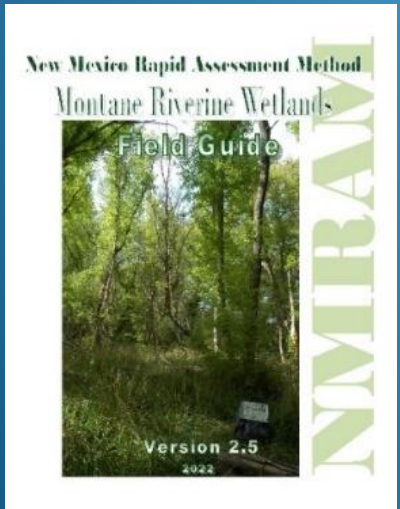
New Mexico Environment Department

New Mexico Rapid Assessment Method (NMRAM)

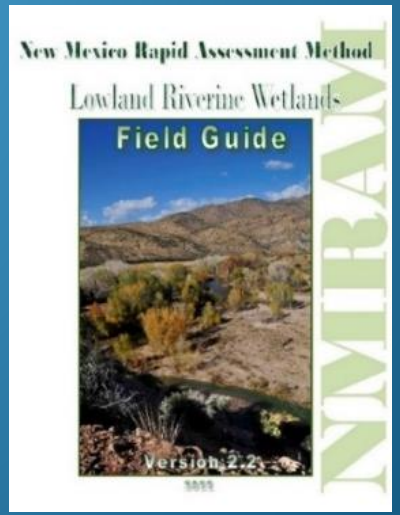
Riverine Wetlands

Groundwater Index



New Mexico Environment Department
Surface Water Quality Bureau
Wetlands Program

Natural Heritage New Mexico
University of New Mexico



Groundwater Index

Assessed by biotic team member

Definition: An index of floodplain groundwater status based on phreatophyte riparian and wetland species presence and condition.

Rationale: Detecting the growing-season high-water table (average position of the top of the hyporheic zone under base flows) as an indicator of the degree of functional impairment. Here, groundwater connectivity is a measure of the amount of surface/groundwater connection in an area as indicated by vegetation composition and stress. This metric assumes that an increase in depth to groundwater tables will result in a change in vegetation vigor of deep-rooted, woody phreatophytes, and a loss of herbaceous obligate (OBL) and facultative wetland (FACW) species supported by near surface groundwater. Additionally, this metric relies on the supposition that significant increases in depth to the groundwater table will result in woody phreatophytes loss and replacement by upland woody or herbaceous species.

Groundwater Index - Composition

Assessed by Biotic team

- On Worksheet 5 assign composition ratings to each strata present
  - Tall Woody (TW)
  - Short Wood (SW)
    - Table A11d list of woody phreatophytes
  - Herbaceous
    - Based on wetland OBL or FACW species

Worksheet 5. Vegetation Community Patch Data for Polygons from the SA Biotic Map for Biotic Metrics B3, B4, and B5 and for Abiotic Metric A11. Enter data for each polygon under a unique number assigned from the SA Biotic Map. Estimate the percentage of the SA (%SA) each polygon covers (expressed as decimal). Each polygon is then evaluated with respect to Vegetation Vertical Structure (B3), Native Tree Regeneration (B4), and Invasive Exotic Plant Species Cover (B5) metrics. Enter the Vertical Structure Type (VST) for B3, tree regeneration % cover within the polygon for B4 and the % cover of invasive exotic species for B5. Use the Tables in Appendix B and the Field Guide for metric instructions. For the Groundwater Index metric (A11) select a composition rating for tall woody, short woody or herbaceous using Table A11a in Appendix B if that stratum occurs in the polygon. A health modifier value is also selected from Table A11b for each woody stratum (tall or short) when riparian woody phreatophytes occur in the polygon. The comments box is used for documenting and describing vegetation community patch features.

Polygon No	% SA	B3 Structure Type	B4 Tree Regeneration % Cover	B5 Invasive Exotic Species % Cover	Invasive Exotic Species (List Code(s))	A11 Tall Woody (TW)	A11 Short Woody (SW)	A11 Herbaceous	A11 TW Health Modifier	A11 SW Health Modifier	Comments
1											
2											

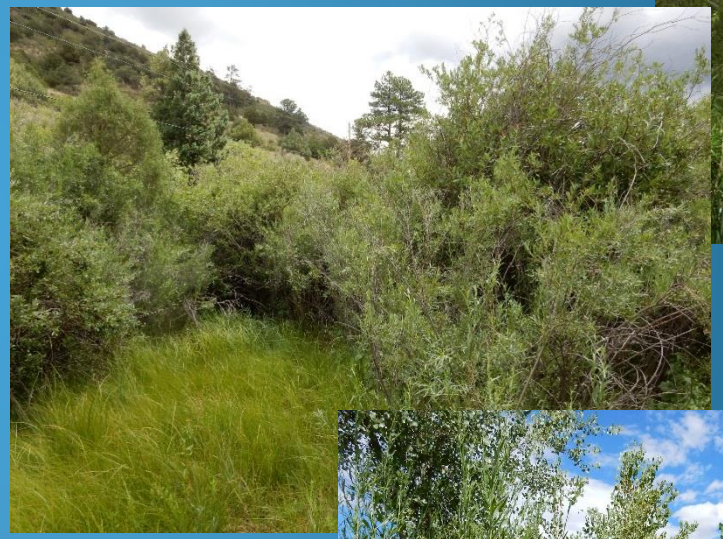
- Assign "-" for composition value when a Strata is not present in polygon including:
  - Bare polygons
  - A strata that has been killed due to treatment or fire
- Assign a "1" for composition value if:
  - Strata is present but has no phreatophytes species

Groundwater Index - Composition

Woody phreatophyte species for Groundwater Index

Table A11d: Groundwater Index Woody Phreatophyte List

	Scientific Name	Common Name
Tree		
	Acer negundo	boxelder
	Alnus incana ssp. tenuifolia	thinleaf alder
	Alnus oblongifolia	Arizona alder
	Fraxinum velutina	velvet ash
	Platanus wrightii	Arizona sycamore
	Populus spp.	cottonwood
	Salix amygdaloides	peachleaf willow
	Salix gooddingii	Goodding's willow
Shrub		
	Baccharis spp.	seepwillow
	Salix spp. willow	



Groundwater Index - Composition

Woody phreatophyte Composition Ratings

Table A11a. Herbaceous Wetland or Riparian Phreatophyte Species Strata Composition	
Rating	**Description**
4	**Strata Dominant:** Wetland herbaceous species and/or riparian phreatophytes dominant. Upland species/non-phreatophytes are not present, or very rare and scattered.
3	**Strata Co-Dominant:** Wetland herbaceous species/phreatophytes are majority species within the strata, but upland species may be common.
2	**Present in Strata:** Strata approximately half or more upland species but wetland herbaceous species/phreatophytes present and at least common.
1	**Absent:** All or vast majority of strata are upland species

Worksheet 5. Vegetation Community Patch Data for Polygons from the SA Biotic Map for Biotic Metrics B3, B4, and B5 and for Abiotic Metric A11. Enter data for each polygon under a unique number assigned from the SA Biotic Map. Estimate the percentage of the SA (%SA) each polygon covers (expressed as decimal). Each polygon is then evaluated with respect to Vegetation Vertical Structure (B3), Native Tree Regeneration (B4), and Invasive Exotic Plant Species Cover (B5) metrics. Enter the Vertical Structure Type (VST) for B3, tree regeneration % cover within the polygon for B4 and the % cover of invasive exotic species for B5. Use the Tables in Appendix B and the Field Guide for metric instructions. For the Groundwater Index metric (A11) select a composition rating for tall woody, short woody or herbaceous using Table A11a in Appendix B if that stratum occurs in the polygon. A health modifier value is also selected from Table A11b for each woody stratum (tall or short) when riparian woody phreatophytes occur in the polygon. The comments box is used for documenting and describing vegetation community patch features.

Polygon No	% SA	B3 Structure Type	B4 Tree Regeneration % Cover	B5 Invasive Exotic Species % Cover	Invasive Exotic Species (List Code(s))	A11 Tall Woody (TW)	A11 Short Woody (SW)	A11 Herbaceous	A11 TW Health Modifier	A11 SW Health Modifier	Comments
1	0.09	VST 1	0	7	ULPU, ELAN, TACH	2	2	1	0.9	0.75	Old exotic treatment area next to levee
2	0.48	VST 2	0	10	ELAN, TACH, ULPU, AIAL	3	-	1	0.9		Mature cottonwood forest with a few scattered RIAU, FOPU but <25%, exotic treatment area
3	0.09	VST 5	0	5	ULPU, SARA, ELAN	-	3	3		0.75	Shrubby terrace edge, disturbed, few scattered trees - PODE, MOAL, GLTR. Small patches of Bermuda grass
4											

Groundwater Index - Health

- On Worksheet 5 for assign a health rating to woody phreatophyte strata that are present
  - TW Health Modifier
  - SW Health Modifier
    - Table A11b list of health modifier values
    - Assign values to woody strata that are standing dead if they would have >25% cover within the stand when alive *except*
      - Do *not* assign ratings to woody strata that have been killed due to treatment or fire (treat these as bare polygons)
  - Herbaceous
    - Does not get a health modifier, just presence or absence

Worksheet 5. Vegetation Community Patch Data for Polygons from the SA Biotic Map for Biotic Metrics B3, B4, and B5 and for Abiotic Metric A11. Enter data for each polygon under a unique number assigned from the SA Biotic Map. Estimate the percentage of the SA (%SA) each polygon covers (expressed as decimal). Each polygon is then evaluated with respect to Vegetation Vertical Structure (B3), Native Tree Regeneration (B4), and Invasive Exotic Plant Species Cover (B5) metrics. Enter the Vertical Structure Type (VST) for B3, tree regeneration % cover within the polygon for B4 and the % cover of invasive exotic species for B5. Use the Tables in Appendix B and the Field Guide for metric instructions. For the Groundwater Index metric (A11) select a composition rating for tall woody, short woody or herbaceous using Table A11a in Appendix B if that stratum occurs in the polygon. A health modifier value is also selected from Table A11b for each woody stratum (tall or short) when riparian woody phreatophytes occur in the polygon. The comments box is used for documenting and describing vegetation community patch features.

Polygon No	% SA	B3 Structure Type	B4 Tree Regeneration % Cover	B5 Invasive Exotic Species % Cover	Invasive Exotic Species (List Code(s))	A11 Tall Woody (TW)	A11 Short Woody (SW)	A11 Herbaceous	A11 TW Health Modifier	A11 SW Health Modifier	Comments
1											
2											

Groundwater Index - Health

Woody phreatophyte Health Ratings

Table A11b. Riparian Woody Phreatophyte Health Modifier	
Modifier Value	**Description**
1.1	**Excellent health:** Very little to no dead foliage or dead limbs, < 5% of potential phreatophyte cover. Standing dead individuals absent or solitary.
0.9	**Good health:** Dead foliage and/or dead limbs present but limited to 5% to < 25% of potential phreatophyte cover. Standing dead individuals rare.
0.75	**Fair health:** Dead foliage and dead limbs represent 25 to < 50% of the potential phreatophyte cover. Standing dead individuals present but scattered.
0.25	**Poor health or standing dead:** Significant dead foliage and dead limbs representing ≥ 50% to of the potential phreatophyte cover. Standing dead individuals common to ubiquitous.
1	**None**: Woody strata present but does not include any phreatophytes.

Worksheet 5. Vegetation Community Patch Data for Polygons from the SA Biotic Map for Biotic Metrics B3, B4, and B5 and for Abiotic Metric A11. Enter data for each polygon under a unique number assigned from the SA Biotic Map. Estimate the percentage of the SA (%SA) each polygon covers (expressed as decimal). Each polygon is then evaluated with respect to Vegetation Vertical Structure (B3), Native Tree Regeneration (B4), and Invasive Exotic Plant Species Cover (B5) metrics. Enter the Vertical Structure Type (VST) for B3, tree regeneration % cover within the polygon for B4 and the % cover of invasive exotic species for B5. Use the Tables in Appendix B and the Field Guide for metric instructions. For the Groundwater Index metric (A11) select a composition rating for tall woody, short woody or herbaceous using Table A11a in Appendix B if that stratum occurs in the polygon. A health modifier value is also selected from Table A11b for each woody stratum (tall or short) when riparian woody phreatophytes occur in the polygon. The comments box is used for documenting and describing vegetation community patch features.

Polygon No	% SA	B3 Structure Type	B4 Tree Regeneration % Cover	B5 Invasive Exotic Species % Cover	Invasive Exotic Species (List Code(s))	A11 Tall Woody (TW)	A11 Short Woody (SW)	A11 Herbaceous	A11 TW Health Modifier	A11 SW Health Modifier	Comments
1	0.09	VST 1	0	7	ULPU, ELAN, TACH	2	2	1	0.9	0.75	Old exotic treatment area next to levee
2	0.48	VST 2	0	10	ELAN, TACH, ULPU, AIAL	3	-	1	0.9		Mature cottonwood forest with a few scattered RIAU, FOPU but <25%, exotic treatment area
3	0.09	VST 5	0	5	ULPU, SARA, ELAN	-	3	3		0.75	Shrubby terrace edge, disturbed, few scattered trees - PODE, MOAL, GLTR. Small patches of Bermuda grass
4											

Groundwater Index – Rating

- Worksheet 10 values:
  - %SA – from Worksheet 5
  - TC – Tall Woody Composition = (Worksheet 5) Tall Woody (TW)
  - TH – Tall Wood Health Modifier = (Worksheet 5) TW Health Modifier
  - SC – Short Woody Composition = (Worksheet 5) Short Woody (SW)
  - SH – Short Wood Health Modifier = (Worksheet 5) SW Health Modifier
  - HC – Herbaceous Composition = (Worksheet 5) Herbaceous
  - TP – Tall Woody Presence – based on TC presence/absence
    - 3 = TC is not null (not "-")
    - 0 = TC is null ("-")
  - SP – Short Woody Presence – based on SC presence/absence
    - 1 = SC is not null (not "-")
    - 0 = SC is null ("-")
  - HP – Herbaceous Presence – based on HC presence/absence
    - 1 = SC is not null (not "-")
    - 0 = SC is null ("-")

$$\text{Health Wtd Groundwater Average} = \frac{((TC*TH)*TP)+(SC*SH)+(HC)}{TP+SP+HP}$$

Groundwater Index – Calculation

A11 - Groundwater Index

Worksheet 10. Groundwater Index. Enter the SA % for each vegetated polygon from Worksheet 5 (polygons with Vertical Structure Type VST 7 are excluded). If a tall woody stratum was present in the polygon (a value entered into A11 Tall Woody (TW) column on Worksheet 5), enter a 3 into the Tall Woody Presence (TP) column. If a short woody stratum was present (a value entered into A11 Short Woody (SW) column on Worksheet 5) enter a 1 in the Short Woody Presence(SP) column. If a herbaceous stratum was present (a value entered into A11 Herbaceous column on Worksheet 5) enter a 1 into the Herbaceous Presence (HP) column. If any stratum was absent, enter a 0 in the corresponding presence column. Fill in Composition (TC, SC and HC) and Health Modifier ratings (Th and SH) from Worksheet 5. Calculate the Health Wtd Groundwater Average using the formula below for each vegetated polygon (excluding the polygons with VST 7). For each polygon multiply the Health Wtd Groundwater Average by its %SA for Area Wtd Groundwater Average. Sum all Area Wtd Groundwater Averages and divide by Total % SA for the GroundWater Index Score. Rate using Table A11d and enter rating on the SA Rank Summary Worksheet.

		TP	SP	HP	TC	TH	SC	SH	HC		
Polygon	%SA	TW Presence	SW Presence	Herbaceous Presence	TW Composition	TW Health Modifier	SW Composition	SW Health Modifier	Herbaceous Composition	Health Wtd Groundwater Average	Area Wtd Groundwater Average
1	0.09	3	1	1	2	0.9	2	0.75	1	1.58	0.14
2	0.48	3	0	1	3	0.9	0	0	1	2.28	1.09
3	0.09	0	1	1	0	0	3	0.75	3	2.63	0.24
4	0.03	3	1	1	3	1.1	3	1.1	3	3.24	0.1
5	0.15	0	1	0	0	0	4	1.1	0	4.4	0.66
6	0.03	3	1	1	1	1	3	0.9	3	1.74	0.05
7	0.03	0	1	1	0	0	3	0.9	3	2.85	0.09
8	0.05	0	1	1	0	0	4	1.1	4	4.2	0.21
9	0.05	3	1	0	1	1	4	1.1	0	1.85	0.09
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
Total % SA	1							**SUM Area Wtd Groundwater Average**			2.67
								Groundwater Index Score (Area Wtd Groundwater Avg/Total %SA)			2.67

Groundwater Index – Rating

- Table A11d – Groundwater Index Rating
- Use GW Index Score from Worksheet 10

Table A11d. Groundwater Index Rating

Rating	Groundwater Index Score
4	≥3.25
3	>2.5 and <3.5
2	>1.75 and ≤2.5
1	≤1.75

A11 - Groundwater Index

Worksheet 10. Groundwater Index. Enter the SA % for each vegetated polygon from Worksheet 5 (polygons with Vertical Structure Type VST 7 are exclu
If a tall woody stratum was present in the polygon (a value entered into A11 Tall Woody (TW) column on Worksheet 5), enter a 3 into the Tall Woody Presence (TP) column. If a short woody stratum was present (a value entered into A11 Short Woody (SW) column on Worksheet 5) enter a 1 in the Short Woody Presence(SP) column. If a herbaceous stratum was present (a value entered into A11 Herbaceous column on Worksheet 5) enter a 1 into the Herbaceous Presence (HP) column. If any stratum was absent, enter a 0 in the corresponding presence column. Fill in Composition (TC, SC and HC) and Health Modifier ratings (Th and SH) from Worksheet 5. Calculate the Health Wtd Groundwater Average using the formula below for each vegetated polygon (excluding the polygons with VST 7). For each polygon multiply the Health Wtd Groundwater Average by its %SA for Area Wtd Groundwater Average. Sum all Area Wtd Groundwater Averages and divide by Total % SA for the GroundWater Index Score. Rate using Table A11d and enter rating on the SA Rank Summary Worksheet.

		TP	SP	HP	TC	TH	SC	SH	HC		
Polygon	%SA	TW Presence	SW Presence	Herbaceous Presence	TW Composition	TW Health Modifier	SW Composition	SW Health Modifier	Herbaceous Composition	Health Wtd Groundwater Average	Area Wtd Groundwater Average
1	0.09	3	1	1	2	0.9	2	0.75	1	1.58	0.14
2	0.48	3	0	1	3	0.9	0	0	1	2.28	1.09
3	0.09	0	1	1	0	0	3	0.75	3	2.63	0.24
4	0.03	3	1	1	3	1.1	3	1.1	3	3.24	0.1
5	0.15	0	1	0	0	0	4	1.1	0	4.4	0.66
6	0.03	3	1	1	1	1	3	0.9	3	1.74	0.05
7	0.03	0	1	1	0	0	3	0.9	3	2.85	0.09
8	0.05	0	1	1	0	0	4	1.1	4	4.2	0.21
9	0.05	3	1	0	1	1	4	1.1	0	1.85	0.09
10											
24											
25											
26											
Total % SA	1							SUM Area Wtd Groundwater Average			2.67
								Groundwater Index Score (Area Wtd Groundwater Avg/Total %SA)			2.67