

**California Wildlife Habitat Relationships System
California Department of Fish and Game
California Interagency Wildlife Task Group**

Red Fir

Reginald H. Barrett

Vegetation

Structure-- Stand structure is typified by even-aged (established within 20-year span) groups of trees that cover several to thousands of square meters. The cause of this pattern is probably a history of recurrent lightning fires, windthrows, and insect outbreaks acting to kill groups of trees (Oosting and Billings 1943, Vankat 1970, Kilgore 1971, 1973, Gordon 1973a, Rundel et al. 1977, Pitcher 1981). Natural regeneration occurs on the disturbed site following the next good cone crop. Young seedling stands are thinned by competition for soil moisture during summer (Gordon 1970, Ustin et al. 1984 (No Ustin et al. 1984 in Hab Lit Cite.)). Logging is becoming a more common source of disturbance, creating larger openings on average than historic disturbances (Chapel et al. 1983).

Composition-- Mature red fir stands normally are monotypic, with very few other plant species in any layer. Heavy shade and a thick layer of duff tends to inhibit understory vegetation, especially in dense stands (Oosting and Billings 1943). To the north, in the Klamath Mountains, red fir gives way to noble fir (Griffin and Critchfield 1972).

Other Classifications-- Because of its distinctiveness, references to the red fir type are unambiguous (Jensen 1947, Storer and Usinger 1963, Munz and Keck 1970 (No Munz and Keck 1970 in Hab Lit Cite), Cheatham and Haller 1975, Kuchler 1977, Matyas and Parker 1979, Eyre 1980, Holstein 1980).

Habitat Stages

Vegetation Changes-- 1;2-5:S-D. After disturbance typically logging or fire red fir vegetation on a site proceeds through 4 seral stages: grass/forb, shrub/sapling, pole/medium tree, and large tree (Oosting and Billings 1943, Vankat 1970, Gordon 1979 (No Gordon 1979 in Hab Lit Cite.), Rundel et al. 1977, Zieroth 1978, Pitcher 1981). The grass/forb stage occurs when red fir seedlings become established on mineral soil or shallow litter and require about 5 years to reach a height of 15 cm (6 in). Herbs, are often sparse due to competition for soil moisture on light soils. In the shrub/sapling stage, large brush fields may develop after hot wildfires and are dominated by *Ceanothus* or other shrub species for many years. The pole/medium tree stage produces dense stands of young red fir that grow slowly with little mortality for many years. In the large tree stage,

subdominant trees die and add to a growing layer of duff and downed woody material, and dominant trees continue to grow for several hundred years to heights of 40 m (130 ft). Old growth stands on poor sites in the Sagehen Creek drainage of Nevada County average about 400 years old. The understory of mature stands is limited to less than 5 percent cover of shade tolerant forbs (e.g., *Chimaphila menziesii*, *Phyrola picta*).

Duration of Stages-- Seral patterns are defined here for both good and poor sites (Schumacher 1928; Dunning and Reineke 1933; Oosting and Billings 1943, Gordon 1970, 1973b, Rundel et al. 1977, Barrett and Salwasser 1982). The seral pattern on good sites includes 10 years in the grass/forb stage, 20 years in the shrub/seedling stage, 80 years in the pole/medium tree stage and 110 years in the large tree stage. The pattern on poor sites includes 20 years in the shrub/seedling stage, 100 years in the pole/medium tree stage and 250 years in the large tree stage. Hence the cumulative year totals are 200 from the good site and 400 from the poor site.

Biological Setting

Habitat-- Red fir habitats occur on frigid soils of the higher mountains of northern California. At lower elevations red fir habitats intergrade with white fir-dominated mixed conifer stands on drier sites and with lodgepole pine-mountain meadow stands on moist sites. Small pockets of lodgepole pine also occur in wet sites scattered throughout large tracts of red fir. Similar inclusions of aspen may be found along riparian zones. Mountain meadows of various sizes, sometimes associated with small lakes, are also typical of red fir habitats. At higher elevations, red fir habitats include increasing numbers of mountain hemlock, western white pine, whitebark pine, and to a lesser extent, foxtail pine and limber pine. Noble fir is associated with red fir in the northwestern region of the State (Rundel et al. 1977).

Wildlife Considerations-- Red fir habitats throughout California provide food or cover for at least one season to a total of 169 wildlife species (8 amphibians, 4 reptiles, 104 birds including 15 waterbirds, and 53 mammals). Red fir habitats can be considered very important for 28 birds and 26 mammals. Of special note are goshawk (sensitive species); blue grouse (game species); great gray owl, red fox, pine marten, and wolverine (rare species). Several rare or endangered raptors use red fir habitats to a minor extent (Grinnell and Storer 1924, Sumner and Dixon 1953, Shelford 1963, Storer and Usinger 1963, Johnston 1970, (No Johnston 1970 in Hab Lit Cite.) Verner and Boss 1980)

Physical Setting

Red fir habitats are found on frigid soils over a wide range of topography exclusive of very wet sites. Annual precipitation ranges from 1000 to 3000 mm (40 to 50 in) per year, primarily as snow that forms packs up to 5 m (15 ft) in winter. Summers are dry, limiting tree growth to seasonally available soil moisture (Rundel et al. 1977).

Distribution

Red fir is distributed in an elevational band from about 1800 to 2750 m (6000 to 9000 ft). It extends from northern Lake County northward through the North Coast Ranges and from Kern County northward through the Sierra Nevada into the Cascade Range of southwestern Oregon (Griffen and Critchfield 1972). Large expanses of nearly monotypic stands of red fir are common throughout its range. Logging of red fir is accelerating, consequently the amount of low seral stages will increase considerably in the future.

Literature Cited

- Barrett, R. H., and H. Salwasser. 1982. Adaptive management of timber and wildlife habitat using DYNAST and wildlife-habitat relationships models. *Proc. W. Assoc. Fish Wildl. Agencies* 62:182-198.
- Chapel, M., M. Smith, K. Sonksen, G. Terrazas, J. Lorenzana, and R. Kinlund. 1983. Wildlife habitat planning demonstration, Rancheria Planning Unit, Kings River Ranger District. U.S. Dep. Agric., For. Serv., Sierra Nat'l. Forest, Fresno, Calif
- Cheatham, N. H., and J. R. Haller. 1975. An annotated list of California habitat types. Univ. of California Natural Land and Water Reserve System, unpubl. manuscript
- Dunning, D., and L. H. Reineke. 1933. Preliminary yield tables for second-growth stands in the California pine region. U.S. Dep. Agric., For. Serv., Tech. Bull. 354.
- Eyre, F. H., ed. 1980. Forest cover types of the United States and Canada. Soc. Amer. Foresters, Washington D.C.
- Gordon, D. T. 1970. Natural regeneration of white and red fir influence of several factors. U.S. Dep. Agric., For. Serv. (Berkeley, Calif.), Res. Pap. PSW-58.
- Gordon, D. T. 1973a. Damage by wind and other causes in mixed white fir-red fir stands adjacent to clearcuttings. U.S. Dep. Agric., For. Serv. (Berkeley, Calif.), Res. Pap.
- Gordon, D. T. 1973b. Released advance reproduction of white and red fir growth, damage, mortality. U.S. Dep. Agric., For. Serv. (Berkeley, Calif.), Res. Pap. PSW-95.
- Griffin, J. R., and W. B. Critchfield. 1972. The distribution of forest trees in California. U.S. Dep. Agric., For. Serv. (Berkeley, Calif.), Res. Pap. PSW-82.
- Grinnell, J., and T. I. Storer. 1924. Animal life in the Yosemite. Univ. of California Press, Berkeley.
- Holstein, G. 1980. California vegetation cover types. California Natural Diversity Data Base, Sacramento.
- Jensen, H. A. 1947. A system for classifying vegetation in California. *Calif. Fish and Game* 33:199-266.
- Kilgore, B. M. 1971. The role of fire in managing red fir forests. *Trans. North Amer. Wildl. and Natur. Res. Conf.* 36:405-416.
- Kilgore, B. M. 1973. The ecological role of fire in Sierran mixed conifer forests: its application to national park management. *J. Quaternary Res.* 3:396-513.
- Kuchler, A. W. 1977. Appendix: the map of the natural vegetation of California. Pages 909-938 In M. G. Barbour and J. Major, eds, *Terrestrial vegetation of California*.

- John Wiley and Sons, New York.
- Matyas, W. J., and I. Parker. 1979. CALVEG: mosaic of existing vegetation of California. U.S. Dep. Agric., For. Serv., Reg. Ecol. Group, San Francisco.
- Oosting, H. J., and W. D. Billings. 1943. The red fir forest of the Sierra Nevada: *Abietum magnificae*. Ecol. Monogr. 13:259-274.
- Pitcher, D. C. 1981. The ecological effects of fire on stand structure and fuel dynamics in red fir forests of Mineral King, Sequoia National Park, California. M.S. thesis, Univ. Of California, Berkeley.
- Rundel, P. W., D. T. Gordon, and D. J. Parsons. 1977. Montane and subalpine vegetation of the Sierra Nevada and Cascade Ranges. Pages 559-599 In M. G. Barbour and J. Major, eds. Terrestrial vegetation of California. John Wiley and Sons, New York.
- Schumacher, F. X. 1928. Yield, stand, and volume tables for red fir in California. Univ. Calif. Agric. Exp. Sta. Bull. 456.
- Shelford, V. E. 1963. The ecology of North America. Univ. of Illinois Press, Urbana.
- Storer, T. I., and R. L. Usinger. 1963. Sierra Nevada natural history . . . an illustrated handbook. Univ. of California Press, Berkeley.
- Sumner, L., and J. S. Dixon. 1953. Birds and mammals of the Sierra Nevada with records for Sequoia and Kings Canyon National Parks. Univ. of California Press, Berkeley.
- VanKat, J. L. 1970. Vegetation change in Sequoia National Park, California. Ph.D. dissertation, Univ. of California, Davis.
- Zieroth, E. 1978. The vegetation and environment of red fir clearcuts in the central Sierra Nevada, California. M.A. thesis, California State Univ., Fresno.