

Mapping Vegetation Defined and Controlled by Fluvial Processes in Drylands of California

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Talk Overview

- ◆ Wash/episodic channel vegetation can be defined
 - There are predictable species that can be considered good indicators of vegetation types and correlated with process intensity, frequency, and substrate variation
 - They can be arranged ecologically and geographically
 - ◆ How to map wash vegetation
 - What are the basic rules?
 - How does scale and resolution of classification and map imagery inform standardized mapping?
 - ◆ How do we assess quality and impacts?
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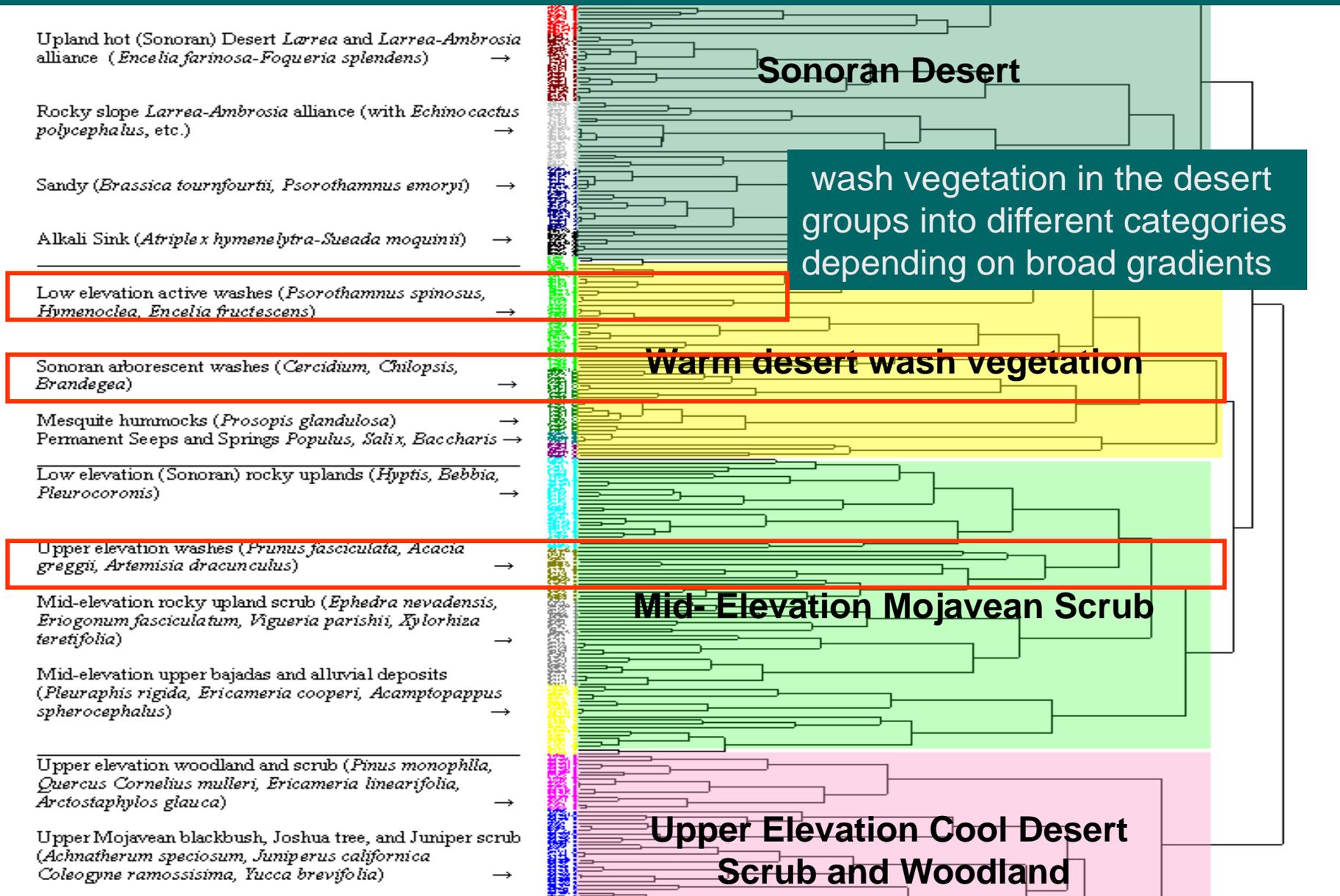
Vegetation can be defined by

- ◆ Characteristic plant species based on
 - Dominance, and/or diagnostic value
 - Correlation with environment at a local and/or regional level
- ◆ Definitions are based on quantitative relationships
 - Analysis of multiple stand samples
 - Descriptions and keys

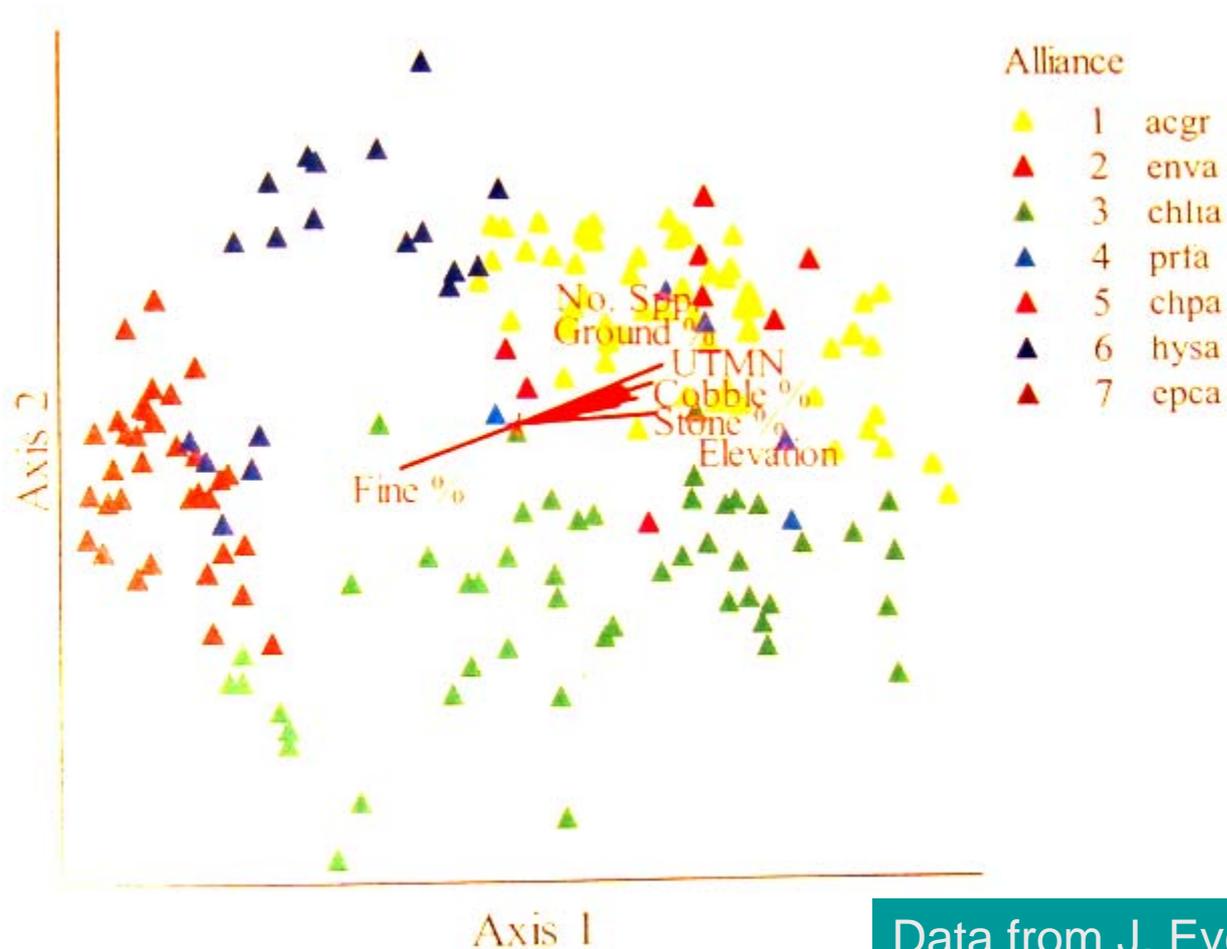
Quantification following sampling of many stands



Major classification divisions within a cluster analysis of the vegetation Of Joshua Tree National Park, California Mojave Desert: Indicator species (Duphrene and Legengre 1997) listed



Ordination of eastern Mojave desert wash vegetation



Data from J. Evens 2000

Keying out Vegetation

Group I: Low elevation desert washes, arroyos, and terraces immediately above washes, not including more permanent intermittent streams or springs with riparian vegetation dominated by willow (*Salix sp.*), cottonwood (*Populus sp.*), fan palm (*Washingtonia*), or sycamore (*Platanus*) :

A. Trees or large shrubs of mesquite (including honey mesquite *Prosopis julifolia torreyana* and/or screwbean, *P. pubescens*) ironwood (*Olneya tesota*), blue palo verde (*Cercidium floridum*), smoketree (*Psoralea argyrea*), desert willow (*Chilopsis linearis*), or tamarisk (*Tamarix spp.*) present:

not as above: **B**

A1. Total mesquite cover (including shrub and trees together) greater than 3% in any single stand and not exceeded by any other species of microphyllous tall shrub or tree. =

Mesquite series (61510.00)

a. Associated species include typical lower desert wash species such as sweetbush (*Bebbia juncea*), sandpaper plant (*Petalonyx thurberi*), smoketree, and cheesebush (*Hymenoclea salsola*) Widespread throughout lower elevation washes and edges of riparian areas of park up to 3000 ft. = **Mesquite wash association 61510.02**

The National Vegetation Classification

- ◆ Is the state and national standard
- ◆ Quantitatively based
- ◆ Hierarchical taxonomy similar to other hierarchical systems such as species taxonomy or soil taxonomy
- ◆ Is most flexible and defensible approach for episodic streamcourse vegetation

Example of hierarchy:

Class 3. Xeromorphic Scrub and Herb Vegetation (Semi-Desert)

Subclass 3.A. Warm Desert and Semi-Desert Scrub and Grassland

Formation 3.A.1. Warm Semi-Desert Scrub and Grassland

Division 3.A.1.a Sonoran and Chihuahuan Semi-Desert Scrub and Grassland

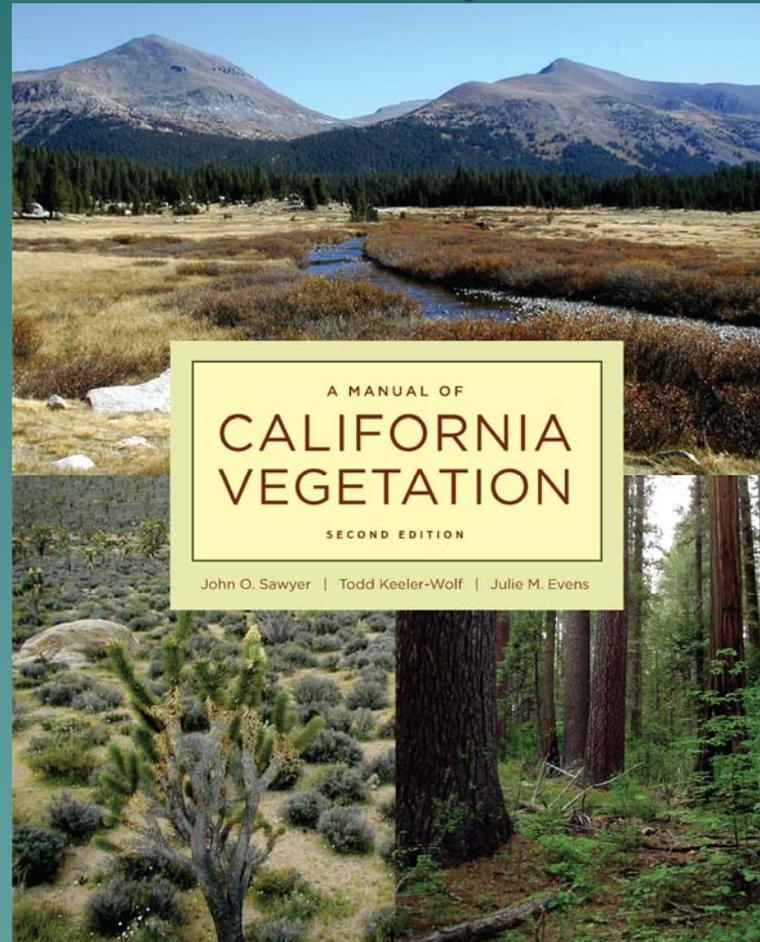
Macrogroup MG092. Madrean Warm Semi-Desert Wash Woodland/Scrub

Group - Sonoran-Coloradan Semi-Desert wash woodland/scrub

Alliance – Blue paloverde-Desert Ironwood
(*Parkinsonia florida*–*Olneya tesota*)

Association – Blue paloverde/Desert lavender
(*Parkinsonia florida* /*Hyptis emoryi*)

The Manual of California Vegetation, Second Edition has most definitions and citations needed for proper identification of episodic stream and riparian vegetation



Floristic and physiological characteristics of episodic wash woody plants

- ◆ Deep rooted, long-lived species
 - Long dormant seeds “wait” for specific germination conditions
 - Once established require deep rooted connections to reliable water
- ◆ Shallow-rooted, short-lived species
 - Seeds usually short viability
 - Easily dispersed (wind)
 - Opportunistic (many not strictly restricted to washes, but occur as disturbance followers)
- ◆ It's often the combination of short and long lived species that characterize a specific plant association

Examples of diagnostic deep-rooted species in episodic desert systems

- ◆ *Acacia greggi* (catclaw)
- ◆ *Olneya tesota* (desert ironwood)
- ◆ *Parkinsonia florida* (blue paloverde)
- ◆ *Psoralea argophylla* (smoketree)
- ◆ *Prunus fasciculatum* (desert almond)
- ◆ *Chilopsis linearis* (desert willow)
- ◆ *Baccharis sergilloides* (desert broom)
- ◆ *Hyptis emoryi* (desert lavender)

Acacia greggii Alliance



Acacia greggii Shrubland Alliance

Catclaw acacia thorn scrub

Acacia greggii is dominant or co-dominant in the shrub canopy with *Ambrosia salsola*, *A. eriocentra*, *Bebbia juncea*, *Cylindropuntia acanthocarpa*, *Encelia virginensis*, *Ephedra californica*, *E. nevadensis*, *Ericameria teretifolia*, *Eriogonum fasciculatum*, *Hyptis emoryi*, *Larrea tridentata*, *Prunus fasciculata*, *Rhus ovata*, *Salazaria mexicana*, *Salvia dorrii*, *Senna armata*, *Viguiera parishii*, and *Yucca schidigera*. Emergent *Chilopsis linearis*, *Juniperus californica*, *J. osteosperma*, *Oleina tesota*, *Parkinsonia florida*, or *Psoralea spinosa* trees may be present at low cover. Shrubs < 3 m; canopy is open to intermittent. Herbaceous layer is sparse to intermittent with seasonal annuals.

Habitats: Arroyos, channels, washes, bajadas, canyon walls, rocky slopes, and valleys. Soils are coarse, well-drained, and moderately acidic to slightly saline. The USFWS Wetland Inventory (1996 National List) recognizes *Acacia greggii* as a FACU plant. Elevation: 10–1500 m.

Rarity ranking: G5 S4. MCV: Catclaw acacia series. NVCS: *Acacia greggii* shrubland alliance. Calveg: Catclaw acacia. Holland: Mojave wash scrub, Mojave desert wash scrub. Munz: Creosote bush, Joshua tree woodland, Shadscale scrub. WHR: Desert wash.



Membership Rules

Acacia greggii > 2% absolute cover and > 50% relative cover in the tall shrub or low tree canopy (Keeler-Wolf et al. 1998b).

Acacia greggii ≥ 2% cover in the tall shrub canopy. No other single, tall shrub species with greater cover, but *Prunus fasciculata* or *Hyptis emoryi* may be equal to or slightly greater in cover than *Acacia*. Smaller shrubs, such as *Ericameria paniculata* or *Ambrosia salsola*, may have cover up to > 2x the cover of *A. greggii* (Keeler-Wolf et al. 2005, Thomas et al. 2004).

Remarks

Acacia greggii is a long-lived tall shrub or small tree that is parasitized by mistletoe (*Phoradendron californicum*). Plants have deep root systems, and stems have curved spines with deciduous bipinnate leaves. Flowering occurs in spring and may continue through fall. Small mammals cache seeds. Animal activity or abrasion scarifies seed coats before germination. *A. greggii* vigorously sprouts following flood damage, heavy browsing, or fire (Uchytel 1990d).

Life History Traits of Principal Species

Life form	Shrub, tree; winter deciduous
Seed storage	Soil
Seed longevity	Medium
Mode of dispersal	Animal
Germination agents	None; scarification
Mode of sprouting	Underground structures (root crown)
Survivability after fire/disturbance	Fire-hardy; high sprouter
Disturbance-stimulated flowering	No
Reproductive range	2 years to life of plant; long-lived
Recruitment	Low
Regional variation	Low

Parkinsonia florida-Olneya tesota Alliance



Parkinsonia florida–Olneya tesota Woodland Alliance Blue palo verde–Ironwood woodland

Parkinsonia florida and *Olneya tesota* are co-dominant, or either species is dominant, in the tall shrub or tree canopy with *Chilopsis linearis*, *Colebrina californica*, *Fouquieria splendens*, *Prosopis glandulosa*, *Prosopis pubescens*, and *Psoralea spinosa*. Shrubs may include *Acacia greggii*, *Ambrosia dumosa*, *A. salsola*, *Bebbia juncea*, *Calliandra eriophylla*, *Cylindropuntia echinocarpa*, *Encelia farinosa*, *Hyptis emoryi*, *Ferocactus cylindraceus*, *Justicia californica*, *Larrea tridentata*, *Lycium andersonii*, *L. brevipes*, and *Simmondsia chinensis*. Trees < 14 m tall; canopy is open to continuous. Shrub layer is intermittent or open. Herbaceous layer is sparse with seasonal annuals.

Habitats: Desert arroyo margins, seasonal watercourses and washes, bottomlands, middle and upper bajadas and alluvial fans, and lower slopes. Soils are



Life History Traits of Principal Species

	<i>Parkinsonia florida</i>	<i>Olneya tesota</i>
Life forms	Tree; drought deciduous	Tree; evergreen
Seed storage	Soil	Soil
Seed longevity	Long	Long
Mode of dispersal	Animal; gravity; water/hydrological	Animal; water/hydrological
Germination agents	Scarification; stratification—winter	Scarification; inundation (wetting increases germination)
Mode of sprouting	Buds on large branches or trunks	Underground structures
Survivability after fire/disturbance	N/A (not relevant in California)	Unknown (but most likely high due to ability to sprout)
Disturbance-stimulated flowering	No	No
Reproductive range	5 years to life of the plant (long-lived)	(20) 50–100+ years
Recruitment	Low; episodic	Low
Regional variation	Low	Unknown

sandy, well drained, and derived from alluvium or coluvium. The USFWS Wetland Inventory (1996 national list) lists *Parkinsonia florida* as a UPL plant. Elevation: 10 m–500 m.

Rarity ranking: G4 S3.2. MCV: Blue palo verde–ironwood–smoke tree series. NVCS: *Parkinsonia florida*–*Olneya tesota* woodland, *Parkinsonia florida* shrubland alliances. Calveg: Desert ironwood, palo verde. Holland: Desert dry wash woodland. Munz: Creosote bush scrub. WHR: Desert wash.

Membership Rules

Olneya tesota > 3% absolute cover in the tall shrub or tree canopy, and not exceeded by other tall shrub or tree species (Keeler-Wolf et al. 1998b).

Parkinsonia florida > 3% absolute cover in the tree canopy, exceeding other tall shrubs or trees (Keeler-Wolf et al. 1998b).

Olneya tesota and/or *Parkinsonia florida* > 2% absolute cover in the canopy together or on their own;

Chilopsis linearis Alliance



Chilopsis linearis Woodland Alliance Desert willow woodland

Chilopsis linearis is dominant or co-dominant in a two-tiered canopy with small trees, including *Olneya tesota*, *Prosopis glandulosa*, *Psoralea argophylla*, or *Yucca brevifolia*, and with shrubs, including *Ambrosia salsola*, *Atriplex polycarpa*, *Bebbia juncea*, *Cylindropuntia acanthocarpa*, *Encelia virginensis*, *Ephedra californica*, *Ericameria paniculata*, *Eriogonum fasciculatum*, *Hyptis emoryi*, *Larrea tridentata*, *Lepidospartum squamatum*, *Petalonyx thurberi*, *Senecio flaccidus*, and *Yucca schidigera*. Trees and shrubs < 6 m; canopy is two tiered and open to intermittent. Herbaceous layer is sparse with seasonal annuals.

Habitats: Washes, intermittent channels, canyon bottoms, arroyos, and along floodplains and wash terraces where flooding is infrequent but where subterranean water is available. Soils are well-drained sands and gravels that are moderately acidic to slightly alkaline. The USFWS Wetland Inventory (1996 national list) recognizes *Chilopsis linearis* as a FACW+ plant. Elevation: 100–1200 m.

Rarity ranking: G4 S3.2. MCV: Desert willow series. NVCS: *Chilopsis linearis* shrubland alliance. Calveg: Desert willow. Holland: Mojave wash scrub, Mojave Desert wash scrub. Munz: Creosote bush scrub. WHR: Desert wash.



Membership Rules

Chilopsis linearis > 2% absolute cover as a small tree or tall shrub canopy; with > 50% relative cover in the tall shrub or small tree canopy (Evens 2000, Thomas et al. 2004).

Remarks

Chilopsis linearis is a relatively long-lived (> 100 years), tall shrub or tree that attains 6 m in height. Plants are part facultatively winter deciduous phreatophytes that opportunistically delay leaf output until water is available. It is sensitive to salinity and alkalinity (Desert Workshop January 2000). Plants shed their seeds in the winter, and seedling establishment is sporadic. Stands have multiple age classes, though a single size class often dominates. Moderate flooding in wet years provides favorable conditions for seedling establishment (Uchytel 1990b). Although the alliance is widely distributed, stands are local and absent in many washes that appear suitable. Most stands receive sheet flooding at least every 10–20 years (Uchytel 1990b), and flood frequencies and intensity levels are

Life History Traits of Principal Species

Life form	Shrub, tree; winter deciduous
Seed storage	Transient
Seed longevity	Short
Mode of dispersal	Wind
Germination agents	None
Mode of sprouting	Underground structures (root crown)
Survivability after fire/disturbance	Fire-hardy; high sprouter?
Disturbance-stimulated flowering	No
Reproductive range	Life of plant
Recruitment	High
Regional variation	Low

Baccharis sergilloides Alliance



Baccharis sergilloides Shrubland Alliance

Broom baccharis thickets

Baccharis sergilloides is dominant or co-dominant in the shrub canopy with *Acacia greggii*, *Artemisia ludoviciana*, *Cylindropuntia acanthocarpa*, *Ericameria linearifolia*, *Eriogonum fasciculatum*, *Gutierrezia microcephala*, *Lotus rigidus*, *Prunus fasciculata*, *Rhus trilobata*, *Sphaeralcea ambigua*, and *Yucca schidigera*. Emergent *Populus fremontii* or *Salix* spp. trees may be present at low cover. Shrubs < 5 m; canopy is open to intermittent. Herbaceous layer is sparse to intermittent.

Habitats: Arroyos, canyon bottoms, springs, washes. Soil textures are gravelly sands and sandy loam surrounding boulders and bedrock, with soils seasonally saturated and intermittently flooded. The USFWS Wetland Inventory (1996 national list) lists *Baccharis sergilloides* as a FAC plant. Elevation: 600–1800 m.

Rarity ranking: G4 S3.2. MCV: Not treated. NVCS: *Baccharis sergilloides* intermittently flooded shrubland alliance. Calveg: Not treated. **Holland:** Mojave Desert wash scrub. **Munz:** Joshua tree woodland, Piñon-juniper woodland. **WHR:** Desert wash.

Membership Rules

Baccharis sergilloides > 3% absolute cover in the shrub canopy, and it has > 50% relative cover in the overstory as the dominant shrub (Evens 2000).

Life History Traits of Principal Species

Life form	Shrub
Seed storage	Transient
Seed longevity	Short
Mode of dispersal	Wind
Germination agents	Inundation (high moisture)
Mode of sprouting	Buds on large branches or trunks (above-ground branches)
Survivability after fire/ disturbance	Fire-sensitive; high sprouter
Disturbance-stimulated flowering	No
Reproductive range	50–70° years
Recruitment	High, episodic
Regional variation	Mojave Desert



Remarks

Baccharis sergilloides is a short-lived shrub that requires relatively high subsurface moisture. Environmental conditions overlap those of the *Salix exigua*. Little literature exists on its ecology. As with *B. pilularis*, it sprouts following disturbance and does not attain great age. Shrubs produce abundant, wind-dispersed seeds with substantial pappus bristles.

Stands are typically small and occupy intermittently to seasonally flooded stretches of desert canyon bottoms or borders of springs and seeps. Boulders and bedrock typically break up the stands although the rooting substrate is typically relatively fine to gravelly sand (Evens 2000).

Fire Characteristics

Fluvial processes rather than fire primarily disturb stands. *Baccharis sergilloides* can sprout after disturbance, but we lack information on its response to fire.

Examples of shallow rooted species in episodic desert systems

- ◆ *Ambrosia salsola* (cheesebush)
- ◆ *Ambrosia eriocentra* (wooly-fruited burrweed)
- ◆ *Salizaria mexicana* (paper-bag bush)
- ◆ *Salvia dorii* (desert purple sage)
- ◆ *Ericameria paniculata* (black-band rabbitbush)
- ◆ *Encelia virginensis* (Virgin River Encelia)
- ◆ *Viguiera reticulata* (net-leaved goldeneye)

Ambrosia salsola Alliance



Ambrosia salsola Shrubland Alliance

Cheesebush scrub

Ambrosia salsola is dominant or co-dominant in the shrub canopy with *Cylindropuntia echinocarpa*, *Encelia farinosa*, *Ephedra californica*, *Ericameria paniculata*, *Eriogonum fasciculatum*, *Gutierrezia microcephala*, *Hyptis emoryi*, *Krameria grayi*, *Larrea tridentata*, *Opuntia basilaris*, *Petalonyx thurberi*, *Peucephyllum schottii*, *Pholisma arenarium*, *Psoralea spinosa*, *Salazaria mexicana*, *Senna armata*, *Sphaeralcea ambigua*, and *Salvia dorrii*. Emergent *Acacia greggii*, *Chilopsis linearis*, *Olneya tesota*, or *Parkinsonia florida* may be present as taller shrubs or low trees at low cover. Shrubs < 2 m; canopy is open to intermittent. Herbaceous layer is sparse or seasonally present.

Habitats: Valleys, flats, rarely-flooded low-gradient deposits, arroyos, intermittent channels and washes. Soils are alluvial, sandy and gravelly, and disturbed desert pavement. The USFWS Wetland Inventory (1996 National List) lists *Ambrosia salsola* as a UPL plant. Elevation: 0–1600 m.

Rarity ranking: G5 S4. MCV: Catclaw acacia series. NVCS: *Hymenoclea salsola* shrubland alliance. Calveg: Cheesebush, Mixed desert scrub. Holland: Mojave Creosote bush scrub, Mojave wash scrub, Sonoran creosote bush scrub. Munz: Creosote bush scrub, Shadscale scrub. WHR: Desert scrub, Desert wash.

Life History Traits of Principal Species

Life form	Shrub; drought deciduous
Seed storage	Soil; transient
Seed longevity	Medium
Mode of dispersal	Water/hydrological; wind
Germination agents	None
Mode of sprouting	Underground structures
Survivability after fire/disturbance	Fire-hardy (benefit from fire and flood); high sprouter
Disturbance-stimulated flowering	No
Reproductive range	Short-lived
Recruitment	Episodic? (seeder)
Regional variation	Low



Membership Rules

Ambrosia salsola > 5% absolute cover in the shrub canopy; emergent *Hyptis emoryi* and *Psoralea spinosa* up to 3% absolute cover (Keeler-Wolf et al. 1998b, Evens and Hartman 2007).

Ambrosia salsola > 2% absolute cover in the shrub canopy; other shrubs < cover in the shrub canopy (Evens 2000).

Ambrosia salsola > 1% absolute cover in the shrub canopy; other shrubs, if present, less than half the cover of *A. salsola* except *Hyptis emoryi* or *Salvia dorrii*, which may have higher cover (Thomas et al. 2004).

Remarks

Ambrosia salsola is a short-lived shrub with shallow roots. Germination rates are high, and not only does it seed in from adjacent sites and colonize bare mineral soil, but it also sprouts following damage from flood or fire. Seedlings are prolific and opportunistic whenever water is available. It occupies upland sites as well as bottomland sites (Tesky 1993c). Strother and Baldwin (2002) recently placed *Hymenoclea salsola* in the genus *Ambrosia*.

Encelia virginensis Alliance



Encelia virginensis Shrubland Alliance Virgin River brittle brush scrub

Encelia virginensis is dominant or co-dominant in the shrub canopy with *Ambrosia salsola*, *Ericameria nauseosa*, *Ephedra nevadensis*, *Gutierrezia microcephala*, *Psoralea arborescens*, *Salvia dorrii*, *Sakazaria mexicana*, *Stephanomeria pauciflora*, *Viguiera reticulata*, and *Yucca baccata*. Emergent *Acacia greggii* or *Pinus monophylla* may be present at low cover. Shrubs < 2 m; canopy is open to intermittent. Herbaceous layer is open to intermittent with seasonal annuals.

Habitats: Intermittently flooded arroyos, canyons, adjacent alluvial fans, road cuts, and other substrates with recent disturbance. Soils are alluvial with gravel and cobble; found particularly on cobbled calcareous substrates. Elevation: 300–1900 m.

Rarity ranking: G4 S3.2. MCV: Not treated. NVCS: *Encelia virginensis* shrubland alliance. Calveg: Not treated. Holland: Mojave creosote bush scrub, Mojave wash scrub, Sonoran Creosote bush scrub. Munz: Creosote bush scrub, Shadscale scrub, Piñon–juniper woodland. WHR: Desert wash, Desert scrub.

Membership Rules

Encelia virginensis ≥ 2% absolute cover in the shrub canopy; *Salvia dorrii* may have equal or greater cover (Evens 2000).

Life History Traits of the Principal Species

Life form	Shrub; drought deciduous
Seed storage	Transient
Seed longevity	Low
Mode of dispersal	Wind
Germination agents	None
Mode of sprouting	Buds on large branches or trunks (stem; weak)
Survivability after fire/disturbance	Fire-sensitive
Disturbance-stimulated flowering	No
Reproductive range	3–30 years
Recruitment	High
Regional variation	Low



Encelia virginensis ≥ 2% absolute cover in the shrub canopy; no other species with greater or equal cover (Thomas et al. 2004).

Remarks

Encelia virginensis, including *E. virginensis* ssp. *actonii*, is a short-lived, drought-deciduous shrub that grows to 1.5 m tall. Plants reproduce by seeds that are well adapted to wind dispersal. The species seeds in well after wet years, and it is an early colonizer of disturbed sites such as washes, road cuts, recently cleared land, fire, or other disturbances. *Encelia virginensis* depends on off-site seed sources to reestablish after disturbances. Populations increase with increasing disturbance and are replaced in areas lacking recurring disturbance. It is common on rocky uplands and in gravelly or cobbled washes with slow internal drainage or where the water table is near the soil surface. The soils can be encrusted with salt. This species is closely related to *E. frutescens* and has been considered a variety (Esser 1993a).

Although less numerous there are also diagnostic episodic stream course species of Cismontane California

Lepidospartum squamatum Shrubland Alliance

Scale broom scrub

Lepidospartum squamatum is dominant, co-dominant, or conspicuous in the shrub canopy with *Ambrosia salicifolia*, *Artemisia californica*, *Baccharis salicifolia*, *Cleome isomeris*, *Cylindropuntia californica*, *Encelia farinosa*, *Eriodictyon crassifolium*, *E. trichocalyx*, *Eriogonum fasciculatum*, *Hesperoyucca whipplei*, *Lotus scoparius*, *Malosma laurina*, *Opuntia littoralis*, *Rhus integrifolia*, *R. ovata*, *R. trilobata*, and *Toxicodendron diversilobum*. Emergent tall plants of *Cercocarpus montanus*, *Juglans californica*, *Juniperus californica*, *Platanus racemosa*, *Populus fremontii*, and *Sambucus nigra* may be present at low cover. Shrubs < 2 m canopy is open to continuous. Herbaceous is layer variable and may be grassy.

Habitats: Intermittently or rarely flooded, low-gradient alluvial deposits along streams, washes, and fans. The USFWS Wetland Inventory (1996 national list) lists *Lepidospartum squamatum* as a NI plant. Elevation: 50–1500 m.

Rarity ranking: G3 S3 (some associations G1 S1.1). **MCV:** Scalebroom series. **NVCS:** *Lepidospartum squamatum* intermittently flooded shrubland alliance. **Calveg:** Scalebroom. **Holland:** Alluvial fan chaparral, Mojave Desert wash scrub, Riversidean alluvial fan sage scrub. **Munz:** Coastal sage scrub. **WHR:** Coastal scrub.

Life History Traits of Principal Species

Life forms	Shrub; evergreen
Seed storage	Transient
Seed longevity	Short
Mode of dispersal	Wind
Germination agents	None
Mode of sprouting	Buds on large branches and trunks (weak); underground structures (root crowns)
Survivability after fire/disturbance	Fire-sensitive; thin epidermis; no/low sprouter; canopy architecture susceptible
Disturbance-stimulated flowering	No
Reproductive range	5? to 75? years
Recruitment	Unknown
Regional variation	Unknown



Membership Rules

Lepidospartum squamatum > 1% cover in alluvial environments (Barbour and Wirtka 1997).

Remarks

Lepidospartum squamatum is a woody, broom-like shrub that grows up to 2 m tall. Leaves are scale-like. Peak of flowering is from late July through early September. Seeds are wind dispersed. Seedlings establish in clearings among older shrubs when soils are moist. Older plants sprout from branches and crown bases. It can reproduce asexually from plant fragments dispersed downstream in intense, scouring floods. Root crowns can sprout from deep beneath flood-deposited alluvium on alluvial fans.

Stands establish after fluvial events, and they are highly variable in species composition. Some areas flood every few years, while others average more than 100 years between major events (Wells and Woods 1996). Variations in soil moisture retention among older stands may explain presence or absence of the large shrubs and trees (Barbour and Wirtka 1997).



Platanus racemosa (California Sycamore) is a good example of an episodic stream course vegetation alliance for cismontane California

Platanus racemosa Woodland Alliance California sycamore woodlands

Platanus racemosa is dominant or co-dominant in the tree canopy with *Alnus rhombifolia*, *Juglans californica*, *Populus fremontii*, *Quercus agrifolia*, *Q. lobata*, *Salix exigua*, *S. gooddingii*, *S. laevigata*, *S. lasiolepis*, *S. lutea*, *Schinus molle*, and *Umbellularia californica*. Trees < 35 m; canopy is open to intermittent. Shrub layer is open to intermittent. Herbaceous layer is sparse or grassy.

Habitats: Gullies, intermittent streams, springs, seeps, stream banks, and terraces adjacent to floodplains that are subject to high-intensity flooding. Soils are rocky or cobbly alluvium with permanent moisture at depth. The USFWS Wetland Inventory (1996 national list) recognizes *Platanus racemosa* as a FACW plant. Elevation: 0–2400 m.

Rarity ranking: G3 S3 (some associations G1 S1 or G2 S2). MCV: California sycamore series. NVCS: *Platanus racemosa* temporarily flooded woodland alliance. Calveg: California sycamore series. **Holland:** Central coast cottonwood-sycamore riparian forest, Southern sycamore-alder riparian woodland, Sycamore alluvial woodland. **Munz:** Not treated. **WHR:** Valley foothill riparian.

Membership Rules

Platanus racemosa > 50% relative cover in the tree layer (Keeler-Wolf et al. 1997).

Life History Traits of Principal Species

Life form	Tree; winter deciduous
Seed storage	Transient
Seed longevity	Short
Mode of dispersal	Water/hydrological; wind
Germination agents	Stratification—winter
Mode of sprouting	Buds on large branches or trunks; underground structures
Survivability after fire/disturbance	Fire-sensitive; thin epidermis; (sensitive to anthracnose)
Disturbance-stimulated flowering	No
Reproductive range	25–400 years
Recruitment	Episodic
Regional variation	Unknown



Platanus racemosa > 30% relative cover in tree canopy; *Quercus agrifolia*, *Salix* species, or *Populus fremontii* may be co-dominant. (Evens and San 2005, Klein and Evens 2005, Keeler-Wolf and Evens 2006, Stillwater Sciences and URS 2007).

Platanus racemosa > 5% absolute cover in tree layer; in mixed stands, *Populus fremontii* < 5% absolute cover in the tree canopy (Potter 2005).

Remarks

Platanus racemosa is a fast-growing, deciduous tree that attains 25 m in height and 400 years in age. Trees produce plumed, wind-dispersed achenes annually. Fresh seeds germinate on moist, clayey sediments. Young trees readily stump-sprout, but they are not very vigorous epicormic sprouters (Sullivan 1994).

Stands of *P. racemosa* are well adapted to intermittent flooding conditions of the streams in the Mediterranean climate of cismontane California. *P. racemosa* also appears to have specific germination requirements that limit its ability to colonize areas that not scoured often by natural flooding events. Keeler-Wolf



Data standards for definition of types and field data collection

- ◆ Field data collection protocols can be found at:

http://www.dfg.ca.gov/biogeodata/vegcamp/veg_publications_protocols.asp

- ◆ Currently accepted Vegetation types:

http://www.dfg.ca.gov/biogeodata/vegcamp/natural_comm_list.asp

Vegetation Mapping

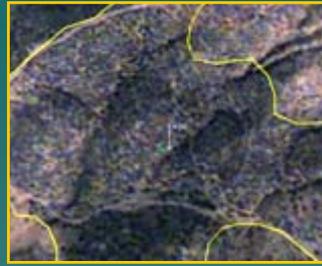
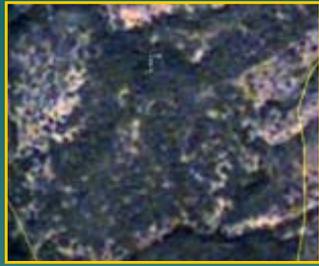
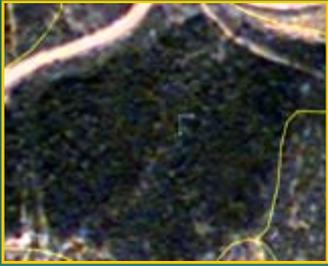
Considerations: In General

- ◆ Why are you doing this?
 - ◆ What is the extent of the project
 - ◆ What is the scale of your source imagery?
 - ◆ What is your time frame?
 - ◆ Are there good quantitative descriptions of the vegetation; at what level of classification?
- 
- A decorative graphic in the bottom right corner of the slide, consisting of a stylized silhouette of a mountain range in a teal color.

Mapping rules must be set based on previous considerations

- ◆ Map to appropriate level of classification hierarchy where ever possible
 - ◆ Develop rules for aggregation into mapping units when vegetation is either not discernable or accurately differentiated from other types
 - ◆ Develop minimum map unit size, width
 - ◆ Develop map unit attributes
- 

Standardizing map attributes



- SHRUBS -

>60% cover (1)

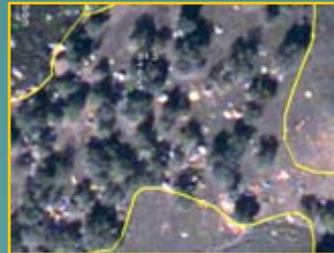
40-60% cover (2)

25-40% cover (3)

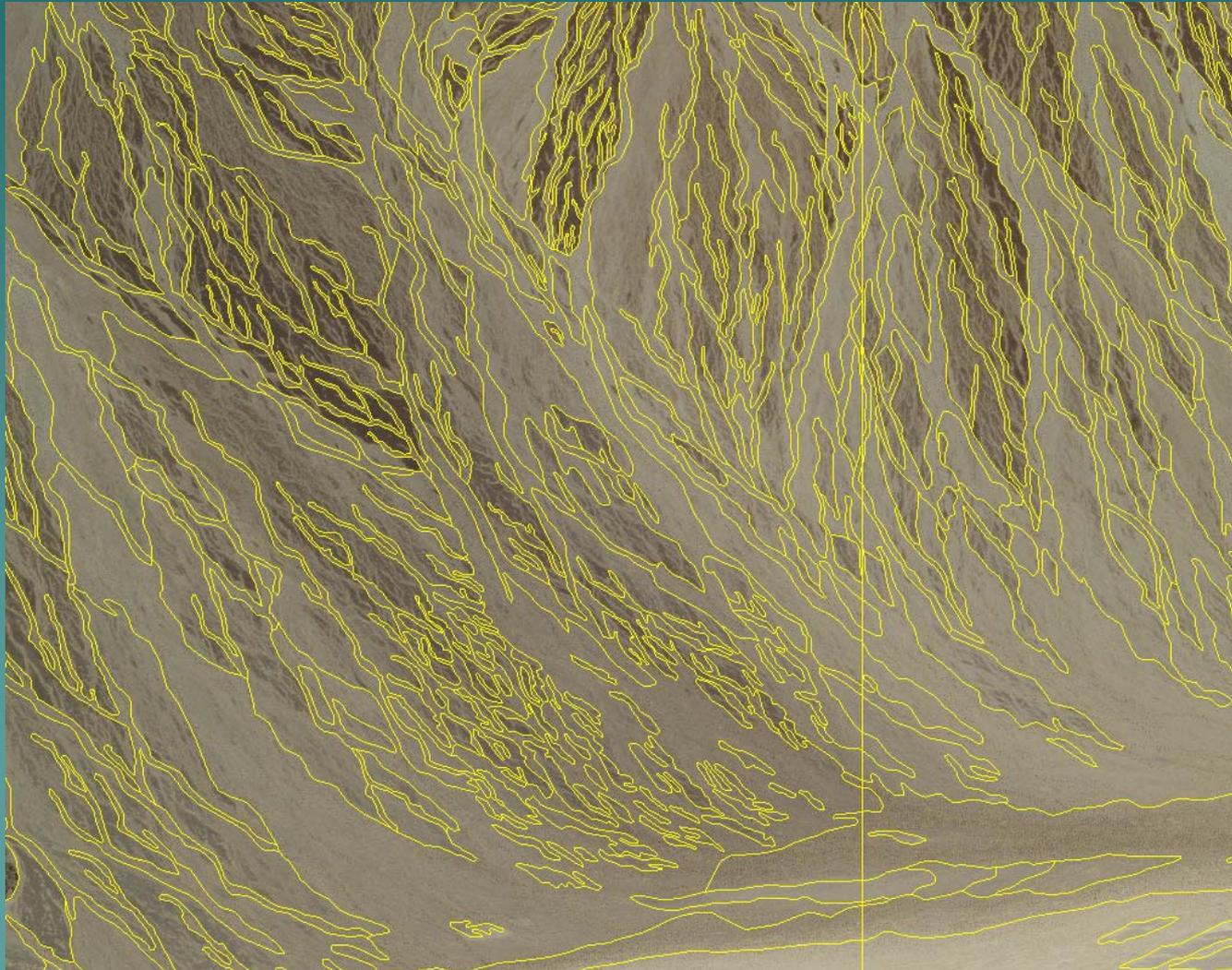
10-25% cover (4)

2-10% cover (5)

- TREES -



Complex delineation of minor rills and wash-lets within ancient geomorphic surface fine scale veg patterns based on 1:12,000 imagery; Joshua Tree NP



Ivanpah Wash Central Mojave map 1:12,000 2009 NAIP, based on 1:64,000 imagery



Episodic stream vegetation: specific mapping issues

- ◆ Fine scale distributary channels
- ◆ Difficult to define appropriate breaks in delineation due to fractal issues of resolution of stands and correlating environmental variables

Things to keep in mind while mapping episodic stream vegetation

- ◆ Environmental influences on veg patterns include:
 - Flooding freq and intensity
 - Depth to reliable water supply
 - Rugosity of surface (dendritic micro-patterning)
- ◆ Veg can be characterized by larger deep rooted species or smaller shallow rooted species, depending on frequency and intensity of fluvial processes
- ◆ The former are longer lived, the latter shorter lived and typically related to more freq disturbance

Complex Patterns in a Colorado Desert Wash: What do we map and what do we “include”?



Keep in mind: mmu, resolution of imagery,
Budget, accuracy

Sheet flow outside of defined washes



Latr-amdu w sheet flow



Refocused distributary sheet flow into anthropogenic wash



Aug 2006

N

Image U.S. Geological Survey
Image © 2010 DigitalGlobe

© 2010 Google

© 2010 Google

33°41'19.92" N 115°34'44.66" W elev 1376 ft

Eye alt 1636 ft

Look for:

- ◆ Relative difference in species composition between uplands and lowland vegetation
- ◆ Define wash vegetation based on fluvial processes and relationships between stand edges and environment

Wash Veg delineation: think systematically and follow a repeatable process



Rule 1:
Don't get
Too narrow

Rule 2: look
For veg sign, and
Corresponding environ

Rule 3: substrate and
Fluvial surface age, doesn't
Always mean a veg shift (heed
your vegetation classification
and rules!)



The General Theory of Relativity

- ◆ Wash vegetation is "real"
- ◆ But real compared to what?
 - Little rain and little topography means facultative wash species as vegetation

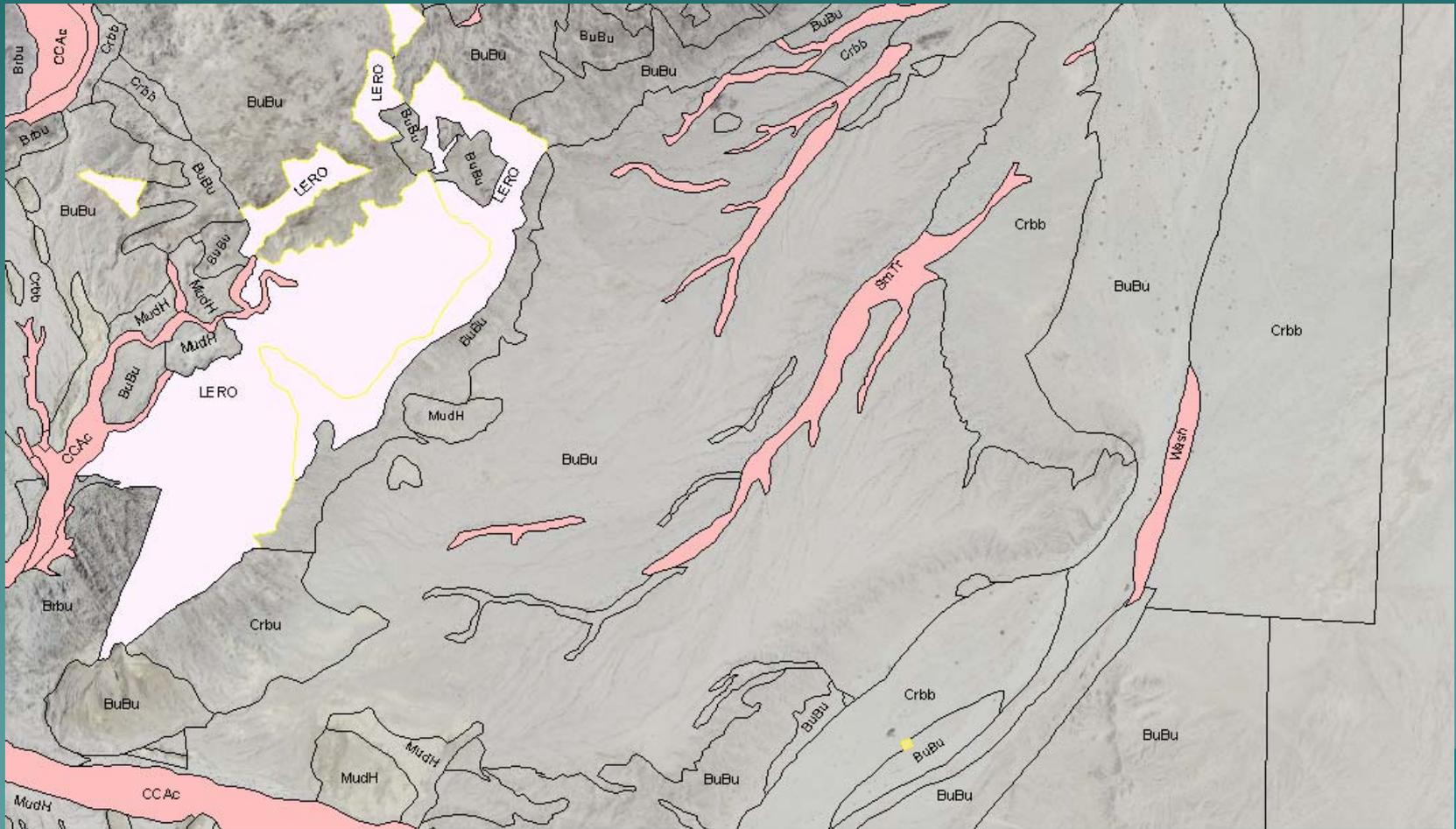
Wash vegetation in Grapevine Canyon Anza-Borrego Desert State Park



In very dry areas of the Colorado desert upland vegetation “becomes” wash vegetation



Same wash vegetation in previous slide does not entirely define fluvial vegetation



Open latr-amdu in Colorado desert follows shallow depressions, hardly “washes”; these would be included in surrounding upland matrix in all but the finest scale mapping



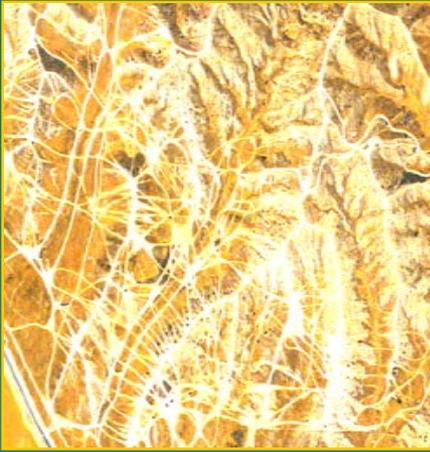
There are creosote bush washes in the driest parts of the desert!



Impact Assessment

- ◆ Many impacts can be reliably mapped
 - ◆ Some can only be reliably interpreted from the ground
 - ◆ Some require more time to evaluate
- 
- A decorative graphic at the bottom of the slide consisting of a dark teal silhouette of a mountain range against a lighter teal background.

Disturbance Modifiers - Examples



High Disturbance: Over 50% of the polygon is affected with roads, trails, disked activity or scrapes on the landscape.



Moderate Disturbance: Between 25% and 50% of the polygon is affected with roads, trails, disked activity or scrapes on the landscape



Minimal Disturbance: At least 5% of the polygon is affected with roads, trails, disked activity or scrapes on the landscape. Polygons adjacent to major disturbances are also placed into this category.

Impact attributes



Roads and trails – Moderate
Invasive exotics - Moderate

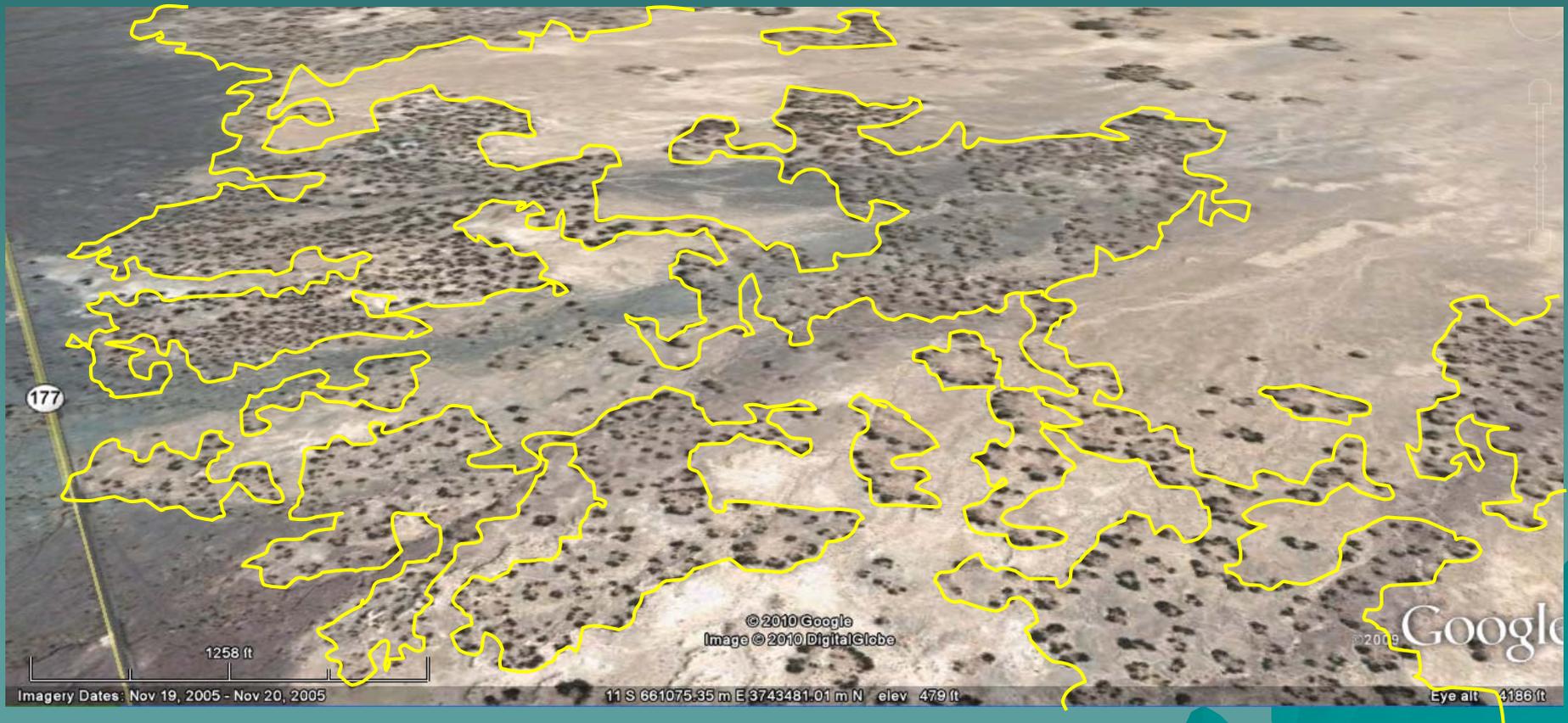
Palen Lake 2 ft tall mesquite



Palen Lake 2 ft tall mesquite



Palen Lake 2 ft tall mesquite:
footprint has not changed for at least
20 years due to behavior of the species



Effect of focused sheet flow what will this mean to down slope veg?



Wash and episodic stream channels vary in plant species composition at regional and local scales

- ◆ Within a single wash system vegetation follows gradients of flooding intensity and substrate characteristics
 - ◆ Within a local area these gradients are similar from wash to wash
 - ◆ Species composition varies from region to region within washes/episodic channels
- 
- A stylized teal silhouette of a mountain range is located in the bottom right corner of the slide.

This means that it is difficult to have a single list of wash indicator plant species for all of the state

- ◆ Desert washes differ from cismontane channels
- ◆ Washes in lower deserts differ from washes in high deserts
- ◆ So, what is the tie that binds definition and delineation of wash/ephemeral stream channels?

Answer:

- ◆ Wash/episodic stream channel veg is best defined relative to the contrasting vegetation outside of the channels
- ◆ Wash species will vary depending on
 - The ambient water supply (very dry desert vs. semi desert for example)
 - The size of the wash (maximum, minimum, and mean flooding cycles supply water and disturbance regimes)
- ◆ Must develop rules of evaluation based on a flexible landscape approach