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Mohawk Research Natural Area: Guidebook Supplement 45

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Cover

Mohawk Research Natural Area. Virtual island of old-growth Douglas-fir forest, surrounded by second-growth forest, viewing south. Spencer Butte is visible in the distance (USD I BLM 2011).

Abstract

Schuller, Reid; Mayrsohn, Cheshire. 2013. Mohawk Research Natural Area: guidebook supplement 45. Gen. Tech. Rep. PNW-GTR-876. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 24 p.

This guidebook describes major biological and physical attributes of the 119-ha (293-ac) Mohawk Research Natural Area. The area supports old-growth Douglas-fir (*Pseudotsuga menziesii*) forest characterized by plant associations representative of the western Cascade foothills. These include the western hemlock/Oregon grape-salal (*Tsuga heterophylla/Berberis nervosa-Gaultheria shallon*); western hemlock/Oregon grape/swordfern (*Tsuga heterophylla/Berberis nervosa/Polystichum munitum*); and western hemlock/Oregon oxalis (*Tsuga heterophylla/Oxalis oregana*) forest plant associations.

Keywords: Research natural area, area of critical environmental concern, old-growth Douglas-fir (*Pseudotsuga menziesii*), western hemlock/Oregon grape-salal (*Tsuga heterophylla/Berberis nervosa-Gaultheria shallon*), western hemlock/Oregon grape/swordfern (*Tsuga heterophylla/Berberis nervosa/Polystichum munitum*), and western hemlock/Oregon oxalis (*Tsuga heterophylla/Oxalis oregana*) plant association.

Preface

The research natural area (RNA) described in this supplement¹ is administered by the Eugene District, Bureau of Land Management (BLM), U.S. Department of the Interior.

Mohawk RNA is part of a federal system² of natural areas established for research and educational purposes.³ Of the 183 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). This report is a supplement to the guidebook.

Each RNA is a site where elements⁴ are protected or managed for scientific purposes and natural processes are allowed to dominate. The objectives for establishing research natural areas are to:

- Maintain a wide spectrum of high-quality areas that represent the major forms of variability found in forest, shrubland, grassland, alpine, and natural situations that have scientific interest and importance that, in combination, form a national network of ecological areas for research, education, and maintenance of biological diversity.
- Preserve and maintain genetic diversity, including threatened, endangered, and sensitive species.

¹ Supplement No. 43 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 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. In addition, the federal agencies cooperate with state agencies and private organizations in Oregon and Washington in the Pacific Northwest Interagency Natural Area Committee. Taken from Wilson, T.M.; Schuller, R.; Holmes, R.; Pavola, C.; Fimbel, R.A.; McCain, C.N.; Gamon, J.G.; Speaks, P.; Seevers, J.I.; DeMeo, T.E.; Gibbons, S. 2009. Interagency strategy for the Pacific Northwest Natural Areas Network. Gen. Tech. Rep. PNW-GTR-798. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 33 p.

³ 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>.

⁴ Elements are the basic units to be represented in a natural area system. An element may 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. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 231 p.

- Protect against human-caused environmental disruptions.
- Serve as reference areas for the study of natural ecological processes, including disturbance.
- Provide onsite and extension educational activities.
- Serve as baseline areas for measuring long-term ecological changes.
- Serve as control areas for comparing results from manipulative research.
- Monitor effects of resource management techniques and practices.

The guiding principle in managing RNAs is to maintain natural ecological processes or conditions for which the site is designated. Activities that impair scientific or educational values are not permitted within RNAs. Management practices necessary to maintain or restore ecosystems may be allowed.⁵

Federal RNAs provide a unique system of publicly owned and protected examples of relatively unmodified 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. Scientists and educators wishing to visit or use Mohawk RNA for scientific or educational purposes should contact the Eugene BLM district office 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.

A scientist or educator wishing to use the RNA is obligated to:

- Obtain permission from the appropriate administering agency before using the area (see footnote 2).
- 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 this approval process is to:

- Ensure that the ecological integrity and scientific and educational values of the RNA are not compromised.

⁵ For a discussion of management direction and strategies which guide research natural area management, see Wilson, T.M.; Schuller, R.; Holmes, R.; Pavola, C.; Fimbel, R.A.; McCain, C.N.; Gamon, J.G.; Speaks, P.; Seevers, J.I.; DeMeo, T.E.; Gibbons, S. 2009. Interagency strategy for the Pacific Northwest Natural Areas Network. Gen. Tech. Rep. PNW-GTR-798. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 33 p.

- Provide information to scientists about other research occurring on the RNA so that potential collaborations may be fostered and conflicts avoided.
- Maintain records of research activities and research results to benefit the BLM, other agencies, and future researchers.

Appropriate uses of RNAs are determined by the administering agency. Destructive analysis of vegetation is generally not allowed, nor are studies requiring extensive substrate modification such as extensive soil excavation. Collection of plant and animal specimens is generally restricted to voucher specimens or approved research activities. Under no circumstances may collecting significantly reduce species populations. Collecting must also be carried out in accordance with all other federal and state agency regulations.

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Introduction

The Mohawk Research Natural Area (RNA) is a 119-ha (293-ac) area located in Lane County, Oregon. The site was established in 1984 as an RNA (Curtis 1986), and the management designation was subsequently reaffirmed in the Eugene District Resource Management Plan (USDI BLM 1995). A short guidebook was written for the area in 1986 (Curtis 1986). Subsequent information includes species inventories (Neitlich and McCune 1995), vegetation community monitoring (Schuller and Greene 2010), a plant association guide for the west-side central Oregon Cascades coniferous forests (McCain and Diaz 2002), and publication of the Oregon Natural Areas Plan (ONHAC 2010).

The importance of the RNA is twofold: it represents (1) old-growth Douglas-fir (*Pseudotsuga menziesii*) forest in an unmodified condition with western hemlock (*Tsuga heterophylla*) occurring as an overstory codominant and Oregon grape (*Berberis nervosa*) and salal (*Gaultheria shallon*) occurring as major shrubs; and (2) Douglas-fir-bigleaf maple (*Acer macrophyllum*) forest in an unmodified condition within the Willamette Valley ecoregion (ONHAC 2010) (see app. 1 for a list of scientific and common names).

Recent forest classification work in the west-central Cascades provides the basis for a fine-scale enumeration of the plant associations¹ occurring within the RNA (McCain and Diaz 2002). These are discussed in the “Vegetation” section of this guidebook.

Access and Accommodations

The RNA is located in Section 19, Township 16 South, Range 2 West, Willamette Meridian, in Lane County, Oregon. To access the area from Interstate 105 in Springfield, Oregon, take the Marcola exit and proceed 10 km (6.2 mi) north on Marcola Road. Turn left onto Donna Road and continue for 1 km (0.6 mi) to its

¹ Plant associations are named based on a combination of the dominant life form plus the characteristic or dominant plant species in the various plant layers (trees, shrubs, and herbs). Plant association acronyms are a shorthand form for communicating the plant association name. Each acronym is made up of the first two letters of the genus name of the dominant or characteristic species within a layer, and combined with the first two letters of the specific epithet of the species (e.g., *Tsuga heterophylla* is shortened to TSHE). Plant associations are generally defined by the dominant or characteristic species which occupies or has the biological potential to occupy the uppermost vegetation layer. In forested plant associations, this is the tree layer. Additional names are used for understory layers when they contain dominant, characteristic, or diagnostic species (e.g., western hemlock/Oregon-grape-salal (*Tsuga heterophylla/Berberis nervosa-Gaultheria shallon*). Life form layers are separated by a slash. Co-dominants within a layer are separated by a hyphen.

intersection with McGowan Creek Road (Bureau of Land Management road 16-2-27). Follow this paved road for 5.5 km (3.4 mi) and park next to a locked gate that crosses a BLM road (a key must be obtained from the BLM office in Springfield to gain entry beyond this point). Follow this road on foot through the gate for 1.1 km (0.7 mi) to the northern boundary of the RNA at a “T” intersection next to a pond. From this point, continue to the left for 0.5 km (0.3 mi) on a road blocked and overgrown with vegetation until it adjoins the old-growth forest (fig. 1).

Prior to visiting the site, obtain permission to access the area for research or educational purposes at the Bureau of Land Management (BLM), Eugene District office in Springfield, Oregon. Maps and additional directions to the area are available at this office. Lodging is available in Eugene, and Springfield, Oregon.

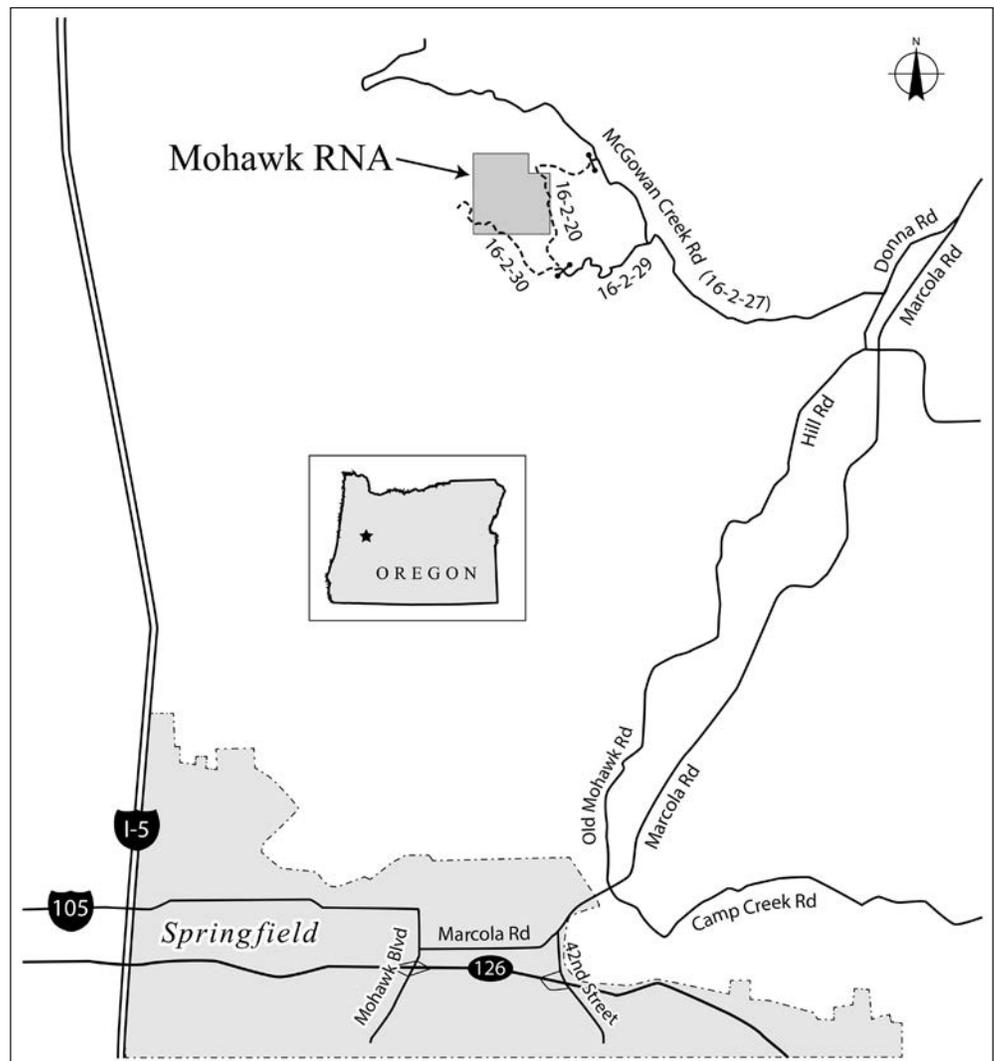


Figure 1—Mohawk Research Natural Area (RNA) location and access.

Environment

The RNA is situated within the Western Cascade ecoregion and straddles foothills overlooking the Willamette Valley, Oregon (Curtis 1986, ONHAC 2010). Elevations within the RNA range from about 457 m (1,500 ft) on the lower benches to 683 m (2,240 ft) near the southwestern boundary. Most of the RNA occupies mid to upper elevations of a north-facing slope along the eastern flank of a north-south ridge. Slope steepness ranges from 3 to 75 percent. Several intermittent streams originate within the RNA and comprise the headwaters of McGowan Creek (USDI BLM 1982). More than half of the RNA is composed of slump benches that have resulted from rotational slope failures. These benches have a mosaic of well-drained and poorly drained soils and sag ponds (Curtis 1986). Windthrow from the 1962 Columbus Day storm has occurred disproportionately on saturated soils. Silty clay loams are represented by the Cumley, Honeygrove, and Peavine soil series and occupy about two thirds of the area. Klickitat stony loams occupy about one third of the RNA (USDA NRCS 2011) (fig. 2).

The area is underlain by basaltic andesite and olivine basalt flows (Peck et al. 1964) of the late Oligocene-early Miocene age of the Little Butte Volcanic Series (Rudys 1975). Bedrock lies 51 to 152 cm (20 to 60 in) below the surface on gentle slopes (USDI BLM 1982).

Climate

The climate is Mediterranean and is characterized by hot, dry summer and cool, wet winters. From late fall through spring, unstable low-pressure air masses from the Pacific Ocean bring frequent storms, sometimes accompanied by high winds. During the summer, stable high-pressure air masses bring generally clear skies and temperature inversions. Temperatures are modified by proximity to the Pacific Ocean, in winter by its warming influence, and in summer by its cooling influence (USDI BLM 1982).

The nearest weather station is at the Eugene Airport, Oregon (352709), about 32 km (20 mi) northwest of the RNA at a comparable elevation. Extended periods of cloudiness and heavy periods of precipitation occur during the winter. About 70 percent of average annual precipitation falls from November through March. Precipitation occurs primarily as rain and averages 1145 mm (45.06 in) per year. Five percent of the average annual precipitation falls from June through August (Curtis 1986, WRCC 2011). Precipitation is likely 10 to 20 percent higher within the RNA than Eugene airport records indicate. Snowfall occurs periodically but

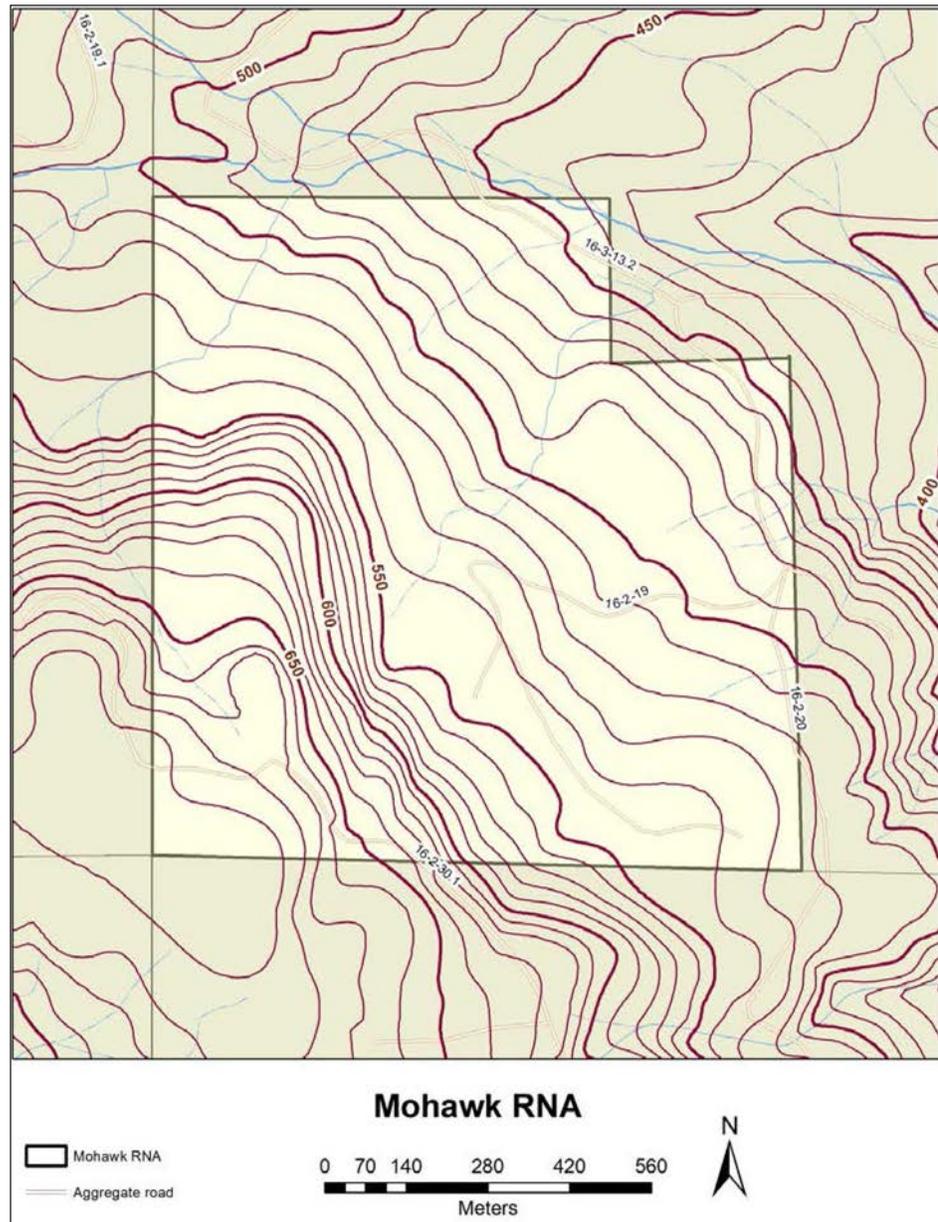


Figure 2—Mohawk Research Natural Area (RNA) topography and boundary.

only accounts for a minor part of the overall precipitation. Severe windstorms, such as the Columbus Day storm in 1962, occur once or twice per century and result in extensive windthrow (Curtis 1986, USDI BLM 1982). Table 1 provides an approximation of precipitation and temperature regimes affecting the area.

Vegetation

Douglas-fir (*Pseudotsuga menziesii*) is the dominant upper canopy tree throughout the RNA. It appears to have become established in waves, perhaps in response to

Table 1—Temperature and precipitation summary, 12/1/1939 to 12/31/2009, Eugene WSO Airport, Oregon (352709)

Variable	Average
Minimum January temperature	0.8 °C (33.5 °F)
Maximum January temperature	7.9 °C (46.3 °F)
Minimum July temperature	10.8 °C (51.4 °F)
Average maximum July temperature	28.0 °C (82.4 °F)
Annual precipitation	1145 mm (45.06 in)
June–August precipitation	63 mm (2.47 in)
Annual snowfall	152 mm (6.0 in)

repeated low- to moderate-severity fires. The largest Douglas-firs reach 222 cm (87 in) d.b.h.² (Schuller and Greene 2010) and are estimated to be 400+ years old (USDI BLM 1982). Many of the largest Douglas-firs exhibit numerous lower branches, suggesting tree growth and stand development under canopy conditions that were more open than today.

Western hemlock (*Tsuga heterophylla*) and western redcedar (*Thuja plicata*) are abundant in the mid- and subcanopy. Western hemlock is abundantly reproducing in the forest understory. Large-size bigleaf maples (*Acer macrophyllum*) support a verdant growth of epiphytes including licorice fern (*Polypodium glycyrrhiza*) and a variety of mosses. Pacific yew (*Taxus brevifolia*), incense cedar (*Calocedrus decurrens*), and grand fir (*Abies grandis*) occur sporadically throughout the RNA. Douglas-fir reproduction is absent in well-shaded, closed-canopy conditions. Younger, second-growth stands of Douglas-fir occur primarily along the outer margins of the old-growth adjacent to the RNA boundary (fig. 3). Figure 4 shows understory conditions within a typical old-growth stand.

Understory shrub cover ranges between 10 and 20 percent (table 2). Major shrubs include vine maple (*Acer circinatum*) and Oregongrape (*Berberis nervosa*). Minor shrubs include salal (*Gaultheria shallon*), red huckleberry (*Vaccinium parvifolium*), and bitter cherry (*Prunus emarginata*). Shrub diversity within the RNA is relatively high, totaling 19 species (app. 1).

Ground vegetation is characterized by western swordfern (*Polystichum munitum*), which is the most dominant herbaceous species (fig. 5). Columbian windflower (*Anemone deltoidea*), sweet-scented bedstraw (*Galium triflorum*), twinflower (*Linnaea borealis*), evergreen violet (*Viola sempervirens*), and broadleaf starflower (*Trientalis borealis* ssp. *latifolia*) are frequent, but minor components

² “d.b.h.” refers to diameter at breast height, a measurement taken at 1.47 m above the ground.

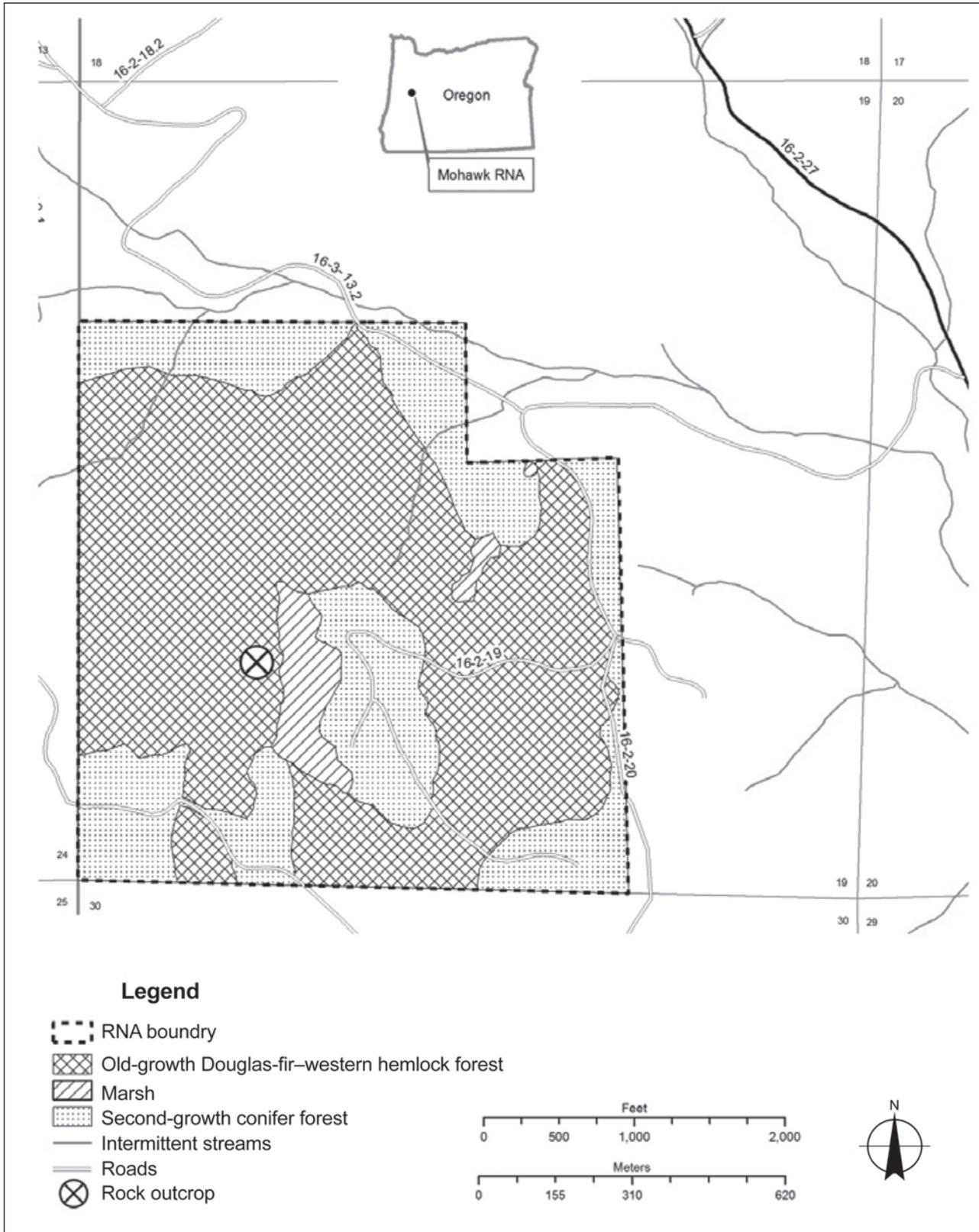


Figure 3—Mohawk Research Natural Area (RNA) vegetation and hydrology.



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Figure 4—Typical understory conditions in mesic conifer forest with Douglas-fir, western redcedar, and western hemlock. Western swordfern and Oregongrape predominate in the floristically depauperate herbaceous layer.



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Figure 5—Typical understory conditions in wet conifer forest with redwood sorrel dominating the herbaceous layer with slough sedge and western swordfern.

in mesic to slightly drier sites, which comprise the majority of the old- and second-growth stands (table 2). Oregon oxalis (*Oxalis oregana*) is common in the mesic to wet sites.

Several small marshy areas contain standing water throughout the year. The largest is 4 ha (10 ac) and is located in the central portion of the site at the base of a steep slope. Oregon ash (*Fraxinus latifolia*) and red alder (*Alnus rubra*) are common in this area. Vine maple (*Acer circinatum*) is a major tall shrub with a variety of herbaceous species. Typical herbs, grasses, sedges, and rushes include lady

Table 2—Plant association, understory coverage, and frequency of four forest plots in Mohawk Research Natural Area

	Plot 1		Plot 2		Plot 3		Plot 4	
	TSHE/MANE2/GASH ^a		TSHE/MANE2/POMU		TSHE/MANE2/POMU		TSHE/OXOR	
	Frequency ^b	Cover	Frequency	Cover	Frequency	Cover	Frequency	Cover
Bare ground	4	tr						
Coarse litter	25	19	21	13	11	1	4	tr
Fine litter	100	90	100	98	100	100	100	100
Moss	100	57	86	42	100	38	89	35
Lichen	93	4	79	5	82	2	86	2
<i>Corylus cornuta</i> var. <i>californica</i> ^c	—		—		—		—	tr
<i>Berberis nervosa</i> ^d	—	2	—	12	—	4	—	8
<i>Gaultheria shallon</i>	—	2	—	2	—		—	5
<i>Acer circinatum</i>	—		—	tr	—		—	7
<i>Vaccinium parvifolium</i>	—	2	—		—		—	
<i>Ribes sanguineum</i>	—	tr	—		—		—	
<i>Polystichum munitum</i>	14	2	39	23	36	14	43	28
<i>Oxalis oregana</i>			57	9			36	10
<i>Anemone deltoidea</i>	4	tr	29	3	4	tr	14	1
<i>Galium triflorum</i>	7	tr	4	tr	4	tr	18	tr
<i>Linnaea borealis</i>	11	3	18	1				
<i>Melica subulata</i>	11	tr	14	tr				
<i>Viola sempervirens</i>	11	tr					4	tr
<i>Achlys triphylla</i>							14	2
<i>Trientalis borealis</i> ssp. <i>latifolia</i>	7	1						

^a TSHE—*Tsuga heterophylla*, MANE2 = *Mahonia nervosa* (this is listed in the text and app. 1 as *Berberis nervosa*, which is the currently accepted name. See Flora of North America (1993+) and the Oregon Flora Project (2011) in the “References” section.), GASH = *Gaultheria shallon*, POMU = *Polystichum munitum*, OXOR = *Oxalis oregana*, tr = trace (<0.5 percent foliar cover), “—” = not recorded.

^b Cover is expressed as percentage of foliar cover; frequency is expressed as percentage of relative frequency. Zero values are not included.

^c See appendix 1 for a listing of scientific and common names.

^d McCain and Diaz (2002) refer to *Berberis nervosa* as *Mahonia nervosa*. The currently accepted name of *B. nervosa* is used in this document. See: Flora of North America (2010) and the Oregon Flora Project (2010) in the “References” section.

fern (*Athyrium filix-femina*), slough sedge (*Carex obnupta*), scouringrush horsetail (*Equisetum hyemale*), rush (*Juncus* sp.), American skunk cabbage (*Lysichiton americanus*), coastal miterwort (*Mitella ovalis*), and western coneflower (*Rudbeckia occidentalis*) (Curtis 1986).

The area supports old-growth Douglas-fir (*Pseudotsuga menziesii*) forest and a variety of plant associations representative of western Cascade Range foothills, including western hemlock/Oregongrape-salal (*Tsuga heterophylla/Berberis nervosa-Gaultheria shallon*), western hemlock/Oregongrape/swordfern (*Tsuga heterophylla/Berberis nervosa/Polystichum munitum*), and western hemlock/Oregon oxalis, (*Tsuga heterophylla/Oxalis oregana*) (McCain and Diaz 2002, Schuller et al. 2001, Schuller and Greene 2010).

A list of scientific and common names for vascular plants, lichens, and fungi known to occur within the RNA appears in appendixes 1, 2, and 3, respectively.

The RNA is considered moderately diverse in lichens (app. 2), and the presence of *Menegazzia terebrata* suggests the area to be sufficiently moist for good development of cyanolichens. The old-growth stand has fairly good development of alectoroid lichens (mainly *Usnea* spp.) (Neitlich and McCune 1995).

Fauna

Amphibians, reptiles, birds, and mammals known or expected to occur within the RNA are listed in appendix 4. These lists have been derived from field observation (Curtis 1986, Maser 1973), published literature (Csuti et al. 1997), and on the species distribution, life history characteristics, and availability of habitat within the RNA.

The intermittent streams within the RNA do not support fish, although McGowan Creek supports fish populations downstream of the RNA (USDI BLM 1982).

Disturbance History

Numerous fire scars on large, old-growth Douglas-fir attest to the historical importance of occasional wildfires within and around the Mohawk RNA. The most recent fire appears to have burned in the past 125 to 175 years. A lightning-caused fire resulted in six trees being felled on the western boundary in 1978. Since landscape-wide fire suppression began about 75 years ago, no fires are known to have occurred within the RNA except for a slash burn that escaped into the RNA from adjacent land and burned a 0.4-ha (1-ac) patch (Curtis 1986).

Until the 1970s, the RNA was used for timber production, livestock grazing, and hunting (USDI BLM 1982). Hunting continues to the present day. The 1962 Columbus Day storm caused scattered blowdown throughout the area. These trees were subsequently salvaged where topography and access were favorable. Clearcut logging was completed on a 38-ha (94-ac) area where blowdown was extensive. The clearcuts were planted with young Douglas-fir in 1965 (Curtis 1986).

For cattle grazing, a local rancher leased the tract that was to later become the RNA, beginning in 1951, for about 30 years (USDI BLM 1982).

Public use of the RNA has increased substantially in recent years. Most activity appears to be associated with the access roads. Off-highway vehicle use, target practice, and timber theft have resulted in soil erosion, litter, and tree damage in local areas. Theft of trees (e.g., western redcedar and bigleaf maple) and medicinal plants (e.g., western yew bark), as well as drilling and plugging of trees for pitch collection have also occurred (USDI BLM 1982).

Fire suppression activities to contain a lightning-caused fire resulted in six trees being felled on the western boundary in 1978.

Research History

The following research and monitoring projects have been undertaken within Mohawk RNA (Curtis 1986, Greene et al. 1986, USDI BLM 1982):

Carroll, G.C.; Carroll, F.E. 1978. Studies on the incidence of coniferous needle endophytes in the Pacific Northwest.

Denison, W.C. 1973. Life in tall trees. *Scientific American*.

Maser, C. 1973. A preliminary list of mammals, birds, amphibians and reptiles of proposed Camas Swale, Fox Hollow, and Mohawk Research Natural Areas.

McCain, C.; Diaz, N. 2002. Field guide to the forested plant association of the west-side central Cascades of northwest Oregon.

Neitlich, P.; McCune, B. 1995. Lichen diversity in the upper Willamette and Siuslaw watersheds Eugene District, Bureau of Land Management.

Schuller, R.; Greene, S.; Widmer, M.; Downing, G.; Mayrsohn, C.; Curtis, A. 2001. Vegetation monitoring data (unpublished).

Schuller, R.; Greene, S. 2010. Vegetation monitoring data (unpublished).

White, D. 1974. Floristic list of proposed Camas Swale, Fox Hollow, and Mohawk Research Natural Areas.

Maps

Maps applicable to Mohawk RNA: Topographic—Mohawk, Oregon, 7.5 minute, 1:24,000 scale, 1984; Eugene BLM District transportation map, 1:63360 [no date].

Acknowledgments

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English Equivalents

1 hectare (ha) = 2.47 acres (ac)

1 kilometer (km) = 0.62 mile (mi)

1 meter (m) = 3.28 feet (ft)

1 square meter (m²) = 10.76 square feet

1 centimeter (cm) = 0.394 inch (in)

1 millimeter (mm) = 0.0394 inch

Degrees Fahrenheit (°F) = 1.8 degrees Celsius + 32

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Appendix 1—Plants^{1 2}

Scientific name	Common name
Coniferous trees:	
<i>Abies grandis</i> (Dougl.) Forbes	Grand fir
<i>Calocedrus decurrens</i> (Torr.) Florin	Incense cedar
<i>Pseudotsuga menziesii</i> (Mirbel) Franco	Douglas-fir
<i>Taxus brevifolia</i> Nutt.	Western yew
Deciduous trees >8 m (26.3 ft) tall:	
<i>Acer macrophyllum</i> Pursh	Bigleaf maple
<i>Alnus rubra</i> Bong.	Red alder
<i>Arbutus menziesii</i> Pursh	Pacific madrone
<i>Chrysolepis chrysophylla</i> (Dougl. ex Hook.) Hjelmq.	Giant chinquapin
<i>Cornus nuttallii</i> Aud. ex T. & G.	Pacific dogwood
<i>Corylus cornuta</i> L. var. <i>californica</i> (DC.) Sharp	Hazelnut
<i>Fraxinus latifolia</i> Benth.	Oregon ash
Tall shrubs 2 to 8 m (6.6 to 26.3 ft) tall:	
<i>Acer circinatum</i> Pursh	Vine maple
<i>Amelanchier alnifolia</i> Nutt.	Western serviceberry
<i>Holodiscus discolor</i> (Pursh) Maxim.	Oceanspray
<i>Philadelphus lewisii</i> Pursh	Lewis' mock orange
<i>Prunus emarginata</i> (Dougl. ex Hook.) D. Dietr.	Bitter cherry
<i>Rhamnus purshiana</i> DC.	Cascara
<i>Salix scouleriana</i> Barratt ex Hook.	Scouler's willow
<i>Sambucus racemosa</i> L. var. <i>arborescens</i> (T. & G) Gray	Red elderberry
Medium shrubs 0.5 to 2 m (1.6 to 6.6 ft) tall:	
<i>Ceanothus velutinus</i> Dougl.	Sticky laurel
<i>Gaultheria shallon</i> Pursh	Salal
<i>Rosa gymnocarpa</i> Nutt.	Baldhip rose
<i>Rubus laciniatus</i> Willd.	Evergreen huckleberry
<i>Rubus leucodermis</i> Dougl. ex T. & G.	Whitebark raspberry
<i>Rubus parviflorus</i> Nutt.	Thimbleberry
<i>Rubus spectabilis</i> Pursh	Salmonberry
<i>Symphoricarpos albus</i> (L.) Blake	Common snowberry
<i>Toxicodendron diversilobum</i> (T. & G) Greene	Poison oak
<i>Vaccinium parvifolium</i> Sm.	Red huckleberry
Low shrubs <0.5 m (1.6 ft) tall:	
<i>Berberis nervosa</i> Pursh	Oregongrape
<i>Rubus ursinus</i> Cham. & Schlecht.	California dewberry

Ferns and allies:

<i>Adiantum pedatum</i> L.	Maidenhair fern
<i>Athyrium filix-femina</i> (L.) Roth.	Lady fern
<i>Dryopteris arguta</i> (Kaulf.) Watt.	Coastal wood fern
<i>Polypodium glycyrrhiza</i> DC. Eat.	Licorice fern
<i>Polystichum munitum</i> (Kaulf.) Presl	Western swordfern
<i>Pteridium aquilinum</i> (L.) Kuhn.	Bracken fern

Herbs:

<i>Achillea millefolium</i> L.	Common yarrow
<i>Achlys triphylla</i> (Sm.) DC.	Sweet after death
<i>Adenocaulon bicolor</i> Hook.	American trailplant
<i>Anaphalis margaritacea</i> (L.) B. & H.	Pearly everlasting
<i>Anemone deltoidea</i> Hook.	Columbian windflower
<i>Asarum caudatum</i> Lindl.	Wild ginger
<i>Calypso bulbosa</i> (L.) Oakes	Fairy slipper
<i>Cardamine angulata</i> Hook.	Seaside bittercress
<i>Cardamine oligosperma</i> Nutt.	Little western bittercress
<i>Cerastium viscosum</i> L.	Sticky chickweed
<i>Chamerion angustifolium</i> (L.) Holub	Fireweed
ssp. <i>circumvagum</i> (Mosq.) Hoch	
<i>Circaea alpina</i> L.	Alpine circaea
<i>Cirsium arvense</i> (L.) Scop. var. <i>Horridum</i> Wimm. & Grab.	Canada thistle
<i>Cirsium vulgare</i> (Savi) Ten.	Bull thistle
<i>Claytonia sibirica</i> L.	Siberian springbeauty
<i>Coptis laciniata</i> Gray	Cutleaf goldthread
<i>Daucus carota</i> L.	Queen Anne's lace
<i>Epilobium brachycarpum</i> C. Presl	Tall annual willowherb
<i>Equisetum hyemale</i> L.	Scouringrush horsetail
<i>Equisetum telmateia</i> Ehrh.	Giant horsetail
<i>Fragaria vesca</i> L.	Woodland strawberry
<i>Galium triflorum</i> Michx.	Sweet scented bedstraw
<i>Geranium molle</i> L.	Dovefoot geranium
<i>Goodyera oblongifolia</i> Raf.	Western rattlesnake plantain
<i>Hypericum perforatum</i> L.	St. John's wort
<i>Hypochaeris radicata</i> L.	Hairy cat's-ear
<i>Iris tenax</i> Dougl. ex Lindl.	Toughleaf iris
<i>Leucanthemum vulgare</i> Lam.	Oxeye daisy
<i>Ligusticum apiifolium</i> (Nutt. ex T. & G.) Gray	Celeryleaf licoriceroot
<i>Linnaea borealis</i> L.	Twinflower
<i>Lotus</i> sp.	Deervetch
<i>Lysichiton americanus</i> Hultén & H. St. John	American skunkcabbage
<i>Maianthemum stellatum</i> (L.) Desf.	Starry false-Solomonseal
<i>Marah oreganus</i> (T. & G.) Howell	Wild cucumber

<i>Mimulus alsinoides</i> Dougl. ex Benth.	Wingstem monkeyflower
<i>Mitella ovalis</i> Greene	Coastal miterwort
<i>Nemophila parviflora</i> Dougl. ex Benth.	Small-flowered nemophila
<i>Osmorhiza berteroi</i> DC.	Sweetcicely
<i>Oxalis oregana</i> Nutt.	Redwood-sorrel
<i>Petasites frigidus</i> (L.) Fr.	Arctic sweet coltsfoot
<i>Plantago lanceolata</i> L.	English plantain
<i>Plantago major</i> L.	Common plantain
<i>Prunella vulgaris</i> L. vulgaris	Self heal
<i>Pyrola picta</i> Sm.	Whiteveined wintergreen
<i>Ranunculus occidentalis</i> Nutt. var. <i>occidentalis</i>	Western buttercup
<i>Rudbeckia occidentalis</i> Nutt.	Western coneflower
<i>Satureja douglasii</i> (Benth.) Briq.	Yerba buena
<i>Senecio jacobaea</i> L.	Tansy ragwort
<i>Stachys rigida</i> Nutt. ex Benth.	Rough hedgenettle
<i>Stellaria crispa</i> Cham. & Schlecht.	Curled starwort
<i>Synthyris reniformis</i> (Dougl. ex Benth.) Benth.	Snowqueen
<i>Tiarella trifoliata</i> L. var. <i>trifoliata</i>	Threeleaf foamflower
<i>Trientalis borealis</i> Raf. ssp. <i>latifolia</i> (Hook.) Hultén	Broadleaf starflower
<i>Vancouveria hexandra</i> (Hook.) Morr. & Dec.	Inside-out flower
<i>Veronica arvensis</i> L.	Corn speedwell
<i>Viola sempervirens</i> Greene	Evergreen violet
Grasses, sedges, and rushes:	
<i>Carex obnupta</i> L.H. Bailey	Slough sedge
<i>Elymus glaucus</i> Buckl.	Blue wildrye
<i>Holcus lanatus</i> L.	Common velvetgrass
<i>Juncus</i> sp.	Rush
<i>Melica subulata</i> (Griseb.) Scribn.	Alaska oniongrass
<i>Scirpus microcarpus</i> J. Presl & C. Presl.	Panicled bulrush

¹ Nomenclature for vascular plants, ferns, and fern-allies follows the *Flora of North America* (1993+) and the Oregon Flora Project Web site (2010).

² Compiled from field surveys (White 1974) with additions from multiple sources.

Appendix 2—Lichens^{1 2}

Scientific name	Authority
Macrolichens:	
<i>Alectoria sarmentosa</i>	(Ach.) Ach.
<i>Alectoria vancouverensis</i>	(Gyelnik) Gyelnik ex Brodo & D. Hawksw.
<i>Bryoria friabilis</i>	Brodo & D. Hawksw.
<i>Bryoria fuscescens</i>	(Gyelnik) Brodo & D. Hawksw.
<i>Cladonia cariosa</i>	(Ach.) Sprengel
<i>Cladonia chlorophaea</i>	(Flörke ex Sommerf.) Sprengel
<i>Cladonia fimbriata</i>	(L.) Fr.
<i>Cladonia furcata</i>	(Hudson) Schr.
<i>Cladonia ochrochlora</i>	Flörke
<i>Cladonia pyxidata</i>	(L.) Hoffm.
<i>Cladonia subsquamosa</i>	Kremp.
<i>Cladonia transcendens</i>	(Vainio) Vainio
<i>Evernia prunastri</i>	(L.) Ach.
<i>Hypocenomyce castaneocinerea</i>	(Räsänen) Timdal
<i>Hypocenomyce friesii</i>	(Ach.) P. James & Gotth. Schneider
<i>Hypogymnia enteromorpha</i>	(Ach.) Nyl.
<i>Hypogymnia imshaugii</i>	Krog
<i>Hypogymnia inactiva</i>	(Krog) Ohlsson
<i>Hypogymnia tubulosa</i>	(Schaerer) Hav.
<i>Hypotrachyna sinuosa</i>	(Sm.) Hale
<i>Leptogium palmatum</i>	(Huds.) Mont.
<i>Letharia vulpina</i>	(L.) Hue
<i>Lichenomphalina</i> sp.	Redhead
<i>Lobaria oregana</i>	(Tuck.) Müll. Arg.
<i>Lobaria pulmonaria</i>	(L.) Hoffm.
<i>Lobaria scrobiculata</i>	(Scop.) DC.
<i>Loxosporopsis corallifera</i>	Brodo, Henssen & Imshaug
<i>Melanelixia fuliginosa</i>	(Fr. ex Duby) O. Blanco et al.
<i>Melanohalea exasperatula</i>	(De Not.) O. Blanco et al.
<i>Menegazzia terebrata</i>	(Hoffm.) A. Massal.
<i>Nephroma bellum</i>	(Sprengel) Tuck.
<i>Nephroma resupinatum</i>	(L.) Ach.
<i>Nodobryoria oregana</i>	(Tuck.) Common & Brodo
<i>Parmelia hygrophila</i>	Goward & Ahti
<i>Parmelia sulcata</i>	Taylor
<i>Peltigera collina</i>	(Ach.) Schrader
<i>Peltigera membranacea</i>	(Ach.) Nyl.
<i>Peltigera neopolydactyla</i>	(Gyelnik) Gyelnik
<i>Platismatia glauca</i>	(L.) W.L. Culb. & C.F. Culb.
<i>Platismatia herrei</i>	(Imshaug) W.L. Culb. & C.F. Culb.
<i>Platismatia stenophylla</i>	(Tuck.) W.L. Culb. & C.F. Culb.

<i>Pseudocyphellaria anomala</i>	Brodo & Ahti
<i>Pseudocyphellaria crocata</i>	(L.) Vainio
<i>Ramalina farinacea</i>	(L.) Ach.
<i>Sphaerophorus globosus</i>	(Hudson) Vainio
<i>Tuckermannopsis chlorophylla</i>	(Willd.) Hale
<i>Tuckermannopsis orbata</i>	(Nyl.) M. J. Lai
<i>Usnea</i> sp.	Dill. ex Adans.
<i>Usnea cavernosa</i>	Tuck.
<i>Usnea glabrata</i>	(Ach.) Vainio
Crustose lichens and caliciales:	
<i>Calicium viride</i>	Pers.
<i>Chaenotheca brunneola</i>	(Ach.) Müll. Arg.
<i>Chaenotheca furfuracea</i>	(L.) Tibell
<i>Cyphelium inquinans</i>	(Sm.) Trevisan
<i>Icmadophila ericetorum</i>	(L.) Zahlbr.
<i>Japewia subaurifera</i>	Muhr & Tønsberg
<i>Japewia tornøënsis</i>	(Nyl.) Tønsberg
<i>Lecanora pacifica</i>	Tuck.
<i>Lecidella elaeochroma</i>	(Ach.) M. Choisy
<i>Mycoblastus sanguinarius</i>	(L.) Norman
<i>Ochrolechia oregonensis</i>	H. Magn.
<i>Ochrolechia subpallescens</i>	Verseghy
<i>Pertusaria subambigens</i>	Dibben
<i>Phlyctis argena</i>	(Sprengel) Flotow
<i>Placopsis gelida</i>	(L.) Lindsay
<i>Porpidia crustulata</i>	(Ach.) Hertel & Knoph
<i>Xylographa parallela</i>	(Ach.: Fr.)

¹ Nomenclature for macrolichen and microlichen species follows Esslinger (2010).

² Compiled from field surveys by Neitlich and McCune (1995).

Appendix 3—Fungi^{1 2}

Scientific name	Common name
<i>Aleuria aurantia</i> (Fries) Fuckel	Orange peel fungus
<i>Amanita pantherina</i> (DC: Fries) Krombh.	Panther amanita
<i>Barssia</i> sp.	—
<i>Cantharellus infundibuliformis</i> (Scop.) Fr	Winter chanterelle
<i>Chlorophyllum rachodes</i> (Vittadini) Vellinga	Shaggy parasol
<i>Choiromyces venosus</i> (Fr.) Th. Fr.	Truffle
<i>Crucibulum laeve</i> (Huds.: Relh) Kambly	Common birds nest fungus
<i>Cryptoporus volvatus</i> (Peck) Shear	Cryptic globe fungus
<i>Elaphomyces</i> sp.	Deer truffle
<i>Fomitopsis cajanderi</i> (Karst.) Kotl. et Pouz.	Rosy conk
<i>Ganoderma applanatum</i> (Persoon) Patouillard	Artist's conk
<i>Ganoderma tsugae</i> Murrill	Hemlock reishi
<i>Helvella acetabulum</i> (L.) Quélet	—
<i>Helvella elastica</i> Bull.	Elfin saddle
<i>Hydnum repandum</i> L.: Fr.	Hedgehog mushroom
<i>Hymenogaster</i> sp.	—
<i>Hysterangium</i> sp.	—
<i>Inocybe lacera</i> (Fr.) P. Kumm.	—
<i>Laetiporus gilbertsonii</i> Burdsall	Chicken of the woods
<i>Martellia</i> sp.	—
<i>Mycena pura</i> (Fries) Quélet	Lilia mycena
<i>Phaeolus schweinitzii</i> (Fries) Pat.	Dyer's polypore
<i>Pluteus cervinus</i> (Schaeff.) Kumm.	Deer mushroom
<i>Polyporus elegans</i> Bull.: Fr.	Elegant polypore
<i>Rhizopogon vinicolor</i>	—
<i>Sarcosoma mexicanum</i> (Ellis & Holw.) Paden & Tylutki	Starving man's licorice

— = no common name available.

¹ Nomenclature follows Mycobank (2011).

² Listed in ONHAC (2010).

Appendix 4—Amphibians, Reptiles, Birds, and Mammals Likely to Occur at Mohawk RNA Based on Known Distributions, Life Histories, and Available Habitat^{1,2}

Family	Scientific name	Common name
Amphibians:		
Ambystomatidae	<i>Ambystoma gracile</i>	Northwestern salamander
	<i>Ambystoma macrodactylum</i>	Long-toed salamander
Dicamptodontidae	<i>Dicamptodon tenebrosus</i>	Pacific giant salamander
Plethodontidae	<i>Aneides ferreus</i>	Clouded salamander
	<i>Ensatina eschscholtzii</i>	Ensatina
	<i>Plethodon dunni</i>	Dunn's salamander
	<i>Plethodon vehiculum</i>	Western redback
Salamandridae	<i>Taricha granulosa</i>	Roughskin newt
Bufonidae	<i>Bufo boreas</i>	Western toad
Hylidae	<i>Pseudacris regilla</i>	Pacific chorus frog
Ranidae	<i>Rana aurora</i>	Red-legged frog
Reptiles:		
Anguillidae	<i>Elgaria coerulea</i>	Northern alligator lizard
	<i>Elgaria multicarinata</i>	Southern alligator lizard
Scincidae	<i>Eumeces skiltonianus</i>	Western skink
Boidae	<i>Charina bottae</i>	Rubber boa
Colubridae	<i>Contia tenuis</i>	Sharptail snake
	<i>Diadophis punctatus</i>	Ringneck snake
	<i>Thamnophis elegans</i>	Western terrestrial garter snake
	<i>Thamnophis ordinoides</i>	Northwestern garter snake
Iguanidae	<i>Thamnophis sirtalis</i>	Common garter snake
	<i>Sceloporus occidentalis</i>	Western fence lizard
Birds:		
Cathartidae	<i>Cathartes aura</i>	Turkey vulture
Accipitridae	<i>Accipiter cooperii</i>	Cooper's hawk
	<i>Accipiter gentilis</i>	Northern goshawk
	<i>Accipiter striatus</i>	Sharp-shinned hawk
	<i>Buteo jamaicensis</i>	Red-tailed hawk
Falconidae	<i>Falco columbarius</i>	Merlin
Phasianidae	<i>Bonasa umbellus</i>	Ruffed grouse
	<i>Callipepla californica</i>	California quail
	<i>Dendragapus obscurus</i>	Blue grouse
	<i>Oreortyx pictus</i>	Mountain quail
Columbidae	<i>Columba fasciata</i>	Band-tailed pigeon
	<i>Zenaidura macroura</i>	Mourning dove
Strigidae	<i>Aegolius acadicus</i>	Northern saw-whet owl
	<i>Asio otus</i>	Long-eared owl
	<i>Bubo virginianus</i>	Great horned owl
	<i>Glaucidium gnoma</i>	Northern pygmy-owl

	<i>Otus kennicottii</i>	Western screech-owl
	<i>Strix occidentalis caurina</i>	Northern spotted owl
	<i>Strix varia</i>	Barred owl
Caprimulgidae	<i>Chordeiles minor</i>	Common nighthawk
Apodidae	<i>Chaetura vauxi</i>	Vaux's swift
Trochilidae	<i>Calypte anna</i>	Anna's hummingbird
	<i>Selasphorus rufus</i>	Rufous hummingbird
Picidae	<i>Colaptes auratus</i>	Northern flicker
	<i>Dryocopus pileatus</i>	Pileated woodpecker
	<i>Picoides pubescens</i>	Downy woodpecker
	<i>Picoides villosus</i>	Hairy woodpecker
	<i>Sphyrapicus ruber</i>	Red-breasted sapsucker
Tyrannidae	<i>Contopus borealis</i>	Olive-sided flycatcher
	<i>Contopus sordidulus</i>	Western wood peewee
	<i>Empidonax hammondii</i>	Hammond's flycatcher
	<i>Empidonax traillii</i>	Willow flycatcher
	<i>Tyrannus verticalis</i>	Western kingbird
Hirundinidae	<i>Hirundo pyrrhonota</i>	Cliff swallow
	<i>Progne subis</i>	Purple martin
	<i>Tachycineta bicolor</i>	Tree swallow
	<i>Tachycineta thalassina</i>	Violet-green swallow
Corvidae	<i>Corvus brachyrhynchos</i>	American crow
	<i>Corvus corax</i>	Common raven
	<i>Cyanocitta stelleri</i>	Steller's jay
	<i>Perisoreus canadensis</i>	Gray jay
Paridae	<i>Parus atricapillus</i>	Black-capped chickadee
	<i>Parus rufescens</i>	Chestnut-backed chickadee
Aegithalidae	<i>Psaltriparus minimus</i>	Bushtit
Sittidae	<i>Sitta canadensis</i>	Red-breasted nuthatch
	<i>Sitta caroliniensis</i>	White-breasted nuthatch
Certhiidae	<i>Certhia americana</i>	Brown creeper
Troglodytidae	<i>Thryomanes bewickii</i>	Bewick's wren
	<i>Troglodytes troglodytes</i>	Winter wren
Muscicapidae	<i>Catharus guttatus</i>	Hermit thrush
	<i>Catharus ustulatus</i>	Swainson's thrush
	<i>Chamaea fasciata</i>	Wrentit
	<i>Ixoreus naevius</i>	Varied thrush
	<i>Regulus satrapa</i>	Golden-crowned kinglet
	<i>Sialia mexicana</i>	Western bluebird
	<i>Turdus migratorius</i>	American robin
Bombycillidae	<i>Bombycilla cedrorum</i>	Cedar waxwing
Vireonidae	<i>Vireo cassinii</i>	Cassin's vireo
	<i>Vireo gilvus</i>	Warbling vireo
	<i>Vireo huttonii</i>	Hutton's vireo
Emberizidae	<i>Dendroica coronate</i>	Yellow-rumped warbler
	<i>Dendroica nigrescens</i>	Black-throated gray warbler
	<i>Dendroica occidentalis</i>	Hermit warbler

	<i>Dendroica petechial</i>	Yellow warbler
	<i>Junco hyemalis</i>	Dark-eyed junco
	<i>Melospiza melodia</i>	Song sparrow
	<i>Molothrus ater</i>	Brown-headed cowbird
	<i>Oporornis tolmiei</i>	MacGillivray's warbler
	<i>Passerella iliaca</i>	Fox sparrow
	<i>Pheucticus meelanocephalus</i>	Black-headed grosbeak
	<i>Pipilo maculatus</i>	Spotted towhee
	<i>Piranga rubra</i>	Western tanager
	<i>Spizella passerine</i>	Chipping sparrow
	<i>Wilsonia pusilla</i>	Wilson's warbler
	<i>Zonotrichia atricapilla</i>	Golden-crowned sparrow
	<i>Zonotrichia leucophrys</i>	White-crowned sparrow
Fringillidae	<i>Carduelis pinus</i>	Pine siskin
	<i>Carduelis psaltria</i>	Lesser goldfinch
	<i>Carduelis tristis</i>	American goldfinch
	<i>Coccothraustes vespertinus</i>	Evening grosbeak
	<i>Loxia curvirostra</i>	Red crossbill
Mammals:		
Didelphidae	<i>Didelphis virginiana</i>	Virginia opossum
Soricidae	<i>Sorex pacificus</i>	Pacific shrew
	<i>Sorex sonomae</i>	Fog shrew
	<i>Sorex trowbridgii</i>	Trowbridge's shrew
Talpidae	<i>Neotrichus gibbsii</i>	Shrew-mole
	<i>Scapanus orarius</i>	Coast mole
Vespertilionidae	<i>Eptesicus fuscus</i>	Big brown bat
	<i>Lasionycteris noctivagans</i>	Silver-haired bat
	<i>Lasiurus cinereus</i>	Hoary bat
	<i>Myotis californicus</i>	California myotis
	<i>Myotis evotis</i>	Long-eared myotis
	<i>Myotis lucifigus</i>	Little brown bat
	<i>Myotis thysanodes</i>	Fringed myotis
	<i>Myotis volans</i>	Long-legged myotis
Leporidae	<i>Sylvilagus bachmani</i>	Brush rabbit
Sciuridae	<i>Glaucomys sabrinus</i>	Northern flying squirrel
	<i>Sciurus griseus</i>	Western gray squirrel
	<i>Tamiasciurus douglasii</i>	Douglas' squirrel
	<i>Tamias townsendii</i>	Townsend's chipmunk
Muridae	<i>Clethrionomys californicus</i>	Western red-backed vole
	<i>Neotoma fuscipes</i>	Dusky-footed woodrat
	<i>Neotoma cinerea</i>	Bushy-tailed woodrat
	<i>Peromyscus maniculatus</i>	Deer mouse
	<i>Phenacomys albipes</i>	White-footed vole
	<i>Phenacomys longicaudus</i>	Red tree vole
	<i>Microtus longicaudus</i>	Long-tailed vole
Dipodidae	<i>Zapus trinotatus</i>	Pacific jumping mouse

Erethizontidae	<i>Erethizon dorsatum</i>	Common porcupine
Canidae	<i>Canis latrans</i>	Coyote
	<i>Urocyon cinereoagrenteus</i>	Common gray fox
	<i>Vulpes vulpes</i>	Red fox
	<i>Ursus americanus</i>	Black bear
Ursidae		
Procyonidae	<i>Procyon lotor</i>	Common raccoon
Mustelidae	<i>Martes americana</i>	American marten
	<i>Mephitis mephitis</i>	Striped skunk
	<i>Mustela ermine</i>	Long-tailed weasel
	<i>Mustela frenata</i>	Short-tailed weasel
	<i>Spilogale gracilis</i>	Western spotted skunk
	<i>Felis concolor</i>	Mountain lion
Felidae	<i>Lynx rufus</i>	Bobcat
Cervidae	<i>Cervus elaphus</i>	Elk
	<i>Odocoileus hemionus columbianus</i>	Black-tailed deer

¹ Compiled from field observations (Curtis 1986, Maser 1973), and from habitat descriptions and distribution maps in Csuti et al. (1997).

² Nomenclature taken from Csuti et al. (1997).

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