Research Review

The Value of Agricultural Land in the United States: A Report on Research

By John P. Doll, Richard Widdows, and Paul D. Velde*

In view of a long history of increasing land prices followed by recent downward adjustments, the question arises: Is farmland overpriced or underpriced in relation to earnings? The answer is important, but the rationale behind the answer is equally important. We have prepared five reports on the subject of land values. The reports include a review of the literature (*6*), an updating and re-estimation of some econometric models of the land market (*22*), estimates of returns to assets in 10 farm production regions (*5*), a descriptive analysis of cash rents (*4*), and some concluding thoughts (*3*).[1] In this article, we present a brief abstract of our literature review and summarize our empirical studies of the econometric models and imputation procedures.

Literature Review

Most research published since the fifties has been directed towards answering one or more of three questions: What are the earnings of farmland? What economic forces affect the price of farmland? Is farmland overpriced or underpriced? The early literature often appealed to the theory of the firm in pure competition—that is, to an evaluation of farmland's marginal value product in the short run and its factor share in the long run. In either case, the question asked was: Are earnings of the input within the firm large enough to justify the market price of the input?

In 1960, Scofield (*17*) noted that land prices were diverging from farm income trends and coined the phrase "land-price paradox." Others echoed these concerns. Two implicit assumptions underlay much of the thinking at that time: (1) farm income per acre is the appropriate variable against which to measure land value, and (2) the traditional valuation formula, $V_e = R_1/d$ (V_e equals present value of an input that earns R_1 dollars per year, given a discount rate of d percent per year), is the appropriate equation for computing the present value of the land asset. This model assumes that land earnings will remain constant at R_1 in perpetuity.

Faced with the paradox of land prices that diverge from farm income trends, researchers looked for alternative explanations. A host of new variables was suggested. New production technologies increased efficiency by lowering costs and creating economies of size. Farm programs maintained prices in the face of these new efficiencies. Expansion of existing farms shifted demand. Demand for land for urban expansion, rural living, highways, and airports decreased supplies of farmland, with the overall effect of increasing prices.

Those who believe in the classical argument of David Ricardo, later espoused by Sir Colin Clark (*1*), that land value must derive from net rent might argue that the above factors increase net rent and thereby increase value. Thus, the search was for new variables that affect net rent—the same old Lorelei in new raiment. Two new explanations did arise. One suggests a problem not resolved in traditional economic theory—the combination of production value and consumption utility in the same resource. Thus, Martin and Jefferies (*13*) attributed a component of demand for land in Arizona to "ranch fundamentalism" or "conspicious consumption" of the western way of life. The second, suggested by Hathaway (*9*) in 1957, was capital appreciation. Hathaway noted that ". . . it is possible for a farmowner who has never enjoyed a high annual income to accumulate substantial assets . . . ." Over the years, Hathaway's measures were refined into the "real capital gains" presented by Melichar (*14*) in 1979. As real capital gains continued to accrue, writers suggested land prices would increase because additional investors would be attracted to the market.

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[1] Italicized numbers in parentheses refer to items in the References at the end of this article.

Whereas the literature of the fifties and sixties tended to stress the search for new variables and the policy implications of increasing farmland values, more recent research efforts have attempted to clarify the manner in which land earnings are defined and are translated into land values In the seventies, the assumptions of the traditional capitalization formula were replaced by more sophisticated assumptions The models proposed incorporated variables to represent inflation, income and capital gains tax rates, finite planning horizons, efficiency and farm size, income variability, and risk aversion (*6*) In 1979, Melichar (*14*) noted that returns to assets were growing, and he used the constant-growth earnings model, which assumes that present earnings will grow at a constant rate, g, into perpetuity The valuation formula for this model is $V_e = [R_0(1 + g)/(d - g)]$, which implies that low annual returns would be expected when growth rates are large ($R_0(1 + g)$ equals R_1 of the traditional valuation formula)

The traditional literature usually relied on partial equilibrium models that considered farmland in isolation from other markets in the economy. Feldstein (*7, 8*) developed a portfolio demand model that considers farmland as an investment relative to other assets such as gold or bonds. Feldstein's model suggests that in inflationary periods land prices will rise in relation to prices of other assets.

In sum, the results of attempts to determine whether the land market tends to overvalue or undervalue land remain inconclusive Many studies have addressed single issues involved in the valuation of farmland, but none has assembled a complete picture of farmland as a productive input, a consumption good, and a speculative portfolio asset

Econometric Models

Following our review of the literature, we updated four econometric models of the market for farmland Data series originally used in the models were duplicated and extended to 1978, the models were then re-estimated for the entire period for which data were available as well as for selected subperiods (*22*) The models we selected were published by Tweeten and Martin in 1966 (*18*), Herdt and Cochrane in 1966 (*10*), Reynolds and Timmons in 1969 (*16*), and Klinefelter in 1973 (*12*) In contrast to a 1979 study by Pope and others (*15*), who evaluated the usefulness of the models for forecasting, we evaluated the stability of the structural coefficients

All models included a selection of variables from the general set of factors thought to affect farmland price, many of the same ones have been discussed in the literature review above Model specifications, however, were quite different and included a partial adjustment model, a recursive model, a jointly determined supply and demand model, and a single equation model, the last could be interpreted as one equation (for price) selected from a set of unrestricted reduced-form equations Thus, efforts to specify econometric models would appear to be hindered by the lack of an appropriate theory to describe the workings of the land market, that is, no underlying optimal theory was available to explain land values. A detailed analysis of these models is included in our literature review (*6*)

Our results suggested that the structural coefficients were unstable when models were re-estimated for periods beyond or within the time periods for which they were originally estimated Coefficient estimates often switched signs or became insignificant To illustrate, we will present some results for the equation of greatest interest here and the one present in all the models in some form—namely, the land price equation. Table 1 lists the general types of variables selected for inclusion in these equations and the frequency of the *a priori* appropriate sign on the estimated coefficients. Variables were represented by different proxies in different models, except for transfers, lagged price, and parity The data in table 1 suggest that capital gains and net earnings performed best when judged by the criteria of expected sign, whereas transfers and interest rates were least successful.

The poor results partly reflect the significant data problems that confront land market modelers. The land "price" series is not the selling price, but is a value series estimated by U S Department of Agriculture (USDA) market observers (*20*) Transfers must be used to represent the quantity variable Only about 3 percent of the total quantity of farmland is transferred each year in the United States, and no standard measure of the productive capacity of the transferred land is available Problems of a similar nature plagued other variables, some of which were represented by a variety of proxies

Table 1—Variables used to explain farmland price in 26 equations from four econometric studies of the U.S. farmland market

Variable	Total appearances	Times sign correct	Times sign incorrect	Percentage of times correct
		Number		*Percent*
Quantity of land	11	8	3	0 73
Size of farms	21	16	5	76
Transfers	26	14	12	54
Net earnings	17	15	2	88
Interest rates	22	11	11	50
Lagged price	9	6	3	.67
Productivity	6	4	2	67
Parity	6	4	2	67
General price level	9	7	2	.78
Government payments	13	9	4	.69
Capital gains	12	11	1	.92

Source (*22*, tables 6, 9, 13, and 16) Equations were examined over the longest time periods permitted by the data

Specification problems coexisted with data problems Lacking a commonly held theoretical basis for determining the effects of land earnings on land values, researchers tended to include a mixed collection of variables in their models If land values are determined by land earnings and if those earnings are properly measured and appropriately specified in the model, then the inclusion of secondary variables that increase or decrease land earnings is redundant. That is, if technology, farm expansion, Government programs, population, mortgage interest rates, and general economic prosperity increase earnings, then their effects will be properly reflected through earnings Inclusion of these variables in a model along with earnings would be an error in specification Thus, while one concern has been whether appropriate proxies could be identified to represent factors affecting land values (*22*), another concern is whether or not any of the factors mentioned should be entered individually in the models Structural changes as well as specification errors may have also contributed to the disappointing performance of the models.

Although all models used national aggregate data, it is, in fact, difficult to conceptualize an aggregate market for farmland Land transactions are not made in a setting of pure competition For reasons developed in our concluding report, we believe a "price leadership" model might be more appropriate (*3*) The product sold is not homogeneous, and the price per unit differs among buyers. As a result, aggregate data represent accounting totals and undoubtedly provide useful descriptive information, but they do not represent market signals that are equivalent to those obtained from crop or livestock markets Econometric models may be more appropriate in local areas which have greater homogeneity

Returns to Production Assets

Although the search for "factors influencing land values" was often heuristic and was sometimes based on value judgments about the nature of the market, one avenue of the search was empirical—the imputation of returns to agricultural inputs One study was published by Johnson as early as 1948 (*11*), and similar studies have appeared since with regularity. USDA researchers have been particularly faithful.

Most imputation studies begin in the same manner, by deriving a gross return from aggregate revenue and cash expense data. The process of allocating this return is where the differences arise Some resources used in agriculture do not have clearly determined market prices, and many inputs (including land) are durables Only one input can be the residual claimant in the imputation process

Some researchers, interested in labor and human capital, imputed returns to land based on cash rent or interest rates on mortgage debt, and they regarded labor as the residual claimant Others valued labor at market rates and imputed returns to land Some were particularly cautious and did both [2] Melichar (*14*) rejected the already battered notion that net farm income should be considered the primary determinant of land values and instead estimated the returns to all production assets in agriculture. As Doll and Widdows (*2*) show, the constant growth earnings model, when applied through time according to Melichar's suggestion, implies that the growth rates in asset values should equal the growth rate in asset earnings Melichar concluded this was generally true in agriculture for the 1950-78 period and that asset earnings do support the capital gains experienced in agriculture

We applied Melichar's test to regional data and supported his conclusions for 8 of 10 regions throughout the 1950-78 period, but supported them for fewer regions in the fifties and sixties Following the techniques developed by Evans for the *Balance Sheet of the Farming Sector* (*19*), we estimated the value of productive assets and the residual earnings of assets in 10 U S farm production regions for 1950-78 (*5*) (The 10 production regions are defined by USDA) Our report presents the techniques used to develop the estimates as well as the empirical findings by regions The results, which are too extensive to report in detail here, suggest that the increase in both earnings and value of assets in all regions has been striking But, large regional differences do exist

A summary of the estimated residual earnings and real capital gains as a percentage of asset values is presented in table 2. We averaged returns by decades to minimize the effects of annual fluctuations These findings suggest that the 10 regions have not shared equally in the economic growth of agriculture

To apply Melichar's test to the regional data, we used regression analysis to estimate continuous growth rates in residual earnings and production asset values (table 3, columns 1 and 2) The growth rates for the two are comparable in all regions except the Lake States and the Northern Plains If residual earnings and asset values have the same growth rates, their ratio should show no trend The trend coefficients for these ratios are presented in column 3 of table 3 Only the two regions noted had trend coefficients significantly different from zero Thus, for the 1950-78 period, the conclusion that earnings do support values is generally supported for the regional disaggregation When we conducted a similar test by decades, the results were less conclusive The hypothesis was supported by only three regions in the fifties, by six in the sixties, and by eight in the seventies As might be expected, the results obtained depend somewhat on the time span chosen Thus, the results are uneven, and we cannot say they provide conclusive support for the constant-growth earnings model.

Could it be said that productive assets were undervalued or overvalued in relation to earnings among regions? One of the interesting conclusions to be drawn from the literature is that after obtaining factor shares, researchers remained uncertain of how those shares should be used to determine the value of land Thus, in the study cited above, Johnson (*11*) stated "It is, of course, impossible to say whether the level of land values of late 1946 is generally too high " The answer to the valuation question ultimately depends on the model selected to transform earnings into values [3]

Analyses based on the traditional valuation model, $V_e = R_1/d$, would lead to the conclusion that funds invested in agriculture were not returning their opportunity cost When real capital gains are added to annual asset earnings, the summed return becomes quite competitive with earnings in alternative uses This latter interpretation requires the acceptance of the equivalence, in some sense, of the real capital gain and the annual income flow Interpretations based on the constant-growth earnings model proposed by Melichar did come closer to suggesting that returns earned by assets do justify their value in most farm regions

In summary, even if the data base and aggregation problems could be resolved, the inherent value of research designed to value land through imputed returns will not be realized until more comprehensive theoretical models are available to translate

[2]References and a more detailed analysis of these imputation procedures are contained in our literature review (*6*, pp 78-89)

[3]Another problem which plagues attempts to base the value of land on the imputed residual is created by the aggregate nature of the data Returns are much higher on Class I farms And, under a "price-leadership" model, the value of land in its most profitable use should set the asking price for all land See our literature review (*6*, pp 85-86)

Table 2—Average residual earnings of assets and average real capital gains as a percentage of asset value, by farm production region

Region	1950-59		1960-69		1970-78	
	Residual earnings	Real capital gains	Residual earnings	Real capital gains	Residual earnings	Real capital gains
	Percent					
Northeast	4 0	2 0	4 6	3 4	4.1	7 8
Appalachian	4 8	2.1	4 4	2.8	5 0	7 0
Southeast	7 5	4.3	6.7	3 7	6 6	6 2
Lake States	5	1 7	3 1	1 4	5 9	8.9
Corn Belt	4 0	1 8	4.2	1 8	5.5	9 8
Delta States	6 4	3 4	6.2	5 0	7 0	3 8
Northern Plains	2 6	1.3	4 2	1.7	6 1	7 5
Southern Plains	4 0	2.8	3 6	3 2	3 4	3 4
Mountain	4 5	1 9	3 9	3 0	4 9	5.7
Pacific	6 7	3 7	5 1	2 0	8 4	2.5
48 States	4.2	2.3	4 4	2 3	5 5	6 6

Source (*5*, table 4)

Table 3—Continuous growth rates in residual earnings and asset values for 10 farm production regions, 1950-78

Region	Percentage growth		Trend coefficient for (1)/(2) (3)
	Growth in residual earnings (1)	Growth in productive asset values (2)	
	------ *Percent* -- ---		
Northeast	4 8	5 0	−0 0021
Lake States[1]	11 3	5 3	[2] 0600
Corn Belt	6 8	5 7	0108
Northern Plains	8 8	5 9	[2] 0293
Appalachian	5 5	5 6	− 0014
Southeast	5 7	6 6	− 0088
Delta States	6 7	6 7	0007
Southern Plains	4 9	6 2	− 0128
Mountain States	6 0	6 1	− 0010
Pacific States	5 7	4 9	0080
48 States	6 7	5 3	0088

[1]Series includes missing values due to negative returns in some years

[2]Significant at the 90-percent level

Source (*21*, tables 19 and 20)

earnings into value We also drew a similar conclusion in our study of the econometric models of the land market

References

(1) Clark, Colin *The Value of Agricultural Land* Oxford Pergamon Press, 1973

(2) Doll, John P , and Richard Widdows "Capital Gains versus Current Income in the Farming Sector Comment," *American Journal of Agricultural Economics*, Vol 63, No 4, Nov 1981, pp 730-33

(3) ________________ *The Value of Agricultural Land in the United States Some Thoughts and Conclusions* (ed Paul D Velde) ERS Staff Report No AGES820323 U S Dept Agr , Econ Res Serv., Mar. 1982

(4) ________________ *A Comparison of Cash Rents and Land Values for Selected Farming Regions of the United States* (ed

Paul D Velde) ERS Staff Report No AGES820415, U S Dept Agr , Econ Res. Serv , Apr. 1982.

(5) ______________________ *Imputing Returns to Production Assets in 10 U S Farm Production Regions* (ed Paul D Velde) ERS Staff Report No AGES820703. U S. Dept Agr., Econ Res Serv , July 1982.

(6) ______________________, and Paul D Velde *A Critique of the Literature on U S Farmland Values* ERS Staff Report No AGES830124 U S Dept Agr , Econ Res Serv , Jan 1983

(7) Feldstein, Martin *The Effects of Inflation on the Prices of Land and Gold* Working Paper No. 296 Cambridge, Mass National Bureau of Economic Research, Nov 1978

(8) ______________________ "Inflation, Portfolio Choice and the Prices of Land and Corporate Stock," *American Journal of Agricultural Economics*, Vol 62, No 5, Dec 1980, pp 839-47.

(9) Hathaway, Dale E "Agriculture and the Business Cycle," *Policy for Commercial Agriculture* Joint Economic Committee, 85th Congress Washington, D C U S Government Printing Office, 1957

(10) Herdt, R W , and W W Cochrane "Farmland Prices and Farm Technological Advance," *Journal of Farm Economics*, Vol 48, No 2, May 1966, pp 243-63

(11) Johnson, D Gale "Allocation of Agricultural Income," *Journal of Farm Economics*, Vol 30, No 4, Nov 1948, pp 724-49

(12) Klinefelter, D A. "Factors Affecting Farmland Values in Illinois," *Illinois Agricultural Economics*, Jan 1973, pp 27-33

(13) Martin, W E , and G L Jefferies "Relating Ranch Prices and Grazing Permit Values to Ranch Productivity," *Journal of Farm Economics*, Vol 48, No 2, May 1966, pp 233-42

(14) Melichar, Emanual "Capital Gains versus Current Income in the Farming Sector," *American Journal of Agricultural Economics*, Vol 61, No 5, Dec 1979, pp 1085-92

(15) Pope, R D , R A Cramer, R D Green, and B D Gardner "An Evaluation of Econometric Models of U S Farmland Prices," *Western Journal of Agricultural Economics*, Vol 4, No 1, July 1979, pp 107-19

(16) Reynolds, J E , and J F Timmons. *Factors Affecting Farmland Values in the United States* Agr Expt Sta Bull 566 Ames Iowa State Univ , Feb 1969

(17) Scofield, William H "Returns to Productive Capital in Agriculture," *Farm Real Estate Market Developments* CD-54 U S Dept of Agri , Econ Res Serv , Feb 1960

(18) Tweeten, L G , and J E Martin "A Methodology for Predicting U S Farm Real Estate Price Valuation," *Journal of Farm Economics*, Vol 48, No 2, May 1966, pp. 378-93

(19) U S Department of Agriculture, Economics, Statistics, and Cooperatives Service *Balance Sheet of the Farming Sector, 1979* AIB-430 1980.

(20) ______________________ *Farm Real Estate Market Developments* CD-84 May 1980

(21) Widdows, Richard "The Valuation of Farm Assets A Theoretical and Empirical Investigation." Unpublished Ph D thesis, Univ of Missouri-Columbia, Dept. of Economics, 1982

(22) ______________________, and John P Doll *Four Econometric Models of the U S Farmland Market An Updating with Comparisons* (ed Paul D Velde). ERS Staff Report No AGES820702 U.S Dept Agr , Econ Res. Serv , July 1982.

Soil Conservation Policies, Institutions, and Incentives

Harold G. Halcrow, Earl O. Heady, and Melvin L. Cotner (eds) Ankeny, Iowa· Soil Conservation Society of America, 1982, 330 pp , $6.00

Review by Craig Osteen*

This well-written and informative collection of papers and discussions accurately represents the current literature on the economics and policy of soil and water conservation—both its strengths and weaknesses The editors group the papers under five topics (1) history of soil conservation, (2) the soil conservation policy process of the Resource Conservation Act of 1977 (RCA), (3) attitudes and behavior of farmowners and operators, (4) socially preferred tradeoffs in soil conservation, and (5) alternative strategies of achieving soil conservation In my opinion, the book really consists of two sections The first addresses policy and institutions and includes topics 1, 2, 5, and Sylvan Wittwer's paper in topic 4 The second considers microeconomics and includes the remaining papers in topics 3 and 4 Each section embodies a different approach to the problems of soil conservation.

Wayne Rasmussen introduces the theme for this book by asking "why erosion remains a severe problem after 45 years of cooperative efforts by farmers and the Federal Government to solve it " The articles addressing soil conservation policy and institutions discuss past and current erosion problems and policies, the structure of soil conservation institutions, and the political pressures shaping these institutions and policies. These papers document the events leading to RCA, the process of implementing RCA, and the implications of RCA for soil conservation institutions—an interesting discussion of policy formation During the seventies, soil conservation experts claimed that erosion with its impacts on future productivity, sediment damages, and water quality increased, whereas budget experts criticized soil conservation programs for ineffectiveness One response to these concerns was RCA, which defined a process for assessing the Nation's soil and water resources, for evaluating current programs, and for planning future policies Several authors discuss factors affecting soil conservation, market imperfections, policy options, and the potential impacts of new agricultural technologies on conservation problems and policies

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I find David Allee's and Christopher Lehman's discussions of the coordinating committee assembled to evaluate existing programs and future policy options for RCA to be a fascinating glimpse into interagency politics These authors view the process as a massive undertaking overwhelmed by data analysis and political infighting They believe that the evaluation of existing programs was not successful and that policy options were not thoroughly examined Lehman and Allee allege that the coordinating committee analyzed too many issues and spent too much time analyzing data, the participants should have concentrated on fewer, more important questions

The first section's most important contribution is showing that, although the General Accounting Office and others criticize the Soil Conservation Service (SCS) and the Agricultural Stabilization and Conservation Service (ASCS) for not concentrating technical and financial assistance in areas with severe erosion problems, resource allocations are a result of the political coalition supporting the program's survival This coalition favors voluntary, locally controlled cost-sharing, and technical assistance programs Attempts to reallocate funds to concentrate programs in areas with severe erosion problems or to develop regulatory programs would require greater centralization in Washington and could damage both the coalition and the programs

Sandra Batie and Lawrence Libby make another important contribution by showing that RCA, as well as the nonpoint pollution control program, has broadened soil conservation policy and its constituency They believe that soil conservation institutions will continue to emphasize traditional concerns of protecting soil fertility and flood control, but will expand their concerns to water quality and other environmental objectives. Libby believes the constituency for soil conservation may expand from farmowners and operators, changing the membership of Soil Conservation Districts and future policies

The papers addressing the microeconomics of soil conservation emphasize the application of data analysis, economic modeling, and the variety of conceptual approaches and viewpoints taken by economic researchers I generally found these papers less current and interesting than most on policies and institutions

William Miller and Earl Heady show the dominance of linear programing in addressing farm planning and soil conservation issues Miller reviews studies of short-term tradeoffs between soil conservation and farm income and long-term benefits of soil conservation He states that many conservation practices reduce current income, that discounting makes future benefits insignificant, and that new technology reduces the impact of declining productivity Miller indicates that conservation practices need to be tailored to specific farm conditions, and he proposes including economic modeling in SCS farm planning to help farmers explore all financial aspects when they choose practices Heady uses the Iowa State model to show that the Nation could reduce erosion in the short run with little sacrifice by emphasizing conservation tillage and contour plowing where feasible. He states that uniform limitations to soil loss across heterogenous soils are neither politically acceptable nor economically sensible, the urgency of the practices depends upon the depth and erodibility of the soils Heady also states that there would be a different mix of practices for maintaining productivity or controlling water pollution

Napier and Foster survey the literature of farmer attitudes and behavior toward soil conservation They find farmers to be interested in short-term gain, aware that erosion is a problem but unaware how severe erosion is on their own land They state that farmers favor voluntary cost-sharing and technical assistance under local control with State or Federal funding Schertz and Wunderlich examine the U S Department of Agriculture's (USDA) landownership survey and the work of other USDA researchers They find that the data do not support a relationship between selected characteristics of owners and conservation, and state that more concentrated landownership may encourage more conservation

Eleveld and Halcrow use the mathematics of constrained optimization to characterize the determination of the socially optimal level of soil conservation. They show that differences in social and private time preferences, imperfect information; and offsite damages from sediment, pesticides, and soil nutrients could cause differences between socially and privately optimal amounts of soil conservation They recommend development of more soil conserving technology, taxes on farming practices which do not maximize net social income, cost-sharing payments as incentives, and greater precision and discrimination in applying soil conservation policy

Daniel Bromley addresses property arrangements surrounding soil erosion Bromley enumerates the externalities of erosion as offsite sediment damages, the differences between social and private time preferences concerning future production losses, and the use of nonrenewable resources in fertilizers to replace lost soil nutrients He states that the interest of landowners in soil management conflicts with the interests of others for whom the prevailing structure provides no protection Although Bromley believes attempts to change the existing structure would raise important economic and political questions, he does not predict the outcome

Neither section addresses how the Soil Conservation District, the State soil conservation agency, and the district soil conservationists that are key agents in soil conservation policy should change their decisions nor does either suggest economic methods to help these agents Miller and Heady come the closest. Most of the other authors concentrate on decisions at the national or farm level, not at the State or local level. I find little discussion on how State and local officials can allocate limited cost-sharing funds and technical assistance among practices, farms, or areas with different erosion problems I see this issue as the key topic for future economic research and policy analysis

Several authors mention the interaction between soil management and water quality, potential conflicts and complements between soil conservation and water quality programs, and the emergence of environmental objectives in soil conservation programs. Unfortunately, they do not explore these timely issues further

The book's strength lies in its showing the agreements and conflicts in the authors' viewpoints. It illustrates much of the recent work on the economics and policy of soil conservation and shows where more work is needed I recommend it to anyone who wants to learn more about this subject

Readings in Farming Systems Research and Development

W. W Shaner, P. F. Philipp, and W. R Schmehl (editors) Boulder, Colo
Westview Press, 1982, 175 pp , $19.

Farming Systems Research and Development, Guidelines for Developing Countries

W W Shaner, P. F Philipp, and W R Schmehl (editors) Boulder, Colo ·
Westview Press, 1982, 414 pp , $25.

Reviews by Michael A. Cullen*

The term "Farming Systems Research" (FSR) has been in use for some time, and through the continual efforts of its practitioners, its acceptance as a method for understanding farmers and farming has grown in recent years It requires that researchers investigate the interdependence of components of a farm unit controlled by the farm household as these components interact with physical, biological, social, and economic factors For example, if a newly introduced crop variety that requires a change in labor practices is to be successfully adopted, then a full understanding of the patterns and customs surrounding labor allocation and requirements in the local economy needs to be established A thorough knowledge of the social structure and of the potential for change is, therefore, essential

FSR's growing acceptance by agricultural scientists working in various parts of the world—principally agronomists, soil scientists, and economists—has come from a perception that the standard approach to agricultural research and extension, whereby each scientist looks at an isolated set of constraints to development (for example, soil fertility or plant breeding), has been largely unsuccessful This perception has convinced many researchers that they have considered farming practices and technological innovations in too narrow a context Scientists have thereby neglected the larger context, the farm as a system operating within other social and environmental systems Thus, researchers working in different parts of the world have independently come to realize that the need for a new approach to the study of farming exists Although these researchers have come to the same conclusion, they have each fashioned their own approaches from their experiences or those of their research institutions Consequently, no single approach has emerged, rather it appears that the term FSR is a large, general rubric under which almost anything can be included

The book, *Readings in Farming Systems Research and Development* (FSR&D), demonstrates the variation in the concepts and interpretations of FSR&D A diversity of opinion exists on the goals of FSR, on which farmers should be studied, on who will collaborate to do the research, and on how it should be connected with existing research institutions

In the paper entitled "A General Overview of FSR," David Norman and Elon Gilbert state "The goal of FSR is to improve the well-being of individual farm families by increasing the overall productivity of the farming system " Such a broadly stated goal would seem to encompass almost anything in the farming system and illustrates a holistic approach.[1] By contrast, in the paper entitled "Aiming Agricultural Research at the Needs of Farmers," Don Winkelmann and Edgardo Moscardi limit the goal of FSR considerably by stating "research results are intended for near or intermediate term application, e g fertilizer research or plant breeding " Such a narrow goal would exclude considering social and economic elements not directly related to the specialized innovations they intend to research and introduce This approach emanates from work done at the International Maize and Wheat Improvement Center (CIMMYT)

In a paper entitled "Motivating Small Farmers to Accept Change," Peter Hildebrand discusses the FSR orientation used at the Agricultural Science and Technology Institute (ICTA), which is geared to small farmers who are defined as "all farmers regardless of the size of their holdings, who are not primarily commercial farmers [who] use predominantly traditional technology " Moreover, the technology which is to be introduced must be ready for immediate use under present conditions and it must be acceptable to target farmers Hildebrand emphasizes change that is suitable to farmers under current conditions, but he does not restrict the kind of innovations or the sort of farm on which he chooses to work Innovations could be in plant variety, changes in input use, or labor-saving implements or techniques

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[1]The holistic approach views the whole farm as a system and emphasizes the interdependence among its components

Hubert Zandstra, in his paper "A Cropping Systems Research Methodology for Agricultural Development Projects," simply states "The goal of agricultural research is to formulate improved production recommendations that are acceptable to farmers " This too is general, but he qualifies the approach by formulating a functional relationship between crop production, management capabilities, and the environment Recommendations must be consonant with the managerial capabilities of the system in question and be conditioned by the environment in which the system is found. Research must be related to the production environment. Zandstra's methodology results from work done at the International Rice Research Institute (IRRI)

Other discrepancies exist between the methods chosen by these researchers Norman and Gilbert ask an important question "How holistic should FSR be?" This query reaches the heart of the matter because it asks what do we need to know and who will discover it? Though all the authors agree on collaborative, multidisciplinary research, they disagree over which fields should be represented While pushing for a practical holism, Norman, Gilbert, and Hildebrand express the need to involve anthropologists and sociologists with economists who are working in consort with the biological scientists Infusing the research with a wide spectrum of orientations is crucial to these authors, for it provides the insight necessary to understand the structures and constraints of the farming system. Winkelmann, Moscardi, and Zandstra, on the other hand, argue for including only agricultural economists in the work with biological scientists, implying that the economist's perspective sufficiently complements the work of the biological scientist who looks at only a narrow range of physical relationships By contrast, the discussions of onfarm research and testing show the greatest similarities among these papers. This is so because the survey and field trial measurement techniques, through wide application and refinement, have evolved more fully than any other facets of FSR. They have been in constant use and are, therefore, diffused throughout the research community

Finally, each paper mentions the links to the existing research institutions, which are mostly nationally funded and maintained, and each paper speaks to the problems these institutions represent By expatiating on the need for FSR, the authors imply that these institutions have failed to develop worthwhile innovations because they have relied too heavily on the conventional research approach. They have remained too limited in their conception of agricultural production problems and so have been prevented from producing lasting, practical results The onfarm approach propounded in this book challenges their accepted widsom and contradicts their research orientation, yet all of the authors advocate including them in the process of introducing FSR They cannot be excluded from the research process because they are already in place and represent substantial investment, and more important, they contain the only pool of trained researchers available in many developing countries. In fact, they may represent the only hope of carrying out research in many of these countries Therefore, if FSR is to infuse the research approach, these available researchers must be trained in its techniques and made aware of its potential for solving the agricultural production problems besetting the developing countries

Even though these researchers conceive of the problems differently and are asking questions referring to specific locations and conditions, it is encouraging that they are going beyond the limits of the conventional research approach The reorientation of agricultural research toward a more holistic outlook can help shed light on the problems of farming for most of the farmers in the developing world

The companion volume, *Farming Systems Research and Development, Guidelines for Developing Countries*, is a well thought-out, practical guide to understanding FSR&D, and it instructs the reader on its underlying concepts and discusses some of the methods already developed. Although there is a diversity of interpretation on the goals involved in FSR&D, this volume succinctly describes its onfarm orientation and the methodology that has been devised for its execution It describes thoroughly how to investigate individual conditions of small farmers by coordinating interdisciplinary research that is "oriented to problem solving, comprehensive, iterative, dynamic, and responsible to society " This is a volume intended for foreign nationals, trained primarily in one of the agricultural sciences, who can benefit from the broad perspective of FSR, which will allow them to approach the problems of agricultural research in a more insightful and productive manner. It emphasizes that physical systems cannot be considered apart from social and economic ones and that this approach can provide more practical and workable results from research than has thus far been the case

As a new point of departure, this volume is quite practical It is an excellent rendering of the concepts elucidated in the *Readings* volume, for it puts into clear language the conceptual framework, research area selection, problem identification, onfarm research planning and analysis, extension of results, and methods of training for these activities The tables, charts, and diagrams are well designed and contain a plethora of information, succinctly illustrating many of the points made in the text. The appendix also details procedures described in the text and instructs the reader in how to follow them For anyone who wants a practical guide to carrying out FSR&D, or simply a nuts and bolts description, this is a fine volume.