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USDA FOREST SERVICE GENERAL TECHNICAL REPORT PNW-47

Forest and Range Soils Research in Oregon and Washington– A Bibliography With Abstracts From 1969 Through 1974

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE
PORTLAND, OREGON

ABSTRACT

An annotated bibliography supplementing bibliographies by Tarrant for 1956 through 1963 and by Klock for 1969 through 1974.

Keywords: Soil management (forest), research.

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FOREST AND RANGE SOILS RESEARCH IN OREGON AND WASHINGTON

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Compiled by

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PREFACE

This paper cites and briefly summarizes published forest and range soils research in Oregon and Washington for the years 1969 to 1974. It supplements USDA Forest Service Research Papers PNW-15 and PNW-90.[1]

The significant growth of forest and range soils research within Oregon and Washington is quite evident in this paper. Research Paper PNW-15 listed 139 publications from 1914 through 1963, and Research Paper PNW-90 showed 115 publications for the 5-year period 1964-68. This report lists 230 publications from 1969 through 1974. The increased interest in promoting forest and range productivity by fertilization and other soil management techniques and concern for our forest environment appear to be the major reasons for so many soils research publications.

I have attempted to briefly record major findings or the theme of most references. This condensed information is intended only to lead the reader to the original publication.[2] A subject matter index is also included.

I keep an active file of Oregon and Washington forest and range soils research publications and would appreciate being notified of any omissions.

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[1] Robert F. Tarrant (compiler). Forest soils research in Oregon and Washington. A bibliography with abstracts through 1963. USDA Forest Service Research Paper PNW-15, 29 p., 1964. (No longer available from Pacific Northwest Forest and Range Experiment Station.)
Glen O. Klock (compiler). Forest and range soils research in Oregon and Washington, a bibliography with abstracts from 1964 through 1968. USDA Forest Service Research Paper PNW-90, 28 p., 1969.

[2] Publications listed herein are not available from the Pacific Northwest Forest and Range Experiment Station unless issued by the Station.

BIBLIOGRAPHY

1. Abee, Albert, and Denis Lavender.
   1972. Nutrient cycling in throughfall and litterfall in 450-year-old Douglas-fir stands in western Oregon. *In* Jerry F. Franklin et al. (eds.), Proceedings--Research on coniferous forest ecosystems--a symposium, p. 133-143, illus. USDA For. Serv., Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

   Comparisons of various major plant nutrients found in canopy throughfall and litterfall were made between six old-growth stands which represented six association types of Douglas-fir.

2. Alban, D. H.
   1969. The influence of western hemlock and western redcedar on soil properties. Soil Sci. Soc. Am. Proc. 33:453-457.

   Many morphological and chemical soil properties were found to differ under individual western hemlock and western redcedar in Washington and Idaho.

3. Anderson, Tom D., and Arthur R. Tiedemann.
   1970. Periodic variation in physical and chemical properties of two central Washington soils. USDA For. Serv. Res. Note PNW-125, 9 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

   Soils derived from two parent materials in central Washington were examined periodically during 1968-69 for physical and chemical Properties. Results indicated that periodic variation in certain chemical properties exists and could be a factor in research findings.

4. Aulerich, D. E., K. N. Johnson, and H. Froehlich.
   1974. Tractors or skylines: What's best for thinning young-growth Douglas-fir? For. Ind. (Nov.), 4 p.

5. Baldwin, D. M., N. W. Hawkinson, and E. W. Anderson.
   1974. High-rate fertilization of native rangelands in Oregon. J. Range Manage. 27:214-216.

   Increasing the rate of fertilization up to 1337 kg/ha N on native rangeland improved the vigor of perennial grasses, increased utilization of herbage by cattle, extended the green-forage season, and temporarily increased nitrate nitrogen in the forage.

6. Ballard, T. M.
   1970. Gaseous diffusion evaluation in forest humus. Soil Sci. Soc. Am. Proc. 34:532.

   A steady state CO_2 diffusion method is proposed for measuring the ratio of direct length to effective diffusion path length and gaseous diffusion coefficients in either loose or structurally intact forest humus samples.

7. Ballard, T. M.
   1971. Role of humic carrier substances in DDT movement through forest soil. Soil Sci. Soc. Am. Proc. 35:145-146.

In DDT-treated forest floor columns, over 30 times as much DDT was recovered by leaching with water when urea was added to disperse the humic acids. With similar treatment and analysis, alundum tension lysimeters in soil 2 cm below the forest floor yielded no detectable levels of DDT. In DDT-treated humic extracts, 91 percent of added o,p'-DDT was recovered in humic acids and 9 percent in fulvic acids plus water.

8. Ballard, T. M., and D. W. Cole.
1974. Transport of nutrients to tree root systems. Can. J. For. Res. 4:563-565.

Nutrient transport through the soil to roots by mass flow possibly accounts for less than 22, 37, and 80 percent, respectively, of the N, K, and Ca uptake by a Douglas-fir stand growing on a N-deficient soil.

9. Barrett, J. W., and C. T. Youngberg.
1970. Fertilizing planted ponderosa pine on pumice soils. *In* Regeneration of ponderosa pine, p. 82-88, illus. Oreg. State Univ. Symp. Proc. 1969. Corvallis.

This paper presents results of four field experiments designed to test the growth response of planted ponderosa pine to seven commercially available fertilizers.

10. Bockheim, J. G., A. K. Schlicte, E. A. Crecelius, and others.
1969. Compositional variations of the Mazama ash as related to variations in the weathering environment,. Northwest Sci. 43:162-173.

11. Bockheim, J. G., and F. C. Ugolini.
1971. Effect of alpine and subalpine vegetation on soil development, Mt. Baker, Washington. *In* Abstracts of the 44th annual meeting, Northwest Scientific Association, Moscow, Idaho, p. 2.

Under conditions where parent material, time, topography, and climate are relatively constant, chemical weathering is more advanced in Podzol soils of alpine and subalpine tree clumps than in Alpine Turf soils of adjacent meadows.

12. Bollen, W. B.
1971. Salty bark as a soil amendment. USDA For. Serv. Res. Pap. PNW-128, 16 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Salt content of Douglas-fir bark from logs floated in seawater ranged from 0.75 to 1.94 percent. This salt was readily removed when leached with rainfall or soaked. Salty bark mulches and incorporations depressed growth of bean and tomato plants in the greenhouse. Few soil bacteria were affected by salt.

13. Bollen, W. B., K. C. Lu, and R. F. Tarrant.
1970. Effect of Zectran on microbial activity in a forest soil. USDA For. Serv. Res. Note PNW-124, 11 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

When Zectran or No. 2 fuel oil was applied to soil in concentrations far greater than those that could result from current operational application rates, neither material adversely affected' soil microbial activity. The authors concluded from these data that low-volume applications of Zectran as an insecticide for forest use poses no hazard to soil microbes.

14. Bollen, W. B., K. C. Lu, J. M. Trappe, and R. F. Tarrant.
1969. Influence of Sitka alder on soil formation and microbiological succession on a landslide of alpine origin at Mount Rainier. USDA For. Serv. Res. Note PNW-103, 5 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

A Sitka alder seedling, growing on 5-year-old avalanche debris below Mount Rainier, led to increased soil carbon and nitrogen and increased microbial populations over a 3-year period.

15. Bollen, W. B., Logan A. Norris, and Kathleen L. Stowers.
1974. Effect of cacodylic acid and MSMA on microbes in forest floor and soil. Weed Sci. 22(6):557-562.

Concentrations of less than 10 mg/kg arsenic in the forest floor had no pronounced effect on organic matter decomposition.

16. Bollen, W. B., and C. M. Tu.
1971. Influence of endrin on soil microbial populations and their activity. USDA For. Serv. Res. Pap. PNW-114, 4 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Endrin applied to soil at rates of more than three times the maximum that might be expected from application of endrin-treated tree seed had no appreciable effect on numbers of soil organisms or on ammonification, nitrification, or sulfur oxidation. Decomposition of soil organic matter was increased significantly in the presence of endrin.

17. Bollen, W. B., and C. M. Tu.
1972. Effects of an organotin on microbial activities in soil. Tin and Its Uses 94:13-15, illus.

TBTO (BIS (tri-N-butyltin) oxide) is a water-insoluble liquid with a high affinity for cellulose. Levels of TBTO to 100 p/m in soil had no biologically significant impact on soil micro-organisms.

18. Bollen, Walter B.
1974. Soil microbes. *In* Environmental effects of forest residues management in the Pacific Northwest, a state-of-knowledge compendium, p. B-1 to B-41, illus. USDA For. Serv. Gen. Tech. Rep. PNW-24. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Desirable soil microbial activity can be enhanced when particle size of residues is reduced, when good contact is provided between residue fragments and soil, and when nitrogen is added or plants are established with nitrogen-fixing nodules.

19. Borchardt, G. A., and M. E. Harward.
1971. Trace element correlation in volcanic ash soils. Soil Sci. Soc. Am. Proc. 35:626-631.

Instrumental neutron activation analysis was used to correlate soils developed on the same volcanic ash deposit.

20. Borchardt, G. A., M. E. Harward, and R. A. Schmitt.
1971. Correlation of volcanic ash deposits by activation analysis of glass separates. Quat. Res. 1:247-260.

21. Boyer, Donald E., and Harold Legard.
1973. Forest land fertilization. 32 p. USDA For. Serv. Pac. Northwest Reg., Portland, Oreg.

22. Brown, George W.
1973. The impact of timber harvest on soil and water resources. Oreg. State Univ. Ext. Bull. 827, 17 p. Corvallis.

23. Brown, George W., Arnold R. Gahler, and Richard B. Marston.
1973. Nutrient losses after clear-cut logging and slash burning in the Oregon Coast Range. Water Resour. Res. 9:1450-1453.

Three small watersheds in Oregon's Coast Ranges were monitored for nutrient release 2 years before and 2 years after logging. No threat to aquatic or terrestrial productivity was observed.

24. Brown, George W., and J. T. Krygier.
1971. Clear-cut logging and sediment production in the Oregon Coast Range. Water Resour. Res. 7:1189-1198.

The impact of road construction, two patterns of clearcut logging, and controlled slash burning on the suspended sediment yield and concentration is reported for three small watersheds in the Oregon Coast Ranges.

25. Burroughs, Edward R., Jr., George R. Chalfant, and Martin A. Townsend.
1973. Guide to reduce road failures in western Oregon. 111 p. Bur. Land Manage., Oreg. State Off., Portland, Oreg.

A training guide designed to provide an introduction to stable road construction on forest lands of western Oregon.

26. Burroughs, Edward R., Jr., and H. A. Froehlich.
1972. Effects of forest fertilization on water quality in two small Oregon watersheds. U.S. Bur. Land Manage., Tech. Note, 8 p. Portland, Oreg.

27. Chichester, F. W., M. E. Harward, and C. T. Youngberg.
1970. pH-dependent ion exchange properties of soils and clays from Mazama pumice. Clays and Clay Miner. 18:81-90.

28. Chichester, F. W., C. T. Youngberg, and M. E. Harward.
1969. Clay mineralogy of soils formed on Mazama pumice. Soil Sci. Soc. Am. Proc. 33:115-120.

Samples of the <2 micrometers fraction in central Oregon had mineral suites consisting predominantly of X-ray amorphous material in combination with a rather complex group of 2:1 phyllosilicates, gibbsite, feldspars, and quartz. The factors primarily controlling clay mineral genesis were hypothesized to be the vesicular structure and chemical composition of the pumiceous parent material.

29. Cline, C. S.
1973. Effects of forest fertilization on the Tahuya River, Kitsap Peninsula, Washington. *In* Abstracts of the 46th annual meeting, Northwest Scientific Association, Walla Walla, Wash., p. 8.

Amounts of urea, amnonia, nitrate, and phosphate entering the river and its tributaries before, during, and after a forest fertilization project in the Tahuya River basin are reported.

30. Cline, C. S., and W. H. Rickard.
1973. Herbage yields in relation to soil water and assimilated nitrogen. J. Range Manage. 26:296-298.

When herbage nitrogen is in the range of 0.5 to 0.7 percent at the end of the spring growing season, nitrogen rather than soil water appears to limit herbage production.

31. Cochran, P. H.
1969. Lodgepole pine clearcut size affects minimum temperatures near the soil surface. USDA For. Serv. Res. Pap. PNW-86, 9 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Narrow widths of cutting strips may be necessary in certain problem areas in pumice soil region of Oregon to obtain natural regeneration of lodgepole pine.

32. Cochran, P. H.
1969. Thermal properties and surface temperatures of seedbeds, a guide for foresters. USDA For. Serv., Pac. Northwest For. and Range Exp. Stn., 19 p, illus. Portland, Oreg.

The important thermal properties of soil are defined and discussed together with other influences on temperature variation at the surface.

33. Cochran, P. H.
1971. Pumice particle bridging and nutrient levels affect lodgepole and ponderosa pine seedling development. USDA For. Serv. Res. Note PNW-150, 10 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Root expansion in the C1 horizon of the lapine soil is limited, apparently, because the gravel-size pumice particles bridge together creating a barrier to root penetration. The low nutrient content of the C1 horizon limited the size of the ponderosa pine seedlings but was not the factor restricting depth of root penetration for either lodgepole or ponderosa pine seedlings.

34. Cochran, P. H.
1972. Temperature and soil fertility affect lodgepole and ponderosa pine seedling growth. For. Sci. 18(2):132-134, illus.

Fertilization increased growth of both species under all nine temperature regimes. Lodgepole was not as sensitive to changes in night temperature as was ponderosa pine. The number of daily degree hours required for maximum growth changed with both soil fertility level and night temperature.

35. Cochran, P. H.
1972. Tolerance of lodgepole and ponderosa pine seeds and seedlings to high water tables. Northwest Sci. 46(4):322-331, illus.

Soil water levels close to saturation favored germination of lodgepole over ponderosa pine. When 2-week-o7d seedlings were subjected to several different soil water levels, both species survived and grew even on saturated soils. Influence of high soil water levels on survival and early growth of the two species is probably not a factor governing "wet-site" occupancy by lodgepole pine on mineral soils.

36. Cochran, P. H.
1973. Natural regeneration of lodgepole pine in south-central Oregon. USDA For. Serv. Res. Note PNW-204, 18 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Several events must occur in sequence for establishment of natural regeneration. These events do not always occur in a reasonable length of time after timber .is cut. Leaving a light slash. cover on the soil surface favorably modifies the environment, but the practice **does** not guarantee natural regeneration.

37. Cochran, P. H.
1973. Response of individual ponderosa pine trees to fertilization. USDA For. Serv. Res. Note PNW-206, 15 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Fertilization of one-tenth acre around individual test trees in thinned stands substantially increased growth in three of four areas studied. In the fourth area, top damage probably confounded results.

38. Cole, D. W., S. P. Gessel, and W. J. B. Crane.
1974. Urea reactions and transformation following fertilization to a forest soil. Am. Soc. Agron. Abstr., p. 175.

The chemistry of the soil solution within the top 30 cm shifted markedly after urea was applied to the surface.

39. Cole, Dale W., and Peter S. Machno.
1969. Factors affecting percolation in a forest soil. *In* Proceedings of symposium on water balance in North America, Banff, Alberta, Canada, p. 101-109. Ser. No. 7. Am. Water Resour. Assoc., Urbana, Ill.

40. Dahms, Walter G.
1971. Growth and soil moisture in thinned lodgepole pine. USDA For. Serv. Res. Pap. PNW-127, 32 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

A levels-of-growing-stock study of lodgepole pine showed that individual trees developed longer crowns, grew more rapidly, and added more wood to potentially merchantable trees at lower stand densities, but total wood production was less. Evapotranspiration drain on soil moisture was also less at the lower stand densities.

41. Dahms, Walter G.
1973. Tree growth and water use response to thinning in a 47-year-old lodgepole pine stand. USDA For. Serv. Res. Note PNW-194, 14 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Results from a 5-year levels-of-growing-stock study of lodgepole pine showed soil moisture withdrawal was substantially reduced at lower stand densities.

42. DeBell, D. S., and W. M. Fergerson.
1972. Soils information - an indispensable tool for intensive forest management. Crown Zellerbach Res. Note No. 1, 6 p. Camas, Wash.

Soils information for planning and conducting forestry operations on Crown Zellerbach's northwestern managed forests is reported.

43. DeBell, Dean S.
1973. Effect of application level on gaseous and leaching losses from urea and sulfur-coated urea fertilizers applied to a Douglas-fir soil. *In* Abstracts of the 46th annual meeting, Northwest Scientific Association, Walla Walla, Wash., p. 10.

Under laboratory conditions, ammonia volatility losses averaged 42 percent of total N applied as urea, and only 4 percent for sulfur-coated urea. Leaching losses in the absence of plant uptake varied from 2 to 56 percent of the N application, but differences in total loss were not associated with treatment.

44. DeBell, Dean S.
1973. Gaseous and leaching losses from urea applied to two forest soils as affected by temperature and rainfall. Am. Soc. Agron. Abstr., p. 138.

Gaseous NH_3 losses up to 42 percent were related to soil, temperature, and timing and amount of rainfall. Leaching losses up to 70 percent of NO_3 and NO_2 were related to soil and increased with temperature and amount of rainfall.

45. Dyrness, C. T.
1969. Hydrologic properties of soils on three small watersheds in the western Cascades of Oregon. USDA For. Serv. Res. Note PNW-111, 17 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Soils on three small experimental watersheds were found to permit rapid rates of water movement as a result of their porous nature. The importance of stone content as a hydrologic factor required some revision of the original soil classification scheme before water storage capacity relationships could be correctly assessed.

46. Dyrness, C. T.
1970. Stabilization of newly constructed road backslopes by mulch and grass-legume treatments. USDA For. Serv. Res. Note PNW-123, 5 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Amounts of soil loss from an unprotected newly constructed backslope were two to four times greater than loss from a comparable slope 5 years

after construction. Of six roadside treatments studied, the two showing consistently large amounts of soil loss during the first critical rainy period were the ones without a straw mulch covering.

47. Dyrness, C. T.
1972. Soil surface conditions following balloon logging. USDA For. Serv. Res. Note. PNW-182, 7 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Balloon logging caused substantially less soil disturbance than previous studies had shown for tractor, high-lead, and skyline logging methods. Deeply disturbed and compacted soil areas occupied 4.3 percent of the total area, and 15.8 percent of the area was classed as slightly disturbed.

48. Dyrness, C. T.
1973. Early stages of plant succession following logging and burning in the western Cascades of Oregon. Ecology 54:57-69.

Differences in soil disturbance from logging and burning 'were shown to have a strong influence on successional trends.

49. Edgren, James W., and William I. Stein.
1974. Artificial regeneration. *In* Environmental effects of forest residues management in the Pacific Northwest, a state-of-knowledge compendium, p. M-1 to M-32, illus. USDA For. Serv. Gen. Tech. Rep. PNW-24. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Effects of forest residues on artificial regeneration are discussed.

50. Fowler, W. B.
1974. Microclimate. *In* Environmental effects of forest residues management in the Pacific Northwest, a state-of-knowledge compendium, p. N-1 to N-18, illus. USDA For. Serv. Gen. Tech. Rep. PNW-24. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Examines basic physical processes underlying development of local microclimates and how they are affected by residue generation and treatment.

51. Fowler, W. B., and H. W. Berndt.
1969. Flourescent materials index soil movements. USDA For. Serv. Res. Note PNW-107, 7 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Tracing movement and dispersion of soil-size flourescent particles is a promising method for detecting and describing soil erosion.

52. Fowler, William B.
1971. Measurement of seasonal air temperatures near the soil surfaces. J. Range Manage. 24:158-160, illus.

Large local differences appeared in the onset and duration of temperature extremes as well as absolute seasonal maximum. Plant cover and soil type are major elements accounting for this local variation.

53. Fredriksen, R. L.
1970. Erosion and sedimentation following road construction and timber harvest on unstable soils in three small western Oregon watersheds. USDA For. Serv. Res. Pap. PNW-104, 15 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

In one steep headwater drainage with road construction and patch-cut logging, total stream-carried sediment over a 9-year period was more than 100 times greater than that from an undisturbed watershed. Ninety-nine percent originated from landslides. In a clearcut-logged watershed with no roads, sedimentation was three times greater than that from an undisturbed watershed.

54. Fredriksen, R. L.
1971. Comparative chemical water quality--natural and disturbed streams following logging and slash burning. *In* Forest land uses and stream environment symposium proceedings, 1970, p. 125-137, illus. Oreg. State Univ., Corvallis.

Following timber harvest on a watershed, loss of nutrients increased 1.6 to 3.0 times. Details of chemicals and rate of **loss** are given.

55. Fredriksen, R. L.
1972. Impact of forest management on stream water quality in western Oregon. *In* Pollution abatement and control in the forest products industry, 1971-72, Proceedings, 26th annual meeting, p. 37-50, illus. For. Prod. Res. Soc.

Sedimentation of streams in Douglas-fir forests is often serious where roads for timber removal cross steep topography. The rise in nutrient concentration after clearcutting and burning and after fertilization declines rapidly as vegetation regrows. Rise in stream temperature can be minimized if shade for stream is left after logging.

56. Fredriksen, R. L.
1972. Nutrient budget of a Douglas-fir forest on an experimental watershed in western Oregon. *In* Jerry F. Franklin et al. (eds.), Proceedings--Research on coniferous forest ecosystems--a symposium, p. 115-131, illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

The study involved nitrogen, phosphorus, the cations, and silica amounts added by precipitation and retained by the forest as well as hypotheses about processes regulating their loss from the forest.

57. Fritschen, L. J., L. W. Gay, and H. R. Holbo.
1974. Estimating evapotranspiration from forests by meteorological and lysimetric methods. *In* R. H. Waring and R. L. Edmonds (eds.), Integrated research in the Coniferous Forest Biome. Coniferous For. Biome Bull. No. 5 (1972):35-40. Univ. Wash., Seattle.

58. Fritschen, Leo J.
1972. The lysimeter installation on the Cedar River watershed. *In* Jerry F. Franklin et al. (eds.), Proceedings--Research on coniferous forest ecosystems--a symposium, p. 255-260, illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

A lysimeter container was built around a 28-m Douglas-fir tree to provide information on rates of evapotranspiration and interception for short periods.

59. Fritschen, Leo J., Lloyd Cox, and Russel Kinerson.
1973. A 28-meter Douglas-fir tree in a weighing lysimeter. For. Sci. 19:256-261.

A 3.7-m diameter by 1.2-m deep soil container was constructed around the root ball of a 28-m Douglas-fir in a naturally regenerated stand.

60. Froehlich, Henry.
1974. Soil compaction: Implication for young-growth management. *In* A. B. Berg (ed.), Managing young forests in the Douglas-fir region, p. 49-64. Sch. For. Symp., Oreg. State Univ., Corvallis.

Describes the importance of soil density for growth of seedlings and young stands, the impact of harvesting on soil density, and the implication for forest productivity.

61. Froehlich, Henry A.
1973. The impact of even age forest management on physical properties of soils. *In* R. K. Hermann and D. P. Lavender (eds.), Even-age management, p. 199-220. Symp. Proc., Oreg. State Univ., Corvallis.

62. Geist, J. Michael.
1973. Physical and chemical properties of volcanic ash and basalt-derived forest soils of northeastern Oregon. Am. Soc. Agron. Abstr., p. 138-139.

Ash materials at low moisture tension showed yields of soil water which was lost rapidly with increasing tension. Basalt soils held less water and released it at a slower rate with increasing tension. Contrast between bulk densities, exchangeable bases, organic matter, and available phosphorus are given.

63. Geist, J. Michael.
1973. Total soil nitrogen analysis using micro-Kjeldahl digestion and portable distillation equipment. USDA For. Serv. Res. Note PNW-198, 8 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Equipment modifications and methodology alternatives for determining total nitrogen in soils with a micro-Kjeldahl digestion apparatus were investigated. Results showed that an air shield over the flask bulbs and a standard copper catalyst-salt mixture should give satisfactory recovery in routine analyses with a running time and sample size similar to those used with macro-Kjeldahl racks. Recovery of several standards was high (96-99 percent), but for recovery of highly refractory compounds, adjustments in methodology will be required.

64. Geist, J. Michael.
1974. Chemical characteristics of some forest and grassland soils of northeastern Oregon. II. Progress in defining variability in Tolo and Klicker soils. USDA For. Serv. Res. Note PNW-217, 15 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Contrasts in general and specific nutrient statuses, trends by soil depth increment, and management implications are discussed. Data are stratified by soil series and by overstory dominant vegetation.

65. Geist, J. Michael, Paul J. Edgerton, and Gerald S. Strickler.
1974. 'Yukky to yummy'--with fertilizers. Rangeman's J. 1(2):39-41, illus.

An experiment was conducted to determine effects of fertilizer on growth and protein content of timothy seeded in a clearcut but, instead, the fertilizer attracted elk.

66. Geist, Jon M.
1971. Orchardgrass responses to fertilization of seven surface soils from the Central Blue Mountains of Oregon. USDA For. Serv. Res. Pap. PNW-122, 12 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

"Orchardgrass responses to N, P, and S applied singly and in combination differed among seven soils studied. Dry matter production showed a significant interaction between N and S treatments in all instances. Only two soils showed a significant response to phosphorus. Largest overall treatment responses were noted on Klicker and volcanic-ash-derived soils."

67. Geist, Jon M., and Gerald S. Strickler.
1970. Chemical characteristics of some forest and grassland soils of northeastern Oregon. I. Results from reference profile sampling on the Starkey Experimental Forest and Range. USDA For. Serv. Res. Note PNW-137, 11 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Chemical soil properties are quantified for individual profiles of six soil series on the Starkey Experimental Forest and Range. Comparisons are made among the study results and with data reported in the literature for some similar soils. Major differences noted include C/N ratios and available phosphorus.

68. Gessel, S. P.
1969. Increasing yield through soil management. Proc., 60th West. For. and Conserv. Assoc. Conf., Spokane, Wash., p. 52-55.

69. Gessel, S. P.
1969. Introduction for forest fertilization in North America. For. Ind., August, p. 1-3.

70. Gessel, S. P.
1969. Status of forest fertilization in the Northwest. *In* Proceedings of the 20th annual Pacific Northwest fertilizer conference, Spokane, Wash., p. 19-36.

71. Gessel, S. P., D. W. Cole, and E. C. Steinbrenner.
1972. Nitrogen balances in forest ecosystems of the Pacific Northwest. Soil Biol. and Biochem. 5:19-34.

72. Gessel, S. P., D. W. Cole, and J. Turner.
1973. Elemental cycling and even-age forest management. *In* R. K. Hermann and D. P. Lavender (eds.), Even-age management, p. 179-198. Symp. Proc., Oreg. State Univ., Corvallis.

73. Gessel, S. P., W. Crane, and D. W. Cole.
1972. Environmental aspects of nitrogenous fertilization in forests. Aust. For. Tree Nutr. Conf., p. 210-219. Sydney, Aust.

74. Gessel, S. P., and N. W. Foster.
1972. The natural addition of nitrogen, potassium, and calcium to a *Pinus banksiana* Lamb. forest floor. Can. J. For. Res. 2:448-455.

75. Gessel, S. P., T. N. Stoate, and J. K. Turnbull.
1969. The growth behavior of Douglas-fir with nitrogenous fertilizer in western Washington. Inst. For. Prod., Univ. Wash., Contrib. 7 p. Seattle.

76. Gessel, S. P., R. B. Walker, T. N. Stoate, and I. G. Morison.
1972. Research on nitrogen and additional elements in the Douglas-fir region. Aust. For. Tree Nutr. Conf., p. 183-190. Sydney, Aust.

77. Gilmour, C. M., C. T. Youngberg, R. L. Pratt, and S. M. Beck.
1973. Energy flow as determined by rates of coniferous forest litter decomposition. *Am.* Soc. Agron. Abstr., p. 91.

Studies indicate that the overall forest litter decomposition process could be expressed in terms of first-order-kinetics and a half-life substrate decay equation.

78. Grier, C. C.
1972. Impact of forest fire on components of mineral cycling processes in a ponderosa pine ecosystem. *In* Abstracts of 45th annual meeting, Northwest Scientific Association, p. 6. West. Wash. State Coll., Bellingham.

79. Grier, C. C.
1973. Organic matter and nitrogen distribution in some mountain heath communities of the Source Lake Basin, Washington. Arctic and Alpine Res. 5, Part 1:261-267.

The soils and vegetation of subalpine mountain heath communities on colluvial residual and organic soils in the Source Lake Basin of the west-central Cascade Range, Washington, were described and sampled for organic matter and nitrogen content in foliage, living stems, attached dead stems, roots, litter, and soil.

80. Grier, C. C., D. W. Cole, C. T. Dyrness, and R. L. Fredriksen.
1974. Nutrient cycling in 37- and 450-year-old Douglas-fir ecosystems. *In* R. H. Waring and R. L. Edmonds (eds.), Integrated research in the Coniferous Forest Biome. Coniferous For. Biome Bull. No. 5 (1972):21-34. Univ. Wash., Seattle.

81. Grier, C. C., and J. G. McColl.
1971. Forest floor characteristics within a small plot in Douglas-fir in western Washington. Soil Sci. Soc. Am. Proc. 35:988-991.

Selected chemical and physical properties and their variabilities within a 0.04-ha plot were determined.

82. Grier, Charles C., and Dale W. Cole.
1971. Influence of slash burning on ion transport in a forest soil. Northwest Sci. 45:100-106.

Slash burning was shown to substantially increase the concentration of ions entering the soil.

83. Grier, Charles C., and Dale W. Cole.
1972. Elemental transport changes occurring during development of a second-growth Douglas-fir ecosystem. *In* Jerry F. Franklin et al. (eds.), Proceedings--Research on coniferous forest ecosystems—a symposium, p. 103-114, illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Six years of intensive monitoring on the H. H. Thompson Research Center provides information on the transfer rates of elements between components of of a second-growth Douglas-fir ecosystem.

84. Harr, R. D.
1973. Field transport of the neutron soil-moisture meter in steep terrain. J. Soil and Water Conserv. 28:181-182.

85. Harwood, M. E., and C. T. Youngberg.
1969. Soils from Mazama ash in Oregon: Identification, distribution, and properties. *In* Proceedings, Pedology and quaternary research, Symposium, May 13-14, 1969, p. 163-178. Univ. Alberta, Edmonton.

86. Hatheway, W. H., P. Machno, and E. Hamerly.
1972. Modeling water movement within the upper rooting zone of a Cedar River soil. *In* Jerry F. Franklin et al. (eds.), Proceedings--Research on coniferous forest ecosystems--a symposium, p. 95-101. USDA For. Serv., Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Observations on the advance of wetting fronts have been obtained by lysimeter techniques and have been analyzed with moisture flow equations for a porous soil.

87. Hawk, G. M., and D. B. Zobel.
1974. Forest successions on alluvial landforms of the McKenzie River Valley, Oregon. Northwest Sci. 48:245-265.

A major factor leading to vegetation succession differences appears to be soil moisture availability in late sumner.

88. Heilman, P.
1974. Effect of urea fertilization on nitrification in forest soils of the Pacific Northwest. Soil Sci. Soc. Am. Proc. 38:664-667.

Levels of nitrate in samples of untreated, incubated soils from Douglas-fir *(Pseudotsuga menziesii)* and western hemlock (*Tsuga heterophylla*) stands varied from 0 to 45 p/m nitrate N. Treatment with urea increased nitrate N in incubated samples an average of 70 p/m, but the increase varied widely among soils. Earlier N fertilization increased nitrification of urea. Nitrification was restricted at temperatures below 5° C.

89. Heilman, P., and G. Ekuan.
1973. Response of Douglas-fir and western hemlock seedlings to lime. For. Sci. 19:220-224.

High rates of lime produced a significant reduction in western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) growth on low-base forest soils used in pot experiments. Application of P alone, or in combination with lime, had no significant effect on the growth of seedlings. The N, Ca, and Mg contents of Douglas-fir leaves were increased by lime, but those of Mn and Al were decreased. In western hemlock the effects were similar, except that K and Mg were reduced. Lime increased soil pH, exchangeable Ca content, and base saturation of the soil. Extractable K, Mg, and P were slightly decreased in soil treated with high rates of lime.

90. Helvey, J. D.
1974. Soil moisture depletion and growth rates after thinning ponderosa pine. *In* Abstracts of 47th annual meeting, Northwest Scientific Association, Vancouver, B.C., p. 15.

Depletion from heavily thinned plots near Baker, Oregon, averaged 8.6 cm less than from control plots the first three summers after treatment. Increases in growth rate during the first 5 years after thinning were largest in stands thinned to 4.6-m spacing.

91. Herman, R. K., and R. G. Petersen,
1969. Root development and height increment of ponderosa pine in pumice soils of central Oregon. For. Sci. 15:226-237.

Trees were excavated from three different pumice soils in central Oregon and inspected for root growth characteristics.

92. Herring, H. G.
1970. Soil moisture trends under three different cover conditions. USDA For. Serv. Res. Note PNW-114, 8 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

A study of soil moisture trends under a grassy opening, a second-growth ponderosa pine stand, and a clearcut plot indicates that if a pine stand were converted to grass as a water-saving scheme, the ultimate benefits might be only 20 percent as great as the initial savings after clearcutting.

93. Hu, L., C. T. Youngberg, and C. M. Gilmour.
1972. Readily oxidizable carbon: An index of decomposition and humification of forest litter. Soil Sci. Soc. Am. Proc. 36:959-961.

Carbon dioxide evolution rates are higher from organic horizons undergoing active decomposition (F-layers) than from well-decomposed and humified horizons (H-layers) and are relatively good indexes of decomposition and humification. Water-soluble carbon contents correlate well with CO_2 evolution values. The more rapid soluble carbon analysis makes this the preferred method for determining stage of decomposition and humification.

94. Johnson, D. W., M. J. Singes, and R. Minden.
1974. Nutrient cycling in a subalpine *Abies* forest. II. Processes of mineral transfer. *In* Abstracts of 47th annual meeting, Northwest Scientific Association, Vancouver, B.C., p. 36.

The carbonic-acid mechanism was found to play a major role in cation leaching in lower elevation *Pseudotsuga menziesii* stands, but it plays a

much smaller role in high elevation *Abies amabilis* stands because of the greater acidity of soil solutions.

95. Klock, G. O.
1969. Some autecological characteristics of elk sedge. USDA For. Serv. Res. Note PNW-106, 5 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

"Cores" of elk sedge were successfully transplanted to the laboratory to investigate this method of reproduction and to provide material for tests of this plant's response to fertilization. Elk sedge showed positive response to nitrogen and potassium fertilization.

96. Klock, G. O.
1969. Use of a starter fertilizer for vegetation establishment. (Abstr.) Northwest Sci. 43:38.

Use of a nitrogen-sulfur fertilizer at planting time appeared imperative for satisfactory establishment of vegetation on disturbed forest soils of low fertility in north-central Washington.

97. Klock, G. O.
1971. Forest erosion control fertilization and streamflow nitrogen loss. West. Soc. Soil Sci. Abstr., p. 12.

98. Klock, G. O.
1971. Streamflow nitrogen loss following forest erosion control fertilization. USDA For. Serv. Res. Note PNW-169, 9 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Reports estimated quantities of urea-N, nitrate-N, and ammonia-N loss through streamflow for 60 days following fertilization of watersheds on the Entiat Experimental Forest severely affected by wildfire.

99. Klock, G. O.
1972. Soil moisture trends on mountain watersheds following forest fire. *In* Abstracts of 45th annual meeting, Northwest Scientific Association, Bellingham, Wash., p. 7.

Compares soil moisture before and after wildfire on the Entiat Experimental Forest in north-central Washington.

100. Klock, G. O.
1973. Helicopter logging reduces soil surface disturbance. *In* Abstracts of the 46th annual meeting, Northwest Scientific Association, Walla Walla, Wash., p. 20.

Helicopter fire salvage logging was shown to cause strikingly less severe surface soil disturbance than high lead-jammer cable skidding or tractor logging methods.

101. Klock, G. O.
1973. Selection of timber harvesting method may be based on soil erosion potential. Am. Soc. Agron. Abstr., p. 140.

Models from this study demonstrate that an opportunity exists on western timberlands for use of soil erosion potential as an important parameter in selecting the most appropriate harvesting technique.

102. Klock, G. O., and L. L. Boersma.
1971. Hard to drain soil responds to plastic tubing. Crops and Soils (January), p. 23-24.

Perforated plastic drainage pipes offer promise of reducing the cost per foot of drain.

103. Klock, G. O., and J. M. Geist.
1971.. Sulfur-coated urea and its possible use in erosion control fertilization. *In* Abstracts of the 42nd annual meeting, Northwest Scientific Association, Moscow, Idaho, p. 7.

The availability of sulfur along with the urea-nitrogen in SCU appears to be beneficial for plant growth in erosion control seedings.

104. Klock, G. O., J. M. Geist, and A. R. Tiedemann.
1971. Erosion control fertilization--from pot study to field testing. Sulphur Inst. J. 7(3):7-10, illus.

Field experimentation was initiated in conjunction with the greenhouse study to evaluate nitrogen and sulfur relations in the natural environment. Seeding along with a starter fertilizer was recommended for some locations. In some areas, sulfur as well as nitrogen was recommended.

105. Klock, G. O., and W. Lopushinsky.
1970. Use of thermocouple psychrometers to measure soil water potential in the root zone of conifer seedlings. *In* Abstracts of the 43rd annual 'meeting, Northwest Scientific Association, Salem, Oreg., p. 64.

Thermocouple psychrometers proved to be a quick, accurate method of measuring soil water potential in many potted conifers.

106. Klock, G. O., A. R. Tiedemann, and W. Lopushinsky.
1974. Seeding trials on firelines in north central Washington. *In* Abstracts of 47th annual meeting, Northwest Scientific Association, Vancouver, B.C., p. 16.

Fertilization was essential for the establishment of introduced species on firelines where the soils were severely disturbed.

107. Klock, Glen.
1973. Mission Ridge - a case history of soil disturbance and revegetation of a winter sports area development. USDA For. Serv. Res. Note PNW-199, 10 p. Pac. Northwest For. and Range Exp. Stn., Portland,. Oreg.

Areas of soil disturbance caused by construction of a winter sports area are identified, and the private operator's use of forest research findings to reduce the effect of these disturbances are reviewed.

108. Klock, Glen 0.
1969. A "vacuum-freeze" technique to prepare disturbed soil for erosion research. West. Soc. Soil Sci. Abstr., p. 19.

A vacuum-freeze technique was developed to establish some structure in soil samples brought from the field for laboratory erosion susceptibility testing.

109. Klock, Glen O.
1969. Forest and range soils research in Oregon and Washington, a bibliography with abstracts from 1964 through 1968. USDA For. Serv. Res. Pap. PNW-90, 28 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

An annotated bibliography continuing a series of bibliographies previously published by Pacific Northwest Forest and Range Experiment Station.

110. Klock, Glen O.
1972. Snowmelt temperature influence on infiltration and soil water retention. J. Soil and Water Conserv. 27:12-14, illus.

Effect of snowmelt water on infiltration and soil water retention is shown by theory and experimentation. Watershed management implications, including possible overland flow hazards and effects of thinning, clearcutting, and wildfire, are discussed.

111. Klock, Glen O.
1974. Site factors influencing erosion on forest and range soils developed from Swauk sandstones. West. Soc. Soil Sci. Abstr., p. 7-8.

Infiltration, slope, and vegetative cover were identified as the most important site factors influencing erosion.

112. Klock, Glen O., and Walter A. Hampton.
1972. Skiing--'and on grass base.' Wash. Farmer-Stockman 97(2):34, illus.

The successful planting procedures developed here could be adapted to revegetation of ski slopes and other disturbed areas in many places along the upper slopes of the Cascade Range.

113. Kruckeberg, A. R.
1969. Plant life on serpentine and other ferromagnesian rock in northwestern North America. Syesis 2:15-114.

In Oregon, Washington, and British Columbia, vegetation on ferromagnesian rocks such as serpentinite, peridotite, and dunite often contrasts markedly with that on adjacent but different rock types.

114. Li, C. Y., K. C. Lu, J. M. Trappe, and W. B. Bollen.
1970. Separation of phenolic compounds in alkali hydrolysates of a forest soil by thin-layer chromatography. Can. J. Soil Sci. 50:458-460.

115. Li, C. Y., K. C. Lu, J. M. Trappe, and W. B. Bollen.
1972. Nitrate-reducing capacity of roots and nodules of *Alnus rubra* and roots of *Pseudotsuga menziesii*. Plant and Soil 37(2):409-414.

Alder roots and nodules reduce nitrate nitrogen to the nitrate form, whereas Douglas-fir roots do not. Since a nitrate reduction capacity is required for absorption of nitrate nitrogen from soil, the good response of Douglas-fir to fertilization with nitrate nitrogen is probably via nitrate-reducing, fungi-forming mycorrhizae with its roots.

116. Lopushinsky, W., and G. O. Klock.
1974. Transpiration of conifer seedlings in relation to soil water potential. For. Sci. 20(2):181-186, illus.

In response to decreasing soil water potential, the transpiration rates of *Pinus* ponderosa and *Pinus contorta* seedlings declined to a greater degree than the transpiration of Pseudotsuga menziesii and *Abies grandis* seedlings. The response of *Picea engelmannii* was intermediate between the pines and the firs.

117. Lowery, R.
1972. Effect of soil temperature and moisture content on early root development in three high elevation tree species. *In* Abstracts of the 45th annual meeting, Northwest Scientific Association, Bellingham, Wash., p. 8.

Root development for mountain hemlock, alpine fir, and Pacific silver fir was found to be a function of soil temperature and soil moisture content.

118. Lu, K. C.
1974. Phenolic compounds and *Poria* weirii. Proc., Eighteenth West. Int. For. Dis. Work Conf., Harrison Hot Springs, B.C., Can., Sep. 14-18, 1970, p. 45-48.

Red alder roots, resistant to the root-rotting fungus *Poria* weirii, contain several *Poria*-inhibiting compounds. Some of these occur in soil under alder. Roots of the highly susceptible Douglas-fir contain a *Poria*-stimulating compound.

119. McCall, M.
1970. The effects of aerial forest fertilization on water quality for two streams in the Capitol Forest. Wash. State Dep. Ecol., 20 p. Olympia.

120. McColl, J. G.
1972. Dynamics of ion transport during moisture flow from a Douglas-fir forest floor. Soil Sci. Soc. Am. Proc. 36:668-674.

Ion transport from the forest floor was found to be related to temperature regime, duration of time before flow, and amount of moisture flow.

121. McColley, P. D., and H. S. Hodgkinson.
1970. Effect of soil depth on plant production.. J. Range Manage. 23:189-192.

Three range soils in eastern Washington with different depths produced different kinds and amounts of forage.

122. McConnell, Burt R., and Justin G. Smith.
1971. Effect of ponderosa pine needle litter on grass seedling survival. USDA For. Serv. Res. Note PNW-155, 6 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Hard fescue survival rates were followed for 6 years on four different pine needle treatment plots. Needle litter had a significant effect on initial survival of fescue seedlings, but subsequent losses undoubtedly resulted from interaction of many factors.

123. Mallonee, E. H., R. F. Strand, D. S. DeBell, and 3. Y. Zin.
1974. Effects of fertilization on growth of young Douglas-fir plantations near Campbell River, British Columbia. Crown Zellerbach For. Res. Note 3, 7 p. Camas, Wash.

124. Malueg, K. W., and D. F. Krawczyk.
1972. Effects of aerial forest fertilization with urea pellets on nitrogen levels in a mountain stream. Northwest Sci. 46:52-58.

The effects on water quality from fertilization of 569 acres of 35-year-old Douglas-fir forest in Linn County, Oregon, are reported.

125. Manhart, L. G., and E. P. Harshman.
1971. Pumice soil-vegetation relationships of Oregon's central high Cascades. Am. Soc. Agron. Abstr., p. 120.

Depth or thickness of the soil beneath the pumice is a key indicator of areas suitable for management for protection of soil, water, and wildlife resources.

126. Mersereau, R. C., and C. T. Dyrness.
1972. Accelerated mass wasting after logging and slash burning. J. Soil and Water Conserv. 27(3):112-114, illus.

Clearcut logging and slash burning in a steep watershed in western Oregon resulted in increased rates of soil movement during the first year after burning. Measured soil and rock movement occurred mainly during the dry season, and amounts were closely tied to steepness of slope, aspect, vegetative cover, and length of time since burning.

127. Meurisse, R. T., and C. T. Youngberg.
1972. Biological assay of four andic soils from the western Oregon fog-belt zone. Am. Soc. Agron. Abstr., p. 141.

Monterey pine seedlings were grown for 6 months in the greenhouse on four soils from western hemlock sites to test response to fertilizer.

128. Miller, R. E., and L. V. Pienaar.
1973. Seven-year response of 35-year-old Douglas-fir to nitrogen fertilizer. USDA For. Serv. Res. Pap. PNW-165, 24 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Applying ammonium nitrate fertilizer to a site V plantation resulted in significant increases in tree diameter, height growth, and in volume growth during the 7 years after treatment.

129. Miller, R. E., and D. C. Young.
1974. Comparative effects of foliar- and soil-applied nitrogen fertilizers on Douglas fir: 11. Tree growth. Am. Soc. Agron. Abstr., p. 177.

Experimental results suggest that concentrated urea-ammonium nitrate solution sprays can provide similar growth response in Douglas-fir and western hemlock as urea prill at N-dosages up to 179 to 224 kg/ha.

130. Miller, Richard E., and Richard L. Williamson.
1974. Dominant Douglas-fir respond to fertilizing and thinning in southwest Oregon. USDA For. Serv. Res. Note PNW-216, 7 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

In 30-year-old, site IV Douglas-fir in southwest Oregon, fertilizing increased average 4-year basal area growth of dominant trees by 57 and 28 percent on clay loam and sandy loam soils, respectively. Fertilizing with thinning increased growth by 94 and 132 percent over untreated growth. Thinning on clay loam soil increased growth by 53 percent. Treatment did not affect height growth on either soil.

131. Miller, Richard E., Richard L. Williamson, and Roy R. Silen.
1974. Regeneration and growth of coastal Douglas-fir. *In* Environmental effects of forest residues management in the Pacific Northwest, a state-of-knowledge compendium, p. J-1 to J-41. USDA For. Serv. Gen. Tech. Rep. PNW-24. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Environmental requirements for regenerating coastal Douglas-fir are described.

132. Minore, Don.
1971. Effects of flooding and shallow water tables on survival and growth of six northwestern tree species. *In* Abstracts of the 44th annual meeting, Northwest Scientific Association, Moscow, Idaho, p. 9.

Redcedar and lodgepole pine seedlings best tolerated flooding. Redcedar and alder best tolerated shallow water tables. Douglas-fir seedlings tolerated neither flooding nor shallow water tables.

133. Minore, Don.
1972. A classification of forest environments in the South Umpqua Basin. USDA For. Serv. Res. Pap. PNW-129, 28 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

A classification of forest environments by elevation, temperature, moisture, potential solar radiation, and soil type is described. It facilitates comparisons of forested areas--comparisons that eventually should make it possible to prescribe optimal management practices for every forest environment in the South Umpqua Basin.

134. Minore, Don, Clark E. Smith, and Robert F. Woollard.
1969. Effects of high soil density on seedling root growth of seven northwestern tree species. USDA For. Serv. Res. Note PNW-112, 6 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Lodgepole pine, Douglas-fir, and red alder roots appear to grow in soil densities that prohibit the growth of Sitka spruce, western hemlock, and western redcedar roots. Pacific silver fir appears intermediate.

135. Mitchell, R. G., and H. G. Paul.
1974. Field fertilization of Douglas-fir and its effect on *Adelges cooleyi* populations. Environ. Entomol. 3:501-504, illus.

Population levels of *Adelges cooleyi* (Gillette) were estimated on 7-year-old Douglas-fir trees after fertilization with three forms of nitrogen--ammonium nitrate and urea solutions and urea prill. In the first year, egg production on trees individually treated with equivalents of 50 and 200 lb N/acre was 11-42 percent higher than on untreated trees. Winter survival of the aphid was also higher than normal on fertilized trees. However,

low rates of establishment on fertilized trees negated these increases. Two years after fertilization, the populations were essentially the same on treated and untreated trees.

136. Mohan, J. M.
1973. 14 years of rabbitbrush control in central Oregon. J. Range Manage. 26:448-451.

Effective kill of rabbitbrush with herbicides depends on the amount of new twig growth, soil moisture, rate and methods of application, total seasonal twig growth, and subsequent drought conditions.

137. Moore, D. G.
1972. Effects of forest fertilization with urea on stream water quality. Am. Soc. Agron. Abstr., p. 141.

Aerial fertilization of a 68.39-ha forested watershed with urea at 224 kg N/ha resulted in a streamflow loss of 0.38 kg N/ha during the first year after application.

138. Moore, Duane G.
1970. DDT in forest soils of western Oregon. *In* Abstracts of the 43rd annual meeting, Northwest Scientific Association, Salem, Oreg., p. 65-66.

DDT residue was found in all samples of forest floor and mineral soil collected along four east-west transects across the Coast and Cascade Ranges of Oregon even though only one site received a direct application of insecticide.

139. Moore, Duane G.
1971. Fertilization and water quality. *In* Western reforestation, p. 28-31. West. Refor. Coord. Comm. Proc., 1971. West. For. and Conserv. Assoc., Portland, Oreg.

Time, form, and amount of nitrogen lost from a 169-acre watershed in the South Umpqua Experimental Forest are described for the first year after fertilization.

140. Moore, Duane G., and Logan A. Norris.
1974. Soil processes and introduced chemicals. *In* Environmental effects of forest residues management in the Pacific Northwest, a state-of-knowledge compendium, p. C-1 to C-33, illus. USDA For. Serv. Gen. Tech. Rep. PNW-24. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

141. Morris, William G.
1970. Effects of slash burning in overmature stands of the Douglas-fir region. For. Sci. 16:258-270.

Pairs of burned and unburned plots were used to determine the effects of fall slash burning in clearcuts of old-growth coniferous forests in western Oregon and Washington.

142. Moshev, M. M.
1971. Irrigation and fertilization of ponderosa pine. *In* Abstracts of the 44th annual meeting, Northwest Scientific Association, Moscow, Idaho, p. 9.

A 10-year study showed that irrigation and fertilization of ponderosa pine increased diameter growth and cone production.

143. Nelson, Earl E.
1969. Occurrence of fungi antagonistic to *Poria weirii* in a Douglas-fir forest soil in western Oregon. For. Sci. 15:49-54, illus.

Five fungi isolated from soil by the dilution plate technique, about 6.7 percent of total fungi counted, were antagonistic to *Poria weirii* on malt agar. Total fungus counts fluctuated seasonally, depending chiefly on soil moisture content.

144. Nelson, Earl E.
1970. Effects of nitrogen fertilizer on survival of *Poria weirii* and populations of soil fungi and aerobic actinomycetes. Northwest Sci. 44: 102-106, illus.

Application of amnonium chloride or sodium nitrate to the forest floor had no measurable effect on survival of *Poria weirii* in 2-inch wood cubes buried 8 inches deep but apparently did affect populations of aerobic actinomycetes at that depth. When the same chemicals were mixed with soil and potted with similar cubes, both substantially reduced survival of the pathogen.

145. Nelson, Earl E.
1972. Effect of urea and wood shavings on populations of soil microfungi, especially *Trichoderma* species. Microbios 5:69-72.

Urea and wood shavings mixed with soil individually or together increased populations of soil microfungi, whereas shavings on the soil surface had no effect. Only urea increased population levels of *Trichoderma*, however. Isolates of *Trichodema* (97 percent *T. viride*) were highly antagonistic to *Poria weirii*.

146. Norgren, J. A., G. A. Borchardt, and M. E. Harward.
1970. Mt. St. Helens Y ash in northeastern Oregon and south central Washington. *In* Abstracts of the 43rd annual meeting, Northwest Scientific Association, Salem, Oreg., p. 66.

Stratigraphy, mineralogy,. and particle-size data are given for a volcanic ash deposit found in forest soils along a transect between Mount St. Helens and Wallowa County, Oregon.

147. Norris, Logan A.
1970. Adsorption and desorption of four herbicides on forest floor material. *In* Abstracts of the 43rd annual meeting, Northwest Scientific Association, Salem, Oreg., p. 66.

148. Norris, Logan A.
1970. Degradation of herbicides in the forest floor. ***In*** Chester T. Youngberg and Charles B. Davey (eds.), Tree growth and forest soils, p. 397-411, illus. Third North Am. For. Soils Conf. Proc. 1968.

Amitrole, picloram, 2,4-D, and 2,4,5-T are degraded in forest litter but at markedly different rates. Constituents of formulation may retard

the degradation rate of 2,4-D. When 2,4-D and DDT are applied together, the degradation rate of 2,4-D is briefly stimulated. Other interactions studied were not significant.

149. Norris, Logan A., and W. B. Bollen.
1971. Behavior of cacodylic acid and MSMA in forest floor material and soil. (Abstr.) *In* Precommercial thinning of coastal and intermountain forests in the Pacific Northwest, Feb. 3 and 4, 1971. Proc., Short Course., Wash. State Univ., Pullman.

150. Okazaki, Rose, Henry W. Smith, Raymond A. Gilkeson, and Jerry Franklin.
1972. Correlation of west blacktail ash with pyroclastic layer T from the 1800 A.D. eruption of Mount St. Helens. Northwest Sci. 46(2):77-89.

151. Owston, Peyton W.
1971. Containerized Douglas-fir grows well in peat moss-vermiculite mixtures. *In* Abstracts of the 44th annual meeting, Northwest Scientific Association, Moscow, Idaho, p. 10.

Douglas-fir grew better in peat moss-vermiculite mixtures than in sandy loam, peat moss, or combinations of Douglas-fir bark and vermiculite.

152. Paeth, R. C., M. E. Harward, E. G. Knox, and C. T. Dyrness.
1971. Factors affecting mass movement of four soils in the western Cascades of Oregon. Soil Sci. Soc. Am. Proc. 35:943-947.

Soils derived from greenish tuff were less stable than soils from reddish and yellowish tuff and had high amounts of smectite, no kaolin, and moderate amounts of free iron oxide. The more stable soils contained kaolin, more chlorite and chloritic intergrades, more free iron oxide, and less smectite. Clay in pseudomorphs in the silt and sand fractions was not active mechanically but did contribute to cation exchange and moisture retention. Color was correlated to clay mineralogy and slope stability.

153. Phillip, M. J., S. M. Beck, C. T. Youngberg, and C. M. Gilmour.
1974. Measurement of CO_2 evolution from the forest floor with an electrolytic respirometer. Am. Soc. Agron. Abstr., p. 177.

A battery-operated electrolytic respirometer was developed making it possible to measure CO_2 evolution from the forest floor in situ independent of root respiration.

154. Pumphrey, F. V.
1971. Grass species growth on a volcanic ash-derived soil cleared of forest. J. Range Manage. 24:200-203.

Grasses producing high forage yields in a 20- to 28-inch precipitation zone of northeastern Oregon on volcanic ash soil (Tolo silt loam) cleared of a stagnant forest were Greenar intermediate wheatgrass, Sherman big bluegrass, and Regar bromegrass. Tall oatgrass, meadow foxtail, and creeping meadow foxtail were high yielding when fertilized.

155. Radwan, M. A., G. L. Crouch, and H. S. Ward.
1971. Nursery fertilization of Douglas-fir seedlings with different forms of nitrogen. USDA For. Serv. Res. Pap. PNW-113, 8 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Ammonium sulfate, calcium nitrate, and urea fertilizers were tested in the nursery to determine the relative values of ammonium, nitrate, and urea as nitrogen sources for Douglas-fir. Seedling growth in the nursery and outplanting performance of the fertilized trees were essentially the same with the nitrate and urea, and both fertilizers were superior to ammonium.

156. Rice, R. M., J. S. Rothacher, and W. F. Megahan.
1972. Erosional consequences of timber harvesting--an appraisal. *In* Watersheds in transition, p. 321-329. Proc., Am. Water Resour. Assoc. and Colo. State Univ., Fort Collins.

Summarizes an understanding of the effects of timber harvesting on erosion.

157. Rickard, W. H., J. F. Cline, and R. 0. Gilbert.
1973. Soil beneath shrub halophytes and its influence upon the growth of cheatgrass. Northwest Sci. 47:213-217.

Shrubs appear to provide a soil media richer in mineral nutrition than adjacent grass-dominated areas.

158. Riekerk, H.
1971. The mobility of phosphorus, potassium, and calcium in a forest soil. Soil Sci. Soc. Am. Proc. 35:350-356.

Radiotracers were sprayed on Douglas-fir forest soil simulating rainwash inputs. Fractions of radiotracers amounted to 10 percent of total phosphorus, 27 percent of total potassium, and 5 percent of total calcium leaching from the forest floor annually.

159. Riekerk, H.
1971. Movement of labeled nutrient elements in a forest soil-tree system. *In* L. R. Donaldson et al. (eds.), The Fern Lake studies, p. 49-53. Univ. Wash., Coll. Fish., Contrib. No. 352.

160. Rothacher, Jack.
1973. Does harvest in west slope Douglas-fir increase peak flow in small forest streams? USDA For. Serv. Res. Pap. PNW-163, 13 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Logging in Douglas-fir forests with deep porous soils has only minor effects on major peak streamflows which occur after soils have been thoroughly wet by fall rainstorms.

161. Rothacher, Jack, and William Lopushinsky.
1974. Soil stability and water yield and quality. *In* Environmental effects of forest residues management in the Pacific Northwest, a state-of-knowledge compendium, p. D-1 to D-23, illus. USDA For. Serv. Gen. Tech. Rep. PNW-24. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

162. Ruth, Robert H.
1974. Regeneration and growth of west-side mixed conifers. *In* Environmental effects of forest residues management in the Pacific Northwest,

a state-of-knowledge compendium, p. K-1 to K-21. USDA For. Serv. Gen. Tech. Rep. PNW-24. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Environmental requirements for regenerating west-side mixed conifers are described.

163. Schlichte, A. K., and F. C. Ugolini.
1972. Morphology and genesis of adjacent prairie and forest soils of the Puget Sound lowland. *In* Abstracts of the 45th annual meeting, Northwest Scientific Association, Bellingham, Wash., p. 12.

Soils formed beneath prairie and forest vegetation on gravelly glacial outwash deposits in the southern Puget Sound lowlands have dramatically different morphological features; however, their mineralization and chemical characteristics are similar.

164. Seidel, K. W.
1974. Natural regeneration of east-side conifer forests. *In* Environmental effects of forest residues management in the Pacific Northwest, a state-of-knowledge compendium, p. L-1 to L-25, illus. USDA For. Serv. Gen. Tech. Rep. PNW-24. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Favorable and unfavorable effects of forest residues and their treatment on natural regeneration of the coniferous forests of eastern Oregon and Washington are discussed.

165. Singer, M. J., and F. C. Ugolini.
1973. Chemical and mineralogical properties of two well drained subalpine soils. *In* Abstracts of the 46th annual meeting, Northwest Scientific Association, Walla Walla, Wash., p. 33.

Two soils from the International Biological Program intensive research site at Findley Lake are compared and contrasted.

166. Sommer, Hermann C.
1973. Managing steep land for timber production in the Pacific Northwest. J. For. 71:270-273.

167. Steinbrenner, E. C.
1971. Logging systems: Soil considerations influencing management policies. *In* Western reforestation, p. 21-23. West. For. and Conserv. Assoc. Proc., 1971.

168. Steinbrenner, E. C., and D. K. Lewis.
1973. Response of ponderosa pine to fertilizer applications. Am. Soc. Agron. Abstr., p. 142.

A complete (NPKS) treatment showed the greatest response on experimental plots near Klamath Falls, although there was significant response to all nitrogen treatments.

169. Strand, Robert F., and C. C. Grier.
1973. Seasonal model of litter decomposition in coniferous forests. *In* Abstracts of the 46th annual meeting, Northwest Scientific Association, Walla Walla, Wash., p. 35.

Describes a litter decomposition model developed for use in watershed modeling.

170. Strand, Robert F., and Richard E. Miller.
1969. Douglas-fir growth can be increased report from Pacific Northwest shows. For. Ind. 96(11):29-31.

171. Swanston, D. N.
1971. Principal mass movement processes influenced by logging, road building, and fire. *In* Forest land uses and stream environment, symposium proceedings, Oct. 19-21, 1970, p. 29-40, illus. Oreg. State Univ., Corvallis.

Dominant classes of soil mass movement active on watershed slopes in the Western United States are identified, and a simple movement mechanism described. The effects of logging, roadbuilding, and fire on mass movement occurrence are also identified and their importance as an erosion-accelerating agent evaluated.

172. Swanston, D. N.
1974. Slope stability problems associated with timber harvesting in mountainous regions of the Western United States. USDA For. Serv. Gen. Tech. Rep. PNW-21, 14 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Natural soil-mass movements on forested slopes in the Western United States include, in order of decreasing importance and regional frequency of occurrence: (1) debris slides, debris avalanches, debris torrents; and (2) creep, slumps, and earth flows. They result largely from slope loading (from road fill arid sidecasting), oversteepened bank cuts, and inadequate provision for slope and road drainage.

173. Swanston, D. N., and C. T. Dyrness.
1973. Stability of steep land. J. For. 71(5):264-269, illus.

Factors controlling and contributing to surface erosion and mass soil movement on steep forested slopes are identified and described. Land management impacts and means of minimizing damage are discussed.

174. Swanston, Douglas N.
1971. Judging impact and damage of timber harvesting to forest soil in mountainous regions of western North America. *In* Western reforestation, p. 14-19, illus. West. Refor. Coord. Comm. Proc., Nov. 30, 1971. West. For. and Conserv. Assoc., Portland, Oreg.

Slope disturbance produced by forest operations on mountainous terrain has been identified as a major contributor to initiation and acceleration of erosion by soil mass movement processes. Roadbuilding is the most damaging operation, but timber cutting and slash burning are effective initiators in local areas. Factors controlling slope stability and current techniques for identification and control are discussed.

175. Tarrant, R. F., D. G. Moore, W. B. Bollen, and B. R. Loper.
1972. DDT residues in forest floor and soil after aerial spraying, Oregon--1965-68. Pestic. Monit. J. 6:65-72.

Of the 12 oz of DDT applied per acre on an eastern Oregon forest, about 26 percent reached the ground surface initially; over 36 months, about 6 percent more was brought to the ground in litter fall. No effect of DDT was noted on soil microbial populations, nitrification rate, or amount of nitrate nitrogen in the soil.

176. Tarrant, Robert F.
1970. Environmental consequences of using fertilizer and other chemicals in forest management. West. For. Pest Comm. Annu. Meet. Proc., p. 13-14.

The environmental impact of forest fertilization is not well defined, although knowledge indicates the effect should not be great. Forest resource managers, forest research administrators, and critics of the use of chemical tools used in forest management all share an obligation to improve their approach to matters affecting the environment.

177. Tarrant, Robert F.
1970. Man-caused fluctuations in quality of water from forested watersheds. *In* Proceedings of the Joint FAO-U.S.S.R. International Symposium on Forest Influences and Watershed Management, Moscow, U.S.S.R., August 1970, p. 209-218.

Changes in energy patterns, chemical or physical constitution, or abundance of organisms in forest waters that do constitute pollution most often result from man's activity.

178. Tarrant, Robert F.
1971. Nutrient release in streamflow from forest watersheds in relation to management practice. (Abstr.) Soc. Am. For. Annu. Meet., p. 4.

179. Tarrant, Robert F., K. C. Lu, W. B. Bollen, and J. F. Franklin.
1969. Nitrogen enrichment of two forest ecosystems by red alder. USDA For. Serv. Res. Pap. PNW-76, 8 p. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

In a coastal Oregon area, where soil nitrogen is perhaps near the maximum attainable in a forest environment, presence of red alder led to a threefold increase in the amount of nitrogen circulating in litter fall.

180. Tarrant, Robert F., and James M. Trappe.
1971. The role of *Alnus* in improving the forest environment. Plant and Soil, Spec. Vol., p. 335-348.

Worldwide experience indicates that alder contributes significantly to the supply of nitrogen in the ecosystem. This contribution markedly benefits soil fertility. A definite potential exists for using alder in forest management in much the same way as legumes are used in agriculture. Research indicates also that *Alnus rubra* may play a significant role in controlling *Poria weirii*, a virulent root pathogen which causes extensive losses of commercial timber tree species in western North America and Japan.

181. Thomas, B. R., G. H. Simonson, and L. Boersma.
1973. Evaluation of criteria for separating soils with xeric and udic moisture regimes. Soil Sci. Soc. Am. Proc. 38:738-741.

Soil and plant-water suctions were monitored in western Oregon under young conifers. Willamette Valley foothills had xeric soil-water regimes, and Coast Range mountain sites were udic. Xeric soils showed greater depletion of available water than udic soils at comparable stages of plant growth.

182. Tiedemann, A. R.
1972. Stream chemistry following the Safety Harbor forest fire and erosion control fertilization in north central Washington. *In* Abstracts of the 45th annual meeting, Northwest Scientific Association, Bellingham, Wash., p. 13.

The effect of fire and urea fertilization on stream chemistry was evaluated from measurements of nitrogenous constituents, chemical properties, and four cations for 1 year in streamflow from a burned watershed, a burned watershed fertilized with 78 kg/ha urea, and an unburned, unfertilized adjacent watershed.

183. Tiedemann, A. R., and H. W. Berndt.
1972. Vegetation and soils of a 30-year deer and elk exclosure in central Washington. Northwest Sci. 46:59-66, illus.

Vegetation and soils of a deer and elk exclosure maintained since 1939 were compared with an adjacent area of continuous game use in 1970. Despite the similarity of soil characteristics between the exclosure and outside, snowbrush ceanothus appears to have had an ameliorating effect on the exclosure because of the greater biomass and litter.

184. Tiedemann, A. R., and J. D. Helvey.
1973. Nutrient ion losses in streamflow after fire and fertilization in eastern Washington. (Abstr.) Bull. Ecol. Soc. Am. 54:20.

185. Tiedemann, A. R., and G. O. Klock.
1973. Meeks Table Research Natural Area - a reference for management decisions in Douglas-fir-pinegrass habitats. *In* Abstracts of the 46th annual meeting, Northwest Scientific Association, Walla Walla, Wash., p. 35.

186. Tiedemann, Arthur R.
1972. Soil properties and nutrient availability in tarweed communities of central Washington. J. Range Manage. 25:438-443, illus.

Comparison of soil nutrient levels and certain soil physical properties between tarweed communities and adjacent stable, productive needlegrass communities indicated a lower nutrient capital of N, S, and exchangeable Mn and poorer physical condition in the tarweed communities. Pot studies with mountain brome and orchard grass revealed low availability of N, S, and P in soils from tarweed communities and suggest a need to amend native soil nutrients with these elements.

187. Tiedemann, Arthur R., and Tom D. Anderson.
1971. Rapid analysis of total sulphur in soils and plant material. Plant and Soil 35:197-200.

The Leco high frequency induction furnace technique was adapted for rapid titrimetric analysis of total S in soils and plant material. Accuracy and precision were tested.

188. Tiedemann, Arthur R., G. O. Klock, H. W. Berndt, and F. C. Hall.
1972. Meeks Table Research Natural Area. *In* Jerry F. Franklin et al., Federal Research Natural. Areas in Oregon and Washington--a guidebook for scientists and educators, p. ME-1 to ME-7, illus. USDA For. Serv. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Soils and vegetation of the Meeks Table Natural Area in Yakima County, Washington, are described.

189. Tiedemann, Arthur R., and Glen O. Klock.
1973. First-year vegetation after fire, reseeding, and fertilization on the Entiat Experimental Forest. USDA For. Serv. Res. Note PNW-195, 23 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

Results indicate that seeding improved vegetative cover by up to one-third, but fertilizer was of questionable benefit. However, preliminary observations the second year indicate that both cover and vigor of vegetation were improved by fertilization treatments.

190. Trappe, James M.
1972. Regulation of soil organisms by red alder--a potential biological system for control of *Poria weirii*. *In* Alan B. Berg (ed.), Managing young forests in the Douglas-fir region. Sch. For., Oreg. State Univ. 3:35-51, illus. Corvallis.

A long-lasting change of soil properties to disfavor root-rotting fungi such as *Poria weirii* would provide an ideal control system. Red alder in pure or mixed stands appears to do this directly, by adding *Poria*-inhibiting compounds to the soil, and indirectly, by increasing populations of soil micro-organisms that compete with, inhibit, or parasitize *Poria* itself.

191. Turner, J., and M. J. Singer.
1974. Nutrient cycling in a subalpine *Abies* forest. I. Nutrient pools and transfers. *In* Abstracts of 47th annual meeting, Northwest Scientific Association, Vancouver, B.C., p. 36.

192. Walkotten, William J.
1972. A recording soil moisture tensiometer. USDA For. Serv. Res. Note PNW-180, 12 p., illus. Pac. Northwest For. and Range Exp, Stn., Portland, Oreg.

Describes a recording water-saturated porous cup tensiometer that operates in the negative pressure range of a mercury manometer-type tensiometer and provides a continuous record of soil moisture tension for up to 31 days.

193. Waring, R. H., and C. T. Youngberg.
1972. Evaluating forest sites for potential growth response of trees to fertilizer. Northwest Sci. 46:67-75.

Constraints such as moisture and temperature which would make forest fertilization an unlikely economic venture and possibly an ecological mistake can be identified with an environmental classification.

194. Watkins, S. G., R. F. Strand, D. S. DeBell, and J. Esch, Jr.
1972. Factors influencing ammonia losses from urea applied to northwestern forest soils. Soil Sci. Soc. Am. Proc. 36:354-357.

Volatilization losses of NH_3 were studied under controlled laboratory conditions. Losses ranged from 6 to 46 percent of the urea N applied and were related to air movement, temperature, and soil acidity.

195. Wicklow, Marcia C., Walter B. Bollen, and William C. Denison.
1974. Comparison of soil microfungi in 40-year-old stands of pure alder, pure conifer, and alder-conifer mixtures. Soil Biol. Biochem. 6:73-78.

The species composition of soil microfungal populations of red alder (*Alnus rubra*), conifers (*Pseudotsuga menziesii, Tsuga heterophylla,* and *Picea sitchensis*), and mixed alder-conifer correlated strongly with the dominant vascular vegetation. This correlation is presumably due to either direct or indirect influences of the dominant tree species on the soil, since other factors such as soil type, soil moisture, climate, etc., are consistent.

196. Wildung, R. E., B. F. Hajek, and K. R. Price.
1971. Chemical properties of the arid soil organic fraction. Northwest Sci. 45: 73-79.

Elemental composition and cation exchange capacity of the arid soil humic acids were similar to analogous isolates from humid regions. The chemical properties of arid soil humic acids were quite uniform regardless of changes in altitude or vegetative type.

197. Will, G. M., and C. T. Youngberg.
1972. Sulfur status of some central Oregon pumice soils. Am. Soc. Agron. Abstr., p. 144.

Experimental results show that forest management operations which remove the surface of pumice soils will seriously lower the sulfur, as well as the nitrogen and phosphorus, status of the site and if productivity is to be maintained, the use of fertilizers will be essential.

198. Wilson, B. C., and H. W. Anderson.
1974. Genetic X fertilizer interaction in young Douglas-fir seedlings. *In* Abstracts of 47th annual meeting, Northwest Scientific Association, Vancouver, B.C., p. 23.

Greenhouse studies on Douglas-fir showed a large amount of variation existed within families, between families, and among families in their response to nitrogen fertilization.

199. Wollum, A. G., II, and C. T. Youngberg.
1969. Effect of soil temperature on nodulation of *Ceanothus velutinus* Dougl. Soil Sci. Soc. Am. Proc. 33:801-803.

Snowbrush (*Ceanothus velutinus* Dougl.) nodulation was evaluated at five soil temperatures: 10°, 15°, 22°, 26°, and 31° C. Generally the nodules were more abundant and larger at 22° and 26° C than at the other temperatures. No nodules were formed at 31° C.

200. Woodman, J. N.
1973. The effect of thinning, fertilization, and irrigation of intraseasonal diameter growth in Douglas-fir. *In* Abstracts of the 46th annual meeting, Northwest Scientific Association, Walla Walla, Wash., p. 37.

Thinning, fertilization, and irrigation increased growth of a 20-year-old stand of Douglas-fir.

201. Wooldridge, David D.
1970. Chemical and physical properties of forest litter layers in central Washington. *In* Chester T. Youngberg and Charles B. Davey (eds.), Tree growth and forest soils, p. 327-337. Third North Am. For. Soils Conf. Proc. 1968.

Objectives of this study were to determine physical and chemical properties of forest floor layers and to compare properties of layers by soil parent materials and forest types--basalt and other parent materials and ponderosa pine and mixed-conifer forest types.

202. Young, D. C., and R. E. Miller.
1974. Comparative effects of foliar- and soil-applied nitrogen fertilizers on Douglas-fir: I. Foliar burning and phytotoxicity. Am. Soc. Agron. Abstr., p. 180.

Experimental results suggest that concentrated foliar sprays at moderate N-dosages (179-224 kg/ha) can be applied to young or mature stands of Douglas-fir or western hemlock without serious foliar burning or top kill.

203. Youngberg, C. T., and W. G. Dahms.
1970. Productivity indices for lodgepole pine on pumice soils. J. For. 68(2):90-94, illus.

Productivity of lodgepole pine is related to soil-vegetation units in terms of site index, basal area, and volume increment. Soil vegetation units are nearly as effective as site index for predicting volume increment.

204. Youngberg, C. T., and A. G. Wollum.
1973. Nitrogen accretion in developing ceanothus stands. Am. Soc. Agron. Abstr., p. 143.

Nitrogen accretion in biomass, litter, and soil for a 10-year ceanothus stand development period was 725 and 1040 kg/ha, respectively, for the pine and fir sites.

205. Youngberg, Chester T.
1969. Forest floors in Douglas-fir forests: I. Dry weight and chemical properties. Soil Sci. Soc. Am. Proc. 30:406-409.

Dry weight and volatile matter of forest floors from Douglas-fir stands having different types of understory vegetation ranged from 20,000 to 76,000 lb/acre and from 69 to 86 percent, respectively. Total N ranged from 0.71

to 1.52 percent. Levels of exchangeable cations were not dependent on total percentage of cations in the forest floor.

206. Youngberg, Chester T., and Charles B. Davey (Eds.).
1970. Tree growth and forest soils. 527 p. Oreg. State Univ. Press, Corvallis.

This is the proceedings of the Third North American Forest Soils Conference held at North Carolina State University at Raleigh in August 1968.

207. Zak, B.
1971. Detoxication of autoclaved soil by a mycorrhizal fungus. USDA For. Serv. Res. Note PNW-159, 4 p., illus. Pac. Northwest For. and Range Exp. Stn., Portland, Oreg.

The mycorrhizal fungus, *Corticium bicolor*, was shown to deactivate toxin(s) formed in soil during autoclaving, allowing Douglas-fir seedlings to grow normally.

208. Zavitkovski, J., and M. Newton.
1971. Litterfall and litter accumulation in red alder stands in western Oregon. Plant and Soil 35:257-268.

209. Zavitkovski, J., Michael Newton, and Babiker El-Hassan.
1969. Effects of snowbrush on growth of some conifers. J. For. 67:242-246.

Findings indicate that snowbrush is more detrimental than beneficial in forest regeneration on west slopes of the Oregon Cascades.

THESES

210. Bockheim, James G.
1972. Effects of alpine and subalpine vegetation on soil development, Mount Baker, Washington. Univ. Wash., Seattle.

211. Bourgeois, William W.
1973. Potassium release from B_{iv} horizons of two forest soils. Univ. Wash., Seattle.

212. Crane, Wilfred J. B.
1972. Urea-nitrogen transformations, soil reactions, and elemental movement via leaching and volatilization in a coniferous forest ecosystem. Univ. Wash., Seattle.

213. Dice, Steven F.
1970. The biomass and nutrient flux in a second-growth Douglas-fir ecosystem; a study in quantitative ecology. Univ. Wash., Seattle.

214. Foster, Neil W.
1971. The natural addition of nitrogen, potassium, and calcium to a jack pine forest floor. Univ. Wash., Seattle.

215. Grier, C. C.
1972. Effects of fire on the movement and distribution of elements within a forest ecosystem. Univ. Wash., Seattle.

216. Hu, Lilly Jho-Yuan.
1969. Soluble carbon and respiration of forest humus. Oreg. State Univ., Corvallis.

217. Knothe, Kenneth P.
1969. Aerial photo interpretation of vegetation and soil surface features on the browse-grass rangelands in southeastern Oregon. Oreg. State Univ., Corvallis.

218. McColl, John G.
1969. Ion transport in a forest soil; models and mechanisms. Univ. Wash., Seattle.

219. McDonald, Glenn A.
1971. Forest soil disturbance in the Blue Mountains from wheeled and crawler skidders. Wash. State Univ., Pullman.

220. Machno, Peter W.
1974. Modeled and observed storage and transport of rainwater in a Douglas-fir ecosystem. Univ. Wash., Seattle.

221. Meurisse, Robert T.
1972. Site quality of western hemlock and chemical characteristics of some western Oregon andic soils. Oreg. State Univ., Corvallis.

222. Morison, I. G.
1970. Foliar nitrogen range and variability in a second-growth Douglas-fir forest and its relationship to certain stand and tree characteristics. Univ. Wash., Seattle.

223. Paeth, Robert C.
1970. Genetic and stability relationships of four western Cascade soils. Oreg. State Univ., Corvallis.

224. Schone, Dieter Hans-Friedrich.
1971. Nutrient uptake by conifer seedlings as influenced by root CEC and competing species. Oreg. State Univ., Corvallis.

225. Scott, William.
1970. Effect of snowbrush on the establishment and growth of Douglas-fir seedlings. Oreg. State Univ., Corvallis.

226. Scott, William.
1973. Some soil factors affecting snowbrush nodulation. Oreg. State Univ., Corvallis.

227. Thomas, Byron R.
1970. The role of soil-water depletion and plant-moisture stress in soil classification and cambial activity in Douglas-fir. Oreg. State Univ., Corvallis.

228. Tucker, Richard E.
1972. Growth and mineral uptake by coniferous seedlings of different genetic make-up as influenced by levels of macronutrients. Univ. Wash., Seattle.

229. Webber, Bruce D.
1973. Plant biomass and nutrient distribution in a young *Pseudotsuga menziesii* forest ecosystem. Oreg. State Univ., Corvallis.

230. Wondercheck, Dale E.
1972. Some soil properties affected by trampling on forested summer range in central Washington. Wash. State Univ., Pullman.

INDEX

The mission of the PACIFIC NOKI'HWEST FOKEST **AND KANGE** EXPEKIMENI' STATION is to provide the knowledge, technology, and alternatives for present and future protection, management, and use of forest, range, nnd related environments.

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