

# Predicting Breeding Values with Applications in Forest Tree Improvement

by

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# Predicting Breeding Values With Applications In Forest Tree Improvement

**T.L. White, G.R. Hodge**



## **Predicting Breeding Values With Applications In Forest Tree Improvement:**

**Predicting Breeding Values with Applications in Forest Tree Improvement** T.L. White,G.R. Hodge,1989-09-30 In most breeding programs of plant and animal species genetic data such as data from field progeny tests are used to rank parents and help choose candidates for selection In general all selection processes first rank the candidates using some function of the observed data and then choose as the selected portion those candidates with the largest or smallest values of that function To make maximum progress from selection it is necessary to use a function of the data that results in the candidates being ranked as closely as possible to the true but always unknown ranking Very often the observed data on various candidates are messy and unbalanced and this complicates the process of developing precise and accurate rankings For example for any given candidate there may be data on that candidate and its siblings growing in several field tests of different ages Also there may be performance data on siblings ancestors or other relatives from greenhouse laboratory or other field tests In addition data on different candidates may differ drastically in terms of quality and quantity available and may come from varied relatives Genetic improvement programs which make most effective use of these varied messy unbalanced and ancestral data will maximize progress from all stages of selection In this regard there are two analytical techniques best linear prediction BLP and best linear unbiased prediction BLUP which are quite well suited to predicting genetic values from a wide variety of sources ages qualities and quantities of data

**Predicting Breeding Values with Applications in Forest Tree Improvement** T.L. White,G.R. Hodge,2013-03-09 In most breeding programs of plant and animal species genetic data such as data from field progeny tests are used to rank parents and help choose candidates for selection In general all selection processes first rank the candidates using some function of the observed data and then choose as the selected portion those candidates with the largest or smallest values of that function To make maximum progress from selection it is necessary to use a function of the data that results in the candidates being ranked as closely as possible to the true but always unknown ranking Very often the observed data on various candidates are messy and unbalanced and this complicates the process of developing precise and accurate rankings For example for any given candidate there may be data on that candidate and its siblings growing in several field tests of different ages Also there may be performance data on siblings ancestors or other relatives from greenhouse laboratory or other field tests In addition data on different candidates may differ drastically in terms of quality and quantity available and may come from varied relatives Genetic improvement programs which make most effective use of these varied messy unbalanced and ancestral data will maximize progress from all stages of selection In this regard there are two analytical techniques best linear prediction BLP and best linear unbiased prediction BLUP which are quite well suited to predicting genetic values from a wide variety of sources ages qualities and quantities of data , Experimental Design and Analysis for Tree Improvement Emlyn Rhys Williams,Alastair Colin Matheson,C. E. Harwood,2002 This new edition of a successful title offers procedures involved in

preparing designing analyzing and interpreting forestry trials primarily for tree introduction and improvement **Multiple Use of Forests and Other Natural Resources** F. Helles, Per Holten-Andersen, Lars Wichmann, 2013-12-01 In 1996 a major six year research programme Economic Optimisation of Multiple Use Forestry and Other Natural Resources was implemented at Department of Economics and Natural Resources The Royal Veterinary and Agricultural University KVL Copenhagen The research is funded by KVL The Danish Agricultural and Veterinary Research Council The Danish Research Academy The Danish Forest and Landscape Institute The Danish Forest and Nature Agency and The Danish Environmental Protection Agency The overall objective of the research programme is to enhance the economic theory of sustainable multiple use forestry and landscape management planning Emphasis is on decision making management planning from an economic point of view the basic criterion being rationality as implemented by application of Operations Research methods with regard to sustainable and multiple use of forests and other natural resources in the landscape The research programme benefits from collaboration agreements with University of California at Berkeley Department of Agricultural and Resource Economics and Oregon State University Department of Forest Resources As part of the research programme a second international conference and workshop was held 6-12 August 1998 at KVL with the title 2nd Berkeley KVL Conference on Natural Resource Management Design and Implementation of Multiple Use Management This event was financed by The Danish Research Academy Some of the papers presented were selected for peer reviewing and subsequent publishing The outcome is the present book in which no paper has been previously published *Plant Breeding Reviews, Volume 22* Jules Janick, 2002-11-13 Plant Breeding Reviews Volume 22 presents state of the art reviews on plant genetics and the breeding of all types of crops by both traditional means and molecular methods The emphasis of the series is on methodology a practical understanding of crop genetics and applications to major crops **Oil Palm Breeding** Aik Chin Soh, Sean Mayes, Jeremy A. Roberts, 2017-08-14 The oil palm is a remarkable crop producing around 40% of the world's vegetable oil from around 6% of the land devoted to oil crops Conventional breeding has clearly been the major focus of genetic improvement in this crop A mix of improved agronomy and management coupled with breeding selection have quadrupled the oil yield of the crop since breeding began in earnest in the 1920s However as for all perennial crops with long breeding cycles oil palm faces immense challenges in the coming years with increased pressure from population growth climate change and the need to develop environmentally sustainable oil palm plantations In Oil Palm Breeding Genetics and Genomics world leading organizations and individuals who have been at the forefront of developments in this crop provide their insights and experiences of oil palm research while examining the different challenges that face the future of the oil palm The editors have all been involved in research and breeding of oil palm for many years and use their knowledge of the crop and their disciplinary expertise to provide context and to introduce the different research topics covered **Modelling Forest Development** Klaus von Gadow, Gangying Hui, 2001-11-30 The key to successful timber management is a proper understanding of growth processes

and one of the objectives of modelling forest development is to provide the tools that enable foresters to compare alternative silvicultural treatments. In a managed woodland the most important periodic disturbances are the thinning operations which are often carried out at regular intervals and which usually have a significant effect on the future evolution of the resource. Thus a realistic model of forest development includes both natural growth and thinnings. One of the outstanding features of this book is its inclusion of thinning models at varying levels of resolution and consideration of differences in foresters' tree marking behaviour. Other interesting aspects include regional resource forecasting approaches, generalized stem taper functions, generalized diameter height relations, new ways of describing and reproducing forest spatial structures, crown modelling and iterative competition modelling. Worked examples and code are provided where appropriate. The intended readership is graduate students.

**Agroforestry for Sustainable Land-Use: Fundamental Research and Modelling with Emphasis on Temperate and Mediterranean Applications**

Daniel Auclair, C. Dupraz, 2013-03-09. This volume comprises a selection of original contributions presented at a workshop held in Montpellier, France, in June 1997. The two main objectives of the workshop were firstly to bring together what is understood about the processes underlying agroforestry practice and secondly to provide a forum to explore relevant models and modelling approaches. The workshop was also able to play a role in examining the agroforestry systems encountered in temperate and Mediterranean areas, including both traditional and more innovative agroforestry practices. The main aspects discussed were ecological interactions amongst components, environmental impact, economics and policy modelling.

*Global Concerns for Forest Resource Utilization* Atsushi Yoshimoto, Kiyoshi Yukutake, 2013-11-11. This book is a collection of papers presented at the international symposium on forest sector analysis held in Miyazaki, Japan, in 1998. It is structured with three themes: understanding global forest sector issues, discussing the contribution of modeling efforts to forest sector analysis, and discussing the role of Japanese forest policy in a global sense. The most important features are the case studies using various types of forest sector models. From a modeling perspective, changes in modeling efforts include more detail of spatial and multiple market levels, intergenerational welfare concerns, non-market valuation issues, and explicit treatment of the uncertainty inherent in both the policy process and in the biophysical systems. The reader of this book will benefit not only from presentation of forest utilization issues in different nations but also from the interrelatedness of the theory and application of forest sector modeling.

*The Economics of Forest Disturbances* Thomas P. Holmes, Jeffrey P. Prestemon, Karen L. Abt, 2008-04-18. by Peter J. Roussopoulos, Director, Southern Research Station. The world and its ecosystems are repeatedly punctuated by natural disturbances, and human societies must learn to manage this reality. Often severe and unpredictable dynamic natural forces disrupt human welfare and alter the structure and composition of natural systems. Over the past century, land management agencies within the United States have relied on science to improve the sustainable management of natural resources. Forest economics research can help advance this scientific basis by integrating

knowledge of forest disturbance processes with their economic causes and consequences As the twenty first century unfolds people increasingly seek the goods and services provided by forest ecosystems not only for wood supply clean water and leisure pursuits but also to establish residential communities that are removed from the hustle and bustle of urban life As vividly demonstrated during the past few years Santa Ana winds can blow wildfires down from the mountains of California incinerating homes as readily as vegetation in the canyons below Hurricanes can fatten large swaths of forest land while associated floods create havoc for urban and rural residents alike Less dramatic but more insidious trees and forest stands are succumbing to exotic insects and diseases causing economic losses to private property values including timber as well as scenic and recreation values As human demands on public and private forests expand science based solutions need to be identified so that social needs can be balanced with the vagaries of forest disturbance processes

**Politics and Economics of Tropical High Forest Management** Thorsten Treue,2001 This text provides a case study into the complexity of tropical high forest in Ghana It documents the fact that national forest inventories for a long time yielded results that were either over optimistic about the annual allowable cut or of little use at policy level Yet the most important reasons for deforestation and forest degradation stem from market and legislative failures This has resulted in major government and export revenues foregone and the capacity of the timber industry has become far higher than the annual allowable cut from forest reserves Trees outside forest reserves could fill the gap between the timber demand and the capacity of forest reserves However sustainable management of trees outside forest reserves requires clear incentives for the actual managers to do so These managers are the rural people who also own the land on which the trees grow Yet the state owns the trees Accordingly the challenge is for the state to replace its old exploitative attitude with a viable production oriented approach to off reserve timber resources

**Modern Time Series Analysis in Forest Products Markets** Jens Abildtrup,F. Helles,Per Holten-Andersen,Jakob Fromholt Larsen,Bo Jellesmark Thorsen,2012-12-06 This volume comprises fifteen papers exploring the consequences of applying modern time series methods particularly co integrated time series methods for the analysis of forest economics problems The methods represent the forefront of econometrics in this area and the volume is the first of its kind An introductory paper explains the econometrics of unit root processes Much of what follows in the other papers depends upon only a few of the ideas presented in the introduction The volume includes tests of e g the Law of One Price land valuation models demand and supply models Granger causality and forecast models The reader will learn a great deal about forest economies particularly in Northern Europe and about the practical use of modern time series methods The methods presented are applicable to other fields of economics The volume is aimed at researchers in applied economics and as a supplement to advanced theoretical textbooks mainly in Natural Resource Economics

**Planted Forests: Contributions to the Quest for Sustainable Societies** James Reid Boyle,Jack K. Winjum,Kathleen Kavanagh,Edward C. Jensen,2013-03-09 Planted forests from irrigated eucalypts in Brazil to Douglas fir seedlings in the mountains of Oregon are

described and discussed by international experts The varieties purposes forms and ecological economic and social aspects of planted forests are considered in technical details and in case studies from temperate and tropical regions of the world

**Environmental Forest Science** Kyoji Sassa,2012-12-06 This proceedings volume has been edited from sixty nine full text papers of the 132 papers presented to the IUFRO International Union of Forestry Research Organizations Conference on Environmental Forest Science which was jointly organized by IUFRO Division 8 Forest Environment and Kyoto University in Kyoto Japan on 19-23 October 1998 The International Union of Forestry Research Organizations IUFRO is one of the oldest scientific societies It was founded in 1892 to foster cooperation of research units on forestry IUFRO consists of 650 research organizations from 100 countries IUFRO th Division 8 is the latest division founded at the 20 World Congress in 1995 by subdividing the previous Division 1 Forest Environment and Silviculture The objective of this first general Conference of Division 8 is to consider research needs in the 21 st century for forest environment and the integration of related fields of sciences to a new concept of environmental forest science Handbook of Quantitative Forest Genetics Lauren Fins,S.T.

Friedman,J.V. Brotschol,2013-06-29 This handbook was designed as a reference tool for forest geneticists tree breeders and other tree improvement personnel as well as a textbook for university courses and short courses at the graduate level in quantitative genetics The chapters focus on the decision points faced by quantitative geneticists and breeders in designing programs and analyzing data Beginning with a justification for the use of quantitative genetics in decision making in tree improvement programs the book continues with a brief presentation of fundamental principles followed by discussions and evaluations of mating designs and field test designs the use of best linear predictors to estimate breeding values the use of computer programs in the analysis of variance for genetic information the deployment of genetically improved stock for capturing gains the use of economic models for program justification and the development of seed transfer guidelines

*Biology and Ecology of Norway Spruce* Mark G. Tjoelker,Adam Boratynski,Władysław Bugała,2007-05-29 This is a concise and comprehensive review of the biology ecology and management of Norway spruce Written by 25 experts in the field and richly illustrated it integrates classic and contemporary literature More than 2000 works are cited in the text which highlights basic research and forestry practices in central and Eastern Europe The huge range of topics covered includes the species morphology its physiology and nutrition and its ecology **Somatic Embryogenesis in Woody Plants** S.M.

Jain,Pramod P.K. Gupta,R.J. Newton,2013-04-17 The rapid progress made on somatic embryogenesis and its prospects for potential applications in improving woody plants prompted us to edit this book initially in three volumes and now to add two more volumes The editors were all convinced that such a treatise was needed and would be extremely useful to researchers and students This Volume 4 has been divided into three sections and contains 23 chapters Section A contains eleven chapters covering studies of embryo development and cell biology of white spruce proliferative somatic embryogenesis in woody species somatic embryo germination and desiccation tolerance in conifers performance of conifer somatic seedlings

apoptosis during early somatic embryogenesis water relation parameters in conifer embryos image analysis of somatic embryos somatic embryogenesis in woody legumes cold storage and cryopreservation and commercialization of plant somatic embryogenesis Section B contains six chapters dealing with angiosperm woody plants such as somatic embryogenesis in myrtaceous plants *Laurus nobilis* *Simarouba glauca* *Magnolia* spp *Juglans cinerea* and somatic embryogenesis and evaluation of variability in somatic seedlings of *Quercus serrata* by RAPD markers The chapters contained in Section C are focused on somatic embryogenesis in gymnosperms including *Pinus patula* *Encephalartos Picea wilsonii* *Pinus banksiana* hybrid firs and *Taxus* All the chapters have been peer reviewed and revised accordingly to improve their quality

*Molecular Biology of Woody Plants* S.M. Jain, S.C. Minocha, 2013-04-17 Woody plants constitute an artificial and heterogeneous group of plants that share some common phenotypic characteristics but otherwise have no strong evolutionary relationships nor do they share a common habitat They are a primary source of fiber and timber and also include many edible fruit species Their unique phenotypic behavior includes a perennial habit associated with extensive secondary growth Additional characteristics of woody plants include developmental juvenility and maturity with respect to growth habit flowering time and morphogenetic response in tissue cultures environmental control of bud dormancy and flowering cycles variable tolerance to abiotic stresses wounding and pathogens and long distance transport of water and nutrients Woody plants particularly tree species have been the focus of numerous physiological studies to understand their specialized functions however only recently have they become the target of molecular studies Recent advances in our understanding of signal transduction pathways for environmental responses in herbaceous plants including the identification and cloning of genes for proteins involved in signal transduction should provide useful leads to undertake parallel studies with woody plants Molecular mapping techniques coupled with the availability of cloned genes from herbaceous plants should provide shortcuts to cloning relevant genes from woody plants The unique phenotypes of these plants can then be targeted for improvement through genetic engineering In this book we present a broad coverage of various aspects of plant molecular biology that are relevant to the improvement of woody plant

**Protocol for Somatic Embryogenesis in Woody Plants** Shri Mohan Jain, Pramod K. Gupta, 2005-05-23 World population is increasing at an alarming rate and this has resulted in increasing tremendously the demand for tree products such as wood for construction materials fuel and paper fruits oils and medicines etc This has put immense pressure on the world's supplies of trees and raw material to industry and will continue to do so as long as human population continues to grow Also the quality of human diet especially nutritional components is adversely affected due to limited genetic improvement of most of fruit trees Thus there is an immediate need to increase productivity of trees Improvement has been made through conventional breeding methods however conventional breeding is very slow due to long life cycle of trees A basic strategy in tree improvement is to capture genetic gain through clonal propagation Clonal propagation via organogenesis is being used for the production of selected elite individual trees However the methods are



labour intensive costly and produce low volumes Genetic gain can now be captured through somatic embryogenesis Formation of embryos from somatic cells by a process resembling zygotic embryogenesis is one of the most important features of plants In 1958 Reinert in Germany and Steward in USA independently reported somatic embryogenesis in carrot cultures Since then tremendous progress in somatic embryogenesis of woody and non woody plants has taken place It offers a potentially large scale propagation system for superior clones

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