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Terrestrial Plant Ecology

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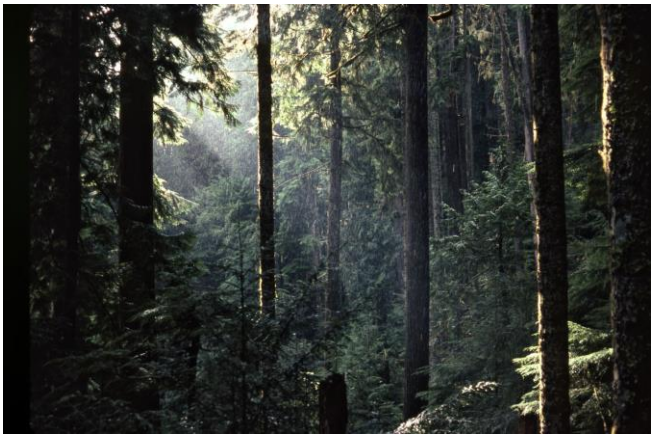
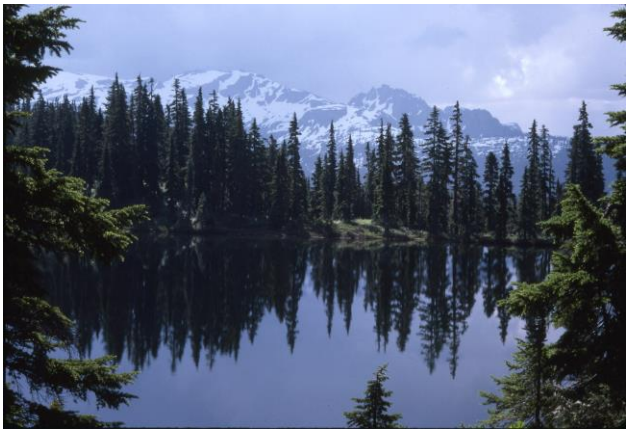
RESEARCH HISTORY AND INTERESTS:

I have been conducting studies of various aspects of terrestrial plant ecology for over 40 years. My focus has been on the dynamics of forest stands and their constituent species in Northwestern North America. However, I have diverse interests under the broad umbrella of terrestrial plant ecology. I consider myself both a community and population ecologist. Just as high species diversity can make a region more interesting, a diversity of research topics can make life more interesting. I have worked on topics ranging from forest succession following volcanic disturbance to gender-specific reproductive differences in dioecious plants.





MAJOR AREAS OF RESEARCH:

Volcanic disturbance and forest succession: My first work was on forest succession in the Rocky Mountains. I then moved on to considering population dynamics of a tree species in the Cascade Mountains, but life is unpredictable. I didn't plan to study volcanic disturbance. The study plan did not include having my initial Ph.D. project blown up by a volcano. However, "disasters" can often be turned into opportunities. Thus after the 1980 eruption of Mount St. Helens, I ended up studying the effects of tephra (volcanic ash) deposits on forest understories. In collaboration with Don Zobel at Oregon State University, I have maintained permanent plots at Mount St. Helens for 4 decades, and we have published a long series of papers on post-disturbance changes in the understory of old-growth forests impacted by tephra deposits. Now we are collaborating with Dylan Fischer at The Evergreen State College who will continues this long-term study. This work led to a substantial increase in understanding of how forest understory plants respond to disturbance and subsequently expand over 40 years. Survival of plants during the tephra disturbance was critical and clonal growth was very important in subsequent expansion of plant cover. We found that in some situations the forest understory may be deflected toward a system substantially different than the one that existed prior to disturbance.

Mount St. Helens – summer 1980

Herb-rich, old-growth forest buried with tephra – summer 1980

Understory trees destroyed by tephra that fell on a snowpack

Plants saved by erosion of the tephra

The same old-growth forest as above, 20 years later

Clonal growth and population ecology of forest understory plants: The work at Mount St. Helens caused me to consider understory herbs in new ways. Clonal growth was pivotal to responses to the tephra disturbance and is a key feature of most forest understory plants. Thus I started conducting studies of below-ground structures and clonal spread. Excavating rhizome systems provides a new perspective on the growth of plants – very different from our typical aboveground view – and is also great fun (like unraveling a mystery). I have intermittently continued studying the below-ground growth patterns and clonal spread of forest understory species, which has been very rewarding work. Most species spread via rhizomes, but some spread via stolons, which can result in rapid expansion. Most "plants" (ramets) in the forest understory actually result from clonal growth and not directly from seed. The work on clonal growth has contributed nicely to understanding of the population dynamics of herbaceous forest plants.

Clintonia uniflora – grew through tephra via long rhizomes

Chimaphila umbellata – a species with an exceptionally large system of persistent rhizomes and attached aerial shoots

Dynamics of old-growth subalpine forests: Although I have spent much of my career studying the effects of disturbance, I am fascinated by the idea that some forests appear to undergo very limited directional change over substantial periods of time. Starting about 25 years ago, I initiated a series of studies with Roberta Parish (now retired from the BC Ministry of Forests) on the dynamics of old-growth forests. We obtained nearly complete age structures for five old-growth subalpine forests in southern British Columbia, three in the Interior and two on the Coast. Two of the Interior stands started from a stand-initiating disturbance, but the other three stands showed no evidence of an initial disturbance and appear very close to "steady-state" forests. Most surprisingly we found extremely old trees in what appeared to be typical forests on the Coast. In a stand on northern Vancouver Island, all four species present had individuals over 900 years in age.

More recently we have used the growth ring data from these stands to examine relationships with climate variation and assess how these forests are likely to respond to changes in the CO_2 concentration of the atmosphere. It appears that at least some old forests are unlikely to increase in growth in response to increasing CO_2 concentration of the atmosphere. However, they store large amounts of carbon and are

thus an important storage reservoir of carbon. Collectively this work has increased understanding of the dynamics of old forests and their growth, both historically and potentially in the future.

Ancient forest at Mt. Elphinstone, coastal British Columbia

Very old (594 years) but only 16 cm diameter *Abies amabilis* at Mt. Cain, Vancouver Island

Tree seedling banks: Our studies of old forests contributed to the realization that seedling banks (advanced regeneration) were important in the dynamics of these forests. Thus we specifically focused some effort on determining age structure and growth of small trees in the seedling bank. Individuals can grow exceedingly slowly and persist for very long periods at a small size. For example, *Abies amabilis* in the understory can be 100 years old when only a meter tall. However, when the canopy opens up, these small individuals can increase in growth. In addition, seedling banks (advanced regeneration) are a major source of new canopy trees following disturbance by bark beetles, a topic I have studied in relation to the recent, major bark beetle outbreak in British Columbia. I would like to pursue further work on seedling banks as these appear to be of major importance to the population dynamics of shade-tolerant tree species and stand development following some disturbances.

Seedling bank *Abies amabilis*

Ecology of stress-tolerant subalpine conifers: I have a long-standing interest in subalpine trees of harsh environments. In graduate school I started work on yellow-cedar (*Callitropsis* (*Chamaecyparis*) *nootkatensis*) but lost a field site to a volcano and thus switched projects! However, I subsequently considered this species when we studied age structure of ancient subalpine forests. I have also studied whitebark pine (*Pinus albicaulis*) with Elizabeth Campbell of the Pacific Forestry Centre. This is an especially interesting species of major importance in timberline forests, but is declining dramatically for a number of reasons, including disease and bark beetles. Long-lived, stress-tolerant species of cold environments are fascinating and warrant much more study to fully understand their population dynamics.

Whitebark pine (*Pinus albicaulis*)

Sex ratios and reproductive allocation in dioecious plants: Dioecious plants often have biased sex ratios and very unequal reproductive allocation between genders; however, the reasons for and consequences of these characteristics are inadequately understood. Gerry Allen (my spouse) and I conducted a series of studies on the reproductive biology of the dioecious, monotypic shrub *Oemleria cerasiformis* (osoberry). Much of this work was conducted on the University of Victoria campus, and thus very efficient. This series of studies resulted in a better understanding of sex ratios and consequences of differential reproduction allocation between genders in this species. I am interested in pursuing further studies of reproductive allocation – a key topic for understanding population biology.

Population ecology and prolonged dormancy of rare plants: The demography and population dynamics of rare species need to be carefully studied in order to understand how to most effectively protect these species. Former students Mike Miller and Allan Hawryzki studied two rare species with the interesting life history characteristic of prolonged dormancy, the situation where plants fail to appear aboveground for one or more years. This feature appears to be common attribute among herbaceous perennial plants, and has a variety of important implications for the population dynamics and persistence of species with this characteristic.

Tree invasion and restoration of mountain meadows: Encroachment of woody plants into grasslands is a world-wide phenomenon of major conservation concern. I have been working with Charlie Halpern of the University of Washington on this topic. Our model system for this study is a montane meadow complex in the Oregon Cascades with extensive tree invasion (Bunchgrass Ridge; project website: http://depts.washington.edu/bgridge/). We examined patterns of tree invasion and initiated a large, long-term meadow restoration study. A thorough examination of the age and size structure of trees encroaching on meadows has yielded a detailed history of the timing, spatial distribution, and mechanisms of tree invasion. The large-scale restoration study involved tree removal with and without burning. Early results indicate pronounced increases in meadow species, but we also found that the system may not fully converge on the composition of natural reference meadows. This long-term experiment is planned to be ongoing for many years and will yield further understanding of the effectiveness of restoration treatments, as the plots are re-measured periodically over the next couple of decades.

Bunchgrass Ridge meadows

GRADUATE STUDENTS:

I have no funding available for graduate students. However, I would be glad to talk to prospective students about possible projects. I am also glad to be on graduate student committees where my expertise can be of use.

UNDERGRADUATE STUDENTS:

An Honours project can be a very rewarding experience for undergraduate students. I encourage students to consider this option and would be glad to discuss possibilities with students interested in this program. My experience supervising Honours projects has been very positive.

PAPERS IN REFEREED JOURNALS:

Zobel, D. B., J. A. Antos and D. G. Fischer. 2022. Community development by forest understory plants after prolonged burial. Plant Ecology 223: 381-396.

Halpern, C. B. and J. A. Antos. 2022. Burn severity and pre-fire seral state interact to shape vegetation responses to fire in a young, western Cascade Range forest. Forest Ecology and Management 507: 120028.

Antos, J. A., D. B. Zobel and D. G. Fischer. 2021. Belowground morphology and population dynamics of two forest understory herbs of contrasting growth form. Botany 99: 569-580.

Zobel, D. B., J. A. Antos and D. G. Fischer. 2021. Secondary disturbance following a deposit of volcanic tephra: A 30 year record from old-growth forest understory. Canadian Journal of Forest Research 51: 1541-1549.

Halpern, C. B. and J. A. Antos. 2021. Rates, patterns, and drivers of tree reinvasion 15 years after large-scale meadow-restoration treatments. Restoration Ecology 29 (5) e13377. doi:10.1111/rec.13377.

Campbell, E. M., S. Magnussen, J. A. Antos and R. Parish. 2021. Size-, species-, and site-specific tree growth responses to climate variability in old-growth subalpine forests. Ecosphere 12(5): e03529. 10.1002/ecs2.3529.

Waxwing, S. R., D. G. Fischer, J. A. Antos, A. Biswas and D. B. Zobel. 2021. Long-term responses of forest-floor bryophytes buried by tephra in the 1980 eruption of Mount St. Helens. Botany 99: 151-165.

Antos, J. A., A. E. McPherson and H. J. Guest. 2020. Growth rates and crown morphology of *Abies amabilis* in the seedling bank of an ancient subalpine conifer forest. Canadian Journal of Forest Research 50: 1124-1130.

Halpern, C. B., J. A. Antos, S. Kothari and A. M. Olson. 2019. Past tree influence and prescribed fire exert strong controls on reassembly of mountain grasslands after tree removal. Ecological Applications 29: e01860.

Hararuk, O., E. M. Campbell, J. A. Antos and R. Parish. 2019. Tree rings provide no evidence of a CO_2 fertilization effect in old-growth subalpine forests of western Canada. Global Change Biology 25: 1222-1234.

Chang, C. C., C. B. Halpern, J. A. Antos, M. L. Avolio, A. Biswas, J. E. Cook, R. del Moral, D. G. Fischer, A. Holz, R. J. Pabst, M. E. Swanson and D. B. Zobel. 2019. Testing conceptual models of early plant succession across a disturbance gradient. Journal of Ecology 107: 517-530.

Fischer, D. G., J. A. Antos, D. B. Zobel and A. Biswas. 2019. Understory succession after burial by tephra from Mount St. Helens. Journal of Ecology 107: 531-544.

Cailleret, M. et al. (48 authors). 2019. Early-warning signals of individual tree mortality based on annual radial growth. Frontiers in Plant Science Vol. 9: Article 1964. Doi: 10.3389/fpls.2018.01964.

Campbell, E. M., J. A. Antos and L. vanAkker. 2019. Resilience of southern Yukon boreal forests to spruce bark beetle outbreaks. Forest Ecology and Management 433: 52-63.

Watt, A. J., D. G. Fischer, J. A. Antos and D. B. Zobel. 2018. Leaf-level physiology in four subalpine plants in tephra-impacted forests during drought. Canadian Journal of Forest Research 48: 431-441.

Zobel, D. B. and J. A. Antos. 2017. Community reorganization in forest understories buried by volcanic tephra. Ecosphere 8(12):e02045. 10.1002/ecs2.2045.

Cailleret, M. et al. (66 authors). 2017. A synthesis of radial growth patterns preceding tree mortality. Global Change Biology 23: 1675-1690.

Fischer, D. G., J. A. Antos, W. G. Grandy, and D. B. Zobel. 2016. A little disturbance goes a long way: 33-year understory successional responses to a thin tephra deposit. Forest Ecology and Management 382: 236-243.

Antos, J. A., C. N. Filipescu and R. W. Negrave. 2016. Ecology of western redcedar (*Thuja plicata*): implications for management of a high-value multiple-use resource. Forest Ecology and Management 375: 211-222.

Goudie, J. W., R. Parish and J. A. Antos. 2016. Foliage biomass and specific leaf area equations at the branch, annual shoot and whole-tree levels for lodgepole pine and white spruce in British Columbia. Forest Ecology and Management 361: 286-297.

Halpern, C. B., J. A. Antos, D. McKenzie and A. M. Olson. 2016. Past tree influence and prescribed fire mediate biotic interactions and community reassembly in a grassland-restoration experiment. Journal of Applied Ecology 53: 264-273.

Zobel, D. B. and J. A. Antos. 2016. Flowering patterns of understory herbs 30 years after disturbance of subalpine old-growth forests by tephra from Mount St. Helens. International Journal of Plant Sciences 177: 145-156.

Campbell, E. M. and J. A. Antos. 2015. Advance regeneration and trajectories of stand development following the mountain pine beetle outbreak in boreal forests of British Columbia. Canadian Journal of Forest Research 45: 1327-1337.

Halpern C. B., J. A. Antos and L. M. Beckman. 2014. Vegetation recovery in slash-pile scars following conifer removal in a grassland restoration experiment. Restoration Ecology 22: 731-740.

Kremer, N. J., C. B. Halpern and J. A. Antos. 2014. Conifer reinvasion of montane meadows following experimental tree removal and prescribed burning. Forest Ecology and Management 319: 128-137.

Brown, K. R. and J. A. Antos. 2012. Seedbanks, germination and early survival of bitter cherry (*Prunus emarginata*) in coastal British Columbia. Forest Ecology and Management 282: 92-104.

Miller, M. T., J. A. Antos and G. A. Allen. 2012. Demography of a dormancy-prone geophyte: influence of spatial scale on interpretation of dynamics. Plant Ecology 213: 569-579.

Rice, J. M., C. B. Halpern, J. A. Antos and J. A. Jones. 2012. Spatio-temportal patterns of tree establishment are indicative of biotic interactions during early invasion of a montane meadow. Plant Ecology 213: 555-568.

Halpern, C. B., R. D. Haugo, J. A. Antos, S. S. Kaas and A. L. Kilanowski. 2012. Grassland restoration with and without fire: evidence from a tree removal experiment. Ecological Applications 22: 425-441.

Hawryzki, A. R., G. A. Allen, and J. A. Antos. 2011. Prolonged dormancy in the geophyte *Allium amplectens* on Vancouver Island. Botany 89: 737-744.

Halpern, C. B., J. A. Antos, J. M. Rice, R. D. Haugo and N. L. Lang. 2010. Tree invasion of a montane meadow complex: temporal trends, spatial patterns, and biotic interactions. Journal of Vegetation Science 21: 717-732.

Antos, J. A., R. Parish, and G. D. Nigh. 2010. Effects of neighbours on crown length of *Abies lasiocarpa* and *Picea engelmannii* in two old-growth stands in British Columbia. Canadian Journal of Forest Research 40: 638-647.

Parish, R., J. A. Antos, P. K. Ott and C. M. Di Lucca. 2010. Snag longevity of Douglas-fir, western hemlock, and western redcedar from permanent sample plots in coastal British Columbia. Forest Ecology and Management 259: 633-640.

Zobel, D. B. and J. A. Antos. 2009. Species properties and recovery from disturbance: forest herbs buried by volcanic tephra. Journal of Vegetation Science 20: 650-662.

Nigh, G. D., J. A. Antos and R. Parish. 2008. Density and distribution of advance regeneration in beetle-killed pine stands of the Montane Spruce zone of southern British Columbia. Canadian Journal of Forest Research 38: 2826-2836.

Antos, J. A., R. Parish and G. D. Nigh. 2008. Growth patterns prior to mortality of mature *Abies lasiocarpa* in old-growth subalpine forests of southern British Columbia. Forest Ecology and Management 255: 1568-1574.

Karst, A. L., J. A. Antos and G. A. Allen. 2008. Sex ratio, flowering and fruit set in dioecious *Rubus chamaemorus* (Rosaceae) in Labrador. Botany 86: 204-212.

Parish, R., G. D. Nigh and J. A. Antos. 2008. Allometry and size structure of trees in two ancient snow forests in coastal British Columbia. Canadian Journal of Forest Research 38: 278-288.

Nelson, C. R., C. B. Halpern and J. A. Antos. 2007. Variation in responses of late-seral herbs to disturbance and environmental stress. Ecology 88: 2880-2890.

Zobel, D. B. and J. A. Antos. 2007. Flowering and seedling production of understory herbs in old-growth forests affected by 1980 tephra from Mount St. Helens. Canadian Journal of Botany 85: 607-620.

Miller, M. T., J. A. Antos and G. A. Allen. 2007. Demographic differences between two sympatric species of *Calochortus* (mariposa lily) as revealed by matrix analysis. Plant Ecology 191: 265-278.

Parish, R. and J. A. Antos. 2006. Slow growth, long-lived trees, and minimal disturbance characterize the dynamics of an ancient, montane forest in coastal British Columbia. Canadian Journal of Forest Research 36: 2826-2838.

Parish, R. and J. A. Antos. 2005. Advanced regeneration and seedling establishment in small cutblocks in high-elevation spruce-fir forest at Sicamous Creek, southern British Columbia. Canadian Journal of Forest Research 35: 1877-1888.

Antos, J. A., H. J. Guest and R. Parish. 2005. The tree seedling bank in an ancient, montane forest: stress tolerators in a productive habitat. Journal of Ecology 93: 536-543.

Miller, M. T., G. A. Allen and J. A. Antos. 2004. Dormancy and flowering in two mariposa lilies (*Calochortus*) with contrasting distribution patterns. Canadian Journal of Botany 82: 1790-1799.

Parish, R. and J. A. Antos. 2004. Structure and dynamics of an ancient montane forest in coastal British Columbia. Oecologia 141: 562-576.

Mitchell, M. G. E., J. A. Antos and G. A. Allen. 2004. Modules of reproduction in females of the dioecious shrub *Oemleria cerasiformis*. Canadian Journal of Botany 82: 393-400.

Clark, D. F., J. A. Antos and G. E. Bradfield. 2003. Succession in sub-boreal forests of west-central British Columbia. Journal of Vegetation Science 14: 721-732.

Campbell, E. M. and J. A. Antos. 2003. Post-fire succession in *Pinus albicaulis-Abies lasiocarpa* forests in southern British Columbia. Canadian Journal of Botany 81: 383-397.

Lantz, T. C. and J. A. Antos. 2002. Clonal expansion in the deciduous understory shrub, devil's club (*Oplopanax horridus*; Araliaceae). Canadian Journal of Botany 80: 1052-1062.

Parish, R. and J. A. Antos. 2002. Dynamics of an old-growth, fire-initiated, subalpine forest in southern interior British Columbia: tree-ring reconstruction of 2 year cycle spruce budworm outbreaks. Canadian Journal of Forest Research 32: 1947-1960.

Antos, J. A. and R. Parish. 2002. Dynamics of an old-growth, fire-initiated, subalpine forest in southern interior British Columbia: tree size, age, and spatial structure. Canadian Journal of Forest Research 32: 1935-1946.

Heinrichs, M. L., J. A. Antos, R. J. Hebda and G. B. Allen. 2002. *Abies lasiocarpa* (Hook.) Nutt. in the late-glacial and early-Holocene vegetation of British Columbia, Canada, and adjacent regions in Washington, USA. Review of Paleobotany and Palynology 120: 107-122.

Antos, J. A. and R. Parish. 2002. Structure and dynamics of a nearly steady-state subalpine forest in south-central British Columbia. Oecologia 130: 126-135.

Lezberg, A. L., C. B. Halpern and J. A. Antos. 2001. Clonal development of *Maianthemum dilatatum* in forests of differing age and structure. Canadian Journal of Botany 79: 1028-1038.

Loewen, D. C., G. A. Allen and J. A. Antos. 2001. Autecology of *Erythronium grandiflorum* in western Canada. Canadian Journal of Botany 79: 500-509.

Campbell, E. M. and J. A. Antos. 2000. Distribution and severity of white pine blister rust and mountain pine beetle on whitebark pine in British Columbia. Canadian Journal of Forest Research 30: 1051-1059.

Antos, J. A., R. Parish and K. Conley. 2000. Age structure and growth of seedling bank trees in subalpine spruce-fir forests of south-central British Columbia. American Midland Naturalist 143: 342-354.

Parish, R., J. A. Antos and M.-J. Fortin. 1999. Stand development in an old-growth subalpine forest in the southern Interior of British Columbia. Canadian Journal of Forest Research 29: 1347-1356.

Lezberg, A. L., J. A. Antos and C. B. Halpern. 1999. Below-ground traits of herbaceous species in young, coniferous forests of the Olympic Peninsula, Washington. Canadian Journal of Botany 77: 936-943.

Antos, J. A. and G. A. Allen. 1999. Patterns of reproductive effort in male and female shrubs of *Oemleria cerasiformis:* a six-year study. Journal of Ecology 87: 77-84.

Clark, D. F., D. D. Kneeshaw, P. J. Burton and J. A. Antos. 1998. Coarse woody debris in sub-boreal spruce forests of west-central British Columbia. Canadian Journal of Forest Research 28: 284-290.

Nams, V. O., J. A. Antos and G. A. Allen. 1998. Seedling establishment in a patchy environment. Ecoscience 5: 86-94.

Antos, J. A. and C. B. Halpern. 1997. Root system differences among species: implications for early successional changes in forests of western Oregon. American Midland Naturalist 138: 97-108.

Zobel, D. B. and J. A. Antos. 1997. A decade of recovery of understory vegetation buried by volcanic tephra from Mount St. Helens. Ecological Monographs 67: 317-344.

Halpern, C. B., J. A. Antos, M. A. Geyer and A. M. Olson. 1997. Species replacement during early secondary succession: the abrupt decline of a winter annual. Ecology 78: 621-631.

Allen, G. A., J. A. Antos, A. C. Worley, T. A. Suttill and R. J. Hebda. 1996. Morphological and genetic variation in disjunct populations of the avalanche lily *Erythronium montanum*. Canadian Journal of Botany 74: 403-412.

Antos, J. A. and G. A. Allen. 1994. Biomass allocation among reproductive structures in the dioecious shrub *Oemleria cerasiformis*: a functional interpretation. Journal of Ecology 82: 21-29.

Allen, G. A. and J. A. Antos. 1993. Sex ratio variation in the dioecious shrub *Oemleria cerasiformis*. American Naturalist 141: 537-553.

Zobel, D. B. and J. A. Antos. 1992. Survival of plants buried for eight growing seasons by volcanic tephra. Ecology 73: 698-701.

Magee, T. K. and J. A. Antos. 1992. Tree invasion into a mountain-top meadow in the Oregon Coast Range, USA. Journal of Vegetation Science 3: 485-494.

Halpern, C. B., J. A. Antos, K. Cromack, Jr. and A. M. Olson. 1992. Species' interactions and plant diversity during secondary succession. Northwest Environmental Journal 8: 203-205.

Zobel, D. B. and J. A. Antos. 1991. 1980 tephra from Mount St. Helens: spatial and temporal variation beneath forest canopies. Biology and Fertility of Soils 12: 60-66.

Zobel, D. B. and J. A. Antos. 1991. Growth and development of natural seedlings of *Abies* and *Tsuga* in old-growth forest. Journal of Ecology 79: 985-998.

Barbour, M. G., B. M. Pavlik and J. A. Antos. 1990. Seedling growth and survival of red and white fir in a Sierra Nevada ecotone. American Journal of Botany 77: 927-938.

Antos, J. A. and G. A. Allen. 1990. A comparison of reproductive effort in the dioecious shrub *Oemleria cerasiformis* using nitrogen, energy and biomass as currencies. American Midland Naturalist 124: 254-262.

Antos, J. A. and G. A. Allen. 1990. Habitat relationships of the Pacific Coast shrub *Oemleria cerasiformis* (Rosaceae). Madroño 37: 249-260.

Antos, J. A. 1988. Underground morphology and habitat relationships of three pairs of forest herbs. American Journal of Botany 75: 106-113.

Allen, G. A. and J. A. Antos. 1988. Reproductive effort in the dioecious shrub *Oemleria cerasiformis*. Oecologia 76: 111-118.

Allen, G. A. and J. A. Antos. 1988. Morphological and ecological variation across a hybrid zone between *Erythronium oregonum* and *E. revolutum* (Liliaceae). Madroño 35: 32-38.

Zobel, D. B. and J. A. Antos. 1987. Survival of *Veratrum viride*, a robust herbaceous plant, when buried by volcanic tephra. Northwest Science 61: 20-22.

Zobel, D. B. and J. A. Antos. 1987. Composition of rhizomes of forest herbaceous plants in relation to morphology, ecology, and burial by tephra. Botanical Gazette 148: 490-500.

Zobel, D. B. and J. A. Antos. 1986. Survival of prolonged burial by subalpine forest understory plants. American Midland Naturalist 115: 282-287.

Antos, J. A. and D. B. Zobel. 1986. Habitat relationships of *Chamaecyparis nootkatensis* in southern Washington, Oregon and California. Canadian Journal of Botany 64: 1898-1909.

Antos, J. A. and D. B. Zobel. 1986. Seedling establishment in forests affected by tephra from Mount St. Helens. American Journal of Botany 73: 495-499.

Zobel, D. B. and J. A. Antos. 1985. Response of conifer shoot elongation to tephra from Mount St. Helens. Forest Ecology and Management 12: 83-91.

Antos, J. A. and D. B. Zobel. 1985. Plant form, developmental plasticity, and survival following burial by volcanic tephra. Canadian Journal of Botany 63: 2083-2090.

Antos, J. A. and D. B. Zobel. 1985. Upward movement of underground plant parts into deposits of tephra from Mount St. Helens. Canadian Journal of Botany 63: 2091-2096.

Antos, J. A. and D. B. Zobel. 1985. Recovery of forest understories buried by tephra from Mount St. Helens. Vegetatio 64: 103-111.

Antos, J. A. and D. B. Zobel. 1984. Ecological implications of belowground morphology of nine coniferous forest herbs. Botanical Gazette 145: 508-517.

Antos, J. A., B. McCune and C. Bara. 1983. The effect of fire on an ungrazed western Montana grassland. American Midland Naturalist 110: 354-364.

McCune, B. and J. A. Antos. 1982. Epiphyte communities of the Swan Valley, Montana. The Bryologist 85: 1-12.

Zobel, D. B. and J. A. Antos. 1982. Adventitious rooting of eight conifers into a volcanic tephra deposit. Canadian Journal of Forest Research 12: 717-719.

Antos, J. A. and D. B. Zobel. 1982. Snowpack modification of volcanic tephra effects on forest understory plants near Mount St. Helens. Ecology 63: 1969-1972.

Antos, J. A. and J. R. Habeck. 1981. Successional development in *Abies grandis* (Dougl.) Forbes forests in the Swan Valley, western Montana. Northwest Science 55: 26-39.

McCune, B. and J. A. Antos. 1981. Diversity relationships of forest layers in the Swan Valley, Montana. Bulletin of the Torrey Botanical Club 108: 354-361.

McCune, B. and J. A. Antos. 1981. Correlations between forest layers in the Swan Valley, Montana. Ecology 62: 1196-1204.

OTHER REFEREED PUBLICATIONS:

Zobel, D. B. and J. A. Antos. 2018. Forest understory buried by volcanic tephra: inertia, resilience and the pattern of community re-development. *In:* C.M. Crisafulli and V.H. Dale (eds.) *Ecological responses at Mount St. Helens: Revisited 35 years after the 1980 eruption*. pp. 113-125. Springer, New York.

Antos, J. A. and D. B. Zobel. 2005. Plant responses in forests of the tephra-fall zone. *In*: Dale, V. H., F. J. Swanson and C. M. Crisafulli (eds.). *Ecological responses to the 1980 eruption of Mount St. Helens*. pp. 47-58. Springer-Verlag, New York.

Antos, J. A., C. B. Halpern, R. E. Miller, K. Cromack, Jr. and M. G. Halaj. 2003. Temporal and spatial changes in soil carbon and nitrogen after clearcutting and burning of an old-growth Douglas-fir forest. USDA Forest Service Research Paper PNW-RP-552. 19 pp.

Antos, J. A. 2002. Understory plants in temperate forests. Article 5.3.1.8 in the *Encyclopedia of Life Support Systems*. EOLSS Publishers Co. Ltd., Oxford, UK.

Parish, R., J. A. Antos and R. J. Hebda. 1999. Tree ring patterns in an old-growth, subalpine forest in southern interior British Columbia. *In*: Wimmer, R. and R. Vetter (eds.). *Tree ring analysis – biological, methodological and environmental aspects*. pp. 231-248. CAB International, Wallingford, U.K.

Antos, J. A. and D. B. Zobel. 1987. How plants survive burial: a review and initial responses to tephra from Mount St. Helens. *In*: Bilderback, D. E. (ed.). *Mount St. Helens 1980: botanical consequences of an explosive eruption.* pp. 246-261. University of California Press, Berkeley.

Antos, J. A. and R. C. Shearer. 1980. Vegetation development on disturbed grand fir sites, Swan Valley, northwestern Montana. USDA Forest Service Research Paper INT-251. 26 pp.

PLANT GUIDES:

I have contributed to two popular plant guides as one of the authors. I primarily contributed to general ecological and range information, and to a lesser extent, editing and advising on species to include, key construction, and species descriptions.

Parish, R., R. Coupé and D. Lloyd, eds. 1996. *Plants of Southern Interior British Columbia.* Lone Pine Publishing Co., Vancouver.

Pojar, J. and A. MacKinnon, eds. 1994. *Plants of Coastal British Columbia*. Lone Pine Publishing Co., Vancouver.