Taxonomic concept mapping by non-specialists: insights from the Alaska Flora project

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Background

Several floristic treatments for Alaska exist, in which authors list plant names. However the precise meaning (i.e., circumscription) of a name can vary among those authors, causing confusion among users. It is the goal of this project to document this variation in name usage among key floras (Hultén 1968, Welsh 1974, Cody 2000, Flora of North America, Panarctic Flora 2020), while developing a documented workflow for such taxonomic usage mapping. Because of the great need for this work, we are also testing the workflow with non-specialists.

Taxon concept mapping (TCM) describes the relationships between two or more taxonomic concepts or circumscriptions (referenced by a name *plus* publication) (Franz. et al 2008, Weakley 2015).
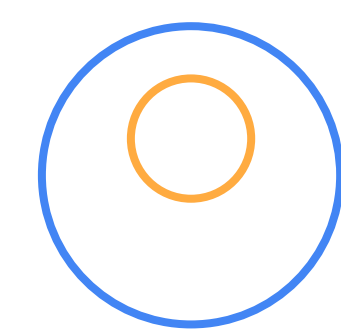
**There are different kinds of set relationships among circumscriptions:**
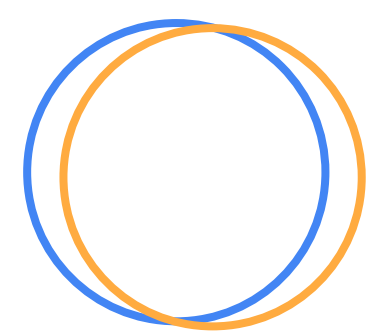
Congruent relationship

Two authors agree completely on the description of a taxon.
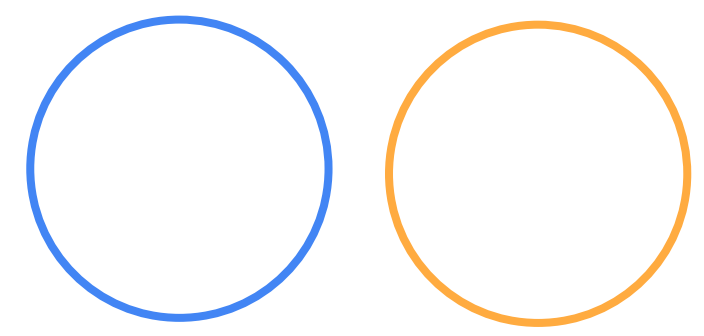
Disjunct relationship

Two authors disagree completely on the description of a taxon.

Including relationship

One author's circumscription is broader than another author's circumscription of a certain taxon.
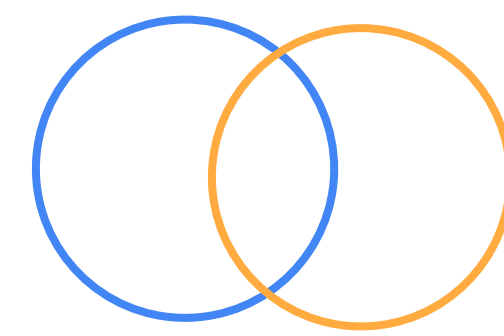
Overlapping relationship

Authors agree on a portion of the circumscription, but each circumscription also contains details that are not included in the others.

Workflow

Getting Started

1. Identify a taxon group (e.g. a genus) with some conflicts in taxon concepts among different authors. Some groups will not need ant TCM work.

2. Record all names listed in the most recent checklist (in our case, generally the Panarctic Flora), and related names in prior treatments.

3. Begin with taxon names/concepts that are the same across all treatments. For example, taxa that are all described at the species level with the same species name ('Simple Cases', upper right).

Mapping

4. Record relationships between individual concepts. Start with the most recent treatment and move backwards in time for each related name. Repeat for each taxon name/concept.

5. Once the taxon names/concepts with the most agreement have been recorded, repeat the same process with other taxon names/concepts that have less agreement through time.

Loose Ends

6. After all linear relationships have been recorded (for example, Author A to Author B to Author C), determine additional mappings from the most current concept to all previous concepts for which there are not congruent paths (e.g., Author A to Author C).

7. If possible, review the taxon concept map with an expert in that particular taxon.

Cases

Simple

Some cases are simple. Authors may have only slight disagreement over time, but overall have similar opinions. **See Graphs 1 and 2**.
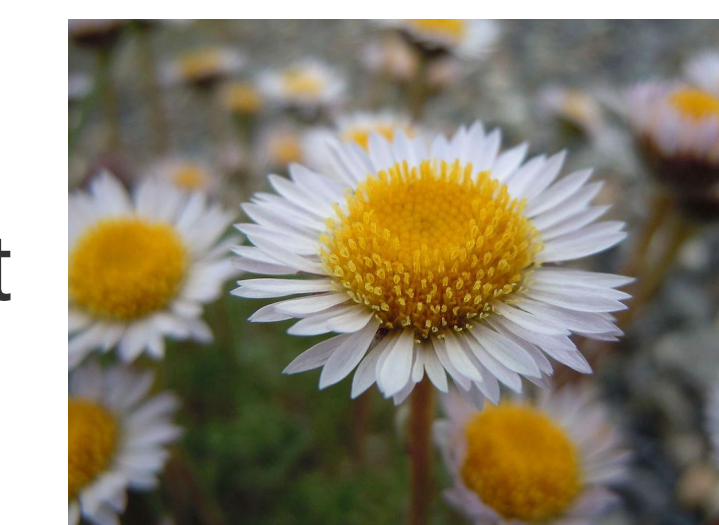
Complex

Other cases are complex. Authors can disagree widely about the circumscription of a given taxon, and also on the name applied to it. It is cases like this that illustrate the importance of this work. **See Graph 3**.

Erigeron compositus Pursh

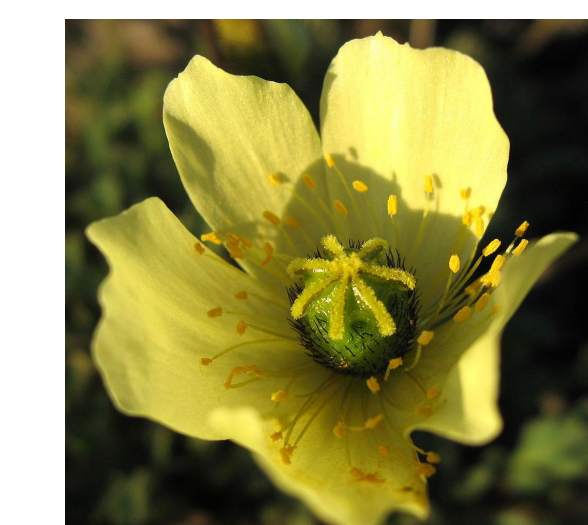*Erigeron* spp. relationships tended to be more linear in most cases. See Graphs 1-2.

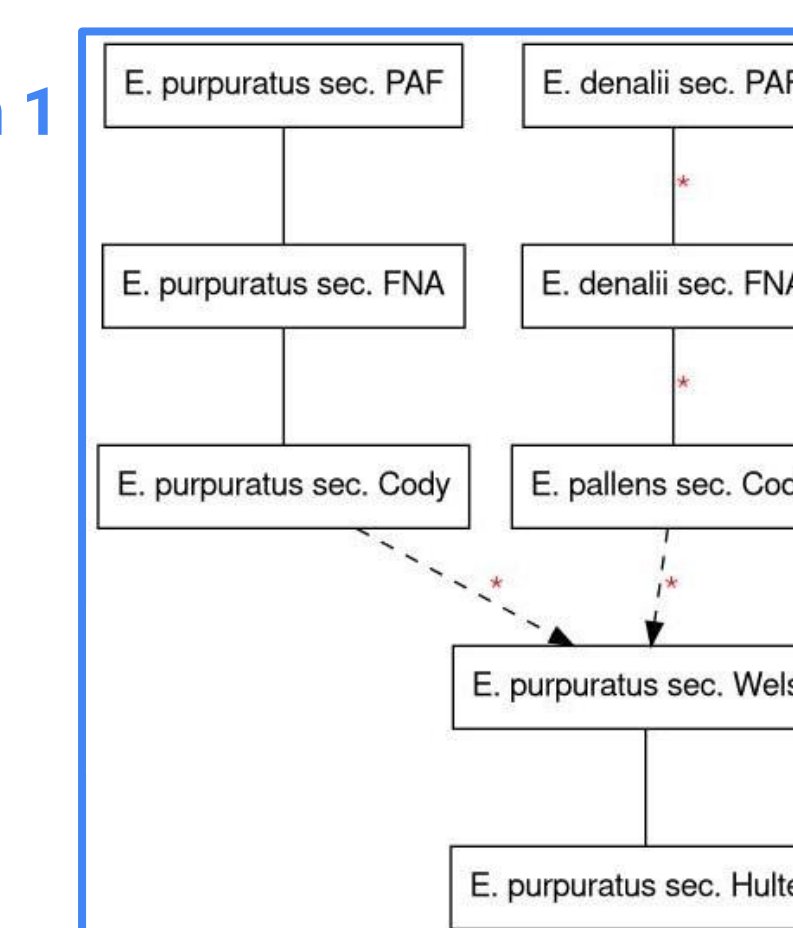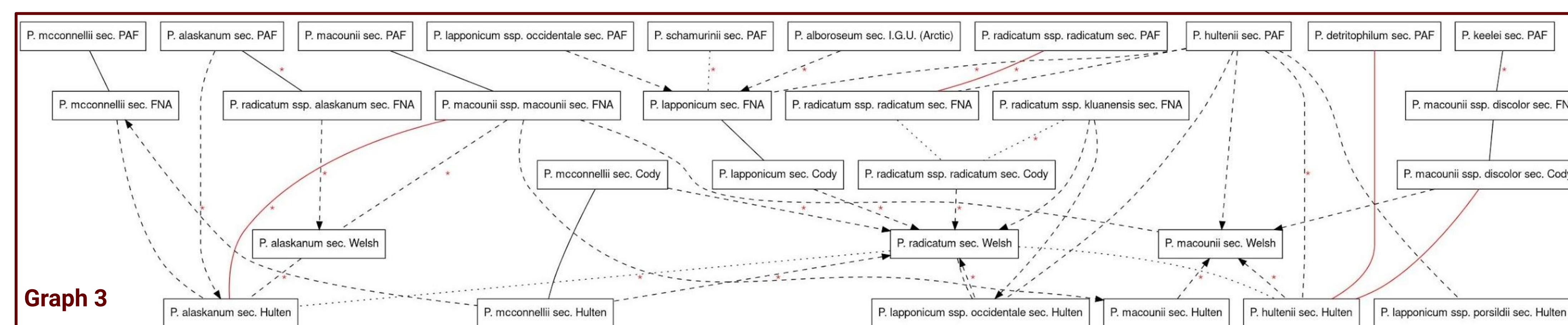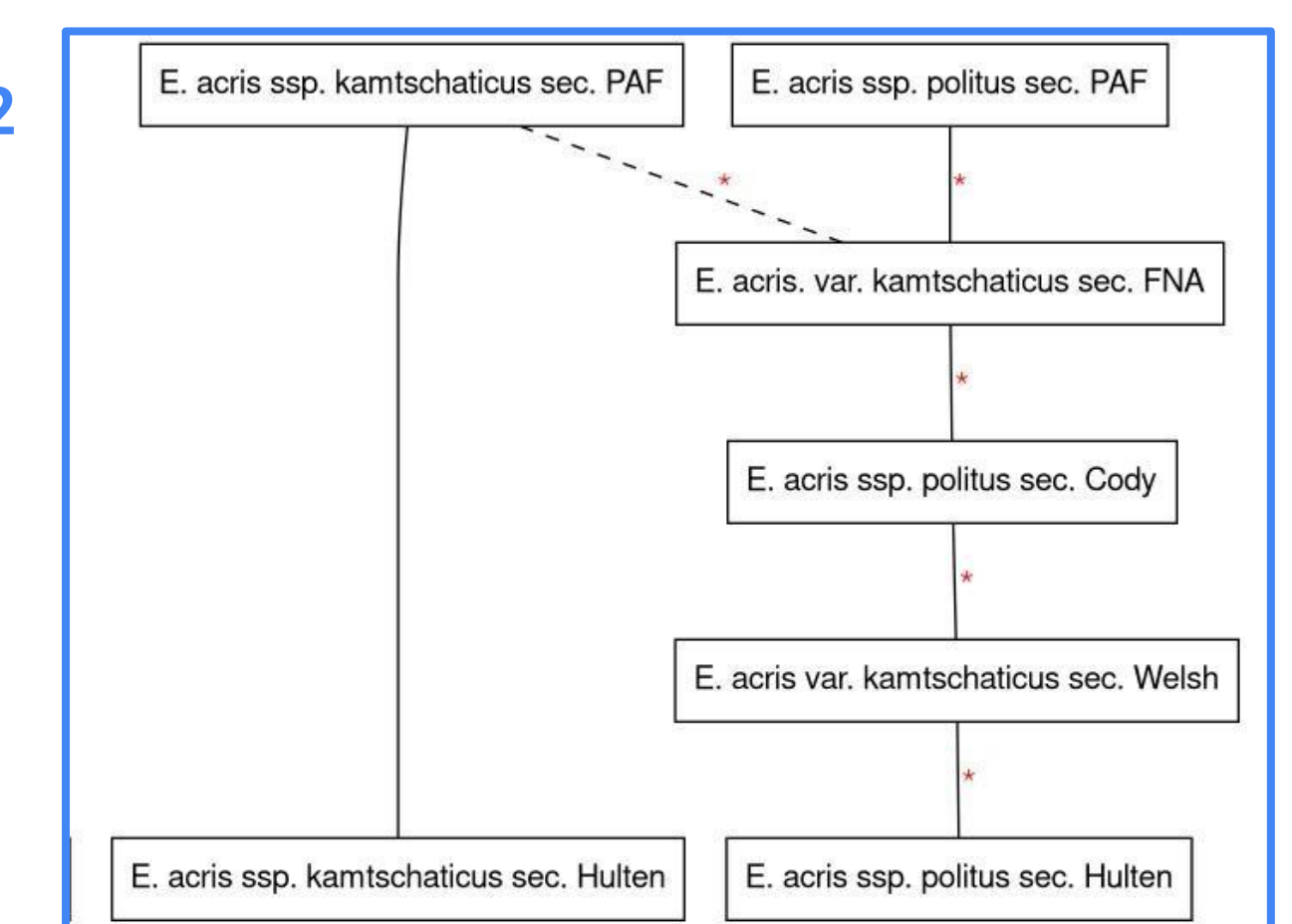*Photo by Matt Lavin, Wikimedia Commons*

Papaver radicatum Rottb.

This taxon proved to be difficult and quite messy. See Graph 3.

Photo by Kim Hansen, Wikimedia Commons

Graph 1 / Graph 2

Graph 3

How to read the graphs

Line descriptions (see also descriptions in Background)

Solid Black: congruent

Dashed Black: overlaps

Dashed Black with arrow: (*arrow from*) is included in (*arrow pointing to*)

Dotted Black: intersects

Solid Red: disjunct

Taxon names

"*Genus species* sec. Author A" can be read as Author A's concept (and/or circumscription) of taxon name *Genus species*.

Lessons Learned

Taxon concept mapping by non-specialists can be very successful. These skills are vital:

1. **Attention to detail.** Not all taxon treatments follow the same structure, details about geography and morphology can be hard to infer.

2. **Comprehension and logic.** The ability to "see the forest for the trees". Inferences about TC relationships are often based on multiple factors (e.g., morphology, synonymy, geography).

On the other hand, prior knowledge of botanical terminology is not required.