This document is part of a collection of Ecological Integrity Assessments addressing 67 of Washington's 99 Ecological Systems. These documents were prepared by the Washington Natural Heritage Program with funding provided by the Washington Department of Fish and Wildlife.

Ecological Integrity Assessment: Inter-Mountain Basins Alkali Closed Depression and Inter-Mountain Basins Playa

Ecological Summary

The Inter-Mountain Basins Playa and the Inter-Mountain Basins Alkali Closed Depression ecological systems occur throughout much of the cool arid and semi-arid regions of the Columbia Plateau and Great Basin either as a large or small patch type. They almost always appear within a shrub steppe or semi-desert landscape. Biogeography separates these from the similar Warm Desert Playa and Western Great Plains Closed Depression Wetland ecological systems.

The Inter-Mountain Basins Playa and the Inter-Mountain Basins Alkali Closed Depression ecological systems are found in closed depressions or in terminal basins and differ by: 1) vegetation cover (Playa is typically sparse to patchily vegetated, generally <10% plant cover while Alkali Closed Depression is moderately to densely covered by herbaceous plants), 2) soil chemistry (playas are considered more saline than alkaline closed depressions), and 3) hydrological regime (playas are more intermittently flooded; closed depressions are more seasonally to semi-permanently flooded).

Precipitation and runoff characteristics in contributing basins are important to system function. During high precipitation years Inter-Mountain Basins Playa systems may have water for 3 to 4 months and during dry years not retain any standing water. Water usually does not percolate because of an impermeable layer. Water loss is primarily through evaporation that results in a high concentration of salts in the upper soil profile. Some playas are influenced by groundwater and have minor surface flooding (Rocchio 2006). Those playas have open water early in the season and as the water evaporates salt crust is left on the soil surface from the salts dissolved in the water. This environment supports a flora adapted to seasonal soil saturation and saline conditions. Species composition varies with soil salinity and moisture and usually displays vegetation zones (Rocchio 2006). The Inter-Mountain Basins Playa system almost always has an unvegetated or sparsely vegetated center at its lowest elevation. Mud flats may appear with the salt flats. A few plants such as *Salicornia* spp. can appear on salt flats but they mostly lack vegetation. *Schoenoplectus acutus*, typically without *Typha latifolia* due to its lower salt tolerance, can establish where flooding occurs 3 or more months. *Eleocharis palustris* can occur in areas inundated for 1 to 3 months. *Amphiscirpus nevadensis* and *Juncus balticus* can grow in areas of high water tables and saline soils. Saline wet meadow plants such as *Distichlis spicata* and *Juncus balticus* are found in seasonally saturated soils (Rocchio 2006).

NatureServe (2007) defines the Inter-Mountain Basins Alkali Closed Depression ecological system as occurring in seasonally to semi-permanently flooded depressions that usually retain water into the growing season and dry completely only during droughts. They are located in basins with internal drainage and many are associated with groundwater (springs). Soils are alkaline to saline clays with hardpans. Seasonal drying exposes mudflats which are often colonized by pioneering species, such as *Hordeum jubatum*. Salt crust may sporadically occur on the soil surface. Species that typify this system are halophytic species such as *Distichlis spicata, Puccinellia lemmonii, Poa secunda, Muhlenbergia* spp., *Leymus triticoides (= Elymus triticoides), Schoenoplectus maritimus, Schoenoplectus americanus, Triglochin maritima*, and *Salicornia* spp. This system often occurs along the margins of perennial lakes with extremely low-gradient shorelines. This system is very similar to Western Great Plains Closed Depression Wetland (NatureServe 2007).

In Washington, the Inter-Mountain Basins Playa and the Inter-Mountain Basins Alkali Closed Depression broadly overlap (Rocchio and Crawford 2009a), are difficult to distinguish and are therefore lumped here for the EIA applications.

Stressors

The stressors described below are those primarily associated with the loss of extent and degradation of the ecological integrity of existing occurrences. The stressors are the cause of the system shifting away from its natural range of variability. In other words, type, intensity, and duration of these stressors is what moves a system's ecological integrity rank away from the expected, natural condition (e.g. A rank) toward degraded integrity ranks (i.e. B, C, or D).

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of playas on the Columbia Basin. Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can also have a substantial impact on the hydrological regime. Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roads or removing vegetation on adjacent slopes) results in changes in the amount and pattern of herbaceous wetland habitat. In general, excessive livestock use leads to a shift in plant species composition. Native species, such as *Juncus balticus*, increase with excessive livestock use. Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors. Several exotic species invade playas including *Cardaria* spp., *Chenopodium glaucum, C. rubra*, (*Salsola* spp.), *Bassia hyssopifolia*, and *Kochia scoparia*. Although most wetlands receive regulatory protection at the national, state, and county level, many wetlands have been and continued to be filled, drained, grazed, and farmed extensively. In addition, recent Supreme Court decisions exclude many, if not most occurrences of this system, from protection under the Clean Water Act (Haukos and Smith 2003). Minor changes in the water table depth or duration of inundation can have profound effects on soil salinity, and consequently, wetland vegetation (Cooper and Severn 1992). Wetland animals, such as waterbirds, amphibians, or invertebrates are affected changes in hydrology.

Conceptual Ecological Model
The general relationships among the key ecological attributes associated with this system are presented in Figure 1.

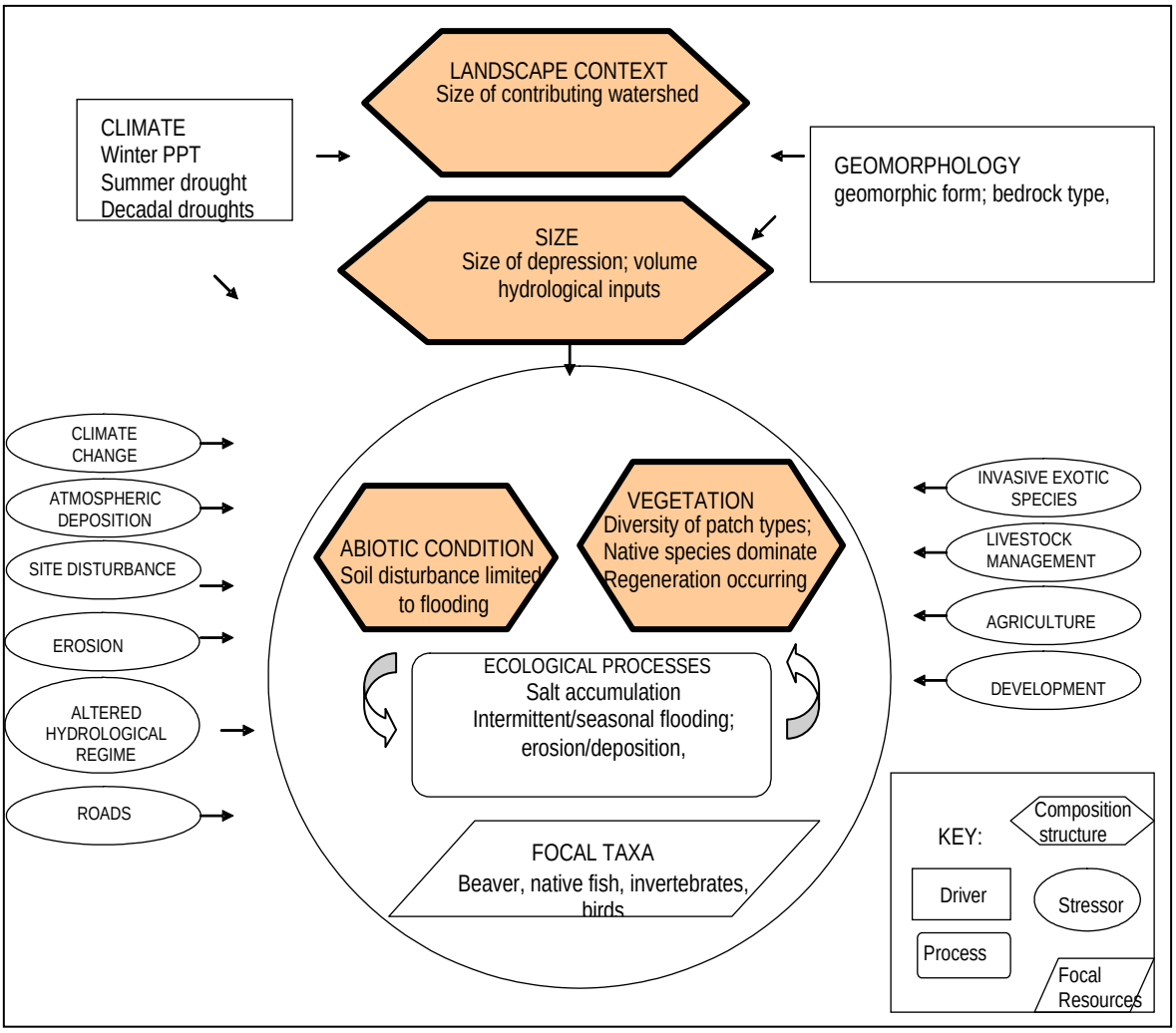

Figure 1. Conceptual Ecological Model for Inter-Mountain Alkali Closed Depression and Playa

Ecological Integrity Assessments
The assessment of ecological integrity can be done at three levels of intensity depending on the purpose and design of the data collection effort. The three-level approach is intended to provide increasing accuracy of ecological integrity assessment, recognizing that not all conservation and management decisions need equal levels of accuracy. The three-level approach also allows users to choose their assessment based in part on the level of classification that is available or targeted. If classification is limited to the level of forests vs. wetlands vs. grasslands, the use of remote sensing metrics may be sufficient. If very specific, fine-scale forest, wetland, and grassland types are the classification target then one has the flexibility to decide to use any of the three levels, depending on the need of the assessment. In other words, there is no presumption that a fine-level of classification requires a fine-level of ecological integrity assessment.

Because the purpose is the same for all three levels of assessment (to measure the status of ecological integrity of a site) it is important that the Level 1 assessment use the same kinds of metrics and major attributes as used at Levels 2 and 3. Level 1 assessments rely almost entirely on Geographic Information Systems (GIS) and remote sensing data to obtain information about landscape integrity and the distribution and abundance of ecological types in the landscape or watershed. Level 2 assessments use relatively rapid field-based metrics that are a combination of qualitative and narrative-based rating with quantitative or semi-quantitative ratings. Field observations are required for many metrics, and observations will typically require professional expertise and judgment. Level 3 assessments require more rigorous, intensive field-based methods and metrics that provide higher-resolution information on the integrity of occurrences. They often use quantitative, plot-based protocols coupled with a sampling design to provide data for detailed metrics.

Although the three levels can be integrated into a monitoring framework, each level is developed as a stand-alone method for assessing ecological integrity. **When conducting an ecological integrity assessment, one need only complete a single level that is appropriate to the study at hand.** Typically only one level may be needed, desirable, or cost effective. But for this reason it is very important that each level provide a comparable approach to assessing integrity, else the ratings and ranks will not achieve comparable information if multiple levels are used.

Level 1 EIA

A generalized Level 1 EIA is provided in Rocchio and Crawford (2009b). Please refer to that document for the list of metrics applicable to this ecological system.

Level 2 EIA

The following tables display the metrics chosen to measure most of the key ecological attributes in the conceptual ecological model above. The EIA is used to assess the ecological condition of an assessment area, which may be the same as the element occurrence or a subset of that occurrence based on abrupt changes in condition or on artificial boundaries such as management areas. **Unless otherwise noted, metric ratings apply to both Level 2 and Level 3 EIAs. The difference between the two is that a Level 3 EIA will use more intensive and precise methods to determine metric ratings.** To calculate ranks, each metric is ranked in the field according the ranking categories listed below. Then, the rank and point total for each metric is entered into the EIA Scorecard and multiplied by the weight factor associated with each metric resulting in a metric 'score'. Metric scores within a key ecological attribute are then summed to arrive at a score (or rank). These are then tallied in the same way to arrive at an overall ecological integrity score.

Table 1. Inter-Mountain Alkali Closed Depression and Playa Level 2 EIA.

Metric	Justification	Rank			
		A (5 pts.)	B (4 pts.)	C (3 pts.)	D (1 pts.)
Rank Factor: LANDSCAPE CONTEXT					
Key Ecological Attribute: *Buffer*					
Buffer Length	The buffer can be important to biotic and abiotic aspects of the wetland. Buffer Width Slope Multiplier 5-14% -->1.3; 15-40%-->1.4; >40%-->1.5	Buffer is > 75 – 100% of occurrence perimeter.	Buffer is > 50 – 74% of occurrence perimeter.	Buffer is 25 – 49% of occurrence perimeter	Buffer is < 25% of occurrence perimeter.
Buffer Width		Average buffer width of occurrence is > 200 m, adjusted for slope.	Average buffer width is 100 – 199 m, after adjusting for slope.	Average buffer width is 50 – 99 m, after adjusting for slope.	Average buffer width is < 49 m, after adjusting for slope.
Buffer Condition		Abundant (>95%) cover native vegetation, little or no (<5%) cover of non-native plants, intact soils, AND little or no trash or refuse.	Substantial (75–95%) cover of native vegetation, low (5–25%) cover of non-native plants, intact or moderately disrupted soils; minor intensity of human visitation or recreation.	Moderate (25–50%) cover of non-native plants, moderate or extensive soil disruption; moderate intensity of human visitation or recreation.	Dominant (>50%) cover of non-native plants, barren ground, highly compacted or otherwise disrupted soils, moderate or greater intensity of human visitation or recreation, no buffer at all.
Key Ecological Attribute: *Landscape Structure*					

Connectivity	The percentage of anthropogenic (altered) patches provides an estimate of connectivity among natural ecological systems.	Intact: Embedded in 90-100% natural habitat; connectivity is expected to be high. (Remaining natural habitat is in good condition (low modification); and a mosaic with gradients).	Variegated: Embedded in 60-90% natural habitat; habitat connectivity is generally high, but lower for species sensitive to habitat modification; (Remaining natural habitat with low to high modification and a mosaic that may have both gradients and abrupt boundaries).	Fragmented: Embedded in 10-60% natural habitat; connectivity is generally low, but varies with mobility of species and arrangement on landscape. (Remaining natural habitat with low to high modifications and gradients shortened).	Relictual: Embedded in < 10% natural habitat; connectivity is essentially absent. Remaining natural habitat generally highly modified and generally uniform).
Landscape Condition Model Index	The intensity and types of land uses in the surrounding landscape can affect ecological integrity.	Landscape Condition Model Index > 0.8		Landscape Condition Model Index 0.65 – 0.79	Landscape Condition Model Index < 0.65
Rank Factor: CONDITION					
Key Ecological Attribute: *Vegetation*					
Relative Cover Native Plant Species	Native species dominate this system; non-natives increase with human impacts.	Cover of native plants 95-100%.	Cover of native plants 80-95%.	Cover of native plants 50 to 79%.	Cover of native plants <50%.
Absolute Cover of Invasive Species	Invasive species can inflict a wide range of ecological impacts. Early detection is critical. *Cardaria* spp. and *Cirsium arvense*, are examples.	None present.	Invasive species present, but sporadic (<3% cover).	Invasive species prevalent (3–10% absolute cover).	Invasive species abundant (>10% absolute cover).
Relative Cover of Native Increasers	Some stressors such as grazing can shift or homogenize native composition toward species tolerant of stressors.	Absent or incidental	<10% cover	10-20% cover	>20% cover

Species Composition Note: Once developed, the Floristic Quality Assessment index could be used here instead.	The overall composition of native species can shift when exposed to stressors.	Species diversity/abundance at or near reference standard conditions. Native species sensitive to anthropogenic degradation are present, functional groups indicative of anthropogenic disturbance (ruderal or "weedy" species) are absent to minor, and full range of diagnostic / indicator species are present.	Species diversity/abundance close to reference standard condition. Some native species reflective of past anthropogenic degradation present. Some indicator/ diagnostic species may be absent.	Species diversity/abundance is different from reference standard condition in, but still largely composed of native species characteristic of the type. This may include ruderal ("weedy") species. Many indicator/diagnostic species may be absent.	Vegetation severely altered from reference standard. Expected strata are absent or dominated by ruderal ("weedy") species, or comprised of planted stands of non-characteristic species, or unnaturally dominated by a single species. Most or all indicator/diagnostic species are absent.
Key Ecological Attribute: *Hydrology*					
Water Source	Anthropogenic sources of water can have detrimental effects on the hydrological regime	Source is natural or naturally lacks water in the growing season. No indication of direct artificial water sources	Source is mostly natural, but site directly receives occasional or small amounts of inflow from anthropogenic sources	Source is primarily urban runoff, direct irrigation, pumped water, artificially impounded water, or other artificial hydrology	Water flow has been substantially diminished by human activity
Hydroperiod	Alteration in hydrology or sediment loads or some onsite stressors can degrade depression	Hydroperiod of the site is characterized by natural patterns of filling or inundation and drying or drawdown.	The filling or inundation patterns in the site are of greater magnitude (and greater or lesser duration than would be expected under natural conditions, but thereafter, the site is subject to natural drawdown or drying.	The filling or inundation patterns in the site are characterized by natural conditions, but thereafter are subject to more rapid or extreme drawdown or drying, as compared to more natural wetlands. OR filling or inundation patterns are of substantially lower magnitude or duration than expected under natural conditions, but thereafter, the site is subject to natural drawdown or drying.	Both the filling/inundation and drawdown/drying of the site deviate from natural conditions (either increased or decreased in magnitude and/or duration).
Hydrological Alterations	The degree to which onsite or adjacent land uses and human activities have altered hydrological processes.	No alterations. No dikes, diversions, ditches, flow additions, or fill present in wetland that restricts or redirects flow	Low intensity alteration such as roads at/near grade, small diversion or ditches (< 1 ft. deep) or small amount of flow additions	Moderate intensity alteration such as 2-lane road, low dikes, roads w/culverts adequate for stream flow, medium diversion or ditches (1-3 ft. deep) or moderate flow additions.	High intensity alteration such as 4-lane Hwy., large dikes, diversions, or ditches (>3 ft. deep) capable to lowering water table, large amount of fill, or artificial groundwater pumping or high amounts of flow additions
Key Ecological Attribute: *Physicochemical*					

Soil Surface Condition	Soil disturbance can result in erosion thereby negatively affecting many ecological processes	Bare soil areas are limited to naturally caused disturbances such as flood deposition or game trails, Salt crust often present and intact	Some bare soil due to human causes but the extent and impact is minimal. The depth of disturbance is limited to only a few inches and does not show evidence of ponding or channeling water. Salt crust mostly intact.	Bare soil areas due to human causes are common. There may be pugging due to livestock resulting in several inches of soil disturbance. ORVs or other machinery may have left some shallow ruts. Salt crust minimally represented.	Bare soil areas substantially & contribute to altered hydrology or other long-lasting impacts. Deep ruts from ORVs or machinery may be present, or livestock pugging and/or trails are widespread. Water will be channeled or ponded. Salt crusts absent or mostly current season's crust.
Water Quality	Excess nutrients, sediments, or other pollutant have an adverse affect on natural water quality	No evidence of degraded water quality. Water is clear; no strong green tint or sheen.	Some negative water quality indicators are present, but limited to small and localized areas. Water may have a minimal greenish tint or cloudiness, or sheen.	Negative indicators or wetland species that respond to high nutrient levels are common. Water may have a moderate greenish tint, sheen or other turbidity with common algae.	Widespread evidence of negative indicators. Algae mats may be extensive. Water may have a strong greenish tint, sheen or turbidity. Bottom difficult to see during due to surface algal mats and other vegetation blocking light to the bottom.
Rank Factor: SIZE					
Key Ecological Attribute: *Size*					
Relative Size	Indicates the proportion lost due to stressors.	Site is at or minimally reduced from natural extent (>95% remains)	Occurrence is only modestly reduced from its original natural extent (80-95% remains)	Occurrence is substantially reduced from its original natural extent (50-80% remains)	Occurrence is severely reduced from its original natural extent (<50% remains)
Absolute Size	Absolute size may be important for buffering impacts originating in the surrounding landscape	>20 Ac	10-20 Ac	2-10 ac	<2 ac

Level 3 EIA
Level 3 metrics would include more quantitative measures of the metrics listed above. In addition, the following metrics should be considered in a Level 3 EIA as outlined in Rocchio (2006):

- Nitrogen Enrichment (C:N)
- Phosphorous Enrichment (C:P)
- Soil Organic Carbon
- Soil Bulk Density
- Water Table Depth

Triggers or Management Assessment Points
Ecological triggers or conditions under which management activities need to be reassessed are shown in the table below. Since the Ecological Integrity rankings are based on hypothesized thresholds, they are used to indicate where triggers might occur. Specific details about how these triggers translate for each metric can be found by referencing the values or descriptions for the appropriate rank provided in the Table above.

Table 2. Triggers for Level 2 & 3 EIA

Key Ecological Attribute or Metric	Trigger	Action
Any metric (except Connectivity)	▪ C rank ▪ Shift from A to B rank ▪ negative trend within the B rating (Level 3)	Level 2 triggers: conduct Level 3 assessment; make appropriate short-term management changes to ensure no further degradation Level 3 triggers: make appropriate management adjustments to ensure no additional degradation occurs. Continue monitoring using Level 3.
Any Key Ecological Attribute	▪ any metric has a C rank ▪ > ½ of all metrics are ranked B ▪ negative trend within the B rating (Level 3)	Level 2 triggers: conduct Level 3 assessment; make appropriate short-term management changes to ensure no further degradation Level 3 triggers: make appropriate management adjustments to ensure no additional degradation occurs. Continue monitoring using Level 3.

Protocol for Integrating Metric Ranks
If desired, the user may wish to integrate the ratings of the individual metrics and produce an overall score for the three rank factor categories: (1) Landscape Context; (2) Condition; and (3) Size. These rank factor rankings can then be combined into an Overall Ecological Integrity Rank. This enables one to report scores or ranks from the various hierarchical scales of the assessment depending on which best meets the user's objectives. Please see Table 5 in Rocchio and Crawford (2009) for specifics about the protocol for integrating or 'rolling-up' metric ratings.

Supporting documents for the EIAs can be found at:
http://www1.dnr.wa.gov/nhp/refdesk/communities/eia.html

Documentation about Ecological Systems can be found at:
http://www1.dnr.wa.gov/nhp/refdesk/communities/ecol_systems.html

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Authorship: Joe Rocchio and Rex Crawford, Washington Natural Heritage Program
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