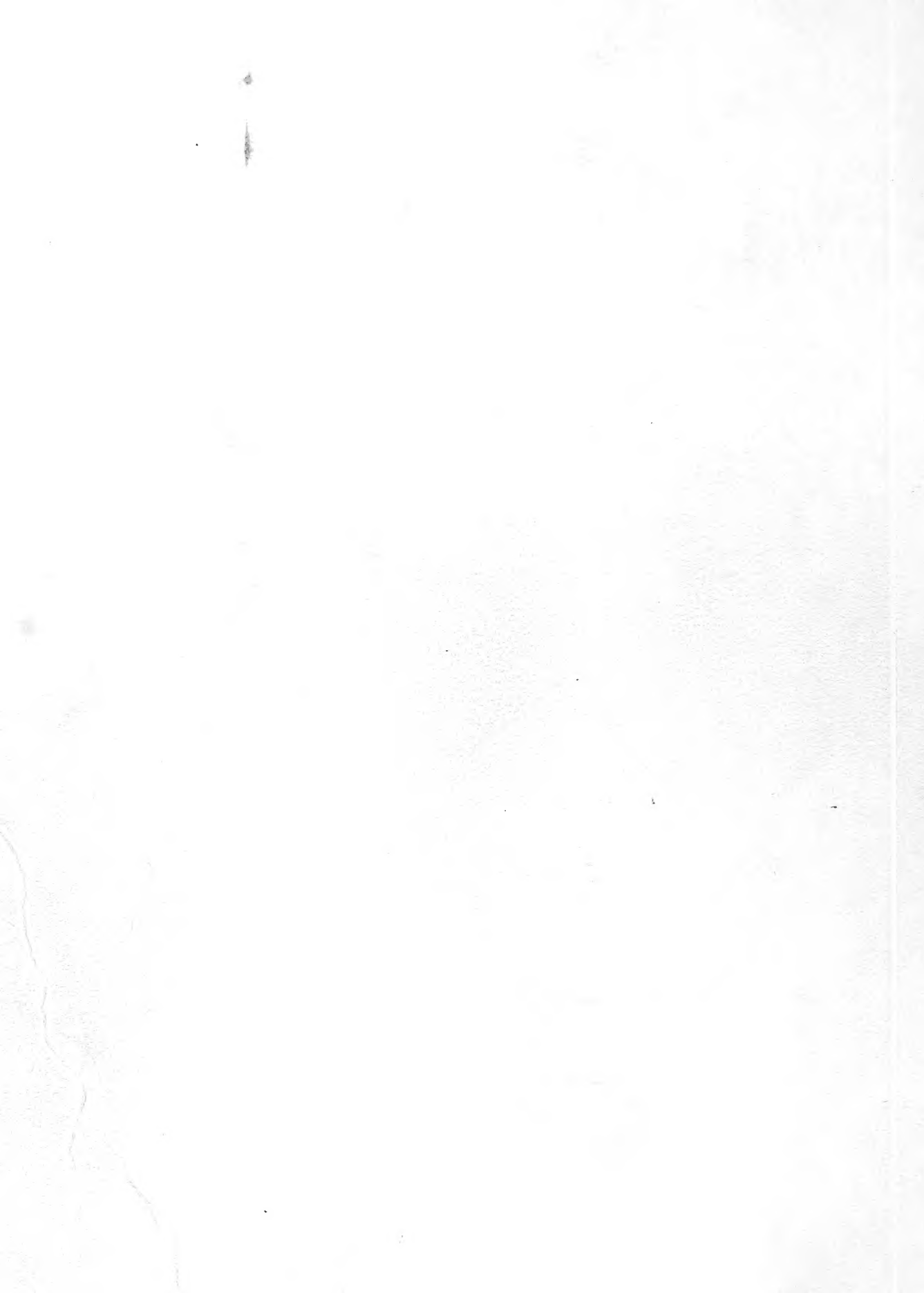
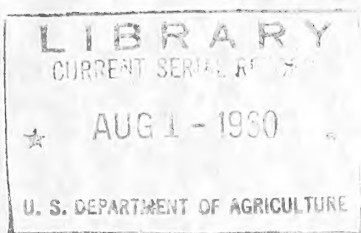


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Occurrence of Shrubs and Herbaceous Vegetation

*AFTER CLEAR CUTTING
OLD-GROWTH DOUGLAS-FIR
in the OREGON CASCADES*

by VERN P. YERKES



PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
U. S. DEPT. OF AGRICULTURE · FOREST SERVICE

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by

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OCCURRENCE OF SHRUBS AND HERBACEOUS VEGETATION
AFTER CLEAR CUTTING OLD-GROWTH DOUGLAS-FIR
IN THE OREGON CASCADES^{1/}

Land managers often express a need for more complete information about the vegetative cover that develops on cutover areas between harvest of old-growth Douglas-fir (Pseudotsuga menziesii) and establishment of a young-growth forest. The composition and density of this cover frequently determines the management techniques that must be used to establish the new stand and provide for watershed and wildlife resources. This paper presents data on the frequency of occurrence of shrub and herbaceous species during the first 6 years after logging and slash burning.^{2/} The study was made on 14 clear-cut units in the H. J. Andrews Experimental Forest, located on the west slope of the Cascade Range, near Blue River, Oreg. The units were in the Lookout Creek drainage, 1,850 to 3,800 feet above sea level, with slopes ranging from almost flat to nearly 100 percent. Nine units had northerly aspects; five, southerly.

METHODS

PLOT ESTABLISHMENT

Forty circular, 4-milacre plots were spaced mechanically across each clear-cut unit on two north-south lines, positioned at one-third and two-thirds of the distance between the east and west extremes. Spacing between plots was one-fortieth of the total length of the two lines, as scaled from a topographic map. Due to the

^{1/} Research reported in this paper was conducted by the Station's Corvallis Research Center, maintained in cooperation with the School of Forestry, Oregon State College.

^{2/} Cover-density data for the same study area is reported in the following: Yerkes, Vern P. Successional trends of lesser vegetation following clearcutting in old-growth Douglas-fir stands. 1958. (Unpublished thesis. Copy on file Oreg. State Col., Corvallis.)

irregular shape of the units, the number of plots per line varied from 12 to 28. Plots were established on nine north-slope units in 1953, two south-slope units in 1956, and three south-slope units in 1957.

PLOT EXAMINATIONS

All plots were examined when established. Plots on the nine north-slope units were reexamined in 1956 and 1957 and those on the two south-slope units established in 1956 were reexamined in 1957.

As slash on four of the north-slope units had been burned in 1952, examination came during the first, fourth, and fifth growing seasons after burning. These units were designated "area A." Slash on the other five north-slope units had been burned in 1951; thus, examination came during the second, fifth, and sixth seasons after burning. These units were designated "area B." One south-slope unit was examined during the second growing season after burning, three during the third and fourth seasons, and one during the fourth season only. Examinations were made between June 30 and August 24, except as follows:

<u>North-slope unit</u>	<u>First examination</u>	<u>Second examination</u>
1F	June 15 and 22, 1953	Sept. 5 and 6, 1956
1G		Sept. 12, 1956
1H		Sept. 11, 1956

On each plot, the presence of one or more plants of a species was recorded as an occurrence. The frequency of each species' occurrence on a unit was expressed as the percentage of plots where that species was found. Also recorded were the percentage of burned surface on each plot and the elevation of the unit.

ANALYSIS OF DATA

A complete list of species was prepared, and plant frequency was indicated for each examination on each unit. This list also showed the appearance and disappearance of individual species. Then, combined data for area A units, area B units, and the south-slope units were examined for trends in vegetation development, based on frequency.

This was done for species considered most important in respect to cover density and general distribution over the study area. The listed species were grouped according to vegetation class and according to their presence (survivors) or absence (invaders) under forest canopy adjacent to the clear-cut units.^{3/}

Next, differences between burned and unburned areas were determined by comparing species frequency on plots more than 90 percent burned with that on plots less than 10 percent burned.

Finally, the units were placed in 500-foot elevation classes ranging from 1,500 feet to 4,000 feet to permit comparison of frequencies between elevation classes.

RESULTS AND DISCUSSION

During this study, 104 separate species and species groups occurred on the cutover areas. Of these, 79 were identified by species or genus.^{4/} ^{5/} Eighteen species appeared sporadically and without identifiable characteristics. Representatives of the Cruciferae, Saxifragaceae, and Labiatae families and the grass, liverwort, moss, and fern groups were present but were not further identified.

As a result of normal succession, area A contained 42 species and species groups the first year after burning; 74, the fourth year; and 63, the fifth year (table 1). Area B exhibited a similar pattern, containing 45 species and species groups the second year; 62, the fifth year; and 46, the sixth year. The south-slope units also exhibited a similar pattern--40 species and groups the second year; 51, the third year; and 57, the fourth year.

^{3/} Species under the forest canopy on north slopes were noted when study plots were examined in 1957; species on south slopes in this area were listed in a previous study by Gashwiler (1959). Species appearing in stand openings but not generally under the canopy were classed as invaders.

^{4/} Approximately half of the identified species were submitted to the Oregon State College herbarium staff for confirmation. The remainder were identified through use of "A Manual of the Higher Plants of Oregon" (Peck, 1941).

^{5/} Identified plants are listed on page 8.

Table 1.--Number of species and species groups on Douglas-fir clear-cut areas, by growing season after slash burning

AREA A NORTH-SLOPE UNITS			
Growing season	New species and groups	Species and groups dropped out	Total species and groups present
1	--	--	42
4	37	5	74
5	6	17	63
AREA B NORTH-SLOPE UNITS			
2	--	--	45
5	29	12	62
6	8	24	46
SOUTH-SLOPE UNITS			
1	--	--	40
3	20	9	51
4	12	6	57

These trends were largely accounted for by a lack of balance between numbers of invading species and those that dropped out. Species dropping out were mostly annuals, which were replaced by perennials. After the second growing season, the vegetation was predominantly perennial. This is undoubtedly that portion of secondary succession, from annual to perennial vegetation, noted by Ingram (1931) and Isaac (1943).

Unlike the findings of Kienholz (1929), but in agreement with his prediction, this study showed some differences between north and south slopes in species present and their frequency. Of the 104 species and species groups found, 101 appeared on north-slope plots and 65 on south-slope plots. Three species were found exclusively on south-slope plots. However, two of these--cascara buckthorn and minerslettuce--were noted on north slopes outside the study plots. The third species, myrtle pachistima, was limited to one south-slope

unit and was not considered a characteristic species on south slopes. Thirty-seven species and species groups were found exclusively on north-slope plots. Six of these were observed on south-slope units outside the study plots. Of the remaining 31, only Oregon oxalis was widely distributed and considered a characteristic survivor from the understory on north slopes. Only modest whipplea and annual species had consistently higher frequency on south slopes than on north slopes.

Data compiled for important plant species on the study plots showed that frequency of occurrence varied widely between clear-cut areas (table 2). Because of this variation, also noted by Isaac (1943), comparisons for frequency trends should be limited to data from the same area.

Species found in each vegetation class were generally the same as reported by Ingram (1931), Isaac (1943), Kienholz (1929), and Morris (1958). Fireweed, the most widely distributed species, appeared on every unit at each examination. Grapeleaf California dewberry^{6/} was second in distribution. Woodland groundsel rose to a high frequency during the first two growing seasons, then dropped rapidly. Annual epilobiums, on the other hand, rose to a high frequency during the second to fourth seasons and maintained a relatively high frequency during the course of the study.

Of the vegetation that survived from the understory, woody species slowly increased in frequency of occurrence, whereas herbaceous species declined rapidly. The slow increase in these woody species was similar to that previously reported, but the decline of the herbaceous species was more rapid. In contrast to findings of previous studies, herbaceous species that survived from under the forest canopy were relatively unimportant. Herbaceous perennials that invaded the clear-cut areas had a general increase in frequency similar to the trend noted by Isaac (1943).

Only a few species listed in table 2 favored either burned or unburned areas. Salal, American twinflower, and Pacific rhododendron had a consistently higher frequency on unburned areas; annual epilobiums, thistle, and woodland groundsel occurred more frequently on burned areas. Those species that were present before logging had a higher frequency on unburned areas; invaders had a higher frequency

^{6/} Known locally as trailing blackberry.

Table 2.--Frequency of occurrence of important species on Douglas-fir clear-cut areas, by growing season after slash burning

Important species ^{1/}	North-slope units						South-slope units		
	Area A			Area B					
	1	4	5	2	5	6	2	3	4
----- Percent -----									
Woody species:									
Survivors:									
Salal	3	13	11	9	21	24	15	26	26
Pacific rhododendron	6	9	19	12	18	17	0	6	26
Modest whipplea	8	24	28	0	24	31	48	58	54
American twinflower	10	19	28	8	24	28	8	18	16
Vine maple	16	22	21	13	24	26	12	18	12
Cascades mahonia	33	44	42	18	50	49	22	30	28
Grapeleaf California dewberry	47	71	52	47	81	78	52	40	51
Invaders:									
Willow	9	22	17	8	10	11	0	4	4
Blueberry elder	9	24	14	6	13	5	5	0	1
Western thimbleberry	15	32	36	4	14	14	8	4	2
Herbaceous species:									
Invaders:									
Annuals:									
Annual epilobiums ^{2/}	5	48	38	33	22	24	48	45	51
Woodland groundsel	54	13	6	18	14	15	85	46	47
Perennials:									
Western hawkweed	1	14	28	0	11	46	15	5	24
Common pearleverlasting	1	24	21	4	21	22	2	2	2
Western bracken	2	4	6	0	5	5	0	8	11
Slender cudweed	4	8	10	2	4	12	12	4	4
Thistle	6	12	26	4	12	22	8	18	22
Fireweed	74	96	94	56	95	93	58	61	80
----- Number -----									
Basis: clear-cut units	4	4	4	5	5	5	1	2	4

^{1/} Listed as "Survivors" if present under adjacent forest canopy; as "Invaders," if absent.

^{2/} E. minutum and E. paniculatum.

on burned areas. After five growing seasons, however, these differences were not evident. Differences in species present on burned and unburned areas and the duration of the differences have been previously reported by Ingram (1931), Isaac (1943), and Morris (1958). Of special note was the higher frequency on burned areas of species with windblown seed. This also was reported by Ingram (1931).

Little consistent difference in species frequency was evident between various elevation classes. However, only one clear-cut unit was located above 3,000 feet, and it is believed that with more data from higher elevations a difference may be evident.

SUMMARY OF RESULTS

Data from a 5-year study on the H. J. Andrews Experimental Forest in the Oregon Cascade Range indicated 104 species and species groups present on clear-cut and slash-burned areas following removal of old-growth Douglas-fir. Of these, 101 were found in varying amounts on north slopes, whereas only 65 were found on south slopes. Species noted as "survivors" or "invaders" according to their presence or absence under the adjacent forest canopy were nearly the same as reported in earlier studies.

Vegetation classes in this study exhibited the following general trends:

Woody survivors increased slowly in frequency;

Herbaceous survivors formed a relatively unimportant part of the vegetative cover;

Woody invaders increased more slowly in frequency than did woody survivors;

Herbaceous invaders (annuals) exhibited a high frequency the first 2 years, then declined;

Herbaceous invaders (perennials) exhibited a generally rapid rise in frequency for the first 4 or 5 years, then increased more slowly.

Species that were present under the forest canopy tended to be more prominent on unburned areas, whereas invading species tended to become established more rapidly on burned areas. After five

growing seasons, however, species frequency on burned and unburned areas differed only slightly.

Little consistent difference in species frequency was evident between elevation classes.

COMMON AND SCIENTIFIC NAMES OF SPECIES RECORDED

Common and scientific names of plants identified on clear-cut units in the study are listed below. Authorities for nomenclature were: "Checklist of Native and Naturalized Trees of the United States" (Little, 1953), for species that attain tree size; "Standardized Plant Names" (Kelsey and Dayton, 1942), for most of the others. A few plants not listed in the latter are named in accordance with "A Manual of the Higher Plants of Oregon" (Peck, 1941). Common names in parentheses are used locally.

Plants are grouped by vegetation class and according to their presence (survivors) or absence (invaders) under the adjacent forest canopy. Those marked with an asterisk were found only on north-slope clear-cut units. In addition to these 26 species, there were 10 unidentified species and 1 species classified only by family name (Labiatae).

WOODY SPECIES

Survivors

American twinflower	<i>Linnaea borealis</i> <u>var.</u> <i>americana</i>
Cascades mahonia (Long-leaved Oregongrape)	<i>Mahonia nervosa</i>
Common pipsissewa	<i>Chimaphila umbellata</i>
Grapeleaf California dewberry (Trailing blackberry)	<i>Rubus ursinus</i> <u>var.</u> <i>vitifolius</i>
Modest whipplea	<i>Whipplea modesta</i>
Pacific rhododendron	<i>Rhododendron macrophyllum</i>
Red whortleberry (Red huckleberry)	<i>Vaccinium parvifolium</i>
Salal	<i>Gaultheria shallon</i>
Snow dewberry	<i>Rubus nivalis</i>
Vine maple	<i>Acer circinatum</i>

Invaders

Baldhip rose	Rosa gymnocarpa
Bigleaf maple	Acer macrophyllum
Bitter cherry	Prunus emarginata
*Black cottonwood	Populus trichocarpa
Blueberry elder	Sambucus glauca
California hazel	Corylus cornuta <u>var.</u> californica
Cascara buckthorn	Rhamnus purshiana
*Common snowberry	Symphoricarpos albus
*Creambush rockspirea (Oceanspray)	Holodiscus discolor
*Fremont silktassel	Garrya fremonti
Golden chinkapin	Castanopsis chrysophylla
*Greenleaf manzanita	Arctostaphylos patula
Hairy manzanita	Arctostaphylos columbiana
Myrtle pachistima	Pachistima myrsinites
Pacific dogwood	Cornus nuttallii
*Red alder	Alnus rubra
Redstem ceanothus	Ceanothus sanguineus
*Salmonberry	Rubus spectabilis
Snowbrush ceanothus	Ceanothus velutinus
Western thimbleberry	Rubus parviflorus
Whitebark raspberry (Western blackcap)	Rubus leucodermis
Willow	Salix <u>spp.</u>
*Winter currant	Ribes sanguineum

HERBACEOUS SPECIES

Survivors

Cutleaf goldthread	Coptis laciniata
Inside-out flower	Vancouveria hexandra
*Oregon oxalis	Oxalis oregana
Violet	Viola <u>spp.</u>
Western starflower	Trientalis latifolia
Western swordfern	Polystichum munitum

Invaders

Annuals

Autumn willowweed	Epilobium paniculatum
* Bellflower	Campanula <u>spp.</u>
* Fieldmadder	Sherardia arvensis
* Geranium	Geranium <u>spp.</u>
* Horseweed fleabane	Erigeron canadensis
Minerslettuce	Claytonia perfoliata
* Monkeyflower	Mimulus <u>spp.</u>
Prickly lettuce	Lactuca serriola
Small-flowered willow-herb	Epilobium minutum
Woodland groundsel	Senecio sylvaticus

Perennials

* American speedwell	Veronica americana
* American yellowskunkcabbage	Lysichitum americanum
Bedstraw	Galium <u>spp.</u>
Big deervetch	Lotus crassifolius
Bunchberry dogwood	Cornus canadensis
* Butter-and-eggs toadflax	Linaria vulgaris
* California aralia	Aralia californica
* Cardwell penstemon	Penstemon cardwelli
Claspleaf twistedstalk	Streptopus amplexifolius
Common beargrass	Xerophyllum tenax
Common pearleverlasting	Anaphalis margaritacea
Deerfoot vanillaleaf	Achlys triphylla
Fireweed	Epilobium angustifolium
Hedgenettle	Stachys chamissonis ^{1/}
Horsetail	Equisetum <u>spp.</u>
Pacific bleedingheart	Dicentra formosa
Pacific trillium	Trillium ovatum
* Pyrola	Pyrola <u>spp.</u>
* Shootingstar	Dodecatheon <u>spp.</u>
Slender cudweed	Gnaphalium thermale
* Spotted catsear	Hypochoeris radicata
Spur lupine	Lupinus laxiflorus

^{1/} Identified at Oregon State College Herbarium.

Perennials (Continued)

*Tansy	Tanacetum <u>spp.</u>
Thistle	Cirsium <u>spp.</u>
Vetch	Vicia <u>spp.</u>
*Washington lily	Lilium washingtonianum
*Western bracken	Pteridium aquilinum <u>var.</u> pubescens
Western coltsfoot	Petasites speciosa
Western hawkweed	Hieracium Albertinum
*Yarrow	Achillea <u>spp.</u>

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