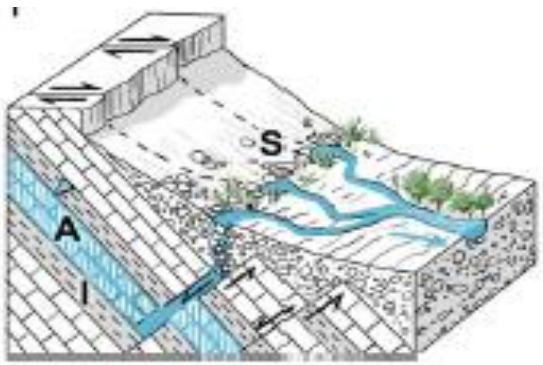


Field Survey Attributes

- **Geologic Setting**
  - Surficial material
  - Lithology
  - Landform
  - Geologic structure type



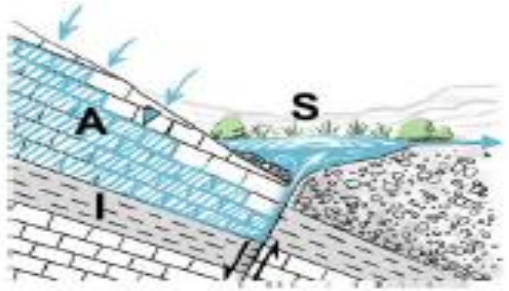
- **GDE Types** (Springer & Stevens, 2009)



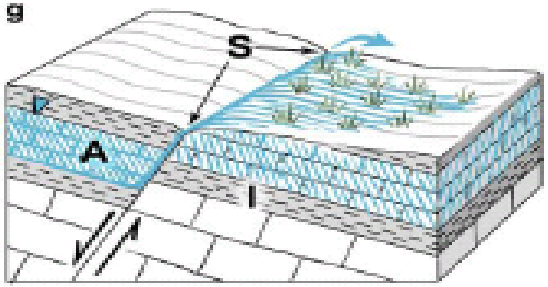
A - Aquifer **I - Impermeable Stratum** **S - Spring Source**

Springer and Stevens, 2009

Hillslope



Limnocrene



Helocrene

A - Aquifer I - Impermeable Stratum S - Spring Source

Springer and Stevens, 2009

Field Survey Attributes (1 of 2)

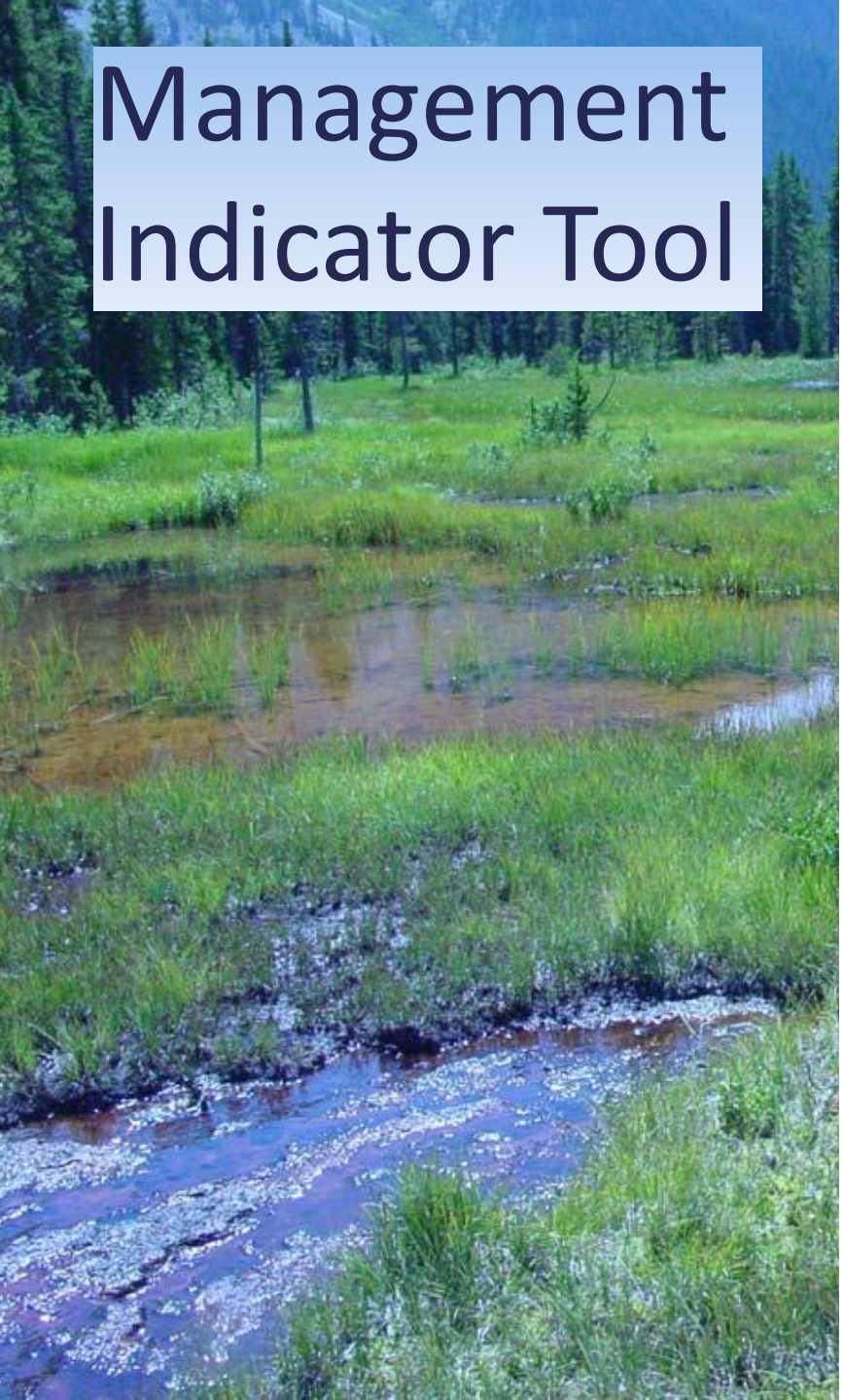
- **Vegetation**
  - Surrounding vegetation
  - Bryophyte abundance
  - Dominant species
  - Species of interest
- **Fauna**
  - Terrestrial herpetofauna
  - Terrestrial vertebrates
  - Aquatic vertebrates
  - Aquatic macroinvertebrates
- **Hydrology**
  - Flow information
  - Water table depth
  - Spring channel characteristics
  - Water quality
- **Soil**
  - Peat thickness
  - Texture/color of mineral layer
  - Redoximorphic features
  - Reaction to HCL

Field Survey Attributes (2 of 2)

- **Natural and Anthropogenic Disturbances**
  - Structures
  - Hydrologic and soil alteration
  - Recreation impacts
  - Impacts of management/land use

- **Management Indicator Tool**

  ID team answers the 25 Yes/No questions together
  - Hydrology
  - Geomorphology and Soils
  - Biology
  - Disturbances



Management Indicator Tool

Site Name _____

Recorder _____

Page _____ of _____

Forest Service GDE Level I Inventory

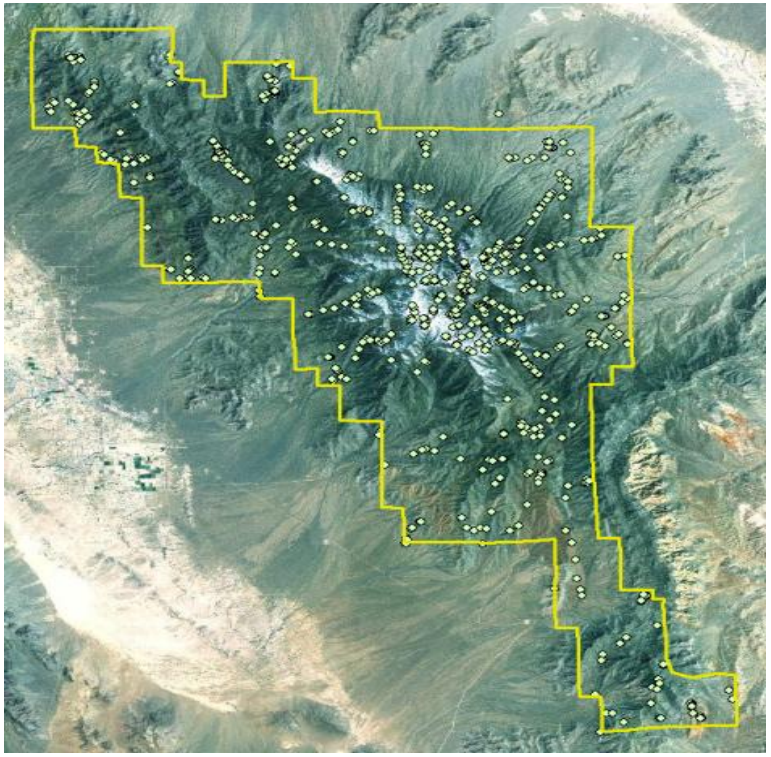
Management Indicator Tool (p. 82)

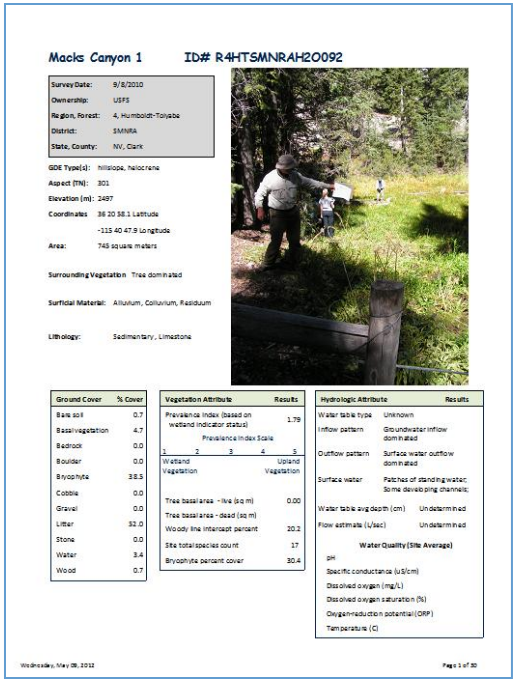
Management Indicators	True (Yes)	False (No)	Does Not Apply	Unable To Assess	Comment
Hydrology					
1. *Aquifer Functionality:* No evidence suggests that the aquifer supplying groundwater to the site is being affected by groundwater withdrawal or loss of recharge.					
2. *Watershed Functionality:* Within the watershed, no evidence suggests upstream/upgradient hydrologic alteration that could adversely affect the GDE site.					
3. *Water Quality:* Changes in water quality (surface or subsurface) are not affecting the groundwater dependent ecosystem site.					
Geomorphology and Soils					
4. *Landform Stability:* No evidence indicates human-caused mass movement or other surface disturbance affecting the GDE site stability.					
5. *Runout Channel:* The channel, if present, is functioning naturally and is not entrenched, eroded, or otherwise substantially altered.					
6. *Soil Integrity:* Soils are intact and functional. For example, saturation is sufficient to maintain hydric soils, if present; there is not excessive erosion or deposition.					
Biology					
7. *Vegetation Composition:* The site includes anticipated cover of plant species associated with the site environment, and no evidence suggests that upland species are replacing hydric species.					
8. *Vegetation Condition:* Vegetation exhibits seasonally appropriate health and vigor.					
9. *TES, SOI/SOC, Focal Floral Species:* Anticipated floral species are present (will vary by ecological region and will require some baseline information).					
10. *Faunal Species:* Anticipated aquatic and terrestrial faunal species associated with the site environment are present.					
11. *TES, SOI/SOC, Focal Faunal Species:* Anticipated faunal species are present (will vary by ecological region and will require some baseline information).					
12. *Invasive Species:* Invasive floral and faunal species are not established at the site.					

Inventory Steps: Post-Field Survey

- Verify geographic data
- Laboratory analyses (samples and specimens)
- Data management and interpretation
  - Transfer data from paper or electronic device
  - Generate summaries and reports
  - Download, label and store photos
  - Scan hand-written materials such as drawings and notes
- Validate and confirm management indicator
- Consider Other Data Analysis

Data Management and Analysis





Macks Canyon 1 **ID# R4HTSMNRAH20092**

Survey Date:	9/8/2010
Ownership:	USFS
Region, Forest:	4, Humboldt-Toiyabe
District:	SMNRA
State, County:	NV, Clark

GDE Type(s): hillslope, helocrene
Aspect (TN): 301
Elevation (m): 2497
Coordinates 36 20 58.1 Latitude
-115 40 47.9 Longitude
Area: 745 square meters

Surrounding Vegetation Tree dominated

Surficial Material: Alluvium, Colluvium, Residuum

Lithology: Sedimentary, Limestone

Ground Cover	% Cover
Bare soil	0.7
Basal vegetation	4.7
Bedrock	0.0
Boulder	0.0
Bryophyte	38.5
Cobble	0.0
Gravel	0.0
Litter	32.0
Stone	0.0
Water	3.4
Wood	0.7

Vegetation Attribute	Results
Prevalence Index (based on wetland indicator status)	1.79
Prevalence Index Scale: 1 Wetland Vegetation … 5 Upland Vegetation	
Tree basal area - live (sq m)	0.00
Tree basal area - dead (sq m)	
Woody line intercept percent	20.2
Site total species count	17
Bryophyte percent cover	30.4

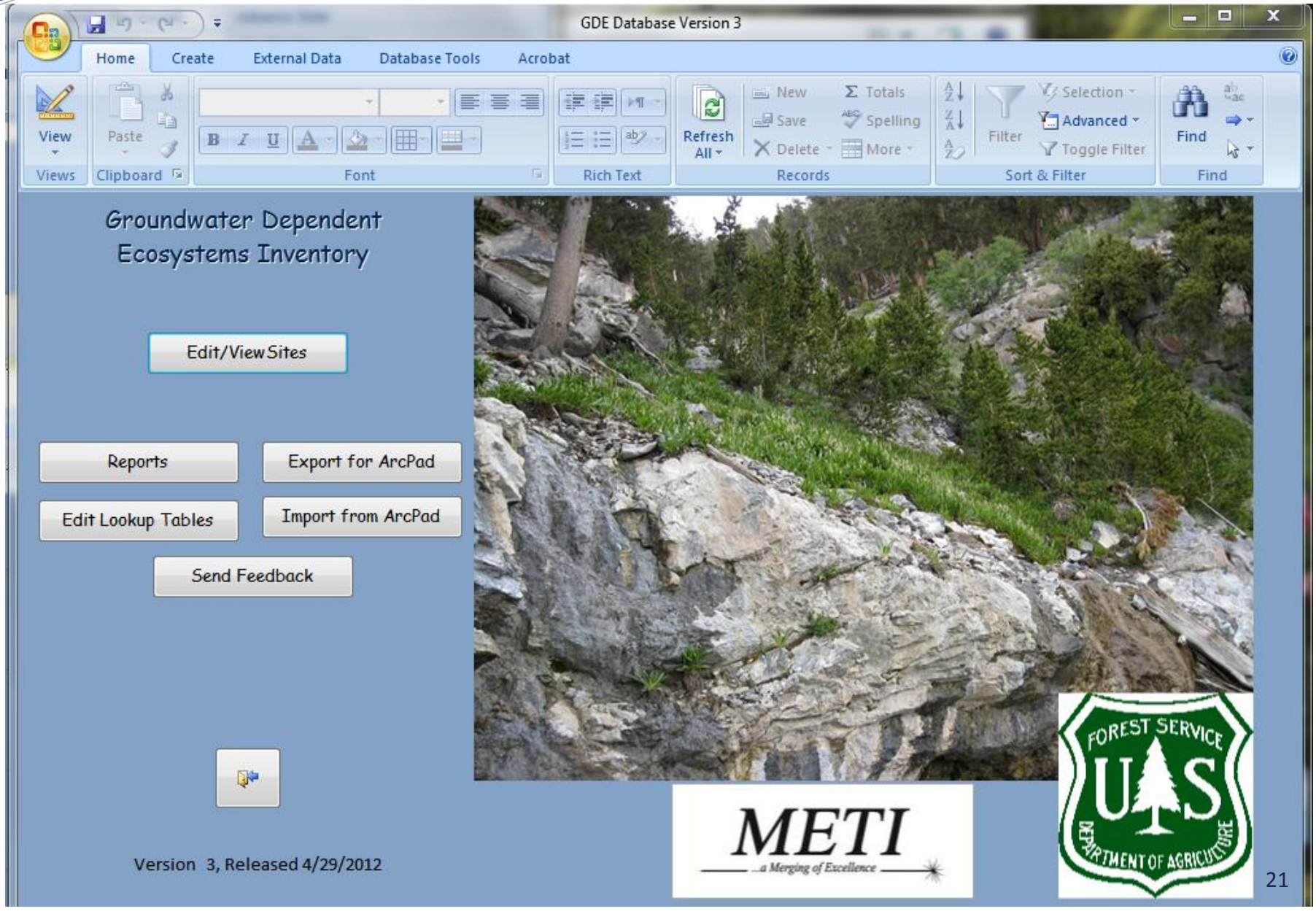
Hydrologic Attribute	Results
Water table type	Unknown
Inflow pattern	Groundwater inflow dominated
Outflow pattern	Surface water outflow dominated
Surface water	Patches of standing water; Some developing channels
Water table avg depth (cm)	Undetermined
Flow estimate (L/sec)	Undetermined

Water Quality (Site Average)

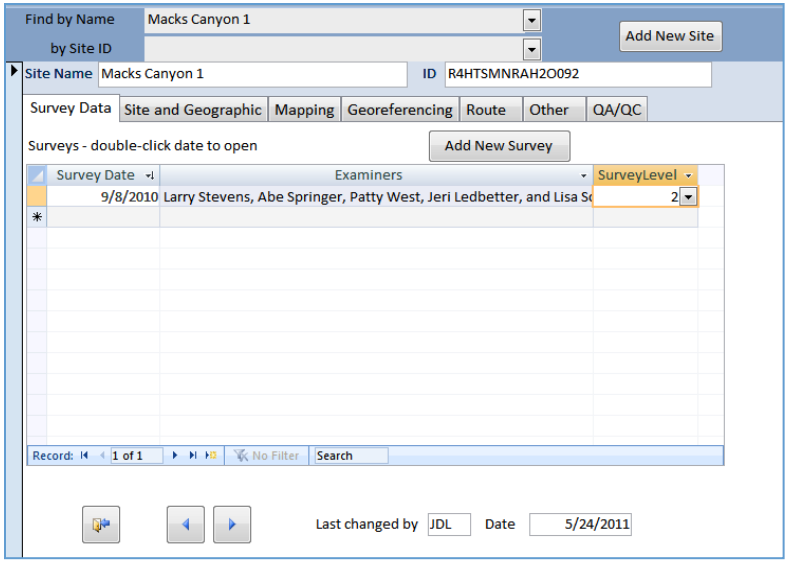
pH
Specific conductance (uS/cm)
Dissolved oxygen (mg/L)
Dissolved oxygen saturation (%)
Oxygen-reduction potential (ORP)
Temperature (C)

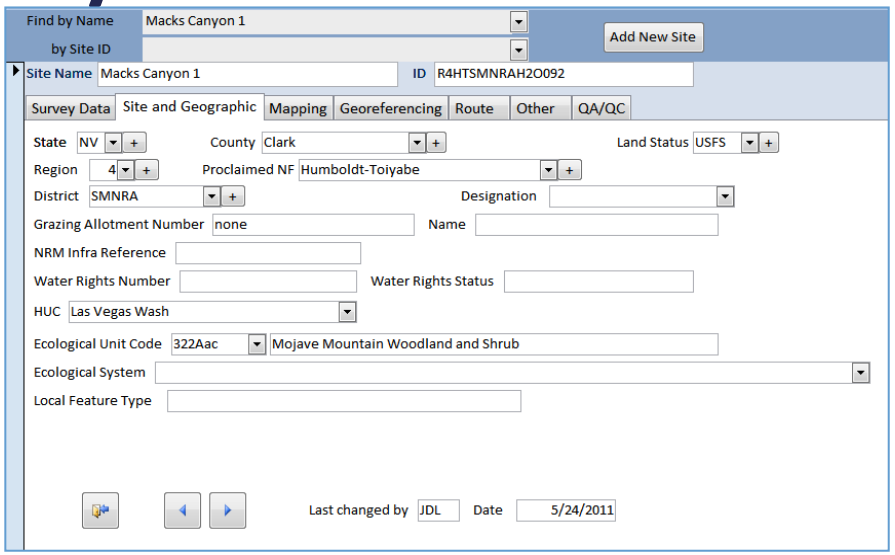
Wednesday, May 09, 2012 Page 1 of 10

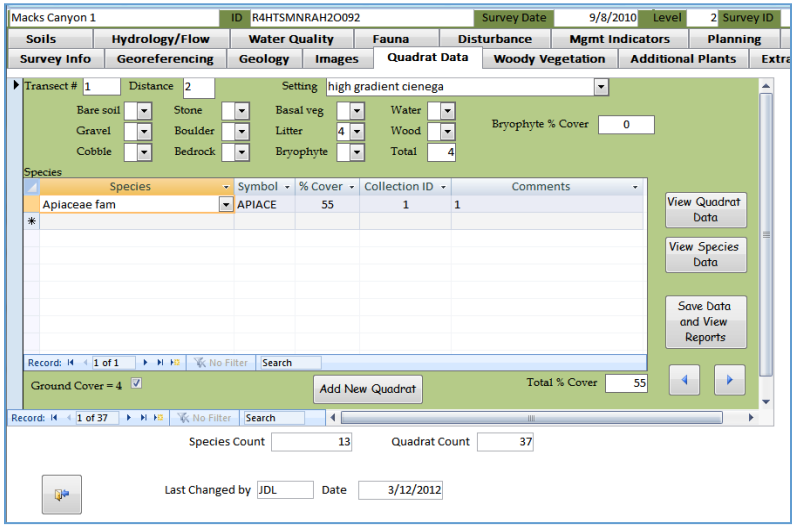
MS Access Database

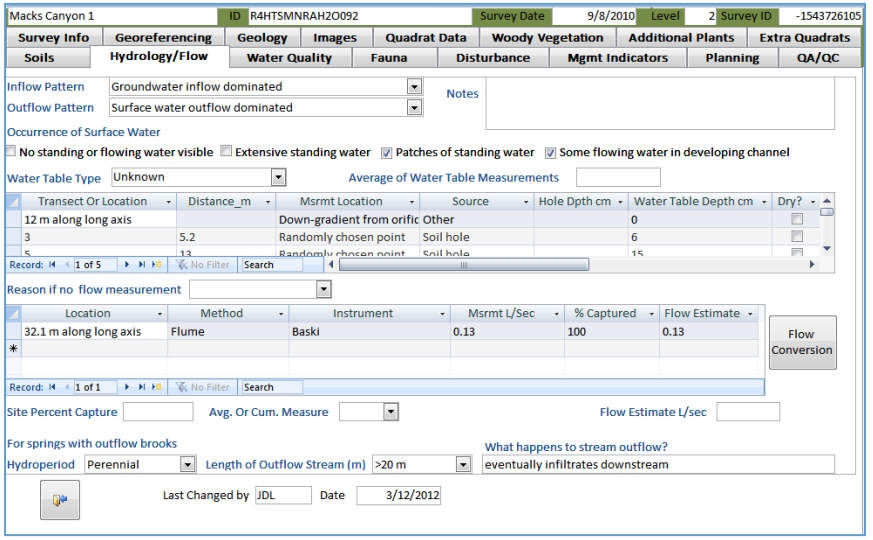


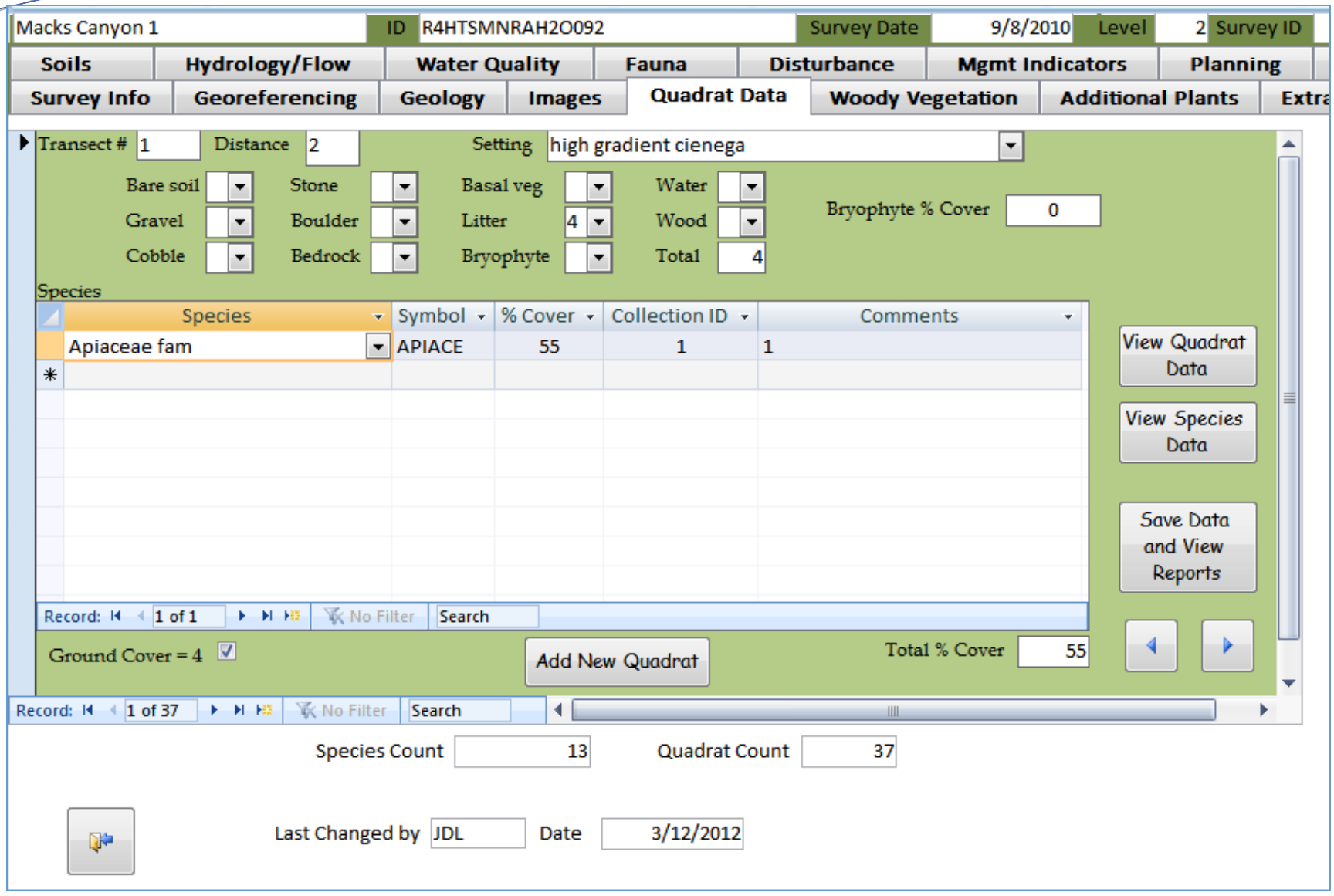
Data Entry Forms

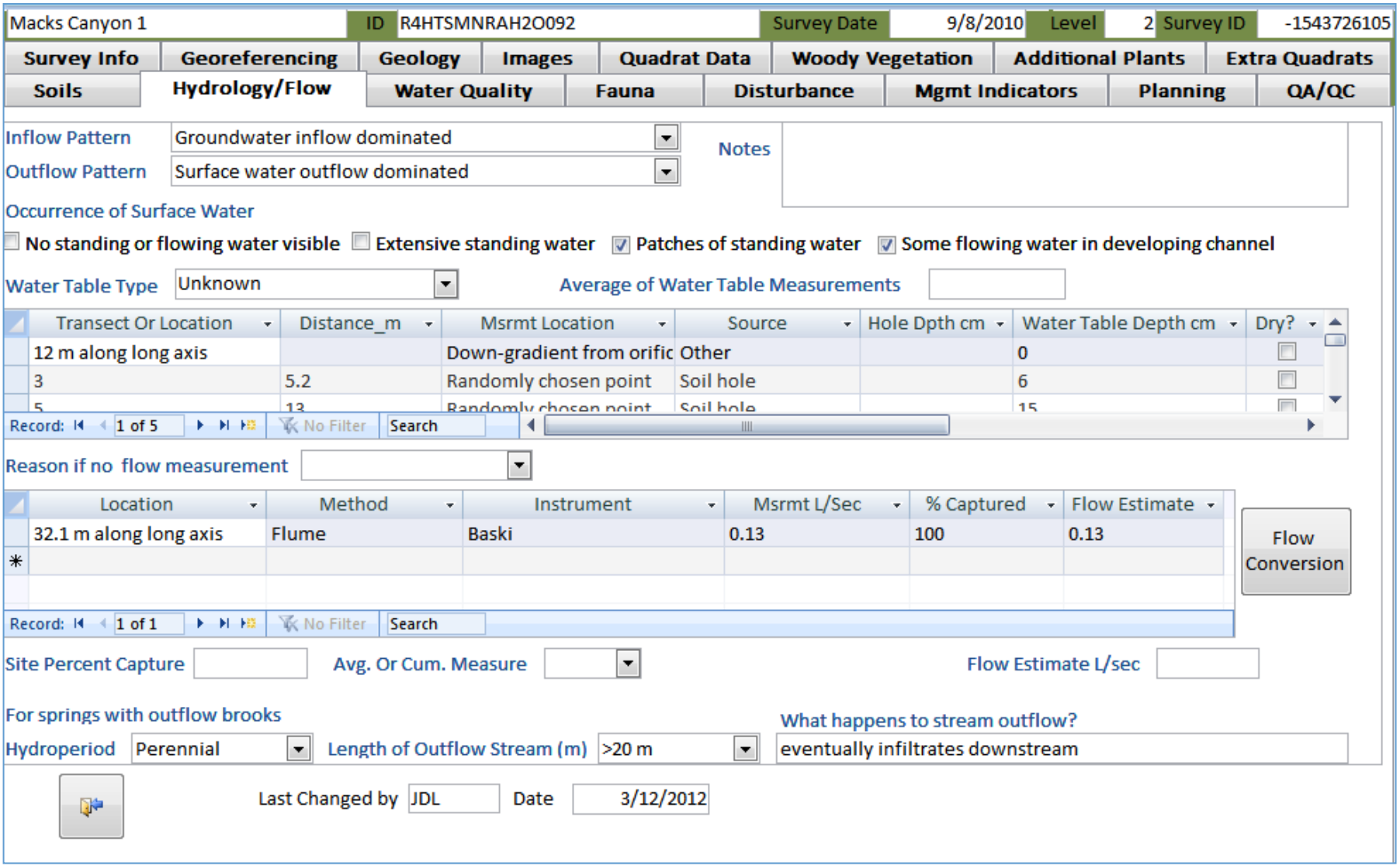









Macks Canyon 1
ID
R4HTSMNRAH2O092
Survey Date
9/8/2010
Level
2
Survey ID
Soils
Hydrology/Flow
Water Quality
Fauna
Disturbance
Mgmt Indicators
Planning
Survey Info
Georeferencing
Geology
Images
Quadrat Data
Woody Vegetation
Additional Plants
Transect #
1
Distance
2
Setting
high gradient cienega
Bare soil
Stone
Basal veg
Water
Gravel
Boulder
Litter
4
Wood
Cobble
Bedrock
Bryophyte
Total
4
Bryophyte % Cover
0
Species
Species
Symbol
% Cover
Collection ID
Comments
Apiaceae fam
APIACE
55
1
1
View Quadrat Data
View Species Data
Save Data and View Reports
Record: 1 of 1
No Filter
Search
Ground Cover = 4
Add New Quadrat
Total % Cover
55
Record: 1 of 37
No Filter
Search
Species Count
13
Quadrat Count
37
Last Changed by
JDL
Date
3/12/2012


Macks Canyon 1
ID R4HTSMNRAH2O092
Survey Date 9/8/2010
Level 2
Survey ID -1543726105
Survey Info
Georeferencing
Geology
Images
Quadrat Data
Woody Vegetation
Additional Plants
Extra Quadrats
Soils
Hydrology/Flow
Water Quality
Fauna
Disturbance
Mgmt Indicators
Planning
QA/QC
Inflow Pattern
Groundwater inflow dominated
Outflow Pattern
Surface water outflow dominated
Notes
Occurrence of Surface Water
No standing or flowing water visible
Extensive standing water
Patches of standing water
Some flowing water in developing channel
Water Table Type
Unknown
Average of Water Table Measurements
Transect Or Location
Distance_m
Msrmt Location
Source
Hole Dpth cm
Water Table Depth cm
Dry?
12 m along long axis
Down-gradient from orific
Other
0
3
5.2
Randomly chosen point
Soil hole
6
Record: 1 of 5
No Filter
Search
Reason if no flow measurement
Location
Method
Instrument
Msrmt L/Sec
% Captured
Flow Estimate
32.1 m along long axis
Flume
Baski
0.13
100
0.13
Flow Conversion
Record: 1 of 1
No Filter
Search
Site Percent Capture
Avg. Or Cum. Measure
Flow Estimate L/sec
For springs with outflow brooks
What happens to stream outflow?
Hydroperiod
Perennial
Length of Outflow Stream (m)
>20 m
eventually infiltrates downstream
Last Changed by
JDL
Date
3/12/2012

Site Report for Level I

Macks Canyon 1 ID# R4HTSMNRAH20092

Survey Date:	9/8/2010
Ownership:	USFS
Region, Forest:	4, Humboldt-Toiyabe
District:	SMNRA
State, County:	NV, Clark

GDE Type(s): hillslope, helocrene

Aspect (TN): 301

Elevation (m): 2487

Coordinates: 36 20 38.1 Latitude
-115 40 47.9 Longitude

Area: 745 square meters

Surrounding Vegetation: Tree dominated

Surficial Material: Alluvium, Colluvium, Residuum

Lithology: Sedimentary, Limestone

Bryophyte Abundance:

Lifeform	Rank	Dominant Species
Tree		
Shrub		
Graminoid		
Forb		
Aquatic		
Unknown		

Plant Species of Interest

None

Hydrologic Attribute	Results
Water table type	Unknown
Inflow pattern	Groundwater inflow dominated
Outflow pattern	Surface water outflow dominated
Surface water	Patches of standing water; Some developing channels;
Water table depth single location (cm)	Undetermined
Flow estimate (L/sec)	Undetermined

Water Quality (Single Location)

pH

Specific conductance (uS/cm)

Dissolved oxygen (mg/L)

Dissolved oxygen saturation (%)

Oxygen-reduction potential (ORP)

Temperature (C)

Macks Canyon 1 (continued)

Fauna

None

Disturbance

Hydrology: Water diversion (permanently diverted);	Recreational effects: Other recreational effects observed--see disturbance notes;	
	Animal effects: Grazing or browsing (by ungulates); Wild animals; Trails by animals and people; Trampling (by ungulates, native or non native);	
Soil alteration: Pedestals or hummocks (by people or animals); Pipes; Trails (by people or animals);	Miscellaneous effects: Tree cutting (timber harvest or other); Refuse disposal;	
	Disturbance Notes	
Structures: Exclosure fence;	Litter, a golf ball, and shotgun shells were found at the site.	

Soils

a long axis, 12m, at 1.3m, sandy loam, 10YR2/2

Macks Canyon 1 (continued)

Management Indicators

1) Aquifer (groundwater) not altered	UA	
2) Watershed (surface water) not altered	True	
3) Water quality changes not affecting site	True	
Geomorphology and Soils		
4) Landform stability not altered	True	
5) Runout channel functioning naturally	False	Some alteration; road adjacent to site; ungulate trampling
6) Soil integrity not altered	False	ungulate trampling
Biology		
7) Vegetation composition as anticipated	False	False
8) Vegetation condition is healthy	True	
9) TES, SOI/SOC, focal flora as anticipated	UA	
10) Faunal species as anticipated	UA	
11) TES, SOI/SOC, focal fauna as anticipated	UA	
12) Invasive species not established	True	
Disturbances		
13) Flow regulation not adversely affecting site	False	
14) Construction, Roads not adversely affecting	True	
15) Fencing functions properly	UA	
16) Herbivory not adversely affecting site	False	
17) Recreation not adversely affecting site	False	
18) Other disturbance not adversely affecting	False	
Administrative Context		
19) Cultural values do not affect site mgmt	False	Most springs have cultural & religious significance
20) Land ownership is FS in and around site	True	
21) Other landowner actions not affecting site	True	
22) Land Management Plan provides protection	True	
23) Environmental compliance occurring	True	
24) Water uses not adversely affecting site	True	
25) Water rights filed and not outstanding	True	

Plant codes and native status are from the USDA PLANTS database web page: http://plants.usda.gov

Site Report for Level II

Macks Canyon 1 ID# R4HTSMNRAH20092

Survey Date:	9/8/2010
Ownership:	USFS
Region, Forest:	4, Humboldt-Toiyabe
District:	SMNRA
State, County:	NV, Clark

GDE Type(s): hillslope, helocrene
Aspect (TN): 301
Elevation (m): 2497
Coordinates: 36 20 58.1 Latitude, -115 40 47.9 Longitude
Area: 745 square meters
Surrounding Vegetation: Tree dominated
Surficial Material: Alluvium, Colluvium, Residuum
Lithology: Sedimentary, Limestone

Ground Cover	% Cover
Bare soil	0.7
Basal vegetation	4.7
Bedrock	0.0
Boulder	0.0
Bryophyte	38.5
Cobble	0.0
Gravel	0.0
Litter	52.0
Stone	0.0
Water	3.4
Wood	0.7

Vegetation Attribute	Results
Prevalence Index (based on wetland indicator status)	1.79
Prevalence Index Scale: 1 2 3 4 5 (Wetland Vegetation … Upland Vegetation)	
Tree basal area - live (sq m)	0.00
Tree basal area - dead (sq m)	
Woody line intercept percent	20.2
Site total species count	17
Bryophyte percent cover	30.4

Hydrologic Attribute	Results
Water table type	Unknown
Inflow pattern	Groundwater inflow dominated
Outflow pattern	Surface water outflow dominated
Surface water	Patches of standing water; Some developing channels;
Water table avg depth (cm)	Undetermined
Flow estimate (L/sec)	Undetermined

Water Quality (Site Average)

pH
Specific conductance (uS/cm)
Dissolved oxygen (mg/L)
Dissolved oxygen saturation (%)
Oxygen-reduction potential (ORP)
Temperature (C)

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Macks Canyon 1 (continued)

Vegetation

Quadrat Species

Species, USDA Symbol	Native Status	% Cover
Apiaceae fam, APIACE	U	12.1
Aquilegia formosa, AQFO	N	2.3
Carex aurea, CAAU3	N	0.6
Carex subfusca, CASU6	N	1.4
Carex, CAREX	N	10.4
Equisetum laevigatum, EQLA	N	7.6
Mainthemum stellatum, MAST4	N	4.9
Parnassia, PARNA	N	1.7
Platanthera sparsiflora, PLSP2	N	2.1
Poa, POA	U	7.4
Primula fragrans, DOJER	N	26.3
Rosa woodsii, ROWO	N	0.1
Viola sororia, VISO	N	3.8

Quadrat Plant Species 13 Average % Cover/Quadrat 80.7

Additional Plants

None

Woody Line-Intercept

Species, USDA Symbol	% Cover
Abies concolor, ABCO	15.3
Juniperus scopulorum, JUSC2	
Ribes, RIBES	
Ribes cereum, RICE	
Rosa woodsii, ROWO	

Tree Belt Transects

None

Wednesday, May 09, 2012

Macks Canyon 1 (continued)

Fauna

Vertebrate Species	Detection	Comments
Clark's Nutcracker, Nucifraga columbiana	obs	
Common Raven, Corvus corax	obs	
crossbill sp.,	obs	
Dark-eyed Junco, Junco hyemalis	obs	
elk, Cervus canadensis	sign	
Mountain Chickadee, Poecile gambeli	obs	
Northern Flicker, Colaptes auratus	obs	
Red-tailed Hawk, Buteo jamaicensis	obs	
Swainson's thrush,	obs	

Invertebrate Species	Detection	Comments
COL Elmidae	obs	optioservus
COL Scirtidae	spot	
DIP Stratiomyidae	spot	
LEP Lycaenidae	obs	
MOLL	spot	Ramshorn terr land
MOLL Succineidae Catinella	obs	
TRI Limnephilidae	obs	
TRI Polycentropodidae Polycentropus	spot	
TUR8 Planariidae	obs	

Macks Canyon 1 (continued)

Disturbance

Hydrology: Water diversion (permanently diverted);	Recreational effects: Other recreational effects observed--see disturbance notes;
	Animal effects: Grazing or browsing (by ungulates); Wild animals; Trails by animals and people; Trampling (by ungulates, native or nonnative);
Soil alteration: Pedestals or hummocks (by people or animals); Pipes; Trails (by people or animals);	Miscellaneous effects: Tree cutting (timber harvest or other); Refuse disposal;
	Disturbance Notes: Litter, a golf ball, and shotgun shells were found at the site.
Structures: Exclosure fence;	

Soils

along long axis, 12m, at 1.3 m, sandy loam, 10YR2/2

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Macks Canyon 1 (continued)

Management Indicators

1) Aquifer (groundwater) not altered	UA	
2) Watershed (surface water) not altered	True	
3) Water quality changes not affecting site	True	
Geomorphology and Soils		
4) Landform stability not altered	True	
5) Runout channel functioning naturally	False	Some alteration; road adjacent to site; ungulate trampling
6) Soil integrity not altered	False	ungulate trampling
Biology		
7) Vegetation composition as anticipated	False	False
8) Vegetation condition is healthy	True	
9) TES, SOI/SOC, focal flora as anticipated	UA	
10) Faunal species as anticipated	UA	
11) TES, SOI/SOC, focal fauna as anticipated	UA	
12) Invasive species not established	True	
Disturbances		
13) Flow regulation not adversely affecting site	False	
14) Construction, Roads not adversely affecting	True	
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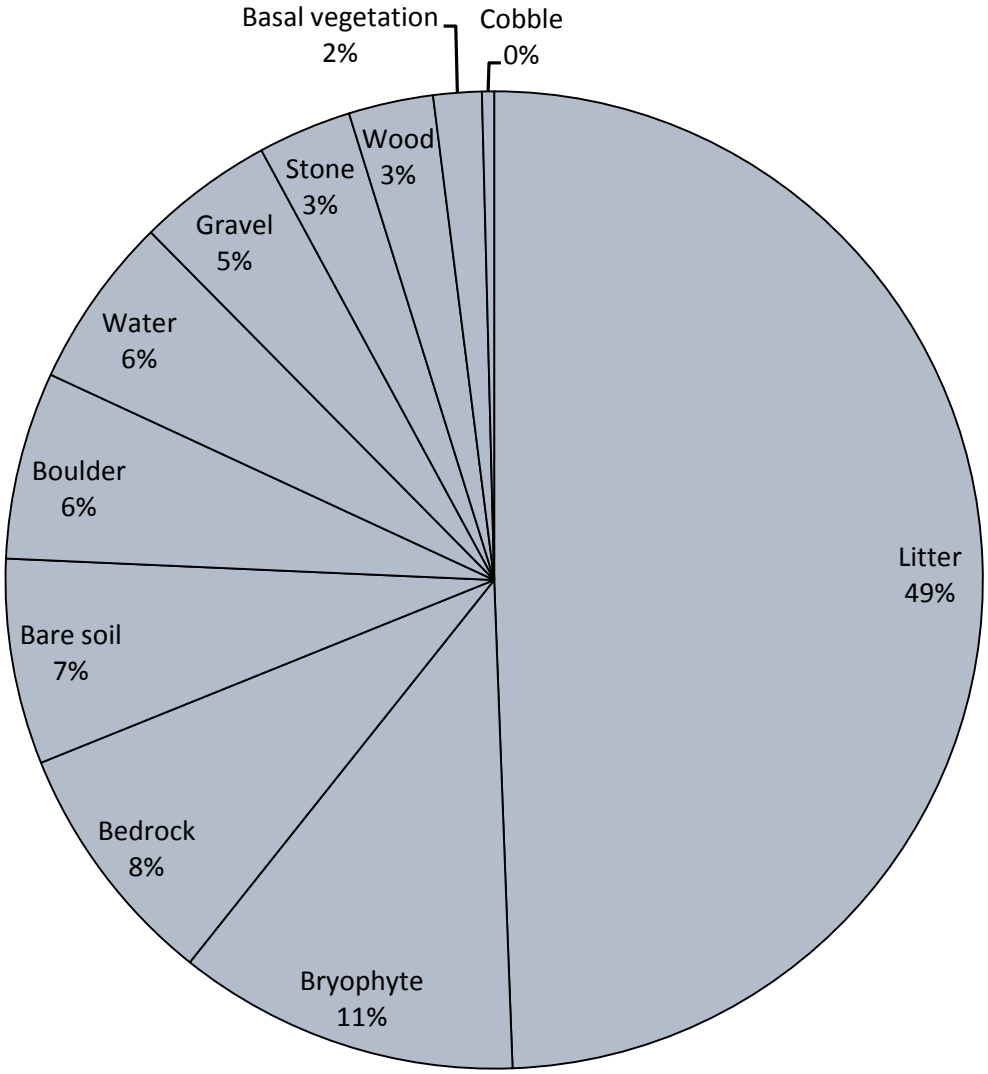
Other Summaries

- Vegetation - Species lists and cover (averages)
- Soil - Depths and thicknesses of organic and mineral layers (averages)
  - Areas of flooded soils (percent of sites)
  - Soil texture and color (list or percent of sites)
- Hydrology
  - Flow (range and average)
  - Water quality (averages) -temperature, pH, conductivity, Oxygen-reduction potential (ORP), Dissolved Oxygen (DO)
- Fauna - Species list and percent of sites with various fauna
- Disturbance - List and percent of sites
- Management Indicator Tool - Percent of sites with each Indicator

CASE STUDY - Spring Mountains NRA

Spring Types (at a site)	Sites
Cave	1
Cave, Hanging garden	1
Gushet, Hillslope	1
Hanging garden	6
Hanging garden, Rheocrene	2
Helocrene, Hillslope	2
Helocrene, Rheocrene	1
Hillslope	6
Hillslope, Rheocrene	11
Hypocrene, Rheocrene	2
Rheocrene	11
Unknown	3
Total	47

Ground Cover - Spring Mountains NRA



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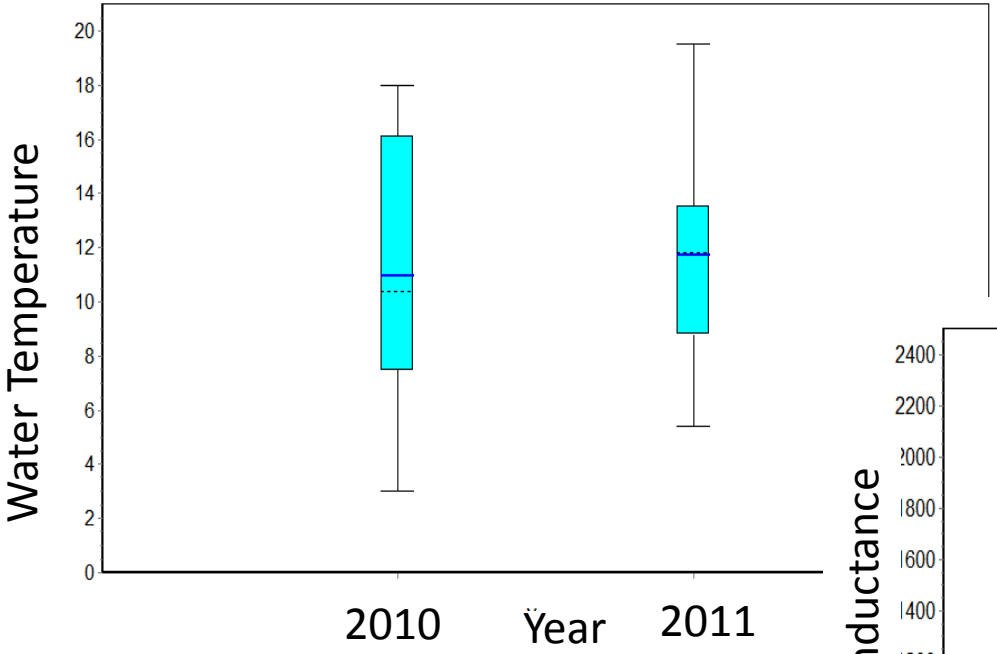
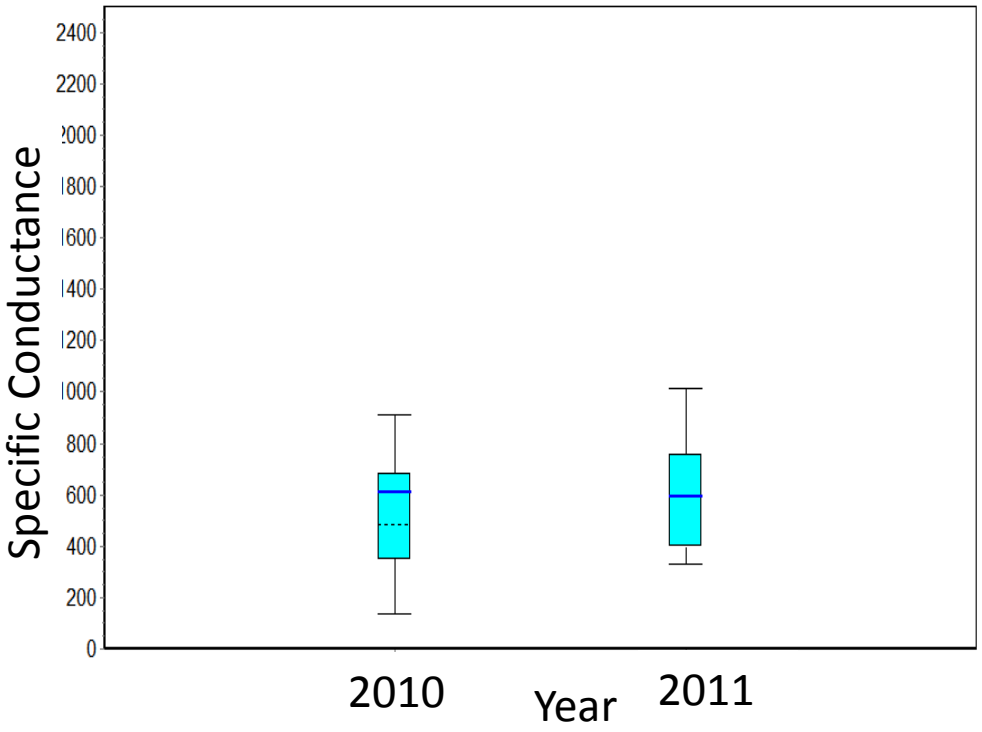
Water Quality - Spring Mountains NRA





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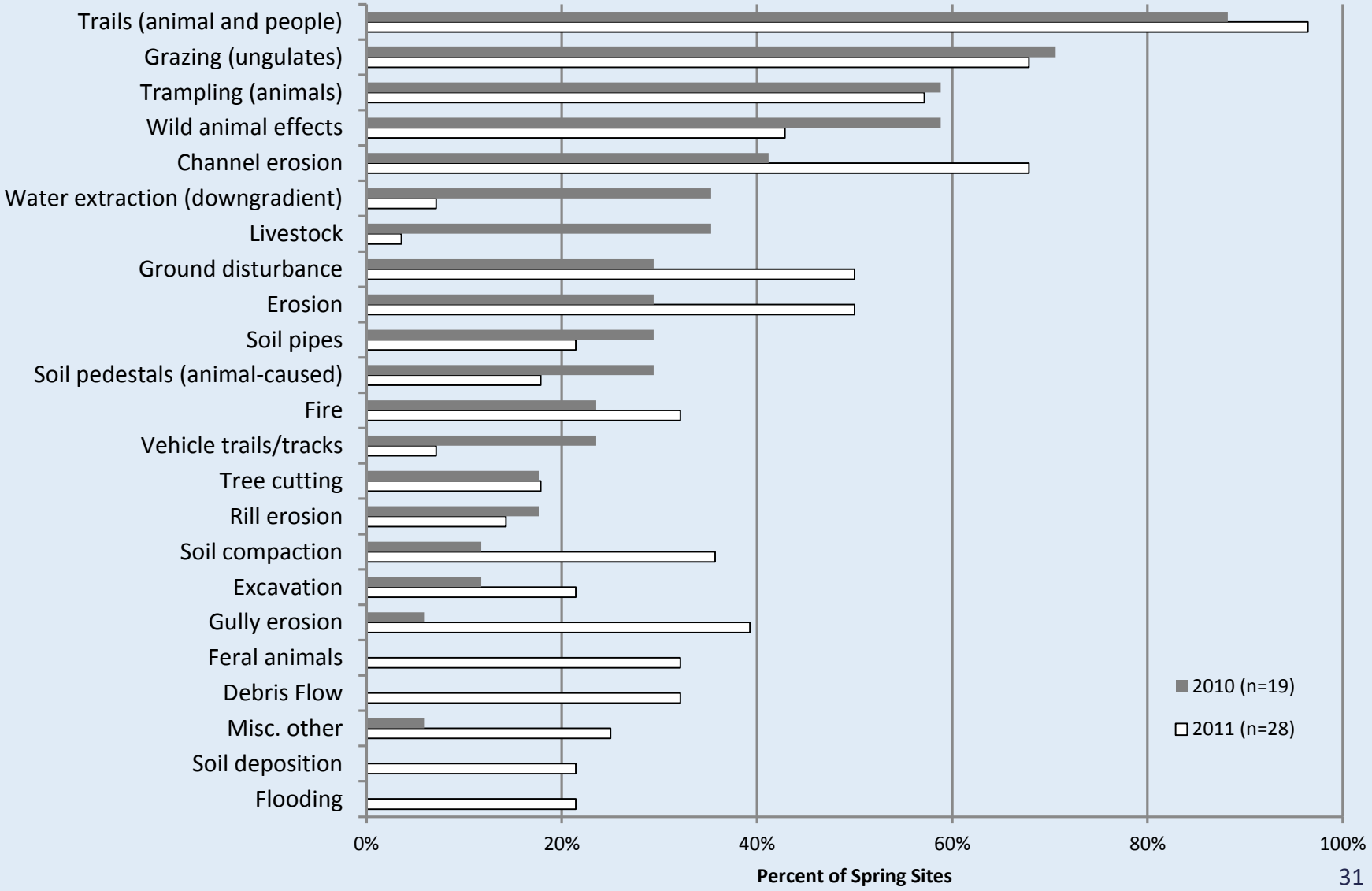
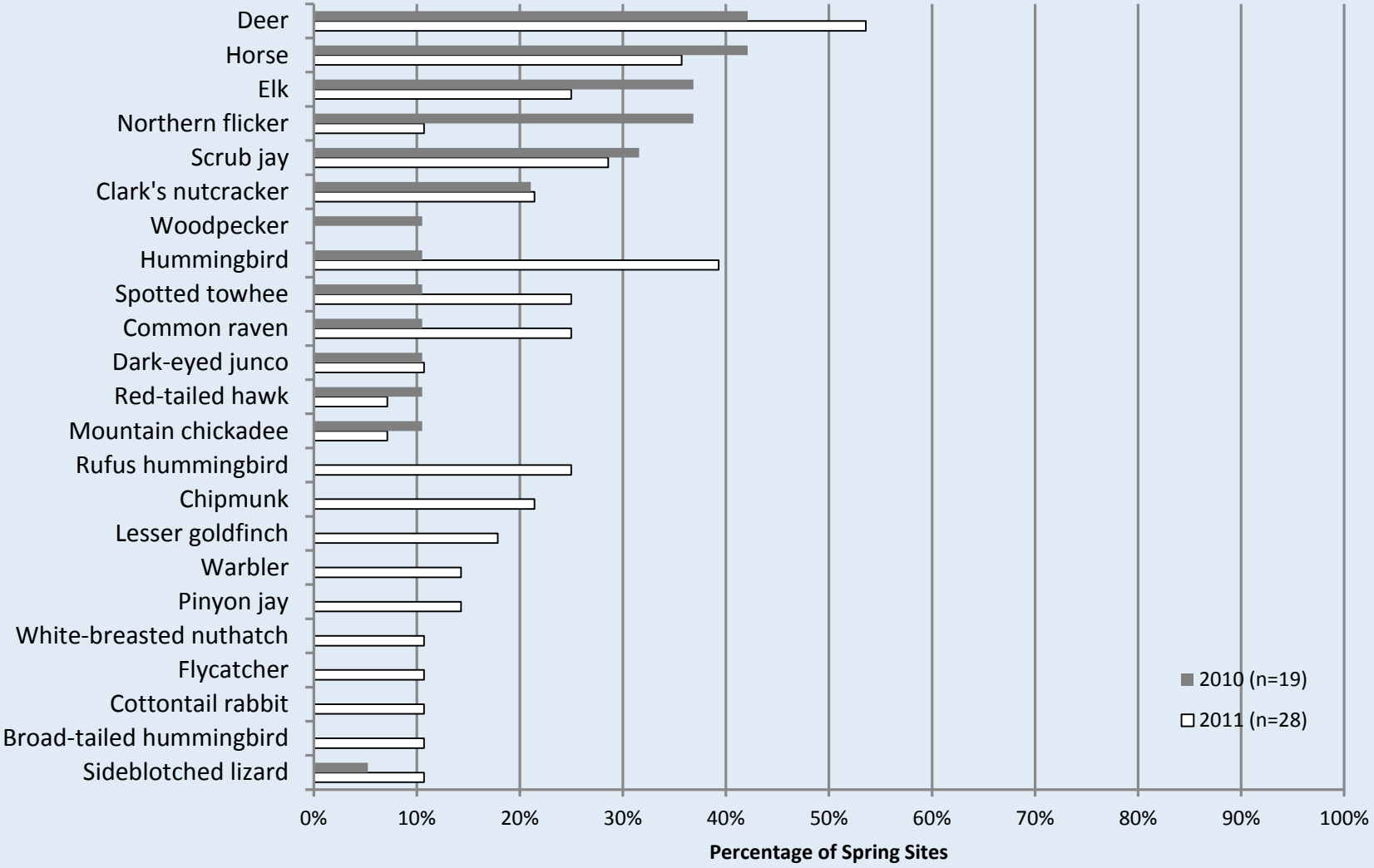
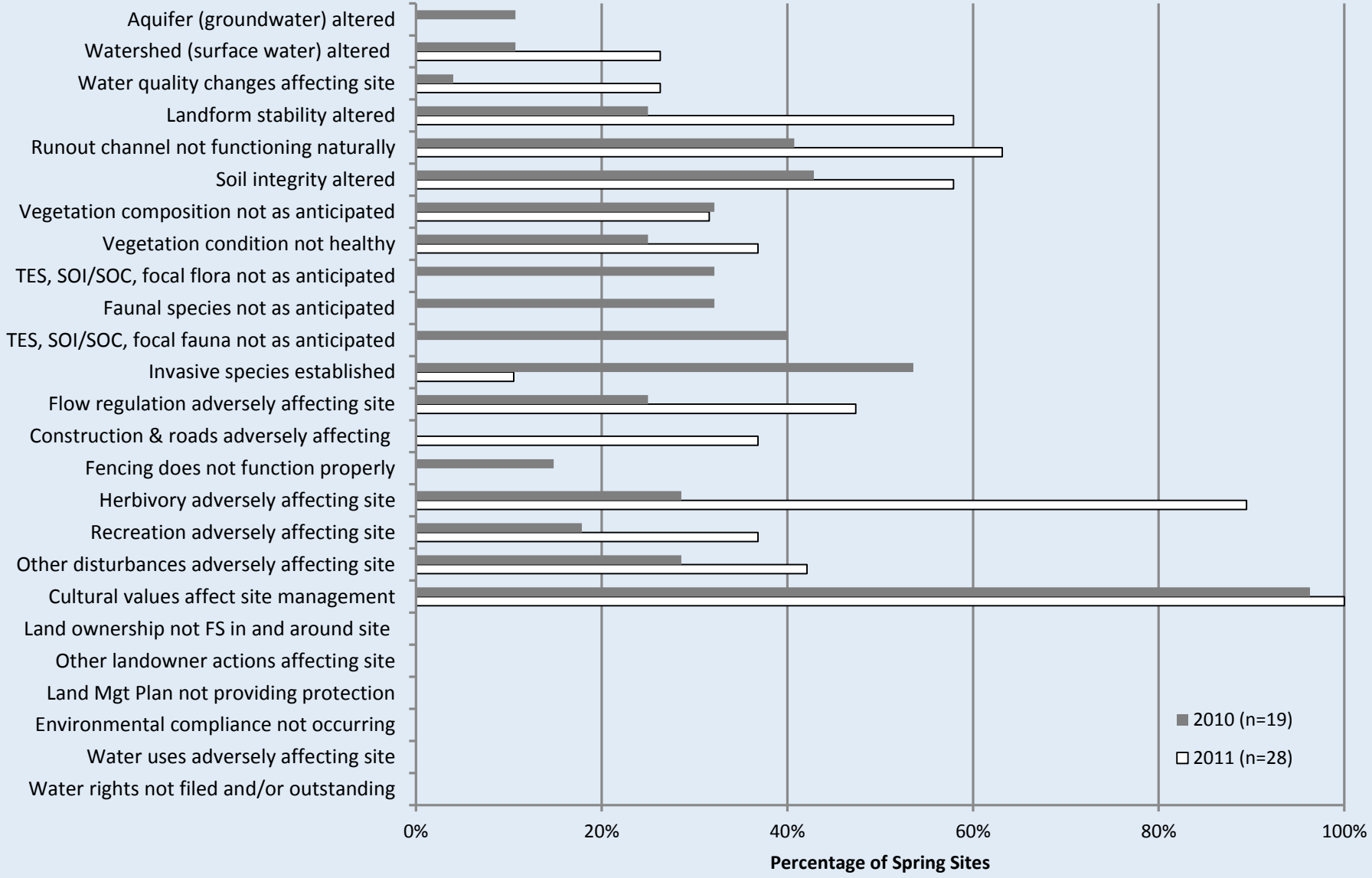
Disturbances - Spring Mountains NRA



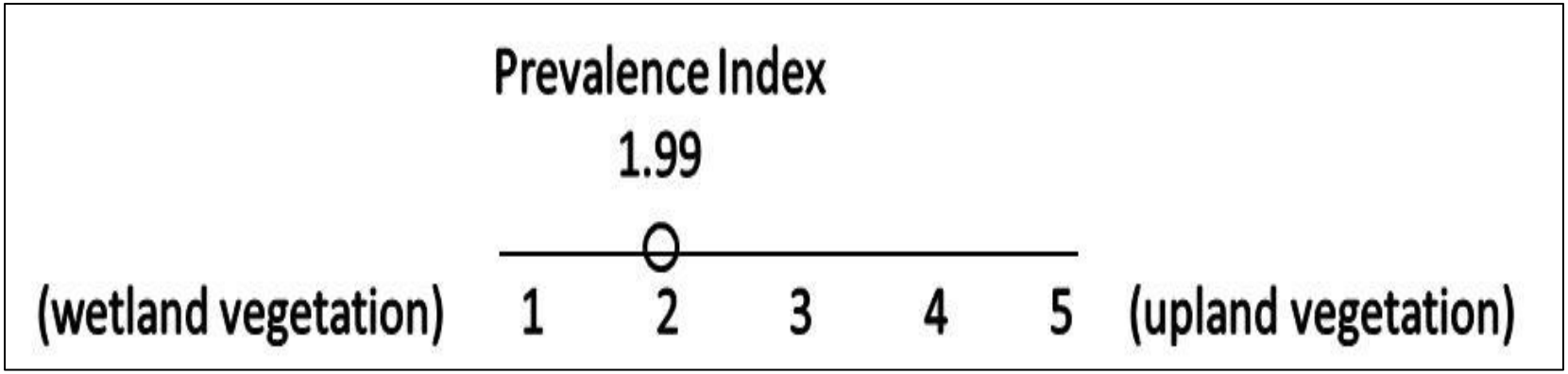
Fauna - Spring Mountains NRA



Management Indicator Tool - Spring Mountains NRA

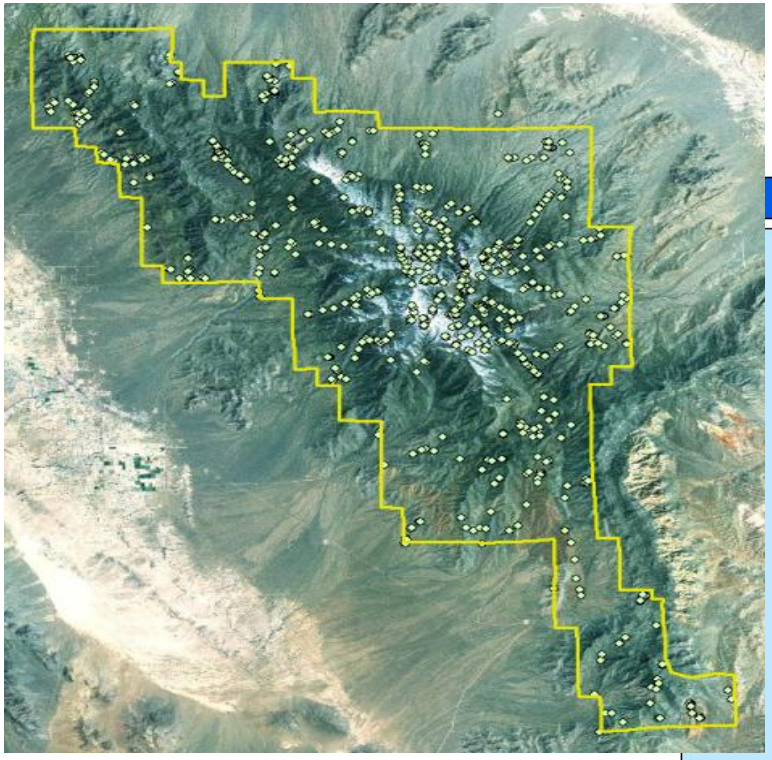


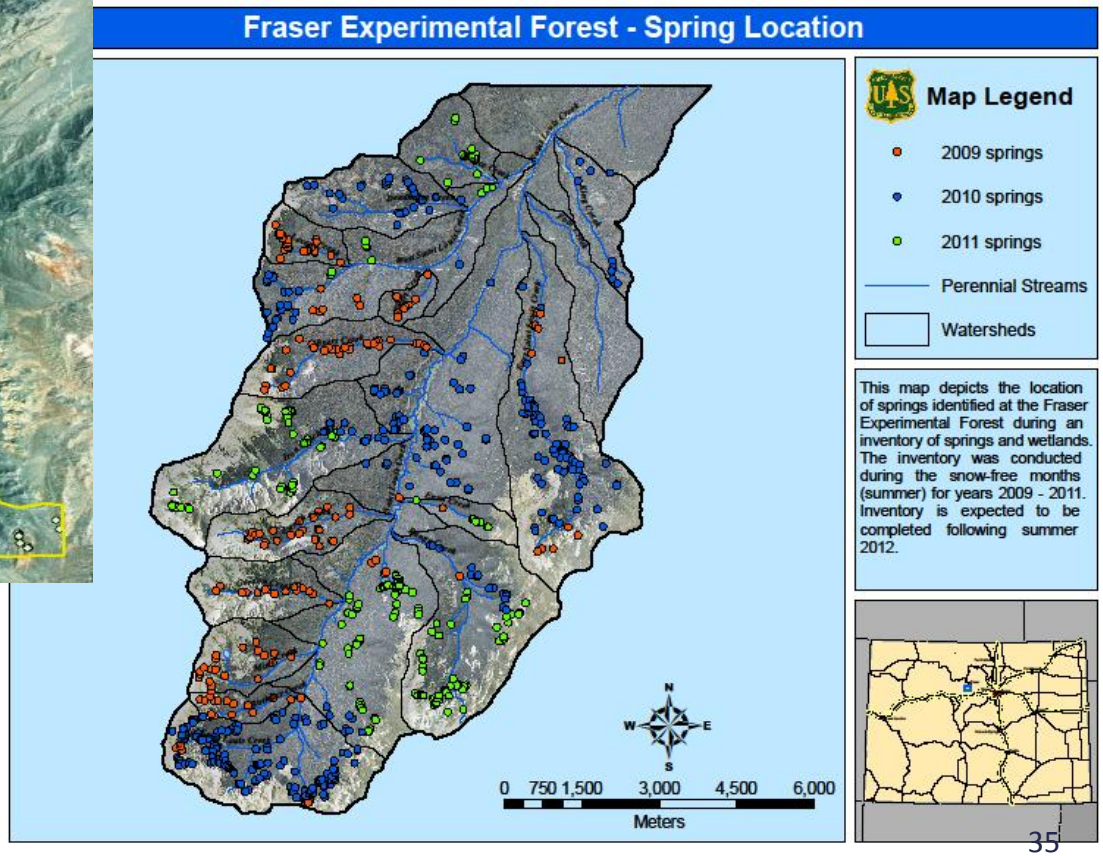
Wetland Vegetation Monitoring



Federal interagency committee for Wetland Delineation, 1989

Geospatial Analysis





Resources

GDE Field Guides available at:

http://www.fs.fed.us/geology/groundwater.html