A New Plant Mapping Program for Arizona

Daryl L. Lafferty and Leslie R. Landrum
Arizona State University Herbarium
School of Life Sciences
Tempe, AZ 85287-4501

Distribution mapping is one of the most common uses of the SEINet (Southwest Environmental Information Network 2009) database, which uses Symbiota software (http://symbiota.org/tiki/tiki-index.php) to make Google maps. These are satisfactory for many purposes, but they usually are not appropriate for publications. For instance, for the family treatments in the Vascular Plants of Arizona project, we needed an outline base map showing all the counties. Daryl Lafferty has created a web-based program that generates these maps. The maps in turn can easily be copied into a manuscript. We are able to query the SEINet database of over 2 million specimens for its 400,000+ Arizona records that have been georeferenced.

Once this goal had been accomplished other ideas occurred to us. How about plotting the dots of distribution onto a relief map or a map of biotic communities? This proved interesting as distributions often coincided with topography or community type. How about mapping multiple species at once to see if their distributions are similar or complementary? This we can already do with SEINet but not with multiple map backgrounds. How about plotting several species of a particular vegetation type (e.g., mixed conifers or chaparral) together as a group so as to produce a map of a vegetation type?

These goals have been accomplished and maps can now be made; we provide instructions here.

1. Go to http://daryllafferty.com/PlantMap/ and you will see this screen:

Enter one to three genera or scientific names. Synonyms can be on one line, separated by semicolon. See below for examples

Submit

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Genus or full scientific names will work.
Examples:

Enter:	Will result in:
Pinus ponderosa;Pinus flexilis	Pinus ponderosa and Pinus flexilis.
Pinus	Pinus ponderosa, Pinus flexilis and all other specimens that start with Pinus.

2. In the rectangle in the upper left corner you can enter a name or names. For instance we might enter "Lupinus sparsiflorus" (author not included, name not in italics). Then click on submit and shortly a screen appears with an outline base map of this
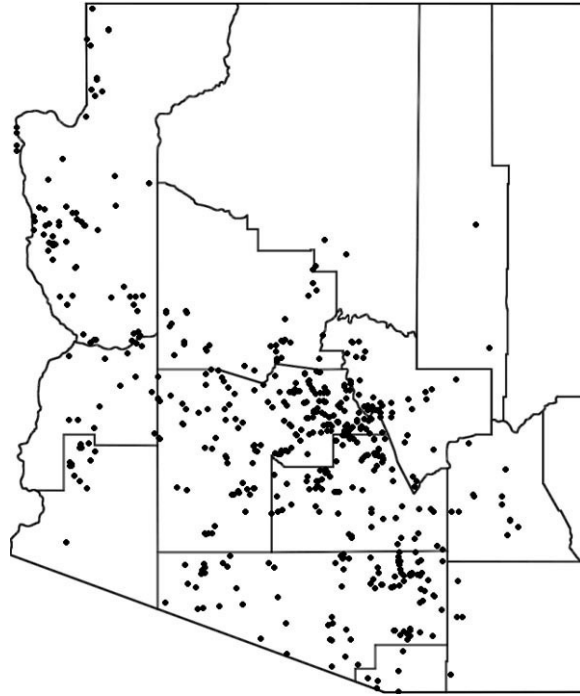
A New Plant Mapping Program for Arizona. Figure 1. Distribution of *Lupinus sparsiflorus* in Arizona according to the SEINet database.

species (Fig. 1). You can also use a generic name, for example, "Pinus" and all the species of *Pinus* will be mapped together with a single dot color.

Click on "Relief "or "Biotic Communities" below this base outline map and the maps in Fig. 2, A & B appear for *Lupinus sparsiflorus*. For more information about the biotic communities map see Brown et al. (2007).

In Fig. 2C we entered three species on separate lines in the program and mapped them on the relief map. These are *Pinus ponderosa* (red), *Rhus ovata* (black), and *Olneya tesota* (green) - upland forest, chaparral, and Sonoran Desert species respectively. In Fig. 2D, we have put a list of 10 species of high elevations on a single line separated by semicolons: *Picea engelmannii*; *Picea pungens*; *Abies lasicarpa*; *Abies bifolia*; *Pinus aristata*; *Populus tremuloides*; *Salix scouleriana*; *Pseudotsuga menziesii*; *Pinus strobiformis*; *Pinus flexilis*. Some of these names may be synonyms of each other, but it is necessary to use them in order to find all the specimens of a species that might be under either name. We used the biotic communities map and it is clear that these upland species correspond in many areas with the higher elevation biotic communities. When the objective is to show one to three distributions on a single map, each with its own color, put the names on separate lines. When the objective is to show a group of species of a particular vegetation type, put them on a single line, separated by semicolons. One line of names will wrap around in the box when it is long.

There is no limit to the number of dots that may appear on a map, but if there are multiple specimens from the same input line indicating a single locality, only the first specimen found in the database will be used. This prevents downloading redundant data

that will not be visible anyway. Specimens at the same location but from separate input lines, however, will be displayed, sometimes shifted incrementally to be made visible.
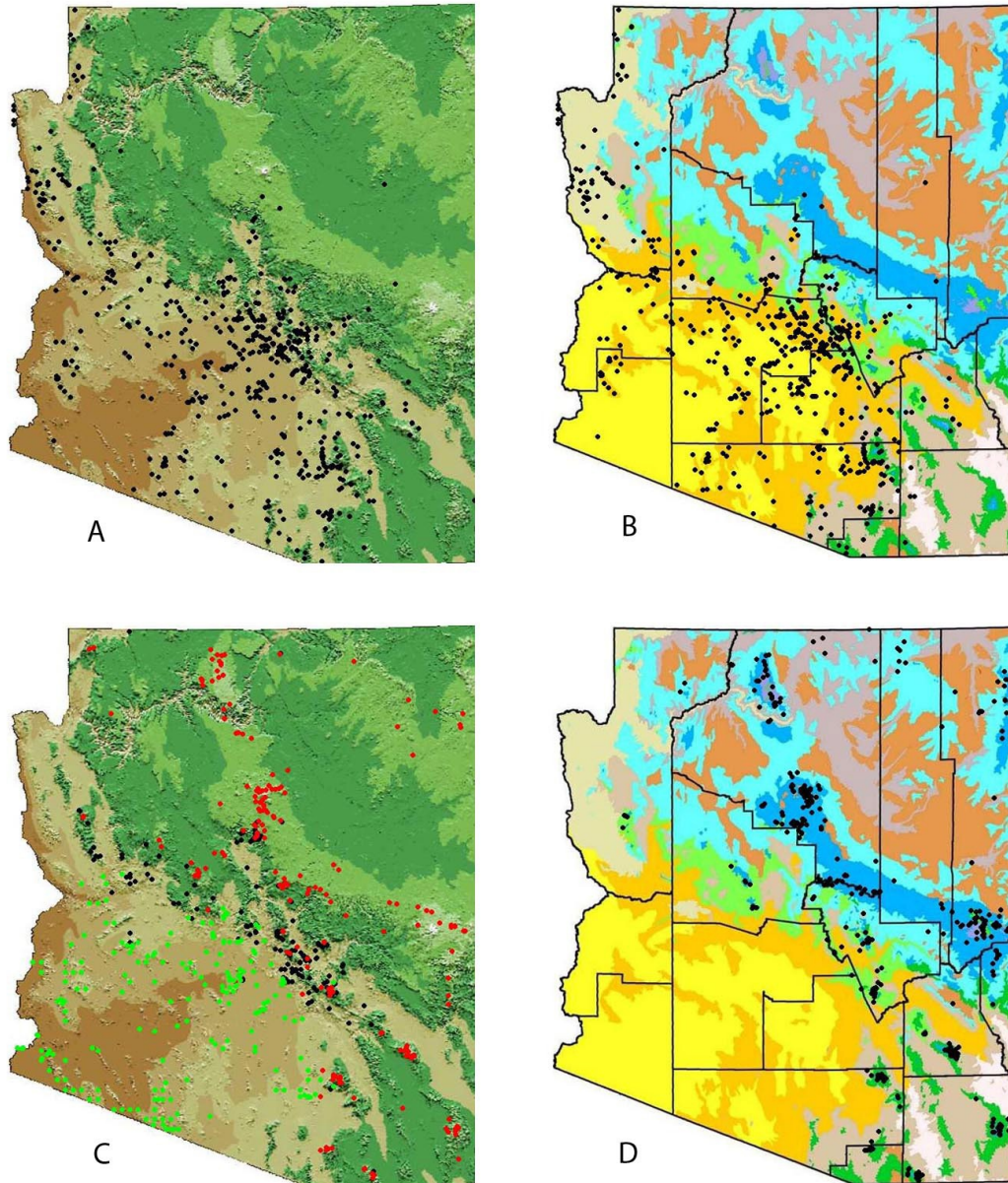
A New Plant Mapping Program for Arizona. Figure 2. A & B, distribution of *Lupinus sparsiflorus* in Arizona according to SEINet database on the relief map (A) and the biotic communities map (B); C, distributions of *Olneya tesota* (green), *Rhus ovata* (black), and *Pinus ponderosa* (red) on the relief map; D, distribution of various high-elevation species on the biotic communities map.

Any user of this program needs to know that there are occasional errors in georeferencing or identification and for a taxonomic or ecological publication it is important to confirm the validity of the dots. If you suspect a dot is misplaced or a specimen misidentified you can "mouse over" it and information about collector, number, herbarium, locality and date will appear. You may want to disregard some suspect dots or correct some georeferencing mistakes. Contact the curator of the collection in question (e.g., ASU, ASC, ARIZ, DES, etc.) if you are interested in making corrections.

We hope you find this program enjoyable and educational.

LITERATURE CITED

BROWN, D. E., T. C. BRENNAN, and P. J. UNMACK. 2007. A digitized biotic community map. *CANOTIA* 3(1):1–12,

SOUTHWEST ENVIRONMENTAL INFORMATION NETWORK. 2009. SEINet. http://swbiodiversity.org/seinet/index.php. Accessed October 2012.

APPENDIX 1.

List of scientific names used in this paper including authors. *Abies bifolia* A. Muir, *Abies lasicarpa* (Hook.) Nutt., *Lupinus sparsiflorus* Benth., *Olneya tesota* A. Gray, *Picea engelmannii* Parry ex Engelm., *Picea pungens* Engelm., *Pinus aristata* Engelm., *Pinus flexilis* James, *Pinus ponderosa* P. & C. Lawson, *Pinus strobiformis* Engelm., *Populus tremuloides* Michx., *Pseudotsuga menziesii* (Mirb.) Franco, *Rhus ovata* S. Wats., *Salix scouleriana* Barratt ex Hook.