## Plot History

The Disturbance

In January 2007, construction activities created a spoil pile of rock and cobble on approximately 1 ha of coastal sage scrub and chaparral on the CSUSB campus (Fig. 1). This spoil pile remained in place until summer, when the pile was removed, returning the area to approximately the original grade (Fig 2).

Figure 1. Spoil pile across the road from the Coussoulis Arena, late spring 2007.

Figure 2. Removal of spoil, summer 2007.

Site Preparation

In the summer of 2007, the soil was partially ripped in random paths to break up soil compaction (Fig. 3.) This provided a random patchwork of compacted and uncompacted soil for study. After partial ripping, the entire surface of the disturbed site was groomed (Fig. 4).

Figure 3. Ripped soil.

Figure 4. Disturbed site with groomed surface adjacent to undisturbed vegetation.

Plot establishment

In the summer of 2008, the US Department of Agriculture awarded funds to California State University San Bernardino to establish an ecological restoration research site on and around the disturbed area and to undertake activities to increase the campus' capacity to train students in restoration ecology. The following spring (2009), 36 plots measuring 6 x 6 m were established

on the site (Fig. 5). Plots were arranged in six blocks (Fig. 6), with some plots being reserved for labs in BIOL 450 (Ecology) and others being reserved for other restoration treatments and experiments. Initial vegetation data were taken the spring of plot establishment, the second growing season after the disturbance.

Figure. 5. Plots established in the spring of 2009.

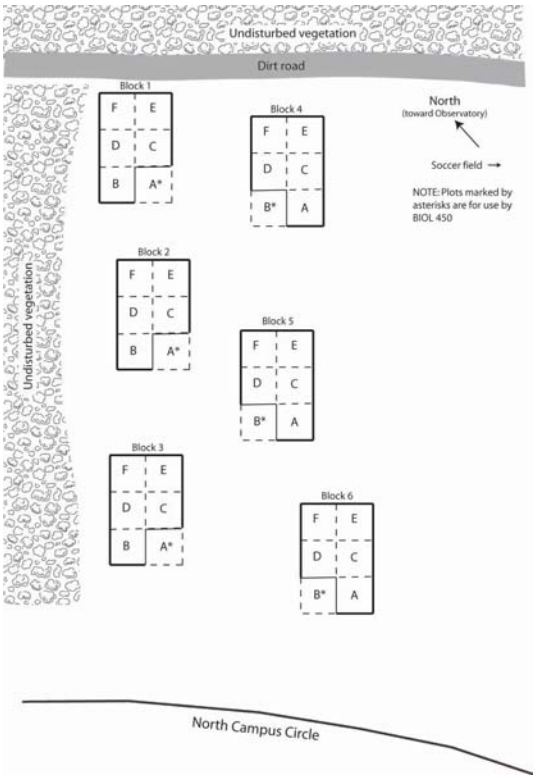


Figure 6. Layout of plots (6 blocks of 6 plots each). Plots measure 6 x 6 m.

By spring of 2011, studies conducted by biology classes and geology students had made it clear that, although many native species had colonized the disturbance, many from adjacent reference sites had not. Furthermore, highly compacted areas within the disturbance were still bare. At the same time, greenhouse studies by students and faculty had shown that the application of smoke-water (a solution of water-soluble chemicals from smoke) to soil from reference sites in the field could stimulate germination of dormant native seeds and that commercial hydromulch (often applied for erosion control) could increase the effectiveness of smoke-water in stimulating seed germination.

In spring of 2011, residual soil compaction in two areas was reduced by digging down and breaking up the soil (Fig. 7). Adjacent control areas were left untreated for comparison.

Figure 7. Breaking up compacted soil.

In the fall of 2012, parts of the ripped (decompacted) sites were seeded with native seeds collected on campus and subjected to treatments designed to test effects of

- Application of hydromulch at four rates (none, 2000 lb/acre, 4000 lb/acre, and 6000 lb/acre)
- Application of smoke-water (with and without), and
- Application of mycorrhizal inoculum (with and without). [Symbiotic mycorrhizal fungi benefit many plant species, but do not colonize mustards, some of the most problematic non-native weedy species in our area.]


Figure 8. Applying hydromuch and smoke-water.

Effects of these treatments on the germination of native species, growth of native species, and suppression of non-native species (especially mustards) is being investigated.