EXPLANATION FOR WETLAND SURVEY DATASET

Explanation Version: September 2021

This explanation describes wetland survey projects completed by the Utah Geological Survey (UGS) with funding from the Environmental Protection Agency's Wetland Program Development Grants and made available through a database download and via an online application. More detailed information about the fields included in the data can be found in associated spreadsheets. Fields are organized into categories in the spreadsheet and are referenced in the text below.

DATA OVERVIEW

The wetland survey dataset compiles information from UGS wetland surveys across Utah (Jones and others, 2014; Menuz and others, 2014, 2016a, 2016b; Menuz and Sempler, 2018; Menuz and McCoy-Sulentic, 2019; McCoy-Sulentic and others, 2021) using the Utah Rapid Assessment Protocol (URAP). URAP was developed in 2014 and is largely based on the Colorado Natural Heritage Programs's wetland assessment protocol (Lemly and Gilligan, 2013). Geospatial data associated with the wetland survey dataset include two layers: Project Data and Assessment Results. The first dataset includes basic information about each wetland survey project that the UGS has conducted and the second dataset summarizes survey results for the projects. The latter dataset only includes data from projects where sites were selected and surveyed using a random design and excludes data from early projects in Snake Valley (Jones and others, 2014) and around Great Salt Lake (Menuz and others, 2014).

PROJECT DATA LAYER

The project data show boundaries for UGS wetland surveys conducted between 2013 and 2020. Individual fields describe the name of the project, the region where the project took place, the years when field data were collected, and a link to the final report if available. This dataset also contains information about each project's study design and how the design may impact the types of wetlands that were surveyed. Choice of target population had a large impact on the types of wetland that were surveyed in the Central Basin, since some projects largely excluded unvegetated or sparsely vegetated features such as playas and aquatic beds. This difference in target population affects the ability to compare Central Basin results across projects because sparsely vegetated wetlands generally have better condition, fewer stressors, and fewer non-native plant species than other wetland types.

ASSESSMENT RESULTS LAYER

The Assessment Results dataset includes a summary of survey results for each project. Sites for most projects were selected using a random stratified design with the spsurvey package (Kincaid and Olsen, 2019) in the open-source statistical program R. A stratified design is a method of sampling that involves dividing the population of interest (in this case wetlands) into smaller groups based on shared characteristics; groups are called strata. We present summarized results by strata, explained in more detail below. Although all projects used the same protocol, some protocol components changed slightly

over the years so data were first standardized to an identical format, which in some cases required reevaluating new metrics using available data. We then reanalyzed data from each project using identical scripts in R. We used cat.analysis and cont.analysis in the spsurvey package in R to estimate parameters for categorical and continuous variables.

Ecoregions and Strata

Ecoregions are areas where ecosystems are generally similar based on patterns related to geology, landforms, soils, vegetation, climate, land use, wildlife and hydrology (Omernik, 1995). Ecoregions are hierarchically arranged at four levels with 2 level I ecoregions, 3 level II ecoregions, 7 level III ecoregions, and 36 level IV ecoregions in Utah. Three level III ecoregions make up more than 95% of Utah, including the Central Basin and Range ("Basin and Range"), the Wasatch and Uinta Mountains, and the Colorado Plateau; wetlands in the latter ecoregion have not yet been the focus of UGS surveys. For the sake of this analysis, we grouped the Wyoming Basin level III ecoregion, which makes up a smaller part of Utah, with the Wasatch and Uinta Mountains to create the Mountains ecoregional group.

Strata for projects were based on ecoregions, watersheds, or political boundaries, depending on the project or strata. However, all strata across the projects fall entirely within either the Basin and Range or Mountains ecoregion. Strata within the Mountains ecoregion are based on Omernik (1995) level IV ecoregions, including (in order from lowest to highest elevation) mountain valleys, semiarid foothills, Wasatch montane zone, and alpine/Uintas. Within the Basin and Range ecoregion, strata designations were more variable, though projects typically include a Great Salt Lake stratum. Strata descriptions for all projects can be found in more detail in associated reports (Jones and others, 2014; Menuz and others, 2014, 2016a, 2016b; Menuz and Sempler, 2018; Menuz and McCoy-Sulentic, 2019; McCoy-Sulentic and others, 2021).

Sites Evaluated

The ***sites evaluated*** category includes data on the number of sites surveyed; the number of sites that were initially evaluated, but considered non-target based on imagery or field review; and the number of sites that were not surveyed due to lack of access. Non-target sites include sites that are not wetland and sites that may be wetland, but not part of the particular target population for a project. No access sites include sites where we were unable to obtain permission from landowners and sites that were inaccessible due to terrain or other obstacles.

Condition Scores

For URAP, wetland condition scores are calculated using a series of qualitative or semi-quantitative metrics. Each metric is composed of a series of potential states, ranked from A through D, to denote a range of conditions from pristine unaltered wetlands to severely altered wetlands. Metrics are grouped into categories of landscape context, physical structure, hydrologic condition, vegetation structure, and vegetation composition, with the final condition score derived from the component scores and converted to numerical scores between 1 and 5, with 1 indicating poor condition and 5 indicating excellent condition. We present condition results in two ways in this dataset. First, we show the percent of sites within each strata that received overall scores classified as very high (URAP overall scores ≥4.5),

high (score ≥3.5 and <4.5), medium, (score ≥2.5 and <3.5), and low (score <2.5). We also report the mean overall and categorical scores for each stratum. More details on the URAP condition method, including information about individual metrics and how they are combined, can be found in McCoy-Sulentic and Menuz (2021).

Stressors

Stressor data in URAP are collected using a method adapted from the Colorado Natural Heritage Program's Ecological Integrity Assessment (Lemly and others, 2016; Lemly and others, 2017). Stressors observed during site assessments are grouped into four categories of impact: landscape stressors within 100 m surrounding the site, stressors to vegetation within the plot, stressors to soil and substrate within the plot, and stressors to hydrology. Some stressors that can be difficult to observe in the field when they occur at a landscape scale, such as stressors to hydrology, are initially assessed in the office using aerial imagery and relevant spatial layers, but all are confirmed and updated as needed in the field. Both the extent and severity of each stressor are considered in the assessment, and stressors can be combined together to create categorical and overall stressor scores. Fields in the ***stressor*** category include mean overall and categorical stressor values, the percent of sites falling into overall stressor categories ranging from absent to very high, and the three most common stressors at each site with the percent of sites where each stressor was recorded. More details on the URAP stressor method can be found in McCoy-Sulentic and Menuz (2021).

Vegetation Metrics

Vegetation community data is summarized with five fields in the ***vegetation metrics*** category. The relative cover of native species is the percent cover of native plant species divided by the percent cover of all plant species with known nativity. Absolute cover of noxious weeds is the total cover of species listed as noxious weeds by the State of Utah. Mean C and cover-weighted mean C are vegetation metrics derived from C-values. C-values are species-specific values between 1 and 10 assigned based on a species' association with disturbance, with low values indicating species highly tolerant of disturbance and high values indicating species intolerant of disturbance and typically found in pristine habitats (Rocchio and Crawford, 2013). All non-native species are assigned a value of 0. See McCoy-Sulentic and others (2021) for a description of how C-values were assigned for species in Utah. We calculated mean C by taking the average C-value for all species at a site and cover-weighted mean C by multiplying the C-value for each species by its cover at the site, summing up the result for all species, and dividing by the cover of all species at the site. Both mean C and cover-weighted mean C range from 0 (low quality) to 10 (pristine). The last vegetation metric is a list of the three most common noxious weeds per stratum and the percent of sites where each species was recorded.

Wetland Type

Each surveyed wetland site is classified as one of 11 wetland types (table 1). Wetland types for the Basin and Range were developed by analyzing data from over 200 sites surveyed by the UGS between 2013 and 2018, taking into account dominant overstory life form, water regime, salinity tolerance, and landscape position (Menuz and McCoy-Sulentic, 2019; McCoy-Sulentic and others, 2021).

Wetland types for the Mountains ecoregion are classified based on dominant overstory life form and water regime based on analysis from Menuz and others (2016b). Two Mountains wetland types—montane wet meadow and montane shrubland— are also classified based on location within level IV ecoregions, such as mountain valley wet meadow and foothill wet meadow. However, since the Mountains strata are derived from level IV ecoregions, we do not separate out different types of wet meadows or shrublands in the results. Fields are left null when a particular wetland type is not relevant for a stratum in question, such as for montane wet meadow for a Basin and Range stratum, and populated with 0 when no wetlands of a particular type were observed. Information in the project layer describes how the choice of target population likely influenced the proportion of different wetland types for each study; these differences primarily impact sites in the Basin and Range.

Table 1. Wetland types presented in the assessment results.

Wetland Type	Ecoregion	Description
Shallow water	All	Wetland consistently flooded with shallow water <1-m deep and very sparsely vegetated (≤2% cover).
Aquatic bed	All	Wetland dominated by submergent or floating aquatic vegetation, typically with ≤10% cover of emergents.
Marsh	All	Wetland dominated by emergent forbs and graminoids and frequently inundated with water ≥15 cm in depth, and typically saturated when not inundated, though water depths may vary throughout the year depending on climate conditions and management.
Basin mudflat	Basin and Range	Wetland dominated by emergent forbs and graminoids and characterized by cycles of inundation and drying from adjacent lakes or artificial impoundments.
Basin saline meadow	Basin and Range	Wetland dominated by highly saline-tolerant emergent forbs and graminoids, typically including Distichlis spicata. Sites frequently supported by high groundwater or shallow inundation of a few centimeters.
Basin fresh meadow	Basin and Range	Wetland dominated by emergent forbs and graminoids that vary in their salinity tolerance. Sites frequently supported by high groundwater or shallow inundation of a few centimeters.
Basin forested shrubland	Basin and Range	Wetland dominated by woody species, typically with ≥20% woody species cover, and frequently found along streams and rivers.
Basin playa	Basin and Range	Wetland with saline soils frequently either sparsely vegetated, dominated by annual species, or dominated by saline-tolerant woody perennials such as Allenrolfea occidentalis (iodinebush)
Montane wet meadow	Mountains	Wetland dominated by emergent forbs and graminoids, typically with ≤10% cover of woody species. Sites frequently supported by high groundwater or shallow inundation of a few centimeters.
Montane shrubland	Mountains	Wetland dominated by shrubs, typically with ≥25% cover of shrubs and higher shrub cover than tree cover.
Montane woodland	Mountains	Wetland dominated by tree species, typically with ≥30% cover of trees.

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