# A seasonal guide to the Flowering Plants of the Kamloops area





I had originally thought to call this photo album "*Wildflowers of the Kamloops area*", but "wildflower" is a very elastic term, with no precise meaning: for some it is restricted to herbaceous plants; others would include woody shrubs; still others would also include flowering trees— if perhaps only the smaller ones. So I wanted a more inclusive name to cover all of these.

I settled on calling it "*Flowering Plants of the Kamloops area*", although that too is problematic, because "*Flowering Plants*", is a phrase corresponding to the technical term *Angiosperms*, which means all plants with true flowers— yet this album excludes many such plants: the sedges, grasses and rushes, as well as most broadleaf trees. In the end I realized there was no easy way around the naming problem, so understand that this is simply a collection of plants united only by having, in the main, eye-catching flowers.

In the next pages there is an overview of what is included in this guide the number of species included, how many of them are native vs. alien, notes on their habitats & seasonal appearance, the geographical scope of the survey, and the numerical breakdown of the sample into their respective plant families— a sort of plant diversity profile.

Then follows a series of eight pages showing comparisons of several groups of easily-confused species, as an aid in distinguishing them.

From p. 20 on, is the main part of this photo-guide, with one page per species in order of their seasonal appearance. The entire list is broken into three blocks, as explained two pages below here. Finally, there are pages concerning plant evolution and classification

**404 species from 60 families** are recorded in this **2021** edition of the guide. Those species deemed native to BC are named in green (295 spp.; 73%); non-native (a.k.a. *alien* or *exotic*) species are named in orange (109 spp.; 27%). This status follows that given in e-Flora (ibis.geog.ubc.ca/biodiversity/eflora/), but authorities occasionally differ on status (*and* on species names too— so beware!)

This album is far from complete. I expect to add further species in years to come. Some errors in previous editions are corrected; some species names have changed; some species have been allocated to other genera and / or families; new species are added.

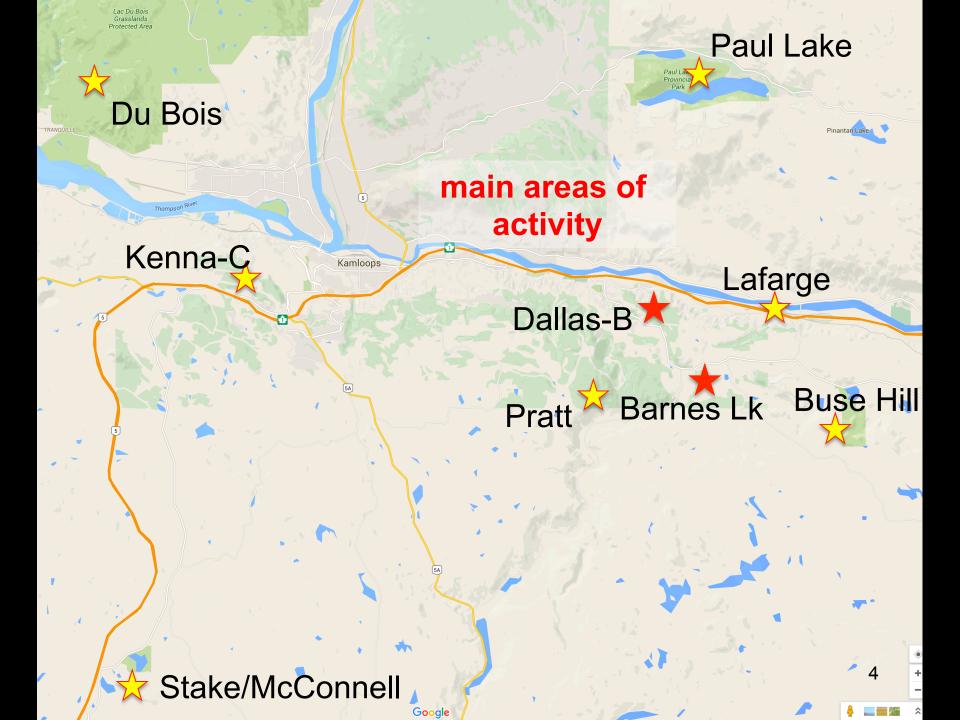


= Known to be present in the Dallas-Barnhartvale Park and/or Blackwell and/or Barnes Lake Trails areas – see map on the next page

On each species page, primary habitats are indicated by symbols, as follows:

- shores, riverbanks, moist areas in other habitats e.g. seeps, springs, pools;
- grasslands &/or scrublands &/or rocky slopes in other general habitats;
- open dry parklands with grasses, shrubs and scattered trees;
- open pine douglas-fir mixed woodlands;
- douglas-fir or mixed forest; can be dry to moist, open to closed;
- disturbed areas, roadsides, pastures, farmlands, etc.
- mountains, subalpine or alpine

(NB: invasive exotics are often found scattered in many other habitats where the native vegetation has been disturbed) © Paul Handford, 2016



## a By-The-Season structure

As in previous editions, species are arranged according to the timing of their *local onset of flowering*, from early spring, when Sagebrush Buttercup appears, through to early fall, when Rabbit-brush blooms.

Species don't replace one another in strict linear sequence, of course; rather, there will often be substantial overlap among them: many begin flowering at more or less the same time; some will have short, but others prolonged, blooming periods; some species bloom more than once, sometimes repeatedly; and flowering always depends on the local conditions of individual plants and the rate of advance of a given year's temperatures. But bearing these complications in mind, species may still be arranged pretty reliably by their *probable flowering onset*, even if they might differ greatly in how long they linger thereafter.

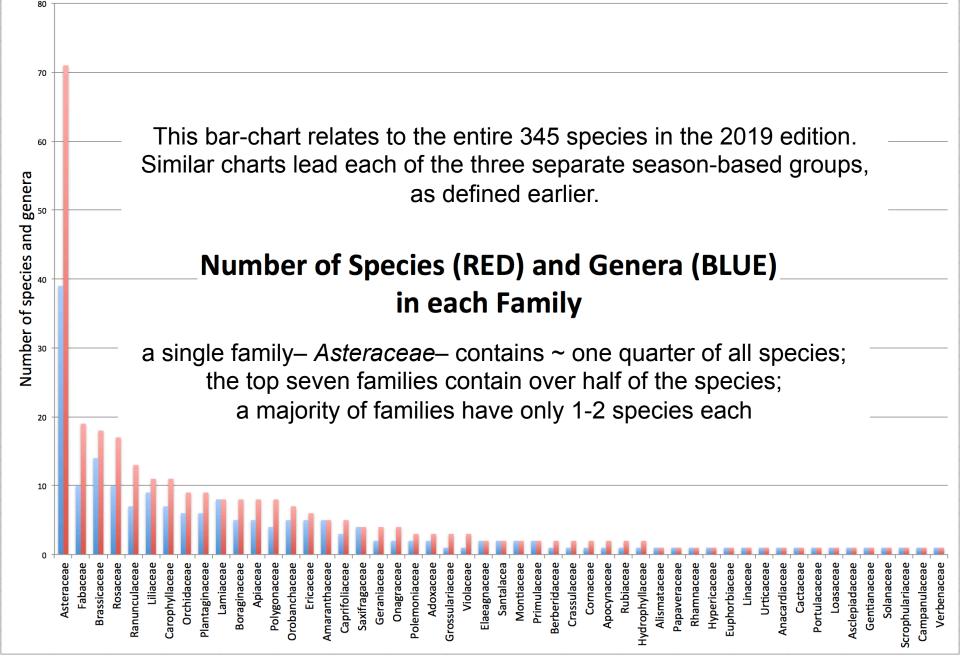
Since 2018, I have felt able to draw up a chart showing where the flowering period of each species is located in the calendar. This chart appears in an accompanying document, *Flowering Season 2021*; it shows my estimate of each species' *local* flowering peak, plus an indication of when early individuals and late stragglers might be found. It also shows published species limits taken from sources, such as websites of the *Flora of North America*, the *Burke Museum* & the *Jepson Herbarium*. Flowering calendar bars for individual species appear on each species' page, like this:



Based on this flowering season chart, I have broken up the total of ~400 species into three groups:
1. Species that start BEFORE the end of April;
2. Species that typically start AFTER the end of April; and 3. Species that usually start flowering AFTER the end of May. Inspection of each subgroup permits us to see how the composition of the flowering community might change through the year— in terms of family affiliations and exotic vs. native species. This is shown numerically and as bar-charts.

#### species new to this 2021 edition

Artemisia michauxiana Caltha leptosepala Cassiope mertensiana Claytonia rubra Crepis occidentalis Fragaria vesca Leptarrhena pyrofolia Lithophragma glabrum Luetkea pectinata Monarda fistulosa Peritoma serrulata Phemeranthus sediformis Phyllodoce glandulifolia Phyllodoce empetriformis Pulsatilla occidentalis Ranunculus eschscholtzia Rhododendron albiflorum Rosa canina Saxifraga ferruginea Sibbaldia procumbens Trollius taxus Epilobium lactiflorum (?)



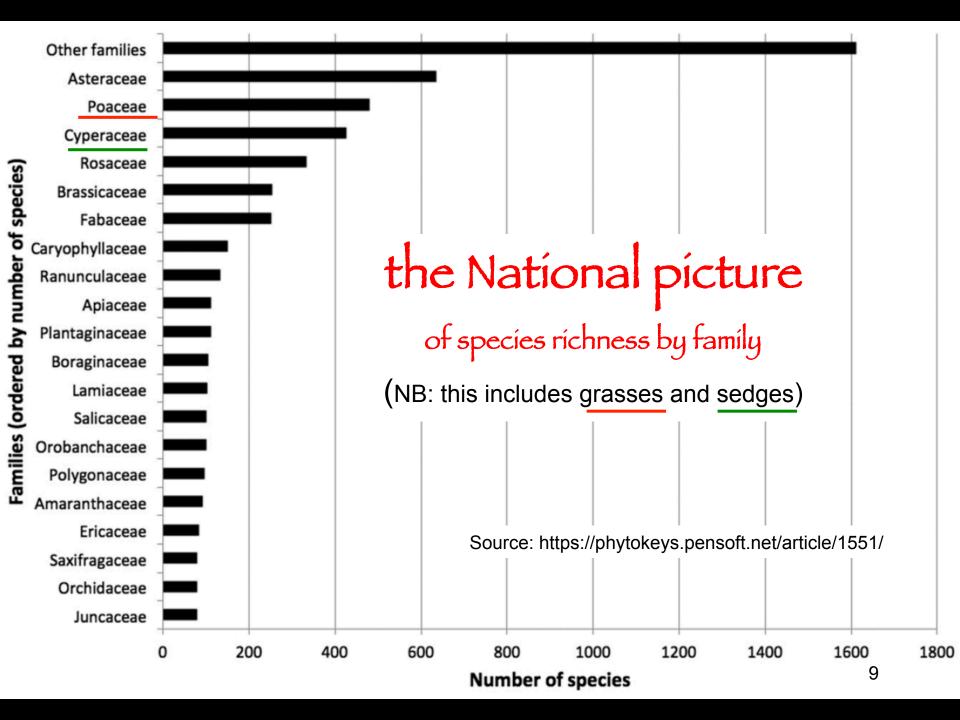
#### Families

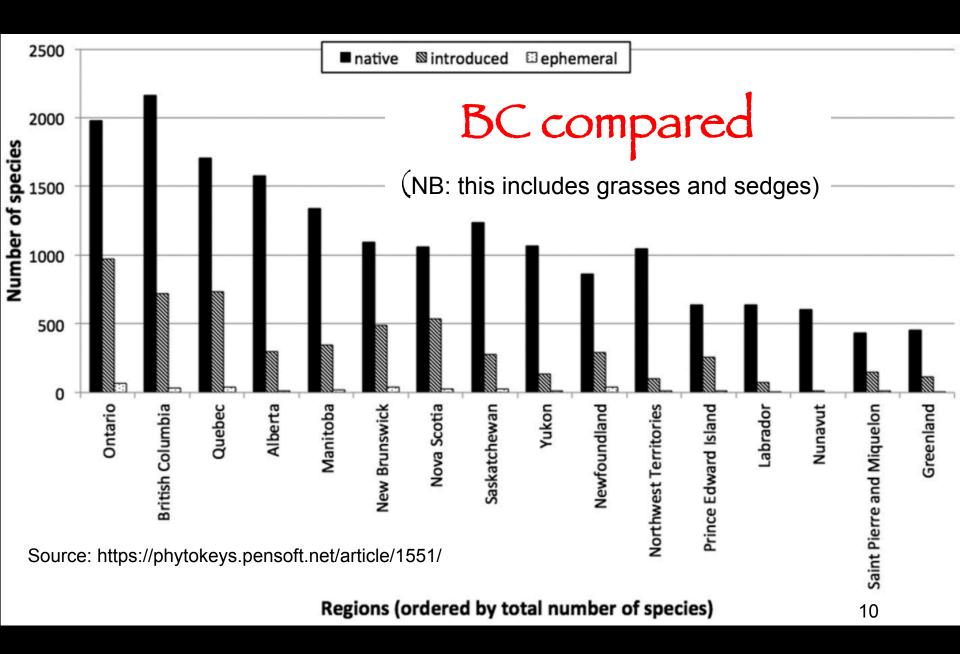
#### Family affiliation of the 700+ species recorded in Kamloops Forest District

(amloops for this plot, I took the species list for the Kamloops Forest District\*\* Merrit 120 Squamish then stripped out the plant groups that I exclude from my album Surrey Chilliwa (grasses, sedges, rushes, most trees, ferns, etc.) so as to 100 make the two lists refer to the same kind of plants (but no attempt was made to remove species from high elevations). 80 The similarity of this profile to that of my sample of our local flora on the previous page is obvious, with the same families (green box) dominating the sample. This lends confidence that the album provides a reasonably unbiased reflection of the flora of the region as a whole. \*\*<http://linnet.geog.ubc.ca/DB Query/RegionalResults.aspx?list=MOFR DIST&</p> region=Kamloops%20Forest%20District&vascular=1> Liliaceae aprifoliaceae noniaaceae ieraniaceae cardiaceae assicacea Drchidacea Apiacea oraginaceae anchacea olygonaceae ogetonaceae ssulariaceae Malvacea Violacea aryllidaceae Araliaceae Cornaceae ophyllacea pericacea Linaceae ncluacea taginacea Montiacea hulariacea bulariacea hamnacea Adoxacea Iridacea elanthiacea rvmacea antalacea solanacea ocynacea assulacea ntianacea oasacea Cactacea imulace Rubiace smatace oaragace oanulace volvulace eagnace phorbiace aloragace **Jrticace** aminace Dipsacace Marsiliace Najadace Ayctaginace elastrace charitaace dneriace -ythrace enyanthace **Myrsinace** erida

Williams Lake

100 Mile House





#### Comparíson of mat-forming Antennaría species - -

#### dímorpha

very compact discs, arcs or rings, tight\_to the ground; tiny narrow leaves; flower heads single per stem, not in clusters



open irregular mats, on or close to the ground; leafy stolons; spoonshaped <u>greenish-</u> <u>grey</u> leaves; several to many flower heads per stem, usually pink, in round clusters

rosea



loose groups; dark woody stems often visible; clusters of <u>silver-grey</u> wedge-shaped leaves usually raised 1" or so off the ground; few to several flower heads per stem in compact brown-edged clusters

*rosea* leaves usually distinctly **broader** than in *umbrinella* 

#### Comparison of Lomatium Desert Parsley species ambíguum geyerí

usually *branched*, erect <u>smooth</u> stems; open umbels usually yellow, occ. white or purplish, no involucels: leaves usually basal, divided 2-3 times into narrow linear leaflets; fruits narrow, linear, w/ narrow or absent wings







small compact umbels white or occ. purplish; all leaves basal, dark green, dissected & fern-like; fruits oblongelliptical w/ rather wide wings

*simple* erect stems;

single erect hairy stems; open yellow umbels, involucels present; leaves mostly basal, perhaps also on stems, divided 2-3 times into narrow linear leaflets; fruits oblong – broad elliptical, wings *narrow* to broad









stems branched near base, spreading or erect; *large* compact umbels, creamy white, occ. purplish; all leaves basal, grevish-green, dissected fern-like; fruits oblong-elliptical w/ narrow wings

#### Comparison of small Erigeron daisies : 1 compositus

simple erect flowerheads, 3-25 cm tall; 20-60 ray florets, <u>usually white</u> (can be pink or blue); leaves divided 1-4 x into 3s

[Apr - Aug]





erect flower-heads, usually simple, 5-30 cm tall; 20-45 ray florets, bright or pale yellow; leaves linear

[May - July]

simple to muchbranched erect flowerheads, 5-30 cm tall; 50-100+ ray florets, <u>usually white</u>, (can be pale pink or blue); leaves lanceolate; whole plant v. hairy

[May - July]







erect flower-heads, usually simple, 3-15 cm tall; 40-125 ray florets, white; leaves broad-lanceolate; trailing leafy stolons

[May - Aug]

#### Comparison of small Erigeron daisies : 2



#### corymbosus

simple or branched erect flower-stems, 10-50 cm tall; 35-65 ray florets, usually deep blue, or perhaps pink; leaves long, linear and tapering, mostly basal [May - July]

#### filifolius

simple or branched erect flower-heads, 10-50 cm tall; 15-50 ray florets, usually blue to purplish, can be pink or white; leaves linear to thread-like

[May - July]



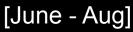


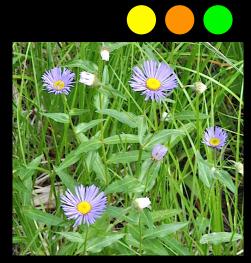
simple or multiple from base, erect to spreading hairy flowerstems, 10-40 cm tall; 75-150 ray florets, white to lilac, <u>buds</u> <u>nodding</u>; leaves hairy, spatulate

[May - July]

#### specíosus

simple or branched erect flower-heads, 15-80 cm tall; 75-150 ray florets, blue to purple, rarely whitish; basal leaves lanceolate to spoonshaped, stem leaves often broader but with pointed tip





#### Tricky Crepis and Hieracium species C. atribarba C. tectorum



erect stems, 15-70 cm, branched distally; flower heads have ~8-12 separated bright yellow ray florets,; lvs. linear, deeply cut into narrow segments

erect stems, 30-100 cm, branched distally; flower heads have many bright yellow ray florets; basal lvs. in short-lived flat rosette, stem lvs. linear, entire, clasping stem

[June - July]







#### H. cynoglossoides

[May - July]

erect stems, 30-100 cm, branched distally; flower heads have few to many bright yellow ray florets; lvs. lanceolate, stalked, grey-green usually densely hairy. basal lvs. persistent

[June - Aug]

#### H. umbellatum

erect stems, 30-100 cm, branched distally; flower heads have <u>many</u> bright yellow ray florets; basal lvs. soon wither, persistent stem lvs. lanceolate, entire or toothed, unstalked, often clasping [July – Sept]



#### Comparison of chickweeds, sandworts, and others: 1 Holosteum umbellatum

simple erect flowerstems, 5-35 cm tall; 2-16 flowers in terminal cluster; flowers white, 5-7mm, <u>raggedly frilled</u> <u>edge</u>; 1-2 cm oblonglanceolate leaves mainly in basal rosette

[Apr-May]





stems often prostrate, usually branched, forming mats, 7-50 cm long; white flowers single or in terminal clusters, <u>petals deeply</u> <u>cleft</u>, 2-3mm; leaves ovate to elliptical, 5-45mm long, hairy [Feb-Oct]

#### Stellaría nítens 🦳

simple to few-branched erect flower-stems, 3-25cm tall; white flowers in small clusters, *petals deeply* <u>cleft, shorter than</u> <u>narrow sharp sepals;</u> leaves linear to lanceolate [Apr-June]





often forms mats or clumps; erect to prostrate flower-stems, usually branched, 5-40 cm long; white flowers in small open clusters, petals 8-12mm, <u>strongly cleft</u>; leaves linear to lanceolate [Apr- Aug]

Cerastíum arvense

ALL PLANTS IN THIS FAMILY HAVE PAIRED OPPOSITE LEAVES + 5 PETALS © Paul Handford, 2016 16

#### Comparison of chickweeds, sandworts, and others: 2 Moehringia lateriflora

much-branched flowerstems, 4-20cm tall; white flowers in small clusters, petals eggshaped, 4-8mm; leaves elliptical to oblong, 3-30mm long





flower-stems branched, 3-30 cm tall; single to few white flowers in open cluster, petals deeply cleft, 3-8mm long; leaves pointed, linear to lanceolate, rather stiff & shiny [May - Aug]

[May - Aug]

#### Arenaría serpyllífolía

usually much-branched flower-stems, erect to prostrate; flowers white, petals narrow, ovate, ~2mm; leaves opposite, ovate to lanceolate, sharppointed

[May - July]





Silene menziesii

flower-stems curving up or down, branched, 5-70 cm long; flowers white, 2-3mm, cleft halfway or more, in open clusters; leaves lanceolate with long points, 2-20cm long

[March - Sept]

ALL PLANTS IN THIS FAMILY HAVE PAIRED OPPOSITE LEAVES + 5 PETALS © Paul Handford, 2016 17

# Comparison of the smaller upland Artemisia species dracunculus campestris frigida Image: Comparison of the smaller upland Artemisia species Image: Comparison of the smaller upland Artemisia Image: Comparison of the smaller upland Artemisia species Image: Comparison of the smaller upland Artemisia Image: Comparison of the smaller upland Artemisia species Image: Comparison of the smaller upland Artemisia Image: Comparison of the smaller upland Artemisia species Image: Comparison of the smaller upland Artemisia Image: Comparison of the smaller upland Artemis



plant slightly to *strongly* aromatic; stems simple, erect, *brown*, 50-150 cm; many greenish flower heads in long *open- branched* inflorescence; leaves *green*; early basal leaves strap-like, often 3divided, soon lost; *stem leaves green*, *abundant*, *linear to oblong* 



plant slightly to non-aromatic; stems simple, erect, *grey-green* turning red-brown, 10-100 cm; many yellow-green flower heads in *narrowly branched* inflorescence; leaves greyish green, largely basal, fairly long, 2-3 times cut into fine segments



plant strongly aromatic; stems simple erect, usually white-grey, 10-40 cm; several to many whitish flower heads with bright yellow florets; basal leaves soon lost; stem leaves silvery greyish green divided 2-3 times into short, very fine linear to thread-like segments

### comparison of Astragalus species: leaf-length; leaflet number, size, & form



4-10 cm; 11-23; 5-20 mm.; elliptic



5-15 cm; 11-25; 10-20 mm.; rounded



3-9 cm; 11-21; 10-20 mm.; oblong; red-brown stems



3-15 cm; 7-21; 5-30 mm.; linear



2-15 cm; 5-19; 5-20 mm.; lanceolate, pointed, white-woolly



5-12 cm; 7-19; 10-30 mm.; narrow-oblong © Paul Handford, 2019



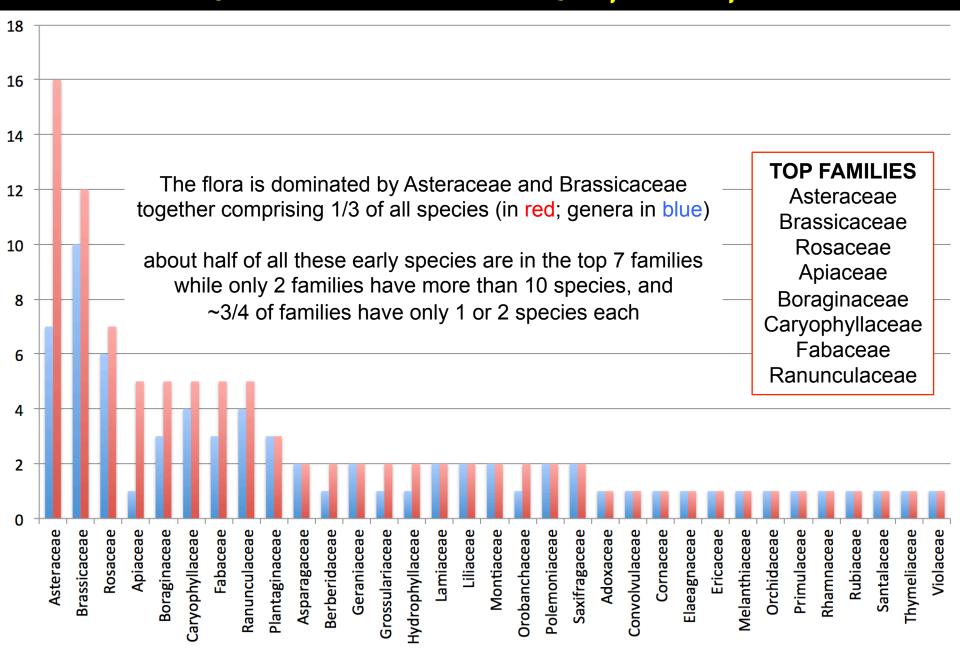
3-8cm; 9-25; 8-25 mm.; narrow-lanceolate; red-brown stems

Group 1 species begin flowering before end-April

Of these 111 species, 89 are native (79%), and 23 are alien (21%)

Some species begin flowering from as early as mid-February, though most flower strongly in April & May, with some reaching well into June, and a few as far as July, with some stragglers lingering into fall.

#### Family Breakdown of Early Spring Species



Sagebrush Buttercup *Ranunculus glaberrímus* 

Group 1 (in 2016 first seen 8 Feb!)

Ranunculaceae Buttercup famíly





#### Geyer's Desert Parsley Lomatium geyeri [March – May]



Apíaceae Carrot famíly

MAR APR MAY JUN JUL

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See page at the end of Introduction for a comparison of similar *Lomatium* species

Group 1 23 © Paul Handford, 2015



# Lily family



once pollinated, flowers turn orange



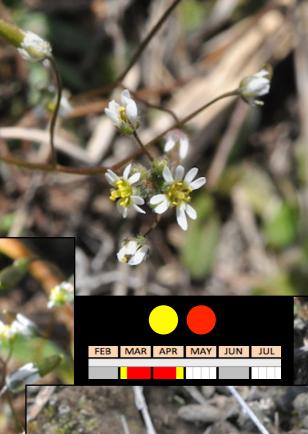
six weeks after flowering the fruit dries and opens



a month after flowering the stalk straightens, raising the fruit upright

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Spring Draba Draba verna Brassicaceae Mustard family







Collins' Sun-cress *Boechera collinsii* 

Brassicaceae Mustard family Group 1

*Boechera* species used to be placed in *Arabis.* These taxa are much given to hybridization and thus very difficult to identify with certainty

> this small, early-flowering sun-cress often has multiple flowering stems with loose terminal raceme of a few white to lilac flowers on longish pedicels











Hornseed Buttercup *Ranunculus testículatus* Ranunculaceae Buttercup famíly



#### Group 1



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Líttlebells Polemonium Polemonium micranthum Polemoniaceae Phlox family







Small-flowered Blue-eyed Mary Collínsía parvíflora Plantagínaceae Plantain family

recently moved from Orobanchaceae







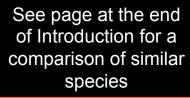
#### Dwarf Montía *Montía dichotoma* Montíaceae - Purslane family

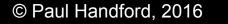
#### Group 1

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Avalanche Lily Erythronium grandiflorum

Lílíaceae Líly famíly

FEB MAR APR MAY JUN JUL AUG SEP

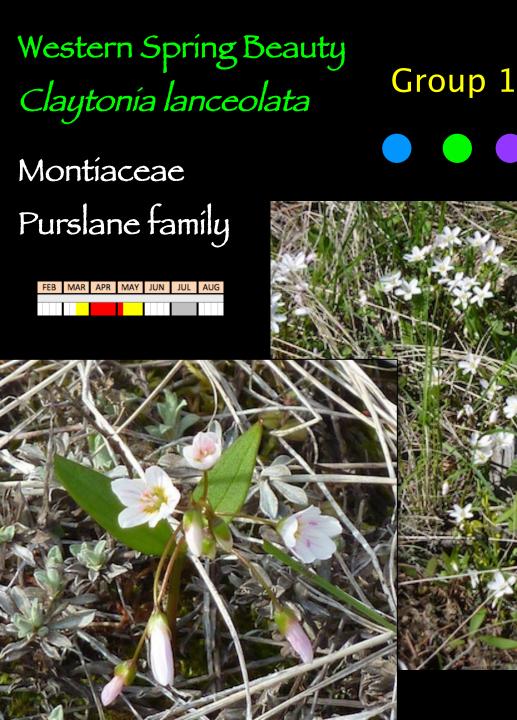


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<sup>©</sup> Paul Handford, 2016





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#### Meadow or Peak Saxífrage Saxífraga (Mícranthes) nídífica

fruits appear ~3 weeks after flowering



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Asteraceae Sunflower family













FEB MAR APR MAY JUN JUL

Brassicaceae - Mustard family

Clasping Pepperweed

Lepídíum perfolíatum

this plant is notable in the dramatic difference in shape between its early vegetative leaves (below) and those on the later flowering stems

Group 1

Pink Twink, Slender Phlox Microsteris (Phlox) gracilis Polemoniaceae Group 1 Phlox family [March – June]







Large-fruited Desert Parsley Lomatium macrocarpum

Carrot family



See page at the end of Introduction for a comparison of similar *Lomatium* species

#### Group 1 \_\_\_\_\_ 41 © Paul Handford, 2016

Small-flowered Woodland Star Lithophragma parviflorum Saxifragaceae Saxifrage family

> very similar to *Lithophragma glabrum* which has more deeplycleft, sharply-tipped petals & barrel-shaped calyx



Smooth Woodland Star *Líthophragma glabrum* 

Saxífragaceae Saxífrage famíly

MAR APR MAY JUN JUL

very similar to *Lithophragma parviflorum*; which has less deeply-cleft, blunt-tipped petals & goblet-shaped calyx









Umber Pussytoes Antennaría umbrínella

Asteraceae Sunflower family



See page at the end of Introduction for a comparison of similar *Antennaria* species

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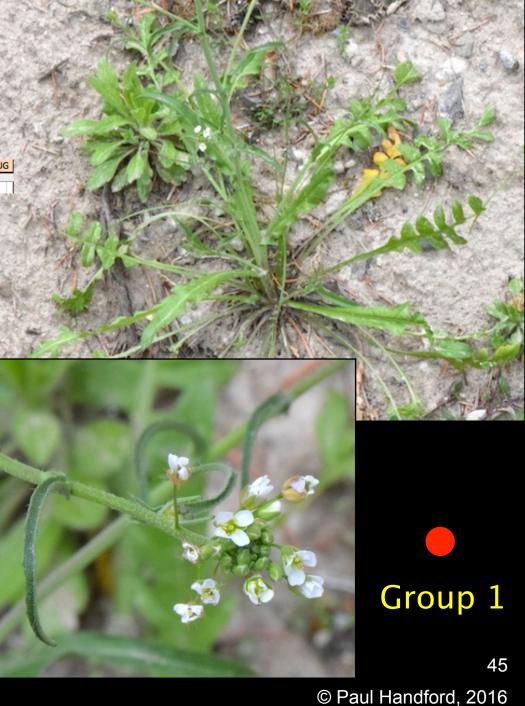


loose open mats w/dark woody stems; silvergrey wedge-shaped leaves often raised 1+" off the ground; several round brown-edged flower heads in compact cluster Shepherd's Purse 🔆 Capsella bursa-pastorís

Brassicaceae Mustard family







Berberídaceae Barberry famíly Tall Oregon Grape *Mahonía aquífolíum* 



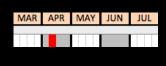
Low Pussytoes Group 1 Antennaría dímorpha • • •

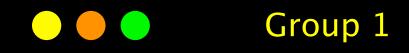
#### Asteraceae Sunflower family

compact mats, arcs, or rings, close to the ground; tiny narrow leaves; flower heads single

> See page at the end of Introduction for a comparison of similar *Antennaria* species

Long-flowered Bluebell Mertensía longíflora Boraginaceae Borage family





Woodland Draba Draba nemorosa Brassicaceae Mustard family Group 1 MAR APR MAY JUN JUL FEB 

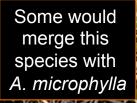




## Rosy Pussytoes Antennaría rosea Asteraceae Sunflower famíly



open mats, on or close to the ground; spoon- or wedgeshaped greenish leaves; several to many ellipsoidal silvery-white or pink flower heads in compact clusters



See page at the end of Introduction for a comparison of similar *Antennaria* species

Cut-leaf Daisy Erigeron compositus Asteraceae

#### Sunflower family

See page at the end of Introduction for a comparison of similar *Erigeron* species



Group 1 51 © Paul Handford, 2016

## Dangling Sun-cress Boechera retrofracta

#### Brassicaceae Mustard family

Boechera species used to be placed in Arabis. These taxa are much given to hybridization and thus difficult to identify with certainty

> this sun-cress flowers in later spring, usually with single tall flowering stems, with an elongated raceme with many white to lilac flowers, each on very short pedicels; the fruits typically all hang on the same side of the stem



Group 1 52 © Paul Handford, 2016 Dangling Suncress Boechera retrofracta Brassicaceae Mustard family [April – June]

Boechera can become infected with the rust fungus *Puccinia monoica*, which sterilizes the plant, so it can produce no flowers. It also causes the host plant to turn its leaves into bright yellow pseudoflowers, which also reflect UV light, visible to bees.

These pseudo-flowers secrete nectar that attracts insects, which distribute fungal reproductive structures among receptive plants, advancing the fungal life-cycle, next leading to the infection of *Stipa* grasses, the alternate host plant species, where the rust eventually produces spores that once again infect *Boechera* individuals, completing the rust life cycle.

this species usually produces its own genuine flowers in April, but these yellow *pseudo-flowers* often appear early in March, along with sagebrush buttercups & yellowbells



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# Red Elderberry - Sambucus racemosa

Adoxaceae Viburnum famíly







#### Group 1













Shiny Starwort *Stellaría nítens* Caryophyllaceae Pínk famíly

#### Group 1

MAR APR MAY JUN JUL

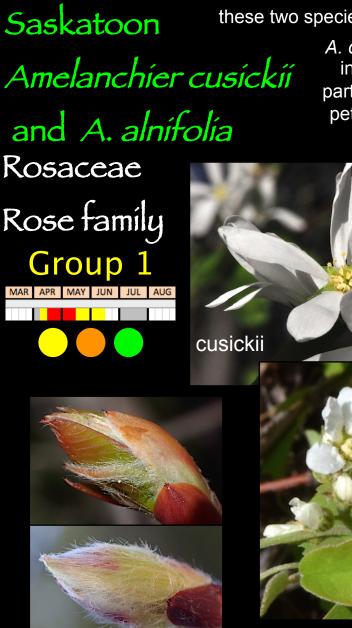
See page at the end of Introduction for a comparison of similar species



*Schoenocrambe línífolía* Brassicaceae Mustard family

Plains Mustard

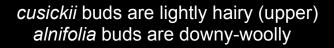
# Group 1



these two species are very similar, recently recognized as distinct

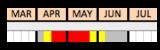
A. cusickii is mainly found in lower, warmer, drier parts, has longer, narrower petals, and flowers ~2-3 weeks earlier

alnifolia



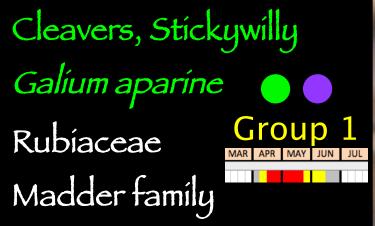












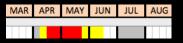






Arrow-leaved Balsamroot Balsamorhíza sagíttata

#### Asteraceae Sunflower family



# Group 1

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# Fairyslipper Calypso bulbosa

Orchidaceae Orchid family







#### Group 1

Lesser GromwellGroup 1Lithospermum incisum•Boraginaeae - Borage family

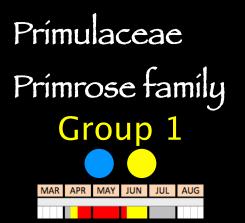




| MAR | APR | MAY | JUN | JUL |
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|     |     |     |     |     |
|     |     |     |     |     |

before flowering, this plant resembles golden-aster, *Heterotheca villosa,* but differs in its smooth pale green stems







© Paul Handford, 2016

rare whiteflowered specimen



Few-flowered Shooting Star Dodecatheon pulchellum <sub>66</sub> Corn Gromwell

Líthospermum arvense

Boraginaceae Borage family







Group 1 Mar Apr May JUN JUL







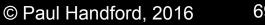


Flixweed Descuraínía sophía Brassicaceae Mustard family



FEB





### Brassícaceae Mustard famíly

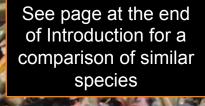


Pale Alyssum *Alyssum alyssoides* 

Jagged Chickweed Holosteum umbellatum Caryophyllaceae Pink family

Group 1

MAR APR MAY JUN





Pale Comandra *Comandra umbellata* Santalaceae Sandalwood famíly







this plant is parasitic on the roots of *Festuca* and *Stipa* grasses



Lemonweed



## Líthospermum ruderale

## Boraginaceae – – Borage family Group 1



emerging shoots resemble those of *Castilleja thompsoni*, except in being smooth & pale green



fruits develop two months or so after the flowers appear

Grape Hyancith *Muscari botryoides* Asparagaceae Asparagus family





### Creeping Oregon Grape Mahonia repens







Berberídaceae Barberry famíly

Group 1

fruits develop ~2 months after the flowers appear

Fern-leaved Desert Parsley Lomatíum díssectum Apíaceae Carrot famíly

Group 1

MAY JUN JUL

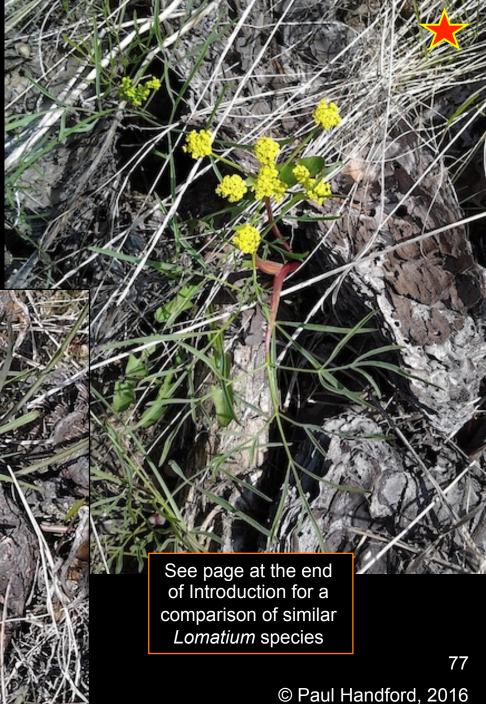
MAR APR



Carrot family









Hooker's & Rough-fruited Fairybells, *Prosartes hookeri P. trachycarpum* 

AUG

Liliaceae

Lily family

P.h.

P.t.

Group 1

two <u>very</u> similar species; *P.h.* found in moist forests; *P.t.* in drier forests, edges, clearings

best distinguished w/ hand lens– *P.h.* leaf hairs point forwards, *P.t.* leaf hairs point outwards. P.t. fruits rough, P.h. fruits smooth







Mountaín, or Sticky Tansy-mustard *Descuraínía íncisa* 

Brassicaceae - Mustard family



Group 1

APR MAY JUN JUL

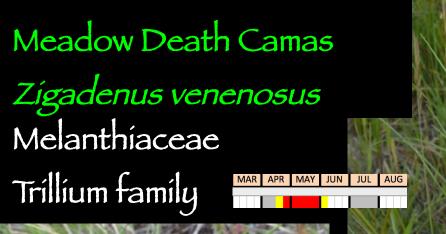
Common Dead-nettle Lamíum amplexícaule

Lamíaceae Mínt famíly













Swale Desert Parsley Lomatíum ambíguum

Apíaceae Carrot famíly

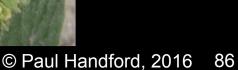
See page at the end of Introduction for a comparison of similar *Lomatium* species







Silverleaf Phacelia Phacelia hastata Hydrophyllaceae Waterleaf family



MAR

APR MAY

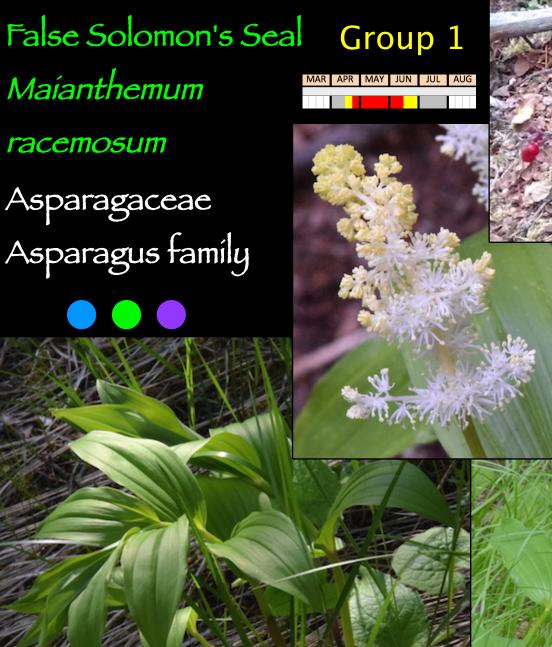
Group 1

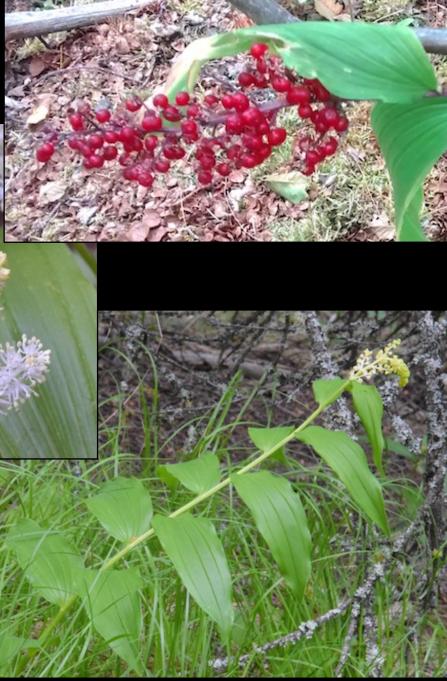
JUN

JUL

AUG

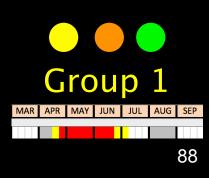
SEP





Field Chickweed *Cerastium arvense* Caryophyllaceae Pink family

See page at the end of Introduction for a comparison of similar species



Harsh Red Paintbrush Castilleja hispida

Orobanchaceae Broomrape family





fruits develop two months or so after the flowers appear



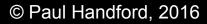
© Paul Handford, 2016

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Common Yarrow Achillea millefolium Asteraceae Sunflower family Group 1



yarrow flower-heads are usually brilliant white, but occasionally they can be pale to deep pink or cream



# Field Pennycress *Thlaspi arvense*

# Group 1





Brassicaceae Mustard family

Red-stem Spring Beauty Claytonía rubra

Montíaceae Purslane famíly



Fuzzy Sun-cress Boechera paucíflora Brassicaceae Mustard family

> Flora of N. Am. suggests this is an apomictic species derived from hybridization between B. retrofracta and B. sparsiflora. It has fewer flowers, longer & less strongly decurved pedicels than B. retrofracta, and the pedicels and sepals are notably hairy.

> > MAR

APR

Group 1 © Paul Handford, 2016

MAY JUN JUL

Black Raspberry *Rubus leucodermís* Rosaceae - Rose famíly







Common Speedwell Veronica officinalis Plantaginaceae Plantain family





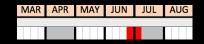


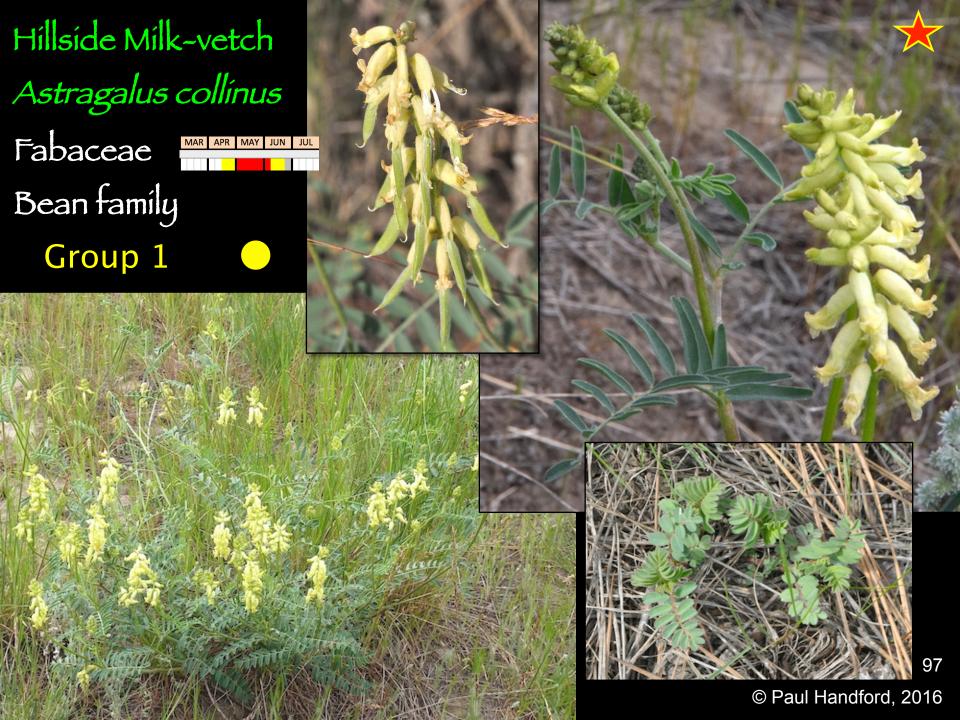
Group 3

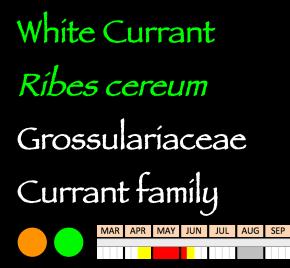


Mountain Sweet-cicely *Osmorhíza berteroi* Apíaceae - Carrot family Group 3













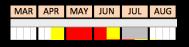


#### Group 1 98 © Paul Handford, 2016

#### Western Stickseed

# Lappula occídentalís (L. redowskíí)

Boraginaceae Borage family





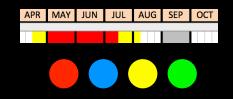




#### Group 1

Common Red Paintbrush *Castilleja miniata* Orobanchaceae Group 1 Broomrape family





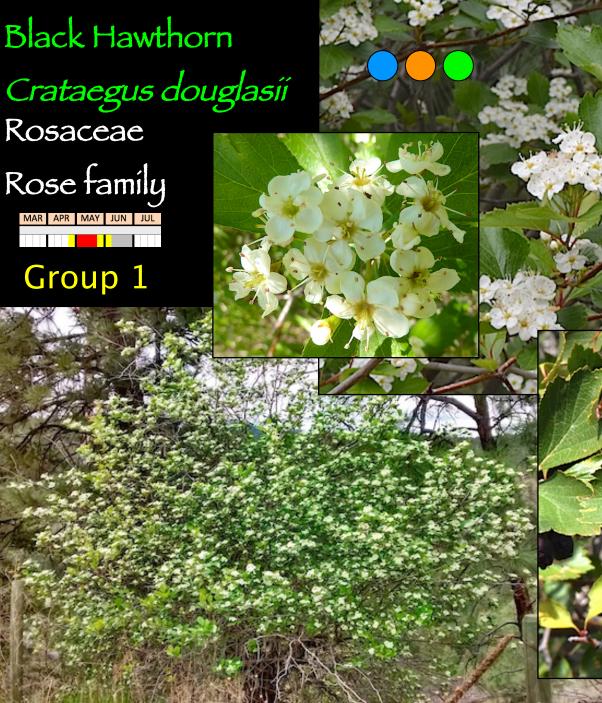


Robert's Geraniumn, or Herb Robert *Geranium robertianum* 





Geraníaceae Geraníum famíly 101





Racemose Pussytoes Antennaría racemosa



Asteraceae Sunflower family





#### Group 1

### Wild Strawberry

# Fragaria virginiana

*F. vesca*, wood strawberry, is very similar, distinguishable by its projecting terminal leaf-tooth

# © Paul 1

## Group 1



Rosaceae

Rose family

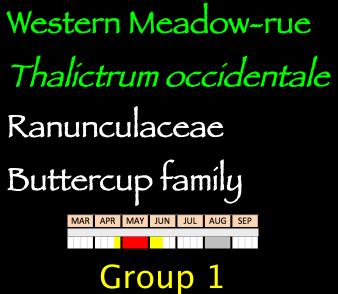
Fíeld Loco-weed *Oxytropís campestrís* 







## Group 1 Mar apr may jun jul aug



Rosaceae - Rose family

Choke Cherry *Prunus vírgíníana* 

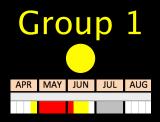
# Group 1



Asteraceae Sunflower family



See page at the end of Introduction for a comparison of similar *Erigeron* species







Shrubby Penstemon Penstemon frutícosus

#### Plantagínaceae Plantaín famíly

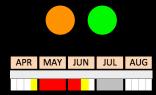
recently removed from Orobanchaceae

| APR | MAY | JUN | JUL | AUG | SEP |
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Howell's Pussytoes Antennaría howellí





#### Group 1

Asteraceae Sunflower famíly

Fine-leaved Daisy *Erigeron linearis* Asteraceae Sunflower family



See page at the end of Introduction for a comparison of similar *Erigeron* species Nodding Microseris

*Mícroserís nutans* Asteraceae - Sunflower family







# Upland larkspur Delphinium nuttallianum





Ranunculaceae Buttercup family Group 1



See page at the end of Introduction for a comparison of similar species



## Caryophyllaceae Pínk famíly

### Common Plantaín *Plantago major* Plantagínaceae Plantaín famíly

| MAR | APR | MAY | JUN | JUL | AUG | SEP |
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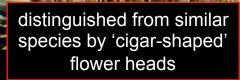
#### Group 1

# Field Bindweed Convolvulus arvensis Convolvulaceae Bindweed family



#### Group 1

Nuttall's Pussytoes *Antennaría parvífolía* Asteraceae Sunflower famíly



Group 1

© Paul Handford, 2016 117

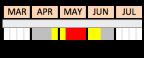




Common Bugle *Ajuga reptans* 

Lamíaceae Mínt famíly





## Group 1

Thread-leaved Phacelia Phacelía línearís Hydrophyllaceae Waterleaf family







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Stork's-bill••••Erodium cicutariumGeraniaceaeGroup 1Geranium family



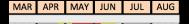




Heart-leaved Arnica Arnica cordifolia Asteraceae Sunflower family



Group 1







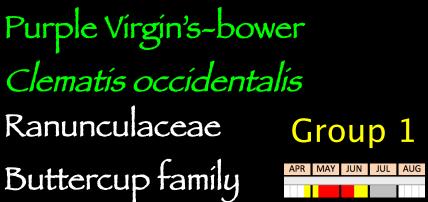
Red-osier Dogwood Cornus (serícía) stolonífera

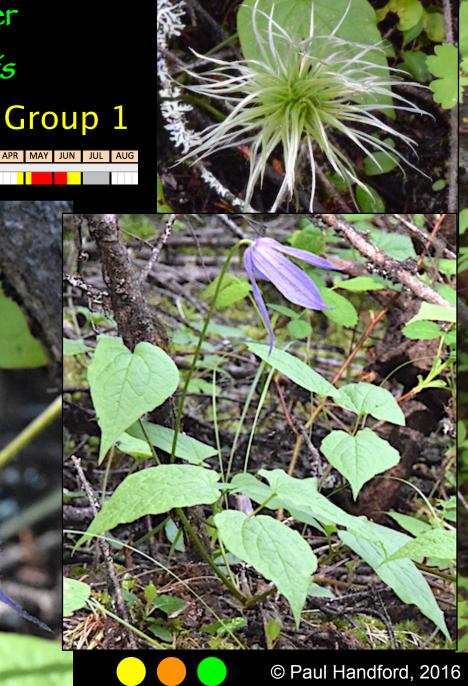
Cornaceae Dogwood family

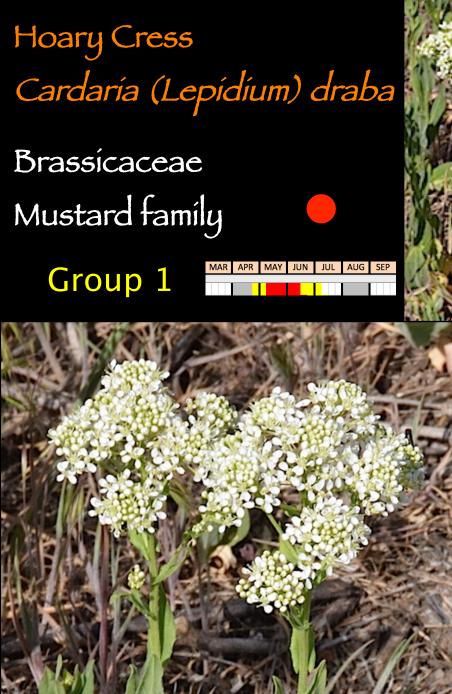














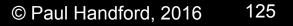
#### Snowbrush *Ceanothus velutínus*



#### Rhamnaceae Buckthorn famíly

| APR | MAY | JUN | JUL | AUG | SEP | OCT |
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#### Group 1



# Silky Lupine Group 1 Lupinus sericeus

Fabaceae

Bean family

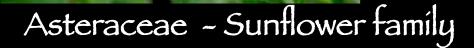
APR MAY JUN JUL AUG SEP



flowers range from purple to white

Showy Pussytoes Antennaría anaphaloídes

APR MAY JUN JUL AUG



This species used to be regarded as a subspecies of *A. pulcherrima* © Paul Handford, 2016



Thompson's Paintbrush Castilleja thompsoni Orobanchaceae Broomrape family



emerging shoots resemble those of *Lithospermum ruderale*, except in being hairy & often reddish (above)



© Paul Handford, 2016

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Slender Mountain Sandwort Eremogone capillaris Caryophyllaceae Pink family

# Group 2

Thread-leaved Daisy Erigeron filifolius Asteraceae • • • • Sunflower family

> in winter/early spring, they resemble Antennaria umbrinella



#### Group 1

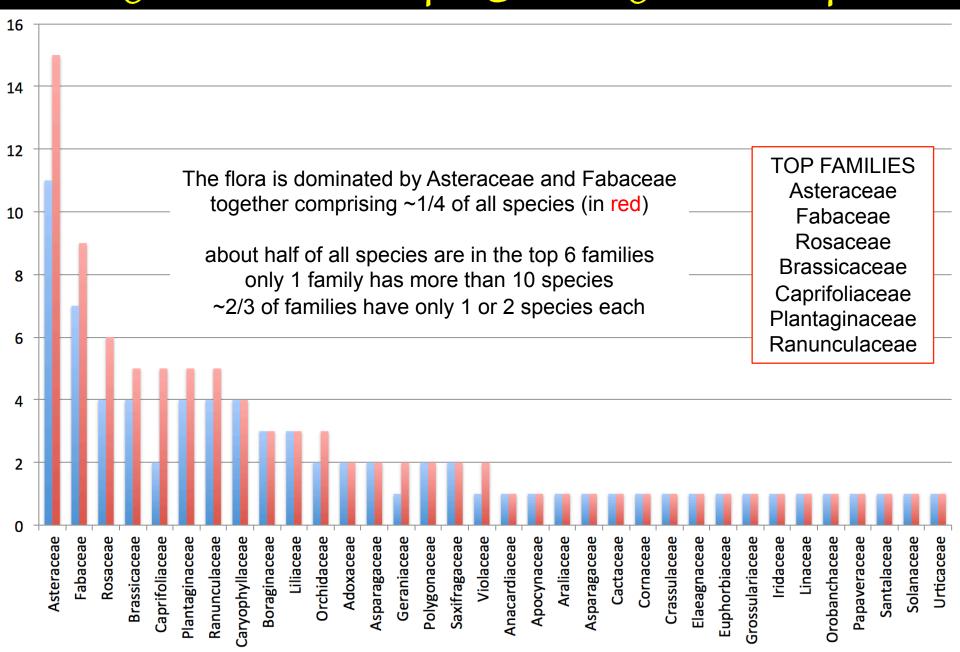
See page at the end of Introduction for a comparison of similar *Erigeron* species

#### Group 2 species begin flowering after end-April

Of these 106 species, 73 are native (69%), and 33 are alien (31%)

These species are rarely seen in flower before the beginning of May; they flower primarily in May and June, but several extend into July, and a few into August

#### Family Breakdown of Spring to Early Summer Species



Siberian Honeysuckle Lonicera tatarica Caprifoliaceae Honeysuckle family







Baneberry • • Actaea rubra

Ranunculaceae Buttercup famíly the berries show two colour forms

AUG

JUL

JUN

MAR APR

all parts of this plant are highly poisonous

Group 2

© Paul Handford, 2016 135

Tall Tumble Mustard Sisymbrium altissimum

#### Brassicaceae Mustard family

APR MAY JUN JUL AUG SEP OCT









### False Toadflax Geocaulon lívídum Group 2 Santalaceae Sandalwood family

this plant is parasitic on the roots of several species of forest tree





© Paul Handford, 2016

yellow streaking on the leaves is caused by the lodgepole pine's Comandra blister rust



Round-leaved Alumroot Heuchera cylíndríca

Saxífragaceae Saxifrage family

MAR APR MAY JUN JUL AUG SEP



# Group 2

Sweet Coltsfoot *Petasites frigidus* Asteraceae Sunflower family





© Paul Handford, 2016 140



See page at the end of Introduction for a comparison of similar *Erigeron* species





MAR APR MAY JUN JUL AUG

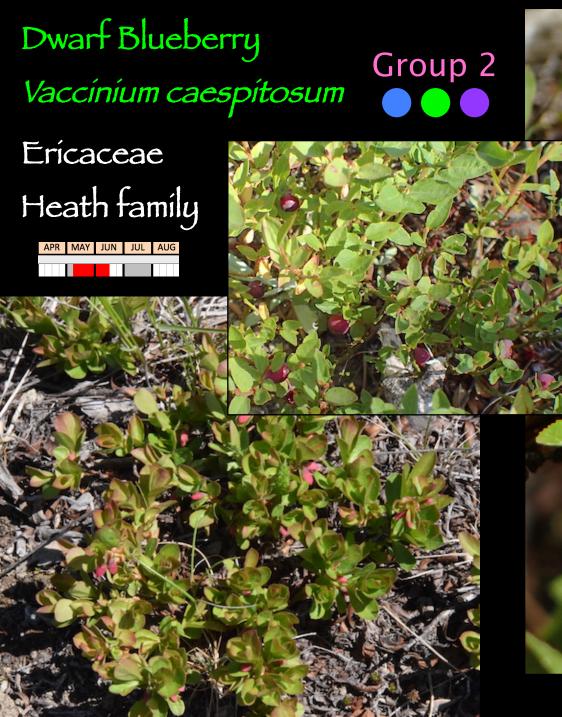




Asteraceae Sunflower family





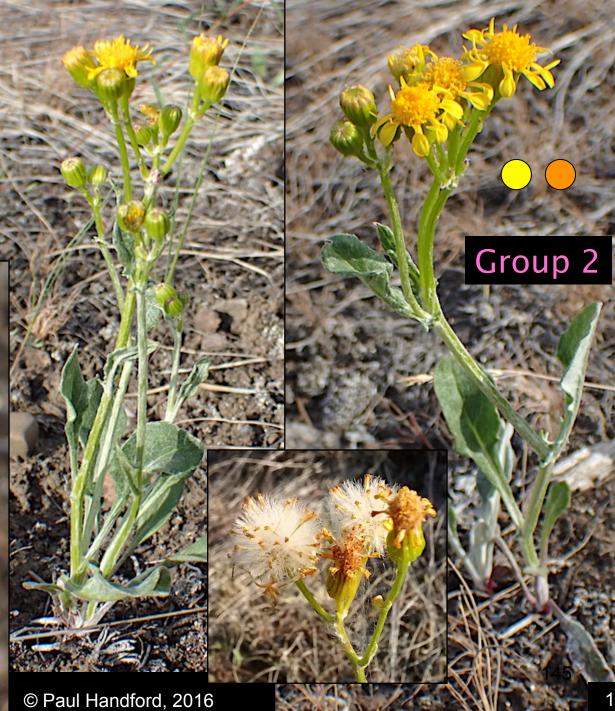




Woolly Groundsel *Packera cana* Asteraceae Sunflower famíly

APR MAY JUN JUL AUG SEP





Striped Coralroot *Corallorhíza striata* 

### Orchídaceae Orchíd famíly

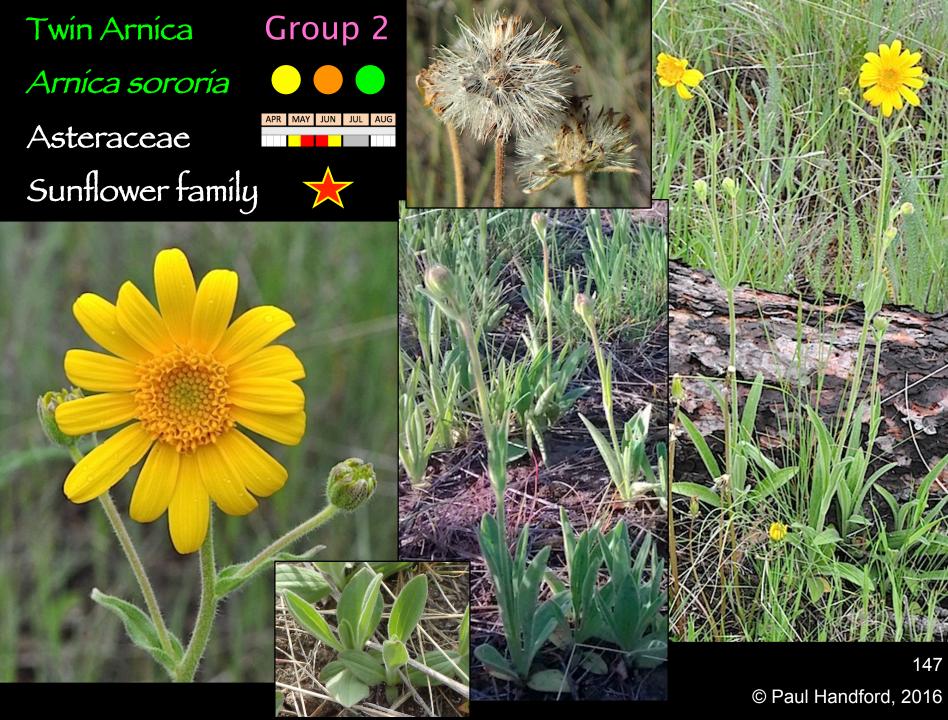
| MAR | APR | MAY | JUN | JUL | AUG | SEP |
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|     |     |     |     |     |     |     |







#### Group 2



Houndstongue *Cynoglossum* officínale

Boragínaceae Borage famíly







Trailing Daisy *Erigeron flagellaris* Asteraceae Sunflower family

> See page at the end of Introduction for a comparison of similar *Erigeron* species







#### 

Montíaceae

#### Purslane family Group 2











Astragalus agrestís

# FabaceaeGroup 2Bean family•••••





Black Twinberry Lonicera involucrata Caprifoliaceae Honeysuckle family



OCT

Group 2



Plantagínaceae







Star-flowered False Solomon's Seal *Maianthemum* 

Group 2

Asparagaceae Asparagus famíly

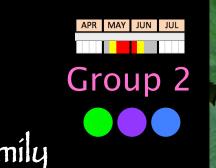


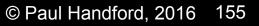


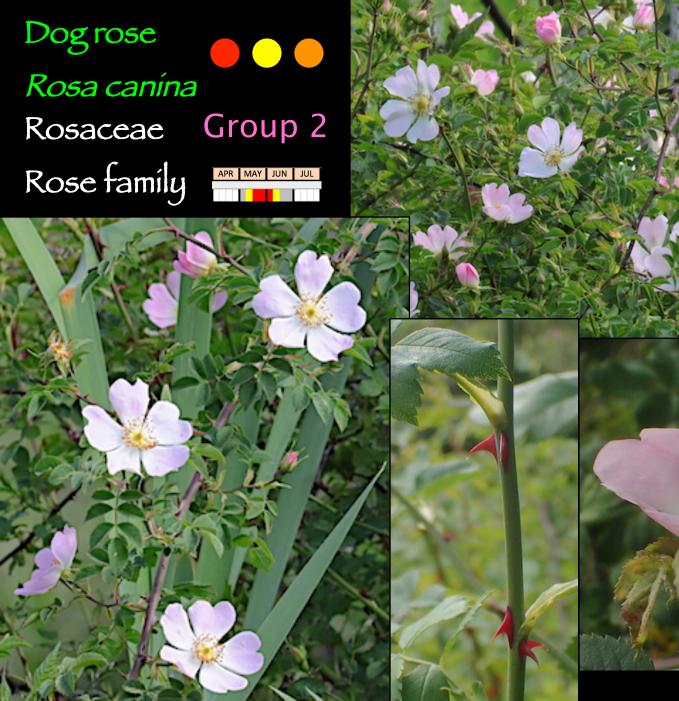


#### Wild Sarsaparilla Aralia nudicaulis

Araliaceae - Ivy family









## Sticky GeraniumGroup 2Geranium viscosisimum





Geraniaceae APR MAY JUN JUL AUG 157 Geranium family © Paul Handford, 2016 Hairy, or Littlepod Flax Camelina mícrocarpa

Brassicaceae Mustard family

Group 2





Red Raspberry *Rubus ídaeus* 

Rosaceae Rose famíly





Group 2

Chocolate or Checker Líly *Frítíllaría affinís* (used to be F. lanceolata)

Lílíaceae Líly famíly











fruits develop ~2 months after the flowers appear 160 © Paul Handford, 2016

#### Sheep Sorrel - Rumex acetosella



Polygonaceae Buckwheat famíly

| APR | MAY | JUN | JUL | AUG |  |
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© Paul Handford, 2016

Woolly Plantaín *Plantago patagoníca* Plantagínaceae Plantaín famíly

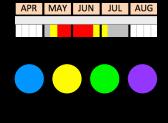


# Group 2

© Paul Handford, 2016

Canada White Violet *Viola canadensis* 

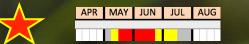
Víolaceae Víolet famíly



Group 2



#### Leafy Spurge Euphorbía esula (E. vírgata)



### Euphorbíaceae Spurge famíly



Group 2

Thyme-leaf Speedwell Veronica serpyllifolia Plantaginaceae Plantain family

Group 2











## Tumble-mustard

#### Sísymbríum loeselíí

Brassicaceae Mustard family



© Paul Handford, 2016

Lewis' Blue Flax Linum lewisii Linaceae Flax family







© Paul Handford, 2016



#### Asteraceae Sunflower famíly



#### Group 2

See page at the end of Introduction for a comparison of similar species

© Paul Handford, 2016

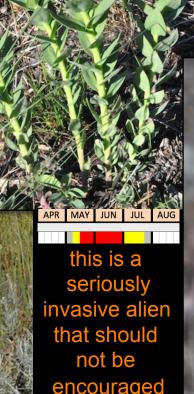
Blunt-leaf Sandwort *Moehringia lateriflora* Caryophyllaceae Pink family







See page at the end of Introduction for a comparison of similar species Dalmatían Toadflax Línaría genístífolía Plantaginaceae Plantain family



Group 2 a.k.a. Linaria dalmatica

encouraged



White Cockle *Silene latifolia* 

Caryophyllaceae Pínk famíly



Group 2







Hoary Alyssum Berteroa íncana Brassícaceae Mustard famíly

White Clover *Trifolium repens* Fabaceae Bean family





#### Group 2



Brown-eyed Susan Gaillardia aristata Asteraceae Sunflower family

Group 2 Apr May JUN JUL AUG SEP OCT

See page at the end of Introduction for a comparison of similar *Erigeron* species



#### Spreading Fleabane Erigeron divergens Group 2 Asteraceae Sunflower family MAR APR MAY IUN JUL

© Paul Handford, 2016 176

AUG SEP

OCT



Black Gooseberry *Ríbes lacustre* Grossularíaceae Currant famíly



# APR MAY JUN JUL AUG SEP OCT

Wild Pansy; Johnny-jump-up Viola tricolor Group 2 Violaceae Violet family

OCT

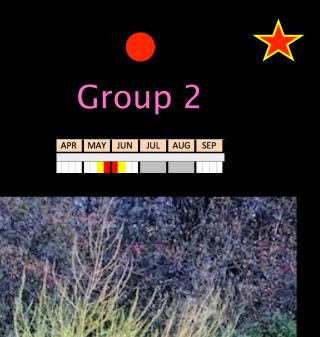


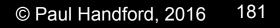


OCT

SEP

Asparagus Asparagus officinalis Asparagaceae Asparagus family





# Small Wallflower *Erysímum ínconspícuum*







Brassicaceae Mustard family

APR MAY JUN JUL AUG



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Michaux's Mugwort Artemisia michauxiana Asteraceae Sunflower family





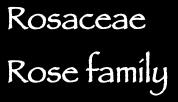




Brittle Prickly-pear Opuntia fragilis Cactaceae Cactus family Group 2

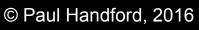
APR MAY JUN JUL

Príckly Rose *Rosa acícularís* 









Orange Honeysuckle Lonicera cíliosa Group 2 Caprifoliaceae Honeysuckle family





European Honeysuckle Lonicera periclymenum Caprifoliaceae APR MAY JUN JUL AUG Honeysuckle family





# Group 2 187

Salsífy, or Goatsbeard *Tragopogon dubíus* 

Asteraceae Sunflower family

young plants resemble grasses or lilies



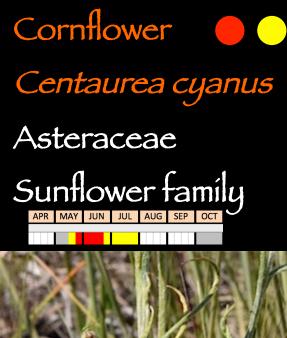
Group 2

AUG

Poison Ivy *Toxicodendron radicans* Anacardiaceae Sumac family

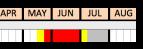
poison ivy ALWAYS has three leaflets; the terminal leaflet has a much longer petiole (stalk) than the base pair











# Group 2

Clustered Broomrape Aphyllon (Orobanche) fascículatum

APR MAY JUN JUL AUG

#### Group 2





Orobanchaceae Broomrape famíly © Paul Handford, 2016

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#### Annual Hawksbeard

Crepis tectorum a.k.a. Narrowleaf Hawksbeard Asteraceae Sunflower family

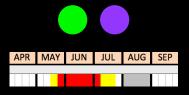
# Group 2 APR MAY JUN JUL AUG

See page at the end of Introduction for a comparison of similar species Bunchberry *Cornus canadensís* 

# CornaceaeGroup 2Dogwood family







Parsnip-flowered Buckwheat *Eriogonum heracleoides* Polygonaceae - Buckwheat family



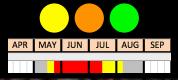


Group 2



Group 2

Cut-leaf Anemone *Anemone multifida* Ranunculaceae Buttercup family



mature seeding heads





#### Group 2 197 © Paul Handford, 2016

# Praírie Agoserís - Agoserís glauca

Group 2

Asteraceae - Sunflower family





Yellow Avens



### Geum aleppícum

#### Rosaceae Group 3 Rose family

Yellow and Large-leaf Avens are often rather tough to distinguish. The main differences lie in the relative sizes of the leaflets of the **basal** leaves, the form of the leaflet margins, the shape of the calyx lobes, and in the shape of the petals:

*aleppicum*: terminal leaflet only a bit larger than lateral ones, cleft to  $\sim 1/2$ depth; leaflet margins double-toothed; calyx lobes lanceolate; petals unnotched

*macrophyllum*: terminal leaflet much larger than lateral ones, often deeply 3lobed; leaflet margins blunt-toothed; calyx lobes triangular; petals with shallow notch

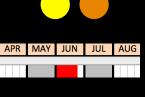


Western Groundsel or Lambstongue Ragwort *Senecío íntegerrímus* 

Asteraceae Sunflower family







#### Group 2

Biennial Cinquefoil Potentilla biennis Rosaceae Rose family APR MAY JUN JUL AUG SEP Group 2



Black Medick Medícago lupulína Fabaceae Bean family Group 2 APR MAY JUN JUL AUG SEP MAR



Bristly Stickseed Lappula squarrosa

Boraginaceae Borage family APR MAY JUN JUL AUG SEP Group 2







High-bush Cranberry *Viburnum edule* Adoxaceae Viburnum family







Prairie Cinquefoil Potentilla pensylvanica Rosaceae Rose family

#### Group 2

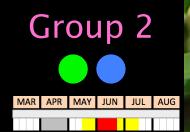


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#### Little Buttercup

#### Ranunculus uncínatus

Ranunculaceae Buttercup family







# Creamy Peavine *Lathyrus ochroleucus* Fabaceae - Bean family







American Vetch *Vicia americana* Fabaceae

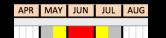
Bean family

NB: deeply toothed, crescentshaped stipules



### Group 2 😑 🔵

Madwort



## Asperugo procumbens Boragínaceae Borage famíly Group 2







# Lance-leaved Stonecrop - Sedum lanceolatum Crassulaceae Stonecrop family

# Group 2







Common Snowberry Symphorícarpos albus

Caprifolíaceae Honeysuckle famíly Group 2







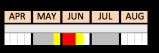
211

Pineapple weed Matricaria discoidea Asteraceae - Sunflower family

Group 2

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# Queen's Cup *Clintonia uniflora* Liliaceae - Lily family





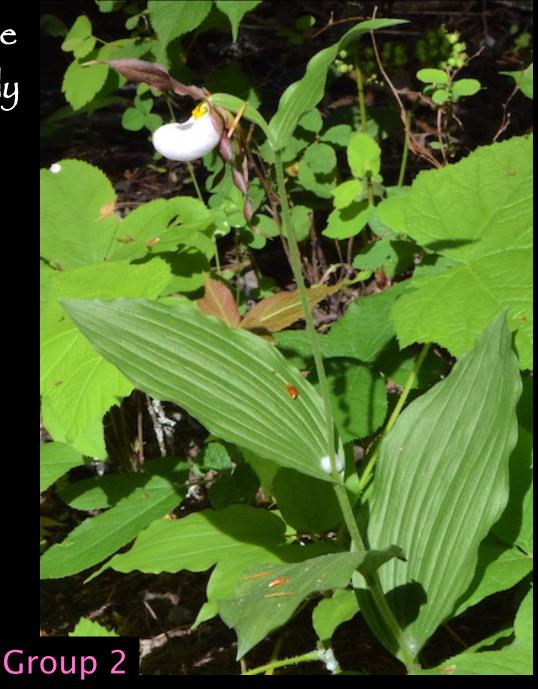


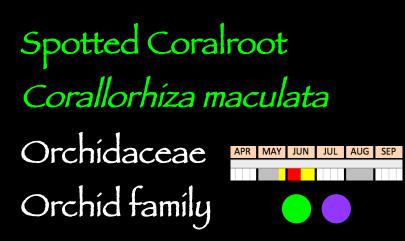


Mountain Lady's slipper Orchid family Cyprípedíum montanum













#### Group 2

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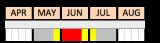
Meadow Buttercup *Ranunculus acrís* Ranunculaceae Buttercup fam<u>í</u>ly





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BlackElderberry *Sambucus nígra* Adoxaceae Víburnum famíly



Group 2

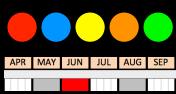






Rough Cinquefoil Group 3 Potentilla norvegica

Rosaceae Rose famíly







Meadow Bírd's-foot Trefoil *Lotus denticulatus* 

Fabaceae Bean famíly







Small Geranium Geraníum pusíllum Geraníaceae Geranium family



Group 2









Stinging Nettle *Urtica dioica* 

Urticaceae Nettle family

# Group 2

ATT .

Thyme-leaved Sandwort

Arenaría serpyllífolia

| APR | MAY | JUN | JUL | AUG |
|-----|-----|-----|-----|-----|
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See page at the end of Introduction for a comparison of similar species

TA SALAT LAN .....

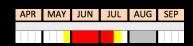
## Group 2

## Caryophyllaceae Pínk famíly

© Paul Handford, 2016 224







Erígeron speciosus

Showy Daisy

Asteraceae Group 2 Sunflower family



See page at the end of Introduction for a comparison of similar *Erigeron* species

© Paul Handford, 2016

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## Asteraceae Sunflower family





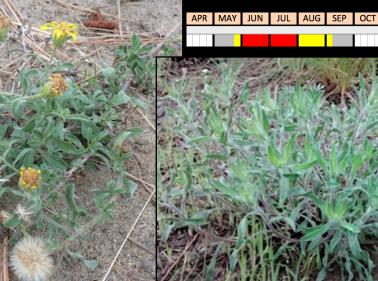
## Western hawksbeard

### Crepis occidentalis

Golden-aster *Heterotheca villosa* Asteraceae

Sunflower family

Group 2



before flowering, this plant resembles lesser gromwell, *Lithospermum incisum*, but differs in its dark red hairy stems







White Sweet-clover *Melilotus albus* Fabaceae Bean family

this plant is essentially the same as Yellow Sweet Clover, *M. officinalis*, (previous page) but with white flowers. The two species often grow together







Straight-up Suncress Boechera strícta

Brassicaceae Mustard family



APR MAY JUN JUL AUG







#### Group 2 © Paul Handford, 2016 231







Common Mítrewort *Mítella nuda* • • • Saxífragaceae Saxífrage famíly

MAR APR

MAY JUN









Long-stalked Starwort Stellaría longípes Caryophyllaceae Pínk famíly See page at the

#### Group 2

| APR | MAY | JUN | JUL | AUG | SEP |
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See page at the end of Introduction for a comparison of similar species



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Bittersweet • Solanum dulcamara Solanaceae Nightshade family







# Wavyleaf ThistleAsteraceaeCirsium undulatumSunflower family

## APR MAY JUN JUL AUG SEP OCT

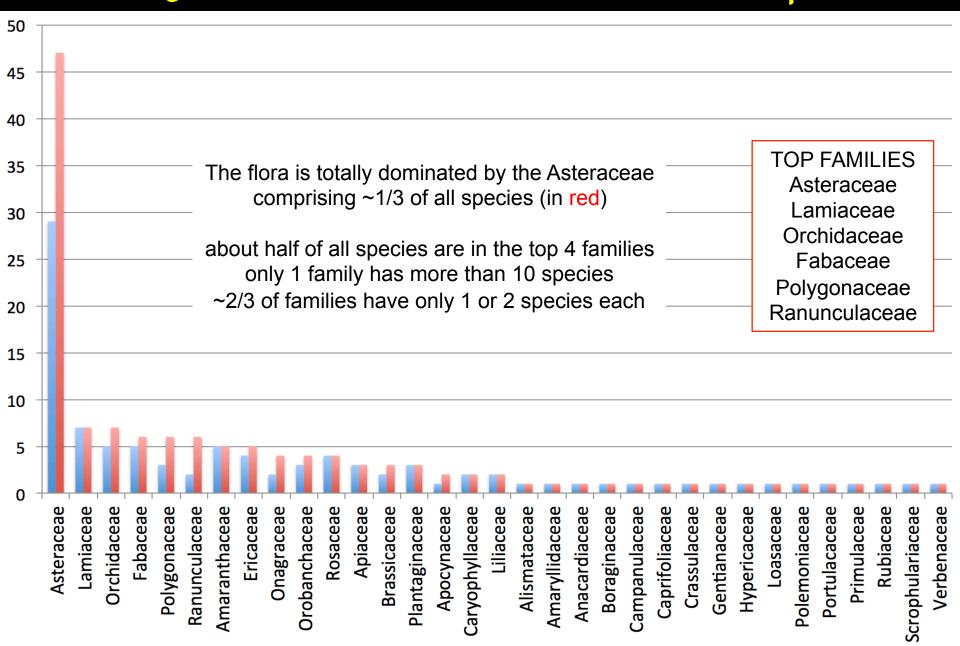


Group 3 species begin flowering after end-May

Of these 187 species, 134 are native (72%), and 53 are alien (28%)

The species are rarely seen in flower before early June; while most flower strongly in July & August many often extend in to September, and a few into October

## Family Breakdown of Mid-summer to Fall Species



Sticky Groundsel *Senecio viscosus* 

Asteraceae Sunflower family



Group 3

JUL

AUG

MAY

JUN

SEP OCT







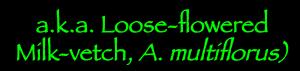
Group 3

MAY JUN JUL AUG SEP









Group 3

## Tiger Lily *Lilium columbianum*



## Group 3 Lílíaceae Líly famíly















Common Chamomile Anthemis arvensis

Asteraceae Sunflower family

| APR     | MAY | JUN | JUL | AUG | SEP | OCT |  |  |
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|         |     |     |     |     |     |     |  |  |

Nodding Onion Allium cernuum Amaryllidaceae Amaryllis family

> first appears with multiple flat <u>dark green</u> leaves

# Group 3

## Douglas' Campion Silene douglasií Caryophyllaceae Pink family

## Group 3 May JUN JUL AUG SEP









Northern Bedstraw *Galíum boreale* Rubíaceae Madder famíly

Group 3





Yellow-dot Saxifrage Group 3 Saxifraga bronchialis (a.k.a. S. vespertina) Group 3 Saxifragaceae – Saxifrage family







# Sítka Valerían Caprifolíaceae Valeríana sítchensís Honeysuckle family





Loasaceae Rock-nettle famíly

Group 3



### Mentzelía laevícaulís



Pennsylvanía Bíttercress Cardamíne pennsylvaníca

Brassicaceae Mustard family



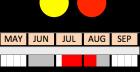




Rocky Mountain Bee-plant *Perítoma serrulata* Cleomaceae Spíderflower family







256 <u>© Pa</u>ul Handford, 2016 Oxeye Daísy Leucanthemum vulgare Asteraceae Sunflower famíly





Chamaeneríon angustifolíum Onagraceae Fíreweed Eveníng-prímrose famíly

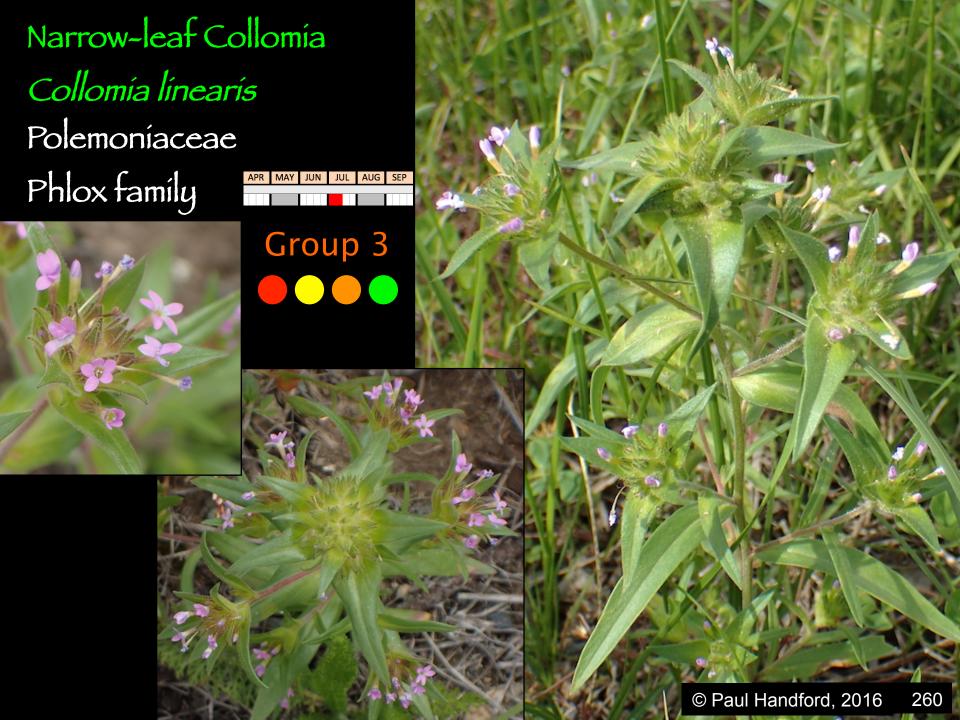




Rocky Mountain Sunflower *Helianthella uniflora* Asteraceae Sunflower family









### Rosaceae Rose family





Robbins' Milk-vetch Astragalus robbinsii Fabaceae Bean family







Birch-leaved Spiraea Spíraea betulífolía Rosaceae Rose family







### Sainfoin - Onobrychis viciifolia

Fabaceae Bean family



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Houndstongue Hawkweed *Hieracium cynoglossoides* Asteraceae Sunflower family





Group 3

See page at the end of Introduction for a comparison of similar species



Smooth Sumac *Rhus glabra* Anacardíaceae Sumac famíly





Group 3

| MAR | APR | MAY | JUN | JUL | AUG |
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Four-part Gentian Gentianella propinqua Gentianaceae Gentian family







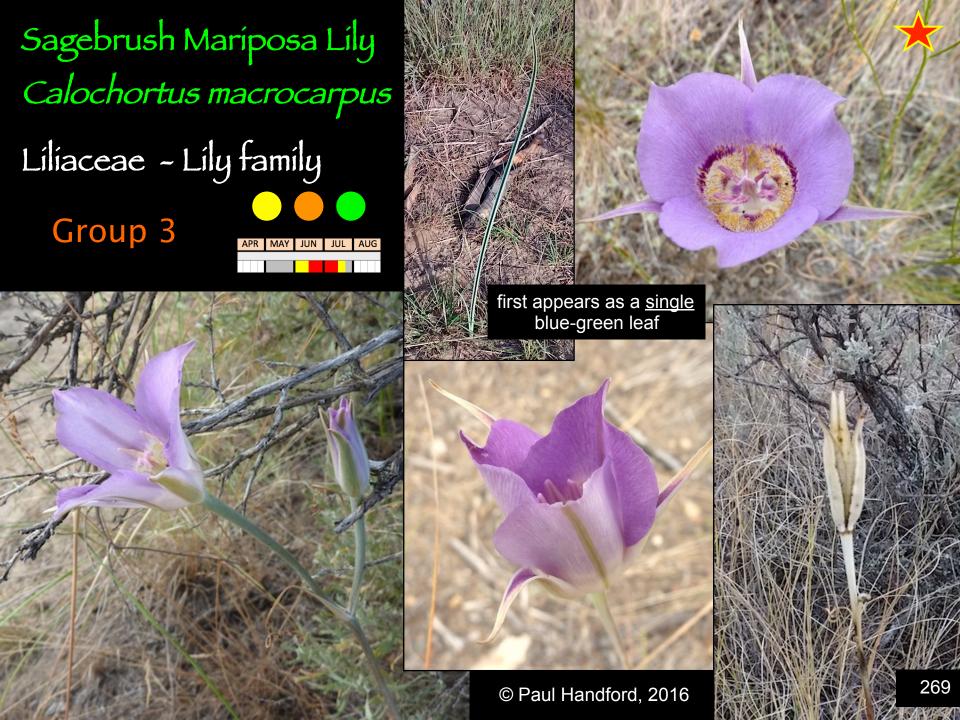
very similar to *G. amarella*, but *G. propinqua* has only four petals, and no fringe in the corolla throat



Tufted Vetch *Vícía cracca* Fabaceae Bean famíly







American Speedwell Veronica beccabunga Plantaginaceae Plantain family Group 3

APR MAY JUN JUL AUG SEP

- Meadow Hawkweed *Hieracium caespitosum* Asteraceae
- Sunflower family



### Group 3









Goldmoss Stonecrop Sedum acre

Stonecrop family Group 3

# Poison Hemlock *Conium maculatum*

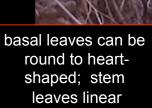
all parts of this plant are DEADLY POISONOUS

Carrot family Apíaceae © Paul Handford, 2016



# Common Harebell Campanula rotundifolia Bellflower family

Campanulaceae





| Group 3 |     |     |     |     |     |  |  |
|---------|-----|-----|-----|-----|-----|--|--|
| MAY     | JUN | JUL | AUG | SEP | OCT |  |  |
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Twinflower *Linnaea borealis* Caprifoliaceae Honeysuckle family





# Group 3





Common Toadflax Plantagínaceae *Linaria vulgaris* Plantain family

Group 3

MAY

JUN

JUL AUG SEP OCT

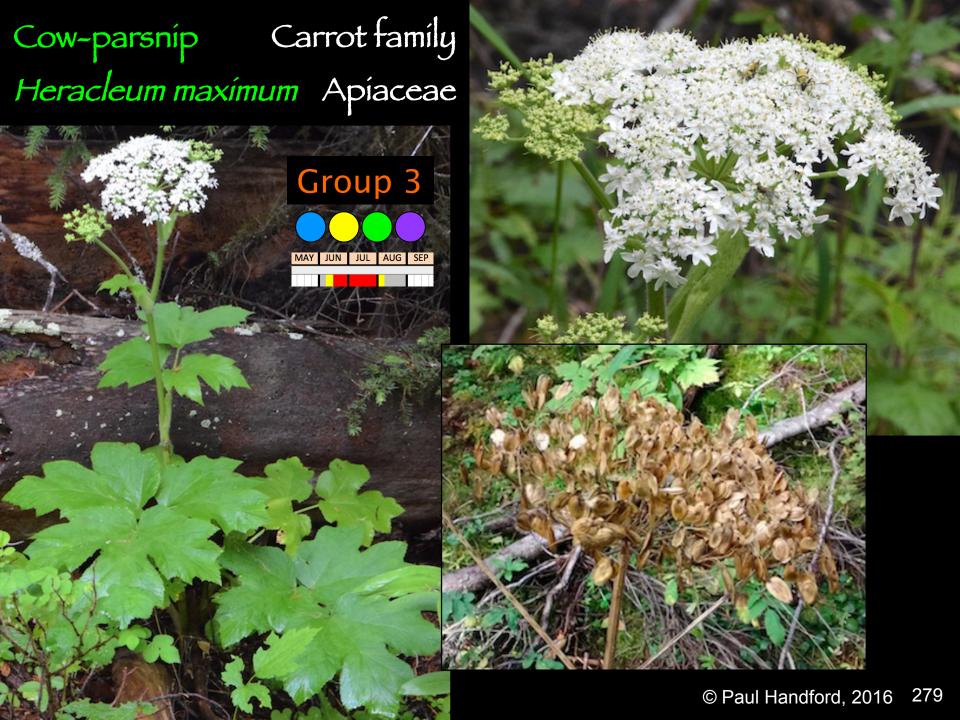




277

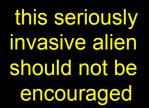
Sickletop Lousewort *Pedicularis racemosa* Orobanchaceae Broomrape family





# Baby's Breath Gypsophila paniculata Caryophyllaceae Pink family







### Alfalfa - Medícago satíva

Fabaceae Bean famíly Group 3



flowers range from deep purple through lilac to white, cream and yellow

281

One-sided Wintergreen Orthilia secunda

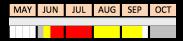
Erícaceae Heath famíly





### Group 3







Pink Wintergreen *Pyrola asarifolia* Ericaceae Heath family





Sulphur Buckwheat *Eríogonum umbellatum* Polygonaceae Buckwheat famíly







# Group 3 🛛 🔿 🔴 🔵

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Arctic Lupine *Lupinus arcticus* Fabaceae – Pea family



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Small-flowered Ipomopsis *Microgilia minutiflora* Polemoniaceae Phlox family Group 3





| MAY | JUN | JUL | AUG | SEP |  |
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### © Paul Handford, 2016 286

Group 3 MAY JUN JUL AUG SEP Boreal/ Northern Starwort Stellaría borealís/ calycantha Caryophyllaceae Pink family

these two species are poorly differentiated and their taxonomy is problematic. Perhaps further samples will permit resolution



Common St. John's-wort Hypericum perforatum Hypericaceae Mangosteen family





### Group 3

Red Clover *Trífolíum pratense* Fabaceae Bean famíly





| MAY | JUN | JUL | AUG | SEP |
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Group 3



#### Green Wintergreen *Pyrola chlorantha* Erícaceae - Heath family





Northern Green Bog-orchid *Platanthera aquílonís* Orchidaceae - Orchid family

> a.k.a. P. hyperborea

MAY JUN JUL AUG SEP

Group 3

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Musk Mallow *Malva moschata* Malvaceae Mallow family







#### Lesser Wintergreen *Pyrola minor* Ericaceae- Heather family



|     |     | X   |     |     |
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| MAY | JUN | JUL | AUG | SEP |
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#### Northern Water-plantain Alisma triviale Group 3

Alismataceae MAY JUN JUL AUG SEP OCT Water-plantain family MAY JUN JUL AUG SEP OCT

Apocynum cannabínum

Hemp Dogbane

#### Apocynaceae Group 3 Dogbane family







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#### Grey Horsebrush

#### Tetradymía canescens

#### Asteraceae Sunflower famíly

this plant resembles the much more common Rabbitbrush, *Ericameria nauseosa*, but that species flowers much later, and the foliage is usually clearly grey rather than green



MAY

JUN

JUL

Group 3

AUG

SEP OCT





Hooker's White Thistle Círsíum hookeríanum Asteraceae Sunflower family





# Northern GentíanImage: Image: Ima





| MAY | JUN | JUL | AUG | SEP | OCT |
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|     |     |     |     |     |     |

White hawkweed *Hieracium albiflorum* 

JUL AUG SEP

Group 3

JUN

Asteraceae Sunflower family



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Showy Polemonium Polemonium pulcherrimum Polemoniaceae Phlox family



## Group 3

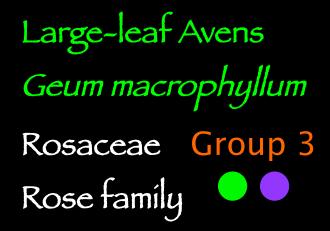
a.k.a. Jacob's Ladder

© Paul Handford, 2016 300

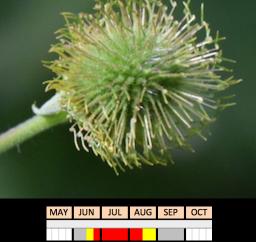
Nodding or Musk Thistle Carduus nutans •••• Asteraceae Group 3

Sunflower family









Canada Thistle *Cirsium arvense* Asteraceae

Sunflower family

- Contraction

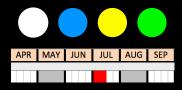
Group 3







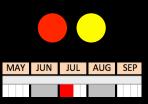
Three-leaf Foamflower *Tiarella trifoliata* Saxifragaceae Saxifrage family





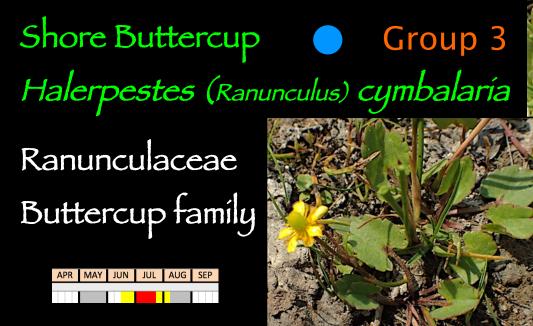


Dyer's Greenweed Genísta tínctoría Fabaceae - Pea family



Group 3







Yellow Clover *Trifolium aureum* Fabaceae Pea family





#### Glandular Baby's-breath *Gypsophila scorzonerifolia* Caryophyllaceae - Pink family





Group 3

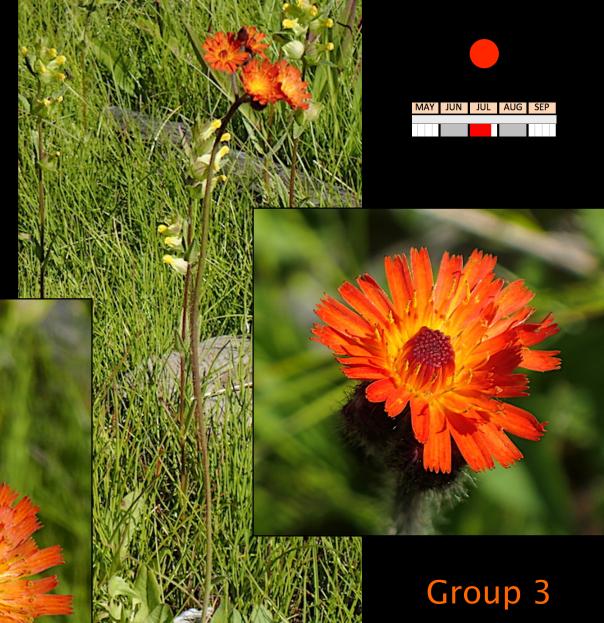
JUL AUG SEP OC

JUN

Orange Hawkweed *Hieracium aurantiacum* 

Asteraceae Sunflower family





# Fringed Willowherb Group 3 Epilobium ciliatum Onagraceae Evening-primrose family





Common Purslane *Portulaca oleracea* Portulacaceae

Purslane family





## Group 3

#### Russian Knapweed Acroptilon repens a.k.a. Rhaponticum repens

this knapweed is distinguished by the smooth edges & lack of spines on the involucral bracts

#### Asteraceae Sunflower family Group 3

MAY JUN JUL AUG SEP OCT







Arrow-leaf Groundsel *Senecio triangularis* Asteraceae

Sunflower family





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Blue Lettuce Mulgedium pulchellum a.k.a. Lactuca tatarica Asteraceae Sunflower family

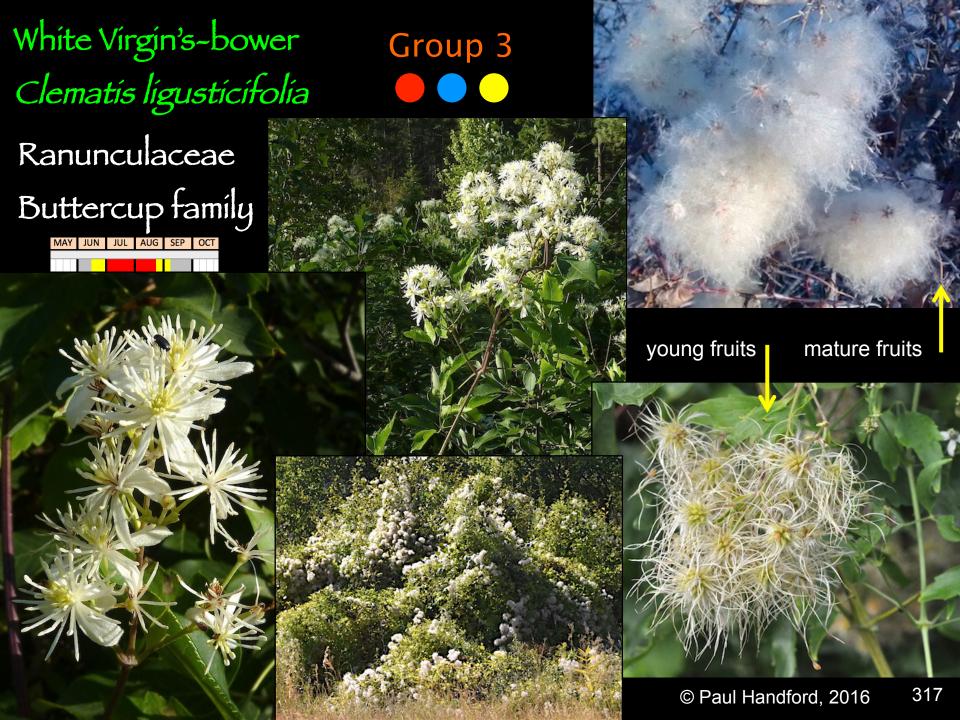


#### Wiry Knotweed *Polygonum majus* Polygonaceae Buckwheat family

*P. majus* is very similar to *P. douglasii*; given descriptions are +/- identical



OCT

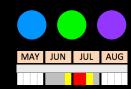


Narrow-leaved Stephanomería Stephanomería tenuífolía Asteraceae Sunflower famíly

### Group 3

| MAY | JUN | JUL | AUG | SEP | OCT |
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One-leaved Rein Orchid Platanthera obtusata Orchidaceae Orchid family



#### Group 3





# Group 3 320







Bracted Lousewort *Pedícularís bracteosa* Orobanchaceae Broomrape famíly





Streambank Groundsel Packera pseudaurea Asteraceae Sunflower family







Hairy evening-primrose Oenothera villosa

Onagraceae Evening-primrose family





### Yellow Rattle Rhinanthus minor Group 3







Orobanchaceae Broomrape family 325

Spreading Dogbane MAY JUN JUL AUG Apocynum androsaemífolíum



# Group 3

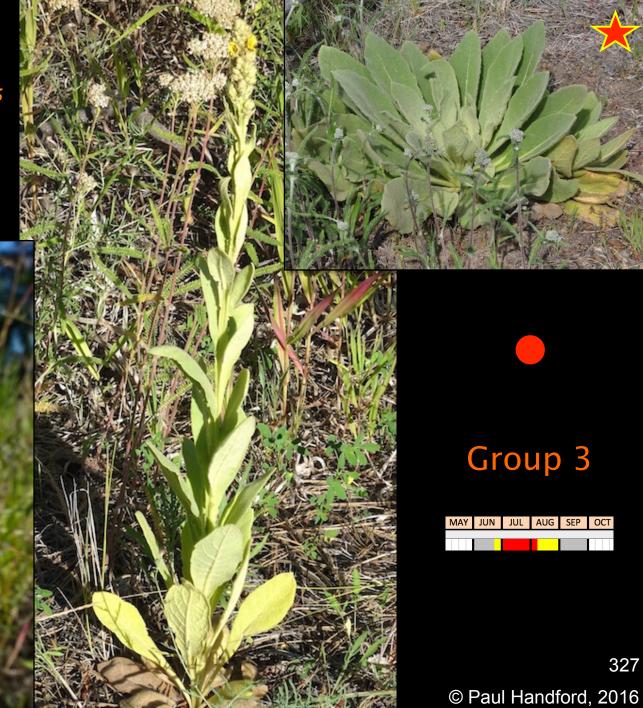






Apocynaceae Dogbane famíly © Paul Handford, 2016 326 Mulleín Verbascum thapsus Scrophularíaceae Figwort family





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#### Sharp-tooth Angelica Apíaceae Angelica arguta Carrot family









Spotted Knapweed Centaurea stoebe (maculosa)

Asteraceae Sunflower family



flowers are usually pink or purple, sometimes white. Distinguished from Diffuse Knapweed by spineless bracts



### Western Yellowcress Rorippa curvisiliqua



#### Brassicaceae Mustard family

| APR | MAY | JUN | JUL | AUG | SEP | OCT |
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#### Group 3

Graceful Cinquefoil Potentilla gracílis Rosaceae Group 3 Rose family





### 

| MAY | JUN | JUL | AUG | SEP |
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Narrowleaf Hawkweed *Hieracium umbellatum* Asteraceae Sunflower family







| MAY | JUN | JUL | AUG | SEP | OCT |
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#### Group 3



See page at the end of Introduction for a comparison of similar species

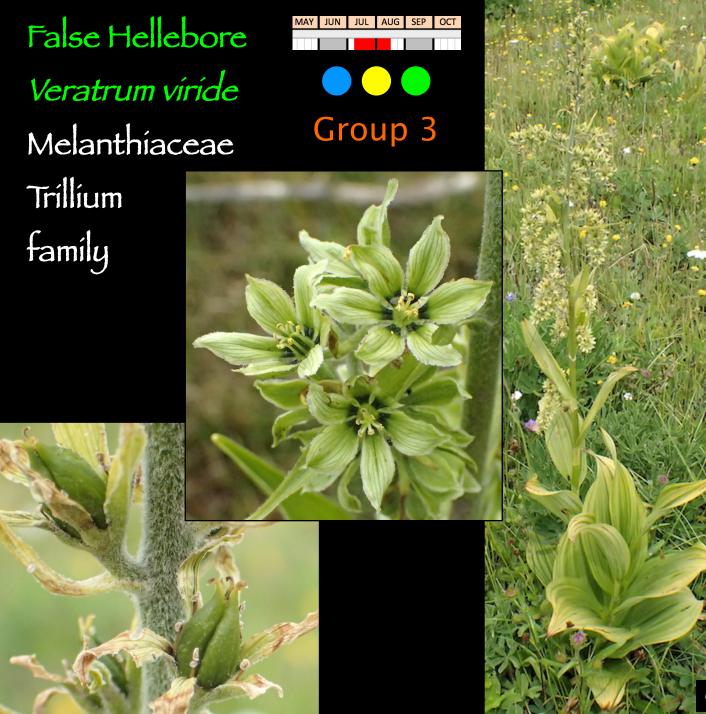
### Wild Bergamot Lamiaceae Monarda fistulosa Mint family











© Paul Handford, 2016 335

Three-tooth Mitrewort *Mitella trifida* Saxifragaceae Saxifrage family





Group 3

| APR | MAY | JUN | JUL | AUG | SEP |
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|     |     |     |     |     |     |

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Self-heal *Prunella vulgarís* 

Lamíaceae Mínt famíly





Curly-cup Gumweed *Gríndelía squarrosa* Asteraceae Sunflower famíly



Common Eyebright *Euphrasía nemorosa* Orobanchaceae Broomrape famíly

#### Group 3







Pearly Everlasting Anaphalis margarítacea

Asteraceae Group 3 Sunflower family



#### Celery-leaved Buttercup *Ranunculus sceleratus* Ranunculaceae

Buttercup family







# Group 3







Common Mare's-tail Híppurís vulgarís Plantaginaceae MAY JUN JUL AUG SEP Group 3

Plantain family



Prairie Fleabane *Erigeron strigosus* Asteraceae Sunflower family







© Paul Handford, 2016 344

#### Chicory *Cichorium intybus* Asteraceae Sunflower family

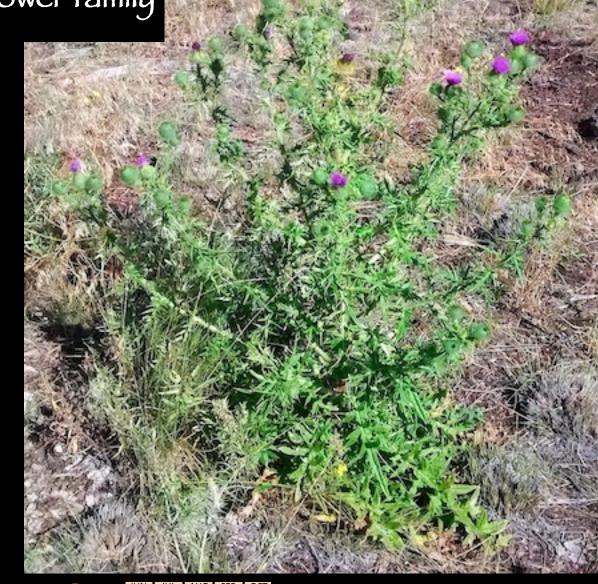




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# Bull ThistleAsteraceaeCirsium vulgareSunflower family





#### Group 3



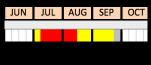
Díffuse Knapweed *Centaurea díffusa* 

# Asteraceae Sunflower family



or purple. Distinguished from Spotted Knapweed by spiny bracts





#### Group 3

## Autumn Willowherb Epílobíum brachycarpum Group 3 Onagraceae Eveníng Prímrose famíly



## 

Showy Aster Group 3 Eurybía (Aster) conspícua Asteraceae - Sunflower family

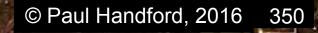




Yellow Monkey-flower *Mímulus guttatus* 

Phrymaceae Lopseed family Group 3







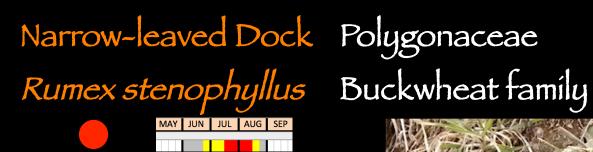
Persícaría maculosa

Polygonaceae - Buckwheat family



Group 3









Group 3

Two-scale Saltbush Atriplex micrantha Amaranthaceae Amaranth family Group 3

| MAY | JUN | JUL | AUG | SEP | OCT |
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# Spikelike Goldenrod - Solidago spathulata Sunflower family Group 3

Asteraceae

a.k.a. Solidago simplex







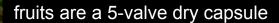


Pipsissewa Group 3 Chimaphila umbellata

Erícaceae Heath famíly



MAY JUN JUL AUG SEP OCT



buds remain closed for a week or two

# Lamb's Quarters Chenopodíum album

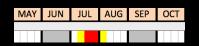
Amaranthaceae Amaranth famíly





#### Fragrant White Bog-orchid Group 3 Platanthera dilatata Orchidaceae • • • • Orchid family







Fringed Loosestrife Primulaceae Lysímachia ciliata Prímrose family

eFlora has this species as Steironema ciliatum in the Myrsinaceae,

Spear-leaf Fleabane *Erígeron lonchophyllus* Asteraceae Group 3 Sunflower famíly







Hemp-nettle *Galeopsís tetrahít* 

Lamíaceae Mínt famíly







Mountaín Sagewort Artemísia norvegíca







Asteraceae
 Sunflower famíly
 © Paul Handford, 2016
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Blake's Knotweed *Polygonum achoreum* Polygonaceae Buckwheat family



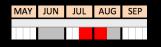




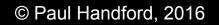


Group 3

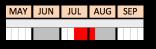
Asteraceae Sunflower famíly







Yellow Owl-clover *Orthocarpus luteus* Orobanchaceae Broomrape famíly







Tall Rein-orchid *Piperia elongata* Orchidaceae Orchid family







Field mint *Mentha arvensis* Lamíaceae Mint family







Wild Marjoram (Oregano) Oríganum vulgare

Lamíaceae Mínt famíly











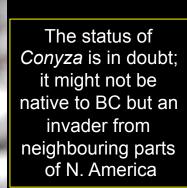
Purple Dragonhead Physostegía parvíflora

#### Lamíaceae Mint family JUN JUL AUG SEP OCT





Horseweed *Conyza canadensís* 



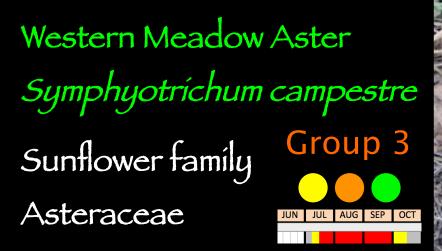


JUN JUL AUG SEP OCT



Asteraceae Sunflower famíly 369 © Paul Handford, 2016









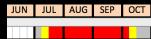
<sup>©</sup> Paul Handford, 2016

Common Tansy *Tanacetum vulgare* Asteraceae - Sunflower family



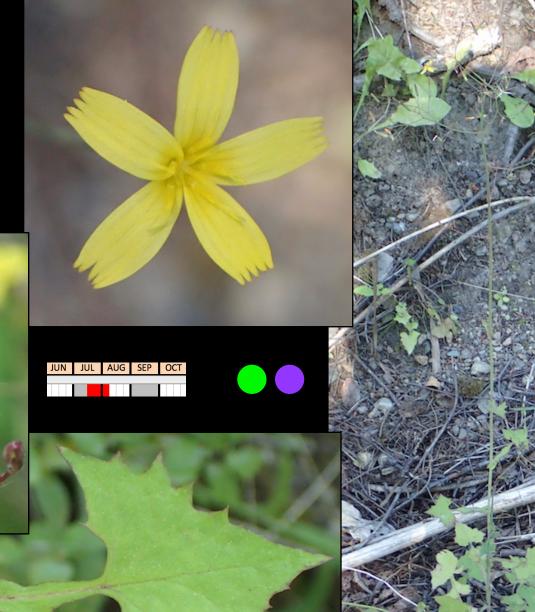


#### Group 3



Wall Lettuce *Mycelis muralis* Asteraceae Sunflower family





Group 3

Blue-leaf Cinquefoil *Potentilla diversifolia* (*P. glaucophylla*) Rosaceae Rose family







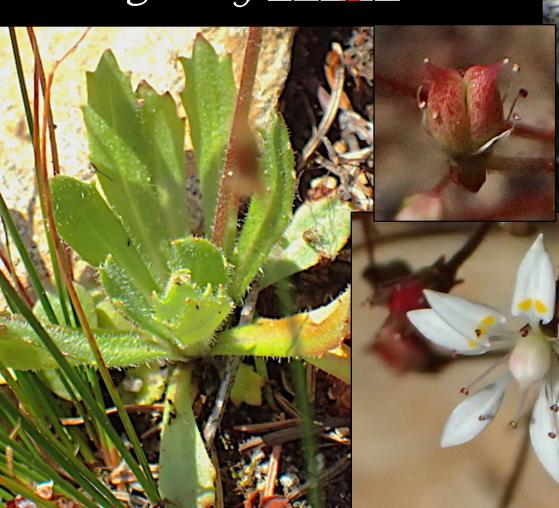


White-flower Willowherb *Epílobíum lactíflorum* Onagraceae Eveníng Prímrose famíly





## Rusty, or Alaska saxifrage *Micranthes (Saxifraga) ferruginea*) Saxifragaceae Group 3 Saxifrage family

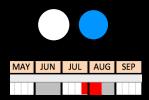




Leatherleaf saxifrage Leptarrhena pyrolífolia) Saxifragaceae Saxifrage family







Group 3

© Paul Handford, 2016



Western bell heather *Cassiope mertensiana* Ericaceae - Heath family





# Pínk mountain heather *Phyllodoce empetriformis* Erícaceae - Heath famíly



Group 3

MAY JUN JUL AUG SEP

270

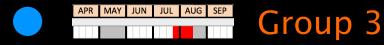
Yellow mountain heather *Phyllodoce glanduliflora* Ericaceae - Heath family





# White mountain marsh-marigold *Caltha leptosepala*

Ranunculaceae-Buttercup family







## Western pasque-flower Ranunculaceae-Buttercup family Pulsatílla (Anemone) occidentalis

MAY JUN JUL





# Subalpíne buttercup *Ranunculus eschscholtzíí*

## Ranunculaceae-Buttercup family

Group 3







Partridge-foot Luetkea pectínata

Rosaceae - Rose family



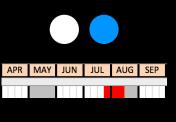
Creeping glow-wort *Sibbaldia procumbens* Rosaceae - Rose family





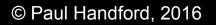
© Paul Handford, 2016

# Globe-flower *-Trollius taxus* Ranunculaceae-Buttercup family



Group 3





White rhododendron *Rhododendron albiflorum* Erícaceae - Heath family







Group 3

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Pink Agoseris *Agoseris lackschevitzii* Asteraceae Sunflower family



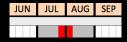




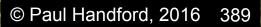


Siberian Aster *Eurybia sibirica* Asteraceae Sunflower family





Group 3



Parry's Arnica Arnica parryi Asteraceae Sunflower family







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Parry's Campion *Silene parryi* Caryophyllaceae Pink family

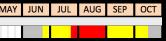
Group 3

JUN JUL AUG SEP

Golden Virgin's-bower *Clematis tangutica* Ranunculaceae Buttercup family







Lesser Spearwort *Ranunculus flammula* 



Ranunculaceae Buttercup famíly

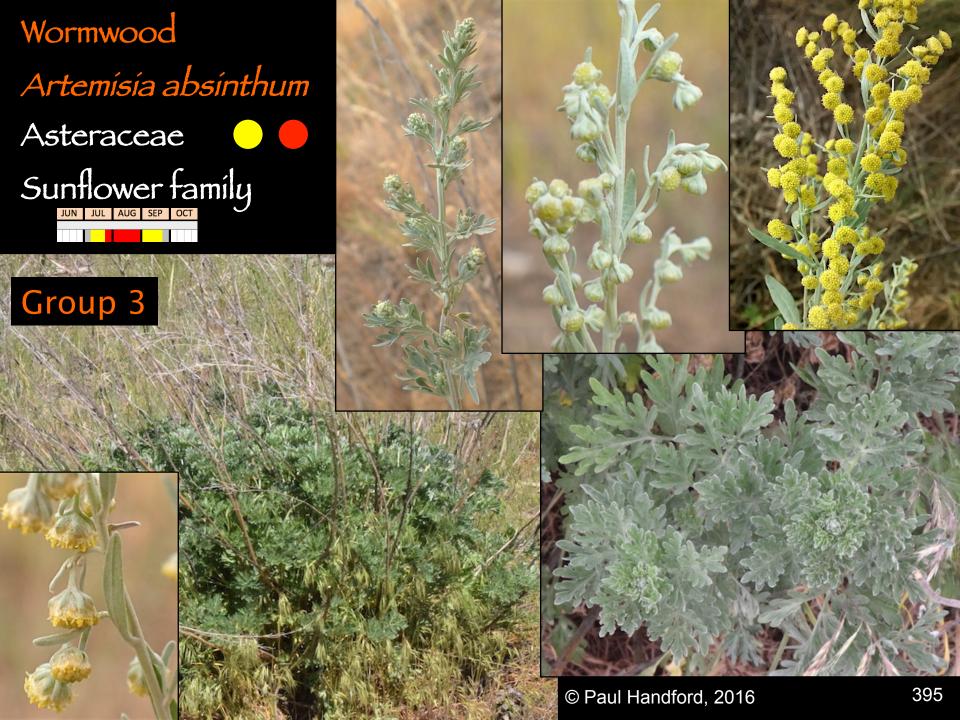


White Water Buttercup *Ranunculus aquatilis* Ranunculaceae Buttercup family









### Water Smartweed Persicaría amphibia Group 3 Polygonaceae Buckwheat family JUN JUL AUG SEP OCT













Canada Goldenrod *Solídago canadensís, Solídago altíssíma* 

Asteraceae Sunflower family

| JUL | AUG | SEP | OCT |
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Fringed Parnassus Parnassia fimbriata Celastraceae Bittersweet family



JUN JUL AUG SEP OCT



Alpíne Speedwell *Veronica wormskjoldií* Plantagínaceae Plantaín famíly





#### Broadleaf Willowherb - Chamaeneríon latífolíum



Onagraceae - Evening primrose family

Group 3

Western Mugwort 🛛 🔵 🛑 Artemísía ludovícíana

Asteraceae Sunflower family Group 3







# Great BurdockArctíum lappaAsteraceae - Sunflower family





Group 3

Prostrate Pigweed Group 3 Amaranthus blitoides Amaranthaceae Amaranth family

MAY

JUN

JUL

AUG SEP OCT





Príckly Lettuce *Lactuca serríola* 

#### Asteraceae Sunflower family





Group 3









Hemlock water-parsnip

Síum suave

Apíaceae Carrot famíly





Russian Thistle Salsola tragus Amaranthaceae Amaranth family



Arum-leaf Arrowhead or Wapato *Sagíttaría cuneata* Alísmataceae Water-plantaín famíly



JUN

OCT

AUG SEP



#### Group 3

© Paul Handford, 2016 409

#### Common Sneezeweed Heleníum autumnale

Asteraceae JUN JUL AUG SEP OCT Sunflower family





410

### Marsh Yellowcress Roríppa palustrís

# Brassicaceae Mustard family Group 3







### Rough Pigweed Amaranthus retroflexus Amaranthaceae Amaranth family





412

Northern Wormwood Artemísía campestrís Asteraceae Sunflower famíly



See page at the end of Introduction for a comparison of similar *Artemisia* species



Group 3 • • • • 413 © Paul Handford, 2016

AUG SEP

OCT

JUN

JUL

Summer Cypress Kochía scoparía Amaranthaceae Amaranth family



414

White Prairie Aster Group 3 Symphyotríchum erícoídes Asteraceae Sunflower family 415 © Paul Handford, 2016

ост

August – September bloomers include several species generally known as **asters**, that have showy white-to-blue-to-purple flowers. Most of these species used to be allocated to the genus *Aster*, but the majority are now in the genus *Symphyotrichum*, while others now appear in *Canadanthus*, *Eucephalus* & *Eurybia*.

The local flora includes up to ten hard-to-distinguish species of *Symphyotrichum*. Identification to species is complicated by the fact that some show substantial variation in form, while at least some of the species hybridize, producing mixes of characters.

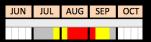


The next few pages show my current understanding of these problematic plants.

I continue to explore these species through submission of photographs to **e-Flora**, and in 2016 I began collecting pressed dried specimens to be sent to the folks at e-Flora for formal identification.

Until I can understand these plants better, I reckon I might be best advised to simply to refer to them all as "aster species in the genus *Symphyotrichum*"

#### Western Mountain Aster



### Symphyotríchum spathulatum

v. similar to *S. eatonii* & *S. lanceolatum,* which are also found in waterside habitats

Group 3





Asteraceae Sunflower famíly

### Willow Aster *Symphyotrichum lanceolatum*



very similar to *S. eatonii* & *S. spathulatum,* which are also found in waterside habitats

in late 2015, I photographed lots of asters along the S. Thompson River, and submitted many of them to e-Flora, UBC, as *Symphiotrichum lanceolatum,* my tentative ID– expecting that some or all might prove to be of other, very similar species.

Indeed, some of the photos were eventually identified at e-Flora as S. eatoni & S. spathulatum (see adjacent)

The seeding individual shown here is the only photo deemed to be *S. lanceolatum*. Other photos were interpreted as hybrids.



Asteraceae Sunflower family



Sunflower family Eaton's Aster Asteraceae Symphyotrichum eatoni



v. similar to S. lanceolatum & S. spathulatum, which are also found in waterside habitats



Big Sagebrush Artemisia tridentata Asteraceae Sunflower family

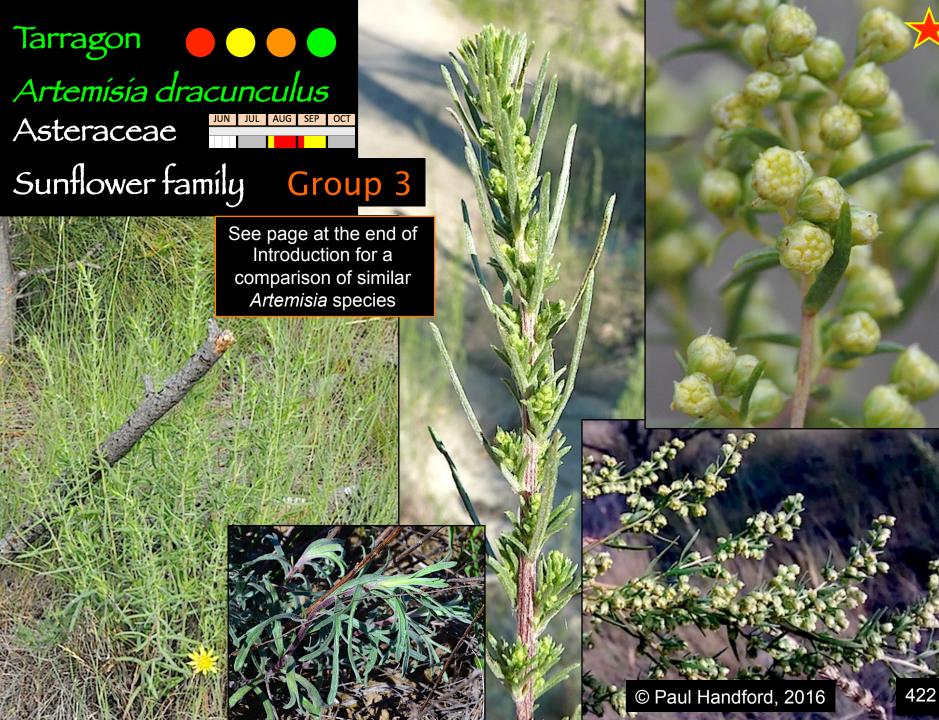




### Columbia River Wormwood Artemisia lindleyana Group 3







Cotton-batting Cudweed *Pseudognaphalium stramineum* Asteraceae - Sunflower family









Hooded Ladies' Tresses Spíranthes romanzoffiana







Western Goldentop *Euthamía occidentalis* Asteraceae Sunflower family











Prairie Sagewort *Artemisia frigida* Asteraceae Sunflower family

See page at the end of

Introduction for a comparison of similar

Artemisia species

AUG SEP OCT

Group 3



Prostrate Knotweed *Polygonum avículare* Polygonaceae Buckwheat famíly



| JUN | JUL | AUG | SEP | OCT |
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# the form of inflorescences

An inflorescence is that part of a plant that bears the flowers, be they single or multiple.

- Flowers are arranged on inflorescences in a variety of ways, depending on the manner in which the plant's body-parts
   – shoots, leaves & flowers
   – develop and grow.
- These various arrangements are usually characteristic of species, and often of whole groups, such as Families,

e.g. umbels in Apiaceae, compound heads in Asteraceae.

Inflorescence form is therefore often of utility in plant identification.

There are two primary classes of inflorescence: "determinate" vs. "indeterminate",

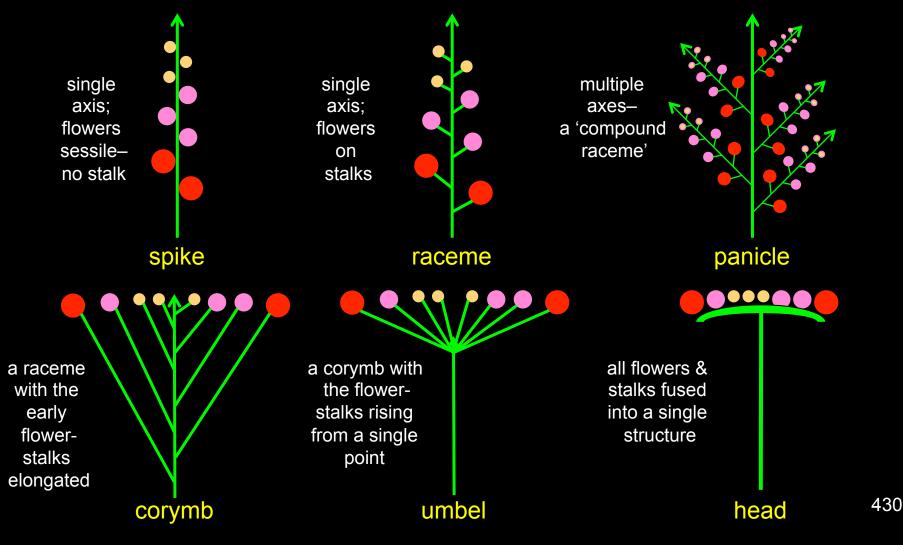
depending on whether the main axis of the inflorescence ends in a terminal flower or a continuously-elongating growing point.

 Within these two groups, inflorescences vary depending largely on the extent and pattern of *branching* shown by the flowering stem

The next two pages diagram some of the main kinds of inflorescence ...

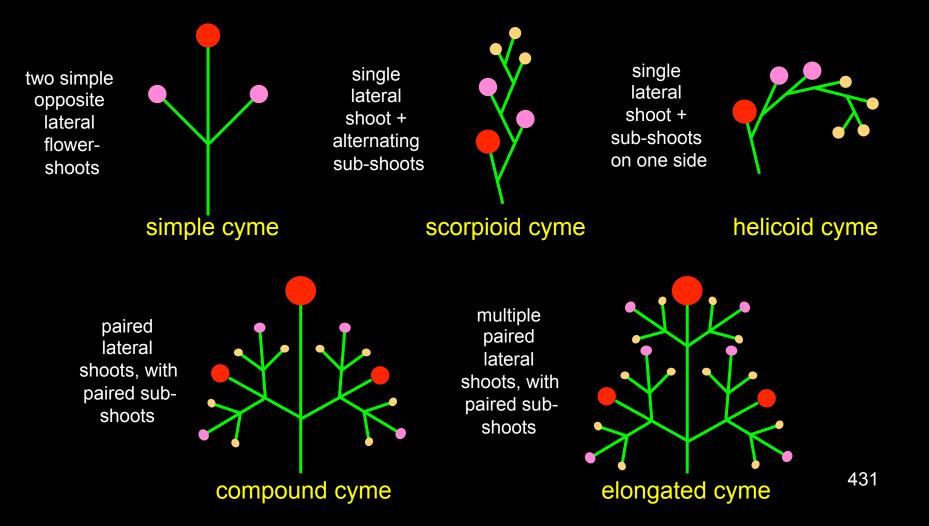
## indeterminate inflorescences

There is no terminal flower: all flowers are formed from lateral buds as the stem elongates. Here, flowers & stalks are shown arranged alternately, but they could also be opposite or spiral. Just as racemes can be compounded as panicles, there are compound coymbs & umbels too.



# determinate inflorescences

The flowering stalk ends in a terminal flower: younger flowers form on lateral shoots below. Lateral shoots may themselves have further sub-shoots of various sorts. Inflorescence types result from the degree & pattern of lateral branching and sub-branching.



#### **Changes in Names & Arrangement**

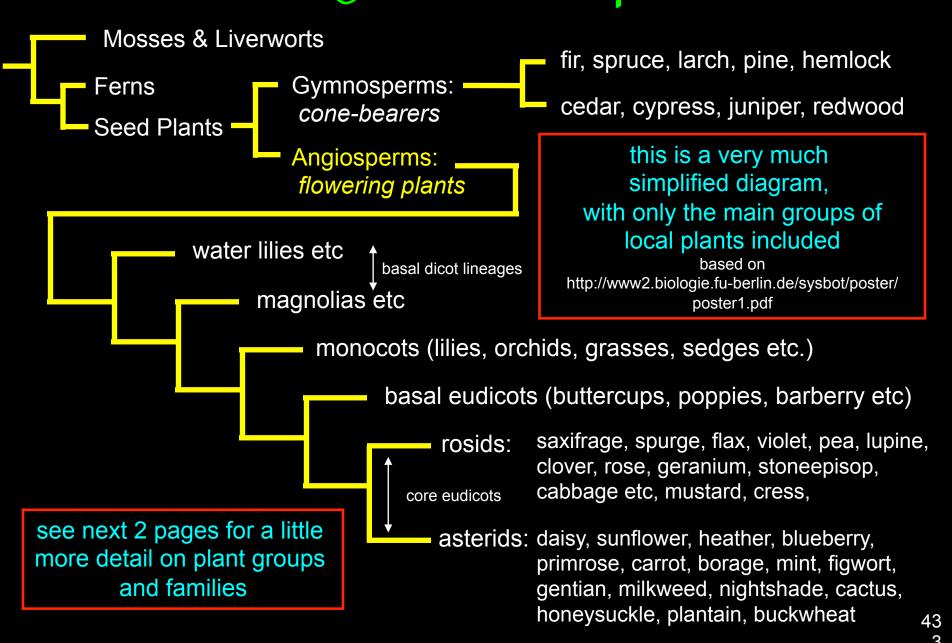
As the evolutionary relationships among plant species and lineages become further clarified, much through the analysis of DNA-sequence data, it is sometimes necessary to make changes to their naming and to their arrangement into a classification— *this is because the naming & classification system is intended to be a precise representation of our best understanding of the evolutionary (genetic, historical, genealogical) affinities among species*— that is, the closeness of the descent relationships among species and species groups, or lineages.

Today's generally accepted plant classification is that of the **Angiosperm Phylogeny Group**, first published in 1998; its most recent version is known as **APG IV** (2016); see following pages and *http://www.kew.org/blogs/kew-science/apg-classification-consensus* for details.

Here are examples of some of the changes that have been made to this list because of advances in our understanding of genealogical evolutionary relationships:

- Disporum hookeri is now moved to a different genus, as Prosartes hookeri
- Smilacina species are now shifted into Maianthemum.
- Several species of *Arabis* have been moved into the genus *Boechera*.
- Some genera (*Collinsia, Penstemon*) have been moved from Orobanchaceae (Broomrapes) into Plantaginaceae (Plantains).
- Though opinion is split on this matter, e-Flora has opted to separate *Phacelia* from the Boraginaceae (Borages, Forget-me-nots) into the Hydrophyllaceae (Waterleaf, Scorpionweed).
- All genera but *Portulaca* have been moved out of family Portulacaceae to other families; in our flora, *Montia* has been moved to Montiaceae.
- The Liliaceae has been broken into several families: Amaryllidaceae (Allium), Asparagaceae (Asparagus, Maianthemum, Muscari), Iridaceae (Iris), Melanthiaceae (Zigadenus), and Liliaceae (Calochortus, Clintonia, Fritillaria, Lilium, Prosartes, Streptopus).

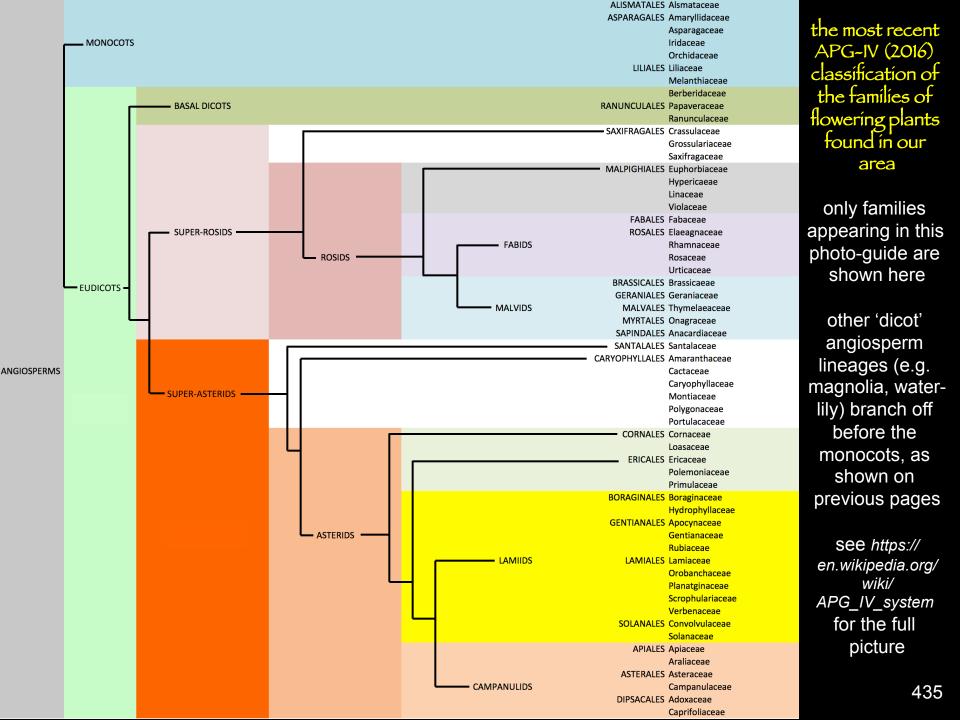
## Evolutionary Relationships of Plants



As mentioned above, our understanding of the evolutionary relationships of Angiosperm plants and their corresponding arrangement in their classification has changed substantially in the last 25 years or so. Before that, flowering plants were seen as comprising two clearly distinct lineages – monocots & dicots – based on physical characters such as flower and leaf structure (while the relationships among their constituent families was often poorly understood.)

From the study of DNA-sequence data, we now know that the monocots are actually nested *among* several lineages of dicot plants, meaning that some dicots are more closely related to the monocots in evolutionary terms than they are to other dicots, despite their morphological similarities, as shown in the preceding tree diagram. The standard modern picture of evolutionary relationships among plant groups is that provided by the Angiosperm Phylogeny Group (APG IV, 2016), followed here and in UBC's e-Flora

| water lily group<br>magnolia group   |  |
|--|--|
| monocots:  | "Liliaceae", Orchidaceae, Poaceae, Cyperaceae, Juncaceae   |
| basal eudicots:  | Ranunculaceae, Berberidaceae, Papaveraceae   |
| core eudicots:   | rosids et al: Saxifragaceae<br>fabids: Euphorbiaceae, Linaceae, Violaceae, Fabaceae,<br>Elaeagnaceae, Rosaceae   |
| a full picture of<br>the evolutionary<br>classification of<br>families in this<br>album is on the<br>next page | malvids: Geraniaceae, Onagraceae, Brassicaceae<br>asterids et al: Santalaceae, Cactaceae, Caryophyllaceae, Montiaceae,<br>Polygonaceae, Ericaceae, Primulaceae<br>lamiids: Boraginaceae, Apocynaceae, Asclepiadaceae,<br>Gentianaceae, Rubiaceae, Orobanchaceae, |
|  | Solanaceae Planataginaceae, Scrophulariaceae<br>campanulids: Asteraceae, Apiaceae, Caprifoliaceae,<br>Campanulaceae  |



#### Why use scientific ("Latin") names? or: What's wrong with common names?

there are two primary reasons why it is more useful to use scientific names in biology:

 common names are neither unique nor standardized; rather they vary and overlap; but scientific (systematic) names are unique, precise & universal

#### common (a.k.a. vernacular, or vulgar) names are simply labels (albeit sometimes descriptive); but scientific names both identify AND carry information about *evolutionary relationships*

as an example, take the vernacular name "*robin*". what kind of bird is being referred to? depending on where you are, you might be pointing to quite different, totally unrelated birds; all they have in common is some red, or reddish, feathers on their chests (and sometimes not even that). "*Robin*" really says little to nothing about who or what these birds really are; but their scientific names do.



*Erithacus rubecula*, the 'original' robin is a member of the large family of Old World flycatchers, the Muscicapidae



*Turdus migratorius*, the American 'robin' is actually a thrush in the wide-ranging family Turdidae, which is fairly closely related to Muscicapidae



Petroica goodenovii, the Australian Red-capped 'robin', is in the strictly Australasian family Petroicidae, only distantly related to the other two here

the same confusion of vernacular names applies even more severely to plants, where the same species might be known by several very different names in different places— or even in the same place! Further, the very same name might be applied to quite different species. These vernacular names rarely give any clear indication of relationships







lemonweed puccoon, western stone-seed, Columbia gromwell, western gromwell, Columbia puccoon

Lithospermum ruderale

species genus

narrowleaf stoneseed, yellow gromwell, fringed gromwell, narrowleaf puccoon, plains stone-seed

Lithospermum incisum

corn gromwell, field gromwell, bastard alkanet

Lithospermum arvense

this example refers to three closely related species, well known in our area.

their most frequent vernacular names (around here at least) are given in **this colour**; those names provide no hint that the three species might be closely related to each other

white text provides alternative vernacular names, offering the possibility of further confusion

on the other hand, the unique scientific names, in yellow, unambiguously refer to one species ONLY, and show these species' close relationship though their being in the same genus; the uniqueness of the names leaves no room for ambiguity over what plant is being referred to.

### The scientific naming system – Carl Linnaeus



dressed for fieldwork



its foundations were laid in the mid-eighteenth century, based in careful observation of the details of anatomy, initially of plants

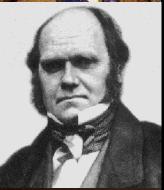
- systematic naming of species began with Linnaeus (1707 1778), a Swedish physician, botanist and zoologist, following his extensive fieldwork in Lapland
  - he saw a '<u>natural order</u>' in the <u>degrees of resemblance</u> shown by organisms
    - his hierarchical grouping & naming system attempted to reflect this order
- his classification system of species, nested successively within genera, within families, within orders, classes, phyla & kingdoms, is based on the degree of sharing of similar structure in flowers & fruits
- species are more structurally similar to members of their own group than they are to members of any other groups at the same level in the classification
  - as we have seen, all species have a two-part name: genus + species
    - species within a given genus are the most similar of all
- Latin was the universal language of 'scientists' (but they also used Greek terms; now we use words from many languages)

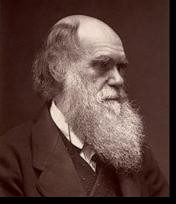
but Linnaeus was not an evolutionist; he offered no <u>explanation</u> for the existence of the patterns he described

dressed for marriage

## Why, then, is there a hierarchy of similarity?







1809 - 1882

this was the primary question addressed by the theory of evolutionary change

- Linnaeus saw the pattern of similarity but didn't know *WHY* it was there
- Ilke other natural philosophers, he saw it as expressive of 'Divine Providence'
  - this changed dramatically with Charles Darwin; he developed a <u>natural</u> <u>explanation</u> for the hierarchy of structural resemblance among organisms
    - he proposed that all life is <u>related by descent</u>; that <u>close similarity</u> reflects <u>close descent from a recent</u> <u>common ancestor</u>
- the branching structure of descent thus explains the hierarchical, tree-like, pattern of similarity among organisms: closer relatives are more similar to one another than they are to more distant relatives
  - we have seen that all species have a two-part name: genus + species
  - species within any given genus are thus each other's closest relatives through evolutionary descent
  - so scientific names are unique, universal, AND directly informative of evolutionary relationships

at left, we see, from top to bottom, images of Charles Darwin in his early 20s, ready for the Beagle voyage; at 50, when The Origin of Species was published; and as the venerable patriarch, in his 70s.

### Revisions to the Tree of Life & Classification



Cactaceae New World cacti



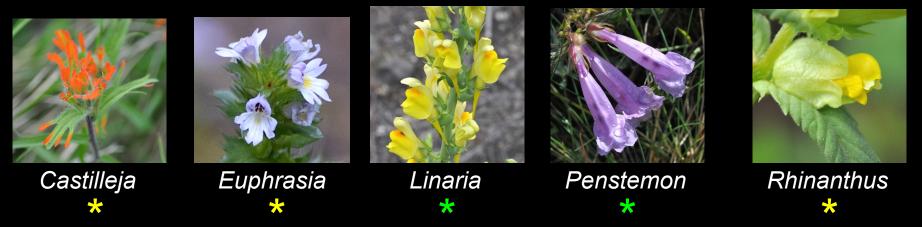
Euphorbiaceae Old World spurges

- similarity of morphological characters can reflect *both* close evolutionary descent relationship (recent common ancestry) *and* adaptation to similar conditions, producing *evolutionary convergence* of form. At left is a striking example of convergence in structure between two <u>unrelated</u> groups of plants in response to the exigencies of life in very arid desert environments: cacti in the New World, spurges in the Old World (there are no native cacti in the Old World).
  - sorting out the 'meaning' of characters can therefore be very tricky even with the floral characters that Linnaeus used
- analysis of DNA has been very helpful in sorting out this matter, and it has given us new pictures– sometimes strikingly distinct ones– of the structure of life's tree
  - these new pictures of descent relationships have required revisions in both naming and in grouping– to the question of "who belongs with whom"?
    - thus, many species have been moved to other genera
      - many genera have been moved to other families
        - and so on, up the hierarchy of life's tree

Descent with Modification was Darwin's answer to the structure of organismal diversity; Natural Selection was his answer to the close fit of organisms to conditions

### Changing Neighbours

Scrophulariaceae- the figwort family- used to embrace many local species:



but recent DNA work has shown that most of our members of this family properly belong with (are more closely related to) two other families- \*Orobanchaceae \*Plantaginaceae

leaving one species in the Scrophulariaceae – Verbascum thapsus, mullein

