Perennial Wildflower Meadow Research

Introduction

Part of the Natural Capital Program, The Landscape Lab is a living vegetative lab spanning the diamond interchanges at Exit 6 of I-85 near LaGrange, Georgia. This living lab is made possible through a partnership between The Ray, the Georgia Department of Transportation (GDOT), and the College of Environment + Design at the University of Georgia. The project focuses broadly on effectively establishing flowering perennial meadows from seed with no irrigation on roadsides in Georgia and the greater Southeast region.

The overarching goal of the landscape lab is to develop effective seed mixes, using largely native plants for use on highways and utility corridors throughout the region. The project provides multiple seasons of flowering events that provide critical pollinator habitats and other ecosystems to support biodiversity. These pollinator habitats act to also make road travel more beautiful all while supporting The Ray's mission of "zero carbon, zero waste, zero deaths." Innovation in the transportation industry plays a key role in offsetting carbon emissions. Native plants are vital in strengthening habitats for wildlife, and research proves they optimize impact for a more sustainable future.

A portion of this research builds on the work of two celebrated figures in the field of landscape architecture: James Hitchmough *and* Joan Nassauer.

James Hitchmough is a landscape architect and professor at the University of Sheffield and a prolific researcher who has been developing methods and seed mixes for perennial meadow establishment for over 20 years. He is most well-known for his work on the 2012 Olympic Park in London, which featured sown meadows grown from seed and underplanted with bulbs and plugs – a complex installation that continues to flourish today. His latest book, *Sowing Beauty*, is rich in details and generous in its recommendations for seed mixes and species choice, installation methods, and long-term field monitoring. This foundation has been invaluable for establishing the Exit 6 Meadow Project.

Photo by Nigel P. Dunnett

The research team is also indebted to Joan Nassauer, landscape architect and professor at the University of Michigan, whose 1995 paper, “Messy Ecosystems, Orderly Frames,” articulates the need for a defined “frame” to make sometimes messy-looking ecological planting designs more legible to a public that is more familiar with traditional ornamental plantings. On the roadside, this “frame” can take the form of mown edges, pavement changes, curbs, and medians but can also be achieved within the meadow itself through careful species selection. By choosing mostly native plants with variable heights, forms, blooms, and seed heads, a designer can lend an orderly skeleton to the planting through structural layering.

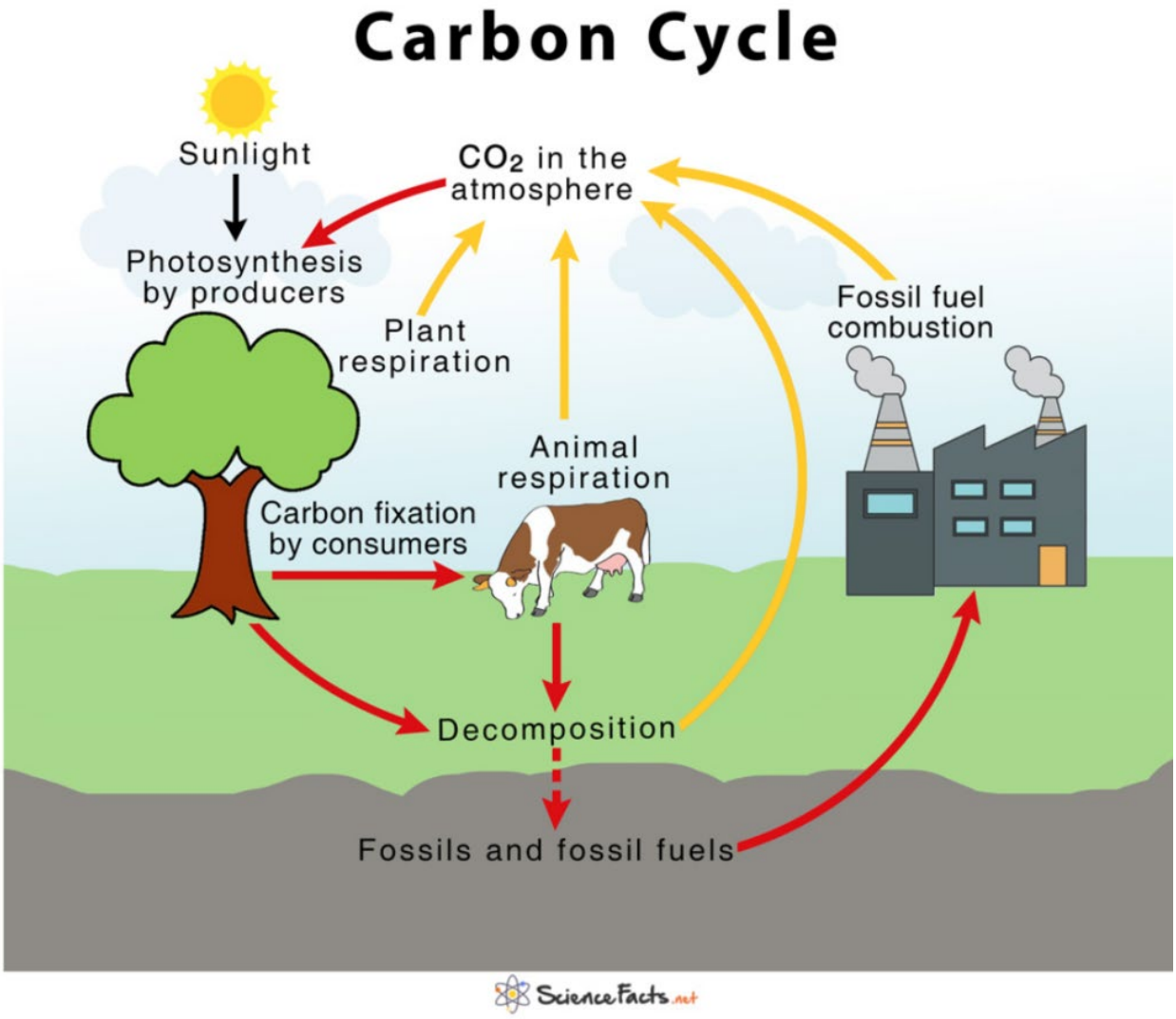
Project Background

The Exit 6 research team also emulated Hitchmough’s novel method of non-chemical weed control, which involves applying 2” thick mineral blanket before sowing. This supplies a competition-free zone that holds undesirable weeds at bay while desirable meadow species establish themselves. Usually, Hitchmough uses construction-grade sharp sand for this purpose. For the Exit 6 Project, the research team chose to use locally quarried granite fines for their “mineral mulch.”

Why Roadside Meadows?

Perennial wildflower meadows offer a range of ecosystem services well beyond what traditional turf grass medians can offer. For one thing, the deep root structures of native perennials are effective at holding soil in place and can, with time, help to restore lost nutrients to the soil as well. These plants are also highly attractive to pollinating insects, which are critical to our food supply and foundational to Georgia’s Agricultural industry. Miles of right-of-way wildflowers could also provide considerable carbon offset benefits,

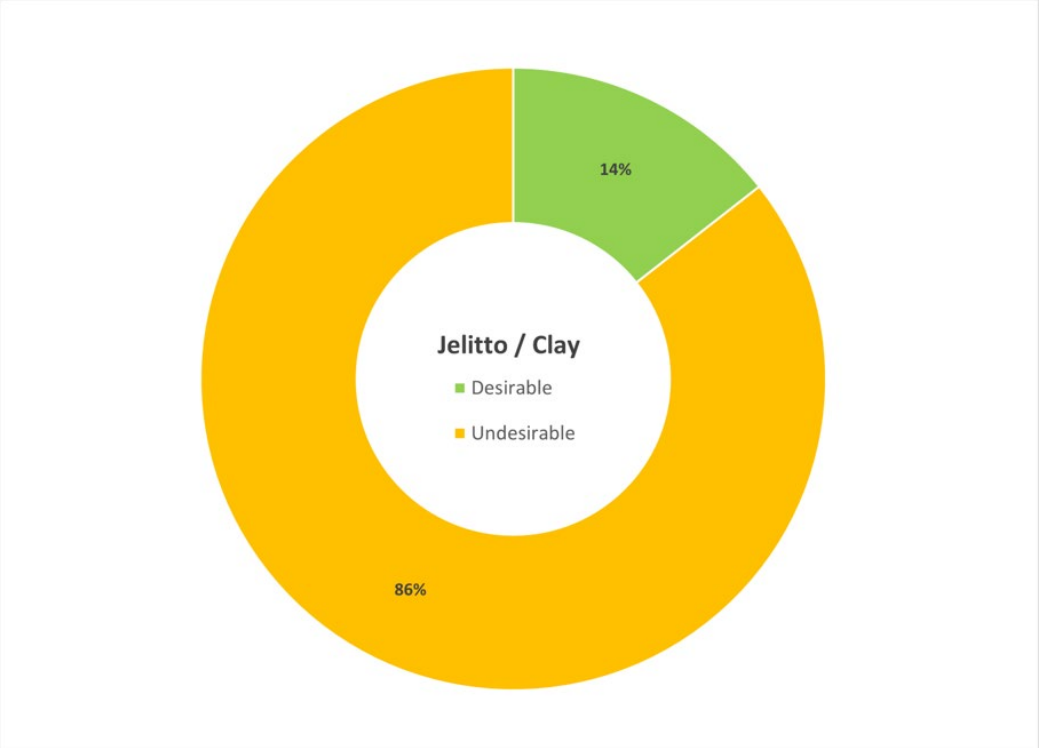
not only through reduced need for mowing but also by locking carbon in the soil through their roots. Beautification of roadways with wildflower meadows is much more appealing for travelers than turf grass, and it supports our natural ecosystems.

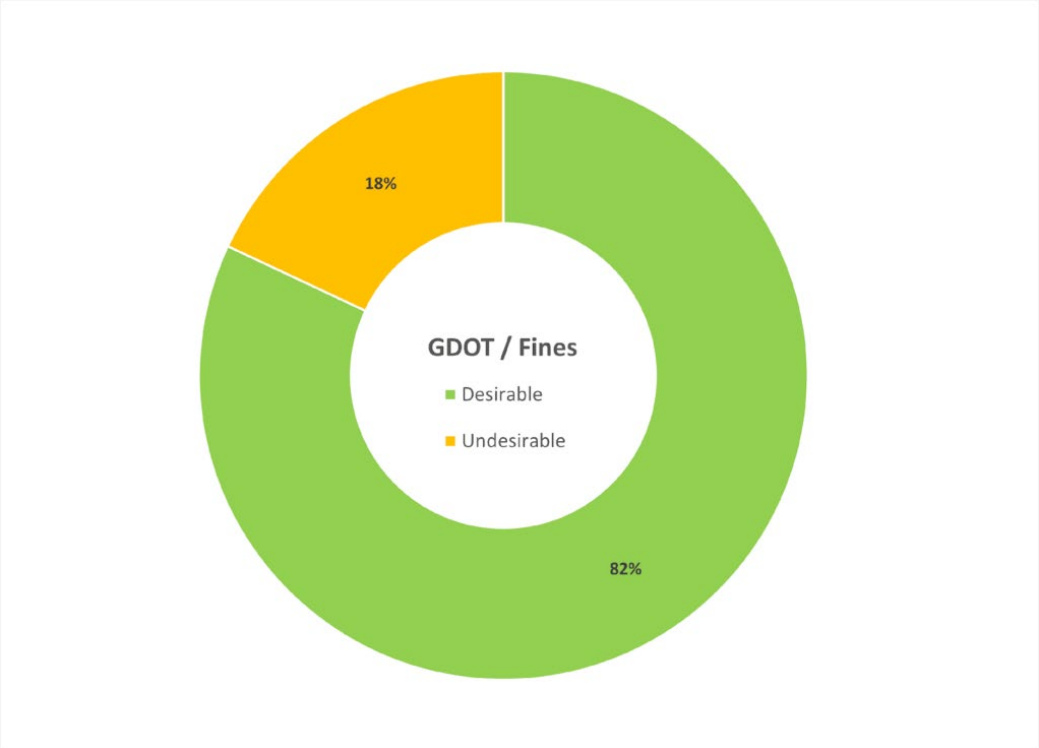


Here you can see the various research plots. For this report, we focus on Site 1, near the exit ramp. This 0.2-acre site has been split into 3 equal areas for testing three different seed mixes. We are testing the difference between bare clay and ground that has been prepared with granite fines. The granite fines received the weed blanket treatment – the “Hitchmough method” of a 2-inch layer of gritty material. Plots where our seed mixes have been sown directly into the native clay serve as our control plots.

Phase I installation took place on January 28, 2020. Again, half fines, half bare clay, mixes sown into appropriate quadrants and subsequently raked in to get good seed-to-soil contact. Since then, we have completed three monitoring visits. The first visit took place on June 2, 2020.

Monitoring – Methodology and Results





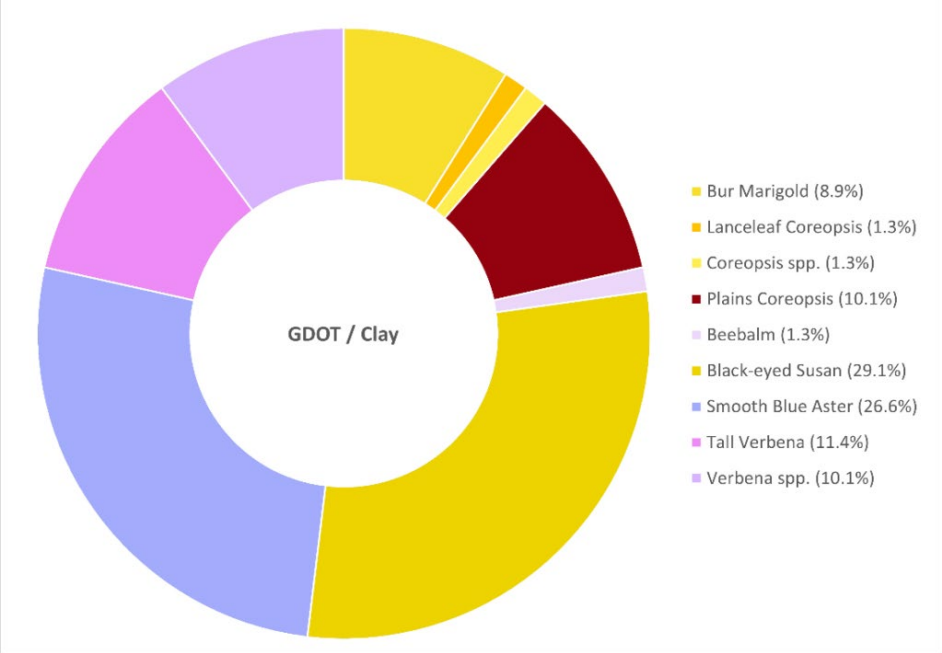
For each visit, quadrant surveys were conducted at Site 1. Two samples were taken of each plot (clay and granite fines). For each sample, all visible plants within the meter-by-meter

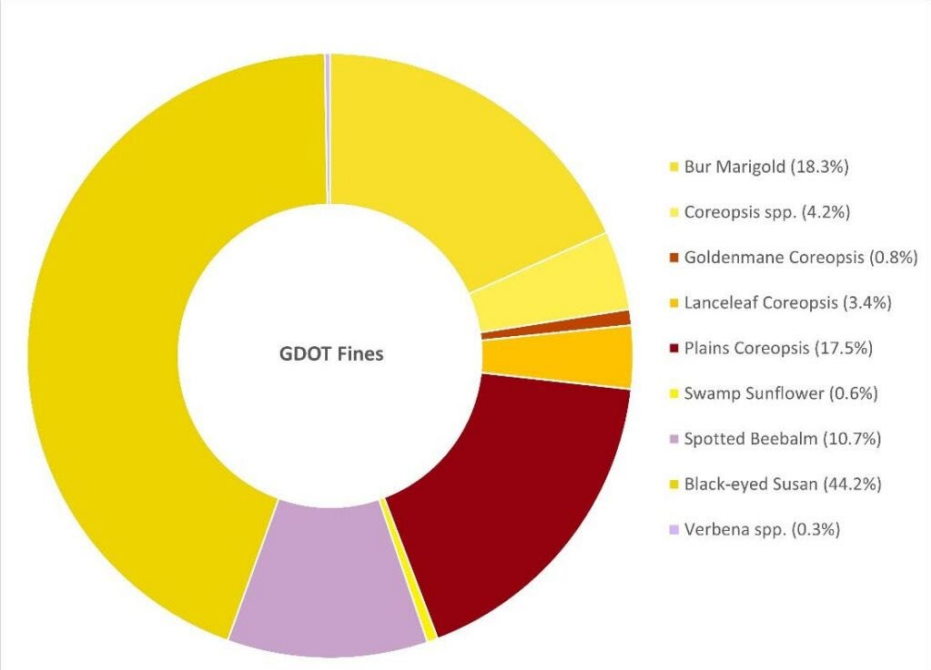
square were counted, identified, and tallied. These samples were conducted for the GDOT, and Jelitto mixes only. Roundstone plots were inspected visually, during which all species visually present or absent were noted for later comparison with the original seed mix.

The 2020 monitoring data for the Jelitto / Clay plot shows Desirable Species as those species that were included in our original sown seed mixes and Undesirable Species as including both known roadside weeds and other non-sown volunteer species. In this case, we are seeing significant weed pressure, with an 86% occurrence of Undesirable Species.

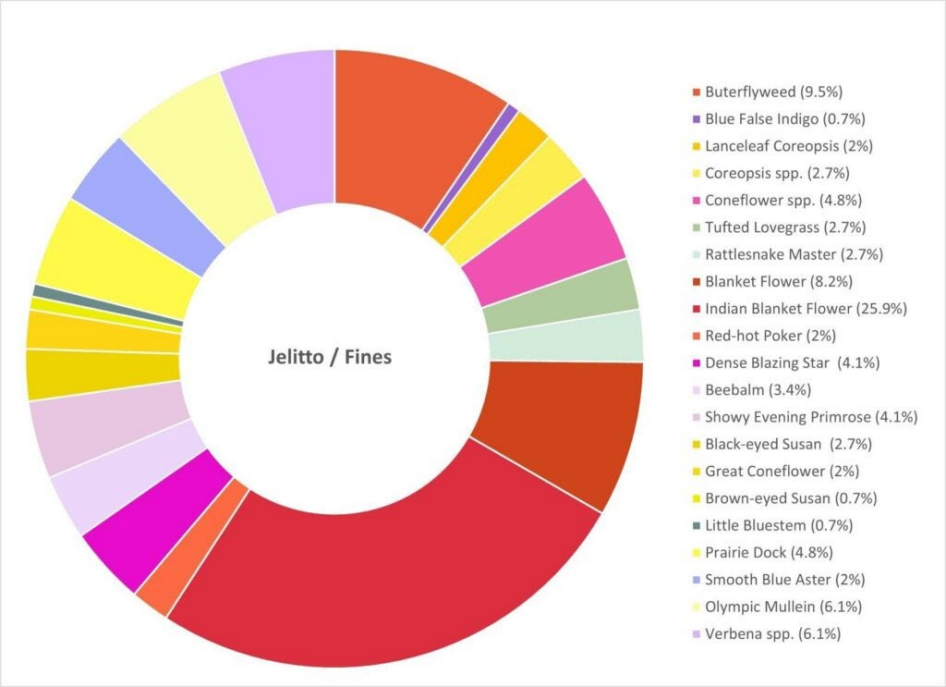
What's next for Exit 6?

As we continue monitoring Site 1 using quadrant surveys, we will be looking for those desirable perennial species that may not have germinated in the first year after planting. For future monitoring visits, we also intend to begin incorporating pin drop surveys, which will give us a better idea for differences in density and percent coverage between the two plot types.





GDOT Seed Mix



Methodology

There are two organizing principles behind our methodology for the meadow project. The first pertains to the mixture of flowering perennials to grasses in the installed seed mixes. Most roadside perennial mixes tend to incorporate an 80/20 ratio of grasses to perennials. For our mixes, we are trying to reverse this ratio and achieve a 20/80 ratio of grasses to perennials, expanding the mixes of flowering perennials. The benefits of increasing the flowers present of our mixes extend beyond the obvious aesthetic benefits – although this is certainly an important consideration – to provide a range of other roadside management benefits.

Once established, perennial wildflower meadows are self-seeding and thus require less maintenance and much less mowing than traditional turf grass. A turf grass median needs to be mown several times a year, and a meadow only needs to be mowed once or twice each year. Finally, meadow perennials send down strong, extensive root systems that help to prevent erosion and stabilize right-of-way soils. Here is a sample of wildflower meadows benefits and low maintenance, deep root systems to support erosion control.

One goal of our landscape lab is to test non-chemical weed control methods alongside new mixes of perennial wildflower and grass seed designed to provide continuous, successive blooms from late spring to early fall across three test sites. As mentioned under Scalability, it is also necessary that we become familiar with the process of coordinating between GDOT and state-hired contractors for installation.

Another focus area is the feasibility of establishing perennial wildflower meadows on the roadside. To do this, we have designed our experimental plots to test establishment with and without weed blankets, which function as a form of non-chemical weed control. On one side of the plot, we have left the ground as bare Georgia clay; on the other, are seeds are sown into a 2" blanket of granite fines. Following installation, we have continued to monitor establishment through successive site visit, during which we have conducted quadrant surveys, through periodic quadrant surveys. To gauge performance, we are particularly tracking which species appear in our quadrant surveys. Which species have yet to make an appearance? Which species appear to be declining? Which species are present and blooming throughout the year?

TABLE 1: *Jelitto / Clay | Desirables | Phase I Quadrants*

TABLE 2: *Jelitto / Fines | Undesirables | Phase Quadrants*

Scientific Name	Common Name	Survey Count	Percent Survey Count
"Cyperus ligularis"	Sedge spp.	3	1.4%
"Chamaecrista fasciculata"	Partridge Pea	1	0.5%
"Digitaria ciliaris"	Southern Crabgrass	15	7.0%
"Digitaria spp."	Crabgrass spp.	14	6.5%
"Erigeron spp."	Fleabane spp.	9	4.2%
"Euphorbia maculata"	Prostrate Spurge	2	0.9%
"Euphorbia lathers"	Gopher Spurge	19	8.9%
"Euphorbia stricta"	Upright Spurge	9	4.2%
"Lolium multiform"	Annual Ryegrass	14	6.5%
"Festuca spp."	Ryegrass spp.	1	0.5%
"Leucanthemum vulgare"	Ox-eye Daisy	10	4.7%
N/A	N/A	6	2.8%
"Oxalis acetosella"	Wood Sorrel spp.	13	6.1%
"Paspalum dilatatum"	Dallis grass	12	5.6%
"Paspalum notatum"	Bahiagrass	43	20.1%
"Pinus spp."	Pine spp.	2	0.9%
"Plantago lanceolata"	Ribwort Plantain	31	14.5%
"Rhus spp."	Sumac spp.	5	2.3%
"Setaria spp."	Foxtail	2	0.9%
"Sonchus oleraceus"	Sow Thistle	1	0.5%
"Verbena officinalis"	Common Verbena	1	0.5%
"Verbena rigida"	Ridgid Verbena	1	0.5%
	TOTAL	214	100.0%

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The Ray is a living lab for innovative technologies to reimagine transportation and infrastructure systems. Highways are one of the most environmentally damaging and dangerous infrastructures in the world. We are on a mission to improve highways across the country and improve safety and ecological beauty.

At The Ray, “zero deaths, zero waste, zero carbon, zero impact” is a new standard for roadways across our globe. Innovative ideas such as roadside solar, pollinator meadows, improved technologies for tires, rubberized asphalt, EV charging station, bioswales, smart planting and more ideas being implemented towards a regenerative mobility ecosystem.