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Little Sink Research Natural Area

Guidebook Supplement 31

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The PNW Research Station is publishing this guidebook as part of a continuing series of guidebooks on federal research natural areas begun in 1972.

Cover:
Perennial sag pond created by rotational soil slumping. The pond supports aquatic and semiaquatic vegetation including cattail (*Typha latifolia*) marshes, sedge (*Carex obnupta* and *C. hendersonii*) marshes, and floatingleaf pondweed (*Potamogeton natans*). Surrounding forest is primarily Douglas-fir (*Pseudotsuga menziesii*) mixed with bigleaf maple (*Acer macrophyllum*) and scattered grand fir (*Abies grandis*) in the midcanopy.

Abstract

Schuller, Reid; Exeter, Ronald L. 2007. Little Sink Research Natural Area: guidebook supplement 31. Gen. Tech. Rep. PNW-GTR-725. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 24 p.

This guidebook describes the Little Sink Research Natural Area, a 32.38-ha (80-ac) tract occupying an area of geologically unstable marine siltstone exhibiting natural geomorphic disturbances including landslides, slump benches, scarps, basins and ponds. The area supports forested stands dominated by Douglas-fir (*Pseudotsuga menziesii*) as well as stands codominated by Douglas-fir and bigleaf maple (*Acer macrophyllum*) representative of coniferous forest along the foothills of the Willamette Valley.

Keywords: Research natural area, geomorphic instability, natural disturbance, Douglas-fir forest, Oregon Coast Range, Willamette Valley foothill forest.

Preface

The research natural area (RNA) described in this supplement[1] is administered by the Bureau of Land Management (BLM), U.S. Department of the Interior. The BLM/Salem District office has RNA program administrative responsibility and the Mary's Peak Resource Area has on-the-ground management responsibility for the RNA. Scientists and educators wishing to visit or use the RNA for scientific or educational purposes should contact the resource area office field manager in advance and provide information about research or educational objectives, sampling procedures, and other prospective activities. Research projects, educational visits, and collection of specimens from the RNA all require prior approval. There may be limitations on research or educational activities.

Little Sink RNA is part of a federal system of such tracts established for research and educational purposes. Each RNA constitutes a site where natural features are protected or managed for scientific purposes and natural processes are allowed to dominate. Their main purposes are to provide:

- Baseline areas against which effects of human activities can be measured or compared.
- Sites for study of natural processes in undisturbed ecosystems.
- Gene pool preserves for all types of organisms, especially rare and endangered types.

The federal system is outlined in *A Directory of the Research Natural Areas on Federal Lands of the United States of America*.[2]

Of the 96 federal RNAs established in Oregon and Washington, 45 are described in *Federal Research Natural Areas in Oregon and Washington: A Guidebook for Scientists and Educators* (see footnote 1). Supplements to the guidebook such as this publication constitute additions to the system.

The guiding principle in managing RNAs is to prevent unnatural encroachments or activities that directly or indirectly modify ecological processes or conditions. Logging and uncontrolled grazing are not allowed, for example, nor is public use that might impair scientific or educational values. Management practices necessary to maintain or restore ecosystems may be allowed.

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[1] Supplement No. 31 to Franklin, J.F.; Hall, F.C.; Dyrness, C.T.; Maser, C. 1972. Federal research natural areas in Oregon and Washington: a guidebook for scientists and educators. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 498 p.

[2] Federal Committee on Ecological Reserves. 1977. A directory of the research natural areas on federal lands of the United States of America. Washington, DC: U.S. Department of Agriculture, Forest Service. [Irregular pagination].

Federal RNAs provide a unique system of publicly owned and protected examples of undisturbed ecosystems where scientists can conduct research with minimal interference and reasonable assurance that investments in long-term studies will not be lost to logging, land development, or similar activities. In return, a scientist wishing to use an RNA is obligated to:

- Obtain permission from the appropriate administering agency before using the area.[3]
- Abide by the administering agency's regulations governing use, including specific limitations on the type of research, sampling methods, and other procedures.
- Inform the administering agency on progress of the research, published results, and disposition of collected materials.

The purpose of these limitations is to:

- Ensure that the scientific and educational values of the tract are not impaired.
- Accumulate a documented body of knowledge and information about the tract.
- Avoid conflict between studies and activities.

Research must be essentially nondestructive; destruction of vegetation is generally not allowed, nor are studies requiring extensive modification of the forest floor or extensive excavation of soil. Collection of plant and animal specimens should be restricted to the minimum necessary to provide voucher specimens and other research needs. Under no circumstances may collecting significantly reduce populations of species. Collecting also must be carried out in accordance with agency regulations. Within these broad guidelines, appropriate uses of RNAs are determined by the administering agency.

Salem BLM management direction is to preserve, protect, or restore native species composition and ecological processes of biological communities (including

[3] Six federal agencies cooperate in this program in the Pacific Northwest: U.S. Department of the Interior, Bureau of Land Management, Fish and Wildlife Service, and National Park Service; U.S. Department of Agriculture, Forest Service; U.S. Department of Energy; and U.S. Department of Defense.

Oregon Natural Heritage Plan terrestrial and aquatic cells[4] in RNAs. These areas will be available for short- or long-term scientific study, research, and education and will serve as a baseline against which human impacts on natural systems can be measured. The Marys Peak Resource Area does not issue special forest product permits within RNAs.

[4] Cells are the basic units which must be represented in a natural area system. A cell can be an ecosystem, community, habitat, or organism. Taken from Dyrness, C.T.; Franklin, J.F.; Maser, C.; Cook, S.A.; Hall, J.D.; Faxon, G. 1975. Research natural area needs in the Pacific Northwest: a contribution to land-use planning. Gen. Tech. Rep. PNW-38. U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 231 p.

Contents

Introduction

The Little Sink Research Natural Area (RNA) is a 32.4-ha (80-ac) tract of coniferous forest situated in the Willamette Valley foothills on the eastern margin of the Oregon Coast Range. The RNA exemplifies the Willamette Valley foothill Douglas-fir forest type (Franklin and Dyrness 1973) underlain by marine siltstone where frequent mass soil movement has produced slump benches, scarps, basins, and several ponds. Stands are generally of two types; (1) stands dominated by Douglas-fir (*Pseudotsuga menziesii*)[1] and (2) stands codominated by Douglas-fir and bigleaf maple (*Acer macrophyllum*) (Dyrness et al. 1975, Hawk 1974, USDI BLM 1996). Grand fir (*Abies grandis*) seedlings and saplings are common throughout the Little Sink area.

Little Sink RNA supports a cross section of representative low-elevation forest associations that occupy low elevations along the eastern flanks of the Oregon Coast Range and within the western foothills of the Willamette Valley (Dyrness et al. 1975, Franklin and Dyrness 1973, Hawk 1974.

Three ponds, created by rotational soil slumping in concert with beaver (*Castor canadensis*) activity, add significantly to the diversity of the area. The diversity within Little Sink is represented in both old-growth and mature Douglas-fir stands, mixed bigleaf maple and Douglas-fir stands, and ponds and transitional wetlands between aquatic and terrestrial upland ecosystems (see apps. 1 and 2). This diversity is further enhanced by slumping landscape.

Little Sink RNA was established in 1973 as an RNA. The RNA is administered by the Salem District of the Bureau of Land Management (BLM) and managed by the Marys Peak Resource Area, BLM.

A guidebook supplement was written for Little Sink RNA in 1974 (Hawk 1974). Since that time, a substantial amount of new information has been developed through inventory, research, and monitoring of Little Sink and the Willamette Valley Foothill ecological province (Franklin and Dyrness 1973, Hawk 1974, Oregon Natural Heritage Program 2003, USDI BLM 1996). This includes information on plants and vegetation, animals, and soils present within the RNA. A regional vegetation classification (McCain and Diaz 2002) has been completed that, combined with an updated statewide natural area plan (Oregon Natural Heritage Plan 2003), provides added perspective to the significance of Little Sink RNA. New data on the statewide distribution and habitat requirements of amphibians, reptiles, birds, and mammals (Csuti et al. 1997) has been supplemented by ongoing surveys

[1] See appendixes for a listing of scientific names matched with their common name equivalent.

at Little Sink (Johnson 1973) by local universities. A new soil survey of Polk County, Oregon, has also been recently completed (USDA NRCS 2006). In summary, much more is known about Little Sink and how it fits into the broader landscape than in 1974 when the original guidebook was prepared.

Access and Accommodations

Little Sink RNA is located in section 33, T. 8 S., R. 6 W., Willamette Meridian approximately 2 air miles south of Falls City, Oregon. The site is most easily accessed over lands owned by the Willamette Council, Campfire Boys and Girls. Permission is required to cross these lands. Alternate routes to the Little Sink RNA may be available. Please contact the Salem BLM, Marys Peak Resource Area for access information and to obtain permission to use the area.

Figure 1 shows road access up to the adjacent private land located immediately west of Little Sink. Directions are as follows: from the junction of Kings Valley Highway (223) and the Bridgeport Road/Independence Highway intersection, travel west on Bridgeport Road for approximately 1.4 mi (2.25 km) to the junction of Liberty Road and Bridgeport Road. Continue left on Bridgeport Road for approximately 2.2 mi (3.5 km) to the intersection of Bridgeport and Frost Road. Continue west on Frost Road for approximately 0.2 mi (0.32 km) to the intersection of Frost Road and Clark Road. Frost Road turns south and Clark Road continues west. Continue west on Clark Road for approximately 0.1 mi (0.16 km) to Teal Creek Road. Turn left on Teal Creek Road and proceed for approximately 1 mi (1.6 km) to the access route across private land.

There are no maintained trails accessing or within Little Sink. However, unmaintained trails are evident in the west-central portion of Little Sink around the ponds. Foot travel within the RNA may be limited in some areas by dense vegetation and uneven terrain. Lodging accommodations are available in Dallas, Oregon.

Environment

Elevations range from 177 m (580 ft) in the northwestern portion of Little Sink to 328 m (1,075 ft) on Tater Hill along the east-southeastern boundary of the RNA (fig. 2). Slopes are predominately northwest- to west-facing. Little Sink has gentle slopes near the ponds but is fairly steep in the higher elevations and in the northwest corner down to Teal Creek. An intermittent stream flows west through the RNA into the largest of three ponds, then drains into Teal Creek about 400 m (1,312 ft) west of the RNA.

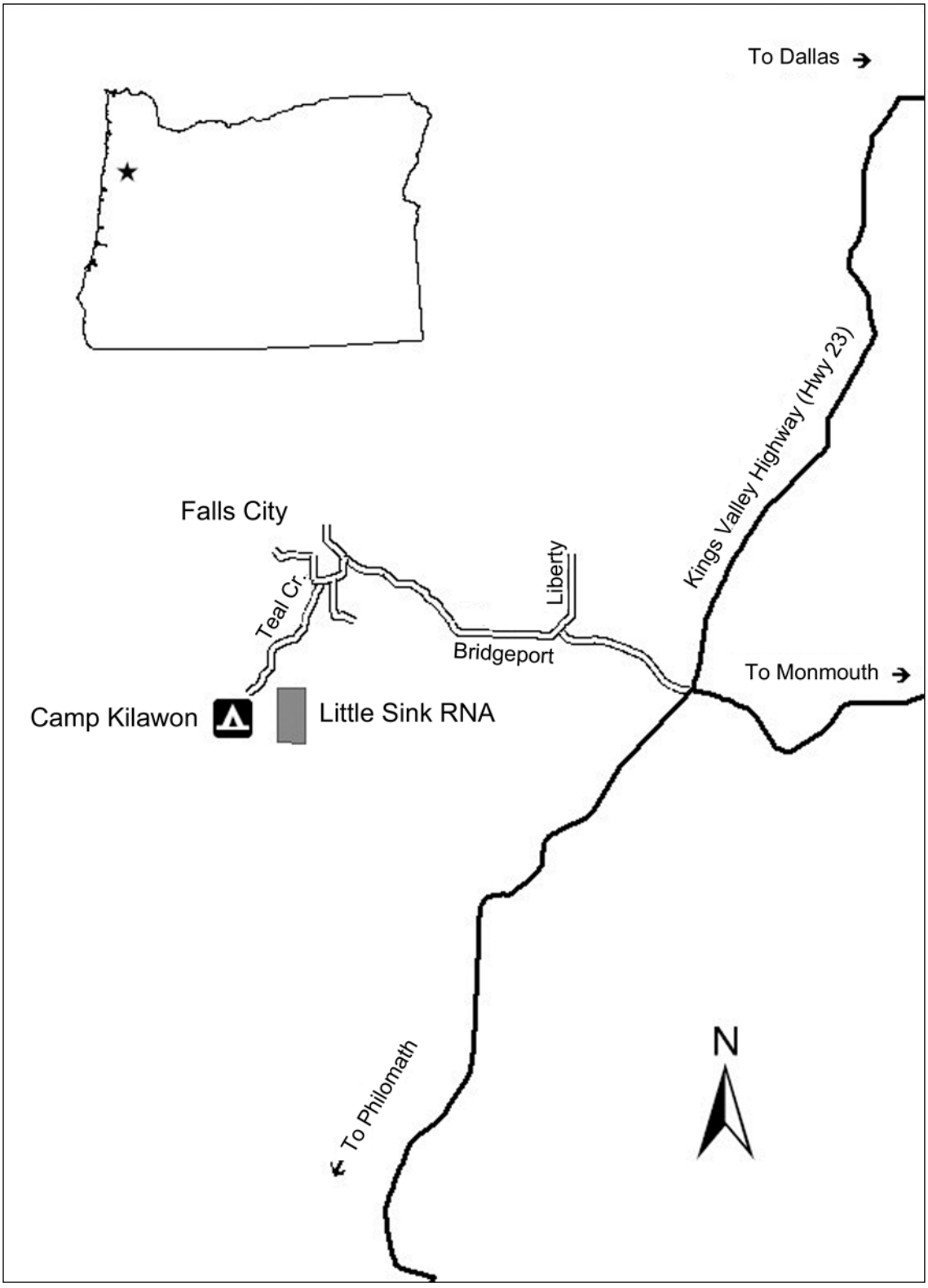

Figure 1—Little Sink Research Natural Area location and access.

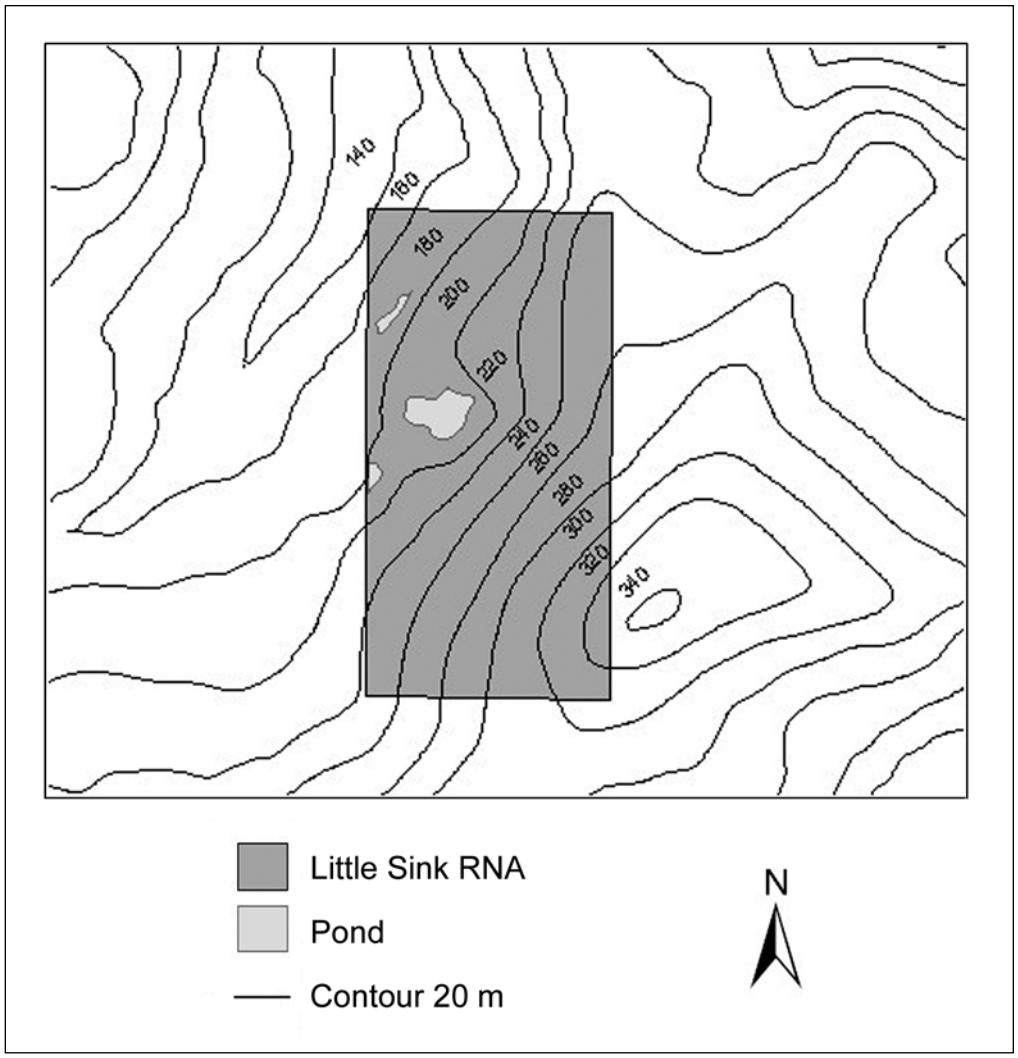

Figure 2—Little Sink Research Natural Area boundary and topographic map.

The permanent ponds are located at lower elevations in the west-central portion of the site. The largest pond (see front cover photo), approximately 0.81-ha (2-ac) in size, receives channel flow from the intermittent stream and has an outlet channel, which has been dammed and is maintained by American beaver.

Bedrock consists primarily of marine siltstone deposited during the Eocene. Soils derived from this rock have been disturbed by a series of landslides, which have resulted in rotational slumps, escarpments, and slump ponds. Terrain is broken and undulating upslope from the slump ponds. Trees of varying sizes have curved stems (pistol butts), which are generally oriented toward the direction of movement or the back of the rotation.[2]

[2] Unpublished field notes on file at the USDI-BLM Salem District office.

Soils within the RNA have been mapped as of 2005 (USDA NRCS 2006, USDA SCS 1982). Forested soils are silty clay loam or gravelly silty clay loam and slopes vary between 3 to 50 percent steepness. Kilowan Series soils make up 57 percent of the area; Blachly Series soils make up 23 percent; and Klickitat Series soils comprise 17 percent. All three soil series are dominantly deep to moderately deep, well drained, and occur on mountainous uplands (USDA SCS 1982). Parent material is colluvium and residuum weathered from sedimentary rock (Kilowan and Blachly Series) or basalt (Klickitat Series). Three percent of the RNA is mapped as water (USDA NRCS 2006, USDA SCS 1982). Forest soils are generally classified as Haplumbrepts (Franklin and Dyrness 1973).

Climate

The climate of Little Sink RNA is modified, rain-shadow climate effect resulting from its position along the lee side of the Oregon Coast Range (Franklin and Dyrness 1973) and its geographic proximity to the warm, dry Willamette Valley (Hawk 1974). Summers are usually moderately dry and warm with the June–August period receiving about 4 percent of the total annual precipitation. Winters are typically cool and wet with the majority of precipitation, mostly in the form of rain, occurring during the November-March period. Average annual snowfall of 274 mm (10.8 in) occurs predominantly from December through February. Snow typically melts quickly. For the 40-year period 1961 to 2001, snowpack depth monthly averages are 0 mm (0 in) (Western Regional Climate Center 2006).

Meteorological data from the nearest climatic station of comparable elevation and distance from the Pacific Ocean are taken from Falls City 2, Oregon (352805) (Western Regional Climate Center 2006). The Falls City station is approximately 11.3 km (7 mi) northwest of Little Sink.

Period of Record: 5/8/1961 to 3/31/2001—Falls City 2, Oregon (352805)

Average minimum January temperature	-0.06° C (31.9° F)
Average maximum January temperature	7.9° C (46.2° F)
Average minimum July temperature	9.6° C (49.3° F)
Average maximum July temperature	26.8° C (80.3° F)
Average annual precipitation	1703 mm (67.03 in)
Average June–August precipitation	65 mm (2.56 in)
Average annual snowfall	274 mm (10.8 in)

Vegetation

Little Sink RNA is situated along the western boundary of the Willamette Valley Foothills ecological province. However, the vegetation is consistent within a "transition zone" between the Oregon Coast Range province and the Willamette Valley Foothill ecological province (Franklin and Dyrness 1973, Hawk 1974, Oregon Natural Heritage Program 2003, USDI BLM 1996).

Forest vegetation occupies approximately 97 percent of the site and is similar to low-elevation forests located on the eastern portion of the Oregon Coast Range province (the transition into the Willamette Valley Foothill ecological province). The major plant communities reflect the relatively warm and dry site conditions present within Little Sink compared to other coniferous forests of the Oregon Coast Range. Conifer forests located at higher elevations and to the west of Little Sink typically support *Tsuga heterophylla* (western hemlock) and Douglas-fir as forest overstory dominants. Western hemlock dominates reproduction layers at higher elevations (Hawk 1974, McCain and Diaz 2002).

Douglas-fir is the most common and widespread overstory tree throughout the RNA. Bigleaf maple varies from a minor overstory component to a major codominant with Douglas-fir in areas that have been subjected to mass soil movement, especially rotational slumping (Hawk 1974). Grand fir occurs in many areas as a midcanopy to subcanopy component of the tree layer. Grand fir seedlings appear to be sparse to absent in the warmest, driest sites.

Pacific dogwood (*Cornus nuttallii*) exhibits a tree growth form within the RNA and occurs sporadically within the midlayer of the forest canopy. Pacific yew (*Taxus brevifolia*) occasionally occupies the midcanopy as a minor component of the tree stratum. Pacific yew occurs mostly around the ponds.

Figure 3 illustrates the age-class distribution of forest communities within Little Sink. Stands in the 200-year-old-or-older age class predominate. Scattered individuals of Douglas-fir 400+ years occur within these stands along with many codominant trees in the 100- to 200-year-old age class.

Tree ages

Tree ages data were collected from four plots established in 2006. A total of 18 trees were cored, 8 of which were dominant. Tree diameters at core height (approximately 1.47 m) and ages of 17 Douglas-fir and one grand fir reflect a multiaged stand with at least one old-growth cohort originating in the 18th century. Diameters at core height ranged between 94 and 185.5 cm (37 and 73 in). Tree ages ranged from 94 years old to 429 years. The 429-year-old Douglas-fir is likely a lone survivor of a previous naturally occurring event (wildfire, windstorm, etc.). The grand fir, 87.6 cm (34.5 in) at core height, extended into the subcanopy and was aged at 165 years. Upper canopy Douglas-fir ranged in diameter at core height between

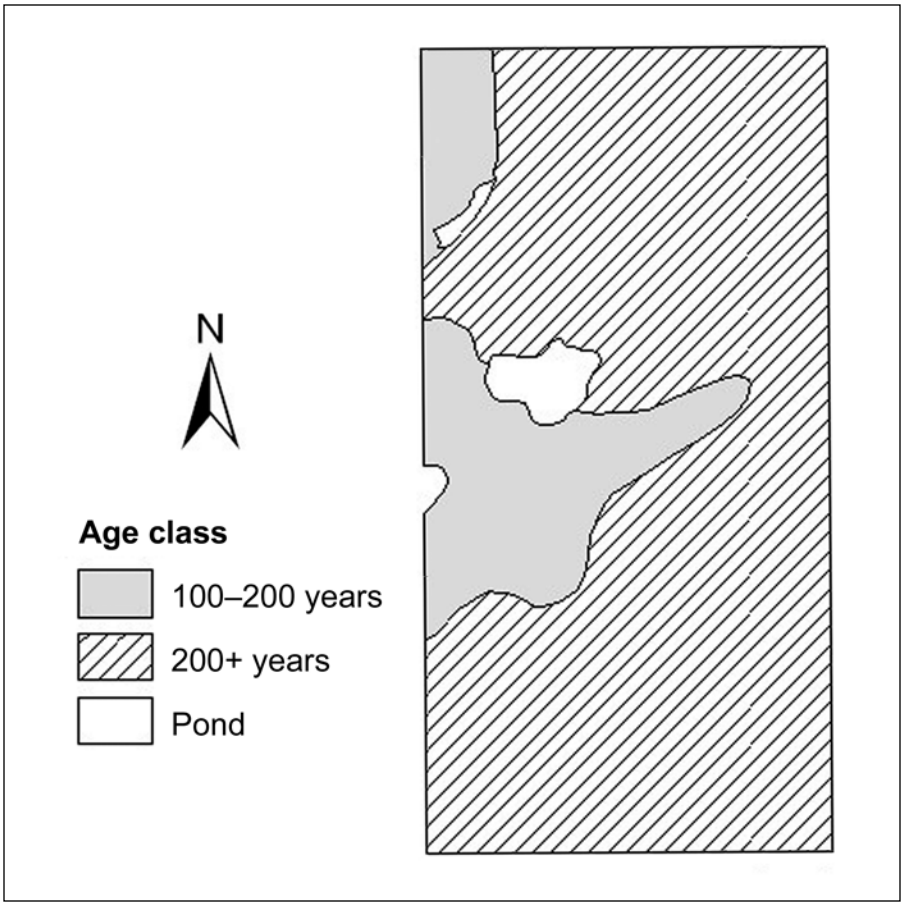

Figure 3—Stand age-class distribution in Little Sink Research Natural Area.

109.7 cm and 185.5 cm (43.2 and 73 in). Tree ages within this group ranged between 189 and 429 years. The median diameter and age for the group was 87.2 cm (34.3 in) and 118 years, respectively.

The tall shrub layer is well represented by hazelnut (*Corylus cornuta* var. *californica*) throughout the RNA. Oceanspray (*Holodiscus discolor*) and baldhip rose (*Rosa gymnocarpa*) also occur in moderate abundance in some areas. Similarly, salal (*Gaultheria shallon*) and Oregongrape (*Berberis nervosa*) characterize the mid- and low-shrub layers, respectively.

The most conspicuous and widespread herbaceous species, swordfern (*Polystichum munitum*), occurs on mesic footslopes and benches at lower elevations with the RNA. A large diversity of herbs occur in the area, in part due to the numerous habitats present, including open-water ponds, pond margins, perennial and intermittent streams, slump benches and scarps, open and closed hardwood, and coniferous forest microhabitats of various ages (Hawk 1974).

Permanent vegetation plots were established in 2006 to quantitatively characterize stand structure and vegetation composition of representative stands within the RNA. Tables 1 and 2 summarize the physical features, plant association, and understory composition and frequency of four permanent plots.

Table 1—Physical features of four permanent plots in Little Sink Research Natural Area

	Plot number			
Physical features	**116**	**117**	**118**	**119**
Elevation (m)	214	262	267	216
Aspect (°)	324	294	352	80
Slope grade (%)	15	27	30	24
Landform	Midslope	Midslope	Midslope	Midslope

Forest plant associations

Plots number 116, 117, and 119 represent examples of the *Abies grandis*/*Berberis nervosa*-*Gaultheria shallon*) forest plant associations as defined by McCain and Diaz (2002). Figure 4 shows an example of the understory conditions of this plant association taken from plot 116. Douglas-fir is a major overstory dominant and the shade-tolerant grand fir occurs in the form of seedlings, saplings, and subcanopy individual trees in each of the three plots. Hazelnut, salal, and Oregongrape range between 4 and 29 percent cover. Swordfern is the principal herbaceous species and ranges between 6 and 47 percent cover. Other herbaceous species include vanilla leaf (*Achlys triphylla*), three-leaved Anenome (*Anemone deltoidea*), sweetscented bedstraw (*Galium triflorum*), and starflower (*Trientalis latifolia*) (see table 2).

Plot 118 (fig. 5) occurs on a warm, dry site that supports the *Pseudotsuga menziesii*/*Berberis nervosa* plant association (McCain and Diaz 2002). Shrub cover in this plot is very low compared to the other plots. Grand fir reproduction is similarly very sparse and is confined to a few individuals (fig. 5). The sparcity of grand fir reproduction may be attributed to the site being slightly warmer and drier than most of the surrounding forest at Little Sink. The herbaceous ground cover is similar, however, to that occurring in plots 116, 117, and 119 (table 2). Appendix 1 lists vascular plants, ferns, and fern-allies known to occur within the Little Sink RNA.

Hawk (1974) described three forested plant communities within Little Sink based on current vegetation and apparent position along a soil moisture gradient. The "driest" community occurs on upper elevation slopes, benches and on south-facing aspects. The tree layer is dominated by Douglas-fir with an occasional bigleaf maple or Pacific dogwood. Douglas-fir is the most common sapling in the forest understory followed by the more shade-tolerant grand fir. This community type is characterized by an abundance of tall and low shrubs, including hazelnut, Oregongrape, salal,

Table 2—Plant association, understory coverage and frequency of four permanent plots in the Little Sink Research Natural Area

	Plots and plant associations							
	116		117		118		119	
	ABGR/ BENE-GASH[a b c d]		ABGR/ BENE-GASH		PSME/BENE		ABGR/ BENE-GASH	
	Cover	Frequency	Cover	Frequency	Cover	Frequency	Cover	Frequency
				Percent				
Shrub cover:[e]								
Berberis nervosa[f]	29	—	20	—	6	—	6	—
Corylus cornuta var. *californica*	8	—	9	—		—	25	—
Gaultheria shallon	4	—	13	—		—	22	—
Linnaea boreais var. *longistylis*		—		—	1	—	tr	—
Lonicera ciliosa	tr[g]	—		—		—		—
Rosa gymnocarpa	tr	—		—	1	—		—
Symphoricarpos mollis		—		—	tr	—		—
Toxiodendron diversilobum		—	tr	—		—		—
Vaccinium parvifolium	1	—		—		—		—
Herb cover and frequency:[e]								
Polystichum munitum	16	36	6	14	22	39	47	75
Achlys triphylla	3	25	4	18	10	39	4	25
Galium triflorum	1	25	1	18	3	54	1	29
Anemone deltoidea	1	18	tr	4	2	39		
Thalictrum occidentale	1	4	1	7	tr	4	4	25
Viola sempervirens	tr	7	tr	7	tr	11	tr	4
Trientalis latifolia	tr	4	3	43	1	18	1	14
Potentilla glandulosa	tr	7						
Asarum caudatum	tr	4						
Cardamine sp.	tr	7			tr	14		
Adenocaulon bicolor			tr	4			2	11
Prosartes smithii			1	7	2	18	1	7
Osmorhiza berteroi			tr	4	1	11	tr	14
Bromus vulgaris			tr	7	tr	4	tr	4
Trisetum ceruum					tr	14	tr	7
Campanula scouleri					1	11		
Melica sp.					tr	4		
Rubus ursinus							1	14
Carex hendersonii							tr	4
Maianthemum stellatum							2	29

[a] ABGR = *Abies grandis*, BENE = *Berberis nervosa*, GASH = *Gaultheria shallon*, PSME = *Pseudotsuga menziesii*.

[b] Plant association names all have a suffix, NWO Coast, which differentiates them from plant associations having similar names that occur in the Oregon Cascades sensu McCain and Diaz (2002) . Plant association names refer to potential vegetation.

[c] Current vegetation may be dominated by different species as that implied by the plant association name depending on the type and size of past disturbance, and the length of time since the past disturbance. Long-lived seral species (such as Douglas-fir) may currently be abundant within the plant association.

[d] McCain and Diaz (2002) refer to *Berberis nervosa* as *Mahonia nervosa*. We use the currently accepted name of *Berberis nervosa* in this document. See: Flora of North America (2006) and the Oregon Flora Project (2006) in the reference section.

[e] Cover is expressed as percentage of foliar cover; frequency is expressed as percentage of relative frequency. Zero values are not included.

[f] See appendixes for a listing of scientific names matched with their common name equivalent.

[g] tr = trace (<0.5 percent foliar cover).

Figure 4—Grand fir/Oregongrape-salal (*Abies grandis*/*Berberis nervosa*-*Gaultheria shallon* Northwest Oregon Coast) plant association with mature Douglas-fir overstory mixed with Pacific dogwood (*Cornus nuttallii*) in the midcanopy and western swordfern (*Polystichum munitum*) is abundant as an herbaceous groundcover. Taken from plot number 116 (see ABGR/BENE-GASH in table 2).

baldhip rose, and oceanspray. A second, more mesic plant community differs from the drier community primarily by exhibiting a much less developed shrub layer. Other, additional shrub species occur in this type, including vine maple (*Acer circinatum*), red huckleberry (*Vaccinium parvifolium*), thimbleberry (*Rubus parviflorus*), false huckleberry (*Menziesia ferruginea*), and Indian plum (*Oemleria cerasiformis*). A third plant community occurs in previously disturbed settings such as slump benches and scarps. Bigleaf maple predominates in these areas along with scattered individuals of Douglas-fir, which are often twisted and bent as a result of mass soil movement. Red alder (*Alnus rubra*) is locally abundant in some areas mostly near the ponds or in areas with a high water table. The upper canopy is more open than in the two undisturbed plant communities resulting in a well-developed and diverse shrub layer, which includes the shrub species mentioned above in addition to mockorange (*Philadelphus lewisii*), serviceberry (*Amelanchier alnifolia*), and poison oak (*Toxiodendron diversilobum*).

Figure 5—Douglas-fir/Oregongrape (*Pseudotsuga menziesii*/*Berberis nervos*a Northwest Oregon Coast) plant association supports large Douglas-fir with bigleaf maple (*Acer macrophyllum*) in the upper canopy. Hazelnut (*Corylus cornuta* var. *californica*) occupies the tall shrub layer and Western swordfern (*Polystichum munitum*) is the dominant ground cover. Taken from plot number 118 (see PSME/BENE in table 2).

Soil movement and slumping have contributed to the formation of three small ponds within the RNA. Collectively, these ponds occupy approximately 1.2 ha (3 ac) in the west-central portion of the RNA. However, they add significant diversity to the area by providing specialized habitats for both plants and animals. Some prominent habitats include cattail (*Typha latifolia*) marshes, sedge (*Carex obnupta*) marshes, skunk cabbage (*Lysichiton americanus*) bogs, and poorly drained springs occupied by devil's club (*Oplopanax horridum*).

Fauna

Amphibians, reptiles, birds, and mammals known or expected to occur within Little Sink are listed in appendix 2. The high species diversity in this 32.4-ha (80-ac) area can be attributed to the interface of terrestrial and aquatic habitats, its proximity to the Willamette Valley, and the low level of nonnative and introduced organisms

within the RNA. These lists have been compiled from a combination of field observations and published literature. Taken together, they represent an informed approximation of species expected to occur within or use the RNA for portions of their life cycles (Csuti et al. 1997, Hawk 1974).

Disturbance History

Little Sink RNA has been subjected to both natural and human-induced disturbances of differing spatial scales over the past few centuries. The most conspicuous disturbance, both past and present, is mass soil movement. Rotational slumping has caused uprooting of trees in many areas within the RNA.

This has resulted in openings in the forest canopy as well as the presence of exposed mineral soil in some areas. The recent and apparent ongoing nature of this soil and geomorphic process at Little Sink is one of the primary reasons that the RNA was established for research and education.

The fire regime of the *Tsuga heterophylla* zone is highly variable, and where western hemlock forests occur in transitional areas to other forest types, the fire regimes of these areas take on characteristics of both areas (Agee 1993). The location of Little Sink RNA lies within such a transitional area. The characteristics of the fire regime can be expected to be a blend of relatively dry, Willamette Valley margins where Douglas-fir is often an overstory dominant with varying mixtures of grand fir, and the more mesic, higher elevations to the west where western hemlock becomes a major dominant in the Oregon Coast Range.

Details of the fire history and fire regime at Little Sink are largely unknown. However, tree core samples taken from 18 trees in 2006 indicate the occurrence of a (near) stand-replacement fire in the 18th century followed by episodic Douglas-fir recruitment. This supports Hawk's (1974) statement that the last major fire at Little Sink occurred between 1600 and 1700.

Evidence of human impacts within the RNA is primarily limited to areas around the ponds, especially beaver dams. Educational groups visiting the RNA walk along pond margins and atop beaver dams, which are used as bridges across pond outlets. Foot trails are evident in these areas. However, most visitation does not coincide with periods when the site is used for nesting by migratory waterfowl (Hawk 1974).

The adjacent lands along the western and northern boundaries were logged in the 1930s. The western boundary was logged again in 2004 and several new natural surfaced roads constructed. Today, logging roads serve as primary foot access from the west. It also appears the privately owned timbered lands adjacent to the other three sides of Little Sink may soon be logged, as newly constructed roads provide

access to the northwest corner and the southern boundaries of Little Sink. Blowdown along Little Sink's edges may increase in the years following harvest on the adjacent private lands; especially along the southwestern edge where several trees have blown down in the past. Although the Oregon Coast Range can receive storm winds exceeding 161 km per hour (100 mph), there is little evidence that large-scale windthrow has occurred within the RNA. Similarly, there is no evidence of catastrophic damage within the RNA resulting from insects or disease.

Research History

Scientists from universities and colleges in western Oregon began conducting biological studies in the RNA in the early 1950s. Inventories of birds, mammals, amphibians, and plants were conducted over the years by scientists from Western Oregon University and Willamette University (Johnson 1973). Hawk (1974) prepared an RNA guidebook supplement describing the natural areas biotic and abiotic significance. Juday (1976) sampled Little Sink RNA as part of his Ph.D. dissertation: "The location, composition and structure of old-growth forests in the Oregon Coast Range." Carroll and Carroll (1978) used Little Sink to examine the distribution and role of fungi on conifer needle surfaces. Greene et al. (1986) reported that a researcher from the University of Kansas used the area to study the population genetics of the northwestern salamander (*Ambystoma gracile).*

Four permanent vegetation plots were established in 2006 to characterize and monitor change in forest composition and structure in geologically unstable slump benches, scarps and basins (the project is summarized, in part, in table 2.) Data are on file at the Salem District office of the BLM, and the Pacific Northwest Research Station, U.S. Forest Service, Corvallis, Oregon.

Site History

The RNA has been used extensively by researchers and as an outdoor laboratory by classes from Western Oregon University, Willamette University, Oregon State University, and the University of Oregon. The Willamette Chapter of the Campfire Boys and Girls at Camp Kilowan has traditionally used Little Sink RNA for outdoor education. The National Audubon Society uses the area for annual Christmas and spring bird counts.

In response to Camp Kilowan's promotion of the outdoor educational values of Little Sink, scientists and educators became knowledgeable of the area. This eventually led to Little Sink becoming established as a research natural area in 1973.

In the mid-1970s, as part of the inventory of the wilderness characteristics of BLM lands, Congress directed that research natural areas and primitive areas

designated prior to November 1, 1975, be examined. Because Little Sink had been designated as a RNA in 1973, it became designated as an Instant Study Area. A review of the Little Sink Instant Study Area was completed and sent to Congress as part of a national package of Instant Study Areas in 1985. Congress has yet to take action on the 1985 study submitted by BLM. Pending future congressional action, the wilderness values of Little Sink will be protected.

Maps and Aerial Photography

Maps—applicable to Little Creek RNA: Topographic—Falls City 7.5 Minute 1:24,000 scale, 1974; BLM Salem District Westside Recreation Map 1:10,560 1996.

Aerial photography—2003 color 1:12,000.

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English Equivalents

1 hectare (ha) = 2.47 acres (ac)
1 kilometer (km) = 0.62 miles (mi)
1 meter (m) = 3.28 feet (ft)
1 centimeter (cm) = 0.394 inch (in)

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Appendix 1

Table 3—Scientific and Common Names of Plants[a] [b]

Scientific name	Common name
Coniferous trees:	
Abies grandis (Dougl.) Lindl.	Grand fir
Pseudotsuga menziesii (Mirb.) Franco	Douglas-fir
Taxus brevifolia Nutt.	Western yew
Thuja plicata Donn.	Western redcedar
Tsuga heterophylla (Raf.) Sarg.	Western hemlock
Deciduous trees >8 m (26.3 ft) tall:	
Acer circinatum Pursh	Vine maple
Acer macrophyllum Pursh	Bigleaf maple
Alnus rubra Bong.	Red alder
Arbutus menziesii Pursh	Pacific madrone
Corylus cornuta L. var. *californica* (DC.) Sharp	Hazelnut
Quercus garryana Dougl.	Oregon white oak
Tall shrubs 2 to 8 m (6.6 to 26.3 ft) tall:	
Acer circinatum Pursh	Vine maple
Amelanchier alnifolia Nutt.	Serviceberry
Cornus nuttallii Aud. ex Torr. & Gray	Pacific dogwood
Cornus stolonifera Michx.	Red-osier dogwood
Fraxinus latifolia Benth.	Oregon ash
Holodiscus discolor (Pursh) Maxim.	Oceanspray
Oemleria cerasiformis Torr. & Gray ex Hook. & Am.	Indian plum
Philadelphus lewisii Pursh	Mockorange
Rhamnus Purshiana DC.	Cascara
Salix sp.	Willow
Sambucus mexicana C. Presl	Blue elderberry
Medium shrubs 0.5 to 2 m (1.6 to 6.6 ft) tall:	
Gaultheria shallon Pursh	Salal
Lonicera sp.	Honeysuckle
Menziesia ferruginea Smith	False huckleberry, azalea
Oplopanax horridum (Smith) Miq.	Devilsclub
Ribes bracteosum Dougl.	Stink currant
Ribes divaricatum Dougl.	Straggly gooseberry
Ribes laxiflorum Pursh	Trailing black currant
Ribes lobbii Gray	Lobb's gooseberry
Ribes sanguineum Pursh	Red-flowering currant
Rosa gymnocarpa Nutt.	Baldhip rose
Rosa pisocarpa Gray	Peafruit rose
Rubus laciniatus Willd.	Cut-leaf blackberry
Rubus leucodermis Dougl. ex Torr. & Gray	Whitebark raspberry
Rubus parviflorus Nutt.	Thimbleberry
Rubus spectabilis Pursh	Salmonberry
Sambucus racemosa L. var. *arborescens* (Torr. & Gray) A. Carrey	Red elderberry
Spiraea douglasii Hook.	Douglas' spirea
Symphoricarpos mollis Nutt.	Common snowberry
Toxiodendron diversilobum (Torr. & Gray) Greene	Poison oak
Vaccinium parvifolium Smith	Red huckleberry

Scientific name	Common name
Low shrubs <0.5 m (1.6 ft) tall:	
Berberis nervosa Pursh	Oregongrape
Linnaea borealis L. var. *longiflora* Torr.	Western twinflower
Rubus ursinus Cham. & Schlecht.	California dewberry
Ferns and allies:	
Adiantum pedatum L.	Maidenhair fern
Athyrium filix-femina (L.) Roth.	Lady fern
Polypodium glycyrrhiza DC. Eat.	Licorice fern
Polystichum munitum (Kaulf.) Presl	Western swordfern
Pteridium aquilinum (L.) Kuhn.	Bracken fern
Herbs:	
Achlys triphylla (Smith) DC.	Vanilla leaf; deer foot
Adenocaulon bicolor Hook.	Pathfinder, Trail plant
Anaphalis margaritacea (L.) Benth. & Hook	Pearly everlasting
Anemone deltoidea Hook.	Three-leaved anemone
Anemone lyallii Britt.	Lyall's anemone
Aquilegia formosa Fisch.	Red columbine
Arnica longifolia D.C. Eat.	Longleaf arnica
Asarum caudatum Lindl.	Wild ginger
Azolla filiculoides Lam.	Pacific azolla
Callitriche sp.	Water starwort
Callitriche hermaphroditica L.	Autumnal water starwort
Calypso bulbosa (L.) Oakes	Calypso orchid
Cardamine angulata Hook.	Angled bittercress
Cardamine oligosperma Torr. & Gray	Little western bittercress
Cardamine pensylvanica Muhl.	Pennsylvania bittercress
Cardamine pulcherrima Greene	Slender toothwoort
Cerastium arvense (L.) Scop.	Field chickweed
Chrysosplenium glechomaefolium Nutt.	Water carpet
Cicuta douglasii (DC.) Coult. & Rose	Western waterhemlock
Circaea alpina L.	Alpine circaea
Cirsium arvense	Canada thistle
Claytonia perfoliata (Donn) Howell	Miner's lettuce
Claytonia sibirica (L.) Howell	Siberian miner's lettuce
Corallorhiza maculata (Raf.) Raf. var. *maculata*	Spotted coralroot
Dicentra formosa (Andr.) Walpers	Pacific bleedingheart
Digitalis purpurea L.	Foxglove
Epilobium sp.	Willowweed
Equisetum telmateia Ehrh.	Giant horsetail
Erythronium oregonum Appleg.	Oregon fawnlily
Fragaria vesca L. var. *crinita* (Rydb.) C.L. Hitchc.	Hairly woodland strawberry
Galium aparine L.	Stickywilly
Galium trifidum L. var. *pacificum* Wieg.	Small bedstraw
Galium triflorum Michx.	Sweetscented bedstraw
Goodyera oblongifolia Raf.	Western rattlesnake plantain
Heracleum lanatum Michx.	Common cowparsnip
Hieracium albiflorum Hook.	White-flowered hawkweed
Hydrophyllum tenuipes Heller	Slender-stem waterleaf
Hypericum anagalloides Cham. & Schlecht.	Trailing St. John's wort

Scientific name	Common name
Hypericum perforatum L.	St. John's wort
Iris tenax Dougl.	Oregon iris
Lathyrus polyphyllus Nutt.	Leafy peavine
Lemna minor L.	Common duckweed
Ligusticum apiifolium (Nutt.) Gray	Parsley leaved lovage
Lotus sp.	Deervetch
Lycopus americanus Muhl.	Cutleaf water horehound
Lysichiton americanus Hult. & St. John	Skunk cabbage
Maianthemum dilatatum (Wood.) Nels. & Macbr.	False lily of the valley
Maianthemum racemosum (L.) Link	Feathery false-Solomonseal
Maianthemum stellatum (L.) Desf.	Starry false-Solomonseal
Mimulus guttatus DC.	Common monkeyflower
Mimulus moschatus Dougl.	Muskplant monkeyflower
Mitella caulescens Nutt.	Leafy mitrewort
Moehringia macrophylla (Hook.) Fenzl	Bigleaf sandwort
Montia parvifolia (Moc.) Greene	Streambank springbeauty
Nemophila parviflora Dougl. ex Benth.	Smallflower nemophila
Osmorhiza berteroi DC.	Mountain sweet-cicely
Oxalis oregana Nutt.	Oregon oxalis
Peltiphyllum pedatum (Torr.) Engl.	Umbrella saxifrage
Petasites frigidus (L.) Fries var. *palmatus* (Ait.) Cronq.	Coltsfoot
Plantago major L.	Common plantain
Potentilla glandulosa Lindl.	Gland cinquefoil
Polygonum cuspidatum Sieb. & Zucc.	Japanese knotweed
Polygonum hydropiper L.	Marshpepper smartweed
Potamogeton natans L.	Floatingleaf pondweed
Prosartes hookeri Torr.	Hooker's fairybells
Prosartes smithii (Hook.) Utech, Shinwari & Kawano	Smith's fairybells
Ranunculus orthorhynchus Hook.	Straightbeak buttercup
Ranunculus uncinatus D. Don	Little buttercup
Rumex acetosella L.	Sheep sorrel, sour weed
Rumex conglomeratus Murr.	Clustered dock
Senecio jacobaea L.	Tansy ragwort
Senecio triangularis Hook.	Arrowleaf groundsel
Sparganium emersum Rehmann	Simple stem bur reed
Stachys sp.	Hedge-nettle
Stellaria crispa Cham. & Schlect.	Crisped starwort
Stellaria media (L.) Cyrill.	Common chickweed
Tellima grandiflora (Pursh) Dougl.	Fringecup
Thalictrum occidentale Gray	Western meadowrue
Tolmiea menziesii (Pursh) Torr. & Gray	Piggy back plant
Trientalis latifolia Hook.	Starflower
Trillium ovatum Pursh	Western trillium
Typha latifolia L.	Common cattail
Urtica dioica L.	Stinging nettle
Vancouveria hexandra (Hook.) Morr. & Dec.	Inside-out flower
Veratrum californicum Durand var. *caudatum* (Heller) C.L. Hitchc.	Cascade false hellebore
Veronica americana Schwein. ex Benth.	American speedwell
Viola glabella Nutt.	Stream violet; yellow wood violet
Viola sempervirens Greene	Redwoods violet

Scientific name	Common name
Wolffia borealis (Hegelm) Landolt & O. Wildi	Northern watermeal
Wolffia columbiana Karst.	Columbia watermeal
Grasses, sedges, and rushes:	
Bromus vulgaris (Hook.) Shear	Columbia brome
Carex hendersonii L.H. Bailey	Henderson's sedge
Carex obnupta L.H. Bailey	Sough sedge
Glyceria elata (Lam.) A. Hitchc.	Tall mannagrass
Holcus lanatus L.	Common velvetgrass
Juncus effusus L.	Common rush
Luzula parviflora (Ehrh.) Desv.	Small-flowered woodrush
Melica subulata (Griseb.) Scribn.	Alaska oniongrass
Scirpus fluviatilis (Torr.) Gray	River bulrush
Trisetum canescens Buckl.	Tall trisetum
Trisetum cernuum Trin.	Nodding trisetum

[a] Compiled from numerous sources. Identifications confirmed.

[b] Nomenclature for vascular plants, ferns, and fern-allies follows the *Flora of North America* Web site (2006) and the Oregon Flora Project Web site (2006).

Appendix 2

Table 4—Amphibians, reptiles, birds, and mammals expected to use Little Sink Research Natural Area[a b]

Order	Scientific name	Common name
Amphibians:		
Caudata	*Ambystoma gracile*	Northwestern salamander
	Ambystoma macrodactylum	Long-toed salamander
	Aneides ferreus	Clouded salamander
	Dicamptodon tenebrosus	Pacific giant salamander
	Ensatina eschscholtzi	Ensatina
	Plethodon dunni	Dunn's salamander
	Plethodon vehiculum	Western redback salamander
	Rhyacotriton variegatus	Southern torrent salamander
	Taricha granulosa	Rough-skinned newt
Anura	*Ascaphus truei*	Tailed frog
	Bufo boreas	Western toad
	Pseudacris regilla	Pacific tree frog
	Rana aurora	Red-legged frog
Reptiles:		
Squamata	*Elgaria coerulea*	Northern alligator lizard
	Charina bottae	Rubber boa
	Coluber constrictor	Racer
	Contia tenuis	Sharptail snake
	Eumeces skiltonianus	Western skink
	Sceloporus occidentalis	Western fence lizard
	Thamnophis elegans	Western terrestrial garter snake
	Thamnophis ordinoides	Northwestern garter snake
	Thamnophis sirtalis	Common garter snake
Testudines	*Clemmys marmorata*	Western pond turtle
Birds:		
Ciconiiformes	*Ardea herodias*	Great blue heron
Anseriformes	*Aix sponsa*	Wood duck
	Anas platyrhynchos	Mallard
	Lophodytes cucullatus	Hooded merganser
	Mergus merganser	Common merganser
Falconiformes	*Accipiter cooperii*	Cooper's hawk
	Accipiter gentilis	Northern goshawk
	Accipiter striatus	Sharp-shinned hawk
	Buteo jamaicensis	Red-tailed hawk
	Cathartes aura	Turkey vulture
	Circus cyaneus	Northern harrier
	Falco sparverius	American kestrel
	Haliaeetus leucocephalus	Bald eagle
Galliformes	*Bonasa umbellus*	Ruffed grouse
	Callipepla californica	California quail
	Dendragapus obscurus	Blue grouse
	Oreortyx pictus	Mountain quail
	Phasianus colchicus	Ring-necked pheasant

Order	Scientific name	Common name
Gruiformes	*Fulica americana*	American coot
	Porzana carolina	Sora
	Rallus limicola	Virginia rail
Charadriiformes	*Actitis macularia*	Spotted sandpiper
	Brachyramphus marmoratus	Marbled murrelet
	Charadrius vociferous	Killdeer
Columbiformes	*Columba fasciata*	Band-tailed pigeon
	Zenaida macroura	Mourning dove
Strigiformes	*Aegolius acadicus*	Northern saw-whet owl
	Bubo virginianus	Great-horned owl
	Glaucidium gnoma	Northern pygmy owl
	Otus kennicottii	Western screech-owl
	Strix occidentalis	Spotted owl
	Strix varia	Barred owl
Caprimulgiformes	*Chordeiles minor*	Common nighthawk
Apodiformes	*Chaetura vauxi*	Vaux's swift
	Selasphorus rufus	Rufous hummingbird
Coraciiformes	*Ceryle alcyon*	Belted kingfisher
Piciformes	*Colaptes auratus*	Northern flicker
	Dryocopus pileatus	Pileated woodpecker
	Picoides pubescens	Downy woodpecker
	Picoides villosus	Hairy woodpecker
	Sphyrapicus ruber	Red-breasted sapsucker
Passeriformes	*Agelaius phoeniceus*	Red-winged blackbird
	Bombycilla cedrorum	Cedar waxwing
	Carduelis pinus	Pine siskin
	Carduelis tristis	American goldfinch
	Carpodacus purpureus	Purple finch
	Catharus ustulatus	Swainson's thrush
	Certhia americana	Brown creeper
	Chamaea fasciata	Wrentit
	Cinclus mexicanus	American dipper
	Cistothorus palustris	Marsh wren
	Coccothraustes vespertinus	Evening grosbeak
	Contopus borealis	Olive-sided flycatcher
	Contopus sordidulus	Western wood peewee
	Corvus brachyrhynchos	American crow
	Corvus corax	Common raven
	Cyanocitta stelleri	Steller's jay
	Dendroica coronata	Yellow-rumped warbler
	Dendroica nigrescens	Black-throated gray warbler
	Dendroica occidentalis	Hermit warbler
	Dendroica petechia	Yellow warbler
	Empidonax difficilis	Pacific-slope flycatcher
	Empidonax hammondii	Hammond's flycatcher
	Empidonax traillii	Willow flycatcher
	Geothlypis trichas	Common yellowthroat
	Hirundo pyrrhonota	Cliff swallow

Order	Scientific name	Common name
	Icteria virens	Yellow-breasted chat
	Ixoreus naevius	Varied thrush
	Junco hyemalis	Dark-eyed junco
	Loxia curvirostra	Red crossbill
	Melospiza melodia	Song sparrow
	Molothrus ater	Brown-headed cowbird
	Myadestes townsendi	Townsend's solitaire
	Oporornis tolmiei	MacGillivray's warbler
	Parus atricapillus	Black-capped chickadee
	Parus rufescens	Chestnut-backed chickadee
	Passerculus sandwichensis	Savannah sparrow
	Perisoreus canadensis	Gray jay
	Pheucticus meelanocephalus	Black-headed grosbeak
	Pipilo maculattus	Spotted towhee
	Piranga rubra	Western tanager
	Progne subis	Purple martin
	Psaltriparus minimus	Bushtit
	Regulus satrapa	Golden-crowned kinglet
	Sialia mexicana	Western bluebird
	Sitta canadensis	Red-breasted nuthatch
	Sitta carolinensis	White-breasted nuthatch
	Spizella passerina	Chipping sparrow
	Stelgidopterix serripennis	Northern rough-winged swallow
	Tachycineta bicolor	Tree swallow
	Tachycineta thalassina	Violet-green swallow
	Thryomanes bewickii	Bewick's wren
	Troglodytes aedon	House wren
	Troglodytes troglodytes	Winter wren
	Turdus migratorius	American robin
	Vermivora celata	Orange-crowned warbler
	Vermivora ruficapilla	Nashville warbler
	Vireo gilvus	Warbling vireo
	Vireo huttoni	Hutton's vireo
	Vireo solitarius	Solitary vireo
	Wilsonia pusilla	Wilson's warbler
	Zonotrichia leucophrys	White-crowned sparrow
Mammals:		
Didelphimorphia	*Didelphis virginiana*	Virginia opossum
Insectivora	*Neurotrichus gibbsii*	Shrew-mole
	Scapanus townsendii	Townsend's mole
	Scapanus orarius	Coast mole
	Sorex bairdi	Baird's shrew
	Sorex bendirii	Pacific marsh shrew
	Sorex pacificus	Pacific shrew
	Sorex sonomae	Fog shrew
	Sorex trowbridgii	Trowbridge's shrew
	Sorex vagrans	Vagrant shrew

Order	Scientific name	Common name
Chiroptera	*Corynorhinus townsendii*	Townsend's big-eared bat
	Eptesicus fuscus	Big brown bat
	Lasionycteris noctivagans	Silver-haired bat
	Lasiurus cinereus	Hoary bat
	Myotis californicus	California myotis
	Myotis evotis	Long-eared myotis
	Myotis lucifugus	Little brown myotis
	Myotis thysanodes	Fringed myotis
	Myotis volans	Long-legged myotis
	Myotis yumanensis	Yuma myotis
Lagomorpha	*Lepus americanus*	Snowshoe hare
	Sylvilagus bachmani	Brush rabbit
Rodentia	*Aplodontia rufa*	Mountain beaver
	Castor canadensis	American beaver
	Clethrionomys californicus	Western red-backed vole
	Erethizon dorsatum	Common porcupine
	Glaucomys sabrinus	Northern flying squirrel
	Microtus longicaudus	Long-tailed vole
	Microtus oregoni	Creeping vole
	Microtus townsemdii	Townsend's vole
	Neotoma cinerea	Bushy-tailed woodrat
	Neotoma fuscipes	Dusky-footed woodrat
	Ondatra zibethicus	Muskrat
	Peromyscus maniculatus	Deer mouse
	Phenacomys albipes	White-footed vole
	Phenacomys longicaudus	Red tree vole
	Spermophilus beecheyi	California ground squirrel
	Tamias townsendii	Townsend's chipmunk
	Tamiasciurus douglasii	Douglas' squirrel
	Thomomys mazama	Western pocket gopher
	Zapus trinotatus	Pacific jumping mouse
Carnivora	*Canis latrans*	Coyote
	Felis concolor	Mountain lion
	Lutra canadensis	Northern river otter
	Lynx rufus	Bobcat
	Martes americana	American marten
	Mephitis mephitis	Striped skunk
	Mustela erminea	Ermine
	Mustela frenata	Long-tailed weasel
	Mustela vison	Mink
	Odocoileus hemionus ssp. *columbianus*	Black-tailed deer
	Procyon lotor	Common raccoon
	Spilogale gracilis	Western spotted skunk
	Urocyon cinereoargenteus	Common gray fox
	Ursus americanus	Black bear
	Vulpes vulpes	Red fox
Artiodactyla	*Cervus elaphus*	Elk

[a] Nomenclature, distribution and habitat characteristics taken from Csuti et al. 1997. Atlas of Oregon wildlife. Oregon State University Press, Corvallis. 492 p + map.
[b] Nomenclature and common names for amphibians taken from Jones et al. 2005.

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