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Data sources associated with **FRED 2.0**:

(Sources followed by an asterisk were added between FRED 1.0 and FRED 2.0).

- Abaimov AP, Prokushkin SG, Zyryanova OA, Kaverzina LN. 1997. Osobennosti formirovanija i fynkcionirovanija listvennichnykh lesov na merzlotnykh pochvakh. (Peculiarities of forming and functioning larch forests on frozen soils). *Lesovedenie* (13-23)
- **Abbott ML, Fraley L, Reynolds TD. 1991.** Root profiles of selected cold desert shrubs and grasses in disturbed and undisturbed soils. *Environmental and Experimental Botany* **31**(2): 165-178.\*
- **Abdelkrim L, Noria S-S, Gradziel T. 2014.** Root architecture of Atlas pistachio in relation to underlying soil properties under arid conditions. *African Journal of Agricultural Research* **9**(6): 620-626.\*
- **Abdi E, Majnounian B, Genet M, Rahimi H. 2010.** Quantifying the effects of root reinforcement of Persian Ironwood (Parrotia persica) on slope stability; a case study: Hillslope of Hyrcanian forests, northern Iran. *Ecological Engineering* **36**(10): 1409-1416.\*
- **Aber JD, Melillo JM, Nadelhoffer KJ, McClaugherty CA, Pastor J. 1985.** Fine root turnover in forest ecosystems in relation to quantity and form of nitrogen availability: a comparison of two methods. *Oecologia* **66**(3): 317-321.
- **Abiven S, Recous S, Reyes V, Oliver R. 2005.** Mineralisation of C and N from root, stem and leaf residues in soil and role of their biochemical quality. *Biology and Fertility of Soils* **42**(2): 119-128.
- **Adamek M, Corre MD, Hölscher D. 2010.** Responses of fine roots to experimental nitrogen addition in a tropical lower montane rain forest, Panama. *Journal of Tropical Ecology* **27**(01): 73-81.
- **Adams CM, Hutchinson TC. 1992.** Fine-root growth and chemical composition in declining Central Ontario sugar maple stands. *Canadian Journal of Forest Research* **22**(10): 1489-1503.
- Adams MB, Campbell RG, Allen HL, Davey CB. 1987. Root and foliar nutrient concentrations in Loblolly pine: effects of season, site, and fertilization. *Forest Science* 33: 984-996.
- **Adams MB, Pennell KD, Campbell RG. 1989.** Fine root distribution in a young loblolly pine (*Pinus taeda* L.) stand: Effects of preplant phosphorus fertilization. *Plant and Soil* **113**(2): 275-278.

- Adams TS, McCormack ML, Eissenstat DM. 2013. Foraging strategies in trees of different root morphology: the role of root lifespan. *Tree Physiology* 33(9): 940-948.
- Addington RN, Donovan LA, Mitchell RJ, Vose JM, Pecot SD, Jack SB, Hacke UG, Sperry JS, Oren R. 2006. Adjustments in hydraulic architecture of *Pinus palustris* maintain similar stomatal conductance in xeric and mesic habitats. *Plant, Cell and Environment* 29(4): 535-545.\*
- **Aerts R 1993.** Biomass and nutrient dynamics of dominant plant species from heathlands. In: Aerts R, Heil GW eds. *Heathlands*: Springer Netherlands, 51-84.
- **Aerts R, Bakker C, De Caluwe H. 1992.** Root turnover as determinant of the cycling of C, N, and P in a dry heathland ecosystem. *Biogeochemistry* **15**(3): 175-190.
- **Ahlström K, Persson H, Börjesson I. 1988.** Fertilization in a mature Scots pine (Pinus sylvestris L.) stand—effects on fine roots. *Plant and Soil* **106**(2): 179-190.
- **Albaugh TJ, Allen HL, Kress LW. 2005.** Root and stem partitioning of *Pinus taeda. Trees* **20**(2): 176-185.\*
- **Albrektson A, Valinger E, Leijon B, Sjögren H, Sonesson J. 2000.** Fine Root Production and Nitrogen Content in Roots of *Pinus sylvestris* L. after Clear-felling. *Scandinavian Journal of Forest Research* **15**(2): 188-193.
- **Alexandre DY, Ouedraogo SJ 1992.** Variations in Root Morphology of Faidherbia albida in Relation to Soil and Agronomic Effects. *Faidherbia albida in the West African semi-arid tropics.* Niamey, Niger: Vandenbeldt, R.J. 107-110.\*
- Alongi DM, Wattayakorn G, Boyle S, Tirendi F, Payn C, Dixon P. 2004. Influence of roots and climate on mineral and trace element storage and flux in tropical mangrove soils. *Biogeochemistry* 69(1): 105-123.
- **Alvarez-Lopez M 1990.** Ecology of *Pterocarpus officinalis* forested wetlands in Puerto Rico. In: Lugo AE, Brinson M, Brown S eds. *Forested Wetlands*. Amsterdam: Elsevier, 251-265.
- Andersen CP, Markhart AH, Dixon RK, Sucoff EI. 1988. Root hydraulic conductivity of vesicular-arbuscular mycorrhizal green ash seedlings. *New Phytologist* 109(4): 465-471.
- **Andersen CP, Sucoff EI, Dixon RK, Markhart AH, III. 1989.** Effects of phosphorus deficiency on root hydraulic conductivity in *Fraxinus pennsylvanica*. *Canadian Journal of Botany* **67**(2): 472-476.
- **Andersson F. 1970.** Ecological studies in a Scanian woodland and meadow area, southern Sweden. II. Plant biomass, primary production and turnover of organic matter. *Botanika Notiser* **123**: 8-51.
- **Angadi SV, Entz MH. 2002.** Root System and Water Use Patterns of Different Height Sunflower Cultivars. *Agronomy Journal* **94**(1): 136.\*
- **Angelo CL, Pau S. 2017.** Root Functional Diversity of Native and Nonnative C<sub>3</sub> and C<sub>4</sub> Grass Species in Hawai'i. *Pacific Science* **71**(2): 117-133.\*
- **Antos JA. 1988.** Underground Morphology and Habitat Relationships of Three Pairs of Forest Herbs. *American Journal of Botany* **75**(1): 106.\*

- **Aosaar J, Varik M, Lõhmus K, Ostonen I, Becker H, Uri V. 2013.** Long-term study of above-and below-ground biomass production in relation to nitrogen and carbon accumulation dynamics in a grey alder (*Alnus incana* (L.) Moench) plantation on former agricultural land. *European Journal of Forest Research* **132**(5-6): 737-749.
- **Appuhn A, Joergensen R. 2006.** Microbial colonisation of roots as a function of plant species. *Soil Biology and Biochemistry* **38**(5): 1040-1051.
- Aragão LEOC, Malhi Y, Metcalfe DB, Silva-Espejo JE, Jiménez E, Navarrete D, Almeida S, Costa ACL, Salinas N, Phillips OL, et al. 2009. Above- and below-ground net primary productivity across ten Amazonian forests on contrasting soils. *Biogeosciences* 6(12): 2759-2778.
- **Archer NAL, Quinton JN, Hess TM. 2002.** Below-ground relationships of soil texture, roots and hydraulic conductivity in two-phase mosaic vegetation in South-east Spain. *Journal of Arid Environments* **52**(4): 535-553.\*
- **Ares A, Peinemann N. 1992.** Fine-root distribution of coniferous plantations in relation to site in southern Buenos Aires, Argentina. *Canadian Journal of Forest Research* **22**(11): 1575-1582.
- **Armas C, Padilla FM, Pugnaire FI, Jackson RB. 2009.** Hydraulic lift and tolerance to salinity of semiarid species: consequences for species interactions. *Oecologia* **162**(1): 11-21.\*
- **Arndt SK, Kahmen A, Arampatsis C, Popp M, Adams M. 2004.** Nitrogen fixation and metabolism by groundwater-dependent perennial plants in a hyperarid desert. *Oecologia* **141**(3): 385-394.\*
- **Arneth A, Kelliher FM, McSeveny TM, Byers JN. 1998.** Net ecosystem productivity, net primary productivity and ecosystem carbon sequestration in a *Pinus radiata* plantation subject to soil water deficit. *Tree Physiology* **18**(12): 785-793.
- **Arthur MA, Fahey TJ. 1992.** Biomass and nutrients in an Engelmann spruce—subalpine fir forest in north central Colorado: pools, annual production, and internal cycling. *Canadian Journal of Forest Research* **22**(3): 315-325.
- **Arunachalam A, Maithani K, Pandey HN, Tripathi RS. 1996a.** The impact of disturbance on detrital dynamics and soil microbial biomass of a *Pinus kesiya* forest in north-east India. *Forest Ecology and Management* **88**(3): 273-282.
- **Arunachalam A, Pandey HN, Tripathi RS, Maithani K. 1996b.** Biomass and production of fine and coarse roots during regrowth of a disturbed subtropical humid forest in northeast India. *Vegetatio* **123**(1): 73-80.
- **Arunachalam A, Pandey HN, Tripathi RS, Maithani K. 1996c.** Fine root decomposition and nutrient mineralization patterns in a subtropical humid forest following tree cutting. *Forest Ecology and Management* **86**(1-3): 141-150.
- **Arunachalam K, Singh ND, Arunachalam A. 2003.** Decomposition of leguminous crop residues in a 'jhum' cultivation system in Arunachal Pradesh, India. *Journal of Plant Nutrition and Soil Science* **166**(6): 731-736.\*

- **Asaye Z, Zewdie S. 2012.** Fine root dynamics and soil carbon accretion under thinned and unthinned *Cupressus lusitanica* stands in, Southern Ethiopia. *Plant and Soil* **366**(1-2): 261-271.
- **Ash AN, Gross HD, Noggle GR. 1975.** Root Growth and Distribution in *Festuca arundinacea*. *Bulletin of the Torrey Botanical Club* **102**(5): 238.\*
- **Aspinwall MJ, King JS, McKeand SE. 2012.** Productivity differences among loblolly pine genotypes are independent of individual-tree biomass partitioning and growth efficiency. *Trees* **27**(3): 533-545.
- **Atkinson LJ, Hellicar MA, Fitter AH, Atkin OK. 2007.** Impact of temperature on the relationship between respiration and nitrogen concentration in roots: an analysis of scaling relationships, Q10 values and thermal acclimation ratios. *New Phytologist* **173**(1): 110-120.
- **Aubrey DP, Coyle DR, Coleman MD. 2011.** Functional groups show distinct differences in nitrogen cycling during early stand development: implications for forest management. *Plant and Soil* **351**(1-2): 219-236.
- **Aulen M, Shipley B, Bradley R. 2011.** Prediction of in situ root decomposition rates in an interspecific context from chemical and morphological traits. *Annals of Botany* **109**(1): 287-297.
- **Badia D, Marti C, Poch RM. 2011.** A Soil Toposequence Characterization in the Irrigable Lands Protected Area Contact Zone of El Basal, NE-Spain. *Arid Land Research and Management* **25**(1): 1-18.\*
- Bagniewska-Zadworna A, Byczyk J, Eissenstat DM, Oleksyn J, Zadworny M. 2012. Avoiding transport bottlenecks in an expanding root system: Xylem vessel development in fibrous and pioneer roots under field conditions. *American Journal of Botany* 99(9): 1417-1426.
- Bahn M, Knapp M, Garajova Z, Pfahringer N, Cernusca A. 2006. Root respiration in temperate mountain grasslands differing in land use. *Global Change Biology* **12**(6): 995-1006.
- **Baitulin IO. 1996.** Root research in natural plant communities of Kazakhstan. *Acta Phytogeographica Suecica* **81**: 7-10.\*
- **Bakker MR, Augusto L, Achat DL. 2006.** Fine root distribution of trees and understory in mature stands of maritime pine (*Pinus pinaster*) on dry and humid sites. *Plant and Soil* **286**(1-2): 37-51.
- **Bakker MR, Kerisit R, Verbist K, Nys C. 1999.** Effects of liming on rhizosphere chemistry and growth of fine roots and of shoots of sessile oak (*Quercus petraea*). *Plant and Soil* **217**(1/2): 243-255.
- **Balasubramanian D, Arunachalam K, Das AK, Arunachalam A. 2012.** Decomposition and nutrient release of *Eichhornia crassipes* (Mart.) Solms. under different trophic conditions in wetlands of eastern Himalayan foothills. *Ecological Engineering* **44**: 111-122.\*
- Balboa-Murias MA, Rojo A, Álvarez JG, Merino A. 2006. Carbon and nutrient stocks in mature *Quercus robur* L. stands in NW Spain. *Annals of Forest Science* 63(5): 557-565.

- **Bang-xing W. 1991.** Studies on the vertical structure of seasonal rain-forest in Xishuangbanna of Yunnan. *Acta Botanica Sinica* **33**: 228-228.
- **Bannan MW. 1940.** The root systems of northern Ontario conifers growing in sand. *American Journal of Botany* **27**(2): 108.\*
- **Bar-Yosef B, Lambert JR. 1981.** Corn and cotton root growth in response to soil impedance and water potential. *Soil Science Society of America Journal* **45**(5): 930.
- **Barbour MG, MacMahon JA, Bamberg SA, Ludwig JA 1977.** The structure and distribution of *Larrea* communities. In: Mabry TJ, Hunziker JH, DiFeo DR, Jr. eds. *Creosote bush: biology and chemistry of Larrea in New World deserts.* Stroudsburg, Pennsylvania, USA: Dowden, Hutchinson and Ross, 227-251.
- **Bard GE. 1952.** Secondary succession on the Piedmont of New Jersey. *Ecological Monographs* **22**(3): 195.
- Barger NN, D'Antonio CM, Ghneim T, Brink K, Cuevas E. 2002. Nutrient limitation to primary productivity in a secondary savanna in Venezuela. *Biotropica* 34(4): 493-501.
- **Barker DJ, Zhang DM, Mackay AD. 1988.** Root distribution in a low fertility hill country sward grazed by sheep. *New Zealand Journal of Experimental Agriculture* **16**(1): 73-76.
- Barron-Gafford GA, Will RE, Burkes EC, Shiver B, Teskey RO. 2003. Nutrient concentrations and contents, and their relation to stem growth, of intensively managed *Pinus taeda* and *Pinus elliottii* stands of different planting densities. *Forest Science* **49**(2): 291-300.
- Bartholomew WV, Meyer J, Laudelout H. 1953. Mineral nutrient immobilization under forest and grass fallow int the Yangambi (Belgian Congo) region.: Institut National pour l'Etude Agronomique du Congo Belge.
- **Baskerville GL. 1965.** Estimation of dry weight of tree components and total standing crop in conifer stands. *Ecology* **46**(6): 867.
- **Baskerville GL. 1966.** Dry-matter production in immature balsam fir stands: Roots, lesser vegetation, and total stand. *Forest Science* **12**: 49-53.
- **Bassirirad H, Tissue DT, Reynolds JF, Chapin FS. 1996.** Response of *Eriophorum vaginatum* to CO<sub>2</sub> enrichment at different soil temperatures: effects on growth, root respiration and PO<sub>4</sub><sup>3-</sup> uptake kinetics. *New Phytologist* **133**(3): 423-430.
- **Bauerle TL, Bauerle WL, Goebel M, Barnard DM. 2014.** Root system distribution influences substrate moisture measurements in containerized ornamental tree species. *Horttechnology* **23**(6): 754-759.
- Beard KH, Vogt KA, Vogt DJ, Scatena FN, Covich AP, Sigurdardottir R, Siccama TG, Crowl TA. 2005. Structural and functional responses of a subtropical forest to 10 years of hurricanes and droughts. *Ecological Monographs* 75(3): 345-361.
- **Becker P, Sharbini N, Yahya R. 1999.** Root architecture and root: shoot allocation of shrubs and saplings in two lowland tropical forests: implications for life-form composition. *Biotropica* **31**(1): 93.\*

- **Beets PN, Pollock DS. 1987.** Accumulation and partitioning of dry matter in *Pinus radiata* as related to stand-age and thinning. *New Zealand Journal of Forestry Science*(17): 246-271.
- **Beets PN, Whitehead D. 1996.** Carbon partitioning in *Pinus radiata* stands in relation to foliage nitrogen status. *Tree Physiology* **16**(1-2): 131-138.
- Beidler KV, Taylor BN, Strand AE, Cooper ER, Schönholz M, Pritchard SG. 2015. Changes in root architecture under elevated concentrations of CO<sub>2</sub> and nitrogen reflect alternate soil exploration strategies. *New Phytologist* **205**(3): 1153-1163.
- **Bell KL, Bliss LC. 1978.** Root growth in a polar semidesert environment. *Canadian Journal of Botany* **56**(20): 2470-2490.
- **Belsky AJ. 1994.** Influences of trees on savanna productivity: Tests of shade, nutrients, and treegrass competition. *Ecology* **75**(4): 922.
- Berendse F, Beltman B, Bobbink R, Kwant R, Schmitz M. 1987. Primary production and nutrient availability in wet heathland ecosystems. *Acta Oecologica* 8: 265-279.
- **Berg B. 1984.** Decomposition of root litter and some factors regulating the process: Long-term root litter decomposition in a scots pine forest. *Soil Biology and Biochemistry* **16**(6): 609-617.
- **Berish CW. 1982.** Root biomass and surface area in three successional tropical forests. *Canadian Journal of Forest Research* **12**(3): 699-704.
- **Berish CW, Ewel JJ. 1988.** Root development in simple and complex tropical successional ecosystems. *Plant and Soil* **106**(1): 73-84.
- **Bernard JM. 1974.** Seasonal changes in standing crop and primary production in a sedge wetland and an adjacent dry old-field in central Minnesota. *Ecology* **55**(2): 350.
- **Bernard JM, Bernard FA. 1973.** Winter biomass in *Typha glauca* godr. and *Sparganium eurycarpum* engelm. *Bulletin of the Torrey Botanical Club* **100**(2): 125.
- **Bernard JM, Fiala K. 1986.** Distribution and standing crop of living and dead roots in three wetland *Carex* species. *Bulletin of the Torrey Botanical Club* **113**(1): 1.
- **Bernard JM, Hankinson G. 1979.** Seasonal changes in standing crop, primary production, and nutrient levels in a *Carex rostrata* wetland. *Oikos* **32**(3): 328.
- **Bernard JM, Seischab FK, Jacoby G. 1985.** Life history and production of above-and belowground structures of *Cladium mariscoides* (muhl.) torr. in a western New York fen. *Bulletin of the Torrey Botanical Club* **112**(3): 288.
- **Berndt HW, Gibbons RD. 1958.** Root distribution of some native trees and understory plants growing on three sites within ponderosa pine watersheds in Colorado. Fort Collins, CO\*
- Bhattachan A, Tatlhego M, Dintwe K, O'Donnell F, Caylor KK, Okin GS, Perrot DO, Ringrose S, D'Odorico P. 2012. Evaluating ecohydrological theories of woody root distribution in the Kalahari. *PLoS ONE* **7**(3): e33996.\*
- **Bhatti JS, Foster NW, Hazlett PW. 1998.** Fine root biomass and nutrient content in a black spruce peat soil with and without alder. *Canadian Journal of Soil Science* **78**(1): 163-169.

- **Bille JC 1977**. Étude de la production primaire nette d'un écosystème Sahélien. *O.R.S.T.O.M.* Paris, France
- **Billings WD, Shaver GR, Trent AW. 1976.** Measurement of root growth in simulated and natural temperature gradients over permafrost. *Arctic and Alpine Research* **8**(3): 247.
- **Billore SK. 1973.** *Net primary production and energetics of a grassland ecosystem at Ratlam, India.* PhD, Vikram University Ujjain, India.
- **Biondini ME, Patton BD, Nyren PE. 1998.** Grazing intensity and ecosystem processes in a northern mixed-grass prairie, USA. *Ecological Applications* **8**(2): 469-479.
- **Birouste M, Kazakou E, Blanchard A, Roumet C. 2011.** Plant traits and decomposition: are the relationships for roots comparable to those for leaves? *Annals of Botany* **109**(2): 463-472.
- **Bishop DM. 1962.** Lodgepole pine rooting habits in the Blue Mountains of Northeastern Oregon. *Ecology* **43**(1): 140-142.\*
- **Björk RG, Majdi H, Klemedtsson L, Lewis-Jonsson L, Molau U. 2007.** Long-term warming effects on root morphology, root mass distribution, and microbial activity in two dry tundra plant communities in northern Sweden. *New Phytologist* **176**(4): 862-873.
- **Blagoveshchenskiy EN. 1968.** The dry savanna of Northwest India. *Soviet Geography* **9**(6): 519-537.
- **Bleby TM, McElrone AJ, Jackson RB. 2010a.** Water uptake and hydraulic redistribution across large woody root systems to 20 m depth. *Plant, Cell & Environment* **33**(12): 2132-2148.\*
- **Bleby TM, McElrone AJ, Jackson RB. 2010b.** Water uptake and hydraulic redistribution across large woody root systems to 20m depth. *Plant, Cell & Environment* **33**(12): 2132-2148.
- **Bliss LC 1975.** Devon Island, Canada. In: Rosswall T, Heal OW eds. *Structure and function of tundra ecosystems*. Stockholm, Sweden: Ecology Bulletin, 17-60.
- **Bliss LC 1977.** General summary Truelove Island ecosystem. In: Bliss LC ed. *Truelove Lowland, Devon Island Canada: A High Arctic Ecosystem*. Edmonton, Canada: University of Alberta Press, 657-675.
- **Bliss LC, Svoboda J. 1984.** Plant communities and plant production in the western Queen Elizabeth Islands. *Ecography* **7**(3): 325-344.
- **Bliss LC, Svoboda J, Bliss DI. 1984.** Polar deserts, their plant cover and plant production in the Canadian High Arctic. *Ecography* **7**(3): 305-324.
- **Bloomfield J. 1993.** Nutrient dynamics and the influence of substrate quality on the decomposition of leaves and fine roots of selected tree species in a lower montane tropical forest in Puerto Rico. Ph. D, Yale New Haven, CT, USA.
- **Bloomfield J, Vogt KA, Vogt DJ. 1993.** Decay rate and substrate quality of fine roots and foliage of two tropical tree species in the Luquillo Experimental Forest, Puerto Rico. *Plant and Soil* **150**(2): 233-245.

- **Bobich Edward G, Huxman Travis E. 2009.** Dry mass partitioning and gas exchange for young Ocotillos (*Fouquieria splendens*) in the Sonoran Desert. *International Journal of Plant Sciences* **170**(3): 283-289.\*
- **Boggie R. 1977.** Water-table depth and oxygen content of deep peat in relation to root growth of *Pinus contorta. Plant and Soil* **48**(2): 447-454.\*
- **Boikov TG, Kharitonov YD 1998.** Biomass of underground organs in Transbaikalian steppe phytocenoses. In: Box JE, Jr. ed. *Root Demographics and Their Efficiencies in Sustainable Agriculture, Grasslands and Forest Ecosystems*: Springer Netherlands, 55-60.
- **Bonal D, Atger C, Barigah T, Ferhi A, Guehl J-M, Ferry B. 2000.** Water acquisition patterns of two wet tropical canopy tree species of French Guiana as inferred from H<sub>2</sub><sup>18</sup>O extraction profiles. *Annals of Forest Science* **57**(7): 717-724.\*
- **Bornman TG, Adams JB, Bate GC. 2004.** The influence of floodplain geohydrology on the distribution of *Sarcocornia pillansii* in the Olifants Estuary on the West Coast, South Africa. *Journal of Arid Environments* **56**(4): 603-625.\*
- **Bornyasz MA, Graham RC, Allen MF. 2005.** Ectomycorrhizae in a soil-weathered granitic bedrock regolith: linking matrix resources to plants. *Geoderma* **126**(1-2): 141-160.\*
- Bouillet J-P, Laclau J-P, Arnaud M, M'Bou AT, Saint-André L, Jourdan C. 2002. Changes with age in the spatial distribution of roots of Eucalyptus clone in Congo. *Forest Ecology and Management* 171(1-2): 43-57.\*
- Bouma TJ, Yanai RD, Elkin AD, Hartmond U, Flores-Alva DE, Eissenstat DM. 2001. Estimating age-dependent costs and benefits of roots with contrasting life span: comparing apples and oranges. *New Phytologist* **150**(3): 685-695.
- **Bowden BN. 1963.** The root distribution of *Andropogon gayanus* var. *bisquamulatus. East African Agricultural and Forestry Journal* **29**: 157-159.
- **Bowns JE, Box TW. 1964.** The influence of grazing on the roots and rhizomes of Seacoast Bluestem. *Journal of Range Management* **17**(1): 36.
- **Bowns JE, West NE. 1976.** Blackbrush (*Coleogyne ramosissima* Torr.) on southwestern Utah rangelands. Utah Agricultural Experiment Station, Logan, Utah, USA.
- **Bowsher AW, Mason CM, Goolsby EW, Donovan LA. 2016.** Fine root tradeoffs between nitrogen concentration and xylem vessel traits preclude unified whole-plant resource strategies in *Helianthus. Ecology and Evolution* **6**(4): 1016-1031.\*
- **Branson FA, Miller RF, McQueen IS. 1976.** Moisture relationships in twelve Northern desert shrub communities Near Grand Junction, Colorado. *Ecology* **57**(6): 1104.
- **Breda N, Granier A, Barataud F, Moyne C. 1995.** Soil water dynamics in an oak stand. *Plant and Soil* **172**(1): 17-27.\*
- **Briones O, Montaña C, Ezcurra E. 1996.** Competition between three Chihuahuan desert species: evidence from plant size-distance relations and root distribution. *Journal of Vegetation Science* **7**(3): 453-460.

- Brown ALP, Day FP, Hungate BA, Drake BG, Hinkle CR. 2007. Root biomass and nutrient dynamics in a scrub-oak ecosystem under the influence of elevated atmospheric CO<sub>2</sub>. *Plant and Soil* 292(1-2): 219-232.
- **Brown ALP, Day FP, Stover DB. 2008.** Fine root biomass estimates from minirhizotron imagery in a shrub ecosystem exposed to elevated CO<sub>2</sub>. *Plant and Soil* **317**(1-2): 145-153.
- **Brunel J-P. 2009.** Sources of water used by natural mesquite vegetation in a semi-arid region of northern Mexico. *Hydrological Sciences Journal* **54**(2): 375-381.\*
- Bryant DM, Holland EA, Seastedt TR, Walker MD. 1998. Analysis of litter decomposition in an alpine tundra. *Canadian Journal of Botany* 76(7): 1295-1304.\*
- **Bucci SJ, Scholz FG, Goldstein G, Meinzer FC, Arce ME. 2009.** Soil water availability and rooting depth as determinants of hydraulic architecture of Patagonian woody species. *Oecologia* **160**(4): 631-641.\*
- **Bunger MT, Thomson HJ. 1938.** Root development as a factor in the success or failure of windbreak trees in the Southern high plains. *Journal of Forestry* **36**: 790-803.\*
- **Burke MK, Raynal DJ. 1994.** Fine root growth phenology, production, and turnover in a northern hardwood forest ecosystem. *Plant and Soil* **162**(1): 135-146.
- Burton A, Pregitzer K, Ruess R, Hendrick R, Allen M. 2002. Root respiration in North American forests: effects of nitrogen concentration and temperature across biomes. *Oecologia* 131(4): 559-568.
- Burton AJ, Pregitzer KS, Hendrick RL. 2000. Relationships between fine root dynamics and nitrogen availability in Michigan northern hardwood forests. *Oecologia* **125**(3): 389-399.
- **Buth GJC. 1987.** Decomposition of roots of three plant communities in a Dutch salt marsh. *Aquatic Botany* **29**(2): 123-138.\*
- **Butterfield BJ, Bradford JB, Munson SM, Gremer JR. 2017.** Aridity increases below-ground niche breadth in grass communities. *Plant Ecology* **218**(4): 385-394.\*
- **Buttner V, Leuschner C. 1994.** Spatial and temporal patterns of fine root abundance in a mixed oak-beech forest. *Forest Ecology and Management* **70**(1-3): 11-21.\*
- **Buyanovsky GA, Kucera CL, Wagner GH. 1987.** Comparative analyses of carbon dynamics in native and cultivated ecosystems. *Ecology* **68**(6): 2023.
- **Caldwell MM, Manwaring JH, Durham SL. 1991.** The microscale distribution of neighbouring plant roots in fertile soil microsites. *Functional Ecology* **5**(6): 765.
- **Caldwell MM, White RS, Moore RT, Camp LB. 1977.** Carbon balance, productivity, and water use of cold-winter desert shrub communities dominated by C<sub>3</sub> and C<sub>4</sub> species. *Oecologia* **29**(4): 275-300.
- Camire C, Cote B, Brulotte S. 1991. Decomposition of roots of black alder and hybrid poplar in short-rotation plantings: Nitrogen and lignin control. *Plant and Soil* 138(1): 123-132.
- **Campbell JJ, Finér L, Messier C. 1998.** Fine-root production in small experimental gaps in successional mixed boreal forests. *Journal of Vegetation Science* **9**(4): 537-542.

- Campioli M, Michelsen A, Demey A, Vermeulen A, Samson R, Lemeur R. 2009. Net primary production and carbon stocks for subarctic mesic–dry tundras with contrasting microtopography, altitude, and dominant species. *Ecosystems* 12(5): 760-776.
- **Canadell J, Roda F. 1991.** Root biomass of *Quercus ilex* in a montane Mediterranean forest. *Canadian Journal of Forest Research* **21**(12): 1771-1778.
- Canham CA, Froend RH, Stock WD, Davies M. 2012. Dynamics of phreatophyte root growth relative to a seasonally fluctuating water table in a Mediterranean-type environment. *Oecologia* 170(4): 909-916.\*
- **Cannon HL, Starrett WH. 1954.** Botanical Prospecting for Uranium on La Ventana Mesa, Sandoval County New Mexico. Trace Elements Investigations. Reston, VA\*
- Cannon WA. 1911. The Root Habits of Desert Plants\*
- Cannon WA. 1913. Botanical Features of the Algerian Sahara\*
- Caplan JS, Stone BWG, Faillace CA, Lafond JJ, Baumgarten JM, Mozdzer TJ, Dighton J, Meiners SJ, Grabosky JC, Ehrenfeld JG. 2017. Nutrient foraging strategies are associated with productivity and population growth in forest shrubs. *Annals of Botany*: mcw271.\*
- **Carbon BA, Bartle GA, Murray AM, MacPherson DK. 1980.** The distribution of root length, and the limits to flow of soil water to roots in a dry sclerophyll forest. *Forest Science* **26**: 656-664.
- Cardinael R, Mao Z, Prieto I, Stokes A, Dupraz C, Kim JH, Jourdan C. 2015. Competition with winter crops induces deeper rooting of walnut trees in a Mediterranean alley cropping agroforestry system. *Plant and Soil* 391(1-2): 219-235.\*
- Carrera AL, Bertiller MB, Larreguy C. 2008. Leaf litterfall, fine-root production, and decomposition in shrublands with different canopy structure induced by grazing in the Patagonian Monte, Argentina. *Plant and Soil* 311(1-2): 39-50.\*
- **Carrick PJ. 2003.** Competitive and facilitative relationships among three shrub species, and the role of browsing intensity and rooting depth in the Succulent Karoo, South Africa. *Journal of Vegetation Science* **14**(5): 761-772.\*
- Carter MR, Gregorich EG. 2010. Carbon and nitrogen storage by deep-rooted tall fescue (*Lolium arundinaceum*) in the surface and subsurface soil of a fine sandy loam in eastern Canada. *Agriculture, Ecosystems & Environment* 136(1-2): 125-132.\*
- Castellanos J, Maass M, Kummerow J. 1991. Root biomass of a dry deciduous tropical forest in Mexico. *Plant and Soil* 131(2): 225-228.
- **Castelli RM, Chambers JC, Tausch RJ. 2000.** Soil-plant relations along a soil-water gradient in great basin riparian meadows. *Wetlands* **20**(2): 251-266.\*
- **Cattanio JH, Anderson AB, Rombold JS, Nepstad DC. 2004.** Phenology, litterfall, growth, and root biomass in a tidal floodplain forest in the Amazon estuary. *Revista Brasileira de Botânica* **27**(4)\*
- **Cavelier J. 1992.** Fine-root biomass and soil properties in a semideciduous and a lower montane rain forest in Panama. *Plant and Soil* **142**(2): 187-201.

- **Cavelier J, Wright SJ, Santamaría J. 1999.** Effects of irrigation on litterfall, fine root biomass and production in a semideciduous lowland forest in Panama. *Plant and Soil* **211**(2): 207-213.
- **Ceballos DS, Frangi J, Jobbágy EG. 2012.** Soil volume and carbon storage shifts in drained and afforested wetlands of the Paraná River Delta. *Biogeochemistry* **112**(1-3): 359-372.\*
- Ceccon C, Tagliavini M, Schmitt AO, Eissenstat DM, Epron D. 2016. Untangling the effects of root age and tissue nitrogen on root respiration in *Populus tremuloides* at different nitrogen supply. *Tree Physiology* 36(5): 618-627.
- **Cerri CC, Volkoff B. 1987.** Carbon content in a yellow Latosol of central Amazon rain forest. *Acta Oecologica Oecologia Generalis* **8**: 29-42.
- **Chagnon P-L, Bradley RL, Klironomos JN. 2015.** Trait-based partner selection drives mycorrhizal network assembly. *Oikos* **124**(12): 1609-1616.\*
- **Chang WJ, Guo DL. 2008.** Variation in root diameter among 45 common tree species in temperate, subtropical, and tropical forests in China. *Journal of Plant Ecology (Chinese Version* **32**: 1248-1257.
- **Chapin FS. 1974.** Morphological and physiological mechanisms of temperature compensation in phosphate absorption along a latitudinal gradient. *Ecology* **55**(6): 1180.
- **Chapin FS 1978.** Phosphate uptake and nutrient utilization by Barrow tundra vegetation. In: Tieszen LL ed. *Vegetation and production ecology of an Alaskan arctic tundra*. New York, NY, USA: Springer-Verlag New York Inc, 483-507.
- **Chapin FS, Bret-Harte MS, Hobbie SE, Zhong H. 1996.** Plant functional types as predictors of transient responses of arctic vegetation to global change. *Journal of Vegetation Science* **7**(3): 347-358.
- Chapin FS, Fetcher N, Kielland K, Everett KR, Linkins AE. 1988. Productivity and nutrient cycling of Alaskan tundra: enhancement by flowing soil water. *Ecology* **69**(3): 693-702.
- **Chapin FS, III, Johnson DA, McKendrick JD. 1980.** Seasonal movement of nutrients in plants of differing growth gorm in an Alaskan tundra ecosystem: implications for herbivory. *The Journal of Ecology* **68**(1): 189.
- **Chapin FS, Moilanen L, Kielland K. 1993.** Preferential use of organic nitrogen for growth by a non-mycorrhizal arctic sedge. *Nature* **361**(6408): 150-153.
- **Chapin FS, Slack M. 1979.** Effect of defoliation upon root growth, phosphate absorption and respiration in nutrient-limited tundra graminoids. *Oecologia* **42**(1): 67-79.
- Chapin FS, Tieszen LL, Lewis MC, Miller PC, McCown BH 1980. Control of tundra plant allocation patterns and growth. In: Brown J, Miller PC, Tieszen LL, Bunnell FL eds. *An arctic ecosystem: the coastal tundra at Barrow, Alaska*. Stroudsburg, PA, USA: Dowden, Hutchinson and Ross, Inc., 140-185.
- **Chapin FS, Tryon PR. 1982.** Phosphate absorption and root respiration of different plant growth forms from northern Alaska. *Ecography* **5**(2): 164-171.
- **Chapman SB. 1970.** The nutrient content of the soil and root system of a dry heath ecosystem. *The Journal of Ecology* **58**(2): 445.

- **Chapman SB. 1979.** Some interrelationships between soil and root respiration in lowland *Calluna* heathland in southern england. *The Journal of Ecology* **67**(1): 1.\*
- Chen G-t, Tu L-h, Peng Y, Hu H-l, Hu T-x, Xu Z-f, Liu L, Tang Y. 2016. Effect of nitrogen additions on root morphology and chemistry in a subtropical bamboo forest. *Plant and Soil* 412(1-2): 441-451.\*
- **Chen H, Harmon ME, Griffiths RP. 2001.** Decomposition and nitrogen release from decomposing woody roots in coniferous forests of the Pacific Northwest: a chronosequence approach. *Canadian Journal of Forest Research* **31**(2): 246-260.\*
- Chen H, Harmon ME, Sexton J, Fasth B. 2002. Fine-root decomposition and N dynamics in coniferous forests of the Pacific Northwest, U.S.A. *Canadian Journal of Forest Research* 32(2): 320-331.
- Chen W, Koide RT, Adams TS, DeForest JL, Cheng L, Eissenstat DM. 2016. Root morphology and mycorrhizal symbioses together shape nutrient foraging strategies of temperate trees. *Proceedings of the National Academy of Sciences* 113(31): 8741-8746.\*
- Chen W, Zeng H, Eissenstat DM, Guo D. 2013. Variation of first-order root traits across climatic gradients and evolutionary trends in geological time. *Global Ecology and Biogeography* 22(7): 846-856.
- **Chen X, Eamus D, Hutley LB. 2004.** Seasonal patterns of fine-root productivity and turnover in a tropical savanna of northern Australia. *Journal of Tropical Ecology* **20**(2): 221-224.
- **Cheng J, Chu P, Chen D, Bai Y, Niu S. 2016.** Functional correlations between specific leaf area and specific root length along a regional environmental gradient in Inner Mongolia grasslands. *Functional Ecology* **30**(6): 985-997.
- Cheng L, Chen W, Adams TS, Wei X, Li L, McCormack ML, DeForest JL, Koide RT, Eissenstat DM. 2016. Mycorrhizal fungi and roots are complementary in foraging within nutrient patches. *Ecology*
- **Chesus KA. 2016.** *Analyzing root traits to characterize juniper expansion into rangelands.* Master's, Colorado State University Fort Collins, Colorado, USA.\*
- **Cheyney EG. 1929.** A study of the roots in a square yard of jack pine forest. *Journal of Forestry* **27**: 546-549.\*
- Chevney EG. 1932. The roots of a jack pine tree. Journal of Forestry 30(8): 929-932.\*
- **Chimner RA, Ewel KC. 2005.** A tropical freshwater wetland: II. Production, decomposition, and peat formation. *Wetlands Ecology and Management* **13**(6): 671-684.\*
- **Christie EK. 1978.** Ecosystem processes in semiarid grasslands. I. Primary production and water use of two communities possessing different photosynthetic pathways. *Australian Journal of Agricultural Research* **29**(4): 773.
- Christina M, Laclau JP, Gonçalves JLM, Jourdan C, Nouvellon Y, Bouillet JP. 2011.

  Almost symmetrical vertical growth rates above and below ground in one of the world's most productive forests. *Ecosphere* 2(3): art27.\*
- **Chung H-H, Kramer PJ. 1975.** Absorption of water and <sup>32</sup>P through suberized and unsuberized roots of Loblolly pine. *Canadian Journal of Forest Research* **5**(2): 229-235.

- **Claus A, George E. 2005.** Effect of stand age on fine-root biomass and biomass distribution in three European forest chronosequences. *Canadian Journal of Forest Research* **35**(7): 1617-1625.\*
- **Clemensson-Lindell A, Asp H. 1995.** Fine-root morphology and uptake of <sup>32</sup>P and <sup>35</sup>S in a Norway spruce (*Picea abies* (L.) Karst.) stand subjected to various nutrient and water supplies. *Plant and Soil* **173**(1): 147-155.
- Clemensson-Lindell A, Persson H. 1992. Effects of freezing on rhizosphere and root nutrient content using two soil sampling methods. *Plant and Soil* 139(1): 39-45.
- Clemmensen KE, Michelsen A, Jonasson S, Shaver GR. 2006. Increased ectomycorrhizal fungal abundance after long-term fertilization and warming of two arctic tundra ecosystems. *New Phytologist* **171**(2): 391-404.
- Cline JR, Uresk DW, Rickard WH. 1977. Plants and soil of a sagebrush community on the Hanford Reservation. *Northwest Science* 51: 60-70.
- **Coetzee JA, Page MI, Meredith D. 1946.** Root studies in Highveld grassland communities. *South African Journal of Science* **42**: 105-118.
- **Coile TS. 1937.** Distribution of forest tree roots in North Carolina piedmont soils. *Journal of Forestry* **35**: 4-39.\*
- **Coleman M. 2007.** Spatial and temporal patterns of root distribution in developing stands of four woody crop species grown with drip irrigation and fertilization. *Plant and Soil* **299**(1-2): 195-213.
- **Coleman MD. 2000.** Contrasting fine-root production, survival and soil CO<sub>2</sub> efflux in pine and poplar plantations. *Plant and Soil* **225**(1/2): 129-139.
- Coleman MD, Dickson RE, Isebrands JG, Karnosky DF. 1996. Root growth and physiology of potted and field-grown trembling aspen exposed to tropospheric ozone. *Tree Physiology* 16(1-2): 145-152.
- **Coleman MD, Friend AL, Kern CC. 2004.** Carbon allocation and nitrogen acquisition in a developing *Populus deltoides* plantation. *Tree Physiology* **24**(12): 1347-1357.
- **Collins CG, Wright SJ, Wurzburger N. 2015.** Root and leaf traits reflect distinct resource acquisition strategies in tropical lianas and trees. *Oecologia* **180**(4): 1037-1047.\*
- Collins NJ, Baker JH, Tilbrook PJ 1975. Signy Island, maritime Atlantic. In: Rosswall T, Heal OW eds. *Structure and Function of Tundra Ecosystems*. Stockholm, Sweden: Swedish Natural Science Research Council, 399-423.
- Comas L, Bouma T, Eissenstat D. 2002. Linking root traits to potential growth rate in six temperate tree species. *Oecologia* 132(1): 34-43.
- **Comas LH, Eissenstat DM. 2004.** Linking fine root traits to maximum potential growth rate among 11 mature temperate tree species. *Functional Ecology* **18**(3): 388-397.
- **Comas LH, Eissenstat DM. 2009.** Patterns in root trait variation among 25 co-existing North American forest species. *New Phytologist* **182**(4): 919-928.

- **Comeau PG, Kimmins JP. 1989.** Above- and below-ground biomass and production of lodgepole pine on sites with differing soil moisture regimes. *Canadian Journal of Forest Research* **19**(4): 447-454.
- **Comino E, Druetta A. 2010.** The effect of Poaceae roots on the shear strength of soils in the Italian alpine environment. *Soil and Tillage Research* **106**(2): 194-201.\*
- **Conn CE, Day FP. 1993.** Belowground biomass patterns on a coastal barrier island in Virginia. *Bulletin of the Torrey Botanical Club* **120**(2): 121.
- **Conn CE, Day Jr FP. 1997.** Root decomposition across a barrier island chronosequence: Litter quality and environmental controls. *Plant and Soil* **195**(2): 351-364.\*
- Coughenour MB, Ellis JE, Popp RG. 1990. Morphometric relationships and developmental patterns of *Acacia tortilis* and *Acacia reficiens* in Southern Turkana, Kenya. *Bulletin of the Torrey Botanical Club* 117(1): 8.
- **Coupland RT 1979.** Conclusion. In: Coupland RT ed. *Grassland Ecosystems of the World*. Cambridge, U.K.: Cambridge University, 335-355.
- **Coupland RT 1992.** Mixed prairie. In: Coupland RT ed. *Grasslands of the World*. Amsterdam, Netherlands: Elsevier, 151-182.
- **Coupland RT, Brayshaw TC. 1953.** The fescue grassland in Saskatchewan. *Ecology* **34**(2): 386.
- **Coupland RT, Johnson RE. 1965.** Rooting characteristics of native grassland species in Saskatchewan. *The Journal of Ecology* **53**(2): 475.\*
- **Coupland RT, Willard JR, Ripley EA, Randell RL 1975.** The Matador Project. In: Cameron TWM, Billingsley LW eds. *Energy Flow its biological dimensions*. Ottawa, Canada: Royal Society of Canada, 19-50.
- **Cox JR, Frasier GW, Renard KG. 1986.** Biomass distribution at grassland and shrubland sites. *Rangelands* **8**: 67-69.
- Cox TL, Harris WF, Ausmus BS, Edwards NT 1973. Organic matter and nutrient dynamics of the forest floor in the Hubbard Brook Forest. In: Marshall JK ed. *Abstracts for the Belowground Eco-system: A Synthesis of Plant-Associated Processes*. Fort Collins, Colorado: U.S. IBP, 23-24.
- Cox TL, Harris WF, Ausmus BS, Edwards NT. 1978. The role of roots in biogeochemical cycles in an eastern deciduous forest. *Pedobiologia* 18: 245-257.
- **Coyle DR, Coleman MD. 2005.** Forest production responses to irrigation and fertilization are not explained by shifts in allocation. *Forest Ecology and Management* **208**(1-3): 137-152.
- **Coyle DR, Coleman MD, Aubrey DP. 2008.** Above- and below-ground biomass accumulation, production, and distribution of sweetgum and loblolly pine grown with irrigation and fertilization. *Canadian Journal of Forest Research* **38**(6): 1335-1348.
- Craine JM, Froehle J, Tilman DG, Wedin DA, Chapin FS, III. 2001. The relationships among root and leaf traits of 76 grassland species and relative abundance along fertility and disturbance gradients. *Oikos* 93(2): 274-285.

- Crawford ER, Day FP, Atkinson RB. 2007. Influence of environment and substrate quality on root decomposition in naturally regenerating and restored Atlantic white cedar wetlands. *Wetlands* 27(1): 1-11.
- Cuevas E, Brown S, Lugo AE. 1991. Above- and belowground organic matter storage and production in a tropical pine plantation and a paired broadleaf secondary forest. *Plant and Soil* 135(2): 257-268.
- Cuevas E, Medina E. 1988. Nutrient dynamics within amazonian forests. *Oecologia* 76(2): 222-235.
- Curt T, Lucot E, Bouchaud M. 2001. Douglas-fir root biomass and rooting profile in relation to soils in a mid-elevation area (Beaujolais Mounts, France). *Plant and Soil* 233(1): 109-125.\*
- **Da Silva F, Suwa R, Kajimoto T, Ishizuka M, Higuchi N, Kunert N. 2015.** Allometric equations for estimating biomass of *Euterpe precatoria*, the most abundant palm species in the Amazon. *Forests* **6**(2): 450-463.\*
- **Daddy F, Trlica MJ, Bonham CD. 1988.** Vegetation and soil water differences among Big Sagebrush communities with different grazing histories. *The Southwestern Naturalist* **33**(4): 413.
- **Dahlman RC, Kucera CL. 1965.** Root productivity and turnover in native prairie. *Ecology* **46**(1/2): 84.
- **Dahlman RC, Kucera CL 1967**. Carbon-14 cycling in the root and soil components of a prairie ecosystem. *2nd National Symposium on Radioecology*. 652-660.
- **Dai Y, Zheng X-J, Tang L-S, Li Y. 2014.** Stable oxygen isotopes reveal distinct water use patterns of two *Haloxylon* species in the Gurbantonggut Desert. *Plant and Soil* **389**(1-2): 73-87.\*
- **Damman AWH. 1971.** Effect of vegetation changes on the fertility of a Newfoundland forest site. *Ecological Monographs* **41**(3): 253.
- **Danjon F, Fourcaud T, Bert D. 2005.** Root architecture and wind-firmness of mature *Pinus pinaster. New Phytologist* **168**(2): 387-400.\*
- **Das DK, Chaturvedi OP. 2008.** Root phytomass recovery and rooting characteristics of five agroforestry tree species in eastern India. *Journal of Tropical Forest Science* **20**(3): 156-166.\*
- **Daubenmire RF. 1941.** Some ecologic features of the subterranean organs of alpine plants. *Ecology* **22**(4): 370-378.\*
- **David TS, Ferreira MI, Cohen S, Pereira JS, David JS. 2004.** Constraints on transpiration from an evergreen oak tree in southern Portugal. *Agricultural and Forest Meteorology* **122**(3-4): 193-205.\*
- David TS, Pinto CA, Nadezhdina N, Kurz-Besson C, Henriques MO, Quilhó T, Cermak J, Chaves MM, Pereira JS, David JS. 2013. Root functioning, tree water use and hydraulic redistribution in *Quercus suber* trees: A modeling approach based on root sap flow. Forest Ecology and Management 307: 136-146.\*

- Davidson E, Lefebvre PA, Brando PM, Ray DM, Trumbore SE, Solorzano LA, Ferreira JN, Bustamante MMdC, Nepstad DC. 2011. Carbon inputs and water uptake in deep soils of an eastern amazon forest. *Forest Science* 57(1): 51-58.\*
- **Davies SJ, Becker P. 1996.** Floristic composition and stand structure of mixed dipterocarp and heath forests in Brunei Darussalam. *Journal of Tropical Forest Science* **8**: 542-569.
- **Davis EA, Pase CP. 1977.** Root system of shrub live oak: Implications for water yield in Arizona chaparral. *Journal of Soil and Water Conservation* **32**: 174-180.
- **Davis GR, Neilsen WA, McDavitt JG. 1983.** Root distribution of *Pinus radiata* related to soil characteristics in five Tasmanian soils. *Australian Journal of Soil Research* **21**(2): 165.\*
- **Dawson TE. 1993.** Hydraulic lift and water use by plants: implications for water balance, performance and plant-plant interactions. *Oecologia* **95**(4): 565-574.\*
- **Dawson TE, Pate JS. 1996.** Seasonal water uptake and movement in root systems of Australian phraeatophytic plants of dimorphic root morphology: a stable isotope investigation. *Oecologia* **107**(1): 13-20.\*
- Day FP, Schroeder RE, Stover DB, Brown ALP, Butnor JR, Dilustro J, Hungate BA, Dijkstra P, Duval BD, Seiler TJ, et al. 2013. The effects of 11 yr of CO<sub>2</sub> enrichment on roots in a Florida scrub-oak ecosystem. *New Phytologist* 200(3): 778-787.
- Day MW. 1941. The root system of red pine saplings. Journal of Forestry 39: 468-472.\*
- **De Castro EA, Kauffman JB. 1998.** Ecosystem structure in the Brazilian Cerrado: a vegetation gradient of aboveground biomass, root mass and consumption by fire. *Journal of Tropical Ecology* **14**(3): 263-283.
- de Graaff M-A, Jastrow JD, Gillette S, Johns A, Wullschleger SD. 2014. Differential priming of soil carbon driven by soil depth and root impacts on carbon availability. *Soil Biology and Biochemistry* 69: 147-156.
- **Deans JD. 1981.** Dynamics of coarse root production in a young plantation of *Picea sitchensis*. *Forestry* **54**(2): 139-155.
- **Delagrange S, Messier C, Lechowicz MJ, Dizengremel P. 2004.** Physiological, morphological and allocational plasticity in understory deciduous trees: importance of plant size and light availability. *Tree Physiology* **24**(7): 775-784.
- **Dell B, Bartle JR, Tacey WH. 1983.** Root occupation and root channels of jarrah forest subsoils. *Australian Journal of Botany* **31**(6): 615.\*
- **DeMeester JE, Richter Dd. 2010.** Differences in wetland nitrogen cycling between the invasive grass *Microstegium vimineum* and a diverse plant community. *Ecological Applications* **20**(3): 609-619.\*
- **Dennis JG. 1977.** Distribution patterns of belowground standing crop in arctic tundra at Barrow, Alaska. *Arctic and Alpine Research* **9**(2): 113.
- **Dennis JG, Johnson PL. 1970.** Shoot and rhizome-root standing crops of tundra vegetation at Barrow, Alaska. *Arctic and Alpine Research* **2**(4): 253.
- **Dennis JG, Tieszen LL, Vetter MA 1978.** Seasonal dynamics of above- and belowground production of vascular plants at Barrow, Alaska. In: Tieszen LL ed. *Vegetation and*

- production ecology of an Alaskan arctic tundra. New York, NY, USA: Springer-Verlag New York Inc, 113-140.
- **Derbel S, Chaieb M. 2013.** Growth establishment and phenology of four woody Saharan species. *African Journal of Ecology* **51**(2): 307-318.\*
- **Deslippe JR, Simard SW. 2011.** Below-ground carbon transfer among *Betula nana* may increase with warming in Arctic tundra. *New Phytologist* **192**(3): 689-698.
- **Devidas S, Pyravaud JP. 1995.** Primary productivity of the herbaceous layer in a grazed savanna woodland, Bandipur National Park, southern India. *Acta Oecologica* **16**: 491-505.
- **Devillez F, Jain TC, Jouret MF, Lebrun J, Marynen T, Renard CH. 1973.** Bio-masse, contenu en eau et productivite d'une pessiere en Haute-Ardenne. Comparaison avec unehetraie (Biomass, water content and productivity in a spruce stand in Haute-Ardenne: Comparison with a beech stand). *Bulletin de la classe des sciences* **59**: 480-491.
- **Dhyani SK, Narain P, Singh RK. 1990.** Studies on root distribution of five multipurpose tree species in Doon Valley, India. *Agroforestry Systems* **12**(2): 149-161.
- **Dice SF. 1970.** The biomass and nutrient flux in a second growth Douglas-fir ecosystem. Ph.D., University of Washington Seattle, Washington, USA.
- **Distel RA, Fernandez OA. 1988.** Dynamics of root growth and decay in two grasses native to semi-arid Argentina. *Austral Ecology* **13**(3): 327-336.
- **Dittmer HJ. 1959.** A study of the root system of certain sand dune plants in New Mexico. *Ecology* **40**(2): 265-273.\*
- **Do FC, Rocheteau A, Diagne AL, Goudiaby V, Granier A, Lhomme JP. 2008.** Stable annual pattern of water use by *Acacia tortilis* in Sahelian Africa. *Tree Physiology* **28**(1): 95-104.\*
- **Dobrowolski JP, Caldwell MM, Richards JH 1990.** Basin hydrology and plant root systems. In: Osmond CB, Hindy GM, Pitelka LF eds. *Plant Biology of the Basin and Range*: Springer Berlin Heidelberg, 243-292.
- **Doi R, Tanikawa T, Miyatani K, Hirano Y. 2017.** Intraspecific variation in morphological traits of root branch orders in *Chamaecyparis obtusa*. *Plant and Soil* **416**(1-2): 503-513.\*
- **Dong L, Mao Z, Sun T. 2016.** Condensed tannin effects on decomposition of very fine roots among temperate tree species. *Soil Biology and Biochemistry* **103**: 489-492.\*
- **Dong X, Wang H, Gu J, Wang Y, Wang Z. 2015.** Root morphology, histology and chemistry of nine fern species (pteridophyta) in a temperate forest. *Plant and Soil* **393**(1-2): 215-227.
- **Donovan LA, Richards JH, Muller MW. 1996.** Water relations and leaf chemistry of *Chrysothamnus nauseosus* ssp. *consimilis* (Asteraceae) and *Sarcobatus vermiculatus* (Chenopodiaceae). *American Journal of Botany* **83**(12): 1637.\*
- **Dorji T, Totland Ø, Moe SR, Hopping KA, Pan J, Klein JA. 2013.** Plant functional traits mediate reproductive phenology and success in response to experimental warming and snow addition in Tibet. *Global Change Biology* **19**(2): 459-472.\*

- **Dornbush ME, Isenhart TM, Raich JW. 2002.** Quantifying fine-root decomposition: An alternative to buried litterbags. *Ecology* **83**(11): 2985-2990.
- **Douglas DA. 1989.** Clonal growth of *Salix setchelliana* on glacial river gravel bars in Alaska. *The Journal of Ecology* **77**(1): 112.\*
- Drake JE, Gallet-Budynek A, Hofmockel KS, Bernhardt ES, Billings SA, Jackson RB, Johnsen KS, Lichter J, McCarthy HR, McCormack ML, et al. 2011. Increases in the flux of carbon belowground stimulate nitrogen uptake and sustain the long-term enhancement of forest productivity under elevated CO<sub>2</sub>. *Ecology Letters* **14**(4): 349-357.
- **Dress WJ, Boerner REJ. 2003.** Temporal and spatial patterns in root nitrogen concentration and root decomposition in relation to prescribed fire. *The American Midland Naturalist* **149**(2): 245-257.\*
- **Drexhage M, Gruber F. 1998.** Architecture of the skeletal root system of 40-year-old *Picea abies* on strongly acidified soils in the Harz Mountains (Germany). *Canadian Journal of Forest Research* **28**(1): 13-22.\*
- **Du J, Wang N, Alpert P, Yu M-J, Yu F-H, Dong M. 2010.** Clonal integration increases performance of ramets of the fern *Diplopterygium glaucum* in an evergreen forest in southeastern China. *Flora Morphology, Distribution, Functional Ecology of Plants* **205**(6): 399-403.\*
- **Dumortier M 1991.** Below-ground dynamics in a wet grassland ecosystem. In: Atkinson D ed. *Plant root growth: an ecological perspective*. Oxford: Blackwell Scientific Publications, 301-309.
- **Duncan WH. 1935.** Root systems of woody plants of old fields of Indiana. *Ecology* **16**(4): 554-567.\*
- **Duncan WH. 1941.** A study of root development in three soil types in the Duke Forest. *Ecological Monographs* **11**(2): 141.
- **Dupuy NC, Dreyfus BL. 1992.** Bradyrhizobium populations occur in deep soil under the leguminous tree *Acacia albida*. *Microbiology* **58**(8): 2415-2419.\*
- **Duvigneaud P, Kestemont P, Ambroes P 1971.** Productivite primaire des forets temperees d'essence feuilles caducifoliees en Europe occidentale. In: Duvigneaud P ed. *Productivity of Forest Ecosystems*. Paris, France: UNESCO, 259-270.
- **Dye PJ. 1996.** Response of Eucalyptus grandis trees to soil water deficits. *Tree Physiology* **16**(1-2): 233-238.\*
- **Eamus D, Chen X, Kelley G, Hutley LB. 2002.** Root biomass and root fractal analyses of an open Eucalyptus in a savanna of north Africa. *Australian Journal of Botany* **50**: 31-41.\*
- **Edwards NT, Harris WF. 1977.** Carbon cycling in a mixed deciduous forest floor. *Ecology* **58**(2): 431.
- **Ehrenfeld JG, Kourtev P, Huang W. 2001.** Changes in soil functions following invasions of exotic understory plants in deciduous forests. *Ecological Applications* **11**(5): 1287-1300.\*

- **Eis S. 1974.** Root system morphology of western hemlock, western red cedar, and Douglas-fir. *Canadian Journal of Forest Research* **4**(1): 28-38.\*
- **Eis S. 1987.** Root systems of older immature hemlock, cedar, and Douglas-fir. *Canadian Journal of Forest Research* **17**(11): 1348-1354.\*
- **Eissenstat DM, Achor DS. 1999.** Anatomical characteristics of roots of citrus rootstocks that vary in specific root length. *New Phytologist* **141**(2): 309-321.
- **Eissenstat DM, Duncan LW. 1992.** Root growth and carbohydrate responses in bearing citrus trees following partial canopy removal. *Tree Physiology* **10**(3): 245-257.
- Eissenstat DM, Kucharski JM, Zadworny M, Adams TS, Koide RT. 2015. Linking root traits to nutrient foraging in arbuscular mycorrhizal trees in a temperate forest. *New Phytologist* 208(1): 114-124.
- **Elkington TT, Jones BMG. 1974.** Biomass and primary productivity of birch (*Betula Pubescens* S. Lat.) in South-West Greenland. *The Journal of Ecology* **62**(3): 821.
- Ellenberg H, Mayer R, Schauermann J, eds. 1986. Ergebnisse des Sollingprojekts 1966-1986. Ulmer, Stuttgart, Germany
- **Elliott GRB. 1924.** Relation between the downward penetration of corn roots and water level in peat soil. *Ecology* **5**(2): 175-178.\*
- Ellsworth PZ, Sternberg LSL. 2015. Seasonal water use by deciduous and evergreen woody species in a scrub community is based on water availability and root distribution. *Ecohydrology* 8(4): 538-551.\*
- **Esler KJ, Rundel PW. 1999.** Comparative patterns of phenology and growth form diversity in two winter rainfall deserts: the Succulent Karoo and Mojave Desert ecosystems. *Plant Ecology* **142**(1/2): 97-104.\*
- **Espeleta JF, Clark DA. 2007.** Multi-scale variation in fine-root biomass in a tropical rain forest: A seven-year study. *Ecological Monographs* **77**(3): 377-404.
- **Espeleta JF, West JB, Donovan LA. 2009.** Tree species fine-root demography parallels habitat specialization across a sandhill soil resource gradient. *Ecology* **90**(7): 1773-1787.
- Estrada-Medina H, Graham RC, Allen MF, Jimenez-Osornio JJ, Robles-Casolco S. 2012. The importance of limestone bedrock and dissolution karst features on tree root distribution in northern Yucatán, México. *Plant and Soil* 362(1-2): 37-50.\*
- **Evdokimova TI, Grishina LA 1968.** Productivity of root systems of herbaceous vegetation on flood plain meadows and methods for its study. In: Ghilarov MS, Kovda VA, Novichkova-Ivanova LN, Rodin LE, Sveshnikova VM eds. *Methods of productivity studies in root systems and rhizosphere organisms*. Nauka, Leningrad, Russia: International Symposium USSR, August 28-September 12, 1968, 24-27.
- **Evenari Walter Schwarz M. 1938.** Root conditions of certain plants of the Wilderness of Judaea. *Journal of the Linnean Society of London, Botany* **51**(340): 383-388.\*
- **Fabião A, Persson HÅ, Steen E. 1985.** Growth dynamics of superficial roots in Portuguese plantations of *Eucalyptus globulus* Labill. studied with a mesh bag technique. *Plant and Soil* **83**(2): 233-242.

- **Fahey TJ, Arthur MA. 1994.** Further studies of root decomposition following harvest of a northern hardwoods forest. *Forest Science* **40**(4): 618-629.
- **Fahey TJ, Hughes JW. 1994.** Fine root dynamics in a northern hardwood forest ecosystem, Hubbard Brook Experimental Forest, NH. *The Journal of Ecology* **82**(3): 533.
- **Fahey TJ, Hughes JW, Pu M, Arthur MA. 1988.** Root decomposition and nutrient flux following whole-tree harvest of northern hardwood forest. *Forest Science* **34**: 744-768.
- Falster DS, Duursma RA, Ishihara MI, Barneche DR, FitzJohn RG, Varhammar A, Aiba M, Ando M, Anten N, Aspinwall MJ, et al. 2015. BAAD: a Biomass And Allometry Database for woody plants. *Ecology* 96(5): 1445-1445.
- **Fan P, Guo D. 2010.** Slow decomposition of lower order roots: a key mechanism of root carbon and nutrient retention in the soil. *Oecologia* **163**(2): 509-515.
- Fan Y, Li P, Hou Z, Ren T, Xiong C, Zhang B. 2012. Water adaptive traits of deep-rooted C<sub>3</sub> halophyte (*Karelinia caspica* (Pall.) Less.) and shallow-rooted C<sub>4</sub> halophyte (*Atriplex tatarica* L.) in an arid region, Northwest China. *Journal of Arid Land* 4(4): 469-478.\*
- Fan Y, Miguez-Macho G, Jobbágy EG, Jackson RB, Otero-Casal C. 2017. Hydrologic regulation of plant rooting depth. *Proceedings of the National Academy of Sciences* 114(40): 10572-10577.\*
- **Farrington P, Greenwood EAN, Bartle GA, Beresford JD, Watson GD. 1989.** Evaporation from Banksia woodland on a groundwater mound. *Journal of Hydrology* **105**(1-2): 173-186.\*
- **Farrish KW. 1991.** Spatial and temporal fine-root distribution in three Louisiana forest soils. *Soil Science Society of America Journal* **55**(6): 1752.
- **February EC, Allsopp N, Shabane T, Hattas D. 2011.** Coexistence of a C<sub>4</sub> grass and a leaf succulent shrub in an arid ecosystem. The relationship between rooting depth, water and nitrogen. *Plant and Soil* **349**(1-2): 253-260.\*
- **February EC, Cook GD, Richards AE. 2013.** Root dynamics influence tree-grass coexistence in an Australian savanna. *Austral Ecology* **38**(1): 66-75.\*
- **Fenner M. 1980.** Some measurements on the water relations of baobab trees. *Biotropica* **12**(3): 205.\*
- **Fernandez OA, Caldwell MM. 1975.** Phenology and dynamics of root growth of three cool semi-desert shrubs under field conditions. *The Journal of Ecology* **63**(2): 703.
- **Fernandez RJ, Paruelo JM. 1988.** Root systems of two Patagonian shrubs: a quantitative description using a geometrical method. *Journal of Range Management* **41**(3): 220.
- **Fiala K. 1976.** Underground organs of *Phragmites communis*, their growth, biomass and net production. *Folia Geobotanica et Phytotaxonomica* **11**(3): 225-259.
- **Fiala K. 1990.** Live and dead underground plant biomass in a natural meadow hydrosere. *Folia Geobotanica et Phytotaxonomica* **25**(2): 113-135.
- **Fiala K, Herrera R. 1988.** Living and dead belowground biomass and its distribution in some savanna communities in Cuba. *Folia Geobotanica et Phytotaxonomica* **23**(3): 225-237.

- **Fiala K, Studenty V. 1988.** Cutting and fertilization effect on the root system in several grassland stands. II. Vertical distribution of root biomass and changes in the carbohydrate content. *Ekologia* **7**: 27-42.
- **Finér L, Messier C, De Grandpré L. 1997.** Fine-root dynamics in mixed boreal conifer broad-leafed forest stands at different successional stages after fire. *Canadian Journal of Forest Research* **27**(3): 304-314.
- **Finn H, Brække. 1995.** Response of understorey vegetation and Scots pine root systems to fertilization at multiple deficiency stress. *Plant and Soil* **168-169**(1): 179-185.
- Fisher RA, Williams M, da Costa AL, Malhi Y, da Costa RF, Almeida S, Meir P. 2007. The response of an Eastern Amazonian rain forest to drought stress: results and modelling analyses from a throughfall exclusion experiment. *Global Change Biology* **13**(11): 2361-2378.\*
- **Fisk MC, Schmidt SK, Seastedt TR. 1998.** Topographic patterns of above- and belowground production and nitrogen cycling in alpine tundra. *Ecology* **79**(7): 2253-2266.
- Fitter AH, Graves JD, Wolfenden J, Self GK, Brown TK, Bogie D, Mansfield TA. 1997.

  Root production and turnover and carbon budgets of two contrasting grasslands under ambient and elevated atmospheric carbon dioxide concentrations. *New Phytologist* 137(2): 247-255.
- **Flombaum P, Sala OE. 2012.** Effects of plant species traits on ecosystem processes: experiments in the Patagonian steppe. *Ecology* **93**(2): 227-234.\*
- **Flower-Ellis JGK 1980.** Diurnal dry weight variation and dry matter allocation of some tundra plants. 2. *Rubus chamaemorus* L. In: Sonesson M ed. *Ecology of a Subarctic Mire*: Ecological Bulletin, 163-179.
- **Fogel R. 1983.** Root turnover and productivity of coniferous forests. *Plant and Soil* **71**(1-3): 75-85.
- **Fogel R, Hunt G. 1979.** Fungal and arboreal biomass in a western Oregon Douglas-fir ecosystem: distribution patterns and turnover. *Canadian Journal of Forest Research* **9**(2): 245-256.
- **Fogel R, Hunt G. 1983.** Contribution of mycorrhizae and soil fungi to nutrient cycling in a Douglas-fir ecosystem. *Canadian Journal of Forest Research* **13**(2): 219-232.
- **Foldats E, Rutkis E. 1975.** Ecological studies of chaparro (*Curatella americana* L.) and manteco (*Byrsonima crassifolia* H.B.K.) in Venezuela. *Journal of Biogeography* **2**(3): 159.\*
- **Follett RF, Allmaras RR, Reichman GA. 1974.** Distribution of corn roots in sandy soil with a declining water table. *Agronomy Journal* **66**(2): 288.\*
- **Fornara DA, Tilman D, Hobbie SE. 2009.** Linkages between plant functional composition, fine root processes and potential soil N mineralization rates. *Journal of Ecology* **97**(1): 48-56.\*
- Fort F, Cruz P, Catrice O, Delbrut A, Luzarreta M, Stroia C, Jouany C. 2015. Root functional trait syndromes and plasticity drive the ability of grassland Fabaceae to

- tolerate water and phosphorus shortage. *Environmental and Experimental Botany* **110**: 62-72.
- Fort F, Jouany C, Cruz P. 2012. Root and leaf functional trait relations in Poaceae species: implications of differing resource-acquisition strategies. *Journal of Plant Ecology* **6**(3): 211-219.
- Fort F, Volaire F, Guilioni L, Barkaoui K, Navas M-L, Roumet C, Watling J. 2017. Root traits are related to plant water-use among rangeland Mediterranean species. *Functional Ecology* 31(9): 1700-1709.\*
- **Frangi JL, Lugo AE. 1985.** Ecosystem dynamics of a subtropical floodplain forest. *Ecological Monographs* **55**(3): 351-369.\*
- **Franzluebbers AJ, Stuedemann JA. 2009.** Soil-profile organic carbon and total nitrogen during 12 years of pasture management in the Southern Piedmont USA. *Agriculture, Ecosystems & Environment* **129**(1-3): 28-36.\*
- Freckman DW, Virginia RA. 1989. Plant-feeding nematodes in deep-rooting desert ecosystems. *Ecology* 70(6): 1665.
- **Fredericksen TS, Zedaker SM. 1995.** Fine root biomass, distribution, and production in young pine-hardwood stands. *New Forests* **10**: 99-110.
- Freschet GT, Kichenin E, Wardle DA, de Bello F. 2015a. Explaining within-community variation in plant biomass allocation: a balance between organ biomass and morphology above vs below ground? *Journal of Vegetation Science* 26(3): 431-440.
- **Freschet GT, Swart EM, Cornelissen JHC. 2015b.** Integrated plant phenotypic responses to contrasting above- and below-ground resources: key roles of specific leaf area and root mass fraction. *New Phytologist* **206**(4): 1247-1260.
- Freycon V, Wonkam C, Fayolle A, Laclau J-P, Lucot E, Jourdan C, Cornu G, Gourlet-Fleury S. 2014. Tree roots can penetrate deeply in African semi-deciduous rain forests: evidence from two common soil types. *Journal of Tropical Ecology* 31(01): 13-23.\*
- **Friesen DK, Rao IM, Thomas RJ, Oberson A, Sanz JI. 1997.** Phosphorus acquisition and cycling in crop and pasture systems in low fertility tropical soils. *Plant and Soil* **196**(2): 289-294.
- **Fu X, Wang J, Wang H, Dai X, Yang F, Zhao M. 2015.** Response of the fine root production, phenology, and turnover rate of six shrub species from a subtropical forest to a soil moisture gradient and shading. *Plant and Soil* **399**(1-2): 135-146.
- **Fujii S, Takeda H. 2012.** Succession of collembolan communities during decomposition of leaf and root litter: Effects of litter type and position. *Soil Biology and Biochemistry* **54**: 77-85.\*
- **Fujimaki R, Takeda H, Wiwatiwitaya D. 2008.** Fine root decomposition in tropical dry evergreen and dry deciduous forests in Thailand. *Journal of Forest Research* **13**(6): 338-346.\*

- Gaines KP, Stanley JW, Meinzer FC, McCulloh KA, Woodruff DR, Chen W, Adams TS, Lin H, Eissenstat DM, Phillips N. 2016. Reliance on shallow soil water in a mixed-hardwood forest in central Pennsylvania. *Tree Physiology* 36(4): 444-458.\*
- **Garcia-Moya E, Castro PM 1992.** Saline grassland near Mexico City. In: Long SP, Jones MB, Roberts MJ eds. *Primary productivity of grass ecosystems of the tropics and sub-tropics*. London, UK: Chapman and Hall, 70-99.
- **Garelkov D 1973.** Biological productivity of some beech forest types in Bulgaria. In: Young HE ed. *IUFRO biomass studies*. Orono, Maine, USA: College of Sciences and Agriculture, University of Maine, 307-314.
- Gargaglione V, Peri PL, Rubio G. 2010. Allometric relations for biomass partitioning of *Nothofagus antarctica* trees of different crown classes over a site quality gradient. *Forest Ecology and Management* 259(6): 1118-1126.
- **Garkoti SC, Singh SP. 1995.** Variation in net primary productivity and biomass of forests in the high mountains of Central Himalaya. *Journal of Vegetation Science* **6**(1): 23-28.
- **Gasry L. 1963.** Distribution of five-stamen tamarisk seepwillow and arrowweed. *Forest Science* **9**(3): 311-314.\*
- **Gaze SR, Brouwer J, Simmonds LP, Bromley J. 1998.** Dry season water use patterns under *Guiera senegalensis* L. shrubs in a tropical savanna. *Journal of Arid Environments* **40**(1): 53-67.
- **Gebauer RLE, Tenhunen JD, Reynolds JF. 1996.** Soil aeration in relation to soil physical properties, nitrogen availability, and root characteristics within an arctic watershed. *Plant and Soil* **178**(1): 37-48.
- **Gehrmann J, Gerriets M, Puhe J, Ulrich B 1984.** Untersuchungen an Boden, Wurzeln, Nadeln und erste Ergebnisse von Depositions-messungen im Hils. In: Ulrich B ed. *Berichte des Forschungszentrum Waldokosysteme/Waldsterben*, 169.
- Gemmer EW. 1928. The root system of a longleaf pine. The Scientific Monthly 27(4): 384-384.\*
- **Gentile RM, Martino DL, Entz MH. 2003.** Root characterization of three forage species grown in southwestern Uruguay. *Canadian Journal of Plant Science* **83**(4): 785-788.\*
- Germon A, Cardinael R, Prieto I, Mao Z, Kim J, Stokes A, Dupraz C, Laclau J-P, Jourdan C. 2015. Unexpected phenology and lifespan of shallow and deep fine roots of walnut trees grown in a silvoarable Mediterranean agroforestry system. *Plant and Soil* 401(1-2): 409-426.\*
- **Gevorkiantz SR, Rudolf PO, Zehngraff PJ. 1943.** A tree classification for aspen, jack pine, and second-growth red pine. *Journal of Forestry* **41**: 268-274.\*
- **Gholz HL, Fisher RF, Prichett WL. 1985.** Nutrient dynamics in slash pine plantation ecosystems. *Ecology* **66**(3): 647.
- **Gholz HL, Hendry LC, Cropper WP, Jr. 1986.** Organic matter dynamics of fine roots in plantations of slash pine (*Pinus elliottii*) in north Florida. *Canadian Journal of Forest Research* **16**(3): 529-538.

- **Gibbens RP, Lenz JM. 2001.** Root systems of some Chihuahuan Desert plants. *Journal of Arid Environments* **49**(2): 221-263.\*
- **Giese M, Gao YZ, Zhao Y, Pan Q, Lin S, Peth S, Brueck H. 2009.** Effects of grazing and rainfall variability on root and shoot decomposition in a semi-arid grassland. *Applied Soil Ecology* **41**(1): 8-18.\*
- **Gijsman AJ, Alarcon HF, Thomas RJ. 1997.** Root decomposition in tropical grasses and legumes, as affected by soil texture and season. *Soil Biology and Biochemistry* **29**(9-10): 1443-1450.
- **Gill RA, Burke IC. 2002.** Influence of soil depth on the decomposition of Bouteloua gracilis roots in the shortgrass steppe. *Plant and Soil* **241**(2): 233-242.\*
- **Gill RA, Jackson RB. 2000.** Global patterns of root turnover for terrestrial ecosystems. *New Phytologist* **147**(1): 13-31.
- Gill RA, Jackson RB 2003. Global Distribution of Root Turnover in Terrestrial Ecosystems
- Girardin CAJ, Aragão LEOC, Malhi Y, Huaraca Huasco W, Metcalfe DB, Durand L, Mamani M, Silva-Espejo JE, Whittaker RJ. 2013. Fine root dynamics along an elevational gradient in tropical Amazonian and Andean forests. *Global Biogeochemical Cycles* 27(1): 252-264.
- **Giroux J-F, Bédard J. 1988.** Estimating above- and below-ground macrophyte production in *Scirpus* tidal marshes. *Canadian Journal of Botany* **66**(2): 368-374.
- **Gisi U, Oertli JJ. 1981.** Oekologische Entwicklung in Brachland verglichen mit Kulturwiesen. *Acta Oecologica Oecologia Plantarum* **2**: 79-86.
- Glatzel G 1983. Root distribution and soil water depletion in an oak-hornbeam stand (*Quercus petraea*, *Q. robur*, *Carpinus betulus*) and a spruce thicket (*Picea abies*). In: Bohm W, Kutschera L, Lichtenegger E eds. *Wurzelökologie und ihre Nutzanwendung/Root ecology and its practical application*. Irdning, F. R. Germany: Bundesanstalt für alpenländische Landwirtschaft Grumpenstein, 577-584.
- **Gloser V, Libera K, Orians CM. 2008.** Contrasting below- and aboveground responses of two deciduous trees to patchy nitrate availability. *Tree Physiology* **28**(1): 37-44.
- **Glover JD. 2010.** Harvested perennial grasslands: Ecological models for farming's perennial future. *Agriculture, Ecosystems & Environment* **137**(1-2): 1-2.\*
- **Glover PE. 1950.** The root systems of some British Somaliland plants—I. *The East African Agricultural Journal* **16**(2): 98-113.\*
- Goebel M, Hobbie SE, Bulaj B, Zadworny M, Archibald DD, Oleksyn J, Reich PB, Eissenstat DM. 2011. Decomposition of the finest root branching orders: linking belowground dynamics to fine-root function and structure. *Ecological Monographs* 81(1): 89-102.
- **Goldfarb D, Hendrick R, Pregitzer K. 1990.** Seasonal nitrogen and carbon concentrations in white, brown and woody fine roots of sugar maple (*Acer saccharum* Marsh). *Plant and Soil* **126**(1): 144-148.

- Golley F, Odum HT, Wilson RF. 1962. The structure and metabolism of a Puerto Rican red mangrove forest in May. *Ecology* 43(1): 9.
- **Göransson H, Fransson A-M, Jönsson-Belyazid U. 2007.** Do oaks have different strategies for uptake of N, K and P depending on soil depth? *Plant and Soil* **297**(1-2): 119-125.
- **Göransson H, Wallander H, Ingerslev M, Rosengren U. 2006.** Estimating the relative nutrient uptake from different soil depths in *Quercus robur*, *Fagus sylvatica* and *Picea abies*. *Plant and Soil* **286**(1-2): 87-97.
- Gordon WS, Jackson RB. 2000. Nutrient concentrations in fine roots. *Ecology* 81(1): 275-280.
- Gordon WS, Jackson RB. 2003. Global distribution of root nutrient concentrations in terrestrial ecosystems. Available on-line [http://www.daac.ornl.gov/] from Oak Ridge National Laboratory Distributed Active archive Center, Oak Ridge, Tennessee, U.S.A.
- **Gower ST. 1987.** Relations between mineral nutrient availability and fine root biomass in two Costa Rican tropical wet forests: A hypothesis. *Biotropica* **19**(2): 171.
- Gower ST, Vogt KA, Grier CC. 1992. Carbon dynamics of Rocky Mountain Douglas-fir: Influence of water and nutrient availability. *Ecological Monographs* 62(1): 43.
- **Graaff M-Ad, Six J, Jastrow JD, Schadt CW, Wullschleger SD. 2013.** Variation in root architecture among switchgrass cultivars impacts root decomposition rates. *Soil Biology and Biochemistry* **58**: 198-206.
- **Graham JH, Syvertsen JP. 1985.** Host determinants of mycorrhizal dependency of citrus rootstock seedlings. *New Phytologist* **101**(4): 667-676.\*
- **Greenland DJ, Kowal JML. 1960.** Nutrient content of the moist tropical forest of Ghana. *Plant and Soil* **12**(2): 154-173.
- **Greenwood KL, Hutchinson KJ. 1998.** Root characteristics of temperate pasture in New South Wales after grazing at three stocking rates for 30 years. *Grass and Forage Science* **53**(2): 120-128.
- Grier CC, Ballard TM. 1981. Biomass, nutrient distribution, and net production in alpine communities of the Kluane Mountains, Yukon Territory, Canada. *Canadian Journal of Botany* 59(12): 2635-2649.
- **Grier CC, Logan RS. 1977.** Old-growth *Pseudotsuga menziesii* communities of a western Oregon watershed: biomass distribution and production budgets. *Ecological Monographs* **47**(4): 373.
- **Grier CC, Milne WA. 1981.** Regression equations for calculating component biomass of young *Abies amabilis* (Dougl.) Forbes. *Canadian Journal of Forest Research* **11**(1): 184-187.
- **Grier CC, Vogt KA, Keyes MR, Edmonds RL. 1981.** Biomass distribution and above- and below-ground production in young and mature *Abies amabilis* zone ecosystems of the Washington Cascades. *Canadian Journal of Forest Research* **11**(1): 155-167.
- Gries D, Zeng F, Foetzki A, Arndt SK, Bruelheide H, Thomas FM, Zhang X, Runge M. 2003. Growth and water relations of *Tamarix ramosissima* and *Populus euphratica* on Taklamakan desert dunes in relation to depth to a permanent water table. *Plant, Cell and Environment* 26(5): 725-736.\*

- **Groeneveld DP, Crowley DE. 1988.** Root system response to flooding in three desert shrub species. *Functional Ecology* **2**(4): 491.\*
- **Grogan P, Jonasson S. 2003.** Controls on annual nitrogen cycling in the understory of a subarctic birch forest. *Ecology* **84**(1): 202-218.
- **Grogan P, Michelsen A, Ambus P, Jonasson S. 2004.** Freeze—thaw regime effects on carbon and nitrogen dynamics in sub-arctic heath tundra mesocosms. *Soil Biology and Biochemistry* **36**(4): 641-654.
- **Groot JJ, Kone D, Traore M, Kamissoko N. 1998.** Description du système racinaire de l'*Andropogon gayanus*, du *Vigna unguiculata* et du *Stylosanthes hamata* en zone soudano-sahélienne. *Biotechnology, Agronomy, Society and Environment* **2**(2): 106-119.
- **Groves RH, Specht RL. 1965.** Growth of heath vegetation I. Annual growth curves of two heath ecosystems in Australia. *Australian Journal of Botany* **13**: 261-280.
- **Growenveld DP 1989**. Shrub rooting and water acquisition on threatened shallow groundwater habitats in the Owens Valley, California. *Symposium on cheatgrass invasion, shrub dieoff, and other aspects of shrub biology and management*. U.S.D.A. Forest Service Intermountain Research Station, Ogden, Utah, USA. 221-237.
- **Gu J, Wang Y, Fahey TJ, Wang Z. 2017.** Effects of root diameter, branch order, soil depth and season of birth on fine root life span in five temperate tree species. *European Journal of Forest Research* **136**: 727-738.\*
- Gu J, Xu Y, Dong X, Wang H, Wang Z. 2014. Root diameter variations explained by anatomy and phylogeny of 50 tropical and temperate tree species. *Tree Physiology* 34(4): 415-425.
- **Guo D, Mitchell RJ, Withington JM, Fan P-P, Hendricks JJ. 2008a.** Endogenous and exogenous controls of root life span, mortality and nitrogen flux in a longleaf pine forest: root branch order predominates. *Journal of Ecology* **96**(4): 737-745.
- **Guo D, Xia M, Wei X, Chang W, Liu Y, Wang Z. 2008b.** Anatomical traits associated with absorption and mycorrhizal colonization are linked to root branch order in twenty-three Chinese temperate tree species. *New Phytologist* **180**(3): 673-683.\*
- **Guo DL, Mitchell RJ, Hendricks JJ. 2004.** Fine root branch orders respond differentially to carbon source-sink manipulations in a longleaf pine forest. *Oecologia* **140**(3): 450-457.
- **Guo LB, Wang M, Gifford RM. 2007.** The change of soil carbon stocks and fine root dynamics after land use change from a native pasture to a pine plantation. *Plant and Soil* **299**(1-2): 251-262.
- Guo X, Lu X, Tong S, Dai G. 2008. Influence of environment and substrate quality on the decomposition of wetland plant root in the Sanjiang Plain, Northeast China. *Journal of Environmental Sciences* 20(12): 1445-1452.\*
- Guo Y-Y, Wang J-J, Kong D-L, Wang W, Guo D-L, Wang Y-B, Xie Q-L, Liu Y-S, Zeng H. 2013. Fine root branch orders contribute differentially to uptake, allocation, and return of potentially toxic metals. *Environmental Science & Technology* 47(20): 11465-11472.

- **Gupta SR, Singh JS. 1981.** The effect of plant species, weather variables and chemical composition of plant material on decomposition in a tropical grassland. *Plant and Soil* **59**(1): 99-117.\*
- **Gupta SR, Singh JS. 1982.** Influence of floristic composition on the net primary production and dry matter turnover in a tropical grassland. *Austral Ecology* **7**(4): 363-374.
- **Haase P, Pugnaire FI, Fernández EM, Puigdefábregas J, Clark SC, Incoll LD. 1996.** An investigation of rooting depth of the semiarid shrub *Retama sphaerocarpa* (L.) Boiss. by labelling of ground water with a chemical tracer. *Journal of Hydrology* **177**(1-2): 23-31.\*
- **Haasis FW. 1921.** Relations between soil type and root form of western yellow pine seedlings. *Ecology* **2**(4): 292-303.\*
- **Hackney CT, De La Cruz AA. 1980.** In situ decomposition of roots and rhizomes of two tidal marsh plants. *Ecology* **61**(2): 226-231.\*
- **Hackney CT, de la Cruz AA. 1986.** Belowground productivity of roots and rhizomes in a giant cordgrass marsh. *Estuaries* **9**(2): 112.
- **Haigh H. 1966.** Root development in the sandy soils of Zulu land. *Forestry in South Africa* **7**: 31-36.\*
- **Hajek P, Hertel D, Leuschner C. 2014.** Root order- and root age-dependent response of two poplar species to belowground competition. *Plant and Soil* **377**(1-2): 337-355.
- **Hansson AC, Aifen Z, Andrén O. 1995.** Fine-root production and mortality in degraded vegetation in Horqin Sandy Rangeland in Inner Mongolia, China. *Arid Soil Research and Rehabilitation* **9**(1): 1-13.
- **Hansson K, Helmisaari H-S, Sah SP, Lange H. 2013.** Fine root production and turnover of tree and understorey vegetation in Scots pine, silver birch and Norway spruce stands in SW Sweden. *Forest Ecology and Management* **309**: 58-65.
- **Hao Y-r, Peng S-l, Mo J-m, Liu X-w, Chen Z-q, Zhou K, Wu J-r. 2006.** Roots of pioneer trees in the lower sub-tropical area of Dinghushan, Guangdong, China. *Journal of Zhejiang University SCIENCE B* **7**(5): 377-385.\*
- **Harris WF, Goldstein RA, Henderson GS 1973.** Analysis of forest biomass pools, annual primary production and turnover of biomass for a mixed deciduous forest watershed. In: Young HE ed. *IUFRO Biomass Studies*. Orono, Maine: University of Maine, 41-64.
- Harris WF, Kinerson RS, Jr., Edwards NT 1977. Comparison of below-ground biomass of natural deciduous forests and loblolly pine plantations. In: Marshall JK ed. *The Belowground Ecosystem: A Synthesis of Plant-Associated Processes*. New York, New York, USA: Dowden, Hutchinson and Ross
- **Harris WF, Kinerson RS, Jr., Edwards NT. 1977.** Comparison of belowground biomass of natural deciduous forest and loblolly pine plantations. *Pedobiologia* **17**: 369-381.
- **Hartmann M. 1999.** Species dependent root decomposition in rewetted fen soils. *Plant and Soil* **213**(1/2): 93-98.\*

- **Haug I, Feger KH. 1990.** Effects of fertilization with MgSO<sub>4</sub> and (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> on soil solution chemistry, mycorrhiza and nutrient content of fine roots in a Norway spruce stand. *Water, Air, & Soil Pollution* **54**(3): 453-467.
- **Hausdörfer HD. 1957.** Die Durchwurzelun unter Kiefer auf zwei Standorten des Choriner Sandes. *Archif für Forstwesen* **6**: 811-827.
- **Haworth F. 1953.** Observations on the root system of Guatemala grass on an upland tea soil in Ceylon. *Tropical Agriculture* **30**: 116-121.
- **Hayes DC, Seastedt TR. 1987.** Root dynamics of tallgrass prairie in wet and dry years. *Botany* **65**(4): 787-791.
- **Haynes BE, Gower ST. 1995.** Belowground carbon allocation in unfertilized and fertilized red pine plantations in northern Wisconsin. *Tree Physiology* **15**(5): 317-325.
- **He W-M, Zhang X-S. 2003.** Responses of an evergreen shrub *Sabina vulgaris* to soil water and nutrient shortages in the semi-arid Mu Us Sandland in China. *Journal of Arid Environments* **53**(3): 307-316.\*
- **Heal OW, Jones HE, Whittaker JB 1975.** Moor House, UK. In: Rosswall T, Heal OW eds. *Structure and function of tundra ecosystems.* Stockholm, Sweden: Ecology Bulletin, 295-320.
- **Heilman PE, Gessel SP. 1963.** Nitrogen requirements and the biological cycling of nitrogen in douglas-fir stands in relationship to the effects of nitrogen fertilization. *Plant and Soil* **18**(3): 386-402.
- **Heim A, Frey B. 2004.** Early stage litter decomposition rates for Swiss forests. *Biogeochemistry* **70**(3): 299-313.\*
- **Heitschmidt RK, Ansley RJ, Dowhower SL, Jacoby PW, Price DL. 1988.** Some observations from the excavation of honey mesquite root systems. *Journal of Range Management* **41**(3): 227.
- **Hellmers H, Horton JS, Juhren G, O'Keefe J. 1955.** Root systems of some chaparral plants in southern California. *Ecology* **36**(4): 667-678.\*
- **Hemminga MA, Kok CJ, de Munck W. 1988.** Decomposition of *Spartina anglica* roots and rhizomes in a salt marsh of the Westerschelde Estuary. *Marine Ecology Progress Series* **48**: 175-184.\*
- **Hendrick RL, Pregitzer KS. 1993.** The dynamics of fine root length, biomass, and nitrogen content in two northern hardwood ecosystems. *Canadian Journal of Forest Research* **23**(12): 2507-2520.
- **Hendrick RL, Pregitzer KS. 1996.** Temporal and Depth-Related Patterns of Fine Root Dynamics in Northern Hardwood Forests. *The Journal of Ecology* **84**(2): 167-176.\*
- **Hendriks CMA, Bianchi FJJA. 1995.** Root density and root biomass in pure and mixed forest stands of Douglas-fir and beech. *Netherlands Journal of Agricultural Science* **43**: 321-331.

- **Henry GHR, Svoboda J, Freedman B. 1990.** Standing crop and net production of sedge meadows of an ungrazed polar desert oasis. *Canadian Journal of Botany* **68**(12): 2660-2667.
- **Henry HAL, Jefferies RL. 2003.** Plant amino acid uptake, soluble N turnover and microbial N capture in soils of a grazed Arctic salt marsh. *Journal of Ecology* **91**(4): 627-636.
- **Herkelrath WN, Miller EE, Gardner WR. 1977.** Water uptake by plants: I. Divided root experiments. *Soil Science Society of America Journal* **41**(6): 1033.
- **Hertel D, ed. 1999.** Das Feinwurzelsystem von Rein- und Mischbeständen der Rotbuche: Struktur, Dynamik und interspezifische Konkurrenz. Dissertationes Botanicae. Berlin, Germany
- Hertel D, Strecker T, Müller-Haubold H, Leuschner C, Guo D. 2013. Fine root biomass and dynamics in beech forests across a precipitation gradient is optimal resource partitioning theory applicable to water-limited mature trees? *Journal of Ecology* **101**(5): 1183-1200.
- **Heyel SM, Day FP. 2006.** Long-term residual effects of nitrogen addition on a barrier island dune ecosystem. *The Journal of the Torrey Botanical Society* **133**(2): 297-303.
- **Heyward F. 1933.** The root system of longleaf pine on the deep sands of western Florida. *Ecology* **14**(2): 136-148.\*
- **Higgins KB, Lamb AJ, van Wilgen BW. 1987.** Root systems of selected plant species in mesic mountain fynbos in the Jonkershoek Valley, south-western Cape Province. *South African Journal of Botany* **53**(3): 249-257.\*
- **Hill GB, Henry GHR. 2011.** Responses of High Arctic wet sedge tundra to climate warming since 1980. *Global Change Biology* **17**(1): 276-287.
- **Hill JO, Simpson RJ, Moore AD, Chapman DF. 2006.** Morphology and response of roots of pasture species to phosphorus and nitrogen nutrition. *Plant and Soil* **286**(1-2): 7-19.
- **Hipondoka MHT, Aranibar JN, Chirara C, Lihavha M, Macko SA. 2003.** Vertical distribution of grass and tree roots in arid ecosystems of Southern Africa: niche differentiation or competition? *Journal of Arid Environments* **54**(2): 319-325.\*
- **Hironaka M. 1961.** The relative rate of root development of cheatgrass and medusahead. *Journal of Range Management* **14**(5): 263.\*
- **Hishi T, Takeda H. 2005.** Dynamics of heterorhizic root systems: protoxylem groups within the fine-root system of *Chamaecyparis obtusa*. *New Phytologist* **167**(2): 509-521.
- **Hnatiuk RJ 1993.** Grasslands of the sub-antarctic islands. In: Coupland RT ed. *Natural Grasslands*. Amsterdam, Netherlands: Elsevier, 411-482.
- **Hobbie JE, Hobbie EA. 2006.** <sup>15</sup>N in symbiotic fungi and plants estimates nitrogen and carbon flux rates in Arctic tundra. *Ecology* **87**(4): 816-822.
- **Hobbie SE. 1996.** Temperature and plant species control over litter decomposition in Alaskan tundra. *Ecological Monographs* **66**(4): 503.
- **Hobbie SE, Chapin FS. 1998.** The response of tundra plant biomass, aboveground production, nitrogen, and CO<sub>2</sub> flux to experimental warming. *Ecology* **79**(5): 1526-1544.

- **Hobbie SE, Oleksyn J, Eissenstat DM, Reich PB. 2009.** Fine root decomposition rates do not mirror those of leaf litter among temperate tree species. *Oecologia* **162**(2): 505-513.
- **Hoffmann A, Kummerow J. 1978.** Root studies in the Chilean matorral. *Oecologia* **32**(1): 57-69.\*
- **Holdaway RJ, Richardson SJ, Dickie IA, Peltzer DA, Coomes DA. 2011.** Species- and community-level patterns in fine root traits along a 120,000-year soil chronosequence in temperate rain forest. *Journal of Ecology* **99**(4): 954-963.
- **Holdo RM, Timberlake J. 2008.** Rooting depth and above-ground community composition in Kalahari sand woodlands in western Zimbabwe. *Journal of Tropical Ecology* **24**(02): 169-176.\*
- **Honer TG 1971.** Weight relations in open- and forest-grown balsam fir trees. In: Young HE ed. *Forest Biomass Studies*. Orono, Maine, USA: University of Maine, 65-77.
- Hong J, Ma X, Yan Y, Zhang X, Wang X. 2017. Which root traits determine nitrogen uptake by alpine plant species on the Tibetan Plateau? *Plant and Soil\**
- **Hopkins MS, Reddell P, Hewett RK, Graham AW. 2009.** Comparison of root and mycorrhizal characteristics in primary and secondary rainforest on a metamorphic soil in North Queensland, Australia. *Journal of Tropical Ecology* **12**(06): 871.
- **Horsegood PH. 1963.** The root distribution of Kikuyu grass and Wattle trees. *East African Agricultural and Forestry Journal* **29**(60-61)
- **Horton HW. 1957.** Department of Northern Affairs and National Resources: Appointments. *Nature* **180**(4580): 270-270.\*
- **Hosegood PH, Howland P. 1966.** A preliminary study of the root distribution of some exotic tree crops, evaluated by a rapid sampling method. *East African Agricultural and Forestry Journal* **32**: 16-18.\*
- **Howard A. 1925.** The Effect of Grass on Trees. *Proceedings of the Royal Society B: Biological Sciences* **97**(683): 284-321.\*
- **Hozumi K, Yoda K, Kokawa S, Kira T 1969.** Production ecology of tropical rain forests in SW Cambodia. I. Plant biomass. In: Kira T, Umesad T eds. *Nature and Life in Southeast Asia*. Kyoto, Japan: Fauna and Flora Research Society, 1-51.
- **Hu F, Mou PP, Weiner J, Li S. 2014.** Contrasts between whole-plant and local nutrient levels determine root growth and death in *Ailanthus altissima* (Simaroubaceae). *American Journal of Botany* **101**(5): 812-819.\*
- **Huang G, Zhao X-y, Zhao H-l, Huang Y-x, Zuo X-a. 2010.** Linking root morphology, longevity and function to root branch order: a case study in three shrubs. *Plant and Soil* **336**(1-2): 197-208.\*
- **Hubble TCT, Docker BB, Rutherfurd ID. 2010.** The role of riparian trees in maintaining riverbank stability: A review of Australian experience and practice. *Ecological Engineering* **36**(3): 292-304.\*
- **Hulbert LC. 1955.** Ecological studies of *Bromus tectorum* and other annual bromegrasses. *Ecological Monographs* **25**(2): 181.

- Hungate BA, Day FP, Dijkstra P, Duval BD, Hinkle CR, Langley JA, Megonigal JP, Stiling P, Johnson DW, Drake BG. 2013. Fire, hurricane and carbon dioxide: effects on net primary production of a subtropical woodland. *New Phytologist* 200(3): 767-777.
- **Huttel C. 1975.** Root distribution and biomass in three ivory coast rain forest plots. *Tropical Ecological Systems* **11**: 123-130.
- Ignatenko IV, Khakimzyanova FI. 1971a. Ekologia 4: 17-24.
- **Ignatenko IV, Khakimzyanova FI. 1971b.** Soils and total phytomass reserves in dwarf birch white dryas and willow tundras of the east European northlands. *Soviet Journal of Ecology* **2**: 300-305.
- **Ignatenko IV, Knorre AV, Lovelius NV, Norin BN 1972.** Standing crop in plant communities at the station Ary-Mas. In: Wielgolaski FE, Rosswall T eds. *Tundra biome*. Stockholm, Sweden: International Biological Programme Tundra Biome Steering Committee, 140-148.
- **Imada S, Yamanaka N, Tamai S. 2008.** Water table depth affectsPopulus albafine root growth and whole plant biomass. *Functional Ecology* **22**(6): 1018-1026.
- **Imai N, Kitayama K, Titin J. 2010.** Distribution of phosphorus in an above-to-below-ground profile in a Bornean tropical rain forest. *Journal of Tropical Ecology* **26**(06): 627-636.\*
- **Ingham RE, Detling JK. 1984.** Plant-herbivore interactions in a North American mixed-grass prairie. *Oecologia* **63**(3): 307-313.
- **Intergovernmental Panel on Climate C. 2014.** Summary for Policymakers. 1-30.\*
- **Isagi Y, Kawahara T, Kamo K, Ito H. 1997.** Net production and carbon cycling in a bamboo *Phyllostachys pubescens* stand. *Plant Ecology* **130**(1): 41-52.
- **Iversen CM, Keller JK, Garten CT, Norby RJ. 2012.** Soil carbon and nitrogen cycling and storage throughout the soil profile in a sweetgum plantation after 11 years of CO<sub>2</sub>-enrichment. *Global Change Biology* **18**(5): 1684-1697.\*
- **Iversen CM, Ledford J, Norby RJ. 2008.** CO<sub>2</sub> enrichment increases carbon and nitrogen input from fine roots in a deciduous forest. *New Phytologist* **179**(3): 837-847.
- Iversen CM, Sloan VL, Sullivan PF, Euskirchen ES, McGuire AD, Norby RJ, Walker AP, Warren JM, Wullschleger SD 2014. Plant Root Characteristics and Dynamics in Arctic Tundra Ecosystems, 1960-2012. In Next Generation Ecosystem Experiments Arctic Data Collection CDIAC, Oak Ridge National Laboratory. New Phytologist: Wiley-Blackwell
- **Jackson RB, Banner JL, Jobbágy EG, Pockman WT, Wall DH. 2002.** Ecosystem carbon loss with woody plant invasion of grasslands. *Nature* **418**(6898): 623-626.
- **Jackson RB, Caldwell MM. 1992.** Shading and the capture of localized soil nutrients: nutrient contents, carbohydrates, and root uptake kinetics of a perennial tussock grass. *Oecologia* **91**(4): 457-462.
- **Jackson RB, Canadell J, Ehleringer JR, Mooney HA, Sala OE, Schulze ED. 1996.** A global analysis of root distributions for terrestrial biomes. *Oecologia* **108**(3): 389-411.
- **Jackson RB, Mooney HA, Schulze ED 2003**. Global Distribution of Fine Root Biomass in Terrestrial Ecosystems

- **Jackson RB, Moore LA, Hoffmann WA, Pockman WT, Linder CR. 1999.** Ecosystem rooting depth determined with caves and DNA. *Proceedings of the National Academy of Sciences* **96**(20): 11387-11392.\*
- Jackson RB, Schenk HJ 2003. Global Distribution of Root Profiles in Terrestrial Ecosystems
- **Jain SK. 1971.** Production studies in some grasslands of Sagar. PhD, Saugar University Sagar, India.
- **Jalota RK, Dalal RC, Harms BP, Page K, Mathers NJ, Wang WJ. 2006.** Effects of litter and fine root composition on their decomposition in a rhodic paleustalf under different land uses. *Communications in Soil Science and Plant Analysis* **37**(13-14): 1859-1875.
- **Jama B, Ndufa JK, Buresh RJ, Shepherd KD. 1998.** Vertical distribution of roots and soil nitrate: tree species and phosphorus effects. *Soil Science Society of America Journal* **62**(1): 280.
- **Jaramillo VJ, Ahedo-Hernández R, Kauffman JB. 2003.** Root biomass and carbon in a tropical evergreen forest of Mexico: changes with secondary succession and forest conversion to pasture. *Journal of Tropical Ecology* **19**(04): 457-464.\*
- **Jeffery RP, Simpson RJ, Lambers H, Kidd DR, Ryan MH. 2016.** Root morphology acclimation to phosphorus supply by six cultivars of *Trifolium subterraneum* L. *Plant and Soil* **412**(1-2): 21-34.\*
- **Jenik J 1969**. Root structure and underground biomass of equatorial forests. In Duvigneaud P. *Brussels symp.*, *Ecology and Conservation*. Paris, France: UNESCO. 323-331.
- **Jenik J, ed. 1971.** Root structure and underground biomass in equatorial forests. Productivity of Forest Ecosystems. Paris, France: UNESCO.
- **Jenkin JF 1975.** Macquarie Island, Subantarctic. In: Rosswall T, Heal OW eds. *Structure and Function of tundra ecosystems*. Stockholm, Sweden: Ecology Bulletin, 375-397.
- **Jennings CMH. 1974.** *The Hydrogeology of Botswana*. Ph.D, University of Natal Natal, South Africa.\*
- **Jia S, McLaughlin NB, Gu J, Li X, Wang Z. 2013.** Relationships between root respiration rate and root morphology, chemistry and anatomy in *Larix gmelinii* and *Fraxinus mandshurica*. *Tree Physiology* **33**(6): 579-589.
- **Jia S, Wang Z, Li X, Sun Y, Zhang X, Liang A. 2010.** N fertilization affects on soil respiration, microbial biomass and root respiration in *Larix gmelinii* and *Fraxinus mandshurica* plantations in China. *Plant and Soil* **333**(1-2): 325-336.
- **Jia S, Wang Z, Li X, Zhang X, McLaughlin NB. 2011.** Effect of nitrogen fertilizer, root branch order and temperature on respiration and tissue N concentration of fine roots in *Larix gmelinii* and *Fraxinus mandshurica*. *Tree Physiology* **31**(7): 718-726.
- **Jia SX, Zhao YL, Ding GQ, Sun Y, Wang ZQ. 2010.** Relationship among fine-root morphology, anatomy, tissue nitrogen concentration and respiration in different branch root orders in *Larix gmelinii* and *Fraxinus mandshurica*. *Chinese Bulletin of Botany* **45**: 174-181.

- **Jimenez EM, Moreno FH, Lloyd J, Penuela MC, Patino S. 2009.** Fine root dynamics for forests on contrasting soils in the colombian Amazon. *Biogeosciences Discussions* **6**(2): 3415-3453.\*
- **Jiménez EM, Moreno FH, Peñuela MC, Patiño S, Lloyd J. 2009.** Fine root dynamics for forests on contrasting soils in the Colombian Amazon. *Biogeosciences* **6**(12): 2809-2827.
- **Jipp PH, Nepstad DC, Cassel DK, Reis De Carvalho C. 1998.** Deep soil moisture storage and transpiration in forests and pastures of seasonally-dry Amazonia. *Climatic Change* **39**(2/3): 395-412.\*
- **Jo I, Fridley JD, Frank DA. 2014.** Linking above- and belowground resource use strategies for native and invasive species of temperate deciduous forests. *Biological Invasions* **17**(5): 1545-1554.\*
- **Jo I, Fridley JD, Frank DA. 2016.** More of the same? *In situ* leaf and root decomposition rates do not vary between 80 native and nonnative deciduous forest species. *New Phytologist* **209**(1): 115-122.
- **Jobbagy EG, Jackson RB. 2004.** Groundwater use and salinization with grassland afforestation. *Global Change Biology* **10**(8): 1299-1312.\*
- **Jobbagy EG, Nosetto MD, Villagra PE, Jackson RB. 2011.** Water subsidies from mountains to deserts: their role in sustaining groundwater-fed oases in a sandy landscape. *Ecological Applications* **21**(3): 678-694.\*
- **Joffre R, Leiva Morales MJ, Rambal S, Fernandez Ales R. 1987.** Dynamique racinaire et extraction de l'eau du sol par des graminées pérennes et annuelles méditerranéennes. *Acta Oecologica Oecologia Plantarum* **8**: 181-194.
- **John B, Pandey H, Tripathi R. 2002.** Decomposition of fine roots of *Pinus kesiya* and turnover of organic matter, N and P of coarse and fine pine roots and herbaceous roots and rhizomes in subtropical pine forest stands of different ages. *Biology and Fertility of Soils* **35**(4): 238-246.\*
- **Johnsen TN. 1962.** One-seed juniper invasion of Northern Arizona grasslands. *Ecological Monographs* **32**(3): 187.
- **Johnson DM, Domec JC, Woodruff DR, McCulloh KA, Meinzer FC. 2013.** Contrasting hydraulic strategies in two tropical lianas and their host trees. *American Journal of Botany* **100**(2): 374-383.\*
- **Johnstone WD 1971.** Total standing crop and tree component distributions in three stands of 100-year-old lodgepole pine. In: Young HE ed. *Forest Biomass Studies*. Orono, Maine: University of Maine, 81-89.
- **Jonasson S, Callaghan TV. 1992.** Root mechanical properties related to disturbed and stressed habitats in the Arctic. *New Phytologist* **122**(1): 179-186.
- **Jones HE, Gore AJP 1981.** A simulation approach to primary production. In: Bliss LC, Heal OW, Moore JJ eds. *Tundra Ecosystems: A Comparative Analysis*. Cambridge, UK: Cambridge University Press, 241-256.

- **Jones MB, Muthuri FM. 2009.** Standing biomass and carbon distribution in a papyrus (*Cyperus papyrus* L.) swamp on Lake Naivasha, Kenya. *Journal of Tropical Ecology* **13**(03): 347.
- **Jones RH, Lockaby BG, Somers GL. 1996.** Effects of Microtopography and Disturbance on Fine-Root Dynamics in Wetland Forests of Low-Order Stream Floodplains. *American Midland Naturalist* **136**(1): 57-71.\*
- **Jonsson K, Fidjeland L, Maghembe JA, Högberg P. 1988.** The vertical distribution of fine roots of five tree species and maize in Morogoro, Tanzania. *Agroforestry Systems* **6**(1-3): 63-69.
- **Jordan CF, Escalante G. 1980.** Root productivity in an Amazonian rain forest. *Ecology* **61**(1): 14.
- **Jordan PW, Nobel PS. 1984.** Thermal and water relations of roots of desert succulents. *Annals of Botany* **54**: 705-718.
- **Joshi SK, Pati DP, Behera N. 1990.** Primary production of herbaceous layer in a tropical deciduous forest in Orissa, India. *Tropical Ecology* **31**: 73-83.
- **Joslin JD, Gaudinski JB, Torn MS, Riley WJ, Hanson PJ. 2006.** Fine-root turnover patterns and their relationship to root diameter and soil depth in a <sup>14</sup>C-labeled hardwood forest. *New Phytologist* **172**(3): 523-535.\*
- **Joslin JD, Henderson GS. 1987.** Organic matter and nutrients associated with fine root turnover in a white oak stand. *Forest Science* **33**: 330-346.
- **Kaletkina NG 1974.** Sezonnoe razvitie rastitel'nosti subal'pijskoj raznotravnoj stepi i kriofil'ioj pustoshi Gissarskogo chrebta (Seasonal development of vegetation in the subalpine steppe and cryophytic heath of the Hissar Mountains). In: Ovchinnikov PN ed. *Rastitel'nost' Tadzhikistana i eë osvoenie (Vegetation of Tajikistan and its use)*. Donish, Dushanbe, 7-41.
- **Kalisz PJ, Zimmerman RW, Muller RN. 1987.** Root density, abundance, and distribution in the mixed mesophytic forest of eastern Kentucky. *Soil Science Society of America Journal* **51**(1): 220.
- **Kamnalrut A, Evenson JP 1992.** Monsoon grassland in Thailand. In: Long SP, Jones MB, Roberts MJ eds. *Primary productivity of grass ecosystems of the tropics and sub-tropics*. London, UK: Chapman and Hall, 100-126.
- **Kandeler E, Eder G, Sobotik M. 1994.** Microbial biomass, N mineralization, and the activities of various enzymes in relation to nitrate leaching and root distribution in a slurry-amended grassland. *Biology and Fertility of Soils* **18**(1): 7-12.
- **Kangas P. 1992.** Root regrowth in a subtropical wet forest in Puerto Rico. *Biotropica* **24**(3): 463.
- **Karasz I. 1996.** The root system of *Juniperus communis* L. in a sandy soil in Central Hungary. *Acta Phytogeographica Suecica* **81**: 32-34.\*
- **Karimov KK, Molotkovski YI. 1996.** Root distribution of natural vegetation at high altitudes in Pamiro-Alai in Tajikistan. *Acta Phytogeographica Suecica*(81): 83-85.\*

- **Karizumi N 1968.** Estimation of root biomass in forests by soil block sampling. In: Ghilarov MS ed. *Methods of Productivity Studies in Root Systems and Rhizosphere Organisms*. Leningrad, Russia: Nauka, 79-86.
- **Karizumi N 1978.** Underground biomass. In: Kira T, Ono Y, Hosokawa T eds. *Biological production in a warm-temperate evergreen oak forest of Japan*. Tokyo, Japan: University of Tokyo Press, 82-88.
- **Karizumi N. 1979.** *Root system forms and distribution of individual trees in Japan.* Tokyo, Japan: Seibundo Shinkosa Publishing co. Ltd.\*
- **Karpov VG, ed. 1983.** Faktory reguliatsii ekosistem elovykh lesov (Regulation factors of spruce forest ecosystems). Nauka, Leningrad, Russia
- **Karrfalt EE. 1981.** The comparative and developmental morphology of the root system of *Selaginella selaginoides* (L.) Link. *American Journal of Botany* **68**(2): 244.\*
- **Kebin Z. 1989.** The growth of man-made forests of *Haloxylon ammodendron* and their soil water contents in the Minqin desert region, Gansu Province, China. *Journal of Arid Environments* **17**: 109-115.
- **Keith H, Raison RJ, Jacobsen KL. 1997.** Allocation of carbon in a mature eucalypt forest and some effects of soil phophorus availability. *Plant and Soil* **196**(1): 81-99.
- **Kellman M. 2009.** Root proliferation in recent and weathered sandy soils from Veracruz, Mexico. *Journal of Tropical Ecology* **6**(03): 355-370.\*
- **Kellman M, Roulet N. 1990.** Nutrient flux and retention in a tropical sand-dune succession. *The Journal of Ecology* **78**(3): 664.
- **Kellman M, Sanmugadas K. 1985.** Nutrient retention by savanna ecosystems: I. Retention in the absence of fire. *The Journal of Ecology* **73**(3): 935.
- Kenzo T, Ichie T, Hattori D, Itioka T, Handa C, Ohkubo T, Kendawang JJ, Nakamura M, Sakaguchi M, Takahashi N, et al. 2009. Development of allometric relationships for accurate estimation of above- and below-ground biomass in tropical secondary forests in Sarawak, Malaysia. *Journal of Tropical Ecology* 25(04): 371-386.\*
- **Kerfoot O. 1963.** The root systems of tropical trees. *The Commonwealth Forestry Review* **42**(1): 19-26.\*
- **Kern CC, Friend AL, Johnson JMF, Coleman MD. 2004.** Fine root dynamics in a developing *Populus deltoides* plantation. *Tree Physiology* **24**(6): 651-660.
- **Kern KG, Moll W, Braun HJ. 1961.** Wurzeluntersuchungen in Rein- und Mischbeständen des Hochschwarzwaldes (Vfl. Todtmoos 2/I-IV). (The rooting in pure and mixed stands of the upper Black Forest, experimental plot Todtmoos 2/I-IV). *Allgemeine Forst- und Jagdzeitung* **132**: 241-260.
- **Kestemont P 1982.** In: Cannell MGR ed. *World forest biomass and primary production data*. London, UK: Academic Press, 27.
- **Keuper FK. 2012.** Direct and indirect effects of climatic changes on vegetation productivity and species composition of permafrost peatlands. PhD, VU University Amsterdam, the Netherlands.

- **Keyes MR, Grier CC. 1981.** Above- and below-ground net production in 40-year-old Douglasfir stands on low and high productivity sites. *Canadian Journal of Forest Research* **11**(3): 599-605.
- **Khiewtam RS, Ramakrishnan PS. 1993.** Litter and fine root dynamics of a relict sacred grove forest at Cherrapunji in north-eastern India. *Forest Ecology and Management* **60**(3-4): 327-344.
- **Khodachek EA. 1971.** Vegetal matter of tundra phytocoenoses in the western part of Taymyr Peninsula. *Botanicheskii Zhurnal* **54**: 1059-1073.
- **Kielland K. 1994.** Amino acid absorption by arctic plants: Implications for plant nutrition and nitrogen cycling. *Ecology* **75**(8): 2373.
- **Kim JG. 2001.** Decomposition of *Carex* and *Nuphar* plants in a subalpine marsh. *Journal of Plant Biology* **44**(2): 73-80.\*
- **Kimber PC. 1974.** The root system of jarrah (*Eucalyptus marginata*). Perth, WA, Australia: Forests Department of Western Australia.\*
- **Kimmins JP, Hawkes BC. 1978.** Distribution and chemistry of fine roots in a white spruce subalpine fir stand in British Columbia: implications for management. *Canadian Journal of Forest Research* **8**(3): 265-279.
- **Kinerson RS, Ralston CW, Wells CG. 1977.** Carbon cycling in a loblolly pine plantation. *Oecologia* **29**(1): 1-10.
- **King JS, Albaugh TJ, Allen HL, Buford M, Strain BR, Dougherty P. 2002.** Below-ground carbon input to soil is controlled by nutrient availability and fine root dynamics in loblolly pine. *New Phytologist* **154**(2): 389-398.
- **King JS, Allen HL, Dougherty P, Strain BR. 1997.** Decomposition of roots in loblolly pine: effects of nutrient and water availability and root size class on mass loss and nutrient dynamics. *Plant and Soil* **195**(1): 171-184.
- **Kinyamario JI, Imbamba SK 1992.** Savanna at Nairobi National Park, Nairobi. In: Long SP, Jones MB, Roberts MJ eds. *Primary productivity of grass ecosystems of the tropics and sub-tropics*. London, UK: Chapman and Hall, 25-69.
- **Kitajima K, Anderson KE, Allen MF. 2010.** Effect of soil temperature and soil water content on fine root turnover rate in a California mixed conifer ecosystem. *Journal of Geophysical Research* **115**(G4)
- **Kleinhampl FJ, Koteff C. 1960.** Botanical prospecting for U rani urn in the Circle Cliffs Area Garfield County, Utah. USGS Bulletin: USGS.\*
- **Klepper EL, Gano KA, Cadwell LL. 1985.** Rooting depth and distributions of deep-rooted plants in the 200 Area control zone of the Hanford Site. Richland, WA, USA: United States Department of Energy.
- **Klinge H. 1973.** Root mass estimation in lowland tropical rain forests of central Amazonia, Brazil. I. Fine root masses of pale yellow Latosol and a giant humus Podzol. *Tropical Ecology* **14**: 29-38.

- **Klinge H. 1975.** Root mass estimation in lowland tropical rain forests of central Amazonia, Brazil. III. Nutrients in fine roots from giant humus podsols. *Tropical Ecology* **16**: 28-38.
- **Klinge H. 1976.** Root mass estimation in lowland tropical rain forests of central Amazonia, Brazil. *Tropical Ecology* **17**: 79-88.
- **Klinge H, Rodrigues WA 1973.** Phytomass estimation in a central Amazonian rain forest. In: Young HE ed. *IUFRO Biomass Studies*. Orono, Maine: University of Maine, 337-350.
- **Knoop WT, Walker BH. 1985.** Interactions of woody and herbaceous vegetation in a southern African savanna. *The Journal of Ecology* **73**(1): 235.
- **Koch GW, Bloom AJ, Chapin FS. 1991.** Ammonium and nitrate as nitrogen sources in two *Eriophorum* species. *Oecologia* **88**(4): 570-573.
- **Kochenderfer JN. 1973.** Root distribution under some forest types native to West Virginia. *Ecology* **54**(2): 445.
- **Kohmann K. 1972.** Rotøkologiske undersøkelser på furu I. Metodiske problemer og generelle rotforhold (Root ecological investigations on pine. I. Problems of methodology and general relationships). *Det Norske Skogforsøksvesen*, Ås, Norge **30**: 325-357.
- **Kohn LM, Stasovski E. 1990.** The mycorrhizal status of plants at Alexandra Fiord, Ellesmere Island, Canada, a high arctic site. *Mycologia* **82**(1): 23.
- **Kohzu A, Matsui K, Yamada T, Sugimoto A, Fujita N. 2003.** Significance of rooting depth in mire plants: Evidence from natural <sup>15</sup>N abundance. *Ecological Research* **18**(3): 257-266.\*
- **Kokoreva II. 1996.** Root systems of *Crataegus* L. in the Trans-Ili Alatau, Kazakhstan. *Acta Phytogeographica Suecica* **81**: 35-38.\*
- Kong D, Ma C, Zhang Q, Li L, Chen X, Zeng H, Guo D. 2014. Leading dimensions in absorptive root trait variation across 96 subtropical forest species. *New Phytologist* 203(3): 863-872.
- Kong DL, Wang JJ, Kardol P, Wu HF, Zeng H, Deng XB, Deng Y. 2016. Economic strategies of plant absorptive roots vary with root diameter. *Biogeosciences* 13(2): 415-424.
- **Konoplenko MA, Gusewell S, Veselkin DV. 2017.** Taxonomic and ecological patterns in root traits of *Carex* (Cyperaceae). *Plant and Soil*(420): 37-48.\*
- **Kosmas CS, Moustakas N, Danalatos NG, Yassoglou N 1996.** The Spata field site: I. The impacts of land use and management on soil properties and erosion. II. The effect of reduced soil moisture on soil properties and wheat production. In: Brandt CJ, Thornes JB eds. *Mediterranean Desertification and Land Use*. Chichester, UK: John Wiley and Sons, 207-228.
- **Koteen LE, Baldocchi DD, Harte J. 2011.** Invasion of non-native grasses causes a drop in soil carbon storage in California grasslands. *Environmental Research Letters* **6**(4): 044001.\*
- Kou L, Chen W, Zhang X, Gao W, Yang H, Li D, Li S. 2015. Differential responses of needle and branch order-based root decay to nitrogen addition: dominant effects of acid-unhydrolyzable residue and microbial enzymes. *Plant and Soil* 394(1-2): 315-327.

- Kramer-Walter KR, Bellingham PJ, Millar TR, Smissen RD, Richardson SJ, Laughlin DC, Mommer L. 2016. Root traits are multidimensional: specific root length is independent from root tissue density and the plant economic spectrum. *Journal of Ecology* 104(5): 1299-1310.
- **Kramer-Walter KR, Laughlin DC. 2017.** Root nutrient concentration and biomass allocation are more plastic than morphological traits in response to nutrient limitation. *Plant and Soil* **416**(1-2): 539-550.\*
- **Kreutzer K 1968.** The root system of the red alder (*Alnus glutinosa* Gärtn.). In: Ghilarov MS, Kovda VA, Novichkova-Ivanova LN, Rodin LE, Sveshnikova VM eds. *Methods of productivity studies in root systems and rhizosphere organisms*. Nauka, Leningrad, Russia: International Symposium USSR, August 28--September 12, 1968, 114-119.
- Krishnamurthy L, Zaman-Allah M, Marimuthu S, Wani SP, Kesava Rao AVR. 2012. Root growth in Jatropha and its implications for drought adaptation. *Biomass and Bioenergy* 39: 247-252.\*
- **Kubisch P, Hertel D, Leuschner C. 2015.** Do ectomycorrhizal and arbuscular mycorrhizal temperate tree species systematically differ in root order-related fine root morphology and biomass? *Frontiers in Plant Science* **6**: 64.
- **Kubisch P, Hertel D, Leuschner C. 2016.** Fine Root Productivity and Turnover of Ectomycorrhizal and Arbuscular Mycorrhizal Tree Species in a Temperate Broad-Leaved Mixed Forest. *Frontiers in Plant Science* **7**: 1233.\*
- **Kubota M, Tenhunen J, Zimmermann R, Schmidt M, Adiku S, Kakubari Y. 2005.**Influences of environmental factors on the radial profile of sap flux density in *Fagus crenata* growing at different elevations in the Naeba Mountains, Japan. *Tree Physiology* **25**(5): 545-556.\*
- **Kudrjasheva OI 1974.** Sezonnoe razvitie rastitel'nosti nizkotravnych polusavann v juzhnoj okonechnosti chrebta Aruk-Tau (stacionar Garauty). (Seasonal development of vegetation in the shortgrass steppe at the southern end of the Aruk-Tau Mountains (Station Garavuti)). In: Ovchinnikov PN ed. *Rastitel'nost' Tadzhikistana i eë osvoenie.* (Vegetation of Tajikistan and its use). Donish, Dushanbe, Tajikistan
- **Kuiper LC, Coutts MP. 1992.** Spatial disposition and extension of the structural root system of Douglas-fir. *Forest Ecology and Management* **47**(1-4): 111-125.\*
- **Kul'tiasov MV. 1925.** Materialy po izucheniju isparenija i kornevoj sistemy soobshchestva vesehhich zfemerov. (Materials on a study of evaporation and the root system of an association of spring ephemerals). *Biulleten' Sredne-Aziatskogo Gosudarstvennogo Universiteta* **10**: 79-87.
- **Kumar A, Joshi MC. 1972.** The Effects of Grazing on the Structure and Productivity of the Vegetation near Pilani, Rajasthan, India. *The Journal of Ecology* **60**(3): 665.
- **Kummerow J, Castillanos J, Maas M, Larigauderie A. 1990.** Production of fine roots and the seasonality of their growth in a Mexican deciduous dry forest. *Vegetatio* **90**(1): 73-80.
- **Kummerow J, Ellis BA, Kummerow S, Chapin FS. 1983.** Spring growth of shoots and roots in shrubs of an Alaskan muskeg. *American Journal of Botany* **70**(10): 1509.

- **Kummerow J, Krause D. 1982.** The effects of variable nitrogen and phosphorous concentrations on *Eriophorum vaginatum* tillers grown in nutrient solutions. *Ecography* **5**(2): 187-193.
- **Kummerow J, Krause D, Jow W. 1977.** Root systems of chaparral shrubs. *Oecologia* **29**(2): 163-177.
- **Kummerow J, Kummerow M, Trabaud L. 1990.** Root biomass, root distribution and the fine-root growth dynamics of *Quercus coccifera* L. in the garrigue of southern France. *Vegetatio* **87**(1): 37-44.
- **Kummerow J, Mangan R. 1981.** Root systems in *Quercus dumosa* Nutt. dominated chaparral in southern California. *Acta Oecologica Oecologia Plantarum* **2**: 177-188.
- **Kummerow J, McMaster GS, Krause DA. 1980.** Temperature effect on growth and nutrient contents in *Eriophorum vaginatum* under controlled environmental conditions. *Arctic and Alpine Research* **12**(3): 335.
- **Kummerow J, Russell M. 1980.** Seasonal root growth in the arctic tussock tundra. *Oecologia* **47**(2): 196-199.
- **Kuschera-Mitter L. 1996.** Growth strategies of plant roots in different climatic regions. *Acta Phytogeographica Suecica* **81**: 12-16.\*
- **Kutzbach L, Wagner D, Pfeiffer E-M. 2004.** Effect of microrelief and vegetation on methane emission from wet polygonal tundra, Lena Delta, Northern Siberia. *Biogeochemistry* **69**(3): 341-362.
- **Laclau J-P. 2004.** The function of the superficial root mat in the biogeochemical cycles of nutrients in Congolese eucalyptus plantations. *Annals of Botany* **93**(3): 249-261.\*
- Laclau J-P, da Silva EA, Lambais GR, Bernoux M, le Maire G, Stape JL. 2013. Dynamics of soil exploration by fine roots down to a depth of 10 m throughout the entire rotation in *Eucalyptus grandis* plantations. *Frontiers in Plant Science* 4: 243.\*
- **Ladygina GM, Litvinova NP. 1974.** Produktivnost' nekotorych lugovych soobshchestv vostochnogo Pamira. *Problemy Botaniki* **12**: 275-285.
- **Lamont B. 1973.** Factors affecting the distribution of proteoid roots within the root systems of two Hakea species. *Australian Journal of Botany* **21**(2): 165.
- **Lamont BB, Brown G, Mitchell DT. 1984.** Structure, environmental effects on their formation, and function of proteoid roots in *Leucadendron laureolum* (Proteaceae). *New Phytologist* **97**(3): 381-390.\*
- **Lana PdC, Guiss C, Disaró ST. 1991.** Seasonal variation of biomass and production dynamics for above- and belowground components of a *Spartina alterniflora* marsh in the euhaline sector of Paranaguá Bay (SE Brazil). *Estuarine, Coastal and Shelf Science* **32**(3): 231-241.
- **Lang GE, Reiners WA, Shellito GA. 1982.** Tissue chemistry of *Abies balsamea* and *Betula papyrifera* var. *cordifolia* from subalpine forests of northeastern United States. *Canadian Journal of Forest Research* **12**(2): 311-318.

- Larmola T, Alm J, Juutinen S, Koppisch D, Augustin J, Martikainen PJ, Silvola J. 2006. Spatial patterns of litter decomposition in the littoral zone of boreal lakes. *Freshwater Biology* **51**(12): 2252-2264.\*
- **Lavrinenko DD. 1972.** Interaction of wood species in different types of forests. New Delhi, India: Indian National Scientific Documentation Center.
- **Lawson GW, Armstrong-Mensah KO, Hall JB. 1970.** A catena in tropical moist semi-deciduous forest near Kade, Ghana. *The Journal of Ecology* **58**(2): 371.
- **Lawson GW, Jenik J, Armstrong-Mensah KO. 1968.** A study of a vegetation catena in Guinea savanna at mole game reserve (Ghana). *The Journal of Ecology* **56**(2): 505.\*
- **Le Roux X, Bariac T, Mariotti A. 1995.** Spatial partitioning of the soil water resource between grass and shrub components in a West African humid savanna. *Oecologia* **104**(2): 147-155.
- **Lee CA, Lauenroth WK. 1994.** Spatial distributions of grass and shrub root systems in the shortgrass steppe. *American Midland Naturalist* **132**(1): 117.
- **Lehmann J, Schroth G, Zech W. 1995.** Decomposition and nutrient release from leaves, twigs and roots of three alley-cropped tree legumes in central Togo. *Agroforestry Systems* **29**(1): 21-36.
- **Lehmann J, Zech W. 1998.** Fine root turnover of irrigated hedgerow intercropping in Northern Kenya. *Plant and Soil* **198**(1): 19-31.
- **Lessa ASN, Anderson DW, Moir JO. 1996.** Fine root mineralization, soil organic matter and exchangeable cation dynamics in slash and burn agriculture in the semi-arid northeast of Brazil. *Agriculture, Ecosystems & Environment* **59**(3): 191-202.
- **Lewis DC, Burgy RH. 1964.** The Relationship between oak tree roots and groundwater in fractured rock as determined by tritium tracing. *Journal of Geophysical Research* **69**(12): 2579-2588.\*
- **Lewis Smith RI, Walton DWH 1975.** South Georgia, Subantarctic. In: Rosswall T, Heal OW eds. *Structure and Function of Tundra Ecosystems*. Stockholm, Sweden: Swedish Natural Science Research Council, 399-423.
- Li A, Fahey TJ, Pawlowska TE, Fisk MC, Burtis J. 2015. Fine root decomposition, nutrient mobilization and fungal communities in a pine forest ecosystem. *Soil Biology and Biochemistry* 83: 76-83.
- **Li A, Guo D, Wang Z, Liu H. 2010.** Nitrogen and phosphorus allocation in leaves, twigs, and fine roots across 49 temperate, subtropical and tropical tree species: a hierarchical pattern. *Functional Ecology* **24**(1): 224-232.
- **Li FL, Bao WK. 2015.** New insights into leaf and fine-root trait relationships: implications of resource acquisition among 23 xerophytic woody species. *Ecology and Evolution* **5**(22): 5344-5351.\*
- Li R, Ling N, Hao J, Min J, Chen X, Guan Q. 2013. Effects of stand ages on carbon storage, fine root morphology and biomass in *Platycladus orientalis* plantation. *Journal of Nanjing Forestry University (Natural Sciences Edition)* 37: 21-27.

- Li R, Peng T, Liu N, Wang D, Min J, Guan Q. 2013. Response of carbon storage, fine root biomass and morphology to thinning in *Platycladus orientalis* plantation. *Journal of Northeast Forestry University* 41(5): 34-38.\*
- **Liang YM, Hazlett DL, Lauenroth WK. 1989.** Biomass dynamics and water use efficiencies of five plant communities in the shortgrass steppe. *Oecologia* **80**(2): 148-153.
- **Liao CZ, Luo YQ, Fang CM, Chen JK, Li B. 2008.** Litter pool sizes, decomposition, and nitrogen dynamics in *Spartina alterniflora*-invaded and native coastal marshlands of the Yangtze Estuary. *Oecologia* **156**(3): 589-600.\*
- **Liao Y, McCormack ML, Fan H, Wang H, Wu J, Tu J, Liu W, Guo D. 2014.** Relation of fine root distribution to soil C in a Cunninghamia lanceolata plantation in subtropical China. *Plant and Soil* **381**(1-2): 225-234.
- **Lichtenegger E. 1996.** Root distribution in some alpine plants. *Acta Phytogeographica Suecica* **81**: 1-5.\*
- **Lichtenegger E, Kutschera-Mitter L. 1991.** Spatial Root Types. *Developments in Agricultural and Managed Forest Ecology* **24**: 359-365.\*
- **Lieffers VJ, Rothwell RL. 1987.** Rooting of peatland black spruce and tamarack in relation to depth of water table. *Canadian Journal of Botany* **65**(5): 817-821.\*
- **Liese R, Alings K, Meier IC. 2017.** Root Branching Is a Leading Root Trait of the Plant Economics Spectrum in Temperate Trees. *Frontiers in Plant Science* 8: 315.\*
- **Liese R, Lübbe T, Albers NW, Meier IC. 2018.** The mycorrhizal type governs root exudation and nitrogen uptake of temperate tree species. *Tree Physiology* **38**(1): 83-95.\*
- Lin C, Yang Y, Guo J, Chen G, Xie J. 2010. Fine root decomposition of evergreen broadleaved and coniferous tree species in mid-subtropical China: dynamics of dry mass, nutrient and organic fractions. *Plant and Soil* 338(1-2): 311-327.\*
- **Lin N, Bartsch N, Heinrichs S, Vor T. 2015.** Long-term effects of canopy opening and liming on leaf litter production, and on leaf litter and fine-root decomposition in a European beech (*Fagus sylvatica L.*) forest. *Forest Ecology and Management* **338**: 183-190.
- **Linder S, Axelsson B 1982**. Changes in carbon uptake and allocation patterns as a result of irrigation and fertilization in a young *Pinus sylvestris* stand. *IUFRO Workshop*. Corvallis, OR: IUFRO. 38-44.
- **Link SO, Gee GW, Thiede ME, Beedlow PA. 1990.** Response of a shrub-steppe ecosystem to fire: Soil water and vegetational change. *Arid Soil Research and Rehabilitation* **4**(3): 163-172.\*
- Link SO, Waugh WJ, Downs JL, Thiede ME, Chatters JC, Gee GW. 1994. Effects of coppice dune topography and vegetation on soil water dynamics in a cold-desert ecosystem. *Journal of Arid Environments* 27(3): 265-278.\*
- **Linkola K, Tiirikka A. 1936.** Über Wurzelsysteme und Wurzelausbreitung der Wiesenpflanzen auf verschiedenen Wiesenstandorten. *Annales Botanici Societatis Zoologicae Botanicae-Fennicae Vanamo* **6**(6)

- **Liu B, He J, Zeng F, Lei J, Arndt SK. 2016.** Life span and structure of ephemeral root modules of different functional groups from a desert system. *New Phytologist* **211**: 103-112.
- **Liu B, Li H, Zhu B, Koide RT, Eissenstat DM, Guo D. 2015.** Complementarity in nutrient foraging strategies of absorptive fine roots and arbuscular mycorrhizal fungi across 14 coexisting subtropical tree species. *New Phytologist* **208**(1): 125-136.
- **Liu C, Xiang W-H, Tian D-L, Fang X, Peng C-H. 2011.** Overyielding of fine root biomass as increasing plant species richness in subtropical forests in central southern China. *Chinese Journal of Plant Ecology* **35**(5): 539-550.
- Liu G, Freschet GT, Pan X, Cornelissen JHC, Li Y, Dong M. 2010. Coordinated variation in leaf and root traits across multiple spatial scales in Chinese semi-arid and arid ecosystems. *New Phytologist* 188(2): 543-553.
- **Liu G, Zhang X, Li X, Wei J, Shan L. 2009.** Adaptive growth of *Tamarix taklamakanensis* root systems in response to wind action. *Science Bulletin* **53**(S2): 164-168.\*
- **Liu P, Huang J, Han X, Sun OJ. 2009.** Litter decomposition in semiarid grassland of Inner Mongolia, China. *Rangeland Ecology & Management* **62**(4): 305-313.\*
- Liu R, Huang Z, Luke McCormack M, Zhou X, Wan X, Yu Z, Wang M, Zheng L. 2016.

  Plasticity of fine-root functional traits in the litter layer in response to nitrogen addition in a subtropical forest plantation. *Plant and Soil* 415(1-2): 317-330.\*
- **Liu YK, Fan C, Li XW, Zhou YG, Feng MS, Huang CD. 2012.** Effects of thinning on fine root biomass and carbon storage of subalpine *Picea asperata* plantation in Western Sichuan Province, China. *Chinese Journal of Plant Ecology* **36**: 625-654.
- **Liu ZG, Zou XM. 2002.** Exotic earthworms accelerate plant litter decomposition in a Puerto Rican pasture and a wet forest. *Ecological Applications* **12**(5): 1406-1417.\*
- **Livesley SJ. 2000.** Competition in tree row agroforestry systems. 1. Distribution and dynamics of fine root length and biomass. *Plant and Soil* **227**(1/2): 149-161.\*
- **Lohmus K, Ivask M. 1995.** Decomposition and nitrogen dynamics of fine roots of Norway spruce (*Picea abies* (L.) Karst.) at different sites. *Plant and Soil* **168-169**(1): 89-94.\*
- **Loiola PP, Scherer-Lorenzen M, Batalha MA. 2015.** The role of environmental filters and functional traits in predicting the root biomass and productivity in savannas and tropical seasonal forests. *Forest Ecology and Management* **342**: 49-55.
- **Long Y, Kong D, Chen Z, Zeng H. 2013.** Variation of the linkage of root function with root branch order. *PLoS ONE* **8**(2): e57153.
- **Lopez B, Sabate S, Gracia CA. 2001.** Vertical distribution of fine root density, length density, area index and mean diameter in a *Quercus ilex* forest. *Tree Physiology* **21**(8): 555-560.\*
- **Low AB, Lamont BB. 1990.** Aerial and belowground phytomass of banksia scrub-heath at Eneabba, south-western Australia. *Australian Journal of Botany* **38**(4): 351.
- **Lucot E, Bruckert S. 1992.** Organisation du système racinaire du chêne pédonculé (*Quercus robur*) développé en conditions édaphiques non contraignantes (sol brun lessivé colluvial). *Annales des Sciences Forestières* **49**(5): 465-479.

- **Lugo AE. 1992.** Comparison of Tropical Tree Plantations with Secondary Forests of Similar Age. *Ecological Monographs* **62**(1): 1.
- Lutz HJL, Ely JB, Jr., Little SL, Jr. 1937. The influence of soil profile horizons on root distribution of white pine (*Pinus strobus* L.). *Yale University School of Forestry Bulletin* 44: 1-75.
- **Lyford WH, Wilson BF. 1964.** Development of the root system of *Acer rubrum* L. Harvard Forest Paper\*
- **Ma C, Xiong Y, Li L, Guo D. 2016.** Root and leaf decomposition become decoupled over time: implications for below- and above-ground relationships. *Functional Ecology* **211**(1): 103-112.
- Ma L-h, Liu X-l, Wang Y-k, Wu P-t. 2013. Effects of drip irrigation on deep root distribution, rooting depth, and soil water profile of jujube in a semiarid region. *Plant and Soil* 373(1-2): 995-1006.\*
- Ma L-h, Wu P-t, Wang X. 2014. Root distribution chronosequence of a dense dwarfed jujube plantation in the semiarid hilly region of the Chinese Loess Plateau. *Journal of Forest Research* 19(1): 62-69.\*
- **MacDougal DT. 1937.** Root systems and volumes of giant sequoias. *American Journal of Botany* **24**(1): 1.\*
- Maessen O, Freedman B, Nams MLN, Svoboda J. 1983. Resource allocation in high-arctic vascular plants of differing growth form. *Canadian Journal of Botany* **61**(6): 1680-1691.
- Magill AH, Aber JD, Hendricks JJ, Bowden RD, Melillo JM, Steudler PA. 1997.

  Biogeochemical response of forest ecosystems to simulated chronic nitrogen deposition.

  Ecological Applications 7(2): 402-415.
- **Majdi H. 2001.** Changes in fine root production and longevity in relation to water and nutrient availability in a Norway spruce stand in northern Sweden. *Tree Physiology* **21**(14): 1057-1061.
- **Majdi H, Andersson P. 2005.** Fine root production and turnover in a Norway spruce stand in northern Sweden: Effects of nitrogen and water manipulation. *Ecosystems* **8**(2): 191-199.
- **Majdi H, Rosengren-Brinck U. 1994.** Effects of ammonium sulphate application on the rhizosphere, fine-root and needle chemistry in a *Picea abies* (L.) Karst. stand. *Plant and Soil* **162**(1): 71-80.
- Makita N, Hirano Y, Dannoura M, Kominami Y, Mizoguchi T, Ishii H, Kanazawa Y. 2009. Fine root morphological traits determine variation in root respiration of *Quercus serrata*. *Tree Physiology* **29**(4): 579-585.
- **Malkonen E. 1974.** *Annual primary production and nutrient cycle in some Scots pine stands.* Helsinki, Finland: Finnish Forest Research Institute.
- **Malmer N, Wallen B. 1986.** Inorganic Elements above and below Ground in Dwarf Shrubs on a Subarctic Peat Bog. *Oikos* **46**(2): 200.

- Manlay RJ, Masse D, Chevallier T, Russell-Smith A, Friot D, Feller C. 2004. Post-fallow decomposition of woody roots in the West African savanna. *Plant and Soil* 260(1/2): 123-136.\*
- Manning SJ, Barbour MG. 1988. Root systems, spatial patterns, and competition for soil moisture between two desert subshrubs. *American Journal of Botany* 75(6): 885.
- Mao Z, Bonis M-L, Rey H, Saint-André L, Stokes A, Jourdan C. 2013. Which processes drive fine root elongation in a natural mountain forest ecosystem? *Plant Ecology & Diversity* 6(2): 231-243.
- Mao Z, Jourdan C, Bonis M-L, Pailler F, Rey H, Saint-André L, Stokes A. 2012. Modelling root demography in heterogeneous mountain forests and applications for slope stability analysis. *Plant and Soil* 363(1-2): 357-382.
- **Marchenko AI, Karpov EM. 1962.** The mineral exchanges in spruce forests of the northern taiga and forest tundra of the Archangel region. *Soviet Soil Science* **7**: 722-734.
- **Marion GM, Kummerow J. 1990.** Ammonium uptake by field-grown *Eriophorum vaginatum* roots under laboratory and simulated field conditions. *Ecography* **13**(1): 50-55.
- **Markesteijn L, Poorter L. 2009.** Seedling root morphology and biomass allocation of 62 tropical tree species in relation to drought- and shade-tolerance. *Journal of Ecology* **97**(2): 311-325.
- Marshall JK 1997. Biomass and production partitioning in response to environment in some North American grasslands. In: Marshall JK ed. *The belowground ecosystem: a synthesis of plant-associated processes*. Fort Collins, CO, USA: Colorado State University, 73-84.
- **Martin D, Chambers J. 2002.** Restoration of riparian meadows degraded by livestock grazing: Above-and belowground responses. *Plant Ecology* **163**(1): 77-91.\*
- **Martin MH. 1968.** Conditions affecting the distribution of *Mercurialis perennis* L. in certain Cambridgeshire woodlands. *The Journal of Ecology* **56**(3): 777.\*
- Martínez F, Merino O, Martín A, García Martín D, Merino J. 1998. Belowground structure and production in a Mediterranean sand dune shrub community. *Plant and Soil* 201(2): 209-216.
- **Matamala R, Schlesinger WH. 2000.** Effects of elevated atmospheric CO<sub>2</sub> on fine root production and activity in an intact temperate forest ecosystem. *Global Change Biology* **6**(8): 967-979.
- **Matthes-Sears U, Larson DW. 1995.** Rooting characteristics of trees in rock: A study of *Thuja occidentalis* on cliff faces. *International Journal of Plant Sciences* **156**(5): 679-686.\*
- **Mauer O, Palatova E. 2012.** Root development in douglas fir (*Pseudotsuga menziesii* [Mirb.] Franco) on fertile sites. *Journal of Forest Science* **58**(9): 400-409.\*
- McClaugherty CA, Aber JD, Melillo JM. 1982. The role of fine roots in the organic matter and nitrogen budgets of two forested ecosystems. *Ecology* 63(5): 1481-1490.\*
- McClaugherty CA, Aber JD, Melillo JM. 1984. Decomposition dynamics of fine roots in forested ecosystems. *Oikos* 42(3): 378.

- McConnell NA, Turetsky MR, David McGuire A, Kane ES, Waldrop MP, Harden JW. **2013.** Controls on ecosystem and root respiration across a permafrost and wetland gradient in interior Alaska. *Environmental Research Letters* **8**(4): 045029.
- McCormack ML, Adams TS, Smithwick EA, Eissenstat DM. 2012. Predicting fine root lifespan from plant functional traits in temperate trees. *New Phytol* **195**(4): 823-831.
- McCormack ML, Gaines KP, Pastore M, Eissenstat DM. 2014. Early season root production in relation to leaf production among six diverse temperate tree species. *Plant and Soil* 389(1-2): 121-129.
- **McGinty DT. 1976.** Comparative root and soil dynamics on a white pine watershed and in the hardwood forest in the Coweeta Basin. University of Georgia Athens, Georgia, USA.
- **McGraw JB, Chapin FS. 1989.** Competitive ability and adaptation to fertile and infertile soils in two *Eriophorum* species. *Ecology* **70**(3): 736.
- McKane RB, Johnson LC, Shaver GR, Nadelhoffer KJ, Rastetter EB, Fry B, Giblin AE, Kielland K, Kwiatkowski BL, Laundre JA, et al. 2002. Resource-based niches provide a basis for plant species diversity and dominance in arctic tundra. *Nature* 415(6867): 68-71.
- **McKay HM, Malcolm DC. 1988.** A comparison of the fine root component of a pure and a mixed coniferous stand. *Canadian Journal of Forest Research* **18**(11): 1416-1426.
- McKell CM, Jones MB, Perrier ER. 1962. Root production and accumulation of root material on fertilized annual range. *Agronomy Journal* 54(5): 459.
- McLaren JR, Buckeridge KM, van de Weg MJ, Shaver GR, Schimel JP, Gough L. 2017. Shrub encroachment in Arctic tundra: *Betula nana* effects on above- and belowground litter decomposition. *Ecology* **98**(5): 1361-1376.\*
- McLaughlin JA, Hsiang T, Hayden GH, Greifenhagen S. 2011. Abiotic and biotic factors used to assess decline risk in red pine (*Pinus resinosa* Ait.) plantations. *The Forestry Chronicle* 87(1): 99-115.\*
- **McNaughton SJ, Banyikwa FF, McNaughton MM. 1998.** Root biomass and productivity in a grazing ecosystem: The Serengeti. *Ecology* **79**(2): 587-592.
- **McQuilkin WE. 1936.** Root development of pitch pine, with some comparative observations on shortleaf pine. *Journal of Agricultural Research* **51**(11): 983-1016.\*
- Medeiros JS, Burns JH, Nicholson J, Rogers L, Valverde-Barrantes O. 2017. Decoupled leaf and root carbon economics is a key component in the ecological diversity and evolutionary divergence of deciduous and evergreen lineages of genus *Rhododendron*. *American Journal of Botany* **104**(6): 803-816.\*
- **Megonigal PJ, Day FP. 1988.** Organic matter dynamics in four seasonally flooded forest communities of the dismal swamp. *American Journal of Botany* **75**(9): 1334-1343.
- Mei L, Gu J, Zhang Z, Wang Z. 2009. Responses of fine root mass, length, production and turnover to soil nitrogen fertilization in *Larix gmelinii* and *Fraxinus mandshurica* forests in Northeastern China. *Journal of Forest Research* 15(3): 194-201.

- Mei L, Xiong Y, Gu J, Wang Z, Guo D. 2014. Whole-tree dynamics of non-structural carbohydrate and nitrogen pools across different seasons and in response to girdling in two temperate trees. *Oecologia* 177(2): 333-344.
- Meier CE, Grier CC, Cole DW. 1985. Below- and Aboveground N and P Use by *Abies amabilis* Stands. *Ecology* 66(6): 1928.
- Meinen C, Hertel D, Leuschner C. 2009. Root Growth and Recovery in Temperate Broad-Leaved Forest Stands Differing in Tree Species Diversity. *Ecosystems* 12(7): 1103-1116.\*
- Meinzer OE. 1927. Plants as indicators of ground water. USGS Water-supply papers: USGS.\*
- **Mekonnen K, Buresh RJ, Jama B. 1997.** Root and inorganic nitrogen distributions in sesbania fallow, natrow fallow and maize fields. *Plant and Soil* **188**(2): 319-327.
- **Mello SLdM, Goncalves JLdM, Gava JL. 2007.** Pre- and post-harvest fine root growth in *Eucalyptus grandis* stands installed in sandy and loamy soils. *Forest Ecology and Management* **246**(2-3): 186-195.\*
- **Menaut JC, Cesar J. 1979.** Structure and primary productivty of lamto savannas, Ivory Coast. *Ecology* **60**(6): 1197.
- Mendes MP, Ribeiro L, David TS, Costa A. 2016. How dependent are cork oak (*Quercus suber* L.) woodlands on groundwater? A case study in southwestern Portugal. *Forest Ecology and Management* 378: 122-130.\*
- **Mensah KOA, Jenik J. 1968.** Root system of tropical trees 2. Features of the root system of iroko (*Chlorophora excelsa* Benth. et Hook.). *Preslia* **40**: 21-27.
- **Mensforth LJ, Walker GR. 1996.** Root dynamics of *Melaleuca halmaturorum* in response to fluctuating saline groundwater. *Plant and Soil* **184**(1): 75-84.\*
- Metcalfe DB, Meir P, Aragão LEOC, da Costa ACL, Braga AP, Gonçalves PHL, de Athaydes Silva Junior J, de Almeida SS, Dawson LA, Malhi Y, et al. 2008. The effects of water availability on root growth and morphology in an Amazon rainforest. *Plant and Soil* 311(1-2): 189-199.
- **Metsavainio K. 1931.** Untersuchungen über das Wurzelsystem der Moorpflanzen. *Druckerei der Finnischen Literatur- Gesellschaft, Helsinki*.
- Miao Y, Chen Y-L, Li X-W, Fan C, Liu Y-K, Yang Z-J, Zhang J, Cai X-L. 2013. Effects of fertilization on *Alnus formosana* fine root morphological characteristics, biomass and issue content of C, N under *A. formosana-Hemarthria compressa* compound mode. *Chinese Journal of Plant Ecology* 37(7): 674-683.
- **Michelsen A, Quarmby C, Sleep D, Jonasson S. 1998.** Vascular plant 15 N natural abundance in heath and forest tundra ecosystems is closely correlated with presence and type of mycorrhizal fungi in roots. *Oecologia* **115**(3): 406-418.
- **Michelsen A, Schmidt IK, Jonasson S, Quarmby C, Sleep D. 1996.** Leaf <sup>15</sup>N abundance of subarctic plants provides field evidence that ericoid, ectomycorrhizal and non-and arbuscular mycorrhizal species access different sources of soil nitrogen. *Oecologia* **105**(1): 53-63.

- Midwood AJ, Boutton TW, Archer SR, Watts SE. 1998. Water use by woody plants on contrasting soils in a savanna parkland: assessment with d2H and d180. *Plant and Soil* 205(1): 13-24.
- **Milchunas DG, Lauenroth WK. 1992.** Carbon dynamics and estimates of primary production by harvest, <sup>14</sup>C dilution, and <sup>14</sup>C turnover. *Ecology* **73**(2): 593.
- Milchunas DG, Mosier AR, Morgan JA, LeCain DR, King JY, Nelson JA. 2005. Root production and tissue quality in a shortgrass steppe exposed to elevated CO<sub>2</sub>: Using a new ingrowth method. *Plant and Soil* 268(1): 111-122.
- **Miller OK. 1982.** Mycorrhizae, mycorrhizal fungi and fungal biomass in subalpine tundra at Eagle Summit, Alaska. *Ecography* **5**(2): 125-134.
- **Miller OK, Laursen GA 1978.** In: Tieszen LL ed. *Vegetation and production ecology of an Alaskan arctic tundra*. New York, NY, USA: Springer-Verlag New York INc, 229-237.
- Miller PC, Mangan R, Kummerow J. 1982. Vertical distribution of organic matter in eight vegetation types near Eagle Summit, Alaska. *Ecography* 5(2): 117-124.
- Miller PC, Ng E. 1977. Root:shoot biomass ratios in shrubs in southern California and central Chile. *Madrono* 24: 215-223.
- Miller PC, Webber PJ, Oechel WC, Tieszen LL 1980. Biophysical processes and primary production. In: Brown J, Miller PC, Tieszen LL, Bunnell FL eds. *An Arctic ecosystem: the coastal tundra at Barrow, Alaska*. Stroudsburg, PA, USA: Dowden, Hutchinson & Ross, 66-101.
- **Miller PM, Eddleman LE, Kramer S. 1990.** Allocation patterns of carbon and minerals in juvenile and small-adult *Juniperus occidentalis. Forest Science* **36**: 734-747.
- **Miller RB. 1963.** Plant nutrients in hard beech. I. The immobilization of nutrients. *New Zealand Journal of Science* **6**: 365-377.
- Millikin CS, Bledsoe CS. 1999. Biomass and distribution of fine and coarse roots from blue oak (*Quercus douglasii*) trees in the northern Sierra Nevada foothills of California. *Plant and Soil* 214(1/2): 27-38.
- **Miroshnichenko YM. 1975.** Kornevye sistemy drevesnych i kustarnikovych rastenij i ich zkologija v vostocnych karakumach. (Root systems of trees and bushes and their ecology in eastern Karakum). *Botanicheskii Zhurnal* **60**: 1776-1795.
- **Misra CM. 1973.** *Primary productivity of a grassland ecosystem at Ujjain.* PhD, Vikram University Ujjain, India.
- **Misra MK, Misra BN. 1984.** Biomass and primary production in an Indian grassland. *Tropical Ecology* **25**: 239-247.
- **Moir WH, Bachelard EP. 1969.** Distribution of fine roots in Three *Pinus radiata* plantations near Canberra, Australia. *Ecology* **50**(4): 658.
- **Mokany K, Ash J. 2008.** Are traits measured on pot grown plants representative of those in natural communities? *Journal of Vegetation Science* **19**(1): 119-126.
- Möller CM, Müller D, Nielsen J. 1945. Graphic presentation of dry matter production of European beech. *Det Forstl. Forsogsvaes. Dan.* 21: 327-335.

- **Montaña C, Cavagnaro B, Briones O. 1995.** Soil water use by co-existing shrubs and grasses in the Southern Chihuahuan Desert, Mexico. *Journal of Arid Environments* **31**(1): 1-13.
- Montane F, Romanya J, Rovira P, Casals P. 2010. Aboveground litter quality changes may drive soil organic carbon increase after shrub encroachment into mountain grasslands. *Plant and Soil* 337(1-2): 151-165.\*
- Montoroi J-P, Pierret A, Maeght J-L, Chintachao W, Chenyapanich S, Kriengsak S 2016. Some convincing evidences of a deep root system within an interfluve aquifer of northeast Thailand. *IOP Conference Series: Earth and Environmental Science*. 52-57.\*
- **Mooney HA, Gulmon SL, Rundel PW, Ehleringer J. 1980.** Further observations on the water relations of *Prosopis tamarugo* of the northern Atacama desert. *Oecologia* **44**(2): 177-180.\*
- **Moore GW, Barre DA, Owens MK. 2010.** Changes in soil chloride following shrub removal and subsequent regrowth. *Geoderma* **158**(3-4): 148-155.\*
- **Moore TR, Bubier JL, Bledzki L. 2007.** Litter decomposition in temperate peatland ecosystems: The effect of substrate and site. *Ecosystems* **10**(6): 949-963.\*
- **Moorhead DL, Reynolds JF, Fonteyn PJ. 1989.** Patterns of stratified soil water loss in a Chihuahuan Desert community. *Soil Science* **148**(4): 244-249.
- **Mordelet P, Menaut J-C, Mariotti A. 1997.** Tree and grass rooting patterns in an African humid savanna. *Journal of Vegetation Science* **8**(1): 65-70.
- **Moreira MZ, Sternberg LdSL, Nepstad DC. 2000.** Vertical patterns of soil water uptake by plants in a primary forest and an abandoned pasture in the eastern Amazon: an isotopic approach. *Plant and Soil* **222**(1/2): 95-107.
- Moreno-Chacon M, Lusk CH. 2004. Vertical distribution of fine root biomass of emergent *Nothofagus dombeyi* and its canopy associates in a Chilean temperate rainforest. *Forest Ecology and Management* 199(2-3): 177-181.\*
- **Moretto AS, Distel RA. 2003.** Decomposition of and nutrient dynamics in leaf litter and roots of *Poa ligularis* and *Stipa gyneriodes. Journal of Arid Environments* **55**(3): 503-514.\*
- Moretto AS, Distel RA, Didoné NG. 2001. Decomposition and nutrient dynamic of leaf litter and roots from palatable and unpalatable grasses in a semi-arid grassland. *Applied Soil Ecology* **18**(1): 31-37.\*
- Muc M 1977. Ecology and primary production of sedge-moss meadow communities, Truelove Lowland. In: Bliss LC ed. *Truelove Lowland, Devon Island, Canada: a high arctic ecosystem*. Edmonton, AB, Canada: University of Alberta Press
- Mucha J, Szymańska AK, Zadworny M, Tylkowski T, Michalak M, Suszka J. 2015. Effect of seed storage temperature on fine root development and mycorrhizal colonization of young *Populus nigra* seedlings. *Annals of Forest Science* 72(5): 539-547.
- Mulia R, Dupraz C. 2006. Unusual fine root distributions of two deciduous tree species in southern France: What consequences for modelling of tree root dynamics? *Plant and Soil* 281(1-2): 71-85.\*

- Mun H-T, Pyo J-H, Shin C-H, Namgung J, Kim J-H. 2002. Weight loss and nutrients dynamics during the decomposition of fine roots. *The Korean Journal of Ecology* 25(1): 41-44.\*
- **Mun HT, Whitford WG. 1997.** Changes in mass and chemistry of plant roots during long-term decomposition on a Chihuahuan Desert watershed. *Biology and Fertility of Soils* **26**(1): 16-22.
- **Mundell TL, Landhäusser SM, Lieffers VJ. 2007.** Effects of *Corylus cornuta* stem density on root suckering and rooting depth of *Populus tremuloides. Canadian Journal of Botany* **85**(11): 1041-1045.\*
- Murphy PG, Lugo AE, Murphy AJ, Nepstad DC 1995. The dry forests of Puerto Rico's South coast. In: Lugo AE, Lowe C eds. *Tropical Forests: Management and Ecology*. New York: Springer New York, 178-209.
- **Nadelhoffer KJ, Aber JD, Melillo JM. 1985.** Fine roots, net primary production, and soil nitrogen availability: A new hypothesis. *Ecology* **66**(4): 1377.
- Nadelhoffer KJ, Johnson L, Laundre J, Giblin AE, Shaver GR. 2002. Fine root production and nutrient content in wet and moist arctic tundras as influenced by chronic fertilization. *Plant and Soil* 242(1): 107-113.
- **Nadelhoffer KJ, Raich JW. 1992.** Fine root production estimates and belowground carbon allocation in forest ecosystems. *Ecology* **73**(4): 1139.
- Naik ML. 1973. Ecological studies on some grasslands of Ambikapur. Sagar University Sagar, India.
- **Nambiar EKS. 1987.** Do nutrients retranslocate from fine roots? *Canadian Journal of Forest Research* **17**(8): 913-918.
- **Nams MLN, Freedman B. 1987.** Phenology and resource allocation in a high arctic evergreen dwarf shrub, *Cassiope tetragona*. *Ecography* **10**(2): 128-136.
- Nardini A, Casolo V, Dal Borgo A, Savi T, Stenni B, Bertoncin P, Zini L, McDowell NG. 2016. Rooting depth, water relations and non-structural carbohydrate dynamics in three woody angiosperms differentially affected by an extreme summer drought. *Plant, Cell & Environment* 39(3): 618-627.\*
- **Neill C. 1992.** Comparison of soil coring and ingrowth methods for measuring belowground production. *Ecology* **73**(5): 1918.
- Nepstad DC, de Carvalho CR, Davidson EA, Jipp PH, Lefebvre PA, Negreiros GH, da Silva ED, Stone TA, Trumbore SE, Vieira S. 1994. The role of deep roots in the hydrological and carbon cycles of Amazonian forests and pastures. *Nature* 372(6507): 666-669.\*
- **Nesterova S. 1996.** Root structure of plants in the Zailiisky Alatau Range, Kazakhstan. *Acta Phytogeographica Suecica* **81**: 86-87.\*
- Neykova N, Obando J, Schneider R, Shisanya C, Thiele-Bruhn S, Thomas FM. 2011.

  Vertical root distribution in single-crop and intercropping agricultural systems in Central Kenya. *Journal of Plant Nutrition and Soil Science* 174(5): 742-749.\*

- **Nicoll BC, Ray D. 1996.** Adaptive growth of tree root systems in response to wind action and site conditions. *Tree Physiology* **16**(11-12): 891-898.\*
- Nie Y-p, Chen H-s, Wang K-l, Ding Y-l. 2014. Rooting characteristics of two widely distributed woody plant species growing in different karst habitats of southwest China. *Plant Ecology* 215(10): 1099-1109.\*
- Nie ZN, Miller S, Moore GA, Hackney BF, Boschma SP, Reed KFM, Mitchell M, Albertsen TO, Clark S, Craig AD, et al. 2008. Field evaluation of perennial grasses and herbs in southern Australia. 2. Persistence, root characteristics and summer activity. *Australian Journal of Experimental Agriculture* 48(4): 424.\*
- **Nihlgard B. 1972.** Plant biomass, primary production and distribution of chemical elements in a beech and a planted spruce forest in south Sweden. *Oikos* **23**(1): 69.
- **Nihlgård B, Lindgren L. 1977.** Plant biomass, primary production and bioelements of three mature beech forests in south Sweden. *Oikos* **28**(1): 95.
- Niiyama K, Kajimoto T, Matsuura Y, Yamashita T, Matsuo N, Yashiro Y, Ripin A, Kassim AR, Noor NS. 2010. Estimation of root biomass based on excavation of individual root systems in a primary dipterocarp forest in Pasoh Forest Reserve, Peninsular Malaysia. *Journal of Tropical Ecology* 26(03): 271-284.\*
- **Nijland W, van der Meijde M, Addink EA, de Jong SM. 2010.** Detection of soil moisture and vegetation water abstraction in a Mediterranean natural area using electrical resistivity tomography. *Catena* **81**(3): 209-216.\*
- **Niklas KJ, Molina-Freaner F, Tinoco-Ojanguren C, Paolillo DJ. 2002.** The biomechanics of *Pachycereus pringlei* root systems. *American Journal of Botany* **89**(1): 12-21.\*
- **Nilsen ET, Sharifi MR, Rundel PW, Jarrell WM, Virginia RA. 1983.** Diurnal and seasonal water relations of the desert phreatophyte *Prosopis glandulosa* (honey mesquite) in the sonoran desert of california. *Ecology* **64**(6): 1381-1393.\*
- Nippert JB, Butler JJ, Kluitenberg GJ, Whittemore DO, Arnold D, Spal SE, Ward JK. 2009. Patterns of *Tamarix* water use during a record drought. *Oecologia* 162(2): 283-292.\*
- **Nnyamah JU, Black TA. 1977.** Rates and patterns of water uptake in a Douglas-fir forest. *Soil Science Society of America Journal* **41**(5): 972.
- **Nobel PS. 1989.** Temperature, water availability, and nutrient levels at various soil depths -- consequences for shallow-rooted desert succulents, including nurse plant effects. *American Journal of Botany* **76**(10): 1486.
- **Nobel PS, Loik ME, Meyer RW. 1991.** Microhabitat and diel tissue acidity changes for two sympatric cactus species differing in growth habit. *The Journal of Ecology* **79**(1): 167.
- **Nobel PS, Zutta BR. 2005.** Morphology, ecophysiology, and seedling establishment for *Fouquieria splendens* in the Northwestern Sonoran Desert. *Journal of Arid Environments* **62**(2): 251-265.\*

- **Norris MD, Blair JM, Johnson LC. 2001.** Land cover change in eastern Kansas: litter dynamics of closed-canopy eastern redcedar forests in tallgrass prairie. *Canadian Journal of Botany* **79**(2): 214-222.\*
- **Nulsen RA, Bligh KJ, Baxter IN, Solin EJ, Imrie DH. 1986.** The fate of rainfall in a mallee and heath vegetated catchment in southern Western Australia. *Austral Ecology* **11**(4): 361-371.\*
- **O'Grady AP, Worledge D, Battaglia M. 2006.** Above- and below-ground relationships, with particular reference to fine roots, in a young *Eucalyptus globulus* (Labill.) stand in southern Tasmania. *Trees* **20**(5): 531-538.
- Obakeng OT, de Vries JJ, Lubczynski MW. 2007. Soil moisture dynamics and evapotranspiration at the fringe of the Botswana Kalahari, with emphasis on deep rooting vegetation. Ph.D, Wageningen University Netherlands.\*
- **Odum HT 1970.** Rain forest structure and mineral-cycling homeostasis. In: Odum HT, Pigeon RF eds. *A tropical rain forest: A study of irradiation and ecology at El Verde, Puerto Rico*. Oak Ridge, Tennessee, USA: Division of Technical Information, U.S. Atomic Energy Commission, 3-52.
- **Ogawa H, Ogino K, Kira T 1965.** Comparative ecological studies on three main types of forest vegetation in Thailand. II. Plant biomass. In: Kira T, Umesad T eds. *Nature and Life in Southeast Asia*. Kyoto, Japan: Fauna and Flora Research Society, 49-80.
- **Ogawa H, Yoda K, Kora T 1961.** A preliminary survey of the vegetation of Thailand. In: Kira T, Umesad T eds. *Nature and Life in Southeast Asia*. Kyoto, Japan: Fauna and Flora Research Society, 21-157.
- Ohnuki Y, Shimizu A, Chann S, Toriyama J, Kimhean C, Araki M. 2008. Seasonal change in thick regolith hardness and water content in a dry evergreen forest in Kampong Thom Province, Cambodia. *Geoderma* 146(1-2): 94-101.\*
- **Okali DUU, Hall JB, Lawson GW. 1973.** Root distribution under a thicket clump on the Accra Plains, Ghana: Its relevance to clump localization and water relations. *The Journal of Ecology* **61**(2): 439.
- **Olajuyigbe S, Tobin B, Hawkins M, Nieuwenhuis M. 2012.** The measurement of woody root decomposition using two methodologies in a Sitka spruce forest ecosystem. *Plant and Soil* **360**(1-2): 77-91.\*
- **Old SM. 1969.** Microclimate, fire, and plant production in an Illinois prairie. *Ecological Monographs* **39**(4): 355.
- **Olff H, Berendse F, Visser WD. 1994.** Changes in nitrogen mineralization, tissue nutrient concentrations and biomass compartmentation after cessation of fertilizer application to mown grassland. *The Journal of Ecology* **82**(3): 611.
- Oliveira RS, Bezerra L, Davidson EA, Pinto F, Klink CA, Nepstad DC, Moreira A. 2005.

  Deep root function in soil water dynamics in cerrado savannas of central Brazil.

  Functional Ecology 19(4): 574-581.\*

- **Olsrud M, Christensen TR. 2004.** Carbon cycling in subarctic tundra; seasonal variation in ecosystem partitioning based on in situ <sup>14</sup>C pulse-labelling. *Soil Biology and Biochemistry* **36**(2): 245-253.
- **Olsthoorn AFM. 1991.** Fine root density and root biomass of two Douglas-fir stands on sandy soils in the Netherlands. 1. Root biomass in early summer. *Netherlands Journal of Agricultural Science* **39**: 49-60.
- **Oosterbaan A, Nabuurs GJ. 1991.** Relationships between oak decline and groundwater class in The Netherlands. *Plant and Soil* **136**(1): 87-93.\*
- Ostbye E, Berg A, Blehr O, Espeland M, Gaare E, Hagen A, Hesjedal O, Hagvar S, Kjelvik S, Lien L, et al. 1975. Hardangervidda, Norway. In: Rosswall T, Heal OW eds. *Structure and function of tundra ecosystems*. Stockholm, Sweden: Ecology Bulletin, 225-264.
- Ostertag R. 2001. Effects of nitrogen and phosphorus availability on fine-root dynamics in Hawaiian montane forests. *Ecology* 82(2): 485-499.
- **Ostertag R, Hobbie SE. 1999.** Early stages of root and leaf decomposition in hawaiian forests: Effects of nutrient availability. *Oecologia* **121**(4): 564-573.
- Ostertag R, Marín-Spiotta E, Silver WL, Schulten J. 2008. Litterfall and decomposition in relation to soil carbon pools along a secondary forest chronosequence in Puerto Rico. *Ecosystems* 11(5): 701-714.\*
- Ostonen I, Truu M, Helmisaari H-S, Lukac M, Borken W, Vanguelova E, Godbold DL, Lõhmus K, Zang U, Tedersoo L, et al. 2017. Adaptive root foraging strategies along a boreal-temperate forest gradient. *New Phytologist* 215(3): 977-991.\*
- Ouimet R, Camiré C, Furlan V. 1995. Endomycorrhizal status of sugar maple in relation to tree decline and foliar, fine-roots, and soil chemistry in the Beauce region, Quebec. *Canadian Journal of Botany* **73**(8): 1168-1175.
- Ouimette A, Guo D, Hobbie E, Gu J. 2012. Insights into root growth, function, and mycorrhizal abundance from chemical and isotopic data across root orders. *Plant and Soil* 367(1-2): 313-326.
- **Ovington JD. 1957.** Dry-matter production by *Finns sylvestris* L. *Annals of Botany* **21**: 287-314.
- **Ovington JD, Forrest WG, Armstrong JS 1967.** Tree biomass estimation. In: Young HE ed. *Symposium on Primary Productivity and Mineral Cycling in Natural Ecosystems*. Orono, Maine: University of Maine, 4-31.
- Ovington JD, Haitkamp D, Lawrence DB. 1963. Plant biomass and productivity of prairie, savanna, oakwood, and maize field ecosystems in Central Minnesota. *Ecology* 44(1): 52-63.
- **Ovington JD, Madgwick HAI. 1959a.** Distribution of organic matter and plant nutrients in a plantation of Scots pine. *Forest Science* **5**: 344-355.
- **Ovington JD, Madgwick HAI. 1959b.** The growth and composition of natural stands of birch. *Plant and Soil* **10**(3): 271-283.
- **Paavilainen E. 1980.** Effect of fertilization on plant biomass and nutrient cycling on a drained dwarf shrub pine swamp. Helsinki, Finland: Finnish Forest Research Institute.

- Pan W, Wang YH, Yu PT, Li ZY, Mo F, Shi DM, Du SC, He P, Duan J. 2009. Response of fine root characteristics of *Pinus massoniana* to the doses of limestone powder mixed in soil in the acid rain area of Chongqing, China. *Forest Research*(22): 840-845.
- **Pandey CB, Singh JS. 1992a.** Influence of rainfall and grazing on belowground biomass dynamics in a dry tropical savanna. *Canadian Journal of Botany* **70**(9): 1885-1890.
- **Pandey CB, Singh JS. 1992b.** Rainfall and Grazing Effects on Net Primary Productivity in a Tropical Savanna, India. *Ecology* **73**(6): 2007.
- **Pandya SM, Sidha VK. 1987.** Seasonal variation in plant biomass and primary production in desert vegetation at Khavda of Kutch District (Gujarat), India. *Tropical Ecology* **28**: 57-68.
- **Parker MM, Van Lear DH. 1996.** Soil heterogeneity and root distribution of mature loblolly pine stands in Piedmont soils. *Soil Science Society of America Journal* **60**(6): 1920.
- **Parrotta JA, Lodge DJ. 1991.** Fine root dynamics in a subtropical wet forest following hurricane disturbance in Puerto Rico. *Biotropica* **23**(4): 343.
- **Parthasarathy N. 1987.** Seasonal dynamics of fine roots in a tropical forest in South India. *J. Indian Bot. Soc.* **66**: 338-345.
- Paudel I, Cohen S, Shaviv A, Bar-Tal A, Bernstein N, Heuer B, Ephrath J, Epron D. 2016. Impact of treated wastewater on growth, respiration and hydraulic conductivity of citrus root systems in light and heavy soils. *Tree Physiology* 36(6): 770-785.
- **Pavlis J, Jeník J. 2000.** Roots of pioneer trees in the Amazonian rain forest. *Trees* **14**(8): 442-455.
- **Pavón NP, Briones O. 2000.** Root distribution, standing crop biomass and belowground productivity in a semidesert in Mexico. *Plant Ecology* **146**(2): 131-136.
- **Pearson LC. 1965.** Primary production in grazed and ungrazed desert communities of Eastern Idaho. *Ecology* **46**(3): 278-285.\*
- **Pelaez DV, Distel RA, Boo RM, Elia OR, Mayor MD. 1994.** Water relations between shrubs and grasses in semi-arid Argentina. *Journal of Arid Environments* **27**(1): 71-78.\*
- **Pereira HC, Hosegood PH. 1962.** Comparative water-use of softwood plantations and bamboo forest. *Journal of Soil Science* **13**(2): 299-313.\*
- **Pereira P, Cacador I, Vale C, Caetano M, Costa AL. 2007.** Decomposition of belowground litter and metal dynamics in salt marshes (Tagus Estuary, Portugal). *Science of The Total Environment* **380**(1-3): 93-101.\*
- **Perez-Ramos IM, Volaire F, Fattet M, Blanchard A, Roumet C. 2013.** Tradeoffs between functional strategies for resource-use and drought-survival in Mediterranean rangeland species. *Environmental and Experimental Botany* **87**: 126-136.
- **Peri P 2011.** Carbon storage in cold temperate ecosystems in Southern Patagonia, Argentina. In: Atazadeh I ed. *Biomass and Remote Sensing of Biomass*. Croatia: InTech, 213-226.
- **Peri P, Lasagno R 2008**. Secuestro de carbono en la estepa de Patagonia Sur. *Actas XXIII Reunion Argentina de Ecologia*: ASAE. 220.

- **Persson H. 1980a.** Fine-root production, mortality and decomposition in forest ecosystems. *Vegetatio* **41**(2): 101-109.
- **Persson H. 1980b.** Spatial distribution of fine-root growth, mortality and decomposition in a young scots pine stand in central Sweden. *Oikos* **34**(1): 77.
- **Persson H. 1982.** Changes in the tree and dwarf shrub fine-roots after clear-cutting in a mature scots pine stand. *Swedish Coniferous Forest Project Technical Report* **31**: 1-19.
- **Persson H, Von Fircks Y, Majdi H, Nilsson LO. 1995.** Root distribution in a norway spruce (*Picea abies* (l.) karst.) stand subjected to drought and ammonium-sulphate application. *Plant and Soil* **168-169**(1): 161-165.
- **Persson HÅ. 1983.** The distribution and productivity of fine roots in boreal forests. *Plant and Soil* **71**(1-3): 87-101.
- **Phillips RP, Bernhardt ES, Schlesinger WH. 2009.** Elevated CO<sub>2</sub> increases root exudation from loblolly pine (*Pinus taeda*) seedlings as an N-mediated response. *Tree Physiology* **29**(12): 1513-1523.
- **Phillips WS. 1963.** Depth of Roots in Soil. *Ecology* **44**(2): 424-424.\*
- **Picard D. 1979.** Evaluation of the organic matter supplied to the soil by the decay of the roots of an intensively managed *Panicum Maximum* sward. *Plant and Soil* **51**(4): 491-501.
- **Picon-Cochard C, Pilon R, Tarroux E, Pagès L, Robertson J, Dawson L. 2011.** Effect of species, root branching order and season on the root traits of 13 perennial grass species. *Plant and Soil* **353**(1-2): 47-57.
- **Piedade MTF, Junk WJ, De Mello JAN 1992.** A floodplain grassland in the central Amazon. In: Long SP, Jones MB, Roberts MJ eds. *Primary productivity of grass ecosystems*. London, UK: Chapman and Hall, 127-158.
- Pietikäinen J, Vaijärvi E, Ilvesniemi H, Fritze H, Westman CJ. 1999. Carbon storage of microbes and roots and the flux of CO<sub>2</sub> across a moisture gradient. *Canadian Journal of Forest Research* 29(8): 1197-1203.
- **Pinheiro EAR, Costa CAG, de Araújo JC. 2013.** Effective root depth of the Caatinga biome. *Journal of Arid Environments* **89**: 1-4.\*
- **Plamboeck AH, Grip H, Nygren U. 1999.** A hydrological tracer study of water uptake depth in a Scots pine forest under two different water regimes. *Oecologia* **119**(3): 452-460.
- **Plewczynska-Kuras U. 1976.** Estimation of biomass of the underground parts of meadow herbage in the three variants of fertilization. *Polish Ecological Studies* **2**: 63-74.
- **Polverigiani S, McCormack ML, Mueller CW, Eissenstat DM. 2011.** Growth and physiology of olive pioneer and fibrous roots exposed to soil moisture deficits. *Tree Physiology* **31**(11): 1228-1237.
- **Poon GT, Maherali H. 2015.** Competitive interactions between a nonmycorrhizal invasive plant, *Alliaria petiolata*, and a suite of mycorrhizal grassland, old field, and forest species. *PeerJ* **3**: e1090.\*

- **Poot P, Lambers H. 2003.** Are trade-offs in allocation pattern and root morphology related to species abundance? A congeneric comparison between rare and common species in the south-western Australian flora. *Journal of Ecology* **91**(1): 58-67.
- **Popov KP. 1979.** Fistashka v srednei Azii. (The pistachio in central Asia). Ylym, Ashkhabad, Turkmenistan
- Poret N, Twilley RR, Rivera-Monroy VH, Coronado-Molina C. 2007. Belowground decomposition of mangrove roots in Florida coastal everglades. *Estuaries and Coasts* 30(3): 491-496.\*
- **Portsmuth A, Niinemets Ü. 2006.** Interacting controls by light availability and nutrient supply on biomass allocation and growth of *Betula pendula* and *B. pubescens* seedlings. *Forest Ecology and Management* **227**(1-2): 122-134.
- **Portsmuth A, Niinemets Ü, Truus L, Pensa M. 2005.** Biomass allocation and growth rates in *Pinus sylvestris* are interactively modified by nitrogen and phosphorus availabilities and by tree size and age. *Canadian Journal of Forest Research* **35**(10): 2346-2359.
- **Powell SW, Day FP. 1991.** Root Production in Four Communities in the Great Dismal Swamp. *American Journal of Botany* **78**(2): 288.
- **Powers JS, Treseder KK, Lerdau MT. 2004.** Fine roots, arbuscular mycorrhizal hyphae and soil nutrients in four neotropical rain forests: patterns across large geographic distances. *New Phytologist* **165**(3): 913-921.
- Pregitzer KS, Kubiske ME, Yu CK, Hendrick RL. 1997. Relationships among root branch order, carbon, and nitrogen in four temperate species. *Oecologia* 111(3): 302-308.
- Pregitzer KS, Laskowski MJ, Burton AJ, Lessard VC, Zak DR. 1998. Variation in sugar maple root respiration with root diameter and soil depth. *Tree Physiology* **18**(10): 665-670.\*
- Pregitzer KS, Zak DR, Curtis PS, Kubiske ME, Teeri JA, Vogel CS. 1995. Atmospheric CO<sub>2</sub>, soil nitrogen and turnover of fine roots. *New Phytologist* 129(4): 579-585.
- **Preston RJ. 1942.** The growth and development of the root systems of juvenile lodgepole pine. *Ecological Monographs* **12**(4): 449-468.\*
- **Price SR. 1911.** The roots of some North African desert-grasses. *New Phytologist* **10**(9-10): 328-340.\*
- Pritchard SG, Davis MA, Mitchell RJ, Prior SA, Boykin DL, Rogers HH, Runion GB. 2001a. Root dynamics in an artificially constructed regenerating longleaf pine ecosystem are affected by atmospheric CO<sub>2</sub> enrichment. *Environmental and Experimental Botany* 46(1): 55-69.
- Pritchard SG, Maier CA, Johnsen KH, Grabman AJ, Chalmers AP, Burke MK. 2010. Soil incorporation of logging residue affects fine-root and mycorrhizal root-tip dynamics of young loblolly pine clones. *Tree Physiology* **30**(10): 1299-1310.
- Pritchard SG, Rogers HH, Davis MA, Van Santen E, Prior SA, Schlesinger WH. 2001b.

  The influence of elevated atmospheric CO<sub>2</sub> on fine root dynamics in an intact temperate forest. *Global Change Biology* **7**(7): 829-837.

- Pritchard SG, Strand AE, McCormack ML, Davis MA, Finzi AC, Jackson RB, Matamala R, Rogers HH, Oren RAM. 2008. Fine root dynamics in a loblolly pine forest are influenced by free-air-CO<sub>2</sub>-enrichment: a six-year-minirhizotron study. *Global Change Biology* 14(3): 588-602.
- Pritchard SG, Taylor BN, Cooper ER, Beidler KV, Strand AE, McCormack ML, Zhang S. 2014. Long-term dynamics of mycorrhizal root tips in a loblolly pine forest grown with free-air CO<sub>2</sub> enrichment and soil N fertilization for 6 years. *Global Change Biology* 20(4): 1313-1326.
- **Pu X, Yin C, Xiao Q, Qiao M, Liu Q. 2016.** Fine roots branch orders of *Abies faxoniana* respond differentially to warming in a subalpine coniferous forest ecosystem. *Agroforestry Systems* **91**: 955-966.
- **Puhe J, Persson H, Borjesson I. 1986.** Wurzelwachstum und Wurzelschäden in skandinavischen Nadelwäldern. (Root growth and root damages in Scandinavian coniferous forests). *Allgemeine Forstzeitung*(20): 488-492.
- Pulling H. 1918. Root habit and plant distribution in the far north. Plant World 21: 223-233.\*
- **Puttsepp U, Lohmus K, Koppel A. 2007.** Decomposition of fine roots and alpha-cellulose in a short rotation willow (*Salix* spp.) plantation on abandoned agricultural land. *Silva Fennica* **41**(2)\*
- **Putz FE, Holbrook NM. 1989.** Strangler Fig Rooting Habits and Nutrient Relations in the Llanos of Venezuela. *American Journal of Botany* **76**(6): 781.\*
- Qiu GK, Shen YK, Li DY, Wang ZW, Huang QM, Yang DD, Gao AX 1992. Bamboo in subtropical eastern China. In: Long SP, Jones MB, Roberts MJ eds. *Primary productivity of grass ecosystems of the tropics and sub-tropics*. London, UK: Chapman and Hall
- **Qiu X, Xie S, Jin G. 1984.** A preliminary study on biomass of Lithocarpus xylocarpus forest in Xujiaba region, Ailao mountains, Yunnan (China). VI. Distribution, biomass and production of roots. *Acta Botanica Yunnanica* **6**(85-92)
- Querejeta JI, Estrada-Medina H, Allen MF, Jimenez-Osornio JJ. 2007. Water source partitioning among trees growing on shallow karst soils in a seasonally dry tropical climate. *Oecologia* 152(1): 26-36.\*
- **Quesnel HJ, Lavkulich LM. 1981.** Comparison of the chemical properties of forest floors, decaying wood, and fine roots in three ecosystems on Vancouver Island. *Canadian Journal of Forest Research* **11**(2): 216-218.
- **Raich JW. 1983.** Effects of Forest Conversion on the Carbon Budget of a Tropical Soil. *Biotropica* **15**(3): 177.
- **Rajwar GS, Ramola VC. 1990.** Variation in net primary production of east and west facing slope montane grasslands of Uttarkashi, Garhwal Himalaya. *Indian Forester* **116**: 717-722.
- **Ralston CW 1973.** Annual primary productivity in a loblolly pine plantation. In: Young HE ed. *IUFRO Biomass Studies*. Orono, Maine: University of Maine, 105-117.

- Ram J, Garg VK, Toky OP, Minhas PS, Tomar OS, Dagar JC, Kamra SK. 2006.

  Biodrainage potential of *Eucalyptus tereticornis* for reclamation of shallow water table areas in north-west India. *Agroforestry Systems* **69**(2): 147-165.\*
- Ram J, Singh SP, Singh JS. 1991. Effect of fertilizer on plant biomass distribution and net accumulation rate in an alpine meadow in Central Himalaya, India. *Journal of Range Management* 44(2): 140.
- **Ramam SS. 1970.** Root development in alluvial grasslands of Varanasi. *Indian Forester* **96**: 100-110.
- Rana BS, Rikhari HC. 1994. Biomass and productivity of different forest grazing lands in central Himalaya. *Proceedings of the Indian National Science Academy B (Biological Sciences)* 60: 129-135.
- **Rao IM 1998.** Root distribution and production in native and introduced pastures in the South American savannas. In: Box JE, Jr. ed. *Root Demographics and Their Efficiencies in Sustainable Agriculture, Grasslands and Forest Ecosystems*: Springer Netherlands, 19-41.
- **Rastin N. 1991.** Influence of waterlogging on root distribution, fine-root biomass and mycorrhizal number of Norway spruce. *Developments in Agricultural and Managed Forest Ecology* **24**: 319-332.\*
- Rawat YS, Bhatt YD, Pande P, Singh SP. 1994. Production and nutrient cycling in *Arundinaria falcata* and *Lantana camara*: the two converted ecosystems in central Himalaya. *Tropical Ecology* 35: 53-67.
- **Rawitscher F. 1948.** The water economy of the vegetation of the `campos cerrados' in Southern Brazil. *The Journal of Ecology* **36**(2): 237.\*
- **Rawitscher F. 1952.** The ecology of the "caatingas" vegetation. *Anais da Academia Brasileira de Ciencias* **34**(1): 287-301.\*
- **Ray D, Nicoll BC. 1998.** The effect of soil water-table depth on root-plate development and stability of Sitka spruce. *Forestry* **71**(2): 169-182.\*
- **Ray D, Schweizer S. 1994.** A study of the oxygen regime and rooting depth in deep peat under plantations of Sitka spruce and lodgepole pine. *Soil Use and Management* **10**(3): 129-136.\*
- **Raz-Yaseef N, Koteen L, Baldocchi DD. 2013.** Coarse root distribution of a semi-arid oak savanna estimated with ground penetrating radar. *Journal of Geophysical Research: Biogeosciences* **118**(1): 135-147.\*
- **Razaq M, Zhang P, Shen H-I, Salahuddin. 2017.** Influence of nitrogen and phosphorous on the growth and root morphology of *Acer mono. PLoS ONE* **12**(2): e0171321.\*
- **Reader RJ, Stewart JM. 1972.** The relationship between net primary production and accumulation for a peatland in Southeastern Manitoba. *Ecology* **53**(6): 1024.
- **Redente EF, Biondini ME, Moore JC. 1989.** Observations on biomass dynamics of a crested wheatgrass and native shortgrass ecosystem in southern Wyoming. *Journal of Range Management* **42**(2): 113.

- **Reed HE, Blair JM, Wall DH, Seastedt TR. 2009.** Impacts of management legacies on litter decomposition in response to reduced precipitation in a tallgrass prairie. *Applied Soil Ecology* **42**(2): 79-85.\*
- **Reekie EG, Redmann RE. 1987.** Growth and maintenance respiration of perennial root systems in a dry grassland dominated by *Agropyron dasystachyum* (hook.) scribn. *New Phytologist* **105**(4): 595-603.
- Reich PB, Buschena C, Tjoelker MG, Wrage K, Knops J, Tilman D, Machado JL. 2003. Variation in growth rate and ecophysiology among 34 grassland and savanna species under contrasting N supply: a test of functional group differences. *New Phytologist* **157**(3): 617-631.
- **Remezov HP. 1959.** Method of studying the biological cycle of elements in forest. *Soviet Soil Science* **1**: 59-67.
- **Resendes ML, Bryla DR, Eissenstat DM. 2008.** Early events in the life of apple roots: variation in root growth rate is linked to mycorrhizal and nonmycorrhizal fungal colonization. *Plant and Soil* **313**(1-2): 175-186.
- **Restom TG, Nepstad DC. 2004.** Seedling growth dynamics of a deeply rooting liana in a secondary forest in eastern Amazonia. *Forest Ecology and Management* **190**(1): 109-118.\*
- **Rewald B, Ephrath JE, Rachmilevitch S. 2011.** A root is a root? Water uptake rates of *Citrus* root orders. *Plant, Cell & Environment* **34**(1): 33-42.
- **Rewald B, Kunze ME, Godbold DL. 2016.** NH<sub>4</sub>: NO<sub>3</sub> nutrition influence on biomass productivity and root respiration of poplar and willow clones. *GCB Bioenergy* **8**(1): 51-58.
- **Rewald B, Raveh E, Gendler T, Ephrath JE, Rachmilevitch S. 2012.** Phenotypic plasticity and water flux rates of *Citrus* root orders under salinity. *Journal of Experimental Botany* **63**(7): 2717-2727.
- **Rewald B, Rechenmacher A, Godbold DL. 2014.** It's complicated: Intraroot system variability of respiration and morphological traits in four deciduous tree species. *Plant Physiology* **166**(2): 736-745.
- **Reynolds ERC. 1970.** Root distribution and the cause of its spatial variability in *Pseudotsuga taxifolia* (Poir.) Britt. *Plant and Soil* **32**(1-3): 501-517.
- **Reynolds TD, Fraley L. 1989.** Root profiles of some native and exotic plant species in Southeastern Idaho. *Environmental and Experimental Botany* **29**(2): 241-248.\*
- **Richards JH, Caldwell MM. 1987.** Hydraulic lift: Substantial nocturnal water transport between soil layers by *Artemisia tridentata* roots. *Oecologia* **73**(4): 486-489.\*
- **Richter DD, Markewitz D. 1995.** How deep is soil? *BioScience* **45**(9): 600-609.\*
- **Rickard WH, Vaughan BE. 1988.** Plant community characteristics and responses. *Developments in Agricultural and Managed Forest Ecology* **20**: 109-179.
- **Riekirk H. 1967.** The movement of phosphorus, potassium, and calcium in a Douglas-fir forestecosystem. Ph.D., University of Washington Seattle, Washington, USA.

- **Riestenberg MM. 1994.** Anchoring of thin colluvium by roots of sugar maple and white ash on hillslopes in Cincinnati. US Geological Survey Bulletin\*
- **Rikhari HC, Negi GCS, Pant GB, Rana BS, Singh SP. 1992.** Phytomass and primary productivity in several communities of a Central Himalayan alpine meadow, India. *Arctic and Alpine Research* **24**(4): 344.
- **Roberts EA, Herty SD. 1934.** *Lycopodium complanatum* Var. *Flabelliforme Fernald*: Its anatomy and a method of vegetative propagation. *American Journal of Botany* **21**(10): 688-697.\*
- **Roberts J. 1976.** A study of root distribution and growth in a *Pinus sylvestris* L. (Scots pine) plantation in East Anglia. *Plant and Soil* **44**(3): 607-621.
- **Robinson N, Harper RJ, Smettem KRJ. 2006.** Soil water depletion by *Eucalyptus* spp. integrated into dryland agricultural systems. *Plant and Soil* **286**(1-2): 141-151.\*
- **Rodin LE 1977**. Produktivnost' rastitel'nosti aridnoi zony Azii (Productivity of vegetation in arid zone of the Asia).In Rodin LE. *itogi sovetskich issledovanij po Mezhdunarodnoj biologicheskoj programme (Soviet Studies for the International Biological Programme)*. Nauka, Leningrad, Russia. 1965-1974.
- **Rodin LE, Basilevich NI, eds. 1967.** *Production and Mineral Cycling in terrestrial vegetation.* Eninburgh and London, UK: Oliver and Boyd.
- **Rodríguez R, Espinosa M, Hofmann G, Marchant M. 2003.** Needle mass, fine root and stem wood production in response to silvicultural treatment, tree size and competitive status in radiata pine stands. *Forest Ecology and Management* **186**(1-3): 287-296.
- Roering JJ, Almond P, Tonkin P, McKean J. 2002. Soil transport driven by biological processes over millennial time scales. *Geology* 30(12): 1115-1118.\*
- **Roman CT, Daiber FC. 1984.** Aboveground and belowground primary production dynamics of two Delaware Bay tidal marshes. *Bulletin of the Torrey Botanical Club* **111**(1): 34.
- **Rood SB, Bigelow SG, Hall AA. 2011.** Root architecture of riparian trees: river cut-banks provide natural hydraulic excavation, revealing that cottonwoods are facultative phreatophytes. *Trees* **25**(5): 907-917.\*
- **Rose K, Graham R, Parker D. 2003.** Water source utilization by *Pinus jeffreyi* and *Arctostaphylos patula* on thin soils over bedrock. *Oecologia* **134**(1): 46-54.\*
- Rosswall T, Flower-Ellis JGK, Johansson LGJS, Ryden BE, Sonesson M 1975. Structure and Function of Tundra Ecosystems. In: Rosswall T, Heal OW eds. *Ecology Buelletin*. Stordalen (Abisko), Sweden, 265-294.
- Rothe GM, Weil H, Geider M, Pfennig P, Wilhelmi V, Maurer WD. 1988. Nutrient element and carbohydrate status of Norway spruce at Mt. Kleiner Feldberg in Taunus exposed to air pollution and soil acidification. *Forest Pathology* 18(2): 98-111.
- Roumet C, Birouste M, Picon-Cochard C, Ghestem M, Osman N, Vrignon-Brenas S, Cao K-f, Stokes A. 2016. Root structure-function relationships in 74 species: evidence of a root economics spectrum related to carbon economy. *New Phytologist* 210(3): 815-826.\*

- Roumet C, Lafont F, Sari M, Warembourg F, Garnier E. 2008. Root traits and taxonomic affiliation of nine herbaceous species grown in glasshouse conditions. *Plant and Soil* 312(1-2): 69-83.
- Roumet C, Urcelay C, Diaz S. 2006. Suites of root traits differ between annual and perennial species growing in the field. *New Phytologist* 170(2): 357-368.
- Roupsard O, Ferhi A, Granier A, Pallo F, Depommier D, Mallet B, Joly HI, Dreyer E. 1999. Reverse phenology and dry-season water uptake by *Faidherbia albida* (Del.) A. Chev. in an agroforestry parkland of Sudanese west Africa. *Functional Ecology* 13(4): 460-472.
- Roux JP, Hopper SD, Smith RJ. 2009. *Isoetes eludens* (Isoetaceae), a new endemic species from the Kamiesberg, Northern Cape, South Africa. *Kew Bulletin* **64**(1): 123-128.\*
- Ruess RW, Cleve KV, Yarie J, Viereck LA. 1996. Contributions of fine root production and turnover to the carbon and nitrogen cycling in taiga forests of the Alaskan interior. *Canadian Journal of Forest Research* 26(8): 1326-1336.
- Rui L, Werger MJA, During HJ, Zhong JC. 1999. Biomass distribution in a grove of the giant bamboo *Phyllostachys pubescens* in Chongqing, China. *Flora (Jena)* 194: 89-96.
- **Ruotsalainen A, Väre H, Vestberg M. 2014.** Seasonality of root fungal colonization in low-alpine herbs. *Mycorrhiza* **12**(1): 29-36.
- Ruotsalainen AL, Väre H, Oksanen J, Tuomi J. 2004. Root fungus colonization along an altitudinal gradient in North Norway. *Arctic, Antarctic, and Alpine Research* 36(2): 239-243.
- **Rutherford MC. 1983.** Growth rates, biomass and distribution of selected woody plant roots in *Burkea africana-Ochna pulchra* savanna. *Vegetatio* **52**(1): 45-63.\*
- **Ryan MG, Hubbard RM, Pongracic S, Raison RJ, McMurtrie RE. 1996.** Foliage, fine-root, woody-tissue and stand respiration in *Pinus radiata* in relation to nitrogen status. *Tree Physiology* **16**(3): 333-343.
- **Rychnovska' M 1993.** Temperate Semi-Natural Grasslands of Eurasia. In: Coupland RT ed. *Natural Grasslands*. Amsterdam, Netherlands: Elsevier, 125-166.
- **Ryser P, Lambers H. 1995.** Root and leaf attributes accounting for the performance of fast- and slow-growing grasses at different nutrient supply. *Plant and Soil* **170**(2): 251-265.
- **Saarinen T. 1996.** Biomass and production of two vascular plants in a boreal mesotrophic fen. *Canadian Journal of Botany* **74**(6): 934-938.
- **Safford LO. 1974.** Effect of fertilization on biomass and nutrient content of fine roots in a beech-birch-maple stand. *Plant and Soil* **40**(2): 349-363.
- **Safford LO, Bell S. 1972.** Biomass of fine roots in a white spruce plantation. *Canadian Journal of Forest Research* **2**(3): 169-172.
- **Saggar S, Hedley C, Mackay AD. 1997.** Partitioning and translocation of photosynthetically fixed <sup>14</sup>C in grazed hill pastures. *Biology and Fertility of Soils* **25**(2): 152-158.

- **Sah VK, Saxena AK, Singh V. 1994.** Seasonal variation in plant biomass and net primary productivity of grazing lands in the forest zone of Garhwal Himalaya. *Tropical Ecology* **35**: 115-131.
- **Sainju UM, Good RE. 1993.** Vertical root distribution in relation to soil properties in New Jersey Pinelands forests. *Plant and Soil* **150**(1): 87-97.\*
- **Salis SM, Lehn CR, Mattos PP, Bergier I, Crispim SMA. 2014.** Root behavior of savanna species in Brazil's Pantanal wetland. *Global Ecology and Conservation* **2**: 378-384.\*
- **Samoilova EM 1968.** The study of the tree root systems on sandy soils. In: Ghilarov MS, Kovda VA, Novichkova-Ivanova LN, Rodin LE, Sveshnikova VM eds. *Methods of productivity studies in root systems and rhizosphere organisms*. Nauka, Leningrad, Russia: International Symposium USSR, August 28--September 12, 195-200.
- **San Jose JJ, Berrade F, Ramirez J. 1982.** Seasonal changes of growth, mortality and disappearance of belowground root biomass in the *Trachypogon* savanna grass. *Acta Oecologica Oecologia Plantarum* **3**: 347-358.
- **San Jose JJ, Garcia-Miragaya J. 1981.** Operational factors on the organic matter production of the Trachypogon savannas. *Bol. Soc. Venez. Cienc. Nut.* **139**: 347-374.
- **Sanford RL**, **Jr. 1989.** Root systems of three adjacent, old growth Amazon forests and associated transition zones. *Journal of Tropical Forest Science* **1**: 268-279.
- **Santantonio D, Grace JC. 1987.** Estimating fine-root production and turnover from biomass and decomposition data: a compartment–flow model. *Canadian Journal of Forest Research* **17**(8): 900-908.
- **Santantonio D, Hermann RK. 1985.** Standing crop, production, and turnover of fine roots on dry, moderate, and wet sites of mature Douglas-fir in western Oregon. *Annales des Sciences Forestières* **42**(2): 113-142.
- **Santantonio D, Hermann RK, Overton WS. 1977.** Root biomass studies in forest ecosystems. *Pedobiologia* **17**: 1-31.
- **Saterson KA, Vitousek PM. 1984.** Fine-root biomass and nutrient cycling inAristida strictain a North Carolina coastal plain savanna. *Canadian Journal of Botany* **62**(4): 823-829.
- **Satterlund DR. 1969.** Some inter-relationships between groundwater and swamp forests in the western Upper Peninsula of Michigan. Ph.D, University of Michigan \*
- **Saurina NI, Kamenetskaya IV. 1969.** Massa kornej sosny obyknovennoj (*Pinus sylvestris* L.) v sosnjake mshisto-lishajnikovom juzhnoj tajgi. (The root mass of *Pinus sylvestris* L. in moss-lichen pine forests of the southern taiga). *Otdel Biologicheskii* **74**: 96-100.
- **Saxena AK, Rana BS, Rao OP, Singh BP. 1996.** Seasonal variation in biomass and primary productivity of para grass (Brachiaria mutica) under a mixed tree stand and in an adjacent open area in northern India. *Agroforestry Systems* **33**(1): 75-85.
- **Scarton F, Day JW, Rismondo A. 2002.** Primary production and decomposition of *Sarcocornia fruticosa* (L.) scott and *Phragmites australis* Trin. Ex Steudel in the Po Delta, Italy. *Estuaries* **25**(3): 325-336.\*

- **Schimel JP, Chapin FS. 1996.** Tundra plant uptake of amino acid and NH<sub>4</sub><sup>+</sup> nitrogen in situ: plants complete well for amino acid N. *Ecology* **77**(7): 2142.
- **Schmid I, Kazda M. 2001.** Vertical distribution and radial growth of coarse roots in pure and mixed stands of *Fagus sylvatica* and *Picea abies. Canadian Journal of Forest Research* **31**(3): 539-548.\*
- **Schmid I, Kazda M. 2005.** Clustered root distribution in mature stands of *Fagus sylvatica* and *Picea abies. Oecologia* **144**(1): 25-31.\*
- **Schneider BU, Zech W. 1990.** The influence of Mg fertilization on growth and mineral contents of fine roots in (*Picea abies* [Karst] L.) stands at different stages of decline in NE-Bavaria. *Water, Air, & Soil Pollution* **54**(3): 469-476.
- **Scholes RJ, Walker BH, eds. 1993a.** *An African Savanna: Synthesis of the Nylsvley Study*: Cambridge University Press.
- **Scholes RJ, Walker BH 1993b.** Primary production. In: Scholes RJ, Walker BH eds. *An African Savanna: Synthesis of the Nylsyley Study*: Cambridge University Press, 144-167.
- **Schreiber KF, Yair A, Schachak M 1995.** Ecological gradients along slopes of the northern Negev highlands, Israel. In: Blume HP, Berkowicz SM eds. *Arid ecosystems*. Cremlingen, Germany: Catena Verlag, 209-229.
- **Schroth G, Kolbe D, Pity B, Zech W. 1996.** Root system characteristics with agroforestry relevance of nine leguminous tree species and a spontaneous fallow in a semi-deciduous rainforest area of West Africa. *Forest Ecology and Management* **84**(1-3): 199-208.
- **Schroth G, Zech W. 1995.** Above- and below-ground biomass dynamics in a sole cropping and an alley cropping system with Gliricidia sepium in the semi-deciduous rainforest zone of West Africa. *Agroforestry Systems* **31**(2): 181-198.
- **Schubauer JP, Hopkinson CS. 1984.** Above- and belowground emergent macrophyte production and turnover in a coastal marsh ecosystem, Georgia. *Limnology and Oceanography* **29**(5): 1052-1065.
- **Schultz JD. 1969.** The vertical rooting habit in black spruce, white spruce, and balsam fir. Ph.D, University of Michigan \*
- **Schultz RP. 1972.** Root development of intensively cultivated slash pine. *Soil Science Society of America Journal* **36**(1): 158.\*
- Schulze ED, Mooney HA, Sala OE, Jobbagy E, Buchmann N, Bauer G, Canadell J, Jackson RB, Loreti J, Oesterheld M, et al. 1996. Rooting depth, water availability, and vegetation cover along an aridity gradient in Patagonia. *Oecologia* 108(3): 503-511.
- **Schuur EAG. 2001.** The effect of water on decomposition dynamics in mesic to wet Hawaiian montane forests. *Ecosystems* **4**(3): 259-273.\*
- **Scully NJ. 1942.** Root distribution and environment in a maple-oak forest. *Botanical Gazette* **103**(3): 492.
- **Seastedt TR. 1988.** Mass, nitrogen, and phosphorus dynamics in foliage and root detritus of tallgrass prairie. *Ecology* **69**(1): 59-65.\*

- **Segal AD, Sullivan PF. 2014.** Identifying the sources and uncertainties of ecosystem respiration in Arctic tussock tundra. *Biogeochemistry* **121**(3): 489-503.
- **Seghieri J. 1995.** The rooting patterns of woody and herbaceous plants in a savanna; are they complementary or in competition? *African Journal of Ecology* **33**(4): 358-365.\*
- **Semmartin M, Garibaldi LA, Chaneton EJ. 2007.** Grazing history effects on above- and below-ground litter decomposition and nutrient cycling in two co-occurring grasses. *Plant and Soil* **303**(1-2): 177-189.\*
- **Shackleton CM, McKenzie B, Granger JE. 1988.** Seasonal changes in root biomass, root/shoot ratios and turnover in two coastal grassland communities in Transkei. *South African Journal of Botany* **54**: 465-471.
- **Shafroth PB, Stromberg JC, Patten DT. 2000.** Woody riparian response to different alluvial water table regimes. *Western North American Naturalist* **60**(1): 66-76.\*
- **Shalyt MS. 1950.** kh i pustynnykh rastenyi i fitocenozov. C. I. Travjanistye i polukustarnigkovye rastenija i fitocenozy lesnoj (luga) i stepnoj zon. (Belowground parts of some meadow, steppe, and desert plants and plant communities. Part I: Herbaceous plants and subshrubs and plant communities of forest and steppe zones). *Geobotanika* 6: 205-442.
- **Shalyt MS. 1952.** Podzemnaja cast' nekotorykh lugovykh, stepnykh i pustynnykh rastenyi i fitocenozov. C. 2. Travjanistye, polukustarnigkovye i kustarnigkovye rastenija i fitocenozy pustynnoj zony. (Belowground parts of some meadow, steppe, and desert plants and plant communities. Part 2: Herbaceous plants, subshrubs, and shrubs, and plant communities of the desert zone). *Geobotanika* 8: 71-139.
- Shalyt MS, Zhivotenko LF 1968. Overground and underground parts of certain grass and dwarf semishrub phytocoenoses of the Crimean Jaila (mountain pastures) and the technique of their estimation. In: Ghilarov MS, Kovda VA, Novichkova-Ivanova LN, Rodin LE, Sveshnikova VM eds. *Methods of productivity studies in root systems and rhizosphere organisms*. Nauka, Leningrad, Russia: International Symposium USSR, August 28-September 12, 1968, 204-208.
- **Shankar U, Pandey HN, Tripathi RS. 1993.** Phytomass dynamics and primary productivity in humid grasslands along altitudinal and rainfall gradients. *Acta Oecologica* **14**: 197-209.
- **Shankar V, Shankarnarayan KA, Rai P. 1973.** Primary productivity, energetics and nutrient cycling in Sehima-Heteropogon grassland. I. Seasonal variation in composition, standing crop and net production. *Tropical Ecology* **14**(238-251)
- **Shariff AR, Biondini ME, Grygiel CE. 1994.** Grazing intensity effects on litter decomposition and soil nitrogen mineralization. *Journal of Range Management* **47**(6): 444.\*
- **Shaver GR, Billings WD. 1975.** Root production and root turnover in a wet tundra ecosystem, Barrow, Alaska. *Ecology* **56**(2): 401.
- **Shaver GR, Chapin F, III, Gartner BL. 1986.** Factors limiting seasonal growth and peak biomass accumulation in *Eriophorum vaginatum* in Alaskan tussock tundra. *The Journal of Ecology* **74**(1): 257.

- **Shaver GR, Chapin FS, III. 1991.** Production: biomass relationships and element cycling in contrasting arctic vegetation types. *Ecological Monographs* **61**(1): 1.
- **Shaver GR, Chapin FS, III, Billings WD. 1979.** Ecotypic differentiation in *Carex aquatilis* on ice-wedge polygons in the Alaskan coastal tundra. *The Journal of Ecology* **67**(3): 1025.
- **Shaver GR, Cutler JC. 1979.** The vertical distribution of live vascular phytomass in cottongrass tussock tundra. *Arctic and Alpine Research* **11**(3): 335.
- Shaver GR, Johnson LC, Cades DH, Murray G, Laundre JA, Rastetter EB, Nadelhoffer KJ, Giblin AE. 1998. Biomass and CO<sub>2</sub> flux in wet sedge tundras: Responses to nutrients, temperature, and light. *Ecological Monographs* 68(1): 75-97.
- **Shaver GR, Laundre JA, Giblin AE, Nadelhoffer KJ. 1996.** Changes in live plant biomass, primary production, and species composition along a riverside toposequence in arctic alaska, u.S.A. *Arctic and Alpine Research* **28**(3): 363.
- Shen Y, Wang N, Cheng R, Xiao W, Yang S, Guo Y, Lei L, Zeng L, Wang X. 2017. Characteristics of fine roots of *Pinus massoniana* in the Three Gorges reservoir area, China. *Forests* 8(6): 183.\*
- **Sherff EE. 1912.** The vegetation of skokie marsh, with special reference to subterranean organs and their interrelationships. *Botanical Gazette* **53**(5): 415-435.\*
- Shi W, Wang Z, Liu J, Gu J, Guo D. 2008. Fine root morphology of twenty hardwood species in Maoershan Natural Secondary Forest in Northeastern China. *Journal of Plant Ecology (Chinese Version* 32: 1238-1247.
- **Shiponeni N, Allsopp N, Carrick PJ, Hoffman MT. 2010.** Competitive interactions between grass and succulent shrubs at the ecotone between an arid grassland and succulent shrubland in the Karoo. *Plant Ecology* **212**(5): 795-808.\*
- Sierra CA, del Valle JI, Orrego SA, Moreno FH, Harmon ME, Zapata M, Colorado GJ, Herrera MA, Lara W, Restrepo DE, et al. 2007. Total carbon stocks in a tropical forest landscape of the Porce region, Colombia. *Forest Ecology and Management* 243(2-3): 299-309.\*
- **Sika A. 1969.** Utilization of soil space by roots in pure spruce stands. *Institute of Forestry of Czechoslovakia* **6**: 71-78.
- **Silva JS, Rego FC. 2003.** Root distribution of a Mediterranean shrubland in Portugal. *Plant and Soil* **255**(2): 529-540.\*
- **Silva JS, Rego FC. 2004.** Root to shoot relationships in Mediterranean woody plants from Central Portugal. *Biologia Bratislava* **59**(13): 1-7.\*
- **Silver WL, Vogt KA. 1993.** Fine root dynamics following single and multiple disturbances in a subtropical wet forest ecosystem. *The Journal of Ecology* **81**(4): 729.
- **Simonovic V 1991.** Biomass of roots in natural oak-hornbeam ecosystem. In: McMichael BL, Persson H eds. *Plant Roots and their Environment*. Uppsala, Sweden, 1-649.\*
- Sims PL, Coupland RT 1979. Producers. In: Coupland RT ed. *Grassland Ecosystems of the World: Analysis of Grasslands and Their Uses*. New York, NY, USA: Cambridge University Press, 49-72.

- **Sims PL, Singh JS. 1978.** The structure and function of ten western North American grasslands: II. Intra-seasonal dynamics in primary producer compartments. *The Journal of Ecology* **66**(2): 547.
- **Singh AK. 1972.** Structure and primary net production and mineral contents of two grassland communities of Chakia Hill, Varanasi. PhD, Banaras Hindu University Varanasi, India.
- **Singh J. 1983.** Estimation of fine root biomass and nutrients in sal plantations in Meghalaya. *Acta Botanica Indica* **11**: 219-223.
- **Singh JS, Coleman DC. 1973.** A technique for evaluating functional root biomass in grassland ecosystems. *Canadian Journal of Botany* **51**(10): 1867-1870.
- **Singh JS, Coleman DC. 1974.** Distribution of photo-assimilated carbon in the root system of a shortgrass prairie. *The Journal of Ecology* **62**(2): 359.
- **Singh JS, Coleman DC 1977.** Evaluation of functional root biomass and translocation of photoassimilated C14 in a shortgrass prairie ecosystem. In: JK M ed. *The belowground ecosystem: a synthesis of plant-associated processes*. Fort Collins, Colorado, USA: Colorado State University, 29-37.
- **Singh JS, Singh KP, Yadava PS 1979.** Ecosystem synthesis. In: Coupland RT ed. *Grassland Ecosystems of the World: Analysis of Grasslands and Their Uses.* New York, NY, USA: Cambridge University Press, 231-239.
- **Singh JS, Singh L, Pandey CB. 1991.** Savannization of dry tropical forest increases carbon flux relative to storage. *Current Science* **61**: 477-480.
- **Singh JS, Yadava PS. 1974.** Seasonal variation in composition, plant biomass, and net primary productivity of a tropical grassland at Kurukshetra, India. *Ecological Monographs* **44**(3): 351.
- **Singh KP, Singh RP. 1981.** Seasonal variation in biomass and energy of small roots in tropical dry deciduous forest, Varanasi, India. *Oikos* **37**(1): 88.
- **Singh RS. 1993.** Effect of winter fire on primary productivity and nutrient concentration of a dry tropical savanna. *Vegetatio* **106**(1): 63-71.
- **Sjors H. 1991.** Phyto- and necromass above and below ground in a fen. *Ecography* **14**(3): 208-218.
- **Slavich PG, Smith KS, Tyerman SD, Walker GR. 1999.** Water use of grazed salt bush plantations with saline watertable. *Agricultural Water Management* **39**(2-3): 169-185.\*
- **Sloan VL. 2011.** Plant roots in arctic ecosystems: stocks and dynamics, and their coupling to above-ground parameters. PhD, University of Sheffield Sheffield, UK.
- **Smit GN, Rethman NFG. 1998.** Root biomass, depth distribution and relations with leaf biomass of *Colophospermum mopane*. *South African Journal of Botany* **64**(1): 38-43.
- Smith KK, Good RE, Good NF. 1979. Production dynamics for above and belowground components of a New Jersey *Spartina alterniflora* tidal marsh. *Estuarine and Coastal Marine Science* 9(2): 189-201.

- Smith MS, Fridley JD, Goebel M, Bauerle TL. 2014. Links between belowground and aboveground resource-related traits reveal species growth strategies that promote invasive advantages. *PLoS ONE* **9**(8): e104189.\*
- **Smith RIL, Walton DWH 1975.** South Georgia, subantarctic. In: Rosswall T, Heal OW eds. *Structure and function of tundra ecosystems*. Stockholm, Sweden: Ecology Bulletin, 399-423.
- Smith SW, Woodin SJ, Pakeman RJ, Johnson D, van der Wal R. 2014. Root traits predict decomposition across a landscape-scale grazing experiment. *New Phytologist* 203(3): 851-862.
- **Sobotik M. 1996.** The anatomical root structure of *Kochia prostrata* (L.) Scrad. *Acta Phytogeographica Suecica* **81**: 48-52.\*
- **Soethe N, Lehmann J, Engels C. 2006.** Root morphology and anchorage of six native tree species from a tropical montane forest and an elfin forest in Ecuador. *Plant and Soil* **279**(1-2): 173-185.\*
- **Soethe N, Lehmann J, Engels C. 2007.** Carbon and nutrient stocks in roots of forests at different altitudes in the Ecuadorian Andes. *Journal of Tropical Ecology* **23**(03): 319.
- **Sommer R, Denich M, Vlek PLG. 2000.** Carbon storage and root penetration in deep soils under small-farmer land-use systems in the Eastern Amazon region, Brazil. *Plant and Soil* **219**(1/2): 231-241.
- Sonn SW, ed. 1960. Per Einfluß des Waldes auf die Böden. Jena, Austria: Fischer Verlag.
- Sorensen PL, Clemmensen KE, Michelsen A, Jonasson S, Ström L. 2008. Plant and microbial uptake and allocation of organic and inorganic nitrogen related to plant growth forms and soil conditions at two subarctic tundra sites in Sweden. *Arctic, Antarctic, and Alpine Research* **40**(1): 171-180.
- **Soumare A, Groot JJ, Kone D, Radersma S 1994**. Structure spatiale du système racinaire de deux arbres du Sahel: *Acacia seyal* et *Sclerocarya birrea*. *Production Soudano-Sahelienne*. Wageningen, Netherlands
- **Sowell JB, Spomer GG. 1986.** Ecotypic variation in root respiration rate among elevational populations of *Abies lasiocarpa* and *Picea engelmannii*. *Oecologia* **68**(3): 375-379.
- **Specht RL, Rayson P. 1957.** Dark Island heath (Ninety-mile Plain, South Australia). III. The root systems. *Australian Journal of Botany* **5**(1): 103.
- **Spence LE. 1937.** Root studies of important range plants on the Boise River Watershed. *Journal of Forestry* **35**(8): 747-754.\*
- **Sperry JS, Hacke UG. 2002.** Desert shrub water relations with respect to soil characteristics and plant functional type. *Functional Ecology* **16**(3): 367-378.\*
- **Sperry TM. 1935.** Root systems in Illinois prairie. *Ecology* **16**(2): 178-202.\*
- **Sprackling JA, Read RA. 1979.** Tree root systems in Eastern Nebraska. Nebraska Conservation Bulletin\*

- **Srivastava AK, Ambasht RS. 1996.** Litterfall, decomposition, and nitrogen release in two age groups of trees in *Casuarina equisetifolia* plantations in the dry tropical Vindhyan plateau, India. *Biology and Fertility of Soils* **21**(4): 277-283.\*
- **Srivastava SK, Singh KP, Upadhyay RS. 1986.** Fine root growth dynamics in teak (*Tectona grandis* Linn. F.). *Canadian Journal of Forest Research* **16**(6): 1360-1364.
- **Stark N. 1971.** Nutrient cycling II: Nutrient distribution in Amazonian vegetation. *Tropical Ecology* **12**: 177-201.
- **Steele SJ, Gower ST, Vogel JG, Norman JM. 1997.** Root mass, net primary production and turnover in aspen, jack pine and black spruce forests in Saskatchewan and Manitoba, Canada. *Tree Physiology* **17**(8-9): 577-587.
- **Steinberger Y, Degani R, Barness G. 1995.** Decomposition of root litter and related microbial population dynamics of a Negev Desert shrub, *Zygophyllum dumosum*. *Journal of Arid Environments* **31**(4): 383-399.\*
- **Sternberg PD, Anderson MA, Graham RC, Beyers JL, Tice KR. 1996.** Root distribution and seasonal water status in weathered granitic bedrock under chaparral. *Geoderma* **72**(1-2): 89-98.
- **Stevenson MJ, Day FP. 1996.** Fine-root biomass distribution and production along a barrier island chronosequence. *American Midland Naturalist* **135**(2): 205.
- **Stewart J, Freedman B 1994.** Biomass allocation in ten *Saxifraga* species in the high arctic. In: Svoboda J, Freedman B eds. *Ecology of a polar oasis: Alexandra Fiord, Ellesmere Island, Canada*. New York, ON, Canada: Captus Press, INc.
- Stiling P, Moon D, Rossi A, Forkner R, Hungate BA, Day FP, Schroeder RE, Drake B. 2013. Direct and legacy effects of long-term elevated CO<sub>2</sub> on fine root growth and plant-insect interactions. *New Phytologist* 200(3): 788-795.
- **Stoeckeler JH, Kluender WA. 1938.** The hydraulic method of excavating the root systems of plants. *Ecology* **19**(3): 355-369.\*
- **Stoner WA, Miller P, Miller PC. 1982.** Seasonal dynamics and standing crops of biomass and nutrients in a subarctic tundra vegetation. *Ecography* **5**(2): 172-179.
- **Stover DB, Day FP, Butnor JR, Drake BG. 2007.** Effect of elevated CO<sub>2</sub> on coarse-root biomass in Florida scrub detected by ground-penetrating radar. *Ecology* **88**(5): 1328-1334.
- **Stover DB, Day FP, Drake BG, Hinkle CR. 2010.** The long-term effects of CO<sub>2</sub> enrichment on fine root productivity, mortality, and survivorship in a scrub-oak ecosystem at Kennedy Space Center, Florida, USA. *Environmental and Experimental Botany* **69**(2): 214-222.
- **Stringer JW, Kalisz PJ, Volpe JA. 1989.** Deep tritiated water uptake and predawn xylem water potentials as indicators of vertical rooting extent in a *Quercus–Carya* forest. *Canadian Journal of Forest Research* **19**(5): 627-631.\*
- Ström L, Tagesson T, Mastepanov M, Christensen TR. 2012. Presence of *Eriophorum* scheuchzeri enhances substrate availability and methane emission in an Arctic wetland. *Soil Biology and Biochemistry* 45: 61-70.

- **Strong WL, Roi GHL. 1983.** Rooting depths and successional development of selected boreal forest communities. *Canadian Journal of Forest Research* **13**(4): 577-588.
- **Strugnell RG, Pigott CD. 1978.** Biomass, shoot-production and grazing of two grasslands in the Rwenzori National Park, Uganda. *The Journal of Ecology* **66**(1): 73.
- **Sturges DL. 1977.** Soil water withdrawal and root characteristics of big sagebrush. *American Midland Naturalist* **98**(2): 257.
- **Sturges DL, Trlica MJ. 1978.** Root weights and carbohydrate reserves of big sagebrush. *Ecology* **59**(6): 1282-1285.\*
- Su Y, Li X, Liu Y, Li J, Yin H, Wang Z. 2015. Fine root morphology and biomass characteristics at preliminary stage of gap border trees of reformed low beneficial *Cupressus funebris* forests. *Acta Botanica Boreali-Occidentalia Sinica* 35(3): 0587-0593.\*
- **Sudmeyer RA, Speijers J, Nicholas BD. 2004.** Root distribution of *Pinus pinaster*, *P. radiata*, *Eucalyptus globulus* and *E. kochii* and associated soil chemistry in agricultural land adjacent to tree lines. *Tree Physiology* **24**(12): 1333-1346.\*
- Sullivan PF, Arens SJT, Chimner RA, Welker JM. 2007a. Temperature and microtopography interact to control carbon cycling in a high arctic fen. *Ecosystems* 11(1): 61-76.
- Sullivan PF, Sommerkorn M, Rueth HM, Nadelhoffer KJ, Shaver GR, Welker JM. 2007b. Climate and species affect fine root production with long-term fertilization in acidic tussock tundra near Toolik Lake, Alaska. *Oecologia* **153**(3): 643-652.
- **Sullivan PF, Welker JM. 2004.** Warming chambers stimulate early season growth of an arctic sedge: results of a minirhizotron field study. *Oecologia* **142**(4): 616-626.
- Sun J-j, Gu J-c, Wang Z-q. 2012. Discrepancy in fine root turnover estimates between diameter-based and branch-order-based approaches: a case study in two temperate tree species. *Journal of Forestry Research* 23(4): 575-581.
- Sun K, Luke McCormack M, Li L, Ma Z, Guo D. 2016. Fast-cycling unit of root turnover in perennial herbaceous plants in a cold temperate ecosystem. *Scientific Reports* 6: 19698.
- **Sun T, Dong L, Mao Z. 2015.** Simulated atmospheric nitrogen deposition alters decomposition of ephemeral roots. *Ecosystems* **18**(7): 1240-1252.\*
- Sun T, Mao Z, Dong L, Hou L, Song Y, Wang X. 2012. Further evidence for slow decomposition of very fine roots using two methods: litterbags and intact cores. *Plant and Soil* 366(1-2): 633-646.
- Sun T, Mao Z, Han Y. 2013. Slow decomposition of very fine roots and some factors controlling the process: a 4-year experiment in four temperate tree species. *Plant and Soil* 372(1-2): 445-458.
- **Sundarapandian SM, Swamy PS. 1996.** Fine root biomass distribution and productivity patterns under open and closed canopies of tropical forest ecosystems at Kodayar in Western Ghats, South India. *Forest Ecology and Management* **86**(1-3): 181-192.

- **Sundriyal RC, Joshi AP. 1990.** Effect of grazing on standing crop, productivity and efficiency of energy capture in an alpine grassland ecosystem at Tungnath (Garhwal Himalaya), India. *Tropical Ecology* **31**: 84-97.
- **Svejcar TJ, Trent JD. 1995.** Gas exchange and water relations of Lemmon's willow and Nebraska sedge. *Journal of Range Management* **48**(2): 121.\*
- **Sveshnikova VM 1968.** Root system distribution and biomass of plants in Pamir Mountain deserts. In: Ghilarov MS, Kovda VA, Novichkova-Ivanova LN, Rodin LE, Sveshnikova VM eds. *Methods of productivity studies in root systems and rhizosphere organisms*. Nauka, Leningrad, Russia: International Symposium USSR, August 28--September 12, 1968, 208-213.
- **Svoboda J 1977.** Ecology and primary production of Raised Beach communities, Truelove Lowland. In: Bliss LC ed. *Truelove Lowland, Devon Island, Canada: a high arctic ecosystem.* Edmonton, AB, Canada: University of Alberta Press, 185-215.
- **Sweet AT. 1933.** Soil profile and root penetration as indicators of apple production in the lake shore district of western New York. USDA Circular\*
- **Syahrinudin. 2005.** The potential of oil palm and forest plantations for carbon sequestration on degraded land in Indonesia: Cuvillier Verlag.\*
- **Symbula M, Day FP. 1988.** Evaluation of two methods for estimating belowground production in a freshwater swamp forest. *American Midland Naturalist* **120**(2): 405.
- **Szanser M. 1997.** Root production and biomass of Arrhenatheretalia meadows of different age. *Ekologia Polska* **45**: 633-646.
- **Tabler RD. 1964.** The root system of *Artemisa tridentata* at 9,500 feet in Wyoming. *Ecology* **45**(3): 633-636.\*
- **Taylor MK, Lankau RA, Wurzburger N, de Vries F. 2016.** Mycorrhizal associations of trees have different indirect effects on organic matter decomposition. *Journal of Ecology*
- **Teskey RO, Hinckley TM. 1981.** Influence of temperature and water potential on root growth of white oak. *Physiologia Plantarum* **52**(3): 363-369.\*
- **Thomas FM. 2000.** Vertical rooting patterns of mature *Quercus* trees growing on different soil types in northern Germany. *Plant Ecology* **147**(1): 95-103.\*
- **Thompson J, Proctor J, Viana V, Milliken W, Ratter JA, Scott DA. 1992.** Ecological studies on a lowland evergreen rain forest on Maraca Island, Roraima, Brazil. I. Physical environment, forest structure and leaf chemistry. *The Journal of Ecology* **80**(4): 689.
- **Thormann MN, Bayley SE, Currah RS. 2001.** Comparison of decomposition of belowground and aboveground plant litters in peatlands of boreal Alberta, Canada. *Canadian Journal of Botany* **79**(1): 9-22.\*
- **Thorsos E. 2011.** Functional traits exert more control on root carbon exudation than do short-term light and nitrogen availability in four herbaceous plant species. Master's, Duke University Durham, North Carolina, USA.\*
- **Tieszen LL, Lewis MC, Miller PC, Mayo J, Chapin FS, III, Oechel WC 1981.** Tundra ecosystems: A comparative analysis. In: Bliss LC, Heal OW, Moore JJ eds. *The*

- *International Biological Programme*. New York, NY, USA: Cambridge University Press, 285-356.
- **Tikhomirov BA, Shamurin VF, Aleksandrova VD 1981.** Phytomass and primary production of tundra communities, USSR. In: Bliss LC, Heal OW, Moore JJ eds. *Tundra Ecosystems: A Comparative Analysis*. Cambridge, New York: Cambridge University Press, 227-237.
- **Timberlake JR, Calvert GM. 1993.** *Preliminary Root Atlas for Zimbabwe and Zambia*: Forestry Commission.\*
- **Tiwari SC. 1986.** Variations in net primary production of Garhwal Himalayan grasslands. *Tropical Ecology* **27**: 166-173.
- **Tjoelker MG, Craine JM, Wedin D, Reich PB, Tilman D. 2005.** Linking leaf and root trait syndromes among 39 grassland and savannah species. *New Phytologist* **167**(2): 493-508.
- **Toky OP, Bisht RP. 1992.** Observations on the rooting patterns of some agroforestry trees in an arid region of north-western India. *Agroforestry Systems* **18**(3): 245-263.
- Tomlinson KW, Sterck FJ, Bongers F, da Silva DA, Barbosa ERM, Ward D, Bakker FT, van Kaauwen M, Prins HHT, de Bie S, et al. 2012. Biomass partitioning and root morphology of savanna trees across a water gradient. *Journal of Ecology* 100(5): 1113-1121.
- **Tripathi SK, Singh KP. 1992.** Nutrient immobilization and release patterns during plant decomposition in a dry tropical bamboo savanna, India. *Biology and Fertility of Soils* **14**(3): 191-199.\*
- **Tripathi SK, Singh KP. 1994.** Productivity and nutrient cycling in recently harvested and mature bamboo savannas in the dry tropics. *The Journal of Applied Ecology* **31**(1): 109.
- **Tripathi SK, Sumida A, Shibata H, Ono K, Uemura S, Kodama Y, Hara T. 2006.** Leaf litterfall and decomposition of different above- and belowground parts of birch (*Betula ermanii*) trees and dwarf bamboo (*Sasa kurilensis*) shrubs in a young secondary forest in Northern Japan. *Biology and Fertility of Soils* **43**(2): 237-246.\*
- Trocha LK, Bulaj B, Kutczynska P, Mucha J, Rutkowski P, Zadworny M. 2017. The interactive impact of root branch order and soil genetic horizon on root respiration and nitrogen concentration. *Tree Physiology* 37(8): 1055-1068.\*
- Trumbore S, Da Costa ES, Nepstad DC, Barbosa De Camargo P, Martinelli LA, Ray D, Restom T, Silver W. 2006. Dynamics of fine root carbon in Amazonian tropical ecosystems and the contribution of roots to soil respiration. *Global Change Biology* 12(2): 217-229.
- **Tryon PR, Chapin FS, III. 1983.** Temperature control over root growth and root biomass in taiga forest trees. *Canadian Journal of Forest Research* **13**(5): 827-833.
- **Turekhanova R. 1996.** Roots system formation of *Hippophae rhamnoides* L. (seabuckthorn). *Acta Phytogeographica Suecica* **49**: 57-58.\*
- **Turner LM. 1936.** A comparison of roots of southern shortleaf pine in three soils. *Ecology* **17**(4): 649-658.

- **Uchida M, Nakatsubo T, Horikoshi T, Nakane K. 1998.** Contribution of micro-organisms to the carbon dynamics in black spruce (*Picea mariana*) forest soil in Canada. *Ecological Research* **13**(1): 17-26.
- **Ulehlova B. 1990.** Resources of soil fertility in grasslands. *Ekologia* **9**: 193-206.
- **Ulrich B 1986.** In: Ulrich B ed. Raten der Deposition, Akkumulation und des Austrags toxischer Luftverunreinigungen als Mab der Belastung und Belastbarkeit von Waldo kosystemen
- **Ushio M, Fujiki Y, Hidaka A, Kitayama K, Poorter L. 2015.** Linkage of root physiology and morphology as an adaptation to soil phosphorus impoverishment in tropical montane forests. *Functional Ecology* **29**(9): 1235-1245.
- **Usman S, Singh SP, Rawat YS, Bargali SS. 2000.** Fine root decomposition and nitrogen mineralisation patterns in *Quercus leucotrichophora* and *Pinus roxburghii* forests in central Himalaya. *Forest Ecology and Management* **131**(1-3): 191-199.\*
- **Usol'tsev VA, Krepkii IS. 1994.** Regression analysis of vertical-fraction distribution of root mass in Aman-Karagai pine forests. *Russian Journal of Ecology* **25**: 87-97.
- Valenzuela-Estrada LR, Vera-Caraballo V, Ruth LE, Eissenstat DM. 2008. Root anatomy, morphology, and longevity among root orders in *Vaccinium corymbosum* (Ericaceae). *American Journal of Botany* 95(12): 1506-1514.
- **Valiela I, Teal JM, Persson NY. 1976.** Production and dynamics of experimentally enriched salt marsh vegetation: Belowground biomass. *Limnology and Oceanography* **21**(2): 245-252.
- Valverde-Barrantes OJ, Smemo KA, Blackwood CB, Norden N. 2015a. Fine root morphology is phylogenetically structured, but nitrogen is related to the plant economics spectrum in temperate trees. *Functional Ecology* 29(6): 796-807.
- Valverde-Barrantes OJ, Smemo KA, Feinstein LM, Kershner MW, Blackwood CB. 2015b. Aggregated and complementary: symmetric proliferation, overyielding, and mass effects explain fine-root biomass in soil patches in a diverse temperate deciduous forest landscape. *New Phytologist* 205(2): 731-742.\*
- van der Wal R, van Lieshout SMJ, Loonen MJJE. 2001. Herbivore impact on moss depth, soil temperature and arctic plant growth. *Polar Biology* 24(1): 29-32.
- van Praag HJ, Sougnez-Remy S, Weissen F, Carletti G. 1988. Root turnover in a beech and a spruce stand of the Belgian Ardennes. *Plant and Soil* 105(1): 87-103.
- **Van Rees KCJ, Comerford NB. 1986.** Vertical root distribution and strontium uptake of a slash pine stand on a Florida spodosol. *Soil Science Society of America Journal* **50**(4): 1042.
- van Wijk MT, Williams M, Gough L, Hobbie SE, Shaver GR. 2003. Luxury consumption of soil nutrients: a possible competitive strategy in above-ground and below-ground biomass allocation and root morphology for slow-growing arctic vegetation? *Journal of Ecology* 91(4): 664-676.
- van Wyk WL. 1963. Ground-Water Studies in Northern Natal, Zulu Land and Surrounding Areas: Pretoria, Gov. Printer.\*

- **Vance ED, Nadkarni NM. 1992.** Root biomass distribution in a moist tropical montane forest. *Plant and Soil* **142**(1): 31-39.\*
- **Vandenbelt RJ. 1991.** Rooting systems of western and southern African *Faidherbia albida* (Del.) A. Chev. (syn. *Acacia albida* Del.) —a comparative analysis with biogeographic implications. *Agroforestry Systems* **14**(3): 233-244.
- **Vanninen P, Makela A. 2005.** Carbon budget for Scots pine trees: effects of size, competition and site fertility on growth allocation and production. *Tree Physiology* **25**(1): 17-30.
- Vanninen P, Ylitalo H, Sievänen R, Mäkelä A. 1996. Effects of age and site quality on the distribution of biomass in Scots pine (*Pinus sylvestris* L.). *Trees* 10(4): 231-238.
- Väre H, Vestberg M, Eurola S. 1992. Mycorrhiza and root-associated fungi in Spitsbergen. *Mycorrhiza* 1(3): 93-104.
- **Vare H, Vestberg M, Ohtonen R. 1997.** Shifts in mycorrhiza and microbial activity along an oroarctic altitudinal gradient in northern Fennoscandia. *Arctic and Alpine Research* **29**(1): 93.
- **Vargas R, Allen MF. 2008.** Environmental controls and the influence of vegetation type, fine roots and rhizomorphs on diel and seasonal variation in soil respiration. *New Phytologist* **179**(2): 460-471.
- **Verzunov AI. 1980.** Growth of the larch and resistance of cultivated phytocenoses with its domination on semihydromorphic soils in the forest steppe in north Kazakhstan. *Ekologiya* **2**: 38-44.\*
- **Veste M, Breckle S-W. 1996.** Root growth and water uptake in a desert sand dune ecosystem. *Acta Phytogeographica Suecica* **81**: 59-62.\*
- **Villares JB, Tundisi A, Becker M. 1953.** The subterranean system of colonial grass (Guinea grass) in various soils of the state of Sao Paulo, Brazil. *Journal of Range Management* **6**(4): 248.
- **Visalakshi N. 1994.** Fine root dynamics in two tropical dry evergreen forests in southern India. *Journal of Biosciences* **19**(1): 103-116.
- Visser EJW, Bögemann GM, Van De Steeg HM, Pierik R, Blom CWPM. 2000. Flooding tolerance of *Carex* species in relation to field distribution and aerenchyma formation. *New Phytologist* **148**(1): 93-103.
- **Vitousek PM, Sanford RL. 1986.** Nutrient cycling in moist tropical forest. *Annual Review of Ecology and Systematics* **17**(1): 137-167.
- **Vitt DH, Pakarinen P 1977.** The bryophyte vegetation, production and organic contents in the Truelove Lowland. In: Bliss LC ed. *Truelove Lowland, Devon Island, Canada: a high arctic ecosystem.* Edmonton, AB, Canada: University of Alberta Press, 225-246.
- **Vivanco L, Austin AT. 2006.** Intrinsic effects of species on leaf litter and root decomposition: a comparison of temperate grasses from North and South America. *Oecologia* **150**(1): 97-107.

- **Vogt KA, Dahlgren R, Ugolini F, Zabowski D, Moore EE, Zasoski R. 1987.** Aluminum, Fe, Ca, Mg, K, Mn, Cu, Zn and P in above- and belowground biomass. II. Pools and circulation in a subalpine *Abies amabilis* stand. *Biogeochemistry* **4**(3): 295-311.
- **Vogt KA, Edmonds RL, Grier CC. 1981.** Seasonal changes in biomass and vertical distribution of mycorrhizal and fibrous-textured conifer fine roots in 23- and 180-year-old subalpine *Abies amabilis* stands. *Canadian Journal of Forest Research* **11**(2): 224-230.
- **Vogt KA, Grier CC, Meier CE, Edmonds RL. 1982.** Mycorrhizal role in net primary production and nutrient cycling in *Abies Amabilis* ecosystems in western Washington. *Ecology* **63**(2): 370.
- **Vogt KA, Grier CC, Meier CE, Keyes MR. 1983.** Organic matter and nutrient dynamics in forest floors of young and mature *Abies amabilis* stands in Western Washington, as affected by fine-root input. *Ecological Monographs* **53**(2): 139.
- **Vogt KA, Grier CC, Vogt DJ. 1986.** Production, turnover, and nutrient dynamics of above- and belowground detritus of world forests. *Advances in Ecological Research* **15**: 303-377.
- **Vogt KA, Vogt DJ, Gower SI, Grier CC 1990**. Carbon and nitrogen interactions for forest ecosystems. In Persson H. *Above- and Below-ground Interactions in Forest Trees in Acidified Soils*: Environmental Research Programme of the Commission of the European Communities. 203-235.
- **Vonlanthen B, Zhang X, Bruelheide H. 2010.** On the run for water Root growth of two phreatophytes in the Taklamakan Desert. *Journal of Arid Environments* **74**(12): 1604-1615.\*
- **Vuuren MMIV, Berendse F, Visser WD. 1993.** Species and site differences in the decomposition of litters and roots from wet heathlands. *Canadian Journal of Botany* **71**(1): 167-173.\*
- **Vyskot M. 1973.** Root biomass of silver fir (*Abies alba Mill.*). *Acta Universitatis Agriculturae* (*Brno*) **42**: 215-261.
- **Wagg JWB. 1967.** Origin and development of white spruce root-forms. Forestry Branch Departmental Publications: Queen's Printer and Controller of Stationery Ottowa.\*
- Wallace A, Bamberg SA, Cha JW. 1974. Quantitative studies of roots of perennial plants in the Mojave Desert. *Ecology* 55(5): 1160.
- Wallace A, Romney EM, Cha JW. 1980. Depth distribution of roots of some perennial plants in the Nevada Test Site area of the northern Mojave Desert. *Great Basin Naturalist Memoirs* 4: 201-207.
- **Wallén B. 1986.** Above and below ground dry mass of the three main vascular plants on hummocks on a subarctic peat bog. *Oikos* **46**(1): 51.
- **Wang B, Qiu YL. 2006.** Phylogenetic distribution and evolution of mycorrhizas in land plants. *Mycorrhiza* **16**(5): 299-363.
- Wang G, Fahey TJ, Xue S, liu F. 2012. Root morphology and architecture respond to N addition in *Pinus tabuliformis*, west China. *Oecologia* 171(2): 583-590.

- Wang G, Liu F, Xue S. 2017. Nitrogen addition enhanced water uptake by affecting fine root morphology and coarse root anatomy of Chinese pine seedlings. *Plant and Soil* 418(1-2): 177-189.\*
- Wang H, Liu S, Mo J. 2010. Correlation between leaf litter and fine root decomposition among subtropical tree species. *Plant and Soil* 335(1-2): 289-298.
- Wang J-J, Tharayil N, Chow AT, Suseela V, Zeng H. 2015. Phenolic profile within the fine-root branching orders of an evergreen species highlights a disconnect in root tissue quality predicted by elemental- and molecular-level carbon composition. *New Phytologist* 206(4): 1261-1273.
- Wang JR, Letchford T, Comeau P, Kimmins JP. 2000. Above- and below-ground biomass and nutrient distribution of a paper birch and subalpine fir mixed-species stand in the Sub-Boreal Spruce zone of British Columbia. *Forest Ecology and Management* 130(1-3): 17-26.
- Wang P, Mommer L, van Ruijven J, Berendse F, Maximov TC, Heijmans MMPD. 2016. Seasonal changes and vertical distribution of root standing biomass of graminoids and shrubs at a Siberian tundra site. *Plant and Soil* 407(1-2): 55-65.\*
- Wang W, Zhang X, Tao N, Ao D, Zeng W, Qian Y, Zeng H. 2013. Effects of litter types, microsite and root diameters on litter decomposition in *Pinus sylvestris* plantations of northern China. *Plant and Soil* 374(1-2): 677-688.
- Wang X, Wang Z, Han Y, Gu J, Guo D, Mei L. 2007. Variations of fine root diameter with root order in Manchurian ash and Dahurian larch plantations. *Frontiers of Forestry in China* 2(1): 34-39.
- Wang Y, Dong X, Wang H, Wang Z, Gu J, Epron D. 2016. Root tip morphology, anatomy, chemistry and potential hydraulic conductivity vary with soil depth in three temperate hardwood species. *Tree Physiology* 36(1): 99-108.
- Wang Z-h, Li R-x, Guan Q-w. 2013. Effects of thinning on fine-root morphology, biomass and N concentration of different branch orders of Chinese fir. *Chinese Journal of Applied Ecology* 24(6): 1487-1493.\*
- Wang Z, Guo D, Wang X, Gu J, Mei L. 2006. Fine root architecture, morphology, and biomass of different branch orders of two Chinese temperate tree species. *Plant and Soil* 288(1-2): 155-171.
- **Watson AJ, Tombleson JD. 2002.** Toppling in juvenile pines: A comparison of the root system characteristics of direct-sown seedlings, and bare-root seedlings and cuttings. *Plant and Soil* **239**(2): 187-196.\*
- Watts SE. 1993. Rooting patterns of co-occurring woody plants on contrasting soils in a subtropical savanna. Master, Texas A&M College Station, Texas, USA.
- **Weaver JE. 1915.** A Study of the root-systems of prairie plants of southeastern Washington. *The Plant World* **18**: 227-248.\*
- Weaver JE. 1919. The Ecological Relations of Roots. Carnegie Institution of Washington\*

- Weaver JE, Darland RW. 1949. Soil-root relationships of certain native grasses in various soil types. *Ecological Monographs* 19(4): 303.
- Weaver JE, Hougen VH, Weldon MD. 1935. Relation of root distribution to organic matter in prairie soil. *Botanical Gazette* 96(3): 389.
- **Weaver JE, Kramer J. 1932.** Root system of *Quercus macrocarpa* in relation to the invasion of prairie. *Botanical Gazette* **94**(1): 51-85.\*
- **Weaver JE, Zink E. 1946.** Annual increase of underground materials in three range grasses. *Ecology* **27**(2): 115.
- Weaver T 1977. Root distribution and soil water regimes in nine habitat types of the northern Rocky Mountains. In: Marshall JK ed. *The belowground ecosystem: a synthesis of plant-associated processes*. Fort Collins, Colorado, USA: Colorado State University, 239-244.
- **Webber PJ 1978.** Spatial and temporal variation of the vegetation and its productivity. In: Tieszen LL ed. *Vegetation and production ecology of an Alaskan arctic tundra*. New York, NY, USA: Springer-Verlag New York Inc, 37-112.
- **Webber PJ, May DE. 1977.** The magnitude and distribution of belowground plant structures in the alpine tundra of Niwot Ridge, Colorado. *Arctic and Alpine Research* **9**(2): 157.
- Weemstra M, Sterck FJ, Visser EJW, Kuyper TW, Goudzwaard L, Mommer L. 2016. Fine-root trait plasticity of beech (*Fagus sylvatica*) and spruce (*Picea abies*) forests on two contrasting soils. *Plant and Soil* 415(1-2): 175-188.\*
- Wei P, Li XW, Fan C, Zhang TF, Liu YK, Su Y, Yang ZJ. 2013. Fine root biomass and carbon storage in surface soil of *Cinnamomum camphora* plantation in rainy area of West China. *Chinese Journal of Applied Ecology* 24: 21-27.
- Wei X, Liu Y, Chen HB. 2008. Anatomical and functional heterogeneity among different root orders of Phellodendron amurense. *Journal of Plant Ecology (Chinese Version* 32: 1238-1247.
- Wei YF, Fang J, Liu S, Zhao XY, Li SG. 2013. Stable isotopic observation of water use sources of *Pinus sylvestris* var. *mongolica* in Horqin Sandy Land, China. *Trees* 27(5): 1249-1260.\*
- Wein RW, Bliss LC. 1974. Primary production in arctic cottongrass tussock tundra communities. *Arctic and Alpine Research* 6(3): 261.
- Welke SE, Hope GD, Hunt GA. 2003. Effects of harvesting on fine root biomass and decomposition in an Engelmann spruce subalpine fir forest. *Canadian Journal of Forest Research* 33(5): 847-853.\*
- Wen DZ, Wei P, Kong GH, W.H. Y. 1999. Production and turnover rate of fine roots in two lower subtropical forest sites at Dinghushan. *Acta Phytoecologica Sinica* 23: 361-369.
- **Wentz WA, Chamie JPM. 1980.** Determining the belowground productivity of *Chamaedaphne calyculata*, a peatland shrub. *International Journal of Ecology and Environmental Sciences* **6**: 1-4.

- Werner PA, Murphy PG. 2001. Size-specific biomass allocation and water content of above and below-ground components of three Eucalyptus species in a northern Australian savanna. *Australian Journal of Botany* 49(2): 155.\*
- **Westman WE, Roggers RV. 1977.** Nutrient stocks in a subtropical eucalypt forest, North Stradbroke Island. *Austral Ecology* **2**(4): 447-460.\*
- White DP, Wood RS. 1958. Growth variations in a red pine plantation influenced by a deeplying fine soil layer. *Soil Science Society of America Journal* 22(2): 174.\*
- White DS, Howes BL. 1994. Translocation, remineralization, and turnover of nitrogen in the roots and rhizomes of *Spartina alterniflora* (gramineae). *American Journal of Botany* 81(10): 1225.
- White MA, Thornton PE, Running SW, Nemani RR. 2000. Parameterization and sensitivity analysis of the BIOME–BGC Terrestrial Ecosystem Model: Net primary production controls. *Earth Interactions* **4**(3): 1-85.
- Whittaker RH, Bormann FH, Likens GE, Siccama TG. 1974. The Hubbard Brook ecosystem study: forest biomass and production. *Ecological Monographs* 44(2): 233.
- Whittaker RH, Woodwell GM. 1969. Structure, production and diversity of the oak-pine forest at Brookhaven, New York. *The Journal of Ecology* 57(1): 155.
- Whittle CA, Duchesne LC, Needham T. 1998. Soil seed bank of a jack pine (*Pinus banksiana*) ecosystem. *International Journal of Wildland Fire* 8(2): 67-71.\*
- **Wielgolaski FE. 1972.** Vegetation types and plant biomass in tundra. *Arctic and Alpine Research* **4**(4): 291.
- **Wielgolaski FE 1975.** Primary productivity of alpine meadow communities. In: Wielgolaski FE ed. *Fennoscandian tundra ecosystems*. New York, NY, USA: Springer-Verlag, 121-128.
- Wielgolaski FE, Bliss LC, Svoboda J, Doyle G 1981. Primary production of tundra. In: Bliss LC, Heal OW, Moore JJ eds. *Tundra Ecosystems: A Comparative Analysis*. Cambridge, UK: Cambridge University Press, 187-225.
- **Will GM. 1966.** Root growth and dry-matter production in a high-producing stand of Pinus radiata.: Forest Research Institute, New Zealand forest Service.
- Withington JM, Reich PB, Oleksyn J, Eissenstat DM. 2006. Comparisons of structure and life span in roots and leaves among temperate trees. *Ecological Monographs* 76(3): 381-397.
- **Wittmann F, Parolin P. 2005.** Aboveground roots in Amazonian floodplain trees. *Biotropica* **37**(4): 609-619.\*
- Wright SJ, Machado JL, Mulkey SS, Smith AP. 1992. Drought acclimation among tropical forest shrubs (Psychotria, Rubiaceae). *Oecologia* 89(4): 457-463.\*
- Wright SJ, Yavitt JB, Wurzburger N, Turner BL, Tanner EVJ, Sayer EJ, Santiago LS, Kaspari M, Hedin LO, Harms KE, et al. 2011. Potassium, phosphorus, or nitrogen limit root allocation, tree growth, or litter production in a lowland tropical forest. *Ecology* 92(8): 1616-1625.
- **Wright TW. 1955.** Profile development in the sand dunes of Culbin Forest, Morayshire. *Journal of Soil Science* **6**(2): 270-283.

- Wrubleski DA, Murkin HR, van der Valk AG, Davis CB. 1997. Decomposition of litter of three mudflat annual species in a northern prairie marsh during drawdown. *Plant Ecology* 129(2): 141-148.\*
- Wu F, Yang W, Zhang J, Deng R. 2010. Fine root decomposition in two subalpine forests during the freeze–thaw season. *Canadian Journal of Forest Research* 40(2): 298-307.\*
- Wu Q-S, Liu C-Y, Zhang D-J, Zou Y-N, He X-H, Wu Q-H. 2015. Mycorrhiza alters the profile of root hairs in trifoliate orange. *Mycorrhiza* 26(3): 237-247.
- **Wurzburger N, Wright SJ. 2015.** Fine-root responses to fertilization reveal multiple nutrient limitation in a lowland tropical forest. *Ecology* **96**(8): 2137-2146.
- **Xia M, Guo D, Pregitzer KS. 2010.** Ephemeral root modules in *Fraxinus mandshurica*. *New Phytologist* **188**(4): 1065-1074.
- **Xia M, Talhelm AF, Pregitzer KS. 2017a.** Chronic nitrogen deposition influences the chemical dynamics of leaf litter and fine roots during decomposition. *Soil Biology and Biochemistry* **112**: 24-34.\*
- **Xia M, Talhelm AF, Pregitzer KS. 2017b.** Long-term simulated atmospheric nitrogen deposition alters leaf and fine root decomposition. *Ecosystems*\*
- Xiao CW, Janssens IA, Sang WG, Wang RZ, Xie ZQ, Pei ZQ, Yi Y. 2010. Belowground carbon pools and dynamics in China's warm temperate and sub-tropical deciduous forests. *Biogeosciences* 7(1): 275-287.\*
- **Xiao CW, Sang WG, Wang R-Z. 2008.** Fine root dynamics and turnover rate in an Asia white birch forest of Donglingshan Mountain, China. *Forest Ecology and Management* **255**(3-4): 765-773.
- Xiong Decheng 熊, Huang Jinxue 黄, Yang Zhijie 杨, Lu Zhengli 卢, Chen Guangshui 陈, Yang Yusheng 杨. 2012. Fine root architecture and morphology among different branch orders of six subtropical tree species. *Acta Ecologica Sinica* 32(6): 1888-1897.
- **Xiong Y, Fan P, Fu S, Zeng H, Guo D. 2012.** Slow decomposition and limited nitrogen release by lower order roots in eight Chinese temperate and subtropical trees. *Plant and Soil* **363**(1-2): 19-31.
- **Xiong Y, Liu X, Guan W, Liao B, Chen Y, Li M, Zhong C. 2016.** Fine root functional group based estimates of fine root production and turnover rate in natural mangrove forests. *Plant and Soil* **413**(1-2): 83-95.\*
- **Xu GQ, Li Y. 2008.** Rooting depth and leaf hydraulic conductance in the xeric tree *Haloxyolon ammodendron* growing at sites of contrasting soil texture. *Functional Plant Biology* **35**(12): 1234.\*
- Xu K, Li F, Gou S, Bao W. 2012. Root functional traits and trade-offs in one-year-old plants of 25 species from the arid valley of Minjiang River. *Acta Ecologica Sinica* 32(1): 215-225.\*

- Xu Q, Li H, Chen J, Cheng X, Liu S, An S. 2011. Water use patterns of three species in subalpine forest, Southwest China: the deuterium isotope approach. *Ecohydrology* **4**(2): 236-244.\*
- **Xu Y. 1990.** Ökologische grundlagen für den anbau der großen küstentanne (*Abies grandis* lindl.) auf vernässten böden. *Berichte des Forschungszentrums Waldökosysteme*
- Xu Y, Gu J-C, Dong X-Y, Liu Y, Wang Z-Q. 2011. Fine root morphology, anatomy and tissue nitrogen and carbon contents of the first five orders in four tropical hardwood species in Hainan Island, China. *Chinese Journal of Plant Ecology* 35(9): 955-964.
- **Yamauchi A, Kono Y, Tatsumi J. 1987.** Quantitative analysis on root system structures of upland rice and maize. *Japanese journal of crop science* **56**(4): 608-617.
- Yang Y-S, Chen G-S, Guo J-F, Lin P. 2004a. Decomposition dynamic of fine roots in a mixed forest of *Cunninghamia lanceolata* and *Tsoongiodendron odorum* in mid-subtropics. *Annals of Forest Science* 61(1): 65-72.\*
- Yang Y-S, Chen G-S, Lin P, Xie J-S, Guo J-F. 2004b. Fine root distribution, seasonal pattern and production in four plantations compared with a natural forest in Subtropical China. *Annals of Forest Science* **61**(7): 617-627.\*
- Yang Z, Culvenor RA, Haling RE, Stefanski A, Ryan MH, Sandral GA, Kidd DR, Lambers H, Simpson RJ. 2015. Variation in root traits associated with nutrient foraging among temperate pasture legumes and grasses. *Grass and Forage Science* 72(1): 93-103.
- **Yano N, Kayama R 1975.** Seasonal and yearly change of biomass and litter -- underground. In: Numata M ed. *Ecological studies in Japanese Grasslands. JIBP Synthesis 13.* Tokyo, Japan: University of Tokyo Press, 147-160.
- Yavitt JB, Harms KE, Garcia MN, Mirabello MJ, Wright SJ. 2011. Soil fertility and fine root dynamics in response to 4 years of nutrient (N, P, K) fertilization in a lowland tropical moist forest, Panama. *Austral Ecology* 36(4): 433-445.
- **Yavitt JB, Wright SJ. 2001.** Drought and irrigation effects on fine root dynamics in a tropical moist forest, Panama. *Biotropica* **33**(3): 421-434.
- Ye LP, Zhou YC, Zhou W, Luo ZD, Huang K. 2013. Response of fine root growth of *Pinus massoniana* middle-aged forest to fertilization. *Journal of Central South University of Forestry and Technology* 33: 50-55.
- **Yeager AF. 1935.** Root systems of certain trees and shrubs grown on prairie soil. *Journal of Agricultural Research* **51**: 1085-1092.
- Yeatman CW. 1955. Tree root development on upland heaths. Forestry Commission Bulletin\*
- **Yin X, Perry JA, Dixon RK. 1989.** Fine-root dynamics and biomass distribution in a *Quercus* ecosystem following harvesting. *Forest Ecology and Management* **27**(3-4): 159-177.
- **Yin X, Perry JA, Dixon RK. 1991.** Temporal changes in nutrient concentrations and contents of fine roots in a *Quercus* forest. *Forest Ecology and Management* **44**(2-4): 175-184.
- Yu LZ, Ding GQ, Zhu JJ, Shi JW, Yu SQ, Wang ZQ. 2007. Effects of fertilization on fine root biomass of *Larix kaempferi* plantation. *Chinese Journal of Applied Ecology* 18: 713-720.

- Yu LZ, Ding GQ, Zhu JJ, Zhang N, Zhang XP, Ying H. 2009. Effects of fertilization on nutrient concentrations of different root orders' fine roots in *Larix kaempferi* plantation. *Chinese Journal of Applied Ecology* 20: 747-753.
- Yuen JQ, Ziegler AD, Webb EL, Ryan CM. 2013. Uncertainty in below-ground carbon biomass for major land covers in Southeast Asia. Forest Ecology and Management 310: 915-926.\*
- **Zadworny M, Eissenstat DM. 2011.** Contrasting the morphology, anatomy and fungal colonization of new pioneer and fibrous roots. *New Phytologist* **190**: 213-221.
- Zadworny M, McCormack ML, Mucha J, Reich PB, Oleksyn J. 2016. Scots pine fine roots adjust along a 2000-km latitudinal climatic gradient. *New Phytologist* 212(2): 389-399.\*
- **Zadworny M, McCormack ML, Rawlik K, Jagodzi ski AM. 2015.** Seasonal variation in chemistry, but not morphology, in roots of *Quercus robur* growing in different soil types. *Tree Physiology* **35**(6): 644-652.
- Zadworny M, McCormack ML, Zytkowiak R, Karolewski P, Mucha J, Oleksyn J. 2017.

  Patterns of structural and defense investments in fine roots of Scots pine (*Pinus sylvestris* L.) across a strong temperature and latitudinal gradient in Europe. *Global Change Biology* 23(3): 1218-1231.\*
- Zangaro W, de Almeida Alves R, de Souza PB, Rostirola LV, Lescano LEAM, Rondina ABL, Nogueira MA. 2014. Succession and environmental variation influence soil exploration potential by fine roots and mycorrhizal fungi in an Atlantic ecosystem in southern Brazil. *Journal of Tropical Ecology* 30(03): 237-248.
- Zangaro W, de Assis RL, Rostirola LV, de Souza PB, Gonçalves MC, Andrade G, Nogueira MA. 2008. Changes in arbuscular mycorrhizal associations and fine root traits in sites under different plant successional phases in southern Brazil. *Mycorrhiza* 19(1): 37-45.
- **Zavitkovski J, Stevens RD. 1972.** Primary productivity of red alder ecosystems. *Ecology* **53**(2): 235.
- **Zerihun A, Montagu KD. 2004.** Belowground to aboveground biomass ratio and vertical root distribution responses of mature *Pinus radiata* stands to phosphorus fertilization at planting. *Canadian Journal of Forest Research* **34**(9): 1883-1894.\*
- **Zerihun A, Montagu KD, Hoffmann MB, Bray SG. 2006.** Patterns of below- and aboveground biomass in *Eucalyptus populnea* woodland communities of Northeast Australia along a rainfall gradient. *Ecosystems* **9**(4): 501-515.\*
- **Zhang C, Chen L, Jiang J. 2014.** Vertical root distribution and root cohesion of typical tree species on the Loess Plateau, China. *Journal of Arid Land* **6**(5): 601-611.\*
- **Zhang H, Morison JIL, Simmonds LP. 1999.** Transpiration and water relations of poplar trees growing close to the water table. *Tree Physiology* **19**(9): 563-573.\*
- **Zhang N, Van der Putten WH, Veen GFC. 2016.** Effects of root decomposition on plant-soil feedback of early- and mid-successional plant species. *New Phytologist* **212**(1): 220-231.\*

- **Zhang X, Wang W. 2015.** The decomposition of fine and coarse roots: their global patterns and controlling factors. *Scientific Reports* **5**(1): 9940.\*
- **Zhanghe C, Hongta C, Bosun W. 2009.** Studies on biomass and production of the lower subtropical evergreen broad-leaved forest in Heishiding Nature Reserve, China. VI. Distribution, biomass and production of roots. *Journal of Tropical Ecology* **10**(02): 273.
- **Zhaparova NK. 1996.** Root development of *Ostrowskia magnifica* Regel, a rare species in Kazakhstan. *Acta Phytogeographica Suecica* **80**: 90-91.\*
- **Zherev NE, Seiidova RD. 1990.** Underground mass of shrub and subshrub plants of the Karakum. *Problems of Desert Development* 1: 49-54.
- **Zhou H, Zhao W, Zhang G. 2017.** Varying water utilization of *Haloxylon ammodendron* plantations in a desert-oasis ecotone. *Hydrological Processes* **31**(4): 825-835.\*
- **Zhou H, Zhao W, Zheng X, Li S. 2015.** Root distribution of *Nitraria sibirica* with seasonally varying water sources in a desert habitat. *Journal of Plant Research* **128**(4): 613-622.\*
- **Zhou Y, Su J, Janssens IA, Zhou G, Xiao C. 2013.** Fine root and litterfall dynamics of three Korean pine (*Pinus koraiensis*) forests along an altitudinal gradient. *Plant and Soil* **374**(1-2): 19-32.