Compare ESD and ESG Quantitative Benchmarks

Introduction

The development of Ecological Sites (ES) and their descriptions (ESD's) represent an enormous effort on behalf of the Natural Resources Conservation Service (NRCS) (Bestelmeyer (2015)). As mentioned in section XX, they do not yet form a continuous coast to coast, nor even across the field office data set (Twidwell et al. (2013)). In order to allay the significant amounts of effort required to develop these, and to make land management decisions in the interim alternative classification systems have been proposed (CITE). One system which incorporates the NRCS ESDs, and which provides continuous coverage across our study area, are the Ecological Site Groups (Nauman et al. (2022)).

The Ecological Site Groups developed largely by United States Geological Survey (USGS) researchers at the Southwest Biological Science Center in Moab [Utah], with assistance from BLM Colorado State Office Staff, are meant to both bridge the spatial gap in ESD development, and to provide a framework for land management decisions at a scale larger than that which generally occurs at a BLM Field Office. The Ecological Site Groups were developed by grouping together similar ESD's, akin to the strictly interpretive approach - which seeks to reduce conceptual fineness - in section XX, and which will respond in a similar fashion to management actions (Duniway et al. (2016)). To these initial groups the field data which largely informed the ESD creation, most notably soil physical parameters, and with the use of an objective and quantitative approaches, which make use of simple *Machine Learning (ML)* method *Random Forest* **section XX** were used to identify recurring themes in the dataset into groups, and then project these onto a 'map' which covers the Upper Colorado River Basin.

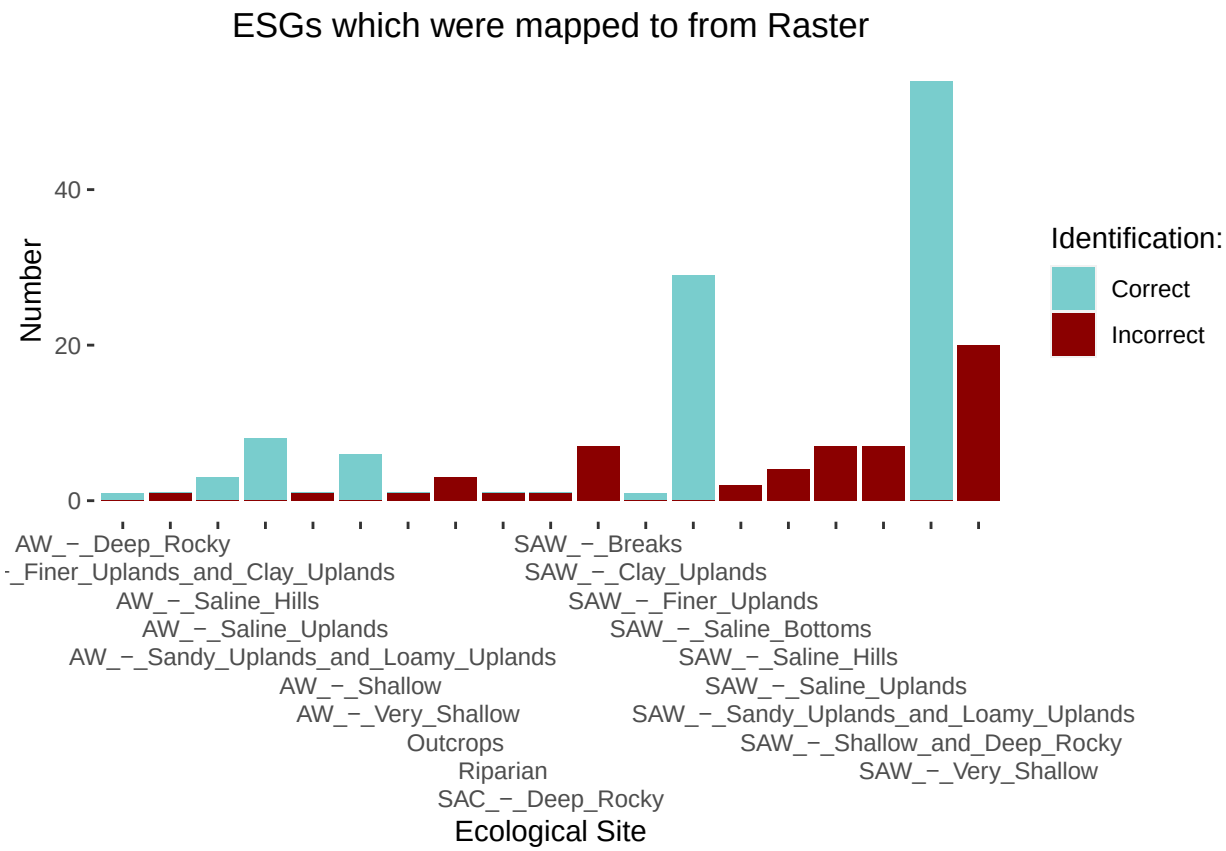
While for most land management decisions at the UFO ESD's, when available, represent the best available scientific evidence upon which to inform decisions, ESG's provide the best alternative for much of the field office, and in the future are likely to maintain influence for large scale decisions at the UFO. Herein we address questions regarding the similarity of estimates arising from ESG's and ESD's. In this report, we are using ESD's for the *reference state benchmarks* which they contain, in other words quantitative goals which we seek to compare land to, and seek to visualize the relationship between the standards of ESD's and ESG's. We also hope to understand which ecological sites are contained in which ES groups, in other words, where do our groups map out to?

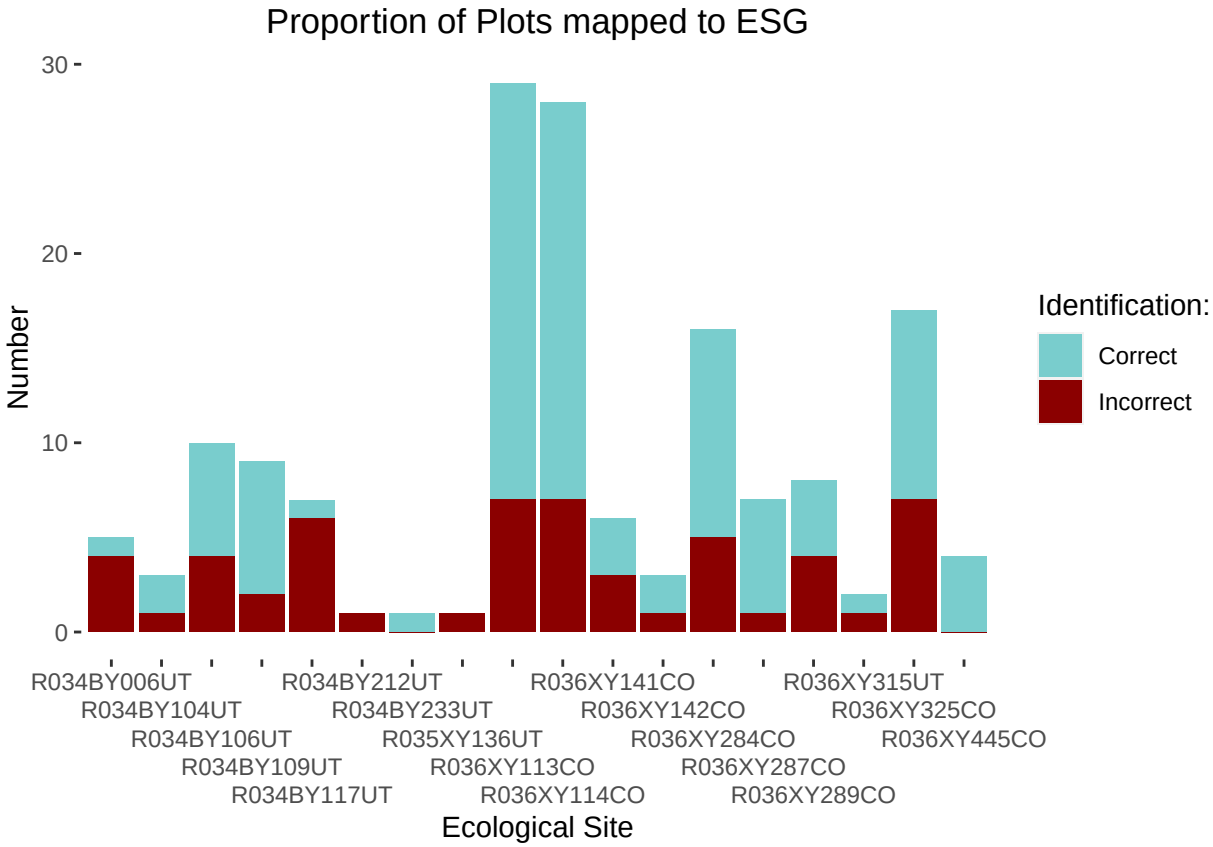
Methods

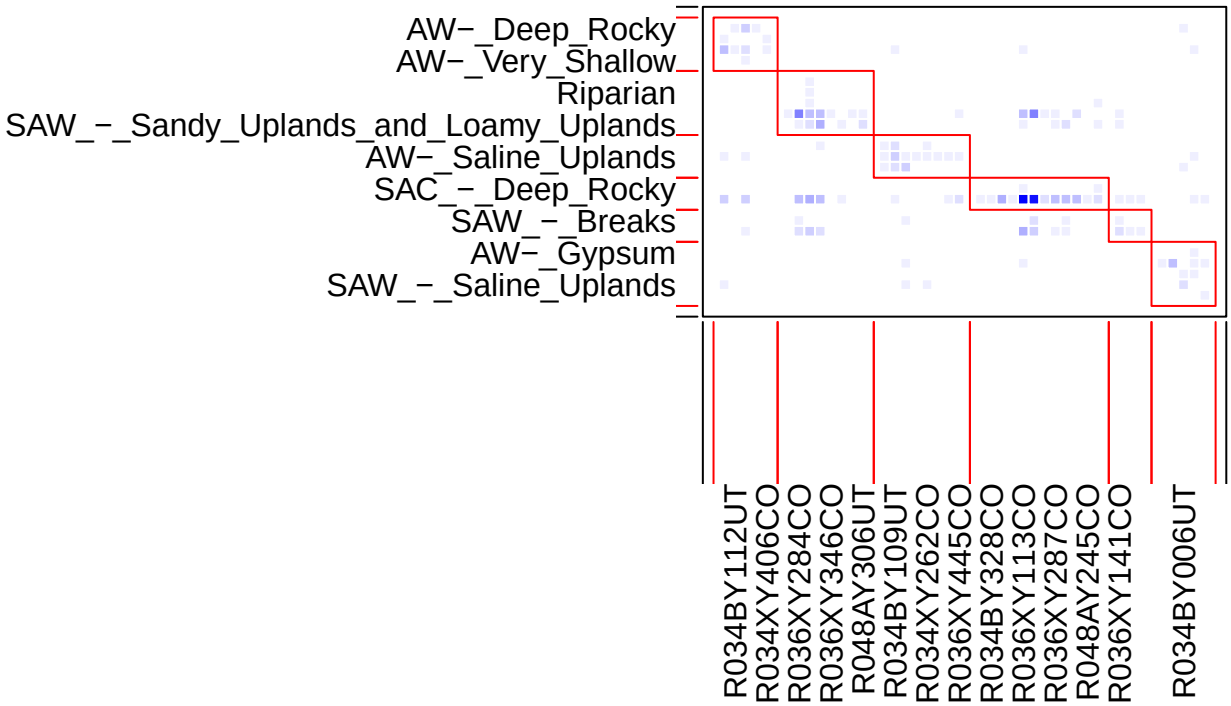
The mean fractional cover of vegetation was manually transcribed from Table 3 of Appendix A from Nauman et al. 2022. The spatial data product which the study which was the outcome of the study was accessed from sciencebase.gov catalog on (Dec. 16, 2022).

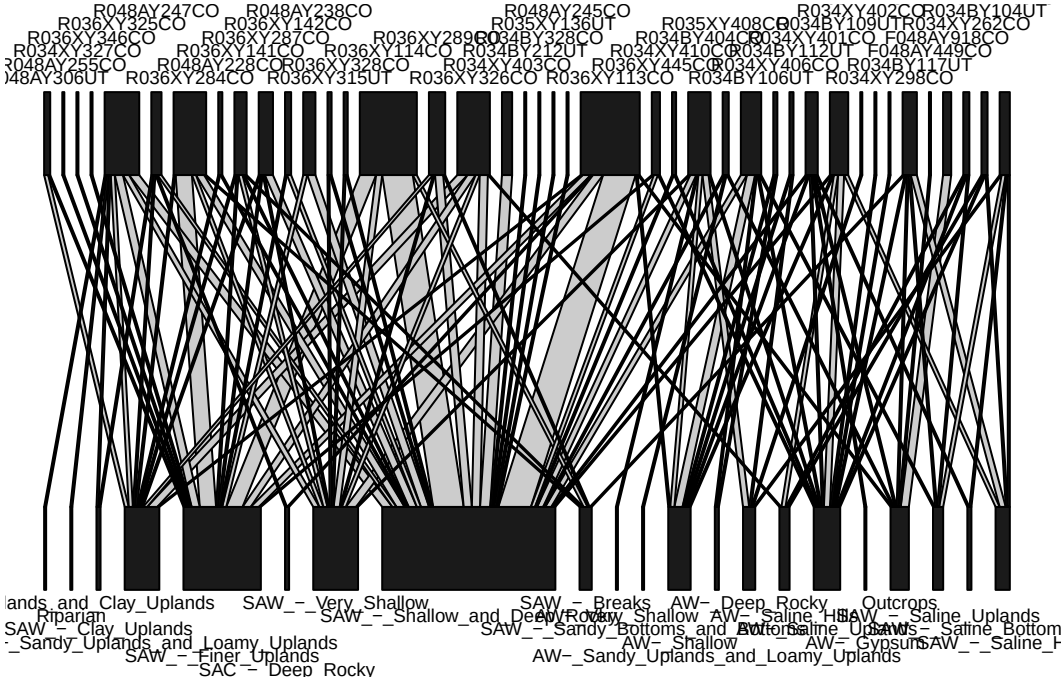
The study utilized 18 of the UFO's (NUMBER) ecosites. We can determine how often the spatial product mapped to the appropriate ESG under multiple circumstances. 1) How often did the PREDOMINANT ESG get returned by the ESD 2) what proportion of all plots were matched correctly to an ESG from the spatial product ?

Multiple options for extracting raster values to points were utilized to try and determine the correct ESG. Three parameters (plot buffer, summary statistic, and bilinear interpolation) were altered in two dichotomous ways (Yes/No), and all but one combinations thereof (the combination of a true point geometry and statistical summary methods cannot coexist) were implemented to determine which gave the best results.

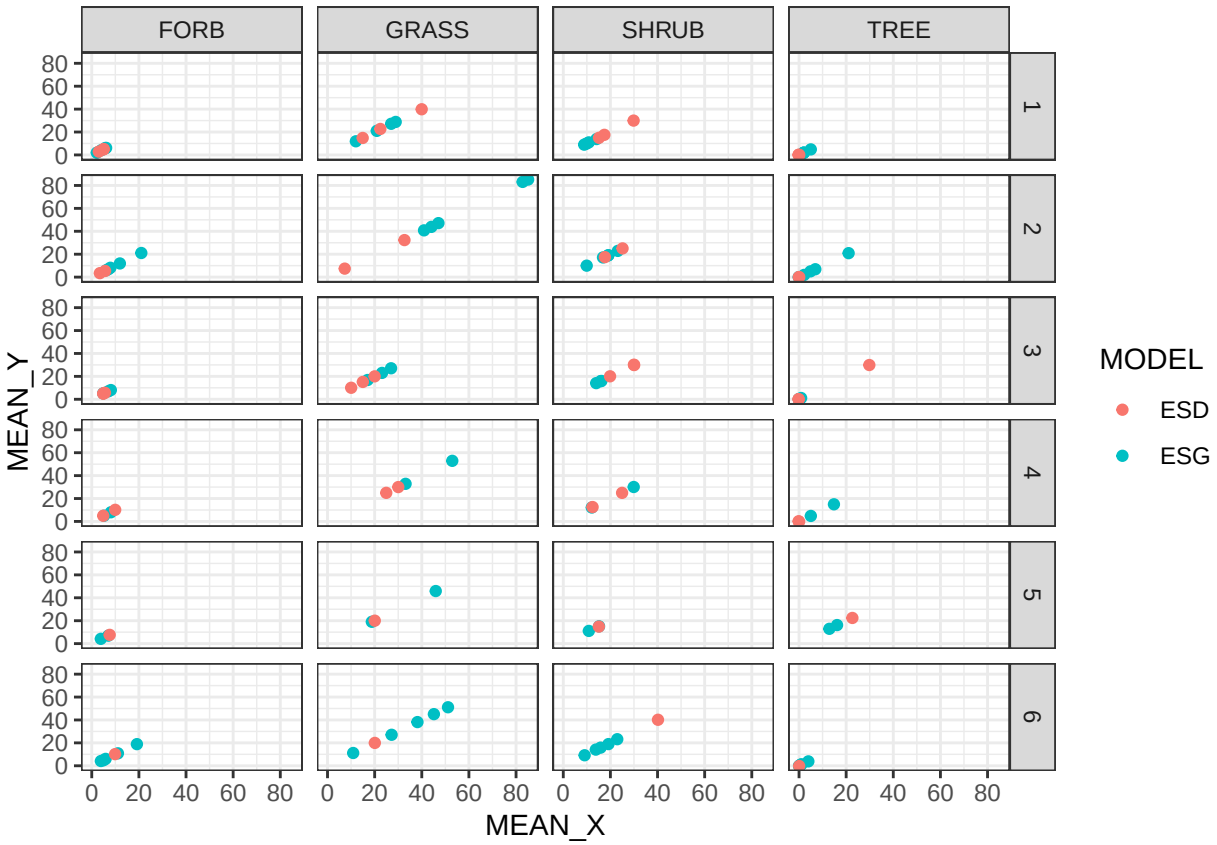

ESGs which were mapped to from Raster
Number
40
20
0
Identification:
Correct
Incorrect
AW_−_Deep_Rocky
-_Finer_Uplands_and_Clay_Uplands
AW_−_Saline_Hills
AW_−_Saline_Uplands
AW_−_Sandy_Uplands_and_Loamy_Uplands
AW_−_Shallow
AW_−_Very_Shallow
Outcrops
Riparian
SAC_−_Deep_Rocky
SAW_−_Breaks
SAW_−_Clay_Uplands
SAW_−_Finer_Uplands
SAW_−_Saline_Bottoms
SAW_−_Saline_Hills
SAW_−_Saline_Uplands
SAW_−_Sandy_Uplands_and_Loamy_Uplands
SAW_−_Shallow_and_Deep_Rocky
SAW_−_Very_Shallow
Ecological Site


Proportion of Plots mapped to ESG
Number
30
20
10
0
R034BY006UT
R034BY104UT
R034BY106UT
R034BY109UT
R034BY117UT
R034BY212UT
R034BY233UT
R035XY136UT
R036XY113CO
R036XY114CO
R036XY141CO
R036XY142CO
R036XY284CO
R036XY287CO
R036XY289CO
R036XY315UT
R036XY325CO
R036XY445CO
Ecological Site
Identification:
Correct
Incorrect


AW−_Deep_Rocky
AW−_Very_Shallow
Riparian
SAW_−_Sandy_Uplands_and_Loamy_Uplands
AW−_Saline_Uplands
SAC_−_Deep_Rocky
SAW_−_Breaks
AW−_Gypsum
SAW_−_Saline_Uplands
R034BY112UT
R034XY406CO
R036XY284CO
R036XY346CO
R048AY306UT
R034BY109UT
R034XY262CO
R036XY445CO
R034BY328CO
R036XY113CO
R036XY287CO
R048AY245CO
R036XY141CO
R034BY006UT



It can be inferred from the above image is that from a per pixel perspective, the mapping between pixels and ESG's is of limited utility. Rather we need to utilize the direct look up tables from the publication... which miss most of our ecosites again...



Results

We run multiple tests of correlation coefficients to determine similarity between these two data sets. ...

Conclusions

The relationship between the novel ESG's and the ESD's...

Bestelmeyer, B. T. (2015). National assessment and critiques of state-and-transition models: The baby with the bathwater. *Rangelands*, *37*(3), 125–129.

Duniway, M. C., Nauman, T. W., Johanson, J. K., Green, S., Miller, M. E., Williamson, J. C., & Bestelmeyer, B. T. (2016). Generalizing ecological site concepts of the colorado plateau for landscape-level applications. *Rangelands*, *38*(6), 342–349.

Nauman, T. W., Burch, S. S., Humphries, J. T., Knight, A. C., & Duniway, M. C. (2022). A quantitative soil-geomorphic framework for developing and mapping ecological site groups. *Rangeland Ecology & Management*, *81*, 9–33.

Twidwell, D., Allred, B. W., & Fuhlendorf, S. D. (2013). National-scale assessment of ecological content in the world's largest land management framework. *Ecosphere*, *4*(8), 1–27.