VEGETATION OF UTAH

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ECOSYSTEMS

In order to organize and facilitate management of Utah's ecosystems, generalization of the ecological variation found across the state is necessary. Ecosystems involve complex interactions between environment and biota, and there have been many efforts to generalize and categorize these interactions in order to gain a better understanding of their structure and organization. The most common method of categorizing ecological variations across large landscapes today incorporates the ecoregion concept. Ecoregions are geographic delineations of landscapes containing ecosystems linked by similar climatic, geologic, soil, and landform characteristics. The primary characteristics used to delineate ecoregions vary depending on the overall goal of the individual or management agency. Therefore, ecoregions vary in their geographic extent and shape, but tend to generally identify similar geographies and ecosystems. Examples of ecoregion delineations in Utah consist of the United States Forest Service Bailey Ecoregions (Bailey, 1995) and the Omernik Ecoregions used by the Environmental Protection Agency (EPA) (Omernik, 1987).

Bailey Ecoregions consist of a hierarchically nested set of units beginning with domains that are the most general and based on variations in climate. Utah falls entirely within the Dry Domain. Within domains are divisions that represent significant climatic variations. Within divisions, provinces are defined based on general natural vegetation cover, and within provinces, sections are defined by terrain features (Figure 7.1). Even within the lowest landscape unit, a section, there exists variation in environmental characteristics that can be further subdivided into progressively finer units. Ecoregions are therefore generally large geographic units of common climatic, vegetation, and landform characteristics that can have significant variation within. A clear example of this is the Henry and La Sal Mountains that have subalpine and alpine zones located within the Northern Canyon Lands Section of the Intermountain Semi-Desert and Desert Province of the Bailey Ecoregions.

Omernik Ecoregions (Figure 7.2), developed for the Environmental Protection Agency, were designed with the intent of generating regional biological criteria and water quality standards and setting goals for nonpoint source pollution. While the areas delineated as individual ecoregions in Omernik's map cover similar geographies to the Bailey delineation, there are significant differences. A major difference is that the Omernik Ecoregions are not hierarchically organized as are Bailey Ecoregions. Furthermore, while the Bailey Ecoregion delineations are based primarily on climatic and geologic differences, Omernik Ecoregions are focused on hydrology.

Levels of productivity and responsiveness to management vary greatly between different kinds of ecosystems and are evident across ecoregions. However, while ecoregions are applicable to regional and global applications, more local applications require a different approach in order to address ecoregion variances and understand differences between vegetation types. In order to distinguish between the kinds of ecosystems found in Utah, and communicate the major differences between them, the following cross-cutting classification system will be used. The major environmental gradient in Utah is climate, particularly precipitation and temperature, which are both highly correlated with elevation. Because of the great variation in elevation in Utah, the principal ecological distinction that has long been recognized is that of life zone. The nomenclature of the Natural Resources Conservation Service (NRCS) that identifies seven individual life zones will be used. The life zones, in order of descending elevation, are alpine, subalpine, high mountain, mountain, upland, semidesert, and desert.

The environmental characteristics that form the boundaries between each life zone tend to vary by user, but generally, there is agreement among land managers as to the individual characteristics of each. In general, precipitation increases and temperature decreases as deserts transition into the semidesert, upland, mountain, high mountain, subalpine, and alpine life zones. With a decrease in temperature as elevation increases, reference evapotranspiration (RET), which is defined as the amount of water that could be evaporated from the surface and transpired from plants, also decreases. The RET assumes that water is not limiting. Therefore, when RET is higher than precipitation, a net deficit in moisture occurs and conditions actually become drier. This relationship forms the general basis for the definition of life zones since water balance, in large part, determines the type and amount of vegetation that can occur in a given Utah environment. Since elevation, precipitation, and RET can be modeled spatially, these variables were used to spatially depict the distribution of life zones in Utah (Figure 7.3).

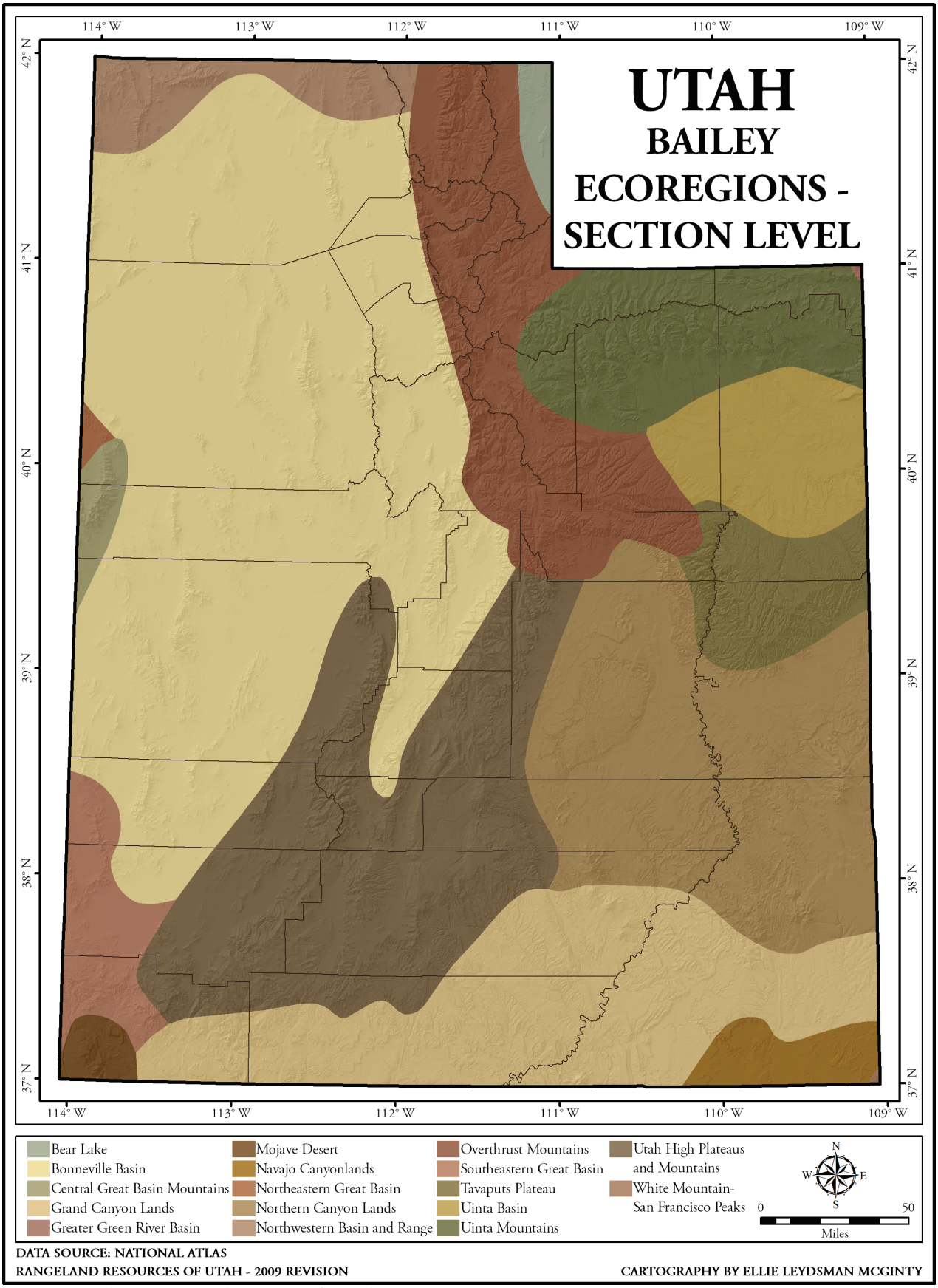

Figure 7.1. Bailey Section Level Ecoregions for Utah.

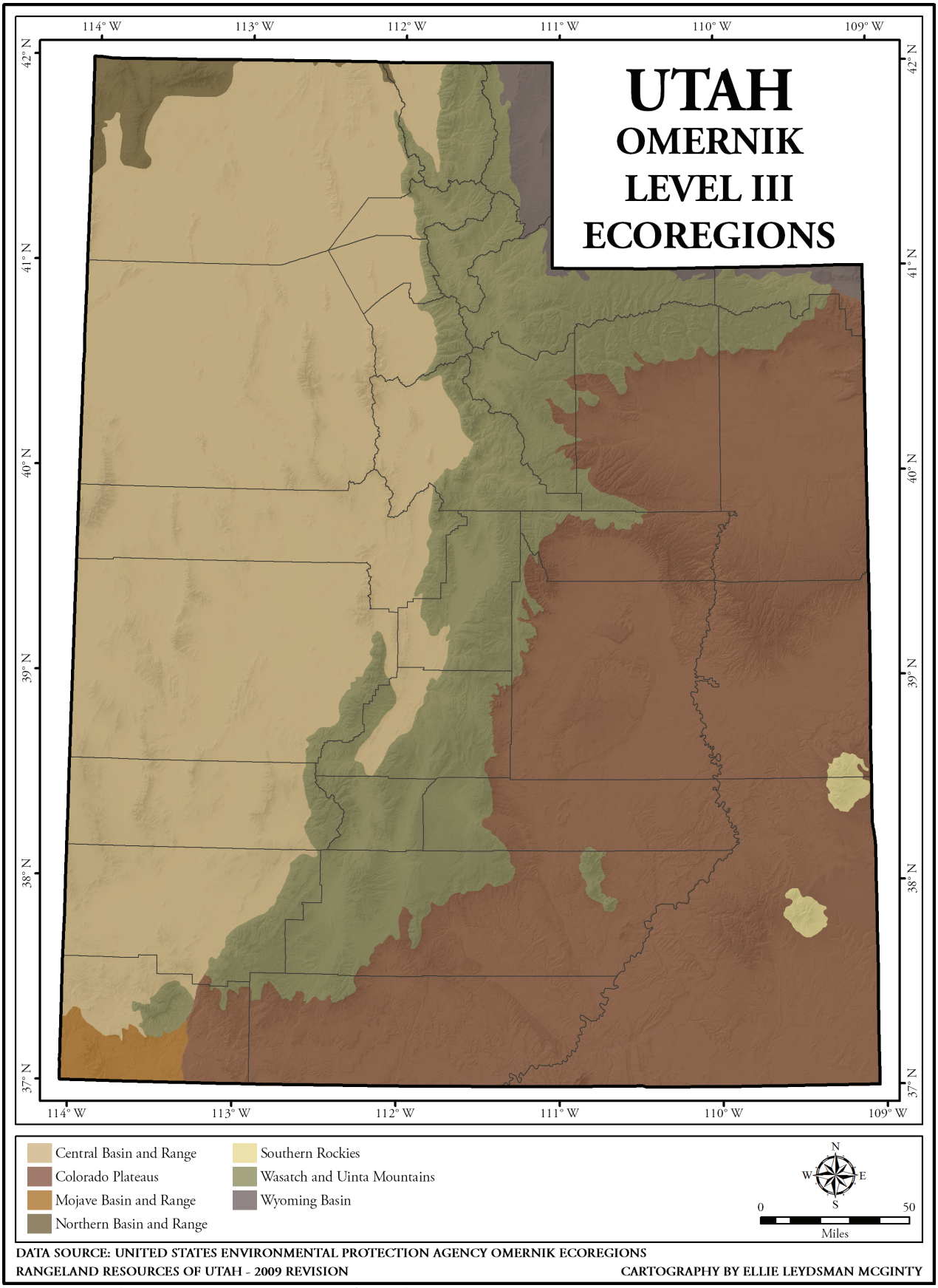

Figure 7.2. Level III Omernik (EPA) Ecoregions for Utah.

A shortcoming of the zonal approach is that some ecosystem types with unusual soils or hydrologic regimes do not easily fit. Examples are sand dunes, wet meadows, and marshlands which often occur in multiple life zones. Those that occupy large acreages or are unusually productive should be considered separately.

Because the efficiency of the precipitation that falls increases northward as average temperatures decrease, the altitudes of each life zone also decrease progressing northward. There is also considerable difference in the seasonality of precipitation from east to west. Accordingly, geography is included in the classification. To accomplish this, the Major Land Resource Areas (MLRAs) used by the NRCS were adopted (Figure 7.4). Those occurring in Utah and their percent occurrence in the state are:

MLRA	NAME	PERCENT
28A	Great Salt Lake Area	36.37
47	Wasatch and Uinta Mountains	23.38
35	Colorado and Green River Plateaus	19.57
34	Central Desertic Basins, Mountains, Plateaus	11.65
39	Arizona and New Mexico Mountains	2.12
48A	Southern Rocky Mountains	1.94
28B	Central Nevada Basin and Range	1.36
29	Southern Nevada Basin and Range	1.25
25	Owyhee High Plateau	0.93
30	Mohave Basin and Range	0.73
37	San Juan River Valley Mesas and Plateaus	0.50
13	Eastern Idaho Plateaus	0.11
43	Northern Rocky Mountains	0.09

It is often difficult when standing at a particular location to determine the life zone or MLRA. Elevations of the most appropriate zone for a given vegetation type vary considerably on different slopes and aspects of a given mountain. The plant indicator concept helps solve this problem. Plant species, particularly perennials, by their presence/absence and vigor, indirectly indicate a great deal about local effective environments. By using knowledge of these relationships, the relative abundances of particular plants can gauge the similarity of both adjacent and distant patches of land. In this way, vegetation becomes relatively easy to determine on the ground when transitioning into another kind of ecosystem. In the following, information is provided on how the most abundant (dominant) plants respond to various environmental conditions.

An individual could look across a landscape of interest, and by noting the repeating patterns of the vegetation, classify it into ecosystem types. This process has, however, already recently been done for Utah through the SWReGAP project (http://earth.gis.usu.edu/swgap) (Lowry et al., 2007). It is from this database that the acreages for each of the ecosystem types discussed in this document were derived.

The SWReGAP project subdivided the state into too many classes of vegetation to conveniently discuss here. Thus, they are aggregated into coarser vegetation types discussed within the zonal context (Figure 7.5). Table 7.1 shows where these coarser SWReGAP vegetation types fit in terms of life zone.

Primarily for reasons of simplicity, a brief consideration of ecosystem types at the highest elevations moving downward will be discussed. Consideration of the alpine zone will be first.

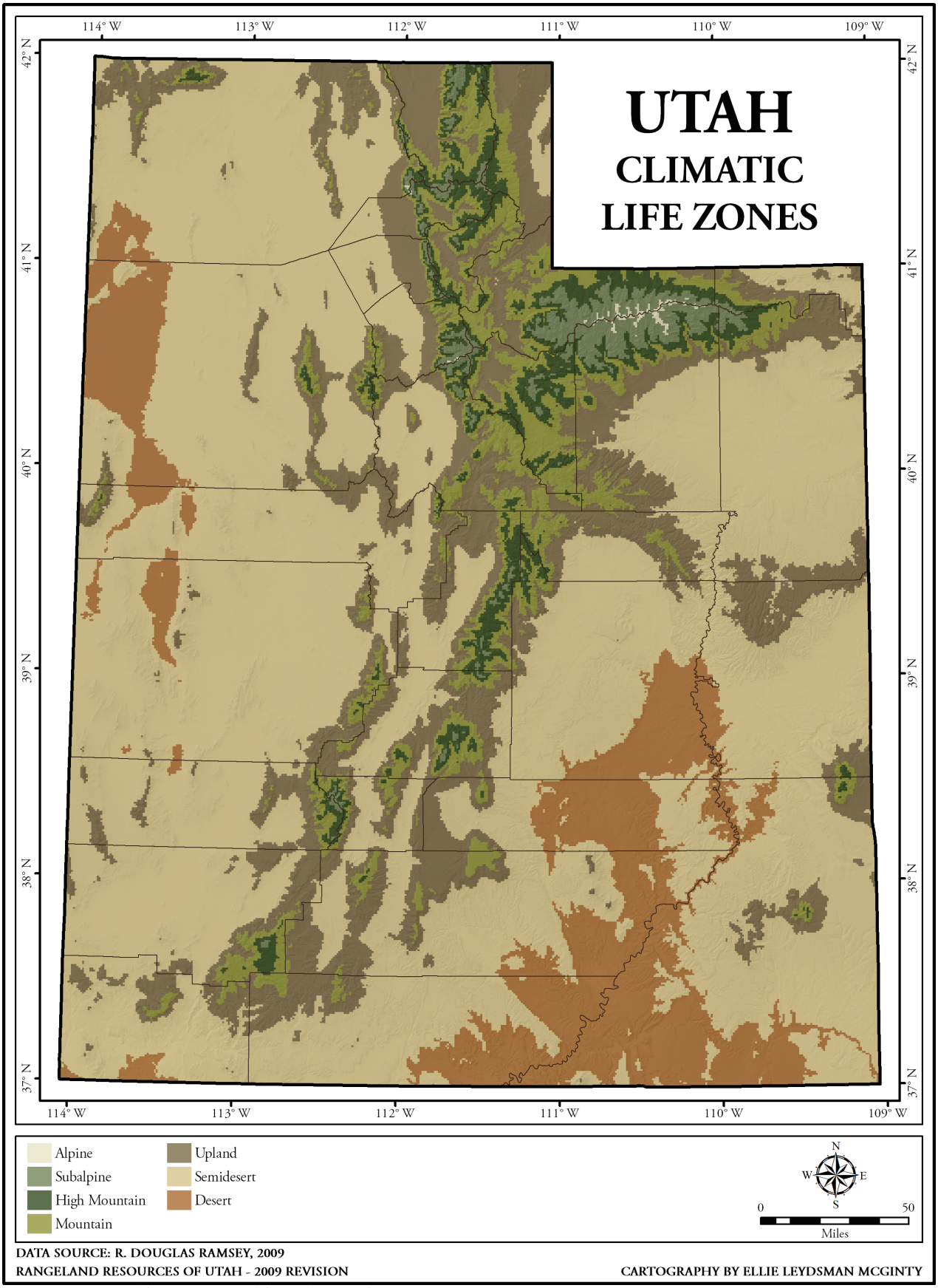

Figure 7.3. Major life zones derived from climatic factors.

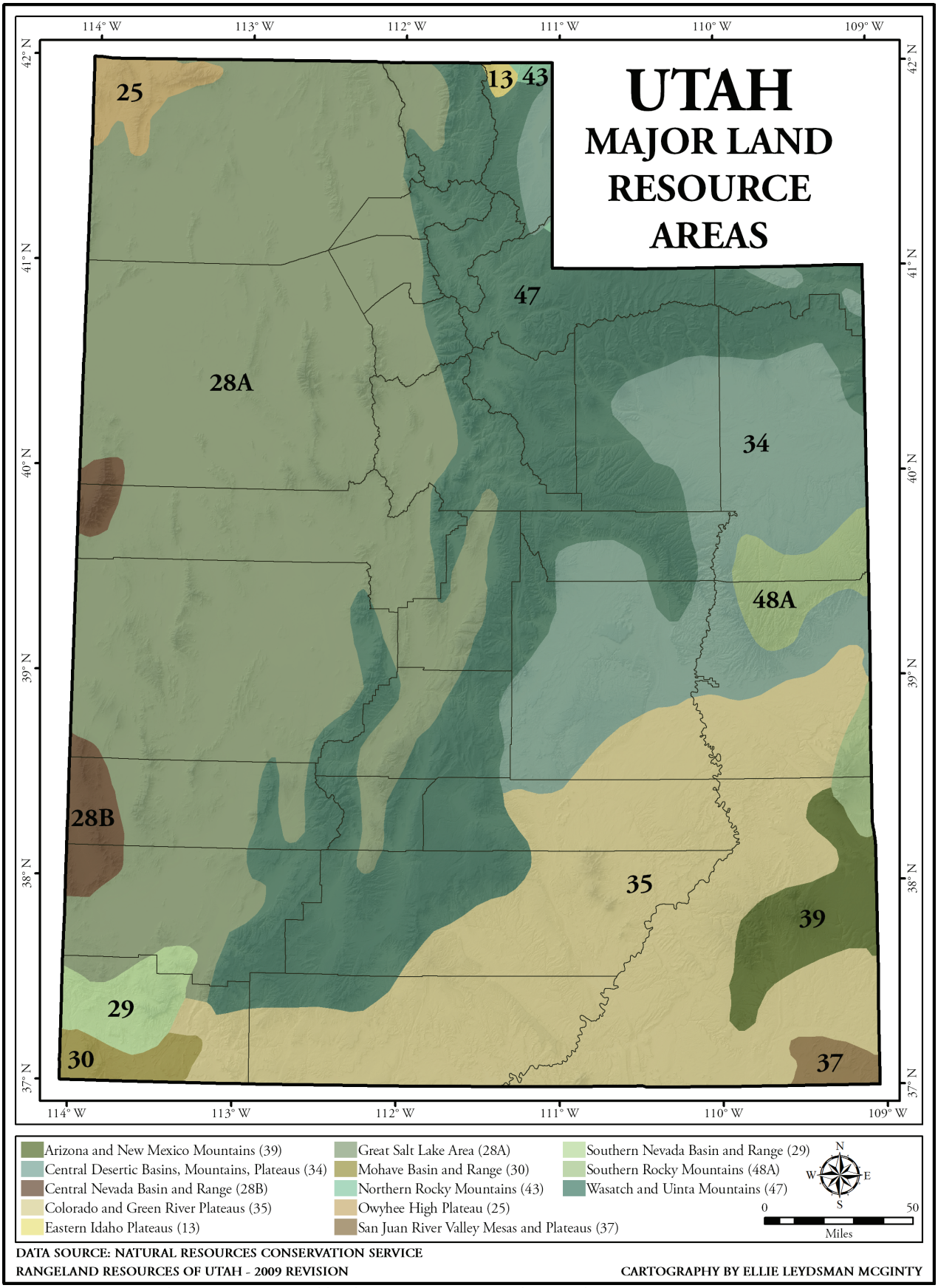

Figure 7.4. Major Land Resource Areas used by the NRCS to categorize large-scale ecosystems.

Figure 7.5. Southwest Regional Gap (SWReGAP) Landcover - reclassified to 45 classes.

Table 7.1. Percent occurrence of each cover type by life zone. Sum of percent of each cover type equals 100.

LEGEND	COVER TYPE	ALPINE	SUBALPINE	HIGH MOUNTAIN	MOUNTAIN	UPLAND	SEMI-DESERT	DESERT	ACRES
1	Agriculture				1%	24%	74%	1%	2,268,637
2	Aspen		4%	27%	47%	21%	1%		1,865,047
3	Badland						55%	45%	451,380
4	Barren Lands						67%	33%	10,551
5	Bedrock Scree	14%	69%	13%	3%	1%			201,263
6	Big Sagebrush		1%	3%	11%	31%	54%		8,507,705
7	Bigtooth Maple		4%	20%	48%	27%	1%		218,765
8	Blackbrush-Mormon Tea						37%	63%	2,242,282
9	Cliff and Canyon		8%	7%	11%	34%	40%		488,546
10	Creosote-White Bursage						65%	35%	202,209
11	Developed				3%	35%	55%	7%	765,031
12	Disturbed		1%	11%	15%	24%	49%		303,644
13	Dune						39%	61%	447,263
14	Dwarf Shrub	8%	91%	1%					27,035
15	Fell Field	13%	86%	1%					43,621
16	Foothill Shrub				2%	86%	12%		62,160
17	Oak			4%	26%	62%	8%		1,631,329
18	Grassland			1%	5%	17%	65%	12%	643,784
19	Greasewood						88%	12%	1,805,404
20	Ice Field	61%	39%						5,239
21	Invasive				1%	7%	84%	8%	1,213,659
22	Limber-Bristlecone Pine		27%	17%	42%	14%			17,280
23	Lodgepole Pine		14%	43%	35%	8%			448,230
24	Low Sagebrush					2%	98%		375,728
25	Marsh					24%	69%	7%	118,848
26	Mat Saltbush						68%	32%	749,958
27	Meadow	1%	35%	30%	16%	12%	6%		241,362
28	Mesquite						34%	66%	756
29	Mixed Conifer		2%	10%	32%	45%	11%		774,468
30	Mixed Shrub		1%	10%	32%	45%	12%		203,321
31	Mogollon Chaparral				3%	46%	51%		143,194
32	Mountain Mahogany		1%	10%	34%	49%	6%		153,943
33	Open Water				2%	7%	81%	10%	1,663,042
34	Pinyon-Juniper				1%	24%	75%		10,567,696
35	Playa						66%	34%	2,787,471
36	Ponderosa Pine				7%	67%	26%		500,466
37	Riparian		2%	7%	13%	22%	53%	3%	365,718
38	Salt Desert Shrub						90%	10%	3,829,998
39	Sand Shrubland						58%	42%	212,370
40	Shrub Steppe						92%	8%	2,056,220
41	Spuce-Fir		26%	33%	28%	13%			1,111,750
42	Tableland					1%	57%	42%	3,513,036
43	Tundra	7%	46%	23%	24%				72,425
44	Volcanic Rockland			12%	19%	12%	56%	1%	80,394
45	Xeric Sagebrush					4%	96%		888,915
	TOTAL								54,281,146