This documentation is a "recipe" for ground-based Normalized Difference Vegetation Index (NDVI) trends. NDVI is a "greenness index" that can substitute for plant phenology.

Phenology data can be very expensive to collect in remote sites because it requires re-visits as frequent as twice-weekly, for human observers to accurately catch the desired plant growth stages.

The instrumentation described here runs unattended, and automatically records spectral reflectance data from the vegetation it is set over.



This is a near-ground data recording system

Sensor height above vegetation is about 50 cm.

Area of view is roughly circular, about 1 meter in diameter.

This is not the same as a phenology camera, which looks horizontally at a landscape. Such cameras have their use, but this system looks down vertically. Down-looking sensors are more comparable with satellite imagery, and are especially important in arid lands with significant bare soil between plants.

The field of view of each instrument is roughly circular, about one meter across. At this scale, a season-long recording can capture the greenness trend of an individual shrub or patch of grass. Comparing trends between instruments can show the effects of treatments such as supplemental watering or early removal of snow, or variations due to site parameters like aspect and slope.

The recipe

A "recipe" has ingredients, and then cooking instructions. We discuss what you need, and then how to put instruments together. In addition we cover management of the data from these instruments. All these, you may vary to taste.

Components

Instrumentation

Protection

Framework

There are three general categories of components:

* Framework: The supporting structure.
* Instrumentation: The sensors, recorders and other electronics mounted on to the framework.
* Protection: This is optional, but we deployed instruments in remote environments where there were small gnawing animals. We designed in protection for vulnerable parts such as sensor cables.

In addition, there are fasteners, but we discuss these along with the components they apply to.

We will discuss the frame, instrumentation, and protection for various alternative designs. Then we will give procedures for instrument deployment and data management.

Suppliers:

Onset Computer Corporation ("Onset"), <http://www.onsetcomp.com/>

Onset was the source for specialized instrumentation such as our data loggers and sensors, and some of the mounting hardware or alternatives.

Fastenal Company ("Fastenal), <http://www.fastenal.com/web/home>

Fastenal is a good source of fasteners such as nuts and bolts. Many of these would also be available at general hardware stores, but Fastenal can provide online one-stop shopping for large orders, especially with specifications such as stainless steel. A few parts, such as "U-bolt plates" (see the "Framework" and "Instrumentation" sections) we found only at Fastenal.

McMaster-Carr ("McMaster"), <http://www.mcmaster.com/>

McMaster provides general hardware for easy online ordering. They were the only source we found for some specialized items such as large junction boxes and stainless steel sleeving (see the "Protection" section).

Home Depot, <http://www.homedepot.com/>

An example of a general hardware source for online or in-store procurement. Similar large retailers would have many of the same items.