

BIOTECHNICAL SLOPE PROTECTION AND EROSION CONTROL



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KRIEGER PUBLISHING COMPANY
MALABAR, FLORIDA

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Appendix II An Annotated List of Selected References for Plants for Erosion Control

References in this appendix have been selected on several criteria. Emphasis has been placed on those references dealing with plants for unique and difficult environments and those which may not have wide distribution in libraries, e.g., government agency reports, bulletins, and circulars. A few references have been included because of wide geographic coverage. Most references are relatively recent because much of the older literature is cited in these.

Information is readily available for plants adapted to areas of adequate summer rainfall, e.g., much of the midwest, eastern and southern parts of North America, or where adequate irrigation is available. Rehder (1954) gives hardiness ratings for woody plants for much of the United States and Canada. *Sunset New Western Garden Book* (1979) gives excellent coverage of the western portion of the United States and adjacent parts of Canada. This publication has developed detailed climatic zones for these areas. Wyman, in several publications (1956, 1965, 1969, 1974, 1977), discusses plants for much of this area. Numerous other garden encyclopedias, regional garden books, Federal and State publications cover ground covers, shrubs and trees suitable for revegetation where summer water is available.

Selection of plant species for difficult sites (wet lands, dry lands, mine spoils, etc.) is not as well covered in the readily available literature. These are the citations chiefly covered here. Even these references are not meant to be all-inclusive. Some have been selected because they are general treatments, some for their special nature. Many of these citations have extensive literature citations themselves. Mine spoil revegetation research in the west is relatively new. The SEAM project will be producing more information on revegetation of these difficult sites.

Plant selection for revegetation and erosion control

should not be limited to existing lists of plants. Unique problem sites will occur which will require unique solutions. Many plant species have never been adequately tested or tested at all. Lists should be used only as guides and starting points, not as ends in themselves. Observations of native and introduced species in the vicinity of the site to be revegetated should always be used in conjunction with plant lists.

Annotations briefly describe the contents and particular usefulness of these references.

Bennet, O. L., Mathias, E. T., Armiger, W. H., and Jones, Jr., J. N. (1978). Plant materials and their requirements for growth in humid regions. In: Schaller, Frank W., and Sutton, Paul, Eds. *Reclamation of drastically disturbed lands*. Amer. Soc. of Agron., Crop Sci. Soc. of Amer., Soil Sci. Soc. of Amer., Madison, Wisc. Ch. 16, pp 285-306.

Requirements and species of forbs, grasses, legumes, trees and shrubs given in text. Extensive literature citations.

Brown, Ray W., Johnston, Robert S., Richardson, Bland Z., and Farmer, Eugene E. (1976). Rehabilitation of alpine disturbances: Beartooth Plateau, Montana. In: Zuck, R. H. and Brown, L. F., Eds. *High altitude revegetation workshop No. 2*. Colo. State Univ., Fort Collins, Colo. pp. 58-73. (Also as USDA Forest Svc. Res. Note INT-206-1976, Ogden Utah.)

Fourteen native and introduced grasses and sedges are listed. Natives are recommended. Five forbs are listed as active colonizers.

Brown, Ray W., Johnston, Robert S., and Johnson, Douglas A. (1978). Rehabilitation of alpine tundra

- disturbances. *J. of Soil and Water Cons.* (July-Aug) pp. 154-160.
- Summary article citing other research. Table lists 12 grass/sedge/rush species, 17 forbs, and 5 woody species. 75 lit. cite.
- Chan, Franklin J., Harris, Richard W., and Leiser, Andrew T. (1971). Direct seeding woody plants in the landscape. *AXT-n27*, Agr. Ext. Serv., Univ. of Calif., Berkeley (Reprinted 1979 as *leaflet 2577*). 12 pp.
- Direct (spot) seeding results with 50 native and introduced species at numerous sites in California from seacoast to Sierras, Redding to Los Angeles. Adaptability to microsites is noted. Mostly without irrigation.
- Dehgan, Bijan, Tucker, John M., and Takher, Balbir S. (1977). Propagation and culture of new species of drought-tolerant plants for highways. *Final report FHWA-CA-77-2* (NTIS PB 273-477). Dept. of Botany, U. C. Davis (for Calif. Dept. of Trans.). 168 pp.
- Descriptions, culture and propagation methods given for 92 California native and introduced species of relatively drought-tolerant plants.
- Edmunson, George C. (1976). Plant materials study. A search for drought-tolerant plant materials for erosion control, revegetation, and landscaping along California highways. *Final Report No. USDASCS L PMC-1*. USDA SCS, Davis, Calif. (to State of Calif. Dept. of Trans., Sacramento, Calif.). 257 pp.
- Research results are given for north central coast foothills, Sierra Nevada foothills, Lake Tahoe Basin and vicinity and Alturas. Appendix A lists sites and species tested, 53 grasses and forbs and 60 shrubs in foothill sites, and 34 grasses and forbs and 47 shrubs at Tahoe. Seed collection and propagation data are furnished. Appendix B lists planting methods, seed mixes and plant characteristics for 25 grasses and 12 forbs. Appendix C is a statewide list of recommended trees and shrubs for the 14 major land resource areas. Lists are applicable to many areas of adjacent states.
- Environmental Laboratory (Hunt, L. Jean, compiler). (1978). Wetland habitat development with dredged material: engineering and plant propagation. *Tech. Report DS-78-16*. U. S. Army Eng. Waterway Expt. Sta., Vicksburg, Miss. 158 pp.
- Table 6 lists 115 species of plants with adaptability to geographic region, pH, soils, marsh conditions (tidal, interior, water depth, etc.) and other factors. Propagules, handling, and planting techniques are in table 7. A synopsis for 28 species is in App. C. Numerous literature citations.
- Everett, Richard L., Meeuwig, Richard O., and Butterfield, Richard I. (1980). Revegetation of untreated acid spoils, Leviathan Mine. Alpine County, California. *Calif. Geology*. 32:1, 3 pp.
- Survival of 20-100% was obtained with 11 of 12 species tested. Mean pH was 4.1. Grass competition reduced survival.
- Ferguson, Robert B. and Monsen, Stephen B. (1974). Research with containerized shrubs and forbs in southern Idaho. Reprinted from: Great Plains Agric. Council. Publ. 68:349-358. U. S. Govt. Prtg. Off. 1974-677-093/39 Reg. No. 8.
- Fourteen of 30 species of trees, shrubs and forbs gave some survival in at least one of three planting seasons. Grasshoppers caused heavy mortality. Survival ranged from 1 to 70%.
- Frischknecht, Neil C. (1978). Use of shrubs for mined land reclamation and wildlife habitat. *Proc. Workshop on Reclamation for Wildlife Habitat*. Ecology Consultants, Inc., Fort Collins, Colo. 14 pp.
- Text lists 10 species as suitable on oil shales in E. Utah.
- Hall, V. L., and Ludwig, J. D. (1975). Evaluation of potential use of vegetation for erosion abatement along the Great Lakes shoreline. *Misc. Paper 7-75*. Coastal Eng. Res. Ctr., U. S. Army Corps of Eng., Ft. Belvoir, Va.
- Methods, plant lists, 34 species from literature reviews and 33 from field surveys along south shores of Lake Superior, Lake Michigan, junction of Lake Michigan and Lake Huron, Lake Erie, and Lake Ontario. Characteristics are briefly described.
- Horton, Jerome S. (1949). Trees and shrubs for erosion control in Southern California mountains. Calif. Div. For. in coop. with Calif. For. and Range Exp. Sta. (now Pacific Southwest For. and Range Exp. Sta.) USDA For. Svc. 72 pp.
- A major source listing 58 native and introduced species in 3 tables according to elevation in So. Calif. mountains, further subdivided into deep and shallow soils, full sun and partial shade. Partially tested species also listed. Descriptive notes on characteristics, range and habitat, uses and planting methods. Useful in similar areas of the west.
- Hoyt, Roland Stewart. (1978). *Ornamental plants for subtropical regions*. Liningston Press. Anaheim, Ca. 485 pp.
- Extensive lists of herbs, shrubs, and trees by adaptation to microsites (soils, seashore, moisture regimes, etc.) and by landscape uses. Plant descriptions and requirements are included. Useful for much of the southwest U. S. and somewhat useful for southern and southeastern coastal states.
- Hunt, L. Jean, Ford, Alfred W., Landin, Mary C., and Wells, B. R. (1978). Upland habitat development with dredged material: Engineering and plant propagation. *Tech. Report DS-78-17*. U. S. Army Eng. Waterways Exp. Sta., Env. Lab., Vicksburg, Miss.
- Extensive list of 70 grasses, 112 forbs, 18 vines, and 153 trees and shrubs. Table 5 lists cultural information, range, habit, etc. Table 6 lists according to soil and regional adaptability. Many literature references.
- Kaul, R. N., Ed. (1970) *Afforestation in arid zones*. Dr. W. Junk, N. V. The Hague. 435 pp.
- Afforestation of various arid zones of the world is covered. Research, current methodology and plant lists and descriptions are included. Botanical index of over 600 species contains many grasses and forbs but is predominately of trees and shrubs. The sections cover the southern fringe of Europe, North Africa, the Near East, the Indian subcontinent, Central Eurasia, the American continents, and Australia. Some chapters list drought tolerant natives. Species selection is noted in text and/or tables and for most areas includes both natives and introduced species. Methods of establishment and results are included in many chapters. An excellent resource for selecting species for test plantings in a wide range of arid climates. Extensive literature references.
- Kay, Burgess L. (1979). Summary of revegetation attempts on the second Los Angeles aqueduct. *Mojave Revegetation Notes No. 22*. Dept. Agron. and Range Sci., U. C. Davis, Calif. 24 pp.
- Four of seven species were established by drill seeding on high elevation desert sites without irrigation.
- Kimmons, J. H., Lovell, G. R., Everett, H. W., Thornton, R. B., and Dudley, R. F., (1976). Evaluation of woody plants and development of establishment procedures for direct woody seeding and/or vegetative reproduction. *Final Report No. FHWA-MD-R-76-19*. USDA Soil Cons. Svc., National Plant Materials Center, Beltsville Md. (for: Md. State Highway Adm., Brooklandville, Md.). 154 pp.
- Research results given for numerous grasses, forbs, shrubs, and trees in Appalachian, Piedmont, and Coastal Plain regions of Maryland (Appendix A). Not separated as to successful and unsuccessful species.
- Knutson, Paul L. (1977). Planting guidelines for marsh development and bank stabilization. *Coastal Eng. Tech. Aid No. 77-3*. U. S. Army Corps of Eng. Fort Belvoir, Va. 21 pp.
- Four species of *Spartina*, cord grass, are listed for use on Atlantic, Gulf, and Pacific Coast areas. Establishment methods are given.
- Kraayenoord, C. W. S. Van. (1968). Poplars and willows in New Zealand with particular reference to their use in erosion control. Int. Poplar Commission, 13th Session, Montreal. Canada.
- Reports on numerous *Populus* and *Salix* species and clones used in N. Z. for erosion control.
- Kraebel, Charles J. (1936). Erosion control on mountain roads. *Circ. 380*. USDA, Washington, D.C. 44 pp.
- The original work on wattling also contains (Table 2) an extensive list of native species with adaptation listed for 6 major Calif. regions, each sub-divided into 3-5 elevational (and vegetational) zones. List contains 8 grass, 36 forb, 56 shrub and 38 tree species. Regions are from north coastal to desert. Many are native or adaptable to adjacent states.
- Leiser, Andrew T., Nussbaum, James J., Kay, Burgess, Paul, Jack, and Thronhill, William. (1974). Revegetation of disturbed soils in the Tahoe basin. *Final Report CA-DOT-TL-7036-1-75-25*. Depts. of Env. Hort. and Agron. and Range Sci., U. C., Davis, Calif. (To: Calif. Dept of Trans., Sacramento, Calif.) 71 pp.
- Grass species and mixes (9 species eminently suitable) and 7 woody species resulting in good revegetation as transplants without irrigation are listed. These are suitable for other similar mountain areas.
- McKell, Cyrus M., Blaisdell, James P., and Goodin, Joe R., Eds. (1971). Wildland shrubs - their biology and utilization. International Symposium. *Tech. Report INT-1*. Intermountain For. and Range Exp. Sta., USDA For. Svc., Ogden, Utah. 494 pp.
- Section I, Continental Aspects of Shrub Distribution, Utilization and Potentials, gives extensive lists of shrubs, usually in text and by plant communities for the Indian Sub-continent, Mediterranean region of Africa, Asia, and Argentina. Many have potential for erosion control on arid sites.
- Monsen, Stephen B., and Plummer, A. Perry. (1978). Plants and treatment for revegetation of disturbed sites in the intermountain area. In: Wright, Robert A. (Ed.). *The reclamation of disturbed arid lands*. Univ. New Mexico Press. Albuquerque, N. M. pp. 155-173.

- Table 8.1 lists pioneer grasses (15) and forbs (17) with areas of adaptation. Table 8.2 lists 48 shrubs established by direct seeding and growing well with forbs. These are rated for growth rate, competitive adaptability and drought tolerance. A few are discussed which do best as transplants.
- Naveh, Z. (1974). The ecological management of non-arable Mediterranean uplands. *Jour. of Env. Management*. 2:351-371.
- Twenty species of shrubs are listed for dry, rocky, limestone slopes. Although based on Israel, these would be good for other areas with similar climates.
- Plummer, A. Perry, Christensen, Donald R., and Monsen, Stephen B. (1968). Restoring big-game range in Utah. Pub. No. 68-3. Utah Div. of Fish and Game. 183 pp.
- Comprehensive manual including site analysis, plant selection, methods, and plant lists. Seed mixes are given by vegetation types. Description of species from a revegetation viewpoint. Ratings of suitability to 20 characteristics, overall evaluation, and adaptation to 10 habitats are given for 56 grasses, 74 forbs, and 77 woody species. Many would be useful in much of the western U. S. Many would be good candidates for establishment by transplanting as well. Native and introduced species are included.
- Plummer, A. Perry. (1970) Plants for revegetation of roadcuts and other disturbed or eroded areas. *Intermountain Region Range Improvement Notes 15(1)*. USDA For. Svc. Intermountain For. and Range Exp. Sta. 8 pp.
- Native and introduced plants for the Intermountain Region rated for 11 habitats, arctic alpine to desert; 23 grasses, 27 forbs and 67 shrubs and trees.
- Plummer, A. Perry. (1976). Shrubs for the subalpine zone of the Wasatch Plateau. In: Zuck, R. H. and Brown, L. F., Eds. *Proceedings High Altitude Revegetation Workshop No. 2*. Colo. State Univ., Fort Collins, Colo.
- Twenty shrubs, mostly natives, rated for seed and transplant establishment, natural spread, growth rates and effectiveness.
- Rehder, Alfred. (1954). *Manual of cultivated trees and shrubs hardy in North America*. The Macmillan Co., N.Y. 996 pp.
- Authoritative, comprehensive manual (keys and technical descriptions) of most hardy (excluding Fla. and So. Calif.) woody plants grown in No. America. Hardiness ratings are given for most by the original 10 minimum temperature zones. These may be easily converted to the more recent USDA hardiness zones.
- Schiechtl, Hugo. (1980). *Bioengineering for land reclamation and conservation*. Univ. of Alberta Press. Edmonton, Alberta. 400 pp.
- Extensive lists of plants for erosion control. Plant characteristics, adaptation to soils and climates, etc. are given. Not organized by site or environmental adaptation for easy use but it is very comprehensive, essentially world-wide in scope. Research results are chiefly European.
- Shetron, Stephen G. and Carroll, Dorian A. (1977). Performance of trees and shrubs on metallic mine mill wastes. *Jour. of Soil and Water Cons.* 32:5, pp 222-225.
- Nineteen woody species listed, 14 of which survived 5 years on iron tailings, 11 on copper tailings, and 11 on dikes and dumps. Michigan data.
- Stark, N. (1966). Review of highway planting information appropriate to Nevada. *Bull. B-7*. Desert Res. Inst., Univ. of Nevada, Reno, Nevada. 209 pp.
- Types of plantings, methods of planting. Approximately 300 native and introduced species are arranged in lists covering ten vegetation zones. Species characteristics, adaptation to soils, exposure, moisture are given. Other lists include grasses, forbs, and ornamentals for Nevada, California, and Oregon. Excellent resource applicable to much of the western U. S. Numerous literature citations.
- Thornburg, A. A. and Fuchs, S. H. (1978). Plant materials and requirements for growth in dry regions. Chap. 23, pp 411-423. In: Schaller, Frank W. and Sutton, Paul, Eds. *Reclamation of drastically disturbed lands*. Amer. Soc. of Agron., Crop Sci Soc. of Amer., Soil Sci. Soc. of Amer. Madison, Wisc.
- Native and introduced species of grasses, forbs, trees and shrubs (113) are listed. Adaptation to specific regions is covered in the text.
- U. S. Army Corps of Eng. (1957). Dune formation and stabilization by vegetation and plantings. *Tech. Memo No. 101*. Beach Erosion Board, U. S. Army Corps of Eng., Fort Belvoir, Va.
- Prevalence and suitability for transplanting plants for eight coastal regions.
- USDA Soil Cons. Svc. (1972). Environmental planting. In: *Minimizing Erosion in Urban Areas: Guidelines, Standards, and Specifications*. publ. by USDA Soil Conservation Service, Madison, Wisconsin, pp. 117-143.
- Grass mixtures (Tables 14 & 15), tree selection guide by use and soils (Table 17), general shrub and vine planting guide by soil groups, use, form, etc. (Table 19), and general information applicable to Wisconsin and adjacent areas.
- U. S. Environment Protection Agency. (1975). Methods of quickly vegetating soils of low productivity, construction activities. *EPA-440/9-75-006*. U. S. Env. Protection Agency, Washington, D.C. 467 pp.
- Case histories of revegetation in 10 areas in the U. S. Plant lists are given for: Idaho batholith, approximately 13 grasses and 35 woody species; New Mexico, 15-20 grasses; Colorado, grasses only; Mississippi, grass and forb mixes by areas; Virginia-West Virginia, grass mixes only; Massachusetts, 11 woody plants plus grasses and forbs; Alaska, grass mixes and 6 each herbaceous and woody ground covers; 17 western states, adaptation and lists of 100 grasses, 22 forbs, and 9 woody species for seed establishment.
- Whitlow, Thomas H., and Harris, Richard W. (1979). Flood tolerance in plants: a state-of-the-art review. Dept. of Env. Hort., Univ. of Calif., Davis. *Tech Rept. E-79-2*. For: U. S. Army Corps of Eng., Waterways Exp. Sta., Env. Lab., Vicksburg, Miss.
- Lists of flooding tolerance throughout the U. S. are given in some 30 tables. Over 10 summary tables, by geographic areas are in the appendix. Very useful for plant selection for wet and flooded areas.
- Williamson, Joseph F., Ed. (1979). *Sunset new western garden book*. 4th Ed. Lane Pub. Co., Menlo Park, CA. 512 pp.
- Garden encyclopedia for U. S. and adjacent parts of Canada from the Rocky Mts. west. Sunset plant climate zones (different from Rehder's and USDA's) given for all plants. Limited lists for specific micro-environments.
- Wyman, Donald. (1956). *Groundcover plants*. The Macmillan Co., N.Y. 175 pp.
- Groundcover plants for American gardens. A general reference.
- (1965). *Trees for American gardens*. The Macmillan Co., New York, 502 pp.
- A general reference on trees.
- Wyman, Donald. (1969). Shrubs and vines for American gardens. Rev. 2nd. Ed. The Macmillan Co., New York pp.
- A general reference on shrubs and vines.
- (1974). Dwarf shrubs: maintenance-free woody plants for today's gardens. The Macmillan Co., N.Y. 137 pp.
- A general reference for maintenance-free shrubs.
- (1977). Wyman's gardening encyclopedia. Rev. Ed. The Macmillan Co., New York 1221 pp.
- A general reference covering a wide range of plants, grasses, forbs, shrubs, trees and their horticulture requirements.

Addendum

Aldon, Earl F. (1973). Revegetating disturbed areas in the semiarid Southwest. *Jour. of Soil and Water Conservation*. 28(5):223-225.

Detailed establishment methods are given for four-wing saltbush and alkali sacaton by transplanting. Detailed methodology and limiting factors make this applicable to much of the arid southwest.

Everett, Richard L. (1980). Use of containerized shrubs for revegetating arid roadcuts. *Reclamation Rev.* 3:33-40.

Thirteen woody species native to the eastern Sierra foothills were established as containerized transplants on north and south exposures. Survival data and cover after 3 years are given for 10 of the species. Eight species on south exposures and 4 species on north exposures had more than 80% survival for at least 2 years.

Johnson, Albert G., White, Donald B., Smithberg, Margaret H., and Snyder, Leon C. (1971). Development of ground covers for highway slopes. Final Report-1971. Dept. of Hort. Sci., Univ. of Minn. for U. S. Dept. of Trans., Fed. Highway Admin., Minn Highway Dept., and Minn. Local Road Res. Board. 55pp.

Four forb and 10 shrub species are recommended, 38 forb and 17 shrub species are given limited recommendation. Several cultivars are also given for a few species. Species are mostly non-natives. Research results and cultural information is also given.

Plass, William T. (1975). An evaluation of trees and shrubs for planting surface-mine spoils. USDA For. Svc. Res. Paper NE-317. N.E. For. Exp. Sta., Upper Darby, Pa.

Fifty-five species tested on acid and alkaline sites. Survival and growth is given by site. Many gave good to excellent survival. Seventeen are listed as being especially good. Seven references are given for other midwestern and eastern sites.