



Restoring the biological crust cover of soils across biomes in arid North America

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Biological soil crust communities provide important ecosystem services to arid lands, particularly regarding soil fertility and stability against erosion. In North America, and in many other areas of the globe, increasingly intense human activities, ranging from cattle grazing to military training, have resulted in the significant deterioration of biological soil surface cover of soils. With the intent of attaining sustainable land use practices, we are conducting a 5-year, multi-institutional research effort to develop feasible soil crusts restoration strategies for US military lands. We are including field sites of varying climatic regions (warm and cold deserts, in the Chihuahuan Desert and in the Great Basin, respectively) and varying edaphic characteristics (sandy and silty soils in each). We have multiple aims. First, we aim to establishing effective “biocrust nurseries” that produce viable and pedigreed inoculum, as a supply center for biocrust restoration and for research and development. Second, we aim to develop optimal field application methods of biocrust inoculum in a series of field trials. Currently in our second year of research, we will be reporting on significant advances made on optimizing methodologies for the large-scale supply of inoculum based on a) pedigreed laboratory cultures that match the microbial community structure of the original sites, and b) “in soil” biomass enhancement, whereby small amounts of local crusts are nursed under greenhouse conditions to yield hundred-fold increases in biomass without altering significantly community structure. We will also report on field trials for methodologies in field application, which included shading, watering, application of chemical polymers, and soil surface roughening. In a soon-to-be-initiated effort we also aim to evaluate soil and plant responses to biocrust restoration with respect to plant community structure, soil fertility, and soil stability, in multi-factorial field experiments. An important part of the plan will be to construct effective channels for sharing challenges and solutions in biocrust restoration with military and federal land managers.