

California Rapid Assessment Method for Wetlands and Riparian Areas

Biotic Structure Attribute



The Biotic Structure Attribute Represents All Elements of Wetland Biology

- The “Biotic Structure” of wetlands includes all of the tangible structure of the biotic elements (e.g., plant tissues), as well as the ecological structure (e.g., populations of producers, consumers, and decomposers) and processes that take place in the wetland.
- In CRAM the multitude of biological and ecological elements included in this concept of structure is simplified to a consideration of the structure of the plant community.
- CRAM’s development included an evaluation of relationships among plant community structure and other biotic/ecological indicators.

The Biotic Structure Attribute Tracks Established Ecological Relationships

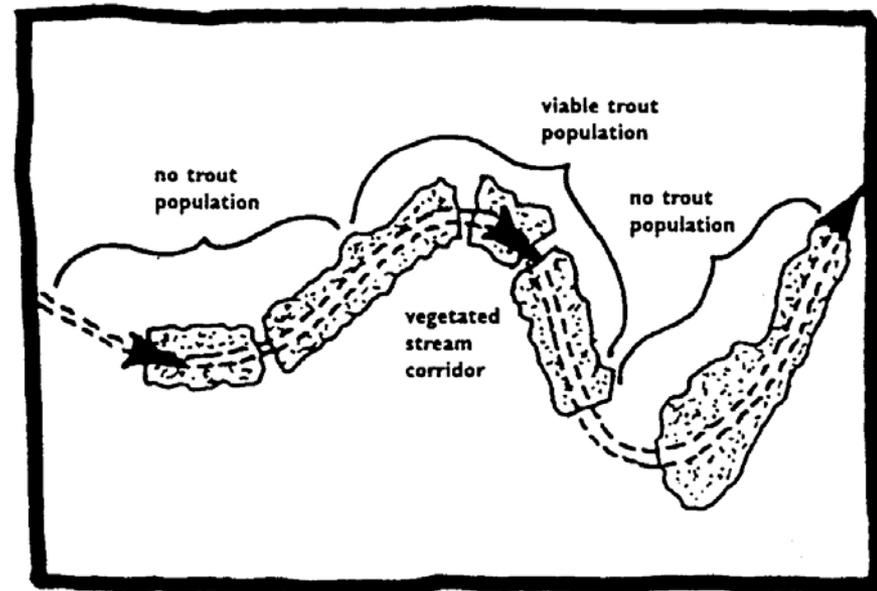
- The Biotic Structure attribute must successfully represent a variety of established ecological patterns in a simplified manner while maintaining the meaning of the original patterns.
- For example, published data indicate that ecologically complex habitats host higher species richness and more individuals.
- The Biotic Structure attribute awards higher scores to more complex habitats, indicated by:
 - Greater plant species richness
 - Greater horizontal “zone” complexity
 - Greater vegetational layering and richness
- Actual measurements of other elements of biological diversity are allocated to Level 3 studies.

Some Wetland Concerns Are Not Assessed Directly Under Biotic Structure

- For example, riparian connectivity is a significant concern for many wildlife and fisheries biologists; this concern is addressed indirectly in CRAM by the Landscape Connectivity metric rather than by the Biotic Structure attribute.

C13. Connectivity of a stream corridor

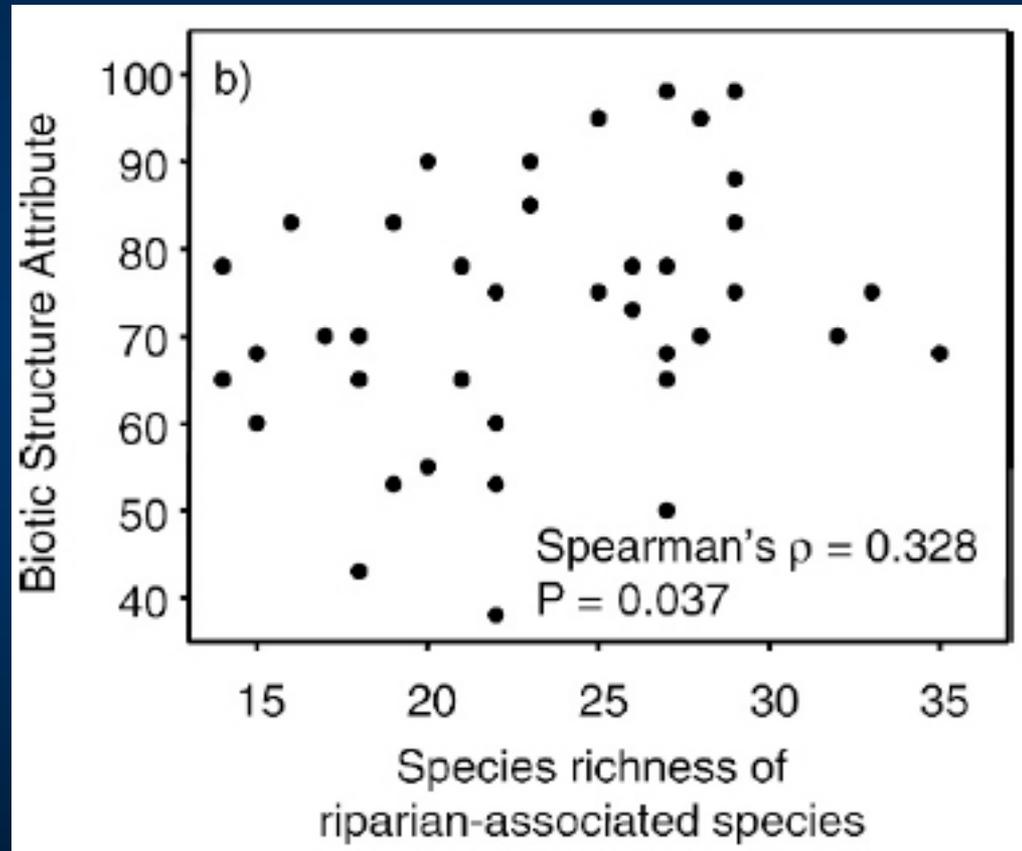
Width and length of a vegetated stream corridor interact or combine to determine stream processes. However, a continuous stream corridor, without major gaps, is essential to maintain aquatic conditions such as cool water temperature and high oxygen content. Without these, plus other physiological conditions, viable populations of certain fish species, such as trout, will not be maintained.



- For many wetlands the “buffer” functions provided by riparian elements are an important management concern, which are addressed indirectly in CRAM by submetrics under the Buffer metric rather than by the Biotic Structure attribute.

The CRAM Biotic Structure Attribute Reflects Established Ecological Patterns

- During CRAM validation studies the positive and significant relationship between CRAM Biotic Structure scores and riparian-associated bird species richness was documented statistically.
- Similarly significant relationships were documented for Biotic Structure scores and the species richness of all birds included in association with streams and wetlands.



Metric 1: Plant Community

- The Plant Community metric assesses the diversity of the vegetation present within the Assessment Area, including:
 - *Plant layer diversity*, based on data indicating that more vegetation layers create richer biotic structure and higher productivity.
 - The *number of dominant plant species*, based on the expectation that more diverse communities are more biologically productive and provide greater opportunity for other organisms to find suitable habitat conditions.
 - The *percentage of the dominant species that are identified as “invasive”* by the CalIPC (a negative relationship), based on the expectation that greater dominance by invasive species reflects a proportional imbalance in the plant community and its ecological functions.

Determining Plant Community Submetrics

Step 1 : Determine number of plant layers

<5% absolute cover

Not counted as a layer

≥5% absolute cover

Counted as a layer

Step 2 : Determine co-dominant plant species/layer

<10% relative cover

Not counted as a dominant

≥ 10% relative cover

Counted as a dominant

Step 3 : Sum unique co-dominants and
determine % that are invasive

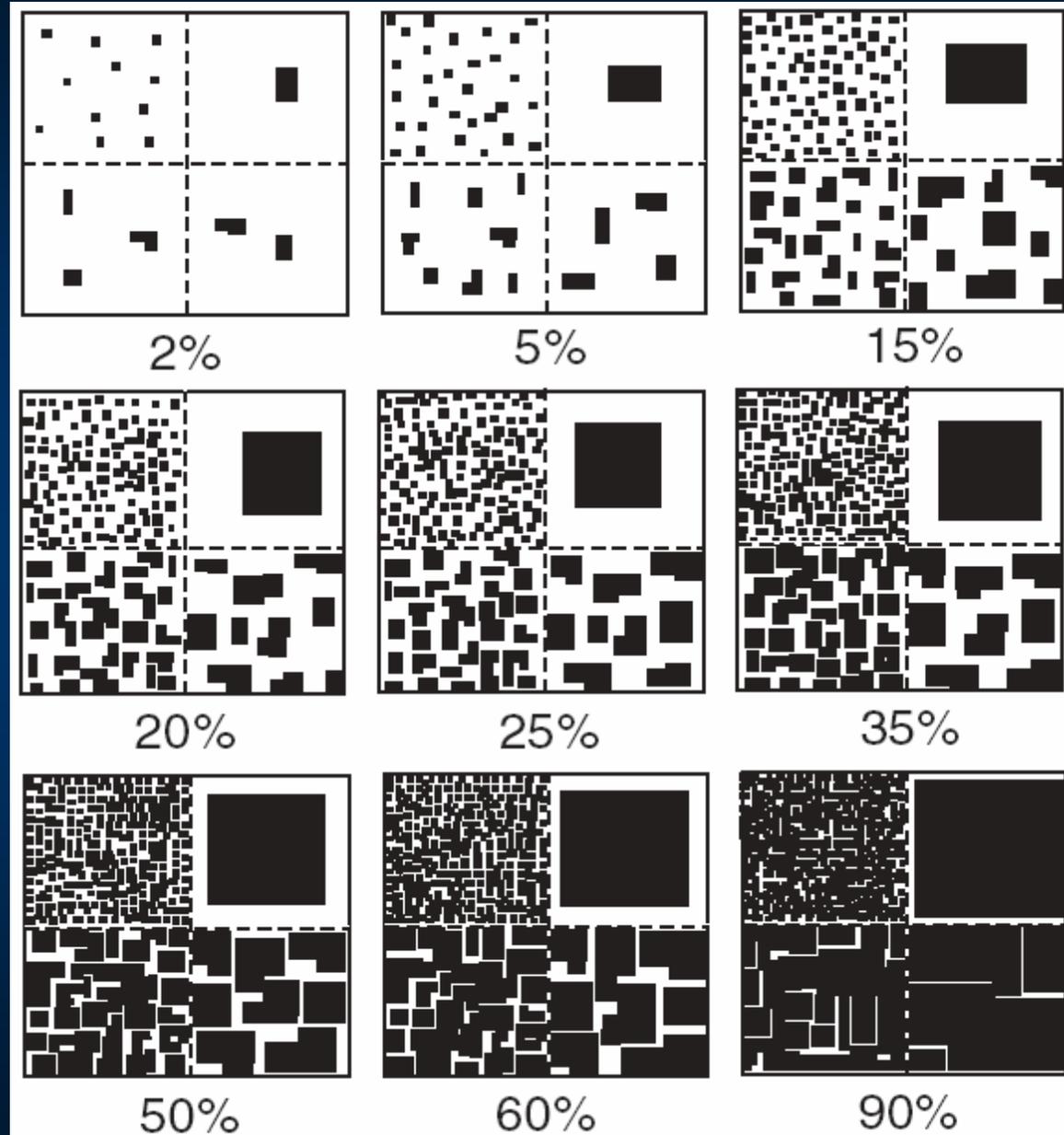
CRAM's Measure of Dominance and Species Richness

- Why does CRAM define “dominance” for a plant species as $> 10\%$ relative cover in a layer?
- CRAM assigns higher condition to wetlands with higher counts of abundant species; wetlands with more species are assumed to provide increased biotic richness. CRAM scores the *number* of species that are abundant enough to be considered “important” (i.e., dominant) in the community.
- The “10% dominance” protocol is merely a way to identify a *count* of the number of abundant species, allowing this submetric to be scored numerically.

Ecological Experience is Usually Needed in Order to Assess Biotic Structure

Applying CRAM has demonstrated two significant facts relating to the Biotic Structure attribute:

1. Most people find it difficult to estimate cover percentages accurately.
2. Many people (including people with extensive experience in wetland regulatory processes) find it difficult to identify plant species adequately to complete an assessment of Biotic Structure without assistance from a qualified botanist/ecologist. This is true for all modules.



Defining Plant Layers

- Each module includes categories of vegetation layering that are used for the module (which may be none; i.e., no layering). For example, the following table indicates layering categories for the Riverine module.

Wetland Type	Plant Layers				
	Aquatic	Semi-aquatic and Riparian			
	Floating	Short	Medium	Tall	Very Tall
Non-confined Riverine	On Water Surface	<0.5 m	0.5 – 1.5 m	1.5 – 3.0 m	> 3.0 m
Confined Riverine	NA	<0.5 m	0.5 – 1.5 m	1.5 – 3.0 m	> 3.0 m

- Note that in CRAM a vegetation layer is defined as 5% of the area in which such a layer is “appropriate” (i.e. potentially occurring); i.e., a floating layer cannot occur in upland areas, and terrestrial layers generally do not occur in parts of an AA that present surface water.

Use a Quantitative Approach to Metric Scoring

- Scoring the “layers” submetric is enhanced by adopting a field approach that is based on areas.
- For example, assume an AA has an area of 3000 m². In order for a layer to exist it must have a minimum area of 5% of 3000 m², or 150 m².
- A dominant species must attain at least 10% coverage in a layer. In order to be a dominant species in a 150-m² layer, a plant species must have a coverage in the layer of at least 15 m².
- Using this more-quantitative approach to identify dominance becomes “second nature” with practice, and is recommended.

Additional Considerations for Plant Community Metrics

- The identification of “invasive” status for dominant species is the presence of that species in any category of the Cal-IPC Invasive Plant Inventory.
- A given species can exist in >1 layer, but a given individual can exist only in one. Although it can be a codominant in multiple layers, a given plant species is counted only once when calculating total number of co-dominants in the AA and percent invasive species.
- Dead vegetation contributes to the absolute cover requirement for a layer, but is not included in the dominant species count.
- Vines are counted in the layer of vegetation they are covering.

Example of Ratings for Submetrics of the Plant Community Metric

Rating	Number of Plant Layers Present	Number of Co-dominant Species	Percent Invasion
Non-confined Riverine Wetlands			
A	4 – 6	≥ 12	0 – 15%
B	3	9 – 11	16 – 30%
C	1 – 2	6 – 8	31 – 45%
D	0	0 – 5	46 – 100%
Confined Riverine Wetlands			
A	4 - 5	≥ 11	0 – 15%
B	3	8 – 10	16 – 30%
C	1 – 2	5 – 7	31 – 45%
D	0	0 – 4	46 – 100%

- Similar scoring tables to this Riverine table exist for each module, although specific values in the tables may (or may not) differ, based on the expectations established for the Plant Community metric for each wetland type.

Metric 2: Horizontal Interspersion

- The second Biotic Structure metric is a measure of the *horizontal distribution of different habitat conditions*. This metric assumes that different vegetation associations represent different habitat types, and greater horizontal “patchiness” provides increased habitat values for wildlife, as indicated by numerous ecological studies.
- The metric responds with higher scores to an increase in the number of “zones” (a surrogate for “habitat patch types”) and the “evenness” of their abundance and distribution in a horizontal two-dimensional array in the AA.
- An “A” condition means BOTH more plant zones AND a greater degree of interspersion among zones, and the departure from the “A” condition is proportional to BOTH the reduction in both the numbers of zones AND their interspersion.

Scoring Horizontal Interspersion

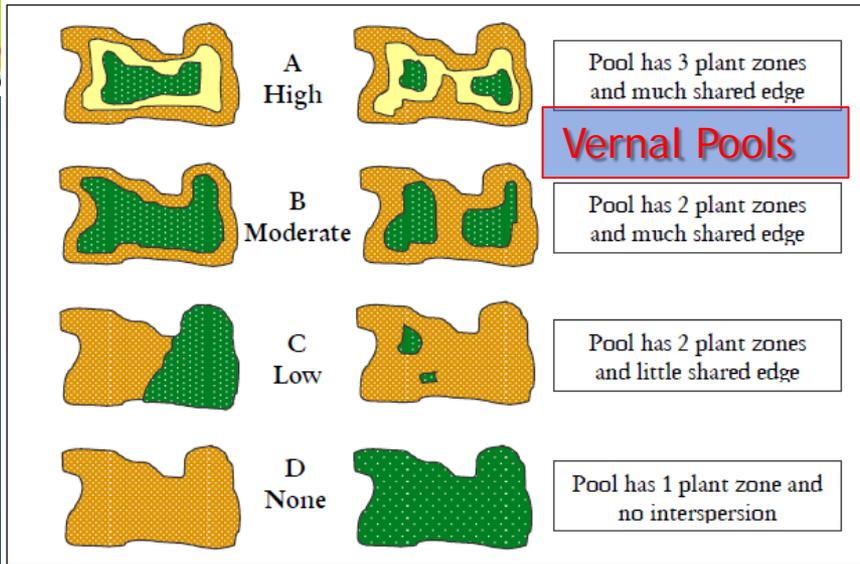
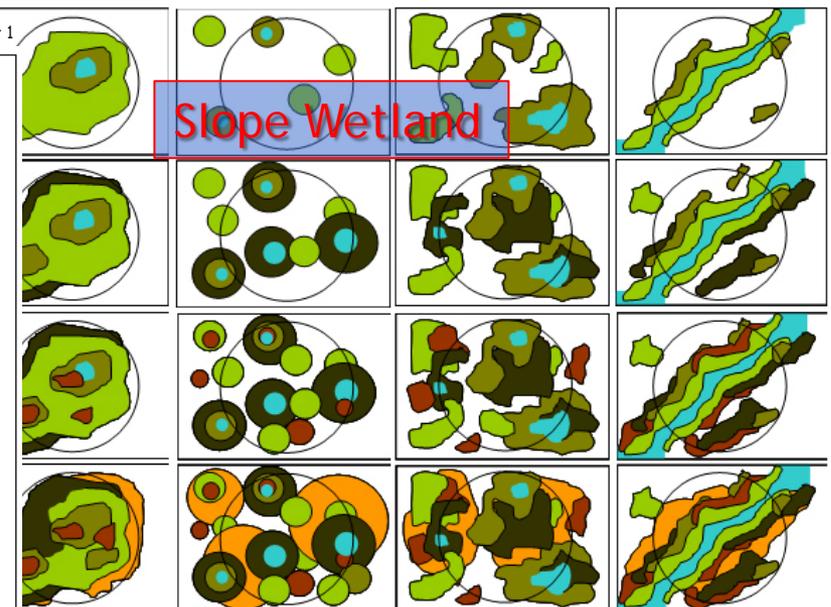
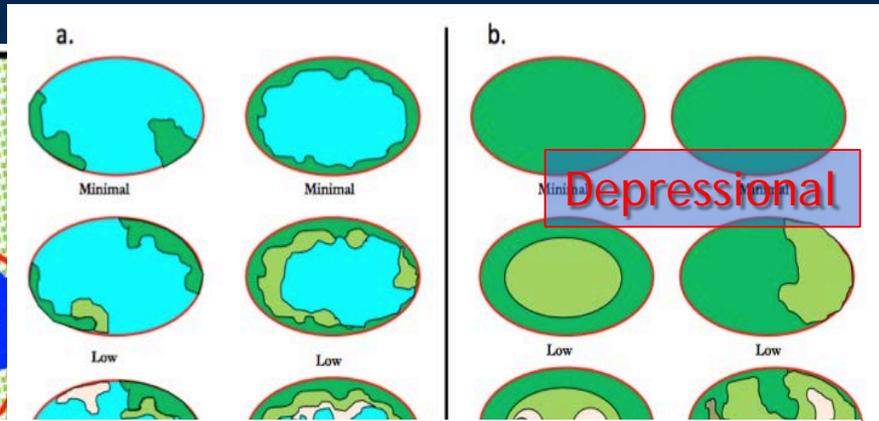
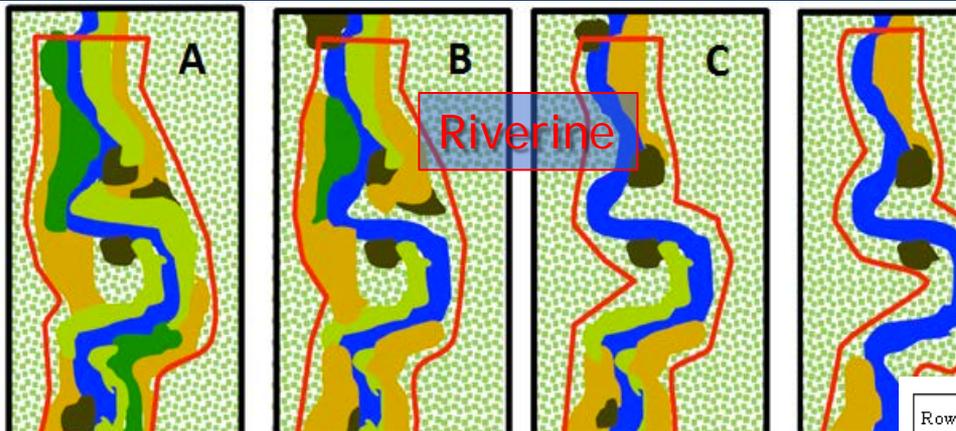
- For short-statured wetland vegetation (e.g., marshes), plant zones effectively collapse to a two-dimensional array of vegetation types dominated by different species.
- For taller plant associations (e.g., riparian forests) identifying the “zones” requires an ability to combine dominant species in the tall columns of trees into a “gestalt” that represents a relatively unvarying vegetation zone throughout the AA.
- Scoring this metric is based on a combination of aerial image interpretation and biological field reconnaissance, resulting in the identification by the assessor of the habitat patches in the AA.

Scoring Criteria for the Horizontal Interspersion Submetric

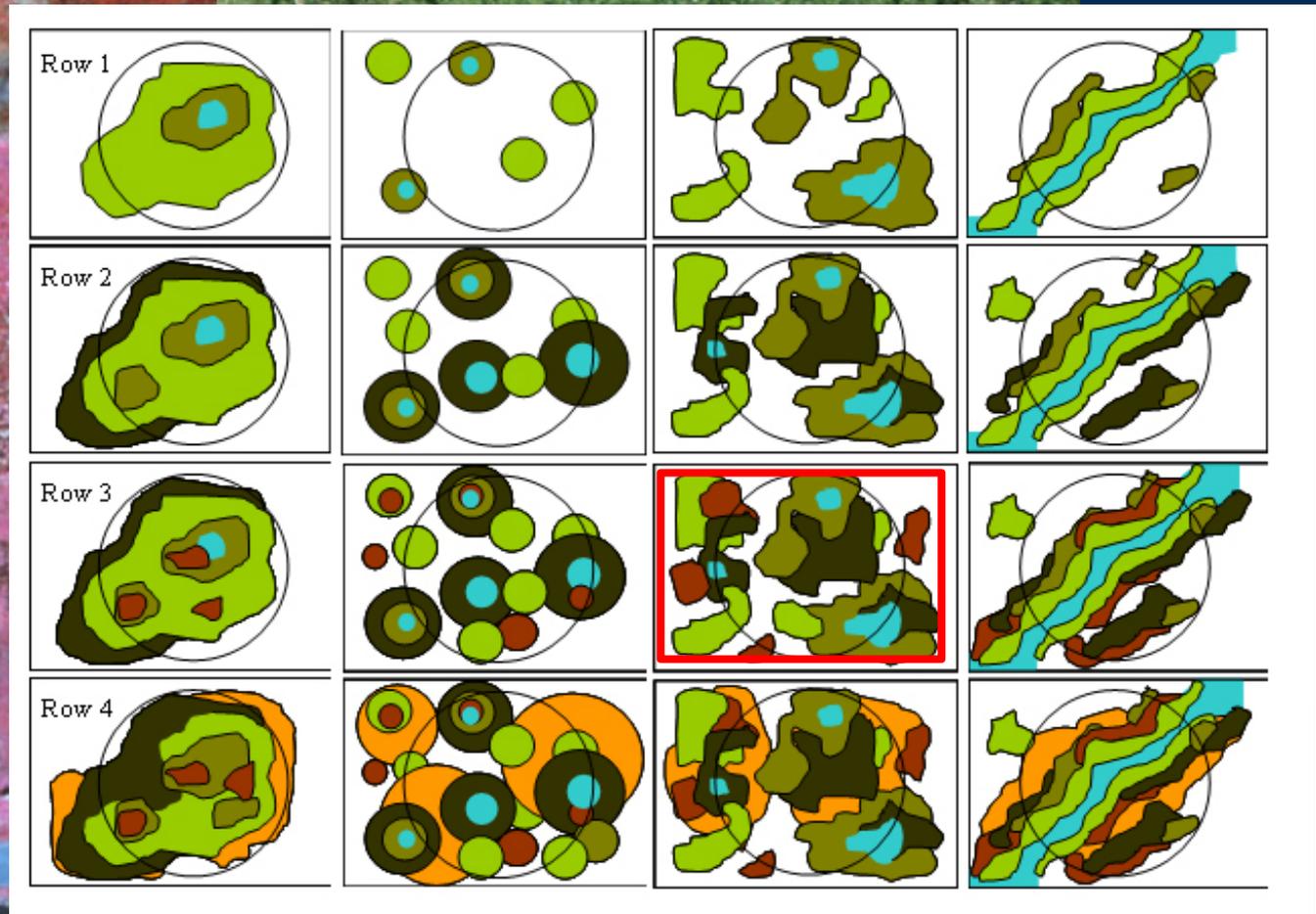
Rating	Alternative States
A	AA has a high degree of plan-view interspersion.
B	AA has a moderate degree of plan-view interspersion.
C	AA has a low degree of plan-view interspersion.
D	AA has minimal plan-view interspersion.

Scoring is based on a worksheet drawing and the assessor's interpretation of a figure from the appropriate field book

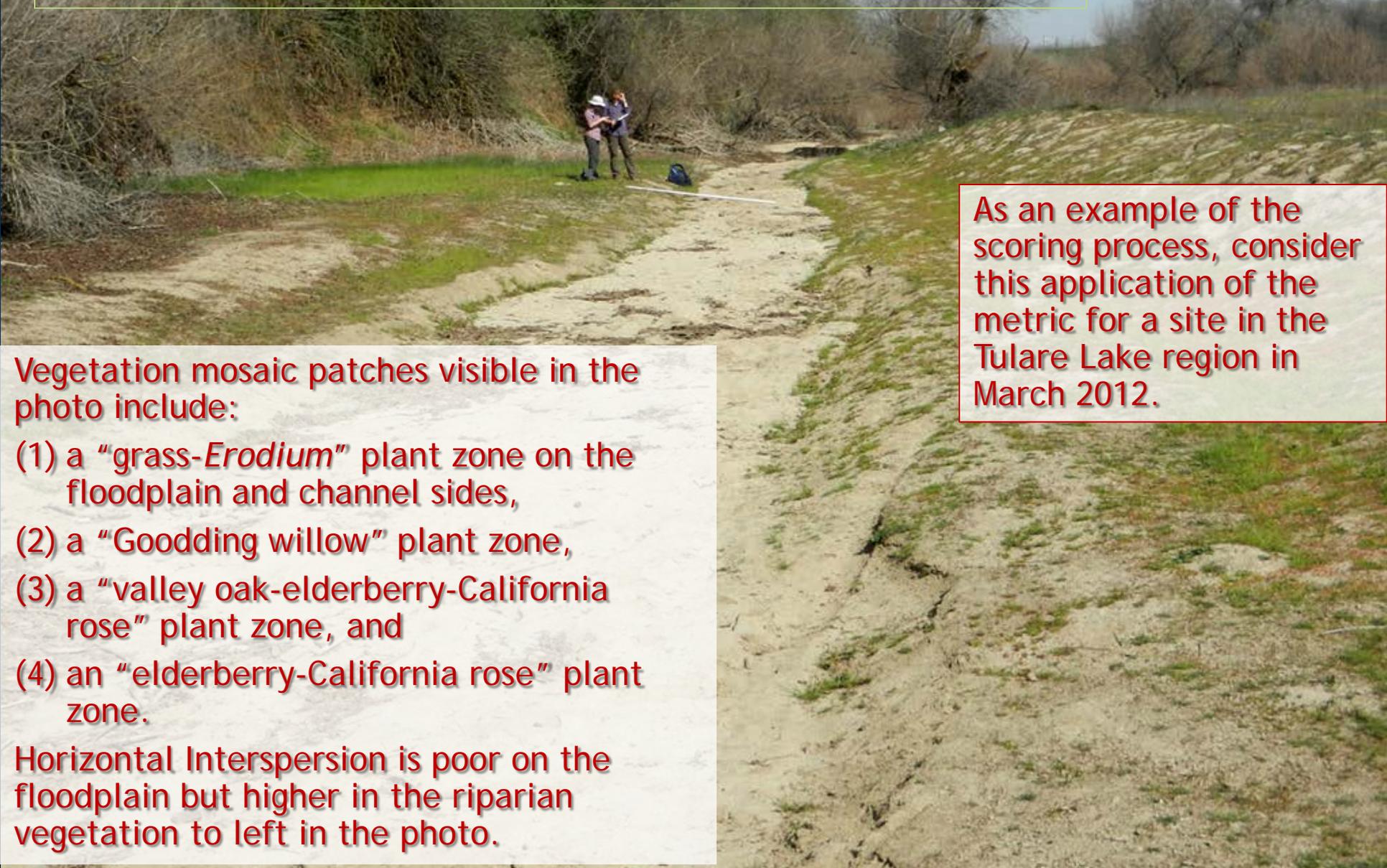
CRAM Modules Have Differing Interspersion Diagrams



Example: Scoring Plant Zone Interspersion in Coastal Zone Slope Wetlands



Example: Identifying Interspersion: Burris Park, Kings River



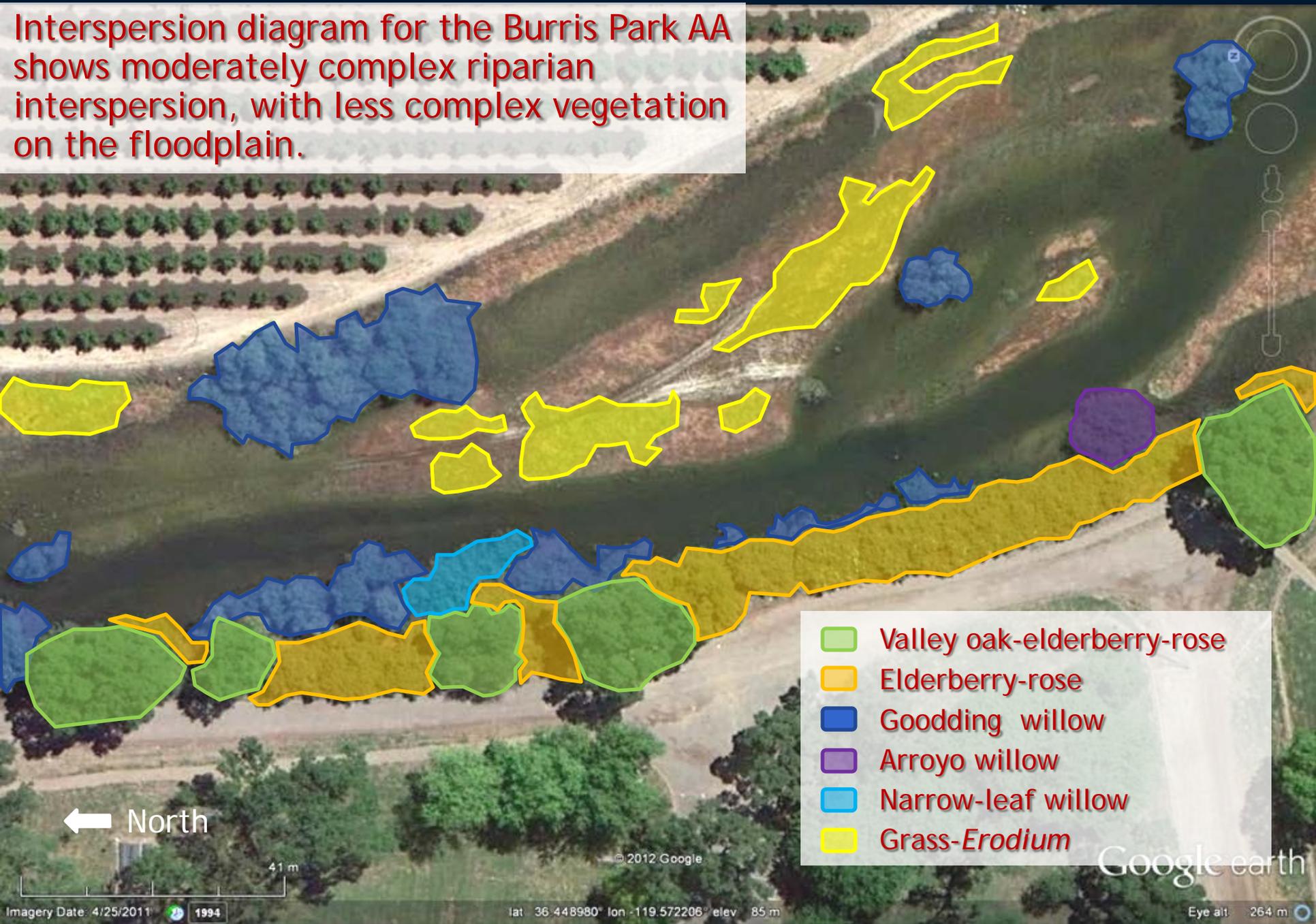
As an example of the scoring process, consider this application of the metric for a site in the Tulare Lake region in March 2012.

Vegetation mosaic patches visible in the photo include:

- (1) a “grass-*Erodium*” plant zone on the floodplain and channel sides,
- (2) a “Goodding willow” plant zone,
- (3) a “valley oak-elderberry-California rose” plant zone, and
- (4) an “elderberry-California rose” plant zone.

Horizontal Interspersion is poor on the floodplain but higher in the riparian vegetation to left in the photo.

Interspersion diagram for the Burris Park AA shows moderately complex riparian interspersion, with less complex vegetation on the floodplain.



North

41 m

© 2012 Google

Google earth

Imagery Date: 4/25/2011 1994

lat 36.448980° lon -119.572206° elev 85 m

Eye alt: 264 m

Rating for Horizontal Interspersion for Burriss Park Example

Rating	Alternative States
A	AA has a high degree of plan-view interspersion.
B	AA has a moderate degree of plan-view interspersion.
C	AA has a low degree of plan-view interspersion.
D	AA has minimal plan-view interspersion.

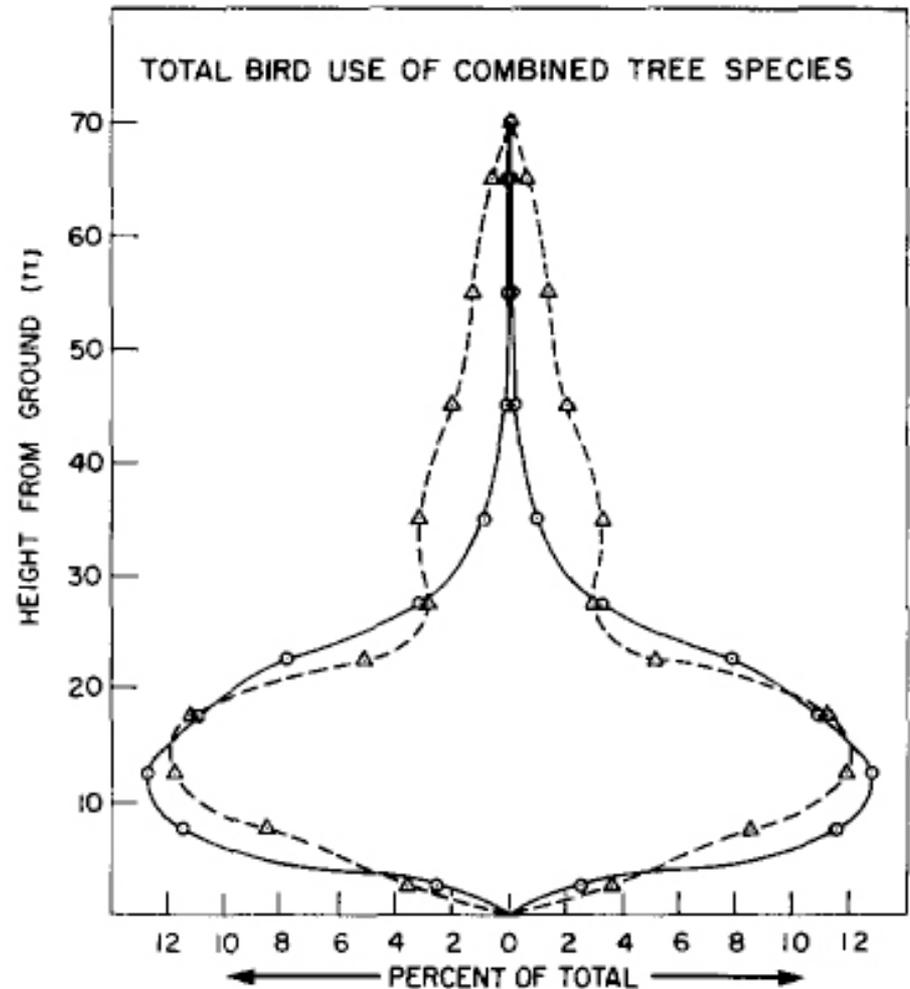
Based on the interpretation of the horizontal interspersion observed in the field and the diagram for Riverine assessments, the Burriss Park site exhibits a "B" condition.

Metric 3: Vertical Biotic Structure

- Metric 3 scores the *vertical diversity of habitat condition* within the Assessment Area.
- Scoring for this metric uses the same vegetation layers identified for the Plant Community metric. [Note that wetlands that lack vertical structure and vegetation layers (e.g., vernal pools) do not include either this metric or the “layers” submetric.]
- Scoring is accomplished by comparing the observed conditions with alternative conditions illustrated in appropriate field books.

The Ecological Pattern Underlying the Layering Metric

- The metric is based on a well-characterized ecological relationship between wildlife (especially bird) use and the vertical layering that exists in essentially every habitat, including wetlands and (especially) riparian areas.
- Fundamentally, organisms use the vertical structure in the habitat as the substrate for foraging, nesting, and other life requisites.



Solid line: distribution of foliage.

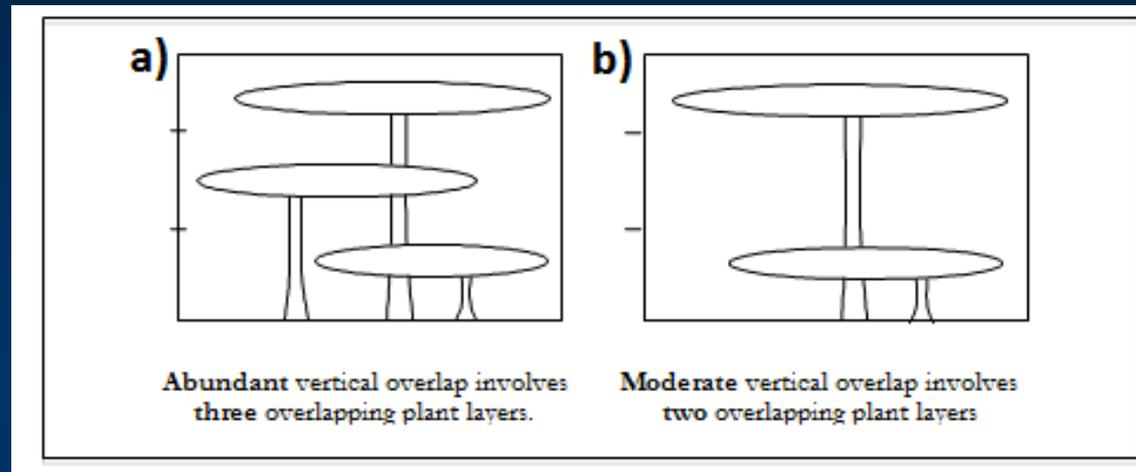
Dashed line: summed bird use.

Data from R.P. Balda, study in SE Arizona.

Vertical Layering Includes Riparian Areas and Entrained Marsh Vegetation

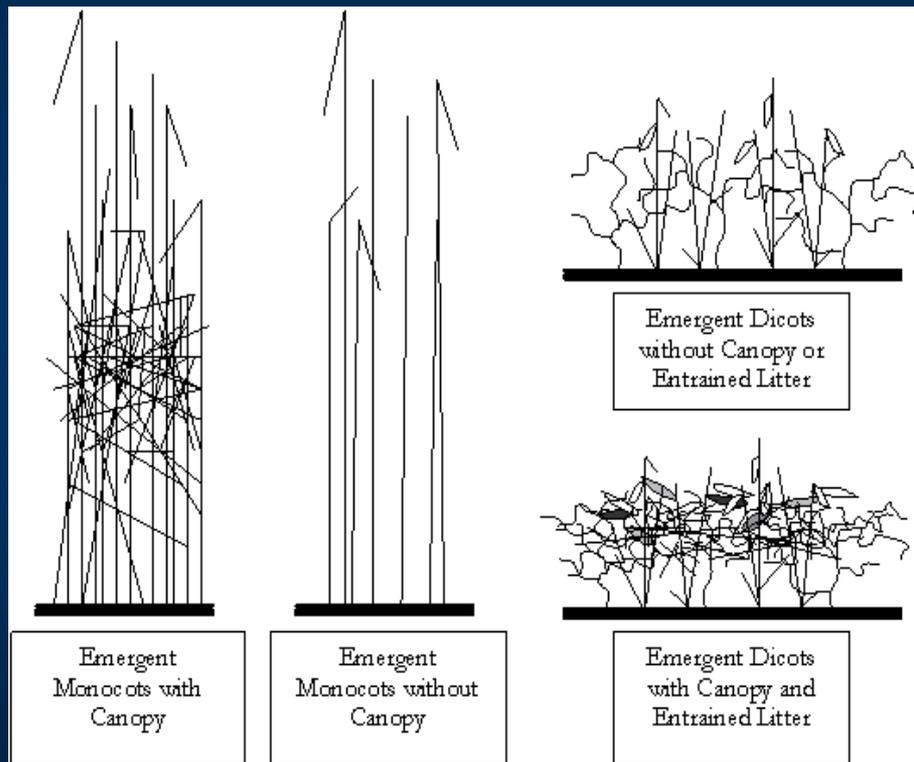
- For many California wetlands overlapping vegetation layers (above or below the water surface) contribute to vertical gradients in light and temperature that result in greater species diversity of invertebrates, fish, amphibians, and birds.
- The species richness of riparian birds, small mammals, and other wildlife increases with the density and number of overlapping plant layers. In addition, many bird species that nest near the ground or water surface commonly require a cover of vegetation at their nest sites.
- In estuarine wetlands, entrained plant canopies entrap coarse plant litter that is lifted into the canopies by rising tides. This “entrained” material is left hanging in the plant cover, providing important shelter for estuarine birds and small mammals.

Vertical Biotic Structure in Woody Riparian Forests



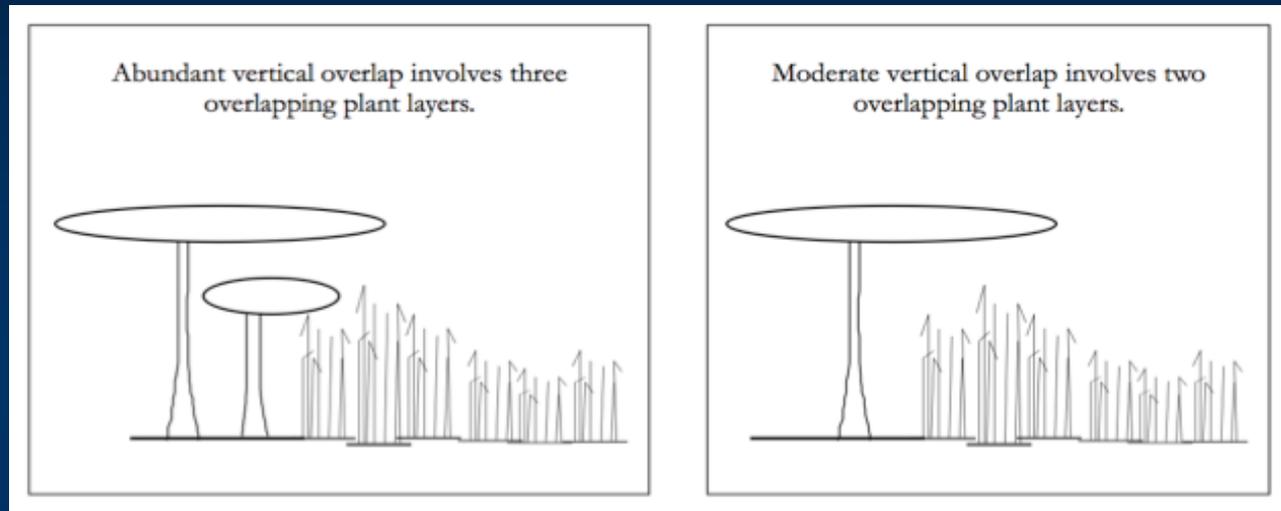
- For wetland types with well-developed vertical woody vegetation structure, the scoring approach developed for riparian areas in Riverine wetlands remains the most appropriate scoring approach for Vertical Biotic Structure, although adjustments to the layer intervals may be appropriate for very tall habitats.

Vertical Biotic Structure in Herbaceous (Marshy) Wetlands



- In order to address the documented values of entrained litter in herbaceous wetlands (e.g., salt marshes, depressional wetlands), the scoring approach for Vertical Biotic Structure developed address entrainment in Estuarine (marshy) wetlands may remain most appropriate.

Vertical Biotic Structure in Emergent Wetlands with Woody Riparian Elements



- For many wetlands (particularly depressional wetlands) that have both marshy emergent layers and woody “riparian” vegetation the recently developed scoring approach that includes both woody and herbaceous layers may be the most appropriate for scoring Vertical Biotic Structure.

Thank You

