Mediated Settlement Agreement for Sequoia National Forest, Section B. Giant Sequoia Groves

Master Bibliography

In the process of data compilation for the evaluation of giant sequoia groves under the Mediated Settlement Agreement, we compiled a digital bibliography for giant sequoia groves on the Sequoia National Forest and for the entire Sierra Nevada. This was done using the bibliographic database program EndNote 2. This master bibliography consists of data that we were not able to include in the printed report due to space constraints. There are over 700 references on giant sequoia ecology and management in the database and an output file of them follows. The data are also contained in the ~ADDENDUM/~A_C08DAT directory in three formats: EndNote 2 database (GS_BIB.EN2), ASCII text (GS_BIB.TXT), and Microsoft Word 6.0 (GS_BIB.DOC).

Agamirova, M. I. (1980). Growth and development of Cryptomeria japonica, Sequoiadendron giganteum and Sequoia sempervirens on the Apsheron Peninsula - Introduction studies. Biull. Gl. Bot. Sada. 115: 32-34.

Agee, J. K. and H. H. Biswell (1967). Christmas tree quality of white fir understory in a giant sequoia forest. California Agriculture. 21: 2-3.

Agee, J. K. (1968). Fuel conditions in a giant sequoia grove and surrounding plant communities, University of California, Berkeley.

Agee, J. K. and H. H. Biswell (1969). Seedling survival in a giant sequoia forest. California Agriculture. 23: 18-19.

Agee, J. K. (1973). Prescribed fire effects on physical and hydrological properties of mixed-conifer forest floor and soil, UC Berkeley School of Forestry and Conservation, Water Resources Center.

Agee, J. K., R. H. Wakimoto, et al. (1978). Fire and fuel dynamics of Sierra Nevada conifers. Forest Ecology and Management 1: 255-265.

Litterfall, decomposition of fine fuel, calorific value of fuel and fuel reduction by controlled burning were studied in plots in pure stands of ponderosa pine, sugar pine (Pinus lambertiana), white fir (Abies concolor), and giant sequoia (Sequoiadendron giganteum) in California. The implications of the results are discussed for fire management in these forest types.

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Albright, H. M. and F. J. Taylor (1957). How we saved the big trees. Saturday Evening Post. February 7.

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American, A. o. S. P. (1973). Field guidebook for Sequoia and Kings Canyon National Parks; the national history, ecology and management of the giant sequoias. Compiled by Richard J. Hartesvelt.

Anderson, R. H. (1944). The valley of giants. Trailways. 9: 6 pages.

Anderson, A. B., R. Riffer, et al. (1968). Chemistry of the genus Sequoia-G V cyclitols from the heart wood of Sequoia-gigantea-G. Phytochemistry 7(8): 1367-1371.

Anderson, R. S. (1988). Current research on the paleoecology and biogeography of the giant sequoia in California's national parks. George Wright Society's Fifth Triennial Conference on Research in the National Parks and Equivalent Reserves.

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Anderson, R. S. and S. J. Smith (1991). Paleoecology within California's Sierra Nevada National Parks: an overview of the past and prospectus for the future. Yosemite Centennial Symposium, El Portal, California, Yosemite Association.

Anderson, R. S. (1992). Paleohistory of a giant sequoia grove: the record from Log Meadow, Sequoia National Park. Symposium on Giant Sequoias: Their Place in the Ecosystem and Society, Visalia, CA, USDA Forest Service.

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Anderson, K. (1993). Indian fire-based management in the sequoia-mixed conifer forests of the central and southern Sierra Nevada.

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Andrews, R. W. (1958). Redwood classic. Seattle, WA, Superior Publishing Company.

Antevs, E. (1925). The big tree as a climatic measure. Carnegie Institute of Washington Publication No. 352: 115-153.

Atchison, T. a. S. F. R. C. (191-). Big trees: Sequoia and General Grant National Parks. The Railway. Chicago, IL.

Attwell, W. G. and A. M. Attwell (1977). An ancient giant speaks - a legend of the giant sequoia. Monterey, CA, Angel Press.

Axelrod, D. I. (1956). Mio-Pliocene floras from west-central Nevada. Berkeley, University of California Publications in Geological Sciences. 33: 1-322.

Axelrod, D. I. (1959). Late Cenozoic evolution of the Sierra big tree forest. Evolution 13: 9-23.

Axelrod, D. I. (1962). A Pliocene Sequoiadendron forest from western Nevada. Berkeley, University of California Publications of the Geological Society. 39: 195-268.

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Baerlocher, F. and J. J. Oertli (1978a). Colonization of conifer needles by aquatic hyphomycetes. Canadian Journal of Botany 56(1): 57-62.

Dead needles of Abies alba, Pinus sylvestris, P. leucodermis and Sequoia gigantea were immersed in a stream for 28 days and then examined for conidiophores of aquatic hyphomycetes. These fungi colonize untreated needles. Numbers of species and conidiophores were significantly higher on needles treated with steam before immersion than on untreated needles; both values were also higher on cut surfaces (mesophyll) than on intact surfaces (epidermis with cuticle) of longitudinally halved needles. Addition of untreated needle powder (Sequoia, P. leucodermis) to malt extract agar depressed linear growth of pure cultures of 5 aquatic hyphomycetes [Anquillospora pseudolongissima, Clavariopsis aquatica, Lemonniera aquatica, Tetracladium marchalianum, Tricladium angulatum]. The inhibition persisted when a 0.1 .mu.m membrane filter was placed between medium and fungal cultures. On water agar, by itself unsuitable for growth, low doses of needle powder allowed growth of the same fungi. At higher doses, inhibition again became predominant. Steam distillation of needle powder yielded 3 fractions: solid residue, soluble residue and steam distillate. Steam distillate did not influence fungal growth on the 2 media, while the other 2 fractions supported growth on water agar but did not lead to a clear dosage-effect curve on malt extract agar

Baerlocher, F. and J. J. Oertli (1978b). Inhibitors of aquatic hyphomycetes in dead conifer needles. Switz. Mycologia 70(5): 964-974.

Needle powders of Pinus leucodermis and Sequoia gigantea were extracted with petroleum ether, ethanol, methanol, or distilled water. After evaporating the solvents, extracts and extracted powder were added to nutrient medium to examine their effect on linear expansion of 5 aquatic Hyphomycetes [Anguillospora pseudolongissima, Clavariopsis aquatica, Lemonnlera aquatica, Tetracladium marchalianum and Tricladium angulatum]. All extracts depressed fungal growth, the inhibition being strongest with the 2 alcoholic extracts. The FeCl3 test indicated phenolic compounds in the alcohol and water but not in the petroleum-ether extracts. There was no correlation between the colorimetrically determined phenol content of an extract and its antifungal activity. Untreated needle powder strongly inhibited fungal growth, as did petroleum-ether or water-extracted powder. By contrast, alcohol-extracted powder did not inhibit fungal growth. The inhibitory effect of methanol extract was much more pronounced at a pH range of 4.0-4.5 than at 5.5-6.5

Baker, R. S. B. (1943). The redwoods. London, England, George Ronald.

Bancroft, W. L., T. Nichols, et al. (1985). Evolution of the natural fire program at Sequoia-Kings Canyon National Parks. Symposium and workshop on wilderness fire, USDA Forest Service.

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Barton, H. M. (1885). A trip to the Yosemite Valley, and the Mariposa grove big trees, California. Dublin, University Press.

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Becker, E. and D. D. Piirto (1980). Environmental assessment - McKinley Grove compartment.

Been, F. (1938?). Big Tree (Sequoia gigantea) census survey report.

Beetham, N. M. (1961). The ecological tolerance range of the seedling stage of Sequoia gigantea, Duke University.

Bellue, A. J. (1930a). A technical report on the Sequoia gigantea of Mariposa Grove.

Bellue, A. J. (1930b). A technical report on the Sequoia gigantea of Merced Grove.

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Berland, O. (1963). Giant forest's reservation: the legend and the mystery. San Francisco, CA.

Berry, E. W. (1923). Tree ancestors; a glimpse into the past. Baltimore, Williams & Wilkins.

Berthon, J. Y., N. Boyer, et al. (1987). Sequential rooting media and rooting capacity of Sequoiadendron giganteum in vitro. Peroxidase activity as a marker. Plant Cell Report 6(5): 341-344.

The rooting capacities of tips of seedling, juvenile and mature shoots of Sequoiadendron giganteum were compared on different rooting media (inductive and expressive media) after passage on an elongating medium. None of the cuttings rooted when continuously kept on medium containing the auxin NAA and vitamin D2. Peroxidase activity of all those cuttings on NAA + D2 first increased during the 7-9 first days and decreased in the days after. Rooting was obtained by transfer of the cuttings after periods longer than 7-9 days from the NAA + D2 inductive medium to a basal medium supplemented or not with rutin (expressive medium). The rooting capacity was emphasized by rutin treatment and was in correlation with the peroxidase peak reached on the NAA + D2 medium. Seedings, characterised by the highest perioxidase activity, were most performing in rooting

Berthon, J. Y., R. Maldiney, et al. (1989). Endogenous levels of plant hormones during the course of adventitious rooting in cuttings of Sequoiadendron giganteum (Lindl) in vitro. Biochemie und Physiologie der Pflanzen 184(5-6): 405-412.

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Bishop, F. E. (1985). A brief history of the big tree and the big stump. (California), F. E. Bishop.

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Biswell, H. H., R. P. Gibbens, et al. (1968b). Fuel conditions and fire hazard reduction costs in a giant sequoia forest. National Parks Magazine. 42: 16-19.

Biswell, H. H. (1975). Placer County big tree grove. National Parks and Conservation Magazine: 5.

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Boe, K. N. (1974). Sequoiadendron giganteum (Lindl.) Buchholz--giant sequoia. [Seed production]. USDA Agricultural Handbook. 45: 767-768.

Bojarczuk, T., H. Chylarecki, et al. (1980). Regionalization of tree and shrub selections for cultivation in Poland. Arbor Kornickie 25: 329-376.

The selections of trees and shrubs which are most valuable and most adapted to local site conditions were described. The list contained 669 spp. and varieties of woody plants. This is connected with the need to popularize many new ornamental varieties and new varieties adapted to particularily difficult urban environments. The tree plantings in the new open muncipal districts require diversification since a greater assortment of various species and varieties is possible. In Poland, 5 climatic regions were delineated: the western zone, the transitory zone, the eastern zone, the southern sub-montane zone and the montane zone. The western climatic zone favored the introduction of many ornamental trees and shrubs known for their sensitivity to winter frosts although exotic trees such as ebony (Diospyros lotus), bamboos (Sinarundinaria nitida) or sequoias (Sequoiadendron giganteum) can be grown. The transitory zone has an intermediate climate. The eastern zone has a cold, more continental climate. The vegetative period is almost 2 mo. shorter than within the neighboring zones (Tarnow, Pszczyna). Only woody plants can grow there which are adapted to long lasting very cold and windy winters, e.g., Acer negundo, Physocarpus opulifolius and Rhus typhina. The submontane zone is defined by other climatic factors. The Subcarpathian valleys and the Silesian lowland belong to the warmest regions of Poland. This characteristic, the abundance of precipitation and the most intense solar radiation throughout Poland permit the introduction of many valuable trees and shrubs from genera Magnolia, Deutzia, Weigela, Juglans and others. The montane zone is different, covering the lower reaches of the Carpathian and Sudety Mountains. Successful cultivation of various species including some evergreen ones like those from genera Rhododendron, Pieris and Chamacecyparis is possible

Bon, M. C., M. Genraud, et al. (1988). Role of phenolic compounds on micropropagation of juvenile and mature clones of Sequoiadendron-giganteum influence of activated charcoal. Scientific Horticulture (Amsterdam) 34(3-4): 283-292.

The beneficial influence of activated charcoal (AC) (20 gl-1), added to the basal culture medium, was noted for in vitro growth and further rooting of microcuttings collected from juvenile clones of Sequoiadendron giganteum. During the elongation phase on the medium containing AC, the growing upper part of the juvenile clone microcuttings contained less polyphenols than the lower part, while this difference was not observed in mature material. Plantlets growing on AC-free medium had almost identical polyphenol levels, which greatly increased after the seventh week of culture both in the tissues and the medium. The effect of AC on microcutting growth as well as the significance of polyphenols for micropropagation are discussed

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Bon, M. C. (1988b). Nucleotide status and protein synthesis in-vivo in the apices of juvenile and maturing Sequoiadendron-giganteum during budbreak. Physiologia Plantarum 72(4): 796-800.

Adenine and guanine nucleotide contents of isolated apices collected from a juvenile and a mature clone of Sequoiadendron giganteum (Lindl.) Buchholz during budbreak were determined. GDP and GTP contents were significantly higher in the juvenile clone apex than in the mature ones, whereas there was no difference in ATP concentration between the two materials. In vivo, induction of protein synthesis was similar in the two clones after 10 min of [35S]-methionine labeling. The increase of [35S]-methionine-tRNAs and labeled proteins continued up to 30 min for the juvenile clone. They markedly declined for the mature clone after 10 min. Only the diminution of this in vivo protein synthesis was well correlated with a decrease in GTP content

Bon, M. C. and O. Monteuuis (1991). Rejuvenation of a 100-year-old Sequoiadendron giganteum through in vitro meristem culture. 2. Biochemical arguments. Physiologia Plantarum 81(1): 116-120.

Bonar, L. (1971). A new mycocalicium on scarred sequoia in California. Madroño. 21: 62-69.

Bonnicksen, T. M. (1975). Spatial pattern and succession within a mixed-conifer-giant sequoia forest ecosystem, University of California, Berkeley.

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Bonnicksen, T. and E. C. Stone (1981). The giant sequoia - mixed conifer forest community characterized through pattern analysis as a mosaic of aggregations. Forest Ecology and Management 3(4): 307-328.

This hypothesis was examined using 5-point pattern analysis techniques. The results showed statistically significant levels of contagion for most of the tree classes analyzed, thereby demonstrating the presence of aggregations in the giant sequoia-mixed conifer forest community. Both distance and quadrat methods of analysis also showed that older and larger trees have a tendency to be uniformly dispersed. Aggregations tended to decrease in size as the age of the trees increased. However, giant sequoia was unique in that its aggregations did not tend to decrease in size as the trees grew older. The quadrat methods also showed that most aggregations in the giant sequoia-mixed conifer forest community range in size 135-1600 m2. These results are compared with the pattern produced by a prescribed burn designed to reduce fuels and restore natural conditions. The prescribed burn reduced the density of trees but it did not significantly alter the pattern of trees in the 41-60 yr and older age classes. The management implications of these findings are discussed

Bonnicksen, T. M. and E. C. Stone (1982a). Managing vegetation within U.S. National Parks: A policy analysis. Environmental Management 6(2): 101-102 and 109-122.

The development of management policies is briefly traced from 1872, and ambiguities in legislation are described and partially resolved. Alternative objectives put forward by the Park Service, aiming at restoring or maintaining natural conditions, are evaluated using data from a giant sequoia (Sequoiadendron giganteum)/mixed conifer forest in Kings Canyon National Park, California [see FA 43, 2232]. It is concluded that structural maintenance objectives (those aiming to maintain the vegetation in its current state, or restore it to its presettlement state and maintain it there) are not biologically feasible since this forest community is not in a steady state. Process maintenance objectives, allowing succession to continue in the current vegetation, or after restoration to a presettlement condition, are, therefore, preferred. A new option is also presented, based on a high resolution description of the presettlement forest community and named the reconstruction-simulation approach.

Bonnicksen, T. M. and E. C. Stone (1982b). Reconstruction of a presettlement giant sequoia-mixed conifer forest community using the aggreation approach. Ecology 63(4): 1134-1148.

The presettlement state of a giant sequoia-mimed conifer forest community in the Redwood Creek watershed, Kings Canyon National Park [USA] is reconstructed using a backward projection in time of plant aggregations. The most conspicuous change in the forest community from the presettlement condition (.apprxeq. = 1890) was a general increase in the area of aggregations dominated by pole-size trees and mature trees, and a corresponding decrease in the area of aggregations dominated by sapling- and seedling-size trees. Aggregations dominated by white fir had both the greatest decline in area for sapling and seedling aggregations and the greatest increase in area for large mature, mature, and pole aggregations of any species in the watershed. The area of aggregations dominated by shrubs also declined, with manzanita aggregations showing the largest loss in area for any shrub species. Hardwoods were also a far more important part of the presettlement forest community than they are today

Bonnicksen, T. (1994). Reconstruction graphics.

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Brown, P. M. (1992/93). Proposal for tree-ring sampling (to B. Rogers, Sequoia National Forest), University of Arizona.

Brown III, M. R. and C. M. Elling (1981). An historical overview of redwood logging resources within the Hume Lake Ranger District, Sequoia National Forest, California, Sonoma State University.

Brussard, P. F., S. A. Levin, et al. (1971). Redwoods: A population model debunked. Science 174: 435.

Bryan, J. Y. (1974). Mountain monarchs. National Parks and Conservation. 48: 5-8.

Bryant, H. C. (1940). The spotted owl nesting in the sequoia belt. Condor 42(6): 307.

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Buchanan, H., H. H. Biswell, et al. (1966b). Succession of vegetation in a cut-over Sierra redwood forest. Utah Academy of Sciences, Arts and Letters. 43: 43-48.

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Buchholz, J. T. (1938). Cone formation in Sequoia gigantea. I. The relation of stem size and tissue development to cone formation. II. The history of the seed cone. American Journal of Botany 25(4): 296-305.

Buchholz, J. T. (1939a). The morphology and embryogeny of Sequoia gigantea. American Journal of Botany 26(2): 93-101.

Buchholz, J. T. (1939b). The genetic segregation of the sequoias. American Journal of Botany 26: 534-538.

Buchholz, J. T. and M. Kaeiser (1940). A statistical study of two variables in the sequoias - pollen grain size and cotyledon number. American Naturalist May-June: 5 pages.

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California, S. D. o. P. a. R. (1990). Calaveras Big Trees State Park general plan.

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Caprio, A. C. and T. W. Swetnam (1993b). Historic fire regimes along an elevational gradient on the west slope of the Sierra Nevada, California. Proceeding of the Symposium on Fire in Wilderness and Park Management, Missoula, MT, USDA, Forest Service.

Caprio, A. C., L. S. Mutch, et al. (1994). Temporal and spatial patterns of giant sequoia radial growth response to a high severity fire in A.D.1297.

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Chalchat, J. C., R. P. Garry, et al. (1988). Constituents of Sequoiadendron giganteum Buchh. leaf oils (giant sequoia). Flavour Fragr. J. 3(2): 69-72.

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Challacombe, J. R. (1954). When the giants fell. Popular Mechanics.

Challacombe (1992). Reviving the great forest: An exercise in applied ecology. Sequoia Watch. 2: 33 pages.

Chandler, E. W. (1970). A different kind of Christmas tree. American Forests 76(12): 32-34.

Christensen, N., L. Cotton, et al. (1987). Review of fire management program for sequoia-mixed conifer forests of Yosemite, Sequoia and Kings Canyon National Parks.

Christensen, N. C. (1988). Succession and natural disturbance: paradigms, problems and preservation of natural ecosystems. Ecosystem management for parks and wilderness. J. K. A. a. D. R. Johnson. Seattle, WA, University of Washington Press: 62-86.

Christensen, N. (1991). Variable fire regimes on complex landscapes: ecological consequences, policy implications, and management strategies.

Cid del Prado Vera, I. and B. F. Lowensbery (1984). Histopathology and host range studies of the redwood nematode Rhizonema-sequoiae. Journal of Nematology 16(1): 68-72.

Second-stage larvae of R. sequoiae tunnel through the cortex of the redwood Sequoia sempervirens (D. Don) Endl. root to the vascular tissue where each developing female induces a single ovoid or occasionally spherical giant cell with a single ovoid to spherical nucleus containing 1-4 enlarged nucleoli. Nematode tunnels are filled with a gel material and often contain 2nd-stage larvae and males. There is tissue necrosis around females, and cortical tissue is destroyed after infection by many 2nd-stage larvae. R. sequoiae females developed to maturity on S. sempervirens, Acer macrophyllum Pursh, Alnus rhombifolia Nutt., Libocedrus Torr, Pseudotsuga menziesii (Mirb.) Franco and Sequoiadendron giganteum (Lindl.) Decne. In the Marin County, California [USA], forest mature females were also found naturally infecting Lithocarpus densiflorus (Hook and Arn.) Rehd., Umbellularia californica (Hook and Arn.) Nutt., and Arbutus menziesii Pursh

Clark, G. (1907). The big trees of California, their history and characteristics. Redondo, CA, Reflex Publishing Company.

Cloer, C. (1992). Reflections on management strategies of the Sequoia National Forest: A grassroots view. Symposium on Giant Sequoias: Their Place in the Ecosystem and Society, Visalia, CA, USDA Forest Service.

Cockrell, R. A., R. M. Knudson, et al. (1971). Mechanical properties of southern Sierra old- and second-growth giant sequoia [giganteum]. California Agriculture Experiment Station Bulletin 854: 1-15.

Cockrell, R. A. and R. M. Knudson (1973). A comparison of static bending, compression and tension parallel to grain and toughness properties of compression wood and normal wood of a giant sequoia (gigantea). Wood Science Technology 7(4): 241-250.

Tests on samples removed from bolts cut at 8 ft and 20 ft above stump level from a leaning suppressed tree and tested by ASTM methods indicated that many of the strength properties of compression wood in both the green and dry state were at least equal, if not considerably superior, to those of the matched samples of normal wood. However, when specific strengths and stiffness were compared, the compression-wood samples showed lower values than normal wood, which in turn showed lower values than opposite or tension wood.

Cockrell, R. A. (1973). The effect of specimen preparation on compression wood and normal latewood pits and wall configurations of giant sequoia. Bulletin of the International Association of Wood Anatomists 4: 19-23.

Cockrell, R. A. (1974). A comparison of latewood pits, fibril orientation, and shrinkage of normal and compression wood of giant sequoia (gigantea, growth defects). Wood Science Technology 8(3): 197-206.

Reports a detailed anatomical study of compression wood in Sequoia gigantea, in which it is an uncommon feature. Late-wood tracheids in compression wood had pit canals that flared towards the lumen. Boiling and drying of compression-wood blocks induced split extensions at the pit-aperture grooves. The mean S2 fibril angle of 21-25 deg (maximum 32 deg) was considerably lower than the value (45 deg) reported in other species. The greater fibril angles of compression wood may be responsible for greater axial shrinkage and lower tangential shrinkage. The low tangential/radial shrinkage ratio is an important physical deviation from normal wood. The magnitude of shrinkage is influenced by the manner of drying, and differs between sapwood and heartwood.

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Seven packrat midden samples make possible a comparison between the modern and late Pleistocene vegetation in Kings Canyon on the western side of the southern Sierra Nevada. One modern sample contains macrofossils and pollen derived from the present-day oak-chaparral vegetation. Macrofossils from the 6 late Pleistocene samples record a mixed coniferous forest dominated by the xerophytic conifers Juniperus occidentalis, Pinus cf. ponderosa and P. monophylla. The pollen spectra of these Pleistocene middens are dominated by Pinus sp., Taxodiaceae-Cupressaceae-Taxaceae (TCT) and Artemisia sp. Mesophytic conifers are represented by low macrofossil concentrations. Sequoiadendron giganteum is presented by a few pollen grains in the full glacial. Edaphic and snow dispersal are the most likely causes of these mixed assemblages. The dominant macrofossils record a more xeric plant community than those that now occur on similar substrates at higher elevations or latitudes in the Sierra Nevada. These assemblages suggest that late Wisconsin climates were cold with mean annual precipitation not necessarily greater than modern values. A model of low summer ablation allowing for the persistence of the glaciers at higher elevations during the late Wisconsin was supported. S. giganteum may have grown at lower elevations along the western side of the range and P. monophylla may have been more widely distributed in cismontane California during the Pleistocene

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Results are reported from 2 plots out of 9 established in 1952-3 to observe growth and mortality. These contained high proportions of second growth Sierra redwood (Sequoiadendron giganteum): 45% in one plot (31-yr-old); and 90% in the other (86-yr-old). Total vol., ingrowth, mortality and p.a.i. and m.a.i. are tabulated for stand ages of 7 to 86 years. Growth rates were similar to those of second growth mixed conifer stands in the Westside Sierra region.

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The method used involved triangulation from various points on a closed traverse and has been developed during the measurement of other exceptionally large trees. Ht. (76.1 m), vol. and diam. measurements for the Adam tree are given and compared with those of 5 other named Sierra redwoods [Sequoiadendron giganteum].

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If starch-free wood or timber [from Abies alba, Chamaecyparis lassoniana, Pinus sylvestris, Sequoiadendron giganteum, Casuarina equisetifolia, Callitris verrucosa, Acer pseudoplatanus, Aesculus hippocastanum, Buxus sempervirens, Catalpa bignonioides, Castanea sativa, Fagus sylvatica, Guaiacum officinale, Ochroma lagopus, Populus nigra, Quercus pedunculata, Sarothamnus scoparius, Tilia cordata, Bambusa sp. and Saccharum officinarum] is sufficiently disintegrated, 2 types of particles are obtained which show either the cellulose or the lignin reaction with suitable reagents, independently of the wood species

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The trails of C. modoc Wheeler follow perennial routes. The ants orient along these using both chemical and visual cues. If the chemical cues are disrupted the ants reform the trail while orienting by visual cues. They can respond to the same visual cues after at least 12 h, and since no evidence was found that the chemical cues survive the winter, probably after 6 months

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The establishment of the botanic garden of the Higher Institute of Forest Engineering.sbd.Sofia, dates since 1964. Investigations are conducted on the growth in height and diameter of the oldest trees from 19 gymnospermous exotic species: Abies cephalonica Loud., Albies concolor Lindl. et Gord., Abies nordmanniana (Stev.) Spach., Cedrus libani Laws., Chamaecyparis lawsoniana Parl., Chamaecyparis pisifera (S. et. Z.) Endl., Ginkgo biloba, L., Libocerdrus decurrens Torr., Metasequoia glyptostroboides Hu et Cheng., Picea pungens Dougl., Pinus ponderosa Dougl., Pinus strobus L., Pseudotsuga menziesii (Mirb.) Franco, ssp. glaucescens, Pseudotsuga menziesii (Mirb.) Franco, ssp. menziesii, Sequoiadendron giganteum (Lindl.) Buchh., Taxodium distichum (L.). Rich., Thuja gigantea Nutt., Thuja occidentalis L., Thuja orientalis L. Most intensive growth in diameter is manifested by Sequoiadendron giganteum.sbd.1,25 cm mean annual increment at the age of 20 years and Cedrus libani.sbd.1,00 cm at the same age. Most intensive growth in height is manifested by Cedrus libani.sbd.49 cm mean annual increment at the age of 20 years and Pinus strobus.sbd.14 cm at the same age

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Sequoia sempervirens is an autoallopolyploid with the genomic formula AAAABB. Its complement-AA and -B, that belong to Stebbins' "1A" and "1B" karyotypic type respectively, are quite similar to the karyotypes of Metasequoia glyptostroboides and Sequoiadendron giganteum (Table 1, 2). So some ancient species of Metasequoia and Sequoidendron may be the two hybrid parents of S. sempervirens, M. glypiostroboides and S. giganteum are probably direct descendants of them. The present study supports Stebbins' suggestion that one ancient species of Metasequoia would be an ancestor of S. sempervirens, but does not agree with his hypothesis that another ancestor is extinct and has not left close relatives. The original process of S. sempervirens may be shown as Fig. 1

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Activation energies and Arrhenius frequency factors were calculated for the racemization reaction of 4 bound amino acids (aspartic acid, glutamic acid, proline and phenylalanine) isolated from sequoia heartwood, by using elevated temperature rate constants. A first-order rate constant of 2.1 .times. 10-5 yr-1 was calculated for the racemization of bound aspartic acid from the extent of racemization in dendrochronologically dated sequoia heartwood samples. Because the racemization reaction is temperature dependent, an average temperature which the bound aspartic acid in sequoia had experienced during the past .apprx. 2200 yr was obtained. This value agrees with modern temperatures near the sample location and estimated paleotemperatures during the past .apprx. 2000 years

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In the apparently empty axils of the needles of Taxus baccata, Sequoia sempervirens, Sequoiadendron giganteum, Cryptomeria japonica, Thuja occidentalis and Thujopsis dolabrata persisting detached meristems were found, which are derived from superficial layers of the apical eumeristem. In T. baccata delayed development of minute axillary buds occurs from these meristems after 1-4 yr on the intact plant. In the other conifers, development of additional axillary buds from these meristems was induced by natural frost damage or by artificial pruning and disbudding. The discovery of these detached meristems is discussed with regard to the regenerative capacity of the conifers in comparison to other plants

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Cuttings taken from 6-month-old greenhouse-grown seedlings of Sequoiadendron giganteum gave 70% rooting after 6 months with a standard mist propagation technique designed for conifers, and 86-88% when a liquid NPK fertilizer was applied weekly to the rooting medium. Fertilizer use was only beneficial under moist conditions, and can reduce rooting under low-mist conditions. Angled cuts (approx. 45deg) increased speed of rooting and possibly rooting % compared with 90deg cuts. Material from 40-yr-old trees was rooted with difficulty, but survival after rooting was very poor

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Sequoiadendron giganteum cones were collected in summer and autumn 1974-76 [in California], and seeds from 2 populations were soaked overnight, and stratified at 2.2-2.8degC for 0-91 days with or without captan. Germination was recorded after 5 wk. The 2 populations were significantly different (av. germination 40.7 and 34.9%). Germination was slower in the presence of captan and after short (0 and 7 days) stratification periods, but final germination percentage were not affected. In a second experiment, seed samples from 5 populations were soaked overnight in aerated water, treated with captan, and stratified for 25 days at 2.8degC. After 5 wk there were significant differences between populations in germination. Av. germination of soaked seeds was 25.6%, compared with 20.2% for unsoaked controls, but the differences were not significant

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Seed samples were collected from 35 natural populations of giant sequoia and examined for seed weight, germination percent, cotyledon number, rootability of cuttings, and isozyme variation. Samples were significantly variable in percent seed germination, cotyledon number, isozyme allele frequencies and observed heterozygosity. Seed germination varied among populations, but did not reveal any clear geographic patterns. Cotyledon numbers (of 871 seedlings) varied among populations and geographic areas. Cuttings (from 608 seedlings) rooted at 94%. Isozyme variation was found in every population sample at one or more loci. Little if any recent gene flow is likely to have occurred between the northern and southern populations. Relatively low heterozygosity among embryo samples suggests that inbreeding and/or population substructuring is likely in giant sequoia populations. Relatively higher levels of heterozygosity are found in the southern parts of the range, suggesting different local selective regimes. Early data suggest that the most northern native population (Placer Grove) may be substantially different from the other populations

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A xylotomic study of wood was made on members of the Taxodiaceae. The wood of 10 spp. [Athrotaxis cupressoides, Cryptomeria japonica, Cunninghamia lanceolata, Glyptostrobus pensilis, Metasequoia glyptostroboides, Sequoia sempervirens, Sequoiadendron giganteum, Taiwania cryptomerioides, Taxodium distichum and T. mucronatum] was studied and described. Microscopic characters of anatomical wood structure changed along the annual ring. The latter is divided into 4 zones, which are characterized by a complex of characters. The change in the anatomical characters in the zones of the annual ring is described. A detailed method was used for the description of wood according to variations in characters. Diagnostic characters, which allow the wood of the genera of the family Taxodiaceae to be distinguished, were established

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Frost resistance in 2 yr old giant sequoia seedlings was analyzed by an artificial freezing test, in which detached twigs are placed in freezing chambers at different temperatures. The temperature that kills 50% of the twig foliage is called the frost-killing-point and is denoted LT50%. The results were compared to damage sustained outdoors by seedlings and support the reliability of the testing methods employed. The experiment included the open-pollinated offspring of 2 trees growing in Hermeskeil, West Germany, and seedling samples of 22 provenances representing the entire natural range of giant sequoia. Significant and substantial differences were found in frost resistance, winter damage and in early height. Frost resistance is correlated with outdoor winter damage and elevation, however not with latitude, longitude nor seedling height. Shoot tip hardness measured by touch is unrelated to frost hardiness

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Reports the results of experiments in which 1-month-old seedlings of Sequoia sempervirens and S. gigantea were exposed to seven species of plant-parasitic nematodes. Heterodera schachtii was the only species that had not infected the trees after 2 months. The top-growth of both tree species was reduced by Pratylenchus penetrans and P. vulnus. The development of these nematodes on both tree species may hinder natural or artificial regeneration.

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From Sequoiadendron giganteum, Taxodium distichum, Ginkgo biloba, Metasequoia glyptostroboides and Cycas revoluta

Marshall, J. T. (1988). Birds lost from a giant sequoia forest during fifty years. Condor 90(2): 359-372.

Not all forest bird species breeding on Redwood Mountain, Tulare County, California [SA] in the 1930s are still there in the 1980s. Over the 50 years virgin giant sequoia forest of the saddle and east slope (within Kings Canyon National Park) remains unchanged but has lost the Olive-sided Flycatcher (Contopus borealis). The mixture of old and second-growth sequioas of Whitaker's Forest, where pines and undergrowth were removed and snags eliminated, is missing the Mountain Quail (Oreotyx pictus), Flammulated Owl (Otus flammeolus), North Pygmy-Owl (Glaucidium gnoma), Spotted Owl (Strix occidentalis), Hairy Woodpecker (Picoides villosus), and Olive-sided Flycatcher. Though unchanged today, the riparian alders of Eshom Creek on the west slope have lost Swainson's Thrush (Catharus ustulatus). Drastic logging by Sequoia National Forest has driven all of the above from the west slope ponderosa pine forest that surrounds Whitaker's Forest. New birds established at Whitaker's Forest by 1986 are the Common Raven (Corvus corax), House Wren (Troglodytes aedon), and Lincoln's Sparrow (Melospiza lincolnii). Intrusion of Brown-headed Cowbirds (Molothrus ater) has begun within yet affecting two abundant species of vireos. The Pileated Woodpecker (Dryocopus pileatus) is reduced; the Winter Wren (Troglodytes troglodytes) has greatly increased. I attempt to explain avifaunal changes by comparing habitats over the 50-year interval. Disappearance of the flycatcher and thrush from unchanged, prime habitat must be caused by destruction of corresponding forests in Central America, where these birds maintain their winter territories

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The endophytous mycorrhizae of vesicular-arbuscular type were described in fine roots of S. gigantea and S. sempervirens. Fine roots were of 2 types: thin smooth white, and thick and of a brown color. The mycorrhizal infection was intense in thick brown roots, whereas white roots had light infection. The optimal development of endophyte hyphae was observed in the central and inner cortical cell layers of root. There were arbuscules and vesicles in the root parenchyma. Coiled intracellular hyphae measured 3.45-8.95 .mu.m in diameter. The roots had no root hairs

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Four provenances of giant sequoia (Sequoiadendron giganteum (Lindl.) Buchh.) originating from the counties Fresno, Calaveras, Tulare and from Sequoia National Forest in California [USA]were tested on three sites in the Federal Republic of Germany (Rengsdorf/Rhineland Palatinate; Reinhausen/Lower Saxony; and at Grosshansdorf/Schleswig-Holstein). At age 14 years differences in survival between locations and provenances were ascertained. At the trial in Grosshansdorf survival was influenced particularly by frost damage in a frost pocket and a following infection by Armillaria mellea (Vahl) Karst. In spite of the small number of provenances there were significant differences in height, d.b.h. and diameter at half tree height between provenances and locations. The provenance Tulare which is known from other trials to perform well proved to have inferior growth and survival up to age 14 years. At the trial at Rengsdorf height growth was slightly negatively correlated with the altitude at the seed origin. A prerequisite for establishing stands of giant sequoia at a commercial scale is the choice of frost hard (and well performing) provenances. Such stands might be promising at suited sites in the Federal Republic of Germany

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Miller, P. R. (1973). Susceptibility to ozone of selected western [US] conifers. 2nd International Congress of Plant Pathology, Minneapolis, MN.

Seedlings of 12 species and two hybrids were grown in greenhouses with carbon-filtered air at Lake Arrowhead, S.California. Fumigation treatments were begun at 2 years old. The conditions of growth and fumigation simulated those of a mountainous area of severe O3 damage to native species. Evaluation of needle injury (mottle, necrosis and abscission) required not less than 42 seedlings of each species. In Pinus ponderosa, one-year-old needles were damaged 3 times as much as current-year needles, and fumigations begun in mid-Aug. resulted in the greatest injury. The species were, in order of decreasing susceptibility: P. monticola, P. jeffreyi X P. coulteri, Abies monticola [A. magnifica ?], P. radiata X P. attenuata, P. ponderosa [Californian], P. coulteri, Pseudotsuga menziesii, Pinus jeffreyi, P. ponderosa (Rocky Mountain), A. concolor, Pseudotsuga macrocarpa, Pinus attenuata, Libocedrus decurrens, Pinus lambertiana, and Sequoia gigantea

Miller, P. R., K. W. Stolte, et al. (1984). Ozone effects on important tree species of the Sequoia-Kings Canyon National Parks, USDA Forest Service, Riverside.

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A total of 7000 meristems were used in experiments to investigate the possibility of cloning Sequoiadendron giganteum Buchholz by in vitro meristem culture of juvenile (2-year-old) and mature (100-year-old) ortets. Cultures were initiated on a low-salt medium containing 0.1 mg l-1 l-naphthaleneacetic acid to stimulate meristematic activity. Benzylamino purine (0.01-0.5 mg l-1) inhibited meristematic activity, whereas gibberellic acid (0.01-0.5 mg l-1) had no effect on meristematic development. The mature ortet showed more specific mineral requirements and a lower capacity for cloning than the juvenile ortet. Rooted plants were obtained only from the juvenile clone. There was a marked seasonal effect on meristematic activity, especially for the mature clone, the most active material being obtained during budbreak

Monteuuis, O. and M. Gendraud (1987). Nucleotide and nucleic acid status in shoot tips from juvenile and mature clones of Sequoiadendron giganteum during rest and growth phases. Tree Physiology 3(3): 257-263.

Nucleoside triphosphate and nucleic acid contents of shoot tips of juvenile and mature clones of Sequoiadendron giganteum Buchholz were analyzed during rest and growth phases. In both juvenile and mature clones, shoot growth activity was characterized by significant increases in ATP, non-adenylic nucleoside triphosphate (NTP) and RNA levels. During the rest period, both ATP/NTP and RNA/DNA ratios were significantly higher in the juvenile clone than in the mature clone. However, during the growth phase, only the ATP/NTP ratio was higher in the juvenile than in the mature clone. The results suggest that the physiological differences between shoot tips of juvenile and mature tissues during the rest phase tend to decline as active shoot growth commences. This conclusion is consistent with morphological observations and with the varying organogenetic capacities of in vitro cultures of explants removed from stock plants at different times

Monteuuis, O., M. C. Bon, et al. (1987). Micropropagation aspects of Sequoiadendron giganteum juvenile and mature clones. Acta Horticulturae(212): 489-497.

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Monteuuis, O. (1989). Microscopic analyses of apical meristems of young and mature Sequoiadendron giganteum during rest phase and bud-break. Bulletin de la Societe Botanique de France - Lettres Botaniques 136(2): 103-107.

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Muir, N. (1978a). The evergreen conifers. Amenity trees for town planting. Gardeners Chronicle and Horticultural Trade Journal 183(13): 24-27.

Pines are considered the most important group of conifers and Cedrus deodara the most important individual species for urban planting. C. libani and C. atlantica, Sequoiadendron giganteum [Sequoia gigantea] and Tsuga heterophylla are most likely to produce large specimens. C. atlantica, T. canadensis and Abies grandis are recommended for thin soils over chalk. Pinus nigra is excellent for screening and general landscaping. The advantages of 11 other Pinus species are discussed. Abies, Picea, Cryptomeria, Calocedrus [Libocedrus] and Thuja are more useful in formal plantings than in landscaping, but are not suitable for industrial or exposed areas. Abies homolepis and A. numidica are fairly successful under urban conditions.

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Species considered for amenity planting in towns are: Sequoia sempervirens, Sequoiadendron giganteum [Sequoia gigantea], Picea smithiana, P. breweriana, P. omorika, P. orientalis, P. pungens, P. abies, P. likiangensis, Chamaecyparis lawsoniana, C. nootkatensis, C. obtusa, Cryptomeria japonica, Calocedrus [Libocedrus] decurrens, Thuja plicata, T. orientalis, T. koraiensis and T. standishii.

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Mutch, L. S. (1994). Growth responses of giant sequoia to fire and climate in Sequoia and Kings Canyon National Parks, California, University of Arizona.

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Neumann, H. (1984). Up-to date experience in North Rhine Westphalia with cultivation and silviculture of Sequoiadendron giganteum (Lindl.) Buchh. Mitteilungen der Deutschen Dendrologischen Gesellschaft 75: 77-104.

Nichols, H. T. (1989). Managing fire in Sequoia and Kings Canyon National Parks. Fremontia. 16: 11-14.

Nikolaeva, L. F., N. B. Florova, et al. (1979). Spectral forms of chlorophyll synthesized in the absence of light by seedlings of relict coniferous plants. Zh. Obsch. Biol. 40(1): 128-137.

Many phylogenetically ancient plant forms can synthesize chlorophyll in the absence of light at early ontogenetic stages. This ability was studied in the representatives of Gymnospermae, both relict and phylogenetically advanced forms. Using low-temperature fluorometry, 12 [Ginkgo biloba, Podocarpus macrophyllus D., Picea abies Karts., Cedrus deodara Lond., Pinus sylvestris L., Larix sibirica L., Cryptomeria japonica L., Sciadopitys verticillata L., Sequoia sempervivens Lamb., Sequoiadendron giganteum Linde., Metasequoia glyptostroboides Hu et Hung, Cercediphyllium manigifum Kai., Zelcova serrata Spach, Arbutus andrachue A. L. de Juss and Callistemon lanceolata A. L. de Juss spp. of Coniferophyta were compared. Representatives of all the families studies (Gingkoaceae, Pinaceae, Taxodiaceae, Podocarpaceae) are able, at a stage of primary leaves, to accumulate in the dark chlorophyll forms differing in the degree of molecular aggregation. In the relict angiosperms studied this ability was absent. A nonphotochemical pathway of chlorophyll biosynthesis is apparently present at the earliest stages of the evolution of Gymnospermae, which might be connected with germination conditions of the latter. Preservation of the ability for chlorophyll synthesis in the darkness at the seedling stage in now living species of Pinaceae and Taxodiaceae might point to a considerable adaptive lability of these plants. Further investigation into the peculiarities of formation of the pigment apparatus of coniferous plants will contribute to elucidation of some plant evolution problems

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The Mlynany Arboretum, founded in 1892, is the richest in respect to the number of species among the numerous parks, botanical gardens and arboreta in Slovakia [Czechoslovakia]. In 1967 there were 1658 species, varieties and forms in this arboretum. At present there are over 2000 spp. in the collection. The Kysihybel Arboretum contains 197 spp., varieties and forms. The Bratislava (638 spp.), Martin (273 spp.), Kosice (265 spp.), and Banska Stiavnica (264 spp.) Botanical Gardens and J. Kral Gardens in Bratislava (254 spp.) are worth visiting. The Topolcianky (299 spp.) and Piestany (216 spp.) parks are notable. A dendrological singularity in Slovakia, and possibly in Czechoslovakia, is a specimen of Citrus trifoliata L. growing in the open. The largest and oldest sequoia (Sequoiadendron giganteum Buchholz) is in a small park in Antol, and in Banska Stiavnica there are the largest cedars, Cedrus atlantica Man. and C. libani Loud.

Pacyniak, C. (1974). A splendid specimen of Sequoiadendron-giganteum in Brwice, Poland. Roca. Sekc. Dendrol. Pol. Tow. Bot. 28: 119-121.

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Parmeter Jr., J. R. (1985). Diseases and insects of giant sequoia. Workshop on Management of Giant Sequoia, Reedley, CA, U.S.D.A. Forest Service.

Parsons, D. J. (1975). Fire in Sequoia and Kings Canyon National Parks. Fremontia 3(1): 13-14.

Parsons, D. J. (1978). Fire and fuel accumulation in a giant sequoia forest [Prescribed burning]. Journal of Forestry 76(2): 104-105.

Studies of fallen woody fuel and of litter and duff accumulation in the sequoia (Sequoiadendron giganteum)/conifer forest of Kings Canyon National Park, California, showed that prescribed burning removed most of the fuel which had accumulated during 60 years of fire suppression. Measurements 1, 4 and 7 years later showed that sufficient fuel had accumulated after 7 yr to support further fire. Fire management is discussed.

Parsons, D. J. and S. H. DeBenedetti (1979). Impact of fire suppression on a mixed-conifer forest. Forest Ecology and Management 2(1): 21-33.

Fire suppression (100 yr) in a mixed-conifer forest which evolved with frequent natural fires has shifted successional patterns, increased the density of small trees, and produced an unnatural accumulation of ground fuels. Analysis of species composition, vegetation structure and age distribution in each of 4 forest types within the mixed-conifer zone of Sequoia and Kings Canyon National Parks, California, USA, has documented a substantial increase in young, shade tolerant white fir [Abies concolor] in each type. The original dominant species have decreased in relative abundance in most cases. The sequoia type has been most affected by the fire suppression policy. Giant sequoia [Sequoiadendron giganteum] show poor reproduction in the absence of fire. The sequoia type also exhibits the greatest accumulation of ground fuels. The ponderosa pine [Pinus ponderosa], white fir and mixed forest types also show successional changes as well as significant accumulations of flammable ground fuels following a century of fire exclusion. The management implications of these findings are discussed.

Parsons, D. J. and T. J. Nichols (1985). Management of giant sequoia in the National Parks of the Sierra Nevada, California. Workshop on Management of Giant Sequoia, Reedley, CA, USDA Forest Service.

Parsons, D., L. Bancroft, et al. (1985). Information needs for natural fire management planning. Proceedings of the Symposium and Workshop on Wilderness Fire, USDA Forest Service.

Parsons, D. J. (1988a). Managing fire as a natural process in the sequoia mixed-conifer ecosystem: questions of science and policy. George Wright Society's Fifth Triennial Conference on Research in the National Parks and Equivalent Reserves.

Parsons, D. J. (1988b). The giant sequoia fire controversy: a case study of the role of science in natural ecosystem management. Third Biennial Conference of Research in California's National Parks, National Park Service Transactions and Proceedings Series.

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Parsons, D. J., D. M. Graber, et al. (1990). Planning for global climate change. The Sixth George Wright Forum.

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Parsons, D. J. (1993). 25 years of restoring fire to giant sequoia groves: What have we learned? Symposium on Fire in Wilderness and Park Management, Missoula, MT, USDA Forest Service.

Perl, J. (1970). The vertical landscape in the redwood forest dense. Art in America.

Peters, M. D. and D. C. Christophel (1978). AUSTROSEQUOIA-WINTONENSIS new-genus new-species Taxodiaceous cone from Queensland Australia. Canadian Journal of Botany 56(24): 3119-3128.

A new taxodiaceous ovulate cone, AUSTROSEQUOIA wintonensis gen. et sp. nov., is described from the area of Winton, Queensland, Australia. The material is believed to come from the Upper Cretaceous but may be younger. The cones have 29-49 cone scales arranged helically around the axis. Each scale has 4-7 ovules arranged in a single row. Reproductive shoot leaves are rhomboidal with an incurved apex and a distinct keel. Comparison with extant taxodiaceous genera indicate a strong similarity to Sequoia sempervirens (D.Don) Endl. and Sequoiadendron giganteum (Lindl.) Buchholz. Only limited similarities are observed with species of the Australian endemic Athrotaxis. The deposit also contains conifer pollen cones, ferns, and angiosperm remains which are yet to be described

Pharis, R. P. and W. Morf (1969). Precocious flowering of coastal and giant redwood-G Sequoia-sempervirens-G, Sequoia-gigantea-G with Gibberellins A-3 A-4-7 and A-13. Bioscience 19(8): 719-720.

Phillips (1993). Saving sequoias. Sunset. 191: 66-73.

Piirto, D. D., J. R. Parmeter, Jr., et al. (1974). Fomes annosus in giant sequoia [gigantea]. Plant Disease Report 58(5): 478.

Describes observations made in national parks in California on 20 trees of Sequoia gigantea that had fallen over: 16 trees showed signs of attack by F. annosus, in the form of sporophores and/or decay in roots and butt.

Piirto, D. D. (1974). Structural failure of giant sequoia: properties of the wood of giant sequoia as related to tree failure, University of California Forest Products Laboratory.

Piirto, D. D., J. R. Parmeter, et al. (1977). Poria incrassata in giant sequoia [Sequoia gigantea]. Plant Disease Report 61(1): 50.

P. incrassata was associated with 2 recently fallen old-growth sequoia trees (Sequoia gigantea). The fungus caused root and butt rot.

Piirto, D. D. (1977). Factors associated with tree failure of giant sequoia, University of California, Berkeley.

Piirto, D. D. and W. W. Wilcox (1978). Critical evaluation of the pulsed-current resistence meter for detection of decay in wood. Forest Products Journal 28: 52-57.

The 'Shigometer' Model 7950 manufactured by Northeast Electronics, Concord, New Hampshire was used to measure the electrical resistance of blocks of Sequoia gigantea and Abies concolor subjected to attack by Poria placenta in a decay chamber. Meter readings decreased with increase in decay. Resistance readings of decayed wood were lower when measured immediately after removal from the decay chamber than when air-dried and rewetted with deionised water. Variability in meter readings may affect detection of decay where the decrease in resistance of decayed wood is small, as in A. concolor. The meter is unsuitable for detecting decay in dry timber, since the effect on resistance of the water necessary to take a reading would be greater than the effects of decay. Improvements in meter design are suggested.

Piirto, D. D. (1979a). Factors associated with tree failure of giant sequoia - pathological aspects. First Conference on Scientific Research in National Parks, Washington, D. C., USDI National Park Service Trans. and Proc. Series No. 5.

Piirto, D. D. (1979b). Guidelines for management of giant sequoia groves, USDA Forest Service.

Piirto, D. D. (1981). Comparative properties of old- and young-growth giant sequoia of potential significance to wood utilization [Sequoia gigantea]. Bulletin of the University of California, Berkeley Cooperative Extension Service 36(4): 1-26.

Piirto, D. D. and W. W. Wilcox (1981). Comparative properties of old-growth and young-growth giant sequoia of potential significance to wood utilization. University of California, Berkeley, Division of Agricultural Sciences Bulletin. 1901: 168.

Piirto, D. D., J. R. Parmeter, et al. (1984). Basidiomycete fungi reported on living or dead giant sequoia or coast redwood, University of California.

Seventy four species found on giant sequoia (Sequoia gigantea) and coast redwood (Sequoia sempervirens) are listed alphabetically, with synonyms, under the name currently used by the USDA Forest Products Lab. Center for Forest Mycology

Piirto, D. D., J. R. Parmeter, et al. (1984). Causes of uprooting and breakage of specimen giant sequoia trees. University of California Division of Agriculture and Natural Resources Bulletin. 1909: 13.

Recently fallen old growth Sequoia gigantea trees in California were examined. In 21 of the 33 study trees 33% or more of the wood in the failure zone had advanced decay. Basal fire scars were found on 27 trees, of which 26 fell towards the scarred side. Nine basidiomycete fungi were associated with decayed wood, including Fomes annosus [Heterobasidion annosum], Poria albipellucida, P. incrassata, and Armillaria mellea. Carpenter ants (Camponotus sp.) were found in or near the failure zones of 16 trees; in most cases they make their galleries in decayed wood, and no evidence was found that they are vectors of decay fungi. Physical disturbances such as roads, trails and streams were associated with 22 tree failures but their role in failure was not clear

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A study of 72 historical and recent nests of the California Condor (Gymnogyps californianus) has revealed considerable variability in nest-site characteristics. This paper primarily summarizes the data on nest elevations and dimensions, entrance orientations, nest longevity and re-use, vulnerability of sites to natural enemies, and use of sites by other species. Although all known nests have been natural cavities, some have been little more than overhung ledges on cliffs, while others have been deep, dark caves with nest chambers completely concealed from the outside. Two sites have been cavities in giant sequoias (Sequoiadendron giganteum). Contrary to previous assumptions, condors do modify the characteristics of their nest sites significantly and commonly construct substrates of coarse gravel on which to rest their eggs. Many nests have been completely accessible to terrestrial predators, many have been poorly protected from avian predators, and some have had structural flaws leading directly to nesting failure. The use of suboptimal sites has not been clearly related to a scarcity of better quality sites

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Litterfall was measured for 4 years and leaf litter decomposition rates were studied for 3.6 years in two mixed conifer forests (giant sequoia - fir and fir-pine) in the southern Sierra Nevada of California. The giant sequoia - fir forest (GS site) was dominated by giant sequoia (Sequoiadendron giganteum (Lindl.)Buchh.), white fir (Abies concolor Lindl. & Gord.), and sugar pine (Pinus lambertiana Dougl.). The fir-pine forest (FP site) was dominated by white fir, sugar pine, and incense cedar (Calocedrus decurrens (Torr.) Florin). Litterfall, including large woody debris < 15.2 cm in diameter, at the GS site averaged 6364 kg .cntdot. ha-1 .cntdot. year-1 compared with 4355 kg .cntdot. ha-1 .cntdot. year-1 at the FP site. Compared with other temperate coniferous forests, annual variability in litterfall (as computed by the ratio of the annual maximum/minimum litterfall) was extremely high for the GS site (5.8:1) and moderately high for the FP site (3.4:1). In the GS site, leaf litter decomposition after 3.6 years was slowest for giant sequoia (28.2% mass loss), followed by sugar pine (34.3%) and white fir (45.1%). In the FP site, mass loss was slowest for sugar pine (40.0%), followed by white fir (45.1%), while incense cedar showed the greatest mass loss (56.9%) after 3.6 years. High litterfall rates of large woody debris (i.e., 2.5-15.2 cm diameter) and slow rates of leaf litter decomposition in the giant sequoia - fir forest type may result in higher litter accumulation rates than in the fir-pine type. Leaf litter times to 95% decay for the GS and FP sites were 30 and 27 years, respectively, if the initial 0.7-year period (a short period of rapid mass decay) was ignored in the calculation. A mass balance approach for total litterfall (< 15.2 cm diameter) decomposition yielded lower decay constants than did the litterbag study and therefore longer times to 95% decay (57 years of the GS siteand 62 years for the FP site)

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The factors influencing leaf litter decomposition and nutrient release patterns were investigated for 3.6 years in two mixed conifer forests in the southern Sierra Nevada of California. The giant sequoia - fir forest was dominated by giant sequoia (Sequoiadendron giganteum (Lindl.)Buchh.), white fir (Abies concolor Lindl. & Gord.), and sugar pine (Pinus labertiana Dougl.). The fir-pine forest was dominated by white fir, sugar pine, and incense cedar (Calocedrus decurrens (Torr.)Florin). Initial concentrations of nutrients and percent lignin, cellulose, and acid detergent fiber vary considerably in freshly abscised leaf litter of the studied species. Giant sequoia had the highest concentration of lignin (20.3%) and the lowest concentration of nitrogen (0.52%), while incense cedar had the lowest concentration of lignin (9.6%) and second lowest concentration of nitrogen (0.63%). Long-term (3.6 years) foliage decomposition rates were best correlated with initial lignin/N (r2 = 0.94, p < 0.05), lignin-concentration (r2 = 0.92, p < 0.05), and acid detergent fiber concentration (r2 = 0.80, p < 0.05). Patterns of nutrient release were highly variable. Giant sequoia immobilized N and P, incense cedar immobilized N and to a lesser extent P, while sugar pine immobilized Ca. Strong linear or negative exponential relationship existed between initial concentrations of N, P, K, and Ca and percent original mass remaining of those nutrients after 3.6 years. This suggests efficient retention of these nutrients in the litter layer of these ecosystems. Nitrogen concentrations steadily increase in decomposing leaf litter, effectively reducing the C/N ratios from an initial range of 68-96 to 27-45 after 3.6 years

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Sequoiadendron giganteum, K (22) = 2Am+2Bm+2Cm+2Dm+2Em+2Fm+2Gm+2Hm+2Ism+2Jm+2SscKm. The karyotype of Sequoia sempervirens Endl. has not been determined yet, but this species has been confirmed to have 6 telomeres trabants just like Cunninghamia lanceolata (Lamb.) Hook.

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