California Rapid Assessment Method for Wetlands and Riparian Areas (CRAM)

Riverine Training Module

Steps of CRAM Assessment

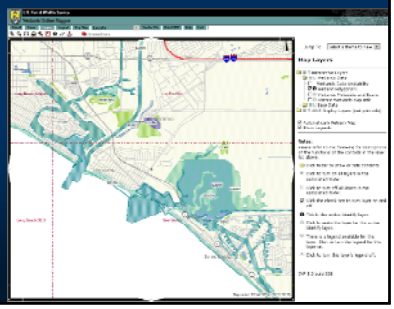
Step 1: Assemble background information
Step 2: Classify the wetland
Step 3: Verify the appropriate season
Step 4: Sketch the CRAM Assessment Area (AA)
Step 5: Conduct the office assessment of AA
Step 6: Conduct the field assessment of AA
Step 7: Complete CRAM QA/QC
Step 8: Submit assessment results using *e*CRAM

Assemble background information

- 1-3m pixel resolution digital geo-rectified site imagery with a scale
- Preliminary map of assessment area (AA)
- Reports on hydrology, ecology, chemistry
- Local plant list
- Access permission (if needed)
- Map/directions to site

Sources of Background Information

- Wetland maps (NWI, Wetland Tracker, Google Earth)
- Other maps (geology, soils, vegetation)
- Project reports (*e.g.*, monitoring reports)
- Phone interviews



Steps of CRAM Assessment

Step 1: Assemble background information
Step 2: Locate and Classify the wetland
Step 3: Verify the appropriate season
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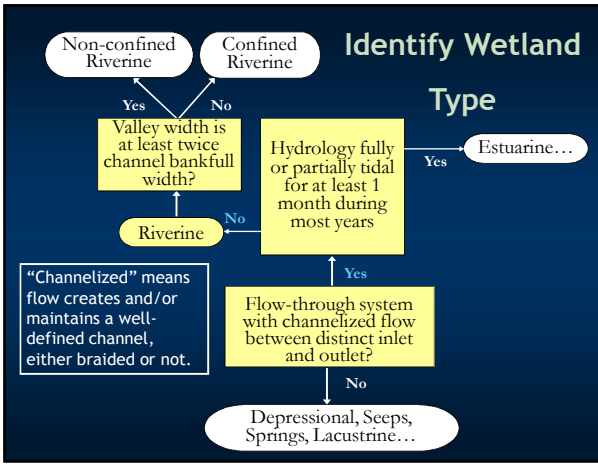
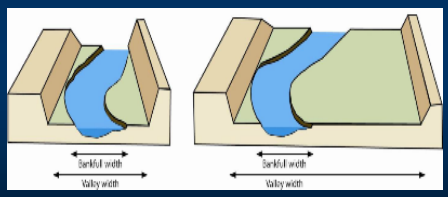
The wetland can be delimited by the boundaries of a project, a JD, or a wetland polygon in a Level 1 inventory.

Identify Wetland Type



Non-confined Channel: Valley width is at least twice bankfull width

Confined Non-confined



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CRAM Assessment Window

- Growing season of plants
  - Usually March – September
    - New growth to senescence
    - Shorter at higher altitudes
    - Later with snow
    - Riverine not during high water

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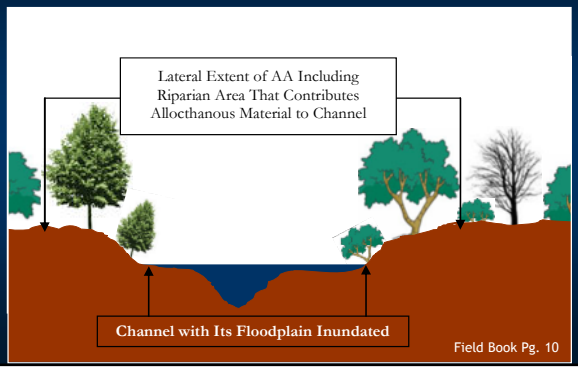
Considerations for delineating the AA

- Purpose of Assessment
  - Project (multiple AAs to cover site)
  - Ambient (AA located at probabilistic draw point)
- Hydrogeomorphic Integrity
  - Bounded by changes in flow and sediment regimes
  - Maximize detection of management effects
- Size Limits for AAs
  - Larger AAs have higher or more variable scores
  - Larger AAs take longer to assess

Sketch the AA subject to field verification

- AA is the channel, its active floodplain, and essential riparian area
- Length = 10 x BF width within limits of 100-200 m
- Width includes portion of riparian area that stabilizes bank, shades wetland, provides allochthanous matter (2 m minimum width)

AA includes portion of Riparian Area directly affecting channel



Field Book Pg. 10

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Office Assessment

Some metrics that rely on background information and broad geographic overview are best assessed in the office, subject to field verification

- Landscape Connectivity
- Percent of AA with Buffer
- Average Buffer Width
- Water source

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Field Assessment Procedure

1. Bring aerial with pre-selected "dot"
2. Walk entire area, drawing AA boundary
3. Walk entire AA making observations and taking notes
4. Fill out datasheets
5. Walk again to clarify uncertainties
6. Finalize field scores, QA data

Buffer and Landscape Context Attribute

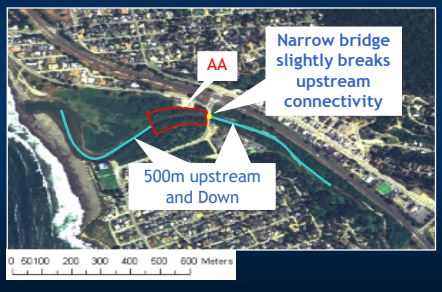
- *Upstream and downstream continuity*
- *Size and quality of buffer surrounding AA*

Landscape Connectivity Metric

- Looking for breaks in the riparian corridor
- Assume riparian area average width is the same upstream and downstream of the AA as it is within the AA
- Assume open water is a type of buffer land cover
- To be a concern, a segment of "non-buffer" cover must:
  - Cut across the riparian area on one or both sides of AA
  - Extend at least 10 m along the channel

Landscape Connectivity

Assess the total length of non-buffer segments 500m upstream and 500m downstream of the AA



Landscape Connectivity

Rating	Aggregate length of non-buffer segments upstream 500m of AA	Aggregate length of non-buffer segments downstream 500m of AA
A	Less than 100m (2 sided)	Less than 100m (2 sided)
B	Less than 100m (2 sided)	Between 100m and 200m (2 sided)
		or
B	Between 100m and 200m (2 sided)	Less than 100m (2 sided)
C	Between 100m and 200m (2 sided)	Between 100m and 200m (2 sided)
D	Greater than 200m (2 sided)	Any condition
		or
D	Any condition	Greater than 200m (2 sided)

Buffer Sub-Metrics

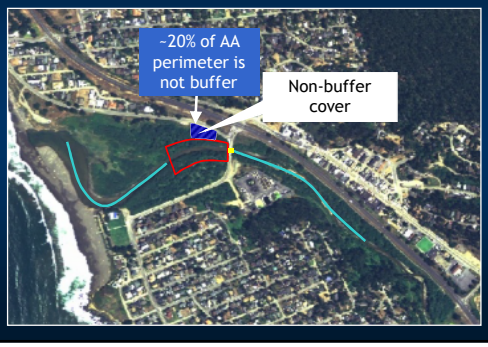
- Percent of AA with buffer
- Average buffer width
- Buffer condition

Guidelines for identifying wetland buffers and breaks in buffers

Examples of Land Covers Included in Buffers	Examples of Land Covers Excluded from Buffers Notes: buffers do not cross these land covers; areas of open water adjacent to the AA are not included in the assessment of the AA or its buffer.
• bike trails • dry-land farming areas • foot trails • horse trails • links or target golf courses • natural upland habitats • nature or wildland parks • open range land • railroads • roads not hazardous to wildlife • swales and ditches • vegetated levees	• commercial developments • fences that interfere with the movements of wildlife • intensive agriculture (row crops, orchards and vineyards lacking ground cover and other BMPs) • paved roads (two lanes plus a turning lane or larger) • lawns • parking lots • horse paddocks, feedlots, turkey ranches, etc. • residential areas • sound walls • sports fields • traditional golf courses • urbanized parks with active recreation • pedestrian/bike trails (i.e., nearly constant traffic)

% of AA with Buffer

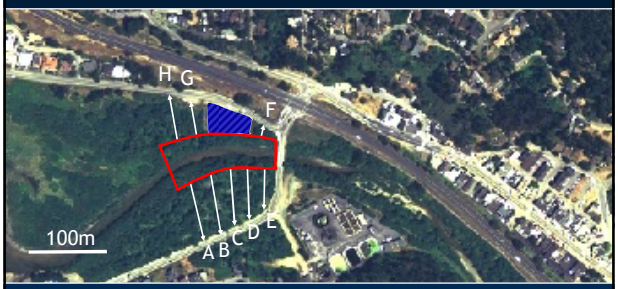
Estimate percent of the AA perimeter adjoining non-buffer land cover that is at least 5m wide and 5m long.



% of AA with Buffer

Rating	Alternative State
A	Buffer is 75 - 100% of AA perimeter
B	Buffer is 50 - 74% of AA perimeter
C	Buffer is 25 - 49% of AA perimeter
D	Buffer is < 25% of AA perimeter

Average Buffer Width



Line A = 100m	Line D = 75m	Line G = 50m
Line B = 100m	Line E = 60m	Line H = 65m
Line C = 80m	Line F = 15m	**Avg. 490/8 = 68m**

Average Buffer Width

Rating	Alternative States
A	Average buffer width is 190 - 250 m.
B	Average buffer width 130 - 189 m.
C	Average buffer width is 65 - 129 m.
D	Average buffer width is 0 - 64 m.

Buffer Condition

Buffer characteristics

- Native vegetation
- Intact soils
- Intensity of visitation

Assess based on field indicators only

Rating for Buffer Condition

Rating	Alternative States
A	Buffer for AA is dominated by native vegetation, has undisturbed soils, and is apparently subject to little or no human visitation.
B	Buffer for AA is characterized by an intermediate mix of native and non-native vegetation, but mostly undisturbed soils, and is apparently subject to little or no human visitation.
C	Buffer for AA is characterized by substantial amounts of non-native vegetation, AND there is at least a moderate degree of soil disturbance/compaction undisturbed soils, and/or there is evidence of at least moderate intensity of human visitation.
D	Buffer for AA is characterized by barren ground and/or highly compacted or otherwise disturbed soils, and/or there is evidence of very intense human visitation.

Hydrology Attribute

- *primary source of water*
- *duration of inundation*
- *connection to surrounding area*

Water Source

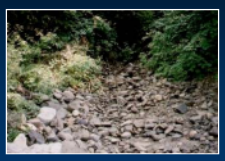
- Consider what affects dry season conditions
- Determine anthropogenic inputs
- Consult information sources
  - watershed reports
  - local experts
  - maps or imagery

Water Source

"…Stream diversion by the City of Watsonville causes the creek to run dry in summer (late July) just below the town of Corralitos. Small tributaries, or field runoff, add water to the creekbed downstream of this point…

Coastal Watershed Council
CORRALITOS CREEK WATERSHED
FINAL ANNUAL REPORT
JULY-DECEMBER 2003

Water Source



Freshwater source within 2km upstream has:

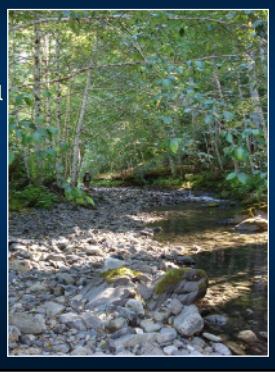
A. No indication of direct anthropogenic inputs.
B. Occasional or small amounts of inflow from anthropogenic sources.
C. Primarily artificial hydrology or flow has been substantially diminished by known diversions.
D. Natural, dry-season sources have been eliminated.

Channel Stability

Consider indicators of channel stability, aggradation, and degradation (incision)

Channel Stability

Field Indicators of Equilibrium



Abundant perennial vegetation above BF contour

Well-sorted bed material

Abundant mosses

Embedded woody debris

Well defined BF contour

Leaf litter in pools

Channel Stability

Field Indicators: Degradation

Failing banks

Exposed roots

Vegetation falling into channel

Channel Stability

Field Indicators: Aggradation

Planar bed

Buried plants and tree trunks

Coarse sediment on floodplain

Hydrologic Connectivity

Degree of entrenchment is used to assess lateral connections between flood flows and riparian area.

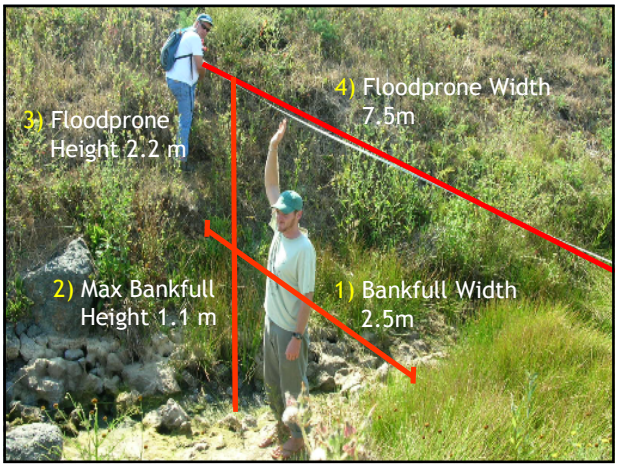
Step 1: Estimate bankfull width (bfw).	
Step 2: Estimate maximum bankfull depth.	
Step 3: Estimate flood prone depth.	
Step 4: Estimate flood prone width (fpw).	
Step 5: Calculate entrenchment ratio (fpw/bfw).	
Step 6: Average of three ratio measurements	

Bankfull width

- Suite of field indicators
  - Depositional benches and bar tops
  - Lower limit of bank vegetation
  - Lower limit of riparian litter

Bankfull width

- Can be difficult to discern
  - Most difficult in unstable reaches
  - Best on straight reaches of uniform slope
  - Multiple observers
  - Multiple points of measurement



Hydrologic Connectivity

Consider the degree of entrenchment, which is the extent to which flooding channel includes an active floodplain.

Step 1: Estimate bankfull width.	2.5m
Step 2: Estimate bankfull depth.	1.1m
Step 3: Estimate flood prone depth.	2.2m
Step 4: Estimate flood prone width.	7.5m
Step 5: Calculate entrenchment ratio. (fpw/bfw)	3.0
Step 6: Average of three ratio measurements	2.6

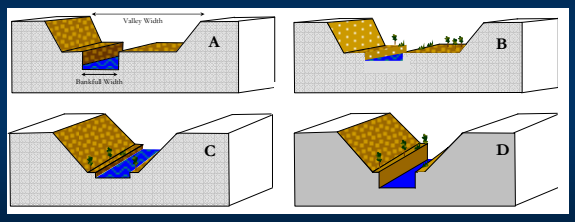
Rating of Hydrologic Connectivity for Non-confined Riverine Wetlands

Rating	Alternative State - based on the entrenchment ratio calculation
A	Entrenchment ratio is > 2.2
B	Entrenchment ratio is 1.9 to 2.2
C	Entrenchment ratio is 1.5 to 1.8
D	Entrenchment ratio is <1.5

Riverine confinement and entrenchment

A. Non-confined entrenched

B. Non-confined Not entrenched



C. Confined Not entrenched

D. Confined entrenched

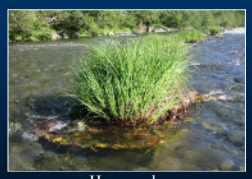
Physical Structure Attribute

- Considers complexity of form and structure affecting bio-diversity
- Two metrics:
  - Structural patch richness
  - Topographic complexity

Structural Patch Type Worksheet

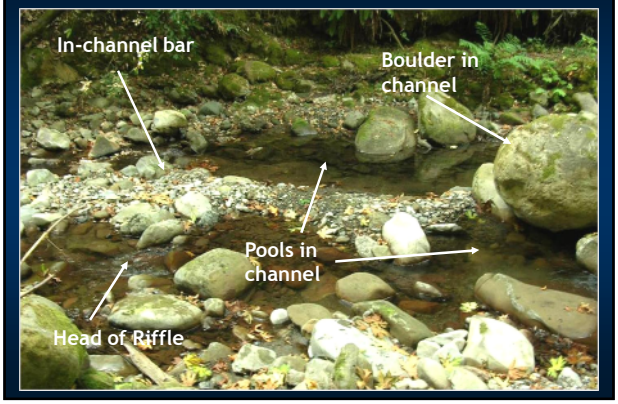
STRUCTURAL PATCH TYPE (check for presence)	Rh-state (Non-riverine)	Rh-state (Lacustrine)
Minimum Patch Size	3 m^2	3 m^2
Secondary channels on floodplains or along shorelines	1	NA
Swales on floodplain or along shoreline	1	NA
Pannes or pools on floodplain	1	NA
Vegetated islands (mostly above high-water)	1	NA
Pools or depressions in channels (wet or dry channels)	1	1
Riffles or rapids (wet channel) or planar bed (dry channel)	1	1
Point bars and in-channel bars	1	1
Debris jams	1	1
Abundant wrackline or organic debris in channel, on floodplain, or across depressional wetland plain	1	1
Plant hummocks and/or sediment mounds	1	1
Bank slumps or undercut banks in channels or along shoreline	1	1
Variegated or crenulated foreshore (instead of broadly arcuate or straight)	1	1
Standing snags (at least 3 m tall)	1	1
Filamentous macroalgae or algal mats	1	1
Cobble and/or Boulders	1	1
Submerged vegetation	1	NA
Total Possible	16	11
No. Observed Patch Types(enter here and use in Table 4.16 below)		

Debris Jam

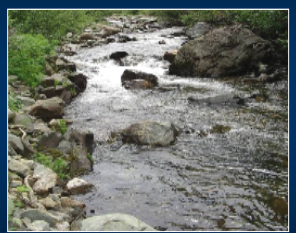


Hummocks

Structural Patch Richness



Structural Patch Richness



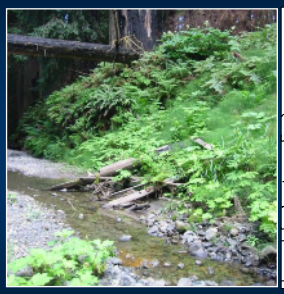
Variegated Shore

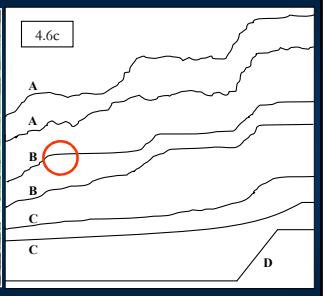
Non-variegated Shore

Rating for Structural Patch Richness (non-confined riverine)

Rating	Alternative States- Field Book Pg. 30
A	≥ 12 of the possible patches types present
B	9-10 of the possible patches types present
C	6-7 of the possible patches types present
D	≤ 5 of the possible patches types present

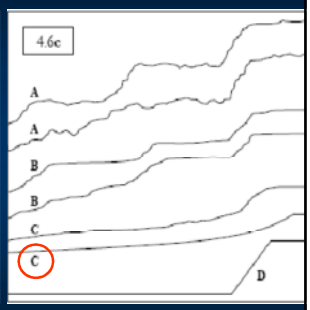
Topographic Complexity





Assess from thalweg to lateral edge of AA

Topographic Complexity



Assess from thalweg to lateral edge of AA

Biotic Structure Attribute

Considers…

- Overall ecological complexity of plant community of the wetland
- Three metrics:
  - Plant Community composition
  - Horizontal interspersion and zonation
  - Vertical biotic structure

Plant Community Sub-Metrics

- Number of Plant Layers Present
- Number of Co-dominant Species
- Percent Invasion

Defining Plant Layers

Wetland Type	Plant Layers				
	Aquatic	Semi-aquatic and Riparian			
	Floating	Short	Medium	Tall	Very Tall
Perennial Saline Estuarine	On Water Surface	<0.3 m	0.3 – 0.75 m	0.75 – 1.5 m	>1.5 m
Perennial Non-saline Estuarine, Seasonal Estuarine	On Water Surface	<0.3 m	0.3 – 0.75 m	0.75 – 1.5 m	>1.5 m
Lacustrine, Depressional and Non-confined Riverine	On Water Surface	<0.5 m	0.5 – 1.5 m	1.5 - 3.0 m	>3.0 m
Slope	NA	<0.3 m	0.3 – 0.75 m	0.75 – 1.5 m	>1.5 m
Confined Riverine	NA	<0.5 m	0.5 – 1.5 m	1.5 – 3.0 m	>3.0 m

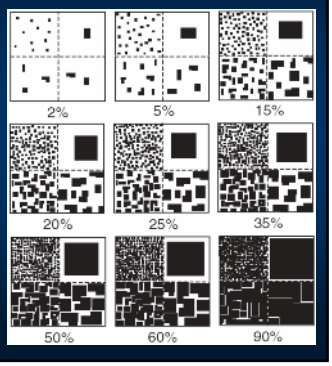
Plant Community Sub-Metrics

Absolute % cover of the vegetation strata is?

- <5 % → Not counted as a layer.
- ≥5 % → Counted as a layer. Relative % cover of each species?
  - <10% → Not a "dominant"
  - ≥10% → Considered "dominant"
    - Non-invasive
    - Invasive

Estimating Percent Areal Cover

It's worthwhile to "calibrate your eyes" to different percent cover situations.



Example: Co-dominants at Serrano Creek

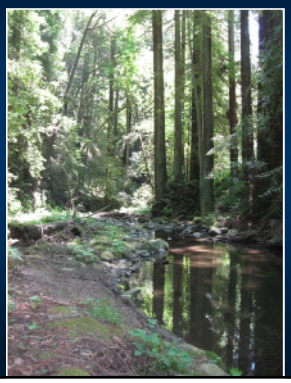
Very Tall (>3m)
- *Salix lasiolepis*
- *Salix gooddingii*
- *Populus fremontii*

Tall (1.5-3m)
- *Typha latifolia*
- *Baccharis salicifolia*

Medium (0.5-1.5m)
- *Artemisia douglasiana*
- *Piptatherum milleaceum*

Short (<0.5m)
- *Delairea odorata*
- *Rubus ursinus*

Example: Co-dominants at Browns Creek



- Very Tall (>3m)
  - *Sequoia sempervirens*
  - *Acer macrophyllum*
- Tall (1.5-3m)
  - *Lithocarpus densiflorus*
- Medium (0.5-1.5m)
  - *Polystichum munitum*
  - *Lithocarpus densiflorus*
- Short (<0.5m)
  - *Oxalis oregana*
  - *Vinca major*

Plant Community Metric Worksheet

Note: Plant species should only be counted once when calculating the Number of Co-dominant Species and Percent Invasion metric scores.

Floating or Canopy-forming	Invasive?	Short	Invasive?
Medium	**Invasive?**	**Tall**	**Invasive?**
Very Tall	**Invasive?**		
		Total number of co-dominant species for all layers combined (enter here and use in Table 4.19)	
		Percent Invasion (enter here and use in Table 4.19)	

Field Book Pg. 37

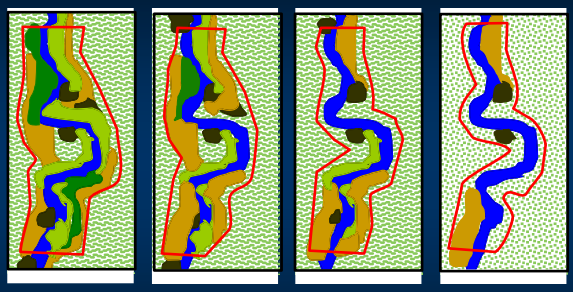
Ratings for submetrics of Plant Community

Rating	Number of Plant Layers Present	Number of Co-dominant Species	Percent Invasion
Perennial Saline Wetlands			
A	4 – 5	≥ 5	0 – 15%
B	2 – 3	4	16 – 30%
C	1	2 – 3	31 – 45%
D	0	0 – 1	46 – 100%
Perennial Non-Saline and Seasonal Estuarine Wetlands			
A	4 – 5	≥ 7	0 – 20%
B	3	5 – 6	21 – 35%
C	1 – 2	3 – 4	36 – 60%
D	0	0 – 2	61 – 100%
Lacustrine, Depressional and Non-confined Riverine Wetlands			
A	4 – 5	≥ 12	0 – 15%
B	3	9 – 11	16 – 30%
C	1 – 2	6 – 8	31 – 45%
D	0	0 – 5	46 – 100%
Slope Wetlands			
A	4	≥ 7	0 – 20%
B	3	5 – 6	21 – 35%
C	1 – 2	3 – 4	36 – 60%
D	0	0 – 2	61 – 100%
Confined Riverine Wetlands			
A	4	≥ 11	0 – 15%
B	3	8 – 10	16 – 30%
C	1 – 2	5 – 7	31 – 45%
D	0	0 – 4	46 – 100%

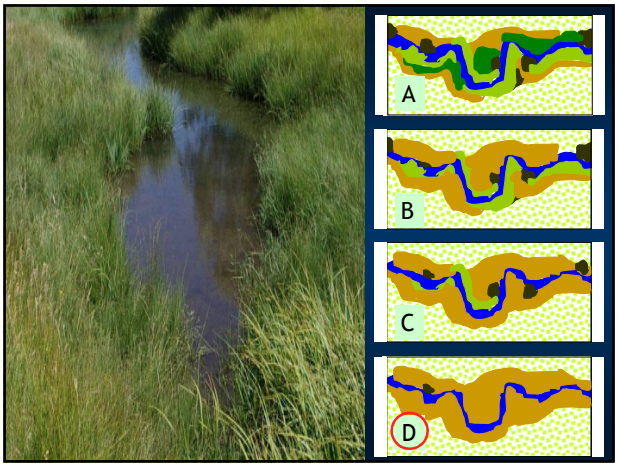
Rules for Plant Community Metrics

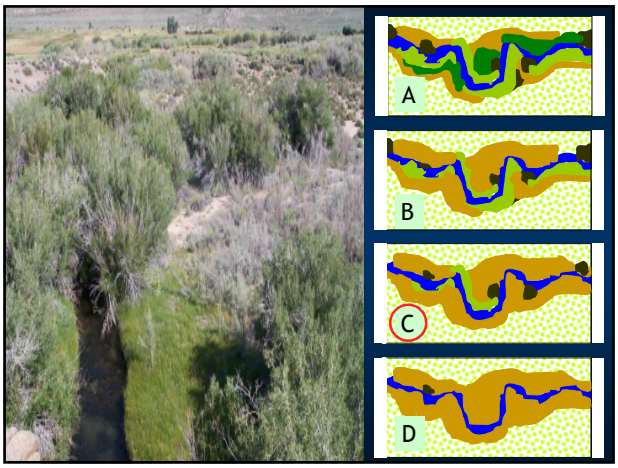
- A species can occupy multiple layers (but an individual can exist only in one)
- A species is counted only once as a co-dominant, no matter how many layers it occupies
- Dead vegetation of a species in growth position can define a layer but cannot be a co-dominant
- A vine can be a co-dominant in the uppermost layer it occupies

Horizontal Interspersion and Zonation

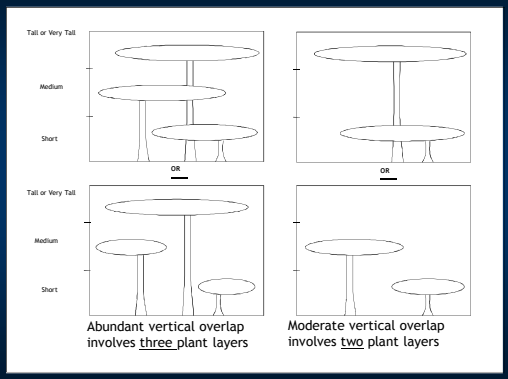


- Measure of the number of zones and the interspersion between them (amount of edge)

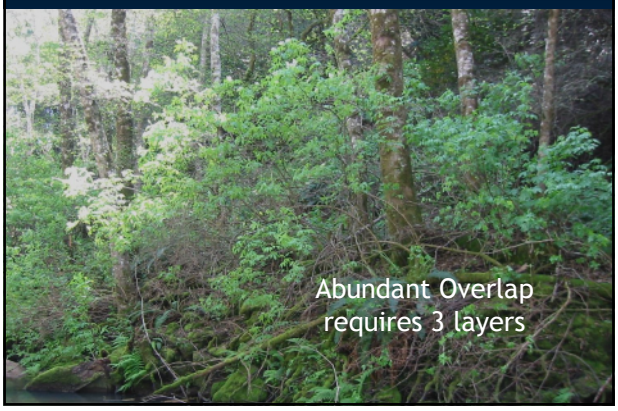




Vertical Biotic Structure



Vertical Biotic Structure



Vertical Biotic Structure

Rating for Vertical Biotic Structure

Rating	Alternative States
A	More than 50% of the vegetated area of the AA supports abundant overlap of plant layers.
B	More than 50% of the vegetated area of the AA supports at least moderate overlap of plant layers.
C	25-50% of the vegetated area of the AA supports at least moderate overlap of plant layers **OR** three layers are well-represented in the AA but there is little to no overlap.
D	Less than 25% of the vegetated area of the AA supports moderate overlap of plant layers **OR** two layers are well-represented with little to no overlap **OR** AA is sparsely vegetated overall.

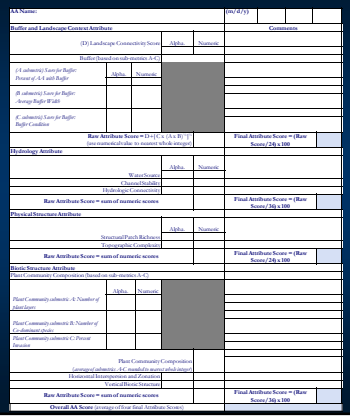
Steps of CRAM Assessment

Step 1: Assemble background information
Step 2: Classify the wetland
Step 3: Verify the appropriate season
Step 4: Sketch the CRAM Assessment Area (AA)
Step 5: Conduct the office assessment of AA
Step 6: Conduct the field assessment of AA
Step 7: Complete CRAM QA/QC
Step 8: Submit assessment results using *e*CRAM

CRAM Initial QAQC

- Review map of AA
- Review and complete all CRAM data fields
- Add comments as needed
- Complete stressor checklist

Scoring Sheet: Riverine Wetlands



AA Name: (m/d/y)

Buffer and Landscape Context Attribute			Comments
	Alpha	Numeric	
(D) Landscape Connectivity Score			
Buffer (based on sub-metrics A-C)			
(A submetric) Score for Buffer: Percent of AA with Buffer			
(B submetric) Score for Buffer: Average Buffer Width			
(C submetric) Score for Buffer: Buffer Condition			
Raw Attribute Score = [3×((A + B)/2)] + C (use numerical value to nearest whole integer)			Final Attribute Score = (Raw Score/24) x 100

Hydrology Attribute			
	Alpha	Numeric	
Water Source			
Channel Stability			
Hydrologic Connectivity			
Raw Attribute Score = sum of numeric scores			Final Attribute Score = (Raw Score/36) x 100

Physical Structure Attribute			
	Alpha	Numeric	
Structural Patch Richness			
Topographic Complexity			
Raw Attribute Score = sum of numeric scores			Final Attribute Score = (Raw Score/24) x 100

Biotic Structure Attribute			
Plant Community Composition (based on sub-metrics A-C)			
	Alpha	Numeric	
Plant Community, submetric A: Number of plant layers			
Plant Community, submetric B: Number of co-dominant species			
Plant Community, submetric C: Percent Invasion			
Plant Community Composition (average of submetrics A-C, rounded to nearest whole integer)			
Horizontal Interspersion and Zonation			
Vertical Biotic Structure			
Raw Attribute Score = sum of numeric scores			Final Attribute Score = (Raw Score/36) x 100
Overall AA Score (average of four final Attribute Scores)			

Stressor Checklist

- Anthropogenic perturbation within the wetland or in the surrounding landscape with negative impact on condition and function
- Can be “present” or “significant”
- Four assumptions:
  - Stressor(s) can lead to deviation from best attainable condition
  - More stressors can cause a decline in condition
  - Increase in intensity/proximity increases decline in condition
  - Continuous/chronic stress increases decline in condition

Stressor Checklist

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)		
Flow diversions or tributical inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/deep structures, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		
Comments		

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