

# MO DIRT: Missourians Doing Impact Research Together Year 1 and 2

Sandra Arango-Caro (sarango-caro@danforthcenter.org) and Terry Woodford-Thomas (tthomas@danforthcenter.org)  
Donald Danforth Plant Science Center, 975 North Warson Road, St. Louis, MO 63132

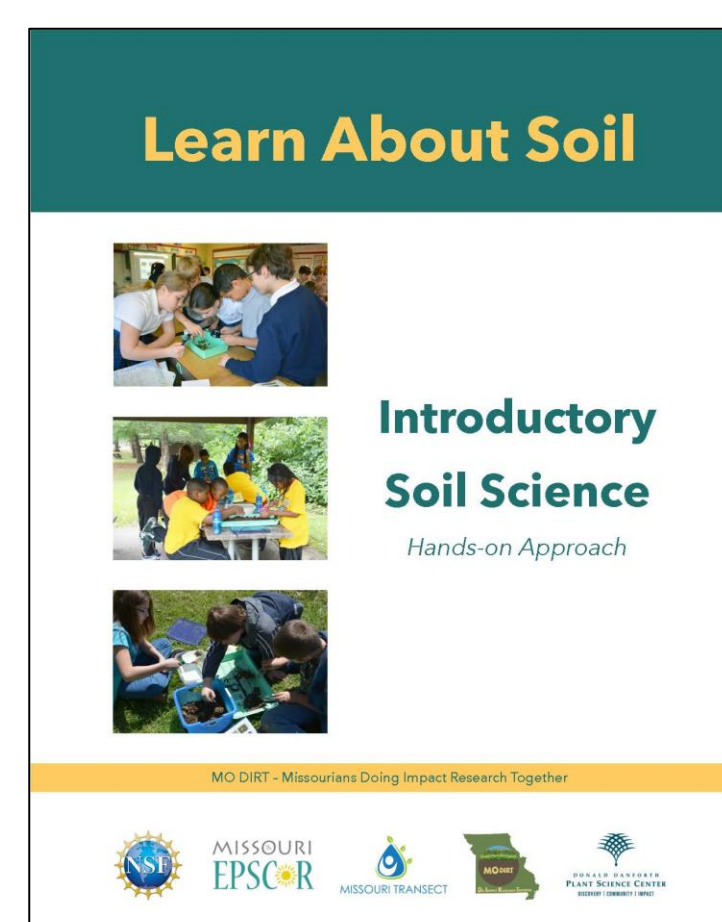
**The Project** is an education component of the **Missouri Transect**, a \$20 million dollar effort supported by the National Science Foundation EPSCoR Program. It focuses on enhancing Missouri's capacity to model and respond to the effects of climate change on plants and communities at a local scale. **MO DIRT** aims to educate citizens on soil health and reciprocal soil-climate interactions across the state. Four components are being offered to the public: Citizen Science Missouri Soil Health Monitoring, K-12 Soil Science Curricula, Opportunities for High School Student Scientists and Enrichment Activities. These components are supported by the MO DIRT project website and an online data portal (modirt.missouriepsco.org).

Missouri Transect institutional partners include the University of Missouri University of Missouri at Columbia, Kansas City and St. Louis, the Donald Danforth Plant Center, the Saint Louis Science Center, Saint Louis University, Lincoln University, Washington University and University of Missouri Science and Technology.

## Specific Goals

- Create public awareness of soil threats and encourage conservation actions
- Train citizens on data collection, analysis and reporting of state soil properties
- Conduct soil surveys with particular emphasis on soil respiration and soil carbon
- Establish a web-based portal for MO DIRT participants that is publically accessible
- Contribute valuable data to scientists involved in Missouri Transect research

**Soil Science Curricula** allow students in grades K-12 to study physical, chemical and biological properties of the soil. A manual on physical properties, is available for elementary and middle school students. The manual presents six activities with background, teacher protocols and student worksheets. In addition, MO DIRT has been working with educators trained to conduct soil health surveys to use the soil kit in their classrooms. Over 50 students have benefitted from using these educational tools. A problems-based high school level curriculum is under development.



**High School Research** allows students to conduct independent, mentored research. Monica Malone, as a senior at a Ladue High School in St. Louis, conducted a study of microbial communities from till and no-till Menfro soils from an agricultural site using genetic fingerprinting. She won first place in the Honors Division of the Academy of Science St. Louis Science Fair, which qualified her to compete in the 2016 INTEL International Science and Engineering Fair (INTEL ISEF) where she placed fourth out of 90 students in the microbiology division.

**Outreach Activities** have been offered to promote soil science education in the state. MO DIRT has participated in 15 events in eight localities, including educational days at agricultural research centers, teachers' professional development workshops, Earth Days events, Boy Scout camps and science fairs. More than 1,500 citizens have benefitted from these activities across the state. Several new events are scheduled for Fall 2016 and 2017.



**Acknowledgements.** The advice and unconditional support of several citizens and soil scientists have made possible the implementation of MO DIRT. The following soil scientists have provided their advice for the soil health surveys: Dr. Kristen Veum, Research Soil Scientist, USDA-ARS; Dave Skaer, Area Resource Soil Scientist, USDA-NRCS; Dr. William F. Brinton and Lucas Rumler, Solvita, Woods End Laboratories; Jorge L. Lugo-Camacho, State Soil Scientist, USDA-NRCS; and Ross Brown, soil scientist and educator extraordinaire. Amy Walsh and Beth Prakash have contributed to the creation and management of the website and data portal. Allison Blevins, Shae Dane, Allison Tielking, Sarah Gebken, Matthew Hageman, and Monica Malone, high school students at the time, have volunteered to MO DIRT in all aspects of the project. Sanki Warnasooriya has been an instructor of the soil health surveys. Supplemental funding and interest from Maritz LLC is greatly appreciated

**Citizen Science Soil Health Surveys** conducted by volunteer citizens, collect and contribute data that will help scientists understand the current status of Missouri soil health and promote a better understanding of soil-climate interactions under climate change. Soil science kits are given to trained volunteers that contain tools and materials needed to measure a set of physical, chemical and biological soil health indicators. The kit includes an 89-page manual with instructions on how to select and set up a site, and collect soil health data.

As of August of 2016, ten training sessions have been offered to state residents on how to conduct soil health surveys (Table 1). Sessions have been offered in St. Louis, Columbia, Kansas City, Rolla, Springfield, and Fenton. Three more sessions are planned for Marshall, Sedalia and St. Louis in Fall 2016.



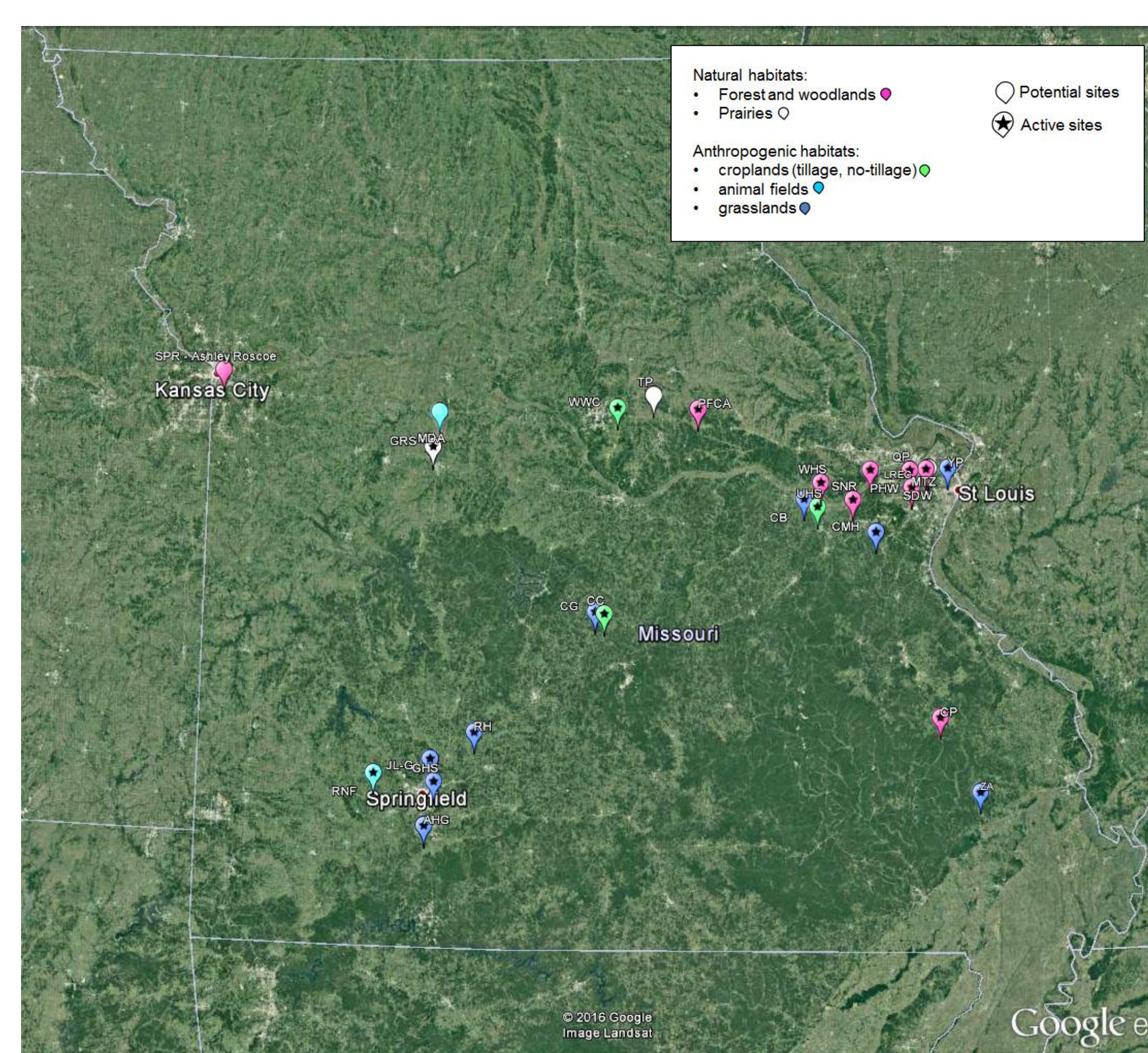
Table 1. Soil Health Surveys Demographics

Citizens trained to conduct the surveys	Number of citizens
High school and middle school teachers	19
High school and middle school students	16
Informal education leaders	10
Master Naturalists	12
Landowners	12
Undergraduate students	5
Graduate students	5
Independent citizens*	10
<b>Total participants</b>	<b>89</b>



Currently, MO DIRT has 23 active survey sites and the participation of 100 citizens. Another 20 sites are under consideration. The map below shows the location and type of habitat of the current soil health survey sites (Figure 1). The MO DIRT website contains the portal where participants enter their soil research data online. The capability of sharing these data among participants with partial public accessibility is being developed. The data collected can be used for teaching purposes, managing lands, and augmenting ongoing Missouri Transect research with the Plant, Climate and Community teams.

Figure 1. Active soil health survey sites in different habitats.



**Summary and Future Developments.** In the first two years of MO DIRT, more than 2,000 people have benefitted from the project through their participation in 25 events in more than 11 localities. Thirty institutions have been involved with MO DIRT, providing support for training, sites for soil health surveys, mentoring and donations. The MO DIRT website offers information, access to educational and training materials, sharing of MO DIRT experiences and the data collection portal for citizen scientists conducting soil surveys. MO DIRT and Missouri Transect Teams are examining ways to use the soil survey data in plant, climate and community research. The soil health data will be available to participants, classrooms, state agencies and the general public.



**Award Statement** This material is based upon work supported by the National Science Foundation under Award Number IIA-1355406. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.